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(54) **Title:** A HEAT MODULE FOR A FLOORING, A HEAT MODULE DEVICE, A HEAT MODULE ARRANGEMENT, A METHOD FOR PRODUCING A HEAT MODULE, AND USE OF SUCH MODULE, DEVICE AND ARRANGEMENT

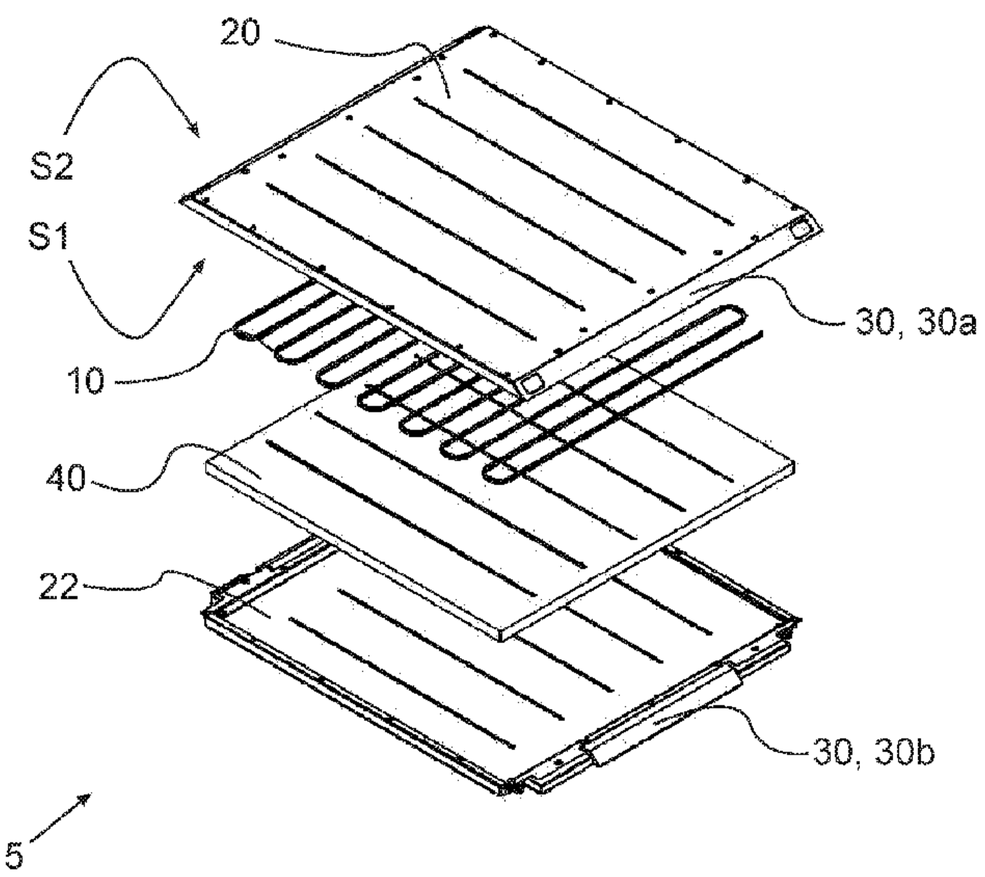

Fig. 2

(57) **Abstract:** A heat module (5) for a flooring (3). The heat module (5) comprises a stepping plate (20) having a first side (S1) and a second side (S2), at least one heat element (10) arranged along the first side (S1) of the stepping plate (20), and a water impermeable insulator (40) at the first side (S1) of the stepping plate (20). The at least one heat element (10) is attached to the first side (S1) of the stepping plate (20) so that emitted heat is directly con-ducted to the stepping plate (20).

[Continued on next page]

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A HEAT MODULE FOR A FLOORING, A HEAT MODULE DEVICE, A HEAT MODULE ARRANGEMENT, A METHOD FOR PRODUCING A HEAT MODULE, AND USE OF SUCH MODULE, DEVICE AND ARRANGEMENT

Introduction

The present invention relates to a heat module for a flooring, in particular an outdoor flooring. The heat module comprises a stepping plate having a first side and a second side, and at least one heat element arranged along the first side of the stepping plate. The second side of the stepping plate is configured to be stepped on by a person. The at least one heat element is configured to emit heat. The heat module further comprises a water impermeable insulator at the first side of the stepping plate arranged so that the at least one heat element is isolated from the surrounding environment.

The present invention further relates to a heat module device, a heat module arrangement, a method for producing a heat module, and use of such module, device and arrangement.

Prior art

A problem with prior art heat modules is the presence of air pockets in the module in which condensed water is accumulating. The accumulated water cannot be drained from the module or alternatively is difficult to drain. The accumulated water increases the risk of earth leakage between module and internal electrical components. This construction also has lower mechanical impact resistance due to stepping plate thickness only provides the load bearing, or mechanical girders are causing weight increase.

When prior art heat modules are made of massive rubber or polyurethane, this construction are causing high weight on module, and still water may ingress along power supply cable to heating cable inside.

US2004245234A1 discloses an outdoor-use heating mat system comprising at least one heating mat. The heating mat includes a base layer, a heating element, a plurality of intermediate strips, a thermal conductor layer and a traffic-exposed structural layer. Forces applied to traffic-exposed layer will be directed through intermediate strips. The thickness of the traffic-exposed layer is preferably 1/8 inch or thicker.

Summary of the invention

The invention has for its object to remedy or to reduce at least one of the drawbacks of the prior art, or at least provide a useful alternative to prior art.

This object is achieved through features, which are specified in the description below and in the claims that follow. In particular, an object of the invention is to provide an improved heat module that prevents condensed water from accumulating. A further objection of the invention is to provide an improved heat module with low weight and thickness.

The object of the invention is provided by means of a heat module for a flooring, wherein the heat module comprises

- a stepping plate having a first side and a second side, wherein the second side of the stepping plate is configured to be stepped on by a person,
- at least one heat element arranged along the first side of the stepping plate, wherein the at least one heat element is configured to emit heat, and
- a water impermeable insulator at the first side of the stepping plate arranged so that the at least one heat element is isolated from the surrounding environment,

wherein the at least one heat element is attached to the first side of the stepping plate so that the emitted heat is directly conducted to the stepping plate.

By attaching the at least one heat element to the first side of the stepping plate, the emitted heat is conducted directly to the stepping plate and enabling the water impermeable insulator to isolate the at least one heat element from the surrounding environment.

According to an embodiment of the invention, the heat module comprises a base plate spaced apart from the stepping plate forming a spacing, wherein the at least one heat element and the insulator are confined in said spacing. The stepping plate and the base plate form the spacing to which the insulator is configured to be introduced for isolating the at least one heat element from the surrounding environment.

According to an embodiment of the invention, the module comprises a connection member configured to hold the stepping plate and the base plate together and isolate the spac-

ing from the surrounding environment. The connection member further has the function of maintaining the spacing between the base plate and the stepping plate.

According to an embodiment of the invention, the stepping plate mainly comprises aluminium. Aluminium has the advantage of providing relatively low weight and high thermal conductivity.

According to an embodiment of the invention, the stepping plate has a wall thickness in an interwall between 0,5 and 3 mm. A low thickness is preferably for reducing the overall weight and cost of the heat module.

According to an embodiment of the invention, the stepping plate has been processed by a rolling rib. Processing the stepping plate by a rolling rib has the advantage of enabling the stepping plate to be produced with low thickness and accordingly low weight.

According to an embodiment of the invention, the base plate mainly comprises a rigid structural material, such as a metal plate or extruded epoxy.

According to an embodiment of the invention, the at least one heat element is attached to the stepping plate by means of one of an adhesive tape, such as aluminium tape, a glue connection, such as heat transferring glue, and a bolt connection.

According to an embodiment of the invention, the heat module comprises at least one further connection member for connecting the at least one heat element to the stepping plate, wherein the at least one further connection member is attached to the stepping plate or coextruded with the stepping plate. The stepping plate is for example extruded in aluminium.

According to an embodiment of the invention, the at least one heat element comprises electric conductive material configured to be provided with an electric current.

According to an embodiment of the invention, the at least one heat element comprises an electric self-regulating heating cable. The self-regulating heating cable is configured to self-regulate to a temperature or a temperature interval.

According to an embodiment of the invention, the at least one heat element comprises an electric heating cable, a heat mat or a heating paint.

According to an embodiment of the invention, the module comprises connection means, such as a bolt connection or a magnet connection, for connecting the module to the floor-

ing.

According to an embodiment of the invention, the module comprises one or more legs for holding the module elevated from the flooring.

According to an embodiment of the invention, the insulator mainly comprises a polymeric foam, such as one of epoxy-foam and polyurethane-foam. The polymeric foam of providing support to the stepping plate.

According to an embodiment of the invention, the insulator is filling the spacing to more than 99.5 %.

According to an embodiment of the invention, the stepping plate comprises an anti-slip layer at the second side opposite to the first side.

The object of the invention is further obtained by means of a heat module device comprising a heat module according to any embodiment above and a power source configured to provide electric power to the at least one heat element.

The object of the invention is further obtained by means of a heat module arrangement comprising a heat module device according to above and two or more heat modules having the respective at least one heat element connected to each other.

The object of the invention is further obtained by means of a method for producing a heat module, the method comprises the steps of:

- arranging a stepping plate having a first side and a second side, and a base plate next to each other and spaced apart forming a spacing,
- attaching at least one heat element along the first side of the stepping plate in the spacing, and
- filling the spacing with a flowable water impermeable insulator.

The filling of the spacing is preferably realized by means of a mixing machine.

According to an embodiment of the invention, the method comprises:

- connecting the at least one heat element to a power source for heating the insulator so that the insulator is curing. The power supply is arranged outside the spacing of the heat module.

According to an embodiment of the invention, the method comprises:

- providing an anti-slip layer on the second side of the stepping plate.

The object of the invention is further obtained by means of use of a heat module according to any of above embodiments, use of heat device according to any of above embodiments and use of heat module arrangement according to any of above embodiments.

Brief description of drawings

In the following is described examples of preferred embodiments illustrated in the accompanying drawings, wherein:

Fig. 1 discloses a heat module arrangement according to an embodiment of the invention, wherein the heat module arrangement comprises two heat modules connected;

Fig. 2 discloses an embodiment of the heat module in fig. 1 in an exploded view;

Fig. 3a discloses a further embodiment of arrangement of a heat module in fig. 2;

Fig. 3b discloses a further embodiment of arrangement of a heat module in fig. 2;

Fig. 3c discloses a further embodiment of arrangement of a heat module in fig. 2;

Fig. 3d discloses a further embodiment of arrangement of a heat module in fig. 2;

Fig. 3e discloses a further embodiment of a heat module in fig. 2; and

Fig. 4 discloses an embodiment of a method of producing a heat module.

Detailed description

Fig. 1 discloses a heat module arrangement 1 according to an embodiment of the invention. The heat module arrangement 1 is configured to be arranged on or in a flooring 3. The heat module arrangement 1 comprises a heat module device comprising two or more heat modules 5, each comprising at least one heat element 10 (visible in fig. 2), and an electric power source 15 connected to the at least one heat element 10. The heat module arrangement 1 further comprises a junction box 18 connecting the heat elements 10 of the heat modules 5. In fig. 1 two heat modules 5 are shown. However, it shall be understood that further heat modules 5 may be connected correspondingly.

In fig. 2 an embodiment of one of the heat modules 5 from fig. 1 is disclosed in an exploded view. The heat module 5 comprises a stepping plate 20 and a base plate 22. The stepping plate 20 comprises a first side S1 and second side S2. The at least one heat element

10 is attached to the first side S1 of the stepping plate 20 so that the emitted heat is directly conducted to the stepping plate 20. The second side S2 of the stepping plate 20 is configured to be step on by a person.

The heat modules 5 further comprises a connection member 30 configured to connect the stepping plate 20 and the base plate 22 and hold them separated from each other, thereby forming a spacing. The connection member 30 further has the function of isolating the spacing from the surrounding environment. In the disclosed embodiment, the connection member 30 comprises a first portion 32a at the stepping plate 20 and a second portion 32b at the base plate 22. The first portion 32a and the second portion 32b are configured to jointly connect the stepping plate 20 and the base plate 22.

According to an embodiment of the invention, the stepping plate 20 comprises an anti-slip layer at the second side S2.

The heat modules 5 in fig. 1 further comprises a water impermeable insulator 40 arranged so that the at least one heat element 10 is isolated from the surrounding environment. The insulator 40 is for example an epoxy-foam or a polyurethane-foam. According to an embodiment, the insulator 40 is arranged filling said spacing to more than 99.5 %. In addition to isolating the heat element 10 from the surrounding environment, and directing the heat to the stepping plate 20, in certain embodiments where the insulator is epoxy-foam or polyurethane-foam, also adds significant structural strength to the heat modules 5.

The stepping plate 20 comprises for example aluminium and has a wall thickness in an interwall between 0,5 and 3 mm. Preferably, the stepping plate 20 has been processed by a rolling rib. By preparing the stepping plate 20 by means of such a rolling rib, it becomes possible to provide the stepping plate 20 with a very low thickness, considerably reducing the weight of the heat module 5.

The at least one heat element 10 is preferably attached to the stepping plate 20 by means of one of an adhesive tape, such as aluminium tape, a glue connection, such as heat transferring glue, and a bolt connection. Alternatively, the heat modules 5 comprises at least one further connection member 42 for connecting the at least one heat element 10 to the stepping plate 20. The at least one further connection member 42 is attached to the stepping plate 20 or coextruded with the stepping plate 20. See fig. 3e.

The base plate 22 mainly comprises a rigid structural material, such as a metal plate or extruded epoxy.

The at least one heat element 10 preferably comprises an electric self-regulating heating cable. The electric self-regulating heating cable enables the temperature to be regulated to a predetermined temperature or a predetermined temperature interval. Alternatively, the at least one heat element 10 comprises an electric heating cable, a heat mat or a heating paint.

According to an embodiment, the heat module 5 comprises connection means 44, such as a bolt connection or a magnet connection, for connecting the heat module 5 to the flooring 3. Alternatively, the heat module 5 comprises one or more legs 50 for holding the heat module 5 elevated from the flooring 3.

In fig. 3a-e are different embodiments of the heat module 5 or arrangements of the heat module 5 disclosed. In fig. 3a is the heat module 5 configured for mounting on top of a flooring 3 or a deck by connection means 44, such as by magnets, bolts or brackets. In fig. 3b the heat module 5 is configured to be arranged elevated from the flooring 3 by means of two legs 50. In fig. 3c is the heat module 5 configured to be arranged connected to side bearing beams 55, thereby forming self-bearing steps of a staircase. In fig. 3d is the heat module 5 configured to be mounted on top of a step 60 of a staircase. In fig. 3e is an embodiment of the stepping plate 20 and the further connection member 42 disclosed.

Fig. 4 discloses a flow diagram of one embodiment of a method for producing a heat module 5 according to the invention. In a step 110, the method comprises arranging a stepping plate 20 having a first side S1 and a second side S2, and a base plate 22 next to each other and spaced apart forming a spacing. In a step 120, the method comprises attaching the at least one heat element 10 along the first side S1 of the stepping plate 20 in the spacing. Thereby, the emitted heat from the at least one heat element 10 is configured to be conducted directly to the stepping plate 20. In a step 130, the method comprises filling the spacing with a flowable water impermeable insulator 40, such as such as one of epoxy-foam and polyurethane-foam.

The method preferably also comprises

- connecting the at least one heat element 10 to a power source 15 for heating the insulator 40 so that the insulator 40 is curing.

In a further alternative step, the method comprises:

- providing an anti-slip layer on the second side S2 of the stepping plate 20.

It should be noted that the above-mentioned embodiments illustrate rather than limit the

invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "comprise" and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

Claims

1. A heat module (5) for a flooring (3), the heat module (5) comprises
- a stepping plate (20) having a first side (S1) and a second side (S2), wherein the second side (S2) of the stepping plate (20) is configured to be stepped on by a person,
- at least one heat element (10) arranged along the first side (S1) of the stepping plate (20), wherein the at least one heat element (10) is configured to emit heat, and
- a water impermeable insulator (40) at the first side (S1) of the stepping plate (20) arranged so that the at least one heat element (10) is isolated from the surrounding environment,
characterised in that the at least one heat element (10) is attached to the first side (S1) of the stepping plate (20) so that the emitted heat is directly conducted to the stepping plate (20).

2. The heat module (5) according to claim 1, wherein the heat module (5) comprises a base plate (22) spaced apart from the stepping plate (20) forming a spacing, wherein the at least one heat element (10) and the insulator (40) are confined in said spacing.

3. The heat module (5) according to any of claims 1 and 2, wherein the heat module (5) comprises a connection member (30) configured to hold the stepping plate (20) and the base plate (22) and isolate the spacing from the surrounding environment.

4. The heat module (5) according to any of the previous claims, wherein the stepping plate (20) mainly comprises aluminium.

5. The heat module (5) according to any of the previous claims, wherein the stepping plate (20) has a wall thickness in an interwall between 0,5 and 3 mm.

6. The heat module (5) according to any of the previous claims, wherein the stepping plate (20) has been processed by a rolling rib.

7. The heat module (5) according to any of the previous claims, wherein the base plate (22) mainly comprises a rigid structural material, such as a metal plate or extruded epoxy.

8. The heat module (5) according to any of the previous claims, wherein the at least one heat element (10) is attached to the stepping plate (20) by means of one of an adhesive tape, such as aluminium tape, a glue connection, such as heat transferring glue, and a bolt connection.

9. The heat module (5) according to any of the previous claims, wherein the heat module (5) comprises at least one further connection member (42) for connecting the at least one heat element (10) to the stepping plate (20), wherein the at least one further connection member (42) is attached to the stepping plate (20) or co-extruded with the stepping plate (20).

10. The heat module (5) according to any of the previous claims, wherein the at least one heat element (10) comprises electric conductive material configured to be provided with an electric current.

11. The heat module (5) according to any of the previous claims, wherein the at least one heat element (10) comprises an electric self-regulating heating cable.

12. The heat module (5) according to any of the previous claims, wherein the at least one heat element (10) comprises an electric heating cable, a heat mat or a heating paint.

13. The heat module (5) according to any of the previous claims, wherein the heat module (5) comprises connection means (44), such as a bolt connection or a magnet connection, for connecting the heat module (5) to the flooring (3).

14. The heat module (5) according to any of the previous claims, wherein the heat module (5) comprises one or more legs (50) for holding the heat module (5) elevated from the flooring (3).

15. The heat module (5) according to any of the previous claims, wherein said insulator (40) mainly comprises a polymeric foam, such as one of epoxy-foam and polyurethane-foam.

16. The heat module (5) according to any of the previous claims, wherein the insulator (40) is filling said spacing to more than 99.5 %.

17. The heat module (5) according to any of the previous claims, wherein the stepping plate (20) comprises an anti-slip layer at the second side (S2).

18. A heat module device comprising a heat module (5) according to any of claim 1-17 and a power source (15) configured to provide electric power to the at least one heat element (10).

19. A heat module arrangement (1) comprising a heat module device according to claim 18 and two or more heat modules (5) having the respective at least one heat element (10) connected to each other.

20. A method for producing a heat module (5), wherein the method comprises the steps of:
- arranging a stepping plate (20) having a first side (S1) and a second side (S2), and a base plate (22) next to each other and spaced apart forming a spacing,
- attaching at least one heat element (10) along the first side (S1) of the stepping plate (20) in the spacing, and
- filling the spacing with a flowable water impermeable insulator (40).

21. The method according to claim 20, wherein the method comprises:
- connecting the at least one heat element (10) to a power source for heating the insulator (40) so that the insulator (40) is curing.

22. The method according to any of claims 20 and 21, wherein the method comprises:
- providing an anti-slip layer on the second side (S2) of the stepping plate (20).

23. Use of a heat module (5) according to any of claims 1-17.

24. Use of a heat device according to claim 18.

25. Use of a heat module arrangement according to claim 19.

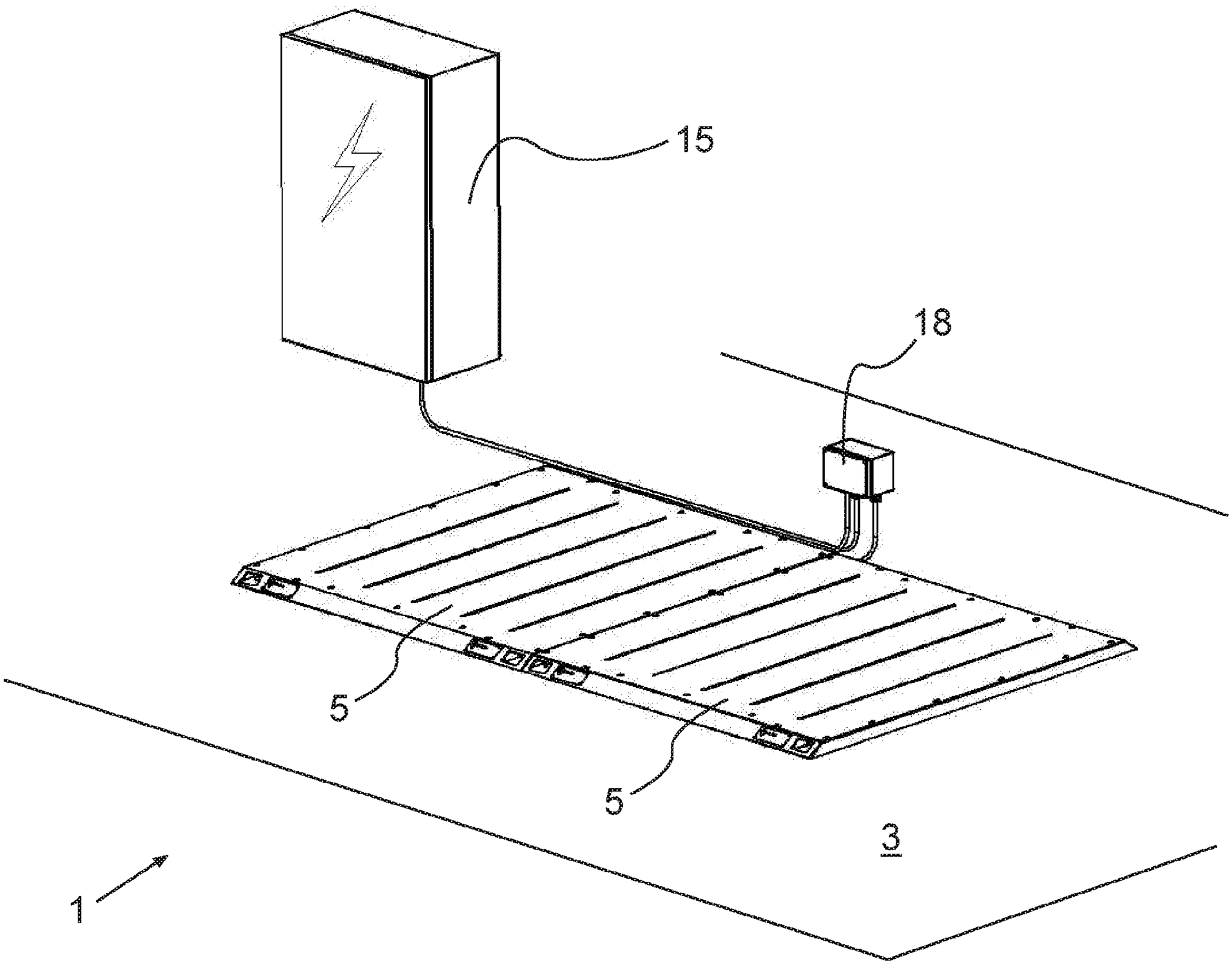

Fig. 1

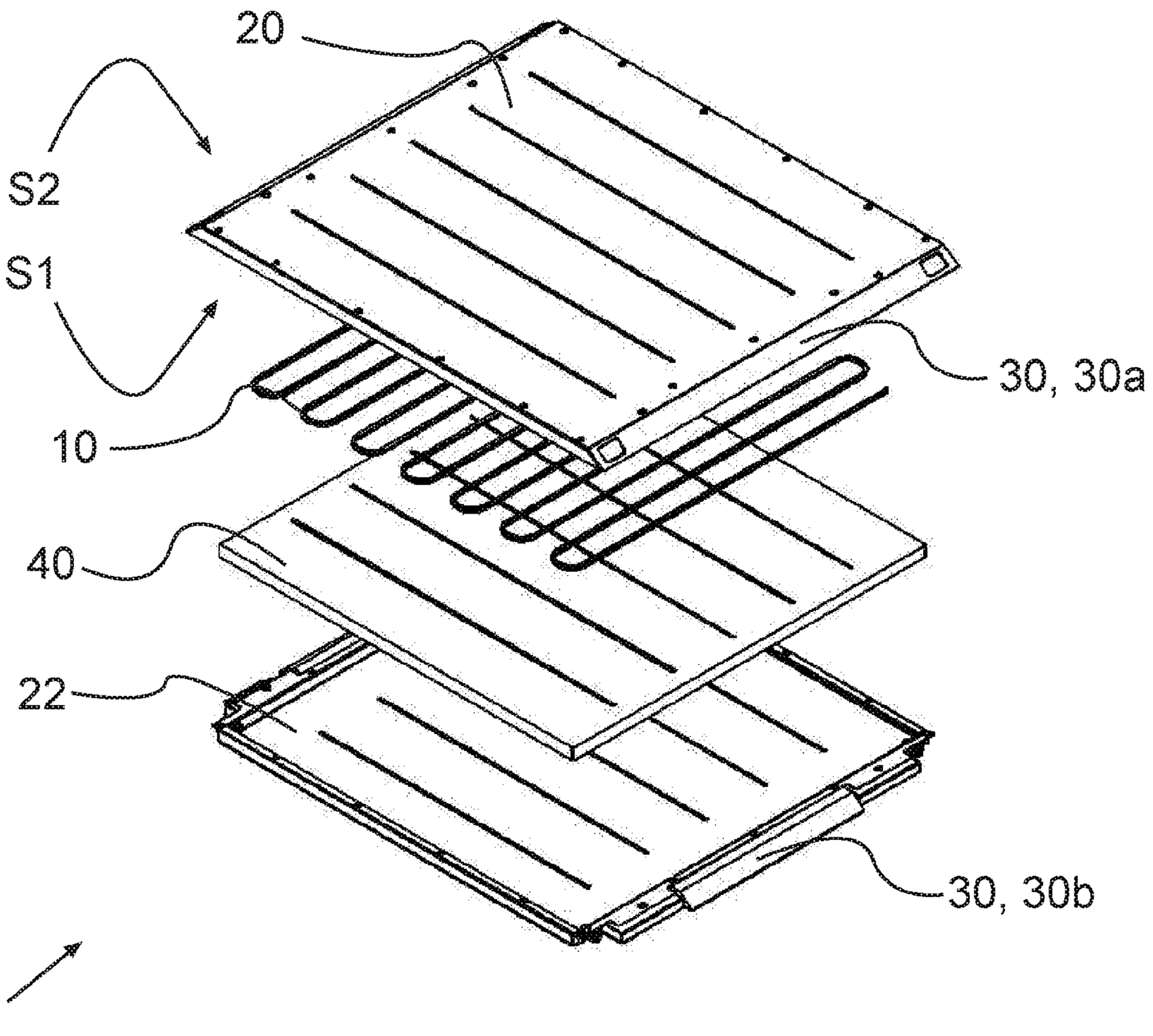

Fig. 2

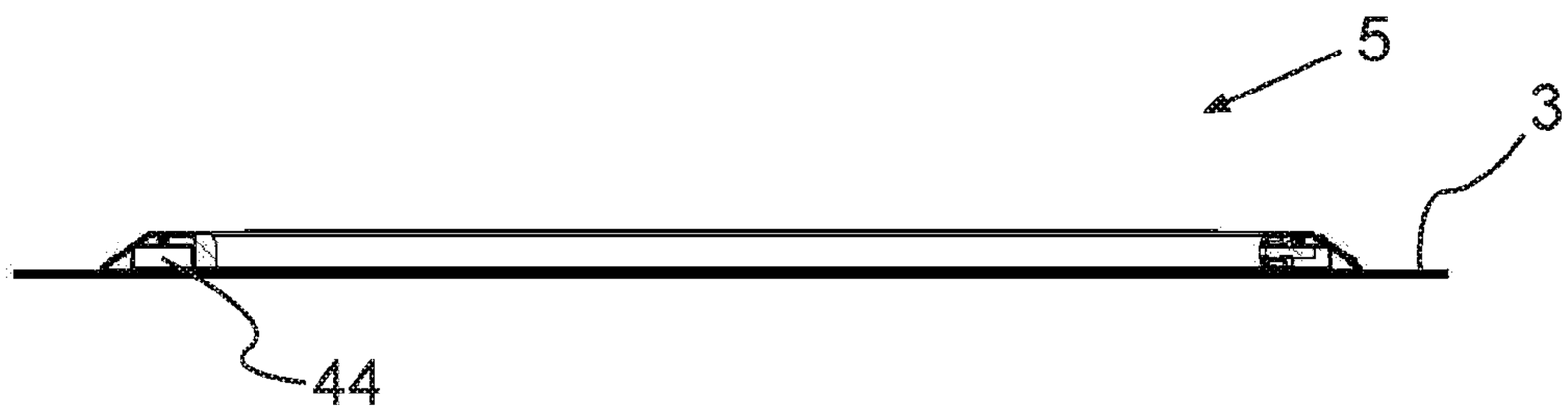

Fig. 3a

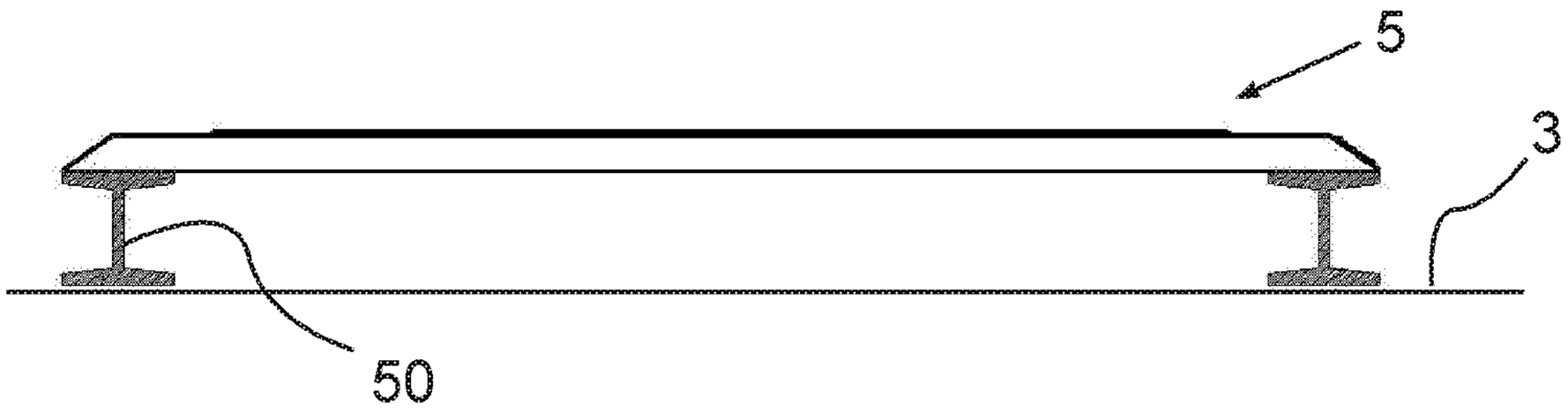

Fig. 3b

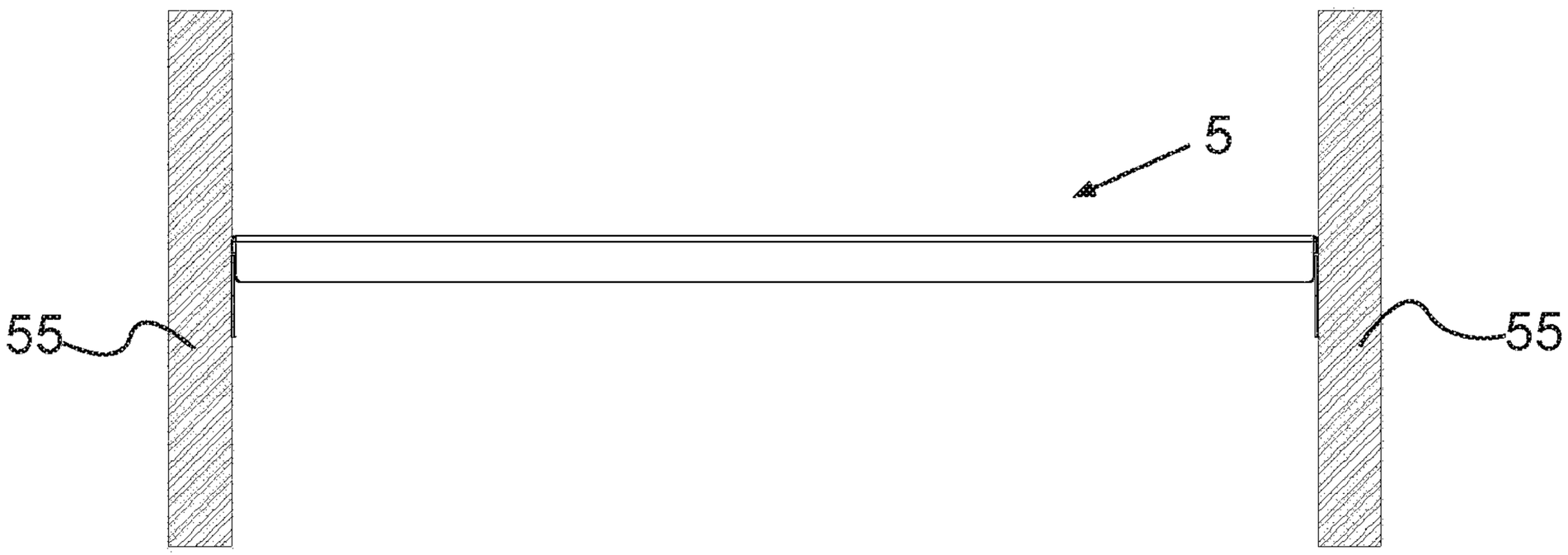

Fig. 3c

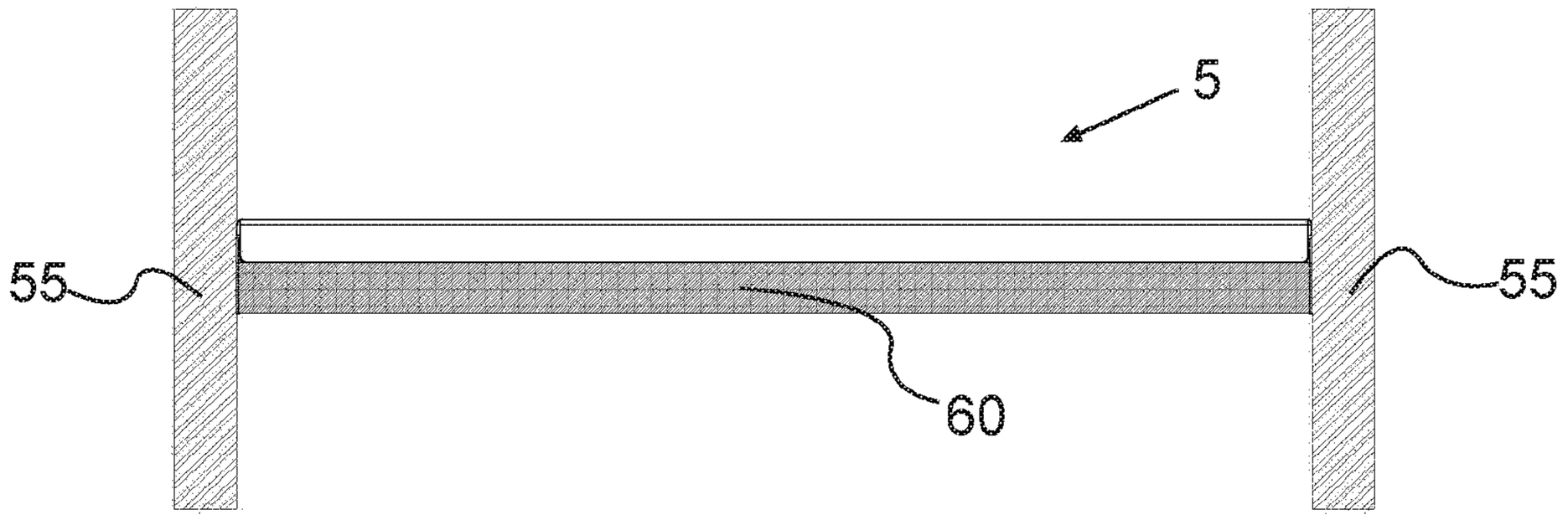

Fig. 3d

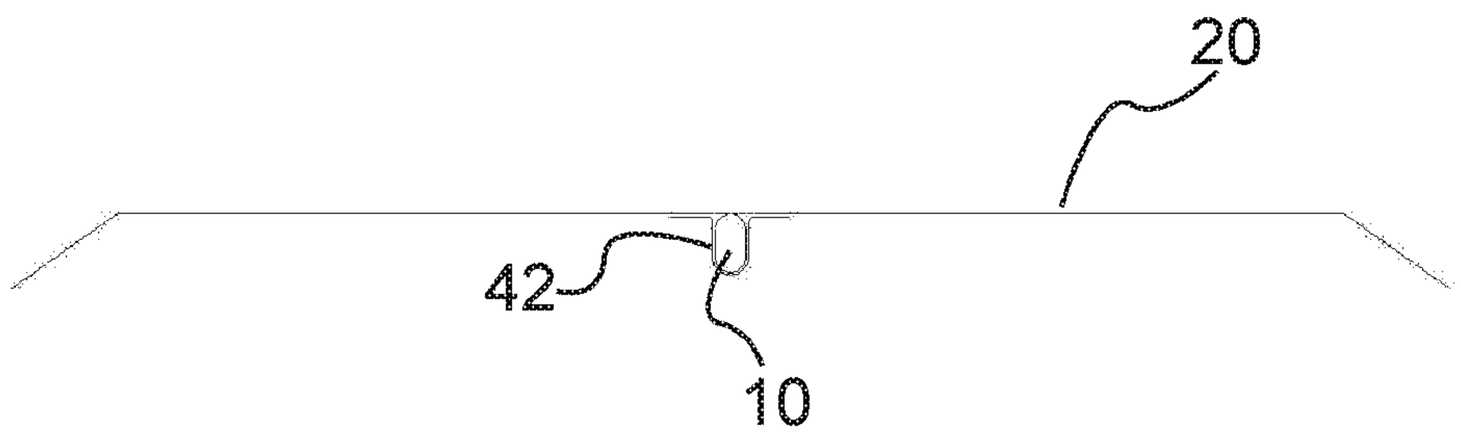

Fig. 3e

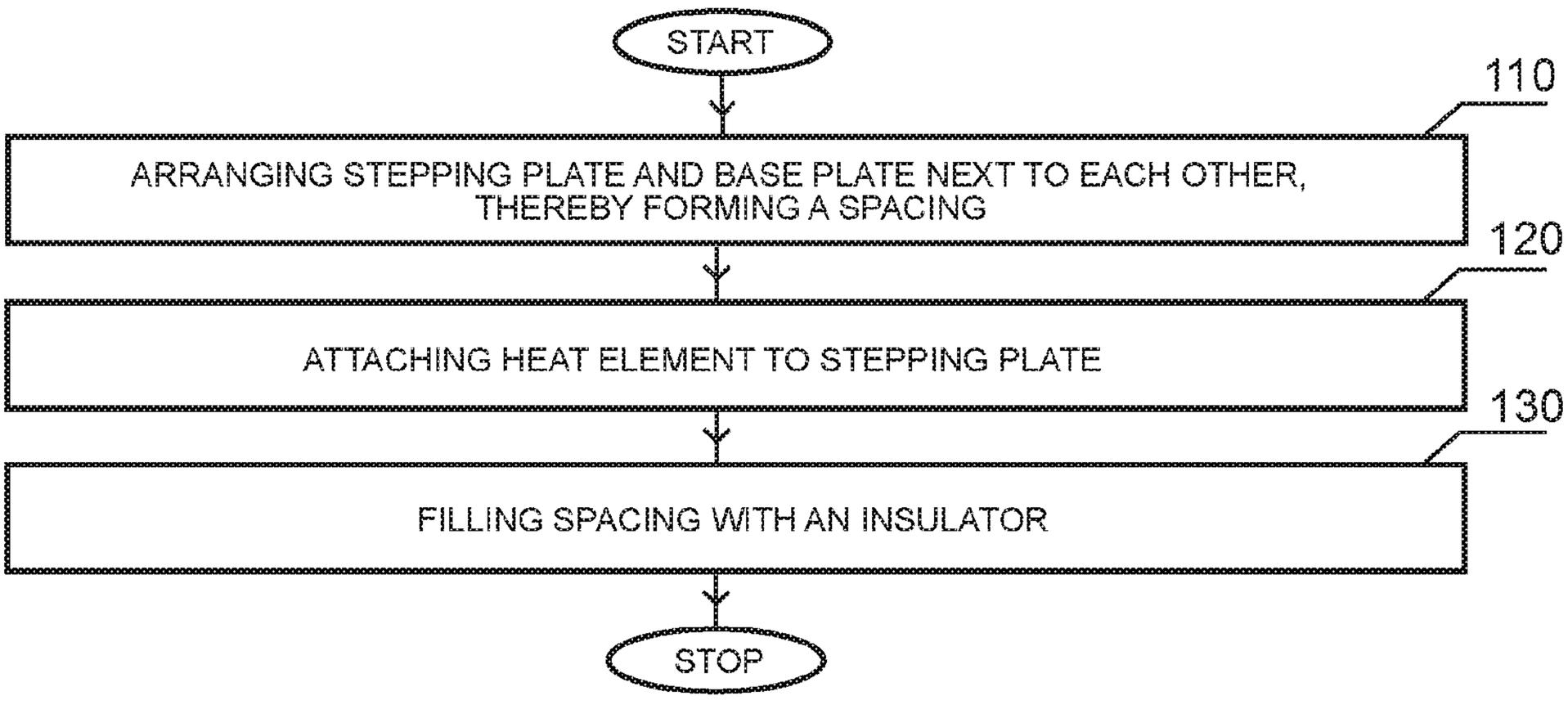
START
110
ARRANGING STEPPING PLATE AND BASE PLATE NEXT TO EACH OTHER, THEREBY FORMING A SPACING
120
ATTACHING HEAT ELEMENT TO STEPPING PLATE
130
FILLING SPACING WITH AN INSULATOR
STOP

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO2020/050268

A. CLASSIFICATION OF SUBJECT MATTER

E04F 15/00 (2006.01); F24D 13/02 (2006.01); H05B 3/18 (2006.01); H05B 3/20 (2006.01); H05B 3/26 (2006.01)

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)

E01C; E04F; F24D; H05B

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

DK, NO, SE, FI: Classes as above.

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

Epodoc, NPL, IoP, AIP, IEEE, INSPEC, RD, TDB, EI Compendex, XPIOP, Epoque Fulltext, WP

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	US 2015382403 A1 (B. PHILIP et al.) 31 December 2015 (2015-12-31)	
X	Paragraphs [0003], [0006], [0010]-[0014], [0024], [0028], [0033], [0041]-[0046], [0050], [0052]-[0055], Claims 1, 4, 20-24, Figures 1, 2, 4, 5, k. 24	1-16, 18-20, 22-25
Y		17
A		21
	US 2017067653 A1 (J. FORSBOM) 09 March 2017 (2017-03-09)	
X	Paragraphs [0076]-[0093], [0104]. Claims 1-5, 9-13. Figures	1-10,12, 13, 15-16, 18-19, 23-25
Y		17
	US 2019112767 A1 (S. LOGAN et al.) 18 April 2019 (2019-04-18)	
X	Paragrpahs [0003], [0006], [0027], [0028], [0031], [0040]. Figures 1-3	1-7, 9, 10, 12, 14, 18, 19, 23-25
	US 2013119043 A1 (N. CONSIGLIO et al.) 16 May 2013 (2013-05-16)	
X	Paragraphs [0006], [0008], [0031], [0036]-[0039], [0045]. Claim 1	1-3, 7, 9, 10, 12, 23-25

☐ 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
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 February 2021	**03 February 2021**
Name and mailing address of the ISA/XN **Nordic Patent Institute** **Helgeshoj Allé 81,** **2630 Taastrup** **Denmark** Telephone No. **+45 43 50 85 00** Facsimile No. **+4543508008**	Authorized officer **Jan Frode Næss** Telephone No. **+45 43 50 85 00**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/NO2020/050268

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