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(54) MID-FLOOR HEIGHT RAILWAY VEHICLE WITH LEVEL-ACCESS AT MIDDLE PLATFORM HEIGHTS

(57) The railway vehicle (10) is intended to circulate on rails (11) and comprises at least two cars (12), each car (12) having a structural body (14) defining a door entrance (29), and each car (12) having a floor (15) extending longitudinally along the railway vehicle. The railway vehicle (10) comprises bogies (16) having wheels (20) of a diameter inferior or equal to 1000 mm. Each structural body (14) held by a bogie (16) comprises lateral recesses (24) each receiving the upper part of a respective wheel (20). The floors (15) are all longitudinally flat and all at a same height. The door entrance (29) is at a height comprised between 800 and 1100 mm above rails (11).

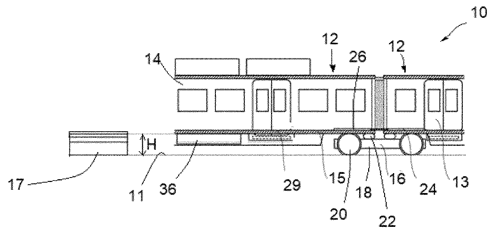

FIG.1

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Description

[0001] The present invention concerns to a mid-floor height railway vehicle with level-access at middle platform heights.

[0002] In railway systems there is a wide range of variations of infrastructure and superstructure parameters. One of them is the platform height, which can be classified in four groups:

a) High platforms: typically ranging from 1100 mm to 1200 mm (measured from top of rail), they are usually found in metros, some commuter networks, and some high-speed systems like in Japan, United States, China, Russia or the future HS2 in United Kingdom.

b) Middle platforms: typically ranging around 800 mm and 1100 mm, it is less frequent and normally linked to conventional rail. Relevant examples are the 900 mm in urban stations in Portugal, or the 915 mm widely in United Kingdom.

c) Low platforms: typically ranging between 500 mm and 800 mm. The most frequent cases are 500 mm and 760 mm, so they are found in a variety of systems including urban, mainline and high-speed. Other values like 680 mm and 685 mm can be found in conventional rail stations in Portugal and Spain.

d) Urban platforms: mostly around 300 mm, such low platforms are found on surface urban railways (tramway and light metro), though there are some rare cases in regional stations too.

[0003] In this disclosure a "mid-floor height railway vehicle with level-access at middle platform heights" is a railway vehicle having an entrance at the same level as the middle platform. It is thus possible to circulate between the vehicle and the platform without any step. This allows easy boarding for all passengers, even autonomous boarding for wheelchair users.

[0004] However, known mid-floor height railway vehicle with level-access at middle platform heights usually do not have a flat floor, but a floor with steps or ramps. Indeed, such a mid-floor height railway vehicle usually have a low floor in passengers areas, and a mid-floor in entrance area, with steps or ramp between these floors.

[0005] Other vehicles are also already known, as high-floor trains, which have an interior flat floor, but in which the floor is higher than the middle platform, so at least one step is needed between the floor and the middle platform.

[0006] Low-floor trains are also already known, but with a step-down to enter from middle platforms. Besides, low-floor trains usually have different interior floor heights, so circulation through the train implies going through steps and/or ramps. Some low-floor train have slightly higher floor, but if they are modified to provide level-access from middle platforms, they still have different interior heights.

[0007] Thus, prior art does not propose a train having both a level-access and a flat floor. This is a problem, in particular for wheelchair users, who have to deal with steps for enter the train and/or with steps or ramps inside the train.

[0008] The invention is intended to solve this problem, in order to facilitate circulation for the passengers, especially for wheelchair users and PRM group.

[0009] To this end, the invention relates to a railway vehicle, intended to circulate on rails, comprising at least two cars, each car having a structural body defining a door entrance, and each car having a floor extending longitudinally along the railway vehicle, characterized in that:

- the railway vehicle comprises bogies having wheels of a diameter inferior or equal to 1000 mm,
- each structural body held by a bogie comprises lateral recesses each receiving the upper part of a respective wheel,
- the floors are all longitudinally flat and all at a same height,
- the door entrance is at a height comprised between 800 and 1100 mm above rails.

[0010] The railway vehicle includes variable number of passenger cars with reduced floor height, a flat floor interior and a number of elements at the access door for multiple platform height compatibility. The combination of solutions offers at the same time level-access from middle platforms (in the proximity of 900-915 mm height from top of rail) and flat floor interiors, providing unique and easy passenger access and interior circulation.

[0011] A railway vehicle of the invention may comprise any of the following features, alone or according to any possible combination:

- Each bogie holds two adjacent cars.
- The door entrance has a lower height than the floor, with an inclined area between the door entrance and the floor.
- The height difference between the door entrance and the floor is less than 80 mm.
- The railway vehicle comprises a gap filler that is horizontally movable to cover a horizontal gap between the vehicle and a platform, the gap filler extending at the same level as the door entrance.
- The railway vehicle comprises a folding step under the door entrance.
- The railway vehicle comprises a deploying ramp under the door entrance.
- The railway vehicle comprises traction and auxiliary equipment under the structure body.

[0012] The invention will be better understood upon reading the following specification, given only as a non-limiting example and made with reference to the attached figures, among which:

Figure 1 is a schematic view from profile of a railway vehicle according to an example of embodiment of the invention;

Figure 2 is a schematic transverse sectional view of the vehicle of Figure 1, in front of different platform heights.

Figure 1 partially shows a railway vehicle 10 according to an example of embodiment of the invention. The railway vehicle 10 is intended to circulate on rails 11. In the following disclosure, all heights are considered with reference to the top of rails 11.

[0013] The vehicle 10 comprises a plurality of cars 12, each having a structural body 14. Each structural body 14 has windows and at least one passenger access door 13 for permitting the flow between the vehicle 10 and a platform 17. The access door 13 gives access to a door entrance 29, which is a floor at the access door.

[0014] Each car 12 have a floor 15 for passenger circulating in the vehicle 10. The vehicle 10 is designed with full flat floors 15 in the longitudinal direction of the train, so passengers can move internally during the trip without going through steps or ramps in each car.

[0015] The vehicle 10 is a mid-floor vehicle, intended to have the door entrance 29 with a level access to a middle platform. The door entrance 29 is at a height comprised between 800 and 1100 mm above rails 11.

[0016] Thus, the platform 17 is a middle platform, with a height H above a rail between 800 and 1100 mm.

[0017] The vehicle 10 comprises at least one bogie 16 carrying two adjacent cars 12. The bogie 16 comprises a structure 18 and wheels 20. The bogie 16 also comprises pneumatic suspensions 22 arranged between the bogie 16 and each structural body 14.

[0018] Preferentially, the wheels 20 have a diameter inferior or equal to 1000 mm.

[0019] The structural body 14 comprises a recess 24 above the bogie 16 so that the bottom of the structural body 14 can be below the upper part of the wheels 20. This recess 24 is preferentially covered by a case 26 on the lateral of the train floor, not affecting the floor height at the center of the vehicle 10, so the corridor along the train remains fully flat.

[0020] The connection between the cars is done through a metallic plate covering the interspace.

[0021] As shown on figure 2, the vehicle 10 is preferentially equipped with door entrance 29 at slightly lower height than the floor 15, which allows for level-access from the lower range of middle platforms (for example for level-access at 900 mm platforms with corridor floor at 1080 mm). Inside the vehicle, a short and inclined area 28 covers the difference between the entrance 29 and the floor 15. Preferentially, the height difference between the door entrance 29 and the floor 15 is less than 80 mm. This difference of heights allows the floor to be raised, leaving space under for installing traction and auxiliary equipments 36 under the train structure (unlike low-floor trains), allowing for easier maintainability.

[0022] Preferentially, the vehicle 10 comprises access devices allowing access to several platform heights. These different platform heights are shown on Figure 2 with a numeral reference corresponding to the corresponding height.

[0023] As indicated before, the door entrance 29 is at the level of a mid-height platform, for instance at a height of 900 mm above the rails 11.

[0024] The access devices comprise a gap filler 30 that is horizontally movable to cover a horizontal gap between the vehicle 10 and the platform 17. The gap filler 30 extends at the same level as the door entrance 29.

[0025] Preferentially, the access devices comprise a folding step 32 under the door entrance 29, which can provide access from low platforms (e.g. of heights of 550 mm, 685 mm or 760 mm) with steps. The folding step 32 may be arranged at another door than the gap filler 30.

[0026] Preferentially, the access devices comprise a deploying ramp 34 which can provide access from low platforms without steps. Usually, the deploying ramp 34 is not arranged at the same door as the gap filler 30.

[0027] Additionally, a manual ramp can be equipped for step-free (e.g. wheelchair user) in many other situations.

[0028] As the railway vehicle 10 has a middle floor height, it can provide access from practically any railway platform heights:

- From high platforms (1200 or 1100 mm), the entrance is performed through a single step down between the platform and the horizontal gap-filler 30.
- From middle platforms (1000 or 900 mm), the entrance is performed at level-access. It is even possible to access on wheelchair or carrying bulky objects or mobility devices like bicycles.
- From low platforms of the upper range (typically 760 and 680 mm), the entrance is performed through a single step up between the platform and the horizontal gap-filler 30.
- From low platforms of the lower range (typically 550 in Europe), the entrance is performed through two steps up, using an optional device like for example the folding step 32.
- For low platforms and PRM door, the vehicle 10 can be equipped with the deploying ramp 34, so wheelchair users can still board autonomously from such platforms.

[0029] All the access from a wide variety of platform heights can be ensured in full compliance of accessibility norms or specifications.

[0030] As an additional innovation to improve the accessibility over the state-of-the art:

The railway vehicle 10 can be provided with two PRM doors per side and allowing interior passage between them. This ensures accessibility even in case of door failure, and the second door can be regularly used by passengers carrying heavy items or rolling devices like

bicycles, wheeled luggage, etc.

[0031] The railway vehicle 10 can be designed with several internal layout symmetries, in particular related to access and priority seat location. In this way, when train changes orientation passengers find the facilities in the same location. This is especially useful for the blind users, but also for passengers with mental disabilities.

[0032] It appears that the vehicle of the invention allows a flat floor along the vehicle, while ensuring a level access to middle platforms and allowing access to other platforms.

[0033] The reduced floor height is achieved in the most restrictive area which is above the bogies. This characteristic is possible with the bogie having limited wheel diameter and a flattened secondary pneumatic suspension. Besides, the structural body 14 includes lateral recesses, not affecting the central corridor, to allow wheel movement.

[0034] The flat floor 15 is maintained along the cars 12 avoiding the floor level reduction in between bogies. Passengers can walk along the whole train interior length without any discontinuity or ramp, with the only exception of the gangway floor device that allows the rotation between vehicles (not more than 80 mm height to ensure fluid passenger movement).

[0035] The floors 15 are all substantially longitudinally flat and all substantially at a same height. By "substantially longitudinally flat", it is meant that the floors 15 extend along horizontal planes, for instance parallel to the ground on which the rails are installed. By "substantially at a same height", it is meant that the height difference between two successive floors 15 of two successive cars 12 is less than 80 mm, for instance less than 70 mm, for instance less than 60 mm, for instance less than 50 mm, for instance less than 40 mm, for instance less than 30 mm, for instance less than 20 mm, for instance less than 10 mm.

[0036] With these solutions, the railway vehicle 10 can provide a flat-floor interiors at a height as low as 1080 mm over top of rails 11. This already provides level-access for platform heights of around 1000 mm.

Claims

1. A railway vehicle (10), intended to circulate on rails (11), comprising at least two cars (12), each car (12) having a structural body (14) defining a door entrance (29), and each car (12) having a floor (15) extending longitudinally along the railway vehicle, **characterized in that**:

   - the railway vehicle (10) comprises bogies (16) having wheels (20) of a diameter inferior or equal to 1000 mm,
   - each structural body (14) held by a bogie (16) comprises lateral recesses (24) each receiving the upper part of a respective wheel (20),
   - the floors (15) are all substantially longitudinally flat and all substantially at a same height,
   - the door entrance (29) is at a height comprised between 800 and 1100 mm above rails (11).

2. The railway vehicle (10) of claim 1, wherein each bogie (16) holds two adjacent cars (12).

3. The railway vehicle (10) of claim 1 or 2, wherein the door entrance (29) has a lower height than the floor (15), with an inclined area (28) between the door entrance (29) and the floor (15).

4. The railway vehicle (10) of claim 3, wherein the height difference between the door entrance (29) and the floor (15) is less than 80 mm.

5. The railway vehicle (10) of any of preceding claims, comprising a gap filler (30) that is horizontally movable to cover a horizontal gap between the vehicle (10) and a platform (17), the gap filler (30) extending at the same level as the door entrance (29).

6. The railway vehicle (10) of any of preceding claims, comprising a folding step (32) under the door entrance (29).

7. The railway vehicle (10) of any of preceding claims, comprising a deploying ramp (34) under the door entrance (29).

8. The railway vehicle (10) of any of preceding claims, having traction and auxiliary equipment (36) under the structure body (14).

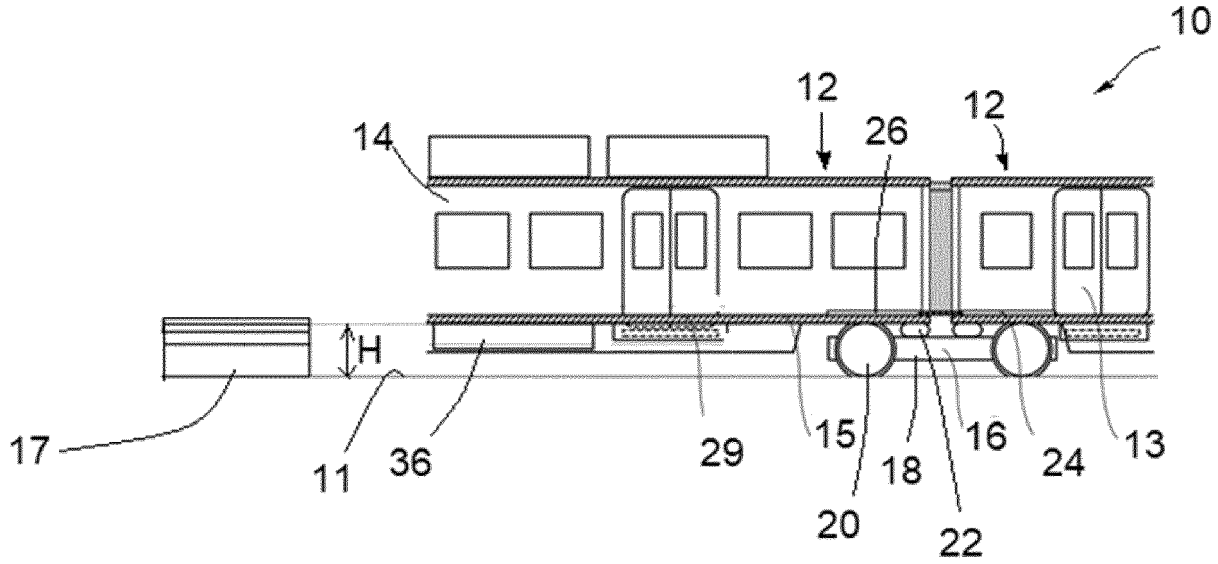

FIG.1

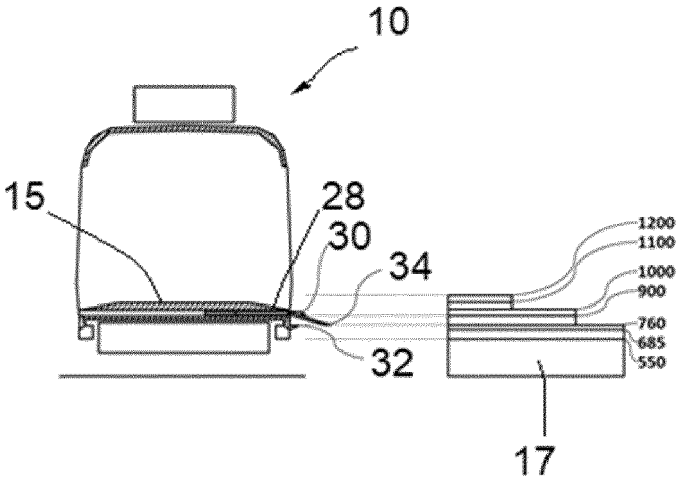

FIG.2

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Application Number
EP 22 30 6647

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	29 March 2023	Awad, Philippe

CATEGORY OF CITED DOCUMENTS

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