

A HELICAL ELEVATING SYSTEM AND METHOD OF INSTALLATION OF MECHANICAL, ELECTRICAL AND PLUMBING (MEP) MODULES USING THE SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The present application relates generally to a synchronised elevating device and more particularly to an array of helical elevating devices working in tandem with each other via an integrated software system to lift and install mechanical, electrical and plumbing (MEP) modules vertically, or to lift any loads/goods from the ground to a specific height above the ground.

2. Description of Related Art

10 Many different types of elevating devices for transfer systems are known. Typically, elevating devices in assembly and automated technologies serve to remove goods, such as work piece carriers, on transfer systems from one particular elevation to another. In addition, elevating devices serve the purpose of lifting work piece holders from a transfer path, for example, in order to perform an operation at a machining or work station.

15 A disadvantage of known elevating devices is that the individual cylinders of the elevating device are indeed commonly controllable, however, usually an asynchronous movement of the individual lifting cylinder occurs, which leads to a non-uniform lifting of the goods through the elevating device. The common control, therefore, cannot guarantee synchronous movement of the lifting cylinders. In extreme cases, this can lead to a tilting of the elevating device and to damage to the transported goods.

20 US Patent Publication No. 20030025107A1, entitled "Elevating Device With Synchronization Mechanism", discloses an elevating device for a transfer system, in particular with a pneumatic drive, for raising and/or lowering transported goods, comprising at least two lifting cylinders (3) and a synchronization device, wherein movements of the at least two lifting cylinders (3) are synchronized by means of said synchronization device.

25 US Patent No. 7073631B2, entitled "Lifting Device With Synchronization Mechanism", discloses A lifting device for a transfer system with a pneumatic drive for raising and/or lowering transported goods, comprising: a base frame; a lifting frame; means for connecting said lifting frame with said base frame and including cylinder bodies provided on one of said frames and arranged in corners of said one frame and four corner pieces provided on the other of said frames and arranged in corners of said other frame, so that said lifting frame is

connected with said base frame through said cylinder bodies and said corner pieces, said base frame being composed of four substantially L-shaped profiles, while said lifting frame is composed of four substantially U-shaped profiles; lifting means for lifting said lifting frame relative to said base frame and including at least two lifting pistons; a synchronization device
 5 provided for synchronization of movements of said at least two lifting pistons and having a shaft rotatably supported on said base frame and having a first toothing system, and a second toothing system provided on said lifting frame and meshing with said first toothing system, said first and second toothing systems being arranged in the lifting device in a protected fashion.

10 SUMMARY OF THE INVENTION

It is an object of the present invention to provide a helical elevating system for vertically transporting a mechanical, electrical and plumbing (MEP) module or loads/goods between different elevations, comprising:

- 15 (a) a base frame (60) being the bottom of the system (100) which rests stably on the ground;
- (b) at least one spiral cylinder (61) configured to perform ascending or descending of the helical elevating system (100) driven by an electro mechanically driven device mounted therein;
- 20 (c) a horizontal lifting plate (50) perpendicularly coupled to the spiral cylinder (61) at one end thereof, the horizontal lifting plate (50) being ascended and/or descended together with the ascending and descending motion of the spiral cylinder (61);
- (d) a plurality of retractable scissor legs (70) coupled to the underneath of the horizontal lifting plate (50) to ascend and descend together with the spiral cylinder (61);
- 25 (e) a plurality of height setting sensors to limit the ascending operation of the horizontal lifting plate (50); and
- (f) an integrated software control designed to operate and control of the vertically transporting of the MEP from one elevation to another elevation and allow synchronous lifting and lowering of the horizontal lifting plate (50) of multiple lifting system synchronised in series or parallel; and
- 30 (g) a display based controlling/operating device which will be used to set parameters of the lift, which also include auto height setting where the helical lifting system can come to a stop after reaching a setting height;

wherein the rotating motion of the spiral cylinder (61) in one direction elevates the horizontal lifting plate (50) to a specific height together with the MEP module mounted onto the horizontal lifting plate (50) for installation onto an elevated ceiling or the like structure .

5 A further object of the present invention is to provide a helical elevating system, wherein the horizontal lifting plate (50) is expandable by incorporating an extension frame (40) to the end thereof, and has motor as a driving mean to control the ascending or the descending vertically of the spiral cylinder (61).

10 Yet another object of the present invention is to provide a helical elevating system, wherein the scissors legs (70) are functioned as a secondary support to allow the horizontal lifting plate (50) to change elevation, and the scissor leg (70) includes an inner scissor leg and outer scissor leg, and each end of the inner and outer scissor legs are connected to the base frame (60) and the horizontal lifting plate (50).

15 Yet still a further object of the present invention is to provide a helical elevating system, wherein the ascending or descending of the horizon platform is by opening or closing of the scissor legs (70).

Another further object of the present invention is to provide a helical elevating system, wherein the base frame (60) is fitted with a plurality of wheels to facilitate the movement of the lifting system (100) and the extension frame (40) at both the ends of the horizontal lifting plate (50) is retractable or foldable.

20 Further object of the present invention is to provide a helical elevating system of Claim 1, wherein the scissor legs (70) are pivoted by a plurality of pins to allow the scissor legs (70) to ascend or descend with respect to the spiral cylinder (61).

Yet still a further object of the present invention is to provide a method of installation of MEP modules onto a ceiling with the helical elevating system, the method comprising the steps of :

- 25 (i) positioning and securing the MEP module onto a MEP hookup;
- (ii) transporting and positioning the lifting system (100) to the hookup MEP module for installation of the MEP module; and
- (iii) commencing the lifting process by initiating the motor of the lifting system to lift up the module to a predefined height; wherein the ascending of the horizontal lifting plate (50) is thus
- 30 synchronously lifted with great accuracy.

Still another object of the present invention is to provide a method of installation of MEP module, wherein the synchronous lifting and lowering of MEP rack is controlled by a plurality of controllers.

Yet still a further object of the present invention is to provide a method of installation of MEP module, further comprising a step of (vi) monitoring using a PC display in the course of lifting step.

A further object of the present invention is to provide a method of installation of MEP module, wherein an indicator or an alarm is provided in order to give warning in the course of the lifting operation.

10 A further object of the present invention is to provide a lifting system which can safely operate in temperatures ranging from -20 deg. C to 50 deg. C.

Still a further object of the present invention is to provide a helical elevating system which can be operated automatically or manually.

15 Yet still a further object of the present invention is to provide a helical elevating system which is mounted with visual alarms for the load and life for maximum safety during operations.

Further object of the present invention is to provide a helical elevating system which can be used in many applications such as moving heavy structures, maintenance, launch or construction of bridges, load transfer operations, installation or maintenance of heavy plant, positioning off-shore platforms, weighing operations, lifting on inclined cylinder axis, etc.

20 Still yet a further object of the present invention is to provide a helical elevating system, wherein the system is ease of installation, reconfiguration and extension to adapt to various working environment.

Yet another object of the present invention is to provide a helical elevating system, where a plurality of castor wheels are mounted to the base frame (60) for the ease of mobility of the system with minimum manpower.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the application are set forth in the appended claims. However, the application itself, as well as a preferred mode of use, and further objectives and advantages thereof, will best be understood by reference to the following detailed description when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of the helical elevating system according to the preferred embodiment of the present invention;

FIG. 2 is a perspective view of the base frame of the helical elevating system in accordance with the present invention;

5 FIG. 3 is a perspective view of the top frame of the helical elevating system in accordance with the present invention; and

FIG. 4 is a perspective view of the extension frame of the helical elevating system in accordance with the present invention.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In the specification, reference may be made to the spatial relationships between various components and to the spatial orientation of various aspects of components as the devices are depicted in the attached drawings.

15 The system and method will be understood, both as to its structure and operation, from the accompanying drawings, taken in conjunction with the accompanying description. It should be understood that various components, parts, and features of the different embodiments may be combined together and/or interchanged with one another, all of which are within the scope of the present application, even though not all variations and particular embodiments are shown in the drawings.

20 Referring now to the drawings wherein like reference characters identify corresponding or similar elements in form and function throughout the several views. FIG. 1 is a perspective view of the helical elevating system for installation of mechanical, electrical and plumbing (MEP) module between different elevations according to the preferred embodiment of the present invention. The helical elevating system (100) comprises: (a) a base frame (60) being
25 the bottom of the system (100) which rests stably on the ground; (b) at least one spiral cylinder (61) configured to perform ascending or descending of the helical elevating system (100) driven by an electro mechanically driven device mounted therein; (c) a horizontal lifting plate (50) perpendicularly coupled to the spiral cylinder (61) at one end thereof, the horizontal lifting plate (50) being ascended and/or descended together with the ascending and descending
30 motion of the spiral cylinder (61); (d) a plurality of retractable scissor legs (70) coupled to the underneath of the horizontal lifting plate (50) to ascend and descend together with the spiral cylinder (61); (e) a plurality of height setting sensors to limit the ascending operation of the

horizontal lifting plate (50); (f) an integrated software control designed to operate and control of the vertically transporting of the MEP from one elevation to another elevation and allow synchronous lifting and lowering of the horizontal lifting plate (50) of multiple lifting system synchronised in series or parallel; and (g) a display based controlling/operating device which will be used to set parameters of the lift, which also include auto height setting where the helical lifting system can come to a stop after reaching a setting height; wherein the rotating motion of the spiral cylinder (61) in one direction elevates the horizontal lifting plate (50) to a specific height together with the MEP module mounted onto the horizontal lifting plate (50) for installation onto an elevated ceiling or the like structure .

FIG. 2 is a perspective view of the base frame (60) of the helical elevating system (100) of the present invention. The base frame (60) is substantially a H-shaped structure comprising a pair of vertical frame (64), and two parallel beams (65), wherein the ends of the beams are perpendicular to the vertical frame (64). In between the two parallel beams (65), a pair of supporting plates (62) are provided which are used to support the spiral cylinder (61) of the helical elevating system (100). The four corners of the base frame (60) can be mounted with castor wheels (not shown) to facilitate the movement of the base frame (60) and/or the helical elevating system (100).

FIG. 3 is a perspective view of the horizon lifting plate (50) of the helical elevating system in accordance with the present invention.

FIG. 4 is a perspective view of the extension frame of the helical elevating system in accordance with the present invention.

The helical elevating system (100) of the present invention can be equipped with a safety system where a Programmable Logic Controller (PLC) is used to ensure that the lifting process operation is safe.

In a preferred embodiment, the normal length of the lifting plate (50) can be extended by incorporating an extension frame (40) to the end thereof. The spiral cylinder (61) is driven to rotate by a driving means such as a motor (not shown) to proceed with the ascending of the horizontal lifting plate (50) to install the MEP onto the ceiling at certain elevation. The motor controls the ascending or the descending vertically of the spiral cylinder (61). In the present preferred embodiment, the maximum lifting height of the spiral cylinder (61) is 4.5 m, and the length of the horizontal lifting plate (50) is ranging from 1-3 meters. The plurality of scissors legs (70) are functioned as a secondary support to allow the horizontal lifting plate (50) to change elevation. In accordance with the present invention, the scissor leg (70) includes an inner scissor leg and outer scissor leg, and each end of the inner and outer scissor legs are

connected to the base frame (60) and the horizontal lifting plate (50). In the course of ascending of the horizon lifting plate (50), the scissor legs (70) are in open condition, and when the scissor legs (70) are closed in the course of descending of the scissor legs (70).

5 In the preferred embodiment, the base frame (60) is fitted with a plurality of castor wheels to facilitate the movement of the lifting system (100). These wheels are fitted at the four corners of the base frame (60) such that the mobility of the lifting system (100) be easily controlled when installation of MEP is in progress.

10 The base frame (60) is provided with a plurality of foldable leg extension (80) mounted at each of the corners of the base frame (60). The scissor legs (70) are pivoted by a plurality of pins to allow the scissor legs (70) to ascend or descend with respect to the spiral cylinder (61).

15 As shown in FIG. 3, there is the horizon lifting plate (50) of the preferred embodiment of the present invention. The plate (50) is substantially a framework which can be used to secure a MEP rack for installation. Both the ends of the lifting plate (50) can be extended with an extension frame (40) to accommodate the size of the MEP rack that to be installed. The extension frame (40) is manually fitted to the lifting plate (50) and can be removed if the extension frame (40) is not in used. As an alternative, the extension frame (40) at both the ends of the horizontal lifting plate (50) can be made retractable or foldable.

20 FIG. 4 is a perspective view of the extension frame (40) of the present invention. The extension frame (40) is substantially a square frame, wherein one of the four edges is provided with a bracket (42) to be mounted with the end of the horizontal lifting plate (50).

In accordance with the present invention, there is provided a method of installation of MEP modules onto a ceiling or the like using the helical elevating system of the present invention. The method comprises the steps of :

25 First, positioning and securing MEP module onto a MEP hookup; secondly, positioning the helical elevating system; and thirdly processing the lifting operation of the lifting system until a predetermined height is reached; and installing the MEP module onto the ceiling.

30 A software is used to control the PLC for a seamless synchronised and integrated lifting of MEP with the lifting system (100) of the present invention. The lifting system (100) can be used to proceed to install a plurality of MEP modules in a single instructions. In the present preferred embodiment, the installation process, that is, the synchronous lifting and lowering of MEP rack is controlled by a software linked to a plurality of controllers.

The process of installation of MEP modules using the lifting system (100) is monitored using a plurality of PC displays, and any abnormal condition in the course of installation will be warned by indicators linked to the lifting system (100) of the present invention.

In accordance with the present invention, the lifting system (100) provides great flexibility, ease of installation, reconfiguration and extension of the system. As no welding is needed, the lifting system (100) can be fabricated efficiently since standard part assemblies are used, and the lifting system (100) is 30% lighter. The lifting system (100) is fitted with castor wheels and therefore the system (100) is ease of mobility, for instance, a 4-tonne module can be moved around by 4 men.

In accordance with the preferred embodiment of the present invention, the spiral cylinder is electro mechanically driven and integrated software control is used, and the height of ascending can be set. That is a plurality of height sensors are mounted to stop the lifting process at a predefined height in the lifting process,

As mentioned above, a safety system is provided via PLC logic, and the lifting capacity of the lifting system (100) of the present invention is in multiples of 10 modules in a single lift, and the size of the modules is 60 m in length and weighs 45 tonnes. In every lifting or lowering process, an electromagnetic disc brake is used to hold the lifting plate (50) in position, and the speed of the lifting system is a function of the spiral cylinder and the speed of the motor that is used to power the spiral cylinder. All these process is managed by the Integrated Software Control (ISC).

The speed of the lifting system (100) can be increased by inputting more horsepower controlled by the ISC. Similarly, if greater capacity of the lifting system is needed, more horsepower is provided by the ISC.

While the assembly and method of the present application is susceptible to various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and are herein described in detail. It should be understood, however, that the description herein of specific embodiments is not intended to limit the application to the particular embodiment disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the process of the present application as defined by the appended claims.

The particular embodiments disclosed above are illustrative only, as the application may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. It is therefore evident that the particular

embodiments disclosed above may be altered or modified, and all such variations are considered within the scope and spirit of the application. Accordingly, the protection sought herein is as set forth in the description. It is apparent that an application with significant advantages has been described and illustrated. Although the present application is shown in
5 a limited number of forms, it is not limited to just these forms, but is amenable to various changes and modifications without departing from the spirit thereof.

WHAT IS CLAIMED IS:

1. A helical elevating system (100) for vertically transporting a mechanical, electrical and plumbing (MEP) module between different elevations, comprising:
 - (a) a base frame (60) being the bottom of the system (100) which rests stably on the ground;
 - (b) at least one spiral cylinder (61) configured to perform ascending or descending of the helical elevating system (100) driven by an electro mechanically driven device mounted therein;
 - (c) a horizontal lifting plate (50) perpendicularly coupled to the spiral cylinder (61) at one end thereof, the horizontal lifting plate (50) being ascended and/or descended together with the ascending and descending motion of the spiral cylinder (61);
 - (d) a plurality of retractable scissor legs (70) coupled to the underneath of the horizontal lifting plate (50) to ascend and descend together with the spiral cylinder (61);
 - (e) a plurality of height setting sensors to limit the ascending operation of the horizontal lifting plate (50); and
 - (f) an integrated software control designed to operate and control of the vertically transporting of the MEP from one elevation to another elevation and allow synchronous lifting and lowering of the horizontal lifting plate (50) of multiple lifting system synchronised in series or parallel; and
 - (g) a display based controlling/operating device being used to set parameters of the ascending operation, which also include auto height setting where the helical elevating system comes to a stop after reaching a setting height;

wherein the rotating motion of the spiral cylinder (61) in one direction elevates the horizontal lifting plate (50) to a specific height together with the MEP module mounted onto the horizontal lifting plate (50) for installation onto an elevated ceiling or the like structure .
2. The helical elevating system of claim 1, further comprising: a safety system through a Programmable Logic controller (PLC) linked to a PC display.
3. The helical elevating system of claim 1, wherein the horizontal lifting plate (50) is expandable by incorporating an extension frame (40) to the end thereof.
4. The helical elevating system of claim 1, wherein a motor is used as a driving mean to control the ascending or the descending vertically of the spiral cylinder (61).
5. The helical elevating system of Claim 1, wherein the scissors legs (70) are functioned as a secondary support to allow the horizontal lifting plate (50) to change elevation.

6. The helical elevating system of Claim 7, wherein the scissor leg includes an inner scissor leg and outer scissor leg, and each end of the inner and outer scissor legs are connected to the base frame (60) and the horizontal lifting plate (50).
7. The helical elevating system of Claim 4, wherein the ascending or descending of the horizon platform is by opening or closing of the scissor legs.
8. The helical elevating system of Claim 4, wherein the motor is used to actuate the spiral cylinder (61).
9. The helical elevating system of Claim 1, wherein the base frame (60) is fitted with a plurality of wheels to facilitate the movement of the lifting system (100).
10. The helical elevating system of Claim 3, wherein the extension frame (40) at both the ends of the horizontal lifting plate (50) is retractable or foldable.
11. The helical elevating system of Claim 1, further comprising a plurality of foldable leg extension (80) mounted at each of the corners of the base frame (60).
12. The spiral lifting system of Claim 1, wherein the scissor legs (70) are pivoted by a plurality of pins to allow the scissor legs (70) to ascend or descend with respect to the spiral cylinder (61).
13. A method of installation of MEP modules onto a ceiling with the helical elevating system as set forth in Claim 1, the method comprising the steps of :
 - (i) positioning and securing the MEP module onto a MEP hookup;
 - (ii) transporting and positioning the lifting system (100) to the hookup MEP module for installation of the MEP module; and
 - (iii) commencing the lifting process by initiating the motor of the lifting system to lift up the module to a predefined height; wherein the ascending of the horizontal lifting plate (50) is thus synchronously lifted with great accuracy.
14. The method of installation of MEP module as set forth in Claim 13, wherein the synchronous lifting and lowering of MEP rack is controlled by a plurality of controllers.
15. The method of installation of MEP module as set forth in Claim 13, further comprising a step of (vi) monitoring using a PC display in the course of lifting step.
16. The method of installation of MEP module as set forth in Claim 15, wherein an indicator or an alarm is provided in order to warn the safety of the operation.