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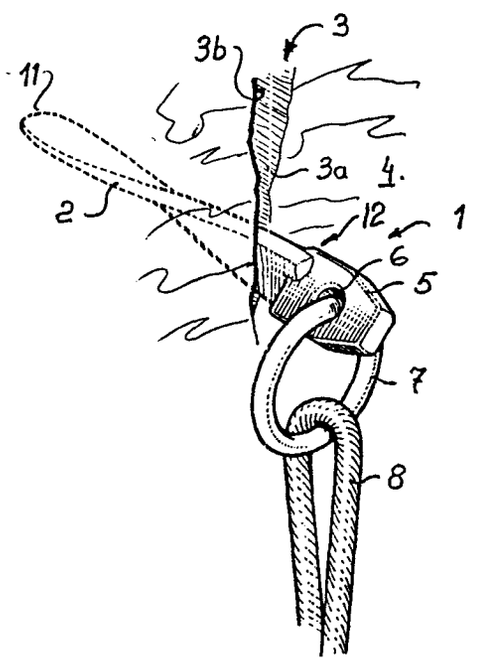
(54) A fastener device which functions as a rock dowel.

(57) A fastener device (1) which functions as a rock dowel and intended for use in rock climbing or for mooring boats, and the like, comprising a first element (2) and a second element (5) which are integrated with one another at a juncture (12). The first element (2) has the form of a wedge intended for co-action with a crack (3) in a rock surface or like surface, and the second element (5) forms an attachment for a line (8) or the like (7). The first element (2) is twisted in its longitudinal axis relative to a central plane (10) extending through the first element (2) from the juncture (12) at the second element (3).



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Title of Invention: A fastener device which functions as a rock dowel.

Technical Field

The present invention relates to a fastener device which functions as a rock dowel, and more specifically to a fastener device which can be used for rock climbing, mooring boats, and like purposes, and which comprises a first and a second element which are integrated one with the other. The first element has the form of a wedge for insertion, for example, into a crack in rock face, and the second element forms an attachment for a rope, chain or like line.

Background Prior Art

Such fastener devices are known to the art in various forms.

In one known embodiment of such devices the first element has the form of a flat wedge intended for insertion into a crack in the rock face, or some other form of opening in some other surface.

This known fastening device, having the planar wedge-shaped first element, is planar and tapers in the direction of its long axis and in relation to a central plane passing through the first element adjacent the second element. The wedge-shaped first element also decreases in width towards its free end.

Wedges of the aforesaid nature may either have plane-parallel side surfaces or have a small wedge angle. Experience has shown that the wedge angle should be smaller than 5^{o}.

The wedge portion of these known fastener devices is also relatively long in relation to its cross-section, normally ratios in this regard being from 5 to 15/cm.

Fastener devices of the aforesaid kind are known to the art in which the first element has a longitudinal extension

in a first plane which is rotated somewhat in relation to a second plane passing centrally through the second element.

Various types of wedge-shaped implements are known, for example for splitting logs, in which the wedge part has the form of a single member and the wedge tip or point is turned 10^{o} in relation to a geometric central plane.

Such wedges have a large hammering or anvil surface at one end thereof and the wedge angle is quite large, for example larger than 10^{o} but smaller than 15^{o}. Such wedges are practically totally inelastic.

Consequently, driving wedges which are intended for splitting logs etc. are not suited for use in conjunction with fastener devices for rock climbing or for mooring boats to rock surfaces.

With respect to prior art fastener devices of the aforesaid kind, attachment of the device via the first element is effected exclusively through direct counter-directional clamping forces, in which a planar wedge surface is pressed against one wall of the crack, and the opposite planar wedge surface is pressed against the opposite wall of the crack. Any deformation which might occur is caused through the action of counter-directed forces acting on the same part or point on the wedge.

It has been found that in order to use such a wedge effectively the crack into which it is driven should have a width which more or less equals the maximum width of the wedge or which is slightly smaller than said width, and that the crack should be quite deep and preferably have a shape which conforms to the shape of the wedge.

Moreover, once driven into an ideal crack, the prior art fastener device is extremely difficult to remove therefrom.

Disclosure of the Present Invention

Technical Problems

With reference to the present state of the art beforedescribed it will be seen that one qualified technical problem resides in the provision of such fastener devices which can be reliably secured in a crack whose width exceeds the maximum thickness of the wedge and/or whose configuration deviates from the configuration of the wedge.

Another technical problem resides in the provision of such a fastener device with which the wedge-shaped element thereof can be subjected to torque such as to be brought into gripping co-action with mutually opposite walls of a crack, this torque causing diametrically opposed wedge edges to grip against said crack walls.

Another technical problem resides in the provision of such a fastener device so formed as to provide a reliable grip through the action of a large, substantially calculatable force, by observing material deformation caused by forces over and above the elastic deformation limit of the material and lying within the plastic deformation range.

With regard to the prior state of the art as described above, it is seen that a further qualified technical problem is one of providing a fastener device of the kind intended for rock climbing, mooring boats to rock surfaces etc., with which the wedge-like first element of the device when inserted, for example, into a crack in a rocksurface strives to engage the crack walls and to conform to the contours of the crack, such as provide good contact between diametrically opposed and outwardly facing edge parts of the first element and the two engaging wall surfaces of the crack.

Still a further technical problem is one of providing such a fastener device with which the diametrically opposed,

outwardly facing edge parts of the first element co-acting with opposite walls of a crack can be brought into positive and reliable engagement therewith and readily released therefrom in a simple manner.

Another technical problem is one of providing means whereby the aforesaid co-action between the wedge-like first element of the device and the walls of a crack can be effected with the aid of torque or torsional forces acting in the material of the wedge-like element, between two outwardly facing and mutually opposite edge parts thereof, so that the wedge will grip firmly in the crack through the agency of such internal forces as those occurring with plastic deformation.

Another technical problem is one of providing such a fastener device which with the aid of simple means can be made to conform more readily to the contours of a crack in a rock surface, such that the configuration of the crack determines the size of the contact surface formed between the two mutually opposed and outwardly facing edge parts, when the pressure forces taken-up shall function as torque on the wedge.

Solution

The present invention relates to a fastener device which functions as a rock dowel and which can be used for rock climbing, mooring boats to rock surfaces, etc., which device includes a wedge-shaped first element for co-action with the walls of a crack in a rock surface, and a second element which is integrated with the first element and which forms an attachment for a rope, chain or the like.

In accordance with the invention the first element is twisted in its longitudinal direction in relation to a centre plane extending through said first element from a location adjacent the second element.

In one preferred embodiment of the invention the first element has a pointed end which can be turned to an angle of at least 30^{o} in relation to the centre plane. According to a further development this pointed end may be rotated through at most 360^{o} in relation to said central plane. In this regard, the pointed end or tip of the first element may be given an angle relative to said central plane of between 45 and 180^{o}, preferably between 60 and 120^{o}.

The first element suitably comprises a material which when brought into gripping engagement with the walls of a crack is subjected at least partially to plastic deformation.

The wedge-like first element of the device may have a form such that it only decreases slightly in thickness towards its pointed end, and if desired also slightly in width.

In accordance with one advantageous embodiment, the second element has a hardness which is greater than that of the first element.

Preferably only a part of the first element is twisted in relation to said central plane, the twist suitably being located at a location in the close vicinity of the second element.

Advantages

Those advantages primarily afforded by a fastener device constructed in accordance with the invention reside in the possibility of inserting the device into a crack in a rock surface, or like surface, and to obtain a firm and reliable grip therein even when the width of the crack exceeds the width of the fastener device, and also in the fact that the securing or fastening forces generated are substantially in the form of torque acting on said device, thereby to facilitate entry of the device into the crack and reliable retention of the device therein. In addition,

the securing or gripping forces can be readily regulated to a desired level, and the device can be readily removed from the crack with the aid of simple means.

The main characteristic features of a fastener device which functions as a rock dowel in accordance with the invention are set forth in the characterizing clause of the following claim 1.

Brief Description of the Drawing

Exemplifying and preferred embodiments of the invention will now be described in detail with reference to the accompanying drawing, in which

Figure 1 is a perspective illustration of a fastner device according to the invention inserted in a crack in a rock surface;

Figure 2 is a perspective illustration of solely the device shown in Figure 1, and illustrates the twist in the first element; and

Figure 3 is a view of an alternative embodiment, similar to the illustrating Figure 2.

Description of embodiments at present preferred

In Figure 1 there is illustrated in perspective a fastener device 1 which functions as a rock dowel for use in rock climbing and which can also be driven into rock surfaces in waterside locations to facilitate the mooring of boats. The dowel or device 1 comprises a first element and a second element which is integrated with the first element. The first element 2, which has a wedge-like configuration is intended to grip against the walls of a crack 3 in a rock surface 4 or like surface. The second element 5 forms

an attachment means for a rope, chain or like line. To this end, the second element 5 is provided with a hole 6 in which a ring 7 is held. Attached to the ring is a line 8, which may either be tied to a climber or to part of a watercraft, depending on the use to which the device is put. When the device is used to secure a boat to a rock at the water's edge for example, the line 8 can be caused to extended substantially horizontally.

It will be understood that the first element 2 need not be constructed to exert a wedge-action along the whole of its length.

Suitably, the wedging-form of the first element 2 only extends a short distance from the tip or point 11 of said element along towards the second element 5, with the remainder of the first element being of more or less right-angled constant cross-section therealong.

Irrespective of the configuration or form of the first element 2, the wedge-angle from the region 12, adjacent the second element 5, to the tip or point 11 should be less than 5^{o}, preferably between 3^{o} and 4^{o}.

A device in which the wedge form of the first element 2 extends along roughly 25% of the total length of said element, with the remainder of the element having a constant cross-section, has been found particularly suitable.

The first element 2 may suitably be made of a material which, with a cross-sectional size of 6x18 mm and a length of 25 mm, will result in the plastic deformation of the element at a torque of 120 Nm. In this respect, variations between 80 and 200 Nm can be accepted.

As shown in the drawing, the first element 2 is twisted along its length in relation to a central plane 10 extending

along the first element from the juncture 12 of its connection with the second element 5, so that one part of the first element is rotated relative to an adjacent part.

As beforementioned, the ring 7 and line 8 have been omitted from Figure 2, for the sake of clarity.

Thus, in the illustrated embodiments, the top or point 11 of the first element 2 is rotated through an angle "a" in relation to the central plane 10 of at least 30^{o}. It will be understood that the tip 11 may be rotated relative to plane 10 through any angle, up to 360^{o}. Preferably the angle "a" lies between 45^{o} and 180^{o}, and then most suitably between 60^{o} and 120^{o}. In the Figure 2 embodiment, the tip 11 has been rotated through 90^{o} in relation to the central plane 10.

The first element 2 is made from a material such that when brought into gripping action with the mutually facing wall portions 3a and 3b of the crack 3, the element can be subjected to plastic deformation, which means that subsequent to driving the first element 2 into the crack 3 (hammering the device), the said element will be permanently deformed when removing the device from the crack 3. It is especially proposed that the device is driven into the crack 3 with such force and in such a manner that the element 2 does in fact become deformed plastically, since such plastic deformation signifies that the material in the first element 2 is used to a maximum in creating those torsional forces which shall hold the first element 2 firmly in the crack 3.

It is sufficient if this plastic deformation is only manifested along given sections of the first element 2.

The gripping forces exerted by the first element 2 on the crack walls 3a and 3b act through the diametrically opposed edges 13 and 14, in combination with the fact that one edge 13 or 14 forms an engagement point or edge surfaces against

a respective wall-portion of the crack.

As will be seen from Figure 2, the first element 2 of the device has a thickness which narrows only slightly towards the tip or point 11 of said element.

The first element 2 may also be shaped so as to present a width which decreases, albeit but slightly, towards said tip or point 11, as illustrated particularly in Figure 3.

The second element 5 of the fastener device 1 may be given a hardness which is greater than the hardness of the first element 2, since the first element 2 shall be capable of being plastically deformed, whereas the second element 5 must be capable of withstanding the impact forces to which it is subjected when driving the first element 2 into the crack 3, and of withstanding the load on the line 8 without being deformed.

In the embodiment illustrated in Figure 3 only a part of the first element 2 has been twisted, namely the part 2a, and the remainder, 2a, of said element is flat. In addition, the twisted part 2a of the first element 2 of the Figure 3 embodiment is located in the vicinity of the juncture of the first element 2 and the second element 5.

With a fastener device constructed in accordance with the present invention it is possible to ascertain visually, when the wedge-like first element 2 is driven or hammered into the crack 3, that the material in said element has been loaded to a point above the elastic limit of said material, therewith guaranteeing that a lowest permitted gripping force has truly been exceeded.

Since the gripping forces concentrate at the edges 13 and 14, a strong and secure grip is achieved when a load is applied in the direction of the line 8. When wishing to remove the

wedge-like first element, it is simply pulled straight out of the crack.

The invention is not restricted to the described and illustrated embodiments, since modifications can be made within the scope of the following claims.

CLAIMS

1. A fastener device (1) which functions as a rock dowel and intended for use in rock climbing or for mooring boats, and the like, comprising a first element (2) and a second element (5) which are integrated with one another at a juncture (12), the first element (2) having the form of a wedge intended for co-action with a crack (3) in a rock surface or like surface, and the second element (5) forming an attachment for a line (8) or the like (7), characterized in that the first element (2) is twisted in its longitudinal axis relative to a central plane (10) extending through the first element (2) from the juncture (12) with the second element (5).

2. A device according to Claim 1, characterized in that the tip (11) of the first element (2) is rotated through an angle of at least 30^{o} in relation to the central plane (10).

3. A device according to Claim 1 or Claim 2, characterized in that the tip (11) of the second element (2) is rotated relative to the central plane (10) through an angle of at most 360^{o}.

4. A device according to Claim 1, 2 or 3, characterized in that the tip of the first element (2) is twisted in relation to the central plane (10) through an angle between 45^{o} and 180^{o}, preferably between 60^{o} and 120^{o}.

5. A device according to Claim 1, 2, 3 or 4, characterized in that the first element (2) is made from a material which tends to become plastically deformed when said first element is in gripping contact with the walls of the crack (3).

6. A device according to Claim 1, characterized in that the first element (2) has a thickness which decreases but slightly down towards the tip (11) thereof.

7. A device according to Claim 6, characterized in that the first element has a width which decreases but slightly down towards the tip (11) thereof.

8. A device according to Claim 1, characterized in that the second element has a hardness which is greater than the hardness of the first element.

9. A device according to Claim 1, characterized in that only a part (2a) of the first element is twisted.

10. A device according to Claim 9, characterized in that only that part of the first element located closely adjacent the second element (5) is twisted.

11. A device according to Claim 1, characterized in that the first element (2) has a length/cross-section ratio of 5-15/cm and a wedge angle smaller than 5^{o}.

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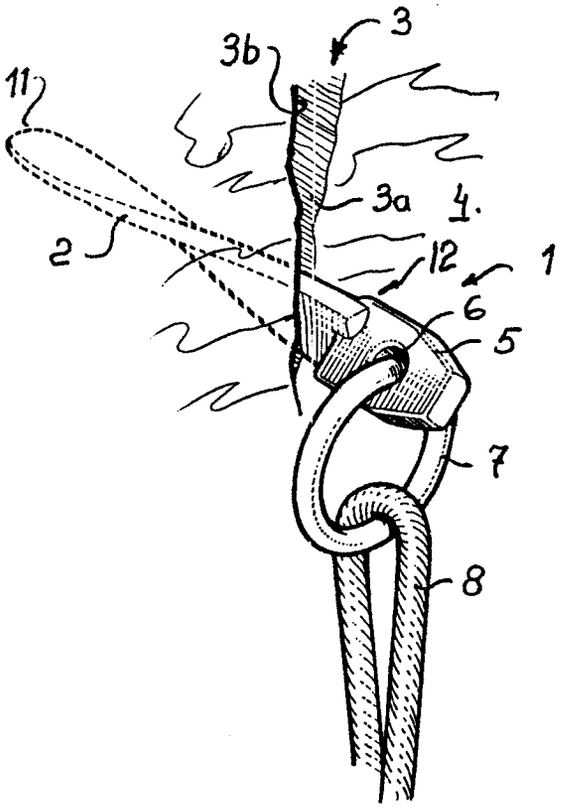

Fig. 1

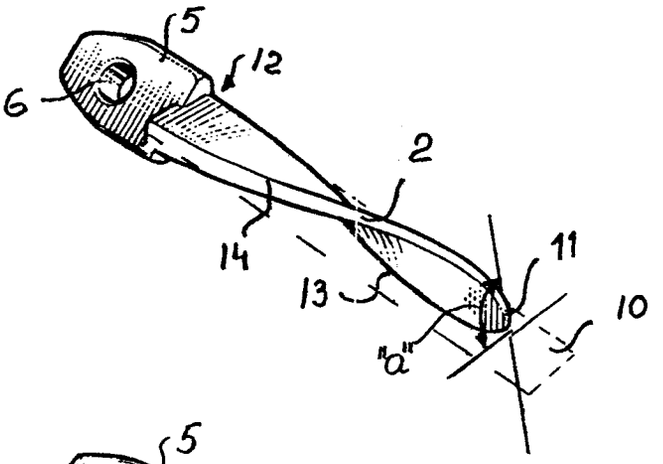

Fig. 2

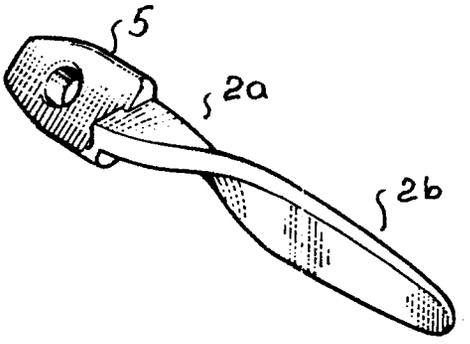

Fig. 3