



US 20080190318A1

(19) **United States**(12) **Patent Application Publication**
PALAIS et al.(10) **Pub. No.: US 2008/0190318 A1**(43) **Pub. Date: Aug. 14, 2008**(54) **RAILCAR FOR PASSENGER TRANSPORT****Publication Classification**(75) Inventors: **Georges PALAIS**, Paris (FR); **Max Lhommet**, Raismes (FR)(51) **Int. Cl.**
B61F 3/12 (2006.01)(52) **U.S. Cl.** **105/3**Correspondence Address:
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WASHINGTON, DC 20037 (US)(57) **ABSTRACT**

This railcar is of the type comprising:

carriages including two driving carriages and intermediate carriages;

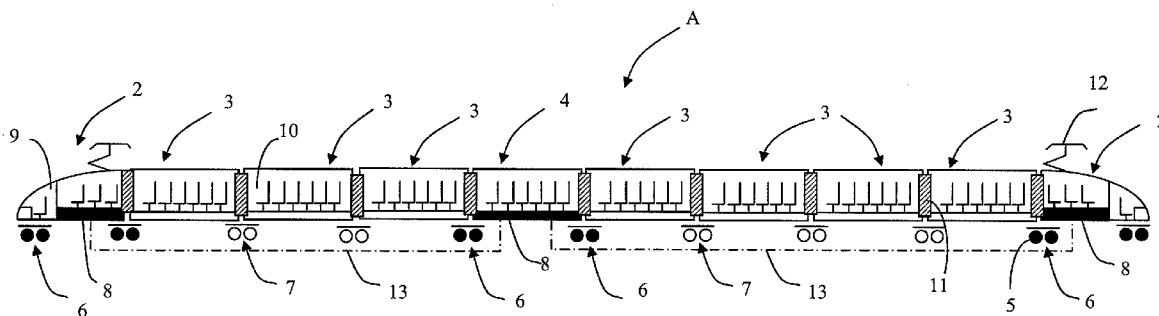
carrier bogies, motor bogies comprising at least one motor axle;

traction drives which are capable of supplying electrical energy to the motors of the motor bogies.

According to one feature of the invention, all the carriages have passenger compartments, the railcar is completely articulated, the traction drives are arranged in three carriages and a motor bogie is arranged below at least one end of each carriage which receives a traction drive.

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Feb. 9, 2007 (FR) 0700935



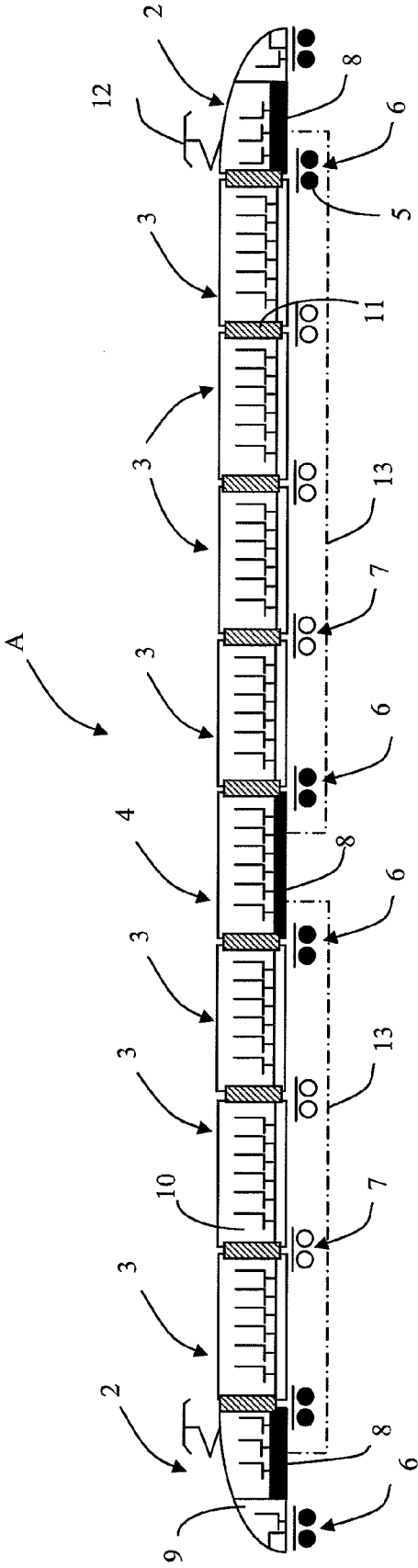


FIG. 1

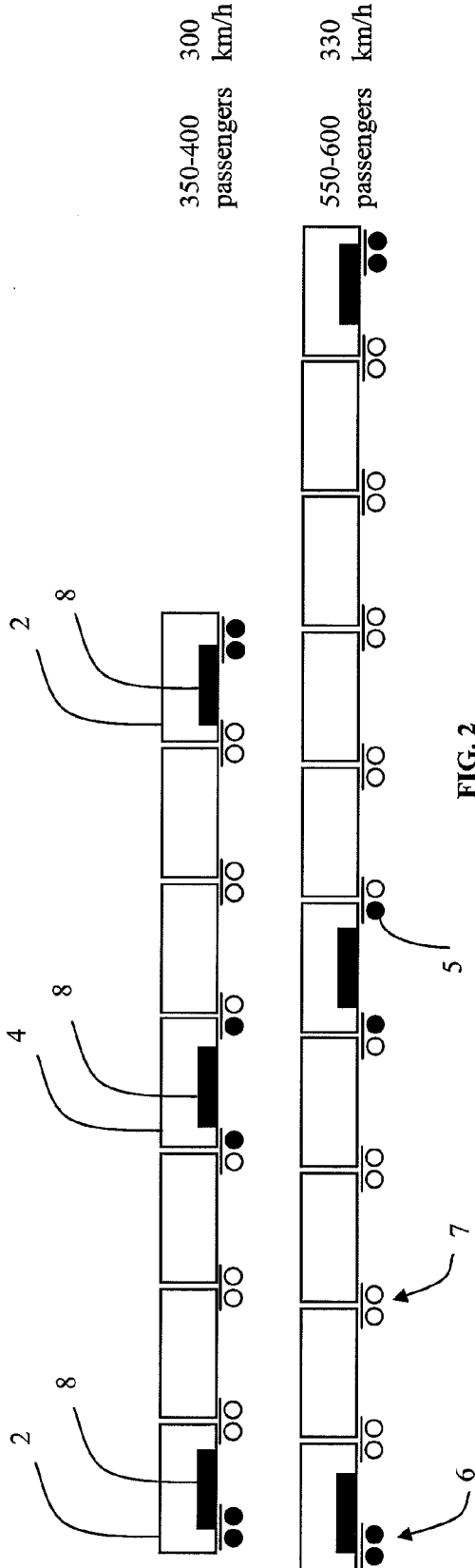


FIG. 2

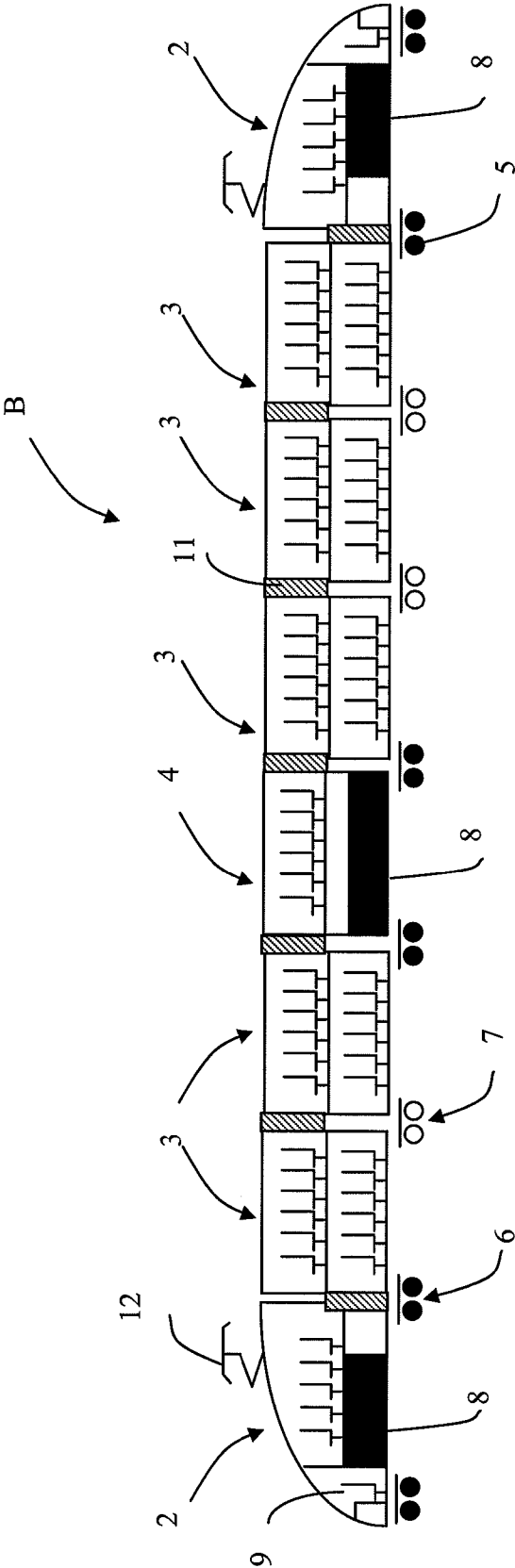


FIG. 3

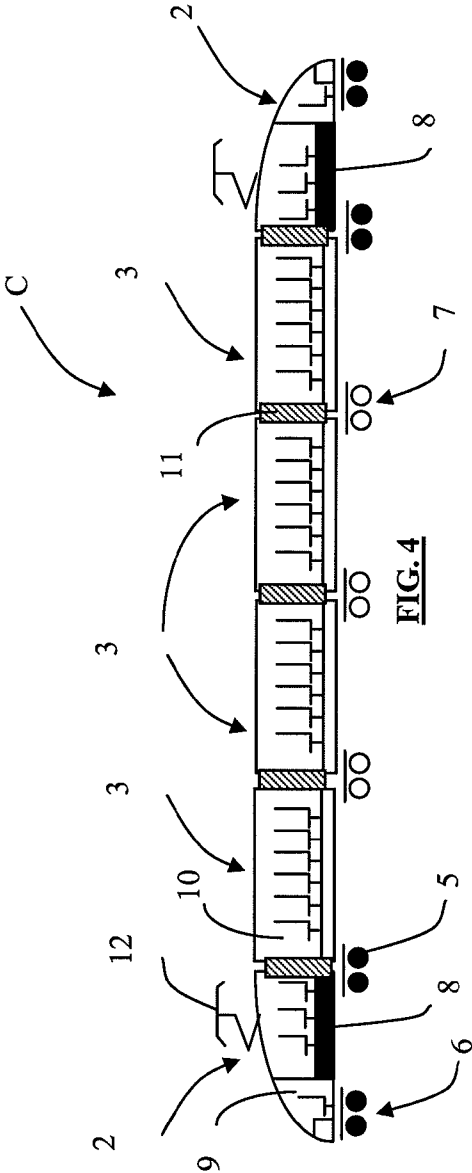


FIG. 4

RAILCAR FOR PASSENGER TRANSPORT

TECHNICAL FIELD

[0001] The present invention relates to a railcar for passenger transport and more specifically a railcar which can be adjusted in terms of passenger capacity and in terms of maximum speed.

BACKGROUND TO THE INVENTION

[0002] The architectures of trains or railcars are differentiated depending on whether they have concentrated or distributed motorisation, depending on whether the carriages composing them are connected in an articulated or non-articulated manner, depending on the arrangement and the number of motor and carrier bogies, and depending on whether they are single or double deck.

[0003] For reasons of clarity, these various notions are defined in the following paragraphs.

[0004] Train or Railcar

[0005] A railcar comprises at least one motorised carriage, that is to say, comprising at least one passenger compartment and at least one traction drive. A railcar may thus comprise only motorised carriages or comprise non-motorised carriages and at least one motorised carriage.

[0006] A train is composed of one or more motor cars and a specific number of passenger carriages. A motor car is not accessible to passengers and comprises, inter alia, a traction drive.

[0007] Concentrated or Distributed Motorisation

[0008] The traction drive comprises a plurality of items of equipment which are either electrical components or electronic power and control components which are capable of acquiring the electrical energy from a traction source (for example, a catenary line), transforming it and converting it into electrical signals for supplying electric motors of the motor bogies in order to drive the train or the railcar.

[0009] The motorisation is said to be concentrated when all the components of the traction drives are grouped in a single location, for example, in the motor car of a train. The motorisation is said to be distributed when the components of the traction drive are distributed over a plurality of carriages, below the chassis of the carriages or in the roof.

[0010] Articulated Carriages or Non-Articulated Carriages

[0011] A bogie conventionally comprises a bogie chassis which rests on two axles. The term axle is generally intended to refer to a pair of coaxial wheels which rest on the rails of a rail track.

[0012] A motor bogie comprises at least one electrical motor for driving the wheels of at least one of the axles thereof, referred to as a motor axle. In contrast, a non-motorised bogie is referred to as a carrier bogie.

[0013] Two adjacent carriages are said to be "articulated" (or in a state of articulated connection) when a first carriage is supported with one of the ends thereof on a bogie and the end facing the second carriage rests on the end of the first one. The bogie therefore straddles below the ends of the two adjacent carriages. A railcar which is composed of two articulated carriages therefore comprises three bogies, since the free ends of the two carriages each rest on a bogie.

[0014] In contrast, two non-articulated adjacent carriages are not, at each of the ends thereof, supported on a common

bogie, each carriage resting on two bogies. A railcar composed of two non-articulated carriages therefore comprises four bogies.

[0015] Single or Double Deck Carriage

[0016] A carriage is said to be single deck when it has a passenger compartment on a single floor level and it is said to be double deck when it comprises two passenger compartments on two levels, superimposed one above the other.

[0017] There are single deck trains, which are non-articulated and which have motorisation concentrated in one or two motor cars. Owing to the non-articulation, this architecture has the disadvantage of having a large number of bogies which increases the resistance to forward movement and consequently the energy consumption of the railcar. A large number of bogies also requires numerous maintenance operations.

[0018] There are also a number of high-speed single deck railcars which are non-articulated and which have distributed motorisation, with different distributions of the traction equipment in the carriages, different locations of the motor bogies or motor axles, depending on the architectures. These railcars comprise a plurality of motorised carriages which each rest on two bogies.

[0019] This type of motorisation requires a large mass of cables having the power which is required to connect the energy acquisition device(s) to the motors, extending through each item of traction equipment, which cables therefore extend between all the carriages which are equipped with an acquisition device or an item of equipment of the traction drive, or a motor bogie.

[0020] There are also single deck or double deck trains with "mixed" connection and concentrated motorisation. The passenger carriages rest on carrier bogies and are surrounded by two motor cars, at each end of the train, resting on motor bogies. The connections of this train are said to be "mixed" since different types of connections connect the carriages and the motor cars. The carriages are connected to each other by means of an articulated connection and the carriages are connected to the motor cars by means of a non-articulated connection.

[0021] This architecture has a reduced passenger capacity compared with a railcar having an identical length since the motor cars are not accessible to passengers.

[0022] The efficiency levels of these vehicles are linked to the architectures thereof: it is possible to cause a high-speed train to travel at lower speeds, but at the expense of passenger capacity since the mass of traction drives cannot be released. It is not possible to cause a vehicle to travel at a higher speed than its maximum speed since a traction drive or a motor cannot simply be added. Manufacturers must therefore design a vehicle which is suitable for every speed range/passenger capacity.

SUMMARY OF THE INVENTION

[0023] The object of the invention is therefore to provide a railcar which does not have the disadvantages of the architectures of the prior art.

[0024] To this end, the invention proposes a railcar for passenger transport which comprises two driving carriages and intermediate carriages, carrier bogies, motor bogies, which comprise at least one motor axle, wherein the carriages are all mutually articulated in pairs, the railcar comprises three or four traction drives, one traction drive being arranged in each driving carriage and at least one traction drive being

arranged in a single intermediate carriage, a motor bogie is arranged below at least one of the two ends of the driving carriages, a motor bogie is arranged below at least one of the two ends of the intermediate carriage which comprises at least one traction drive.

[0025] The railcar comprises one or more of the following features, taken in accordance with any technically possible combination:

[0026] each traction drive drives at least one motor axle of the motor bogie(s) which is/are arranged below one end or below the two ends of each carriage in which the traction drive is arranged;

[0027] the railcar comprises, between the intermediate carriage comprising at least one traction drive and each of the driving carriages, at least one intermediate carriage which has no traction drive;

[0028] at least one intermediate carriage which has no traction drive is supported at least at one of the two ends thereof by a carrier bogie;

[0029] the carriages are double deck.

[0030] The railcar is completely articulated, that is to say that the carriages are all mutually articulated in pairs. A bogie is arranged in a straddling manner below the two adjacent ends of two adjacent carriages, the free ends of the driving carriages resting on a single bogie.

[0031] It comprises three or four traction drives, one traction drive being arranged in each driving carriage and at least one traction drive (one or two) being arranged in a single intermediate carriage. For this reason, this intermediate carriage will be referred to as the motorised intermediate carriage. The railcar therefore has concentrated motorisation, the concentration being carried out in three carriages, whether there are three or four traction drives.

[0032] A motor bogie is arranged below at least one of the two ends of the two driving carriages and the motorised intermediate carriage comprising a traction drive. In other words, each carriage which comprises a traction drive is supported at the two ends thereof either by a motor bogie and a carrier bogie or by two motor bogies.

[0033] The railcar comprises, between the motorised intermediate carriage and each of the driving carriages, at least one intermediate carriage which has no traction drive. Since this intermediate carriage does not comprise a traction drive, it is referred to as a trailer.

[0034] A trailer is supported at least at one of the two ends thereof by means of a carrier bogie. A trailer is therefore supported at the ends thereof either by means of a carrier bogie and a motor bogie, or by two carrier bogies.

[0035] A railcar according to the invention therefore complies with a regulation for alternating carriages which comprise a traction drive and which comprise no traction drive, and a regulation for alternating motor bogies and carrier bogies in order to comply with the maximum axle load.

[0036] Indeed, all rail vehicles must comply with the restriction of the axle load, the value of which is set out by the infrastructure or by the standards relating to the tracks on which these vehicles travel.

[0037] The axle load of the railcar according to the invention is kept below the maximum admissible load since:

[0038] each driving carriage is supported on a dedicated bogie and a common bogie with another carriage and the load thereof is therefore distributed over a larger number of axles than the intermediate carriages. Consequently, a driving carriage is able to support a greater mass than the

other carriages without exceeding the maximum axle load. Each driving carriage therefore receives passengers, the traction drive and all or some of the auxiliary items of equipment for energy production (electrical and pneumatic),

[0039] the trailers which have no traction drives have a lower empty weight than the driving carriages and the motorised carriage,

[0040] the intermediate motorised carriage receives passengers and the items of equipment of at least one traction drive. The motor bogies at each end of the motorised carriage each support half of the mass of the motorised intermediate carriage and half of the mass of the adjacent trailer, since at least one trailer is interposed between the driving carriage and the motorised intermediate carriage. Since a trailer is less heavy than the motorised intermediate carriage, each motor bogie which is arranged in a straddling manner below one of the ends of the motorised intermediate carriage and below the end of the adjacent trailer supports a mean mass which remains lower than the maximum load per axle.

[0041] The balance of the masses on each carrier bogie and motor bogie is also obtained by means of optimisation of the distribution of the various items of traction equipment or auxiliary equipment of the railcar and the internal fitting of the carriages which differs depending on the comfort desired (different type and number of seats depending on the class of the carriage).

[0042] The internal fitting of the motorised intermediate carriage depends in particular on the mass of the traction drive(s) which are themselves dependent on the desired performance levels of the railcar (multi-voltage traction, maximum speed, etc.). For example, if the mass of the items of traction equipment installed is high, the internal fitting of the motorised intermediate carriage will be reduced in weight and be configured as a buffet car, a carriage which provides services, or which has a reduced passenger capacity compared with the capacity of the trailers.

[0043] Each traction drive drives at least one motor axle of the motor bogie(s) which is/are arranged below one end or the two ends of the carriages in which one or more traction drives are arranged. The railcar may thus comprise from three to twelve motor axles, depending on whether each driving carriage and the motorised intermediate carriage are supported by one or two motor bogies which themselves comprise one or two motor axles.

[0044] One advantage of an architecture which is completely articulated is that the railcar is more stable in the event of derailment. Owing to the articulated architecture, the resistance to forward movement and therefore the energy consumption required to drive the vehicle remains limited compared with a non-articulated railcar of the same length, since there are fewer bogies. The maintenance operations are also reduced. Owing to the railcar composition, the vehicle provides a large capacity since the entire length of the vehicle is used to receive passengers.

[0045] One advantage of the concentration of traction drives in the driving carriages and in a single motorised intermediate carriage allows better protection from and control of fires by physically separating the traction drives from each other and by physically separating the traction drives from the passenger compartments.

[0046] The invention and other advantages will be better understood from a reading of the following description, given purely by way of example, and with reference to the appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0047] FIGS. 1, 3 and 4 are schematic side views of railcars according to the invention, according to a plurality of embodiments.

[0048] FIG. 2 is a table which schematically illustrates the position of the motor axles in accordance with the number of carriages composing the railcar.

[0049] Conventionally, the wheels of the motor axles are indicated in black in the drawings.

DESCRIPTION OF PREFERRED EMBODIMENTS

First Embodiment

[0050] As illustrated in FIG. 1, a railcar A comprises seven trailers 3 and a motorised intermediate carriage 4 which are arranged between two driving carriages 2.

[0051] A first driving carriage 2 is located at a first end of the railcar A (from the left-hand side in FIG. 1). It has a free end, where a driver's cabin 9 is located, and rests on a motor bogie 6 which is composed of two motor axles 5. A first traction drive 8 is arranged below the passenger compartment 10 of this first driving carriage 2. At the opposite end thereof, the driving carriage 2 is articulated to a first trailer 3. The two ends facing the carriages 2 and 3 rest on a single motor bogie 6 which is composed of two motor axles 5.

[0052] The first trailer 3 therefore shares, at the first end thereof, a motor bogie 6 with the driving carriage 2 and shares, at the other end thereof, a carrier bogie 7 with the second adjacent trailer 3.

[0053] The second trailer 3 is articulated to the first trailer 3 and to the third trailer 3. The second trailer 3 shares, with each of the first and third trailer 3, a carrier bogie 7. The third trailer 3 is articulated to a motorised intermediate carriage 4 which is located in the railcar of this embodiment in fifth position from the left-hand side.

[0054] None of the first three trailers 3 receives a traction drive 8.

[0055] The motorised intermediate carriage 4 shares, at each of the ends thereof, a motor bogie 6 with the adjacent trailers. Two traction drives 8 are arranged below the passenger compartment 10 and supply the motors of the motor bogies, which each comprise two motor axles, located at each end of the motorised intermediate carriage 4.

[0056] The four subsequent trailers 3 are also articulated and rest on carrier bogies 7, with the exception of the ends of the trailers 3 which are articulated to the motorised intermediate carriage 4 or to the driving carriage 2 which rest on motor bogies 6. The second driving carriage 2 is identical to the first.

[0057] All the carriages 2, 3, 4 of the railcar A have a passenger compartment 10. Each of the carriages 2, 3, 4 communicates with the or each adjacent carriage by means of a passage 11. Since the vehicle is completely articulated, the railcar A of FIG. 1 has eleven bogies, six motorised bogies 6 and five carrier bogies 7, for a length of approximately 200 m. In this embodiment, all the axles of the motor bogies are motorised. A railcar of this type may transport at least 550 passengers at a commercial speed of at least 330 km/h.

[0058] In each of the driving carriages 2 and motorised intermediate carriage 4, the traction drive(s) 8 is/are arranged below the floor of the passenger compartment 10 in order to retain the length of the passenger compartment 10. FIG. 1 schematically illustrates the location of the traction drives 8 below the entire length of the passenger compartments 10 of the carriages 2 and 4, but depending on the actual spatial requirement of the various components of the traction drive 8, it may extend completely or partially below the floor of the passenger compartments 10.

[0059] In a variant, the traction drives 8 of the driving carriages 2 may be arranged in intermediate compartments between the driver's cabin 9 and the passenger compartment 10.

[0060] In conventional manner, each of the driving carriages 2 is provided with a pantograph 12 in order to acquire the electrical energy on a catenary line (not illustrated).

[0061] A high-voltage cable 13 distributes the electrical energy acquired by each pantograph 12 to the traction drive 8 which is located in the motorised intermediate carriage 4. For reasons of clarity in the drawings, the cables 13 are illustrated at the outer side of the carriages with dot-dash lines. In practice, these cables extend, for example, in the roof.

[0062] The concentration of the traction drives 8 and the motor bogies 6 over a very limited number of carriages allows the mass of the necessary cables to be limited, since only high-voltage cables 13 extend between the driving carriages 2 and the traction drive 8 of the motorised intermediate carriage 4. These cables have a lower mass than the mass of the power cables of the architectures of the railcars of the prior art. The complexity of the cabling is also significantly reduced.

Variants of the First Embodiment

[0063] FIG. 2 illustrates, in the form of a table, two possible configurations of the railcar according to the first embodiment given by way of example. Only the driving carriages 2, the motorised carriages 4, the traction drives 8, the motor bogies 6, the motor axles 5, the carrier bogies 7, the passenger capacity and the possible operating speeds are numbered.

[0064] A railcar which is composed of seven carriages, comprising two driving carriages 2, four trailers 3, a motorised intermediate carriage 4 and four motorised axles 5 requires only three traction drives 8. A single traction drive 8 is therefore arranged in the motorised intermediate carriage 4, in contrast to the first embodiment. In this variant, two motor bogies 6 support the two ends of the motorised carriage 4, but each has only a single motor axle 5. The space released by the second traction drive can be used to install auxiliary equipment or the mass released can be used to install more seats in the compartment 10 of the motorised intermediate carriage 4. In this same variant, only the bogies below the free ends of the driving carriages 2 are motorised and they each comprise two motor axles 5. This variant having seven carriages therefore comprises four motor bogies 6 but six motor axles 5. This railcar may transport between 350 and 400 passengers (depending on the internal fitting) and travel at least at 300 km/h.

[0065] The second variant of the railcar according to the invention having ten carriages is identical to the variant comprising seven carriages, with the exception that it comprises three additional trailers. It may have the same performance levels as the railcar A of the first embodiment by increasing the power at the axle.

[0066] In this manner, the railcar produced according to the invention is completely adjustable in terms of passenger

capacity and speed since it may comprise from seven to eleven carriages, three or four traction drives **8**, from three to twelve motor axles **5** which are distributed over from three to six motor bogies **6** and can reach a maximum speed of between 140 and 350 km/h.

[0067] This adjustability is achieved by means of the simplification of the types of carriages (driving **2**, trailer **3** and motorised **4**) whilst applying the regulation for alternating the trailers and the carriages which receive a traction drive **8** and the regulation for alternating the motor bogies **6** and carrier bogies **7** in order to comply with the maximum axle load.

Second Embodiment

[0068] As illustrated in FIG. 1, the railcar A comprises only single deck carriages. In a variant, the driving carriages **2** and the intermediate carriages **3**, **4** are double deck, as illustrated in FIG. 3.

[0069] Advantageously, in a railcar B which has double deck carriages, the lower level of a driving carriage **2** and the motorised intermediate carriage **4** which receives a traction drive **8** is used to accommodate the traction drive(s) **8**, the other level being reserved for passengers.

[0070] The passages **11** are placed at the upper level in order to move from one trailer **3** to another. In contrast, the passages between the driving carriages **2** and the adjacent trailers **3** are formed at the lower level. A stairway (not illustrated) which is arranged in the driving carriage **2** and in the trailers **3** allows the upper level to be reached from the access doors (not illustrated) of the carriages **2**, **3**, **4**.

Third Embodiment

[0071] For a short railcar, in the order of from 120 to 160 m, it is advantageous to reduce the number of motor bogies by removing the motorised intermediate carriage **4** which receives the traction drive(s) **8** and removing the associated motor bogies **6**.

[0072] In this manner, in the variant illustrated in FIG. 4, in which the references to the elements which are similar to those of FIG. 1 have been retained, a railcar C is distinguished from that of the preceding embodiments in that it comprises only trailers **3** which have no traction drives **8**. The railcar C therefore has no motorised intermediate carriage **4** which receives a traction drive **8**.

[0073] The railcar C comprises four motorised bogies **6** which are arranged below the free ends of the driving carriages **2**, and in a straddling manner below the end of a driving carriage **2** and the end of the adjacent trailer **3**. In accordance with the desired power/mass ratio, from four to eight axles could be motorised, each motor bogie **6** having at least one motor axle **5**.

[0074] Owing to the removal of the motorised intermediate carriage **4**, the power/mass ratio of a short railcar remains sufficiently high for the railcar to travel at high speed whilst having optimised traction power taking into consideration the

use thereof. This possibility for adapting the traction power is not possible on a train, since the motor cars have a traction power which is sized for the maximum number of carriages to be pulled; if intermediate carriages are removed, the power is needlessly excessive. The adaptation of the traction power cannot be readily carried out on a railcar having distributed motorisation since removing a carriage is equivalent to removing an element of the traction drive.

1. Railcar for passenger transport comprising:

two driving carriages and intermediate carriages,
carrier bogies,
motor bogies, which comprise at least one motor axle,
wherein:

the carriages are all mutually articulated in pairs,
the railcar comprises three or four traction drives, one
traction drive being arranged in each driving carriage
and at least one traction drive being arranged in a
single intermediate carriage,

a motor bogie is arranged below at least one of the two
ends of the driving carriages,

a motor bogie is arranged below at least one of the two
ends of the intermediate carriage which comprises at
least one traction drive.

2. Railcar according to claim 1, wherein each traction drive
drives at least one motor axle of the motor bogie(s) which
is/are arranged below one end or below the two ends of each
carriage in which the traction drive is arranged.

3. Railcar according to claim 1, wherein it further com-
prises, between the intermediate carriage comprising at least
one traction drive and each of the driving carriages, at least
one intermediate carriage which has no traction drive.

4. Railcar according to claim 2, wherein it further com-
prises, between the intermediate carriage comprising at least
one traction drive and each of the driving carriages, at least
one intermediate carriage which has no traction drive.

5. Railcar according to claim 1, wherein at least one inter-
mediate carriage which has no traction drive is supported at
least at one of the two ends thereof by a carrier bogie.

6. Railcar according to claim 2, wherein at least one inter-
mediate carriage which has no traction drive is supported at
least at one of the two ends thereof by a carrier bogie.

7. Railcar according to claim 1, wherein the carriages are
double deck.

8. Railcar according to claim 2, wherein the carriages are
double deck.

9. Railcar according to claim 3, wherein the carriages are
double deck.

10. Railcar according to claim 4, wherein the carriages are
double deck.

11. Railcar according to claim 5, wherein the carriages are
double deck.

12. Railcar according to claim 6, wherein the carriages are
double deck.

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