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(54) **Titre : SEMI-PRODUIT COMPOSITE EN ALUMINIUM-CUIVRE POUR L'ELECTROTECHNIQUE ET SON PROCEDE DE FABRICATION**

(54) **Title: ALUMINIUM-COPPER COMPOSITE SEMI-FINISHED PRODUCT FOR ELECTRICAL ENGINEERING AND METHOD FOR PRODUCING SAME**

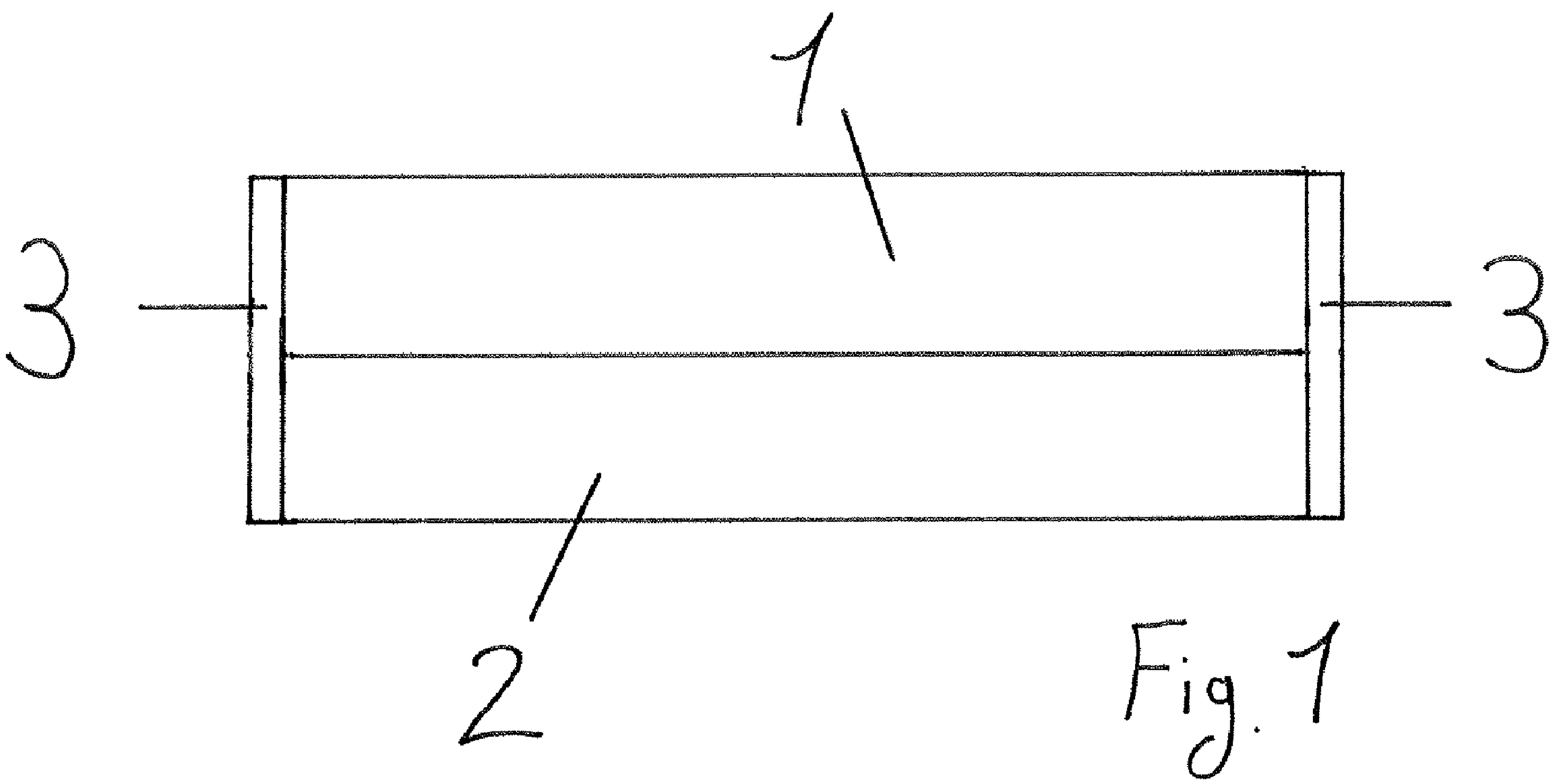

Fig. 1

(57) **Abrégé/Abstract:**
The invention relates to a semi-finished product for electrical engineering, which is a composite of an aluminum plate (1) and a copper plate (2). According to the invention, the semi-finished product bears an acrylate-based protective layer (3), which was

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(57) **Abrégé(suite)/Abstract(continued):**
applied as a lacquer containing at least one photoinitiator, which lacquer was cured by light exposure, with acrylate polymer, preferably acrylate copolymer, being formed. The invention further relates to a semi-finished good produced from such a semi-finished product. In addition, the invention relates to a method for producing such a semi-finished product.

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ABSTRACT

A semi-finished product for electrical engineering is described, which is a composite of an aluminium sheet 1 and a copper sheet 2. According to the invention, the semi-finished product bears an acrylate-based protective layer 3, which has been applied as a lacquer, which contains at least one photoinitiator and has been cured under the effect of light to form acrylate polymer, preferably acrylate copolymer. The invention also relates to an unfinished product produced from such a semi-finished product. A method for producing such a semi-finished product is also described.

(Figure 1)

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ALUMINIUM-COPPER COMPOSITE SEMI-FINISHED PRODUCT FOR ELECTRICAL ENGINEERING AND METHOD FOR PRODUCING SAME

DESCRIPTION

The invention relates to a semi-finished product for electrical engineering, which is a composite of an aluminium sheet and a copper sheet. Copper has high electrical conductivity but is an expensive raw material. Replacing some of the copper with aluminium makes it possible to produce less expensive and more lightweight semi-finished products. Such semi-finished products are also referred to as Al-Cu hybrid material and can be produced by plating aluminium sheets and copper sheets partly or completely overlapping.

A problem of aluminium-copper composite semi-finished products and the products produced therefrom is a very high susceptibility to corrosion of the aluminium-copper composite.

An object of the present invention is to discover a way to reduce the susceptibility to corrosion of aluminium-copper composite semi-finished product.

This object is achieved by a semi-finished product having the features specified in claim 1, an unfinished product produced from such a semi-finished product, and a method for producing a semi-finished according to claim 9.

According to the invention, the semi-finished product is provided with an acrylate-based protective layer instead of providing corrosion protection by means of a cost-intensive galvanised coating. Said protective layer does not need to cover the whole surface of the semi-finished product but can be applied in a targeted manner to the parts of the surface of the semi-finished product that require corrosion

protection, that is, are not used subsequently for electrical contacting. The protective layer is applied as a lacquer, which contains at least one photoinitiator. The lacquer is then cured under the effect of light to form acrylate polymer, preferably acrylate copolymer.

For example, aromatic epoxy acrylate monomers, aliphatic epoxy acrylate monomers and/or polyester acrylate monomers can be used as the acrylate monomers in the not yet cured lacquer. Suitable monomers are for example 2-phenoxyethyl acrylate monomers and tetrahydrofurfuryl acrylate monomers. In addition, acrylate oligomers, for example urethane acrylate oligomers or polyester-modified epoxy-di-acrylates, can be added to the lacquer.

An advantageous refinement of the invention provides for the lacquer to contain two or more different photoinitiators that have different absorption spectra. In this manner, the radiation-induced polymerisation can be greatly accelerated, since larger ranges of the spectrum of a radiation source can be utilised. This is a significant advantage for economical manufacture, since short polymerisation times imply correspondingly short exposure times of the semi-finished product under a radiation source. Particularly well-suited are photoinitiators that induce polymerisation of the lacquer under the effect of UV radiation. For example, trimethyl benzophenone, α-hydroxyketone, 2-hydroxy-2-methylpropiophenone, 2-hydroxy-2-methyl-1-phenylpropan-1-one and/or bis(2,4,6-trimethylbenzoyl)phenylphosphine oxide can be used as photoinitiators.

A further advantageous refinement of the invention provides for the lacquer to contain at least one adhesion promoter, preferably an acrylate-based adhesion promoter, as an additive. Particularly well-suited are methacrylate-based adhesion promoters, for example phosphoric acid

methacrylate. In this manner, the adhesion of the lacquer to the aluminium and copper surfaces of the semi-finished product can be improved. Alternatively or additionally, the lacquer can contain a substrate wetter, for example based on polysiloxane, and/or a rheological additive, preferably based on silicate, for example bentonite, phyllosilicate or silicic acid.

A further advantageous refinement of the invention provides for the lacquer to contain quartz powder and/or talcum as a filler.

A further advantageous refinement of the invention provides for the lacquer still to contain reactive monomers after curing under the effect of light, in order to allow improved adhesion between lacquer and plastic when the semi-finished product is further processed by encapsulation with plastic.

The lacquer used according to the invention can have the following constituents, for example:

- up to 40 wt%, preferably 20 to 35 wt% aromatic epoxy acrylate monomers,

- up to 15 wt%, preferably 5 to 15 wt% aliphatic epoxy acrylate monomers,

- 10 to 30 wt% reactive diluent,

- 0.5 to 10 wt% adhesion promoter,

- 1 to 10 wt% photoinitiator,

- 15 to 35 wt% filler or pigment,

- up to 10% additives, for example defoamer, substrate wetter, rheological additives, flow modifier, dispersants and/or thickener.

The weight percentages of the specified components can add up to 100 wt%, but can also be less in a lacquer if it contains additional components that are not specified above, for example acrylate oligomers, in particular urethane acrylate oligomers. Each component specified can be a mixture of different substances. For example, the lacquer can contain 1 to 10 wt% of a single photoinitiator or several photoinitiators that together add up to 1 to 10 wt%. Likewise, several different fillers or pigments can be used, for example.

An illustrative embodiment of the lacquer can have the following composition:

- 10 to 25 wt% 2-phenoxyethyl acrylate as monomers,
- 10 to 50 wt% epoxy acrylate as binder,
- 10 to 25 wt% tetrahydrofurfuryl acrylate as monomers,
- 5 to 10 wt% urethane acrylate oligomer as binder,
- 5 to 10 wt% 2-acrylic acid, reaction products with pentaerythritol as accompanying substances,
- 1 to 5 wt% 2-hydroxy-2 methyl propiophenone as photoinitiator,
- 1 to 5 wt% phenylbis(2,4,6-trimethylbenzoyl)-phosphine oxide as photoinitiator,
- up to 0.1 wt% acrylic acid as accompanying substance.

A semi-finished product according to the invention can be produced by placing an aluminium sheet and a copper sheet one on top of the other in an edge region and then joining them by rolling. It is also possible to place an aluminium sheet and a copper sheet such that one lies completely on top of the other and then to join them by rolling. The aluminium sheet can for example consist of AlSi1 or another aluminium alloy that preferably contains at least 99 wt% aluminium. The copper sheet can for example consist of OF copper or a copper alloy that contains at least 99 wt% copper. The copper sheet can for example also consist of bronze, in particular CuSnx where $x \leq 20$, or of brass, in particular CuZnx where $5 \leq x \leq 37$.

A semi-finished product according to the invention can be in the form of a sheet, for example a strip or hoop. A semi-finished product according to the invention can be further processed to form an unfinished product, for example by punching, bending or another forming method. During the production of an unfinished product according to the invention, a semi-finished product according to the invention can also have plastic moulded on or around it, for example.

Figure 1 schematically shows a sectional view of an illustrative embodiment of a semi-finished product according to the invention, which consists of an aluminium sheet 1 and a copper sheet 2. The semi-finished product bears an acrylate-based protective layer 3 on the sides on which the aluminium sheet 1 is adjacent to the copper sheet 2.

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CLAIMS

1. A semi-finished product for electrical engineering, which is a composite of an aluminium sheet (1) and a copper sheet (2), characterised in that the semi-finished product bears an acrylate-based protective layer (3), which has been applied as a lacquer, which contains at least one photoinitiator and has been cured under the effect of light to form acrylate polymer, preferably acrylate copolymer.

2. The semi-finished product according to claim 1, characterised in that the protective layer (3) contains at least 5 wt% urethane acrylate.

3. The semi-finished product according to claim 2, characterised in that the protective layer (3) contains no more than 15 % urethane acrylate, preferably no more than 10 wt% urethane acrylate.

4. The semi-finished product according to any one of the preceding claims, characterised in that the protective layer (3) contains at least 10 wt%, preferably at least 20 wt% epoxy acrylate.

5. The semi-finished product according to any one of the preceding claims, characterised in that the protective layer (3) contains at least 5 wt% ethyl acrylate, preferably 10 wt% to 25 wt% ethyl acrylate.

6. The semi-finished product according to any one of the preceding claims, characterised in that the lacquer contains two or more different photoinitiators.

7. The semi-finished product according to any one of the preceding claims, characterised in that the lacquer still contains reactive monomers after curing under

the effect of light, in order to allow improved adhesion between lacquer and plastic when the semi-finished product is further processed by encapsulation with plastic.

8. An unfinished product produced from a semi-finished product according to any one of the preceding claims.

9. A method for producing a semi-finished product for electrical engineering, in which a composite of an aluminium sheet (1) and a copper sheet (2) is produced, characterised in that an acrylate-based lacquer, which contains acrylate monomers and at least one photoinitiator, is applied to the composite, and then the acrylate monomers are polymerised under the effect of radiation.

10. The method according to claim 9, characterised in that at least some of the acrylate monomers are aromatic or aliphatic epoxy acrylate monomers.

11. The method according to claim 8 or 10, characterised in that at least some of the acrylate monomers are polyester acrylate monomers.

12. The method according to any one of claims 9 to 11, characterised in that the lacquer contains a reactive diluent.

13. The method according to any one of claims 9 to 12, characterised in that at least some of the acrylate monomers contain at least two ethylenic double bonds per molecule.

14. The method according to any one of claims 9 to 13, characterised in that the lacquer contains an adhesion promoter, preferably an acrylate-based adhesion

promoter, particularly preferably a methacrylate-based adhesion promoter, as an additive.

15. The method according to any one of claims 8 to 13, characterised in that the lacquer contains a substrate wetter, preferably based on polysiloxane, as an additive.

16. The method according to any one of claims 9 to 15, characterised in that the composite is produced from an aluminium sheet (1) and a copper sheet (2), in which the aluminium sheet (1) and the copper sheet (2) are placed one above the other in an edge region and then joined by rolling.

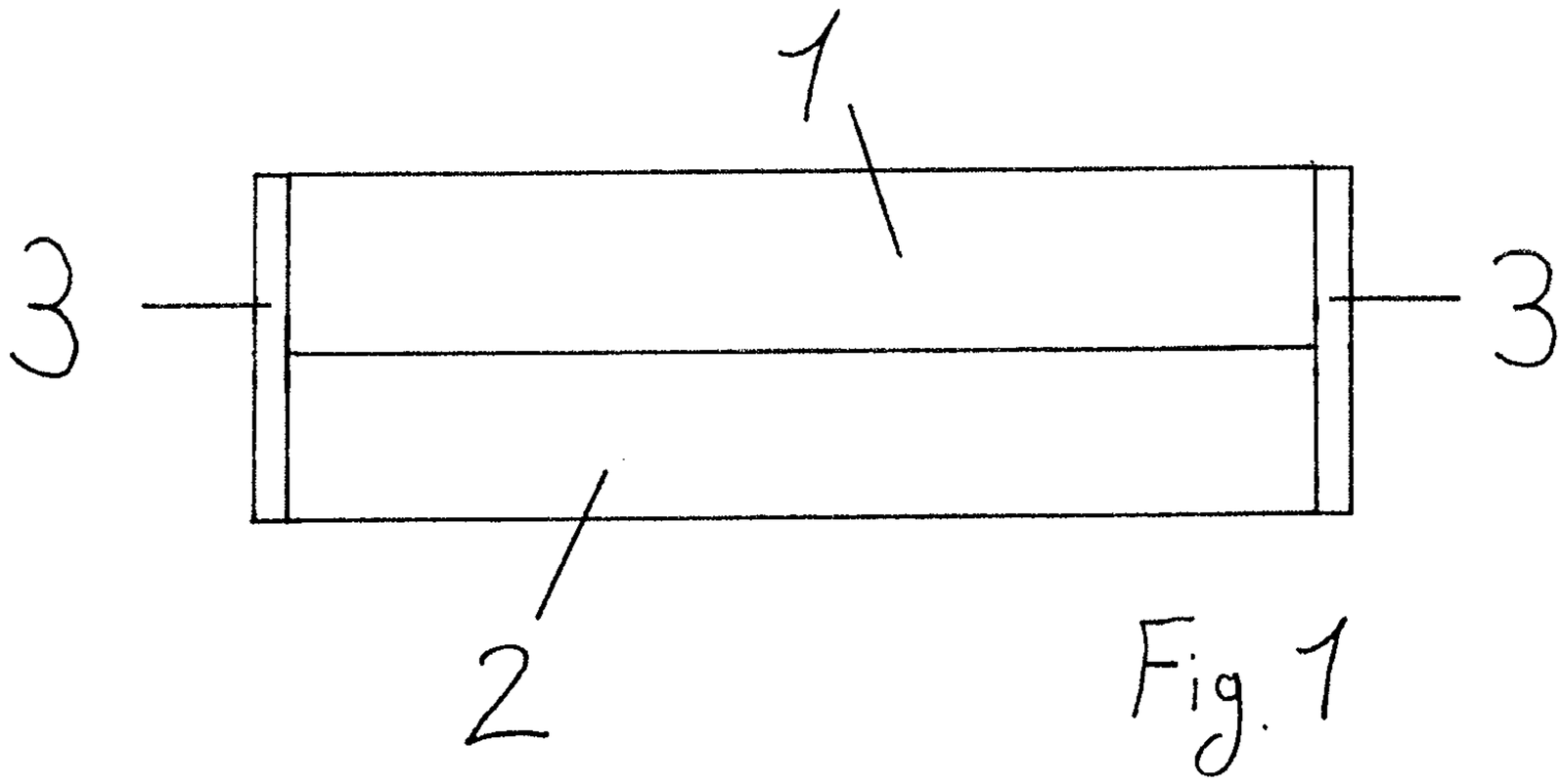

Fig. 1

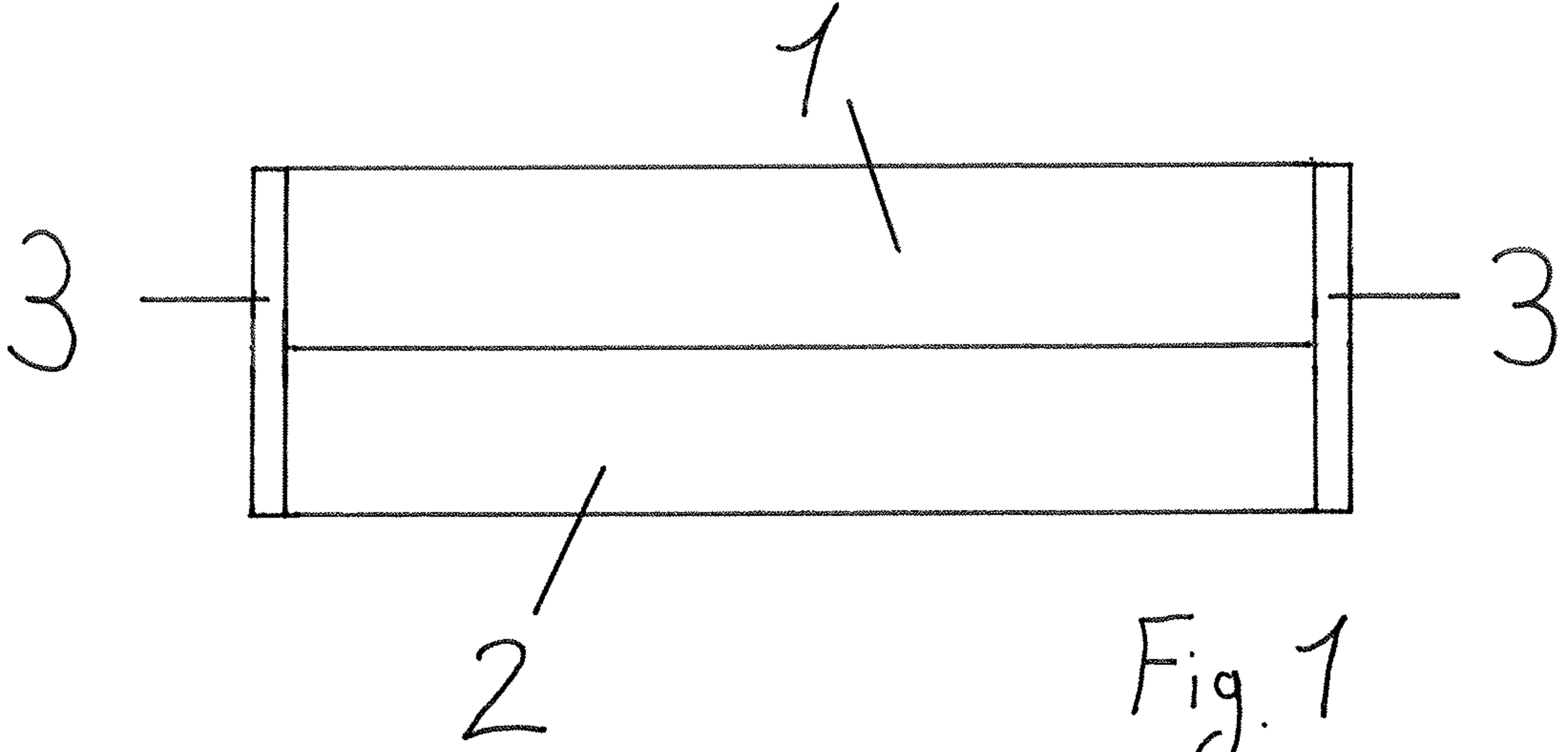

Fig. 1