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CA 2617531 A1 2007/02/08

(21) 2 617 531

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2006/06/21
(87) Date publication PCT/PCT Publication Date: 2007/02/08
(85) Entrée phase nationale/National Entry: 2008/01/31
(86) N° demande PCT/PCT Application No.: EP 2006/063417
(87) N° publication PCT/PCT Publication No.: 2007/014801
(30) Priorité/Priority: 2005/08/02 (DE10 2005 036 299.0)

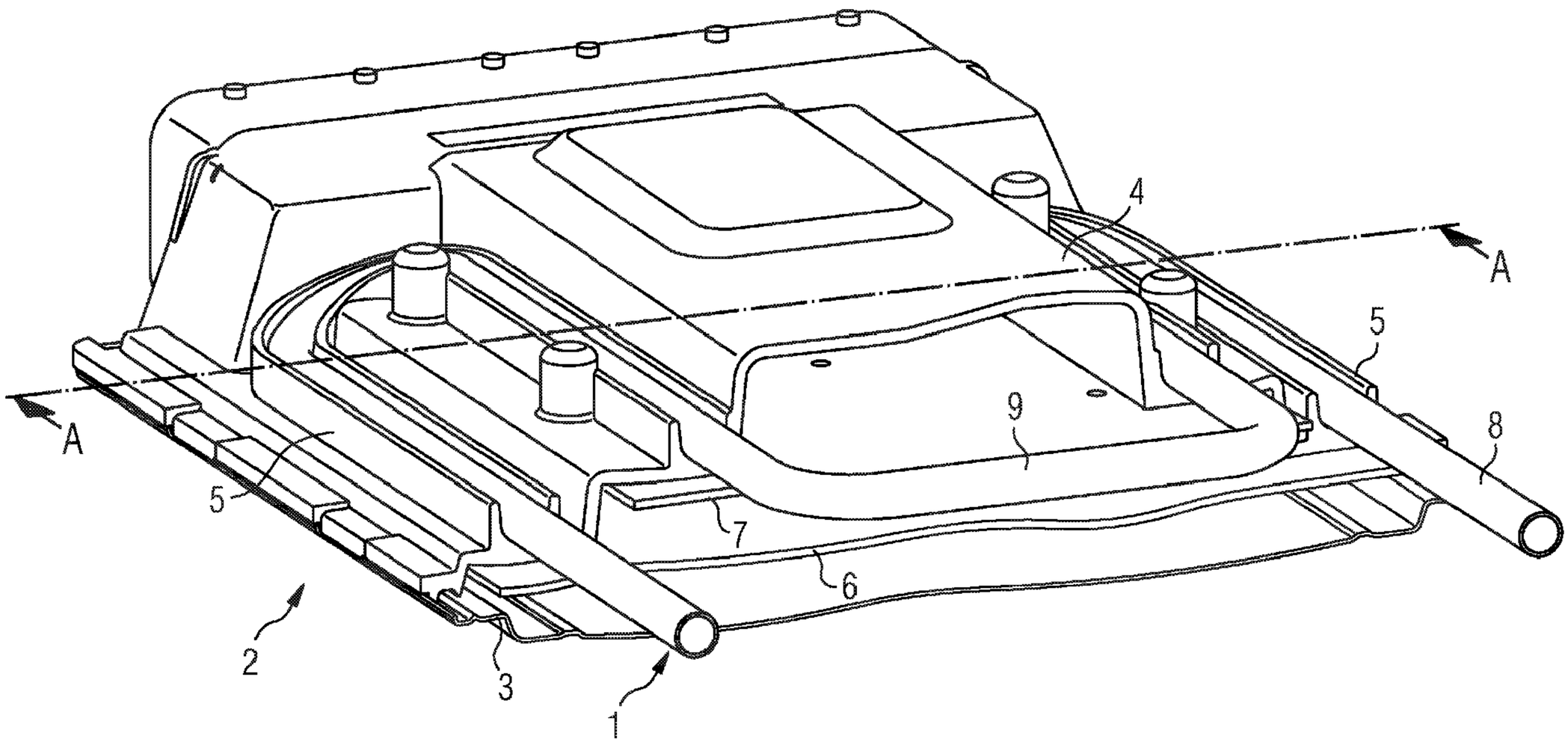
(51) Cl.Int./Int.Cl. *H05K 5/00* (2006.01), *B60R 16/023* (2006.01), *H05K 7/20* (2006.01)

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(54) Titre : SYSTEME DE REFROIDISSEMENT POUR BOITIER ELECTRONIQUE
(54) Title: COOLING SYSTEM FOR ELECTRONICS HOUSINGS



(57) Abrégé/Abstract:
The invention relates to a cooling system, through which liquid flows, for carrying away waste heat for electronics housings, particularly for the automotive industry. According to the invention, the cooling system (1) is adapted to the dimensions of the housing (2). Firstly, the invention advantageously creates an effective cooling system (1) for electronics housings (2) via a number of circuit board levels (6, 7) away with a space-saving compact design. The invention is particularly suited for applications in the automotive industry.

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
8. Februar 2007 (08.02.2007)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2007/014801 A3

(51) Internationale Patentklassifikation:
H05K 5/00 (2006.01) *B60R 16/023* (2006.01)
H05K 7/20 (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2006/063417

(22) Internationales Anmeldedatum:
21. Juni 2006 (21.06.2006)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10 2005 036 299.0 2. August 2005 (02.08.2005) DE

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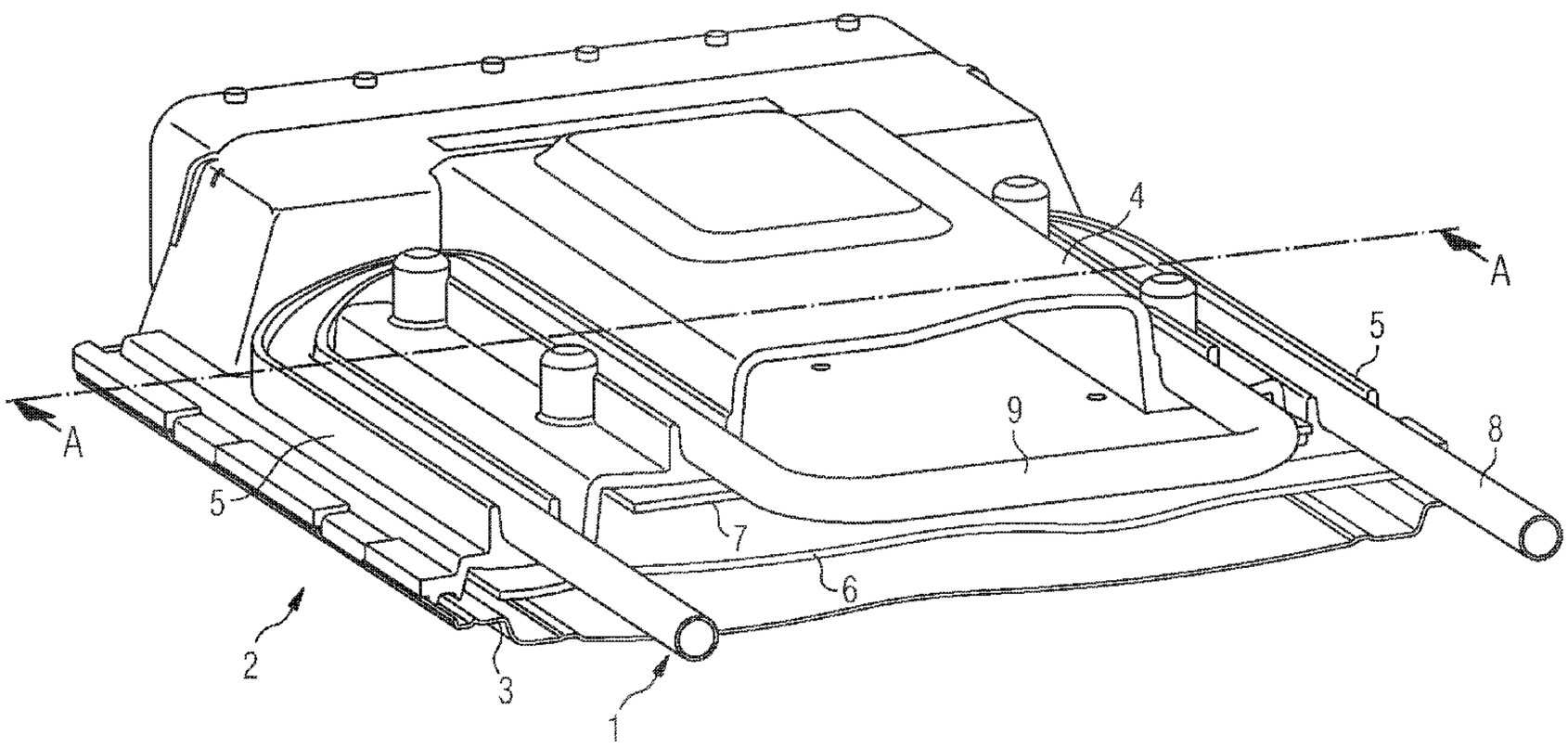
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(84) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, MD, RU,

[Fortsetzung auf der nächsten Seite]

(54) Title: COOLING SYSTEM FOR ELECTRONICS HOUSINGS

(54) Bezeichnung: KÜHLSYSTEM FÜR ELEKTRONIKGEHÄUSE



(57) Abstract: The invention relates to a cooling system, through which liquid flows, for carrying away waste heat for electronics housings, particularly for the automotive industry. According to the invention, the cooling system (1) is adapted to the dimensions of the housing (2). Firstly, the invention advantageously creates an effective cooling system (1) for electronics housings (2) via a number of circuit board levels (6, 7) away with a space-saving compact design. The invention is particularly suited for applications in the automotive industry.

(57) Zusammenfassung: Die Erfindung betrifft ein flüssigkeitsdurchströmtes Kühlsystem zum Abführen von Abwärme für Elektronikgehäuse, insbesondere für den Automobilbereich. Erfindungsgemäß ist das Kühlsystem (1) an die Geometrie des Gehäuses (2) angepasst. Die vorliegende Erfindung schafft erstmals vorteilhaft ein effektives Kühlsystem (1) für Elektronikgehäuse (2) über mehrere Leiterplattenebenen (6, 7) hinweg mit platzsparender, 15 kompakter Bauweise. Sie eignet sich insbesondere für Anwendungen im Automobilbereich.

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TJ, TM), europäisches (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Veröffentlicht:

— *mit internationalem Recherchenbericht*

(88) Veröffentlichungsdatum des internationalen Recherchenberichts: 26. Juli 2007

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

Cooling system for electronics housing

The invention relates to a cooling system through which a liquid flows, for carrying away waste heat for electronics housings, particularly for the automotive industry.

The thermal demands imposed on electronics are becoming ever greater in the area of electronic controllers for engine management of an automobile. This can essentially be attributed to the inclusion of functions which require additional components for their implementation. The power dissipation also increases as a result of these additional components. The proximity to the engine area imposes especially high requirements on the temperature stability of the electronic control devices. This leads to the temperatures being able to exceed permitted limits in the internal connections, such as solder points for example, as well as in said components. As a result problems in relation to service life can occur.

Basically the problem of overheating is to be solved by active cooling with liquid coolers. Known concepts for liquid-cooled electronic control devices are based as a rule on additional coolers which are built onto or into the electronic unit. This makes good heat dissipation from the electronics possible.

DE 198 42 615 A1 describes an electronic device featuring a housing in which a circuit board module is accommodated. A forced cooling device with cooling fins is connected to the outer wall of the housing. The disadvantage of this solution however is that the cooling elements are not arranged in the immediate vicinity of the electronic components from which heat is emitted but somewhat to the side, which leads to an increased space requirement. In addition this cooler is not suitable for cooling electronics distributed over a number of

circuit board levels, since it generally involves flat constructions. One current solution to this problem consists of using a number of coolers or specially shaped coolers, which in respect of their manufacturing or installation however, once again demand increased outlay.

Using this solution as its starting point, the underlying object of the invention is to create a cooling system with a space-saving, compact design which guarantees secure cooling even across a number of circuit board levels.

This object is achieved by a cooling system for electronics housings with the features of claim 1. Advantageous embodiments and developments, which can be used individually or in combination, are the subject matter of the dependent claims.

The outstanding feature of the inventive cooling system is that it is adapted to the geometry of the housing. This allows a space-saving compact design for the overall electronic device since no additional space is needed for the cooling system. In addition the geometrical adaptation of the cooling system to the housing advantageously leads to cooling being applied directly to the electronic components emitting heat.

It is especially preferred for the cooling system to be arranged over a number of circuit board levels. This makes it possible for the components prone to power loss to be better distributed and for heat peaks to be avoided by applying cooling directly to the heat-emitting element.

The inventive cooling system is preferably essentially provided by a serpentine cooling tube which is formed from a pipe by simply bending it into the desired geometry. This very simple manufacturing method also allows very demanding housing

geometries to be provided with an effective cooling.

Preferably a single-part cooling system is to be used since no sealing problems can arise in this way.

Advantageously the cooling system is arranged outside, i.e. on the side of the housing facing away from the printed circuit boards, so that the cooling liquid does not come into direct contact with the electronic components should a defect arise.

To guarantee an effective cooling, it is also advantageous for the inventive cooling system to be manufactured from a thermally-conducting material, such as aluminum for example.

For secure support of the inventive cooling system it is additionally advantageous for this to be disposed in a guide slot, so that a fixed positioning and thus a continuous cooling are guaranteed.

Furthermore it is advantageous for the pipe diameter of the cooling system to be embodied to vary between 4 mm and 20 mm, especially between 8 and 18 mm, and thus be able to be selected depending on the desired conditions, with the cooling system being applicable for all possible constructionally sensible diameters.

It is especially preferable for the cooling system to be manufactured from a corrosion-resistant material, since it is supported outside the housing and can thus come into contact with salt spray mist, water or other, in some cases chemically aggressive, substances such as alkalis, acids or cleaning agents for example.

The present invention advantageously creates for the first time a cooling system for electronics housings covering a number of circuit board levels with a space-saving, compact

design. It is especially suitable for applications in the automotive area.

Further advantages and embodiments of the invention will be explained below on the basis of an exemplary embodiment as well as with reference to the drawing.

The figures show the following schematic diagrams:

Fig. 1 a perspective diagram of an inventive cooling system; and

Fig. 2 the inventive cooling system depicted in Fig. 1 in a cross-sectional diagram.

Fig. 1 shows a perspective view of an inventive cooling system 1 for electronics housings in the assembled state. The electronics housing 2 depicted in Fig. 1 comprises a lower housing part 3 as well as an upper housing part 4, on which the cooling system 1 is supported, preferably in symmetrically arranged U-shaped guide slots 5. In this case the limbs of the U-shaped guide slot 5 are not at the same level but at the same position as the circuit board levels 6 and 7 supported within the electronics housing 2. A total of three levels are produced. Level 1 comprises the space between lower housing part 3 and circuit board level 6. Level 2 comprises the space between the circuit board levels 6 and 7. The third level is delimited by the printed circuit board level 7 and the upper part of the housing 4. The cooling system 1, which is preferably embodied by a serpentine cooling tube 8, rests outside the housing 2, i.e. on the side of the housing facing away from the printed circuit boards (6, 7) in the U-shaped guide slots 5 arranged symmetrically from the housing center point on levels 2 and 3, which are connected to each other by a transition area 9 on level 3. The inventive cooling system 1

is thus positioned in the immediate vicinity of the printed circuit board levels 6 and 7. The serpentine cooling tube 8 is preferably embodied in one piece and made from a heat-conducting and corrosion-resistant material. The cooling tube 8 preferably has a diameter of 4 to 20 mm, especially of 8 to 18 mm.

Fig. 2 shows the inventive cooling system 1 in a cross-sectional diagram on the three levels of the electronics housing 2. The electronics housing is equipped with high-power components such as semiconductor elements 9 or capacitors 10 for example. The semiconductor components 9 are arranged in each case below the circuit board level 6 or 7 and directly under the cooling tube located in the guide slot 8. The printed circuit board levels 6 and 7 are partly broken through in the area of the semiconductor components 9, to guarantee a continuous dissipation of heat of the heating-up semiconductor components. The capacitors 10 are located at level 3 and rest on the circuit board levels 7. These components are cooled by a cooling tube 8 through which liquid flows, which is supported both above the upper part of the housing 4 and also to the side on level 2, with cool water of the engine circulation preferably being used as the coolant. Any other medium can be used however, provided a corresponding coolant circulation is established or the inventive cooling system is used in another environment, i.e. not in the motor vehicle.

The present invention advantageously for the first time creates a cooling system for electronics housings covering a number of circuit board levels with a space-saving, compact design. It is especially suitable for applications in the automotive area.

Claims

1. A cooling system (1) with liquid flowing through it for removal of waste heat for electronics housings (2), especially for the automotive industry, characterized in that the cooling system (1) is adapted to the geometry of the housing (2).

2. The cooling system (1) as claimed in claim 1, with the electronics housing (2) comprising at least two printed circuit boards (6, 7) arranged on different levels, characterized in that the cooling system (1) is arranged over a number of circuit board levels (6, 7).

3. The cooling system (1) as claimed in claim 1 or 2, characterized in that the cooling system (1) is a serpentine cooling tube (1).

4. The cooling system (1) as claimed in one of the claims 1 to 3, characterized in that the cooling system (1) is embodied in one piece.

5. The cooling system (1) as claimed in one of the claims 1 to 4, characterized in that the cooling system (1) is arranged on the side of the housing (2) facing away from the printed circuit boards (6, 7).

6. The cooling system (1) as claimed in one of the claims 1 to 5, characterized in that the cooling system (1) is manufactured from a heat-conducting material, especially from aluminum.

7. The cooling system (1) as claimed in one of the claims 1 to 6, characterized in that the cooling system (1) is supported in a guide slot (5).

8. The cooling system (1) as claimed in one of the claims 1 to 7, characterized in that the cooling system (1) has a pipe

diameter of 4 to 20 mm, preferably of 8 to 18 mm.

9. The cooling system (1) as claimed in one of the claims 1 to 8, characterized in that the cooling system (1) is manufactured from a corrosion-resistant material.

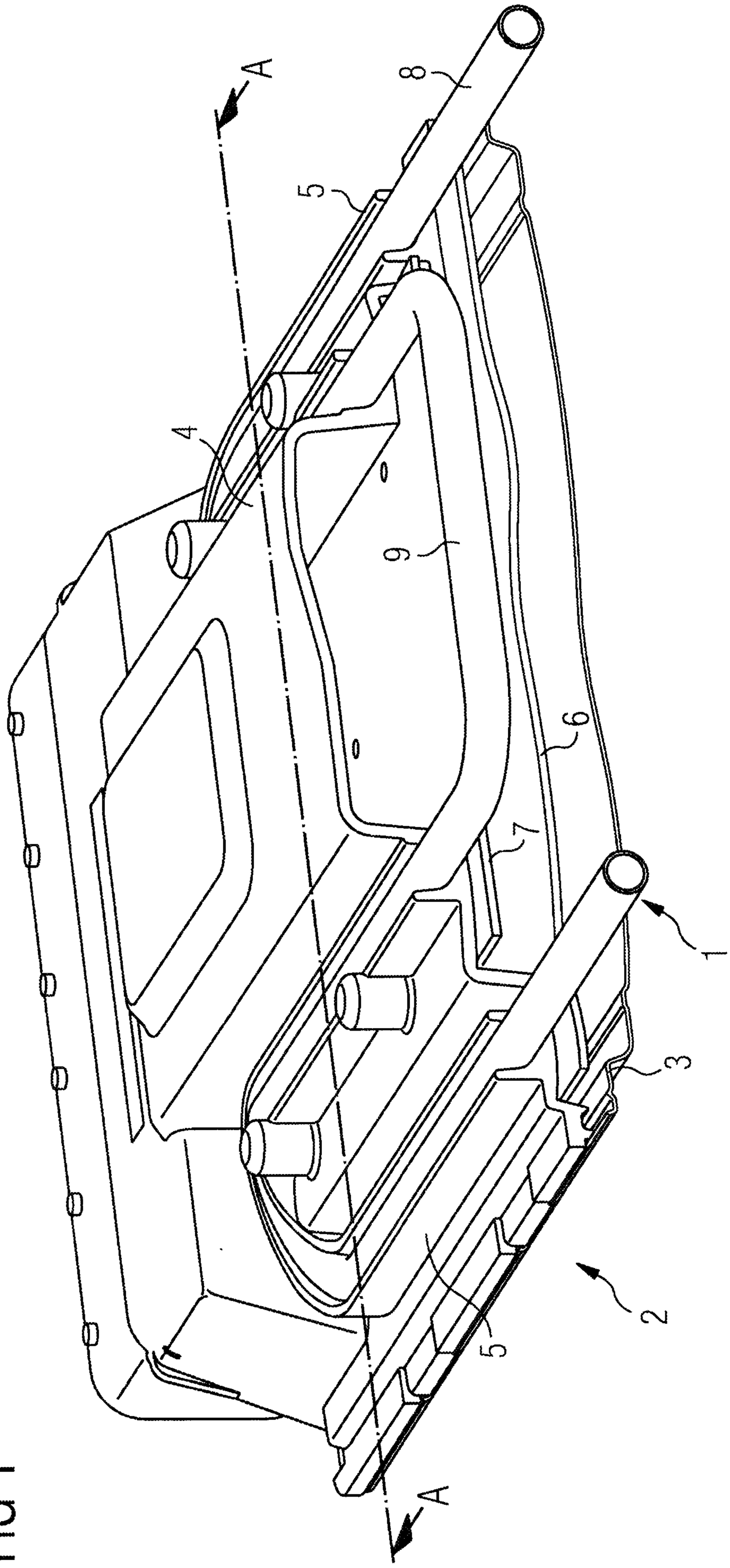


FIG 1

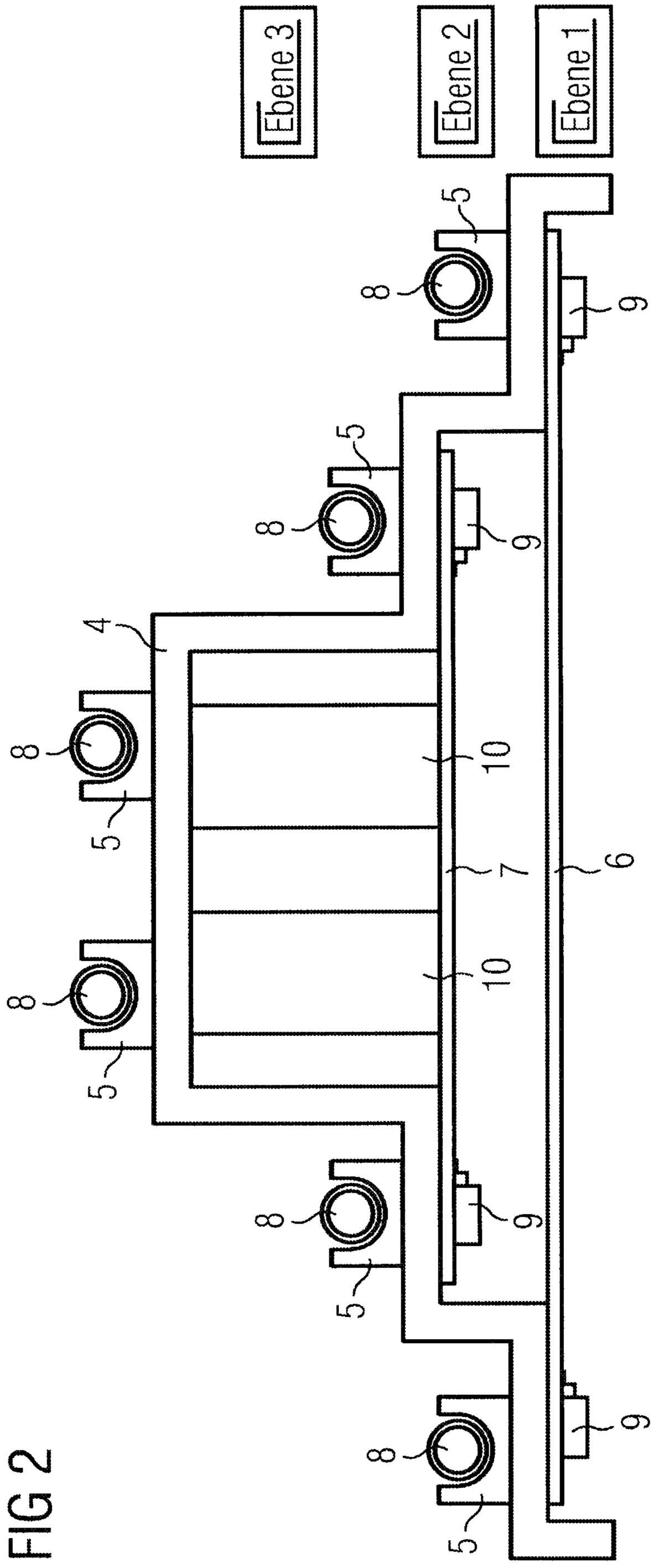
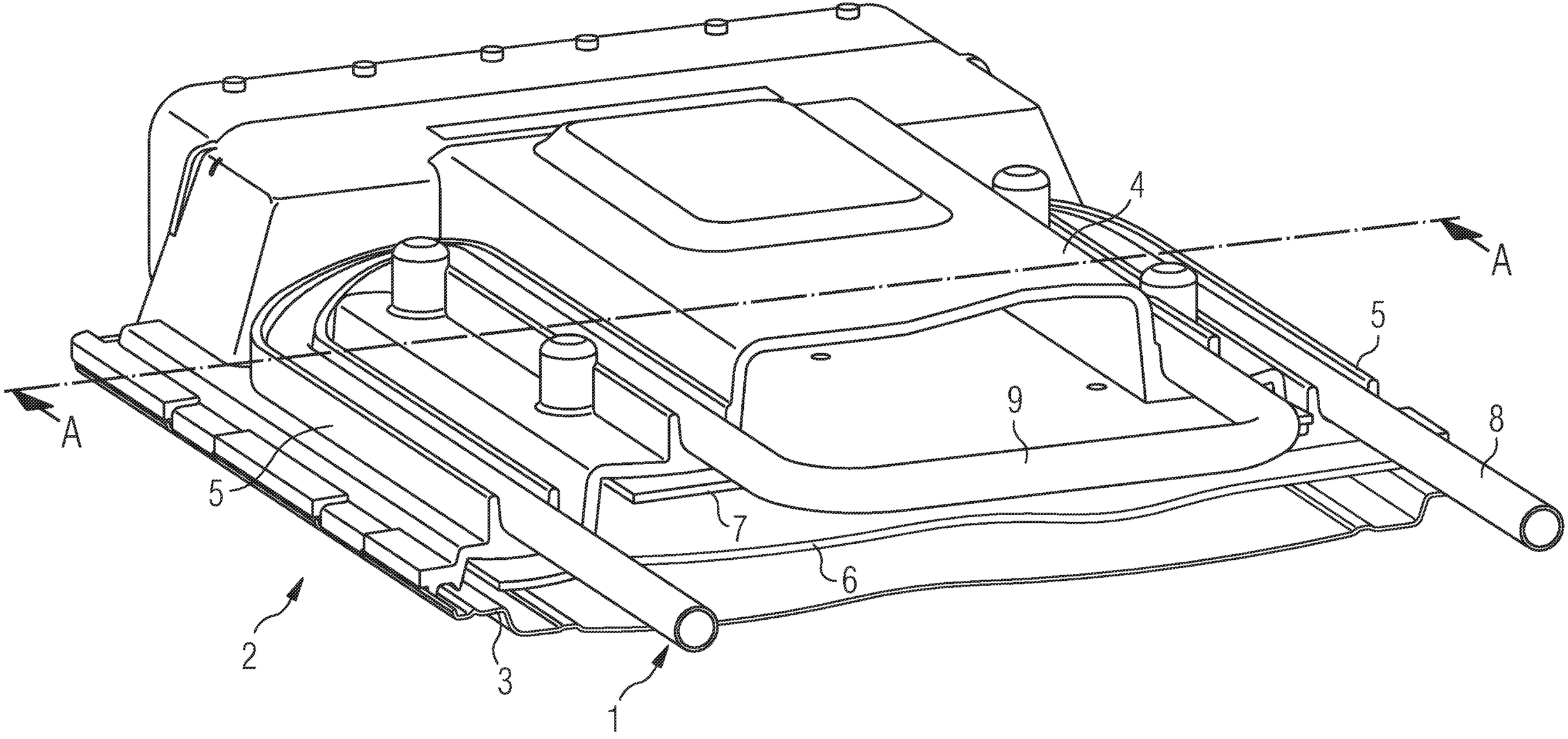


FIG 2


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