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(54) **Composite self-supporting housing for a railway car**

(57) A railway car(10) comprises a car body (12), a component (16, 22) fixed to a roof (20) or under the floor (24) of the car body (10) and a housing (18, 26) for enclosing the component (16, 22). The housing (18, 22) comprises at least one transverse panel (28, 30, 32, 24) facing the car body (12) and at least one side flap panel (36, 38, 40, 42) movable between a closed position in which the side flap panel (36, 38, 40, 42) closes a volume for the component (16, 22) defined between the transverse panel (28, 30, 32, 34) and the car body (12) and an open position. The housing (18, 26) is provided with securing means (50, 52) for securing the side flap panel

(36, 38, 40, 42) in the closed position. In order to reduce the weight of the housing, the side flap panel (36, 38, 40, 42) and the transverse panel (28, 30, 32, 34) are made of lightweight material. To achieve further reduction of the weight, the structure (28, 30, 32, 34) is preferably not self-supported in the open position. The securing means (50, 52) are provided between the transverse panel (28, 30, 32, 34) and the side flap panel (36, 38, 40, 42) in the closed position such that the transverse panel (28, 30, 32, 34), the side flap panel (36, 38, 40, 42) in the closed position and the securing means form a unitary and interacting self-supporting and load-bearing structure

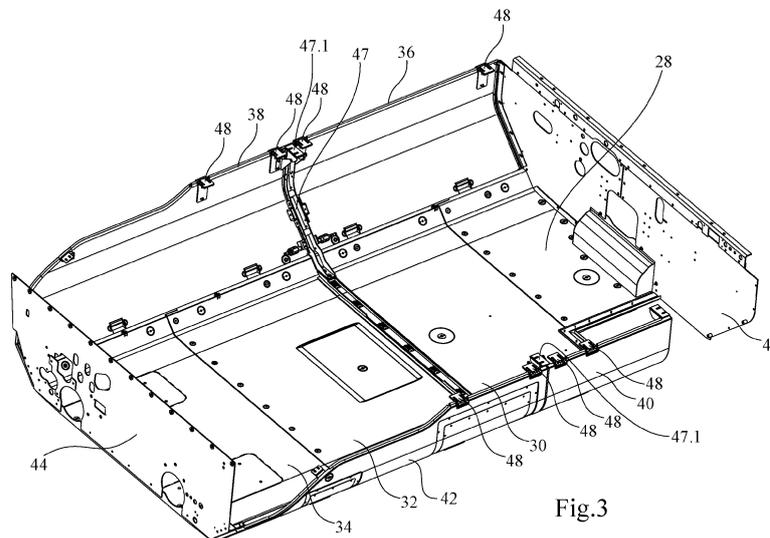


Fig.3

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Description**TECHNICAL FIELD OF THE INVENTION**

[0001] The invention relates to the protection of functional components of a railway car, such as a diesel engine, a compressor, an electric transformer, a braking system, an exhaust gas cleaning system, a tank or wirings, which are located outside the car body of the railway car, on the roof or under the floor of the car body. It relates more particularly to a housing for such components.

BACKGROUND ART

[0002] The roof and/or underframe of a railway car can be equipped with a number of functional components of the railway car, which are usually protected by a housing made of sheet metal. The housing is generally provided with side flaps giving easy access to the components for maintenance purposes. Such a housing, which is rendered necessary to streamline the vehicle, protect the component from dust or pollution, prevent access to unauthorised staff and/or reduce the noise generated by the component, adds weight to the vehicle. In order to minimise the weight of such housings, it has been proposed to replace the usual sheet metal flap door panels with panels made of fibre-reinforced composite material. However, the weight reduction thus achieved is limited.

[0003] An underfloor soundproof encapsulation housing for an engine of a railway car is disclosed in EP 1 377 488. The housing can be made of sheet metal covered with noise-damping material. Alternatively, it can be made of a plastic material with noise-damping characteristics. However, the mechanical strength of this only elusively mentioned alternative is not discussed.

[0004] An underfloor construction of a monorail vehicle is disclosed in US 4,825,774. The underfloor includes truck enclosures detachably mounted at positions where trucks are mounted to enclose the periphery of the trucks, and an enclosure for underfloor equipment for enclosing the sides and lower surface of the underfloor equipment. The wiring ducts and underfloor equipment are mounted to the underframe and wiring work is conducted between the wiring duct and the underfloor equipment before the enclosure is mounted, which improves the workability during the assembly process. The enclosure for the underfloor equipment is composed of inside and outside supports, upper and lower frames and side panels pivotably mounted on the upper frame by means of hinges. The lower frames are connected by a joint member horizontally arranged in a lateral direction of the vehicle body and take the form of a ladder, on which small equipment such as switches are installed. The underframe is provided with side beams. The enclosure for underfloor equipment is mounted on fitting rails formed on the side beams by means of detachable fastening members such as bolts. The enclosure includes a great number of constituent parts, which involves a tedious assembly proc-

ess. The resulting assembly, made of a steel frame and sheet metal panels, is heavy.

SUMMARY OF THE INVENTION

[0005] The foregoing shortcomings of the prior art are addressed by the present invention. According to one aspect of the invention, there is provided a railway car comprising a car body, at least one component fixed to the exterior of the car body, in particular to a roof or under the floor of the car body, and a housing also fixed to the exterior of the car body and enclosing the component. The housing comprises at least one transverse panel facing the car body and at least one side flap panel movable between a closed position in which the side flap panel closes a volume for the component defined between the transverse panel and the car body and an open position giving access to the volume and to the component. The housing is provided with securing means for securing the side flap panel in the closed position. In order to reduce the overall weight of the housing, the side flap panel and the transverse panel are made of lightweight material. The securing means are provided between the transverse panel and the side flap panel in the closed position such that the transverse panel, the side flap panel in the closed position and the securing means form a unitary and interacting self-supporting and load-bearing structure, which is able to sustain the stress experienced during normal operation of the railway car, due in particular to the combined effects of weight, accelerations, deflections, vibrations, temperature variations and wind pressure and defined exceptional loads, e.g. in an overrunning collision. The securing means prevent any relative movement between the transverse panel and the side flap panel in the closed and secured position, whereby forces are integrally transferred between the side flap panel and the transverse panel.

[0006] The invention relies on the observation that the mechanical requirements on the housing are different when the vehicle is stationary or when the vehicle moves, and on the recognition that the housing does not need to be fully self-supporting when the side flap panel is open (and the vehicle is stationary). Hence, it becomes possible to design a housing in which the side flap panel in the closed position substantially contributes to the shear stiffness and structural strength of the whole housing. In turn, this makes it possible to significantly reduce the mass of the transverse panel and the number of parts of the housing. According to a preferred embodiment, the housing in the open position of the side flap panel does not need to be a self-supporting structure.

[0007] According to a preferred embodiment, the transverse panel does not support any part of the enclosed component. Preferably, the transverse panel does not contact the enclosed component.

[0008] According to a preferred embodiment, the side flap panel in the closed position overlaps and is pressed against an outwardly-oriented face of the transverse panel.

el to achieve this unitary structure.

[0009] The securing means preferably comprise a form-fit and/or friction-fit connection between the transverse panel and the side flap panel. According to one embodiment, the securing means include at least one self-centering tapered or conical locator, which is able to transfer shearing stress and forces at the interface between the transverse panel and the side flap panel, i.e. forces directed substantially parallel to a contact plane between the side flap panel and the transverse panel, and perpendicular to a main axis of the locator.

[0010] The securing means may include at least one bolt and nut connection, or a quarter turn fastener.

[0011] Preferably, the housing further comprises at least one, and preferably two opposed sheet metal end panels, which extend substantially in a vertical plane. Preferably, the transverse panel or one of the transverse panels is fixed to at least one such end panel, which in such a case can contribute to stiffening the whole structure of the housing.

[0012] According to one embodiment, the housing comprises at least two transverse panels and a metallic structural cross-member having two ends secured to the car body and forming an arch extending between the two transverse panels, each of the two transverse panels being secured to the structural cross-member. This optional arched cross-member is used to stiffen the structure if the length of the housing is not compatible with a single transverse panel.

[0013] In order to minimise the weight and optimise the strength of the structure, the lightweight material preferably comprises an anisotropic composite material, in particular with a fibre-reinforced thermoset or thermoplastic matrix. The fibre-reinforced composite material may include a low-density core material sandwiched between fibre-reinforced layers. The core material may be a honeycomb structure, a foam and/or a folded honeycomb structure. Preferably, a waterproof core is used.

[0014] In order to improve the sound insulation, a compromise may have to be found between weight and damping properties of the fibre-reinforced composite material.

[0015] According to a preferred embodiment, the housing further comprises at least one metallic hinge for hinging the side flap panel to the car body. The hinge connection ensures easy opening and closing of the housing. The hinge is preferably such as to limit or prevent axial movement between the side flap panel and the car body. Hence, the hinge connection between the side flap panel and the car body contributes to the structural strength of the whole housing.

[0016] Advantageously, the housing may include at least one side flap panel on each side of the railway car.

[0017] According to one embodiment, the housing is fixed to an underframe of the car body and the transverse panel is a bottom panel. According to another embodiment, the housing is fixed to a roof of the car body and the transverse panel is a cover panel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Other advantages and features of the invention will become more clearly apparent from the following description of a specific embodiment of the invention given as a non-restrictive example only and represented in the accompanying drawings in which:

- Fig. 1 is schematic view of a railway car provided with components enclosed in a external housing located under the floor or on the roof of a car body of the vehicle;
- Fig. 2 is an exploded view of the constituent parts of one of the housing of Fig. 1;
- Fig. 3 is an isometric view of the housing of Fig. 2;
- Fig. 4 is a detail view of a hinge connection between the car body and a side flap panel of the housing of Fig. 2;
- Fig. 5 is a detail view of a bolt and nut securing connection between the side flap panel and a bottom panel of the housing of Fig. 2;
- Fig. 6 is a detail view of a tapered locator between the side flap panel and the bottom panel of the housing of Fig. 2.

[0019] Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS

[0020] Referring to Fig. 1, a railway car 10, e.g. a passenger or freight car hauled by a locomotive or a self-propelled rail car, comprises a car body 12 supported by bogies 14. The railway car is provided with an external subunit 16 such as a HVAC unit located on the roof 18 of the car body 12 and enclosed in a housing 20. The railway car 10 is also provided with a an external subunit 22 such as a diesel engine or a braking unit, supported under the floor 24 of the car body by an underframe of the car body and enclosed in a housing 26. Both housings 20, 26 are made of composite panels, as will be described in detail below, with reference to Fig. 2 to 6 and to the underframe housing 26.

[0021] The housing 26 is made of four bottom panels 28, 30, 32, 34, two side flap panels 36, 38 resp. 40, 42 on each side of the car body 12, two end walls 44, 46 and a structural cross-member 47. The structural cross-member 47 has two ends 47.1 secured to the car body 12 and forms an arch extending between the two transverse panels 30, 32, which are secured to the structural cross-member 47 by clamping means.

[0022] The bottom and side flap panels, which have no contact with the subunit 16, 22, are made of fibre-reinforced composite materials e.g. polyurethane sandwich structures whereas the end walls and cross-member are metallic, e.g. made of aluminium.

[0023] The bottom panels 28, 30, 32, 34 extend horizontally from one side flap panel 36, 38 to the opposed side flap panel 40, 42 on the other side of the car body. They are connected to one another by means of any appropriate unremovable or removable securing means, such as glue and screws. They are provided with slanted lateral end portions 28.1, 30.1, 32.1, 34.1 to form a substantial planar contact interface with the side flap panels.

[0024] The side flap panels 36, 38, 40, 42 are articulated to the underframe of the car body of the vehicle by means of hinges 48. Each hinge 48, as illustrated in Fig. 4, has a stationary wing 48.1 attached to the car body structure, in this instance to the underframe of the car body, and a movable wing 48.2 which pivots about a pivot axis 48.3 and is attached to the side flap panel 36 to allow movement of the side flap panel 36 with respect to the car body 12 and to the bottom panels between a closed position and an open position. The side flap panel 36 is equipped with an attachment plate 37 provided with studs 37.1 on which the movable wing 48.2 is attached by means of bolts (not shown). The hinge connection 48 is such as to limit axial motion of the side flap panel 36 with respect to the car body parallel to the pivot axis 48.3 and to integrally transmit forces parallel to the pivot axis 48.3 from the side flap panel 36 to the car body 12. A sealing is provided around the side flap panels. The side flap panels are also provided with handles.

[0025] In the closed position, an inwardly-oriented flat face 36.1, 38.1, 40.1, 42.1 of each side flap panel 36, 38, 40, 42 contacts and overlaps an outwardly oriented face 28.11, 30.11, 32.11, 34.11 of the slanted lateral end portion 28.1, 30.1, 32.1, 34.1 of at least one of the bottom panels and bears against it. In this position, the side flap panel can be secured to the bottom panel by means of securing means including bolt and nut connections 50 depicted in Fig. 5 and tapered locators 52 depicted in Fig. 6.

[0026] The bolt and nut connection 50 illustrated in Fig. 5 comprises a nut 50.1 made of two parts 50.11, 50.12 that bear on the two opposed faces 28.11, 28.12 of the slanted lateral end portion 28.1 of the bottom panel 28, a receiving sleeve 50.2 also made of two parts 52.31, 52.32 inserted in the side flap panel 36 and a bolt 50.3 inserted in the sleeve 50.2 and in threaded engagement with the nut 50.1. The tapered locator 52 illustrated in Fig. 6 consists of a tapered pin 52.1 protruding from the slanted lateral end portion 28.1 of the bottom panel 28 and is received in a mating conical and reinforced hole 52.2 provided in the side flap panel. The tapered locator 52 and bolt 50 have insertion axes 52.5, respectively 50.5 that are perpendicular to the contact faces 28.11, 36.1 of the bottom panel 28 and side flap panel 36, and preferably perpendicular to the direction of motion of the side

flap panel 36 at the point of contact with the bottom panel 28. Obviously, the tapered locators 52 are engaged at the end of the motion of the side flap panel 36, 38, 40, 42 towards the closed position, and the bolts 50 are engaged afterwards. The tapered locators 52 ensure a permanent radial contact between the tapered pins 52.1 the conical holes 52.2, and therefore a clearance-free connection. The tapered locators 52 are designed such that the top of the tapered pin 52.1 is visible, preferably flush with the outer surface of the side flap panel 36 in the closed position to allow inspection of the closing position of the side flap panel 36. The bolt and nut connection 50 apply the required axial force between the two contact surfaces 28.11, 36.1. Obviously, the description made with reference to the bottom panel 28 and side flap panel 36 also applies to the other panels, e.g. roof panels.

[0027] Various modifications can be made. In particular, various securing means can be selected. The orientation of the lateral end portion of the bottom panel with respect to the general plane of the bottom panel can vary from 0° to 90° depending on a number of factors including the ergonomics for the staff opening and closing the housing, the volume of the enclosed component and the hull of the vehicle.

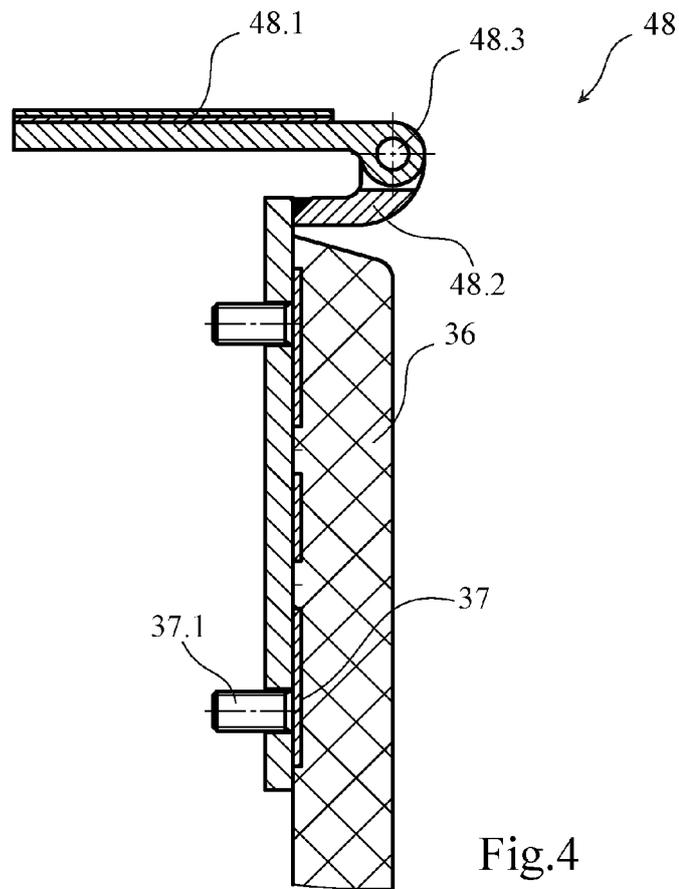
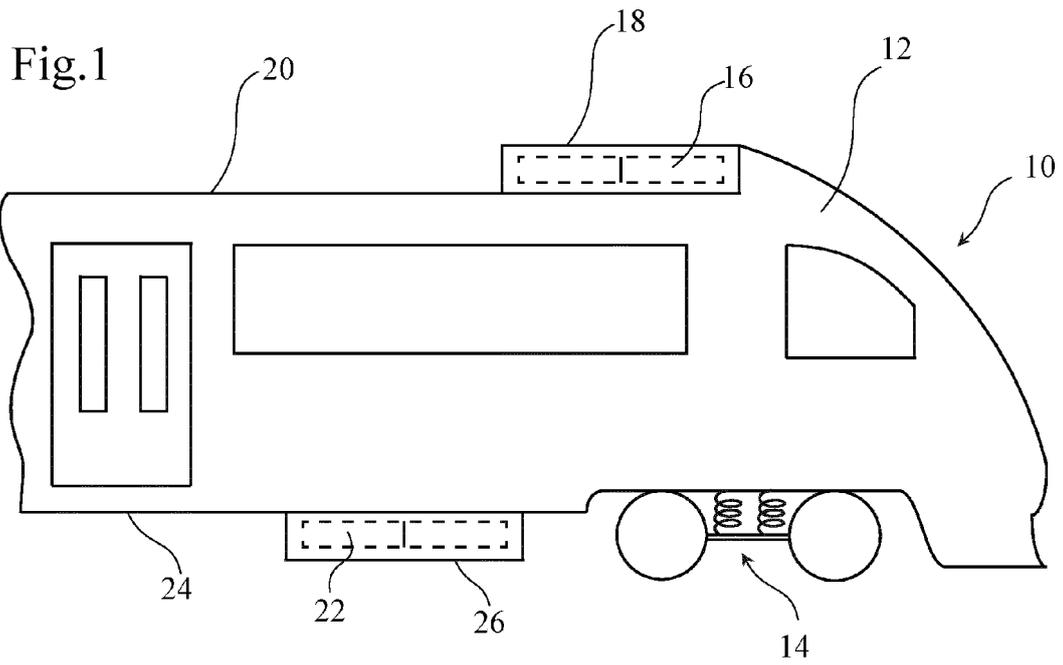
[0028] The Side flap panels can partly encompass the bottom of the bottom panels, in which case the connecting means provide form fit only in the longitudinal direction of the railway car.

[0029] The outer edges of the bottom panels may be reinforced only in the longitudinal direction of the railway car.

Claims

1. A railway car (10) comprising a car body (12), at least one component (16, 22) fixed to the exterior of the car body (10) and a housing (18, 26) fixed to the exterior of the car body for enclosing the component (16, 22), the housing (18, 26) comprising at least one transverse panel (28, 30, 32, 34) facing the car body (12) and at least one side flap panel (36, 38, 40, 42) movable between a closed position in which the side flap panel (36, 38, 40, 42) closes a volume for the component (16, 22) defined between the transverse panel (28, 30, 32, 34) and the car body (12) and an open position, the housing (18, 26) being provided with removable securing means (50, 52) for securing the side flap panel (36, 38, 40, 42) in the closed position, **characterised in that** the side flap panel (36, 38, 40, 42) and the transverse panel (28, 30, 32, 34) are made of lightweight material, and **in that** the securing means (50, 52) are provided between the transverse panel (28, 30, 32, 34) and the side flap panel (36, 38, 40, 42) in the closed position such that the transverse panel (28, 30, 32, 34), the side flap panel (36, 38, 40, 42) in the closed position and the securing means form a unitary and interacting self-

- supporting and load-bearing structure.
2. The railway car of claim 1, **characterised in that** the housing is not self-supported in the open position of the side flap panel.
 3. The railway car of claim 1 or claim 2, **characterised in that** the side flap panel (36, 38, 40, 42) in the closed position overlaps and is pressed against an outwardly-oriented face (28.11, 30.11, 32.11, 34.11) of the transverse panel (28, 30, 32, 24), such that movement parallel to a plane of the outwardly-oriented face and perpendicular to the outwardly-oriented face is prevented.
 4. The railway car of any one of the preceding claims, **characterised in that** the securing means (50, 52) comprise a form fit and/or friction fit connection.
 5. The railway car of any one of the preceding claims, **characterised in that** the securing means (50, 52) include at least one self-centering tapered locator (52), which preferably comprises a top that is visible, preferably flush with the side flap panel, in the closed position of the side flap panel.
 6. The railway car of any one of the preceding claims, **characterised in that** the securing means (50, 52) include at least one bolt and nut connection (50).
 7. The railway car of any one of the preceding claims, **characterised in that** the housing further comprises at least one, and preferably two opposed sheet metal stiffening end panels (44, 46).
 8. The railway car of any one of the preceding claims, **characterised in that** the housing comprises at least two transverse panels (36, 38, 40, 42) and a metallic structural cross-member (47) having two ends secured to the car body (12) and forming an arch extending between the two transverse panels (36, 38, 40, 42), each of the two transverse panels (36, 38, 40, 42) being secured to the structural cross-member (47).
 9. The railway car of any one of the preceding claims, **characterised in that** the lightweight material is an anisotropic material, preferably a composite material, preferably a fibre-reinforced composite material, preferably with a thermoset or thermoplastic matrix.
 10. The railway car of any one of the preceding claims, **characterised in that** the lightweight material, in particular the fibre-reinforced composite material, comprises a low-density core material sandwiched between fibre-reinforced layers, wherein the core material is preferably a honeycomb structure, a foam and/or a folded honeycomb structure, wherein the
- core material is preferably waterproof.
11. The railway car of any one of the preceding claims, **characterised in that** the housing (18, 26) further comprises at least one metallic hinge (48) for hinging the side flap panel (36, 38, 40, 42) to the car body (12).
 12. The railway car of claim 10, **characterised in that** the hinge (48) is such as to limit or prevent translation movement of the side flap panel (36, 38, 40, 42) with respect to the car body (12) parallel to a pivot axis (48.3) of the hinge (48).
 13. The railway car of any one of the preceding claims, **characterised in that** the housing (18, 26) includes at least one side flap panel (36, 38, 40, 42) on each side of the railway car.
 14. The railway car of any one of the preceding claims, **characterised in that** the housing (26) is fixed to an underframe of the car body (12) and the transverse panel (28, 30, 32, 34) is a bottom panel.
 15. The railway car of any one of claims 1 to 12, **characterised in that** the housing (18) is fixed to a roof (14) of the car body and the transverse panel is a cover panel.



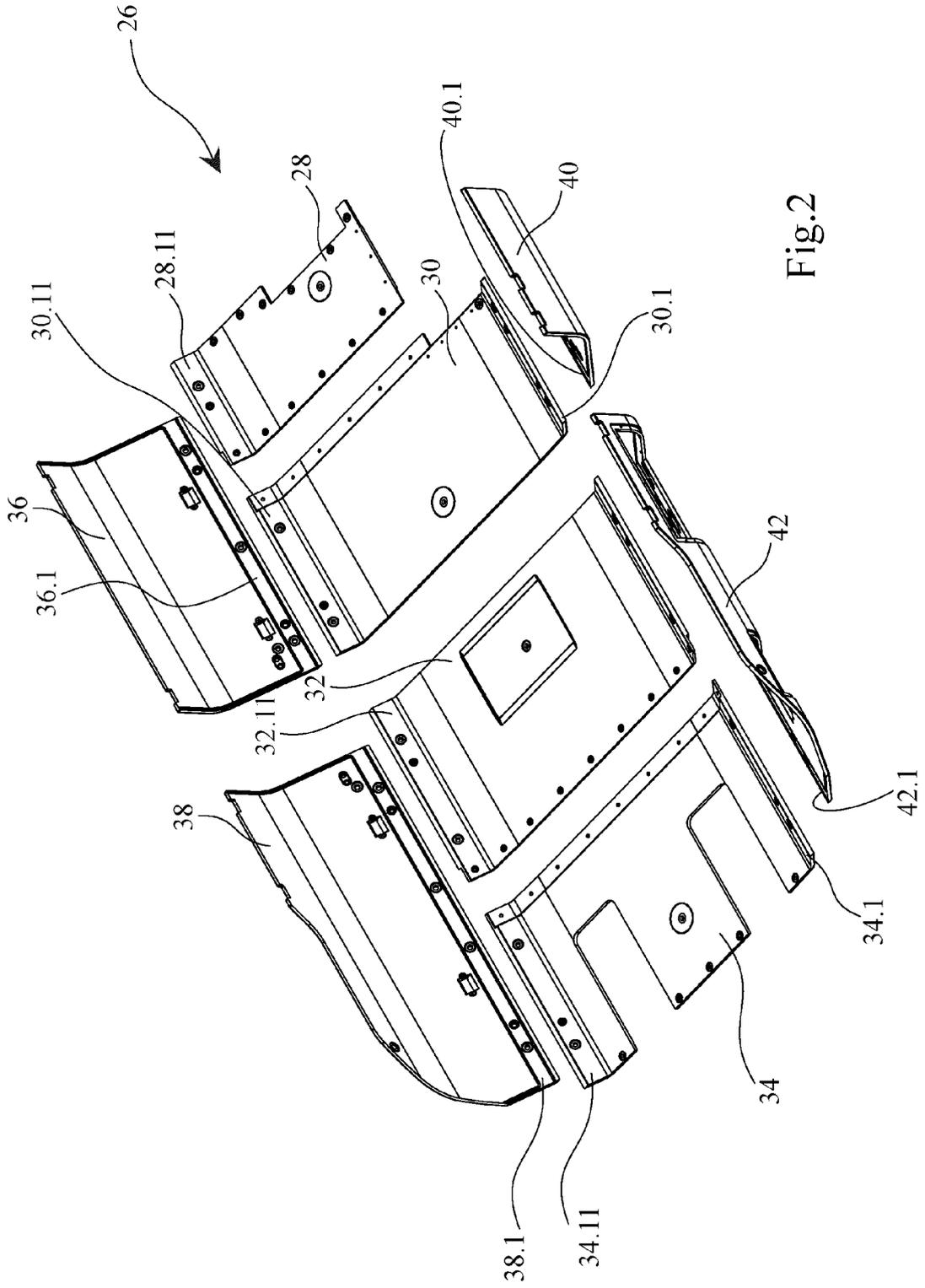


Fig.2

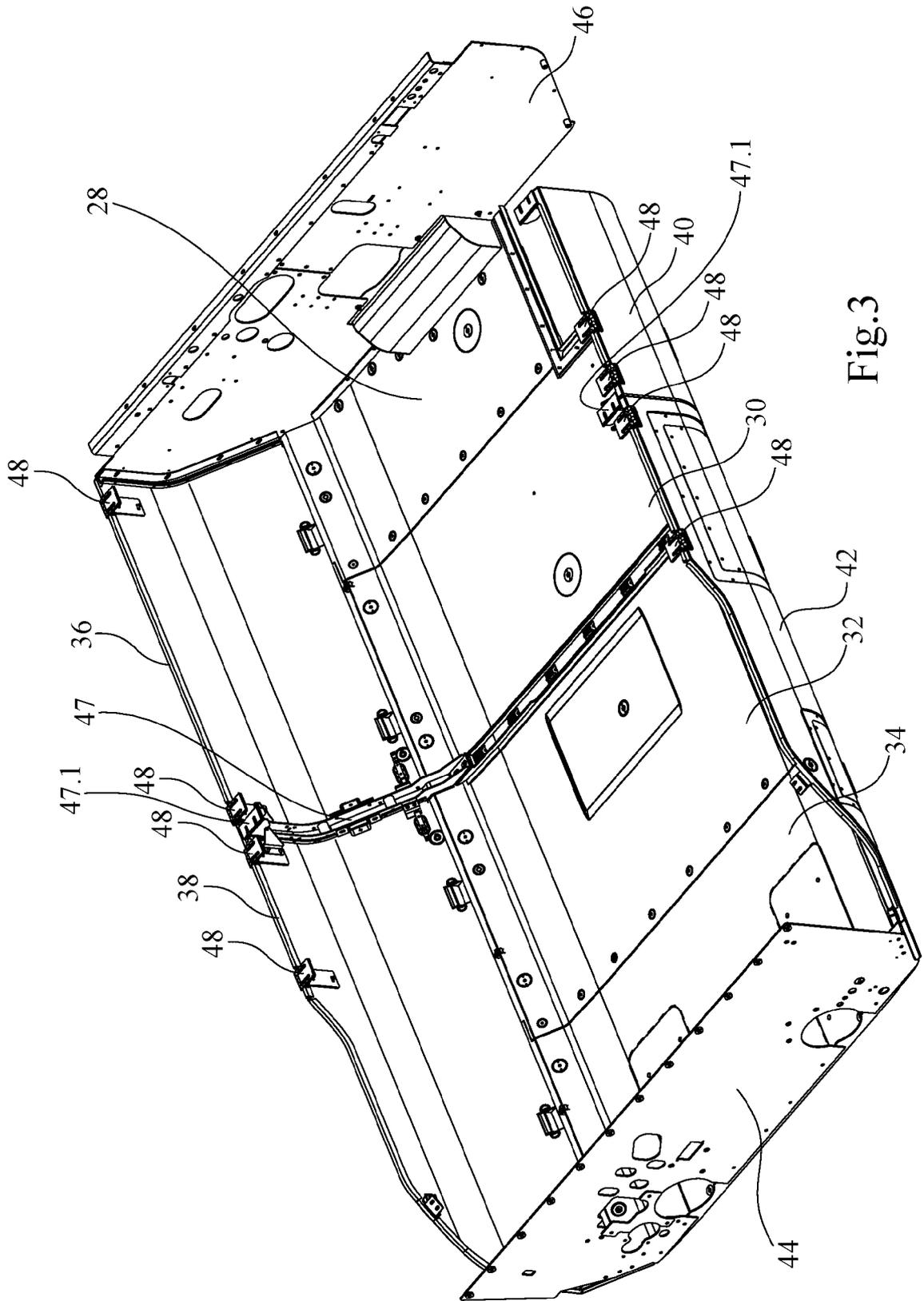


Fig.3

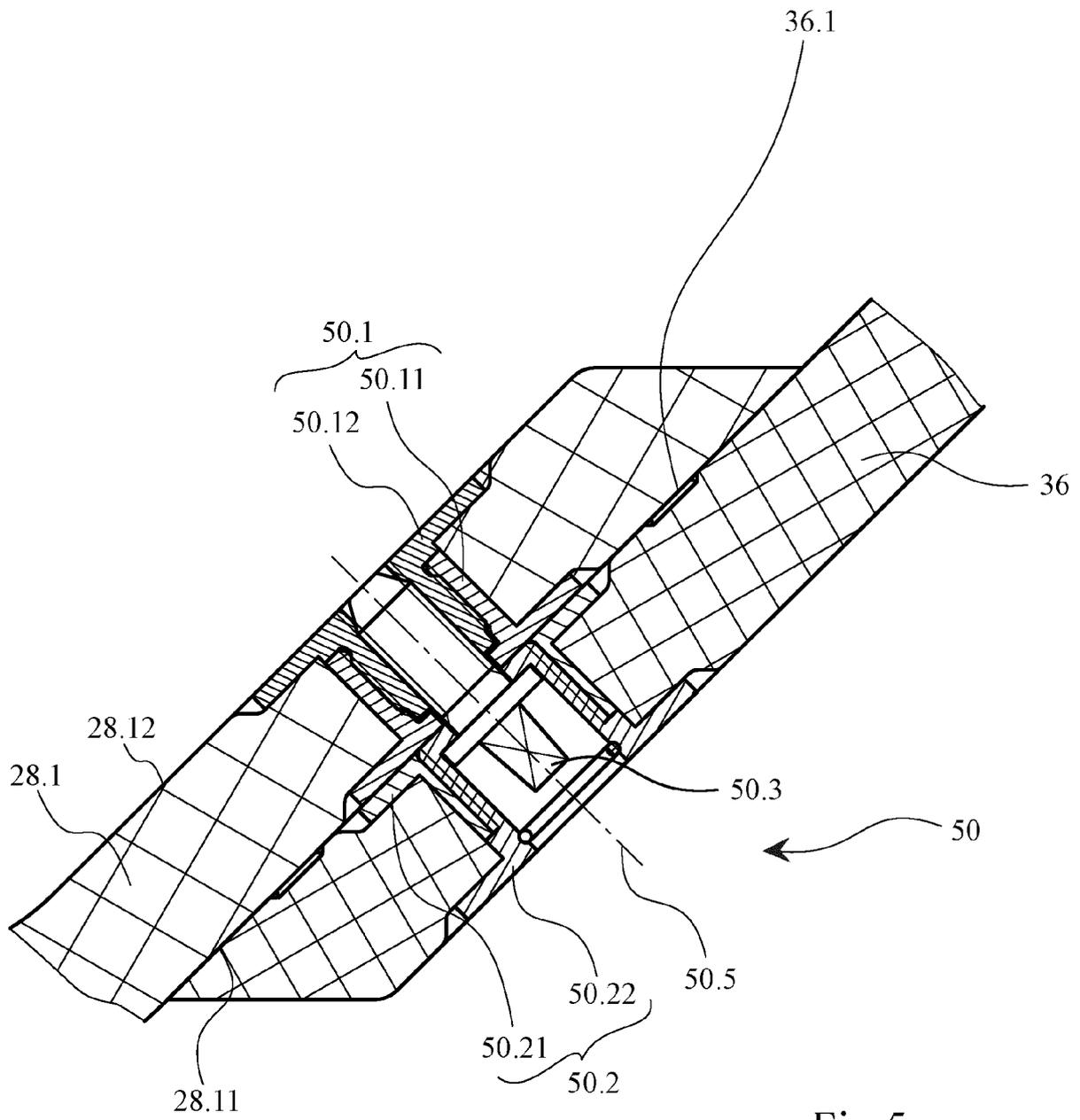


Fig.5

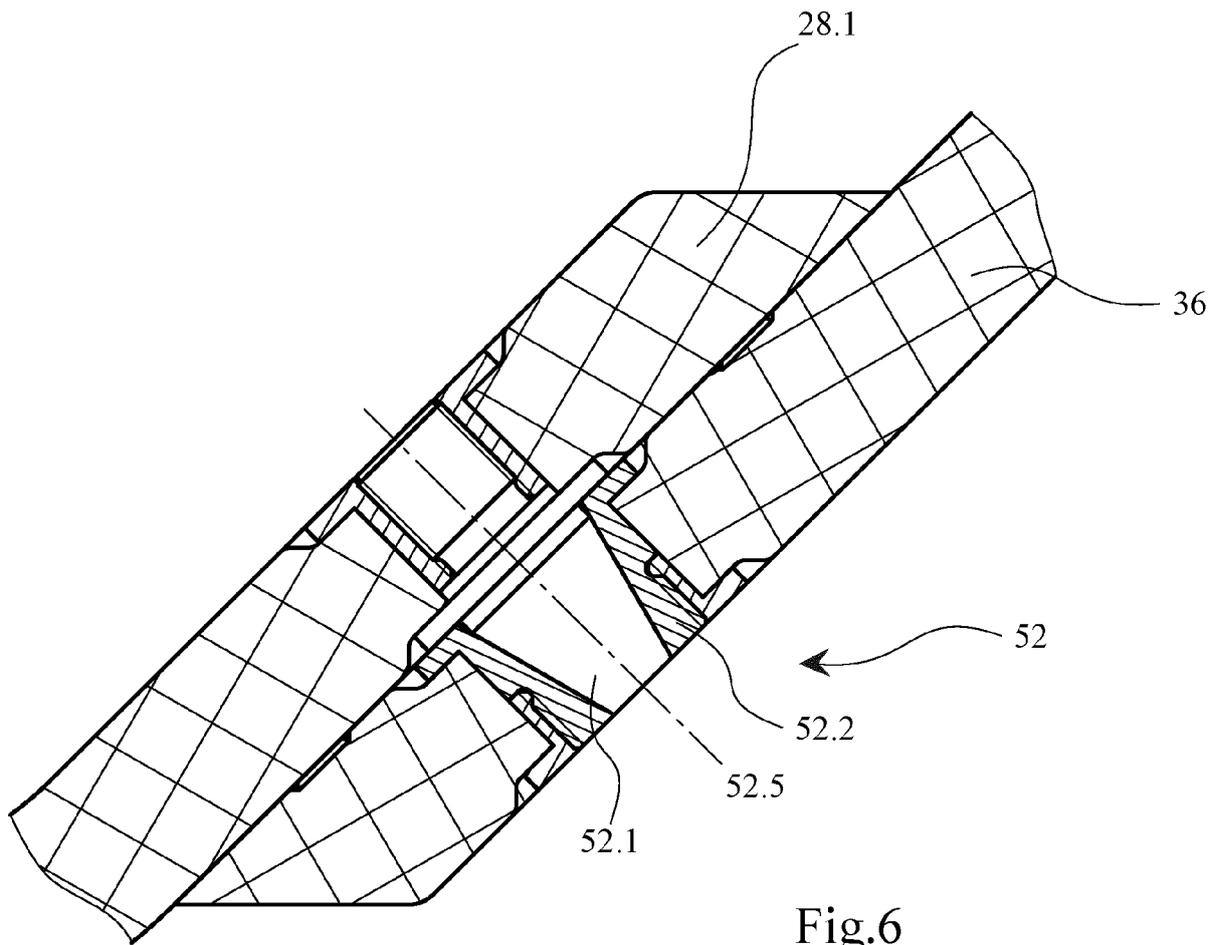


Fig.6



EUROPEAN SEARCH REPORT

Application Number
EP 12 16 1100

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 10 2009 006637 A1 (SIEMENS AG [DE]) 19 August 2010 (2010-08-19) * figure 1 * -----	1	INV. B61D17/10
			TECHNICAL FIELDS SEARCHED (IPC)
			B61D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 September 2012	Examiner Lorandi, Lorenzo
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 16 1100

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04-09-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102009006637 A1	19-08-2010	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1377488 A [0003]
- US 4825774 A [0004]