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(57) Abstract: A swivel end anchor to which a cable of a fall arrest system is attached is disclosed. The anchor comprises a first plate mountable to a fixed support structure on a building or scaffold installation and a second plate pivotally mounted to the first plate, said second plate having means for attaching an end of a cable of a fall arrest system thereto. A fall arrest system and structural anchor is also disclosed.



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Safety Devices

Description

The present invention relates to devices for use in horizontal, inclined and vertical
5 cable-based solutions as part of fall arrest systems for protecting workmen
operating at elevated positions. For example, the present invention relates to a
swivel anchor, a fall arrest system including said swivel anchor, a clamp mounting a
cable anchor of a fall arrest system to a scaffolding pole installation and a structural
anchor for attaching a fall arrest system support post to a structural surface. Several
10 different problems are addressed and it is envisaged that some or all of the devices
referred to below can be used independently or in conjunction with each other
depending on the system requirements.

Workmen who need to gain access to elevated areas local to potential fall hazards
15 are generally required by health and safety regulations to be equipped with an
appropriate safety system such as a fall restraint or fall arrest system so that in the
event of a slip or fall potential injury or fatality can be prevented. These systems
typically involve the workman wearing a harness attached via a lanyard and a clip to
an anchoring point mounted on a building. In the instances where individual
20 anchoring points are used, the workman has to repeatedly reattach the lanyard to
another anchoring point to access areas beyond the reach of the lanyard and in the
process of doing so compromising their safety.

Alternatively, a horizontal, inclined or vertical cable system can be employed acting
25 as a continuous anchoring point wherein the clip of the lanyard is permanently
attached to a cable secured across the top of the roof or other structure. The cable
is stretched between two end anchors typically secured to upright steel posts which
are rigidly fastened to the roof or structure. Furthermore, intermediate anchors can
be used so as to support and reduce any slack in the cable. The cable system enables
30 the workman to move relatively unrestrained because as the lanyard pulls the clip,
the clip slides freely along the cable over any intermediate anchors.

In the use of a horizontal or inclined cable system, a fall is arrested by the fall arrest system such that the lanyard pulls on the cable in a vertical direction due to gravity as well as in a horizontal direction as the cable would generally not extend immediately over the falling hazard. This causes the steel post, which upper portion
5 is rigidly secured to the end anchor and its lower portion firmly attached to the roof, to be subjected to bending as a result of the vertical pulling of the cable and torsion due to the horizontal forces exerted on the cable. Consequently, the steel post is weakened in more than one plane and so does not provide optimum safety for workmen performing their duties at elevated positions.

10

The present invention seeks to provide a modified fall arrest system that substantially alleviates the aforementioned problem and prevents twisting of the anchoring post.

15 To further secure a steel post to a roof or other structure bolts can be used. However, when a post is being retrofitted to an existing roof, access to the underside of the roof lining to enable the bolts to be tightened is not available. Therefore, it is necessary to use a fastener that can be inserted through the roof and tightened from the upper side only.

20

The present invention also seeks to provide a modified fastener for mounting an anchoring post to a roof structure.

Appropriate safety systems are also necessary for workmen operating on scaffolding
25 at elevated positions. Currently, individual anchoring points are used on scaffolding as scaffolding is generally erected for temporary use and adapted to the existing structure and so it is not feasible to install permanent fixation points such as the previously described steel posts.

30 Accordingly, there is a need for devices seeking to provide secure and temporary solutions for installing a horizontal, inclined and/or vertical cable system on scaffolding. This includes devices which are temporarily secured onto the braces of scaffolding acting as end anchors stretching the cable across a distance. As the

structure of scaffolding is usually adapted to an already existing building the configuration of the cable system has to be tailored to suit each specific scaffold installation and so there is a need for end anchors of different designs as well as intermediate anchors supporting the cable.

5

Further considerations to take into account to provide a safe and functional cable system for scaffolding is to maintain its orientation. A cable system may comprise of differently orientated sections and it is particularly important that a horizontal section of a cable system is maintained in such an orientation for it to successfully
10 arrest a fall. In the case of implementing a fall arrest system on scaffolding, braces which are temporarily joined together usually lie in different planes since a typical coupler receives one brace on top of a second brace and so end anchors secured to the two braces are of different heights resulting in misalignment of a section of the cable.

15

Additionally, scaffolding can extend over various levels with interconnecting paths and junctions and so a cable system shall ideally provide devices, such as a turntable, which grant access to another cable system extending to another level or path without the need for the workman to reattach his harness to the cable.

20

The present invention seeks to overcome or substantially alleviate the problems mentioned above.

According to the present invention there is provided a swivel end anchor to which a
25 cable of a fall arrest system is attached, the anchor comprising a first plate mountable to a fixed support structure on a building or scaffold installation and a second plate pivotally mounted to the first plate, said second plate having means for attaching an end of a cable of a fall arrest system thereto.

30 Preferably, the swivel end anchor comprises a base plate mounted to a fixed support structure, the first plate comprising a yaw plate mounted to the base plate for rotation about a vertical axis.

Conveniently, the second plate comprises a pitch plate coupled to the yaw plate such that the pitch plate rotates relative to the yaw plate about a horizontal axis.

5 The base plate may be configured to enable it to be mounted to a fixed support structure such that it rotates about a horizontal axis.

Preferably, the base plate pivots about a horizontal axis perpendicular to the horizontal axis of the pitch plate and the yaw plate.

10 Conveniently, the means for attachment of the end of a cable is pivotally mounted to the second plate.

In one embodiment, the means for attaching an end of a cable comprises an eyebolt.

15 Preferably, the eyebolt rotates about an axis which is perpendicular to the axis about which the first and second plates rotate relative to each other.

In another embodiment, the yaw plate is a U-shaped bracket and the pitch plate is a U-shaped bracket that is received within the yaw plate.

20 According to another aspect of the invention there is also provided a fall arrest system comprising a swivel end anchor as previously described and an anchoring member for attachment to a fixed support structure, the base plate comprising a wall extending between two perpendicular sidewalls, the anchoring member being
25 received between said side walls such that a bolt may be passed through the side walls and the anchoring member to attach the swivel anchor to the anchoring member.

Preferably, the base is rotatable relative the anchoring member about an axis of a
30 bolt connecting the base to the anchoring member.

In one embodiment, the anchoring member is a post, the top of the post being received between the side walls of the base plate.

The fall arrest system including the anchoring member may further comprise a clamp plate having a cylindrical portion positionable between the side walls of the base to receive a bolt extending therethrough to attach the anchoring member to
5 the base.

Preferably, the anchoring member includes a scaffold clamp for attachment to a scaffolding pole, the scaffold clamp having an upstanding flange for attachment of the clamp plate thereto.

10

Conveniently, the upstanding flange and clamp plate each have corresponding holes therein to receive bolts to couple the clamp plate to the scaffold clamp.

According to another aspect of the present invention a clamp is provided for
15 mounting a cable anchor of a fall arrest system to a pole of a scaffolding installation, the clamp comprising a first member fixedly attachable to a scaffolding pole and a cable attachment bracket mounted to the first member.

In one embodiment, the cable attachment bracket is pivotally mounted to the first
20 member for relative rotation of the cable attachment bracket and first member.

Preferably, the cable attachment bracket comprises a base plate attached to the scaffolding clamp such that the base plate rotates about an axis perpendicular to the axis of a scaffolding pole received in the first member.

25

The cable attachment bracket may further comprise a wall upstanding from the base plate and comprises means for attachment of a cable thereto.

Preferably, said means comprises an anchor end plate is attached to the upstanding
30 wall, said anchor end plate having a hole therein to couple a cable to said clamp.

In an alternative embodiment, the cable attachment bracket comprises an anchor end plate having a hole for receiving an end of a cable fixedly mounted to said first member.

- 5 Conveniently, the cable attachment bracket is fixed and integral with the first member.

The end anchor cable attachment plate may be removably attachable to the cable attachment bracket, the cable attachment plate having means for coupling a cable
10 thereto.

Preferably, the cable attachment bracket comprises means to support a cable mid way along its length.

- 15 According to another aspect of the present invention, there is also provided a structural anchor for attaching a fall arrest system support post to a structural surface, the swivel structural anchor comprising a cylindrical body threaded at one end, the other end being formed from a first part-cylindrical portion extending from the body and a second part cylindrical swivel portion pivotally attached to the first
20 portion about an axis extending perpendicularly to the longitudinal axis of the cylindrical body, the first and second portions together forming a complete cylinder having a diameter no greater than the diameter of the threaded end of the cylindrical body when the longitudinal axis of the second part is aligned with the longitudinal axis of the first part, the second part being pivotable into an second
25 orientation in which the longitudinal axis of the second part is perpendicular to the longitudinal axis of the first part.

- Preferably, the pivotal attachment of the swivel portion to the first portion is offset from the centre of mass of the second portion in a longitudinal direction so that the
30 swivel portion will rotate from its aligned orientation into its second orientation under its own weight.

Embodiments of the present invention will now be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a perspective view of a swivel end anchor;

Figure 2 shows an exploded view of the swivel end anchor of Figure 1;

5 Figure 3 shows an exploded view of a real plate and a clamp plate for mounting swivel end anchor of Figure 2 and 3;

Figure 4 shows an exploded view of the swivel end anchor of Figure 1, 2 and 3 mounted on a scaffolding clamp;

Figure 5 shows an exploded view of a rotational end anchor;

10 Figure 6 shows a perspective view of the rotational end anchor of Figure 5;

Figure 7 shows an exploded view of a fixed end anchor;

Figure 8 shows a perspective view of the fixed end anchor of Figure 7;

Figure 9 shows an exploded view of an intermediate anchor;

Figure 10 shows a perspective view of the intermediate anchor of Figure 9;

15 Figure 11 shows a perspective view of a spacer bracket;

Figure 12 shows a perspective view of an assembly including the spacer bracket of

Figure 13 shows an exploded view of the assembly of Figure 12;

Figure 14 shows a side view of a folded up swivel structural anchor;

Figure 15 shows a perspective view of the swivel structural anchor of Figure 13;

20 Figure 16 shows a frontal view of an unfolded swivel structural anchor; and

Figure 17 shows a side view of the unfolded swivel structural anchor of Figure 15.

Referring now to the drawings there is shown in Figure 1 and 2 a swivel end anchor 1 for attaching an end of a cable used in a horizontal or inclined cable system
25 employed in a fall arrest or restraint system. The swivel end anchor 1 comprises a yaw plate 2, pitch plate 3, base plate 4 and an eyebolt 5 coupled together so that they can rotate relative to each other about four separate axes, as will become apparent from the following description.

30 The yaw plate 2 includes a bottom wall 7 and upstanding side walls or wings 8, 9 extending perpendicular from two opposite ends of the bottom wall 7 so as to form a U-shaped bracket. A hole 10, 11, 12 is formed on each wall, respectively for reasons that will be explained.

Similarly, the pitch plate 3 includes an end wall 13 extending between the edges of two perpendicular side walls 14, 15. All three walls comprise a hole 16, 17, 22. The yaw plate 2 and pitch plate 3 are configured so that the side walls 8, 9 of the yaw plate 2 receive the side walls 14, 15 of the pitch plate 3 therebetween, such that the inner surface 8a, 9a of the side walls 8, 9 of the yaw plate 2 is parallel to the outer surface 14a, 15a of the side walls 14, 15 of the pitch plate 3, respectively.

Consequently, the holes 11, 12, 16, 17 on the side walls of the yaw 2 and pitch plate 3 are aligned such that an axle 18 extends through the four holes coupling the two plates together. At either end of the axle 18, a washer 19 is located followed by a spring clip 20 passing through a hole 21 in the axle 18 so that the axle 18 is secured in position. This configuration allows the pitch plate 3 to pivot about the longitudinal or second axis of the axle 18 such that it rotates relative to the yaw plate 2.

The hole 22 formed on the end wall 13 of the pitch plate 3 provides means to secure the eyebolt 5 to the pitch plate 3. The threaded portion 23 of the eyebolt 5 extends through the hole 22 such that it protrudes between the side walls 14, 15 of the pitch plate 3. The eyebolt 5 is further provided with an eyebolt bearing 24 and a nut 25 enabling it to securely rotate about its longitudinal axis relative to the pitch plate 3. The eye of the eyebolt 5 is the part of the swivel end anchor which receives the end of a cable or a shackle and a shackle pin.

The base plate 4 comprises a bottom wall 26 and side walls 27, 28 extending perpendicular from two opposite ends of the base plate 4. The bottom wall 26 of the base plate 4 is provided with a protruding threaded stud 29 which projects through the hole 10 of the bottom wall 7 of the yaw plate 2 wherein it receives a plate bearing 30 followed by a nut 31 which permanently couples the yaw and base plate 2, 4 and simultaneously enables the yaw plate 2 to rotate about the longitudinal or first axis of the threaded stud 29 relative to the base plate 4.

The base plate 2 is further provided with anchoring members or securing means enabling the swivel end anchor 1 to be secured to a steel post on a roof or to a

scaffolding clamp so that the cable system can be implemented on scaffolding. As can be appreciated in Figures 1 and 2 the securing means comprises a bolt 34 which extends through holes 32, 33 in the side walls 27, 28 of the base plate 4 and is secured with a washer 35 on either side and a nut 36 at the threaded end of the bolt 34. The bolt 34 may be passed through a further structural cooperating element so to secure the swivel end anchor 1 to an anchoring point and to provide rotation of the swivel end anchor 1 in yet another direction. Such a structural cooperating element may be a clamp plate 37 as seen in Figure 3. The clamp plate 37 comprises a plate having two holes 38a, 38b and a tube 39 formed at the upper edge for receiving the bolt 34. The engagement of the bolt 34 and the base plate 4 allows for the base plate 4 to move about the longitudinal or third axis of the bolt 34 so that the base plate 4 moves relative to the anchoring point.

The present invention further includes a scaffolding clamp 50 for connecting the swivel end anchor 1 to scaffolding. The scaffolding clamp 50 as seen in Figure 4 comprises a clamp 51 having a flange or an integrated plate 52 with two holes 53a, 53b. The integrated plate 52 and the clamp plate 37 as previously described are aligned such that bolts 54 are passed through the paired holes and secured with washers 55 and nuts 56. The portion of the clamp 51 that secures to a scaffolding brace or pole is itself conventional and will so not be described in any detail.

It is envisaged that the swivel end anchor 1 may be secured to any anchoring member comprising a hole of appropriate dimensions by extending the bolt 34 of the base through the hole. Alternatively, the clamp plate 37 may be secured to any anchoring member having corresponding holes.

The swivel end anchor 1 is configured to pivot about four axes so that as a fall is arrested by a horizontal or inclined cable system the swivel end anchor rotates towards the direction of the pulling cable such that the longitudinal axis of the eyebolt is aligned with the cable. Consequently, the steel post is primarily subjected to bending and only deforms in one plane leaving the steel post less deformed and weakened compared to when rigid end anchors are used which results in the steel post being subjected to both torque and bending such that the steel post deforms

and weakens in two planes. Furthermore, it should be realised that the swivel end anchor 1 can also be used in vertical cable systems, however, as the application of a vertical load only subjects the swivel end anchor to deformation in one plane its entire function is not required or utilised.

5

It will be appreciated that for a cable system implemented on scaffolding it may in some cases be advantageous to reduce the rotational freedom of the end anchor depending on the structure of the scaffolding. A rotating end anchor 60 which only pivots about one axis is illustrated in Figures 5 and 6. The rotating end anchor 60
10 comprises a clamp 61 having a threaded stud 62 protruding from its upper side 63. The stud 62 is connected to a base plate 64 having two perpendicularly configured walls, a horizontal 65 and a vertical wall 66, wherein a central hole 66 is formed on the horizontal wall 65 so to receive the stud 62 which further holds a bearing 68 and a nut 69 enabling the base plate 64 to securely rotate about a longitudinal axis of the
15 stud 62 relative to the clamp 61. The vertical wall 66 of the base plate 64 comprises two holes 70a, 70b which are aligned with two holes 71a, 71b on an end anchor plate 72 such that bolts 73 extending through the paired holes 70a, 71a, 70b, 71b secured by washers 74 and nuts 75 so that the two components are securely attached. The end anchor plate 72 further comprises a third hole 76 which is located
20 at a part of the end anchor plate 72 which extends parallel in a horizontal direction relative to the vertical wall 66 of the base plate 64 such that the hole can be freely accessed and receive the end of a cable used for cable systems in fall arrest applications.

25 Figures 7 and 8 illustrate a fixed end anchor 80 comprising a clamp 81 having a perpendicular integrated plate 82 on its upper side formed with two holes 83a, 83b, a fixed rectangular end anchor plate 84 having a bevelled upper left corner and two holes 85a, 85b which are aligned with said two holes 83a, 83b of the integrated plate 82 such that bolts 86 extend through the paired holes 83a, 86a, 83b, 86b and further
30 secure the two plates 82, 84 by receiving washers 87 and nuts 88. The end anchor plate 84 also comprises a third hole 88 located at the right upper corner which extends beyond the circumference of the integrated plate such that the hole can be freely accessed and receive the end of a cable part of a cable system.

It is envisaged that the described end anchors with different rotational abilities can be employed in scaffolding for supporting a cable of different orientated sections by attaching either end of the cable to appropriate end anchors which are secured to scaffolding via relevant scaffolding clamp. The type of end anchor preferred is
5 dependent on the structure of the scaffolding where the anchoring points of the cable system is installed as well as the location of the fall hazard.

It will be appreciated that cables may be directly attached to the end anchors using a shackle and a shackle pin extending through the appropriate hole or eyebolt as well
10 as the loop of the cable. Additionally, a bottle jack can be attached to the end anchor and the end of the cable so as to adjust the tension of the cable.

Cable systems can also be installed with intermediate anchors so as to distribute the load of an arrested fall and to ensure that the integrity of the structural system such
15 as scaffolding is maintained. Figures 9 and 10 illustrate an intermediate anchor 90 for use in cable systems mounted on scaffolding wherein any of the previously described end anchors are employed to secure the cable along a desired pathway. The intermediate anchor 90 comprises a clamp 91 as previously described wherein
20 its upper surface 92 includes a perpendicular integrated plate 93 having two holes 94a, 94b to which a spring clip 95 is attached. The spring clip 95 comprises a tube 96 having a longitudinal opening 97 defining two parallel edges 98a, 98b from which two walls 99, 100 extend in a direction away from each other so to provide the spring clip with a recoil effect as the edges 101, 102 of the walls furthest away from
25 the tube 96 are pushed together. The longitudinal opening 97 of the tube 96 enables the spring clip 95 to receive a cable tube 103 holding the cable. More specifically, the tube 96 of the spring clip 95 encloses an annular recess 104 of the cable tube which corresponds to the length of the tube 96 of the spring clip 95 such that the cable tube is prevented from sliding in the grip of the spring clip 95. The cable tube
30 103 is further secured in the spring clip 95 and to the clamp 91 as the walls 99, 100 of the spring clips 95 are pushed together and secured to the integrated plate 93 by the bolts 105 passing through holes 106 on the walls 99, 100 of the spring clip 95

and the holes 94a, 94b on the integrated plate 93 and secured by washers 106 and nuts 107.

It is imperative for a cable system that the cable is maintained in its position or
5 orientation, in particularly horizontal cable sections, so as to provide optimum
safety in the event of a fall or slip of a workman attached to the over all fall arrest
system. However, horizontal braces of scaffolding are generally connected with a
coupler which receives one brace on top of the other resulting in the coupled braces
being located in different horizontal planes and so end anchors and intermediate
10 anchors as previously described attached to these braces are located at different
heights and so the cable is not horizontally positioned. To compensate for the
difference in height of two connecting horizontal braces a spacer bracket 110 can be
implemented as shown in Figures 11, 12 and 13. The spacer bracket 110 comprises a
rear wall 111 extending perpendicular between an edge of an upper 112 and an edge
15 of a lower 113 wall. Two holes 112a, 112b, 113a, 113b are formed on respective
upper and lower wall for reasons described below.

An example of an assembly 120 of the spacer bracket 110 will now be described
with reference to Figures 12 and 13. A corner tube 121 holding the cable is attached
20 to a left and right scaffolding clamp 122, 123 via a left and right tube plate 124, 125.
As the left scaffolding clamp 122 is mounted on to a brace (not shown) lying in a
lower horizontal plane than the brace (not shown) to which the right scaffolding
clamp 123 is attached a spacer bracket 110 is employed to compensate for the
difference in height. The lower wall 113 of the spacer bracket 110 is secured to an
25 integrated plate 126 of the left scaffolding clamp 122 and the upper wall 112 of the
spacer bracket 110 is secured to the left tube plate 124. The means for securing the
components include the holes of the respective walls and plates being aligned such
that bolts 127 extend through the paired holes which are fastened by washers 128
and nuts 129.

30

It will be appreciated that by adjusting the height of the rear wall of the spacer
bracket it can be adapted to compensate for braces of different diameters or
differently configured couplers. Moreover, the spacer bracket can also be

implemented in a vertical manner so as to compensate for braces lying in different vertical planes.

The present invention also includes a turntable 130 for use in a cable system
5 implemented on scaffolding. The configuration of a turntable is well known from the prior art and will therefore not be described in any detail, although it is not previously been equipped with scaffold clips to enable it to be clamped to scaffolding braces. As seen in Figures 14 and 15, the typical components of a
10 turntable providing access in three directions are located at an upper surface 131 of an irregular hexagonal board 132. A lower surface 133 of the board 132 holds three plates 134 extending perpendicular to said lower surface and are located at the three shorter sides of the hexagonal board 132. The plates 134 comprises two holes and are secured to integrated plates of scaffolding clamps 135 also having two holes by bolts 136, washers 137 and nuts 138. The scaffolding clamps 135 are mounted onto
15 braces of the scaffolding.

It will be appreciated that the spacer bracket can be implemented to the scaffolding clamps of the turntable so to correct for any misalignment.

20 The above described embodiments for use in a cable solution of a fall arrest system implemented on scaffolding enables the cable to securely extend in various directions and orientations such that it may follow various pathways and comprise an interconnected matrix allowing for a workman to freely move around the structure under safe conditions without the need to reattach their harness.
25 Furthermore, it should be realised that the devices are not limited to temporary scaffolding as it may also be applied to permanent structures comprising braces wherein it is more appropriate to use clamps to secure the cable rather than forming holes for bolts or bonding.

30 The aforementioned embodiments including end anchors and intermediate anchors may also be secured to roofs and buildings by steel posts. The strength of the steel post and its attachment to the roof are imperative for the function of a cable system. Steel posts installed prior to the roof may be secured from two directions

and thereby offer safer anchorage than steel posts fitted retrospectively wherein the steel posts can only be secured from the top of the roof. A swivel structural anchor 140 as illustrated in Figures 16, 17, 18 and 19 may be employed to provide further fixation of a steel post which is to be retrofitted. The swivel structural anchor 140
5 comprises a main body 141 having one cylindrical threaded end 142 and one opposite half cylindrical end 143 to which a swivel portion 144 is attached constituting a corresponding half cylinder such that the swivel structural anchor 140 is cylindrical in shape having a uniform diameter when the swivel portion 144 is aligned with the main body 141. The swivel portion 144 marginally extends in the
10 longitudinal direction away from the main body 141 and is connected to the corresponding half cylindrical end 143 with a nut and screw 145 including a bearing or any other alternative means allowing the swivel portion 144 to rotate ideally up to 90° relative to the main body 141. The point of connection on the swivel portion 144 is slightly to one side of the centre of mass in the longitudinal direction so to
15 reduce the swivel's degree of stability when it is aligned with the main body 141 such that only a small amount of external force is needed for an aligned swivel portion 144 to assume its perpendicular position.

Operation of the swivel structural anchor 140 will now be described in reference to
20 Figures 16, 17, 18 and 19. A hole is drilled into the outer layer of a roof. The main body 141 and the swivel portion 144 of the swivel structural anchor 140 are aligned so that the end 143 of the main body 141 holding the swivel portion 144 can be inserted into the hole whereupon the swivel structural anchor 140 is gently shaken so that the swivel portion 144 rotates 90° . The swivel structural anchor 140 is then
25 pulled up so that the swivel portion 144 is in contact with lower surface of the roof. A nut is screwed onto the threaded end 142 resulting in the swivel structural anchor 140 being securely fastened to the roof.

The swivel structural anchor 140 further receives a compression tube and then a
30 base plate to which end anchors as described in previous embodiments can be fastened.

It will be appreciated that the swivel structural anchor 140 provides anchoring points for base plates to an already constructed roof such as a steel plate roof or a roof purlin wherein there is only access to the roof from the outer surface. In cases where more than one layer is to receive the swivel structural anchor, for example, a
5 profile of a profiled roof sheet which is already installed to a roof purlin a load bearing spacer can be employed to prevent any excessive load transferring to the profile or other fragile surfaces. The swivel structural anchor 140 is particularly favourable for roofs comprising materials that are not suitable for threading, bonding or plugging.

10

It will be appreciated that the swivel structural anchor is not limited to the application of roofs but may be employed to any structure providing only one surface for fastening.

15 Although embodiments of the invention have been shown and described, it will be appreciated by those skilled in the art that variations may be made to the above exemplary embodiments that lie within the scope of the invention, as defined in the following claims.

20

Claims

1. A swivel end anchor to which a cable of a fall arrest system is attached, the anchor comprising a first plate mountable to a fixed support structure on a building
5 or scaffold installation and a second plate pivotally mounted to the first plate, said second plate having means for attaching an end of a cable of a fall arrest system thereto.
2. A swivel end anchor according to claim 1, comprising a base plate mounted
10 to a fixed support structure, the first plate comprising a yaw plate mounted to the base plate for rotation about a first axis.
3. A swivel end anchor according to claim 2, wherein the second plate
15 comprising a pitch plate coupled to the yaw plate such that the pitch plate rotates relative to the yaw plate about a second axis.
4. A swivel end anchor according to claim 3, wherein the base plate is
20 configured to enable it to be mounted to a fixed support structure such that it rotates about a third axis.
5. A swivel end anchor according to claim 4, wherein the base plate pivots
about an axis perpendicular to and in the same plane as the horizontal axis of the pitch plate and the yaw plate.
- 25 6. A swivel end anchor according to claim 3 or 4, wherein the means for attachment of the end of a cable is pivotally mounted to the second plate.
7. A swivel end anchor according to claim 6, wherein the means for attaching
an end of a cable comprises an eyebolt.
- 30 8. A swivel end anchor according to claim 7, wherein the eyebolt rotates about an axis which is perpendicular to the axis about which the first and second plates rotate relative to each other.

9. A swivel end anchor according to any of claims 3 to 8, wherein the yaw plate is a U-shaped bracket and the pitch plate is a U-shaped bracket that is received within the yaw plate.

5

10. A fall arrest system including a swivel end anchor according to any of claims 2 to 9, and an anchoring member for attachment to a fixed support structure, the base plate comprising a wall extending between two perpendicular sidewalls, the anchoring member being received between said side walls such that a bolt may be
10 passed through the side walls and the anchoring member to attach the swivel anchor to the anchoring member.

11. A fall arrest system according to claim 10, wherein the base is rotatable relative the anchoring member about an axis of a bolt connecting the base to the
15 anchoring member.

12. A fall arrest system according to claim 11, wherein the anchoring member is a post, the top of the post being received between the side walls of the base plate.

20 13. A fall arrest system according to claim 10 or 11, wherein the anchoring member includes a clamp plate having a cylindrical portion positionable between the side walls of the base to receive a bolt extending therethrough to attach the anchoring member to the base.

25 14. A fall arrest system according to claim 13, wherein the anchoring member includes a scaffold clamp for attachment to a scaffolding pole, the scaffold clamp having an upstanding flange for attachment of the clamp plate thereto.

30 15. A fall arrest system according to claim 14, wherein the upstanding flange and clamp plate each have corresponding holes therein to receive bolts to couple the clamp plate to the scaffold clamp.

16. A clamp for mounting a cable anchor of a fall arrest system to a pole of a scaffolding installation, the clamp comprising a first member fixedly attachable to a scaffolding pole and a cable attachment bracket mounted to the first member.
- 5 17. A clamp according to claim 16, wherein the cable attachment bracket is pivotally mounted to the first member for relative rotation of the cable attachment bracket and first member.
18. A clamp according to claim 17, wherein the cable attachment bracket
10 comprises a base plate attached to the scaffolding clamp such that the base plate rotates about an axis perpendicular to the axis of a scaffolding pole received in the first member.
19. A clamp according to claim 17 or 18, wherein a wall upstands from the base
15 plate and comprises means for attachment of a cable thereto. .
20. A clamp according to claim 19, wherein said means comprises an anchor end
plate is attached to the upstanding wall, said anchor end plate having a hole therein to couple a cable to said clamp.
20
21. A clamp according to claim 16, wherein the cable attachment bracket comprises an anchor end plate having a hole for receiving an end of a cable fixedly mounted to said first member.
- 25 22. A clamp according to claim 16, wherein the cable attachment bracket is fixed and integral with the first member.
23. A clamp according to claim 22, wherein an end anchor cable attachment
plate is removably attachable to the cable attachment bracket, the cable attachment
30 plate having means for coupling a cable thereto.
24. A clamp according to claim 16, wherein the cable attachment bracket comprises means to support a cable mid way along its length.

25. A structural anchor for attaching a fall arrest system support post to a structural surface, the swivel structural anchor comprising a cylindrical body threaded at one end, the other end being formed from a first part-cylindrical
5 portion extending from the body and a second part cylindrical swivel portion pivotally attached to the first portion about an axis extending perpendicularly to the longitudinal axis of the cylindrical body, the first and second portions together forming a complete cylinder having a diameter no greater than the diameter of the threaded end of the cylindrical body when the longitudinal axis of the second part is
10 aligned with the longitudinal axis of the first part, the second part being pivotable into an second orientation in which the longitudinal axis of the second part is perpendicular to the longitudinal axis of the first part.

26. A structural anchor according to claim 25, wherein the pivotal attachment of
15 the swivel portion to the first portion is offset from the centre of mass of the second portion in a longitudinal direction so that the swivel portion will rotate from its aligned orientation into its second orientation under its own weight.

27. A swivel end anchor substantially as hereinbefore described, with reference
20 to the accompanying drawings.

28. A fall arrest system substantially as hereinbefore described, with reference to the accompanying drawings.

25 29. A structural anchor substantially as hereinbefore described, with reference to the accompanying drawings.

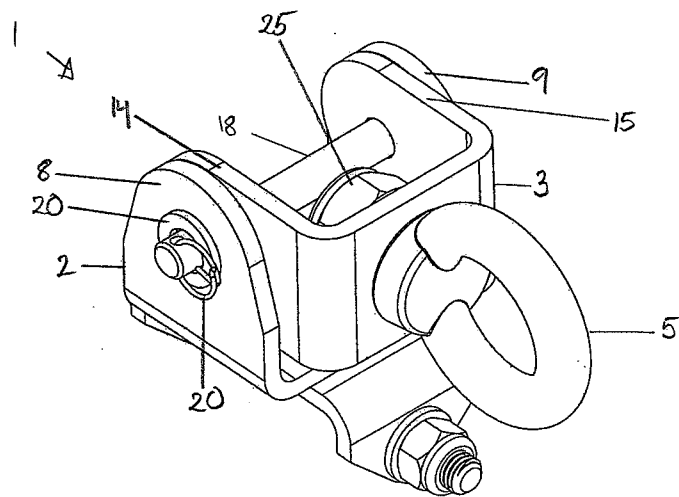


Figure 1

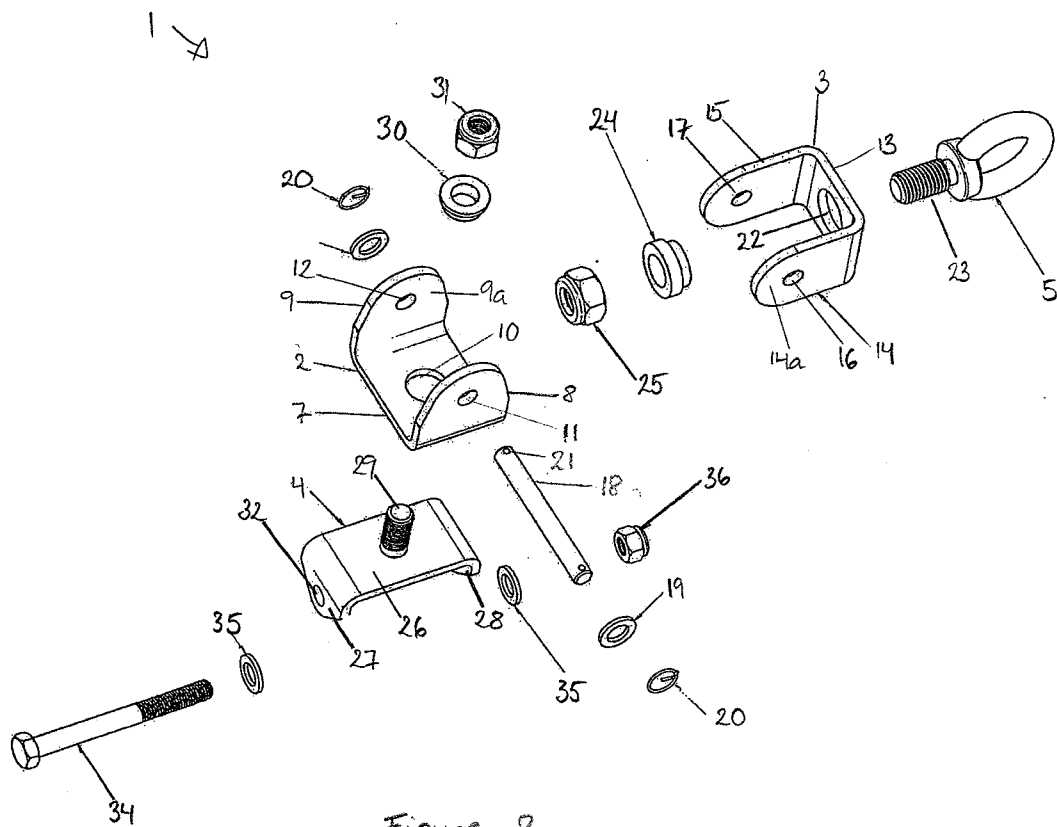
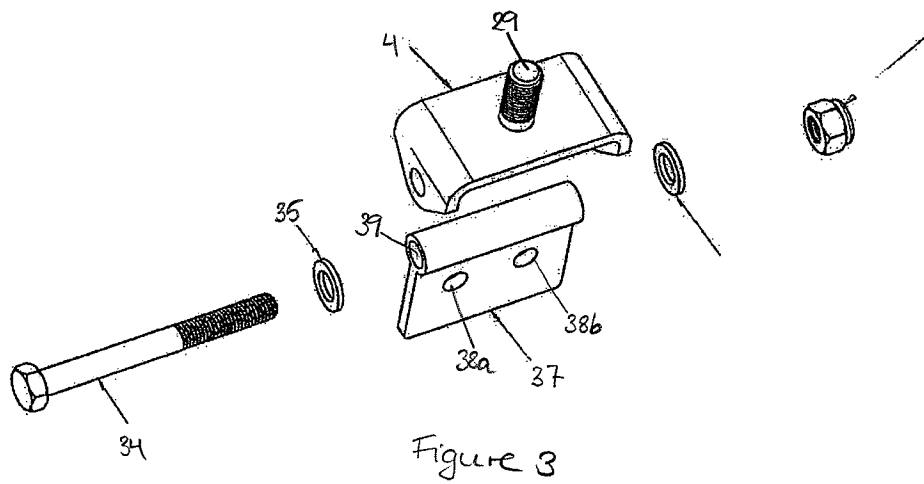


Figure 2



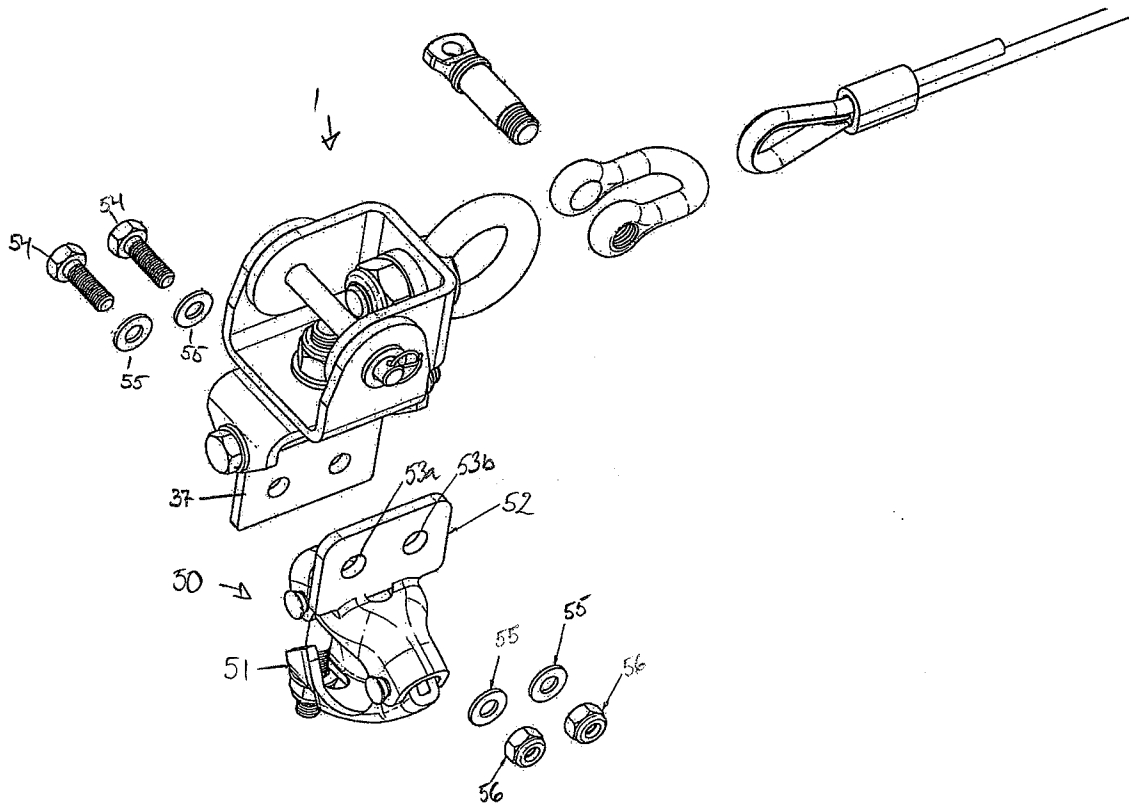


Figure 4

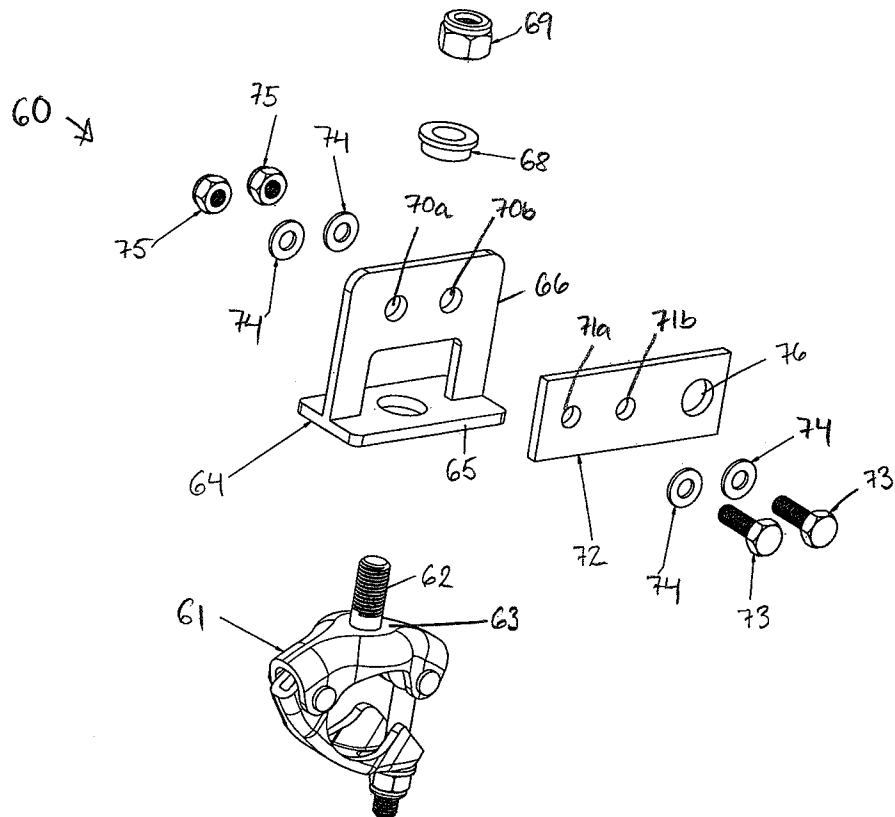


Figure 5

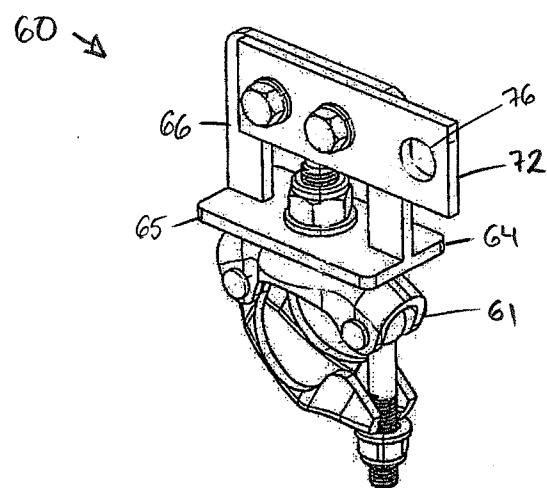


Figure 6

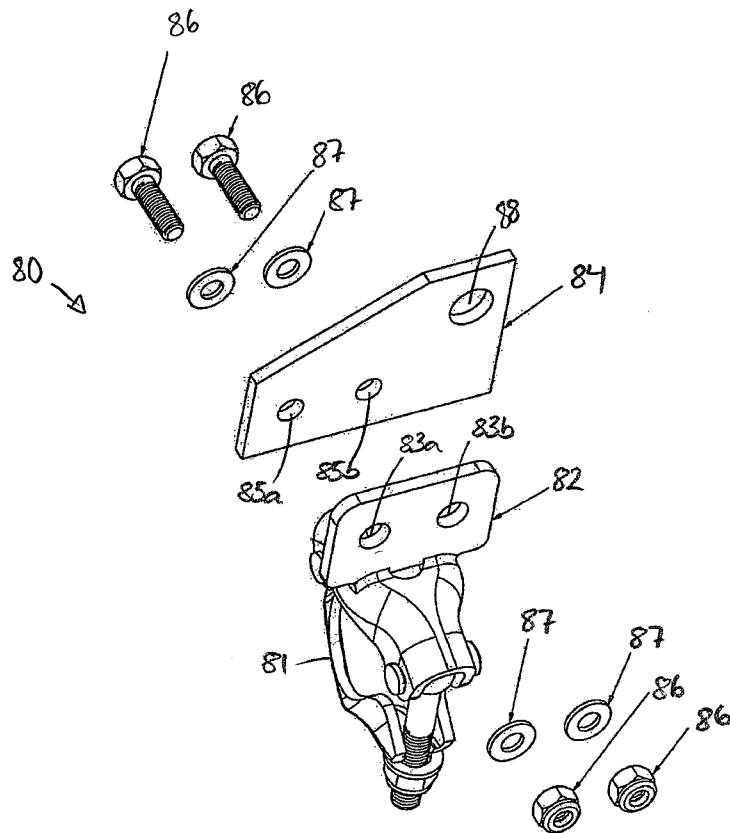


Figure 7

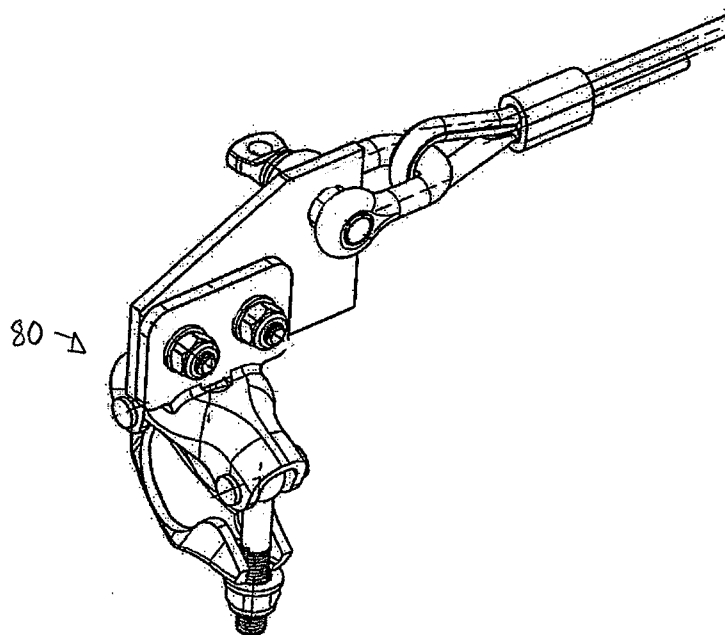


Figure 8

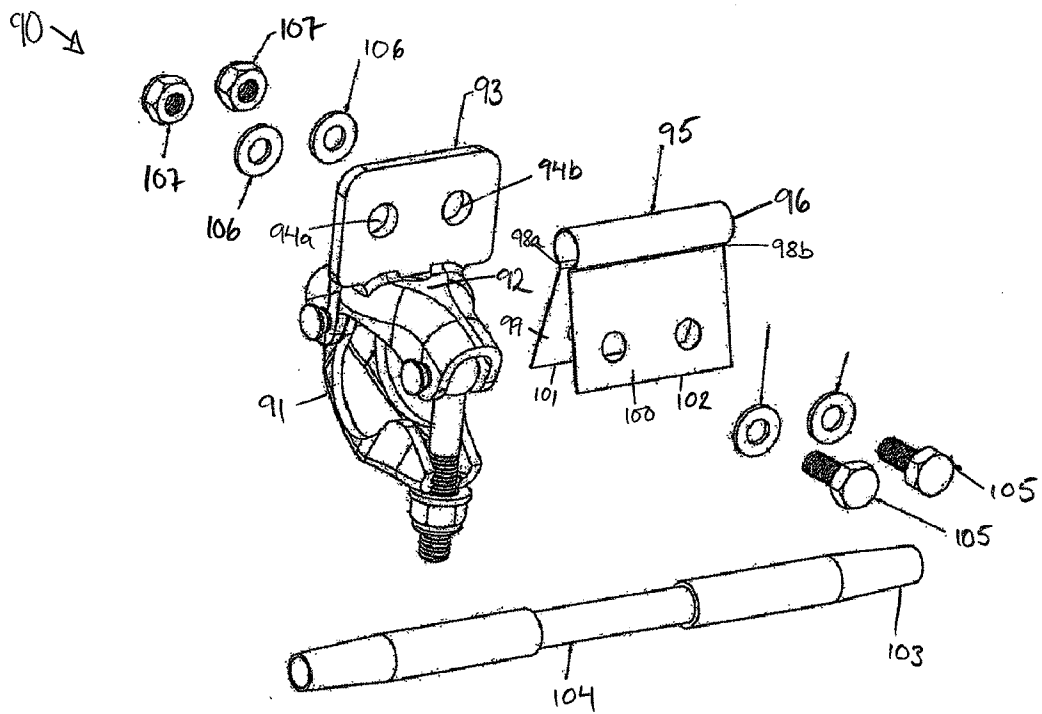


Figure 9

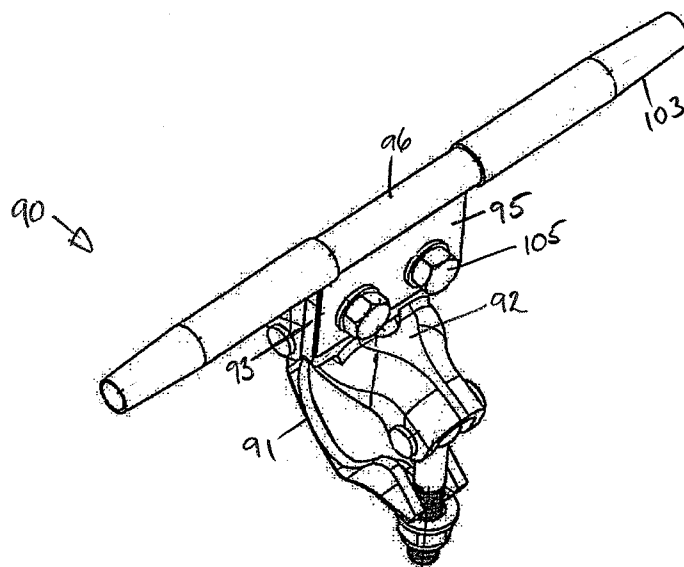


Figure 10

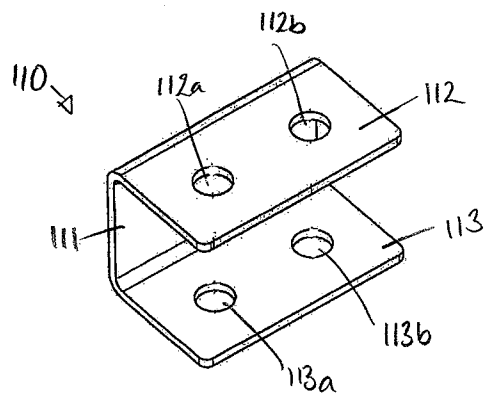


Figure 11

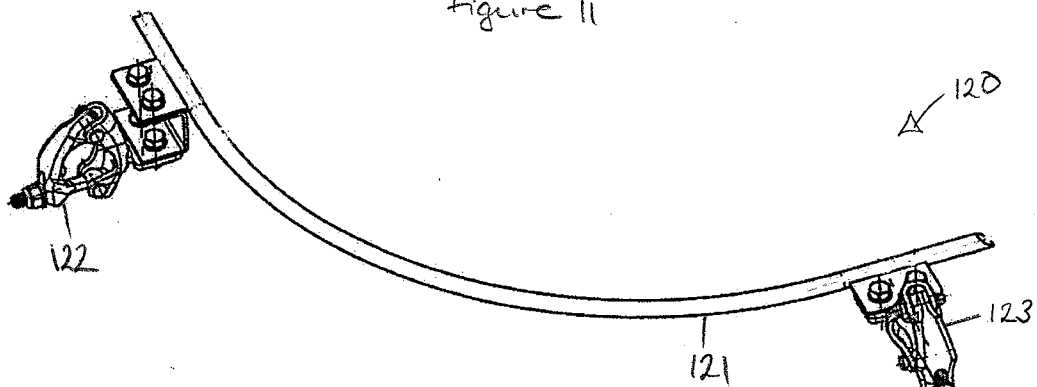


Figure 12

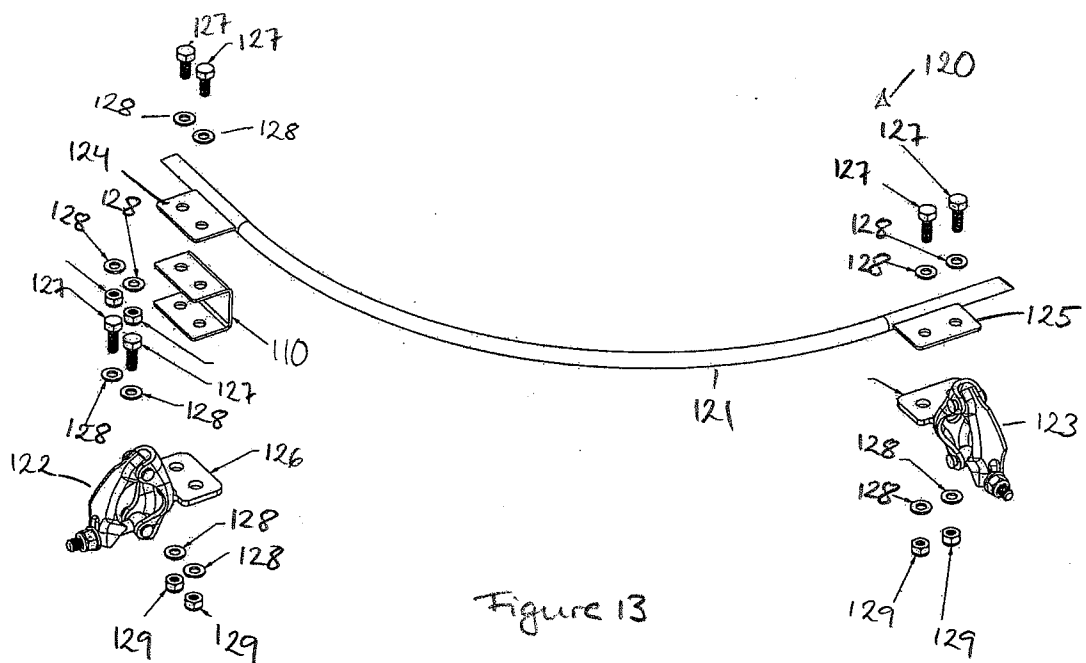


Figure 13

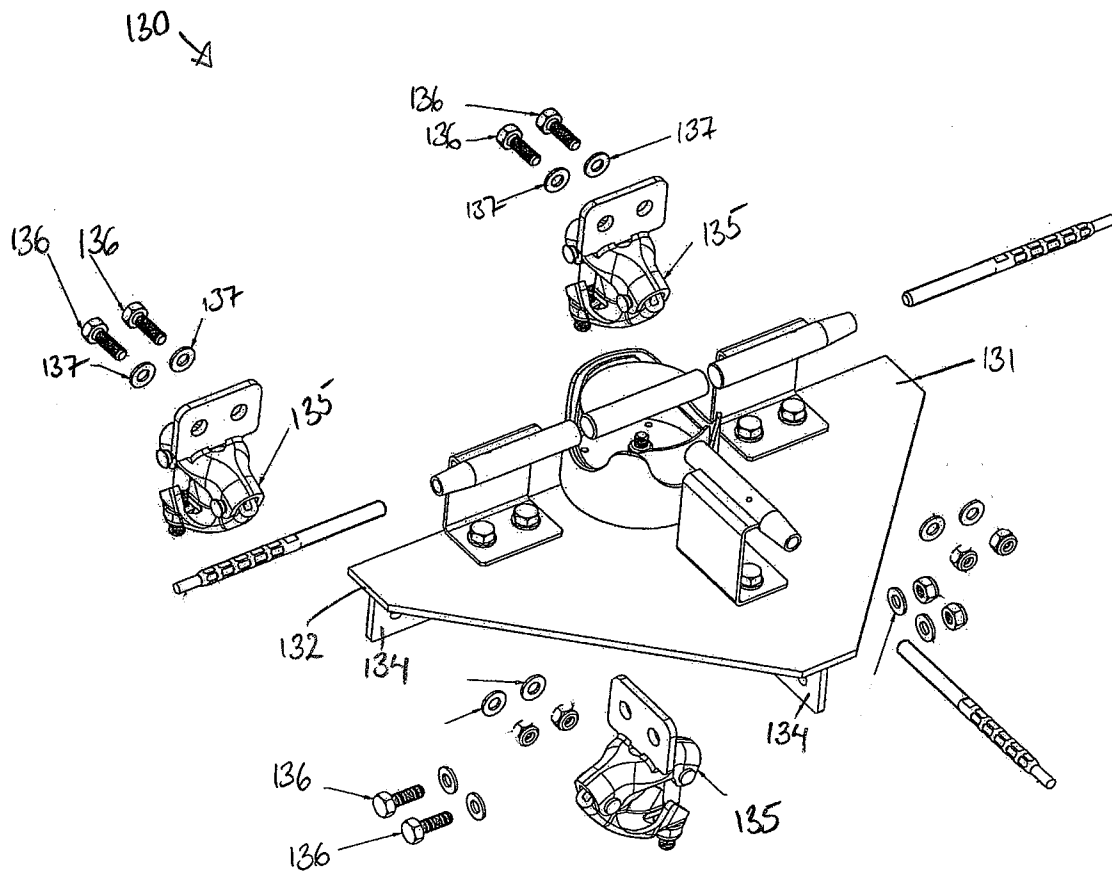


Figure 14

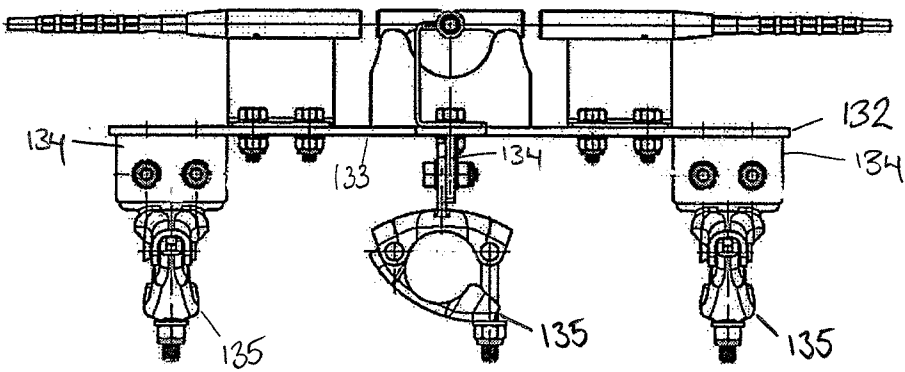


Figure 15

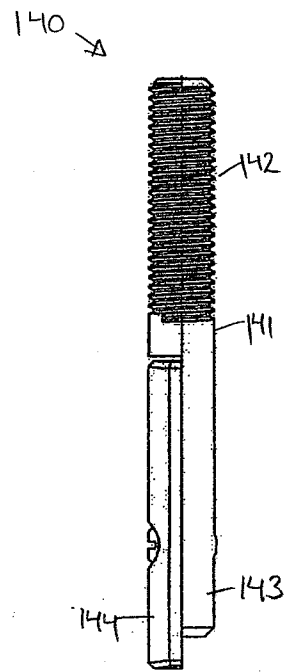


Figure 16

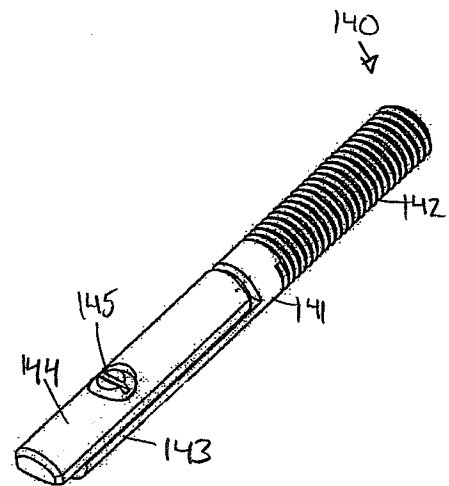


Figure 17

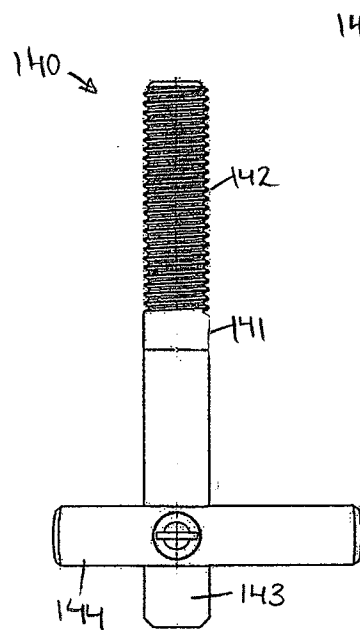


Figure 18

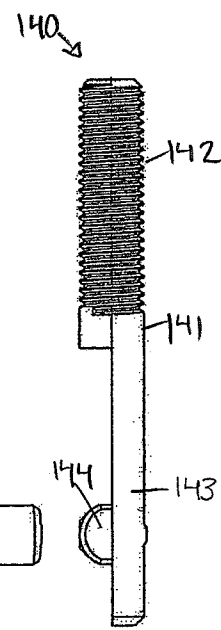


Figure 19