

TITLE OF INVENTION
PARKING APPARATUS

TECHNICAL FIELD

5 The present invention relates to a parking apparatus for parking vehicles having feed plug receptacles. In particular, it relates to a parking apparatus for parking vehicles including electric cars having feed plug receptacles.

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BACKGROUND TECHNOLOGY

To park a plurality of vehicles, there is a case to use a parking apparatus having a parking mechanism.

15 The parking mechanism parks a vehicle by moving it between a load/unload space and a parking space.

For example, the parking mechanism will be a merry-go-round method parking mechanism, an elevator method parking mechanism, an elevator-and-slide method parking mechanism, a planar reciprocatory method parking mechanism, a transport-and-store method parking mechanism, or a two-stage/multistage method parking mechanism.

20 For example, the elevator method parking mechanism arranges multistage parking spaces in a vertical direction along a vertical hoistway, moves up and down a cage on which a vehicle is placed, transfers the vehicle from the cage to a parking space, and parks the vehicle at there. A motor winds up and down a cable with which the cage is suspended. Another motor moves the vehicle between the cage and the parking space.

30 For example, the elevator-and-slide method parking

mechanism arranges parking spaces in multistage in vertical and horizontal directions, places a vehicle on a carrier, transports the same between a load/unload space and a parking space, and transfers the vehicle between the carrier and the parking space. The carrier is moved by way of a motor. The vehicle between the carrier and the parking space is moved by way of another motor.

For example, the planar reciprocatory method parking mechanism horizontally arranges parking spaces, makes a carrier transport a vehicle between a load/unload space and a parking space, and transfers the vehicle between the carrier and the parking space. A motor moves the carrier. Another motor moves the vehicle between the carrier and the parking space.

Now, electrification of vehicles is accelerated. These vehicles are generally referred to as electric vehicles.

The electric vehicles include hybrid cars, plug-in hybrid cars, electric cars, electric motorbikes, and the like.

There is an idea to feed electricity to an electric vehicle while it is parking.

Among the electric vehicles, there is a type that charges an onboard battery with externally fed power.

These electric vehicles have power feed plug receptacles to receive power.

To a feed plug of a rapid charger, or to a socket of a 100/200-V power source, a charging cable is connected and a feed plug of the charging cable is connected to the feed plug receptacle of an electric vehicle, thereby charging

the vehicle.

In a parking apparatus employing a parking mechanism that places and handles a vehicle on a pallet, the pallet may be provided with a vehicle relay terminal so that the vehicle relay terminal is electrically connected through a charging cable to a feed plug receptacle of the vehicle loaded on the pallet, to charge the vehicle during a parking time.

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SUMMARY OF INVENTION

PROBLEMS TO BE SOLVED BY INVENTION

In consideration of the above-mentioned problems, the present invention provides a parking apparatus for parking vehicles having feed plug receptacles.

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MEANS TO SOLVE THE PROBLEMS

In order to accomplish the above-mentioned object, the present invention provides a parking apparatus for parking vehicles having power feed plug receptacles. The parking apparatus includes a plurality of pallets on which a plurality of vehicles are loadable respectively, a load/unload space that is a space to load or unload a vehicle, a plurality of parking spaces that are spaces in which a plurality of the pallets can be placed for parking respectively, a transport device that can carry and transport the pallet between the load/unload space and a space beside an optional one of the parking spaces, a transfer device that can horizontally move and transfer the pallet in a predetermined transfer direction between the transport device stopped beside the parking space and the

parking space, a connector having a first terminal with a first terminal surface that is a planar terminal surface and a second terminal with a second terminal surface that is a planar terminal surface, the first terminal surface and second terminal surface being brought into contact with each other in a face-to-face manner to make the first terminal and second terminal electrically conductive to each other, the first terminal surface and second terminal surface being separated from each other to electrically isolate the first terminal and second terminal from each other, a feed circuit that electrically connects the feed plug receptacle of the vehicle loaded on the pallet and the first terminal to each other, and a power source circuit that feeds electric power from a power source to the second terminal. The first terminal is supported with the pallet and the second terminal is positioned and supported in the parking space, so that the first terminal surface and second terminal surface are oriented to a horizontal direction and are faced to each other when the transfer device horizontally moves the pallet in the transfer direction between the transport device stopped beside the parking space and the parking space.

The above-mentioned configuration of the present invention allows a plurality of the pallets to load a plurality of vehicles, respectively. The load/unload space is a space to load or unload a vehicle. The plurality of parking spaces are spaces in which a plurality of the pallets can be placed for parking respectively. The transport device can carry and transport the pallet between the load/unload space and a space beside an optional one of

the parking spaces. The transfer device can horizontally move and transfer the pallet in a predetermined transfer direction between the transport device stayed beside the parking space and the parking space. The connector has the first terminal with the first terminal surface that is a planar terminal surface and the second terminal with the second terminal surface that is a planar terminal surface. The first terminal surface and second terminal surface are brought into contact with each other in a face-to-face manner to make the first terminal and second terminal electrically conductive to each other. The first terminal surface and second terminal surface are separated from each other to electrically isolate the first terminal and second terminal from each other. The feed circuit electrically connects the feed plug receptacle of the vehicle loaded on the pallet and the first terminal to each other. The power source circuit feeds electric power from the power source to the second terminal. The first terminal is supported with the pallet and the second terminal is positioned and supported in the parking space, so that the first terminal surface and second terminal surface are oriented to a horizontal direction and are faced to each other when the transfer device horizontally moves the pallet in the transfer direction between the transport device stayed beside the parking space and the parking space.

As results, the pallet is transported from the load/unload space and horizontally moved from beside a parking space to the parking space. Then, the first terminal and second terminal of the connector are electrically connected to each other to feed power to the

vehicle. When the pallet is moved from the parking space to the side of the parking space, the first terminal and second terminal of the connector are electrically isolated from each other.

5 Parking apparatuses according to embodiments of the present invention will be explained. The present invention has various aspects that include any one of the below-mentioned embodiments and combinations of two or more of the embodiments.

10 In a parking apparatus according to an embodiment of the present invention, at least one of the first terminal and second terminal has a terminal member that defines the terminal surface and a swing support mechanism that swingably supports the terminal member so that the
15 horizontal-direction-oriented terminal surface swings up, down, left, and right.

 According to the configuration of the above-mentioned embodiment, at least one of the first terminal and second terminal has the terminal member and swing support
20 mechanism. The terminal member defines the terminal surface. The swing support mechanism swingably supports the terminal member so that the horizontal-direction-oriented terminal surface swings up, down, left, and right.

 As results, even if the orientations of the first
25 terminal and second terminal deviate from each other, the first terminal surface and second terminal surface are properly kept in contact with each other.

 In a parking apparatus according to an embodiment of the present invention, at least one of the first terminal
30 and second terminal has a terminal member that defines the

terminal surface, a straightforward support mechanism that supports the terminal member so that the terminal member is straightforwardly movable along the transfer direction within the range of a predetermined stroke, and a biasing
5 mechanism that uniformly biases the terminal member with a predetermined biasing force toward the other terminal surface of the first/second terminal within the range of the stroke.

According to the configuration of the above-mentioned
10 embodiment, at least one of the first terminal and second terminal has the terminal member, straightforward support mechanism, and biasing mechanism. The terminal member forms the terminal surface. The straightforward support mechanism supports the terminal member so that the terminal
15 member is straightforwardly movable along the transfer direction within the range of the predetermined stroke. The biasing mechanism uniformly biases the terminal member with the predetermined biasing force toward the other terminal surface of the first/second terminal within the
20 range of the stroke.

As results, a contact pressure between the terminal surfaces is kept at the predetermined biasing force.

A parking apparatus according to an embodiment of the present invention includes a parking shelf that has parking
25 shelf rails that support the pallet in the parking space so that the pallet is horizontally movable in the transfer direction and a lock/unlock mechanism that, when the pallet is placed for parking in the parking space, prevents the pallet from horizontally moving on the parking shelf rails
30 in the transfer direction, and when the pallet is

horizontally moved in the transfer direction between the transport device stopped beside the parking space and the parking space, allows the pallet to horizontally move. When the lock/unlock mechanism prevents the horizontal
5 movement of the pallet, the first terminal surface and second terminal surface come into contact with each other and the straightforward support mechanism supports the terminal member at an optional position along the transfer direction within the range of the stroke except an end of
10 the stroke.

According to the configuration of the above-mentioned embodiment, the parking shelf has the parking shelf rails and lock/unlock mechanism. The parking shelf rails support the pallet in the parking space so that the pallet is
15 horizontally movable in the transfer direction. The lock/unlock mechanism prevents, when the pallet is placed for parking in the parking space, the pallet from horizontally moving on the parking shelf rails in the transfer direction, and when the pallet is horizontally
20 moved in the transfer direction between the transport device stopped beside the parking space and the parking space, allows the pallet to horizontally move. When the lock/unlock mechanism prevents the horizontal movement of the pallet, the first terminal surface and second terminal
25 surface come into contact with each other and the straightforward support mechanism supports the terminal member at an optional position along the transfer direction within the range of the stroke except an end of the stroke.

As results, a contact pressure between the terminal
30 surfaces is kept at the predetermined biasing force.

In a parking apparatus according to an embodiment of the present invention, the parking shelf has a terminal surface cover member that changes its position between a cover posture for covering the terminal surface of at least one of the first terminal and second terminal and an expose posture for exposing the terminal surface and a link mechanism that keeps the position of the terminal surface cover member at the expose posture when pushed by the pallet when the pallet is placed in the parking space. When the pallet is not placed in the parking space, the position of the terminal surface cover member becomes the cover posture.

According to the configuration of the above-mentioned embodiment, the terminal surface cover member changes its position between the cover posture for covering the terminal surface of at least one of the first terminal and second terminal and the expose posture for exposing the terminal surface. The link mechanism is pushed by the pallet when the pallet is placed in the parking space so as to keep the position of the terminal surface cover member at the expose posture. When the pallet is not placed in the parking space, the position of the terminal surface cover member becomes the cover posture.

As results, the terminal surface is protected when the pallet is not present in the parking space.

In order to accomplish the above-mentioned object, the present invention provides a pallet that is used to carry a vehicle in a parking apparatus having a plurality of parking spaces and a power source device, is capable of carrying a vehicle to which power is fed through a charging

cable, and is fed with electric power from the power source device at least when placed in the parking space. The pallet has a pallet main structure that is a plate structure substantially having a rectangular shape when viewed from above and provided with a left and right pair of guide faces that are arranged between a left and right pair of long sides of the substantial rectangular shape and guide left and right revolving tires of the vehicle, a terminal box that is arranged on a top face of the long side of the pallet main structure and forms an upward convex contour, a vehicle-side relay terminal that is electrically connectable to the charging cable, and a relay device that relays power fed from the power source device to the vehicle-side relay terminal. The vehicle-side relay terminal is stored in the terminal box.

According to the above-mentioned configuration of the present invention, the pallet is used to carry a vehicle in the parking apparatus having a plurality of the parking spaces and the power source device, is capable of carrying a vehicle to which power is fed through the charging cable, and is fed with electric power from the power source device when placed in the parking space. The pallet main structure is a plate structure substantially having a rectangular shape when viewed from above and provided with the left and right pair of guide faces that are arranged between the left and right pair of long sides of the substantial rectangular shape and guide left and right revolving tires of the vehicle. The terminal box is arranged on the top face of the long side of the pallet main structure and forms an upward convex contour. The

vehicle-side relay terminal is electrically connectable to the charging cable. The relay device relays power fed from the power source device to the vehicle-side relay terminal. The vehicle-side relay terminal is stored in the terminal
5 box.

As results, the vehicle is guided along the guide faces of the pallet and is loaded or unloaded to or from the pallet and power fed from the power source device is fed through the relay device, vehicle-side relay terminal,
10 and charging cable to the vehicle loaded on the guide faces.

Pallets according to embodiments of the present invention will be explained. The present invention has various aspects that include any one of the below-mentioned embodiments and combinations of two or more of the
15 embodiments.

In a pallet according to an embodiment of the present invention, the pallet main structure has a left and right pair of upright parts that rise along the left and right pair of long sides, have each a flat top face, and sandwich
20 the left and right pair of guide faces between them, the terminal box being arranged on the top face of the upright part and forming the upward convex contour.

According to the configuration of the above-mentioned embodiment, the pallet main structure has the left and
25 right pair of upright parts that rise along the left and right pair of long sides, have each a flat top face, and sandwich the left and right pair of guide faces. The terminal box is arranged on the top face of the upright part and forms the upward convex contour.

30 As results, even if the tires of the vehicle that is

loaded by being guided along the guide faces of the pallet go onto the upright parts, the tires will not easily be damaged.

5 In a pallet according to an embodiment of the present invention, the terminal box forms an upward convex circular contour from the top face of the pallet main structure when horizontally viewed from a left-right direction of the pallet main structure.

10 According to the configuration of the above-mentioned embodiment, the terminal box forms the upward convex circular contour from the top face of the pallet main structure when horizontally viewed from a left-right direction of the pallet main structure.

15 As results, even if the tires of the vehicle go onto the terminal box, the tires will not easily be damaged.

In a pallet according to an embodiment of the present invention, the terminal box has a terminal box body that has an open part at an upper part thereof and supports the stored vehicle-side relay terminal and a terminal cover
20 that covers the open part so that the open part is opened and closed.

According to the configuration of the above-mentioned embodiment, the terminal box has the terminal box body that has the open part at an upper part thereof and supports the stored vehicle-side relay terminal and the terminal cover
25 that covers the open part so that the open part is opened and closed.

As a result, the terminal cover of the terminal cover body that covers the open part is opened so that the
30 charging cable is coupled with the terminal surface of the

vehicle-side relay terminal.

In a pallet according to an embodiment of the present invention, the terminal cover is swingable around a rotation axis extending along a left-right direction so that the position of the terminal cover is changeable
5 between an open posture to open the open part and a closed posture to close the open part.

According to the configuration of the above-mentioned embodiment, the terminal cover swings around the rotation
10 axis extending along the left-right direction. The position of the terminal cover is changeable between the open posture to open the open part and the closed posture to close the open part.

As a result, the terminal cover swings around the
15 rotation axis extending along the left-right direction so that its position may change between the open posture and the closed posture. The terminal cover is turned to the open posture and the charging cable is coupled with the vehicle-side relay terminal. The charging cable is removed
20 from the vehicle-side relay terminal and the terminal cover is turned to the closed posture.

In a pallet according to an embodiment of the present invention, the relay device has a relay cable whose first end is electrically connected to the vehicle-side relay
25 terminal and a relay cable storing device that automatically stores the relay cable under the terminal box.

According to the configuration of the above-mentioned embodiment, the first end of the relay cable is electrically connected to the vehicle-side relay terminal.
30 The relay cable storing device automatically stores the

relay cable under the terminal box.

As a result, if the pulled vehicle-side relay terminal is released, the relay cable is stored under the terminal box.

5 In a pallet according to an embodiment of the present invention, the terminal box lifts the vehicle-side relay terminal by a predetermined height when the position of the terminal cover changes from the closed posture to the open posture.

10 According to the configuration of the above-mentioned embodiment, the terminal box lifts the vehicle-side relay terminal by the predetermined height when the position of the terminal cover changes from the closed posture to the open posture.

15 As results, the vehicle-side relay terminal is easily grasped when the terminal cover is changed to the open posture.

For a pallet according to an embodiment of the present invention, the parking apparatus has a parking
20 shelf that is made of conductive material and supports the pallet in the parking space. The relay device has a grounding brush that is fixed relative to the pallet main structure and comes in contact with the parking shelf when the pallet is positioned in the parking space and a relay
25 grounding circuit that electrically connects the grounding brush and vehicle-side relay terminal to each other.

According to the configuration of the above-mentioned embodiment, the parking shelf made of conductive material supports the pallet in the parking space. The grounding
30 brush is fixed relative to the pallet main structure and

comes in contact with the parking shelf when the pallet is positioned in the parking space. The relay grounding circuit electrically connects the grounding brush and vehicle-side relay terminal to each other.

5 As results, a grounding terminal of the vehicle-side relay terminal can be grounded.

A pallet according to an embodiment of the present invention has a left and right pair of the terminal boxes and a left and right pair of the vehicle-side relay
10 terminals. The left and right pair of the terminal boxes are arranged along the long sides in a point symmetry manner substantially around the center of the pallet main structure viewed from above. The left and right pair of the vehicle-side relay terminals are stored in the left and
15 right pair of the terminal boxes, respectively.

According to the configuration of the above-mentioned embodiment, the left and right pair of the terminal boxes are arranged along the long sides in a point symmetry manner substantially around the center of the pallet main
20 structure viewed from above. The left and right pair of the vehicle-side relay terminals are stored in the left and right pair of the terminal boxes, respectively.

As results, when the pallet is turned by 180 degrees, one of the left and right pair of the vehicle-side relay
25 terminals is usable.

EFFECT OF INVENTION

As explained above, the parking apparatus according to the present invention is configured to provide the
30 below-mentioned effects.

The pallet on which a vehicle is loaded is transported by the transport device from the load/unload space to a side of the parking space and the transfer device transfers the pallet from the transport device
5 stopped beside the parking space to the parking space. When the pallet is placed in the parking space, the terminal surface of the first terminal supported with the pallet and the terminal surface of the second terminal supported to be positioned in the parking space
10 horizontally face each other and come in contact with each other. Power of the power source is guided from the second terminal to the first terminal and is guided through the feed circuit to the feed plug receptacle of the vehicle. When the pallet is transported from the load/unload space
15 and is horizontally moved from a side of the parking space to the parking space, the first terminal and second terminal of the connector are electrically connected to each other to feed power to the vehicle. When the pallet is horizontally moved from the parking space to the side of
20 the parking space, the first terminal and second terminal of the connector are electrically disconnected from each other.

The terminal member forms the terminal surface. The terminal member is so supported that the horizontal-
25 direction-oriented terminal surface swings up, down, left, and right. Even if the orientations of the first terminal and second terminal are not proper, the first terminal surface and second terminal surface are properly kept in contact with each other.

30 The terminal member that forms the terminal surface

is so supported that the terminal member is straightforwardly movable along a transfer direction within the range of a predetermined stroke and is uniformly pushed by the biasing mechanism with a predetermined biasing force.

5 As results, a contact pressure between the terminal surfaces is kept at the predetermined biasing force.

When the lock/unlock mechanism prevents the pallet placed in the parking space from horizontally moving on the parking shelf rails, the terminal member is supported at an
10 optional position within the range of the stroke except an end of the stroke. As a result, a contact pressure between the terminal surfaces is kept at the predetermined biasing force.

When the pallet is placed in the parking space, the
15 link mechanism pushed by the pallet changes the position of the terminal surface cover member, which can cover the terminal surface, to the cover posture. When the pallet is not placed in the parking space, the position of the terminal surface cover member becomes the expose posture.
20 As a result, the terminal surface is protected when the pallet is not present in the parking space.

In this way, there is provided the parking apparatus for parking a vehicle having a feed plug receptacle.

As explained above, the pallet according to the
25 present invention is configured to provide the below-mentioned effects.

The pallet is used to carry a vehicle in a parking apparatus having a plurality of parking spaces. The pallet main structure of the pallet is a plate structure
30 substantially having a rectangular shape when viewed from

above the pallet. The top face of the long side of the pallet main structure is provided with the terminal box that forms an upward convex contour. The vehicle-side relay terminal that is electrically connectable to the charging cable for feeding power to the vehicle is stored
5 in the terminal box. Power of the power source device is relayed through the relay device to the vehicle-side relay terminal. The vehicle is guided along the guide faces of the pallet and is loaded or unloaded to and from the pallet.
10 Power fed from the power source device is fed through the relay device, vehicle-side relay terminal, and charging cable to the vehicle that is on the guide faces.

To sandwich the left and right pair of guide faces of the pallet main structure, the upright parts are arranged
15 along the left and right pair of long sides. The terminal box is arranged on the upright part. When the vehicle is guided along the guide faces and is loaded onto the pallet, the tires of the vehicle are not easily damaged even if the tires go onto the upright parts.

20 The terminal box has the upward convex circular shape when horizontally seen from a left-right direction, and therefore, the tires of the vehicle are not easily damaged even if the tires go onto the terminal box.

The terminal box body that supports the vehicle-side
25 relay terminal has the open part at an upper part thereof and the terminal cover covers the open part to open and close the open part. When the terminal cover of the terminal cover body for covering the open part is opened, the charging cable can be connected to the terminal surface
30 of the vehicle-side relay terminal.

The terminal cover is swingable around a rotation axis extending in a left-right direction to change the open posture and closed posture from one to another. The terminal cover is turned to the open posture so that the charging cable is coupled with the vehicle-side relay terminal. The charging cable is removed from the vehicle-side relay terminal and the closed posture is established.

The relay cable whose first end is connected to the vehicle-side relay terminal is automatically stored under the terminal box. When the pulled vehicle-side relay terminal is released, the relay cable is stored under the terminal box.

When the position of the terminal cover is set to the open posture, the vehicle-side relay terminal is lifted by a predetermined height so that the vehicle-side relay terminal is easily grasped when the terminal cover is set to the open posture.

The parking shelf that supports the pallet in the parking space is made of conductive material. When the pallet is positioned in the parking space, the grounding brush fixed to a bottom face of the pallet main structure comes in contact with the parking shelf, so that the grounding brush and vehicle-side relay terminal are electrically connected to each other. As a result, the grounding terminal of the vehicle-side relay terminal can be grounded.

The left and right pair of terminal boxes that store the vehicle-side relay terminals are arranged along the long sides in a point symmetry around the center of the pallet main structure. When the pallet is turned by 180

degrees, one of the left and right pair of vehicle-side relay terminals is usable.

In this way, there is provided the pallet for a parking apparatus, appropriate for feeding power to a vehicle to be parked.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a schematic view of a parking apparatus according to a first embodiment of the present invention.

10 Figure 2 is a perspective view of the parking apparatus according to the first embodiment of the present invention.

Figure 3 is an arrow A-A view of the parking apparatus according to the first embodiment of the present invention.

15 Figure 4 is a detailed partial view of the parking apparatus according to the first embodiment of the present invention.

Figure 5 is a schematic view of a connector (1) according to the first embodiment of the present invention.

20 Figure 6 is a schematic view of a connector (2) according to the first embodiment of the present invention.

Figure 7 is a schematic view of a connector (3) according to the first embodiment of the present invention.

25 Figure 8 illustrates arrow B-B and C-C views of a connector according to a second embodiment of the present invention.

Figure 9 is a schematic view of a parking apparatus according to the second embodiment of the present invention.

30 Figure 10 is a schematic view of parking apparatuses

of various types.

Figure 11 is a schematic view of a parking apparatus according to a third embodiment of the present invention.

Figure 12 is a perspective view of the parking
5 apparatus according to the third embodiment of the present invention.

Figure 13 is an arrow D-D view of the parking apparatus according to the third embodiment of the present invention.

10 Figure 14 is a partial view of a pallet according to the third embodiment of the present invention.

Figure 15 is a plan view of the pallet according to the third embodiment of the present invention.

Figure 16 is an E-E sectional view of the pallet
15 according to the third embodiment of the present invention.

Figure 17 is an arrow F-F view (1) of the pallet according to the third embodiment of the present invention.

Figure 18 is an arrow F-F view (2) of the pallet according to the third embodiment of the present invention.

20 Figure 19 is a plan view of a pallet according to a fourth embodiment of the present invention.

Figure 20 is an arrow F-F view (1) of the pallet according to a fifth embodiment of the present invention.

Figure 21 is an arrow F-F view (2) of the pallet
25 according to the fifth embodiment of the present invention.

Figure 22 is an arrow F-F view of a pallet according to a sixth embodiment of the present invention.

Figure 23 is an arrow F-F view of a pallet according to a seventh embodiment of the present invention.

30 Figure 24 is an arrow F-F view of a pallet according

to an eighth embodiment of the present invention.

Figure 25 is an arrow F-F view of a pallet according to a ninth embodiment of the present invention.

Figure 26 is a schematic view of a parking apparatus
5 according to a tenth embodiment of the present invention.

Figure 27 is a schematic view of parking apparatuses of various types.

MODE OF IMPLEMENTING INVENTION

10 Embodiments of the present invention will be explained with reference to the drawings.

Parking apparatuses according to the first and second embodiments are apparatuses for parking vehicles having feed plug receptacles.

15 A vehicle 5 is a car to which DC or AC power is fed.

For example, the vehicle 5 is a hybrid car that is fed with electricity and runs with electricity or liquid fuel.

For example, the vehicle 5 is a car that is fed with
20 electricity and runs only with electricity.

A parking apparatus according to the first embodiment of the present invention will be explained.

Figure 1 is a schematic view of the parking apparatus according to the first embodiment of the present invention.

25 Figure 2 is a perspective view of the parking apparatus according to the first embodiment of the present invention.

Figure 3 is an arrow A-A view of the parking apparatus according to the first embodiment of the present invention.

Figure 4 is a detailed partial view of the parking
30 apparatus according to the first embodiment of the present

invention. Figure 5 is a schematic view of a connector (1) according to the first embodiment of the present invention. Figure 6 is a schematic view of a connector (2) according to the first embodiment of the present invention. Figure 7 is a schematic view of a connector (3) according to the first embodiment of the present invention. Figure 8 illustrates arrow B-B and C-C views of a connector according to the second embodiment of the present invention.

The parking apparatus according to the first embodiment is realized by applying the present invention to the elevator method parking mechanism.

The parking apparatus according to the first embodiment of the present invention includes a plurality of pallets 10, a load/unload space 20, a plurality of parking spaces 30, a transport device 40, a transfer device 50, a plurality of connectors 60, a plurality of feed circuits 70, a power source circuit 80, and a plurality of parking shelves 90.

The pallets 10 are capable of loading vehicles, respectively.

For example, the pallet 10 includes a pallet main structure 11, four wheels 12, a pallet-side terminal box 13, and a locking projection part 14.

The pallet main structure 11 is a plate structure substantially having a rectangular shape when viewed from above.

The pallet main structure 11 has a pair of upright parts along a left and right pair of long sides. Sandwiched between the pair of upright parts, there are arranged a left and right pair of rolling faces to guide

the left and right rolling tires of a vehicle.

The four wheels 12 may be arranged at four corners of the pallet main structure 11, to roll in a direction along short sides of the rectangular shape.

5 Each two of the wheels 12 form a pair and the pairs roll on two parking shelf rails 91 (to be explained later), respectively.

For example, the pallet 10 is horizontally movable such that the short sides of the pallet main structure 11
10 move along a longitudinal direction of the parking shelf rails 91 (to be explained later).

The pallet-side terminal box 13 is a member to fix a first terminal 61 (to be explained later) to the pallet 10.

For example, the pallet-side terminal box 13 is
15 arranged in the vicinity of the wheel 12 on the long side of the pallet main structure 11.

The locking projection part 14 is a projection part that engages with a lock/unlock mechanism 92 (to be explained later).

20 For example, the locking projection part 14 is arranged on a side face of the short side of the pallet main structure 11. When engaged with the lock/unlock mechanism 92, the locking projection part 14 prevents the pallet 10 from the horizontal movement. When not engaged
25 with the lock/unlock mechanism 92, the locking projection part 14 allows the pallet 10 to horizontally move.

The load/unload space 20 is a space in which the vehicle 5 is loaded or unloaded.

For example, a vehicle to be loaded goes onto the
30 pallet 10 in the load/unload space 20 and a vehicle to be

unloaded goes out of the pallet 10 in the load/unload space 20.

According to the elevator system parking mechanism, the load/unload space 20 is positioned just under a vertical movement space H.

Figure 2 illustrates a case that arranges a turn device to turn a front-rear direction of a vehicle in front of the load/unload space 20.

The parking spaces 30 are spaces capable of placing the pallets 10 for parking, respectively.

For example, the pallet 10 carrying the vehicle 5 is placed in the parking space 30, thereby parking the vehicle 5.

Figure 2 illustrates a state that a plurality of left-and-right pairs of the parking spaces 30 are vertically arranged in multiple stages on the left and right sides of the vertical movement space H.

Under one parking space 30, one parking shelf 90 (to be explained later) is arranged.

The pallet 10 carrying the vehicle 5 is put on the parking shelf 90, thereby parking the vehicle 5 in the parking space 30.

For example, the transport device 40 can stay in a space that is beside the parking space 30 in the direction of the short sides of the pallet main structure 11 positioned in the parking space 30. The pallet 10 horizontally moves along the short sides of the pallet main structure 11 and is horizontally movable between the transport device 40 stopped beside the parking space 30 and the parking space 30. In this case, the direction of the

short sides of the pallet main structure 11 corresponds to a transfer direction.

The transport device 40 is capable of carrying and transporting the pallet 10 between the load/unload space 20
5 and a space beside an optional parking space 30.

For example, the transport device 40 includes a lift cage 41 and a winding device 42.

The lift cage 41 is a structure that is suspended with a wire in such a way as to be vertically movable in the
10 vertical movement space H.

The pallet 10 is put on the lift cage 41.

The winding device 42 is a device to wind up and down the wire.

The winding device 42 winds up or down the wire, to
15 move the lift cage 41 to a side of the parking space 30. The pallet 10 carrying the vehicle 5 is positioned beside an optional one among the parking spaces 30.

The transfer device 50 is a device that is capable of horizontally moving and transferring the pallet 10 in a
20 predetermined transfer direction between the transport device 40 stopped beside the parking space 30 and the parking space 30.

The transfer device 50 horizontally moves the pallet 10 in a predetermined direction from the transport device
25 40 stopped at the side of the parking space 30 to the parking space 30, thereby putting the pallet 10 in the parking space 30.

The transfer device 50 horizontally moves the pallet 10 in a predetermined direction from the parking space 30
30 to the transport device 40 stopped at the side of the

parking space 30, thereby putting the pallet 10 onto the transport device 40.

The transfer device 50 may be installed on the transport device 40.

5 Figure 3 illustrates a state that the transfer device 50 is fixed to an upper part of the transport device 40.

For example, the transfer device 50 has a turn lever whose front end can be engaged with the pallet 10. The turn lever is turned to horizontally move the pallet 10 in
10 a transport direction between the transport device 40 stopped beside the parking space 30 and the parking space 30.

The transfer device 50 horizontally moves and transfers the pallet 10 in a predetermined left-right
15 direction between the transport device 40 stopped beside the parking space 30 and the parking space 30.

The connector 60 includes a first terminal 61 having a first terminal surface T1 that is a planer terminal surface and a second terminal 62 having a second terminal
20 surface T2 that is a planar terminal surface.

The first terminal surface T1 and second terminal surface T2 are faced to each other and are brought into contact with each other, thereby electrically connect the first terminal 61 and second terminal 62 to each other.

25 The first terminal surface T1 and second terminal surface T2 are removed from each other, to electrically disconnect the first terminal 61 and second terminal 62 from each other.

For example, the connector 60 includes the first
30 terminal 61 having the first terminal surface T1 that is a

flat terminal surface and the second terminal 62 having the second terminal surface T2 that is a flat terminal surface. The first terminal surface T1 and second terminal surface T2 are faced to each other and are brought into surface-to-surface contact with each other so that they become electrically conductive to each other.

For example, the connector 60 includes the first terminal 61 having the first terminal surface T1 that is a curved terminal surface and the second terminal 62 having the second terminal surface T2 that is a curved terminal surface. The curved shape of the first terminal surface T1 and the curved shape of the second terminal surface T2 have a convex-concave relationship and the first terminal surface T1 and second terminal surface T2 are faced to each other and are brought into face-to-face contact with each other so that they become electrically conductive to each other.

When the transfer device 50 horizontally moves the pallet 10 in a transfer direction between the transport device 40 stopped beside the parking space 30 and the parking space 30, the first terminal surface T1 and second terminal surface T2 are horizontally faced to each other. To achieve this, the first terminal 61 is supported with the pallet 10 and the second terminal 62 is positioned and supported in the parking space 30.

Figure 4 illustrates a situation that the pallet 10 is placed on the parking shelf 90 (to be explained later) and the first terminal surface T1 and second terminal surface T2 are horizontally faced to each other because the first terminal 61 is so supported with the pallet 10 and

the second terminal 62 is so supported with the parking shelf 90 in the parking space 30.

Figure 4 illustrates that the first terminal 61 is fixed at a location in the vicinity of a location where the wheel 12 is fitted.

For example, the first terminal 61 is incorporated in the pallet-side terminal box 13 and the first terminal surface T1 is horizontally exposed to face the second terminal 62.

Figure 4 illustrates that the second terminal 62 is fixed to the parking shelf rail 91 and is provided with a terminal surface cover member 93.

At least one of the first terminal 61 and second terminal 62 may have a terminal member that defines the terminal surface T and a swing support mechanism that swingably supports the terminal member so that the horizontally oriented terminal surface swings up, down, left, and right.

For example, the first terminal 61 may have the terminal member having the first terminal surface T1 and the swing support mechanism that swingably supports the terminal member so that the horizontal-direction-oriented first terminal surface T1 swings up, down, left, and right.

For example, the second terminal 62 may have the terminal member having the second terminal surface T2 and the swing support mechanism that swingably supports the terminal member so that the horizontal-direction-oriented second terminal surface T2 swings up, down, left, and right.

At least one of the first terminal and second terminal may have a terminal member that forms the terminal

surface, a straightforward support mechanism that supports the terminal member so that the terminal member is straightforwardly movable within the range of a predetermined stroke S along the transfer direction, and a
5 biasing mechanism that uniformly biases the terminal member with a predetermined biasing force toward the other terminal surface of the first/second terminal within the range of the stroke S.

For example, the first terminal 61 may have the
10 terminal member defining the first terminal surface T1, the straightforward support mechanism that supports the terminal member so that the terminal member is straightforwardly movable within the range of the predetermined stroke S along the transfer direction, and
15 the biasing mechanism that uniformly biases the terminal member with a predetermined biasing force toward the second terminal surface T2 of the second terminal 62 within the range of the stroke S.

For example, the second terminal 62 may have the
20 second terminal member 62a defining the second terminal surface T2, the straightforward support mechanism 62b that supports the second terminal member 62a so that the second terminal member is straightforwardly movable within the range of the predetermined stroke S along the transfer
25 direction, and the biasing mechanism 62c that uniformly biases the second terminal member 62a with a predetermined biasing force toward the first terminal surface T1 of the first terminal 61 within the range of the stroke S.

Several concrete examples of structure of the
30 connector 60 will be explained later in detail.

The feed circuit 70 is a circuit to electrically connect the power feed plug receptacle of the vehicle loaded on the pallet and the first terminal to each other.

For example, the feed circuit 70 includes a charging
5 cable 71 and a feed plug 72.

A first end of the feed cable 71 is electrically connected to the first terminal 61.

A second end of the feed cable 71 is electrically connected to the feed plug 72.

10 The feed plug 72 can be inserted into and removed from the feed plug receptacle of the vehicle 5.

Power fed through the connector 60 to the first terminal 61 is supplied through the feed cable 71 and feed plug 72 to the vehicle 5.

15 The power source circuit 80 is a circuit to feed power from a power source to the second terminal 62.

For example, the power source circuit 80 has a power source cable 81 and a power source panel 82.

A commercial power source is connected to the power
20 source panel.

For example, a charge controller is incorporated in the power source panel 82.

Charge power is fed through the power source cable 81 to each of the plurality of second terminals 62.

25 A plurality of charge controllers may be provided for the plurality of parking shelves, respectively.

The parking shelf 90 is a mechanism that is arranged under each parking space 30 and is used to place the pallet
10 in the parking space 30 so that the vehicle 5 is parked
30 in the parking space 30.

The parking shelf 90 has the parking shelf rails 91, the lock/unlock mechanism 92, the terminal surface cover member 93, and a link mechanism 94.

5 The parking shelf rails 91 are mechanical elements that support the pallet so that the pallet is horizontally movable in a transfer direction in the parking space.

The parking shelf rails 91 are arranged under each of the parking spaces 30 that are arranged in a vertical direction.

10 The wheels 12 of the pallet 10 roll along upper surfaces of the parking shelf rails 91.

The lock/unlock mechanism 92 prevents, when the pallet 10 is placed for parking in the parking space 30, the pallet 10 from horizontally moving on the parking shelf rails 91 in the transfer direction, and when the pallet 10 is horizontally moved in the transfer direction between the transport device 40 stopped beside the parking space 30 and the parking space 30, allows the pallet 10 to horizontally move.

20 When the lock/unlock mechanism 92 prevents the horizontal movement of the pallet 10, the first terminal surface T1 and second terminal surface T2 come into contact with each other and the straightforward support mechanism supports the terminal member at an optional position along the transfer direction within the range of the stroke S except an end of the stroke.

For example, when the lock/unlock mechanism 92 prevents the horizontal movement of the pallet 10, the first terminal surface T1 and second terminal surface T2 come into contact with each other and the straightforward

30

support mechanism 62b supports the second terminal member 62a at an optional position along the transfer direction within the range of the stroke S except an end of the stroke.

5 With this, the first terminal surface T1 and second terminal surface T2 come in contact with each other with a predetermined biasing force.

Figure 4 illustrates a state that the lock/unlock mechanism engages with the locking projection part 14 provided on a side face of the pallet 10, thereby preventing the pallet 10 from the horizontal movement in the transfer direction and a state that the lock/unlock mechanism releases the locking projection part 14 provided on the side face of the pallet 10, thereby allowing the horizontal movement of the pallet 10 in the transfer direction.

The terminal surface cover member 93 changes its position between (i) a cover posture for covering the terminal surface of at least one of the first terminal 61 and second terminal 62 and (ii) an expose posture for exposing the terminal surface.

For example, the terminal surface cover member 93 changes its position between a cover posture for covering the first terminal surface T1 of the first terminal 61 and an expose posture for exposing the first terminal surface T1.

For example, the terminal surface cover member 93 changes its position between a cover posture for covering the second terminal surface T2 of the second terminal 62 and an expose posture for exposing the second terminal

surface T2.

Figure 4 illustrates a state that the position of the terminal surface cover member 93 is changed between the cover posture to cover the second terminal surface T2 and the expose posture to expose the second terminal surface T2.

When the pallet is not placed in the parking space, the position of the terminal surface cover member becomes the cover posture.

The link mechanism 94 is a mechanism that is pushed by the pallet 10 to keep the position of the terminal surface cover member 93 at the expose posture when the pallet 10 is placed in the parking space 30.

When the pallet 10 is not placed in the parking space 30, the pallet 10 is separated from the link mechanism 94 to make the terminal surface cover member 93 take the cover posture.

For example, when the pallet 10 is not placed in the parking space 30, the pallet 10 is separated from the link mechanism 94 to make the terminal surface cover member 93 take the cover posture with its own weight.

For example, when the pallet 10 is not placed in the parking space 30, the pallet 10 is separated from the link mechanism 94 to make the terminal surface cover member 93 take the cover posture with a spring force (not illustrated).

Three examples of structure of the connector 60 will be explained with reference to the drawings.

A connector (1) according to the embodiment of the present invention will be explained.

Figure 5 illustrates schematic views of the connector

(1) according to the first embodiment of the present invention.

The connector 60 has a first terminal 61 and a second terminal 62.

5 The first terminal 61 is fixed relative to the pallet 10.

The first terminal 61 is attached to the pallet-side terminal box 13 so that the first terminal surface T1 is not displaced relative to the pallet 10 and is exposed.

10 The second terminal 62 is fixed relative to the parking shelf 90.

The second terminal 62 is attached to the parking shelf rail 91 so that the second terminal surface T2 is straightforwardly movable along the parking shelf rail 91 within the range of the predetermined stroke S in a transfer direction.

The second terminal 62 includes the second terminal member 62a, the straightforward support mechanism 62b, and biasing mechanism 62c.

20 The second terminal member 62a is a member defining the second terminal surface T2.

For example, the second terminal member 62a is a member that defines a circular flat second terminal surface T2.

25 The straightforward support mechanism 62b supports the second terminal member 62a so that the second terminal member 62a is straightforwardly movable within the range of the predetermined stroke S along a transfer direction.

For example, the straightforward support mechanism 30 62b guides the second terminal member 62a in the transfer

direction.

The biasing mechanism 62c is a mechanism that uniformly biases the second terminal member 62a with a predetermined biasing force toward the first terminal surface T1 within the range of the stroke S.

For example, the biasing mechanism 62c is a resilient spring that pushes the second terminal member 62a with a compressed spring force toward the first terminal surface T1.

10 A connector (2) according to the embodiment of the present invention will be explained.

Figure 6 illustrates schematic views of the connector (2) according to the first embodiment of the present invention.

15 The connector 60 has a first terminal 61 and a second terminal 62.

The first terminal 61 is fixed to the pallet-side terminal box 13 of the pallet 10.

20 The first terminal 61 is attached to the pallet-side terminal box 13 so that the first terminal surface T1 is unable to displace relative to the pallet 10.

The first terminal 61 includes a first terminal member 61a and a swing support mechanism 61b.

25 The first terminal member 61a is a member defining the first terminal surface T1.

The swing support mechanism 61b swingably supports the first terminal member 61a so that the horizontally oriented first terminal surface T1 swings up, down, left, and right.

30 For example, the swing support mechanism 61b has a

member having a concave face of curvature R and a member having a convex face of curvature R , the concave and convex faces facing each other and being in contact with each other. The member having the concave face of curvature R is fixed to the pallet-side terminal box 13. The member having the convex face of curvature R is fixed relative to the first terminal member 61a.

With this, the horizontally oriented first terminal surface $T1$ freely swings up, down, left, and right.

The second terminal 62 is fixed relative to the parking shelf 90.

The second terminal 62 is attached to the parking shelf rail 91 such that the second terminal surface $T2$ is straightforwardly movable within the range of the predetermined stroke S in a transfer direction along the parking shelf rail 91.

The second terminal 62 has a second terminal member 62a, a straightforward support mechanism 62b, and a biasing mechanism 62c.

The second terminal member 62a is a member defining the second terminal surface $T2$.

For example, the second terminal member 62a is a member that defines a flat circular second terminal surface $T2$.

The straightforward support mechanism 62b supports the second terminal member 62a such that the second terminal member 62a straightforwardly movable within the range of the stroke S in a transfer direction.

For example, the straightforward support mechanism 62b guides the second terminal member 62a so that the

second terminal member 62a straightforwardly movable in the transfer direction.

The biasing mechanism 62c is a mechanism that uniformly pushes the second terminal member 62a with a predetermined biasing force toward the first terminal surface T1 within the range of the stroke S.

For example, the biasing mechanism 62c is a resilient spring that pushes the second terminal member 62a by use of a compressed spring force toward the first terminal surface T1.

With this, the second terminal member 62a is supported such that the second terminal member 62a is straightforwardly movable along a transfer direction within the range of the stroke S and is uniformly pushed with the predetermined biasing force toward the first terminal surface T1 within the range of the stroke S.

A connector (3) according to the embodiment of the present invention will be explained.

Figure 7 is a schematic view of the connector (3) according to the first embodiment of the present invention.

The connector 60 has a first terminal 61 and a second terminal 62.

The first terminal 61 is fixed relative to the pallet 10.

The first terminal 61 is attached to the pallet-side terminal box 13 so that the first terminal surface T1 is unable to displace relative to the pallet 10.

The first terminal 61 has a first terminal member 61a and a swing support mechanism 61b.

The first terminal member 61a is a member that forms

the first terminal surface T1.

The swing support mechanism 61b is a mechanism that swingably supports the first terminal member 61a so that the horizontally oriented first terminal surface T1 swings
5 up, down, left, and right.

For example, the swing support mechanism 61b supports the first terminal member 61a with a spring such that a plurality of circumferential positions of the first terminal member 61a are movable in a transfer direction.

10 With this, the horizontally oriented first terminal surface T1 becomes swingable up, down, left, and right.

The second terminal 62 is fixed relative to the parking shelf 90.

The second terminal 62 is attached to the parking
15 shelf rail 91 such that the second terminal surface T2 is straightforwardly movable with respect to the parking shelf rail 91 within the predetermined range of the stroke S.

The second terminal 62 has a second terminal member 62a, a straightforward support mechanism 62b, and a biasing
20 mechanism 62c.

The second terminal member 62a is a member defining the second terminal surface T2.

For example, the second terminal member 62a is a member that defines a circular flat second terminal surface
25 T2.

The straightforward support mechanism 62b supports the second terminal member 62a such that the second terminal member 62a is straightforwardly movable within the range of the stroke S in a transfer direction.

30 For example, the straightforward support mechanism

62b guides the second terminal member 62a such that the second terminal member 62a is movable in a transfer direction.

The biasing mechanism 62c is a mechanism that
5 uniformly biases the second terminal member 62a with a predetermined biasing force toward the first terminal surface T1 within the range of the stroke S.

For example, the biasing mechanism 62c is a resilient spring that pushes the second terminal member 62a with a
10 compressed spring force toward the first terminal surface T1.

With this, the second terminal member 62a is supported such that the second terminal member 62a is straightforwardly movable within the range of the
15 predetermined stroke S along a transfer direction and is uniformly pushed with the predetermined biasing force toward the first terminal surface T1 within the range of the stroke S.

A parking apparatus according to the second
20 embodiment of the present invention will be explained with reference to the drawings.

Figure 9 is a schematic view of the parking apparatus according to the second embodiment of the present invention.

The parking apparatus according to the second
25 embodiment is realized by applying the present invention to the planar reciprocatory method parking mechanism.

The parking apparatus according to the second embodiment of the present invention has a plurality of pallets 10, a load/unload space 20, a plurality of parking
30 spaces 30, a transport device 40, a transfer device 50, a

plurality of connectors 60, a plurality of feed circuits 70, a power source circuit 80, and a plurality of parking shelves 90.

5 A plurality of the pallets 10, the load/unload space 20, the transfer device 50, the plurality of connectors 60, the plurality of feed circuits 70, and the power source circuit 80 have the same configurations as those of the parking apparatus according to the first embodiment, and therefore, explanations thereof are omitted.

10 The parking spaces 30 are spaces in which the pallets are placed, respectively.

For example, the pallet 10 carrying a vehicle 5 is placed in the parking space 30, thereby parking the vehicle 5.

15 Figure 9 illustrates a state that a plurality of left-and-right pairs of the parking spaces 30 are horizontally arranged on left and right sides of a horizontal movement space G.

The transport device 40 is capable of carrying and
20 transporting the pallet 10 between the load/unload space 20 and a space beside an optional one of the parking spaces 30.

For example, the transport device 40 is a traveling carrier that travels through the horizontal movement space G.

25 The transport device 40 travels in the horizontal movement space G and stays beside the parking space 30.

The parking shelf 90 is a mechanism that is arranged under each of the parking spaces 30 and is used to place the pallet 10 in the parking space 30 and park the vehicle
30 5 in the parking space 30.

The parking shelf 90 has parking shelf rails 91, a lock/unlock mechanism 92, a terminal surface cover member 93, and a link mechanism 94.

5 The parking shelf rails 91 are mechanical elements that support the pallet 10 such that the pallet 10 is horizontally movable in a transfer direction in the parking space 30.

10 The parking shelf rails 91 are arranged under each of the parking spaces 30 that are arranged in a horizontal direction.

Wheels 12 of the pallet 10 roll on upper faces of the parking shelf rails 91.

15 The lock/unlock mechanism 92, terminal surface cover member 93, and link mechanism 94 have the same configurations as those of the parking apparatus according to the first embodiment, and therefore, explanations thereof are omitted.

20 The parking apparatus according to the embodiment of the present invention is configured to provide the below-mentioned effects.

25 The pallet 10 on which the vehicle 5 is loaded is transported by the transport device 40 from the load/unload space 20 to a side of the parking space 30 and the transfer device 50 transfers the pallet 10 from the transport device 40 stopped beside the parking space 30 to the parking space 30.

30 When the pallet 10 is placed in the parking space 30, the first terminal surface T1 of the first terminal 61 supported with the pallet 10 and the second terminal surface T2 of the second terminal 62 horizontally face each

other and come in contact with each other. Power from the power source is guided from the second terminal 62 to the first terminal 61 and is guided through the feed circuit 70 to the feed plug receptacle of the vehicle 5.

5 When the pallet 10 is transported from the load/unload space 20 and is horizontally moved from a side of the parking space 30 to the parking space 30, the first terminal 61 and second terminal 62 of the connector 60 are electrically connected to each other to feed power to the
10 vehicle 5. When the pallet 10 is horizontally moved from the parking space 30 to the side of the parking space 30, the first terminal 61 and second terminal 62 of the connector 60 are electrically disconnected from each other.

 The first terminal surface T1 and second terminal
15 surface T2 have the same shapes having a convex-concave relationship, and when they are faced to each other and brought into contact with each other, the first terminal 61 and second terminal 62 of the connector 60 are electrically stably connected to each other.

20 The first terminal member 61a defines the first terminal surface T1 and is supported such that the horizontally oriented first terminal surface T1 swings up, down, left, and right. Even if the first terminal 61 and second terminal 62 are not properly oriented, the first
25 terminal surface T1 and second terminal surface T2 are properly brought into contact with each other so that the first terminal 61 and second terminal 62 are surely electrically connected to each other.

 The second terminal member 62a defining the second
30 terminal surface T2 is supported to be straightforwardly

movable along a transfer direction and is uniformly pushed with a predetermined biasing force within the range of the forward stroke S. As a result, a contact pressure between the first terminal surface T1 and second terminal surface T2 is kept at a predetermined biasing force.

When the lock/unlock mechanism 92 prevents the pallet 10 placed in the parking space 30 from horizontally moving on the parking shelf rails 91, the second terminal member 62a is supported at an optional position in the range of the stroke S except a stroke end. As a result, a contact pressure between the first terminal surface T1 and second terminal surface T2 is kept at a predetermined biasing force to secure electrical connection between them.

When the pallet 10 is placed in the parking space 30, the link mechanism 94 is pushed by the pallet 10, to make the terminal surface cover member 93 capable of covering the second terminal surface T2 take the cover posture. When the pallet 10 is not in the parking space 30, the terminal surface cover member 93 takes the expose posture. As a result, the terminal surface is protected when the pallet is not in the parking space.

The present invention is not limited to the above-mentioned embodiments and allows various modifications without departing from the scope of the present invention.

According to the embodiments, the first terminal is provided with the swing support mechanism and the second terminal is provided with the straightforward support mechanism and biasing mechanism. This does not limit the present invention. For example, one of the terminals may be provided with the swing support mechanism,

straightforward support mechanism, and biasing mechanism.

Although the embodiments change the position of the terminal surface cover member with the link mechanism, this does not limit the present invention. For example, the
5 position of the terminal surface cover member may be changed with an actuator.

Parking apparatuses according to the third to tenth embodiments will be explained.

The embodiments of the present invention will be
10 explained with reference to the drawings.

Pallets 100 according to the third to tenth embodiments of the present invention each are a structure used to carry a vehicle in a parking apparatus.

The parking apparatus includes a plurality of pallets
15 100, a plurality of parking spaces 200, and a power source device 300.

The parking apparatus may include a plurality of pallets 100, a plurality of parking spaces 200, a power source device 300, and a pallet transfer device 400.

20 A vehicle 240 receives power through a charging cable 250.

The charging cable 250 may be on the vehicle 240.

The charging cable 250 may be provided for the parking apparatus.

25 The charging cable 250 has a charging terminal 251, a charging cable body 252, and a power feed plug.

The charging terminal 251 is a terminal to be coupled with a vehicle-side relay terminal 130 (to be explained later).

30 The feed plug is a terminal to be connected to a feed

plug receptacle of the vehicle.

The charging cable body 252 electrically connects the charging terminal 251 and feed plug to each other.

The pallet 100 can carry the vehicle 240, and when
5 placed at least in the parking space 200, receives power from the power source device 300.

For the sake of easy explanation, an example of the parking apparatus will be explained with reference to the drawings.

10 Figure 11 illustrates a parking apparatus employing an elevator method parking mechanism.

For example, the parking apparatus includes a plurality of pallets 100, a plurality of parking spaces 200, a power source device 300, and a pallet transfer device 400.

15 The pallet 100 is a plate structure substantially having a rectangular shape when viewed from above and provided with a left and right pair of guide faces L that are present between a left and right pair of long sides E of the substantial rectangular shape and guide the left and
20 right revolving tires of a vehicle 240.

The parking space 200 is a space to place the pallet 100 that is vacant or is carrying the vehicle 240.

Figure 11 illustrates a state that a plurality of the parking spaces are vertically stacked on each side of a
25 hoistway H.

The parking space 200 may have a parking shelf 210 and a pallet lock mechanism 220.

The parking shelf 210 is a shelf structure to support the pallet 100.

30 For example, the pallet 100 has pallet wheels 113 to

roll on the parking shelf 210.

The pallet lock mechanism 220 is a mechanism to lock the pallet 100 positioned in the parking space 200 so that the pallet 100 becomes unable to horizontally move.

5 The power source device 300 is a device to feed power through the pallet 100 to the vehicle.

The power source device 300 may have a feed cable 320 and a power source box 330.

10 The feed cable 320 is a cable to feed power outputted from the power source box 330 to a vehicle-side relay terminal 130 (to be explained later).

The feed cable 320 may directly feed power to the vehicle-side relay terminal 130.

15 The feed cable 320 may feed power through a relay device 140 to the vehicle-side relay terminal 130.

The power source box 330 outputs power to be fed to the vehicle.

20 For example, the power source device 300 includes a feed terminal 310, the feed cable 320, and the power source box 330.

The feed terminal 310 is connected to a parking-shelf-side relay terminal 141, to feed power through the vehicle-side relay terminal 130.

25 The feed cable 320 feeds power outputted from the power source box 330 to the feed terminal 310.

The pallet transfer device 400 is a device that transfers the pallet 100 between the load/unload space 230 and one of the plurality of parking spaces 200.

30 For example, the pallet transfer device 400 includes a lifter 410, a lift mechanism 420, and a traverse

mechanism 430.

The lifter 410 is a mechanism that is capable of carrying the pallet 100 and ascending and descending the hoistway H.

5 The lift mechanism 420 is a mechanism that moves the lifter 410 up and down.

The traverse mechanism 430 is a mechanism that horizontally carries the pallet 100 between the lifter 410 and the parking space 200.

10 The pallet according to the embodiment of the present invention will be explained with reference to the drawings.

For the sake of explanation, the parking apparatus employing the elevator method parking mechanism will be explained as an example.

15 In the parking apparatus employing the elevator method parking mechanism, the power source device 300 includes the feed terminal 310, feed cable 320, and power source box 330.

20 The pallet 100 according to the third embodiment of the present invention will be explained with reference to the drawings.

Figure 14 is a partial view of the pallet according to the third embodiment of the present invention. Figure
25 15 is a plan view of the pallet according to the third embodiment of the present invention. Figure 16 is an E-E sectional view of the pallet according to the third embodiment of the present invention. Figure 17 is an arrow F-F view (1) of the pallet according to the third
30 embodiment of the present invention. Figure 18 is an arrow

F-F view (2) of the pallet according to the third embodiment of the present invention.

The pallet 100 according to the third embodiment of the present invention includes a pallet main structure 110, a terminal box 120, a vehicle-side relay terminal 130, and a relay device 140.

The pallet 100 according to the third embodiment of the present invention may include the pallet main structure 110, a left and right pair of the terminal boxes 120, a left and right pair of the vehicle-side relay terminals 130, and a left and right pair of the relay devices 140.

The left and right pair of terminal boxes are arranged along long sides in a point symmetrical manner around a substantial center C viewed from above the pallet main structure. The left and right pair of vehicle-side relay terminals are stored in the left and right pair of terminal boxes, respectively.

The pallet main structure 110 is a plate structure substantially having a rectangular shape when viewed from above and provided with a left and right pair of guide faces L that are present between a left and right pair of long sides E of the substantial rectangular shape and guide the left and right revolving tires of a vehicle 240.

The pallet main structure 110 may have a left and right pair of upright parts F that sandwich the left and right pair of guide faces.

The upright part F has an upper face that rises along the long side E and has a flat top face.

The pallet main structure 110 may have a pallet upper member 111, a pair of pallet beam members 112, four pallet

wheels 113, and a pair of locking projection parts 114.

The pallet upper member 111 is a plate structure substantially having a rectangular shape when viewed from above and forms the left and right pair of upright parts F
5 and the left and right pair of guide faces L.

Figure 14 illustrates a state that the pallet upper member 111 forms the upright parts F that rise along the long sides E and have each a channel-like sectional shape and the left and right pair of guide faces L that are
10 sandwiched between the left and right pair of upright parts F. A face that is sandwiched between the left and right pair of guide faces L is higher than the guide faces L.

The pallet beam members 112 each are a beam structure that is fixed to the pallet upper member 111 such that its
15 longitudinal direction crosses the long side E.

The pallet wheels 113 are wheels that are freely rotatably fixed to the pallet beam members 112.

The pallet wheels 113 are capable of rolling on a top face of the above-mentioned parking shelf 210.

20 The locking projection part 114 is a projection that is provided for the pallet beam member 112 and is engaged with the above-mentioned pallet lock mechanism 220 to prevent the pallet 100 from traversing.

The terminal box 120 is a structure that is arranged
25 on the top face of the long side E of the pallet main structure and defines an upward convex contour.

The vehicle-side relay terminal 130 (to be explained later) is stored in the terminal box 120.

The terminal box 120 may define an upward convex
30 circular contour from the top face of the pallet main

structure 110 when the pallet main structure is horizontally viewed from a left-right direction.

The terminal box 120 may define an upward convex circular contour from the top face of the upright part F of the pallet main structure 110 when the pallet main structure 110 is horizontally viewed from a left-right direction.

The terminal box 120 may have a terminal box body 121 and a terminal cover 122.

10 The terminal box body 121 is a member that has an open part O at an upper part thereof and supports the stored vehicle-side relay terminal 130.

For example, the terminal box body 121 includes a terminal box lower plate 121a, a left and right pair of terminal box side plates 121b, and a terminal fixing member 121c.

The terminal box lower plate 121a is a plate member that is fixed to the top face of the pallet main structure 110. A left-right width of the terminal box lower plate 121a is substantially agrees with a left-right width of the top face of the upright part F.

The left and right pair of terminal box side plates are plate members that have lower sides fixed to a left and right pair of edges of the terminal box lower plate 121a and each have an upward convex circular edge.

The terminal fixing member 121c is a member that is fixed to the terminal box lower plate 121a and is used to fix the vehicle-side relay terminal 130.

The terminal cover 122 is a member to cover the open part O so that the open part O is opened and closed.

For example, the terminal cover 122 is a plate member that has a terminal cover upper plate 122a and is swingable around a rotation shaft arranged on one side extending in a left-right direction.

5 The terminal cover upper plate 122a is a plate member that has an upward convex circular curvature.

The position of the terminal cover 122 is changeable between an open posture to open the open part O and a closed posture to close the open part O.

10 Figure 17 illustrates a state that the position of the terminal cover 122 is the closed posture.

Figure 18 illustrates a state that the posture of the terminal cover 122 is the open posture.

15 The vehicle-side relay terminal 130 is a terminal that is electrically connected to the charging cable 250.

The vehicle-side relay terminal 130 is fixed relative to the terminal box 120.

For example, the vehicle-side relay terminal 130 is fixed relative to the terminal fixing member 121c.

20 A terminal surface of the vehicle-side relay terminal 130 stored in the terminal box 120 may be oriented upward.

The terminal has one or a plurality of contacts.

The contacts include a power contact and a communication contact.

25 The contacts also include a contact-type contact and a noncontact-type contact.

For example, the vehicle-side relay terminal 130 is a socket of AC 100 V or 200 V.

30 The relay device 140 is an electric device that relays power fed from the power source device to the

vehicle-side relay terminal 130.

The relay device 140 may have a parking-shelf-side relay terminal 141, a relay cable 142, a grounding brush 143, and a relay grounding circuit 144.

5 The parking-shelf-side relay terminal 141 is a terminal that is fixed relative to the pallet main structure 110 and is capable of feeding power from the power source device 300 when the pallet 100 is positioned in the parking space 200.

10 For example, the parking-shelf-side relay terminal 141 is electrically connected to the feed terminal 310 when the pallet 100 is positioned in the parking space 200.

15 For example, the parking-shelf-side relay terminal 141 has a contact type terminal surface T1. The terminal surface T1 comes in contact with the terminal surface of the parking-shelf-side relay terminal 141 to realize power feed.

20 The relay cable 142 is a cable that electrically connects the parking-shelf-side relay terminal 141 and vehicle-side relay terminal 130 to each other.

The grounding brush 143 is fixed relative to the pallet main structure 110 and comes in contact with the parking shelf when the pallet 100 is positioned in the parking space.

25 The relay grounding circuit 144 is a circuit that electrically connects the grounding brush 143 and vehicle-side relay terminal 130 to each other.

30 The pallet 100 according to the fourth embodiment of the present invention will be explained with reference to

the drawings.

Figure 19 is a plan view of the pallet according to the fourth embodiment of the present invention.

An essential configuration of the pallet 100 according to the fourth embodiment of the present invention is substantially the same as that of the pallet according to the third embodiment, and therefore, explanations of the same parts are omitted and different points will be explained.

10 The pallet 100 according to the fourth embodiment of the present invention includes a pallet main structure 110, a terminal box 120, a vehicle-side relay terminal 130, and a relay device 140.

15 The pallet 100 according to the present embodiment of the present invention may have the pallet main structure 110, a left and right pair of the terminal boxes 120, a left and right pair of the vehicle-side relay terminals 130, and a left and right pair of the relay devices 140.

20 The pallet main structure 110 is a plate structure substantially having a rectangular shape when viewed from above and provided with a left and right pair of guide faces L that are present between a left and right pair of long sides E of the substantial rectangular shape and guide the left and right revolving tires of a vehicle 240.

25 The pallet main structure 110 is a plate structure substantially having a flat top face and provided with the left and right pair of guide faces L that are present between the left and right pair of long sides E of the substantial rectangular shape and guide the left and right revolving tires of a vehicle 240.

30

The pallet main structure 110 may have a pallet upper member 111, a pair of pallet beam members 112, four pallet wheels 113, and a locking projection part 114.

5 The pallet upper member 111 is a plate structure substantially having a rectangular shape when viewed from above, has a flat top face, and forms on the flat top face the left and right pair of guide faces L sandwiched between the left and right pair of long sides E.

10 Figure 19 illustrates a state that the pallet upper member 111 forms the left and right pair of guide faces L sandwiched between the long sides E.

The pallet beam members 112 are beam structures that are fixed relative to the pallet upper member 111 in such a way as to cross the long sides E.

15 The pallet wheels 113 are wheels that are rotatably fixed relative to the pallet beam members 112.

The pallet wheels 113 are capable of rolling on the top face of the above-mentioned parking shelf 210.

20 The locking projection part 114 is a projection that is provided for the pallet beam member 112 and is engaged with the above-mentioned pallet lock mechanism 220 to prevent the pallet 100 from traversing.

25 The terminal box 120 is a structure that is arranged on the top face of the long side of the pallet main structure and defines an upward convex contour.

The remaining configuration of the terminal box 120 is the same as that of the pallet according to the third embodiment, and therefore, explanation thereof is omitted.

30 The configurations of the vehicle-side relay terminal 130 and relay device 140 are the same as those of the

pallet according to the third embodiment, and therefore, explanations thereof are omitted.

5 The pallet 100 according to the fifth embodiment of the present invention will be explained with reference to the drawings.

Figure 20 is an arrow F-F view (1) of the pallet according to the fifth embodiment of the present invention. Figure 21 is an arrow F-F view (2) of the pallet according to the fifth embodiment of the present invention.

Figure 20 illustrates a state that the position of a terminal cover 122 is a closed posture.

Figure 21 illustrates a state that the position of the terminal cover 122 is an open posture.

15 Essential parts of the pallet 100 according to the fifth embodiment of the present invention are substantially the same as those of the pallet according to the third embodiment, and therefore, explanations of the same parts are omitted and different points will be explained.

20 The pallet 100 according to the fifth embodiment of the present invention includes a pallet main structure 110, a terminal box 120, a vehicle-side relay terminal 130, and a relay device 140.

25 The pallet 100 according to the fifth embodiment of the present invention may have the pallet main structure 110, a left and right pair of the terminal boxes 120, a left and right pair of the vehicle-side relay terminals 130, and a left and right pair of the relay devices 140.

30 The structure of the pallet main structure 110 is the same as that of the pallet according to the third

embodiment, and therefore, explanation thereof is omitted.

The terminal box 120 is a structure that is arranged on the top face of a long side E of the pallet main structure and defines an upward convex contour.

5 The vehicle-side relay terminal 130 (to be explained later) is stored in the terminal box 120.

 The terminal box 120 may define an upward convex circular contour from the top face of the pallet main structure when the pallet main structure is horizontally
10 viewed from a left-right direction.

 The terminal box 120 may define an upward convex circular contour from the top face of an upright part F of the pallet main structure 110 when the pallet main structure is horizontally viewed from a left-right
15 direction.

 The terminal box 120 may have a terminal box body 121 and a terminal cover 122.

 The terminal box body 121 is a member that has an open part O at an upper part thereof and supports the
20 stored vehicle-side relay terminal 130.

 For example, the terminal box body 121 includes a terminal box lower plate 121a and a terminal fixing member 121c.

 The terminal box lower plate 121a is a plate member
25 that is fixed to the top face of the pallet main structure 110. A left-right width of the terminal box lower plate 121a is substantially agrees with a left-right width of the top face of the upright part F.

 The terminal fixing member 121c is a member that is
30 fixed relative to the terminal box lower plate 121a and is

used to fix the vehicle-side relay terminal 130.

The terminal cover 122 is a member to cover the open part O so that the open part O is opened and closed.

For example, the terminal cover 122 is a plate member
5 that has a terminal cover upper plate 122a and a left and right pair of terminal cover side plates 122b and is swingable around a rotation shaft arranged on one side extending in a left-right direction.

The terminal cover upper plate 122a is a plate member
10 that has an upward convex circular curvature.

The left and right pair of terminal cover side plates 122b each are a plate member that has an upward convex circular edge and a linear lower edge.

A left and right pair of sides of the terminal cover
15 upper plate 122a are fixed to the upward convex circular edges of the left and right pair of terminal cover side plates 122b, respectively.

The position of the terminal cover 122 is changeable between an open posture to open the open part O and a
20 closed posture to close the open part O.

The configurations of the vehicle-side relay terminal 130 and relay device 140 are the same as those of the pallet 100 according to the third embodiment, and therefore, explanations thereof are omitted.

25

The pallet 100 according to the sixth embodiment will be explained with reference to the drawings.

Figure 22 is an arrow F-F view of the pallet according to the sixth embodiment of the present invention.

30 The pallet 100 according to the sixth embodiment of

the present invention includes a pallet main structure 110, a terminal box 120, a vehicle-side relay terminal 130, and a relay device 140.

5 The pallet 100 according to the sixth embodiment of the present invention may have the pallet main structure 110, a left and right pair of the terminal boxes 120, a left and right pair of the vehicle-side relay terminals 130, and a left and right pair of the relay devices 140.

10 The configuration of the pallet main structure 110 is the same as that of the pallet according to the third embodiment, and therefore, explanation thereof is omitted.

The structure of the terminal box 120 is the same as that of the pallet 100 according to the third embodiment, and therefore, explanation thereof is omitted.

15 The vehicle-side relay terminal 130 is a terminal that is electrically connected to a charging cable 250.

For example, the vehicle-side relay terminal 130 is a socket.

20 The vehicle-side relay terminal 130 is supported with the terminal box 120.

For example, the vehicle-side relay terminal 130 is supported with a terminal fixing member 121c.

25 When the vehicle-side relay terminal 130 is lifted, the vehicle-side relay terminal 130 is separated away from the terminal fixing member 121c within a range in which a relay cable is extendable.

A terminal surface of the vehicle-side relay terminal 130 stored in the terminal box 120 may be oriented upward.

30 The relay device 140 is an electric device that relays power fed from a power source device to the vehicle-

side relay terminal.

The structure of the relay device 140 is the same as that of the pallet 100 according to the third embodiment, and therefore, explanation thereof is omitted.

5

The pallet 100 according to the seventh embodiment of the present invention will be explained with reference to the drawings.

Figure 23 is an arrow F-F view of the pallet
10 according to the seventh embodiment of the present invention.

An essential configuration of the pallet 100 according to the seventh embodiment of the present invention is substantially the same as that of the pallet
15 according to the third embodiment, and therefore, explanations of the same parts are omitted and different points will be explained.

The pallet 100 according to the present embodiment includes a pallet main structure 110, a terminal box 120, a
20 vehicle-side relay terminal 130, and a relay device 140.

The pallet 100 according to the present embodiment may have the pallet main structure 110, a left and right pair of the terminal boxes 120, a left and right pair of the vehicle-side relay terminals 130, and a left and right
25 pair of the relay devices 140.

The configurations of the pallet main structure 110, terminal box 120, and vehicle-side relay terminal 130 are the same as those of the pallet 100 according to the sixth embodiment, and therefore, explanations thereof are omitted.

30 The relay device 140 is an electric device that

relays power fed from a power source device to the vehicle-side relay terminal.

The relay device 140 may have a parking-shelf-side relay terminal 141, a relay cable 142, a grounding brush 143, a relay grounding circuit 144, and a relay cable storing device 145.

The configurations of the parking-shelf-side relay terminal 141, relay cable 142, grounding brush 143, and relay grounding circuit 144 are the same as those of the pallet 100 according to the third embodiment, and therefore, explanations thereof are omitted.

The relay cable storing device 145 is a device that automatically stores the relay cable 142 under the terminal box 120.

The relay cable storing device 145 includes an idler 145a, a take-up 145b, and a biasing mechanism 145c.

The idler 145a is a pulley that idles. The relay cable 142 is wound along about 1/4 of the circumference of the idler 145a.

The relay cable 142 is vertically extended on a side thereof that is connected to the vehicle-side relay terminal 130 and is substantially horizontally extended on the opposite side thereof that is wound around the idler 145a.

The take-up 145b is a pulley that idles and applies tension to the relay cable 142 that is wound around substantially half the circumference of the take-up 145b.

The biasing mechanism 145c applies a biasing force to the take-up 145b to apply tension to the relay cable 142.

For example, the biasing mechanism 145c is a coil

spring.

When the vehicle-side relay terminal 130 is lifted, the relay cable 142 is pulled out.

When the vehicle-side terminal 130 is released, the
5 relay cable 142 is pulled under the terminal box 120 and the vehicle-side relay terminal 130 is supported with the terminal fixing member 121c.

The pallet 100 according to the eighth embodiment
10 will be explained with reference to the drawings.

Figure 24 is an arrow F-F view of the pallet according to the eighth embodiment of the present invention.

Essential parts of the pallet 100 according to the eighth embodiment of the present invention are
15 substantially the same as those of the pallet according to the third embodiment, and therefore, explanations of the same parts are omitted and different points will be explained.

The pallet 100 according to the eighth embodiment of
20 the present invention includes a pallet main structure 110, a terminal box 120, a vehicle-side relay terminal 130, and a relay device 140.

The pallet 100 according to the present embodiment may have the pallet main structure 110, a left and right
25 pair of the terminal boxes 120, a left and right pair of the vehicle-side relay terminals 130, and a left and right pair of the relay devices 140.

The configuration of the pallet main structure 110 is the same as that of the pallet 100 according to the third
30 embodiment, and therefore, explanation thereof is omitted.

The terminal box 120 is a structure that is arranged on the top face of a long side E of the pallet main structure and forms an upward convex contour.

The vehicle-side relay terminal 130 (to be explained
5 later) is stored in the terminal box 120.

The terminal box 120 may form an upward convex circular contour from the top face of the pallet main structure when the pallet main structure is horizontally viewed from a left-right direction.

10 The terminal box 120 may form an upward convex circular contour from the top face of an upright part F of the pallet main structure 110 when the pallet main structure is horizontally viewed from a left-right direction.

15 When the position of the terminal cover changes from a closed posture to an open posture, the terminal box lifts the vehicle-side relay terminal by a predetermined height.

The terminal box 120 may have a terminal box body 121, a terminal cover 122, and a terminal lift arm 123.

20 The configurations of the terminal box body 121 and terminal cover 122 are the same as those of the pallet 100 according to the third embodiment, and therefore, explanations thereof are omitted.

The terminal lift arm 123 is an arm that is
25 interlinked with movement of the terminal cover 122, and when the position of the terminal cover changes from the closed posture to the open posture, lifts the vehicle-side relay terminal 130 by the predetermined height.

Figure 24 illustrates the terminal lift arm 123 fixed
30 relative to the terminal cover 122.

When the position of the terminal cover is the closed posture, the terminal lift arm 123 retracts under the terminal cover 122.

When the position of the terminal cover is the open posture, the terminal lift arm 123 lifts the vehicle-side relay terminal 130 by the predetermined height.

The pallet according to the ninth embodiment will be explained with reference to the drawings.

10 Figure 25 is a plan view of the pallet according to the ninth embodiment of the present invention.

Essential parts of the pallet according to the ninth embodiment of the present invention are substantially the same as those of the pallet according to the fourth embodiment, and therefore, explanations of the same parts are omitted and different points will be explained.

The pallet 100 according to the present embodiment includes a pallet main structure 110, a terminal box 120, a vehicle-side relay terminal 130, and a relay device 140.

20 The pallet 100 according to the present embodiment may have the pallet main structure 110, a left and right pair of the terminal boxes 120, a left and right pair of the vehicle-side relay terminals 130, and a left and right pair of the relay devices 140.

25 The structure of the pallet main structure 110 is the same as that of the pallet 100 according to the fourth embodiment, and therefore, explanation thereof is omitted.

The terminal box 120 is a structure that is arranged on the top face of a long side E of the pallet main structure and forms an upward convex contour.

30

The vehicle-side relay terminal 130 (to be explained later) is stored in the terminal box 120.

The terminal box 120 may form an upward convex circular contour from the top face of the pallet main structure when the pallet main structure is horizontally
5 viewed from a left-right direction.

The terminal box 120 may form an upward convex semispherical contour from the top face of the pallet main structure 110 when the pallet main structure is
10 horizontally viewed from a left-right direction.

The terminal box 120 may have a terminal box body 121 and a terminal cover 122.

The terminal box body 121 is a member that has an open part at an upper part thereof and supports the stored
15 vehicle-side relay terminal 130.

For example, the terminal box body 121 includes a terminal box lower plate 121a, a left and right pair of terminal box side plates 121b, and a terminal fixing member 121c.

20 The terminal box lower plate 121a is a plate member that is fixed relative to the top face of the pallet main structure 110.

The left and right pair of terminal box side plates are plate members that have lower sides fixed relative to a
25 left and right pair of edges of the terminal box lower plate 121a, form an upward convex semispherical shape, and are partly provided with an open part O.

The terminal fixing member 121c is a member that is fixed relative to the terminal box lower plate 121a and is
30 used to fix the vehicle-side relay terminal 130.

The terminal cover 122 is a member to cover the open part O so that the open part O is opened and closed.

For example, the terminal cover 122 is a plate member that has a terminal cover upper plate 122a and is swingable
5 around a rotation shaft arranged on one side extending in a left-right direction.

The terminal cover upper plate 122a is a plate member that has an upward convex semispherical shape and is capable of closing the open part O.

10 The position of the terminal cover 122 is changeable between an open posture to open the open part O and a closed posture to close the open part O.

The pallet 100 according to the tenth embodiment of
15 the present invention will be explained with reference to the drawings.

Figure 26 is a schematic view of a parking apparatus according to the tenth embodiment of the present invention.

The pallet 100 according to the tenth embodiment of
20 the present invention is a pallet that is used for the parking apparatus employing the elevator-and-slide method or planar reciprocatory method.

The parking apparatuses according to the embodiments
25 of the present invention are configured to provide the below-mentioned effects.

In the parking apparatus having a plurality of the parking spaces 200, the pallet 100 is used to load the vehicle 240. The pallet main structure 110 of the pallet
30 100 is a plate structure substantially having a rectangular

shape when viewed from above the pallet 100. The top face of the long side E of the pallet main structure 110 is provided with the terminal box 120 that forms an upward convex contour.

5 The vehicle-side relay terminal 130 that is electrically connectable to the charging cable 250 for feeding power to the vehicle 240 is stored in the terminal box. Power from the power source device 300 is relayed through the relay device 140 to the vehicle-side relay
10 terminal 130. The vehicle 240 is guided along the guide faces L of the pallet 100 and is loaded and unloaded to and from the pallet 100. Power fed from the power source device 300 is fed through the relay device 140, vehicle-side relay terminal 130, and charging cable 250 to the
15 vehicle 240 that is on the guide faces L.

To sandwich the left and right pair of guide faces L of the pallet main structure 110, the upright parts F are arranged along the left and right pair of long sides E. The terminal box 120 is arranged on the upright part F.
20 When the vehicle 240 is guided along the guide faces L and is loaded onto the pallet 100, the tires of the vehicle 240 are not easily damaged even if the tires go onto the upright parts F.

The terminal box 120 has an upward convex circular
25 contour when horizontally seen from a left-right direction, and therefore, the tires of the vehicle 240 are not easily damaged even if the tires go onto the terminal box 120.

The terminal box body 121 that supports the vehicle-side relay terminal 130 has the open part O at an upper
30 part thereof, the terminal cover 122 covers the open part O

in an open and close fashion, and a terminal surface of the vehicle-side relay terminal 130 is oriented upward. When the terminal cover 122 that covers the open part O of the terminal box body 121 is opened, the charging cable 250 can
5 be connected to the upward-oriented terminal surface of the vehicle-side relay terminal 130.

The terminal cover 122 is swingable around a rotation axis extending in a left-right direction to change the open posture and closed posture from one to another. The
10 terminal cover 122 is turned to the open posture so that the charging cable 250 is coupled with the vehicle-side relay terminal 130. The charging cable 250 is removed from the vehicle-side relay terminal 130 and the closed posture is established.

15 The relay cable 142 whose first end is connected to the vehicle-side relay terminal 130 is automatically stored under the terminal box 120. When the vehicle-side relay terminal 130 that is pulled is released, the relay cable 142 is stored under the terminal box 120.

20 When the position of the terminal cover 122 is set to the open posture, the vehicle-side relay terminal 130 is lifted by a predetermined height so that the vehicle-side relay terminal 130 is easily grasped when the terminal cover 122 is set to the open posture.

25 The parking shelf 210 that supports the pallet 100 in the parking space 200 is made of conductive material. When the pallet 100 is positioned in the parking space 200, the grounding brush 143 fixed to a bottom face of the pallet main structure 110 comes in contact with the parking shelf
30 210, so that the grounding brush 143 and the grounding

terminal of the vehicle-side relay terminal 130 are electrically connected to each other. As a result, the grounding terminal of the vehicle-side relay terminal 130 can be grounded.

5 The left and right pair of terminal boxes 120 that store the vehicle-side relay terminals 130 are arranged along the long sides in a point symmetry around the center of the pallet main structure 110. When the pallet is turned by 180 degrees, one of the left and right pair of
10 vehicle-side relay terminals 130 is usable.

 The terminal box 120 is producible to have a low profile, so that the vehicle does not hit the terminal box 120.

 Since the open part O of the terminal box 120 is
15 covered with the terminal cover, a waterproof structure may easily be realized.

 The present invention is not limited to the above-mentioned embodiments and allows various modifications
20 without departing from the scope of the present invention.

 Although the explanations have been made in connection with the parking apparatus employing the elevator method parking mechanism, this does not limit the present invention. The present invention is applicable to
25 a parking apparatus employing any one of the merry-go-round method parking mechanism, elevator method parking mechanism, elevator-and-slide method parking mechanism, planar reciprocatory method parking mechanism, transport-and-store method parking mechanism, and two-stage/multistage method
30 parking mechanism.

Although the terminals are connected to each other in the explanations, the terminals may be brought into contact with each other, or may be connected to each other in a noncontact fashion.

5 Although the vehicle-side relay terminal 130 and parking-shelf-side relay terminal are electrically connected to each other through the long relay cable 142 in the explanations, the vehicle-side relay terminal 130 and parking shelf relay terminal may substantially be integral
10 with each other.

EXPLANATION OF REFERENCE NUMERALS

	H: Vertical movement space (hoistway)
	G: Horizontal movement space
15	T1: First terminal surface
	T2: Second terminal surface
	R: Curvature
	S: Stroke
	5: Vehicle
20	10: Pallet
	11: Pallet main structure
	12: Wheel
	13: Pallet-side terminal box
	14: Locking projection part
25	20: Load/unload space
	30: Parking space
	40: Transport device
	41: Lift cage
	42: Winding device
30	50: Transfer device

	60: Connector
	61: First terminal
	61a: First terminal member
	61b: Swing support mechanism
5	62: Second terminal
	62a: Second terminal member
	62b: Straightforward support mechanism
	62c: Biasing mechanism
	70: Feed circuit
10	71: Feed cable
	72: Feed plug
	80: Power source circuit
	81: Power source cable
	82: Power source panel
15	90: Parking shelf
	91: Parking shelf rail
	92: Lock/unlock mechanism
	93: Terminal surface cover member
	94: Link mechanism
20	
	C: Center
	E: Long side
	L: Guide face
	F: Upright part
25	O: Open part
	T1: Terminal surface
	230: Load/unload space
	240: Vehicle
	250: Charging cable
30	251: Charging terminal

	252: Charging cable body
	100: Pallet
	110: Pallet main structure
	111: Pallet upper member
5	112: Pallet beam member
	113: Pallet wheel
	114: Locking projection part
	120: Terminal box
	121: Terminal box body
10	121a: Terminal box lower plate
	121b: Terminal box side plate
	121c: Terminal fixing member
	122: Terminal cover
	122a: Terminal cover upper plate
15	122b: Terminal cover side plate
	123: Terminal lift arm
	130: Vehicle-side relay terminal
	140: Relay device
	141: Parking-shelf-side relay terminal
20	142: Relay cable
	143: Grounding brush
	144: Relay grounding circuit
	145: Relay cable storing device
	145a: Idler
25	145b: Take-up
	145c: Biasing mechanism
	200: Parking space
	210: Parking shelf
	220: Pallet locking mechanism
30	300: Power source device

- 310: Feed terminal
- 320: Feed cable
- 330: Power source box
- 400: Pallet transfer device
- 5 410: Lifter
- 420: Lift mechanism
- 430: Traverse mechanism

PATENT DOCUMENTS

- 10 Document 1: Japanese Unexamined Patent Application
Publication No. H05-256038
- Document 2: Japanese Unexamined Patent Application
Publication No. H04-366283
- Document 3: Japanese Unexamined Patent Application
15 Publication No. H05-227668
- Document 4: Japanese Unexamined Patent Application
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Document 13: Japanese Unexamined Patent Application
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Document 14: Japanese Unexamined Patent Application
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Document 15: Japanese Unexamined Patent Application
Publication No. 2001-359203

10 Document 16: Japanese Unexamined Patent Application
Publication No. 2002-004620

Document 17: Japanese Unexamined Utility Model
Application Publication No. H06-028124

Document 18: Japanese Unexamined Utility Model
15 Application Publication No. H06-035535

CLAIMS

1. A parking apparatus for parking vehicles having feed plug receptacles, comprising:

5 a plurality of pallets on which a plurality of vehicles are loadable respectively;

a load/unload space defined to load or unload a vehicle;

10 a plurality of parking spaces in which a plurality of the pallets can be placed for parking respectively;

a transport device being able to carry and transport the pallet between the load/unload space and a space beside an optional one of the parking spaces;

15 a transfer device being able to horizontally move and transfer the pallet in a predetermined transfer direction between the transport device stopped beside the parking space and the parking space;

20 a connector having a first terminal with a first terminal surface being a planar terminal surface and a second terminal with a second terminal surface being a planar terminal surface, the first terminal surface and second terminal surface being brought into contact with each other in a face-to-face fashion to make the first terminal and second terminal electrically conductive to
25 each other, and the first terminal surface and second terminal surface being separated from each other to electrically isolate the first terminal and second terminal from each other;

30 a feed circuit electrically connecting the feed plug receptacle of the vehicle loaded on the pallet and the

first terminal to each other;

a power source circuit feeding electric power from a power source to the second terminal, wherein

in a case where the transfer device horizontally moves the pallet in the transfer
 5 direction between the transport device stopped beside the parking space and the parking space, the first terminal is supported with the pallet and the second terminal is positioned and supported in the parking space so that the first terminal surface and second terminal surface are oriented to a horizontal direction and are faced to each other; and

a parking shelf having:

10 a terminal surface cover member that changes its position between a cover posture for covering the terminal surface of at least one of the first terminal and second terminal and an expose posture for exposing the terminal surface and

a link mechanism that keeps the position of the terminal surface cover member at the expose posture upon pushed by the pallet when the pallet is placed in the parking space,

15 wherein

as the pallet is not placed in the parking space, the position of the terminal surface cover member becomes the cover posture.

2. The parking apparatus according to claim 1, wherein

20 at least one of the first terminal and second terminal has a terminal member defining the terminal surface and a swing support mechanism swingably supporting the terminal member so that the horizontal-direction-oriented terminal surface swings up, down, left, and right.

3. The parking apparatus according to claim 2, wherein

at least one of the first terminal and second terminal has a terminal member defining the terminal surface,

a straightforward support mechanism supporting the terminal member so that the
5 terminal member is straightforwardly movable along the transfer direction within the range of a predetermined stroke, and

a biasing mechanism that uniformly biases the terminal member with a predetermined biasing force toward the other terminal surface of the first/second terminal

within the range of the stroke.

4. The parking apparatus according to claim 3, wherein the parking shelf has parking shelf rails supporting the pallet in the parking space so that the pallet is

5 horizontally movable in the transfer direction and

a lock/unlock mechanism preventing the pallet from horizontally moving on the parking shelf rails in the transfer direction as the pallet is placed for parking in the parking space, and allowing the pallet to horizontally move as the pallet is horizontally moved in the transfer direction between the transport device stopped beside the parking space and the

10 parking space, wherein

as the lock/unlock mechanism prevents the horizontal movement of the pallet, the first terminal surface and second terminal surface come into contact with each other and the straightforward support mechanism supports the terminal member at an optional position along the transfer direction within the range of the stroke except an end of the stroke.

15

20

25

5. The parking apparatus according to claim 1, wherein:

at least one of the first terminal and second terminal has

a terminal member defining the terminal surface,

5 a straightforward support mechanism supporting the terminal member so that the terminal member is straightforwardly movable along the transfer direction within the range of a predetermined stroke, and

a biasing mechanism that uniformly biases the terminal member with a predetermined biasing force toward the other terminal surface of the first/second terminal within the range of
10 the stroke.

6. The parking apparatus according to claim 5, comprising a parking shelf that has

parking shelf rails supporting the pallet in the parking space so that the pallet is horizontally movable in the transfer direction and

15 a lock/unlock mechanism preventing the pallet from horizontally moving on the parking shelf rails in the transfer direction as when the pallet is placed for parking in the parking space and allowing the pallet to horizontally move as the pallet is horizontally moved in the transfer direction between the transport device stopped beside the parking space and the parking space, wherein

as the lock/unlock mechanism prevents the horizontal movement of the pallet, the first terminal surface and second terminal surface come into contact with each other and the straightforward support mechanism supports the terminal member at an optional position
5 along the transfer direction within the range of the stroke except an end of the stroke.

7. A pallet being used to carry a vehicle in a parking apparatus having a plurality of parking spaces and a power source device, being capable of carrying a vehicle to which
10 power is fed through a charging cable, and being fed with electric power from the power source device at least when placed in the parking space, the pallet comprising:

a pallet main structure having a plate structure

substantially defining a rectangular shape of top view and provided with a left and right pair of guide faces arranged between a left and right pair of long sides of the substantial rectangular shape and guiding left and right revolving tires of the vehicle;

5 a terminal box arranged on a top face of the long side of the pallet main structure and defining an upward convex contour;

a vehicle-side relay terminal being electrically connectable to the charging cable; and

a relay device relaying power fed from the power source device to the vehicle-side relay terminal, wherein:

the vehicle-side relay terminal is stored in the terminal box;

10 the terminal box has a terminal box body having an open part at an upper part thereof and supporting the stored vehicle-side relay terminal, and a terminal cover covering the open part so that the open part is opened and closed;

the terminal cover is swingable around a rotation axis extending along a left-right direction so that the position of the terminal cover is changeable between an open posture to
15 open the open part and a closed posture to close the open part; and

the terminal box lifts the vehicle-side relay terminal by a predetermined height as the position of the terminal cover changes from the closed posture to the open posture.

8. The pallet according to claim 7, wherein:

20 the pallet main structure has a left and right pair of upright parts that rise along the left and right pair of long sides, have each a flat top face, and sandwich the left and right pair of guide faces between them; and

the terminal box is arranged on the top face of the upright part and defines the upward convex contour.

9. The pallet according to claim 8, wherein the terminal box defines an upward convex circular contour from the top face of the pallet main structure as horizontally viewed from a left-right direction of the pallet main structure.

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10. The pallet according to claim 7, wherein the relay device has a relay cable whose first end being electrically connected to the vehicle-side relay terminal and a relay cable storing device automatically storing the relay cable under the terminal box.

5 11. The pallet according to claim 7, wherein:

the parking apparatus has a parking shelf being made of conductive material and supporting the pallet in the parking space; and

the relay device has a grounding brush fixed relative to the pallet main structure and coming in contact with the parking shelf as the pallet is positioned in the parking

space and a relay grounding circuit electrically connecting the grounding brush and vehicle-side relay terminal to each other.

12. The pallet according to claim 7, further comprising:

5 a left and right pair of the terminal boxes; and

a left and right pair of the vehicle-side relay terminals, wherein:

the left and right pair of the terminal boxes are arranged along the long sides in a point symmetry fashion substantially around the center of the pallet main structure viewed from above; and

10 the left and right pair of the vehicle-side relay terminals are stored in the left and right pair of the terminal boxes, respectively.

13. The pallet according to claim 7, wherein

15 the terminal box forms an upward convex circular contour from a top face of the pallet main structure when horizontally viewed from a left-right direction of the pallet main structure.

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14. The pallet according to claim 7, wherein

the relay device has a relay cable whose first end is electrically connected to the vehicle-side relay terminal and a relay cable storing device that automatically stores the relay cable under the terminal box.

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15. The pallet according to claim 7, wherein

the terminal box lifts the vehicle-side relay terminal by a predetermined height when the position of the terminal cover changes from the closed posture to the open posture.

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16. A pallet being used to carry a vehicle in a parking apparatus having a plurality of parking spaces and a power source device, being capable of carrying a vehicle to which power is fed through a charging cable, and being fed with electric power from the power source device at least when placed in the parking space, the pallet comprising:

5 a pallet main structure having a plate structure substantially defining a rectangular shape of top view and provided with a left and right pair of guide faces arranged between a left and right pair of long sides of the substantial rectangular shape and guiding left and right revolving tires of the vehicle;

a terminal box arranged on a top face of the long side of the pallet main structure and
10 defining an upward convex contour;

a vehicle-side relay terminal being electrically connectable to the charging cable;

a relay device relaying power fed from the power source device to the vehicle-side relay terminal, wherein

the vehicle-side relay terminal is stored in the terminal-box;

wherein:

- 5 the parking apparatus has a parking shelf that is made of conductive material and supports the pallet in the parking space; and

the relay device has

a grounding brush that is fixed relative to the pallet main structure and comes in contact with the parking shelf as the pallet is positioned in the parking space and

- 10 a relay grounding circuit that electrically connects the grounding brush and vehicle-side relay terminal to each other.