

A METAL SUPPORT

FIELD OF INVENTION

[0001] The present invention relates broadly, but not exclusively, to a metal support for lifting a metal object and to devices and methods employing such a metal support.

BACKGROUND

[0002] In building, civil engineering and construction, it is often necessary to carry out testing on piles and foundations to validate the design and to determine its bearing capacity before further work can be performed. Traditionally, layers of large concrete blocks are stacked on top of each other to provide the necessary weight. The concrete blocks are placed on a platform above the piles/foundations for a predetermined period, thereby putting the piles and foundations under load. Gauges are used to measure the piles and foundations resistance, capacity, movement and soundness. The process is repeated on a predetermined number of piles and foundations based on a professional engineer's design.

[0003] It has been noted that moving such large concrete blocks can be cumbersome and dangerous. Further, some concrete blocks may potentially slip off the stack and cause serious injuries and/or damages. Unused concrete blocks require large space for storage.

[0004] One existing solution to the above issues involves the use of flat steel plates to replace the concrete blocks. As steel has a higher density than concrete, the height of the stack can be reduced while still providing the same weight. Hooks may be welded to the steel plates to facilitate lifting and transportation from one point to another.

[0005] A typical hook that has been used in the industry has the shape of an inverted L such that one end of the hook is welded to the steel plate while the other end is free-hanging. To hoist the steel plate, a lifting device such as a lifting hook,

lifting wire, lifting chain or lifting rope is latched onto the free hanging inverted L-shaped hook. However, the free-hanging end is prone to being bent, broken or otherwise damaged during normal use as a result of impact. Rectification and repair of damaged hooks normally incur additional costs, as well as downtime for the steel plates. The shape of the hook can also cause wires/cables to become stuck during moving, the lifting device may also disengage from the inverted L-shaped hook during impact, thus posing further hazards. Because of the free hanging design of the inverted L-shaped hook, there is no safety provision or latch to prevent the disengagement of the lifting device(s) during operation.

[0006] A need therefore exists to provide devices and methods that seek to address at least some of the above problems.

SUMMARY

[0007] According to a first aspect of the present invention, there is provided a metal support for lifting a metal object. The metal support includes an attachment wall having a first face and a second face opposite the first face, wherein the metal support is configured to be fixedly attached to the metal object at the first face; a cover wall having an outer face and an inner face opposite the outer face; and a beam extending substantially perpendicularly from the second face of the attachment wall and terminating at the inner face of the cover wall.

[0008] The attachment wall may be connected to the cover wall to form a hollow passage, and the beam may traverse the hollow passage.

[0009] The attachment wall and cover wall may be substantially flat, and the metal support further may comprise first and second end walls connecting the attachment wall and the cover wall to form a rectangular hollow passage.

[0010] The attachment wall and cover wall may have the same wall height, and the beam may have a beam thickness equal to a predetermined portion of the wall height.

[0011] A bottom face of the beam may be elevated with respect to a bottom face of the attachment wall and cover wall, and a top face of the beam may be substantially flush with a top face of the attachment wall and cover wall.

[0012] According to a second aspect of the present invention, there is provided a weight including one or more metal plates and a plurality of metal supports as defined in the first aspect. Each metal support is fixedly attached to the one or more metal plates at the respective first face.

[0013] The plurality of metal supports may be configured to extend laterally with respect to the one or more metal plates.

[0014] The plurality of metal supports may have a height less than or equal to a thickness of the one or more metal plates.

[0015] The weight may include a plurality of metal plates, and the plurality of metal plates may be fixedly attached to each other.

[0016]

[0017] According to a third aspect of the present invention, there is provided a method for load testing, the method including disposing at least one weight as defined in the second aspect to provide load on a load carrier.

[0018] According to a fourth aspect of the present invention, there is provided a method for stabilizing and compaction of ground, the method comprising disposing at least one weight as defined in the second aspect on the ground such that a major face of the at least one weight rests on the ground.

[0019] According to a fifth aspect of the present invention, there is provided a method for ground protection, the method comprising disposing at least one weight as defined in the second aspect on the ground such that a major face of the at least one weight rests on the ground.

[0020] Disposing the at least one weight may include arranging a plurality of weights in a stack.

[0021] According to a sixth aspect of the present invention, there is provided a method for lifting a metal object. The method includes fixedly attaching a plurality

of metal supports as defined in the first aspect to the metal object; connecting a lifting means to selected ones of the plurality of metal supports; and lifting the metal object using the lifting means.

[0022] Fixedly attaching the plurality of metal supports to the metal object may include positioning the metal supports such that the metal supports extend laterally with respect to the metal object.

[0023] Connecting the lifting means to selected ones of the plurality of metal supports may include disposing a catch of the lifting means around respective beams of said metal supports and securing the catch.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] 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:

[0025] Figure 1A shows a perspective view of a metal support for lifting a metal object according to an example embodiment.

[0026] Figure 1B shows a top view of the metal support of Figure 1A.

[0027] Figure 1C shows a sectional view of the metal support taken about the line A-A in Figure 1B.

[0028] Figure 2 shows a perspective view of a metal support according to another example embodiment.

[0029] Figure 3 shows a perspective view of a metal support according to another example embodiment.

[0030] Figure 4 shows a perspective view of a metal support according to another example embodiment.

[0031] Figure 5 shows a perspective view of a metal support according to another example embodiment.

[0032] Figure 6 shows a perspective view of a metal support according to another example embodiment.

[0033] Figure 7 shows a perspective view of a weight according to an example embodiment.

[0034] Figure 8 shows a flow chart illustrating a method of lifting a metal object according to an example embodiment.

DETAILED DESCRIPTION

[0035] Embodiments will be described, by way of example only, with reference to the drawings. Like reference numerals and characters in the drawings refer to like elements or equivalents.

[0036] Figures 1A, 1B and 1C show various views of a metal support 100 for lifting a metal object, e.g. a steel plate, according to an example embodiment. The metal support 100 includes an attachment wall 102, a cover wall 104 and a beam 106 extending from the attachment wall 102 to the cover wall 104. In this embodiment, ends of the attachment wall 102 are connected to corresponding ends of the cover wall 104 to form a hollow passage 108, such that the beam 106 traverses the hollow passage 108. For example, the attachment wall 102 and cover wall 104 are substantially flat, and the metal support 100 further includes a first end wall 110 and a second end wall 112 connecting the attachment wall 102 and the cover wall 104 to form a rectangular hollow passage 108.

[0037] However, it will be appreciated that in alternate embodiments, the cover wall 104 may not be flat, such that the hollow passage 108 may have e.g. a triangular, B-shaped, or D-shaped cross-section. In other embodiments, the first end wall 110 and second end wall 112 may be omitted.

[0038] As shown in Figures 1A and 1B, the attachment wall 102 includes a first face 114 and a second face 116 opposite the first face 114, while the cover wall 104 includes an outer face 118 and an inner face 120 opposite the outer face 118. The beam 106 extends substantially perpendicularly from the second face 116 of the attachment wall 102 and terminates at the inner face 120 of the cover wall 104. In use, the metal support 100 is configured to be fixedly attached to the metal

object at the first face 114. For example, the metal support 100 may be welded to the metal object at the first face 114. A chamfer 115 is provided along a perimeter of the first face 114 to facilitate the weld. Compared to an end of an inverted L-shaped hook currently used, the attachment wall 102 provides a larger welding surface, thus a stronger joint between the metal support 100 and the metal object. However, it will be appreciated that in alternate embodiments, the first face 114 may not have the chamfered perimeter.

[0039] In a preferred implementation as shown in Figures 1A-1C, the beam 106 includes fillets 107 (i.e. rounded corners) at either end, the hollow passage 108 includes fillets 109, and the outer wall 118 includes rounded edges 111. The use of fillets and rounded edges may strengthen the metal support 100 by reducing stress concentration that may be present at sharp corners. In other embodiments, some or all of the fillets and rounded edges may be omitted.

[0040] Referring now to the cross-sectional view in Figure 1C, the attachment wall 102 and cover wall 104 have the same wall height 122, but the beam 106 has a beam thickness 124 equal to a predetermined portion of the wall height. For example, a bottom face 126 of the beam 106 is elevated with respect to a bottom face 128 of the attachment wall 102 and cover wall 104, and a top face 130 of the beam 106 is substantially flush with a top face 132 of the attachment wall 102 and cover wall 104. In use, this configuration provides space which allows a catch, e.g. a hook or chain, to go around the beam 106 relatively easily even if the metal support 100 is resting on soil or another metal support. The thickness 124 of the beam 106 can be determined based on factors such as the weight of the metal object to be lifted, the number of metal supports concurrently used for lifting the metal object, the strength of the material used for the beam 106, etc. A generally flat and shallow (e.g. trapezium-shaped) notch 133 is cut into the attachment wall 102. The trapezium-shaped notch 133 is designed to offset the bottom face 128 to increase the weld contact surface area between the metal support 100 and the metal object. However, it will be appreciated that in alternate embodiments, the bottom face 128 may not be offset or may not have a trapezium-shaped notch 133.

[0041] It will be appreciated by a skilled person in the art that there can be several ways of manufacturing the metal support 100. In one example, the metal support 100 may be cast in whole using steel casting techniques. In another example, the metal support 100 may be machined as a unitary piece from a steel block. In yet another

example, the beam 106 may be formed separately and then welded to the attachment wall 102 at one end and the cover wall 104 at the other end.

[0042] Figures 2-6 shows non-limiting examples of variations of the metal support 100 as described above with reference to Figures 1A-1C while maintaining a general construction. Specifically, Figure 2 shows a metal support 200 corresponding to the metal support 100 above and including a beam 206 with fillets 207 (i.e. rounded edges) at either end, but other edges and corners of the metal support 200 are not rounded. Figure 3 shows a metal support 300 corresponding to the metal support 100 above and including a hollow passage 308 with fillets 309 and outer wall 318 with rounded edges 311, but without fillets at either end of beam 306. Figure 4 shows a metal support 400 corresponding to the metal support 100 above, but without any rounded edges or corners. Figure 5 shows a metal support 500 corresponding to the metal support 100 above and including an attachment wall 502 and a chamfer 515 to facilitate welding, but without a notch being cut into the attachment wall 502. Figure 6 shows a metal support 600 corresponding to the metal support 100 above and including an attachment wall 602, but without a chamfer or notch to facilitate welding. It will be appreciated that other permutations are possible. The omission of certain features may simplify the fabrication of the metal support in these example embodiments, thereby reducing cost. The appropriate combination of features can be selected to balance performance and cost requirements.

[0043] Figure 7 shows a perspective view of a weight 700 according to an example embodiment. The weight 700 includes one or more metal plates 702 (e.g. steel plates) and a plurality of metal supports 704a, 704b, 704c, 704d corresponding to the metal supports as described above with respect to Figures 1-6. Each of the metal supports 704a, 704b, 704c, 704d is fixedly attached to the one or more metal plates 702 at the respective first face. In a preferred implementation, the metal supports 704a, 704b, 704c, 704d are positioned to extend laterally with respect to the one or more metal plates 702, and the metal supports 704a, 704b, 704c, 704d have a height less than or equal to a thickness of the one or more metal plates 702. This configuration can improve safety and weight distribution especially when the weight 700 is used in a stack. For example, if multiple weights 700 are used for load testing, ground protection and/or stabilizing and compacting the ground, the weights 700 can be stacked on top of each other, with the one or more metal plates 702 resting flatly against the metal plates

below. The weight is spread out over the large flat area of the metal plates and the risk of the metal plates slipping from the stack can be reduced.

[0044] In the example shown in Figure 7, three metal plates 702 are used, but it will be appreciated that in alternate embodiments there can be fewer or more metal plates per each weight. If multiple metal plates 702 are used, the metal plates 702 are preferably fixedly attached to each other. Figure 7 shows the metal plates 702 being joined to each other using welds 706 placed at predetermined positions, e.g. at the corners and along the length and width of the metal plates 702. Other joining techniques such as the use of welds, braces, clamps, etc. may also be possible.

[0045] The weight 700 can be used for load testing, ground protection and/or stabilizing and compacting the ground by either laying on a ground surface such that a major face 708 of the weight 700 rests on the ground or by acting on a load carrier. In order to provide sufficient weight for load testing and/or stabilizing and compacting the ground, multiple such weights 700 can be arranged in a stack. For example, the weight 700 can act as dead load/weight in the Kentledge pile load test when stacked on top of each other on a platform, with the platform acting on the pile under test. In another example, the weight 700 can be used as a mat for protecting the ground and to spread point loads to prevent ground penetration and/or damage to the ground surface during movement or placement/installation of heavy equipment. After use, the weight 700 can be lifted and moved to a different location using the metal supports as described.

[0046] Figure 8 show a flow chart 800 illustrating a method of lifting a metal object according to an example embodiment. At step 802, a plurality of metal supports corresponding to those as described above with reference to Figures 1-6 are fixedly attached to the metal object. This may involve positioning the metal supports such that the metal supports extend laterally with respect to the metal object. At step 804, a lifting means in the form of e.g. a crane, hoist, pulley, etc. is connected to selected ones of the plurality of metal supports. This may involve disposing a catch (e.g. a hook or chain) of the lifting means around respective beams of said metal supports and securing the catch. At step 806, the metal object is lifted using the lifting means.

[0047] As described, the example embodiments provide devices and methods that can be used safely and effectively at a construction site to lift and move objects, and use such object for load testing, stabilizing and compaction of ground as well as ground protection. For example, the cover wall of the metal supports as described with reference to Figures 1-6 can provide a rigid and durable protection against impact. The

devices and methods as described are also highly adaptable. For example, the metal supports can be used together with the metal plates as new parts off-site, or as replacement parts for the conventional hooks on-site. Furthermore, minimal or no re-training of the operators is required, as the general procedures can still be followed.

[0048] 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 metal support for lifting a metal object, the metal support comprising:

an attachment wall having a first face and a second face opposite the first face, wherein the metal support is configured to be fixedly attached to the metal object at the first face;

a cover wall having an outer face and an inner face opposite the outer face;
and

a beam extending substantially perpendicularly from the second face of the attachment wall and terminating at the inner face of the cover wall.

2. The metal support as claimed in claim 1, wherein the attachment wall is connected to the cover wall to form a hollow passage, and wherein the beam traverses the hollow passage.

3. The metal support as claimed in claim 2, wherein the attachment wall and cover wall are substantially flat, and wherein the metal support further comprises first and second end walls connecting the attachment wall and the cover wall to form a rectangular hollow passage.

4. The metal support as claimed in any one of the preceding claims, wherein the attachment wall and cover wall have the same wall height, and wherein the beam has a beam thickness equal to a predetermined portion of the wall height.

5. The metal support as claimed in claim 4, wherein a bottom face of the beam is elevated with respect to a bottom face of the attachment wall and cover wall, and a top face of the beam is substantially flush with a top face of the attachment wall and cover wall.

6. A weight comprising:

one or more metal plates; and

a plurality of metal supports as claimed in any one of claims 1 to 5, wherein each metal support is fixedly attached to the one or more metal plates at the respective first face.

7. The weight as claimed in claim 6, wherein the plurality of metal supports are configured to extend laterally with respect to the one or more metal plates.

8. The weight as claimed in claim 7, wherein the plurality of metal supports have a height less than or equal to a thickness of the one or more metal plates.

9. The weight as claimed in any one of claims 6 to 8, comprising a plurality of metal plates, wherein the plurality of metal plates are fixedly attached to each other.

10. A method for load testing, the method comprising disposing at least one weight as claimed in any one of claims 6 to 9 to provide load on a load carrier.

11. A method for stabilizing and compaction of ground, the method comprising disposing at least one weight as claimed in any one of claims 6 to 9 on the ground such that a major face of the at least one weight rests on the ground.

12. A method for ground protection, the method comprising disposing at least one weight as claimed in any one of claims 6 to 9 on the ground such that a major face of the at least one weight rests on the ground.

13. The method as claimed in any one of claims 10 to 12, wherein disposing the at least one weight comprises arranging a plurality of weights in a stack.

14. A method for lifting a metal object, the method comprising:
fixedly attaching a plurality of metal supports as claimed in any one of claims 1 to 5 to the metal object;
connecting a lifting means to selected ones of the plurality of metal supports; and
lifting the metal object using the lifting means.

15. The method as claimed in claim 14, wherein fixedly attaching the plurality of metal supports to the metal object comprises positioning the metal

supports such that the metal supports extend laterally with respect to the metal object.

16. The method as claimed in claim 14 or 15, wherein connecting the lifting means to selected ones of the plurality of metal supports comprises disposing a catch of the lifting means around respective beams of said metal supports and securing the catch.