



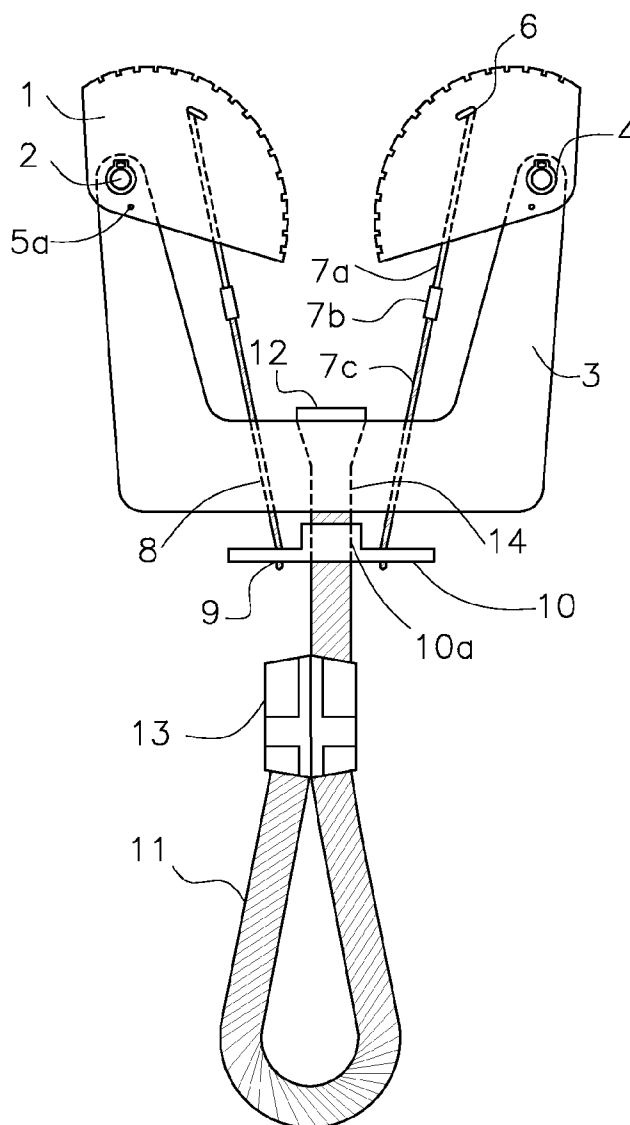
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Maltsev(10) **Pub. No.: US 2009/0230268 A1**(43) **Pub. Date: Sep. 17, 2009**(54) **CAMMING DEVICE FOR ANCHORING TO
ROCK PROTRUSIONS**(52) **U.S. Cl. 248/231.9**(76) **Inventor: Alexandre S. Maltsev, Ithaca, NY
(US)**(57) **ABSTRACT**

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A climbing aid having a rigid frame, two axles supported parallel to each other by the rigid frame, two pairs of cams pivotally mounted one pair per axle, and spring members mounted on the axles, which act to urge each cam into its extended position. The device clamps onto a rock protrusion such that the two pairs of cams are situated on the opposite sides of the protrusion. Initial force holding the device clamped comes from the spring members. Because of the shape of the cams, application of downward pull to the device translates into additional clamping forces applied to the rock protrusion. Application of pull onto a slidably mounted trigger actuates the cams into a retracted position, allowing the device to clamp onto protrusions of a range of sizes.



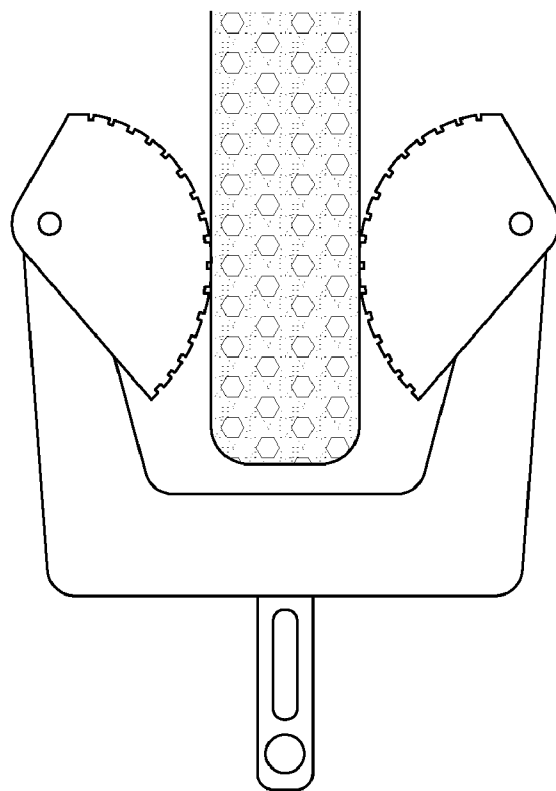


Fig. 1

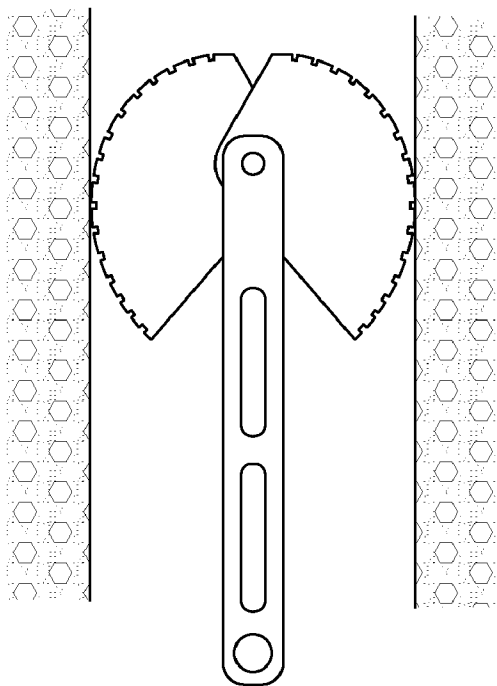


Fig. 2
PRIOR ART

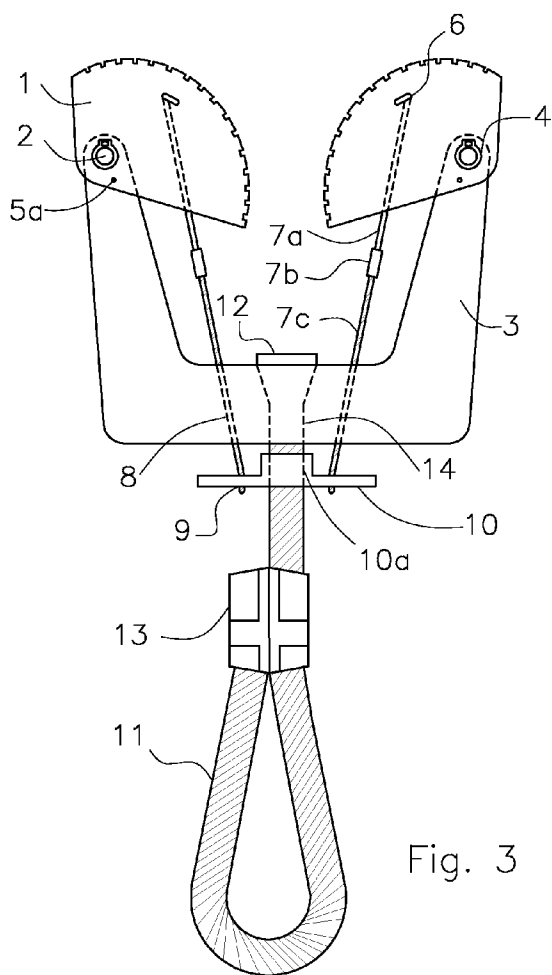


Fig. 3

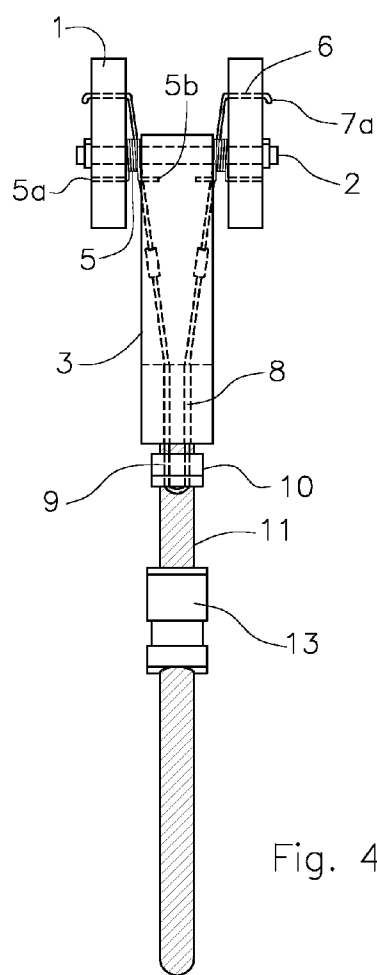


Fig. 4

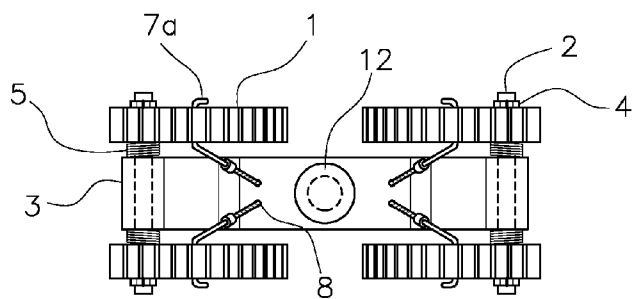


Fig. 5

CAMMING DEVICE FOR ANCHORING TO ROCK PROTRUSIONS

BACKGROUND OF THE INVENTION

[0001] This invention relates to climbing aids and is particularly though not necessarily exclusively concerned to climbing aids for rock climbing and the like.

[0002] Modern rock climbing is a surprisingly safe sport thanks to the well thought through system of protection developed since the emergence of the sport in the 1960s. A climber moving up a rock face is tied into one end of a rope, the other end of which is handled by a climbing partner from a safe stance. The climber protects himself by clipping the rope into intermediate anchoring points as he proceeds up the route. On most climbing routes one has to rely on artificial anchoring points. In the past, use of semi-permanent anchors such as pitons and bolts was common. However, those practices led to irreversible degradation of rock faces, and were consequently almost entirely abandoned by the climbing community. In the modern “traditional” rock climbing, pieces of protection are placed into rock that can be easily removed afterwards and that cause no damage to the rock. Pieces of protection can be divided into passive and active. The most popular pieces of active protection are broadly referred to as SLCDs, or “spring-loaded camming devices”, because of the key element of structure—spring biased cams of a special shape. As first introduced in U.S. Pat. No. 4,184,657, SLCD operates by converting a traction force moving out of the crack into a force applied against the walls of the crack through the use of cams, such that the friction created between the cams and crack walls counteracts the force pulling on the device. Thus, however large the applied pull is, there results enough friction to prevent SLCD from getting pulled out (as long as the placement is sound, and the rock is good). Typically, an SLCD has three or four cams, two of them engaging one wall of the crack and the rest engaging the other wall. When SLCD is placed, the cams behave semi-independently, adjusting to the shape of a particular crack.

[0003] One of the most important features of SLCDs is the shape of the cams. The cams have an arcuate surface in the shape of logarithmic spiral, characterized by the property that the angle between the tangent and radial line at a point is constant. The radius of the spiral increases between two sizes, making it possible to place an SLCD of a particular nominal size into different cracks having a range of widths. But independently of width of the crack, the SLCD will distribute forces at a constant angle to the walls of the crack, determined by the angle chosen for the logarithmic spiral of the cams.

[0004] Advent of SLCDs created a revolution in traditional climbing, by making many climbs much easier to protect, and making climbing generally safer. However, what may be considered a common weakness of all the existing types of gear used in traditional climbing is that it must be placed into cracks or suitably shaped recesses in the rock. Generally speaking, absence of cracks renders a rock face “unprotectable”, such that it cannot be climbed safely. The only way to protect such a climb would be to place bolts or pitons. The present invention presents a drastically novel piece of protection that does not require a crack for successful placement; instead it is placed onto rock protrusions of suitable shapes.

SUMMARY OF THE INVENTION

[0005] Certain types of rock—such as limestone, sandstone, and tufas—rarely or never form cracks. They do, how-

ever, often provide protrusions that rock climbers “pinch” with their fingers. The present invention can be placed over some of the same protrusions to provide an anchoring point.

[0006] This invention relies on the cams of the same shape, and on the same principle of transformation of the force of pull into force of friction that are used in SLCDs. FIG. 1 shows the conceptual representation of the invention, that is easy to compare to the conceptual representation of an SLCD shown in FIG. 2. FIGS. 1 and 2 illustrate the positioning of the cams of the respective devices, and how the devices are placed in/over rock. (Notice, that this invention can indeed be placed onto a protrusion with parallel surfaces). The novel necessary features of this invention include a fork-shaped rigid frame and two axles supporting the cams. The invention basically clamps onto a rock protrusion using the forces applied through the cams. As detailed in the description of the preferred embodiment and FIGS. 3-5, the present invention utilizes some other of the same ideas as used in SLCDs; namely cams are spring biased, and are actuated through a system of cables by pulling on a trigger. It is suggested that this invention be manufactured in a set of sizes, following the paradigm already accepted by SLCD users. Namely that each device of a nominal size should cover a range of protrusion sizes, and the devices of neighboring nominal sizes should have overlapping ranges. In case of this invention the nominal size can be defined by both the size of the fork-like frame, and the size of the cams.

[0007] The current invention can be contrasted to other conceivable clamping devices. First, consider a device (referred to below as “device A”) that uses powerful springs to create sufficient forces of friction. Typical requirement for a not-too-small SLCD is that it should be able to support a force of pull of 14 kN (roughly 20 times the weight of a 70 kg person). To create sufficient forces of friction the springs of device A would have to create forces on the order of 100 kN. These springs would obviously be impossible to operate directly by hand. Any mechanistic ways to operate such springs would add extra weight and bulk, and would be inconvenient in a climbing situation. Second, consider a device (“device B”) that uses a sort of screw driven cams to squeeze a rock protrusion to provide necessary forces of friction. Device B will be impossible to operate with one hand, because until its width is properly adjusted it cannot support itself on the rock. But being able to operate climbing gear with one hand is extremely important for a climber because he has to use one hand to support himself on the rock. Another problem with device B is that it would take a substantial amount of time to adjust its width, because that would require multiple turns of a screw. But any extra time spent on the rock drains a climber’s energy that may be required later on the climb.

[0008] A “device C” may be similar to pole climbing devices of U.S. Pat. Nos. 4,407,391 and 4,595,078. As can be seen in FIG. 3 of U.S. Pat. No. 4,407,391, the pivoted blades 17 are used to transform the downward pull on the device into extra grip on the surface of the pole, which is similar to the mode of operation of the current invention. The problem with device C is what happens when it is clamped onto protrusions of different widths. The pivoted blades of device C would direct forces at different angles to the surface of the protrusion depending on its width. The consequence will be a changing reliability of placement. Considering the shape of the blades, since the blades cannot actually bite into the rock, the area of the contact with the rock will be very small, making the

possibility of slippage and placement failure very high. In contrast, the special shape of cams of the current invention provides more extensive contact with the rock, individual adjustment of cams to the surface of the protrusion, and the constant angle of force application to the rock. It thus appears reasonable to conclude that the current invention is the best alternative for clamping onto rock protrusions in application specifically to traditional rock climbing.

DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 shows a conceptual representation of the present invention with regards to location and orientation of the cams and placement over a rock protrusion.

[0010] FIG. 2 shows a conceptual representation of an active camming device according to the prior art with regards to location and orientation of the cams and placement in a crevice in a rock face.

[0011] FIG. 3 is a front view of the preferred embodiment of the present invention.

[0012] FIG. 4 is a side view of the preferred embodiment of the present invention.

[0013] FIG. 5 is a top view of the preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0014] According to the present invention the anchoring device in FIGS. 3-5 engages rock with four cams 1 mounted in two pairs on two axles 2. Axles 2 pass through the fork-shaped rigid frame 3 such that they are parallel to each other, and are separated by the trough of the frame 3. Each cam 1 possesses an arcuate surface in the shape of a logarithmic spiral. Cams 1 are positioned on axles 2 in such a way that their arcuate surfaces face the trough of the frame 3, with the direction of largest cam radius pointing towards the bottom of frame 3. Cams 1 are biased by the force of springs 5 to achieve the minimum distance between their arcuate surfaces and the longitudinal symmetry axis of the frame 3; this position of the cams will be referred to as "extended". Springs 5 are coiled around the axles 2 and are positioned between the frame 3 and each of the cams 1. Springs 5 have ends that are bent parallel to the axle axis and received into holes 5a and 5b drilled in the cams 1 and the frame 3 respectively. The assembly of cams 1 and springs 5 is secured on the axle 2 with the help of spring clips 4 located on both ends of the axle 2.

[0015] Each cam 1 is actuated by a length of rigid wire 7a, which is bent approximately perpendicular to its length to pass through a hole 6 in the cam, and which is free to pivot within the hole. The free end of the wire 7a is further bent to prevent it from slipping through the hole 6. The opposite ends of the rigid wires 7a from the cams located on the same axle

2 are crimped with malleable connectors 7b to opposite ends of a flexible cable 7c. The flexible cable 7c passes through two holes 8 in the frame 3, and is attached to the trigger 10 by looping through two holes 9 at one end of the trigger. The main support cable 11 passes through a hole 10a in the trigger 10, so that when the trigger is manually engaged it can slide along the cable 11. When the trigger is pulled, the pulling force and motion are transmitted through cables 7c and wires 7a to cams 1 to actuate them against their biasing springs 5; the actuated position of the cams will be referred to as "retracted".

[0016] It is suggested that the main support cable 11 is made of stainless steel enclosed in a layer of flexible transparent plastic. In this case the cable will be comfortable for a climber to handle, will have a desired flexibility, and will be easy to inspect for signs of damage. The main support cable 11 passes through a hole 14 in the frame 3 and is connected by brazing to a conical wedge 12. The hole 14 is shaped so as to prevent the wedge 12 from pulling through when a pull is applied to the cable 11. The other end of the main support cable 11 is looped back approximately 180 degrees and connected with a swaged connector 13 to a point on the cable so as to form a loop to which a climbing rope may be attached by using a carabiner or other similar device. The loop also forms the means for engaging a human thumb so as to permit operation of the cams 1 by the opposing motion of the thumb and fingers with the fingers engaging the trigger 10.

What I claim is:

1. A climbing aid that engages rock protrusions or other suitably shaped objects, said climbing aid comprising:

- (a) a fork-shaped rigid frame,
- (b) two axles supported parallel to each other by said fork-shaped rigid frame, said axles located on the opposite sides of the trough of said fork-shaped rigid frame,
- (c) at least one convex cam pivotally mounted on each said axle, said convex cams having their arcuate surfaces facing the trough of said fork-shaped rigid frame,
- (d) means to urge said convex cams into extended position,
- (e) a trigger,
- (f) flexible means connecting said trigger to said convex cams, such that application of force to said trigger results in urging said convex cams towards retracted position.

2. Invention of claim 1, wherein the convex cams have arcuate surfaces in the shape of logarithmic spiral.

3. Invention of claim 1, wherein a flexible cable attached to the fork-shaped rigid frame is provided for attaching a climbing rope.

4. Invention of claim 3, wherein the trigger is slidably mounted on the flexible cable.

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