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(54) Title: METHOD FOR PRODUCING BUSBAR DUCTS AND DUCTS OBTAINED

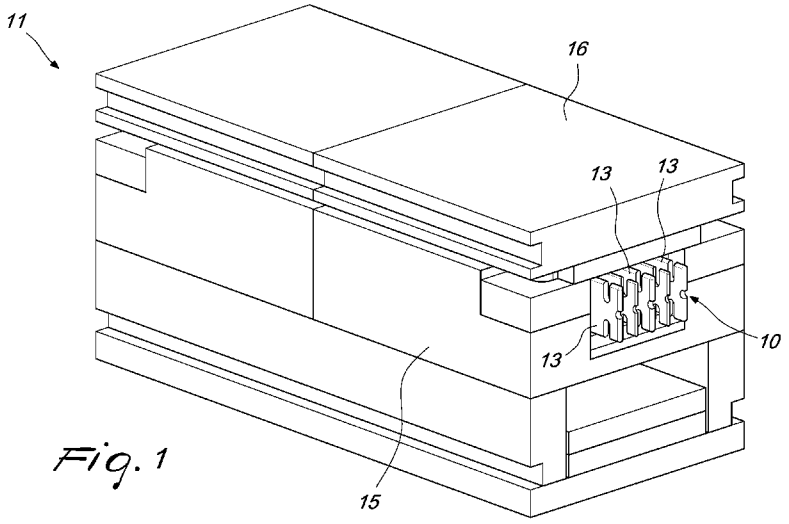


Fig. 1

(57) Abstract: A method for providing busbar ducts, comprising the steps of: preparing a mold (11); performing a co-molding of metallic bars (13) of the busbar ducts simultaneously with an insulating material (14); the insulating material (14) being constituted by a thermosetting composite reinforced with glass fibers.

METHOD FOR PRODUCING BUSBAR DUCTS AND DUCTS OBTAINED

The present invention relates to a method for providing busbar ducts and to the ducts thus obtained. More particularly, the invention relates to a method for providing prefabricated and modular busbar ducts that allow to distribute power in work environments, where electrical machines of a certain power are to be installed.

As is known, busbar ducts are constituted by individual metallic bars, made of copper or aluminum, on which an insulator is applied and which are assembled appropriately inside a metallic enclosure.

The processes required to provide these busbar ducts are currently the following.

First of all, a plurality of tapes of insulating film (polypropylene and Mylar) are wrapped around each individual bar. The bars are then taped together so as to increase the structural stability of the item in case of a short circuit.

The bars are then bent at the uninsulated terminal point so as to space them, an operation that is made necessary by the previously mentioned taping.

The processes described above entail the use of labor, which has a considerable impact on the cost of the finished product.

Moreover, there are busbar ducts of the compact type in which, in particularly aggressive environmental conditions, the electrical insulation of the busbar duct is ensured by the use of an epoxy resin which, having arrived by pouring, incorporates inside it the busbars, leaving available only the terminals (in this case the application of the insulating film, the taping step and the end bending step are not necessary).

At assembly time, the joints of the busbar ducts also are embedded in place in the resin, creating an electrical distribution system that is entirely insulated from the environment in which it is placed.

The busbar duct of the compact type described above in any case has high production costs, due both to the cost of the epoxy resin used and to the low productivity of the process caused by the resin hardening times (approximately 12 hours).

Moreover, the article obtained with the method described above is considerably heavier than a standard busbar duct, with additional assembly costs.

The aim of the present invention is to provide a method for providing busbar ducts that allows increased productivity with respect to methods and busbar ducts of the known type.

Within this aim, an object of the present invention is to provide a method for providing busbar ducts and a corresponding duct that lacks the insulating film that characterizes standard busbar ducts.

Another object of the present invention is to provide a method and a busbar duct that do not require a taping operation.

Another object of the present invention is to provide a method and a busbar duct that do not require a bar bending operation.

Another object of the present invention is to provide a busbar duct that has a reduced weight with respect to busbar ducts of the known type.

Another object of the present invention is to provide a busbar duct that has a reduced insulation cost by way of the minimal quantity that is needed.

Another object of the present invention is to provide a busbar duct that is highly reliable, relatively simple to provide and at competitive costs.

This aim and these and other objects that will become better apparent hereinafter are achieved by a method for providing busbar ducts, characterized in that it comprises the steps of:

preparing a mold;

performing a co-molding of metallic bars of the busbar ducts simultaneously with an insulating material;

said insulating material being constituted by a thermosetting composite reinforced with glass fibers, said thermosetting composite having a polymeric matrix selected among polyester-based, epoxy-based, phenolic-based, vinyl ester-based, vinyl ester-hybrid based polymeric matrices.

Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment, of the busbar duct according to the present invention, illustrated by way of nonlimiting example in the accompanying drawings, wherein:

Figure 1 is a perspective view of a mold for providing the method according to the present invention;

Figure 2 is an exploded perspective view of the mold of Figure 1;

Figure 3 is a transverse sectional view of the mold of Figures 1 and 2.

With reference to the figures, the busbar duct according to the invention, generally designated by the reference numeral 10, is provided by means of a co-molding process, in which the metallic bars 13 are co-molded simultaneously with the insulation 14, which is constituted by a thermosetting composite reinforced with glass fibers, having a polymeric matrix selected among polymeric matrices, for example:

polyester-based (SMC and BMC);

epoxy-based;

phenolic-based;

vinyl ester-based;

vinyl ester-hybrid based.

The technology that can be used for co-molding can be selected among:

hot compression molding of thermosetting material;

hot injection molding of thermosetting material;

hot injection-compression molding of thermosetting material;

hot transfer molding of thermosetting material;

cold molding of thermosetting material with cross-linking by UV irradiation.

Among the molding technologies listed above, hot compression molding of thermosetting material has turned out to be the technology that has the best characteristics for the invention, since it allows to reduce molding times to the order of minutes, thanks to the cross-linking rate of the materials used, differently from what occurs with vacuum and pressure casting methods.

Moreover, the compression co-molding step allows to provide the busbar duct in a single step.

A mold with seats for fixing the bars is used to perform the method described above.

The mold, designated by the reference numeral 11, therefore comprises, at the lower mold part 15, adapted seats 12 for fixing the bars 13 of the busbar duct 10.

Once the bars 13 have been inserted in the mold 11, and once the composite 14 (the insulation) has been introduced, the mold closes with its upper mold part 16 and, by means of an applied pressure, covers the bars 13 with an insulating layer 14 with a thickness of, for example, a few millimeters along the entire length of the bars 13, thanks to the fluidization and subsequent cross-linking of the composite proper.

The entire co-molding cycle might last for example about 5 minutes for a polyester- or vinyl ester-based composite, approximately 10 minutes instead for an epoxy-based or phenolic-based composite, with a considerable increase in productivity with respect to traditional methods for the production of busbar ducts.

The method thus described allows, with respect to busbar ducts of the standard type, to avoid the wrapping of a plurality of layers of insulating film, to avoid the taping operation and to avoid the bar bending operation.

Moreover, this allows to adjust directly in the field the length of the busbar ducts, thus being able to obviate any design errors.

It is in fact possible, during installation and with an appropriate apparatus (milling machine), if necessary, to act on the useful length of the busbar duct, removing the excess insulation.

With respect instead to busbar ducts of the compact type, the method according to the invention allows to reduce the weight of the busbar duct due to the reduced quantity of composite with respect to the resin for casting.

It also allows to reduce the cost of the insulation, in view of the smaller quantity of insulation, the lower cost of the composite (resin + filler + glass) with respect to pure epoxy resin.

In practice it has been found that the method for providing busbar ducts according to the present invention fully achieves the intended aim and objects.

The method thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims. All the details may further be replaced with other technically equivalent elements.

In practice, the materials used, as well as the contingent shapes and dimensions, may be any according to requirements and to the state of the art.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

CLAIMS

1. A method for providing busbar ducts, characterized in that it comprises the steps of:

preparing a mold (11);

performing a co-molding of metallic bars (13) of the busbar ducts simultaneously with an insulating material (14);

said insulating material (14) being constituted by a thermosetting composite reinforced with glass fibers, said thermosetting composite having a polymeric matrix selected among polyester-based, epoxy-based, phenolic-based, vinyl ester-based, vinyl ester-hybrid based polymeric matrices.

2. The method according to claim 1, characterized in that said co-molding method is performed according to a method of hot compression molding of thermosetting material performed in a single step.

3. The method according to one or more of the preceding claims, characterized in that said thermosetting composite reinforced with glass fibers constitutes an insulation layer (14) that covers the entire surface of the bars (13) of said busbar ducts except for the terminal ends.

4. A busbar duct, characterized in that it is provided by means of a method according to one or more of the preceding claims.

5. A mold (11) for providing the method according to one or more of claims 1 to 3, characterized in that it comprises seats (12) adapted to fix the bars (13) of the busbar ducts.

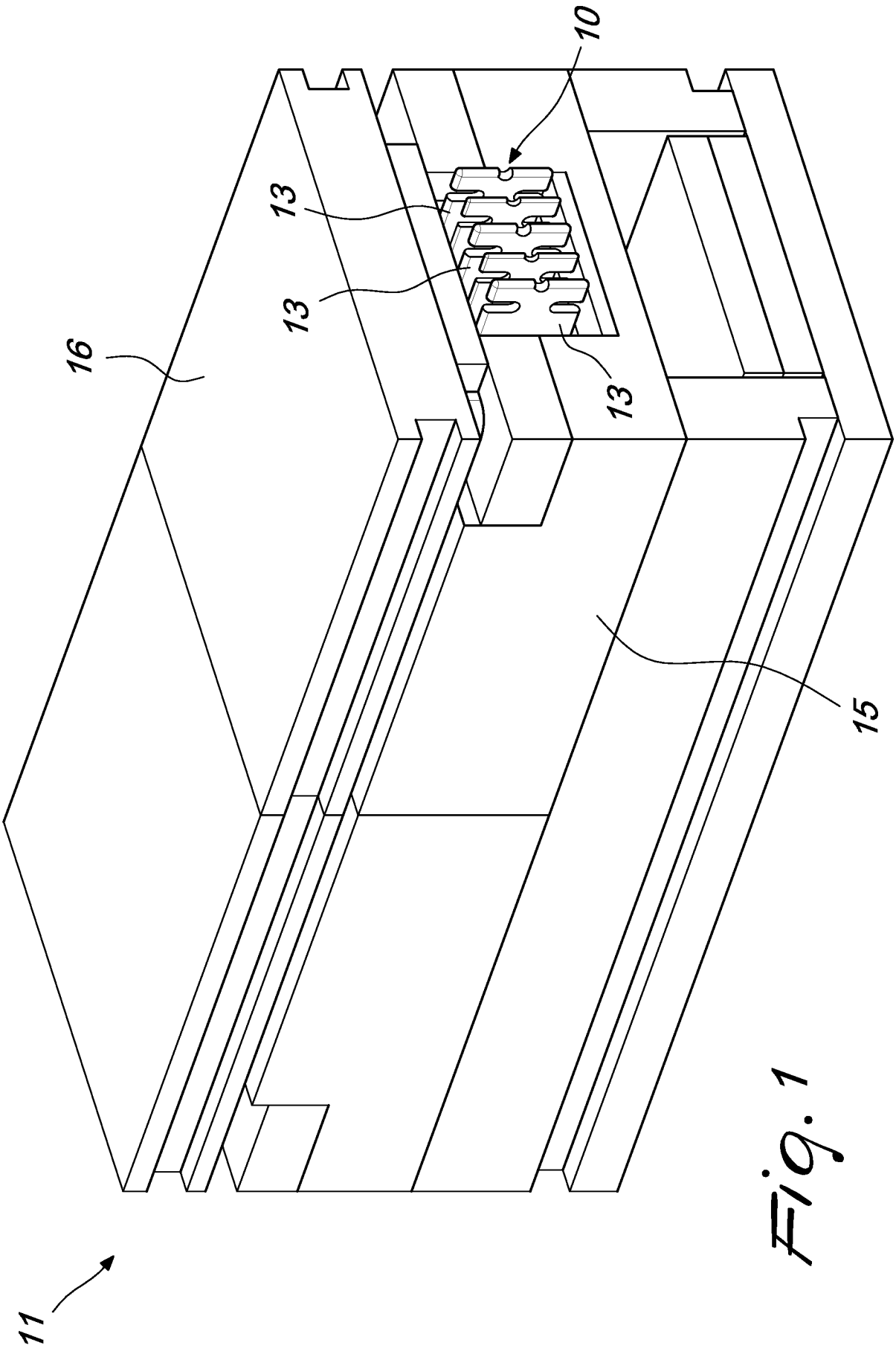


Fig. 1

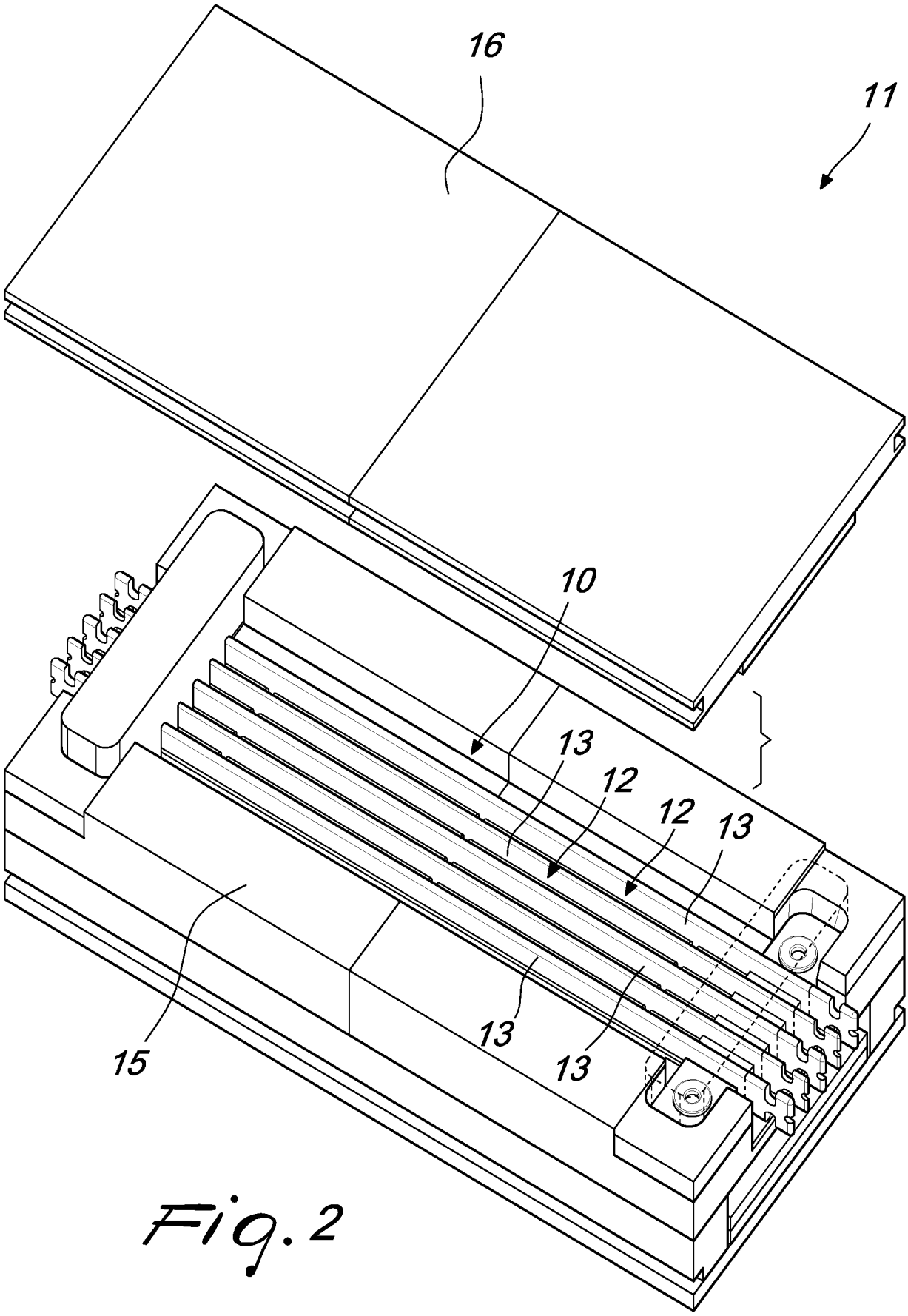


Fig. 2

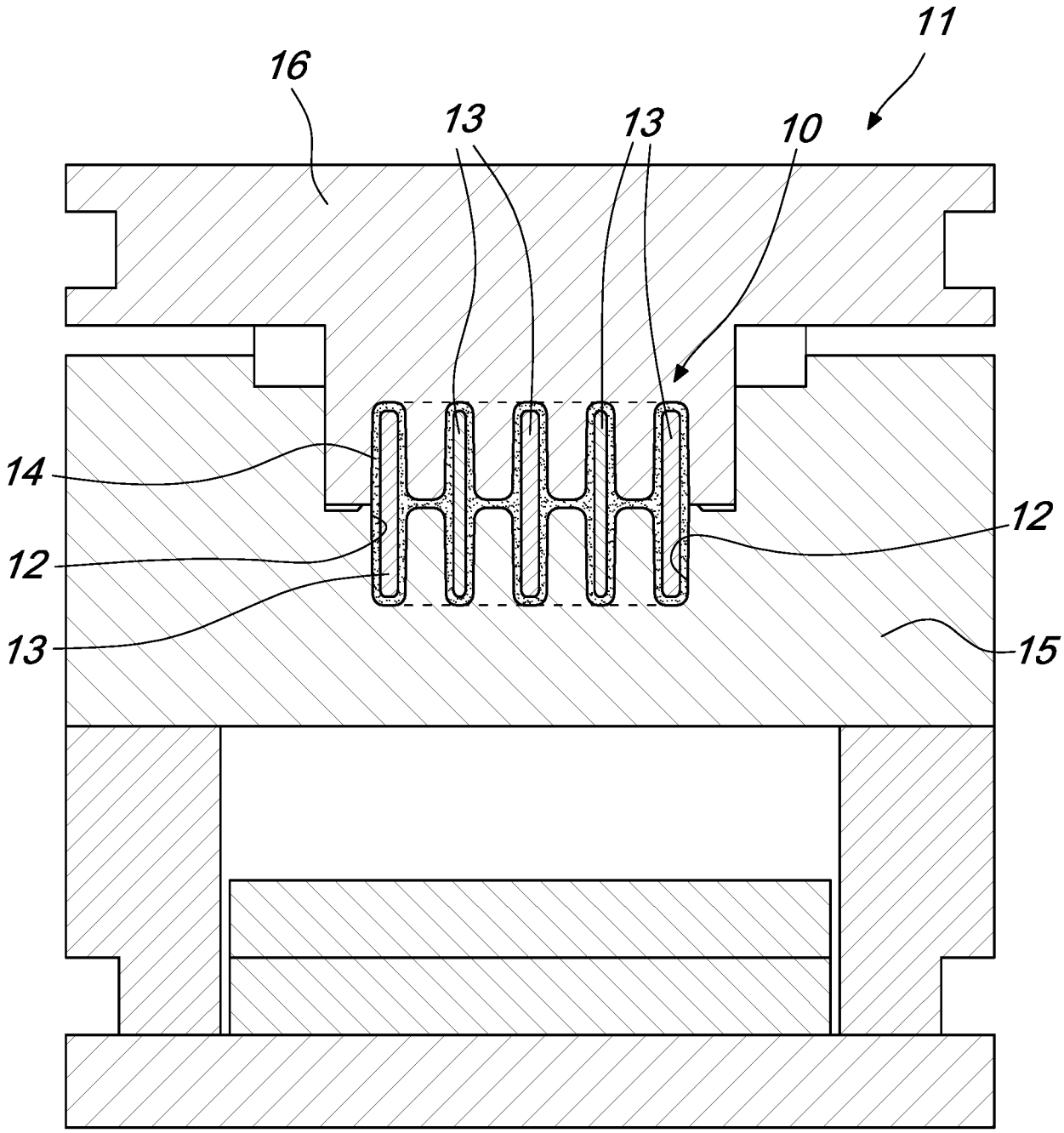


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/050400

A. CLASSIFICATION OF SUBJECT MATTER
INV. H02B1/00 H02G1/00 B29C43/18
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)
H02B H02G B29K B29L B29C

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 103 707 460 A (HICONICS TECHNOLOGY WUHAN CO LTD) 9 April 2014 (2014-04-09) Reference numerals 5,2,7 Fig. 1,2	1-5
A	US 2013/143426 A1 (FUJIWARA NAOYA [JP] ET AL) 6 June 2013 (2013-06-06) Fig.3 Bus Duct	1-5
A	EP 2 442 404 A1 (KOBE STEEL LTD [JP]) 18 April 2012 (2012-04-18) Isolation scheme - fig.3	1-5

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

☒ See patent family annex.

* Special categories of cited documents :

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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