

A FALL PROTECTION DEVICE AND A METHOD OF INSTALLING THE SAME AND A FALL PROTECTION SYSTEM

TECHNICAL FIELD

[0001] The present invention relates broadly to a fall protection device and a method of installing the same and a fall protections system.

BACKGROUND

[0002] Cranes are used to lift heavy items or transport them from one place to another. Cranes can usually be found in construction sites and factories. Depending on the working conditions, e.g. the requirement of the work to be carried out and the industries, different sizes and types of cranes are deployed. The cranes that are more commonly used in construction sites are mobile crane and crawler crane. Typically, these cranes comprise two parts, i.e. a carrier and a boom. A carrier provides mobility for the crane while a boom holds and lifts the load.

[0003] In many circumstances, crane operators are required to work on top of the boom. For example, a crane operator may need to walk on top of the boom from one end of the boom to another to dismantle or install the boom. Most of the booms have an elevated height of about 2 meters above the ground and a length of more than 10 meters. Thus, working on the boom without a proper safety harness could pose danger to the operator.

[0004] There are numerous fall protection systems in the market, e.g. gantries type fall arrest system, lifeline fall arrest system and arm type fall arrest system. However, it is noted that the fall protection systems in the market may not be suitable for operations on a crane. For example, crane operations may be carried out at a remote location. The existing fall protection systems are mostly heavy and bulky, thus, it may be difficult to transport and install these systems at the remote location.

[0005] In addition, the existing fall protection systems usually protect the crane operator by securing the harness to the crane platform. However, this type of fall protection does not properly protect the operator from injury during the fall. It has been noted that securing the harness above the shoulder of the operator may be a better way of preventing any injury during the fall. This type of fall protection system requires a rigid and stable structure that has a height which is much higher than the overall crane height.

[0006] Further, most of the existing fall protection systems require a flat ground or a fixed and rigid structure to be mounted on for stability. These systems are thus not suitable for use in some operations because most crane operations are invariably carried out on rough terrain such as slope or soft soil environments. Moreover, the existing fall protection system may have other shortcomings, e.g. sagging of wire, unacceptable falling clearance, short working range.

[0007] A need therefore exists to provide a fall protection device that seeks to address at least some of the problems above or to provide a useful alternative.

SUMMARY

[0008] According to a first aspect of the present invention, there is provided a fall protection device comprising:

- a base; and

- a frame member connected to the base and operable between a contracted first position and an extended second position relative to the base;

- wherein the base is adaptable based on a datum supporting the fall protection device.

[0009] The base may be adapted to be mounted to a structure of a crane.

[0010] The base may be adapted to be mounted to a boom of the crane.

[0011] The base may be adapted to be mounted to an outrigger of the crane.

[0012] The base may be adapted to be mounted to a ground.

[0013] The base may comprise at least one adjustment member for adapting to a profile of the ground.

[0014] The frame member may be slidably connected to the base.

[0015] The frame member may be pivotably connected to the base.

[0016] The frame member may comprise a plurality of elongated arms, the plurality of elongated arms being in sliding engagement with each other.

[0017] The frame member may be telescopically extendable.

[0018] The fall protection device may further comprise a drive mechanism for moving the frame member between the first and second positions.

[0019] The fall protection device may further comprise a locking mechanism for fastening the frame member to the base in the second position.

[0020] According to a second aspect of the present invention, there is provided a fall protection system comprising:

- at least two devices as claimed in any one of the preceding claims; and
- an elongated beam connecting the frame members of the at least two devices.

[0021] The elongated beam may be an I-beam.

[0022] The elongated beam may comprise a stopper at a first end and a second end of the elongated beam.

[0023] According to a third aspect of the present invention, there is provided a method for protecting a person against a fall, the method comprising suspending the person using the device as provided in the first aspect or the system as provided in the second aspect.

[0024] According to a fourth aspect of the present invention, there is provided a method of installing a fall protection device, the method comprising the steps of:

adapting a base of the fall protection device to a datum supporting the fall protection device;

mounting the base to the datum; and

extending a frame member connected to the base from a contracted first position to an extended second position relative to the base.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] Embodiments of the invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

[0026] Figure 1A shows a schematic diagram illustrating a fall protection device according to an example embodiment.

[0027] Figure 1B shows a schematic diagram illustrating the fall protection device of Figure 1A in which the post member is at a lowered (i.e. contracted) position.

[0028] Figure 2A shows a schematic diagram illustrating a fall protection device according to an alternate embodiment.

[0029] Figure 2B shows a schematic diagram illustrating a fall protection device of Figure 2A in which the retractable frame is at a lowered (i.e. contracted) position.

[0030] Figure 3A shows a schematic diagram illustrating a perspective view of a fall protection system according to an example embodiment.

[0031] Figure 3B shows a schematic diagram illustrating a front view of a fall protection system of Figure 3A.

[0032] Figure 4 shows a schematic diagram illustrating a perspective view of a fall protection system according to a further example embodiment.

[0033] Figure 5A shows a schematic diagram illustrating a perspective view of fall protection system according to a further example embodiment.

[0034] Figure 5B shows a schematic diagram illustrating the fall protection system of Figure 5A in which the post members are at a lowered (i.e. contracted) position.

[0035] Figure 5C shows an enlarged view of an example configuration of the base in the Figures 5A and 5B.

[0036] Figure 6 shows a flow chart illustrating a method of installing a fall protection device according to an example embodiment.

DETAILED DESCRIPTION

[0037] Figure 1A shows a schematic diagram illustrating a fall protection device 100 according to an example embodiment. The fall protection device 100 comprises a base 102, in the form of a stand-alone base 102, standing on a ground. The fall protection device 100 further comprises a frame member 104, e.g. in the form of a post member 104. The post member 104 is pivotably connected to the stand-alone base 102 at a connection 106, such that the post member 104 is operable between a contracted first position and an extended second position relative to the stand-alone base 102. The base 102 is adaptable based on a datum supporting the fall protection device 100. In other words, the base 102 can take other forms in alternate embodiments depending on where the base 102 is mounted or supported.

[0038] The stand-alone base 102 in the example embodiment is mounted to a ground. In an alternate embodiment, the base 102 may be adapted to be mounted to a structure of a crane (not shown). For example, the boom and outrigger of the crane are very rigid structures which are suitable for the mounting of the base of a fall protection device, as described in detail below with respect to Figures 3A-3B, 4 and 5A-5C. It will be appreciated by a person skilled in the art that the base 102 may be adaptable to be mounted on other datum, e.g. other structures of the crane.

[0039] The stand-alone base 102 comprises four legs 108a-d, wherein the legs 108a-d extend radially from a common vertical axis. The stand-alone base 102 also comprises wheels 110a-b for portability of the fall protection device 100 on the ground. The stand-alone base 102 has a relatively broad structure, such that a counterweight may be placed on it to enhance the stability of the fall protection device 100.

[0040] In the example embodiment, each leg 108a-d of the stand-alone base 102 further comprises an adjustment member 112 for adapting the fall protection device 100 to a profile of the ground. Each adjustment member 112 comprises an adjustable contact pad 114 and a flatness adjustment winch 116. The adjustable contact pad 114 may be raised or lowered according to the profile of the ground by manually rotating the flatness adjustment winch 116. Thus, the fall protection device 100 may be used for grounds with profiles other than a flat surface, e.g. slope or uneven terrain.

[0041] The fall protection device 100 further comprises a drive mechanism 118, in the form of a winch 118, adjacent to the connection 106. The post member 104 may be contracted or extended at the connection 106 by manually rotating the winch 118. Thus, the installation work above the connection 106 may be completed before raising the post member 104. This may be an advantage in terms of safety as well as time and cost. In alternate embodiments, the frame member 104 may be connected to the base 102 via other connection means, as will be appreciated by a person skilled in the art. For example, the frame member 104 may be slidably connected to the base 102, as described in detail below with respect to Figures 2A-2B.

[0042] As shown in Figure 1A, the post member 104 comprises a plurality of elongated arms 120a-d. The elongated arms 120a-d are in telescopic engagement, thus the post member 104 is telescopically extendable. Depending on the locations and requirements of the activities to be carried out, the post member 104 may be extended to a suitable length. Further, the telescopic post member 104 may significantly reduce the footprint occupied by the fall protection device 100 by fully retracting the post member 104. This may advantageously enhance the portability of the fall protection device 100.

[0043] During installation of the fall protection device 100, the post member 104 is first extended to a suitable length. The post member 104 is then raised to a suitable position and securely fastened to the base 102 using a locking mechanism (not shown). The locking mechanism may comprise a safety lock and a safety pin. Typically, when the fall protection device 100 is in use, the post member 104 is extended to a height of approximately 1 to 6 meters above a structure (not shown) where an operator is working on, or about 2 to 8 meters above a ground.

[0044] The post member 104 further comprises a railing frame 122 connected to the elongated arm 120a. In some embodiments, the railing frame 122 may be attached to a personal fall arrest device (not shown) worn by the operator, at a distal end 124 of the railing frame 122. In alternate embodiments, the distal end 124 of the railing frame 122 may be connected to an elongated beam (not shown) in a fall protection system, as described in detail below with respect to Figures 3A-3B, 4 and 5A-5C.

[0045] Figure 1B shows a schematic diagram illustrating the fall protection device 100 of Figure 1A in which the post member 104 is at a lowered (i.e. contracted) position. During installation of the fall protection device 100, the post member 104 is telescopically extended to a suitable length. The post member 104, with the railing frame 122 connected hereto, is then raised to a suitable height by manually rotating the winch 118, e.g. with a gearing mechanism (not shown).

[0046] Figure 2A shows a schematic diagram illustrating a fall protection device 200 according to an alternate embodiment. The fall protection device 200 comprises a base 202, in the form of a stand-alone base 202. In contrast with the base 102 as described with respect to Figure 1A, the base 202 in this example embodiment does not comprise an adjustment member. Instead, each leg 204a-d of the stand-alone base 202 comprises a stationary stand 206.

[0047] The fall protection device 200 in the example embodiment further comprises a frame member 208, in the form of a retractable frame 208. As shown in Figure 2A, the retractable frame 208 is slidably connected to the stand-alone base 202. Further, the retractable frame 208 comprises a plurality of elongated arms 210a-c, such that the plurality of elongated arms 210a-c are in sliding engagement with each other.

[0048] Further, it is shown that a railing frame 212 is connected to the elongated arm 210a. A distal end 214 of the railing frame 212 may be connected to a personal fall arrest device (not shown) or an elongated beam (not shown) in a similar configuration as the distal end 124 of the railing frame 122 as described above with respect to Figure 1A.

[0049] Figure 2B shows a schematic diagram illustrating a fall protection device 200 of Figure 2A in which the retractable frame 208 is at a lowered (i.e. contracted) position. During installation of the fall protection device 200, the retractable frame 208 is raised vertically to a suitable height by sliding the plurality of elongated arms 210a-c upwards. The retractable frame 208 may also be lowered, hence reducing the footprint occupied by the fall protection device 200.

[0050] Figures 3A and 3B show a schematic diagram illustrating a perspective view and front view of a fall protection system 300 respectively according to an example embodiment. The fall protection system 300 comprises at least two fall protection devices. In the example shown in Figures 3A and 3B, the fall protection system 300 comprises five fall protection devices 302, 304, 306, 308, 310. Each fall protection device 302, 304, 306, 308, 310 comprises a base, in the form of a retractable ladder 312, 314, 316, 318, 320. Each fall protection devices 302, 304, 306, 308, 310 further comprises a frame member, in the form of an arm 322, 324, 326, 328, 330. The fall protection system 300 further comprises an elongated beam 332, connecting the arms 322, 324, 326, 328, 330 of the fall protection devices 302, 304, 306, 308, 310. Typically, the distance between adjacent fall protection devices is approximately six meters. The elongated beam 332 comprises at least one trolley (not shown). The at least one trolley is configured to be mounted by a personal fall arrest device of an operator. In the event that there are two trolleys or more, the trolleys can slide along the elongated beam 332 independently of one another.

[0051] In preferred embodiments, the elongated beam 332 connecting the arms 322, 324, 326, 328, 330 is an I-beam. The I-beam may provide a seamless movement for the operator to move from one end to the other end of a boom. In other words, the operator working on the boom would not have to dismount the personal fall arrest from the trolley when passing by any one of the fall protection devices 302, 304, 306, 308, 310. It will be appreciated by a person skilled in the art that different structures of beam may be

connected to the frame member, and the above-described configuration is one of the examples.

[0052] The elongated beam 332 further comprises a stopper (not shown) at each of a first end 334 and a second end 336 of the elongated beam 332. The placement of the stopper at each of the first end 334 and the second end 336 may prevent the trolleys from dislocating from the elongated beam 332, thereby preventing the operator from falling. All the components in the fall protection system 300, including the frame member and base are typically made of a rigid material, e.g. steel, that can withstand a force of 15kN without exhibiting any deformation or failure.

[0053] It is noted that the configurations of the fall protection devices 302, 304, 306, 308, 310 in Figures 3A and 3B are similar. Thus, for illustration purposes, the components of only the fall protection device 302 in Figures 3A and 3B are labelled and explained below. In Figures 3A and 3B, the retractable ladder 312 is mounted in an upright position to a boom 338 of a crane. Here, the retractable ladder 312 is mounted securely on horizontal trusses 340, 342 of the boom 338, thereby providing stability and support to the fall protection device 312. The retractable ladder 312 may provide convenience for the operator when carrying out work on the boom 338, making the activity of climbing up and down the boom 338 easier.

[0054] The arm 322 in the example embodiment is pivotably connected to the retractable ladder 312 at a connection 344. When transporting the fall protection device 302, the arm 322 is usually lowered at the connection 344, such that the arm 322 and retractable ladder 312 are brought together. Further, the connection 344 may make the installation of the fall protection system 300 easier as all the installation work above the connection 344 may be completed before raising the arm 322 above the boom 338.

[0055] Figure 4 shows a schematic diagram illustrating a perspective view of a fall protection system 400 according to a further example embodiment. Here, the fall protection system 400 comprises two fall protection devices 402, 404. Each fall protection device 402, 404 comprises a base 406, 408, in the form of a first ladder 406, 408. Each fall protection devices 402, 404 further comprises a frame member 410, 412, in the form of a second ladder 410, 412. As can be seen in Figure 4, each second ladder

410, 412 comprises a reinforcement structure 414, 416 that may increase the strength of the second ladders 410, 412. The fall protection system 400 further comprises an elongated beam 418, connecting the second ladders 410, 412 of the fall protection devices 402, 404.

[0056] As can be seen in Figure 4, the second ladders 410, 412 are lowered down at the connections 420, 422 such that the first ladders 406, 408 and second ladders 410, 412 are brought together. During operation of the fall protection system 400, the second ladders 410, 412 are raised to a suitable position above the boom 424.

[0057] Figure 5A shows a schematic diagram illustrating a perspective view of fall protection system 500 according to a further example embodiment. The fall protection system 500 comprises two fall protection devices 502, 504. Each fall protection device 502, 504 comprises a base 506, 508. Each base 506, 508 comprises a clamp 510, 512, which is mounted to respective outrigger 514, 516 of a crane 518.

[0058] Each fall protection devices 502, 504 further comprises a frame member 520, 522, in the form of a post member 520, 522. It is noted that the configuration of the post members 520, 522 are similar to that of the post member 104 as described with respect to Figures 1A. The fall protection system 500 further comprises an elongated beam 524 connecting railing frames 526, 528 of the fall protection devices 502, 504 respectively.

[0059] Figure 5B shows a schematic diagram illustrating the fall protection system 500 of Figure 5A in which the post members 520, 522 are at a lowered (i.e. contracted) position. During installation of the fall protection system 500, the post members 520, 522 are telescopically extended to a suitable length. The post members 520, 522, with the railing frames 526, 528 connected hereto, are then raised to a suitable height. The configuration of the base 508 is described in detail below with respect to Figure 5C.

[0060] Figure 5C shows an enlarged view of an example configuration of the base 508 in the Figures 5A and 5B. The base 508 comprises a clamp 512, wherein the clamp 512 comprises four pairs of clamping screws 530a-d to open or close the clamp 512. The clamp 512 may be adjustable depending on width of the outrigger 516. In an alternate

embodiment, the fall protection device 504 may be mounted on the outrigger 516 using an edge clamp. It will be appreciated by a person skilled in the art that different clamps and combinations thereof may be used and the above-described configurations are some of the examples.

[0061] *Embodiments of the present invention provide a device and system for protecting a person against a fall by suspending the person, thereby preventing the person from falling. As described above with reference to Figures 1A to 5C, the fall protection devices have a base that is adaptable based on a datum that is supporting the fall protection devices. In other words, the fall protection devices may be mounted on different datum by changing the base.*

[0062] For example, in the above examples, the fall protection devices may be mounted to a boom or outrigger of a crane or a ground. Depending on the location, different base may be adapted to the fall protection device. As a result, transportation of heavy and bulky fall protection device may be avoided. The fall protection device may also be suitable for use at locations with unpredictable working condition since the base is adaptable to different datum.

[0063] Figure 6 shows a flow chart 600 illustrating a method of installing a fall protection device according to an example embodiment. At step 602, a base of the fall protection device is adapted to a datum supporting the fall protection device. At step 604, the base is mounted to the datum. At step 606, a frame member connected to the base is extended from a contracted first position to an extended second position relative to the base.

[0064] It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

CLAIMS

1. A fall protection device comprising:
a base; and
a frame member connected to the base and operable between a contracted first position and an extended second position relative to the base;
wherein the base is adaptable based on a datum supporting the fall protection device.
2. The fall protection device as claimed in claim 1, wherein the base is adapted to be mounted to a structure of a crane.
3. The fall protection device as claimed in claim 2, wherein the base is adapted to be mounted to a boom of the crane.
4. The fall protection device as claimed in claim 2, wherein the base is adapted to be mounted to an outrigger of the crane.
5. The fall protection device as claimed in claim 1, wherein the base is adapted to be mounted to a ground.
6. The fall protection device as claimed in claim 5, wherein the base comprises at least one adjustment member for adapting to a profile of the ground.
7. The fall protection device as claimed in any one of the preceding claims, wherein the frame member is slidably connected to the base.
8. The fall protection device as claimed in any one of claims 1 to 6, wherein the frame member is pivotably connected to the base.
9. The fall protection device as claimed in any one of the preceding claims, *wherein the frame member comprises a plurality of elongated arms, the plurality of elongated arms being in sliding engagement with each other.*

10. The fall protection device as claimed in claim 9, wherein the frame member is telescopically extendable.

11. The fall protection device as claimed in any one of the preceding claims, further comprises a drive mechanism for moving the frame member between the first and second positions.

12. The fall protection device as claimed in any one of claims 8 to 11, further comprises a locking mechanism for fastening the frame member to the base in the second position.

13. A fall protection system comprising:
at least two devices as claimed in any one of the preceding claims; and
an elongated beam connecting the frame members of the at least two devices.

14. The fall protection system as claimed in claim 13, wherein the elongated beam is an I-beam.

15. The fall protection system as claimed in any one of claim 13 or 14, wherein the elongated beam comprises a stopper at a first end and a second end of the elongated beam.

16. A method for protecting a person against a fall, the method comprising suspending the person using the device as claimed in any one of claims 1 to 12 or the system as claimed in any one of claims 13 to 15.

17. A method of installing a fall protection device, the method comprising the steps of:

adapting a base of the fall protection device to a datum supporting the fall protection device;

mounting the base to the datum; and

extending a frame member connected to the base from a contracted first position to an extended second position relative to the base.