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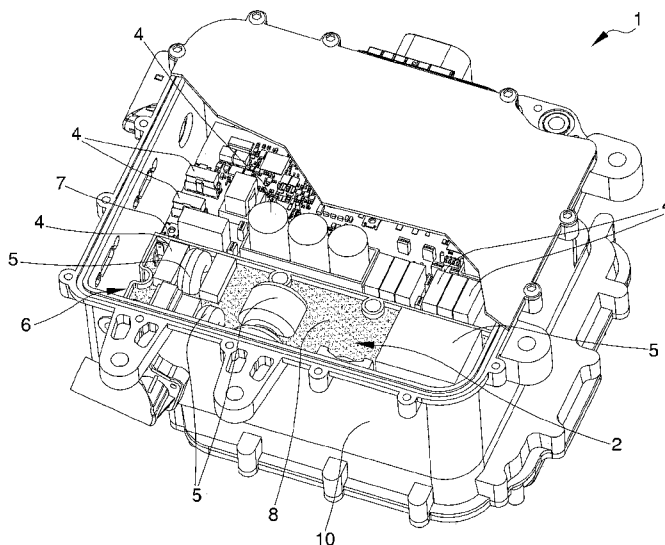
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(54) **Title:** PROCEDURE FOR THE MANUFACTURE OF BATTERY CHARGERS FOR VEHICLES AND BATTERY CHARGERS THUS OBTAINABLE

Fig. 1



(57) **Abstract:** The procedure for the manufacture of battery chargers for vehicles comprises a stage of manufacturing an electronic circuit (2) connectable to the battery of a vehicle and suitable for charging the battery, the electronic circuit (2) having a printed circuit (3) and at least a wound component (5) electronically connected to the printed circuit (3), wherein the stage of manufacturing comprises the steps of: - fixing the wound component (5) to the printed circuit (3); - depositing a heat hardening material (8) onto at least one portion of the printed circuit (3) in correspondence to the wound component (5); - solidifying the heat hardening material (8) for the blocking of the wound component (5) on the printed circuit (3).



## **PROCEDURE FOR THE MANUFACTURE OF BATTERY CHARGERS FOR VEHICLES AND BATTERY CHARGERS THUS OBTAINABLE**

### Technical Field

The present invention relates to a procedure for the manufacture of battery  
5 chargers for vehicles and battery chargers thus obtainable.

### Background Art

It is known that battery chargers for vehicles generally comprise a printed  
circuit connectable to the battery of a vehicle, made on a support in electrically  
insulating material such as vetronite or on a metal support of the IMS (Insulated  
10 Metal Substrate) type.

It is underlined in particular that in the field of the manufacture of battery  
chargers for vehicles, the use of printed circuits with metal support is preferred  
because it permits achieving high thermal efficiency, due precisely to the heat  
dissipation characteristics of the metal used (generally aluminium).

15 It is further known that the battery chargers of known type generally comprise a  
further module, separated from the printed circuit, made up of a support for  
housing all the large-size wound electrical components (for powers in the region  
of kW) made up of components such as transformers, filters and inductances.

Such further module is necessary because the wound components, precisely  
20 because they are of large size, are difficult to fix directly to the printed circuit.

With particular reference to the printed circuit with support in vetronite, in fact,  
the fixing of the wound components directly on the support would result in the  
printed circuit having low mechanical sturdiness, thus negatively and  
substantially affecting the life of the battery charger.

25 Furthermore, with reference to the use of a printed circuit with IMS type metal  
support, to the problem of low mechanical sturdiness must be added the fact that  
the fixing of the wound components on the support would require drilling the  
support itself, with the consequent high risk of electrical short circuits.

It is in fact known that IMS type supports comprise a metal plate, commonly  
30 made of aluminium, covered with a thin layer of dielectric material on which  
the copper tracks are made.

Consequently, drilling the support to fix a wound component would mean

making a possible power connection between the wound component itself and the aluminium of the support, thereby creating a short circuit.

In the battery chargers of known type, therefore, the module with the wound electric components is connected to the printed circuit by means of specific power cables and both are fixed inside a specific box or in different boxes.

#### Description of the Invention

The main aim of the present invention is to provide a procedure for the manufacture of battery chargers for vehicles which permits the manufacture of a battery charger for vehicles of smaller dimensions and with high mechanical sturdiness.

Another object of the present invention is to provide a procedure for the manufacture of battery chargers for vehicles which permits the manufacture of a battery charger with high thermal efficiency.

Another object of the present invention is to provide a procedure for the manufacture of battery chargers for vehicles and a battery charger thus obtainable which allow to overcome the mentioned drawbacks of the state of the art in the ambit of a simple, rational, easy and effective to use as well as low cost solution.

The above objects are achieved by the present procedure for the manufacture of battery chargers for vehicles, comprising a stage of manufacturing at least an electronic circuit connectable to the battery of a vehicle and suitable for charging said battery, said electronic circuit having at least a printed circuit and at least a wound component electronically connected to said printed circuit, characterized by the fact that said stage of manufacturing comprises the steps of:

- fixing said wound component to said printed circuit;
- depositing a heat hardening material onto at least one portion of said printed circuit in correspondence to said wound component;
- solidifying said heat hardening material for the blocking of said wound component on said printed circuit.

The above objects are also achieved by the present battery charger for vehicles, comprising at least an electronic circuit connectable to the battery of a vehicle and suitable for charging said battery, said electronic circuit having at least one

printed circuit and at least one wound component electronically connected to said printed circuit, characterized by the fact that said wound component is fixed to said printed circuit and by the fact that said electronic circuit comprises at least a layer of solidified heat hardening material deposited onto at least a portion of said printed circuit and in correspondence to said wound component for the blocking of said wound component on said printed circuit.

#### Brief Description of the Drawings

Other characteristics and advantages of the present invention will become more evident from the description of a preferred, but not sole, embodiment of a procedure for the manufacture of battery chargers for vehicles and a battery charger thus obtainable, illustrated purely as an example but not limited to the annexed drawings in which:

Figure 1 is an axonometric and partial section view of the battery charger according to the invention;

Figures from 2 to 8 show different steps of the procedure according to the invention.

#### Embodiments of the Invention

With particular reference to figure 1, globally indicated by 1 is a battery charger for vehicles, usable in particular for recharging batteries of electric vehicles.

The battery charger 1 comprises an electronic circuit, indicated altogether in figure 1 by the reference 2, connectable to the battery of a vehicle and suitable for recharging the battery itself.

In particular, the electronic circuit 2 comprises:

- a printed circuit 3;
  - a plurality of electronic components 4 suitable for processing the supply voltages and currents and made up, e.g., of electronic power components, condensers, etc.;
  - a plurality of wound components 5 made up, e.g., of components such as transfonners, filters and inductances.
- In particular, the wound components 5 are large-size components usable for powers in the region of kW.

The electronic components 4 are fixed to the printed circuit 3 and are connected

electronically to the conductive tracks of the printed circuit itself.

Advantageously, the wound components 5 are also directly fixed to the printed circuit 3 and are electronically connected to the conductive tracks of the printed circuit itself.

5 Consequently, in a different way compared to the state of the art, where the large-size wound components are housed inside a separate module and connected to the printed circuit by means of specific electric cables, in the battery charger 1 according to the present invention, the large-size wound components 5 are arranged and fixed directly to the printed circuit 3.

10 The electronic circuit 2 also comprises a template 6 anchored to the printed circuit 3 and having an outer retention wall 7 which surrounds the portion of the printed circuit on which the wound components 5 are fixed.

Advantageously, the electronic circuit 2 comprises a layer of solidified heat hardening material 8 deposited on the entire area of the printed circuit 3  
15 delimited by the template 6 and suitable for allowing the securing of the wound components 5 on the printed circuit itself.

In practice therefore, the layer of solidified heat hardening material 8 permits achieving a greater mechanical sturdiness of the electronic circuit 2, ensuring the securing of the large-size wound components 5 directly on the printed  
20 circuit 3.

Usefully, the layer of hardening material 8 also permits a uniform and efficient dispersion of the heat generated by the wound components 5 during normal operation.

Usefully, the heat hardening material 8 can be made up of a resin or of a like  
25 material.

The printed circuit 3 can be made using techniques of known type on a support in dielectric material of the vetronite type or like electrically insulating material. Alternatively, a preferred embodiment of the battery charger 1 contemplates the realization and the use of a printed circuit of the IMS (Insulated Metal  
30 Substrate) type.

In this case, therefore, the printed circuit 3 comprises a support in metal material, preferably aluminium, on which is deposited a dielectric layer.

As shown in particular in the figures 3 and 4, in the case of the use of a printed circuit 3 of the IMS type, the electronic circuit 2 comprises a plurality of supports 9 in dielectric material.

To each of the supports 9 is fixed a corresponding wound component 5.

5 In turn, each of the supports 9 is fixed to the support of the printed circuit 3.

The supports 9 are preferably plate-shaped and have an upper face suitable for accommodating the respective wound component 5 and a lower face associable integral with the printed circuit 3.

Different conformations of the supports 9 cannot however be ruled out.

10 Advantageously, the use of the supports 9 allows fixing the wound components 5 to the printed circuit 3 with the metal support without the risk of power connection between the wound components and the printed circuit themselves. Consequently, the use of the supports 9 allows avoiding undesired short-circuits.

15 This way, the use of a printed circuit 3 of the IMS type, together with the fixing of the wound components 5 to the printed circuit itself by means of the supports 9, allows obtaining a battery charger of reduced dimensions and with high thermal efficiency, at the same time simplifying the fitting of the wound components themselves.

20 The printed circuit 3 of the IMS type, in particular the metal support, does in fact allow considerably improving the dispersion of the heat produced during the use of the battery charger 1.

Usefully, each of the supports 9 can comprise electronic means of connection between the respective wound component 5 and the printed circuit 3.

25 In particular, each of the supports 9 can be made up in turn of a printed circuit, wherein the electronic means of connection are made up of suitable conductive tracks and/or suitable terminals on the support which electronically connect the wound component 5 to the printed circuit 3.

30 Furthermore, the battery charger 1 comprises a box 10 for housing and protecting the electronic circuit 2.

The procedure for the manufacture of the battery charger 1 is described below.

The procedure comprises the manufacture of the electronic circuit 2 connectable

to the battery of a vehicle and suitable for charging the battery.

In particular, the procedure comprises:

- manufacturing the printed circuit 3;
- fixing to the printed circuit electronic components 4 suitable for  
5 processing the supply voltages and currents and made up, e.g., of electronic  
power components, condensers or the like;
- the electronic connection of the electronic components 4 to the  
conductive tracks of the printed circuit.

The printed circuit 3 with the electronic components 4 is shown by way of  
10 example in figure 2.

Advantageously, the procedure according to the invention comprises the fixing  
of the large-size wound components, such as transformers, filters and  
inductances, directly to the printed circuit 3.

In particular, with reference to a preferred but not exclusive embodiment and as  
15 shown schematically in the figures 3 and 4, in the case of the use of a printed  
circuit 3 of the IMS type with metal support, the fixing of the wound  
components 5 to the printed circuit comprises:

- fixing each wound component 5 to a respective support 9 in dielectric  
material;
- 20 - fixing the support 9 to the printed circuit 3.

The procedure according to the invention further comprises the electronic  
connection of the wound components 5 to the conductive tracks of the printed  
circuit 3.

Usefully, for this purpose, each of the supports 9 can have electronic means of  
25 connection, not shown in the illustrations.

In particular, each of the supports 9 can in turn be made up of a printed circuit,  
wherein the electronic means of connection are made up of suitable conductive  
tracks and/or suitable terminals on the support, electronically connecting the  
wound component 5 to the printed circuit 3.

30 In this case, the procedure comprises:

- the connection of the wound component 5 to the electronic means of  
connection of the support 9;

the connection of the electronic means of connection of the support 9 to the printed circuit.

Advantageously, as shown in figure 5, the procedure comprises the anchoring of a template 6 to the printed circuit 3.

- 5 In particular, the template 6 has the outer retention wall 7 which surrounds an area of the printed circuit 3 wherein the wound components 5 are fixed.

As shown in figure 6, the procedure comprises depositing a layer of heat hardening material 8 on the printed circuit 3 in correspondence to the wound components 5.

- 10 The heat hardening material 8 is preferably made of a resin or a like material.

In particular, the heat hardening material 8 is deposited in such a way as to cover the entire area of the printed circuit 3 delimited by the outer wall 7 of the template 6.

- Consequently, the template 6 performs the function of containing the heat  
15 hardening material 8 still not solidified inside the predetermined area of the printed circuit 3.

The procedure subsequently comprises the solidification of the heat hardening material 8 for securing the wound components 5 on the printed circuit 3.

- In practice therefore, the layer of solidified heat hardening material 8 allows  
20 reaching a greater mechanical sturdiness of the electronic circuit 2, ensuring the securing of the large-size wound components 5 directly on the printed circuit 3.

Usefully, furthermore, the layer of hardening material 8 allows a uniform and efficient dispersion of the heat produced by the wound components 5 during normal operation.

- 25 Finally, as shown schematically in the figures 7 and 8, the electronic circuit 2 made this way is arranged and fixed inside the protection box 10 and is connected to suitable input and output connectors.

It has in point of fact been ascertained how the described invention achieves the proposed objects.



## CLAIMS

- 1) Procedure for the manufacture of battery chargers for vehicles, comprising a stage of manufacturing at least an electronic circuit (2) connectable to the battery of a vehicle and suitable for charging said battery, said electronic circuit
- 5 (2) having at least a printed circuit (3) and at least a wound component (5) electronically connected to said printed circuit (3), characterized by the fact that said stage of manufacturing comprises the steps of:
- fixing said wound component (5) to said printed circuit (3);
  - depositing a heat hardening material (8) onto at least one portion of said

10 printed circuit (3) in correspondence to said wound component (5);

  - solidifying said heat hardening material (8) for the blocking of said wound component (5) on said printed circuit (3).
- 2) Procedure according to claim 1, characterized by the fact that it comprises the step of anchoring at least one template (6) to said printed circuit (3), before
- 15 said step of depositing, said template (6) having at least an outer retention wall (7) which extends at least in part around said wound component (5).
- 3) Procedure according to claim 2, characterized by the fact that said depositing comprises covering with said heat hardening material (8) the entire area of said printed circuit (3) delimited by said outer wall (7) of the template (6).
- 20 4) Procedure according to one or more of the preceding claims, characterized by the fact that said stage of manufacturing comprises the step of fixing a plurality of wound components to said printed circuit (3) and by the fact that said outer wall (7) of the template (6) surrounds said plurality of wound components.
- 25 5) Procedure according to one or more of the preceding claims, characterized by the fact that said heat hardening material (8) is of the resin type or the like.
- 6) Procedure according to one or more of the preceding claims, characterized by the fact that said printed circuit (3) comprises at least a support made of dielectric material.
- 30 7) Procedure according to one or more of the preceding claims, characterized by the fact that said printed circuit (3) comprises at least a support made of metal material.

8) Procedure according to one or more of the preceding claims, characterized by the fact that said step of fixing comprises the steps of:

- fixing said wound component (5) to at least a support (9) made of dielectric material;

5       - fixing said support (9) to said printed circuit (3).

9) Procedure according to claim 8, characterized by the fact that said support (9) made of dielectric material comprises electronic means of connection between said wound component (5) and said printed circuit (3) and by the fact that said step of connecting comprises:

10       - after said step of fixing said wound component (5) to said support (9), a step of electronically connecting said wound component (5) to said electronic means of connection of the support (9);

- after said step of fixing said support (9) to said printed support (3), a step of electronically connecting said electronic means of connection of the support (9) to said printed circuit (3).

10) Procedure according to one or more of the preceding claims, characterized by the fact that it comprises the step of arranging said electronic circuit (2) inside a protection box (10).

11) Battery charger (1) for vehicles, comprising at least an electronic circuit (2) connectable to the battery of a vehicle and suitable for charging said battery, said electronic circuit (2) having at least one printed circuit (3) and at least one wound component (5) electronically connected to said printed circuit (3), characterized by the fact that said wound component (5) is fixed to said printed circuit (3) and by the fact that said electronic circuit (2) comprises at least a layer of solidified heat hardening material (8) deposited onto at least a portion of said printed circuit (3) and in correspondence to said wound component (5) for the blocking of said wound component (5) on said printed circuit (3).

12) Battery charger (1) according to claim 11, characterized by the fact that said electronic circuit (2) comprises at least a template (6) anchored to said printed circuit (3), said template (6) having at least an outer retention wall (7) which extends at least in part around said wound component (5).

13) Battery charger (1) according to claim 12, characterized by the fact that said

solidified heat hardening material (8) covers the entire area of said printed circuit (3) delimited by said outer wall (7) of the template (6).

14) Battery charger (1) according to one or more of claims from 11 to 13, characterized by the fact that said electronic circuit (2) comprises a plurality of wound components fixed to said printed circuit (3) and by the fact that said  
5 outer wall (7) of the template (6) surrounds said plurality of wound components.

15) Battery charger (1) according to one or more of claims from 11 to 15, characterized by the fact that said printed circuit (3) comprises at least one support made of dielectric material and/or one support made of metal material.

10 16) Battery charger (1) according to one or more of claims from 11 to 18, characterized by the fact that said electronic circuit (2) comprises at least a support (9) made of dielectric material, said wound component (5) being fixed to said support (9) and said support (9) being fixed to said printed circuit (3).

15 17) Battery charger (1) according to the claim 17, characterized by the fact that said support (9) made of dielectric material comprises electronic means of connection between said wound component (5) and said printed circuit (3).

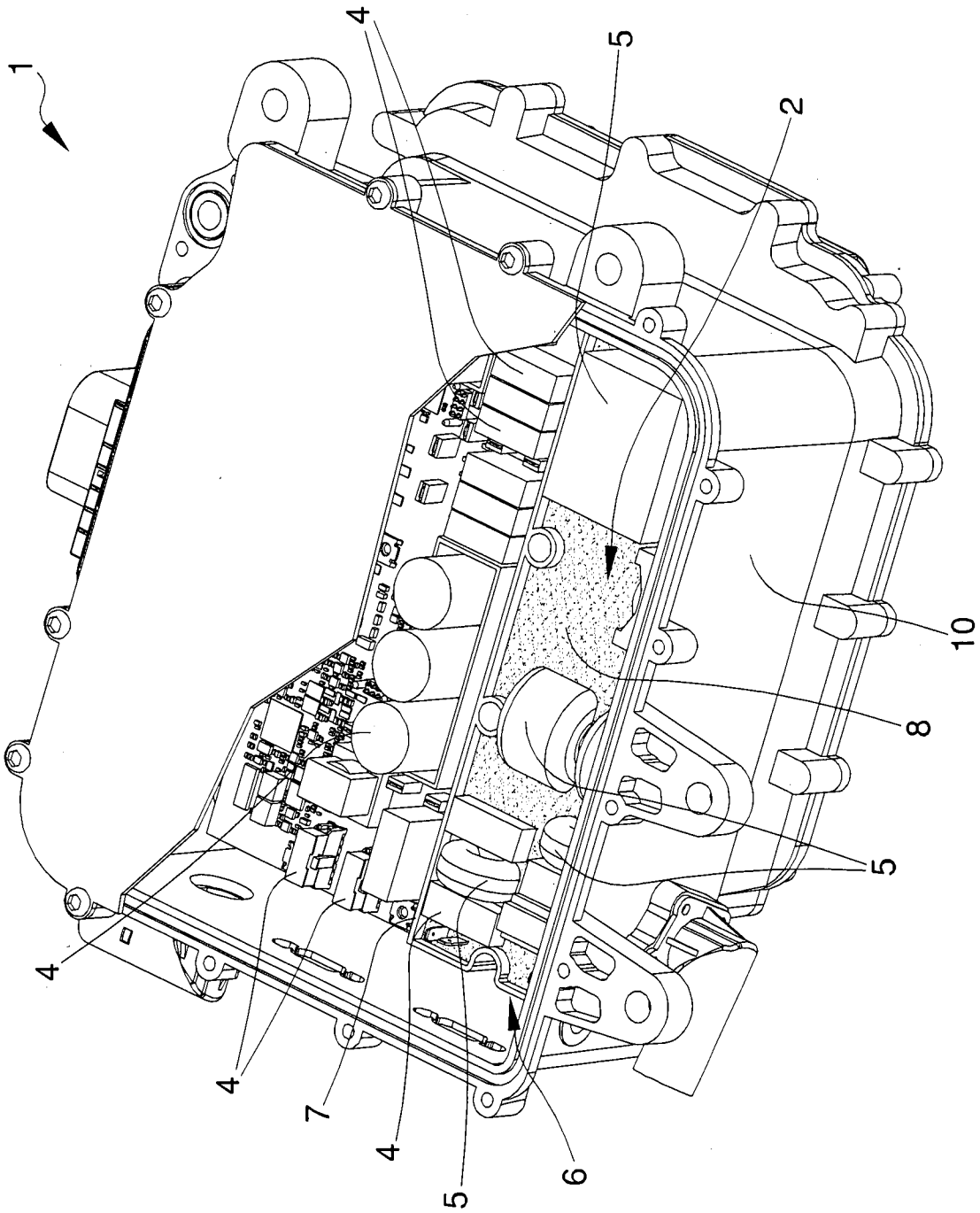


Fig. 1

Fig. 2

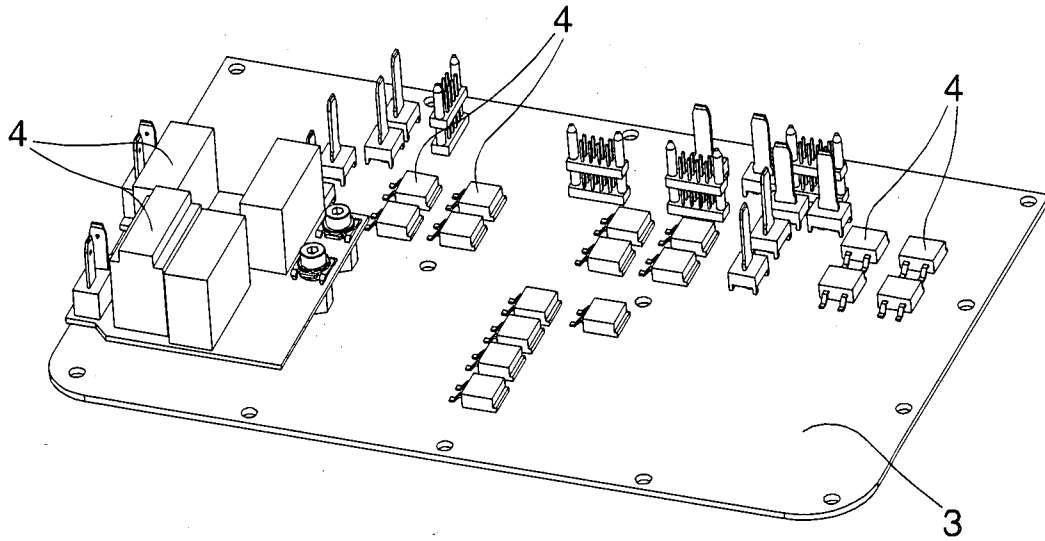


Fig. 3

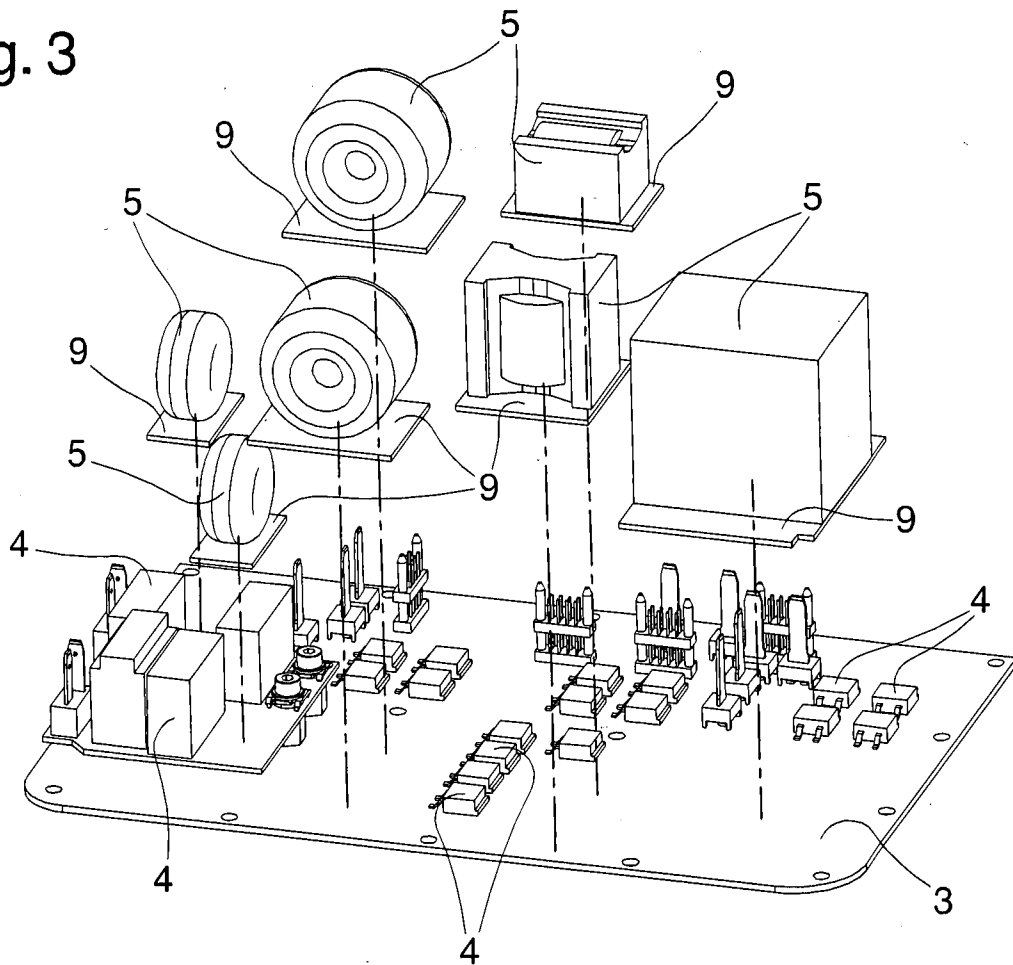


Fig. 4

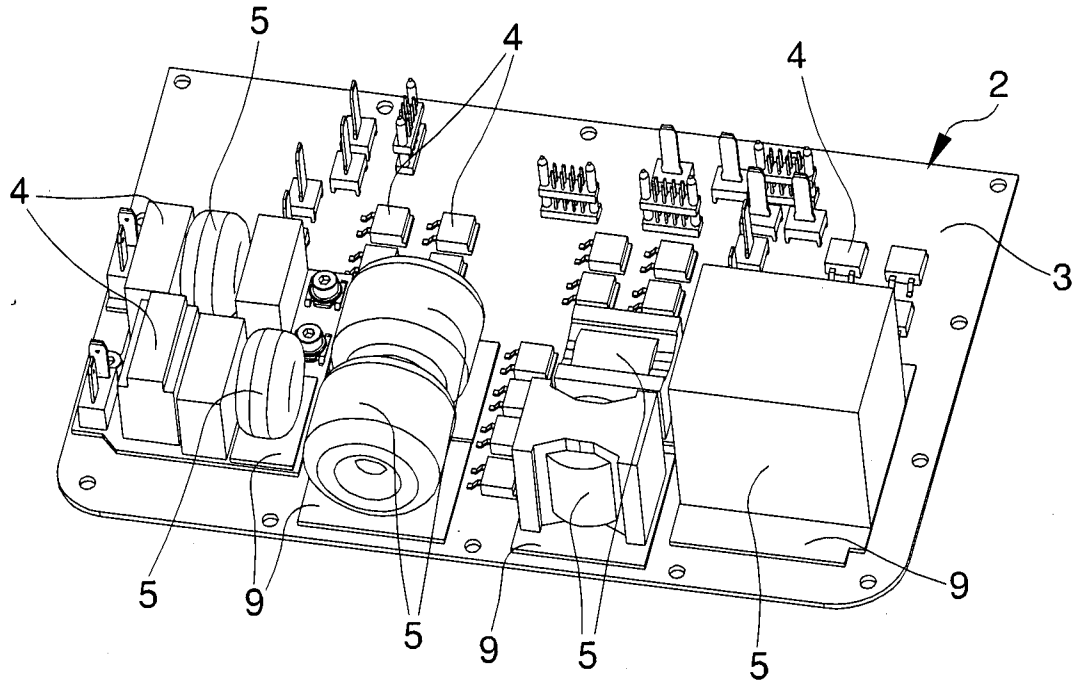


Fig. 5

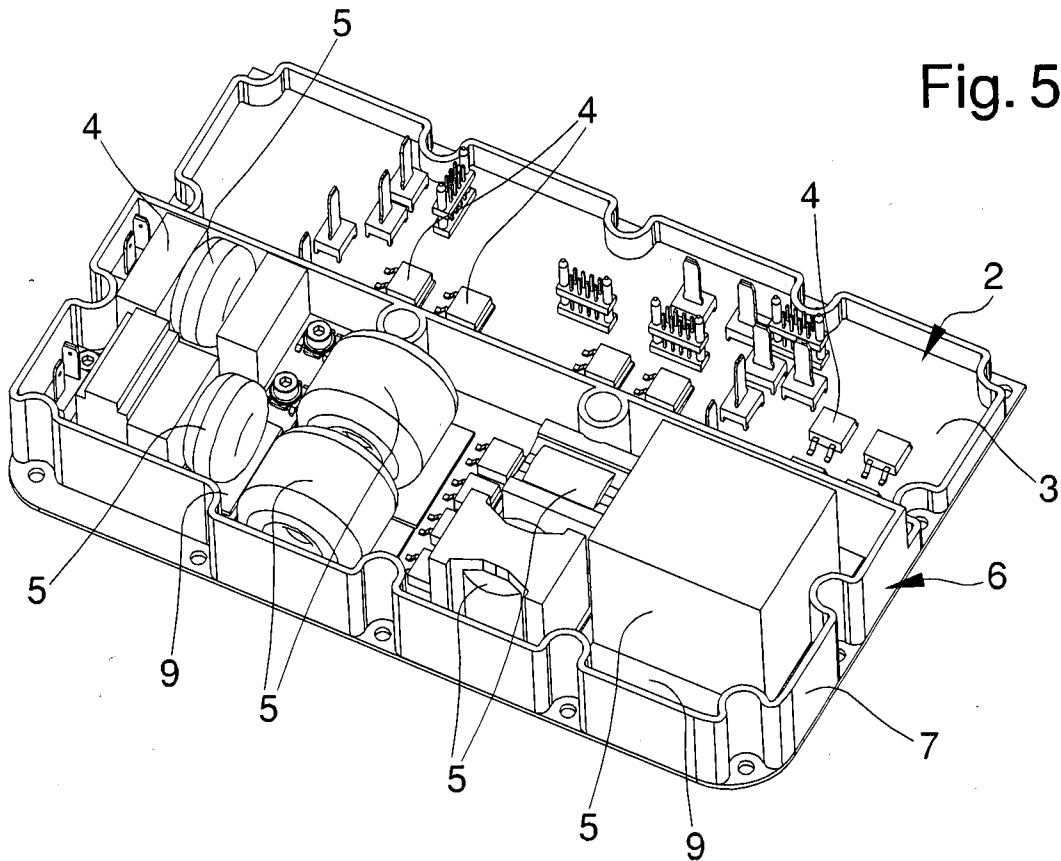


Fig. 6

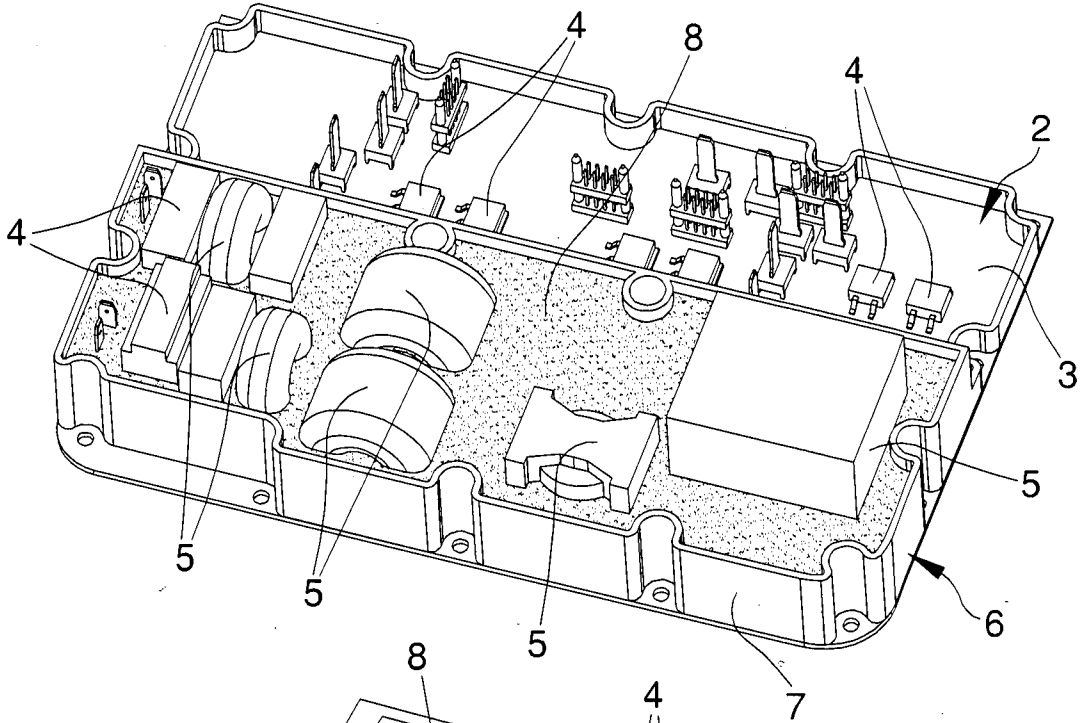
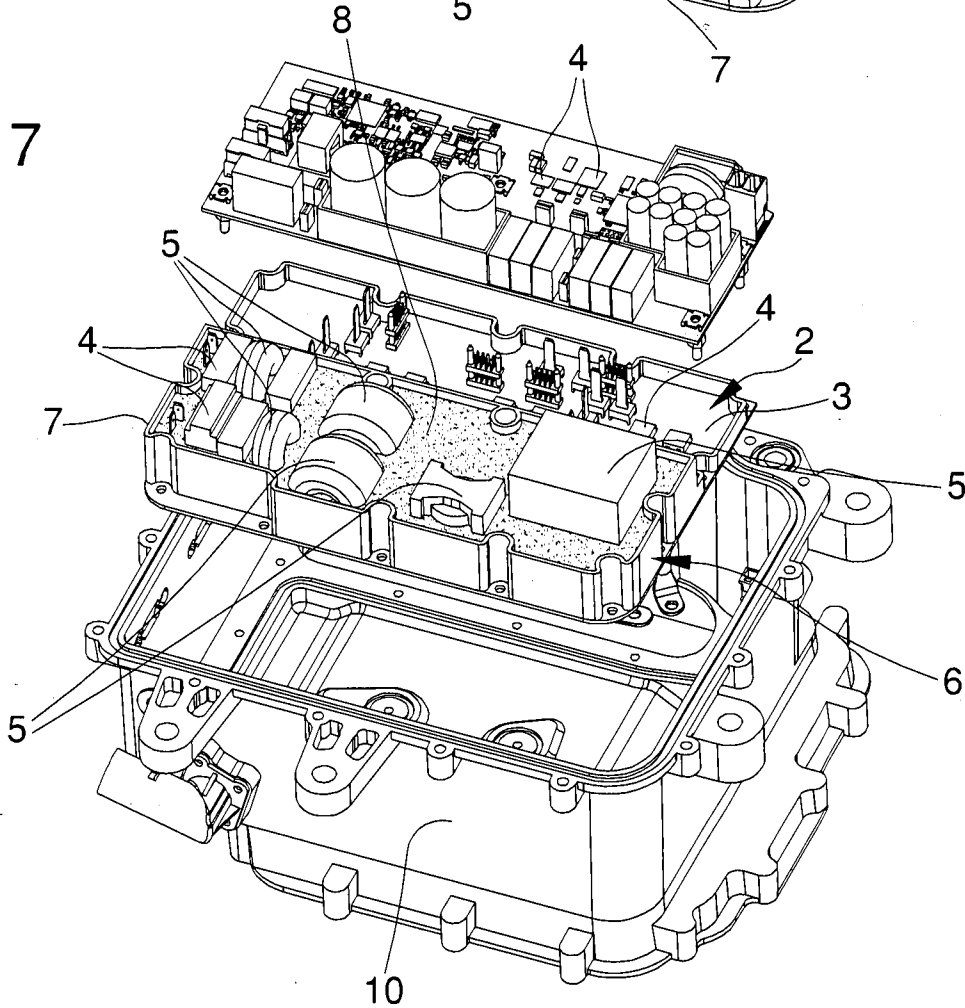


Fig. 7



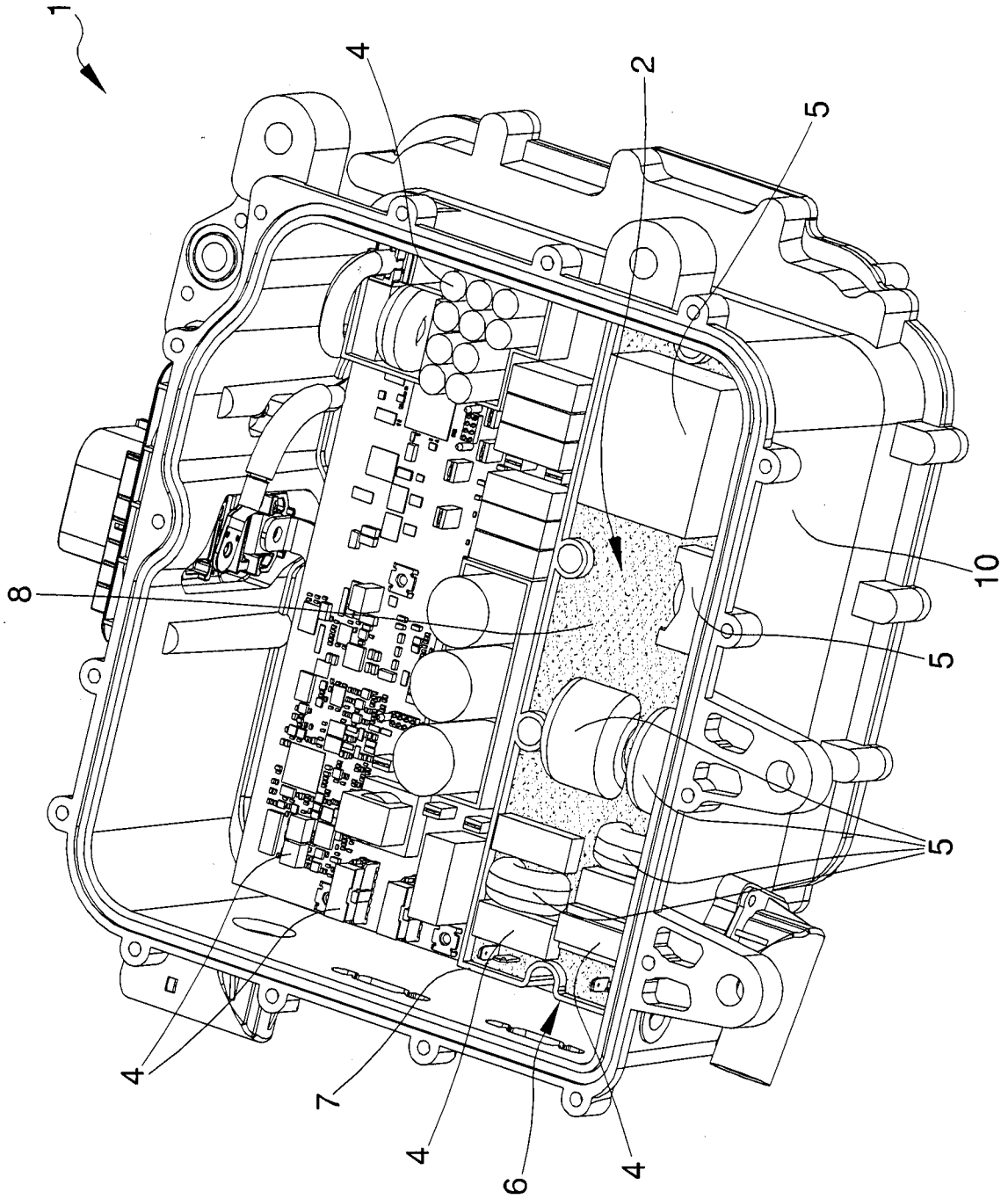


Fig. 8



**INTERNATIONAL SEARCH REPORT**

International application No  
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A. CLASSIFICATION OF SUBJECT MATTER  
**INV. H02J7/00 H02M3/00**  
 ADD.  
 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)  
**H02J H02M B60L H05K**

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 practicable, 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	US 2005/083665 AI (NAKASHIMA KOJI [JP] ET AL) 21 April 2005 (2005-04-21) paragraphs [0025] - [0033] paragraphs [0053], [0055] figures 1a, 1B, 2, 4	1-17
X	US 2008/150623 AI (LIN MOU-SHIUNG [TW] ET AL) 26 June 2008 (2008-06-26) paragraphs [0078], [0149] - [0156]; figure 12	1, 11
A	US 2005/052888 AI (TAKESHIMA YOSHIHIRO [JP] ET AL) 10 March 2005 (2005-03-10) PCB in thermoset; paragraphs [0061] - [0063]; figure 1	1-17

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

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
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"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search <b>4 February 2013</b>	Date of mailing of the international search report <b>13/02/2013</b>
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## INTERNATIONAL SEARCH REPORT

International application No  
PCT/IB2012/002594

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 336 254 A (DANFOSS AS [DK] ) 13 October 1999 (1999-10-13) the whole document	1, 11
A	----- US 2010/277121 AI (HALL KATHERINE L [US] ET AL) 4 November 2010 (2010-11-04) paragraphs [0239] , [0240] -----	1-17

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No <b>PCT/IB2012/002594</b>
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005083665	AI	21-04-2005	CN 1685595 A 19-10-2005
			US 2005083665 AI 21-04-2005
			Wo 2005025042 AI 17-03-2005
-----			
US 2008150623	AI	26-06 -2008	NONE
-----			
us 2005052888	AI	10-03 -2005	CN 1585248 A 23-02 -2005
			US 2005052888 AI 10-03 -2005
-----			
GB 2336254	A	13-10 -1999	DE 19813639 AI 25-11 -1999
			GB 2336254 A 13-10 -1999
			US 6091604 A 18-07 -2000
-----			
US 2010277121	AI	04-11 -2010	NONE
-----			