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(71) Applicant *(for all designated States except US)*: **DWA DEUTSCHE WAGGONBAU GMBH** [DE/DE]; Kablower weg 89, 12526 Berlin (DE).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **NOACK, Maik** [DE/DE]; Dorfstrasse 21, 15913 Laasow (DE).

(74) Agent: **AKERS, Noel, James**; Howrey Simon Arnold & White, CityPoint, One Ropemaker Street, London EC2Y 9HS (GB).

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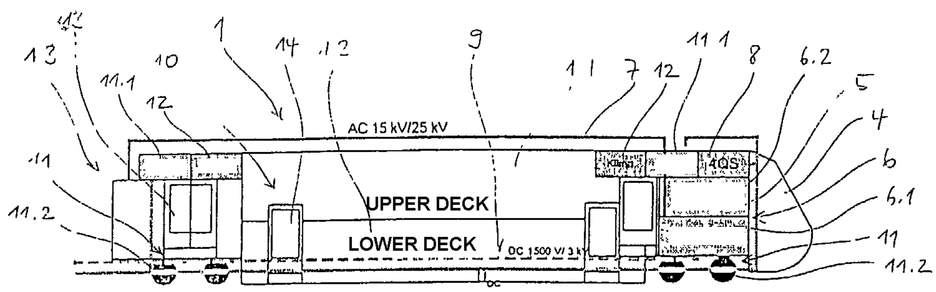

6.1 TRANSFORMER
6.2 PERIPHERAL COMPONENTS
11.1 POWER INVERTER DEVICE
12 AIR-CONDITIONING SYSTEM

(57) Abstract: Passenger train, in particular double decker train, having a first wagon (1) which has at least one power supply device (6) for supplying a traction device (11), and a second wagon (2), characterized in that the first wagon (1) is embodied as an end wagon with driver's cab (4) and, in order to reduce the installations in the passenger space (10), has a machine space (5) which is arranged in the region of the driver's cab (4) and in which essentially all the main components (6.1) of the power supply device (6) which are intensive in terms of installation space and/or mass are arranged.

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POWER SUPPLY MEANS FOR RAIL VEHICLE

The present invention relates to a passenger train, in particular a double decker train, having a first wagon which has the purpose of conveying passengers and has at least one power supply device for supplying a traction device, and a second wagon for conveying passengers.

Prior Art

A series of such passenger trains is known in which the main components of the power supply device, for example transformers, power inverters and the like, are arranged at different locations on the train, in particular at different locations on the first wagon which is frequently also referred to as a motorcar. For example, a double decker traction engine of the series BR 445 from the Deutsche Bahn AG is known in which the machine space behind the driver's cab is taken up by power inverters and auxiliary operation converters, while the transformer is arranged at the rear end of the motorcar.

In known passenger trains there is firstly the problem that the installations which are partially distributed in the passenger space are restricted to the transport capacity of the train. On the other hand, such installations impede the flow of passengers in the vehicle. Finally, such installations do not allow a view through into adjacent wagons and also adversely affect the visibility in the train and as a result also the subjective sensation of safety of the passengers. Furthermore, this restricts the freedom of choice in the arrangement of the doors, and thus also with respect to the entry height.

Object of the invention

The present invention is therefore based on the object of making available a vehicle concept for a passenger train of the type mentioned at the beginning, which does not have the abovementioned disadvantages, or at least only has them to a relatively small degree, and in particular ensures improved passenger flow in the vehicle while increasing the transport capacity of the train.

The present invention achieves this object on the basis of a passenger train in accordance with the preamble of Claim 1 by means of the features disclosed in the characterizing part of Claim 1.

The present invention is based on the technical teaching that the transport capacity is increased, while the passenger flow in a vehicle is simultaneously improved or facilitated, if the first wagon is embodied as an end wagon with a driver's cab, and, in order to reduce the installations in the passenger space, has a machine space which is arranged in the region of the driver's cab and in which essentially all the main components of the power supply device which are intensive in terms of installation space and/or mass are arranged. The concentration according to the invention of all the main components of the power supply device which are intensive in terms of installation space or mass in the machine space behind the driver's cab makes it advantageously possible to dispense with further installations in the passenger space which impede the passenger flow in the vehicle. This makes it possible to manufacture a passenger space which can be used virtually uninterruptedly for passengers from the machine space up to the end of the train without relatively large restrictions. This not only ensures unimpeded passenger flow but also, in the first instance, increases the transport capacity of the vehicle. In addition, such an uninterrupted passenger space, which no longer has any regions which cannot be looked into, can be looked into more easily, and thus also monitored if appropriate, a not insignificant result of which is that the subjective sense of safety of the passengers is increased. Finally, such an uninterrupted passenger space provides a much larger range of configuration possibilities of the devices for the passengers, for example rows of seats etc. Providing an uninterrupted passenger space also makes it possible to arrange doors at any desired location so that the entries can be adapted to all the current heights of platforms.

The present invention can be applied both for autonomous or partially autonomous as well as for non-autonomous passenger trains, irrespective of the selected drive system or power supply system. The main components of the power supply device are of course determined here by the power supply system or the type of power feeding system selected.

In preferred variants of the invention with power inverter operating mode or multi-system operating mode, i.e. for operation in an AC voltage system or in the multi-system operating mode with at least one AC voltage, at least one transformer device for the voltage of the current collector overhead line is arranged in the machine space as part of the main components.

When there is a DC current drive, preferably at least one power system filter inductor, and additionally or alternatively a braking resistor are arranged in the machine space. The braking resistor then of course has to be preferably cooled in a suitable way.

Finally, when there is a diesel-electric drive, at least one diesel assembly and an associated generator, in particular including auxiliary devices and if necessary a braking resistor, are preferably arranged in the machine space. Furthermore, of course the associated fuel tank can also be arranged in the machine space as part of the main components.

It goes without saying of course that the invention can be applied to the same degree and with the same advantages to other power supply systems, such as, for example, a power supply using fuel cells or the like.

With a correspondingly optimized configuration, the main components may be arranged in such a way that the machine space takes up as little room as possible and a largest possible area is also available for conveying passengers in the first wagon. New components which are particularly space-saving, such as superconductive transformers or high-voltage direct inverters, permit the installation space for the machine space to be reduced further. The main components can be arranged here in the machine space in basically any desired fashion, irrespective of functional requirements. However, limits are usefully set by the resulting mass distribution in the vehicle as a comparatively low centre of gravity of the first wagon is advantageous for the travelling properties. On the other hand, the centre of gravity in the longitudinal direction of the vehicle should not lie outside the permissible limits. However, the invention enables both requirements to be advantageously complied with in an easy way.

In order to comply with the first requirement of the low centre of gravity there is therefore in preferred variants provision for the main components to be arranged or embodied in such a way that the centre of gravity is located below the rolling pole of the first wagon, a stable driving behaviour being advantageously ensured.

A particularly advantageous utilization of space and distribution of mass is obtained with variants of the passenger train according to the invention, peripheral components of the power supply device which are possibly intensive in terms of installation space but less intensive in terms of mass being arranged above the main components. Such peripheral components may be, for example, expansion vessels, protection and measuring devices, piping, feed lines etc. Further optimizations in terms of the utilization of space and the distribution of mass can be achieved in many ways. For example, when there is an AC current operating mode or multi-system operating mode, the power supply device generally comprises a feed device for feeding the electrical energy from a current collector overhead line into at least one intermediate circuit which is preferably arranged above the transformer device, in order to obtain a utilization of space and distribution of mass which are as advantageous as possible.

Such a feed device may be, for example, a four-quadrant actuator, in particular a conventional four-quadrant actuator. Such a feed device converts the alternating current, whose voltage is generally already adapted by means of a transformer, from the current collector overhead line into a DC current. The latter is then fed into the intermediate circuit and passes via it to the traction devices. The intermediate circuit can be configured in any desired way. This may be, for example, what is referred to as a distributed intermediate circuit or what is referred to as a power bus or what is referred to as a busbar via which the energy passes to the individual traction devices which are distributed over the train, and possibly also the on-board power system supply devices. The DC current is then preferably transformed for the respective operating currents of the motors on an individual basis in each individual traction device. Preferably the DC voltages DC 1500 V, DC 3 kV (preferably in the tolerances according to EN 50163) as well as DC 1800 V (+/- 5%) are provided for such a busbar or such a distributed intermediate circuit. These voltages can either be fed indirectly from the current collector overhead line or fed via the aforesaid power feed devices when operating with AC voltage power systems.

In preferred variants for the multi-system operating mode, there is provision for the power to be transmitted to the traction devices by means of a busbar which, when operating with DC power systems, is fed directly from the current collector overhead line via the power system filter inductor device or the secondary winding of the transformer which is correspondingly used as such, or, when operating with AC power systems, is fed by a corresponding power supply device as a result of which the busbar then constitutes the intermediate circuit depending on the situation.

The optimization of space and mass can of course also be achieved in other ways. It is thus possible, for example, to make a saving in terms of individual components by integrating functions, by assigning different functions to one component in different operating states. Thus, in one preferred variant of the passenger train according to the invention for the multi-system operation there is provision for the power supply device to be designed to use a secondary winding of the transformer device as a filter inductor in the DC operating mode, as a result of which it is unnecessary to provide a separate filter inductor.

A particularly favourable way of utilizing space and thus achieving the highest possible transport capacity is obtained with preferred variants of the passenger train according to the invention in which the maximum width available in the first wagon is essentially completely utilized for the machine space. Here, the width of the wagon minus a possibly necessary escape path for the driver of the vehicle is preferably utilized.

A particularly generously configured passenger space which is more or less uninterrupted is obtained with advantageous refinements of the passenger train according to the invention in which, in the vicinity of the drive motor, the current is converted into the operating current for the drive motor. In preferred variants for a traction device which comprises a power inverter device which is connected to the power supply device, and at least one driven wheel set, there is therefore preferably provision for the power inverter device to be arranged in the roof region of the wagon above the driven wheel set. As a result, the passenger space is advantageously restricted as little as possible by installations or the like.

In advantageous variants of the invention with a plurality of traction devices which are distributed over the train, the current is converted into the operating currents for the respective drive motor in a preferably decentralized fashion, i.e. preferably in each case in the vicinity of the respective motor. For this reason, a number of traction devices is preferably provided over the train, which devices each comprise a power inverter device which is connected to the power supply device, and at least one assigned, driven wheel set, the power inverter device being arranged in the roof region of the wagon above the assigned wheel set, and exclusively supplying the drive means for the assigned wheel set. Alternatively, the corresponding power inverter device may also be arranged in the direct vicinity of the respective motor.

The traction devices are preferably provided in the end wagons of the train, it being possible to select the arrangement of the driven wheel sets, for example of the powered bogies, primarily in such a way that the wheel set weights are optimized. In order to reduce wagon junctions for the feed lines to the traction devices, individual or a plurality of traction devices may however also be arranged in central wagons as required.

If the power supply of the train takes place entirely or at least partially via a current collector overhead line, in preferred variants of the passenger train according to the invention at least one first current collector device which is connected to the power supply device is provided for drawing electrical power from a current collector overhead line and at least one feed device which is connected thereto is provided for feeding the electrical power into at least one intermediate circuit, that the second wagon accommodates the first current collector device, and the feed device is arranged in the first wagon. By distributing the feed device and the current collector device onto the first and second wagons, the passenger space is adversely affected, if at all, only to a slight degree by the respective installations in both wagons. In addition, the first wagon is relieved of the components arranged in the second wagon.

In order to obtain a passenger space which is adversely affected as little as possible by installations, in further advantageous refinements of the passenger train according to the invention the first current collector device is arranged in the region of a first end of the second wagon, while a traction device is provided in the region of a second end of the second wagon. (repetition). This separation permits a particularly favourable distribution of the installations over the second wagon, combined with the smallest possible restrictions of the passenger space. In further variants of the passenger train according to the invention with an increased transport capacity, a third wagon is provided which has a second current collector device in the region of one end, and additionally or alternatively has a traction device in the region of its other end, in order to obtain similarly favourable distribution of the installations.

In further advantageous variants of the passenger train according to the invention for a multi-system operating mode, one of the current collector devices is configured for full load and maximum speed of a voltage system or of a group of voltage systems, while the other is provided merely with emergency running properties, the current collector devices being arranged in particular at adjacent ends of the second and third wagons.

Preferably, a first current collector device is configured here for full load and maximum speed of at least one first voltage system, while a second current collector device is merely provided with emergency running properties for the first voltage system. The second current collector device is then configured for full load and maximum speed of at least one second voltage system, while a first current collector device is provided merely with emergency running properties for the second voltage system.

In preferred variants of the passenger train according to the invention there is provision for it to have a number of second wagons and/or third wagons depending on the performance and/or capacity requirements and/or the requirements of the feed system.

In preferred variants of the passenger train according to the invention, a cooling device is provided for the power inverter device. The latter comprises at least one fan device, the fan device being designed additionally to generate a cooling air stream for the motors of the traction device so that a separate fan device for the traction device can be dispensed with and there can thus be a saving in terms of installation space. Preferably, further functional integration and thus a saving in space is achieved by additionally designing the fan device to generate a cooling air stream for auxiliary devices such as air-conditioning systems or the like. The fan of the air-conditioning back cooling system is preferably used as a fan device. In order to adversely affect the passenger space as little as possible, the cooling devices are also preferably arranged in the roof region of a wagon, as generally applies in any case with respect to the fan of the air-conditioning back cooling system. The present invention also relates to a first wagon for a passenger train according to one of the preceding claims. According to the invention, the latter has the features which are described in detail above with respect to the passenger train according to the invention so that at this point reference will only be made to the above description.

Examples

Further preferred configurations of the invention emerge from the subclaims and the following description of preferred exemplary embodiments which refer to the appended drawings, in which:

Figures 1A to 1C show schematic sections through a first wagon of a preferred exemplary embodiment of the passenger train according to the invention,

Figure 2 shows a schematic partial section through a first wagon of a further preferred exemplary embodiment of the passenger train according to the invention,

Figures 3A to 3C show schematic sections through a second wagon of the passenger train from Figures 1A to 1C,

Figure 4 shows a schematic partial section through a second wagon of a further preferred exemplary embodiment of the passenger train according to the invention,

Figures 5A to 5C show schematic sections through a second wagon of the passenger train from Figures 1A to 1C,

Figures 6A to 6C show schematic sections through a first wagon of a further preferred exemplary embodiment of the passenger train according to the invention,

Figure 7 shows a schematic view of a cooling circuit for a wagon from Figures 1A to 1C.

Figures 1A to 1C show schematic sections through a first wagon 1 - also designated below as a motorcar - of a preferred exemplary embodiment of a double decker train according to the invention. Here, Figure 1A shows a longitudinal section through the first wagon 1, while Figures 1B and 1C show horizontal sections at the level of the upper deck 1.1 and of the lower deck 1.2 of the first wagon 1. Figures 3A to 3C show schematic sections through a second wagon 2 - also referred to below as a central wagon - of the double decker train from Figures 1A to 1C. Here, Figure 3A shows a longitudinal section through the second wagon 2, while Figures 3B and 3C show horizontal sections at the level of the upper deck 2.1 and of the lower deck 2.2 of the second wagon 2.

Figures 5A to 5C finally show schematic sections through a third wagon 3 - also referred to below as control wagon – of the double decker train from Figures 1A to 1C. Here, Figure 5A shows a longitudinal section through the third wagon 3, while Figures 5B and 5C show horizontal sections at the level of the upper deck 3.1 and of the lower deck 3.2 of the third wagon 3.

As is apparent from Figures 1A to 1C, in particular Figure 1A, the motorcar 1 is embodied as an end wagon with a driver's cab 4. Directly behind the driver's cab 4, a machine space 5 is arranged in which all the main components of the power supply device 6 of the train that are intensive in terms of installation space and mass are arranged.

The power supply of the train which is equipped for operation in an AC voltage system or a mixed system with at least one AC voltage is provided via a current collector overhead line (not illustrated in Figure 1A). The current which is drawn from the current collector overhead line passes here via a feed line 7 into a transformer 6.1 which is surrounded by a so-called transformer tank by means of which the voltage of the current collector overhead line is transformed into the operating voltage which is necessary for further processing.

The transformer tank with the transformer 6.1 constitutes the main components of the power supply device 6 which is most intensive in terms of mass. Said tank is configured and arranged in such a way that its centre gravity lies below the rolling pole of the motorcar 1. A suitable driving behaviour of the motorcar is achieved by virtue of this low centre of gravity.

The peripheral components of the power supply device 6 which are less intensive in terms of mass and which include, in particular, the transformer peripheral 6.2, that is to say inter alia the switching and protection devices etc. which are associated with the transformer 6.1 are arranged above the transformer 6.1 in the machine space 5. Furthermore, a feed device in the form of a four-quadrant actuator 8 which transforms the oscillating current which is transformed by the transformer 6.1 and feeds it as a DC current into an intermediate circuit in the form of a busbar 9 is arranged in the machine space 5 above the transformer 6.1. The UIC-adapted busbar 9 makes available the following voltages in the present example : DC 1500 V, DC 3 kV (tolerances according to EN 50163) which, in the case of the mixing operating mode, is possibly fed directly from the current collector overhead line using the transformer secondary winding as a power system filter inductor as well as DC 1800 V (+/- 5%) from the output of the four-quadrant actuator.

By concentrating the main components which are intensive in terms of installation space and mass, and also the peripheral components of the power supply device 6 which are less intensive in terms of mass, in the machine space 5 which is directly arranged behind the driver's cab 4, it is possible to obtain passenger space 10 which is virtually uninterrupted and which is only adversely affected to an insignificant degree by the installations associated with the power supply device. As a result, on the one hand the transport capacity of the vehicle is increased and on the other hand there are no impediments, in particular in the junction region 1.3 with the adjoining central wagon (not illustrated in Figure 1A) as a result of such installations so that a smooth passenger flow in this region is ensured.

Via the busbar 9, inter alia the traction devices 11 of the train are supplied, said traction devices 11 comprising in each case a power inverter device, connected to the busbar 9, in the form of a pulse-controlled power inverter 11.1, and a powered bogie 11.2 which is connected to the pulse-controlled power inverter 11.1. The pulse-controlled power inverter 11.1 which is similar in terms of design to the four-quadrant actuator 8 converts the DC current here from the busbar 9 into the corresponding operating currents for the motors of the driven wheel sets of the powered bogie 11.2. In order to adversely affect the passenger space as little as possible, the respective pulse-controlled power inverter 11.1 is respectively arranged in the roof region of the wagon directly above the associated powered bogey 11.2.

Further auxiliary devices of the train, for example air-conditioning systems 12, are also arranged in the roof region of the respective wagon in order to ensure to the same extent that the passenger space is adversely affected as little as possible by these installations.

The inventive arrangement of the components of the power supply device 6, of the traction devices 11 and of the further auxiliary devices of the train permit not only a passenger space which is uninterrupted virtually without impediments, but also, owing to the variability of the passenger space 10 which is virtually free of supply installations, at the same time allow the implementation of an entry concept with high-level entry 13 as well as low-level entry 14. As a result, the train according to the invention can be used in a particularly versatile way.

As is apparent from Figure 1C, essentially the entire width of the wagon minus an escape path 15 for the vehicle driver is devised for the machine space 5 in order to obtain a machine space 5 which is as short as possible [lacuna] the longitudinal direction of the vehicle, and thus a passenger space 10 which is as long as possible. It goes without saying that in other variants of the invention with a driver's cab with emergency exits such an escape path may also be missing, as a result of which a shorter machine space can also be obtained.

The embodiment from Figures 1A to 1C is, as mentioned, an AC current drive system, i.e. a system for operation in AC voltage systems. However, it goes without saying that the motorcar from these figures can also be used with slight modifications for a multi-system drive system. In particular, by functionally integrating individual components it is possible to achieve an advantageous saving in installation space. In particular, one of the secondary windings of the transformer may serve as a filter inductor for the DC current operating mode.

Figure 2 shows a partial section through the first wagon 1' of a further variant of the passenger train according to the invention in which a DC current drive system, i.e. a drive system for operation in a DC current system, is implemented. The basic configuration of the first wagon 1' corresponds here to that of the first wagon 1 from Figure 1A so that only the differences will be explored here.

The difference consists in the fact that the main component of the power supply device 6' arranged in the machine space 5' is a power system filter reactor 6.1' via which the corresponding DC voltage is fed into the feed lines to the pulse-controlled power inverters. Furthermore, a braking resistor 16, including the necessary cooling devices, is arranged in the machine space 5'.

As is apparent from Figures 3A to 3C, in particular Figure 3A, the central wagon has, in the region of its first end 2.3 facing the motorcar 1, a first current collector device 17 via which power is drawn from a current collector overhead line 18. The first current collector device 17 comprises a current collector 17.1 and associated switching and protection devices 17.2 which are connected to the transformer 6.1 of the motorcar 1 via the line 7. A current collector device 17 is also arranged at the second end 2.4 of the central wagon 2. The current collector devices are accommodated here in correspondingly shaped troughs of the air-conditioning systems. The number of current collector devices of the entire train is also determined here according to the train configuration and the redundancy requirements.

Both the switching and protection devices 17.2 and further auxiliary devices of the train which are supplied via the busbar 9, such as air-conditioning systems 12, are in turn arranged in the roof region of the wagon 2 in order to ensure that the uninterrupted passenger space 10 is adversely affected as little as possible by such installations.

In the embodiment from Figures 3A to 3C, current collector devices 17 are arranged at the two ends of the central wagon 2. However, it goes without saying that when necessary instead of the current collector device it is also possible to arrange a traction device 11 at one end of the central wagon, as has already been described above in conjunction with Figures 1A to 1C. Figure 4 shows a partial section through such a variant of a central wagon 2' which has, at its first end 2.3', a traction device 11 with a pulse-controlled power inverter 11.1 and a powered bogey 11.2 such as has been described above with reference to Figures 1A to 1C.

The central wagon 2' otherwise does not differ from the central wagon from Figures 3A to 3C so that reference is to be made here only to the above statements. Finally, as is apparent from Figures 5A to 5C, the control wagon 3 which is embodied as an end wagon has a second current collector device 19 at its first end 3.3 facing the central wagon 2. The current collector device 19 with the current collector 19.1 and the switching and protection devices 19.2 corresponds in its configuration to the current collector device 17 already described above.

At the second end 3.4 of the control wagon 3, a traction device 11 which is supplied via the busbar 9, such as has already been explained above, is arranged. A further driver's cab 20 is also arranged at this end 3.4.

It is to be noted at this point that on the one hand the train configuration described above with the feeding of high voltage exclusively into the machine space 5 and the distribution of power to the traction devices 11 and of auxiliary devices from the machine space via the busbar 9 reduces the expenditure on cabling and piping, while on the other hand this "bus structure" which is embodied by means of the busbar advantageously permits the traction within the train to be modularized. Finally, the reduction in the interfaces and the hierarchical structure within the train facilitates diagnostics. In addition, this improves the redundancy of the system.

Both the switching and protection devices 19.2 of the second current collector device 19 and further auxiliary devices of the train which are supplied via the busbar 9, such as air-conditioning systems 12, are also arranged in turn in the roof region of the wagon 3 in order to ensure that the uninterrupted passenger space 10 is adversely affected as little as possible by such installations.

In one variant of the passenger train according to the invention, which is suitable in particular for multi-system designs, a current collector device 17 is provided at the adjacent second end 2.4 of a further central wagon in addition to the current collector device 19 on the control wagon 3. Only a first of the two current collector devices 17 and 19 is then configured in a first system or a first system group, for example, from one or more AC voltage systems, for full load and maximum speed of the train, while the other, second current collector device in this first system or this first system group is merely provided with emergency running properties in order to be able to achieve appropriate redundancy in this way. On the other hand, the second of the two current collector devices 17 and 19 is configured in a second system or a second system group, for example, from one or more AC voltage systems, for full load and maximum speed of the train, while the other, first current collector device in this second system or this second system group is merely provided with emergency running properties. Figures 6A to 6C show schematic sections through a first wagon 1'' of a further preferred exemplary embodiment of the passenger train according to the invention with a diesel-electric power supply. The sections and the basic design of the motorcar 1'' resemble those and that of the motorcar 1 from Figures 1A to 1C so that only the differences will be explored here.

The difference consists in the fact that a diesel assembly and an associated generator are arranged in the machine space 5'' as main components 6.1'' of the power supply device 6''. Furthermore, the fuel tank 21 is arranged there. The cooling devices 22 for the diesel assembly and generator as well as the components 23 of the exhaust gas system are arranged above the diesel assembly as peripheral components.

The generator feeds a busbar 9'' via which traction devices 11 with a pulse-controlled power inverter 11.1 and a powered bogey 11.2 are supplied, as has already been described above. In the region of the traction device 11, a braking resistor 16 and further auxiliary devices, for example an air-conditioning system 12, are also arranged.

Both the pulse-controlled power inverter 11.1, the further auxiliary devices of the train which are supplied via the busbar 9'', such as the air-conditioning system 12, and the braking resistor 16 are also in turn arranged here in the roof region of the motorcar 1'' in order to ensure that the uninterrupted passenger space 10'' is adversely affected as little as possible by such installations. The braking resistor is matched here to the power installed in the bogey and is thus of correspondingly small dimension so that it can take up the installation space which is usually taken up by the high-voltage equipment in the electric traction units.

Figure 7 shows a schematic view of a cooling circuit for the motorcar 1 from Figures 1A to 1C. Here, a cooling device 24 which is arranged in the roof region of the motorcar 1 is provided with a fan device in the form of a fan 24.1. The cooling air stream which is generated by the fan 24.1 thus serves both for cooling the pulse-controlled power inverter 11.1 and for cooling the coolant 12.1 of the air-conditioning system 12 and for cooling the motors 11.3 of the powered bogie 11.2.

As is apparent from Figure 7, the pulse-controlled power inverter 11.1 is embodied with water cooling here via a cooling circuit 25. The cooling air is fed to the motors via corresponding ducts in the side walls of the motorcar 1. The cooling circuit described above is preferably used when there are correspondingly high powers to be processed. However, it goes without saying that in the case of use profiles with correspondingly lower necessary powers or with a high alternating load characteristic, such as for example in local public transport, air-cooled pulse-controlled power inverters can also be used in conjunction with self-cooled, i.e. air-stream-cooled motors.

Furthermore, it goes without saying that corresponding cooling systems can be configured and arranged in the same way for the feed device as has been described above for the pulse-controlled power inverter.

Through the described functional integration within the cooling device 24, on the one hand a considerable saving in space is achieved and on the other hand the arrangement of the cooling device 24 in the roof region of the motorcar 1 ensures in turn that the passenger space is adversely affected as little as possible. In all the variants described above, there is preferably provision for the housings for all the components mounted in the roof region of the respective wagon to be constructed in such a way that they are integrated directly into the wagon body structure as structural elements of the wagon body. There is preferably also provision for all the maintenance connections and/or parts which are subject to inspection to be accessible from the roof of the passenger space, for example in the junction regions between the wagons.

The invention has been described above exclusively with reference to examples of double decker trains. It goes without saying however that the invention can equally well also be applied to other passenger trains with the same advantages.

List of reference numerals

1; 1'; 1'';	First wagon
1.1	Upper deck
1.2	Lower deck
1.3	Junction region
2; 2'	Second wagon
2.1	Upper deck
2.2	Lower deck
2.3'	First end
2.4	Second end
3	Third wagon
3.1	Upper deck
3.2	Lower deck
3.3	First end
3.4	Second end
4; 4'	Driver's cab
5; 5'; 5''	Machine space
6; 6'; 6''	Power supply device
6.1; 6.1'; 6.1''	Transformer
6.2	Peripheral components
7	Feed line
8	Feed device
9; 9''	Intermediate circuit
10; 10''	Passenger space
11	Traction device
11.1	Power inverter device
11.2	Wheel set
11.3	Motors
12	Air-conditioning system
12.1	Coolant
13	High-level entry
14	Low-level entry
15	Escape path
16	Braking resistor

17	First current collector device
17.1	Current collector
17.2	Switching and protection device
18	Current collector overhead line
19	Second current collector device
19.1	Current collector
19.2	Switching and protection device
20	Driver's cab
21	Fuel tank
22	Cooling device
23	Components
24	Cooling device
24.1	Fan device
25	Cooling circuit

CLAIMS

1. Passenger train, in particular double decker train, having a first wagon (1; 1'; 1'') which has at least one power supply device (6; 6'; 6'') for supplying a traction device (11), and a second wagon (2; 2'), characterized in that the first wagon (1; 1'; 1'') is embodied as an end wagon with driver's cab (4; 4') and, in order to reduce the installations in the passenger space (10), has a machine space (5; 5'; 5'') which is arranged in the region of the driver's cab (4; 4') and in which essentially all the main components (6.1; 6.1'; 6.1'') of the power supply device (6; 6'; 6'') which are intensive in terms of installation space and/or mass are arranged.

2. Passenger train according to Claim 1, characterized in that peripheral components (6.2) of the power supply device (6) which are less intensive in terms of mass are arranged above the main components (6.1).

3. Passenger train according to Claim 1 or 2, characterized in that, as part of the main components,

- at least one transformer device (6.1) for the voltage of the current collector overhead line is arranged in the machine space (5) when there is AC current operation or multi-system operation,
- a power system filter inductor (6.1') and/or a braking resistor (16) are arranged in the machine space (5') when there is DC current operation,
- at least one diesel assembly and a generator, in particular including auxiliary devices, are arranged in the machine space (5'') when there is diesel-electric drive .

4. Passenger train according to Claim 3, characterized in that, when there is an AC current drive or multi-system drive, the power supply device (6) comprises a feed device (8) for feeding the electrical energy from a current collector overhead line (18) into at least one intermediate circuit (9), in particular a four-quadrant actuator which is arranged above the transformer device (6.1).

5. Passenger train according to one of the preceding claims, characterized in that the main components (6.1; 6.1'; 6.1'') are arranged and/or embodied in such a way that the centre of gravity is located below the rolling pole of the first wagon.

6. Passenger train according to one of the preceding claims, characterized in that, when there is a multi-system drive, the power supply device (6) is designed to use a

secondary winding of the transformer device (6.1) as a filter inductor in the DC current operation.

7. Passenger train according to one of the preceding claims, characterized in that, the maximum width available in the first wagon (1; 1'; 1''), in particular the width of the wagon minus an escape path (15) for the driver of the vehicle, is essentially completely utilized for the machine space (5; 5'; 5'').

8. Passenger train according to one of the preceding claims, characterized in that the traction device (11) comprises a power inverter device (11.1), which is connected to the power supply device (6; 6'; 6''), and at least one driven wheel set (11.2), the power inverter device (11.1) being arranged in the roof region of the wagon (1; 1'; 1''; 2; 2'; 3) above the driven wheel set (11.2).

9. Passenger train according to one of the preceding claims, characterized in that a number of traction devices (11) are provided, which each comprise a power inverter device (11.1) connected to the power supply device (6; 6'; 6''), and at least one assigned, driven wheel set (11.2), the power inverter device (11.1) being arranged in the roof region of the wagon (1; 1'; 1''; 2; 2'; 3) above the assigned wheel set (11.2), and exclusively supplying the drive means for the assigned wheel set (11.2).

10. Passenger train according to one of the preceding claims, characterized in that at least one first current collector device (17) which is connected to the power supply device (6; 6') is provided for drawing electrical power from a current collector overhead line (18), and at least one feed device (8) which is connected thereto is provided for feeding the electrical power into at least one intermediate circuit (9), the second wagon (2; 2') accommodating the first current collector device (17), and the feed device (8) being arranged in the first wagon (1; 1').

11. Passenger train according to Claim 10, characterized in that the first current collector device is arranged in the region of a first end of the second wagon, and a traction device is provided in the region of a second end of the second wagon.

12. Passenger train according to Claim 10 or 11, characterized in that a third wagon (3) is provided which has a second current collector device (19) in the region of one end and/or has a traction device (11) in the region of its other end.

13. Passenger train according to Claim 12, characterized in that one of the current collector devices (17; 19) is configured for full load and maximum speed while the other is provided merely with emergency running properties, the current collector devices (17; 19) being arranged in particular at adjacent ends of the second and third wagons.

14. Passenger train according to Claim 12 or 13, characterized in that for the multi-system drive, a first current collector device (17) is configured for full load and maximum speed of at least one first voltage system, while a second current collector device (19) is merely provided with emergency running properties for the first voltage system, and the second current collector device (19) is configured for full load and maximum speed of at least one second voltage system, while a first current collector device (17) is provided merely with emergency running properties for the second voltage system.

15. Passenger train according to one of the preceding claims, characterized in that it has a number of second wagons (2; 2') and/or third wagons (3) depending on the performance and/or capacity requirements and/or the requirements of the feed system.

16. Passenger train according to one of Claims 8 to 15, characterized in that a cooling device (24) is provided for the power inverter device (11.1), which cooling device (24) comprises at least one fan device (24.1), the fan device (24.1) being designed additionally to generate a cooling air stream for the motors (11.3) of the traction device (11), and in particular additionally to generate a cooling air stream for auxiliary devices such as air-conditioning systems (12).

17. Passenger train according to Claim 16, characterized in that the cooling device (24) is arranged in the roof region of a wagon (1; 1'; 1''; 2; 2'; 3).

18. First wagon for a passenger train according to one of the preceding claims.

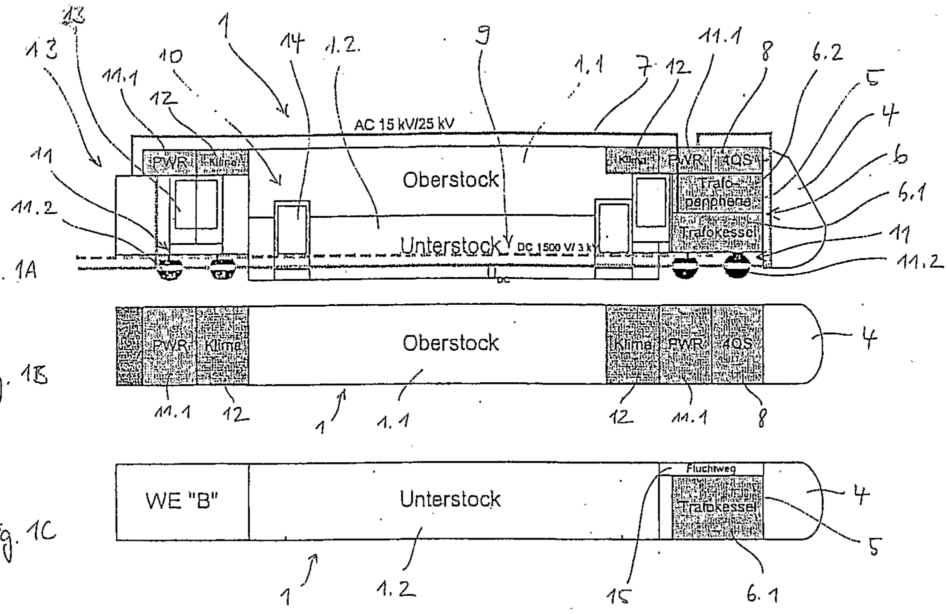


Fig. 1A

Fig. 1B

Fig. 1C

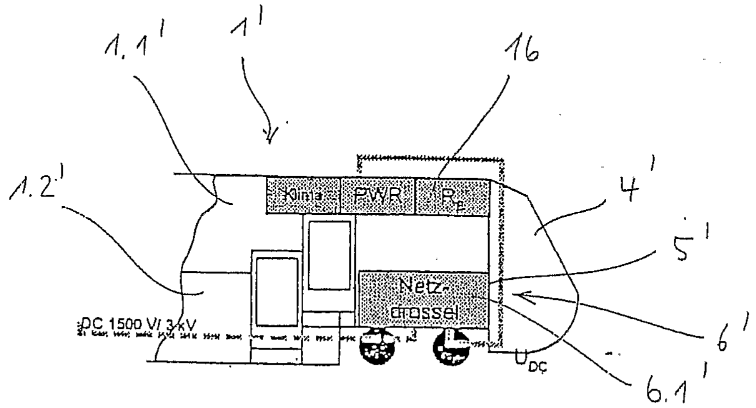

1.1'
1'
16
1.2'
Klima
PWR
R_F
4'
5'
Netz-
drossel
DC 1500 V/ 3 kV
U_{DC}
6'
6.1'

Fig. 2

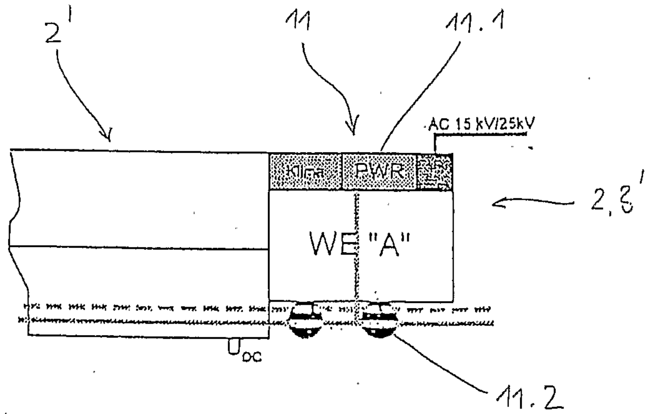
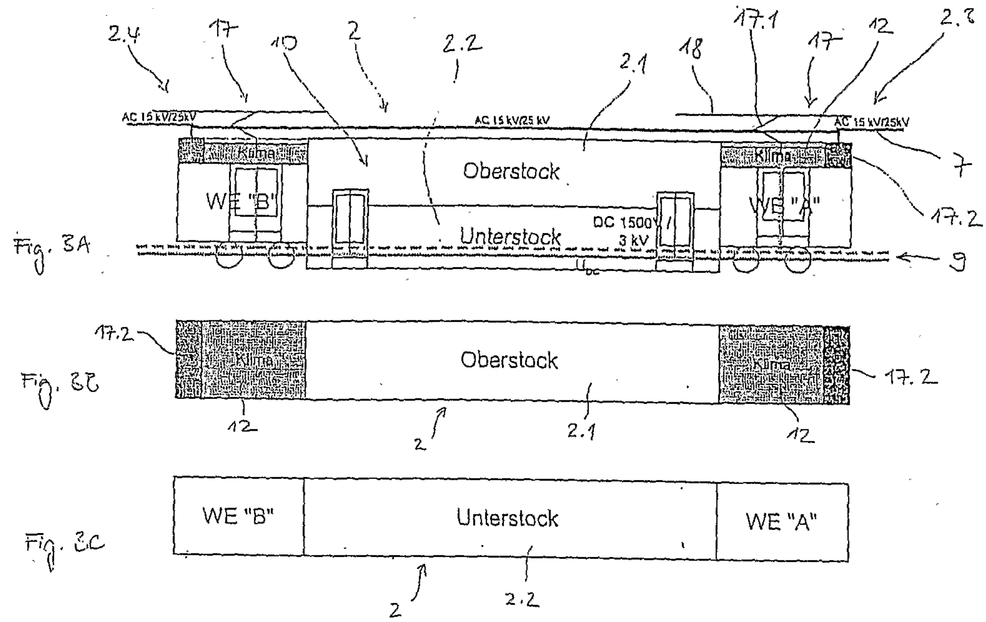
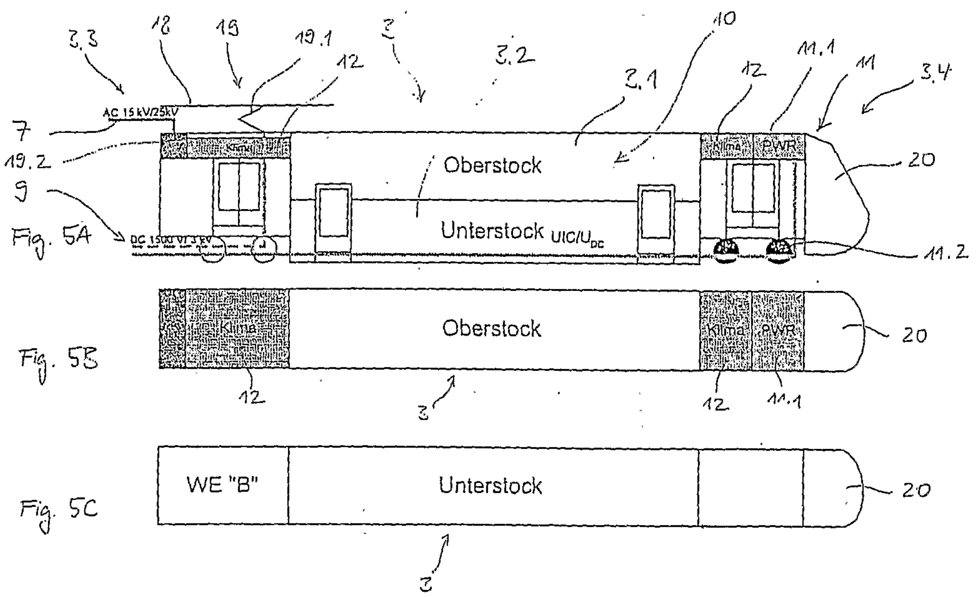

2'
11
11.1
AC 15 kV/25kV
Klima
PWR
2.3'
WE "A"
U_{DC}
11.2

Fig. 4


AC 15 kV/25kV
Klima
WE "B"
Oberstock
Unterstock
DC 1500 V / 3 kV
WE "A"
Fig. 3A
Fig. 3B
Fig. 3C


AC 15 kV/25kV
Klima
Oberstock
Unterstock UIC/U_DC
PWR
Fig. 5A
Fig. 5B
WE "B"
Fig. 5C