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(54) RAILWAY VEHICLE COMPRISING AN AIR DEFLECTION SYSTEM AT A LONGITUDINAL EXTREMITY OF A CAR ROOF FACING ANOTHER CAR

(57) A railway vehicle (10) comprising a first car (12) and a second car (14) successive in a longitudinal direction (L), the first car and the second car delimiting an intermediate space (16), the first car having a roof (32) extending along a transverse direction (T), and two lateral walls (46, 48) extending along an elevation direction (V). The vehicle comprises a first system (18) fixed to a longitudinal extremity (64) of the first roof facing the second car, the first system having an upper surface (66) inclined with respect to the first roof, the first system being adapted for deflecting, away from the intermediate space, a flow of air (72) flowing longitudinally along the first roof towards the second car, the intermediate space being open in the elevation direction, downstream of the first system with respect to the first flow of air.

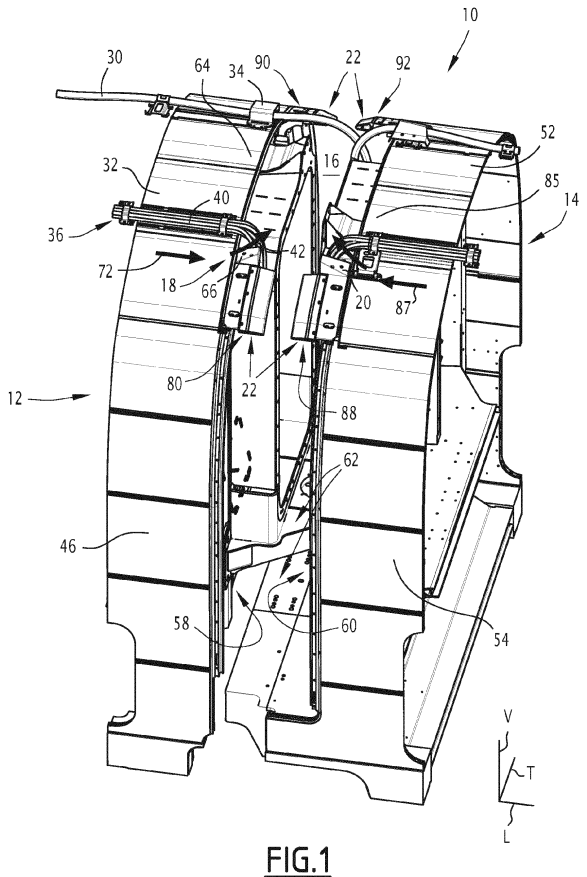

FIG.1

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Description

FIELD OF THE INVENTION

[0001] The present invention deals with a railway vehicle comprising at least a first car and a second car successive in a longitudinal direction in which the vehicle is intended to move, the first car and the second car longitudinally delimiting an intermediate space between themselves, the first car having a first roof extending along a transverse direction perpendicular to the longitudinal direction, and two lateral walls extending from the first roof downwards along an elevation direction perpendicular to the longitudinal direction and to the transverse direction, the second car having a second roof.

BACKGROUND OF THE INVENTION

[0002] The intermediate space usually hosts various systems, such as electrical and mechanical connections between the first car and the second car, and possibly a gangway allowing passengers to move from the first car to the second car and vice-versa.

[0003] For aerodynamic, aesthetic and/or safety reasons, the intermediate space may be at least partly closed radially with respect to the longitudinal direction, for example using lateral bellows connecting the lateral walls of the first car to the lateral walls of the second car.

[0004] However, the intermediate space usually remains partly open, at least in its upper part, in order to provide easy access to the above mentioned systems, for example for control and/or maintenance. Therefore, in some existing high-speed trains, the lateral sides of the intermediate spaces between the cars are closed, while their top side remains open.

[0005] However, it has been noticed that, at high speed, the level of noise coming from outside the vehicle into in the gangway or a platform located in a longitudinal extremity of a car is significantly higher than in a passenger compartment, for example 10 dB higher, which may create a nuisance for passengers.

[0006] An aim of the invention is to provide a vehicle that reduces the level of noise in the platform and the gangway, if any.

SUMMARY OF THE INVENTION

[0007] To this end, the invention proposes a railway vehicle comprising at least a first car and a second car successive in a longitudinal direction in which the vehicle is intended to move, the first car and the second car longitudinally delimiting an intermediate space between themselves, the first car having a first roof extending along a transverse direction perpendicular to the longitudinal direction, and two lateral walls extending from the first roof downwards along an elevation direction perpendicular to the longitudinal direction and to the transverse direction, the second car having a second roof, wherein the vehicle further comprises at least a first system fixed to a longitudinal extremity of the first roof facing the second car, the first system having an upper surface in the elevation direction, the upper surface being inclined with respect to the first roof, the first system being adapted for deflecting, away from the intermediate space, a first flow of air flowing longitudinally along the first roof towards the second car, the intermediate space being open in the elevation direction, downstream of the first system with respect to the first flow of air.

[0008] In other particular embodiments, the vehicle comprises one or several of the following features, taken in isolation or any technically feasible combination:

- the upper surface and the first roof locally define an angle comprised between 25° and 30°;
- the upper surface is flat;
- the first system comprises a first portion mounted on the first roof and forming a longitudinal extension of the first roof, and a second portion mounted on top the first portion and defining the upper surface;
- the vehicle comprises at least one second system structurally analogous to the first system, the second system being fixed to a longitudinal extremity of the second roof facing the first car, the second system being adapted for deflecting, away from the intermediate space, a second flow of air flowing longitudinally along the second roof towards the first car, the intermediate space being open in the elevation direction, downstream of the second system with respect to the second flow of air;
- the second system is aligned with the first system in the longitudinal direction;
- the vehicle transversely defines a central zone and two lateral zones on either sides of the central zone and symmetrical with respect to a median plane of the first car perpendicular to the transverse direction, the first system being within the central zone, the vehicle further comprising a third system including a first flap and a second flap respectively mounted on the first roof and the second roof in one of the two lateral zones, and forming longitudinal extensions of the first roof and the second roof, the first flap and the second flap facing each other in the longitudinal direction in order to partly close the intermediate space along the elevation direction, the first flap comprising a distal portion with respect to the first roof, the second flap comprising a distal portion with respect to the second roof, said distal portions comprising an elastomeric material;
- the first system is located in a transverse extremity of the central zone, the transverse extremity being on the side of the first flap with respect to the median plane;
- the first flap comprises a proximal portion with respect to the first roof, the proximal portion of the first flap and the first portion of the first system being integral with each other;

- said distal portions are separated by a longitudinal distance when the vehicle moves along a straight line, the longitudinal distance being smaller than 15 cm;
- the third system includes a third flap and a fourth flap structurally analogous to the first flap and the second flap respectively, the third flap and the fourth flap being mounted on the first roof and the second roof above the intermediate space in the other of the two lateral zones, the third flap and the fourth flap facing each other in the longitudinal direction and partly closing the intermediate space along the elevation direction;
- the vehicle comprises a high voltage cable extending longitudinally on the first roof, and a support of the high voltage cable protruding from the first roof and in which the high voltage cable is intended to slide, the first system and a portion of the support being located at the same distance and on either sides of a median plane of the first car perpendicular to the longitudinal direction;
- the vehicle comprises a bundle of low voltage cables, the bundle having a part extending longitudinally on the first roof, and another part turning from the first roof into the intermediate space, said other part and the first system being in mechanical contact or separated by a transverse distance smaller than 25 cm;
- the first system and the first roof have uppermost parts in the elevation direction defining a distance in the elevation direction, said distance being smaller than 5 cm; and
- the vehicle comprises a gangway adapted for allowing passengers to move from the first car to the second car and vice-versa, said gangway crossing the intermediate space, wherein the first system is spaced apart from the gangway in the transverse direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The invention and its advantages will be better understood upon reading the following description, given solely by way of example and with reference to the appended drawing, in which:

- Figure 1 is a partial perspective view of vehicle according to the invention, directed at the intermediate space,
- Figure 2 is a partial top view of the vehicle represented in Figure 1,
- Figure 3 is a detailed perspective view showing the first, second and third systems of the vehicle shown in Figures 1 and 2, and
- Figure 4 is a partial axial view of the first car of the vehicle shown in Figures 1 to 3, seen from the second car along the longitudinal direction of the vehicle.

DETAILED DESCRIPTION

[0010] A railway vehicle 10 according to the invention will now be described with reference to Figures 1 and 2.

[0011] The vehicle 10 is for example a high-speed train, advantageously designed to travel at a speed greater than 250 km/h under regular commercial operating conditions.

[0012] The vehicle 10 comprises a first car 12 and a second car 14 (partially shown in Figures 1 and 2). Only extremities of the car body structures are shown successive in a longitudinal direction L in which the vehicle is intended to move, the first car 12 and the second car 14 longitudinally delimiting an intermediate space 16 between themselves.

[0013] The vehicle 10 may comprise other cars (not shown), in the form of one or several trains (not shown) of cars, each train including two or more cars.

[0014] A transverse direction T of the vehicle 10 is defined as perpendicular to the longitudinal direction L and intended to be horizontal when the vehicle moves on a horizontal surface (not shown). An elevation direction V of the vehicle 10 is also defined as perpendicular to the longitudinal direction L and to the transverse direction T. The elevation direction V is thus vertical when the vehicle 10 moves on said horizontal surface.

[0015] The vehicle 10 comprises at least a first system 18 (Figures 1 to 4) adapted for reducing noise coming from the intermediate space 16. In the example, the vehicle 10 comprises a second system 20 (Figures 1 and 2) and a third system 22 (Figures 1 to 4) having the same purpose.

[0016] For example, the vehicle 10 transversely defines a central zone 24, and two lateral zones 26, 28 (Figures 2 and 4) on either sides of the central zone and symmetrical with respect to a median plane P of the first car 12 perpendicular to the transverse direction T. In the example, the first system 18 and the second system 20 are within the central zone 24, the third system 22 being in at least one of the two lateral zones 26, 28.

[0017] As a variant (not shown), the vehicle 10 comprises one or several additional system(s) analogous to the first system 18. The additional systems are located near the first system 18 in the transverse direction T, and/or near a location that is symmetrical to the location of the first system 18 with respect to the median plane P.

[0018] In a particular embodiment, the vehicle 10 comprises a high voltage cable 30 (Figures 1 to 4) extending longitudinally on a first roof 32 of the first car 12, and a support 34 of the high voltage cable protruding from the first roof in the elevation direction V and in which the high voltage cable is intended to slide. By "high voltage", it is for example meant "more than 1000 V".

[0019] In the example, the vehicle 10 comprises a bundle 36 of low voltage cables 38 (Figures 1 to 4), the bundle having a part 40 extending longitudinally on the first roof 32, and another part 42 turning from the first roof into the intermediate space 16. By "low voltage", it is for

example meant "1000 V or less than 1000 V".

[0020] Advantageously, the vehicle 10 comprises a gangway 44 adapted for allowing passengers (not shown) to move from the first car 12 to the second car 14 and vice-versa, said gangway crossing the intermediate space 16.

[0021] Apart from the first roof 32, the first car 12 comprises two lateral walls 46, 48 extending from the first roof 32 downwards along the elevation direction V.

[0022] The first roof 32 extends in the transverse direction T, and usually mainly in the longitudinal direction L. In the example, the first roof 32 is curved and barely has a horizontal portion 50.

[0023] For example, the first roof 32 and the lateral walls 46, 48 are continuous in shape around the longitudinal direction L.

[0024] In order to define limits between the first roof 32 and the lateral walls 46, 48, the lateral walls are vertical or inclined for example less than 45° with respect to the elevation direction V, whereas the first roof is inclined for example more than 45° with respect to the elevation direction V.

[0025] The second car 14 is for example analogous to the second car 12 and will not be described in detail. The second car 14 comprises a second roof 52, and lateral walls 54, 56.

[0026] The intermediate space 16 is delimited in the longitudinal direction L by a first longitudinal extremity 58 of the first car 12 and a second longitudinal extremity 60 of the second car 14 facing each other. In the example, the intermediate space 16 is delimited by the gangway 44 radially with respect to the longitudinal direction L, the gangway advantageously having a tubular shape and the intermediate space partly surrounding the gangway. For example, the intermediate space 16 is delimited in the elevation direction V downwards by lower parts 62 (Figures 1 and 2) of the first car 12 and the second car 14 adapted for connecting the first car and the second car to each other.

[0027] Advantageously, the intermediate space 16 is at least party closed transversely by flaps (not shown) or similar elements (such as bellows), for example removable, and fixed to the lateral walls 46, 48, 54, 56 of the first car 12 and the second car 14, in order to insure longitudinal continuity of the lateral walls, while allowing access to the intermediate space when the flaps or said similar elements are removed.

[0028] The first system 18 is fixed to a longitudinal extremity 64 of the first roof 32 facing the second car 14. The first system 18 has an upper surface 66 in the elevation direction V, the upper surface being inclined with respect to the first roof 32. For example, the first system 18 is transversely delimited by two walls 68, 70 which are advantageously parallel to the longitudinal direction L (Figure 4).

[0029] In the example, the first system 18 is offset longitudinally towards the second car 14 relative to the first roof 32. As a variant, not shown, the first system 18 is located on the first roof 32.

[0030] The first system 18 is adapted for deflecting, away from the intermediate space 16 and upwards, a first flow of air 72 (Figure 3) flowing longitudinally along the first roof 32 towards the second car 14, the intermediate space 16 being open in the elevation direction V, downstream of the first system 18 with respect to the first flow of air 72.

[0031] Advantageously, the first system 18 comprises a first portion 74 mounted on the first roof 32 and forming a longitudinal extension of the first roof, and a second portion 76 mounted on top the first portion and defining the upper surface 66 (Figures 3 and 4).

[0032] For example, the first system 18 comprises at least 90wt% of steel.

[0033] The first system 18 is for example located in a transverse extremity 78 of the central zone 24, the transverse extremity 78 being on the side of a first flap 80 of the third system 22 with respect to the median plane P.

[0034] Advantageously, the first system 18 and a portion 82 of the support 34 are located at the same distance D and on either sides of the median plane P (Figures 2 and 4). Thanks to this feature, the first car 12, in the example, does not need a system analogous to the first system 18 and symmetrical to the first system 18 with respect to the median plane P. The portion 82 of the support 34 is advantageously adapted for playing the same role as the first system 18, at least to some extent, i.e. deflecting a flow of air (not shown) flowing longitudinally along the first roof 32 towards the second car 14.

[0035] The first system 18 and the other part 42 of the bundle 36 are in mechanical contact or separated by a transverse distance D1 smaller than 25 cm. This allows minimizing the opening of the intermediate space 16 near the first system 18.

[0036] Advantageously, the first system 18 and the first roof 32 have uppermost parts 84, 86 in the elevation direction V defining a distance D2 between them in the elevation direction V, said distance being smaller than 5 cm. This allows not increasing, or not significantly, the height of the first car 12.

[0037] In the central zone 24, the first car 12 (and the vehicle 10) can have a certain height or gauge, and positioning the first system 18 in the central zone allows not to exceed an authorized height or gauge. On the contrary, positioning the first system 18 in one of the lateral zones 26, 28 could raise an issue in terms of height of the vehicle.

[0038] For example, the first system 18 is spaced apart from the gangway 44 in the transverse direction T, for acoustic reasons and for allowing the other part 42 of the bundle 36 to easily extend between the gangway and the first system.

[0039] Advantageously, the upper surface 66 and the first roof 32 locally define an angle α comprised between 25° and 30° in order to maximize noise reduction. In the example, the upper surface 66 is flat.

[0040] The second system 20 is for example structu-

rally analogous to the first system 18 and will not be described in detail.

[0041] For example, the second system 20 is symmetrical to the first system 18 with respect a plane P' perpendicular to the longitudinal direction L and crossing the intermediate space 16.

[0042] As a result, the second system 20 is aligned with the first system 18 in the longitudinal direction L.

[0043] As a variant (not shown), the second system 20 is located on the other side of the median plane P with respect to its location in the example, i.e. aligned with the support 34.

[0044] The second system 20 is fixed to a longitudinal extremity 85 of the second roof 52 facing the first car 12. The second system 20 is adapted for deflecting, away from the intermediate space 16 and upwards, a second flow of air 87 flowing longitudinally along the second roof 52 towards the first car 12, the intermediate space 16 being open in the elevation direction V, downstream of the second system with respect to the second flow of air.

[0045] The third system 22 includes the first flap 80 and a second flap 88 respectively mounted on the first roof 32 and the second roof 52 in one of the two lateral zones 26, 28, and forming longitudinal extensions of the first roof 32 and the second roof 52 above the intermediate space 16.

[0046] For example, the third system 22 includes a third flap 90 and a fourth flap 92 respectively mounted on the first roof 32 and the second roof 52 in the other of the two lateral zones 26, 28, and forming longitudinal extensions of the first roof 32 and the second roof 52 above the intermediate space 16.

[0047] The first flap 80 and the second flap 88 face each other in the longitudinal direction L in order to partly close the intermediate space 16 along the elevation direction V.

[0048] The first flap 80 comprises a distal portion 94 (Figure 3) with respect to the first roof 32 and the second flap 88 comprises a distal portion 96 with respect to the second roof 52.

[0049] Since the flaps 80, 88, 90, 92 are longitudinal extensions of the first roof 32 and the second roof 52, they advantageously do not form vertical protrusions in the lateral zones 26, 28 with respect to the first roof and the second roof.

[0050] The distal portions 94, 96 for example comprise, or are made of, an elastomeric material. The distal portions 94, 96 are advantageously separated by a longitudinal distance D3 when the vehicle moves along a straight line, the longitudinal distance D3 being smaller than 15 cm.

[0051] The third flap 90 and the fourth flap 92 face each other in the longitudinal direction L and partly closing the intermediate space 16 along the elevation direction V. The third flap 90 and the fourth flap 92 are advantageously structurally analogous to the first flap 80 and the second flap 88, except that they are shorter in the transverse direction T in the example.

[0052] For example, the first flap 80 comprises a proximal portion 98 with respect to the first roof 32. Advantageously, the proximal portion 98 and the first portion 74 of the first system 18 are integral with each other.

[0053] The operation of the vehicle 10 will now be briefly explained.

[0054] When the vehicle 10 moves, the upper surface 66 of first system 18 deflects the first flow of air 72. It has been noticed that this allows reducing the noise generated within the intermediate space.

[0055] The second system 20 plays the same role by deflecting the second flow of air 87, or the first flow of air 72 depending on whether the vehicle 10 moves to the right or to the left in Figure 2.

[0056] The third system 22 also reduces interaction between flows of air due to movement of the vehicle 10 and air within the intermediate space 16 in the lateral zones 26, 28.

[0057] Thanks to the above features, the vehicle 10 reduces the level of noise originating from the intermediate space 16 and perceived by the passengers in the gangway 44 or nearby platforms of the first car 12 and the second car 14.

Claims

1. A railway vehicle (10) comprising at least a first car (12) and a second car (14) successive in a longitudinal direction (L) in which the vehicle (10) is intended to move, the first car (12) and the second car (14) longitudinally delimiting an intermediate space (16) between themselves, the first car (12) having a first roof (32) extending along a transverse direction (T) perpendicular to the longitudinal direction (L), and two lateral walls (46, 48) extending from the first roof (32) downwards along an elevation direction (V) perpendicular to the longitudinal direction (L) and to the transverse direction (T), the second car (14) having a second roof (52), wherein the vehicle (10) further comprises at least a first system (18) fixed to a longitudinal extremity (64) of the first roof (32) facing the second car (14), the first system (18) having an upper surface (66) in the elevation direction (V), the upper surface (66) being inclined with respect to the first roof (32), the first system (18) being adapted for deflecting, away from the intermediate space (16), a first flow of air (72) flowing longitudinally along the first roof (32) towards the second car (14), the intermediate space (16) being open in the elevation direction (V), downstream of the first system (18) with respect to the first flow of air (72).

2. The vehicle (10) according to claim 1, wherein the upper surface (66) and the first roof (32) locally define an angle (α) comprised between 25° and 30°.

3. The vehicle (10) according to claim 1 or 2, wherein

the upper surface (66) is flat.

4. The vehicle (10) according to any one of claims 1 to 3, wherein the first system (18) comprises a first portion (74) mounted on the first roof (32) and forming a longitudinal extension of the first roof (32), and a second portion (76) mounted on top the first portion (74) and defining the upper surface (66).

5. The vehicle (10) according to any one of claims 1 to 4, comprising at least one second system (20) structurally analogous to the first system (18), the second system (20) being fixed to a longitudinal extremity (85) of the second roof (52) facing the first car (12), the second system (20) being adapted for deflecting, away from the intermediate space (16), a second flow of air (87) flowing longitudinally along the second roof (52) towards the first car (12), the intermediate space (16) being open in the elevation direction (V), downstream of the second system (20) with respect to the second flow of air (87).

6. The vehicle (10) according to claim 5, wherein the second system (20) is aligned with the first system (18) in the longitudinal direction (L).

7. The vehicle (10) according to any one of claims 1 to 6, transversely defining a central zone (24) and two lateral zones (26, 28) on either sides of the central zone (24) and symmetrical with respect to a median plane (P) of the first car (12) perpendicular to the transverse direction (T), the first system (18) being within the central zone (24), the vehicle (10) further comprising a third system (22) including a first flap (80) and a second flap (88) respectively mounted on the first roof (32) and the second roof (52) in one of the two lateral zones (26, 28), and forming longitudinal extensions of the first roof (32) and the second roof (52), the first flap (80) and the second flap (88) facing each other in the longitudinal direction (L) in order to partly close the intermediate space (16) along the elevation direction (V), the first flap (80) comprising a distal portion (94) with respect to the first roof (32), the second flap (88) comprising a distal portion (96) with respect to the second roof (52), said distal portions (94, 96) comprising an elastomeric material.

8. The railway vehicle (10) according to claim 7, wherein the first system (18) is located in a transverse extremity of the central zone (24), the transverse extremity being on the side of the first flap (80) with respect to the median plane (P).

9. The railway vehicle (10) according to claim 4 and claim 7 or 8, wherein the first flap (80) comprises a proximal portion with respect to the first roof (32), the proximal portion of the first flap (80) and the first portion (74) of the first system (18) being integral with each other.

10. The vehicle (10) according to any one of claims 7 to 9, wherein said distal portions (94, 96) are separated by a longitudinal distance (D3) when the vehicle (10) moves along a straight line, the longitudinal distance (D3) being smaller than 15 cm.

11. The vehicle (10) according to any one of claims 7 to 10, wherein the third system (22) includes a third flap (90) and a fourth flap (92) structurally analogous to the first flap (80) and the second flap (88) respectively, the third flap (90) and the fourth flap (92) being mounted on the first roof (32) and the second roof (52) above the intermediate space (16) in the other of the two lateral zones (26, 28), the third flap (90) and the fourth flap (92) facing each other in the longitudinal direction (L) and partly closing the intermediate space (16) along the elevation direction (V).

12. The vehicle (10) according to any one of claims 1 to 11, comprising a high voltage cable (30) extending longitudinally on the first roof (32), and a support (34) of the high voltage cable (30) protruding from the first roof (32) and in which the high voltage cable (30) is intended to slide, the first system (18) and a portion (82) of the support (34) being located at the same distance (D) and on either sides of a median plane (P) of the first car (12) perpendicular to the longitudinal direction (L).

13. The vehicle (10) according to any one of claims 1 to 12, further comprising a bundle (36) of low voltage cables (38), the bundle (36) having a part (40) extending longitudinally on the first roof (32), and another part (42) turning from the first roof (32) into the intermediate space (16), said other part (42) and the first system (18) being in mechanical contact or separated by a transverse distance (D1) smaller than 25 cm.

14. The vehicle (10) according to any one of claims 1 to 13, wherein the first system (18) and the first roof (32) have uppermost parts (84, 86) in the elevation direction (V) defining a distance (D2) in the elevation direction (V), said distance (D2) being smaller than 5 cm.

15. The vehicle (10) according to any one of claims 1 to 14, comprising a gangway (44) adapted for allowing passengers to move from the first car (12) to the second car (14) and vice-versa, said gangway (44) crossing the intermediate space (16), wherein the first system (18) is spaced apart from the gangway (44) in the transverse direction (T).

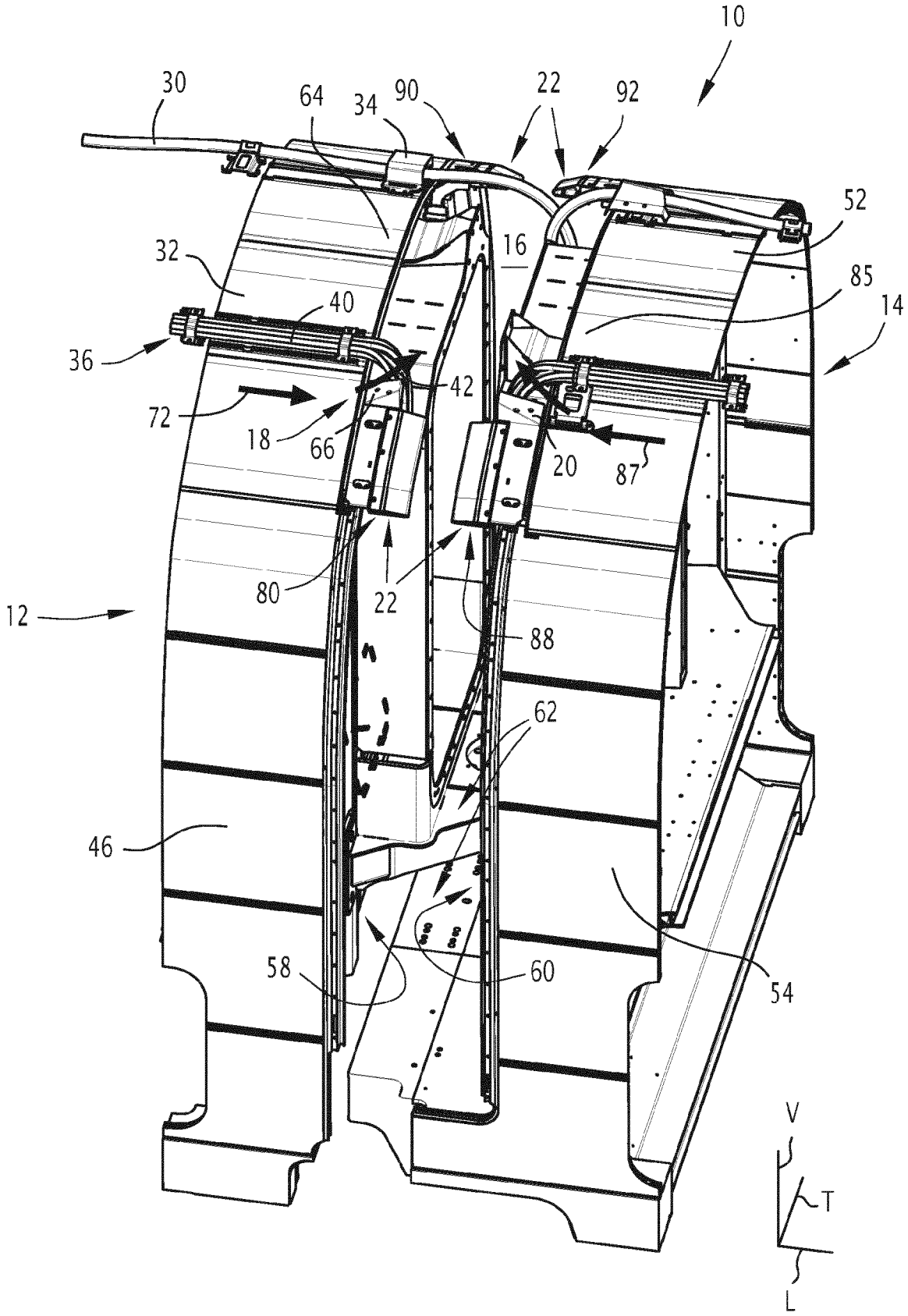
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FIG.1

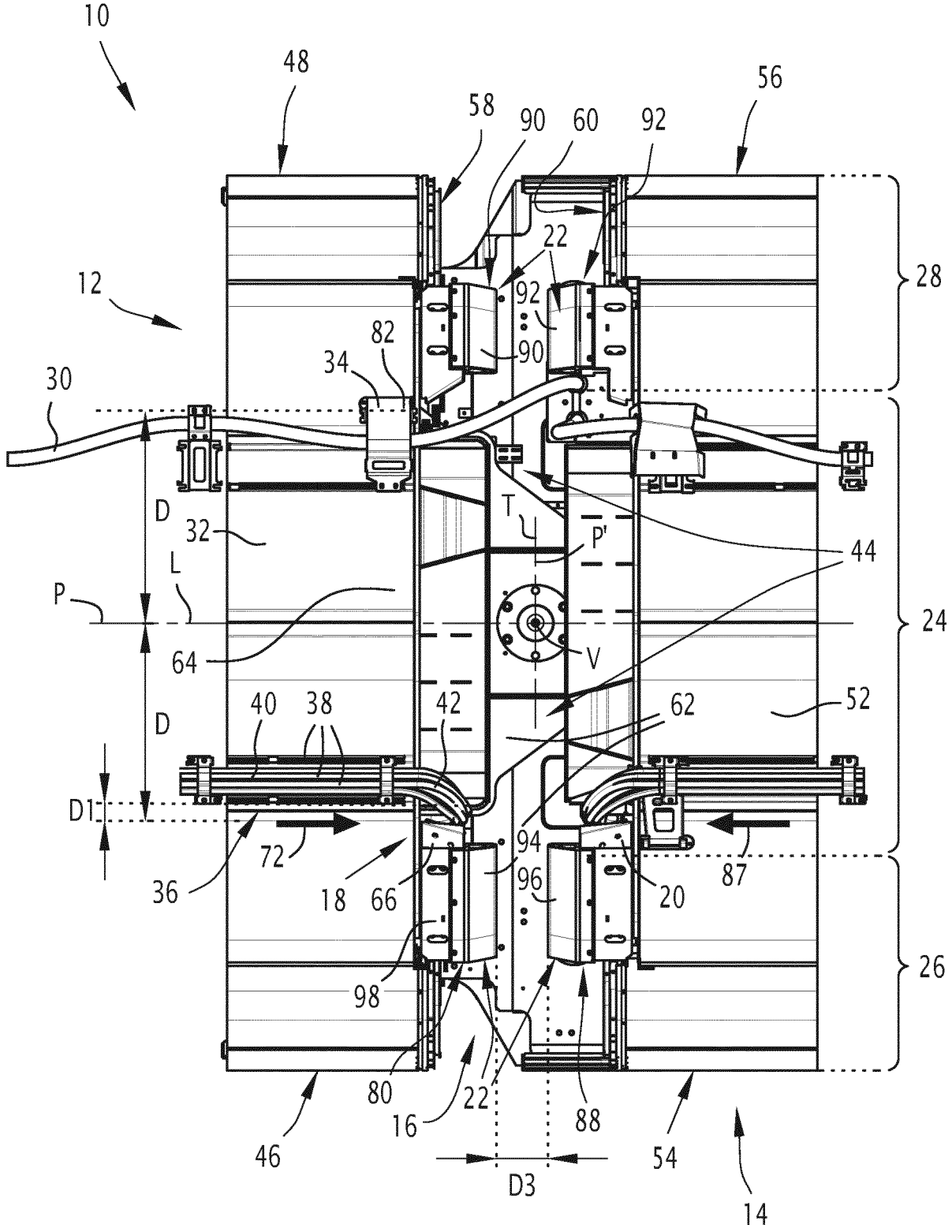
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FIG.2

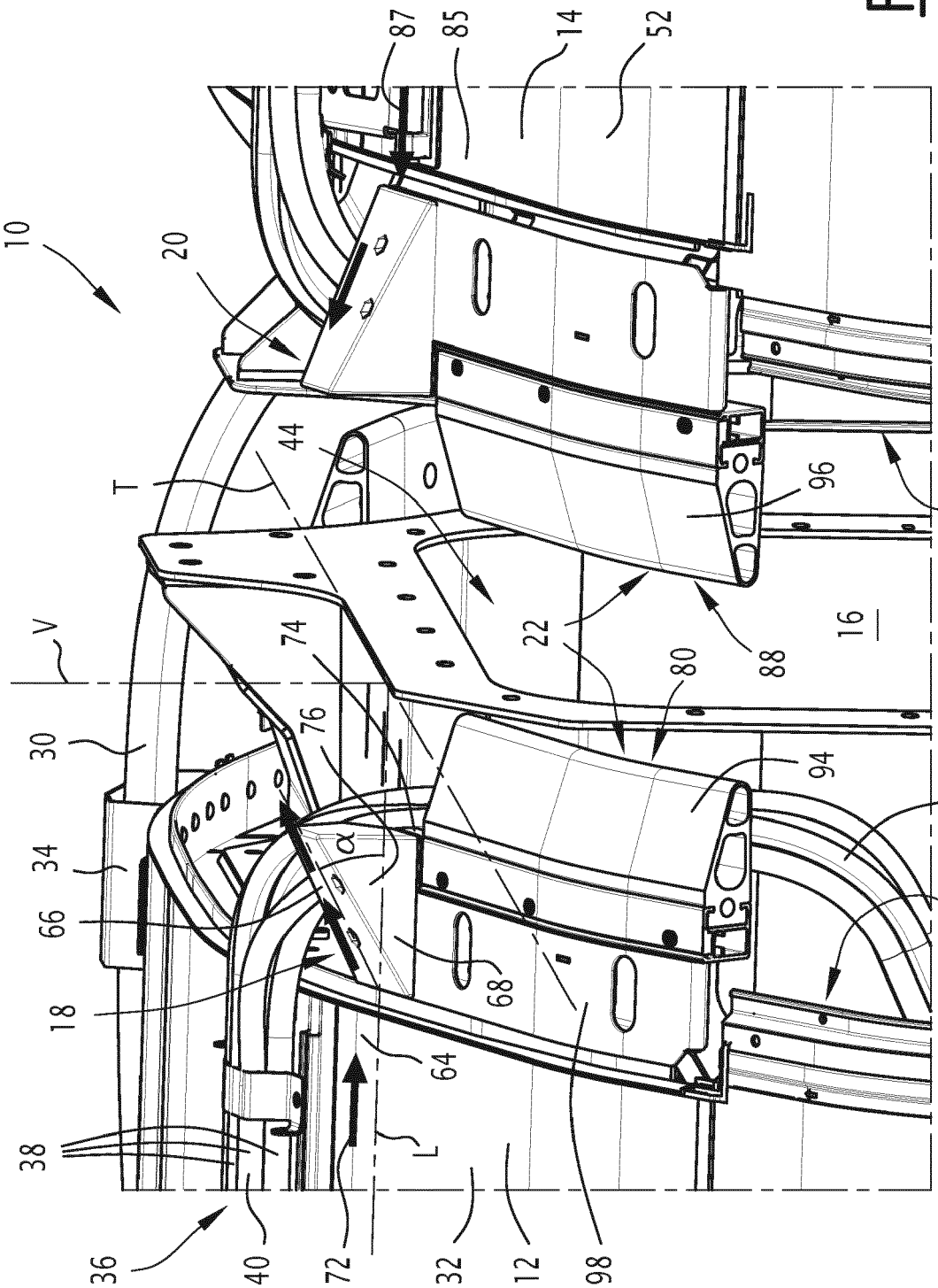
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FIG.3

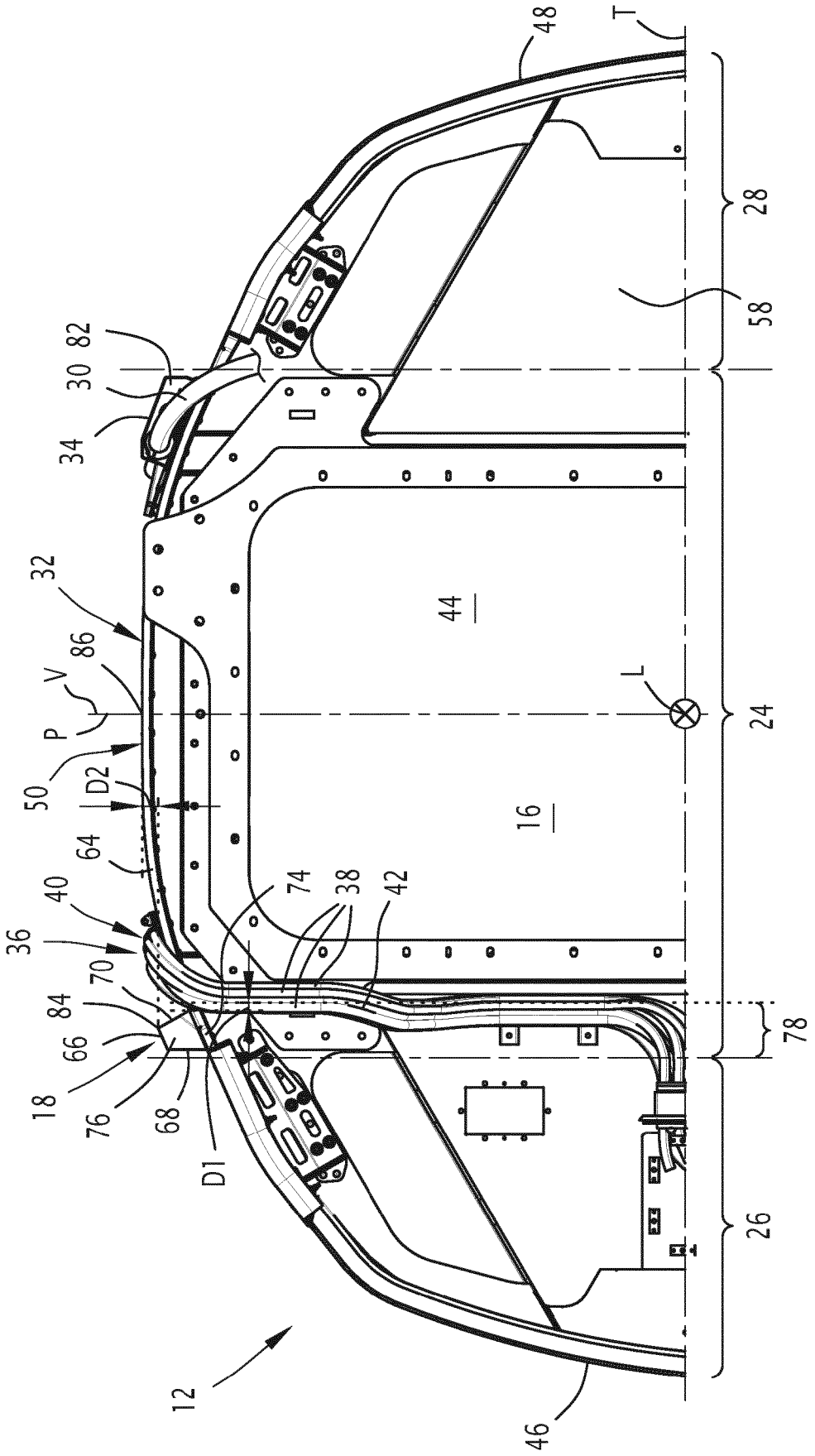
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FIG.4

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 23 30 6855

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 2020/353957 A1 (MAYNES SPENCER WHEATLEY [US] ET AL) 12 November 2020 (2020-11-12) * the whole document *	1-6, 12-15 7-11	INV. B61D17/02
X A	FR 3 092 061 A1 (SNCF MOBILITES [FR]) 31 July 2020 (2020-07-31) * figures 1, 2, 5b, 6 *	1-6, 12-15 7-11	
A	US 10 981 583 B2 (HUEBNER GMBH & CO KG [DE]) 20 April 2021 (2021-04-20) * claim 4; figures 2, 3 *	7-11	
A	KR 101 234 563 B1 (S J KOREA CO LTD [KR]) 19 February 2013 (2013-02-19) * figures 1-6 *	7-11	

TECHNICAL FIELDS SEARCHED (IPC)

B61D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 March 2024	Denis, Marco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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