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(54) **METHOD AND APPARATUS FOR
CONVERTING CARGO RINGS INTO SIX
DEGREE OF RESTRAINT ATTACHMENTS**

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(57) **ABSTRACT**

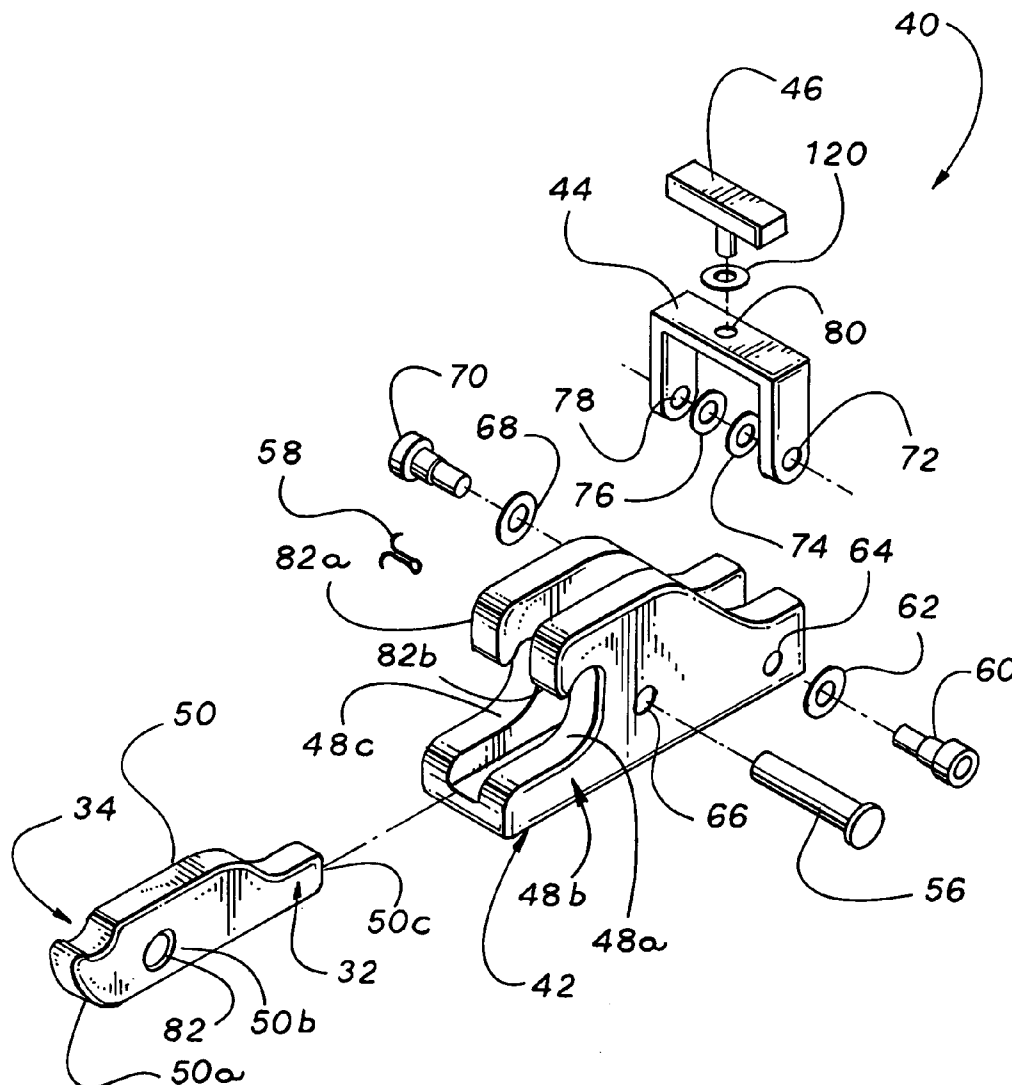
(21) **Appl. No.: 11/595,781**

A system and method for securing a load to a conveyance or transportation surface having a securement point, preferably a cargo ring. In a preferred embodiment of the present invention, a clamp is provided that, when securely engaged with the securement point, an adapter plate secured to the clamp seats firmly onto the transportation surface. When seated, the present invention provides for a securement point upon which a load may be secured, the securement point resisting movement in all directional axes.

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Related U.S. Application Data

(60) **Provisional application No. 60/736,008, filed on Nov. 10, 2005.**



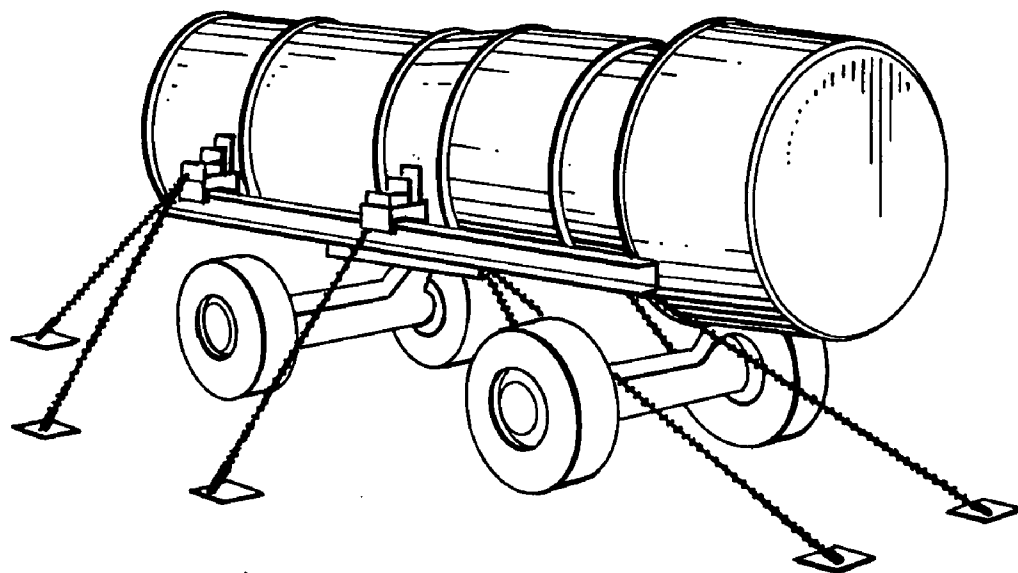


FIG. 1
PRIOR ART

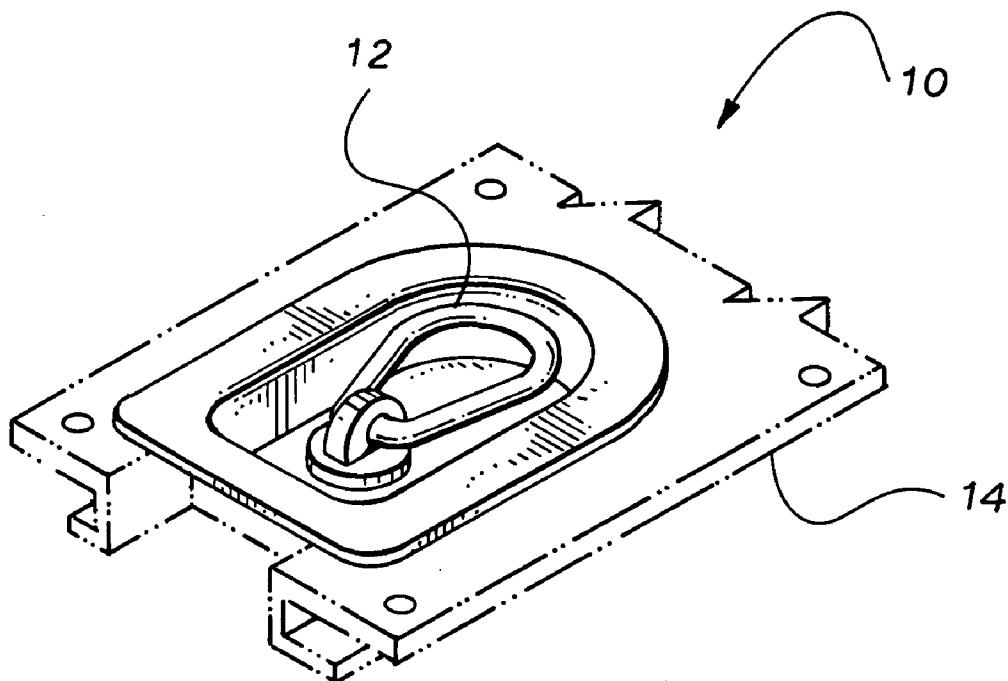
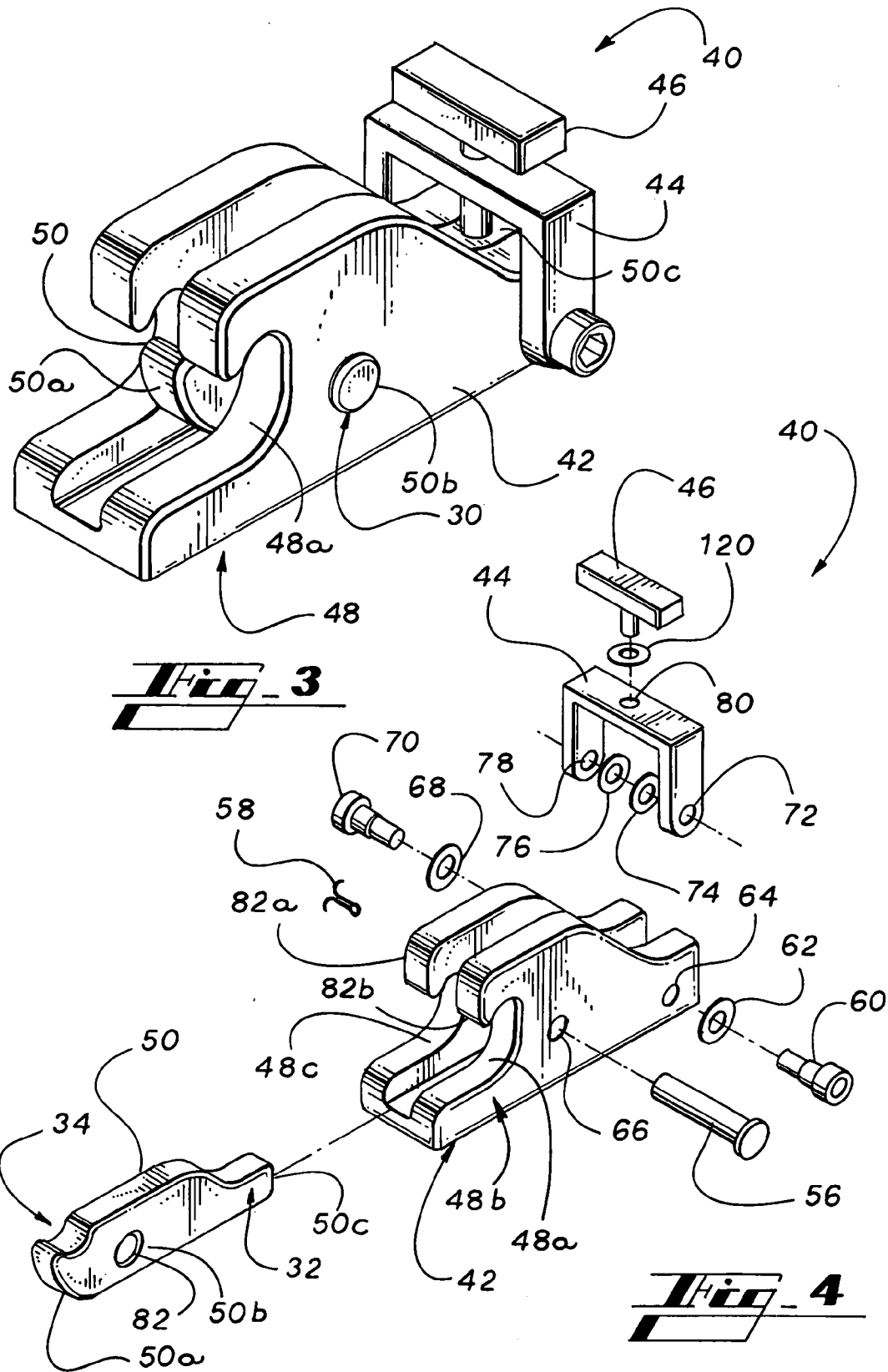


FIG. 2
PRIOR ART



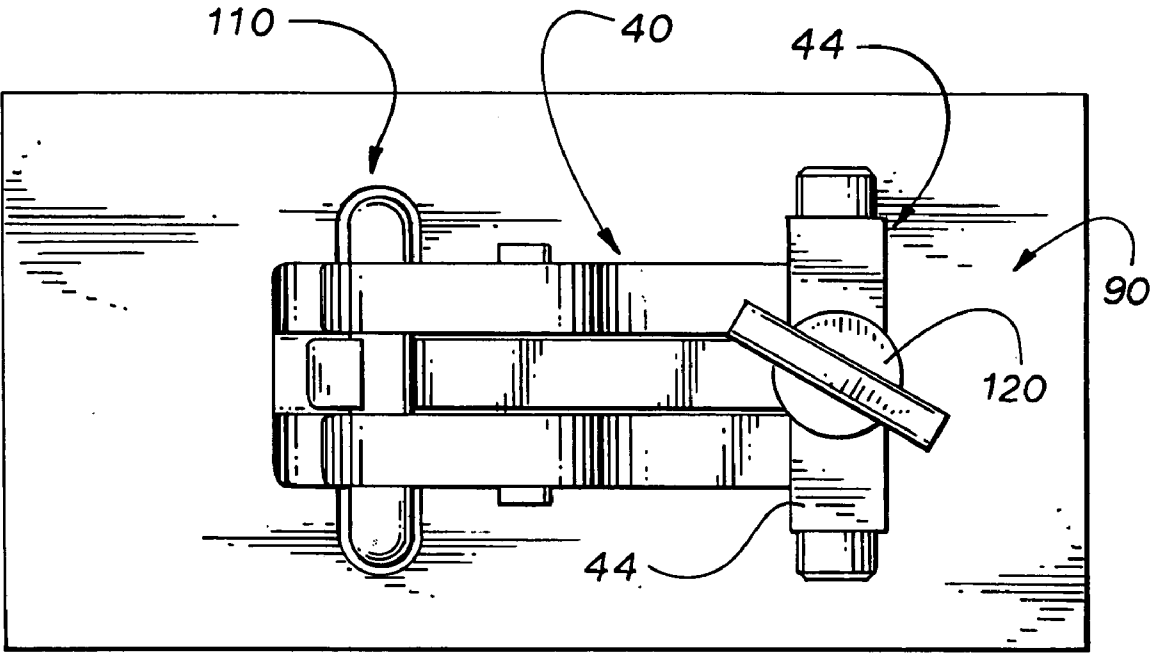


Fig. 5

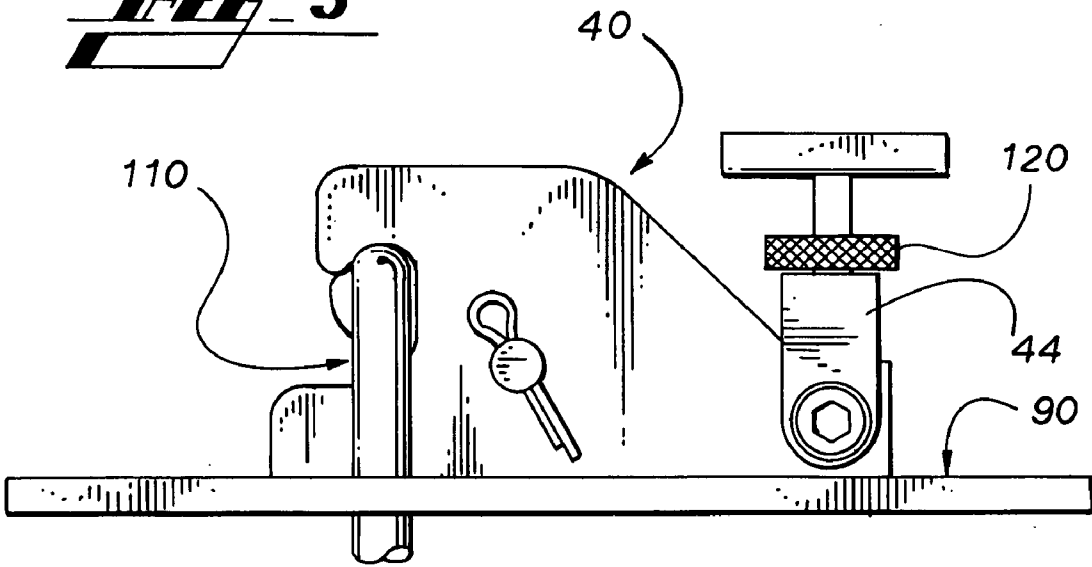


Fig. 6



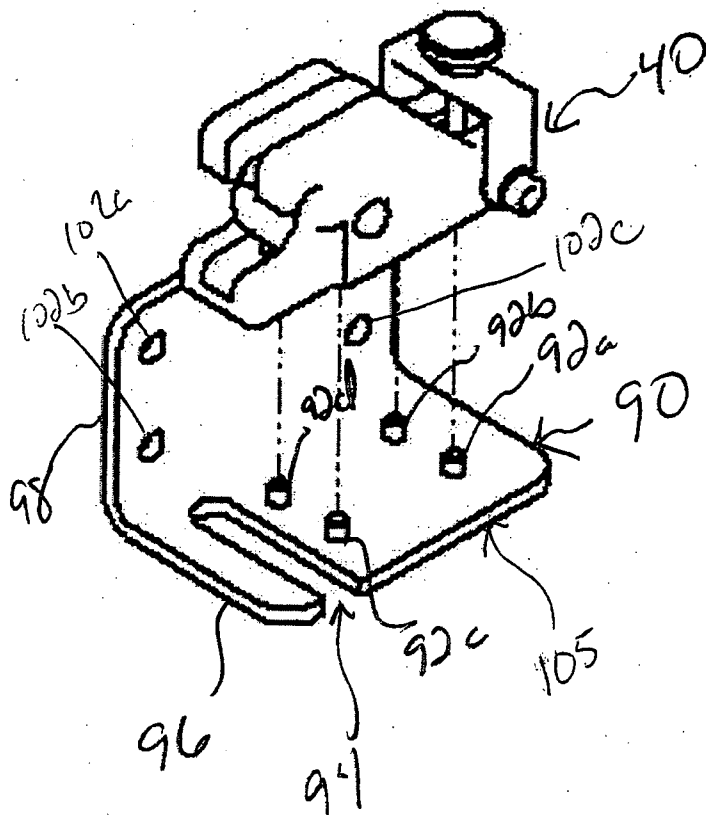


FIG 7

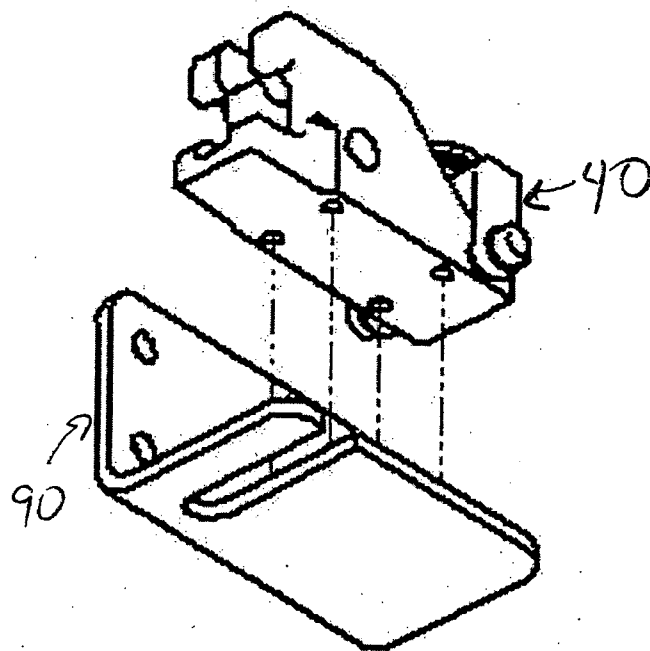


FIG 8

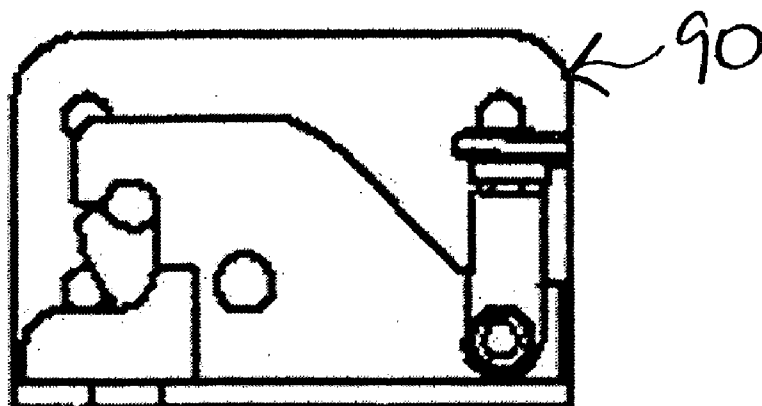


FIG 9

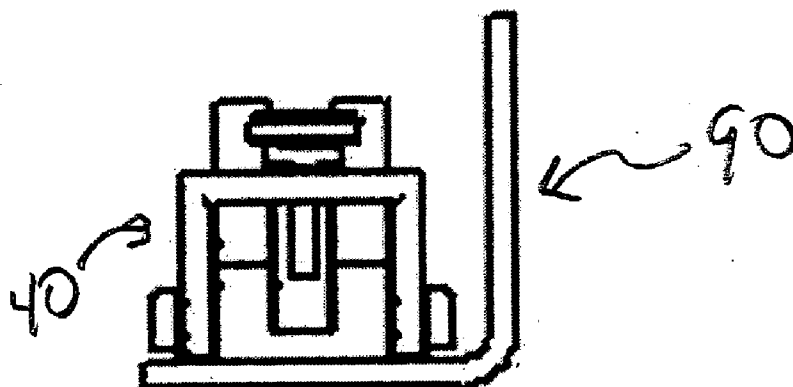
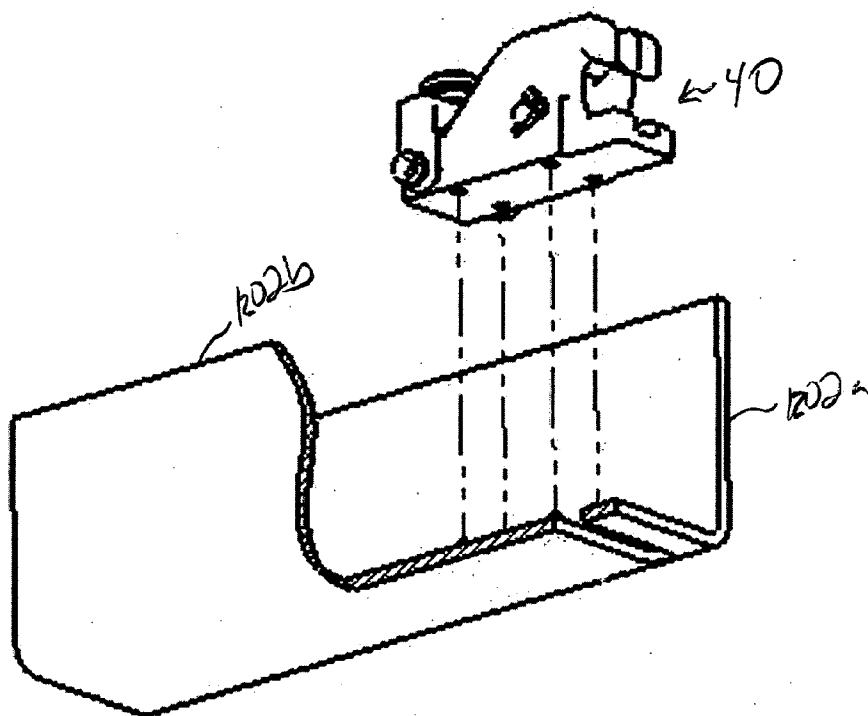
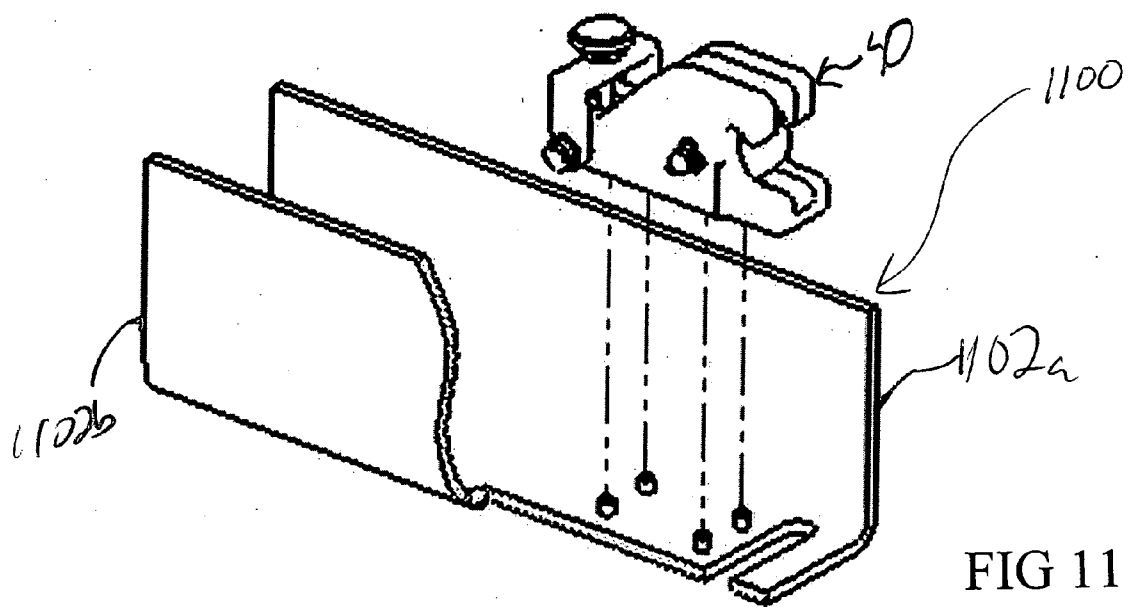


FIG 10



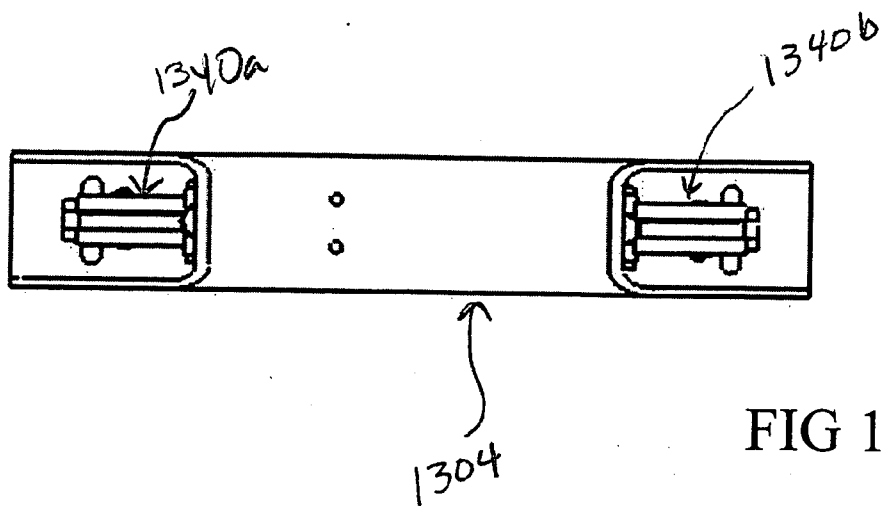


FIG 13

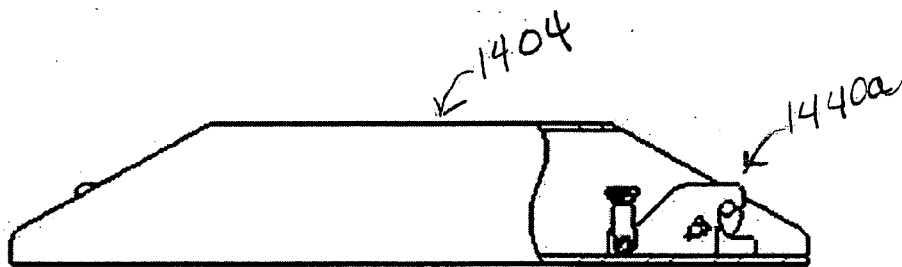


FIG 14

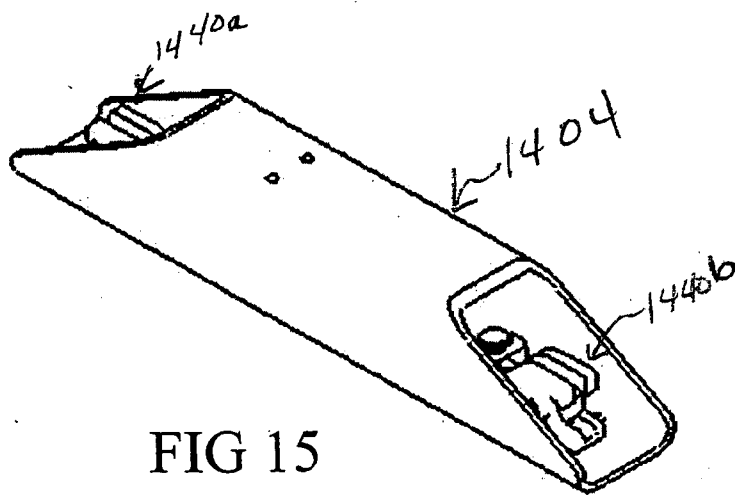


FIG 15

METHOD AND APPARATUS FOR CONVERTING CARGO RINGS INTO SIX DEGREE OF RESTRAINT ATTACHMENTS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present provisional application claims reference to U.S. Provisional Application No. 60/736,008, filed on Nov. 10, 2005, the entire contents thereof is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Technical Field

[0003] The present invention relates generally to clamps, and more specifically, to a method and apparatus for affixing cargo and/or equipment onto the surface/floor of a conveyance that utilizes standard cargo rings.

[0004] 2. Description of Related Art

[0005] Many modern cargo conveyances, i.e. any means of providing transportation of or for cargo, use cargo rings as a securement or attachment point to secure/attach cargo to a surface of the conveyance to prevent it from shifting or moving. As illustrated in FIG. 1, the current art approach to securing the cargo is to use a variety of chains, ropes, and/or straps with a variety of pre-tensioning devices, including binders, tensioners, screws, slip-knots, or the like, to firmly secure the cargo in place using cargo rings, or other securement point means such as eye-bolts or the like. An example of a current art cargo ring is shown in FIG. 2. As shown, current art cargo ring 12 is attached to load securement surface 14. The current art approach of installing temporary equipment in/on vehicles is similar.

[0006] Thus, current art methods are typically "tension only" devices; i.e., they only function to restrain using tension because, while a securement point of the current art may be rigid in one axis, i.e. the upward or Z-axis, they are generally flexible or mobile in the other axes.

[0007] Because of the flexibility inherent in multiple axes in securement points of the current art, tension only devices of the current art are limited in that the devices only restrain a portion of the load at any given time. For example, consider a large pallet of cargo mounted onto a flat bed truck. Best practice dictates that the pallet should have a minimum of four attachments, one from each corner of the pallet to the bed of the truck. For maximum effectiveness, the four attachments (ropes, straps, or chains) are typically angled away from the centerline of the truck bed.

[0008] In a static condition, i.e. no movement of the conveyance upon which the pallet is secured, tension only devices are adequate. But in a dynamic condition, i.e. movement of the conveyance, the limitations of the current art allow movement of the pallet. If the truck stops suddenly during braking, the pallet's momentum will tend to cause the pallet to slide forward. This forward momentum or movement will only be restrained by the two attachments behind/aft of the pallet. The two attachments forward of the pallet are ineffective to provide any counteracting force.

[0009] Continuing with the current example, if the truck accelerates, the pallet's momentum will tend to slide backward and only the two attachments forward of the pallet

would be effective. A similar effect is noted for lateral forces. For example, to restrain a 5,000 pound equipment pallet in an aircraft with 5,000 pound capacity cargo rings, it would be necessary to use a minimum of four (4) cargo rings, one forward, one aft and one on each side because only one ring at a time would be effective. This is not an effective approach because it uses only one-fourth of the capacity of the cargo rings.

[0010] Current art techniques for attaching cargo/equipment to a cargo ring are, thus, limited to the number of securement points that will be effective in any given situation, because cargo rings react to tension loads only. This also results in the need to use a large number of securement points. What is needed is a method and apparatus that overcomes the limitations of the prior art; namely, a method and apparatus for restraint of a cargo or load in all possible axes of movement.

BRIEF SUMMARY OF THE INVENTION

[0011] Briefly described, in a preferred embodiment, the present invention overcomes the above-mentioned limitations and meets the recognized need by providing a method and apparatus that facilitates the reaction to tension loads in all directions, as well as torsion (twisting) loads about any axis.

[0012] In a preferred embodiment, the present invention comprises an adapter plate and a clamp. Generally, a load is attached to the adapter plate which is secured to the clamp of the present invention. The adapter plate has a slot that is sized appropriately to receive a cargo ring therethrough and retained against a structure by the clamp operably engaged with the cargo ring. The adapter plate of the present invention also has a seating surface that is frictionally engaged with the conveyance surface when the clamp of the present invention is secured to a securement point.

[0013] Further, pins in the adapter plate interface with matching holes in the base of the clamp to prevent any lateral motion between the adapter plate and the clamp. Adjusting a thumbscrew activates a lower locking mechanism, in the nature of a "lower jaw", which locks the cargo ring into the assembly. A securing nut on the thumbscrew secures the present invention and prevents loosening of the clamp due to vibration. Once installed and adjusted, the present invention can resist forces between the adapter plate and the cargo ring in any direction. Torsional loads (moment loads) and other forces are transferred, at least in part, by the adapter plate into the structure.

[0014] The adapter plate can be adapted to attach to almost any cargo system or equipment configuration. Minor dimensional changes make the clamp assembly compatible with any existing ring configuration.

[0015] One of the more unique aspects of the clamp assembly is that it requires no modification to the original structure; it may be installed and removed without the need for any hand tools.

[0016] The invention described herein differs from the prior art in that it converts the cargo ring into a rigid attachment means that will react against tension and compression loads in all directions, as well as torsional (twisting) loads, about any axis. It accomplishes this action by pre-tensioning the "ring to floor" attachment against an adapter

plate that the ring passes through. The adapter plate then provides the securement or attachment point for any desired cargo or equipment.

[0017] In one aspect of the present invention, a system is disclosed having a least one clamp adapted to releasably attach to a securement point, at least one adapter plate having a seating surface, and a load securement surface, wherein the adapter plate is removably attachable to the clamp.

[0018] In another aspect of the present invention, a method of securing a load to a securement point is disclosed, the method having the steps of removably attaching an adapter plate to a clamp and attaching the load to the adapter plate to secure the load to the securement point.

[0019] In a further aspect of the present invention, a clamp is described having a jaw with 1) a workpiece contacting end, 2) a central fulcrum 3) a cantilever element, and 4) at least one adapter plate removably attached to the clamp.

[0020] In a still further aspect of the present invention, a method is disclosed for converting a flexible securement point having sufficient structural capacity to provide a resistive force in or about a first axis, to a rigid securement point, having the step of converting a force in or about a second axis to a force in or about the first axis.

[0021] Accordingly, a feature and advantage of the present invention is its ability to provide a removable rigid securement point for rigidly securing a load.

[0022] Another feature and advantage of the present invention is its ability to provide a securement point capable of resisting motion in or about a plurality of axes.

[0023] Another feature and advantage of the present invention is its ability to resist motion in and about three mutually orthogonal axes.

[0024] Another feature and advantage of the present invention is its ability to provide a rigid securement point by converting an existing flexible securement point.

[0025] Another feature and advantage of the present invention is its ability to be removed, thereby re-converting the existing securement point to a flexible securement point.

[0026] Another feature and advantage of the present invention is its ability to be used with an existing securement point without permanent alteration thereof.

[0027] Another feature and advantage of the present invention is its ability to be attached to an existing securement point without tools.

[0028] These and other objects, features, and advantages of the invention will become more apparent to those ordinarily skilled in the art after reading the following Detailed Description of the Invention and Claims in light of the accompanying Figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Accordingly, the present invention will be understood best through consideration of, and reference to, the following Figures, viewed in conjunction with the Detailed Description of the Invention referring thereto, in which like reference numbers throughout the various Figures designate like structure and in which:

[0030] FIG. 1 is a perspective view illustrating prior-art tension devices;

[0031] FIG. 2 is a perspective view of a typical cargo ring used to provide a point of securement;

[0032] FIG. 3 is a perspective view of the preferred embodiment of the clamp of the present invention;

[0033] FIG. 4 is an exploded view of the clamp of FIG. 3, illustrating the preferred components and assembly;

[0034] FIG. 5 is a plan view illustrating the clamp of FIG. 3 in use with the cargo ring of FIG. 2;

[0035] FIG. 6 is a side view illustrating the clamp of FIG. 3 in use with the cargo ring of FIG. 2;

[0036] FIG. 7 is a top perspective, exploded view illustrating the preferred method of securing the clamp of FIG. 3 to an adapter plate of the present invention, the adapter plate providing a securement point for the load;

[0037] FIG. 8 is a bottom perspective, exploded view illustrating the preferred method of securing the clamp of FIG. 3 to an adapter plate of the present invention, the adapter plate providing a securement point for the load;

[0038] FIG. 9 is a side view of the apparatus of FIGS. 6 and 7;

[0039] FIG. 10 is a rear view of the apparatus of FIGS. 6 and 7;

[0040] FIG. 11 is an elevated, perspective, cutaway view showing an alternative embodiment of the adapter plate;

[0041] FIG. 12 is a perspective, cutaway view showing the underside of the alternative embodiment of FIG. 11;

[0042] FIG. 13 is a top view showing another alternative embodiment of the adapter plate of the present invention;

[0043] FIG. 14 is a side, cutaway view of the embodiment of FIG. 13; and,

[0044] FIG. 15 is an elevated, perspective view of the embodiment of FIG. 13.

DETAILED DESCRIPTION OF THE INVENTION

[0045] In describing preferred embodiments of the present invention illustrated in the Figures, specific terminology is employed for the sake of clarity. The invention, however, is not intended to be limited to the specific terminology so selected, and it is to be understood that each specific element includes all technical equivalents that operate in a similar manner to accomplish a similar purpose.

[0046] In that form of the preferred embodiment of the present invention chosen for purposes of illustration, FIG. 3 shows clamp 40 preferably adapted to secure a load to the cargo ring of FIG. 2, which may be provided in a means of conveyance for a load. Clamp 40 preferably includes jaw 50 with workpiece end 50a, central fulcrum 50b, and cantilever element 50c. More specifically, clamp 40 preferably includes workpiece contacting end 48 comprising workpiece contacting surface 48a, for receiving a structure of a securement point, such as cargo ring 110 of FIG. 2. Workpiece contacting end 48 preferably further includes jaw 50 for securing the structure of the securement point, such as when

the structure is in contact with workpiece contacting surface 48a. Clamp 40 preferably further includes screw 46 for applying a downward force to cantilever element 50c, thereby rotating jaw 50 about central fulcrum 50b, which preferably comprises pin 30.

[0047] Preferably, clamp 40 also comprises body 42 that provides a structure upon which the components of clamp 40 are mounted to stabilize clamp 40 and to provide a supporting structure for the lever/fulcrum system. To lock jaw 50 of clamp 40 onto cargo ring 110, or other securement point structure, clamp 40 preferably has locking screw 120 (FIGS. 4-6), such as a thumb screw, that engages bridge 44, thereby preventing screw 46 from loosening and maintains the force applied thereby to cantilever element 50c.

[0048] To more fully illustrate the components of clamp 40, reference is drawn to FIG. 4. Body 42 of clamp 40 is preferably milled from steel, though it is considered to be within the scope of the present invention to optionally use similar metals or compounds having physical properties similar to steel. It will be further appreciated that alternative methods of manufacture, of this and all other parts of the present invention, are contemplated, such methods comprising castings, stampings, or the like. Body 42 preferably includes protruding hooks 82a, b and respective workpiece contacting surfaces 48b, c which form workpiece contacting surface 48a (described above with reference to FIG. 3). Workpiece contacting surface 48a preferably has commensurate shape and size to permit cargo ring 110, or other securement point structure, to be inserted into workpiece contacting surface 48a, as shown more fully in FIGS. 5 and 6.

[0049] Jaw 50 of clamp 40 preferably includes semi-circular receiving notch 34. Receiving notch 34 preferably acts in conjunction with hooks 82a, b to secure cargo ring 110 therebetween (best seen with reference to FIGS. 5 and 6). To provide the necessary compressive and/or restraining forces to prevent outside forces from extracting cargo ring 110 from clamp 40, central fulcrum bore 82 is preferably disposed through jaw 50. When pressed against surface 32 of cantilever element 50c, screw 46 preferably pushes notch 34 upwards by rotation about pin 56, inserted through aperture 66 and fulcrum bore 82 and held in place by cotter pin 58.

[0050] To maintain the force imparted by screw 46 onto surface 32, preferably bridge 44 is provided. Screw 46 is preferably threaded through threaded aperture 80. Bridge 44 is preferably rotatably connected to clamp body 42 by pin 60. Pin 60 is preferably inserted into receiving pin 70 through apertures 78, 72, and 64 (and a corresponding aperture not shown). To facilitate the rotation of bridge 44, washers 62, 74, 76, and 68 are preferably provided.

[0051] When screw 46 is tightened to push surface 32 of cantilever element 50c downward, preferably imparting a resulting upward force on surface 34 of workpiece end 50a, through fulcrum 50b, receiving passageway 48b, c, hooks 82a, b, and workpiece contacting surface 48a preferably clamp onto cargo ring 110.

[0052] For purposes of illustration only, the securement element discussed herein is cargo ring 110, as shown by example in FIGS. 2, 5 and 6, having a generally circular shape attached at a point to a conveyance, most preferably

an aircraft. It should be appreciated by those of ordinary skill in the art that the present invention may optionally be used on, or in association with, a variety of types of securement points and/or conveyances.

[0053] FIG. 5 is a top-down view of the present invention clamped onto a typical aircraft securement point, such as cargo ring 110. As shown, when locking element 44 screw 46 is tightened, cargo ring 110 is preferably secured within the jaw of clamp 40. Further, in a preferred embodiment of the present invention, when cargo ring 110 is secured within clamp 40, adapter plate 90, which is removably attached to clamp 40, is preferably securely seated flat onto surface 100 in which the securement point is attached, in this example the cargo floor of an aircraft. Having adapter plate 90 seated securely onto surface 100 when clamp 40 is preferably engaged with cargo ring 110 preferably provides for a securement point that resists forces in, and about, all axes of possible movement.

[0054] FIG. 6 is a side view showing cargo ring 110 secured within the jaw of clamp 40. As described above, in a preferred embodiment of the present invention, clamp 40 is preferably sized so that when cargo ring 110 is secured by clamp 40, adapter plate 90 is preferably pressed firmly against surface 100 in which cargo ring 110 is attached.

[0055] FIG. 7 shows more fully how adapter plate 90 is preferably attached to clamp 40. As shown, adapter plate 90 is preferably a unitary piece having various portions to provide for the present invention. More specifically, adapter plate 90 preferably has projections 92a-d which mate with four corresponding apertures on the underside face of clamp 40 (not shown). When properly aligned, adapter plate 90, through projections 92a-d, is preferably fixedly engaged with clamp 40. Alternatively, projections 92a-d may be replaced by apertures, and adapter plate 90 may be screwed, or otherwise mechanically fastened to clamp 40. Further, adapter plate 90 preferably also has slot 94 and extension surface 96 which allows the securement point of the prior figures to be aligned with the jaw of clamp 40 and slide into the jaw when opened; thus, providing for an opening for extending the securement point to the opening of the jaw of clamp 40.

[0056] Additionally, in a preferred embodiment of the present invention, adapter plate 96 also has surface 98 which is preferably disposed substantially perpendicular to surface 105. Surface 98 preferably has apertures 102a-d (aperture 102d not shown) through which a load may be secured to adapter plate 90. As discussed previously, when clamp 40 is engaged with a securement point (not shown), surface 105 is preferably securely engaged with surface 100. FIG. 8 shows the underside of the preferred embodiment of the present invention. FIG. 9 shows the side view of the preferred embodiment of the present invention. FIG. 10 is a backside view of the preferred embodiment of the present invention.

[0057] Because load securement devices may vary, various types of adapter plates may be necessary in order to secure the load to the clamp of the present invention. As an example, FIG. 11 shows clamp 40 preferably secured to C-channel adapter plate 1100. C-channel adapter plate 1100 is preferably a unitary piece having a shape similar to the shape of adapter plate 90 of the prior figures, further including an additional perpendicular surface. As shown,

adapter plate **1100** preferably has perpendicular surfaces **1102a,b** that allow the cargo to be secured to the present invention, and that utilize a C-channel cargo securement apparatus. FIG. **12** shows the underside of adapter plate **1100** having surfaces **1202a,b**.

[0058] Another embodiment of the present invention is shown more fully in FIG. **13**. For instances in which a load needs to be secured to multiple securement points, due to various requirements, including, for example, space limitations and/or design considerations, FIG. **13** shows an alternative embodiment of the present invention in which clamps **1340a,b** are preferably secured within tubular adapter **1304**. Clamps **1340a,b** are constructed similarly to clamp **40**, as described above. When engaged to two securement points, adapter **1304** preferably provides a load securement point that is stronger than may be provided using a single clamp. FIG. **14** is a cutaway side view showing clamp **1440a** secured within adapter **1404**. FIG. **15** is a perspective view showing clamps **1440a,b** secured within adapter **1404**.

[0059] Having, thus, described exemplary embodiments of the present invention, it should be noted by those skilled in the art that the within disclosures are exemplary only and that various other alternatives, adaptations, and modifications may be made within the scope and spirit of the present invention. Accordingly, the present invention is not limited to the specific embodiments as illustrated herein, but is only limited by the following claims.

- 1. A system for securing a load to a surface having a securement point, said system comprising:
 - at least one clamp adapted to releasably attach to said securement point; and
 - at least one adapter plate having a seating surface; and
 - a load securement surface, wherein said adapter plate is removably attachable to said load securement surface.
- 2. The system of claim 1, wherein said securement point comprises at least one cargo ring.
- 3. The system of claim 1, wherein said clamp comprises a jaw, said jaw having a workpiece contacting end and a fulcrum.
- 4. The system of claim 3, wherein said clamp further comprises a lock member in operable engagement with said jaw.
- 5. The system of claim 4, wherein said lock member further comprises a rotatable bracket attached to said clamp having a screw disposed in the bracket.
- 6. The system of claim 1, wherein the load is removably attached to said load securement surface.
- 7. The system of claim 1, wherein said clamp further comprises at least one workpiece contacting surface and means for applying a force to said at least one workpiece contacting surface in the direction of an axis of restraint of said securement point.

8. The system of claim 7, wherein said at least one adapter plate is selectively rigidly attachable to the surface.

9. A method for securing a load to a securement point, said method comprising the steps of:

- removably attaching an adapter plate to a clamp;
- clamping said clamp onto said securement point; and
- attaching the load to said adapter plate to secure the load to the securement point.

10. The method for securing a load to a securement point of claim 9, wherein said clamping step comprises applying a force to said securement point in a direction along an axis of restraint of said securement point.

11. The method for securing a load to a securement point of claim 9, wherein the step of attaching said load to said adapter plate comprises rigidly attaching the load to a structure to which said securement point is connected.

12. The method for securing a load to a securement point of claim 9, further comprising locking said clamp whereby a force is continuously applied to said securement point in a direction along an axis of restraint of said securement point is provided.

13. A clamp comprising:

- a jaw having a workpiece contacting end, a central fulcrum, and a cantilever element; and

at least one adapter plate, wherein said adapter plate is removably attached to said clamp.

14. The clamp of claim 13, further comprising a locking mechanism for preventing motion of said jaw in at least one direction.

15. The clamp of claim 13, further comprising a biasing member for applying a force to said cantilever element to cause rotation of said jaw about said fulcrum.

16. A method for converting a flexible securement point having sufficient structural capacity to provide a resistive force in or about a first axis, to a rigid securement point, said method comprising the step of:

- converting a force in or about a second axis to a force in or about said first axis.

17. The method of claim 16, further comprising the step of attaching a clamp to said securement point.

18. The method of claim 17, wherein the step of attaching comprises providing a force in a direction opposite the resistive force sufficient to prevent movement of said clamp in or about the second axis.

19. The method of claim 18, further comprising the step of removing said clamp from said securement point to re-convert said securement point to a flexible securement point.

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