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(54) Anchoring device for mountain climbers.

(57) Anchoring device for use by mountain climbers for detachable anchoring in cracks or slots having mainly parallel walls. The device consists of two opposite wedges which are slidably arranged side-by-side and are joined via a releasable spring member. The device is automatically anchored by friction and transverse tension caused by loading.

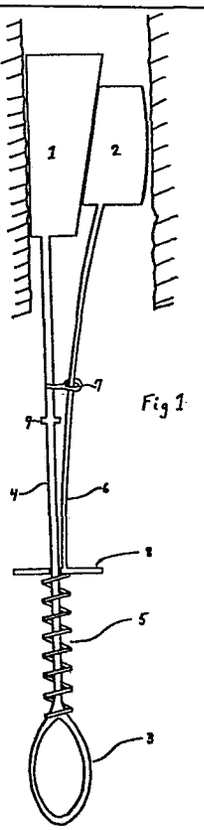

Fig 1

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Anchoring device for mountain climbers

The present invention relates to a device for releasable anchoring in slots having opposite walls, in particular slots having essentially parallel walls. The device can be attached or released with one hand in a simple and rapid way. It is primarily intended for use in mountain climbing to obtain an anchor in rock cracks.

When two or more climbers move over steep and difficult rock it is common practice to utilize a rope to secure the climbers together and to anchor the rope in slidable manner to the rock being climbed.

US Patent No 4 184 657 discloses an anchoring device for mountain climbers which can be used also in parallel-sided slots and can be attached or released with one hand. The device is based on camming action and has become extremely popular although it is mechanically complicated, heavy and very expensive to produce. An additional disadvantage is that it can not be made for use in cracks being more narrow than about 2 cm.

In MOUNTAIN Magazine, Vol 53, p 48, 1977, it is suggested to arrange an anchor for mountain climbers by placing two conventional mountaineering wedges ("chocks") side by side in a crack but turned in opposite directions, in order to obtain an anchor in a slot being too wide for a single wedge. The wedges are tied together with a flexible rope sling which is thread through the longitudinal holes in each wedge in such a manner that the wedges are pressed in opposite directions and give a firm anchor when the sling is loaded. The disadvantage with this system is

that it is safe only when constant pressure is maintained on the sling, and it does not normally work in parallel-sided slots. Further it can not be handled with one hand, can not be inserted deeply into slots and can not be used in slots being less wide than about 3 cm.

In French Patent Application No 78 31275 there is suggested a device which is also based on the idea of opposite wedges, preferably three wedges having different shape and size. The device is said to be useful for anchoring in open slots which are wider at the surface, that is non-parallel slots. The device cosists of two or more entirely separate parts which easily can be lost, and the device is presumably difficult or impossible to handle with one hand. It has not been commercially produced.

Many other types of simple anchoring devices for mountain climbers are known, but the simple devices are in the main only suitable for anchoring in slots which have a constriction in the direction of the load.

The object of the present invention is to bring forward a device which does not possess the disadvantages and limitations mentioned in the foregoing. This object has been attained by a device which has the characterizing features given in the appended claims. According to the invention there is thus obtained a device which can be handled with one hand and stays safely in place, and which can be made so that a single device suits a very wide range of different slot-sizes including parallel-sided slots and slots being less wide than 2 cm. The device comprises only a few parts and is inexpensive to produce. The invention will in the following be explained in detail with reference to some embodiments shown in the annexed drawings wherein fig. 1 illustrates one particular embodiment of the invention, and fig. 2-5 illustrate various types of wedges which can be used in the device according to the invention.

The wedge-shaped member 1 to the left in fig. 1 is in the following denoted "loading wedge", because it is intended to support an outer load (e.g a climber) which is attached to the attachment eye 3. The wedge-shaped member 2 to the right is denoted "locking

wedge", because it is intended to lock the loading wedge in the desired fixed position by friction against the slot wall.

A calculation of the forces which work on the wedges shows that a prerequisite for the desired locking to take place when a downward force is applied to the attachment eye 3 is that tang v, where v is the angle in fig. 1 which is formed between the left angle-cut side of the locking wedge and the right wall of the slot, is less than the coefficient of friction n between the locking wedge and the right wall of the slot, provided that the coefficient of friction n_0 between the locking wedge and the loading wedge can be neglected. If this last-mentioned friction can not be neglected then the criterion is that tang ($v + v_0$), where v_0 is the angle whose tang is n_0 , has to be less than n.

It is apparent from the last-mentioned formula that the coefficient of friction n_0 should be as low as possible and the coefficient of friction n should be as high as possible, in order to obtain a safe lock. In practice the coefficient of friction n may be about 0.5 or more, which means that the angle v has to be less than c:a 25^o. The angle v should preferably be between 8-14^o. The friction between the loading wedge and the wall of the slot surprisingly has no influence on the lock in parallel-sided slots. However, it has been found that if this friction is low then the wedges will be subjected to strong transverse compressive forces which can cause deformation of the wedges or dangerously expand a crack in bad rock.

The loading wedge in fig. 1 is connected with an attachment eye 3 via a first rod 4. This rod should be rather long, and preferably between 15-30 cm (including the length of the attachment eye), so that the wedges if desired can be guided deeply into a slot. The rod 4 should be flexible but sufficiently stiff that one without difficulty can guide the wedges to the desired position even when the device is only held closely to the attachment eye. The rod may suitably consist of a stiff steel cable, the one end of which has been formed to an attachment eye 3 to which the load can be applied with the aid of a carabiner or similar connecting means.

The rod 4 is surrounded by a spring member 5, illustrated by a coil-spring in fig. 1. The one end of the spring is mounted close to the attachment eye and the other end is mounted to a second rod 6. The other end of this rod is mounted to the locking wedge. The rod 6 runs through a guide eye 7 which is mounted to the rod 4. The rod 6 is flexible and resilient so that the resilience and the guide eye holds the locking wedge in direct contact with the loading wedge side by side.

The purpose of the spring member 5 is to push the locking wedge upwards relative to the loading wedge, so that the wedges expand and stay in the place where they have been positioned even when no outer load is attached to the attachment eye 3. When the device is to be released from the slot, the load must first be removed whereupon the spring 5 is compressed with hand power, preferably by inserting one's thumb in the attachment eye 3 and then gripping with the fingers on the rod 6 between the spring and the locking wedge. This operation is facilitated if a special finger hold, shown as a circular hollow plate 8 in fig. 1, is mounted on the rod 6. A similar compression of the spring is usually necessary also when the device is inserted in a slot. A stop lug 9 is mounted on the rod 4 to prevent the finger grip and thus, indirectly, the locking wedge from being displaced beyond a pre-selected end position. This end position is selected so that the locking wedge does not slide off the loading wedge or ceases to cooperate effectively with same.

The rod 6 will only be subjected to a minor compressive strain from the spring, and may thus be made thinner than the rod 4 and may be made of elastic materials such as plastics or rubber with low tensile strength. The fastening of the rod 6 in the locking wedge may for example be made by simple gluing in a hole which has been drilled in the locking wedge. The fastening of the rod 4 in the loading wedge must however be performed according to such known methods which give a more strong connection. The rod 4 and the attachment eye 3 should in fact be able to withstand forces of between 4000- 40 000 Newton when the device is used in mountain climbing.

The loading wedge and the locking wedge must also withstand compressive forces of the order of 10^4 Newton, and are preferably made of metals such as steel, titanium, plain bearing metal, or aluminium alloys. In order to obtain a low coefficient of friction n_o between the common contact surface of the loading wedge and the locking wedge, these surfaces may be treated by for example honing, polishing, teflon coating or other permanent or temporary lubricant coating.

In the embodiment shown in fig. 1 that side of the locking wedge which bears on the slot is shaped slightly convex. This gives a more centered fit-up in slots which are either narrowing or widening in the direction of the load. In such slots the upper or lower edge of the locking wedge would otherwise carry the whole strain which might cause deformation of this. The side of the loading wedge which bears on the slot is shown plane in fig. 1, but can also be designed concave or even somewhat convex. The sides of the wedges which bear on the wall of the slot may if desired be provided with transverse furrows, slices of rubber or other means for increasing the friction.

The anchoring device according to the invention should preferably be designed so that one single device can be made to fasten in the widest possible range of different slot-widths. In order to attain this it is suitable to have two load-bearing rods mounted on the loading wedge on each side of the same, instead of having a single centrally mounted rod. It is then possible to displace the lower edge of the locking wedge close to the opposite wall of the slot, without interfering with a rod mounted on the loading wedge, which means that the device can be used in more narrow slots than would otherwise be possible. Fig. 2 illustrates a suitable configuration of a loading wedge and a locking wedge to achieve this. An additional advantage with this configuration is that the locking wedge slides in a groove in the loading wedge and is thus stabilized sideways.

In fig. 3 there is illustrated another suitable configuration of a loading wedge and a locking wedge, wherein the common contact surface of the wedges have the shape of a section of a cir-

cular cylinder surface. Such an embodiment is advantageous because the locking wedge and the loading wedge will be allowed to turn relative each other, which gives a more stable fit-up in slots having walls which are not exactly parallel in a cross-section being transverse to the general direction of the load, that is so-called flared slots. In the embodiment shown in fig. 3 the convex side of the cylindrical surface is a part of the loading wedge and the concave side of the surface is a part of the locking wedge. It is of course possible to make it quite the reverse.

In fig. 4 there is illustrated a loading wedge and locking wedge having a common contact surface which consists of two planes forming a small angle between them. Furthermore, the outer surfaces of the wedges are convex and somewhat unsymmetrical, which is advantageous when using the device in non-parallel slots.

In fig. 5 there is illustrated an embodiment of a loading wedge and locking wedge which is especially suitable when making a device according to the invention which is to be used in very narrow (e.g. 0.3 - 1.0 cm) vertical slots, in particular parallel slots or slots which slightly open up sideways. The loading wedge has a single load-bearing rod which is rigidly mounted on one side of the loading wedge, the rod and the wedge in fact being made in a single piece of metal. Also the locking wedge and corresponding rod is made in one piece. The wedges are further distinguished by the fact that their width, height and thickness is diminished in a direction away from the attachment points of the rods in the wedges. This is advantageous because the device can then be used in slots of very different widths. Only the outer narrow section of the wedges is inserted in slots being correspondingly narrow.

The invention is not limited to the specific embodiments disclosed above. Several variations are possible within the scope of the claims. The coil-spring 5 may for example be substituted with an elastic cord, the one end of which is mounted on the rod 4 close to the loading wedge, and the other end being mounted on the rod 6 close to the finger grip 8. The guide member 7 can be substituted with two or more guide members being attached to the cord and being slidable along the rods 4 and 6. The coil-spring 5 which exerts pressure may be substituted with a coil-spring which resists expansion and is fixedly mounted on the rod 4 closer to the loading wedge. The rod 6 and the finger grip is then mounted at the lower end of the coil-spring, and the rod 6 may run inside the coil-spring so that the spring acts as a guide member for the rods. A further variation comprises joining the guide member 7 with the stop-lug 9 to one single unit.

Claims

1. Anchoring device for mountain climbers for detachable anchoring in slots having essentially parallel walls, which device comprises a first wedge (1) and a load-bearing rod (4) mounted on the narrow end of the wedge whereby the other end of the rod is provided with an attachment eye (3) intended for attachment of an outer load, a second wedge (2) and a rod (6) mounted on the wide end of this wedge, whereby the wedges are slidably arranged side by side with low friction against each other and having their narrow ends turned in opposite direction to each other, the device being characterized by that the rods (4,6) are provided with one or more guide members (7) which keep the rods and the wedges mounted thereon joined to a single unit in such a way that the rods and the wedges are longitudinally displaceable relative each other, the rods being mounted to a spring member (5) which pushes the narrow ends of the wedges in opposite directions so that the combination of wedges is expanded and held in place against the walls of the slot, and a finger grip (8) is mounted on one of the rods for compression of the spring member in order to achieve a reduction of the combined width of the wedges when the device is being placed into the slot.

2. Anchoring device according to claim 1 characterized by that the second wedge slides in a groove in the first wedge and that the first wedge is provided with two load-bearing rods which are placed on each side of the groove.

3. Anchoring device according to claim 1 characterized by that the common contact surface of the wedges has the shape of a section of a circular cylinder surface.

4. Anchoring device according to claim 1 characterized by that the common contact surface of the wedges comprises two planes forming a small angle between them.

5. Anchoring device according to claim 1 characterized by that the sides of the wedges which are to be turned against the walls of the slot are shaped convex.

6. Anchoring device according to claim 1 characterized by that the rods are rigidly mounted on one side of the wedges.

7. Anchoring device according to claim 6 characterized by that the wedges are narrowing in a direction away from the attachment points of the rods in the wedges.

8. Anchoring device according to claim 1 characterized by that it is provided with means (9) which prevent the second wedge from sliding off the first wedge so that the wedges would cease to cooperate with each other.

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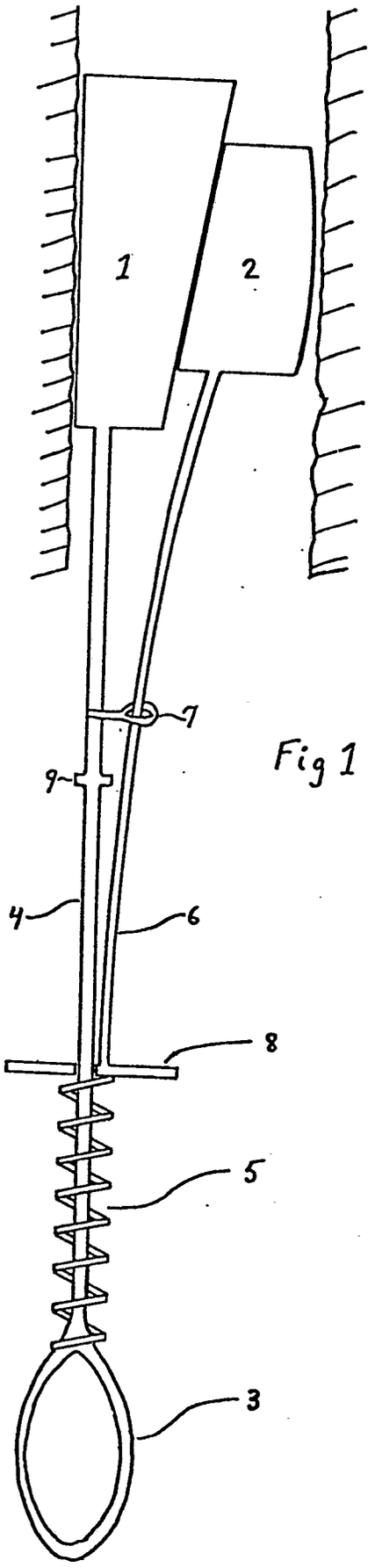

Fig 1

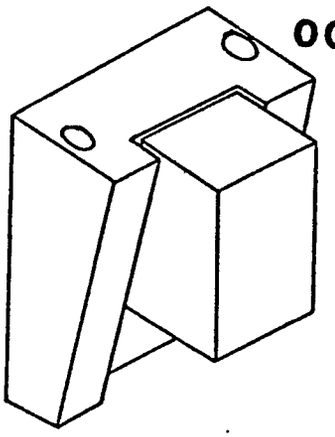

Fig 2

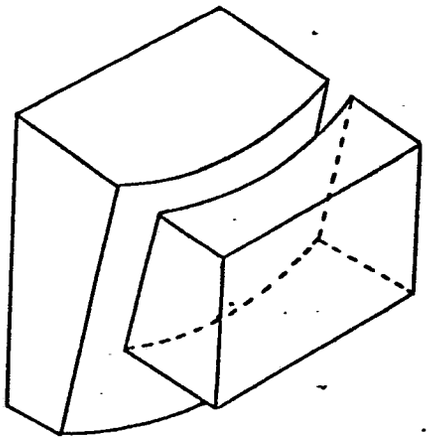

Fig 3

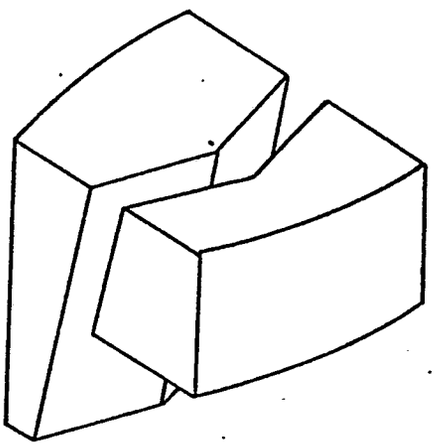

Fig 4

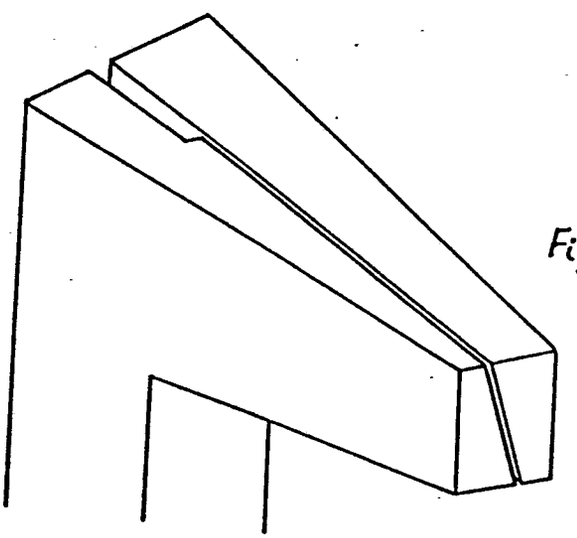

Fig 5