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(54) **PROTECTION DEVICE FOR USE IN CLIMBING**

(57) A camming device comprises a head (10) on which is carried a plurality of pivotable cam elements (28). Each cam element (28) can pivot between an extended position and a withdrawn position. A trigger (34) is operable to pivot the cam elements (28) towards the withdrawn position. A stem (12) is connected to the head (10), the stem having a first and a second portion, an end part of the first portion being secured to the head (10), and the second portion having two branches that are secured to a common termination component (50) at spaced-apart locations. The first portion of the stem (12) comprises a single tensile member (40) or a plurality of tensile members that extend in contact with one another. At least one cam element (28) has a body on which is formed a working surface (66), in which the body, as manufactured, has applied to it a coating, other than in the region of the working surface.

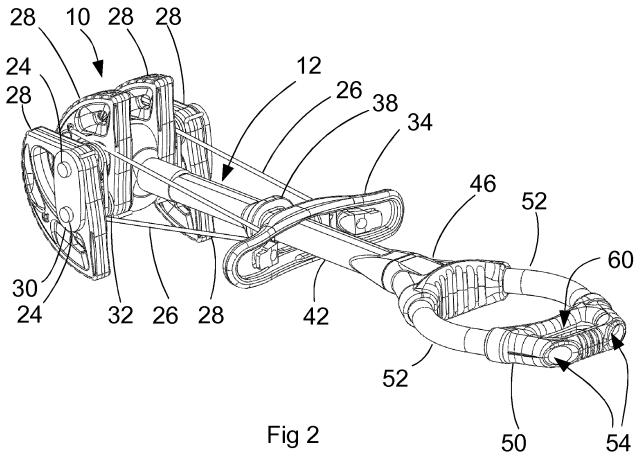

Fig 2

EP 2 954 937 A1

Description

[0001] This invention relates to a protection device for use in climbing. It has particular application to a protection device of the type known as a "camming device".

[0002] A camming device includes a stem on which is carried a head that comprises a plurality of pivotal cam elements. The cam elements are sprung to an expanded position, and can be drawn to a retracted position by operation of a manual control, typically by drawing it along the stem. For use, the elements are retracted and the head is inserted into a recess in a rock. The control is released, and the cam elements move towards the expanded position to make contact with and to grip the rock, and thereby retain the head within the recess. The cams are arranged such that if a force is applied to the stem that would pull the head from the recess, the effect is to urge the cam elements towards the expanded position, thereby enhancing the grip of the cams on the rock. The stem includes a loop to which a flexible sling can be connected, typically during manufacture, and/or a carabiner can be connected by a user as required.

[0003] The above description relates to a typical, known camming device. Since the requirements for construction of an effective camming device, and the variations possible in its detailed design, are well-known to those skilled in the technical field, further details will not be included here.

[0004] A conventional camming device has a stem that comprises one or more cables connected to a component of the head, and which may be further connected to a termination, or which is formed as a loop, to allow connection optionally by way of a sling to a carabiner.

[0005] EP-A-1 557 202 discloses a camming device in which the stem is formed from a single length of cable that is formed into a loop, and has two opposite end portions secured to the head between the camming elements. The stem has an elongate portion extending from the head, in which lengths of the cable run parallel to one another. Remote from the head, a connection the cable forms a loop to which a carabiner or sling can be connected. This is a compact and lightweight arrangement.

[0006] A disadvantage can arise when a carabiner such as that disclosed in EP-A-1 557 202 is connected to a sling made of very high-strength polymer or other material. Unless such a sling is constructed with particular care, it can cause loads that present very high localised pressure to be applied to the loop, which has the potential to reduce the strength of the loop, so the use of such a sling is effectively precluded. This has the effect of reducing the versatility of the device in use, since the length of such a sling is generally fixed on manufacture, and cannot be altered by a user.

[0007] An aim of this invention is to provide a camming device that has a stem which provides the advantages of the device of EP-A-1 557 202, yet which can be used with a wider range of slings and carabiners without a reduction in the strength of the device.

[0008] To this end, from a first aspect, this invention provides a camming device comprising a head on which is carried a plurality of pivotable cam elements that can pivot between an extended position and a withdrawn position, a trigger operable to pivot the cam elements towards the withdrawn position, and a stem connected to the head, wherein the stem has a first and a second portion, an end part of the first portion being secured to the head, and the second portion having two branches that are secured to a common termination component at spaced-apart locations. Loads arising from connection of the device to other equipment (typically through the intermediary of a carabiner or a sling) can be borne primarily by the termination component rather than the tensile members, thereby removing a potential source of weakness in known devices.

[0009] In typical embodiments, the stem comprises a plurality of tensile members. Each tensile member may be constituted by a length of cable, such as stainless steel or galvanised steel cable, or by a length of synthetic or composite material. In such embodiments, the tensile members may be connected to the head by all of them being swaged, soldered or otherwise fixed within a common formation of the head, such as a common recess, or tubular formation. Alternatively, they may be secured independently, but closely spaced.

[0010] Preferably, in the first portion, each of the tensile members are close to or in contact with one another, or there is a single tensile member. The first portion may be enclosed within a flexible sleeve. This presents the appearance of a single, approximately cylindrical, covered member. The trigger may be carried on the stem in the region of the first portion such that it can slide along the stem. In the second portion, tensile members may diverge from one another in a direction away from the head, thereby forming a branch in the stem. At least part of the divergent portion of tensile members may be contained within a channel in a splitter block. The splitter block may have a concave surface facing away from the head, the concave surface serving as a convenient and comfortable abutment to which a user can apply a manual force to assist in operation of the trigger. In such embodiments, there is typically a space between the splitter block and the termination component, for example by spacing the splitter block and the termination components apart along the length of the tensile members. This enables a carabiner or other connection device to be introduced into the space between the splitter block and the termination component between the two branches of the second portion of the stem to enable the device to be connected to other equipment. An aperture is advantageously provided through the termination component. Such embodiments of the invention may include such a sling, which is typically formed of a web of woven material, such as a polyethylene or other polymer or composite fibre of extreme strength, such as that made by DSM Dyneema B.V., and sold under the trade mark Dyneema. The sling is typically a continuous loop that preferably

passes twice through the aperture. It will be seen that this arrangement provides a barrier between the sling and a carabiner within the branched second portion of the stem, so preventing the carabiner from damaging the sling.

[0011] An end portion of each of the two branches of the second portion is retained by the termination component. For example, the branches of the stem may extend through respective bores in the termination component, each tensile member carrying blocking means that cannot pass through at least part of the bore. For example, the blocking means may be a ferrule applied to an end portion of the tensile member.

[0012] The termination component is typically formed from a casting, forging of or is machined from metal alloy.

[0013] In a camming device, each of the cam elements typically has a body on which a curved working surface is formed. The working surface is the part of the cam element that is intended to engage with a surface to cause the device to be retained in place, for example within a recess or crack in a rock. The working surface typically has additional formations, such as grooves or ridges, to enhance its grip.

[0014] From a second aspect, this invention provides a cam element for a camming device which has a body on which is formed a working surface, in which the body, as manufactured, has applied to it a coating, primarily for size identification during use, other than in the region of the working surface.

[0015] Although this adds to complication in manufacture, the absence of a coating enhances the grip of the working surface (or avoids the degradation of the grip that is caused by the presence of a coating). It should be noted that in conventional cam elements, which are entirely coated, the coating may partially or completely wear from the working surface after a period of use. In this context, the coating is one that is applied as a manufacturing step, such as by an anodisation process, as distinct from a naturally-occurring passivation coating as forms naturally on metals such as aluminium.

[0016] One or more cam elements in a device embodying the first aspect of the invention may be embodiments of the second aspect of the invention.

[0017] This invention also provides a method of making a cam element comprising forming a body, applying a coating to the body, and performing an operation on the body to form a working surface, thereby removing the coating in the region of the working surface. Such an operation may include one or more of machining, abrading, or blasting. This invention further provides a method of making a cam element comprising forming a body that includes a working surface, applying a resist or a mask to the working surface, and then applying a coating to the body other than in the region of the resist or mask.

[0018] More generally, from a third aspect, this invention provides a camming device comprising a head on which is carried a plurality of pivotable cam elements, at least one cam element being an embodiment of the second aspect of the invention.

[0019] An embodiment of the invention will now be described in detail, by way of example, and with reference to the accompanying drawings, in which:

Figure 1 is a cross-sectional view of a camming device being an embodiment of the invention;

Figure 2 is a perspective view of the embodiment of Figure 1;

Figure 3 shows the metal components only of the embodiment of Figure 1;

Figure 4 is a detailed view of a head of the camming device of Figure 1;

Figure 5 shows the device of Figure 1 in use with a carabiner (sling 62 not shown);

Figure 6 shows the device of Figure 1 in use with a sling in a shortened condition; and

Figure 7 shows the device of Figure 1 in use with a sling in a lengthened condition.

[0020] With reference to the drawings, a camming device comprises a head 10 and stem 12.

[0021] The head comprises an axle boss 20 formed from metal alloy, which may be cast, forged or machined as appropriate. The axle boss 20 has a projecting termination tube 22. In addition, the axle boss 20 has a plurality (four, in this embodiment) of projecting pivot pin 24. The axle boss 20 has a central plane of symmetry upon which the termination tube 22 is centred. All of the pivot pins 24 project normally from the plane of symmetry, half of them in one direction and half in the opposite direction. A securing plate 30 serves to retain each cam element 28 on its pivot pin. In this embodiment, each securing plate 30 extends between two pins on one side of the central plane.

[0022] Each pivot pin 24 carries a respective cam element 28, such that each cam element 28 can pivot about the pin 24 on which it is carried between a withdrawn position, and an extended operational position, the latter being shown in the drawings. A respective spring 32 surrounds each pivot pin 24 that acts to urge the corresponding cam element 28 towards the extended position.

[0023] In this embodiment the stem 12 comprises two similar lengths of stainless steel cable40. An end portion of each of the lengths of cable 40 is inserted into the termination tube 22, which is then crimped to securely retain the cables 40 within. A first length of both of the cables 40 extends from the termination tube 22 within a common flexible polymer sleeve 42.

[0024] Remote from the head 10, a rigid splitter block 46 is carried at an end of the sleeve 42. The cables enter the splitter block 46 from the end of the sleeve 42. Within

the splitter block 46, the cables 40 extend within respective bores that diverge apart from one another, causing whereby the stem is branched, and then emerge from the splitter block 46 with an acute angle between them in a plane that is generally parallel to the axes of the pivot pins 24. The splitter block 46 has a concave curved surface 48 within which ridges are formed extending between the cables 40 where they leave the splitter block 46.

[0025] The cables 40 extend from the splitter block 46 to a forged or cast alloy termination block 50. The termination block 50 has a respective bore 54 within which each cable 40 is received. Between the splitter block 46 and the termination block 50, the cables curve such that they converge as they enter the termination block 50. A central part of the bore 54 has a diameter that is a close fit around the cable 40. A respective terminating ferrule 56 is secured to an end portion of each cable 40 by a crimping and/or silver soldering. The ferrules 56 have an external diameter greater than the diameter of the central parts of the bores 54, and thus prevent removal of the termination block 50 from the cables 40. Between the splitter block 46 and the termination block 50, each cable is contained within a respective flexible tube 52, which may be transparent to enhance the appearance of the device. End portions of the bores in the splitter block 46 and the termination block 50 are enlarged to receive end portions of the flexible tubes 52.

[0026] A rounded aperture 60 is formed through the termination block 50 normal to the plane of the cables 40. A length of strong, flexible webbing is passed twice through the aperture 60 and formed into a continuous loop by sewing its opposite end portions together to form a continuous sling 62 with two loops, each passing through the aperture 60.

[0027] A trigger 34 is carried on the stem 12, such the trigger 34 can slide along the polymer sleeve 42. Respective portions of the trigger 34 extend in the plane of the cables 40 to opposite sides of the sleeve 42. These portions have respective concave surfaces 36 facing the head 10. The trigger 34 is connected to each of the cam elements 28 by wires 26. When the cam elements 28 are in the extended position, the trigger 34 is close to the head 10 and is retained against a stop 38 formed on the sleeve 42. If the trigger 34 is drawn along the stem 12 away from the head, the wires pull the trigger elements 28 towards the withdrawn position against the force of the springs 32. This can be achieved by a user placing one finger on each of the concave faces 36 of the trigger 34 and their thumb on the concave surface 48 of the splitter block 46, and drawing their fingers towards their thumb. When the trigger 34 is released, the springs 32 return the cam elements 28 towards the extended position (although with the device in use, the cam elements 28 will typically engage a rock surface before reaching the fully-expanded position).

[0028] As can be seen from Figure 4, each cam element 28 has a body and a peripheral curved working surface 66 that makes contact with rock when the device is in use. The working surface 66 has a plurality of grooves 68 extending across it to enhance its grip. Most of each cam element 28 is anodised. This serves two purposes: the anodised coat can be coloured to indicate some property of the device (most usually, its size) in a clear and easy-to-recognise manner, and the coat inhibits corrosion of the metal of the cam element 28. The working surface 66 is, however, free from such a coating. This can be achieved during manufacture in various ways. For example, the working surface may have a resist or mask applied prior to the cam element being subject to anodisation. Alternatively, the entire cam element may be anodised prior to a subsequent manufacturing step in which the working surface 66 and its grooves 68 are machined, thereby removing the coating in the region of the working surface.

[0029] It will be appreciated that the cam elements shown in Figure 4 have potential application to camming devices in general. Such a camming device may include all, some, or none of the other features of the devices described here.

[0030] The camming device can be connected to other equipment in various ways. First, a carabiner 70 can be inserted into the loop formed by the splitter block 46, the termination block 50 and the two lengths of cable running between them, as shown in Figure 5.

[0031] Alternatively, the sling 62 can be connected to a connecting device such as a carabiner. As shown in Figure 6, both loops of the sling 62 can be drawn from the termination block 50, and a connecting device passed through both loops. Alternatively, just one loop can be drawn from the termination block and the connecting device is passed through that one loop, as shown in Figure 7. The latter configuration 62 provides a sling that is almost twice as long as the former.

[0032] In either case, the termination block 50 is subject to the greatest loading, so avoiding high, localised loads being applied to a cable, or other component that could be damaged by such a load.

[0033] In an alternative embodiment, the first portion of the stem, which extends from the head to the splitter block, is formed from a single length of cable. The second portion of the stem is constituted by two lengths of cable that extend from the splitter block to the termination block.

[0034] In another alternative embodiment, the first portion of the stem, which extends from the head to the splitter block, is formed from a single length of cable. The second portion of the stem is constituted by another length of cable that extends from the splitter block, through the termination block, and is secured back in the opposite side of the splitter block to form a loop.

Claims

1. A cam element for a camming device which has a body on which is formed a working surface, in which

the body, as manufactured, has applied to it a coating **characterised in that** the coating is applied to the body other than in the region of the working surface.

2. A cam element according to claim 1 in which the working surface is a peripheral, curved working surface.

3. A cam element according to claim 1 or claim 2 in which the working surface has additional formations, such as grooves or ridges, to enhance its grip.

4. A cam element according to claim 3 in which the working surface has a plurality of grooves extending across it.

5. A camming device comprising a head on which is carried a plurality of pivotable cam elements, at least one cam element being in accordance with any preceding claim.

6. A camming device according to claim 5 comprising a head on which is carried a plurality of pivotable cam elements that can pivot between an extended position and a withdrawn position, a trigger operable to pivot the cam elements towards the withdrawn position, and a stem connected to the head, wherein the stem has a first and a second portion, an end part of the first portion being secured to the head, and the second portion having two branches that are secured to a common termination component at spaced-apart locations.

7. A method of making a cam element for a camming device comprising forming a body, applying a protective coating to the body, and **characterised by** performing an operation on the body to form a working surface, thereby removing the coating in the region of the working surface.

8. A method of making a cam element for a camming device according to claim 7 in which the protective coating is applied to the body in a manufacturing step that includes an anodisation process.

9. A method of making a cam element for a camming device according to claim 7 or claim 8 in which the operation performed in the body includes one or more of machining, abrading, or blasting.

10. A method of making a cam element for a camming device comprising forming a body that includes a working surface **characterised by** applying a resist or a mask to the working surface, and then applying a protective coating to the body other than in the region of the resist or mask.

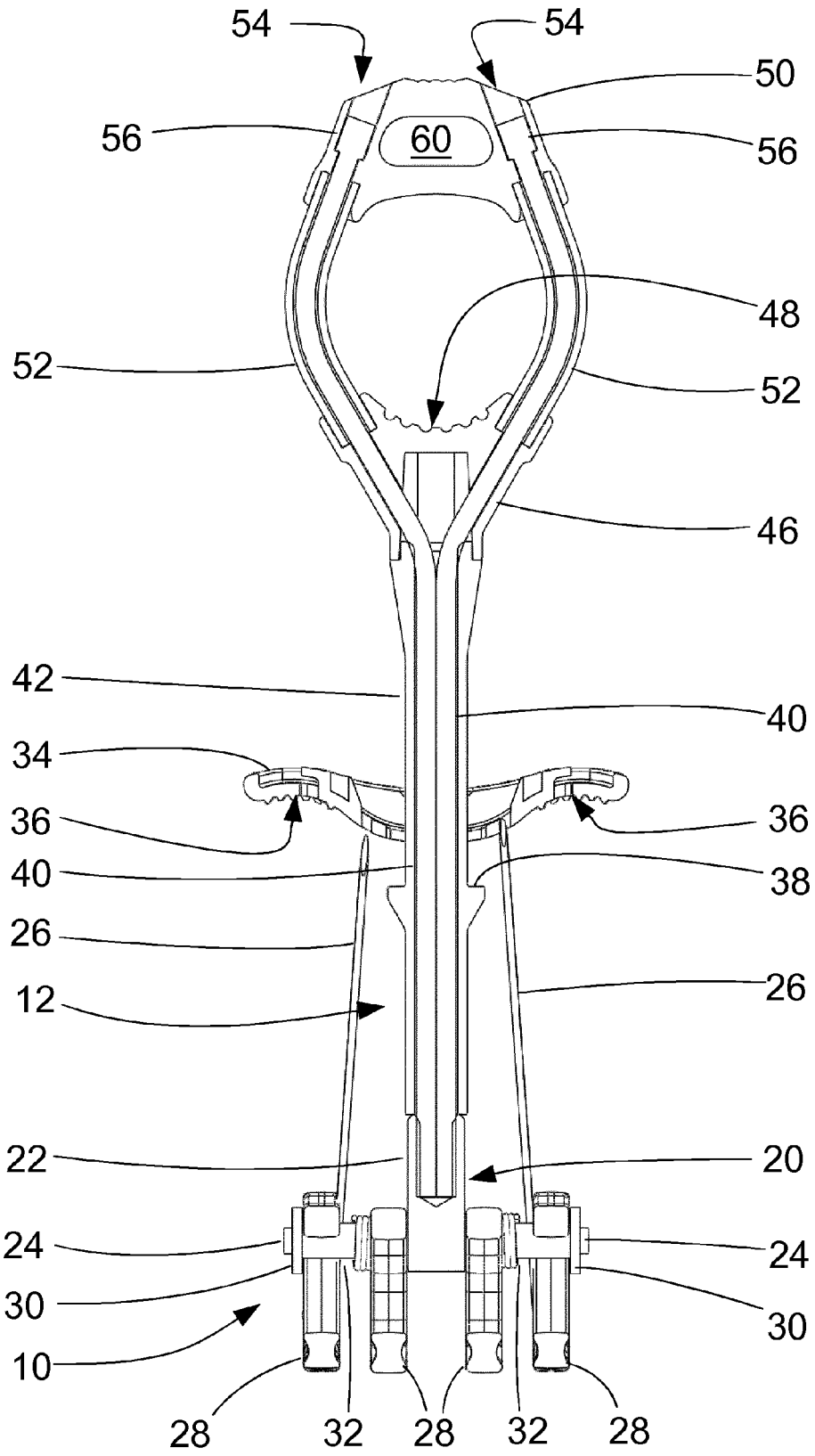
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Fig 1

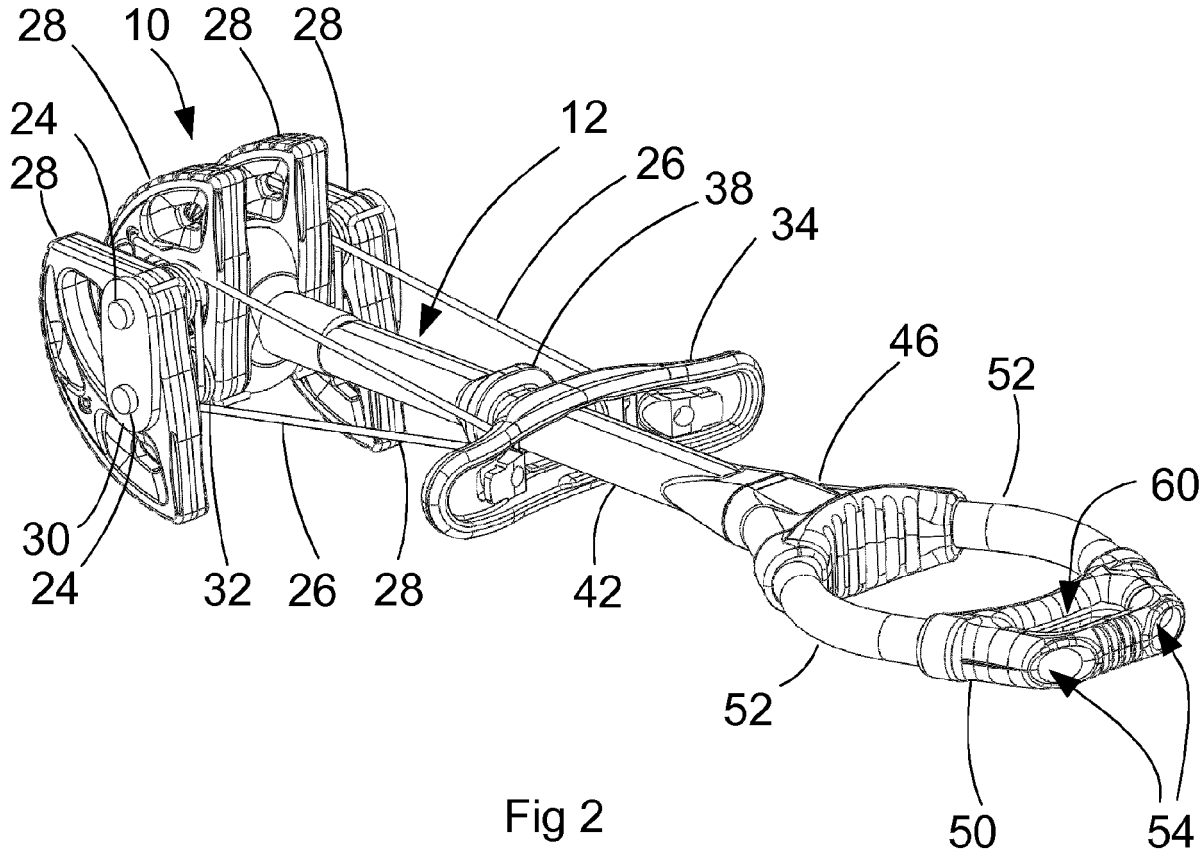
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Fig 2

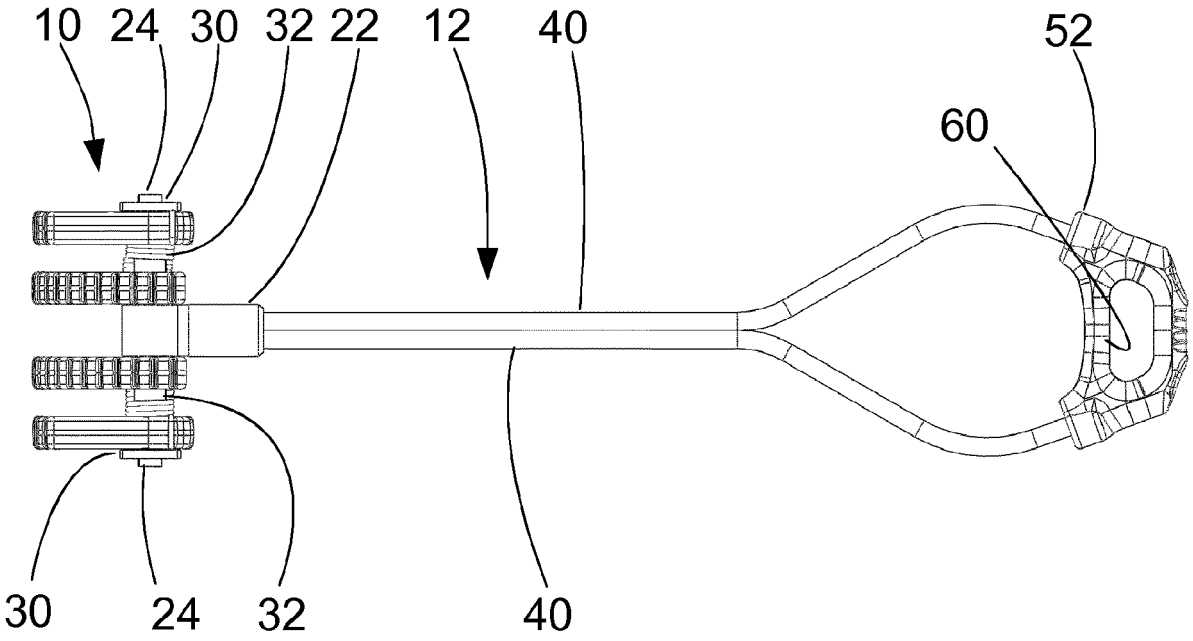
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Fig 3

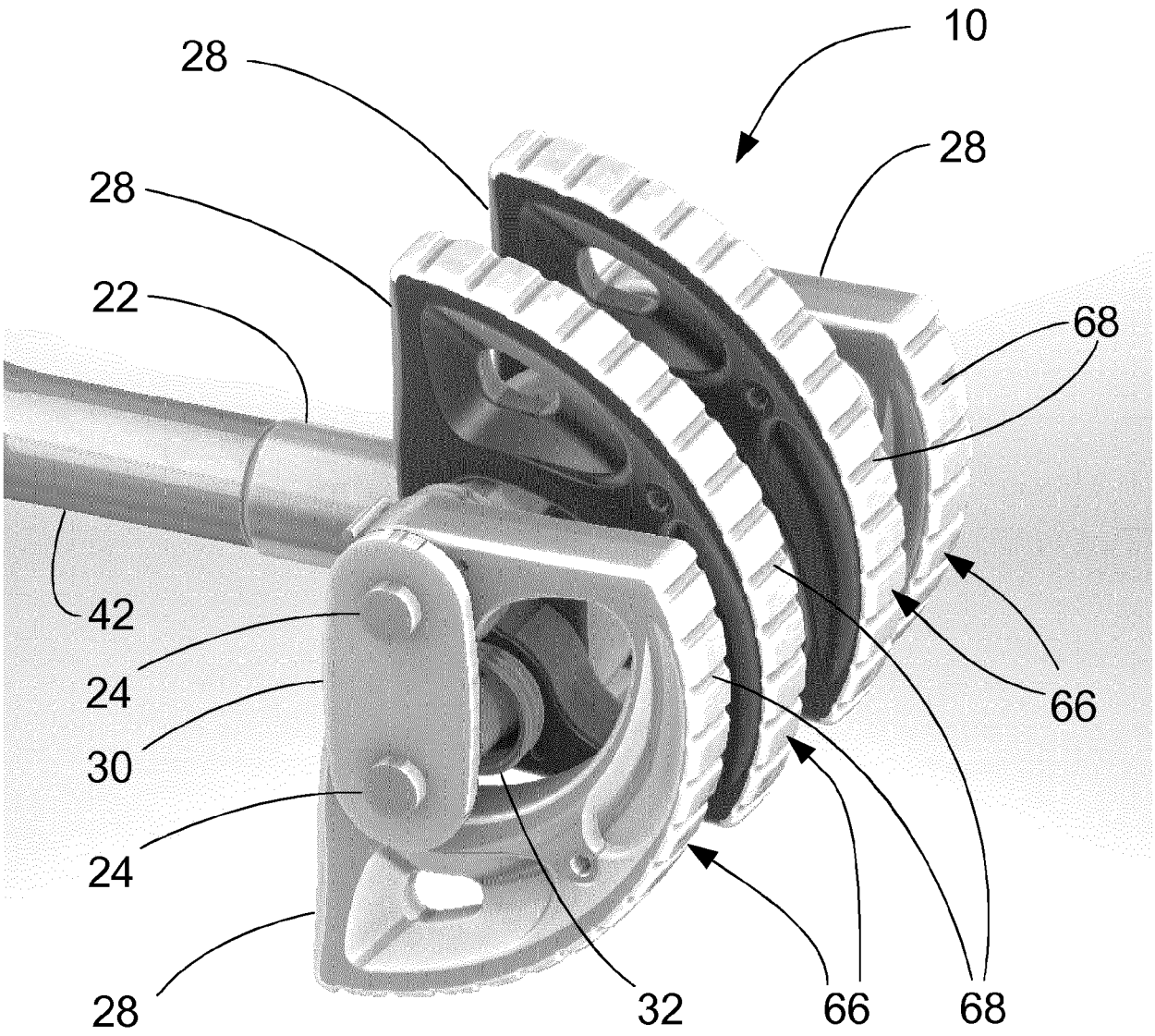

Fig 4

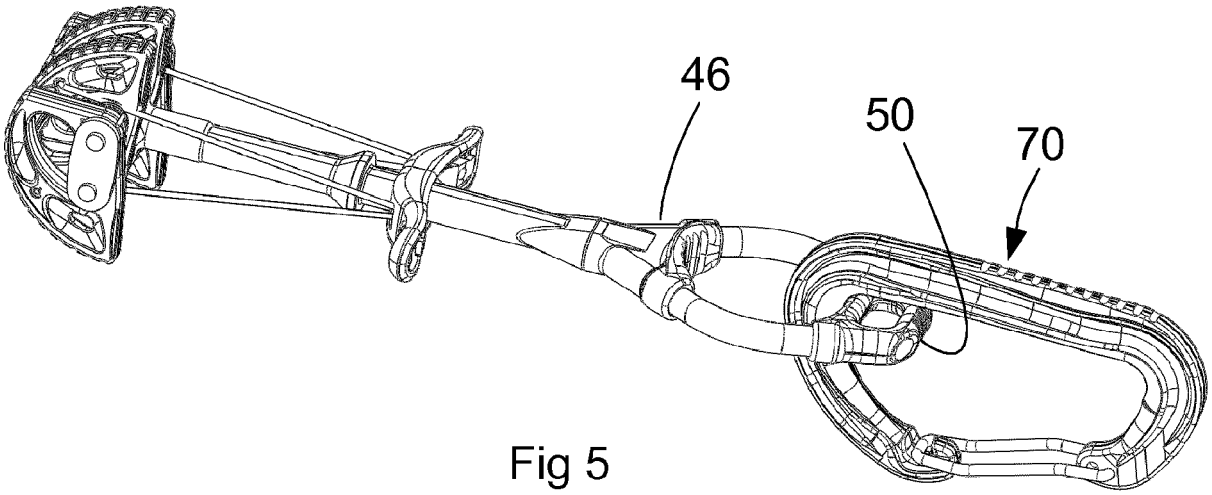

Fig 5

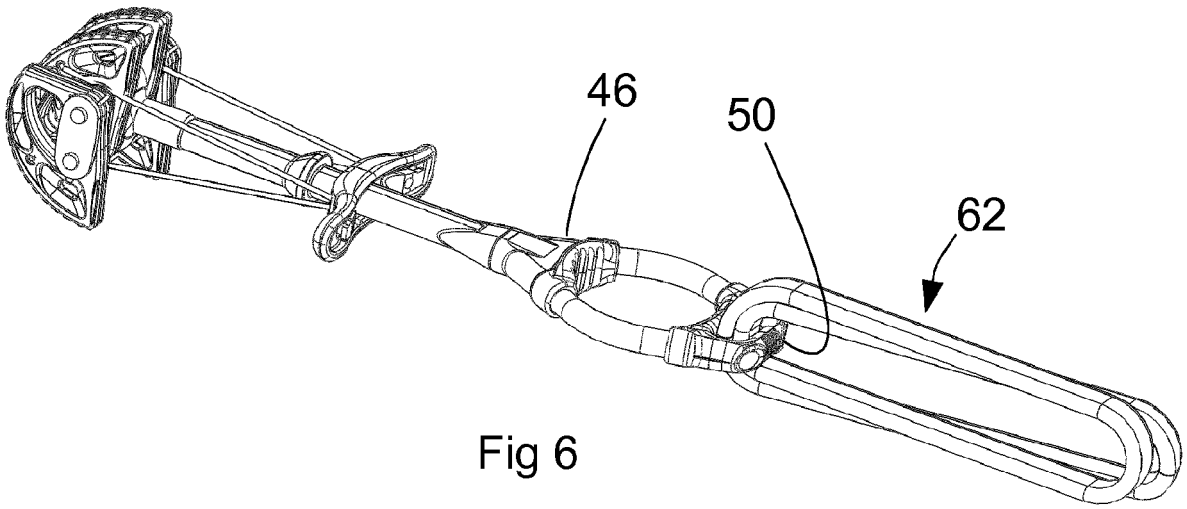

Fig 6

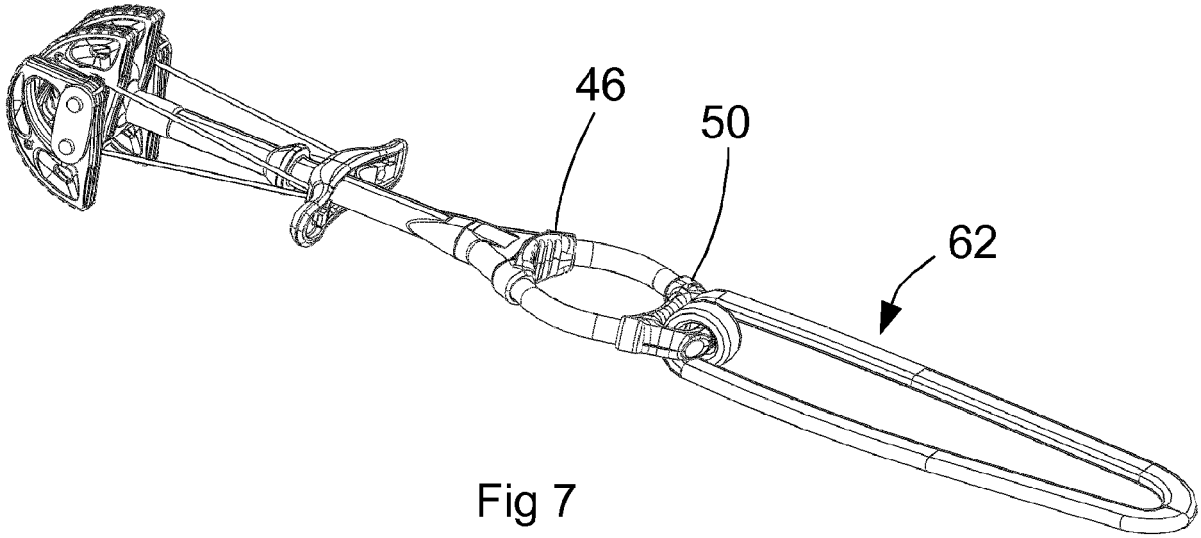

Fig 7

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EUROPEAN SEARCH REPORT

Application Number
EP 15 17 4664

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 October 2015	Herry, Manuel

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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