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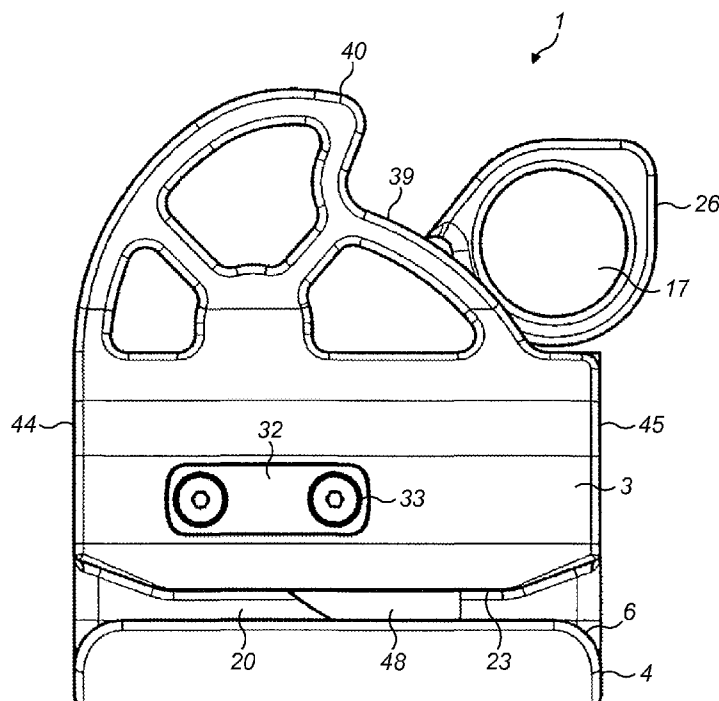


FIG. 1

(57) Abstract: A safety clamp for use in a fall arrest system having a safety rail is disclosed. The safety clamp comprises a body portion and a plate portion together defining a passage having a longitudinal axis to receive a safety rail extending therethrough such that, in use, the clamp slides along said safety rail in a longitudinal direction. The portions being movable relative to each other between a first position in which the passage is open along its length to enable a safety rail to be inserted into, or removed from, the passage, at any location along the length of the safety rail and a second position in which the safety rail is retained within the passage.



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A Safety Clamp

Description

The present invention relates to a safety clamp for use in a fall arrest system for
5 protecting workmen operating at elevated positions.

Workmen who need to gain access to elevated areas local to potential fall hazards 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
10 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 safety clamp to a safety rail mounted on a building. The safety rail comprises a rigid cable or rod having two opposing ends that are secured by end anchors to a building. The safety rail may be positioned horizontally or vertically to a roof or a wall,
15 respectively, and it may also be further supported by intermediate anchors. Fall arrest systems enable the workman to move relatively unrestrained because as the workman moves the lanyard pulls on the clamp such that the clamp freely slides along the rail over any intermediate anchors.

20 Known safety clamps are configured such that to attach the safety clamp to a safety rail, either of the two ends of the safety rail is fed through a passage of the safety clamp. The passage is at least partially enclosing the safety rail and so enables the safety clamp to slide along the safety rail without accidentally detaching. The safety clamp is removed from the safety rail at either ends of the safety rail, by
25 withdrawing the safety rail out of the passage of the safety clamp. Therefore, known safety clamps can only be attached and removed at either ends of the safety rail, which may cause inconvenience to a user who needs to move between fall arrest systems prior to reaching the end of the safety rail.

30 The present invention seeks to provide a safety clamp for use in such a fall arrest system that overcomes or substantially alleviates the problems mentioned above.

According to the present invention, there is provided a safety clamp for use in a fall arrest system having a safety rail, the safety clamp comprising a body portion and a plate portion together defining a passage having a longitudinal axis to receive a safety rail extending therethrough such that, in use, the clamp slides along said
5 safety rail in a longitudinal direction, the portions being movable relative to each other between a first position in which the passage is open along its length to enable a safety rail to be inserted into, or removed from, the passage, at any location along the length of the safety rail and a second position in which the safety rail is retained within the passage.

10

Preferably, the plate portion is pivotally connected to the body portion about an axis parallel to the longitudinal axis of the passage.

15

The safety clamp may further comprise an actuating member located between the plate portion and the body portion, the actuating member being pivotally attached to the plate portion for rotation about an axis.

20

Conveniently, the axis about which the actuating member rotates extends transversely to the longitudinal axis of the passage.

25

Preferably, the body portion is configured to prevent rotation of the body portion and the plate portion relative to each other until the actuating member is pivoted into a specific position.

30

In one embodiment, the body portion comprises a cut out that aligns with the actuating member in its specific position such that a portion of the actuating member is received in said cut out when the body and plate portions are rotated relative to each other.

The actuating member may comprise an aperture for attachment of a lanyard thereto, the body and/or plate portion being configured such that the actuating member cannot be rotated into its specific position when a lanyard is attached to the actuating member through the aperture.

Advantageously, the body and/or plate portion may extend over the aperture in the actuating member when the actuating member is in its specific position such that rotation of the actuating member into its specific position is blocked by said plate
5 and/or body portion when a lanyard is coupled to the actuating member via the aperture.

Preferably, the safety clamp comprises a locking mechanism to lock the actuating member to the body portion when said actuating member is not in its specific
10 position.

Conveniently, the locking mechanism comprises a cam pin on the actuating member which is slideably received in a cam track formed on the body portion, the cam track and the cam pin having cooperating means that engage for a portion of the
15 movement of the actuating member to prevent rotation of the body portion and plate portion relative to each other until the specific position of the actuating member has been reached.

In one embodiment, the actuating member is mounted for rotation on an axle pin
20 and the body portion has a hole, the axle pin locating in said hole when the body portion and plate portion are in their second position.

The safety clamp may comprise a biasing member biasing the actuating member towards the first position.
25

Preferably, the actuating member comprises a braking surface at its opposite end remote from the aperture, said actuating member being pivotable into a position in which the braking surface engages a safety rail received in the passage to stop the clamp sliding along the safety rail.

30 In one embodiment, the body and plate portions together define a second passage parallel to the first passage, said second passage having a longitudinal axis and being configured to receive a safety rail extending therethrough, the plate and body

portions being rotatable relative to each other from the first position in which the second passage is also open along its length to enable a safety rail to be inserted into, or removed from, the second passage, at any location along the length of the safety rail and the second position in which said safety rail is retained within the
5 second passage.

Conveniently, the second passage is formed from a first member attached to the body portion and the second member attached to the plate portion.

10 Preferably, the body portion is formed with an aperture and the second member extends through the aperture when the body portion and the plate portion are in the second position.

The second member may extend from a side of the plate portion and across a side
15 of the body portion when the body portion and the plate portion are in the second position.

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

20

Figure 1 shows a planar front view of a first exemplary embodiment of a safety clamp according to the present invention;

Figure 2 shows a planar rear view of the safety clamp shown in Figure 1;

Figure 3 shows a perspective rear view of the safety clamp shown in Figures 1 to 2;

25 Figure 4 shows an exploded view of the safety clamp shown in Figures 1 to 3;

Figure 5 shows a cross-sectional view of the safety clamp shown in Figures 1 to 4;

Figure 6 shows a perspective view of the safety clamp in a closed position shown in Figures 1 to 5;

Figure 7 shows a perspective view of the safety clamp in an opened position shown
30 in Figures 1 to 6;

Figure 8 shows a planar front view of the safety clamp in an open position according to a different embodiment;

Figure 9 shows a planar rear view of the safety clamp shown in Figure 8;

Figure 10 shows a perspective rear view of the safety clamp shown in Figures 8 and 9;

Figure 11 shows a perspective bottom view of the safety clamp shown in Figures 8 to 10;

5 Figure 12 shows a planar side view of the safety clamp shown in Figures 8 to 11;

Figure 13 shows a fall arrest system for use with the safety clamp shown in Figures 8 to 11; and

Figure 14 shows a junction used in the fall arrest system shown in Figure 13.

10 Referring now to Figures 1 to 7, a safety clamp 1 of a first exemplary embodiment is shown comprising a body portion 2, a plate portion 3 defining a first passage 4 for receiving a vertical safety rail. The portions 2, 3 are moveable relative to each other between an open and a closed position so that a vertical safety rail can be received in the passage or be removed from the passage at any point along the length of a
15 vertical safety rail as will become apparent from the description below.

It should be understood that the term 'vertical' used herein in association with a safety rail or a safety rail section includes any safety rail that is formed at an angle relative to a horizontal plane.

20

The body portion 2 comprises a plate 5 having an edge 6 folded backwards on itself so as to partially form the first passage 4 of the safety clamp 1. The plate 5 further comprises a cam track 7 following a curved path having a narrow end 8 opposing a wide end 9, and a funnelled shaped hole 10 where the diameter of the hole is larger
25 on an inner surface 11 and smaller on an outer surface 12 of the plate 5. The funnelled shaped hole 10 is located at the circular centre of the curved cam track 7. An edge 13 opposing the partially formed passage 4 of the plate 5 comprises a curved section 14 having a cut away portion 15 extending downwards in a direction towards the funnelled shaped hole 10. On either short ends 16, 17 of the body
30 portion 2 a hinge hole 18a, 18b is formed configured to receive a pin 19 (as can best be seen in Figures 3 and 4) that is also inserted in corresponding hinge holes (not shown) formed on the plate portion 3 as described below.

The plate portion 3 comprises a thicker part 21 and a thinner part 22 as can be appreciated from Figures 3 and 4. The thicker part 21 has a lower edge 23 formed with an arched cross section which together with the folded edge 6 of the body portion 2 defines the first passage 4 for receiving a vertical safety rail. An inner side 24 of the lower edge 23 of the plate portion 3 is further formed with an actuating member recess 25 (as seen in Figure 4) which extends from the lower edge 23 upwards on the inner side 24 of the thicker part 21 of the plate portion 3. The recess 25 provides space for an actuating member 26 to rotate relative to the plate portion 3 as described below. Referring now to Figure 4, on an opposing outer surface 27 of the thicker part 21, an indentation 28 is formed having two threaded holes 29, 30 located on either side of a central hole 31. The indentation 28 and the central hole 31 are configured to receive an axle pin 32. The axle pin 32 comprises a head portion which specifically locates in the indentation 28, and a pin portion which is received in the central hole 31. The head portion of the axle pin 32 is formed with two holes 34 which receives two threaded screws 33 that also locate in the two threaded holes 29, 31 formed in the indentation 28 such that axle pin 32 is secured to the plate portion 3. The axle pin 32 protrudes on the opposite inner side 24 of the plate portion 3 where it is received in a hole 54 of the actuating member 26 such that the actuating member can rotate about the axle pin 32 relative to the plate portion 3.

An elongate spring recess 35 is formed above the actuating member recess 25 on the inner side 24 of the plate portion 3. The spring recess 35 receives a first arm 36 of a spring 37 as can be appreciated from Figure 2. The thinner part 22 is formed with an upper edge 39 opposing the lower edge 23 of the thicker part 21. The upper edge 39 is formed with a ridge 40 which is aligned with the central hole 31 receiving the axle pin 32. The thinner part 22 may be formed with apertures as shown in Figures 1, 4, 6 and 7 to reduce weight, however this feature is optional.

Proximal to the short edges 44, 45 of the plate portion 3, on the inner side 24 of the thicker part 21, the plate portion 3 is formed with two hinge holes (not shown). Each hole aligns with its corresponding hinge hole 18a, 18b formed on the body portion 2, and pins 19 are inserted in both pairs of hinge holes so that the plate

portion 3 can pivot relative to the body portion 2 about an axis that is parallel to a longitudinal axis of the passage 4. The plate portion 3 is hinged to the body portion 2 such that a gap 20 is formed between the lower edge 23 of the thicker portion 21 of the plate portion 3 and the folded edge 6 of the body portion 2. The width of the gap 20 is smaller than the diameter of a vertical safety rail so that when a vertical safety rail is received in the passage the vertical safety rail cannot pass through the gap 20 and is thereby confined within the first passage 4 of the safety clamp 1 in a direction transverse to the longitudinal axis of said first passage 4.

10 The actuating member 26 is located between the body portion 2 and the plate portion 3 and comprises a bar 46 having an aperture 47 at one end for receiving a carabiner (not shown) which is connected to a user's harness via a lanyard, and a stopping portion 48 at the opposite end which locates in the passage 4 and engages with a vertical safety rail. The braking surface of the stopping portion 48 that faces the passage 4 is formed with a track 49 extending in the direction of the passage 4. 15 The actuating member 26 is further formed with a flange 50 located at the corner of the bar 46 and the stopping portion 48. The flange 50 comprises a hole 51 through which a guided member or a cam pin 51 is received. The cam pin 51 extends through the curved cam track 7 and a head 52 of the cam pin 51 locates on the outer surface 12 of the plate 5 of the body portion 2. The head 52 of the cam pin 51 is smaller in diameter than the width of the wide end 9 of the cam track 7 so that the head 52 of the cam pin can pass through the cam track 7, however the head 52 of the cam pin is larger in diameter than the width of the narrow end 8 of the cam track 7 thereby preventing the head 52 of the cam pin to be withdrawn from the cam track. 20 Therefore, when the cam pin 51 is located at the wide end 9 of the cam track and can be withdrawn or inserted into the cam track 7, the rotational plane of the actuating member 26 relative to the plate 5 of the body portion can be changed. When the cam pin is located in the narrow end 8 of the cam track 7 such that the cam pin 51 cannot be withdrawn from said cam track 7, the rotational plane of the actuating member 26 cannot be changed and so is maintained parallel to the plane of the body portion 2. Thus, the cam track 7 and the cam pin 51 act as a locking mechanism. 30

Adjacent to the stopping portion 48, the hole 54 is formed configured to receive the axle pin 32. The end of the axle pin 32 is provided with an end cap 55 such that the actuating member 26 is rotationally secured to the plate portion 3. The actuating member 26 is thereby pivotable about the axle pin 32 relative to the plate portion 3.

5 The end cap 55 comprises a pin 56 received in the axle pin 32 and a head cap that comprises a flange 58 and a conical end portion 59. The flange 58 secures the actuating member 26 on the axle pin 32 and the conical end portion 59 locates in the funnelled shaped hole 10 and so enables the actuating member 26 to rotate in a controlled manner relative to the body portion 2 without the actuating member 26, or the axle pin 32, being secured or attached to the body portion 2.

10

The bar 46 of the actuating member 26 is further provided with an elongate spring recess 53 which extends in the direction of the bar 46. The elongate spring recess 53 receives a second arm 38 of the spring 37, the first arm 36 of the spring 37 being

15 located in the spring recess 35 formed on the plate portion 3. The actuating member 26 is therefore biased by the spring 37 towards a resting position in which the stopping portion 48 locates in the first passage 4, and when the clamp is in use such that a vertical safety rail is received in the first passage 4, the stopping portion 48 engages the vertical safety rail, thereby preventing the safety clamp 1 from moving

20 in a downward direction along the vertical safety rail section.

When the safety clamp is in use, and a downward load is applied to the actuating member 26 due to the weight of a user who has fallen, the actuating member 26 rotates relative to the body portion 2 and the plate portion 3 about the axle pin 32.

25 As the actuating member 26 rotates, the pin head 52 of the cam pin 51 attached to the actuating member 26 slides further towards the narrow end 8 such that the actuating member is restricted to rotate within one plane. The actuating member 26 rotates towards a fall arrest position in which the stopping portion 48 further engages the vertical safety rail section thereby preventing any downward movement

30 of the safety clamp 1 along the vertical safety rail section. Therefore, a fall of a user along a vertical safety rail section will be arrested.

When the clamp is in normal use and a user moves in an upward direction along a vertical safety rail, the actuating member 26 rotates towards a disengaged position in that it is released from the resting position by the lanyard attached to the safety clamp 1 pulling on the actuating member 26 such that it rotates in an opposite
5 direction to when a downward load is applied. In the disengaged position, the stopping portion is withdrawn from the passage into the actuating member recess 25 and the head 52 of the cam pin 51 slides in a direction towards the wide end 9 of the cam track 7, however the head 52 remains within the narrow end 8 such that the actuating member is restricted to rotating within one plane.

10

The configuration of the safety clamp 1 according to the present invention enables the safety clamp to be connected or removed from a vertical safety rail, at any point along the length of the vertical safety rail. To connect or remove the safety clamp from a vertical safety rail, the actuating member is moved from a first position to a
15 second position such that the safety clamp 1 can be moved from a closed position as shown in Figure 6 into an open position as illustrated in Figure 7.

In a closed position as seen in Figures 1 to 3 and 5 to 6, when the safety clamp is not in use, such that it does not receive a safety rail or a carabiner, the plane of the
20 plate 5 of the body portion 2 is parallel to the plane of the plate portion 3.

Furthermore, the actuating member 26 is free to rotate about the pin axle 32, however it is biased towards the resting position and the head 52 of the cam pin 51 locates in the narrow end 8 of the cam track 7. The actuating member 26 is free to rotate from a first position to a second position. The first position includes the fall
25 arrest position, resting position and a disengaged position, and the second position is defined as a position where the actuating member 26 is located further beyond the disengaged position such that the bar of the actuating member is aligned with the cut away portion of the body portion 2.

30 The safety clamp is moved to an open position so that it can be connected to a vertical safety rail by rotating the actuating member 26 to its second position against the force of the spring 37. The actuating member 26 is rotated such that the bar 46 aligns with the cut away portion 15 of the plate portion 5 of the body portion 2. As

the actuating member 26 rotates from the first position to the second position, the head 52 of the cam pin 51 of the actuating member 26 moves within the cam track 7 from the narrow end 8 to the wide end 9.

5 As the bar 46 is aligned with the cut away portion 15 and the head 52 of the cam pin 51 is located at the wide end 9 of the cam track 7, the plate portion 3 and the actuating member 26 can be pivoted relative to the body portion 2 about the axis formed by the pins 19 received in the hinge holes 18a, 18b provided on the plate portion 3 and the body portion 2. The plate portion 3 and the actuating member 26
10 is pivoted in a direction such that the bar 46 of the actuating member 26 locates in the cut away portion 15 and the ridge 40 of the thinner part 22 moves closer to the curved section 14 of the body portion 2. The head 52 of the cam pin 51 is thereby withdrawn from the wide end 9 of the cam track 7 and the conical end portion 59 disengages the funnelled shaped hole 10. By rotating the safety clamp 1 into an
15 opened position, the gap 20 is widened between the lower edge 23 of the plate portion 3 and the folded edge 6 of the body portion 2. The widened gap is parallel to the longitudinal axis of the first passage 4 and is widened to such an extent that it supersedes the diameter of a vertical safety rail. Therefore, in an opened position a vertical safety rail can locate in the first passage 4 of the safety clamp by passing
20 through the widened gap by the longitudinal axis of the safety rail moving parallel to the longitudinal axis of the first passage 4.

When the vertical safety rail is received in the first passage 4, the safety clamp is rotated towards its closed position and the biasing force of the spring forces the
25 actuating member towards the first position, in particular towards the resting position. Thereafter, a user connects a carabiner to the aperture 47 of the actuating member 26. The attached carabiner prevents the actuating member from rotating to the second position due to the ridge 40 of the thinner part 22 of the plate portion 3 impeding on the carabiner. The ridge 40 is configured to extend to such a height
30 and to be located close to the actuating member that a carabiner does not fit through a space formed between the ridge 40 and the actuating member 26. Therefore, the actuating member 26 is prevented to rotate to the second position when in use, thus the safety clamp cannot be moved to its opened position.

Therefore, the safety clamp is securely slidably attached to the safety rail when in use. Furthermore, as the actuating member 26 is restricted to rotate to the second position when the safety clamp is in use, the head 52 of the cam pin 51 can only slide within the narrow end 8 of the cam track 7. The rotation of the actuation
5 member 26 is therefore controlled so that the actuating member only rotates within one plane.

The safety clamp 1 is removed from a safety rail received in the first passage 4, by removing any fastening means such as a carabiner from the aperture 47 of the
10 actuating member 26. Thereafter, the actuating member 26 is rotated into its second position so that the plate portion 3 can be rotated relative the body portion 2 so as to widen the gap between the lower edge 23 of the thicker portion 21 of the plate portion 3 and the folded edge 6 of the body portion 2.

15 The aforementioned embodiment of the safety clamp has been described to have a gap between the lower edge 23 of the thicker portion 21 of the plate portion 3 and the folded edge 6 of the body portion 2 when the safety clamp is in a closed position. Although this gap 20 is of a smaller width than the diameter of a vertical safety rail, it shall be understood that the safety clamp may be formed without the
20 gap, such that the lower edge 23 and the folded edge 6 directly engage when the safety clamp is in a closed position, and when the safety clamp is moved to its opened position a gap is formed.

In an alternative un-illustrated embodiment, the curved section 14 of the body
25 portion 2 is alternatively or additionally configured to restrict the actuating member 26 from rotating to its second position. For this to be achieved, the curved section 14 of the body portion 2 is configured to extend beyond the aperture 47 of the actuating member 26 in a direction transverse to the longitudinal axis of the first passage 4.

30

Furthermore, although the cam track 7 and the corresponding cam pin 51 assist in restricting the plate portion 3 from rotating about its axis and assist in enabling the actuating member 26 to rotate in one plane, it is envisaged that the cam track 7 and

cam pin 51 are optional. That is because when the actuating member 26 is in its first position, any pivotal movement of the plate portion 3 is prevented by the the actuating member engaging or impeding the body portion 2. Furthermore, the narrow space between the body portion 2 and the plate portion 3 assist the
5 actuating member to only rotate in one plane.

The safety clamp 1 described with reference to Figures 1 to 7 is configured to be used on vertical safety rails including inclined safety rails. The safety clamp can also be configured to be used on a horizontal safety rail. This may be achieved by
10 configuring the actuating member so that it does not extend into the first passage. In particular, the actuating member may be formed without a stopping portion so that as the actuating member rotates, no part of the actuating member engages the safety rail at any point.

15 In an alternative second exemplary embodiment of the present invention, the safety clamp 60 is configured to be used in a fall arrest system 61 comprising at least one horizontal and at least one vertical safety rail section 104, 105 as shown in Figure 13. Such a safety clamp 60 is illustrated in Figures 8 to 12.

20 The safety clamp 60 is for use where the horizontal and the vertical safety rail sections 104, 105 are configured to be secured to a structure such that the horizontal safety rail section 104 extends along a horizontal part of the structure, for example a roof, and the vertical safety rail section 105 extends along a vertical or inclined part of the structure, for example a wall. Each safety rail section comprises
25 a first 107, 108 and a second end each having a longitudinal axis. The first ends 107, 108 of the horizontal and vertical safety rail sections 104, 105 meet at a junction 106 as illustrated in Figure 14. The vertical safety rail section 105 bends towards a horizontal position as it approaches the junction 106 such that the longitudinal axis of each first end 107, 108 is held parallel to one another and overlap for a small
30 distance. The ends 107, 108 are also spaced apart in a direction transverse to the longitudinal axis so as to provide a space for the safety clamp 60 to slide through the junction 106. In this embodiment, the safety clamp 60 is configured to slide from a vertical to a horizontal safety rail section and vice versa so that a user does

not need to change clamps when moving from a vertical to a horizontal safety rail section and vice versa.

5 The safety clamp 60 illustrated in Figures 8 to 12 is similarly configured to the first embodiment described with reference to Figures 1 to 7, and may also comprise any combination of the optional features discussed in relation to said first embodiment. Therefore, a detailed description is omitted herein and elements of the safety clamp which are generally the same as for the first exemplary embodiment retain the same reference numerals.

10

The safety clamp 60 comprises a body portion 2, plate portion 3 and an actuating member 26 as described above in relation to the first embodiment. However, the safety clamp 60 of the second embodiment further comprises a second passage 63 as is best seen in Figures 9 to 12. The second passage is formed by a first and a
15 second member 64, 65. The first member 64 comprises a partially tubular portion 66 having an attachment element 67 extending therefrom. The attachment element 67 is formed with four threaded holes (not shown) that correspond to four threaded holes (not shown) formed on a bottom of the passage 4 of the body portion 2. Threaded screws 68 are inserted into the paired holes such that the first member 64
20 is securely attached to the body portion 2.

The second member 65 comprises a panel 69 formed with an inner surface secured to the inner side 24 of the thicker part 21 of the plate portion 3 with fastening means (not shown). A lower edge 70 of the second member is provided with an
25 arched extension 71 which together with the partially tubular portion 66 of the first member 64 form the second passage 63.

The plate 5 of the body portion 2 is formed with an aperture 72 to accommodate for the second member 65 as is best seen in Figure 10. The aperture 72 enables the
30 second member to extend from the plate portion 3 through the body portion 2 to the opposite side so that the arched extension 71 aligns with the partially tubular portion 66 when the safety clamp is in a closed position. As the second member 65 is secured to the plate portion 3, the second member 65 is pivotable together with

the plate portion 3 and so pivots relative to the body portion 2 when the safety clamp 1 is moved from an open to a closed position and vice versa.

In the closed position of the second embodiment of the safety clamp 60, the body
5 portion 2, plate portion 3 and the actuating member 26 are positioned relative to one another as in the first embodiment described with reference to Figures 1 to 7. Additionally, the arched extension 71 is aligned with the partially tubular portion 66 so as to form the second passage 63. The first and second members 64, 65 are configured such that a gap (not shown) is formed between two of their respective
10 outer edges 73, 74 which align when the safety clamp 60 is in a closed position. The gap is configured such that its width does not exceed the diameter of a safety rail, therefore when a safety rail is received in the second passage 63 and the safety clamp 60 is in a closed position, the safety rail is confined within said passage in a direction transverse to a longitudinal axis of said passage 63. However, it should be
15 understood that the passage 63 enables the safety clamp 60 to freely slide along the safety rail received in said second passage 63.

It should be appreciated that in an alternative embodiment, there is no gap between the outer edges 73, 74 of the partially tubular portion 66 and the arched extension
20 71 when the safety clamp 60 is in a closed position.

Similar to the first embodiment described with reference to Figures 1 to 7, the safety clamp 60 is in a closed position when in use, and the attachment of a carabiner to the aperture 47 of the actuating member prevents the safety clamp to
25 be moved into an open position due to the limited space between ridge 40 of the thinner part 22 of the plate portion 3 and the actuating member 26.

The safety clamp 60 is moved into an opened position to receive or remove a safety rail from either or both of its passages in a similar manner to the first embodiment
30 described with reference to Figures 1 to 7. Briefly, any attachments such as a carabiner are removed from the aperture 47 of the actuating member 26. Thereafter, the actuating member 26 is rotated to its second position against the force of the spring 37 so as to enable the plate portion 3 to be rotated relative to the body

portion 2 about the axis formed by the pins 19 received in the hinge holes 18a, 18b provided on the plate portion 3 and the body portion 2. The plate portion 3 and the actuating member 26 is pivoted in a direction such that the bar 46 of the actuating member 26 locates in the cut away portion 15 and the ridge 40 of the thinner part 22 moves closer to the curved section 14 of the body portion 2. The gap 20 of the first passage 4, between the lower edge 23 of the plate portion 2 and the folded edge 6 of the body portion 2, is widened. Furthermore, the gap of the second passage 63, between the outer edges 73, 74 of the partially tubular portion 66 and the arched extension 71, is also widened. The widened gaps are both parallel to the longitudinal axes of the first and second passages 4, 63 and are widened to such an extent that each gap supersedes the diameter of a safety rail. Therefore, a safety rail can be passed through each widened gap so as to be received or removed from the relevant passage 4, 63.

Simultaneously, the second member 65 is rotated with the plate portion 3 such that the arched extension 71 is located half-way through the aperture 72 formed in the plate 5 of the body portion 2. The outer edge 74 of the arched extension 71 catches on a lower edge of the aperture 72 and so prevents the arched extension 71 from fully rotating through said aperture 72. This is best illustrated in Figure 12. In an alternative un-illustrated embodiment, the outer edge 74 is configured to not catch on the lower edge of the aperture 72. In this embodiment, the engagement of the bar 46 of the actuating member 26 and the cut away portion 15 restricts the rotation of the plate portion 3 and the second member 65 attached thereto.

When the safety clamp 60 is in an open position as described above, it should be understood that the gaps of both the first and the second passages 4, 63 are simultaneously widened so as to enable a vertical and a horizontal safety rail section to be passed through the respective widened gaps.

The safety clamp 60 is moved into its closed position similar to the embodiment described with reference to Figures 1 to 7. Briefly, the plate portion 3 is rotated relative to the body portion 2 so that the plane of both portions 3, 2 are parallel to

one another. The actuating member is moved or biased from its second position to its first position.

As can be appreciated from Figure 12, the partially tubular portion 66 is sufficiently
5 deep so that a safety rail received therein does not impede on the rotating arched extension 71.

In an alternative un-illustrated embodiment, the arched extension is replaced by two
arched members extending from outer sides 44, 45 of the plate portion 3. This
10 obviates the need for an aperture in the body portion 2 as the arched members extend on either short side of the body portion when the safety clamp is in a closed position.

The second exemplary embodiment of the safety clamp may be formed with an
15 actuating member without a stopping portion extending into the first passage. In this embodiment, either of the passages can be used for horizontal safety rail as no part of the actuating member engages with a safety rail as the actuating member rotates.

20 The second embodiment described with reference to Figures 8 to 12, provides the advantage over the prior art in that the safety clamp can be used in a fall arrest system wherein the safety rail comprises horizontal and vertical safety rail sections, and so obviates the need for the user to re-attach his lanyard to a different clamp when switching from a horizontal section to a vertical section, and vice versa.

25 Additionally, the present invention enables the safety clamp 1,60 to be removed or attached at any point along the length of a safety rail. Therefore, there is no need to feed the passage(s) 4, 63 of the safety clamp 1, 60 onto a free end of a safety rail in order to slidably attach the safety clamp to the safety rail as is required with the
30 safety clamps known from the prior art. Advantageously, the safety clamp can be more easily switched between fall arrest systems and the safety clamp can swiftly be removed half way of a long safety rail.

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.

Claims

1. A safety clamp for use in a fall arrest system having a safety rail, the safety clamp comprising a body portion and a plate portion together defining a passage
5 having a longitudinal axis to receive a safety rail extending therethrough such that, in use, the clamp slides along said safety rail in a longitudinal direction, the portions being movable relative to each other between a first position in which the passage is open along its length to enable a safety rail to be inserted into, or removed from, the passage, at any location along the length of the safety rail and a second position
10 in which the safety rail is retained within the passage.
2. A safety clamp according to claim 1, wherein the plate portion is pivotally connected to the body portion about an axis parallel to the longitudinal axis of the passage.
15
3. A safety clamp according to claim 2, further comprising an actuating member located between the plate portion and the body portion, the actuating member being pivotally attached to the plate portion for rotation about an axis.
- 20 4. A safety clamp according to claim 3, wherein the axis about which the actuating member rotates extends transversely to the longitudinal axis of the passage.
5. A safety clamp according to claim 4, wherein the body portion is configured
25 to prevent rotation of the body portion and the plate portion relative to each other until the actuating member is pivoted into a specific position.
6. A safety clamp according to claim 5, wherein the body portion comprises a cut out that aligns with the actuating member in its specific position such that a
30 portion of the actuating member is received in said cut out when the body and plate portions are rotated relative to each other.

7. A safety clamp according to claim 6, wherein the actuating member comprises an aperture for attachment of a lanyard thereto, the body and/or plate portion being configured such that the actuating member cannot be rotated into its specific position when a lanyard is attached to the actuating member through the
5 aperture.

8. A safety clamp according to claim 7, wherein the body and/or plate portion extends over the aperture in the actuating member when the actuating member is in its specific position such that rotation of the actuating member into its specific
10 position is blocked by said plate and/or body portion when a lanyard is coupled to the actuating member via the aperture.

9. A safety clamp according to any of claims 5 to 8, comprising a locking mechanism to lock the actuating member to the body portion when said actuating
15 member is not in its specific position.

10. A safety clamp according to claim 9, wherein the locking mechanism comprises a cam pin on the actuating member which is slideably received in a cam track formed on the body portion, the cam track and the cam pin having
20 cooperating means that engage for a portion of the movement of the actuating member to prevent rotation of the body portion and plate portion relative to each other until the specific position of the actuating member has been reached.

11. A safety clamp according to any of claims 5 to 10, wherein the actuating
25 member is mounted for rotation on an axle pin and the body portion has a hole, the axle pin locating in said hole when the body portion and plate portion are in their second position.

12. A safety clamp according to any of claims 5 to 12, comprising a biasing
30 member biasing the actuating member towards the first position.

13. A safety clamp according to any of claims 5 to 12, wherein the actuating member comprises a braking surface at its opposite end remote from the aperture,

said actuating member being pivotable into a position in which the braking surface engages a safety rail received in the passage to stop the clamp sliding along the safety rail.

14. A safety clamp according to any preceding claim, wherein the body and plate
5 portions together define a second passage parallel to the first passage, said second passage having a longitudinal axis and being configured to receive a safety rail extending therethrough, the plate and body portions being rotatable relative to each other from the first position in which the second passage is also open along its
10 length to enable a safety rail to be inserted into, or removed from, the second passage, at any location along the length of the safety rail and the second position in which said safety rail is retained within the second passage.

15. A safety clamp according to claim 14, wherein the second passage is formed from a first member attached to the body portion and the second member attached
15 to the plate portion.

16. A safety clamp according to claim 15, wherein the body portion is formed with an aperture and the second member extends through the aperture when the body portion and the plate portion are in the second position.

20

17. A safety clamp according to claim 15, wherein the second member extends from a side of the plate portion and across a side of the body portion when the body portion and the plate portion are in the second position.

25 18. A safety clamp substantially as hereinbefore described, with reference to the accompanying drawings.

30

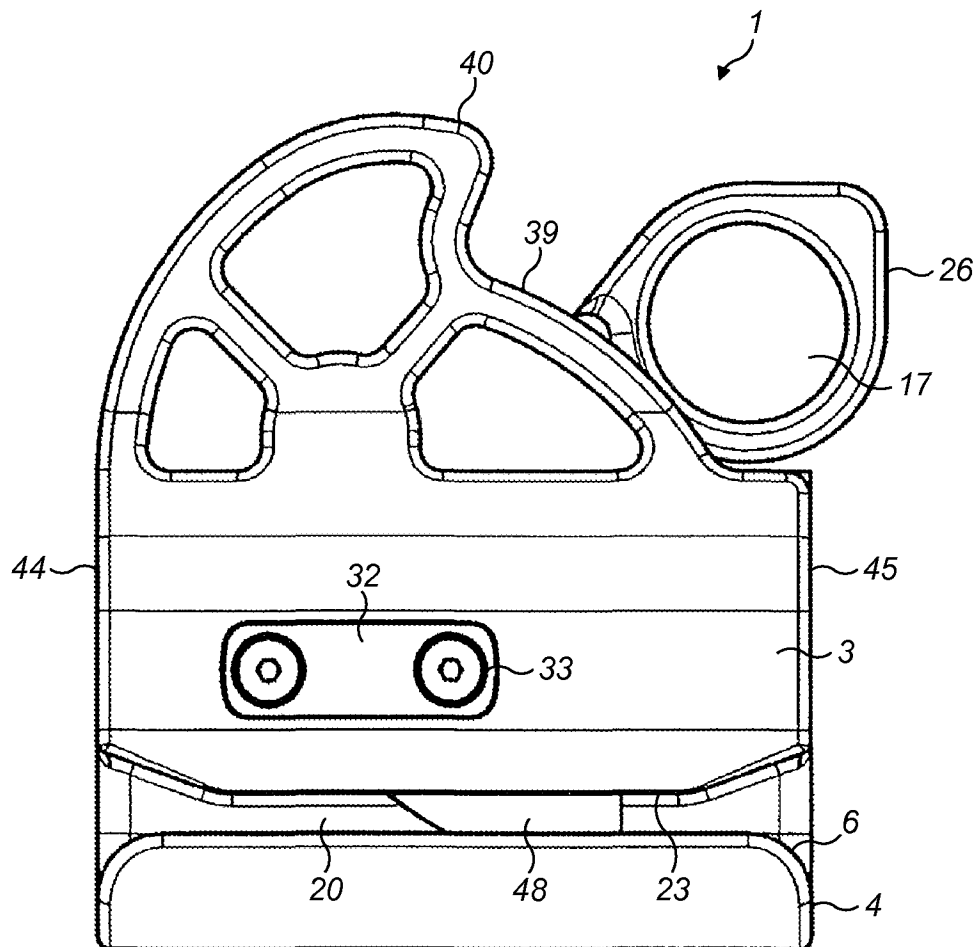


FIG. 1

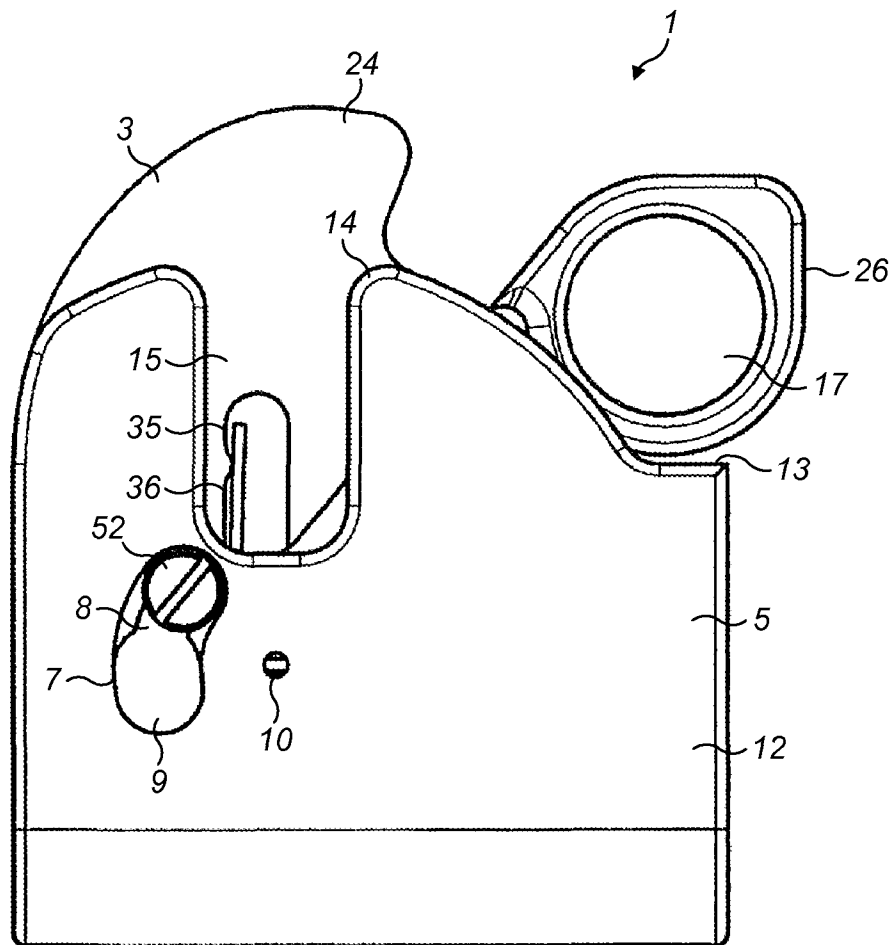


FIG. 2

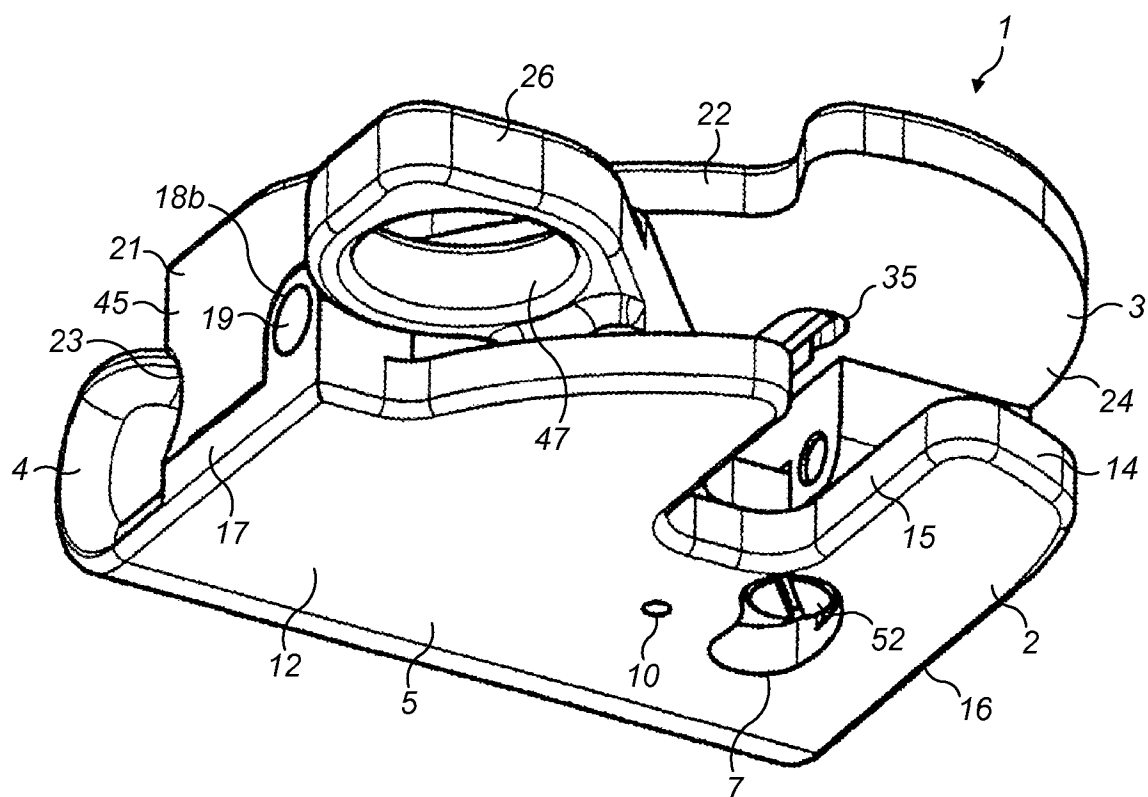


FIG. 3

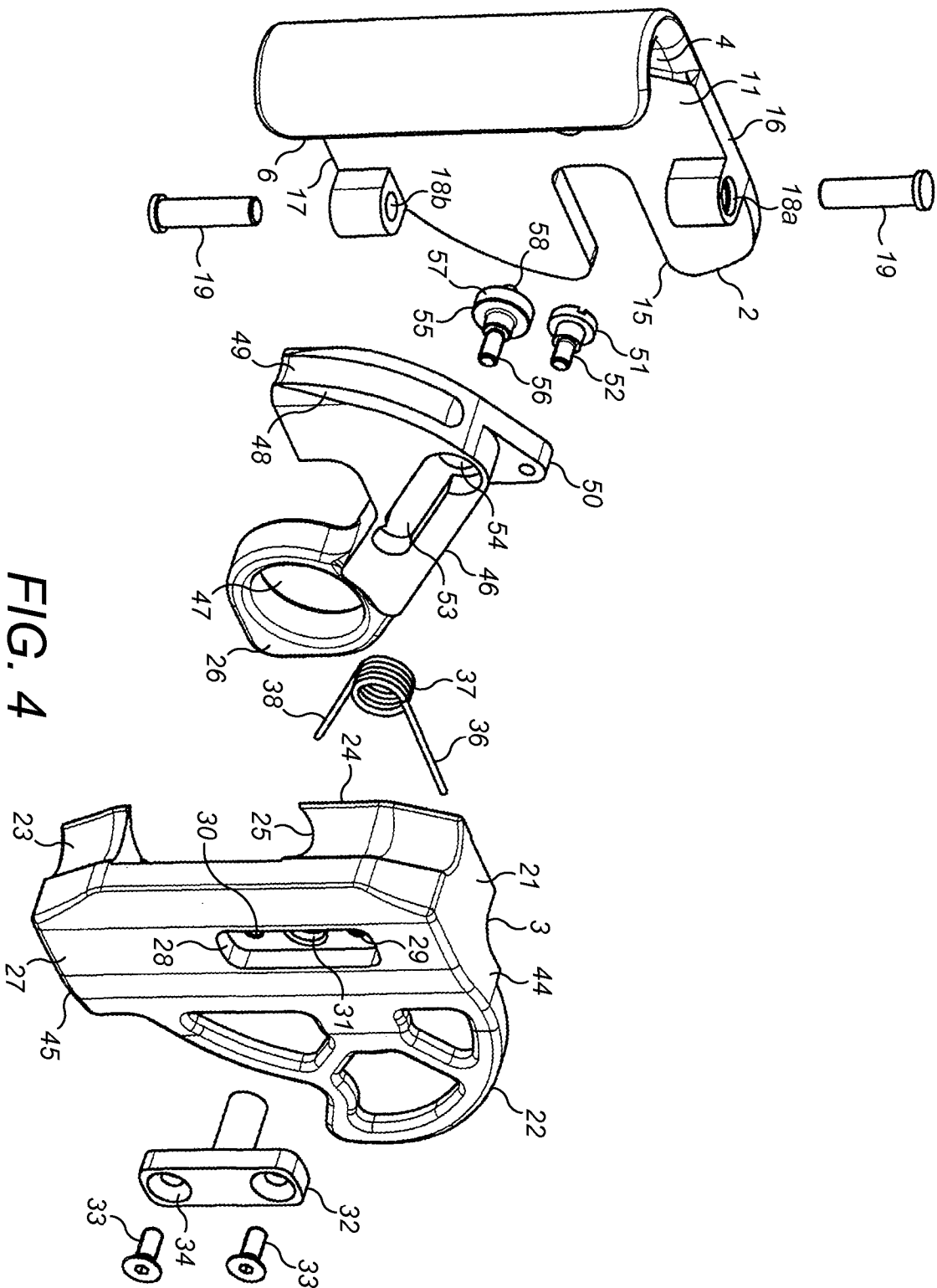


FIG. 4

5 / 13

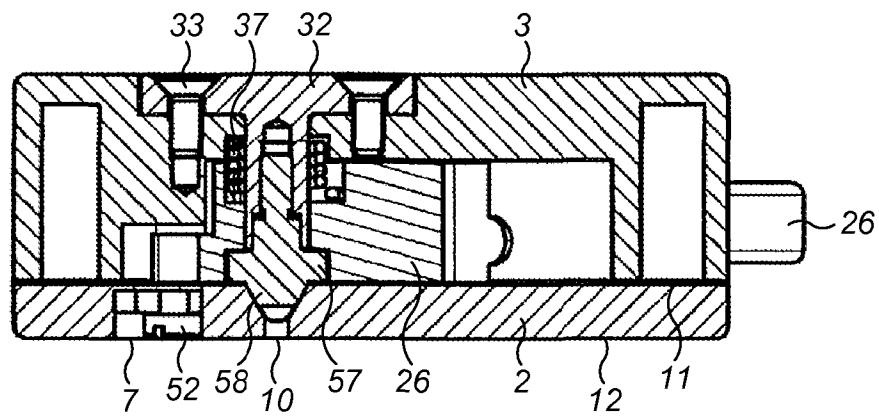


FIG. 5

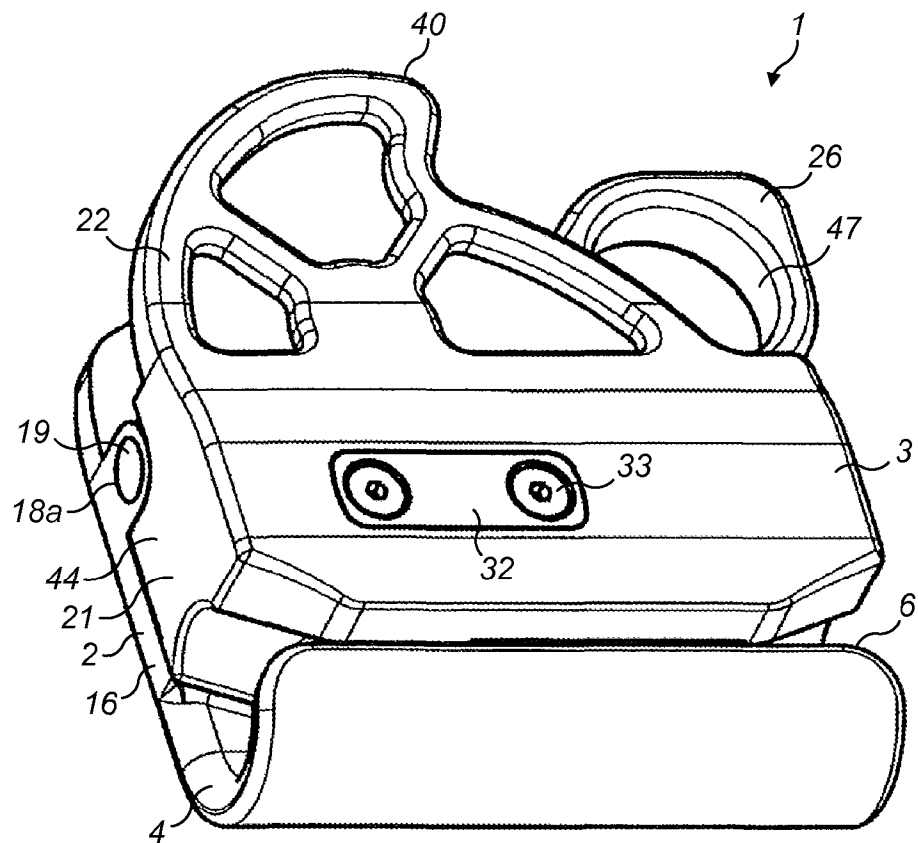


FIG. 6

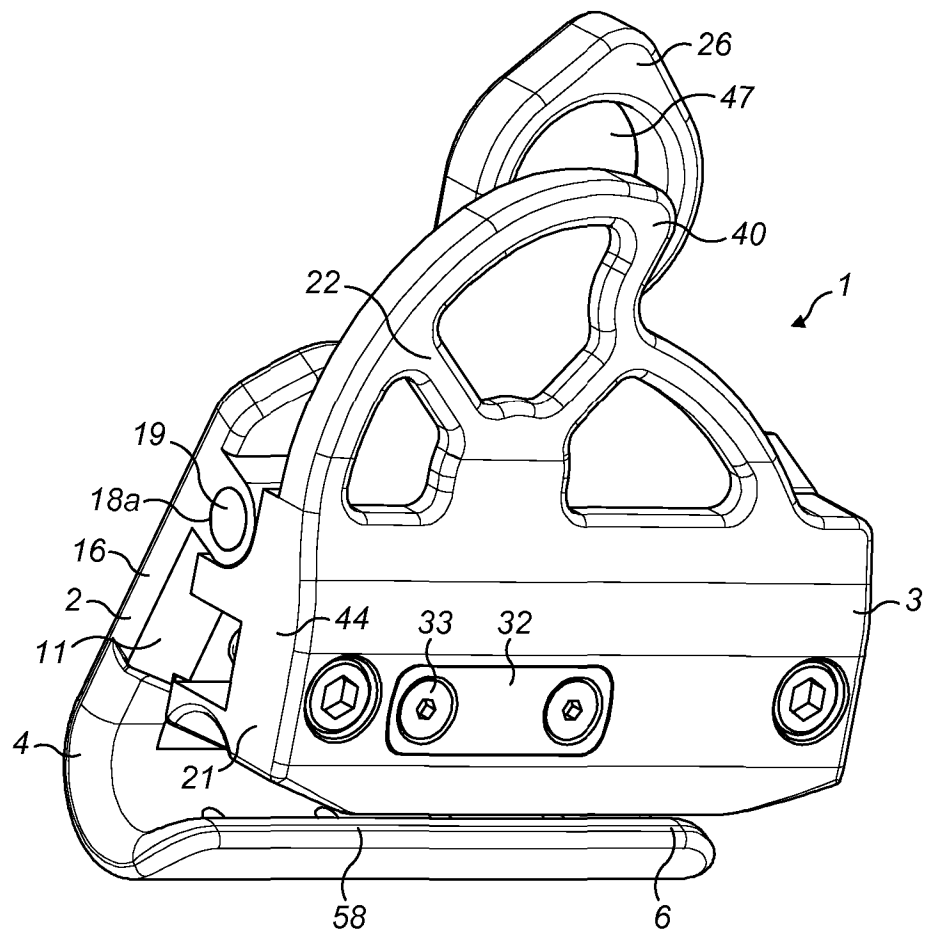


FIG. 7

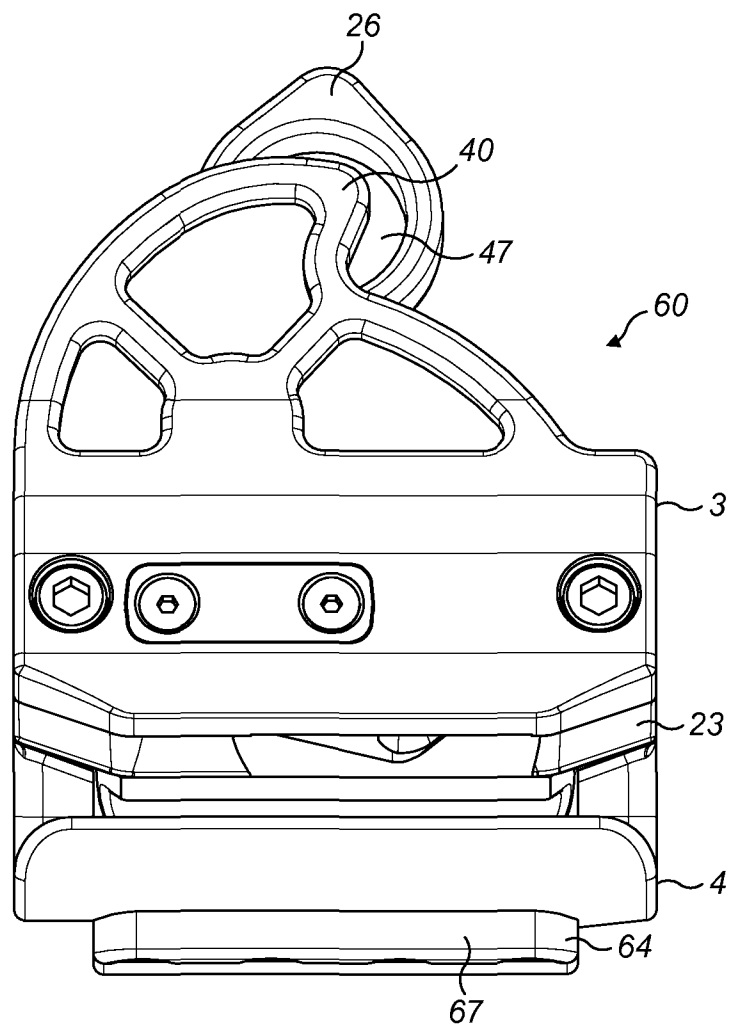


FIG. 8

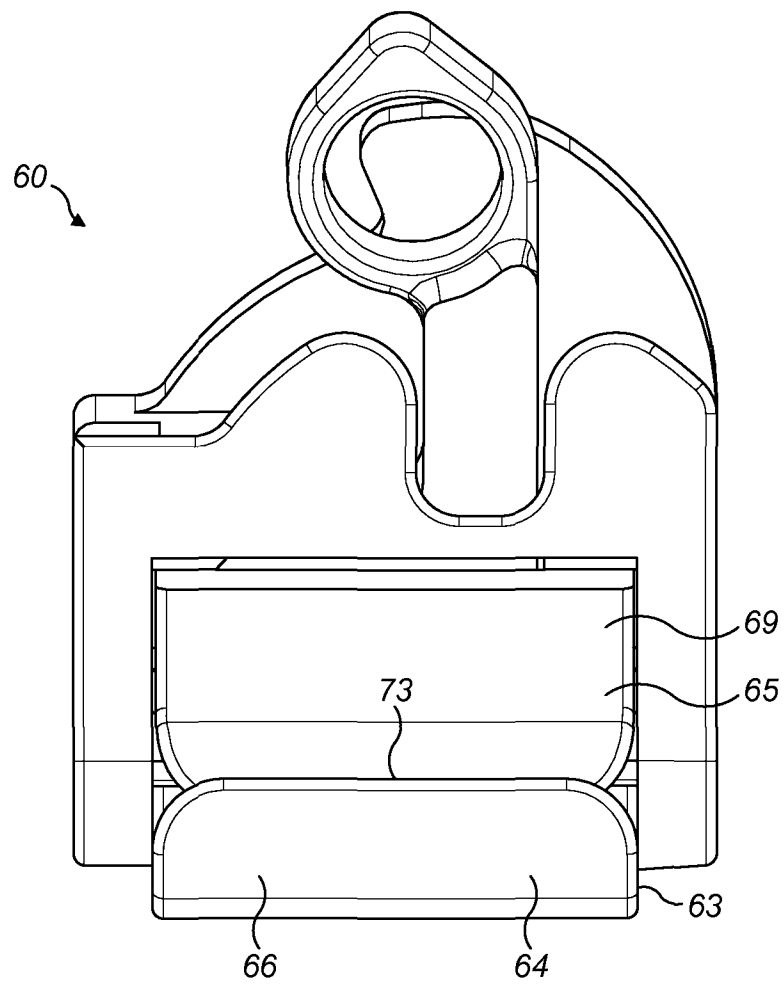


FIG. 9

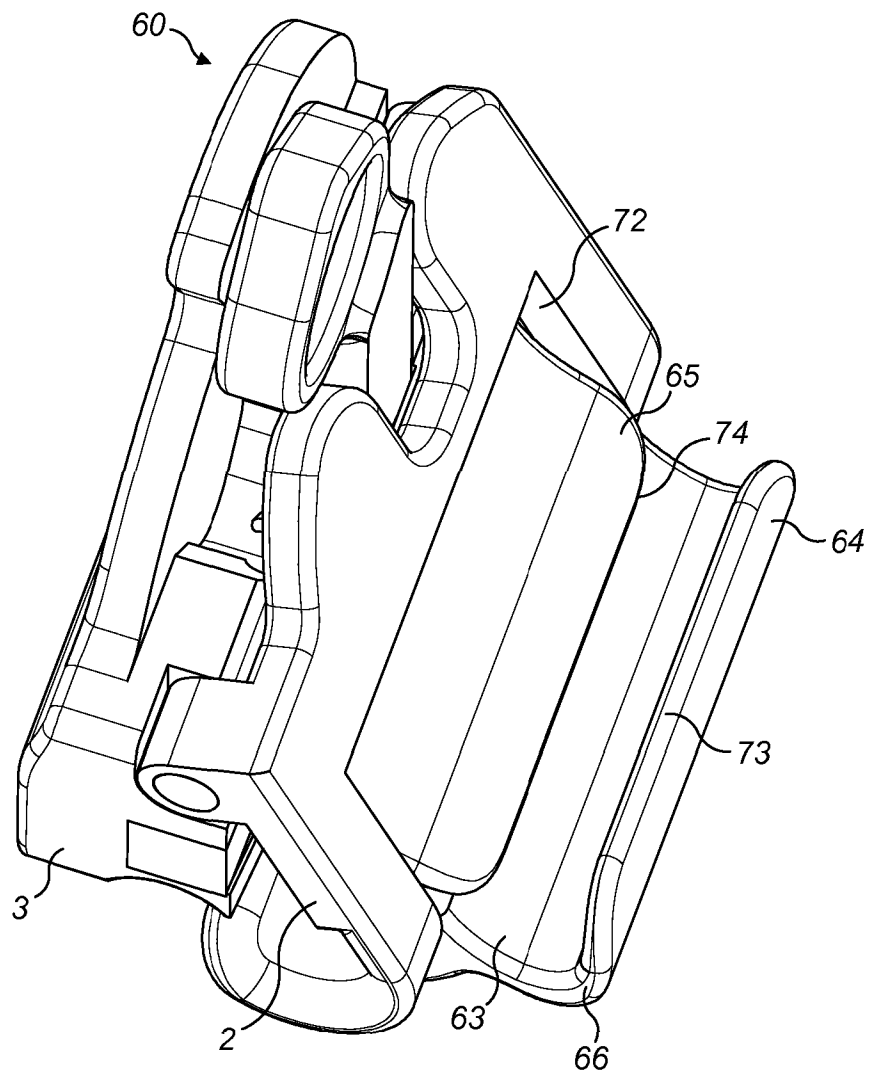


FIG. 10

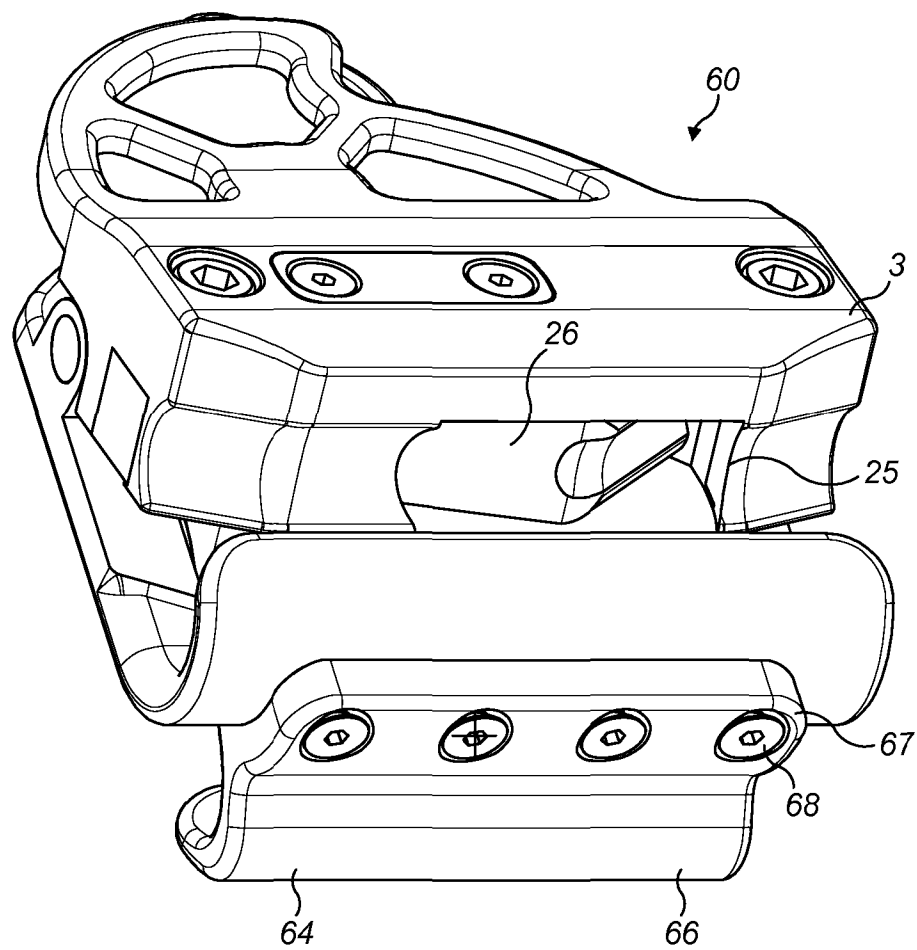


FIG. 11

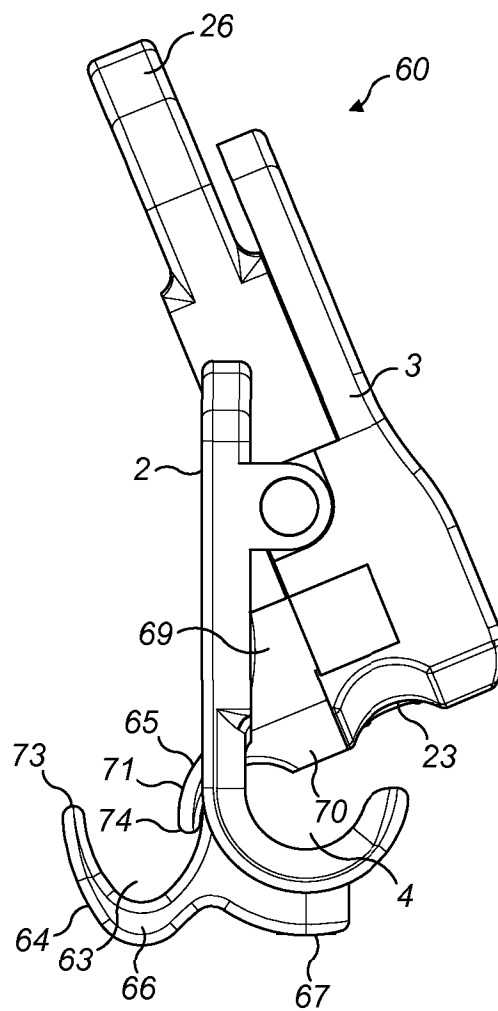


FIG. 12

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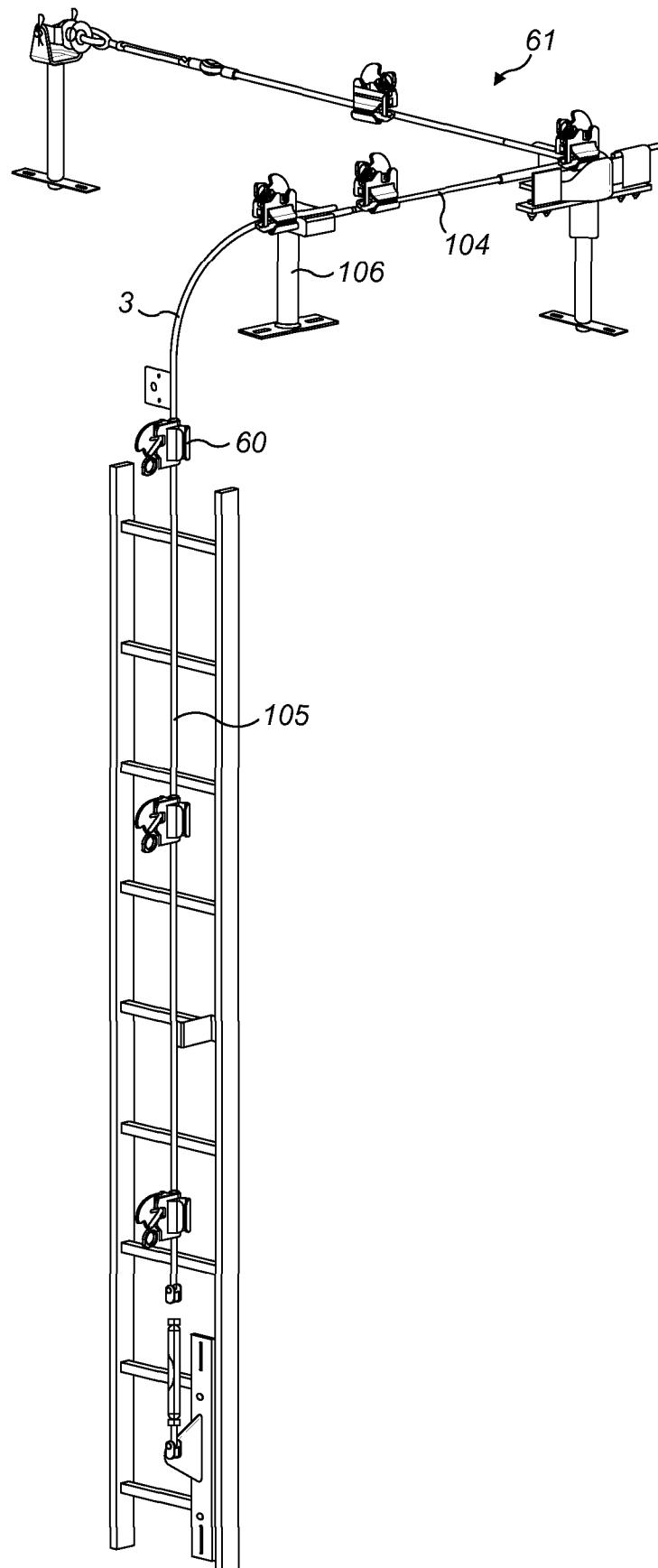


FIG. 13

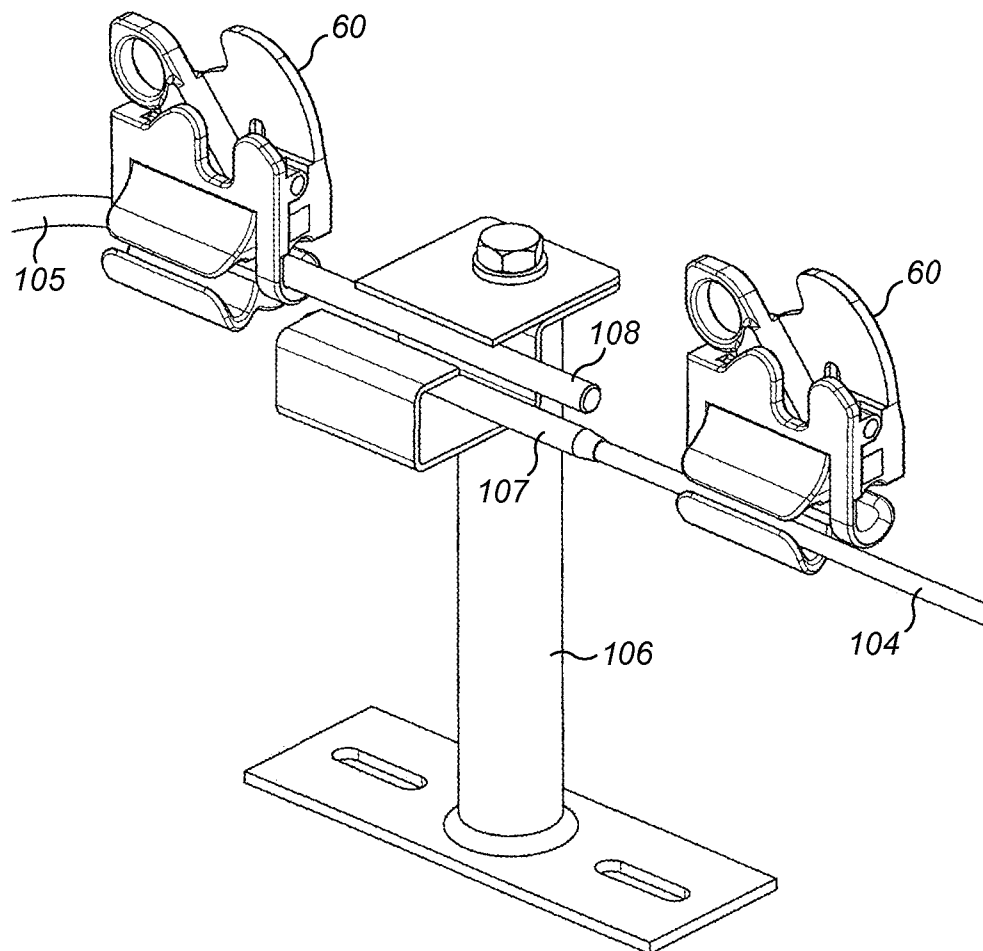


FIG. 14