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(54) Title: LIFTING FLOOR TRAIN

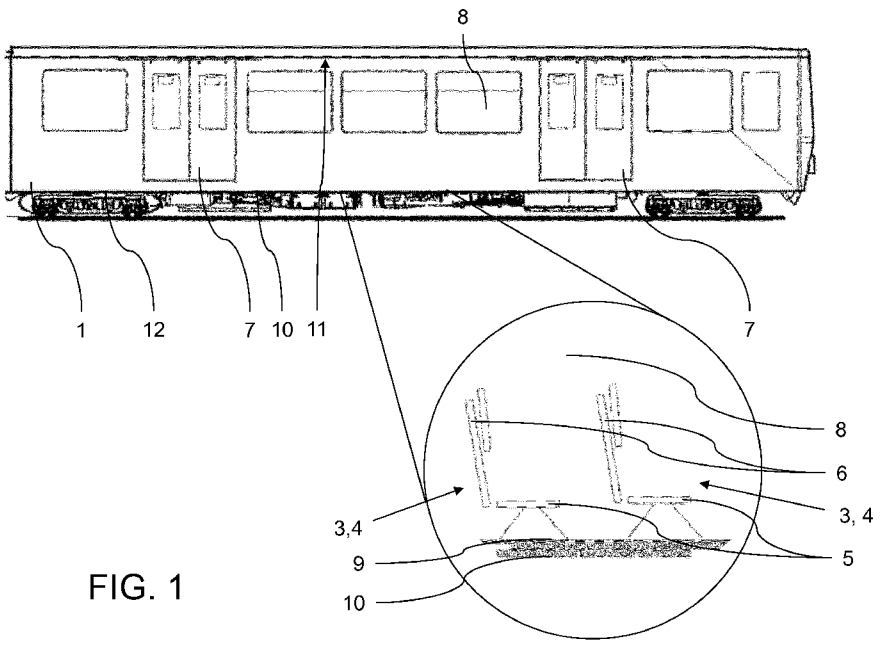

FIG. 1

(57) Abstract: The invention relates to a railway vehicle (1) comprising a ground floor (10) and a movable floor (9) arranged thereon, whereby the movable floor (9) comprises passenger seating furniture (3) arranged thereon and is vertically movable in respect to the ground floor (10) between a passenger position and a freight position such that, by moving the movable floor (9) from the passenger position to the freight position, the passenger seating furniture (3) is raised and automatically retracted thereby enabling a freight space (13) between the ground floor (10) and the movable floor (9), and, by moving the movable floor (9) from the freight position to the passenger position, the passenger seating furniture (3) is lowered and automatically extracted thereby enabling a passenger space (8) on the movable floor (9).

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Lifting floor train

FIELD OF INVENTION

The invention relates to a railway vehicle comprising a ground floor and a movable floor arranged thereon, whereby the movable floor comprises passenger seating furniture arranged thereon.

BACKGROUND

Railway vehicles are known from prior art since more than one hundred years and comprise passenger carriages and freight carriages. Passenger carriages are characterized by firmly installed passenger seating furniture such as multiple rows of seats or benches. Rail freight transport carriages are not designed for transporting passengers and thus do not have firmly installed passenger seating furniture installed therein. Instead, rail freight transport carriages often comprise a single cabin, in which shipments or freight can be loaded for example on baggage trolleys or cars. For loading, the baggage trolleys or cars can be manually moved into the rail freight transport carriages or by means of a motorized baggage truck. Anyway, such railway vehicles are specifically designed and manufactured either for passenger transportation as passenger carriages, for transportation of shipments or freight, or for a mixture thereof. In the latter case one part of the railway vehicle is provided with said firmly installed passenger seating furniture and the other part is firmly designed for transportation of shipments or freight.

In any case passenger carriages and freight carriages are both characterized by high capital investment costs and the described specific, firmly fixed purposes. However, the last decades have demonstrated that passenger carriages and freight carriages often show a poor underutilization if in operation: If, for example, a passenger carriage of a train has a good utilization with passenger, the freight carriage of the respective train is often only poorly utilized, or vice versa. Even above described mixed passenger and freight carriages suffer such poor underutilization. Thus, in addition to the high capital investment costs

and due to the frequent underutilization, operational unit costs of such carriages for transporting a shipment respectively freight is often also high.

SUMMARY OF SOME EMBODIMENTS OF THE INVENTION

It is an object of the invention to provide a railway vehicle for transporting passengers and/or shipments, which is characterized by an increased utilization and reduced capital investment.

The object is solved by the features of the independent claim. Preferred embodiments are described by the features of the dependent claims.

Thus, the object is solved by a railway vehicle comprising a ground floor and a movable floor arranged thereon, whereby the movable floor comprises passenger seating furniture arranged thereon and is vertically movable in respect to the ground floor between a passenger position and a freight position such that, by moving the movable floor from the passenger position to the freight position, the passenger seating furniture is raised and automatically retracted thereby enabling a freight space between the ground floor and the movable floor, and, by moving the movable floor from the freight position to the passenger position, the passenger seating furniture is lowered and automatically extracted thereby enabling a passenger space on the movable floor.

It is therefore a key point of the invention to provide a dual-purpose carriage, which increases passenger and freight utilization and reduces capital investment. For enabling maximized usage, storage capacity for freight is created by simply raising the movable floor from the passenger position to the freight position. In other words, if the passenger space or compartment with the passenger seating furniture installed on the movable floor formed is raised, the passenger seating furniture is automatically retracted such that a freight compartment, i.e. the freight space, between the ground floor and the movable floor is created for transporting freight in the same railway vehicle.

Railway freight movements are predominantly executed overnight, which is not necessarily in-line with current service economy, 24/7 retail, drive to convenience, etc. The increased demand for 24/7 retail has forced an increase in road congestion and pollution. The present solution addresses both problems by offering an alternative mode of transport and thus provides an innovative solution to current service economy demands. In other words, the invention provides a flexible solution through dual-usage of railway carriages for the two conflicting requirements of a railway network infrastructure of moving passengers and moving freight.

For example, with the railway vehicle it can be flexibly decided if passengers or freight should be transported: If passengers should be transported, the movable floor is moved into the passenger position such that the passenger seating furniture is automatically extracted and that passenger can enter the railway vehicle for enjoying a train journey. If freight or any kind of shipments should be transported, the movable floor is moved into the freight position such that the passenger seating furniture is automatically retracted for enabling the freight space between the ground floor and the movable floor. Thus, moving the movable floor always goes automatically along with extracting respectively retracting the passenger seating furniture.

Moving the movable floor between the passenger position and the freight position can be done at a train station and/or various times during a train journey. It is also possible to use the same railway vehicle during night hours for freight transportation with the movable floor in the freight position and during day hours for passenger transportation with the movable floor in the passenger position, thus allowing a very high utilization of the railway vehicle and optimization of the capital investment costs.

In sum, the invention maximizes usage of railway carriages, reduces capital investment and protects the passenger environment by separating the designated passenger and freight areas through reclining the passenger seating furniture and raising the movable floor to create the separate freight area for storing freight. Further, by reclining the passenger seating furniture, the passenger carriage and furniture is protected from damage. Ease of transition between passenger and freight uses provides flexibility of usage and

quick transition between said uses, thereby resulting in a train of carriages of multiple use rather than one train of single purpose only per journey.

According to a preferred embodiment, in the passenger position, the movable floor touches the ground floor and/or, in the freight position, the retracted passenger seating furniture touches a ceiling of the railway vehicle. Preferably, in the passenger position, the passenger space extends, in vertical extension, between the movable floor and the ceiling. Further preferably, in the freight position, the distance between the movable floor and the ceiling is smaller than 1, 0.5, 0.25 or 0.1 meters.

Generally, various technical possibilities exist for moving the movable floor in vertical direction. However, according to an especially preferred embodiment, the railway vehicle comprises a hydraulic and/or electrical engine and/or a scissor lift for vertically moving the movable floor and/or the movable floor is provided as a hydraulic and/or electrical lift, as a hydraulic and/or electrical ramp and/or a lifting platform. Such platform may rest in touching manner in the passenger position on the ground floor and, once moved into the freight position, may form the ceiling of the freight space and/or the freight or cargo compartment. Vertically movable is understood as meaning that the movable floor is capable of moving in a direction perpendicular to the plane formed by the ground floor, while the movement may comprise a partial horizontal movement. Preferably, the term movable comprises raising and lowering the movable floor in vertical direction. The movable floor and/or the ground floor can be provided from metal or any other means known in the art for forming a ground floor in passenger and/or freight compartment of a railway vehicle.

According to another preferred embodiment, the railway vehicle comprises a chassis and the chassis comprises a ceiling arranged above the chassis, and whereby the ground floor is firmly arranged on the chassis and the movable floor is vertically movable between the ground floor and the ceiling. According to a further preferred embodiment, the passenger seating furniture is provided as multiple seats or benches, the passenger seating furniture is retractable and/or foldable and the passenger seating furniture comprises a retractable seat part and/or back rest. Preferably, the passenger seating furniture is firmly installed onto the movable floor and/or comprises multiple rows of seats and/or benches, wherein

each row comprises multiple seats arranged next to one another or a single bench. Further preferably, the retracted passenger seating furniture comprises, in vertical direction, a height of less than 0.5, 0.25 or 0.1m, thereby providing a space maximization of the freight area.

In a further preferred embodiment, retracting the passenger seating furniture comprises reclining and/or folding up the passenger seating furniture and/or whereby extracting the passenger seating furniture comprises raising and/or folding out the passenger seating furniture. If the passenger seating furniture is provided as seats each having a seat part and a back rests, the retracting preferably comprises folding the seat part and back rest for lowering the height of the seat. Unfolding the seats preferably comprises bringing the respective seat parts and back rests in a position such that a passenger can conveniently sit on the seat during a train journey.

Automatically extracting and retracting the passenger seating furniture can be done in various ways. According to an especially preferred embodiment the passenger seating furniture comprises a spring for automatically extracting the passenger seating furniture when moving the movable floor from the freight position to the passenger position. By moving the movable floor from the passenger position to the freight position the passenger seating furniture preferably compresses the spring. Preferably, the passenger seating furniture retracts when the passenger seating furniture hits the ceiling during the vertical movement into the freight position. The spring allows for an easy implementation of the automatic extracting and retracting during the vertical movement of the movable floor.

According to another preferred embodiment, the railway vehicle is provided as a passenger coach and/or as a passenger train. Thus, it is even possible to implement the invention in a passenger coach and/or a passenger train known from prior art. It is especially preferred that the railway vehicle comprises a door arranged at a lateral side of the railway vehicle and provided such that, in the freight position, freight is loadable through the door onto the ground floor and that, in the passenger position, the passenger seating furniture is accessible by passengers. Preferably, the railway vehicle comprises doors arranged at both opposite lateral sides and/or various doors at the lateral side.

In another preferred embodiment, in the freight position, the distance between the ground floor and the movable floor is greater than 1m, 1.5m, 2m or 2.5m, thereby providing a space maximization of the freight area. According to another preferred embodiment, the ground floor and the movable floor comprise an equal extension or the movable floor comprise a partial extension of the ground floor, and/or the railway vehicle comprises multiple movable floors, which are vertically movable independently from each other and/or together. Thus, the railway vehicle comprising multiple movable floors can be dynamically separated into various departments for passengers and freight as per actual demand. Preferably, each of the multiple movable floors comprises, for example, a hydraulic and/or electrical scissor lift for vertically moving the movable floor and/or a spring for automatically retracting and extracting the respective passenger seating furniture. For example, a train can be equipped with the movable floor between its two lateral doors, while the remaining part of the train between the doors and the frond end respectively back end is only provided with a fixed ground floor and passenger seating furniture installed thereon.

Other example embodiments of the invention will be described in the following with reference to the figures. It has to be noted that the figures are only provided for illustration of the general concept of the invention by examples not defining the scope of protection of the invention. The figures are not drawn to scale. Features shall not be considered to be essential for the present invention because they are depicted in the figures.

BRIEF DESCRIPTION OF THE FIGURES

In the figures

Fig. 1 shows a railway vehicle according to an exemplary embodiment of the invention in a schematic side-view with a bordered detail view in the passenger position, and

Fig. 2 shows the railway vehicle according to the exemplary embodiment of the invention in the schematic side-view with the bordered detail view in the freight position.

DETAILED DESCRIPTION OF THE FIGURES

The invention will be described in the following with reference to exemplary embodiments showing a railway vehicle 1 for transporting freight 2 and passengers in Fig. 1 and Fig. 2 according to a preferred embodiment.

Fig. 1 and Fig. 2 show said railway vehicle 1, which, from the outside, is provided as a passenger carriage or passenger coach as known from prior art. Inside, the railway vehicle 1, as shown in the bordered detail in Fig. 1, comprises passenger seating furniture 3 having various rows with a number of seats 4 for the passengers arranged side by side, whereby each seat 4 comprises a seat part 5 and a back rest 6. The bordered detail in Fig. 1 shows two seats 4 arranged behind each other. The railway vehicle 1 comprises at each lateral side two doors 7, through which passengers can reach a passenger space 8 respectively passenger compartment of the railway vehicle 1 with the passenger seating furniture 3 installed therein.

The passenger seating furniture 3 comprising the number of seats 4 are installed on a flat movable floor 9, which extends throughout the whole longitudinal extension of the railway vehicle 1. In Fig. 1, the movable floor 9 rests in a passenger position touching on respectively above a ground floor 10 of the railway vehicle 1 such that the distance between the movable floor 9 and a ceiling 11 of the passenger space 8 is more than 2 meters. This way passengers entering the passenger space 8 through the doors 8 can upright walking reach the passenger seating furniture 3. The ground floor 10 is firmly arranged on a chassis 12 of the railway vehicle 1.

The movable floor 9 is vertically movable in respect to the ground floor 10 between said passenger position, in which the movable floor 9 rests on the ground floor 10 as shown in Fig. 1, and a freight position as shown in Fig. 2. Vertically movable means that the mov-

able floor 9 is capable of moving in a direction perpendicular to a plane formed by the chassis 12 of the railway vehicle 1. Thus, if the movable floor 9 moves from the passenger position towards the freight position, the distance towards the ceiling 11 decreases. In parallel, the passenger seating furniture 3 is raised and automatically retracted thereby enabling a freight space 13 between the ground floor 10 and the movable floor 9 as shown in Fig. 2.

In particular, as can be seen from the bordered detail in Fig. 2, if the movable floor 10 is moved from the passenger position to the freight position, the seats 4 of the passenger seating furniture 3 are automatically retracted i.e. the seat parts 5 and the back rests 6 of the seats 4 are automatically retracted. In the freight position, the retracted passenger seating furniture 3 touches the ceiling 11 of the railway vehicle 1. Further, the movable floor 9 does not rest on the ground floor 10 anymore i.e. the freight space 13 comprises a vertical height of 2 meters. This way, freight 2 can be loaded through the doors 7 into the freight space 13 and placed on the ground floor 10. The freight 2 can be provided as baggage trolleys or cars as shown in Fig. 2, as ordinary boxes or as any other transportable goods such as shipments or the like.

For moving the movable floor 9 between the passenger position and the freight position a hydraulic scissor lift 15 is provided. Alternatively, the movable floor 9 can be provided as a hydraulic lift, as a hydraulic ramp and/or a lifting platform. For automatically extracting the passenger seating furniture 3 when moving the movable floor 9 from the freight position to the passenger position the passenger seating furniture 3 comprises a spring 16. When the movable floor 9 is moved into the freight position, the retracting of the passenger seating furniture 3 compresses the spring 16 and creates spring 16 load. The load of the compressed spring 16 will then extract the passenger seating furniture 3 when moving the movable floor 9 out of the freight position.

In Fig. 2, the movable floor 9 extends in longitudinal extension of the railway vehicle 1 between the both ends of the railway vehicle 1. It is also possible that the movable floor 9 only extends between the two doors 7 and/or that there are multiple movable floors 9 provided along the longitudinal and/or traverse extension of the railway vehicle 1 respec-

tively the ground floor 10, whereby the individual multiple movable floors 9 can be moved independently or together.

Depicted or described connections between components are generally to be understood to be functional connections. They can be implemented as direct links or as indirect links via several other components. The order of presented actions is not mandatory; alternative orders are possible. Actions can be implemented in different ways. They could be implemented in software using program instructions; or they could be implemented in hardware; or they could be implemented making use of a combination of hardware and software. It is to be understood that the described embodiments are examples only, which may be modified and/or supplemented in many ways within the scope of the claims. In particular, any feature described for a particular embodiment can be used by itself or in combination with other features in any other embodiment. Each feature that has been described for an embodiment of a particular category can also be used in an equivalent manner in an embodiment of any other category.

REFERENCE NUMERALS

Railway vehicle	1
Freight	2
Passenger seating furniture	3
Seat	4
Seat part	5
Back rest	6
Door	7
Passenger space	8
Movable floor	9
Ground floor	10
Ceiling	11
Chassis	12
Freight space	13
Scissor lift	15
Spring	16

CLAIMS

1. Railway vehicle (1) comprising a ground floor (10) and a movable floor (9) arranged thereon, whereby

the movable floor (9) comprises passenger seating furniture (3) arranged thereon and is vertically movable in respect to the ground floor (10) between a passenger position and a freight position such that,

by moving the movable floor (9) from the passenger position to the freight position, the passenger seating furniture (3) is raised and automatically retracted thereby enabling a freight space (13) between the ground floor (10) and the movable floor (9), and,

by moving the movable floor (9) from the freight position to the passenger position, the passenger seating furniture (3) is lowered and automatically extracted thereby enabling a passenger space (8) on the movable floor (9).

2. Railway vehicle (1) according to the previous claims, whereby, in the passenger position, the movable floor (9) touches the ground floor (10) and/or, in the freight position, the retracted passenger seating furniture (3) touches a ceiling (11) of the railway vehicle (1).

3. Railway vehicle (1) according to any of the previous claims, comprising a hydraulic engine and/or a scissor lift (15) for vertically moving the movable floor (9) and/or whereby the movable floor (9) is provided as a hydraulic lift, as a hydraulic ramp and/or a lifting platform.

4. Railway vehicle (1) according to any of the previous claims, comprising a chassis (12), the chassis (12) comprises a ceiling (11) arranged above the chassis, and whereby the ground floor (10) is firmly arranged on the chassis and the movable floor (9) is vertically movable between the ground floor (10) and the ceiling (11).

5. Railway vehicle (1) according to any of the previous claims, whereby the passenger seating furniture (3) is provided as seats (4) or as benches, the passenger seating furniture

(3) is retractable and/or foldable and the passenger seating furniture (3) comprises a retractable seat part (5) and/or back rest (6).

6. Railway vehicle (1) according to any of the previous claims, whereby retracting the passenger seating furniture (3) comprises reclining and/or folding up the passenger seating furniture (3) and/or whereby extracting the passenger seating furniture (3) comprises raising and/or folding out the passenger seating furniture (3).

7. Railway vehicle (1) according to any of the previous claims, whereby the passenger seating furniture (3) comprises a spring (16) for automatically extracting the passenger seating furniture (3) when moving the movable floor (9) from the freight position to the passenger position.

8. Railway vehicle (1) according to any of the previous claims, whereby the railway vehicle (1) is provided as a passenger coach.

9. Railway vehicle (1) according to any of the previous claims, comprising a door (7) arranged at a lateral side of the railway vehicle (1) and provided such that, in the freight position, freight (14) is loadable through the door (7) onto the ground floor (10) and that, in the passenger position, the passenger seating furniture (3) is accessible by passengers.

10. Railway vehicle (1) according to any of the previous claims, whereby, in the freight position, a distance between the ground floor (10) and the movable floor (9) is greater than 1m, 1.5m, 2m or 2.5m.

11. Railway vehicle (1) according to any of the previous claims, whereby the ground floor (10) and the movable floor (9) comprise an equal extension or the movable floor (9) comprise a partial extension of the ground floor (10), and/or whereby the railway vehicle (1) comprises multiple movable floors (9), which are vertically movable independently from each other and/or together.

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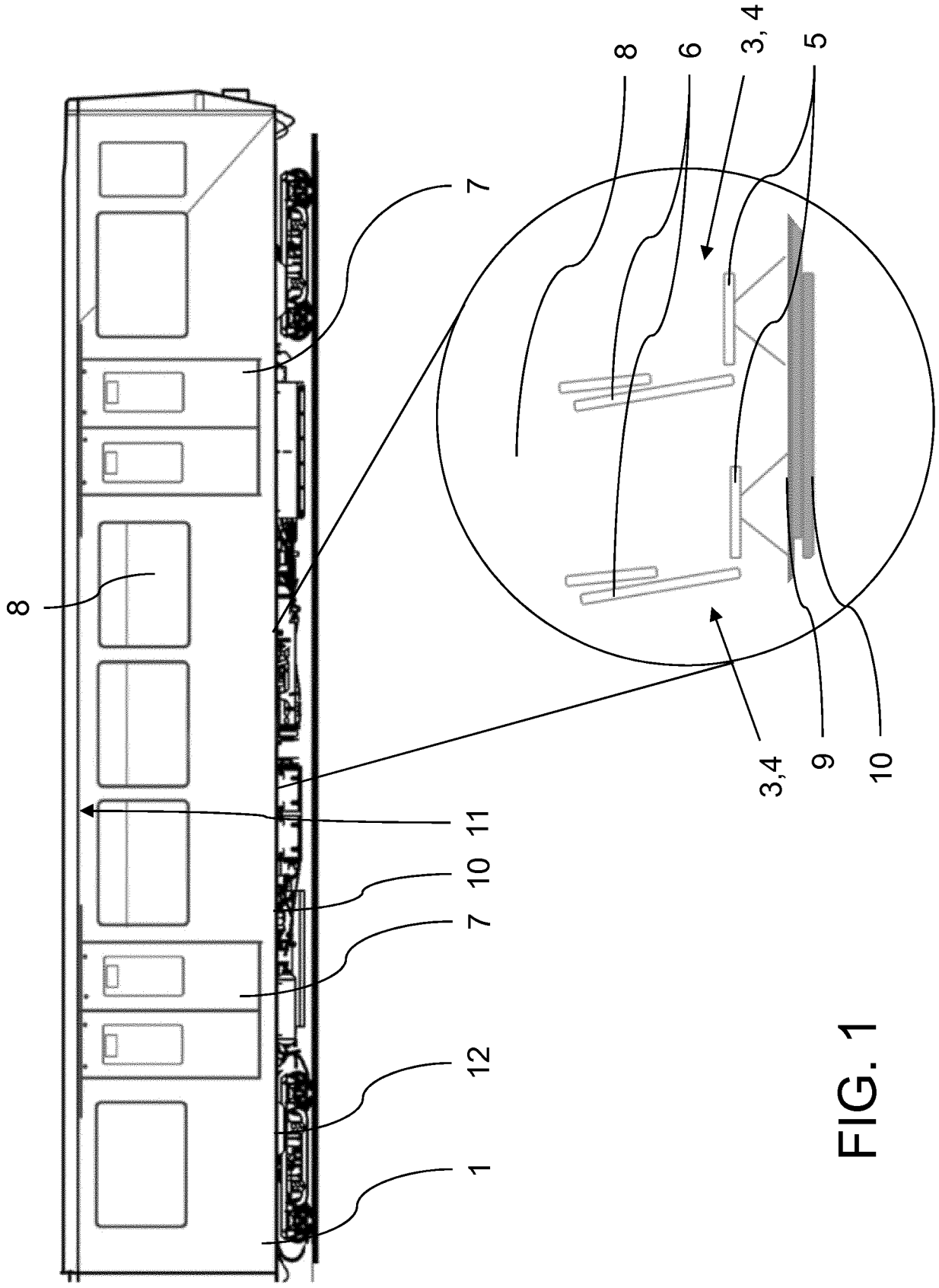

FIG. 1

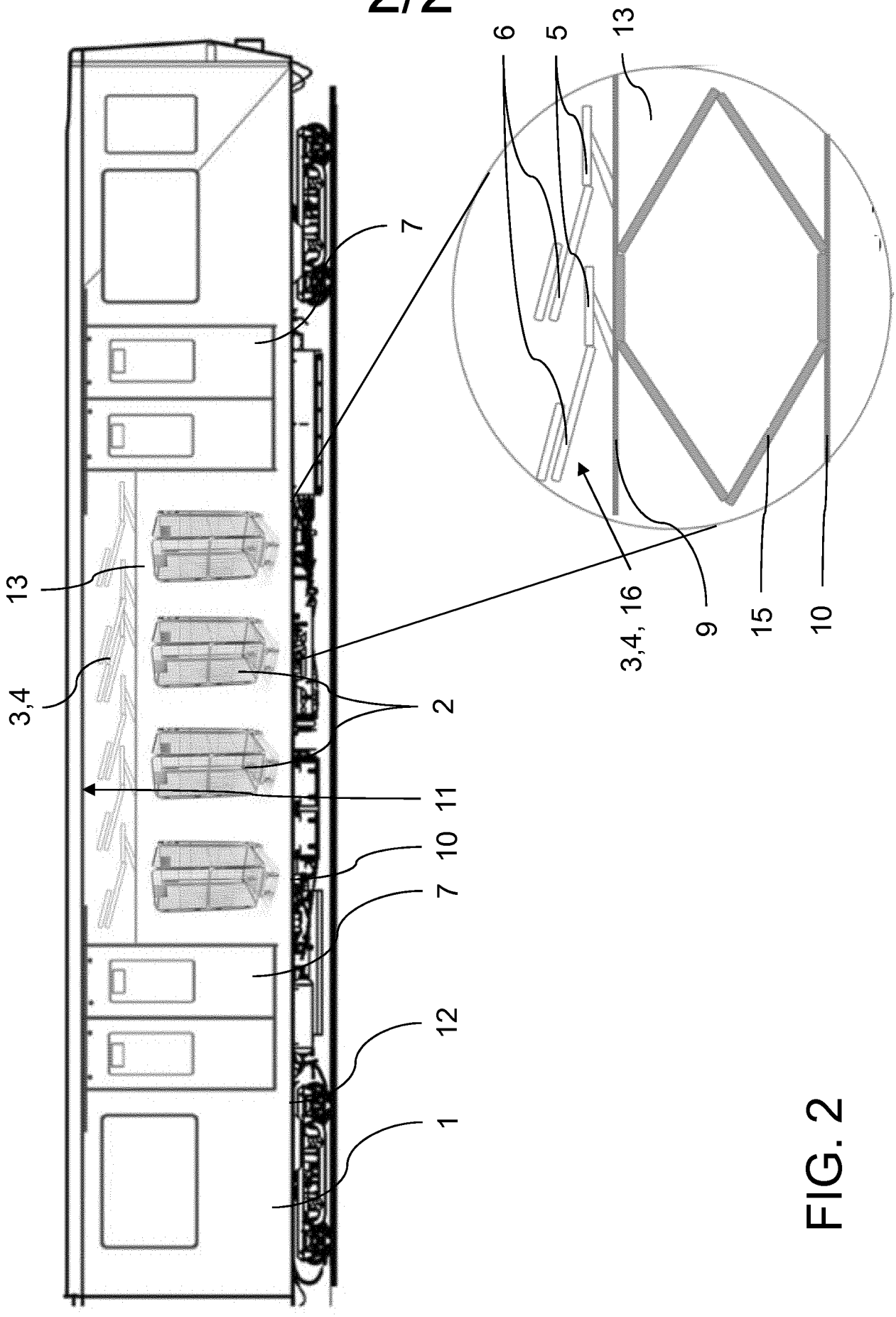

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/079739

A. CLASSIFICATION OF SUBJECT MATTER
INV. B61D17/10 B61D33/00 B60N2/36
ADD.

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)
B61D B60N

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	DE 38 17 111 A1 (MONORAIL KOGYO K K [JP]) 16 March 1989 (1989-03-16) the whole document	1-11
A	US 4 943 204 A (EHRLICH RODNEY P [US]) 24 July 1990 (1990-07-24) the whole document	1-11

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2017/079739

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