[DESCRIPTION]

[Invention Title]

AUTO WAGON DEVICE, CONTROL METHOD FOR DEVICE, AND CONSTRUCTION METHOD USING DEVICE

[Technical Field]

The present invention relates to an auto wagon device, a control method for the device, and a construction method using the device.

Specifically, the present invention relates to an auto wagon device for transporting utility unit modules to a construction site, aligning the utility module units in a longitudinal direction so as to be suitable for construction, joining (combining) the units, and uniformly performing a lifting operation, a control method for the device, and a construction method using the device.

[Background Art]

In general, in places that need to be maintained in a clean or super-clean state, for example, semiconductor fabs, TFT-LCD fabs, PDP fabs, factories for manufacturing medicine and medical supplies or food, workplaces for producing or assembling optical products or printing or precision machinery, operating rooms, or

the like, fine or ultrafine dust or mist heavily affects the quality of products. Therefore, there is provided a clean room for maintaining a temperature and humidity within a predetermined range through isothermal-isohumidity control and preventing vibration.

In particular, a semiconductor fab for producing silicon wafers is a large-scale facility that is maintained in an ultra-clean state, and is generally sectioned into a fab floor and an underlying sub-fab floor. A waffle-slab, which is a lattice-structured concrete slab in which porous grating panels or steel grating panels for supporting equipment are laid, is formed between the fab floor and the sub-fab floor. In some cases, the semiconductor fab may be formed in a multiple floor structure.

Here, the sub-fab floor may be divided into a clean sub-fab floor, on which pipe racks are installed, and a facility sub-fab floor.

During conventional construction of a semiconductor fab, pipe building work is performed as follows: base pipe building work is performed by installing pipe racks in multiple layers on the columns located in the clean sub-fab floor in the construction site, installing passage scaffolds for installation, inspection and

manipulation, and installing various gas and liquid transport pipes and air-conditioning ducts horizontally on the multi-layered pipe racks in the construction site, and thereafter, hookup work is performed by connecting the points of connection (POCs) of the base pipes to various types of equipment located in respective functional regions disposed in the fab floor, typically including a chemical mechanical planarization (CMP) region, an oxidation (OX) region, a photolithography (LITHO) region, a dry etching (ETCH) region, a wet etching (WET) region, a thin film (TF) formation region, a metal deposition (MP) region, an ion implantation (IMP) region, a diffusion (DIFF) region, and an integration (INT) region, and connecting the POCs of the base pipes to various auxiliary facilities, pumps, valve manifold boxes (VMPs), cabinets, etc. located in the facility sub-fab floor.

Described in more detail, the hookup or equipment connection work, which is performed after the base pipe building work described above, serves to complete equipment installation and various types of electrical and fluidal connection so that the equipment is capable of operating according to the purpose of use thereof after installation.

In semiconductor fabs, TFT-LCD fabs, or PDP fabs,

the base pipe building work and the hookup work described above require various kinds of work in various technological fields, such as electrical and electronic hookup, process cooling water pipes, ultrapure water pipes, argon, nitrogen, oxygen, helium, liquefied natural gas or vacuum pipes, various dry etching fluorine gas and wet etchant pipes, and/or air-conditioning and heating pipes.

Therefore, in the conventional method of constructing a semiconductor fab, even if engineers skilled in various technological fields effectively collaborate on construction and maintenance, there is a problem in that lifting work, which is expensive, installation of racks and supports, and penetration work is duplicated frequently when work in the respective technological fields is performed. In addition, due to problems such as delays in collaboration, confusion in selection of wiring and piping routes, duplication of labor, complexity of the workplace, frequent accidents, the risk of fire in welding, and difficulty in maintaining uniform quality, it is difficult to efficiently perform construction and thus difficult to effectively shorten a construction period.

Meanwhile, regarding a pipe rack, Patent Registration No. 10-1466590 discloses a pre-assembled rack module and a clean room construction method using the same (Conventional Art 1), Patent Registration No. 1901691489 discloses a pipe module and a method of installing the pipe module (Conventional Art 2), Patent Laid-open Publication No. 10-2017-0000278 discloses a pipe-integrated module and a method of installing the pipe-integrated module (Conventional Art 3), and Patent Registration No. 10-1505579 discloses a pipe rack structure or a beam-column joint structure using prestressed precast concrete and a construction method thereof (Conventional Art 4).

These Conventional Arts 1 to 4 have a problem in that when lifting work is performed to move pipe racks upwards, the lateral space between a column and another column is not capable of being utilized, and other processes are increasingly likely to be delayed.

[Conventional Art Documents]

[Patent Documents]

(Patent Document 0001) Patent Registration No. 10-1466590 (published on November 28, 2014)

(Patent Document 0002) Patent Registration No. 1901691489 (published on December 30, 2016)

(Patent Document 0003) Patent Laid-open Publication No. 10-2017-0000278 (January 2, 2017)

(Patent Document 0004) Patent Registration No. 10-1505579 (published on March 26, 2015)

[Disclosure]

[Technical Problem]

It is an object of the present invention to provide an auto wagon device for transporting utility unit modules to a construction site, aligning the utility module units in a longitudinal direction so as to be suitable for construction, joining (combining) the units, and uniformly performing a lifting operation, a control method for the device, and a construction method using the device.

[Technical Solution]

In order to accomplish the above object, an auto wagon device according to the present invention is configured to transport utility unit modules to a construction site, align the utility unit modules in a longitudinal direction so as to be suitable for

construction, and uniformly perform a lifting operation.

In addition, the auto wagon device includes a lower plate (10), and an upper plate (20) configured to be moved upwards away from or moved downwards toward the lower plate (10).

The upper plate (20) is provided on the top surface thereof with a plurality of direction-change and transport wheels (21).

In addition, each of direction-change and transport wheels (21) is configured as a gear having threads and is inclined in a width direction thereof to help transportation and direction change of a rack (R) supported by the top surface of the upper plate (20).

In addition, the lower plate (10) includes a driving wheel (11) provided at one side thereof, the driving wheel (11) being configured to receive power from a driving-wheel motor (11a) and acquire directionality from a steering device (11b), and an auxiliary wheel (12) configured as a caster composed of a plurality of wheels to help change the direction of the lower plate (10).

In addition, the lower plate (10) includes a battery (30) configured to supply power, a spiral-driving motor (40) configured to be driven using power supplied from the battery (30), a shaft (50) connected at one end thereof to the spiral-driving motor (40) so as to be driven by receiving rotational force, a spiral lift (60) connected to another end of the shaft (50) so as to be moved upwards or downwards using driving force transmitted from the shaft (50) and fixed at respective ends thereof to the lower plate (10) and the upper plate (20), an auxiliary device (70) implemented as an X-lift type and fixed at respective ends thereof to the lower plate (10) and the upper plate (20) to prevent shaking during ascent or descent of the upper plate (20), and a main control panel (80) configured to perform a wireless relay function, an inverter function, and an operation signal input function.

In addition, the spiral lift (60) has an outer circumferential surface formed in a spiral shape, the shaft (50) is connected to the outer circumferential surface of the spiral lift (60), and the spiral lift (60) is moved upwards or downwards by rotational force applied from the spiral-driving motor (40).

In addition, the upper plate (20) is configured to have an empty interior, and includes an auxiliary frame (22) provided therein, to which the direction-change and transport wheels (21) are connected, and holes formed in regions corresponding to the direction-change and transport wheels (21), thus facilitating repair of the upper plate (22) when the upper plate (22) is worn.

A construction method using the above-described auto wagon device includes: (a) loading racks R on the upper side of an upper plate; (b) transporting the racks R to a construction site after the loading; (c) aligning auto wagon devices so as to be suitable for the construction site after the transporting; (d) combining utility unit modules loaded on the racks R after the aligning; (e) moving a spiral lift upwards after the combining utility unit modules; and (f) performing and completing construction after the moving a spiral lift upwards.

In addition, the above-described auto wagon device is controlled so as to transport a plurality of pipe racks R to a construction site based on a control signal from a main control panel (80) and to be automatically aligned in the state of supporting the plurality of pipe

racks R.

In addition, the auto wagon device is controlled so as to uniformly move the plurality of pipe racks R upwards based on a control signal from the main control panel (80).

[Effects of the Invention]

According to an auto wagon device, a control method for the device, and a construction method using the device according to the present invention, the present invention exhibits effects of conveniently transporting a plurality of utility unit modules to be constructed from a source (a transportation vehicle or the like) to a construction site, aligning the utility unit modules to be constructed so as to be suitable for construction, combining (bonding) the aligned utility unit modules, and uniformly performing a lifting operation so that construction commences.

In this case, when the utility unit modules are moved upwards to the ceiling, the present invention does not affect spaces other than the space required for ascent, thereby exhibiting an effect of improving space utilization.

[Brief Description of Drawings]

FIG. 1 is a view showing the ascent of an upper plate in an auto wagon device according to the present invention.

FIG. 1A is a view showing the top surface structure of the upper plate in the auto wagon device according to the present invention.

FIG. 2 is a view showing the descent of the upper plate in the auto wagon device according to the present invention.

FIG. 3 is a view of the auto wagon device of FIG. 1 when viewed from one side.

FIG. 4 is a view of the auto wagon device of FIG. 2 when viewed from one side.

FIG. 5 is a view of the auto wagon device of FIG. 1 when viewed from the front that is oriented in a direction perpendicular to one side.

FIG. 6 is a view of the auto wagon device of FIG. 2 when viewed from the front that is oriented in a direction perpendicular to one side.

FIG. 7 is a view showing an example in which racks R are loaded on the auto wagon device according to the present invention and are constructed by the same.

[Detailed Description of the Invention]

It should be understood that the terms or words used in the specification and appended claims should not be construed as being limited to general and dictionary meanings but be construed based on the meanings and concepts according to the spirit of the present invention on the basis of the principle that the inventor is permitted to define appropriate terms for the best explanation.

Therefore, embodiments described in the specification and the configuration of elements illustrated in the drawings are merely considered to be preferred embodiments and do not represent all the technical ideas of the present invention, and thus it should be understood that various equivalents and modifications may exist at the time of filing this application.

Prior to describing the present invention with reference to the accompanying drawings, it is to be noted that matters unnecessary to show the subject matters of the present invention, that is, well-known configurations that can be apparently added by those skilled in the art, are neither shown nor described in detail.

The present invention relates to an auto wagon device, a control method for the device, and a construction method using the device.

[60] Specifically, the present invention relates to an auto wagon device for transporting utility unit modules to a construction site, aligning the utility unit modules in a longitudinal direction so as to be suitable for construction, and uniformly performing a lifting operation, a control method for the device, and a construction method using the device.

The present invention will be described with reference to the accompanying drawings.

An auto wagon device shown in FIGs. 1 and 2 is configured such that an upper plate (20) is moved upwards away from or moved downwards toward a lower plate (10).

To this end, the lower plate (10) may be provided with a battery (30) configured to supply power, a spiral-driving motor (40) configured to be driven using power supplied from the battery (30), a shaft (50) connected at one end thereof to the spiral-driving motor (40) so as to be driven by receiving rotational force, a spiral lift (60) connected to the other end of the shaft (50) so as to be moved upwards or downwards using the driving force

transmitted from the shaft (50) and fixed at respective ends thereof to the lower plate (10) and the upper plate (20), an auxiliary device (70) implemented as an X-lift type and fixed at respective ends thereof to the lower plate (10) and the upper plate (20), thereby preventing shaking during ascent or descent of the upper plate (20), and a main control panel (80) configured to perform a wireless relay function, an inverter function, and an operation signal input function.

In this case, the spiral lift (60) includes an outer circumferential surface formed in a spiral shape, and the shaft (50), which is connected to the spiral-driving motor (40), is connected to the outer

circumferential surface of the spiral lift (60).

Accordingly, as the shaft (50) is rotated by the spiral-driving motor (40), it drives the spiral lift (60) so that the spiral lift (60) is capable of ascending or descending.

In this case, the outer side of the spiral lift (60) is covered by a cover, thereby improving the aesthetic appearance of the spiral lift (60), which is formed in a spiral shape.

In addition, referring to FIG. 3, a plurality of driving wheels (11) may be provided at corner regions of the lower plate (30) so as to be oriented in the downward direction of the lower plate (30).

These driving wheels (11) receive a control signal from the main control panel (80) to drive the auto wagon device according to the present invention.

Specifically, the driving wheels (11) may receive power from driving-wheel motors (11a) connected to the lower plate (10), and may acquire directionality from steering devices (11b) that receive control signals from the main control panel (80).

In addition, a plurality of auxiliary wheels (12)

may be disposed at regular intervals on a portion of the bottom surface of the lower plate (30). Each auxiliary wheel (12) is configured as a caster composed of three wheels, and serves to help change the direction of the auto wagon device according to the present invention.

Further, referring to FIG. 1 among the accompanying drawings, a plurality of direction-change and transport wheels (21) may be disposed on the top surface of the upper plate (20).

Each direction-change and transport wheel (21) is configured such that a portion thereof is embedded in the top surface of the upper plate (20) and the remaining portion thereof is exposed and such that it is secured to the upper plate (20) via a shaft so as to be rotated by external force.

When a rack (R) to be described later is supported by the upper plate (20), the direction-change and transport wheels (21) function to help transport the rack (R) and to help rotate the rack (R) on the upper plate (20).

To this end, each direction-change and transport wheel (21) is configured as a wide gear, which has threads formed therein and is inclined in the width direction, as shown in the accompanying drawings.

In this case, the direction-change and transport wheels (21) may be formed such that neighboring ones thereof are inclined in directions opposite each other. Alternatively, two neighboring direction-change and transport wheels (21), which are located opposite each other with respect to the center of the upper plate (20) in the longitudinal direction, are inclined in directions opposite each other, and the other direction-change and transport wheels (21), which are located further outwards than the two neighboring wheels (21), are inclined in the same directions as the two neighboring wheels (21).

In addition, the upper plate (20) may be configured in the form of a hollow frame, and may include an auxiliary frame (22) provided therein. The auxiliary frame (22) exhibits an effect of increasing the strength and supporting force of the upper plate (20). To this end, the auxiliary frame (22) is preferably formed of a material having a predetermined strength.

In addition, when the auxiliary frame (22) is included, the shafts of the direction-change and transport wheels (21) may be connected to the auxiliary frame (22), and holes may be formed in the upper plate (20) at positions corresponding to the direction-change and transport wheels (21).

Accordingly, when the top surface of the upper plate (20) is worn and thus it is difficult to uniformly support the rack (R) thereon due to frequent support and transportation of the rack (R) on the top surface of the upper plate (20), it may be necessary to remove and replace only the top surface of the upper plate (20), thereby providing an effect of simplifying repair.

As described above, the main control panel (80) performs a wireless relay function, an inverter function, and an operation signal input function. Specifically, the main control panel (80) may be configured to communicate with a separate external terminal to perform specific notification or to transmit and receive a control signal, or may be configured to function as a manipulator to enable direct input of a control signal.

Meanwhile, depending on the design conditions, the auxiliary device (70), which is configured in the form of an X-lift having a single x-shaped structure, may be changed to have two x-shaped structures such that each auxiliary device (70) has a '¬' shape and is fixed at respective ends thereof to the upper plate (20) and the lower plate (10), and the spiral lift (60) may be configured so as to move a predetermined distance from

the upper plate (20).

Specifically, the spiral lift (60) may move a predetermined distance using a guide structure. The guide structure is a structure that is predictable by those skilled in the art. A guide groove may be formed in the bottom surface of the upper plate (20), each spiral lift (60) may be guided rather than being inserted into the guide groove, and the guide groove may be formed in a longitudinal movement direction.

Accordingly, although not shown in the drawings, while ascending, the upper plate (20) is capable of moving slightly in the lateral direction. Thus, it is to be understood that an effect of efficiently helping the fine alignment of the rack (R) supported by the upper plate (20) is provided.

According to the auto wagon device of the present invention having the above-described structure, in the state of being supported by the top side of the upper plate (20), racks R are transported to a construction site and are aligned in a row. When the alignment is completed, the spiral lift (60) is moved upwards, and construction commences.

A construction method using the auto wagon device according to the present invention includes:

(a) a step of loading racks R on the upper side of the upper plate;

(b) a step of transporting the racks R to a construction site after loading the same;

(c) a step of aligning the auto wagon devices so as to be suitable for the construction site after transportation to the construction site;

(d) a step of combining utility unit modules loaded on the racks R after alignment;

(e) a step of moving the spiral lift upwards after combining the utility unit modules; and

(f) a step of performing and completing construction after moving the spiral lift upwards.

For this construction method, reference may be made to FIG. 7. As shown in FIGs. 1 to 6, the construction method may be realized using a sensor (S) provided at the lower plate (10). In this case, the sensor (S) may be implemented as any of various well-known sensors, so long as it is capable of functioning to detect an object ahead.

That is, the above-described alignment may be realized by the sensor (S) provided at one side of the lower plate (10).

Meanwhile, the auto wagon devices need to be accurately aligned in a row. The reason for this is to connect pipes located on the racks R without error.

A method of controlling the auto wagon device to realize this will be described below.

To this end, depending on the design conditions, each of signal-outputting sensors may be provided at a respective one of the corner regions of one side of the lower plate (10) of the auto wagon device. The signal-outputting sensors may be configured to output signals (laser beams or the like) in the same direction as each other. Signal-receiving diodes may be provided at the side opposite the side at which the sensors are provided.

In this case, multiple signal-receiving diodes are provided at each of the corner regions, and are configured to have the same signal reception direction as each other.

Based on this, the auto wagon device may be controlled in response to a control signal using the method described below.

Alignment control method

A. step of controlling alignment

The step of controlling alignment is a step in which the auto wagon devices are controlled so as to be aligned in response to a control signal.

B. step of determining whether signals have been input to two signal-receiving diodes

The step of determining whether signals have been input to two signal-receiving diodes is a step of determining whether both of the signals output from the two signal-outputting sensors have been completely received through a plurality of signal-receiving diodes after the step of controlling the alignment.

Specifically, as described above, multiple signal-receiving diodes are provided at each of two corners.

Thus, if the auto wagon devices are not aligned, the signal may not be received by the signal-receiving diodes provided at any one of the corners.

Therefore, in the step of determining whether signals have been input to the two signal-receiving diodes, when it is determined that both of the signals have not been input, the step of controlling the alignment is performed again.

C. step of completing alignment

The step of completing the alignment is a step of completing alignment control when it is determined that both of the signals have been input in the step of determining whether the signals have been input to the two signal-receiving diodes.

According to other design conditions, in the state in which the auto wagon devices are completely aligned, a plurality of spiral lifts (60), provided on the plurality of lower plates (10), may be uniformly moved upwards while maintaining the same height.

The main control panel (80) may be configured to stop the operation when uniform ascent is not realized.

This is performed using the method described below.

Uniform ascent control method

A. step of controlling spiral lifts

The step of controlling the spiral lifts is a step of controlling the spiral lifts (60) of “n” auto wagon devices such that the spiral lifts ascend.

In this case, each spiral lift (60) is provided with an output sensor for outputting a signal and a reception sensor for receiving a signal. For example, in order to

receive a signal output from an output sensor provided at one spiral lift (60), a reception sensor is provided at one side of another spiral lift (60) adjacent thereto, and an output sensor is provided at the opposite side of the other spiral lift (60). In addition, still another spiral lift (60) adjacent thereto is provided with a reception sensor.

In this case, the spiral lifts adjacent to each other may be spiral lifts (60) that are disposed on one lower plate (10) so as to be adjacent to each other in the longitudinal direction or in the width direction, or may be a spiral lift (60) provided at one lower plate (10) and another spiral lift (60) provided at another neighboring lower plate (10).

To this end, referring to FIG. 7, the distance range of the signal output from the output sensor is set to a level capable of spanning the distance between the auto wagon devices.

B. step of determining whether signals have been input to all of “n” spiral lifts

The step of determining whether signals have been input to all of “n” spiral lifts is a step of determining whether the signals output from the output sensors are being received by the reception sensors among the “n”

spiral lifts (60) having the above-described structure.

If all of the reception sensors are uniformly receiving signals, the step of controlling the spiral lifts is continuously performed, and is terminated.

C. emergency stop step

The emergency stop step is a step of performing, by the main control panel (80), emergency stop of the ascent control when it is determined that a signal is not received by the reception sensor of at least one spiral lift (60) in the step of determining whether signals have been input to all of the “n” spiral lifts.

To this end, the main control panels (80) of all of the auto wagon devices may be configured to be interlocked between the auto wagon devices, and may be controlled by a server provided separately.

D. step of determining whether a signal is being input to a vertical array of reception sensors of each of “n” spiral lifts

The step of determining whether a signal is being input to a vertical array of reception sensors of each of the “n” spiral lifts is a step of determining, after the emergency stop step, whether there is a cylinder that is

continuously ascending in spite of the emergency stop control.

To this end, separate multiple reception sensors are further provided below the reception sensor in the spiral lift (60). The separate multiple reception sensors are a vertical array of reception sensors, which are arranged vertically. In this case, the vertical array of reception sensors are preferably spaced apart from the reception sensor by a predetermined distance.

The emergency stop is performed when the heights of the spiral lifts (60) are not uniform. However, due to this difference in height, if the vertical array of reception sensors are not disposed so as to be spaced apart from the reception sensor, a signal from the output sensor may be received by the vertical array of reception sensors even when the cylinder is not driven after the emergency stop.

That is, the output sensor is configured to output a signal again after the emergency stop. In this case, when a signal is received by at least one of the vertical array of reception sensors, this means that the corresponding spiral lift (60) is continuously operating due to the occurrence of error in emergency stop control

or the like.

When no signal is input to the vertical array of reception sensors, a service personnel may perform repair in the emergency stop state.

E. step of interrupting supply of energy to the determined spiral lift

When there is a cylinder in which a signal is input to the vertical array of reception sensors, this means that the spiral lift (60) is continuously ascending in spite of emergency stop control.

In this case, the step of interrupting the supply of energy to the determined spiral lift is a step of interrupting the supply of energy to the spiral lift (60) that is continuously ascending.

This step may be realized by interrupting the supply of power from the battery (30) provided at the lower plate (10) of the auto wagon device, in which the determined spiral lift (60) is included.

Only the main matters of the present invention have been described above with reference to the drawings, and various designs may be available within the technical scope, and, therefore, it is apparent that the present

invention is not limited to the configuration of the drawings.

[Description of Reference Numerals]

10: lower plate

11: driving wheel

11a: driving-wheel motor

11b: steering device

12: auxiliary wheel

20: upper plate

21: direction-change and transport wheel

22: auxiliary frame

30: battery

40: spiral-driving motor

50: shaft

60: spiral lift

70: auxiliary device

80: main control panel

S: sensor

R: rack