Oct. 7, 1969 T. B. WARDEN, JR 3,470,982

ROPE GRIPPING DEVICE FOR CLIMBING ROPES

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Fig 2.

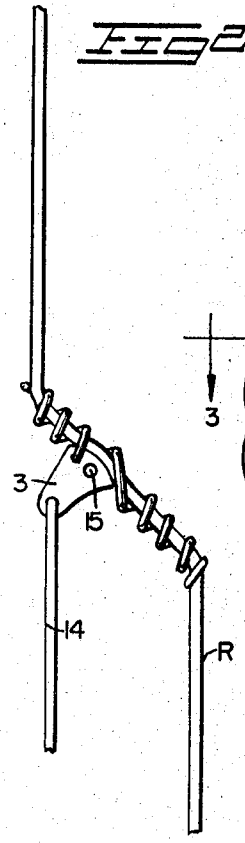


Fig 1.

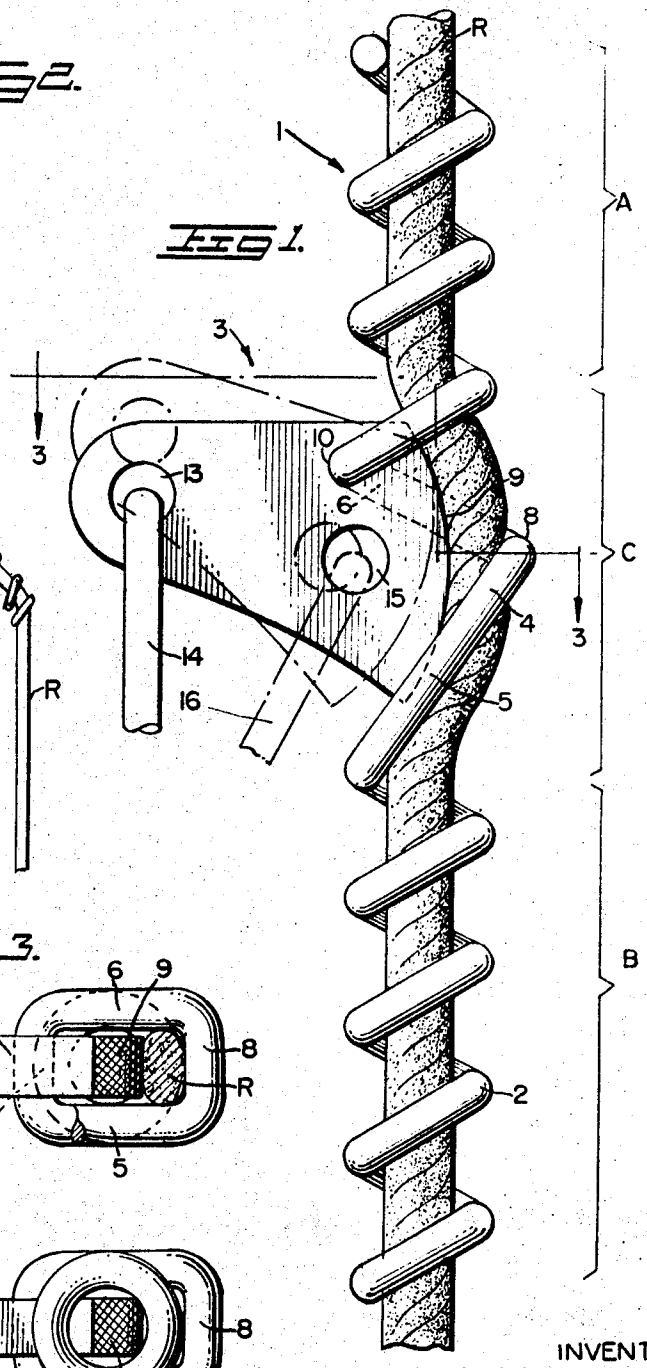


Fig 3.

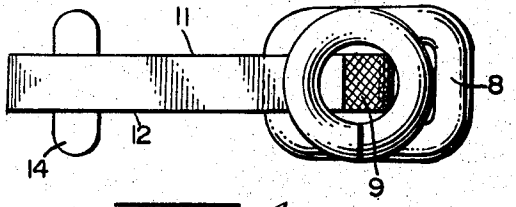


Fig 4.

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ROPE GRIPPING DEVICE FOR CLIMBING ROPES

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ABSTRACT OF THE DISCLOSURE

A rope gripping device for use by alpinists, speleologists, etc., in ascending and descending a climbing rope, said device including a sleeve member in the form of a helical spiral having a rope gripping member mounted thereon intermediate the ends thereof, said spiral having a pitch to provide spaces between adjacent convolutions thereof dimensioned to admit entrance of a bight of a climbing rope therebetween so that the device may be operatively and slidingly mounted on a climbing rope at any point in the length of said rope by entering a bight of said rope into the end convolution at either end of the spiral and relatively rotating the spiral and climbing rope in a direction to thread the climbing rope into the hollow center of the sleeve member.

This invention is a rope gripping device for use by alpinists, speleologists and others for ascending and descending a climbing rope.

One object of the invention is to provide a rope gripping device of the character referred to which is rugged in construction and positive in operation in all kinds of weather and regardless of whether the climbing rope with which it is used be wet or dry.

A further object of the invention is to provide a rope gripping device of the character described which is free from nuts, bolts, hinges and the like which are sources of trouble in known devices designed for this use and which require dismantling to be operatively engaged with a climbing rope at a point intermediate the ends thereof.

Another object of the invention is to provide a rope gripping device which may be operatively engaged with a climbing rope at any point in the length of the rope without disassembly of the device. This eliminates the troublesome step of starting at one end of the climbing rope and feeding a long length thereof through the gripping device on occasions when it is desired to operatively engage the gripping device with a climbing rope at a point intermediate the ends of said rope.

Another object of the invention is to provide a rope gripping device of the character described which when used in pairs to ascend a climbing rope in a known step-by-step manner, permits either gripping device to be removed from the climbing rope while the climbing rope is under tension imposed thereon by the weight of the climber supported by the other of said pair of rope gripping devices.

These and other objects of the invention will become apparent from reading the following specification in the light of the accompanying drawings wherein I have illustrated the preferred embodiment of my invention and wherein

FIG. 1 is an elevational view of my invention showing it operatively engaged with a portion of the climbing rope,

FIG. 2 is a diagrammatic view showing the position taken by my rope gripping device on a climbing rope when the rope is under tension due to the weight of the climber supported by the rope gripping device,

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 1, and

FIG. 4 is an end view looking down upon the upper end of the rope gripping device with the rope removed.

In the accompanying drawings a preferred form of my invention is shown as comprising an elongated sleeve member in the form of a helical spiral indicated generally at **1**. The helical spiral **1** may be formed of any suitable material strong enough to withstand the pressures to which it is subjected when in use but I prefer to use a rod **2** of mild steel or other ferrous metal alloy of sufficient gauge, as of the order of ¼″ or ⅜″ in diameter and of the length sufficient to form a helical spiral approximately 10″ to 12″ in length. The required length of rod from which the spiral is made will depend of course upon the diameter of the climbing rope which must pass freely through the hollow core of the helical spiral when in use. Usually the climbing rope such as shown at R is of the order of ⅜″ to ½″ in diameter.

The helical spiral may be either a left-hand or a right-hand spiral and may be formed in any convenient manner such, for example, as by heating the rod and winding it while hot about a mandrel of proper diameter while taking steps to regulate the pitch of the spiral so as to insure longitudinal spacing between adjacent convolutions thereof of approximately the diameter of the climbing rope with which the gripping device is to be used, this for a purpose as will be explained later.

Referring to FIG. 1 of the drawings, it will be noted that the helical spiral member comprises an upper section indicated by A, and a lower section indicated by B, and an intermediate section indicated by C. The upper and lower sections A and B each comprise a sufficient number of convolutions to afford proper guiding of a climbing rope through the rope gripping device. While a single complete convolution in each section A and B is sufficient for this purpose, it may be desirable at times to design these sections of the spiral to serve as hand grip portions for use by a climber. I find that 3 or 4 convolutions for either or both of sections A and B, as shown in FIG. 1, is sufficient for this purpose, and these convolutions are generally symmetrical. In the intermediate section C of the spiral the symmetry of the helical spiral **1** is modified to provide support means for a rope gripping cam lever **3**. Thus an intermediate convolution **4** of the spiral is distorted by substantially increasing or extending the pitch of the spiral as shown at **5** and **6** while at the same time expanding the diameter or the transverse dimension of the spiral as shown, see FIGS. 3 and 4. The convolution **4** of the spiral is further modified to provide a first substantially horizontal land portion **7** on which a rope gripping cam lever **3** is pivotally mounted. A second substantially horizontal land portion **8** is formed in the convolution **4** as shown in FIGS. 3 and 4 and this second land portion **8** functions as an anvil for the rope gripping cam lever **3**. To this end the second land portion is disposed substantially diametrically opposite the first land portion **7** and somewhat below the land portion **7** in a position to cooperate operatively with a knurled rope gripping cam surface **9** provided on the inner end of the cam lever **3**. It will be noted that the cam surface **9** is arcuately formed and is eccentric with respect to the pivotal axis of the lever **3** which is defined by an aperture **10** provided in the lever **3**.

The rope gripping cam lever **3** is a plate-like structure as shown in FIGS. 3 and 4, and the portions **5** and **6** of the convolution **4** are contracted inwardly towards the side faces **11** and **12** of the lever **3** to serve as guiding or limiting means for the cam member so as to maintain said lever in a plane substantially parallel to the plane of the axis of the spiral sleeve member **1**. Also, the portions **5** and **6** of the convolution **4** limit the lateral shifting of the cam lever **3** on the land portion **7** when the device is in use.

The rope gripping cam lever **3** is provided with an aperture **13** by which a climber support element such as a rope or cable **14** may be attached thereto. When in use, the cable **14** is provided with a loop (not shown) designed to receive the foot of a climber so that a climber may support himself in such loop to actuate the lever **3** to put clamping force on a climbing rope operatively associated with the device in a well-known manner.

The aperture **13** is disposed with respect to the pivot axis of the lever **3** to apply to said lever a turning couple which when the climber is supported by said support rope **14**, is sufficient to apply to the climbing rope within the sleeve **1** a clamping force adequate to support safely the weight of the climber as the climber alternately supports his weight in one or the other of a pair of climbing devices such as herein described, in a conventional manner well known to alpinists and speleologists. This operation may be employed both to ascend or to descend a climbing rope when progress along the climbing rope is to be intermittent or step by step. Sometimes a climber desires to descend a climbing rope in a continuous but controlled manner as is done in what is known as a Rappell descent. To provide for a Rappell operation with my invention, I provide a second aperture **15** in the cam lever **3** adapted to receive the tension applying support rope or cable **16** to the lever **3**, the opposite end of which cable may be attached to a body sling or a French seat sling (not shown) worn by the climber. It will be noted that the aperture **15** is disposed with respect to the pivot axis of the cam lever **3** so that the weight of the climber when applied to the support rope **16** will deliver to the lever **3** a turning force or couple of considerably less magnitude than that when the same weight is applied to the lever **3** by the support rope **14**. Thus the aperture **15** is disposed with respect to the pivot axis of the lever **3** so that when the climber is supported by the rope **16** a turning couple is applied to said lever which is sufficient to brake but insufficient to stop the passage of the climbing rope through the gripping device and thus provide for a safe, controlled Rappell operation. The support ropes **14** and **16** may both be attached to the lever **3** at the same time so that at anytime during a Rappell descent the climber may by shifting his weight from the support rope **16** to the support rope **14** cause the gripping device to grip the climbing rope with sufficient force to stop the climber's descent or to otherwise vary the speed of descent.

In respect to the position of the parts as shown in FIG. 1, it will be appreciated that the climbing rope R is shown partially compressed. With no weight applied to the lever **3**, it may occupy an elevated position such that the climbing rope R passes freely between the cam portion **9** of the lever and the land anvil **8**. In such position aperture **15** is disposed below and to the left of the pivotal axis of the lever **3**, as viewed in FIG. 1, so that when the climber's weight is supported from the rope **16**, a turning couple is set up which moves a lever **3** in a counterclockwise direction to cause braking action on the climbing rope R which passes between the cam **9** and the land anvil **8**.

To operatively engage the gripping device of my invention with a climbing rope, the spiral sleeve member **1** is positioned alongside the rope at any point in its length and generally parallel thereto. A portion or bight of the climbing rope is then entered into the space between an end convolution (at either end of the spiral) and the sleeve member is then rotated with respect to the axis of the rope and in a direction to cause the rope to thread between successive convolutions of the spiral until the entire sleeve surrounds the rope and the rope slides freely within the sleeve.

The climber support ropes **14** and **16** may be attached to the lever **3** in any convenient manner such as by tieing or by employing any desired form of easily attached and released hook devices which are known but form no part of my invention.

In the foregoing specification I have referred to certain sizes of metal stock from which the spiral may be formed, as well as preferred sizes of climbing rope and spaces between adjacent convolutions in the spiral. These are suggested dimensions that have been found desirable when my invention is used as a gripper for conventional climbing ropes but it will be understood by those skilled in the art that depending upon the particular use to which the gripper of my invention is put and the forces and stresses to which it is subject, these suggested dimensions may be modified if desired.

From the foregoing description it is apparent that my invention provides a rope gripping climbing device which is simple in construction and positive at all times in its operation; that may be operatively associated with a climbing rope at any point in the length of said climing rope without disassembling the device and without requiring the threading of long lengths of climbing rope through the gripping device; that provides safe step-by-step ascent or descent of a climbing rope; and which will provide safe, controlled Rappell descent when desired.

Having described a preferred form of my invention what I claim as new is:

1. A rope gripping device for use by alpinists and speleologists in ascending and in descending a climbing rope comprising a sleeve member in the form of a helical spiral having an internal diameter dimensioned so as to slide freely on a climbing rope with which it is adapted to be used, the pitch of said spiral being such as to provide longitudinal spacing between adjacent convolutions thereof not substantially less than the inner diameter of said sleeve member, a rope gripping member mounted on a convolution of said spiral at a point intermediate the ends of said sleeve member and means controllably to operate the rope gripping device selectively to grip and to release a climbing rope within said sleeve member.

2. The rope gripping device described in claim **1** wherein said rope gripping member comprises a lever member pivotally mounted upon a first land portion formed on said convolution, said lever member including an inner end portion having a rope gripping cam portion positioned to move within and transversely of the sleeve member when the lever member is pivotally actuated, said lever member including an outer actuating end portion disposed outside of the sleeve member and anvil means on said sleeve member disposed in opposition to said rope gripping cam portion of the lever, said cam portion and said anvil portion being disposed on opposite sides of a climbing rope when passed through said sleeve member.

3. The rope gripping device described in claim **2** wherein said anvil means comprises a second land portion formed on said convolution at a point below the pivot axis of said lever.

4. The rope gripping device described in claim **3** wherein said first and second land portions are disposed in a generally parallel relation and transversely of the axis of the sleeve member and on opposite sides of said axis.

5. The rope gripping device described in claim **4** wherein said lever member is provided with planar side faces in the region of its pivotal axis which are substantially parallel to the axis of said sleeve member and wherein portions of said convolution respectively above and below said first land portion and on opposite sides of said lever are disposed in close proximity to said planar side faces of the lever member whereby to limit sliding movement of the lever member along said first land portion and to maintain said lever member in a plane substantially parallel to the axis of said sleeve member.

6. The rope gripping device described in claim **2** wherein said lever member is mounted for pivotal movement about an axis transverse to the axis of said sleeve member and eccentric with respect to said cam surface, and wherein means for applying clamping force to said lever member includes means for attaching a climber support member to said lever at a point effective to move the cam

surface of said lever towards said anvil for clamping engagement with a climbing rope passing through the sleeve member between the cam and said anvil.

7. The rope gripping device described in claim 6 wherein plural means are provided for attaching climber support members to said lever at points respectively disposed thereon with respect to the pivotal axis thereof to impose on said lever turning couples of different magnitude in response to the application of the climber's weight to said lever at different points respectively.

8. The method of operatively engaging a rope gripping device with a climbing rope, said rope gripping device including a sleeve member in the form of helical spiral having a longitudinal passage dimensioned to slidingly receive the climbing rope and having a rope gripping member mounted thereon intermediate the ends thereof, the method comprising the steps of placing the sleeve in close side-by-side relation with the rope, laterally entering a bight of said rope into an end convolution of the

spiral sleeve member and then rotating the sleeve member relative to the rope in a direction to thread the rope progressively along the spiral and into the central longitudinal passage of the sleeve member in operative sliding relation with respect to said rope gripping member carried by the sleeve.

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188—65.5, 65.2