TITLE OF THE INVENTION

RAIL VEHICLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001]

The present invention relates to a rail vehicle.

2. Description of the Related Art

[0002]

A rail vehicle operated along a laid track generally includes a hexahedral rail vehicle structure including an underframe forming a floor surface, end structures erected at both end portions of the underframe in a longitudinal direction of the underframe, side structures erected at both end portions of the underframe in a width direction of the underframe, and roof structures placed on upper end portions of the end structure and the side structure.

[0003]

An upper floor is provided on an upper surface of the underframe, and a seat (long seat or the like) having a heater is provided below the side structure. A heat insulating material and a sound insulating material are provided on the vehicle interior side of the roof structure and the side structure, and interior members such as a side

member and a ceiling member are provided in a form of covering the heat insulating material and the sound insulating material, respectively, to provide a comfortable vehicle interior environment.

[0004]

JP 2022-091325 A discloses a rail vehicle in which a seat is configured by a substantially vertical portion along a side structure and a horizontal portion along an underframe and is supported by a seat support portion fixed to the side structure, in order to provide a heater device capable of reducing the number of design and manufacturing steps, having a large heat generation capacity, and having high safety. The heater device is attached to a heater support box fixed to the horizontal portion via an adjustment fitting, and the adjustment fitting has a substantially Z shape in cross section intersecting the longitudinal direction of the rail vehicle.

SUMMARY OF THE INVENTION

[0006]

In general, a railway vehicle that represents a rail vehicle and is used for commuting to work and school often includes a long seat (seat along the longitudinal direction of the railway vehicle) on a vehicle interior side of the lower portion of a side structure in a form

along a rail direction. A heater for heating which operates in winter is provided on the lower surface of the long seat. An electric wire for supplying electric power to the heater penetrates the underframe forming the floor surface of the railway vehicle and an upper floor provided on the upper surface of the underframe in a form of hanging down from the heater on the lower surface of the seat. Further, in order to protect the electric wire between the lower portion of the heater and the upper floor (underframe), a conduit is provided.

[0007]

Therefore, there is a concern that the conduit not only limits an effective usable dimension (referred to as an effective dimension) of the upper floor of the railway vehicle in a sleeper direction, but also becomes an obstacle when temporarily placing a load that is not placed on a load shelf under the seat, or becomes an obstacle when cleaning the upper floor (in particular, below the seat).

[0008]

An object of the present invention is to provide a rail vehicle capable of securing an effective dimension of an upper floor forming a floor surface of the rail vehicle in a sleeper direction, effectively utilizing a space under a seat as a cargo storage area, and facilitating cleaning of the space under the seat.

[0009]

In order to achieve the above objects, the representative of a rail vehicle according to the present invention is achieved by a rail vehicle including an underframe forming a floor surface, a side structure erected at an end portion of the underframe in a width direction of the underframe, an in-vehicle device, and an underfloor device connected to the in-vehicle device by an operation line. The operation line penetrates, in a height direction, a side beam that constitutes the underframe and is provided at the end portion of the underframe in the width direction of the underframe.

[0010]

According to the present invention, it is possible to provide a rail vehicle capable of securing an effective dimension of an upper floor forming a floor surface of the rail vehicle in a sleeper direction, effectively utilizing a space under a seat as a cargo storage area, and facilitating cleaning of the space under the seat.

Objects, configurations, and advantageous effects other than those described above will be clarified by the descriptions of the following embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 is a side view of a railway vehicle;

Fig. 2 is a cross-sectional view (cross-sectional view taken along line A-A in Fig. 1) intersecting a longitudinal direction of the railway vehicle; and

Fig. 3 is a perspective view of a connection portion between an end portion of an underframe intersecting the longitudinal direction of the railway vehicle in a width direction of the underframe and a lower end portion of a side structure, when viewed from below.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012]

Hereinafter, a rail vehicle according to an embodiment of the present invention will be described with reference to the drawings. First, each direction is defined to describe the configuration of the rail vehicle. It is assumed that a longitudinal direction of the rail vehicle is an x-direction, a width direction of the rail vehicle is a y-direction, and a height direction of the rail vehicle is a z-direction. It may be simply referred to as the x-direction, the y-direction, and the z-direction.

[0013]

The rail vehicle is a vehicle operated along the laid track, and indicates a railway vehicle, a monorail

vehicle, a new transportation system vehicle, a tram, and the like. A railway vehicle will be described as a representative example of the rail vehicle.

[0014]

Fig. 1 is a side view of a railway vehicle, and Fig. 2 is a cross-sectional view (cross-sectional view taken along line A-A in Fig. 1) intersecting a longitudinal direction of the railway vehicle. Fig. 3 is a perspective view of a connection portion between an end portion of an underframe intersecting the longitudinal direction of the railway vehicle in a width direction of the underframe and a lower end portion of a side structure, when viewed from below.

[0015]

A railway vehicle 1 includes a hexahedral railway vehicle structure and a pair of carriages 7 that support lower surfaces of both end portions of the railway vehicle structure in the x-direction. The railway vehicle structure includes an underframe 10 forming a floor surface, side structures 20 erected at both end portions of the underframe 10 in the y-direction, an end (head) structure 30 erected at an end portion of the underframe 10 in the x-direction, and roof structures 40 placed on upper end portions of the side structure 20 and the end (head) structure 30. The carriage 7 supports the railway vehicle

structure and is movable along a track 5.

[0016]

The underframe 10 includes a floor portion 12 constituting a central portion in the y-direction and a side beam 11 that is connected to the floor portion 12 and constitutes both end portions of the underframe 10 in the y-direction. Both the floor portion and the side beam 11 are formed of a hollow extruded material extruded in the x-direction. The side structure 20 includes a vehicle interior side surface plate 20a, a vehicle exterior side surface plate 20b, and a plurality of connection plates 20c connecting the both side surface plates. A support portion 11a protruding upward is provided in an upper portion of the side beam 11 in order to support a lower end portion of an interior member provided on the vehicle interior side of the side structure 20. In addition to the support portion 11a, the side beam 11 includes a pair of side beam surface plates 11b and 11c that are erected in the z-direction and disposed separately in the y-direction, and a plurality of horizontal plates 11d that connect the side beam surface plates 11b and 11c and extend horizontally.

[0017]

A heat insulating material and a sound absorbing material (not illustrated) are provided in a space between the support portion 11a of the side beam 11 and the vehicle

interior side surface plate 20a of the side structure 20. The interior member having a lower end portion that is supported by the support portion 11a presses and holds the heat insulating material and the sound absorbing material in a direction of the side structure 20.

[0018]

An obstacle discharger 14 is provided on a lower surface of an end portion of the underframe 10 in the x-direction. An underfloor device 16 is provided on a lower surface of the underframe 10 between the front and rear carriages 7 provided below the underframe 10. The underfloor device 16 includes a main conversion device (not illustrated) that supplies electric power to a main motor of the carriage 7, an auxiliary power supply device that supplies electric power to a heater 54, an air compressor (not illustrated) that generates compressed air to be supplied to a door engine that drives a brake device and a side sliding door 24, and the like. The underfloor device 16 is covered with an underfloor device cover 18 (See Figs. 1 and 3) to be protected from ice and snow in winter.

[0019]

The side structure 20 includes, for example, a window portion 22, the side sliding door 24 used when a passenger or the like gets on and off the railway vehicle 1, a crew door 26 used by a crew or the like. The roof

structure 40 includes an air conditioner 42 that supplies conditioned air to the vehicle interior of the railway vehicle 1, at an upper portion of the roof structure 40.

[0020]

The underframe 10 includes an upper floor 17 on an upper surface of the underframe 10, and includes a seat 50 above the upper floor 17. The seat 50 includes a seat support portion 52, a seat surface 51 provided in an upper portion of the seat support portion 52, and a backrest (not illustrated). The seat support portion 52 is fixed to the vehicle interior side of the lower portion of the side structure 20 in the z-direction and discretely provided in the x-direction of the side structure 20. Preferably, a lower end of the seat support portion 52 is inserted between the support portion 11a and the vehicle interior side surface plate 20a, and is supported by abutting the upper end of the support portion 11a on the stepped portion of the seat support portion 52. A lower end portion of a grip rod 53 is connected to an end portion of the seat support portion 52 in the y-direction, and the heater 54 used for heating in winter is provided in the lower portion of the seat support portion 52.

[0021]

The grip rod 53 in the form along the z-direction is provided discretely along the x-direction. The heater

54 extends in the x-direction and is fixed to the lower portion of the seat support portion 52 below the seat surface 51 forming the seat 50.

[0022]

An electric wire 55 for supplying electric power is connected to the heater 54. The electric wire 55 hangs down in the -z direction along the surface of the vehicle interior side surface plate 20a of the side structure 20, and passes between the vehicle interior side surface plate 20a and the support portion 11a. Then, the electric wire 55 penetrates the inside of a conduit 28 provided in the side beam 11 forming the underframe 10, and extends below the underframe 10. The conduit 28 is provided to penetrate the side beam 11 in the -z direction between the vehicle interior side surface plate 20a of the side structure 20 and the support portion 11a integrally provided in the side beam 11. More specifically, the hollow conduit 28 is inserted through openings formed in the plurality of horizontal plates 11d (and the side beam surface plates 11b) of the side beam 11 and held and fixed. The upper end of the conduit 28 is preferably disposed below the upper end of the support portion 11a in the z-direction.

[0023]

After being drawn out of the lower end portion of the conduit 28, the electric wire 55 penetrates the

underfloor device cover 18 along the +y direction (left direction in Fig. 2) below the underframe 10 and is connected to the auxiliary power supply device of the underfloor device 16. The electric wire 55 in a range from the lower end portion of the conduit 28 to the underfloor device cover 18 is covered with a protective case 70 bridged between the underfloor device cover 18 and the side beam 11 in order to suppress damage due to ice and snow in winter or the like.

[0024]

Although not illustrated, an example of an air tube for supplying compressed air to the door engine that opens and closes the side sliding door 24 will be described instead of the electric wire 55 for supplying electric power to the heater 54 in the lower portion of the seat 50 described above.

[0025]

The door engine that opens and closes the side sliding door 24 is provided on the vehicle interior side of the side structure 20 in the upper portion of the side sliding door 24. There are types of door engines that operate with compressed air and on electricity. The door engine of the type that operates with compressed air is provided on the vehicle interior side of a connection portion between the side structure 20 and the roof

structure 40.

[0026]

The air tube for supplying the compressed air to the door engine hangs down (−z direction) the vehicle interior side of the side structure 20 from the door engine, and penetrates the side beam 11 forming the underframe 10. Then, the air tube changes the direction from the −z direction to the +y direction, penetrates the underfloor device cover 18, and is connected to the underfloor device (including an air tank connected to the air compressor) 16. More specifically, the air tube is inserted through the openings formed in the plurality of horizontal plates 11d of the side beam 11. An annular or cylindrical cushioning member may be disposed between the opening and the air tube. The air tube in a range from below the side beam 11 to the underfloor device cover 18 is covered with the protective case 70 bridged between the underfloor device cover 18 and the side beam 11. The electric wire 55 and the air tube are collectively referred to as an operation line.

[0027]

<Effects>

In the present embodiment, the in-vehicle device such as the heater 54 and the door engine provided on the vehicle interior side of the railway vehicle 1 and the in-

vehicle device from the underfloor device 16 provided under the floor of the railway vehicle 1 are connected to each other by the operation line such as the electric wire 55 and the air tube, and the operation line is caused to penetrate the side beam 11 provided at the end portion of the underframe 10 in the y-direction.

[0028]

Furthermore, the operation line penetrate between the support portion 11a of the side beam 11 and the vehicle interior side surface plate 20a of the side structure 20 in the height direction. The heat insulating material and the sound absorbing material are accommodated in the space between the support portion 11a and the vehicle interior side surface plate 20a. The interior member having the lower end portion that is fixed to the support portion 11a presses and holds the heat insulating material and the sound absorbing material in the direction of the side structure 20.

[0029]

The operation line is accommodated in the above-described space and penetrates the side beam 11 between the support portion 11a and the vehicle interior side surface plate 20a defining the space in the height direction, and thus connects the in-vehicle device of the railway vehicle 1 and the underfloor device 16 to each other.

[0030]

Further, the operation line that penetrates the side beam 11 forming the underframe 10 in the height direction changes the direction in the +y direction below the underframe 10 (side beam 11), penetrates the underfloor device cover 18, and is connected to the underfloor device 16 covered by the underfloor device cover 18. The operation line in a range from the underframe 10 to the underfloor device cover 18 is covered with the protective case 70 bridged from the side beam 11 to the underfloor device cover 18 in order to suppress the damage due to ice and snow in winter.

[0031]

With the above-described configuration, it is possible to provide a railway vehicle capable of increasing the effective dimension (underseat space 80) of the upper floor forming the floor surface of the railway vehicle in the sleeper direction, effectively utilizing the underseat space 80 as a cargo storage area, and facilitating cleaning of the underseat space 80.

[0032]

The present specification includes the following disclosure of the invention.

(First Aspect)

A rail vehicle including:

an underframe forming a floor surface;

a side structure erected at an end portion of the underframe in a width direction of the underframe;

an in-vehicle device; and

an underfloor device connected to the in-vehicle device by an operation line, in which

the operation line penetrates, in a height direction, a side beam that constitutes the underframe and is provided at the end portion of the underframe in the width direction of the underframe.

[0033]

(Second Aspect)

The rail vehicle according to the first aspect, in which

the in-vehicle device is a heater provided at a lower portion of a seat of the rail vehicle, and

the operation line is an electric wire for supplying electric power to the heater.

[0034]

(Third Aspect)

The rail vehicle according to the first or second aspect, in which

the side beam includes a conduit that penetrates the side beam in the height direction, and

the electric wire penetrates an inside of the

conduit.

[0035]

(Fourth Aspect)

The rail vehicle according to any one of the first to third aspects, in which

the in-vehicle device is a door engine that opens and closes a side sliding door provided in the side structure, and

the operation line is an air tube for supplying compressed air to the door engine.

[0036]

(Fifth Aspect)

The rail vehicle according to any one of the first to fourth aspects, in which

the operation line passes between a support portion that is provided in the side beam and supports an interior member and a vehicle interior side surface plate of the side structure, and penetrates the side beam in the height direction.

[0037]

(Sixth Aspect)

The rail vehicle according to any one of the first to fifth aspects, further including:

a protective case that is bridged between the side beam and an underfloor device cover that protects the

underfloor device, in which

the operation line penetrates the side beam in the height direction, and then changes a direction in a width direction of the rail vehicle, passes between the underframe and the protective case, and reaches the underfloor device cover.

What is claimed is:

1. A rail vehicle comprising:

an underframe forming a floor surface;

a side structure erected at an end portion of the underframe in a width direction of the underframe;

an in-vehicle device; and

an underfloor device connected to the in-vehicle device by an operation line, wherein

the operation line penetrates, in a height direction, a side beam that constitutes the underframe and is provided at the end portion of the underframe in the width direction of the underframe.

2. The rail vehicle according to claim 1, wherein

the in-vehicle device is a heater provided at a lower portion of a seat of the rail vehicle, and

the operation line is an electric wire for supplying electric power to the heater.

3. The rail vehicle according to claim 2, wherein

the side beam includes a conduit that penetrates the side beam in the height direction, and

the electric wire penetrates an inside of the conduit.

4. The rail vehicle according to claim 1, wherein

the in-vehicle device is a door engine that opens

and closes a side sliding door provided in the side structure, and

the operation line is an air tube for supplying compressed air to the door engine.

5. The rail vehicle according to claim 1, wherein

the operation line passes between a support portion that is provided in the side beam and supports an interior member and a vehicle interior side surface plate of the side structure, and penetrates the side beam in the height direction.

6. The rail vehicle according to claim 1, further comprising:

a protective case that is bridged between the side beam and an underfloor device cover that protects the underfloor device, wherein

the operation line penetrates the side beam in the height direction, and then changes a direction in a width direction of the rail vehicle, passes between the underframe and the protective case, and reaches the underfloor device cover.