

{DESCRIPTION}

{Title of Invention}

PALLET FOR MULTI-STOREY MECHANICAL PARKING LOT AND MULTI-
STOREY MECHANICAL PARKING LOT PROVIDED THEREWITH

{Technical Field}

{0001}

The present invention relates to a pallet for a multi-storey mechanical parking lot, in particular, to a pallet for a multi-storey mechanical parking lot that enables charging of a vehicle-installed battery in a parked electrically-powered vehicle, as well as to a multi-storey mechanical parking lot provided therewith.

{Background Art}

{0002}

In recent years, there has been an increasing trend towards environmental protection at the global scale, and there has been a remarkable increase in the use of hybrid vehicles and electric vehicles (hereinafter, referred to as electrically-powered vehicles) that cause low levels of environmental pollution. Such an electrically-powered vehicle is provided with a large-capacity battery and travels by driving an electrically-driven motor driven by power stored in the vehicle-installed battery. Then, charging of the vehicle-installed battery is performed by connecting a charging connection portion provided at a vehicle body surface of the

electrically-powered vehicle to a power-source outlet, such as a domestic power supply or the like, through a charging cable.
{0003}

In association with this trend, there is a demand for providing charging devices that enable charging of the vehicle-installed batteries of the electrically-powered vehicles also in multi-storey mechanical parking lots, such as multi-storey parking facilities or the like. In such a multi-storey mechanical parking lot, since an electrically-powered vehicle is moved up and down as well as left and right in the multi-storey mechanical parking lot in a state where the vehicle is on a pallet, techniques, for example, disclosed in Patent Literatures 1 and 2 have been proposed so that electric power can be stably supplied to the electrically-powered vehicle even in the aforementioned case.

{0004}

In the multi-storey mechanical parking lot disclosed in Patent Literature 1, an upright charging stand is provided at the front or rear side of one side portion of the pallet on which a vehicle is placed, a charging cable extends from this charging stand, the electrically-powered vehicle is parked on the pallet in a position where a charging connection portion provided in the vehicle body is close to the charging stand, and the vehicle-installed battery is charged by connecting the charging cable extended from the charging stand to the

charging connection portion of the vehicle body.

{0005}

In addition, in the multi-storey mechanical parking lot disclosed in Patent Literature 2, an outlet-like power supply portion is provided at a top surface of an upright curb-like wheel-guiding wall provided at a side edge portion of the pallet, and the vehicle-installed battery is charged by connecting this power supply portion and the charging connection portion of the electrically-powered vehicle through the charging cable.

{List of References}

{Patent Literature}

{0006}

{PTL 1} Japanese Laid-open Patent Publication No. 2010-112027

{PTL 2} Japanese Laid-open Utility Model Publication No. H06-028124

{Summary of Invention}

{Problem to be solved}

{0007}

With the multi-storey mechanical parking lot disclosed in Patent Literature 1, when the charging stand is not in use, it is necessary to prevent the charging cable from hanging down from the pallet or being a hindrance to the parked vehicle, by hanging the charging cable on the charging stand, by winding the charging cable using winding means such as a reel, and so

on. However, since the charging cable is a thick electric cable having a diameter of about 15 mm and, in addition, since the length thereof needs to be at least 1 m or greater, there is a problem in terms of a lack of compactness. The problem includes a situation that even if such a thick, long charging cable is hung on the charging stand, it would still be a hindrance by being formed like a large arc, and a situation that a reel having a large diameter is required when winding with the winding means such as a reel or the like needs to be performed. Moreover, there is a possibility that the electrically-powered vehicle or another vehicle accidentally comes in contact with the upright charging stand provided on the pallet, and, in such a case, there is a risk of damaging the vehicle.

{0008}

In addition, with the multi-storey mechanical parking lot disclosed in Patent Literature 2, since the outlet-like power supply portion is simply provided at the side edge portion of the pallet, a user needs to pulled out a vehicle-installed charging cable from the electrically-powered vehicle to connect it to both the power supply portion of the pallet and the charging connection portion of the electrically-powered vehicle. As described above, charging battery involves a bothersome process of pulling out the charging cable and connecting both ends thereof. Moreover, since the position of

the power supply portion in the pallet is low, the user must bend down to perform the connection task, which makes it highly likely that a woman wearing a skirt will end up getting her skirt dirty from touching the pallet, for example, and thus, this work has been considered hard to perform.

Furthermore, since the charging cable ends up touching the floor surface of the pallet, the charging cable tends to get dirty, and since the user touches it with bare hands, his or her hands, clothes, etc. tend to get dirty.

{0009}

Furthermore, in both of Patent Literatures 1 and 2, since an extra length is provided in the charging cable, the charging cable sometimes droops downward from the pallet when charging the electrically-charged vehicle, and, since a vehicle in a multi-storey mechanical parking lot is rapidly transported up and down, left and right, as well as back and forth many times while placed on the pallet, there is a risk of the charging cable interfering with other structures in the surroundings of the pallet when the charging cable hanging out of the pallet swings about, and thereby causing inconveniences such as damage thereto or the like.

{0010}

The present invention has been conceived in order to solve the above-described problems, and implementation of the techniques disclosed herein may provide a pallet for a multi-storey mechanical parking lot

capable of efficiently accomodating a charging cable for charging an electrically-powered vehicle at the pallet side with a simple, low-cost, compact structure having a good external appearance, facilitating the work of connecting the charging cable, preventing the charging cable from drooping, and, additionally, preventing the vehicle from being damaged or the like; as well as to provide a multi-storey mechanical parking lot provided therewith.

{Means for solving the Problem}

{0011}

The invention is defined in the independent claim. Some optional features of the invention are defined in the dependent claims.

The present invention may provide the following solutions.

Specifically, a pallet for a multi-storey mechanical parking lot according to a first exemplary arrangement is a pallet for a multi-storey mechanical parking lot which an electrically-powered vehicle is parked on and transports the vehicle to a predetermined parking position, the pallet comprising a charging device that can charge a battery installed in the electrically-powered vehicle while the electrically-powered vehicle is parked on the pallet, wherein the charging device has: a charging cable that is connected to the pallet side at one end thereof, that is provided with a charging connector at the other end which can be connected to a charging connection portion of the electrically-powered vehicle, that can be expanded and

contracted in a curled cord-like form, and that is contracted into a coil-like form when a stretching force is not exerted thereon; and a cable accommodating portion that is provided in the pallet and that accommodates the charging cable when contracted into the coil-like form.
{0012}

With the above-described configuration, since the charging cable, when not in use, contracts into a coil-like form having its minimum volume, the cable accommodating portion formed in the pallet to accommodate this charging cable may also have a small volume, and thereby the pallet can have a structure that is simple, low-cost, and also compact. In addition, since the charging cable contracts into the coil-like form, it is not necessary to accommodate the charging cable by winding or hanging it, as has conventionally been done, and since the charging cable contracted into the coil-like form can be accommodated in the cable accommodating portion without taking any additional action, the charging cable can be accommodated easily.

{0013}

In the pallet for the multi-storey mechanical parking lot according to the first exemplary arrangement, it is preferable that the cable accommodating portion comprises an accommodating hollow portion provided as a hollow shape along an edge portion of the pallet and an openable/closable lid

member for closing an opening at an upper part of the accommodating hollow portion. When this configuration is employed, since the edge portion of the pallet is generally formed like a curb that guides a tire so as to prevent derail, and an excess space exists inside thereof, the cable accommodating portion can be provided by utilizing this excess space. Accordingly, it is possible to prevent the cable accommodating portion from being externally exposed, and, with this configuration, it is possible to make the structure of the pallet compact and also to improve the external appearance thereof. In addition, since the charging cable contracts into the coil-like form, it is not necessary to accommodate it by winding or hanging it, as has conventionally been done, and since the charging cable contracted into the coil-like form merely needs to be put into the cable accommodating portion, the charging cable can be easily accommodated.

{0014}

In addition, in the pallet for the multi-storey mechanical parking lot according to the first exemplary arrangement, it is preferable that the cable accommodating portion is provided inside an upright pole member on an edge portion of the pallet, the charging cable extends from a lower part or an upper part of the pole member, and the charging connector is held by the pole member so as to be positioned at a location higher than the pallet when the

charging cable is accommodated in the cable accommodating portion of the upright pole member.

{0015}

With this configuration, since the pole member is formed of, for example, a rod member (channel member) having a rectangular U-shaped cross-section and the internal space thereof can serve as the cable accommodating portion without modification, it is possible to achieve the storability of the charging cable with a compact, simple, low-cost configuration having a good external appearance. Moreover, since the charging connector at the distal end of the charging cable is held by the pole member so as to be positioned at a location higher than the pallet, a user can take the charging connector into his/her hand to connect it to the charging connection portion of the electrically-powered vehicle without having to bend down, which makes it easy to perform the connection work.

{0016}

In addition, since the charging cable pulled out of the cable accommodating portion is connected by being stretched out directly from the proximal portion of the pole member to the charging connection portion of the electrically-powered vehicle, the charging cable can be connected without causing any drooping thereof and in its shortest distance. Therefore, it is possible to make the charging cable reliably reach the charging connection portion of the electrically-powered

vehicle, and also to avoid the inconveniences caused by drooping of the charging cable. In addition, since the connection work can be performed without causing the charging cable to touch the floor surface of the pallet, it is possible to prevent the charging cable from getting dirty or damaged.

{0017}

In addition, in the pallet for the multi-storey mechanical parking lot according to the first exemplary arrangement, it is preferable that, in the state in which the charging cable is accommodated in the cable accommodating portion, the pole member can be pivoted between a collapsed position, in which the pole member is collapsed so as to be positioned below the edge portion of the pallet, and an upright position, in which the pole member stands perpendicularly to the top surface of the edge portion. With this configuration, since the charging cable can be accommodated inside the pole member and the pole member can be collapsed down into the collapsed position when the charging cable is not in use, the external appearance can be improved by making the charging cable and the pole member inconspicuous, and it is also possible to eliminate concerns about the electrically-powered vehicle or other vehicle coming into contact with the pole member.

{0018}

In addition, in the pallet for the multi-storey

mechanical parking lot according to the first exemplary arrangement, it is preferable that the pallet further comprises folding means for enabling the pole member to be collapsed into the collapsed position in the state in which the charging cable extends from the lower part of the pole member. With this configuration, it is possible to prevent the pole member from becoming a hindrance to the user while using the charging cable and to improve the external appearance at the same time.

{0019}

In addition, in the pallet for the multi-storey mechanical parking lot according to the first exemplary arrangement, it is preferable that at least a surface of the pole member is of a material that does not harm the parked vehicle. With this configuration, it is possible to prevent damage to the vehicle in the unlikely event of the parked vehicle coming into contact with the pole member.

{0020}

In addition, in the pallet for the multi-storey mechanical parking lot according to the first exemplary arrangement, it is preferable that the pole member be flexible. With this configuration, in the unlikely event of the parked vehicle colliding with the pole member, due to bending of the pole member, it is possible to prevent damage to the vehicle and also to prevent breakage of the pole member

at the same time.

{0021}

In addition, a multi-storey mechanical parking lot according to a second exemplary arrangement is provided with one of the pallets described above, and therefore, it is possible to provide a multi-storey mechanical parking lot that affords functions and advantages afforded by the individual pallets described above.

{Advantageous Effects of Invention}

{0022}

As described above, in a pallet for a multi-storey mechanical parking lot and a multi-storey mechanical parking lot provided therewith, with a simple, low-cost, compact structure having a good external appearance, a charging cable for charging an electrically-powered vehicle can efficiently be accommodated in the pallet, the work for connecting the charging cable is easy, drooping of the charging cable can also be prevented, and, additionally, damage, etc. to the vehicle can be prevented.

{Brief Description of Drawings}

{0023}

{Fig. 1} Fig. 1 is a longitudinal sectional view showing an example of a multi-storey mechanical parking lot in which a pallet as described herein can be employed.

{Fig. 2} Fig. 2 is a front view showing a pallet provided with a charging device, which is a first exemplary arrangement, as well as an electrically-powered vehicle.

{Fig. 3} Fig. 3 is a perspective view showing a state in which a lid member of a cable accommodating portion in the charging device shown in Fig. 2 is open.

{Fig. 4} Fig. 4 is a perspective view showing a state in which a charging cable is pulled out from the cable accommodating portion in the charging device shown in Fig. 2.

{Fig. 5} Fig. 5 is a perspective view showing a state in which the charging cable is pulled out from the cable accommodating portion in the charging device shown in Fig. 2 and the lid member thereof is closed.

{Fig. 6} Fig. 6 is a front view showing a pallet provided with a charging device, which is a second exemplary arrangement, as well as an electrically-powered vehicle.

{Fig. 7} Fig. 7 shows the charging device in Fig. 6, where (a) is a front view showing a state in which a charging cable is accommodated in a cable accommodating portion, and (b) is a front view showing a state in which the charging cable is pulled out from the cable accommodating portion.

{Fig. 8} Fig. 8 is a perspective view of the charging device shown in Figs. 6 and 7.

{Fig. 9} Fig. 9 is a longitudinal sectional view of the charging device taken along the line IX-IX in Fig. 7(a), and

(a) and (b) are diagrams respectively showing the differences in the shape of a charging-connector holding portion.

{Fig. 10} Fig. 10 is a perspective view showing a state in which a pole member of a charging device, which is a third exemplary arrangement, is in a collapsed position.

{Fig. 11} Fig. 11 is a perspective view showing a state in which the pole member shown in Fig. 10 is in an upright position.

{Fig. 12} Fig. 12 is a front view showing a state in which the charging cable is pulled out from the pole member.

{Fig. 13} Fig. 13 is a perspective view showing a state in which the charging cable is pulled out from the cable accommodating portion, and the pole member is returned to the collapsed position.

{Fig. 14} Fig. 14 is a perspective view showing an example in which a locking mechanism is provided in the pole member.

{Description of Embodiments}

{0024}

Embodiments of the present invention will be described below with reference to the drawings. Note that, so long as a multi-storey mechanical parking lot having a vehicle mounting function employing a pallet is considered, the present invention can widely be employed, and it is not limited only to a multi-storey parking lot with an elevator system

described below.

{0025}

Fig. 1 is a perspective view showing an example of a multi-storey mechanical parking lot in which a pallet can be employed. This multi-storey mechanical parking lot 1 is a multi-storey parking facility with an elevator system in which a plurality of vehicles can be accommodated and is provided with a parking tower 4 having an entry/exit gate 3 for a vehicle 2 provided at a ground portion thereof. A turntable 5 that rotationally changes the direction of a vehicle is provided at a floor surface on the ground level of the parking tower 4. The turntable 5 is provided with a turning plate 7 and a turning drive portion 8 in a depression-like pit 6 formed in the floor surface of the ground level.

{0026}

A vertical ascending/descending pathway 11 is formed in a center portion of the parking tower 4, inside of which an elevator-like transport platform 12 is provided so that it can ascend/descend. The transport platform 12 is, for example, suspended by a plurality of wire ropes 13, which hold the platform at four corners thereof and extend downward from a winch (not shown in the drawings) provided at a top portion of the parking tower 4, and ascends/descends in the ascending/descending pathway 11 when the winch described above

is driven.

{0027}

On the other hand, vehicle-housing shelves 14 are provided on both sides of the ascending/descending pathway 11. These vehicle-housing shelves 14 are provided at vertically multiple levels at the both sides of the ascending/descending pathway 11, and a single pallet 15 for loading a vehicle is accommodated in each of the vehicle-housing shelves 14. Note that support pillars, etc. of the vehicle-housing shelves 14 are not illustrated. Floor surfaces of the transport platform 12 and the vehicle-housing shelves 14 are provided with delivery mechanisms (not shown in the drawings) that can smoothly deliver an empty pallet 15 or a pallet 15 with the vehicle 2 loaded thereon from the transport platform 12 to a vehicle-housing shelf 14 or from a vehicle-housing shelf 14 to the transport platform 12, when the heights of the floor surfaces of the two components 12 and 14 are aligned.

{0028}

When a vehicle 2 enters this multi-storey mechanical parking lot 1, the pallet 15 in a vehicle-housing shelf 14 in which a vehicle 2 is not housed is set on the turning plate 7 on the turntable 5 in advance by means of the transport platform 12. The vehicle 2 coming from the entry/exit gate 3 is stopped on the pallet 15 set on the turntable 5, and, subsequently, the turntable 5 is turned to change the

direction thereof so that the orientation of the vehicle 2 becomes parallel to the orientation of the vehicle-housing shelf 14. The pallet 15 whose direction has been changed is transported upward by the transport platform 12, the position thereof is aligned with the height of the vehicle-housing shelf 14 in which a vehicle 2 is not housed, and the pallet 15 is moved by sliding from the floor surface of the transport platform 12 to the floor surface of the vehicle-housing shelf 14. By doing so, the vehicle 2 is housed in the vehicle-housing shelf 14 together with the pallet 15.

{0029}

At the time of leaving, the transport platform 12 is stopped so as to be aligned with the height of the vehicle-housing shelf 14 in which the leaving vehicle 2 is housed, the vehicle 2 housed in the vehicle-housing shelf 14 is transferred to the transport platform 12 together with the pallet 15, the transport platform 12 descends to the turntable 5, on which the pallet 15 and the vehicle 2 are placed, and the vehicle 2 leaves once the direction thereof is changed by means of the turntable 5 so as to face the direction of the entry/exit gate 3.

{0030}

In addition to a general vehicle 2 that travels by means of the motive power of an internal combustion engine, an electrically-powered vehicle that travels by means of the

motive power of an electrically-driven motor can be parked on the pallet 15, and a charging device is provided for charging a vehicle-installed battery while the electrically-powered vehicle is parked, after transporting the electrically-powered vehicle to the vehicle-housing shelf 14. A plurality of embodiments of the pallet 15 and the charging device will separately be described below. Note that, in the individual embodiments, reference signs for the pallet and the charging device will be distinguished as 15A and 16A in a first embodiment, 15B and 16B in a second embodiment, and 15C and 16C in a third embodiment, respectively.

{0031}

{First Embodiment}

Figs. 2 to 5 show the first exemplary arrangement, and Fig. 2 is a front view of the pallet 15A, the charging device 16A, and an electrically-powered vehicle EV. The main body of the pallet 15A has a general, W-shaped cross-sectional structure which is formed by press molding a steel plate, as with ones employed in general multi-storey mechanical parking lots, and two wheel-guiding channels 24 that guide wheels 23 of the electrically-powered vehicle EV, as well as those of a general vehicle, along the longitudinal direction of the pallet 15A are formed between a center-guide protrusion 21 formed at a center portion of the pallet 15A in the width direction and a pair of left and right upright edge

portions 22 provided at side edge portions on both sides of the pallet.

{0032}

Although the charging device 16A is provided at the edge portion 22 of the pallet 15A, it may be provided, in accordance with the position of a charging connection portion (not shown in the drawings) of the electrically-powered vehicle EV, at one of the left and right edge portions 22 or may be provided at both of them, and, in addition, it may be provided at any of the front, rear, and middle of the edge portions 22. By providing charging devices 16A at multiple locations at differing positions, it becomes possible to enhance the flexibility with respect to the type and parking direction of the electrically-powered vehicle EV.

{0033}

The charging device 16A is provided with a charging cable 26 and a cable accommodating portion 27 for accommodating this charging cable 26. The cable accommodating portion 27 is built into the edge portion 22 of the pallet 15A and is configured to have an accommodating hollowing portion 28, which is provided along the edge portion 22, and an openable/closable lid member 29 for closing an opening at the top of the accommodating hollow portion 28. Although the accommodating hollow portion 28 has a structure in which a portion of the top surface of the edge portion 22 is cut out

in a rectangular shape and a separate accommodating box 30 is secured to the opening from its under surface side by securing means such as welding or the like, the accommodating hollow portion 28 may be provided, for example, integrally with the edge portion 22 by means of press molding or the like.

{0034}

An internal space of the accommodating hollow portion 28 is formed like an elongated cuboid along the longitudinal direction of the edge portion 22. In addition, the lid member 29 is provided at the top surface of the edge portion 22 in the form of a door that can be freely opened/closed by using a plurality of hinge members 31 and is provided with a pulling handle hole 32, however, the lid member 29 may have a sliding open/close structure or the like. Note that, although the width of the edge portion 22 provided with the charging device 16A is greater than the width of the edge portion 22 on the opposite side in this case, the widths of the left and right edge portions 22 may be configured to be equal.

{0035}

On the other hand, the charging cable 26 is a curled cord-like electric cable that can be expanded/contracted, that is contracted into a coil-like form when a stretching force is not exerted thereon, and that can be extended to more than twice its length when stretched from the contracted state. One end (the proximal end) of the charging cable 26 passes

through a bottom portion of one lengthwise end (for example, the rear end) of the accommodating hollow portion 28 and is electrically connected to a power supply portion (not shown in the drawings) provided at the under surface or the like of the pallet 15A. A grommet 33 (see Fig. 4) made of, for example, rubber, is fitted to the portion where the charging cable 26 passes through at the bottom portion of the accommodating hollow portion 28 so as to secure, protect, and insulate the proximal end of the charging cable 26. In addition, the other end (the free end) of the charging cable 26 is provided with a charging connector 35 that is connected to the charging connection portion of the electrically-powered vehicle EV.

{0036}

As shown in Fig. 3, the size of the cable accommodating portion 27 (accommodating hollow portion 28) is configured so that the charging cable 26, when contracted into the coil-like form, and the charging connector 35 can be stored with sufficient extra space. The cable accommodating portion 27 is configured so that the lid member 29 does not apply pressure to the charging cable 26 and the charging connector 35 when the charging cable 26 and the charging connector 35 are accommodated in the cable accommodating portion 27 and the lid member 29 is closed. The lid member 29 has sufficient strength to endure the weight of a vehicle even if in the unlikely event where the vehicle gets on the edge portion 22.

In addition, since a U-shaped cut-out portion 37 is formed at an end of the lid member 29 to avoid the charging cable 26, it is possible to close the lid member 29 in a state in which the charging cable 26 is pulled out as shown in Fig. 5. Note that a drainage hole (not shown in the drawings) is provided at the bottom portion of the cable accommodating portion 27.

{0037}

When the electrically-powered vehicle EV is parked on the pallet 15A configured in this way and battery charge is performed using the charging device 16A, the electrically-powered vehicle EV is stopped on the pallet 15A in a position where the charging connection portion (not shown in the drawings) provided in the vehicle body of the electrically-powered vehicle EV is close to the charging device 16A, the lid member 29 of the charging device 16A is subsequently opened to pull out the charging cable 26 and the charging connector 35 accommodated in the cable accommodating portion 27, and the battery charge is performed by connecting the charging connector 35 to the charging connection portion of the electrically-powered vehicle EV. Although the charging cable 26 contracted into the coil-like form is stretched out at this time, the charging cable 26 reaches the charging connection portion from the cable accommodating portion 27 in a straight shortest distance due to the contractibility of the charging cable 26, and thus, it does not come in contact with

the floor surface of the pallet 15A. Note that the lid member 29 may be left open during the battery charge, however, closing the lid member 29 can prevent it from becoming a hindrance.

{0038}

When the electrically-powered vehicle EV is leaving, the charging connector 35 is removed from the charging connection portion of the electrically-powered vehicle EV, and the lid member 29 of the charging device 16A is opened to accommodate the charging cable 26 and the charging connector 35 in the cable accommodating portion 27. Since the charging cable 26 becomes contracted into the coil-like form to achieve its minimum volume when the charging connector 35 is removed, the charging cable 26 can easily be accommodated in the cable accommodating portion 27 (accommodating hollow portion 28) together with the charging connector 35. Subsequently, the lid member 29 of the cable accommodating portion 27 is closed.

{0039}

With the pallet 15A and the charging device 16A, since the charging cable 26 has a curled cord-like form, which can be expanded/contracted, and contracts into the coil-like form when a stretching force is not exerted thereon, achieving its minimum volume, the cable accommodating portion 27 that accommodates the charging cable 26 can also be a small one, and thereby the pallet 15A can have a simple, low-cost, and

compact structure. Moreover, since the charging cable 26 contracts into the coil-like form, it is not necessary to accommodate the charging cable 26 by winding or hanging it as has conventionally been done, and the charging cable 26 contracted into the coil-like form can easily be accommodated merely by fitting it into the cable accommodating portion 27. Since the charging cable 26 can be accommodated without taking any additional action, it can be easily accommodated. In addition, since the contractibility of the charging cable 26 causes it to contract during charging, preventing contact with the floor surface of the pallet 15A, the charging cable 26 is less likely to get dirty or damaged, it can easily be handled, and, furthermore, it is possible to prevent damage to the charging cable 26 itself.

{0040}

On the other hand, since the cable accommodating portion 27 is provided with the accommodating hollow portion 28 provided along the edge portion 22 of the pallet 15A and the openable/closable lid member 29 for closing the top opening of the accommodating groove 28, it is possible to provide the cable accommodating portion 27 by utilizing an excess space inside the edge portion 22, originally provided in the pallet 15A so as to prevent the tires of a vehicle from derailing. Accordingly, the cable accommodating portion 27 is prevented from being externally exposed and thereby the pallet 15A can

have a compact structure and also can be advantageous in terms of its external appearance.

{0041}

In addition, since the pallet 15A is provided with the charging cable 26 as the charging device 16A, the user does not need to take out a charging cable installed in his/her own vehicle to connect it to the pallet 15A. Accordingly, the trouble of taking out the charging cable from the vehicle body and the trouble of connecting both ends of the charging cable to both the vehicle and the pallet 15A can be avoided.

{0042}

{Second Embodiment}

Figs. 6 to 9 show the second exemplary arrangement, and Fig. 6 is a front view of the pallet 15B, the charging device 16B, and the electrically-powered vehicle EV. Since the basic configuration of the pallet 15B is the same as that of the pallet 15A described in the first embodiment except for the portion relating to the charging device 16B, the same reference signs are assigned to each of the relating portions, and descriptions thereof are omitted here. In addition, although the charging device 16B is provided at the edge portion 22 of the pallet 15B, it may be provided, as with the first embodiment, at one of the left and right edge portions 22 or may be provided at both of them, and, in addition, it may be provided at any of the front, rear, and

middle of the edge portions 22 at any number of locations.

{0043}

The charging device 16B is provided with an upright pole member 41 on the edge portion 22 of the pallet 15B and the charging cable 26 provided in relation with the pole member 41. As with the one described in the first embodiment, the charging cable 26 is connected to the pallet 15B at one end thereof, is provided with the charging connector 35 at the other end, has a curled cord-like form capable of being expanded/contracted, and is contracted into a coil-like form when a stretching force is not exerted thereon.

{0044}

The pole member 41 is formed of, for example, a rod member (channel member) having an angular U-shaped cross-section, and a flat plate-like securing plate 42 is perpendicularly secured at the bottom end thereof by means of welding or the like. In addition, a prism-shaped scaffolding member 43 is secured to the edge portion 22 at an inner side thereof by means of welding or the like, and the top surface of this scaffolding member 43 and the top surface of the edge portion 22 are set at the same height. Note that, as shown in Fig. 8, ends 41a of the angular U-shaped cross-section of the pole member 41 are rounded so as not to damage the charging cable 26.

{0045}

The securing plate 42 of the pole member 41 is secured to the top surface of the scaffolding member 43 by being fastened with a plurality of bolts 44. Since the securing plate 42 is secured, being offset toward the center of the pallet 15B relative to the pole member 41, the pole member 41 stands approximately above the edge portion 22 when the securing plate 42 is secured to the scaffolding member 43. The scaffolding member 43 is provided with sloped portions 43a at both front and rear ends thereof, which generate a thrust force that, when the wheel of a vehicle hit them, pushes the wheel inward in the pallet 15B, and thereby the vehicle is prevented from coming excessively close to the pole member 41. Note that the edge portion 22 may be formed more widely than a conventional one and the pole member 41 may directly be secured thereto so as to omit the scaffolding member 43. In addition, if the pole member 41 can be formed in a sufficiently thin manner, the pole member 41 may be directly secured to the top surface of the edge portion 22 having a narrow width, as in the conventional case.

{0046}

As shown in Fig. 8, the securing plate 42 is provided with a through-hole 46 in an area surrounded by the pole member 41, and, as shown in Figs. 9(a) and (b), the through-hole 46 is a penetrating hole that also penetrates through the top surface of the edge portion 22. Then, one end (the

proximal end) of the charging cable 26 passes through the through-hole 46 and is electrically connected to a power supplying line 47 disposed at the under surface or the like of the pallet 15B by means of a power-supply connector 48 or the like. Note that a grommet 49 made of, for example, rubber, is fitted to the through-hole 46 to secure, protect, and insulate the proximal end of the charging cable 26.

{0047}

The internal space of the pole member 41 serves as a cable accommodating portion 51 and, as shown in Figs. 6, 7(a), 9(a), and 9(b), the charging cable 26 contracted into the coil-like form is accommodated therein. As shown in Fig. 7(b), when the charging cable 26 is pulled out therefrom, the charging cable 26 can be extended, increasing in length, from the bottom end of the pole member 41 toward the top surface of the pallet 15B. Note that a U-shaped cut-out portion 52 that can hold an intermediate portion of the charging cable 26 is formed at the rear surface of the pole member 41 at the top end thereof. In addition, a connector holding portion 53 that holds the charging connector 35 of the charging cable 26 at a position higher than the floor surface of the pallet 15B is provided at the rear surface side of the pole member 41 at an intermediate portion thereof.

{0048}

Although the forms shown in Figs. 8, 9(a), and 9(b) are

conceivable as the shape of the connector holding portion 53, it does not mean that the shape is limited. However, it is necessary to form the connector holding portion 53 in such a way that the charging connector 35 is held in a direction parallel to the front-to-rear direction of the pallet 15B so that the charging connector 35 held by the connector holding portion 53 does not significantly protrude toward the center portion of or outward from the pallet 15B. The connector holding portion 53 may be a coupler having the same dummy shape as the charging connection portion of the electrically-powered vehicle. It is preferable that the heights of the pole member 41 and the connector holding portion 53 be approximately set at a height where a user can naturally take the charging connector 35 held by the connector holding portion 53 into his/her hand without having to bend down.

{0049}

When the electrically-powered vehicle EV is parked on the pallet 15B configured in this way and charging thereof is performed by means of the charging device 16B, the electrically-powered vehicle EV is stopped on the pallet 15B in a position where the charging connection portion (not shown in the drawings) provided in the vehicle body of the electrically-powered vehicle EV is close to the charging device 16B (pole member 41), and, subsequently, charging is performed by removing the charging connector 35 of the

charging cable 26 from the connector holding portion 53 and connecting it to the charging connection portion of the electrically-powered vehicle EV. The charging cable 26 contracted into the coil-like form is stretched at this time, connecting between the bottom end of the pole member 41 and the charging connection portion in a straight shortest distance. Accordingly, the charging cable 26 does not come into contact with the floor surface of the pallet 15B.

{0050}

When the electrically-powered vehicle EV is leaving, since the charging cable 26 contracts into the coil-like form due to removal of the stretching force, when the charging connector 35 is removed from the charging connection portion of the electrically-powered vehicle EV, the charging cable 26 can easily be accommodated in the cable accommodating portion 51 inside the pole member 41. Then, the distal end side of the charging cable 26 is suspended from the cut-out portion 52 provided at the top end of the pole member 41, and the charging connector 35 is held by the connector holding portion 53.

{0051}

In this charging device 16B, since the internal space of the pole member 41 having a rectangular U-shaped cross-section serves as the cable accommodating portion 51 that accommodates the charging cable 26 without modification, it is possible to

achieve the storability of the charging cable 26 with a compact, simple and low-cost configuration having a good external appearance. Moreover, since the charging connector 35 of the charging cable 26 is positioned at a higher location than the floor surface of the pallet 15B by being held by the connector holding portion 53 provided at the pole member 41, the user can take the charging connector 35 into his/her hand to connect it to the charging connection portion of the electrically-powered vehicle EV without having to bend down, which makes it extremely easy to perform the connection work.

{0052}

Furthermore, since the charging cable 26 pulled out from the pole member 41 (cable accommodating portion 51) is connected by being linearly extended from the proximal end portion of the pole member 41 to the charging connection portion of the electrically-powered vehicle EV and contracts after being connected due to the contractibility thereof, the charging cable 26 can be connected without causing any drooping thereof and also in the shortest distance. Therefore, it is possible to make the charging cable 26 reliably reach the charging connection portion of the electrically-powered vehicle EV and also to avoid various inconveniences caused by drooping of the charging cable 26. Moreover, since the connection work can be performed without causing the charging cable 26 to touch the floor surface of

the pallet 15B, it is possible to prevent the charging cable 26 from getting dirty or damaged.

{0053}

By forming the pole member 41 with a material that will not harm a parked vehicle, such as a hard rubber, polyurethane, or the like, or by covering at least the surface thereof with a soft material such as a soft plastic, a soft rubber or the like, in the unlikely event of a vehicle coming into contact with the pole member 41 when the vehicle enters/leaves the parking lot, it is possible to prevent damage to the vehicle. In addition, by forming the pole member 41 with a flexible material (for example, polyurethane, a hard rubber, or the like), and thereby imparting the pole member 41 with flexibility, in the unlikely event of a parked vehicle colliding with the pole member 41, it is possible to prevent damage to the vehicle due to bending of the pole member 41, and breakage of the pole member 41 can be avoided at the same time.

{0054}

Note that, although the charging cable 26 in this embodiment extends from the bottom end of the pole member 41, the charging cable 26 may be configured so as to extend from the top end of the pole member 41.

{0055}

{Third Embodiment}

Figs. 10 to 13 show the pallet 15C and the charging device 16C according to the third exemplary arrangement. The basic configuration of the pallet 15C is the same as that of the pallets 15A and 15B described in the first embodiment and the second embodiment except for the portion relating to the charging device 16C. The charging device 16C in this case may also be provided at one of the left and right edge portions 22 of the plate 15C or may be provided at both of them, and, in addition, it may be provided at any of the front, rear, and middle of the edge portions 22 at any number of locations.

{0056}

This charging device 16C is formed by making the pole member 41 of the charging device 16B in the second embodiment collapsible. Specifically, an opening 61 is formed by cutting out a portion of the top surface of the edge portion 22 of the pallet 15C in a rectangular shape, a pivot shaft 62 is provided at the inner surface side of the edge portion 22 adjacent to one end (for example, front end) of this opening 61 so as to protrude perpendicularly and horizontally, and the proximal end of the pole member 63 is supported by this pivot shaft 62 in a freely pivotable manner. With this configuration, the pole member 63 can be pivoted between a collapsed position 63a, in which it is collapsed down so as to be positioned below a top surface of the edge portion 22, as

shown in Fig. 10, and an upright position 63b, in which it stands perpendicularly to the top surface of the edge portion 22, as shown in Fig. 11. When the pole member 63 is in the collapsed position 63a, the pole member 63 is flush with the top surface of the edge portion 22.

{0057}

The pole member 63 is formed of, for example, a rod member (channel member) having a rectangular U-shaped cross-section, as with the pole member 41 in the second embodiment. A surface of the pole member 63 that serves as the top surface when placed in the collapsed position 63a is provided with a pulling handle hole 65 at the free end thereof, and a U-shaped cut-out portion 66 (folding means) is formed at the proximal end thereof. Note that a stopper 67 for stopping the pole member 63 at the collapsed position 63a protrudes from the inner surface of the edge portion 22 of the pallet 15C (see Fig. 11).

{0058}

The internal space of the pole member 63 serves as a cable accommodating portion 69, and a partition plate 70 (see Fig. 11) that separates the cable accommodating portion 69 side and the pivot shaft 62 side is secured to the proximal portion side of the pole member 63. This partition plate 70 is provided with a through-hole (not shown in the drawings), and, as with the second embodiment, the charging cable 26

passes through this through-hole, and the charging cable 26, when contracted into the coil-like form, is accommodated in the cable accommodating portion 69, as shown in Fig. 11.

{0059}

The pole member 63 can be collapsed down into the collapsed position 63a in the state in which the charging cable 26 is accommodated in the cable accommodating portion 69 in the aforementioned way. Since the charging connector 35 of the charging cable 26 is positioned at the free end of the pole member, when the pole member 63 stands in the upright position 63b in the state in which the charging cable 26 is accommodated in the cable accommodating portion 69 of the pole member 63, the charging connector 35 of the charging cable 26 accommodated in the cable accommodating portion 69 is held by the pole member so as to be positioned at a location higher than the floor surface of the pallet 15C.

{0060}

When the pole member 63 stands in the upright position 63b, as shown in Fig. 11, and the charging cable 26 is pulled out from the cable accommodating portion 69, the charging cable 26 can be stretched from the bottom end portion of the pole member 63 toward the top surface side of the pallet 15C, as shown in Fig. 12. Then, even in the state in which the charging cable 26 extends from the bottom end portion of the pole member 63 as described above, the pole member 63 can be

collapsed down into the collapsed position 63a, as shown in Fig. 13. At this time, with the charging cable 26 passing through the U-shaped cut-out portion 66 formed at the proximal end of the pole member 63, the pole member 63 can be collapsed down into the collapsed position 63a without shearing the charging cable 26.

{0061}

When the electrically-powered vehicle EV is parked on the pallet 15C configured as described above and charging thereof is performed by means of the charging device 16C, the electrically-powered vehicle EV is stopped on the pallet 15C in a position where the charging connection portion (not shown in the drawings) provided in the vehicle body of the electrically-powered vehicle EV is close to the charging device 16C (pole member 63), subsequently, the pole member 63 is moved from the collapsed position 63a so as to stand in the upright position 63b, next, the charging cable 26 and the charging connector 35 accommodated in the cable accommodating portion 69 inside the pole member 63 are taken out, and the charging connector 35 is connected to the charging connection portion of the electrically-powered vehicle EV. The charging cable 26 contracted into the coil-like form is stretched out, connecting between the bottom end side of the pole member 63 and the charging connection portion of the electrically-powered vehicle EV in a straight and its shortest distance,

and since the contractibility thereof causes the contraction of the cable, the charging cable 26 does not come into contact with the floor surface of the pallet 15C. Then, as needed, the pole member 63 is returned to the collapsed position 63a as shown in Fig. 13.

{0062}

Since this charging device 16C also has the internal space of the pole member 63 having a rectangular U-shaped cross-section which serves as the cable accommodating portion 69 that accommodates the charging cable 26 without modification, it is possible to achieve the storability of the charging cable 26 with a compact, simple and low-cost configuration having a good external appearance. Moreover, since the charging connector 35 of the charging cable 26 accommodated in the cable accommodating portion 69 is positioned at a location higher than the pallet 15C when the pole member 63 stands in the upright position 63b, the user can take the charging connector 35 into his/her hand to connect it to the charging connection portion of the electrically-powered vehicle EV without having to bend down, which makes it easy to perform the connection work.

{0063}

In addition, as with the charging device 16B in the second embodiment, since this charging device 16C also has the charging cable 26 which is pulled out from the pole member 63

(cable accommodating portion 69) to be connected by being directly extended from the proximal portion of the pole member 63 to the charging connection portion of the electrically-powered vehicle EV, the charging cable 26 can be connected without causing any drooping thereof and also in the shortest distance, and it is possible to avoid the inconveniences caused by drooping of the charging cable 26 as well as getting the charging cable 26 dirty or damaged.

{0064}

Furthermore, since the charging cable 26 can be accommodated inside the pole member 63, and the pole member 63 can be collapsed down into the collapsed position 63a when the charging cable 26 is not in use, the external appearance can be improved by making the charging cable 26 and the pole member 63 inconspicuous, and it is also possible to eliminate concerns about the electrically-powered vehicle EV or other vehicle coming into contact with the pole member 63. In addition, even when the charging cable 26 is in use, that is, in the state in which the charging cable 26 is extended from the bottom end portion of the pole member 63, the pole member 63 can be collapsed down into the collapsed position 63a with the charging cable 26 passing through the cut-out portion 66, therefore, it is possible to prevent the pole member 63 from becoming a hindrance to the user and to simultaneously improve the external appearance.

{0065}

As shown in Fig. 14, the pole member 63 may be provided with a locking mechanism 72 so that the pole member 63 can be locked in the upright position 63b. As the locking mechanism 72, a configuration such as one which has a linkage member 74 that can be folded in two links and that connects between an intermediate portion of the pole member 63 and a bracket 73 provided at an inner-circumferential portion of the opening 61 can be employed. By providing such a locking mechanism 72, the pole member 63 can reliably be kept standing in the upright position 63b.

{0066}

Note that, also with the charging device 16C, by forming the pole member 63 of a material that will not harm a parked vehicle, such as a hard rubber, polyurethane, or the like, or by covering at least the surface thereof with a soft material such as a soft resin, a soft rubber, or the like, when the pole member 63 is left in the upright position 63b and a vehicle enters/leaves the parking lot, and in the unlikely event of the vehicle coming into contact with the pole member 63, it is possible to prevent damage to the vehicle. In addition, by forming the pole member 63 of a flexible material (for example, polyurethane, a hard rubber, or the like), thereby imparting the pole member 63 with flexibility, in the unlikely event of a parked vehicle colliding with the pole

member 63, damage to the vehicle can be prevented due to bending of the pole member 63, and breakage of the pole member 63 can be avoided at the same time.

{0067}

Note that the present invention is not limited only to the examples of the individual embodiments described above, and, as has been described at the beginning of the embodiments of the present invention, it can be employed in multi-storey mechanical parking lots with other systems so long as the multi-storey mechanical parking lots have a vehicle mounting function employing a pallet. In addition, a single pallet may be configured, for example, employing a mixture of the techniques of the charging devices 16A to 16C in the first to third embodiments.

{Reference Signs List}

{0068}

1 multi-storey mechanical parking lot

4 parking tower

5 turntable

11 ascending/descending pathway

12 transport platform

14 vehicle housing shelf

15A, 15B, 15C pallet

16A, 16B, 16C charging device

22 edge portion

26 charging cable
27, 51, 69 cable accommodating portion
28 accommodating hollow portion
29 lid member
35 charging connector
41, 63 pole member
43 scaffolding member
53 connector holding portion
63a collapsed position
63b upright position
66 cut-out portion (folding means)
EV electrically-powered vehicle

{Claim 1}

A pallet for a multi-storey mechanical parking lot, the pallet configured for an electrically-powered vehicle to park on and to transport the vehicle to a predetermined parking position, comprising:

a charging device that can charge a battery installed in the electrically-powered vehicle while the electrically-powered vehicle is parked on the pallet,

wherein the charging device has:

a charging cable arranged for connection to the pallet side at one end thereof, that is provided with a charging connector at the other end which can be connected to a charging connection portion of the electrically-powered vehicle, that can be expanded and contracted in a curled cord-like form, and that is contracted into a coil-like form when a stretching force is not exerted thereon; and

a cable accommodating portion that is provided in the pallet and that accommodates the charging cable when contracted into the coil-like form,

wherein the charging cable is arranged for connecting a proximal portion of the charging cable and the charging connection portion without causing any drooping of the charging cable by the contractibility which makes the charging cable contracted into the coil-like form, when the charging connector is being connected to the charging connection portion of the electrically-powered vehicle.

{Claim 2}

The pallet for the multi-storey mechanical parking lot according to Claim 1, wherein the cable accommodating portion comprises an accommodating hollow portion provided as a hollow shape along an edge portion of the pallet and an openable/closable lid member for closing an opening at an upper part of the accommodating hollow portion.

{Claim 3}

The pallet for the multi-storey mechanical parking lot according to Claim 1, wherein the cable accommodating portion is provided inside an upright pole member on an edge portion of the pallet, arranged for the charging cable to extend from a lower part or an upper part of the pole member, and arranged for the charging connector to be held by the pole member so as to be positioned at a location higher than the pallet when the charging cable is accommodated in the cable accommodating portion of the upright pole member.

{Claim 4}

The pallet for the multi-storey mechanical parking lot according to Claim 3, wherein, in the state in which the charging cable is accommodated in the cable accommodating portion, the pole member can be pivoted between a collapsed position, in which the pole member is folded so as to be positioned below the top surface of the edge portion of the pallet, and an upright position, in which the pole member stands perpendicularly to the top surface of the edge portion.

{Claim 5}

The pallet for the multi-storey mechanical parking lot 15 according to Claim 4, further comprising:

folding means for enabling the pole member to be folded into the collapsed position in the state in which the charging cable extends from the lower part of the pole member.

{Claim 6}

The pallet for the multi-storey mechanical parking lot according to any one of Claims 3 to 5, wherein at least a surface of the pole member is of a material that does not harm the parked vehicle.

{Claim 7}

The pallet for the multi-storey mechanical parking lot according to any one of Claims 3 to 5, wherein the pole member has flexibility.

{Claim 8}

The multi-storey mechanical parking lot comprising the pallet according to any one of Claims 1 to 5.