LADDER LIFT SYSTEMS

Background

Technical Field

Embodiments of the invention relate generally to ladder lift systems for transfer of loads between two bodies.

Description of Related Art

In the offshore and marine industry, various items of materials and equipment must be transferred from land onto platform or rig, and vice versa. Workers are often called upon to transfer loads; however, manual transfer is prone to accidents as the workers have to cope with the weight of the load as well as the elevation between land and platform. For heavier loads, lifting devices such as cranes are also employed to transfer loads; however, lifting devices often require multiple persons to operate, and are expensive to purchase and maintain.

Motorized ladder hoists are used in the construction industry for lifting loads from one elevation to another, e.g. from ground to roof. Some examples of ladder hoists that may be used in the construction industry are described in patent publications U.S. Patent Number 3,115,211 (J.A. Ostrander Jr), U.S. Patent Number 5,911,287 (Campbell), U.S. Patent Number 4,183,423 (Lewis), U.S. Patent Number 7,424,932 (Murphy), U.S. Design Patent Number 615,725 S (Phillips) and U.S. Application Publication Number 2007/0269303 (Quare). A person skilled in the art would appreciate that the above-identified ladder hoists are designed to operate at high tilt angles where an angle between the ladder and a horizontal is in the region of 70 degrees. If the ladder hoists were arranged at less than 70 degrees, the ladder hoist of U.S. Patent Number 3,115,211, for example, would exhibit sagging in the ladder tracks and operate at substantially below full load conditions. Also, these ladder hoists are designed to transfer loads between stationary bodies. Consequently, the above-identified ladder

hoists are not suitable to be employed in the offshore and marine industry where the loads to be lifted are much heavier, for example, cables, chains and tools, which can weigh up to 1 tonne or even more. Further, as load transfer in the offshore and marine industry typically takes place over a body of water, employing the above-identified ladder hoists will result in arranging the ladder at much lower tilt angles which will lead to sagging of the ladder tracks and, inevitably, failure of the ladder tracks and major safety issues.

Accordingly, ladder lift systems for heavier loads and which are safe to operate at low tilt angles are desirable.

Summary

Embodiments of the invention disclose a ladder lift system which includes a ladder suitably dimensioned to traverse between two bodies (i.e. a first and a second body). The ladder lift system includes a first brace secured to the second body and also disposed to support the upper end of the ladder to prevent relative movement between the upper end of the ladder and the second body. The ladder lift system also includes a reinforcement system connected between the ladder and the first brace to prevent deflection of the ladder tracks. The ladder lift system further includes a carriage movably coupled to the tracks, and a motor for driving the carriage along the tracks to transfer a load between the first and the second body, and vice versa.

According to one embodiment of the invention, the reinforcement system is an elongate truss frame, wherein the elongate truss frame has a lower end connected between the lower end of the ladder and the first body, and an upper end connected between the upper end of the ladder and the first brace.

According to another embodiment of the invention, the reinforcement system includes a second brace being secured to the first body, at least a first elongate member connected between the first brace and a first intermediate

position along the ladder, and at least a second elongate member connected between the second brace and a second intermediate position along the ladder.

Brief Description of the Drawings

Embodiments of the invention are disclosed hereinafter with reference to the drawings, in which:

Figure 1 illustrates a ladder lift system in a load transfer position according to one embodiment of the invention;

Figure 2A is a perspective view of a truss frame illustrated in Figure 1;

Figure 2B is a close-up view of wall support pads provided on the truss frame of Figure 2A;

Figure 2C is a front view of the truss frame of Figure 2A;

Figure 2D is a sectional view taken along line A-A in Figure 2C;

Figure 2E is a top view of the truss frame of Figure 2A;

Figure 3 illustrates a ladder lift system in a load transfer position according to another embodiment of the invention;

Figure 4A is a perspective view of a truss frame provided at the first body as illustrated in Figure 3;

Figure 4B is a front view of the truss frame of Figure 4A;

Figure 4C is a sectional view taken along line B-B in Figure 4B; and

Figure 4D is a top view of the truss frame of Figure 4A.

Detailed Description

In the following description, numerous specific details are set forth in order to provide a thorough understanding of various illustrative embodiments of the invention. It will be understood, however, to one skilled in the art, that embodiments of the invention may be practiced without some or all of these specific details. In other instances, well known process operations have not been described in detail in order not to unnecessarily obscure pertinent aspects of embodiments being described.

Reference is made to Figure 1 which illustrates a ladder lift system 100 in a load transfer position according to one embodiment of the invention. A first body 1 and a second body 2 are disposed across a body of water 3, e.g. sea, channel, for transferring loads to and/or fro. The ladder lift system 100 includes a ladder 10 which traverses the body of water 3, and has a lower end and an upper end. The ladder may be provided with parallel tracks with spaced apart rungs connected thereto. The ladder 10 may be provided as a single section or as multiple sections which may be coupled to each other by means of bolts and nuts. The lower end of the ladder 10 may be provided with foot supports which engage with a first body 1 when the ladder 10 is disposed in a load transfer position. Also in the load transfer position, the upper end of the ladder 10 is coupled to a first brace frame which is in turn secured to the second body.

The ladder lift system 100 includes a reinforcement system to stiffen the ladder 10. In the embodiment of Figure 1, the reinforcement system is provided as an elongate truss frame 110 which is coupled to the ladder 10. Various methods are available to couple the elongate truss frame 110 to the ladder 10. For example, the elongate truss frame 110 and ladder 10 may be coupled by high strength bolt and nuts which will allow assembly and disassembly of the frame 110 and ladder 10 as and when required. Alternatively, the frame 110 and ladder 10 may be coupled by welding into a fixed structure. An upper end of the elongate brace frame 110 is connected between (or disposed in compression support between) the ladder 10 and the first brace frame 20, while a lower end of the elongate brace frame 110 is connected between (or disposed in compression support between) the ladder 10 and the first body 1.

With the reinforcement system, the ladder 10, in the load transfer position, may be disposed at a lower tilt angle (θ) of less than 70 degrees relative to a horizontal without causing deflection in the ladder tracks even when carrying loads.

The ladder lift system 100 also includes a first brace 20 which is secured to the second body 2 through conventional means such as cable, wires, etc. In the load transfer position, the first brace 20 supports an upper end of the ladder 10 to prevent relative movement between the upper end of the ladder 10 and the second body 2. The first brace 20 may be provided as a first truss frame. Figure 2A is a perspective view of an example truss frame that may be used as the first brace 20. The truss frame may be formed of a plurality of straight members or bars whose ends are connected at joints. At one side of the truss frame, a plurality of wall support pads 22 may be provided (see Figure 2B). The wall support pads 22 allow the truss frame to support against a wall of the second body 2. The truss frame may also provide a separate ladder that allows operator access to the truss frame as and when required. The truss frame may be provided with a retainer structure or other appropriate structure to receive the upper end of the ladder when it is disposed in a load transfer position. Figure 2C is a front view of the truss frame of Figure 2A. Figure 2D is a sectional view taken along line A-A in Figure 2C. Figure 2E is a top view of the truss frame of Figure 2A.

A carriage 40 is movably coupled to the ladder tracks where the carriage 40 is suitably constructed and arranged to support loads thereon. For example, the carriage 40 may be provided with a platform or housing (not shown) for retaining the load within the carriage 40 or securing the load to the carriage 40 during transfer.

A motor, e.g. winch motor, (not shown) for driving the carriage 40 to and from the upper and lower ends of the ladder may be provided on the first body 1. The motor may be electrically coupled to one or more control devices to control a movement of the carriage 40 along the ladder tracks. For example, if two control devices (i.e. a first and a second control device) are provided, the control devices may be respectively disposed on the first body 1 and the second body 2 so that

control of the carriage 40 may be assumed from either end to increase convenience of the operators involved.

The carriage 40 may be provided with a sensor for detecting carriage overload conditions. For example, if the sensor ascertains that the carriage load exceeds a predetermined limit, the operator may be appropriately notified and the carriage 40 is prevented from moving towards an opposite end of the ladder 10.

Reference is made to Figure 3 which illustrates a ladder lift system 300 in a load transfer position according to another embodiment of the invention. The ladder lift system 300 of Figure 3 includes a ladder 10, a first brace 20, carriage 40 and motor as described in the foregoing paragraphs. The ladder lift system 300 of Figure 3 also includes a reinforcement system which employs the first brace 20, a second brace 30 and elongate members 310 connected between (or disposed in compression support between) the first brace 20 and the ladder 10 as well as between the second brace 30 and the ladder 10. Particularly, the elongate members 310 are coupled to intermediate positions along the ladder 10 and are subject to compressive stress exerted by the ladder 10 and the respective brace frame 20 or 30 thereby stiffening the ladder 10. This way, the reinforcement system allows the ladder 10 to operate at a lower tilt angle of less than 70 degrees relative to a horizontal without causing deflection in the ladder tracks.

The second brace 30 is secured to the first body 1 and may be provided as a second truss frame. Figure 4A is a perspective view of an example truss frame that may be used as the second brace 30. The truss frame may be formed of a plurality of straight members or bars whose ends are connected at joints. At one side of the truss frame, a hook 32 may be provided to allow the second brace 30 secure to a wall of the first body 1. The hook 32 may be provided as a metal sheet having an angled end to adapt to the wall or physical profile of the

first body 1. The truss frame of the second brace 30 may be provided with a separate ladder that allows operator access to the truss frame as and when required. The truss frame may be provided with a retainer structure or other appropriate structure to receive the lower end of the ladder 10 when it is disposed in a load transfer position. Figure 4C is a front view of the truss frame of Figure 4A. Figure 4D is a sectional view taken along line B-B in Figure 4C. Figure 4E is a top view of the truss frame of Figure 4A.

Embodiments of the ladder lift system as described herein provide various advantages including, but not limited to:

- The ladder lift system is capable of transferring heavy loads without deflection in the ladder. In U.S. Patent Number 3,115,211, a person skilled in the art would appreciate that the ladder hoist of '211 may carry loads up to 250 kg when the ladder is arranged with a tilt of around 70 degrees, however the ladder hoist of '211 may carry loads up to 100 kg with tolerable deflection in the ladder tracks when the ladder is arranged with a tilt of around 45 degrees. Comparatively, assuming a same motor specification, a ladder lift system of the present invention would be able to carry loads up to 250 kg with no or insignificant deflection even if the ladder is arranged with a tilt of around 45 degrees. Accordingly, this reduces reliance on cranes to transfer heavy loads. Further, if the motor specification is increased and/or the material used for the reinforcement system and ladder has greater strength, the ladder system of the present invention would be capable of carrying loads of up to 1 tonne or more.
- In situations where loads are transferred between two bodies spaced from each other by a body of water, the ladder connecting the two bodies may have to be arranged at low tilt angles due to the horizontal distance between the two bodies. This may cause sagging of the ladder due to the ladder track length as well as the weight of the ladder and any load. With the reinforcement system in place, embodiments of the invention allow the ladder to be arranged at low tilt angles during the load transfer position, i.e.

less than about 70 degrees with respect to the horizontal, without deflection in the ladder. This increases the reliability and safety of the ladder lift system even under high load conditions. Accordingly, embodiments of the invention are also suitable in other situations where the two bodies are separated by a region which is less accessible to operator personnel, e.g. mud, sand, etc.

- The overload sensor allows overload conditions to be detected before the carriage moves off along the tracks.

Other embodiments will be apparent to those skilled in the art from consideration of the specification and practice of the invention. Furthermore, certain terminology has been used for the purposes of descriptive clarity, and not to limit the disclosed embodiments of the invention. The embodiments and features described above should be considered exemplary, with the invention being defined by the appended claims.

What is claimed is:

1. A ladder lift system for load transfer between two bodies, the ladder lift system comprising:

a ladder having parallel tracks and spaced rungs connected thereto, the ladder having a lower end and an upper end;

a first brace being secured to the second body, the first brace disposed to support an upper end of the ladder to prevent relative movement between the upper end of the ladder and the second body;

a reinforcement system connected between the ladder and the first brace to prevent deflection of the tracks;

a carriage movably coupled to the tracks; and

a motor for driving the carriage along the tracks to transfer a load between the first and the second body, and vice versa, wherein the first and the second body are disposed across a body of water.

2. The ladder lift system of claim 1, wherein the first brace includes a first truss frame having a plurality of pads to support the first brace against a wall of the second body, and

wherein the reinforcement system includes an elongate truss frame coupled to the ladder, the elongate truss frame having a lower end connected between the lower end of the ladder and the first body, and having an upper end connected between the upper end of the ladder and the first brace.

3. The ladder lift system of claim 2, further comprising at least a first and a second control device disposed respectively at the first and the second body, the first and the second control device electrically coupled to the motor to control a movement of the carriage along the tracks.

4. The ladder lift system of claim 2, wherein the ladder makes an angle of less than 70 degrees relative to a horizontal when the ladder is disposed in a load transfer position.

5. The ladder lift system of claim 2, further comprising:

a sensor provided at the carriage to detect an overload condition, wherein the sensor is operable to prevent the carriage from moving towards an opposite end of the ladder when the overload condition is detected.

6. The ladder lift system of claim 1, wherein the reinforcement system includes

a second brace being secured to the first body,

at least a first elongate member connected between the first brace and a first intermediate position along the ladder,

at least a second elongate member connected between the second brace and a second intermediate position along the ladder.

7. The ladder lift system of claim 6, wherein the second brace includes a second truss frame, the second truss frame having a hook to engage with the first body.

8. The ladder lift system of claim 6, further comprising at least a first and a second control device disposed respectively at the first and the second body, the first and the second control device electrically coupled to the motor to control a movement of the carriage along the tracks.

9. The ladder lift system of claim 6, wherein the ladder makes an angle of less than 70 degrees relative to a horizontal when the ladder is disposed in a load transfer position.

10. The ladder lift system of claim 6, further comprising:

a sensor provided at the carriage to detect an overload condition, wherein the sensor is operable to prevent the carriage from moving towards an opposite end of the ladder when the overload condition is detected.