

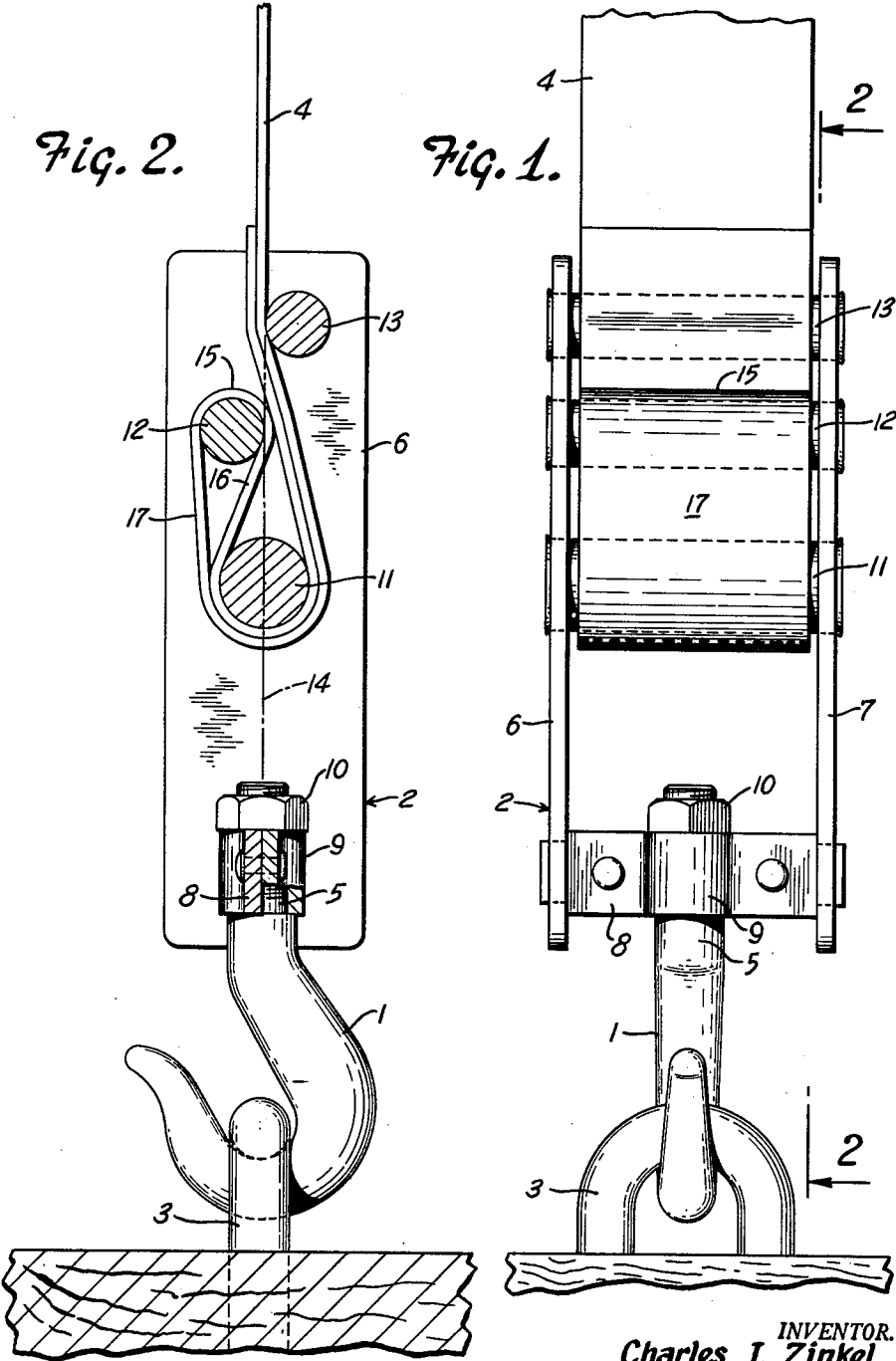
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MULTIPLE PLY FRICTION TIE-DOWN UNIT

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MULTIPLE PLY FRICTION TIE-DOWN UNIT
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This invention relates to a multiple ply friction tie-down unit and particularly to a fastener having a plurality of spaced pin means about which a tie-down strap is threaded to securely attach the strap to the fastener in a manner permitting exceptionally high pull forces to be applied to the strap without slippage or yield of the strap with respect to the fastener.

In securing loads, cargo and the like, strap members are often thrown over the loads and secured by suitable fasteners to the base or supporting structure. Fasteners have been provided with suitable cross pins or bars about which the strap is threaded to provide overlying plies of the strap with the free end of the strap normally sewed to the adjacent strap portion. Pulling on the strap results in frictional engagement of the outer ply upon the inner ply. For relatively high forces or tensions, it is conventional to sew the free end of the strap to the adjacent strap area to prevent slip and yield. However, sewing of the strap is only effective for a certain longitudinal length of the strap. Consequently, sewing of the strap will only result in a limited increase in the strength. Further, a sewn strap cannot be readily unthreaded from the cross pins if it is desired to replace the webbing or strap.

Although complicated pin arrangements have been provided to eliminate the necessity of sewing, threading the web through the various pins is generally quite difficult, particularly where relatively thick webbing is employed to carry substantial loads. Further, applicant knows of no cross pin threading arrangement not employing a sewn strap which will permit pull loads in excess of ten thousand pounds.

The present invention is particularly directed to a web or strap securement over three spaced pins arranged to provide high frictional forces which eliminates the necessity for sewing of the free end of the strap to the adjacent strap areas. The strap is therefore readily releasable from the fastener while allowing exceptionally high loads on the strap.

In accordance with the present invention, the fasteners include a pair of side bearing plates or members interconnected at one end by a lateral connecting brace for connecting one end of the fastener to a support. Three pins are longitudinally spaced between the bearing plates and each is rigidly attached at its opposite ends to the bearing plates. The innermost pin constitutes a friction pin, the intermediate pin constitutes an anchor pin and the outermost pin constitutes a pull locating pin. The strap is threaded through the pins with a loop encircling the anchor pin and forming a double ply of the strap which extends around the opposite circumference of the friction pin and then back between the anchor pin and the pull locating pin. The pins are located to provide mutual coaction such that the outer ply of the strap frictionally engages the inner ply of the strap about the friction pin with the friction force increasing with increased load. The pull locating pin further is positioned to cause the double ply of the strap to frictionally bear against the strap on the anchor pin to provide an increased binding friction position.

To obtain maximum effectiveness and efficiency of the tie-down unit, the three pins are disposed to symmetrically position the fastener in line with the direction of pull or stress. The friction pin is aligned with the plane through the strap and the brace. The anchor and the

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pull locating pins are offset on opposite sides of the longitudinal plane. The pin location establishes equalized stresses in the bearing plates longitudinally of the fastener and minimizes distortion of the bearing plates.

The present invention provides a reliable and simply threaded attachment of a strap or similar member for releasably interconnecting the strap to a fastener or the like and permits higher loads on the friction locked strap than has been heretofore provided by sewing of the strap.

The drawing furnished herewith illustrates the best mode presently contemplated for carrying out the invention.

In the drawing:

FIG. 1 is a front elevational view of a fastener incorporating the subject matter of this invention; and

FIG. 2 is a vertical section taken on line 2—2 of FIG. 1.

Referring to the drawing, a hook 1 is secured to one end of a fastener 2 and releasably interconnected to a base support loop 3. A tie-down web or strap 4 of indefinite length is releasably secured to the fastener 2, as more fully described hereinafter, and is connected at the opposite end, not shown, to a load, not shown.

The hook 1 is of any suitable variety including a substantially closed circular hook end or portion which is adapted to releasably engage the loop 3 for anchoring the corresponding end of strap 4 to a base support or the like. The hook 1 includes a shank 5 projecting radially from the curved end of the hook 1 into and being secured to the fastener 2.

The illustrated fastener 2 includes a pair of side bearing plates 6 and 7 spaced apart somewhat more than the width of strap 4. A hook brace 8 extends laterally between the lower end of the bearing plates 6 and 7 and through suitable openings in bearing plates 6 and 7. The outer ends of brace 8 are bent over to rigidly secure the brace 8 to the bearing plates. The brace 8 is formed with a central tubular portion 9 through which the hook shank 5 is passed. The outer end of the hook shank 5 is threaded and receives a securing hex nut 10 to releasably interconnect the hook 1 to one end of the fastener 2, in the illustrated embodiment of the invention. The opposite end of fastener 2 is releasably attached to strap 4.

The opposite end of fastener 2 supports a series of three cross pins 11, 12 and 13 which are fixedly secured in longitudinally spaced relation between the bearing plates 6 and 7. The strap 4 is threaded about the cross pins 11—13 as subsequently described to provide a releasably non-sewed attachment of the strap 4 to the fastener 2.

Referring particularly to FIG. 2, the cross pin 11 constitutes a friction cross pin which is secured in slightly spaced relation to the support brace 8. The axis of the pin 11 is located in a longitudinal plane of the fastener 2 including the line 14 which passes through the axis of the tubular portion 9 of brace 8 and therefore shank 5.

The cross pin 12 constitutes an anchor pin which is secured outwardly from the friction pin 11 with the axis thereof lying to the one side of the line 14, shown to the left in FIG. 2. The anchor pin 12 is secured with the corresponding circumference thereof substantially lying in the longitudinal plane of line 14.

The cross pin 13 constitutes a pull locating pin which is secured outwardly from the anchor pin 12 on the opposite side of the plane including line 14. The circumference of the pull locating pin 13 is also generally in the longitudinal plane 14.

The strap 4 is threaded about the pins 11—13 with a loop 15 encircling or threaded about the anchor pin 12 and defining an inner ply 16 and an outer ply 17. From the anchor pin 12, both the inner and the outer plies 16 and 17 thread about the friction pin 11 and then outwardly between the anchor pin 12 and the pull locating pin 13.

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The outer ply 17 bears on the side of the locating pin 13 in the longitudinal plane of line 14 and moves both inner and outer plies 16 and 17 toward anchor pin 12. The pins 12 and 13 are longitudinally spaced to establish a further frictional engagement between the strap loop 15 on the anchor pin 12 and the inner ply 16 and between the inner and outer plies 16 and 17. As the pulling or tension force applied to the strap 4 increases, the frictional gripping of the outer ply 17 upon the inner ply 16 over the engaging surface of the friction pin 11 increases accordingly to provide a firm substantial hold upon the strap. Further, the placement of the locating pin 13 results, as previously noted, in frictional engagement between plies 16 and 17 and with the strap loop 15 encircling the anchor pin 12 to further prevent yielding and slipping of the strap with respect to the fastener 2.

The bearing plates 6 and 7 are sufficiently deep to protect the threaded strap 4 from rubbing on adjacent elements and preventing destruction thereof.

In the illustrated embodiment of the invention, the friction pin 11 is shown with its axis in the longitudinal plane including the line 14. The anchor pin 12 and the pull locating pin 13 are disposed generally equally on opposite sides of the line 14 and result in a symmetrical positioning of the fastener 2 in line with the direction of the pull exerted on the strap 4. The forces of strap 4 are therefore symmetrically located about plane 14 and substantially eliminate twisting of the fastener to insure similar and more effective frictional engagement of the strap 4 under all loads. The pin location furthermore provides essentially longitudinal stresses on the bearing plates 6 and 7 which minimizes substantially the distortion forces on the bearing plates 6 and 7.

The limiting pull which can be exerted on the strap 4 without rupturing the strap increases with the diameter of friction pin 11. The diameter of pins 12 and 13 is not critical. Consequently, particularly where a thick, heavy strap is employed, the pin 11 is selected with a diameter which provides the desired pull strength and the anchor pin 12 and the locating pin 13 are formed with a somewhat smaller diameter. The pins 11-13 can then be located to permit ready threading of the relatively heavy straps about the pins 11-13 while providing a high strength attachment to a compact fastener.

Applicant has found that a one and three-fourths inch strap of nylon or Dacron webbing of substantially one-fourth inch thickness supports a two-way direct pull in excess of eleven thousand pounds when threaded as described above about a friction pin 11 of seven-eighths inch diameter and an anchor pin 12 and locating pin 13 of only five-eighths inch diameter.

The present invention provides a small, compact fastener having a friction bound attaching strap which may be readily manipulated and will also maintain maximum strength requirements.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. A tie-down fastener for frictionally securing one end of a flexible strap, a pair of laterally spaced bearing support members having a securement means at one end thereof and defining a line of pull for the fastener and strap, at least three cross pins rigidly secured to the bearing members and longitudinally spaced therebetween along said line of pull, the innermost cross pin nearest said securement means constituting a friction pin and having its axis substantially intersecting said line of pull and normal thereto, the intermediate cross pin constituting an anchor pin with its axis on one side of the line of pull, the outermost cross pin constituting a pull locating pin with its axis on the opposite side of the line of pull and with the line of pull substantially tangential thereto, extending from the fastener opposite said securement means and

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looped around said anchor pin to define at least one inner and one outer ply passing about the friction pin and back between said anchor pin and said pull locating pin with the free end portion of the strap constituting the inner ply on said friction pin and frictionally confined between the outer ply and said loop.

2. The construction of claim 1 wherein said friction pin diameter is greater than the diameter of the anchor pin and of the pull locating pin.

3. The construction of claim 1 wherein said bearing members are formed of solid plates of sufficient width to project outwardly of the exposed facing of the threaded strap.

4. A friction tie-down fastener assembly which comprises a flexible fastening strap of indefinite length, a pair of bearing plates secured in spaced parallel relation with a spacing exceeding the width of the strap, three longitudinally spaced cross pins between the plates and rigidly connected at opposite ends to the plates, the pull line of said fastener extending substantially tangential of the outermost pin and generally through the body of the innermost pin, the intermediate cross pin constituting an anchor pin and having its axis lying to the side of said pull line opposite said outermost pin, the innermost cross pin constituting a friction pin for holding the strap against slippage, said strap being disposed on the cross pins and extending from the fastener in the direction of said pull line with a loop encircling the anchor pin and defining a free-end inner ply and an outer ply passing around the friction pin and then back between the anchor pin and the outermost pin, and said pins being located to dispose the end of the inner ply and the outer ply between said friction pin and the outermost pin bearing against the loop encircling the anchor pin.

5. A friction tie-down fastener comprising a flexible strap, a pair of laterally spaced bearing frames interconnected at one end by a lateral brace, a securement means secured to said lateral brace and providing a pull line for the fastener extending generally longitudinally of said bearing frames from said securement means, at least three cross pins rigidly secured to and between the bearing frames and longitudinally spaced along said pull line outwardly of said brace, the intermediate cross pin constituting an anchor pin, the innermost cross pin constituting a friction pin, the outermost cross pin constituting a pull locating pin with said pull line substantially tangential thereto, and said pins being arranged with the strap threaded on the pins and extending from said outermost pin in the direction of said pull line, said strap encircling said anchor pin to define at least one inner ply and one outer ply passing from the anchor pin about the friction pin and back between said anchor pin and said pull locating pin with the free end of said strap constituting the inner ply, said cross pins being constructed with said friction pin substantially larger in diameter than said anchor pin and with said inner and outer plies of said strap encircling said friction pin for a distance substantially greater than 180° of the circumference of the pin.

6. A tie-down fastener, which comprises a fastening strap, a pair of bearing plates secured in spaced parallel relation with a spacing exceeding the width of the strap, a lateral hook brace rigidly attached to one end of the bearing plates and spanning the space therebetween, a hook having a shank fixedly secured centrally of the hook brace with the shank axis parallel to a central longitudinal plane through said pair of plates, three longitudinally spaced cross pins between the plates and rigidly connected at opposite ends to the plates, the cross pin closest to said hook having its axis lying in said longitudinal plane and constituting a friction pin, the intermediate cross pin having its axis lying to one side of said longitudinal plane with a circumferential line generally coinciding with said longitudinal plane and constituting an anchor pin, the outermost cross pin having its axis lying to the opposite side of the longitudinal plane with the circumferential line

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generally in said longitudinal plane and constituting a pull locating pin, said strap being disposed on the cross pins and extending from the fastener in said longitudinal plane with a loop encircling the anchor pin and defining a free-end inner ply and an outer ply passing around the friction pin and then back between the anchor pin and the pull locating pin whereby a pull on the outer ply establishes a firm frictional engagement of the outer ply upon the adjacent inner ply at the friction pin and of the double ply upon the loop encircling the anchor pin.

7. The construction of claim 6 wherein said friction pin has a larger diameter than said anchor pin and said pull locating pin.

8. The construction of claim 7 wherein said bearing

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plates are of sufficient width to project beyond the exposed facing of the threaded strap to protect the strap.

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