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(54) **DEVICES, SYSTEMS AND METHODS FOR EMERGENCY DESCENT FROM A HEIGHT**

VORRICHTUNGEN, SYSTEME UND VERFAHREN FÜR DEN NOTFALLABSTIEG AUS DER HÖHE

DISPOSITIFS, SYSTEMES ET PROCEDES POUR LA DESCENTE EN URGENCE D'UNE HAUTEUR

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## Description

### Field Of The Invention

**[0001]** The present invention relates generally to devices, systems and methods for emergency descent from a height, and, particularly, to devices, systems and methods for use by firefighters in a descent escape from a height.

### Background Of The Invention

**[0002]** The outer, protective garments worn by firefighters (commonly referred to as turnout gear) typically include a large coat and pants that have an outer layer and a removable inner liner. The outer layer is fabricated from materials that are resistant to heat, flame, abrasion and water. Firefighters also wear other protective gear, including a helmet, thick gloves, and an air tank that is typically part of a self-contained breathing apparatus (SCBA).

**[0003]** In executing their duty, firefighters often enter burning buildings, including multilevel or high-rise buildings. It is desirable that a firefighter be equipped with equipment to enable escape from a height (for example, from a rooftop or window). Without such escape equipment, a firefighter trapped at a height above the ground, must find a suitable escape point and await a ladder from a fellow firefighter to escape injury.

**[0004]** Harnesses have been incorporated into the outer garments worn by a firefighter, but such harnesses have been generally inadequate to provide an escape or rescue from a height. Recently, U.S. Patent No. 6,487,725 disclosed a harness assembly 16 for use by a firefighter having an integral support line 20 that can be used to escape from a height. That harness assembly includes a harness body having first and second ends and a hollow interior which receives the support line. The support line has first and second ends that extend from the harness body. A large portion of the support line, which is preferably shaped as a flat ribbon, is disposed within each of multiple elongated chambers or sleeves provided on the harness body using a rod-shaped tool. Several loops of the support line may be received in each of the chambers. Separating the support line into a series of individual pockets or chambers purportedly reduces the probability of tangling, twisting, or knotting of the support line, and the support line can be readily withdrawn from the harness body. The first end of the support line may be pulled away from the harness to extend the support line therefrom. The second end of the support line is releasably secured to the harness.

**[0005]** Although attempts have been made to provide devices and systems for escape from a height for use by firefighters and others, it remains desirable to provide improved devices, systems and methods to facilitate escape from a height.

### Summary Of The Invention

**[0006]** Generally, the present invention provides a personal emergency escape or descent system including an article to be worn by a user comprising: a shock absorbing descender device attached to a waist belt of the article, a support line passing through the shock absorbing descender device, an anchor connection attached to a first end of the support line in the vicinity of the shock absorbing descender device, and an assembly for holding the support line. The assembly for holding the support line can take any number of forms including those shown in U.S. Patent No. 6,487,725.

**[0007]** In one embodiment, the assembly includes a plurality of holders in which intermediate loops of the support line are retained near the terminus of each of the intermediate loops. The assembly can, for example, include a first group of holders and a second group of holders, wherein each group of holders includes at least two holders. A first intermediate loop of the support line can be passed through a first holder of the first group of holders. The support line is then looped in an extended, generally u-shaped loop. A second intermediate loop is formed in the support line and is passed through a first holder of the second group of holders. The support line is then looped back in an extended, generally u-shaped loop. A third intermediate loop of the support line is formed and is passed through a second holder of the first group of holders. The support line is then looped in an extended u-shaped loop, and a fourth intermediate loop formed in the support line is passed through a second holder of the second group of holders. This packing or holding pattern can be repeated until the desired length of the support line is held in the assembly.

**[0008]** The assembly can further include a first retainer and a second retainer. The first retainer includes a first length of material attached to the assembly that is adapted to be threaded through the intermediate loops passing through the holders of the first group of holders. The second retainer includes a second length of material attached to the assembly that is adapted to be threaded through the intermediate loops passing through the holders of the second group of holders. The support line can be in operative connection with each of the first retainer and the second retainer so that application of force to the first end of the support line causes the first retainer to be withdrawn from the intermediate loops passing through the first group of holders and the second retainer to be withdrawn from the intermediate loops passing through the second group of holders. Further application of force to the first end of the support line, after the first retainer and the second retainer are withdrawn from the intermediate loops, causes the intermediate loops to be withdrawn from the holders of the first group of holders and the second group of holders.

**[0009]** The second end of the support line is not attached to the assembly for holding the support line. Preferably, the support line can have formed in the vicinity of

the second end a termination knot that prevents passage of the second end of the support line through the shock absorbing descender. The termination knot can, for example, be one-time releasable so that the support line can pass through the shock absorbing descender and the support line can be operatively disengaged from the shock absorbing descender. Such one-time release can, for example, be accomplished under load. In one embodiment, a cover is formed over at least a portion of the knotted section of the termination knot of the support line so that the cover must be removed before the termination knot is released. The cover can include a shrink wrap. Once the termination knot is released, the support line may not be reattached to the shock absorbing descender.

**[0010]** The shock absorbing descender comprises a shock absorbing element and a descender device. In one embodiment, the descender device is a plate that is attached to a waist belt of the article worn by a user by a shock-absorbing element that includes an extending section of material which absorbs energy, for example, upon initial descent. Preferably, the extending section of material is threaded through a pair of rings and then doubled over on itself and stitched together with rip stitching. The rip stitching can be adapted to rip under a certain force to absorb energy while the rings are adapted to deform under a certain force to absorb energy. Various descender devices can be used including a plate with holes, tubes and friction disks.

**[0011]** The support line is made from a flame and heat-resistant material. In one example, the support line is fabricated from KEVLAR material. The support line can, for example, be formed in the flattened shape of a ribbon.

**[0012]** In another example, at least one indicator is placed in operative connection with the support line, wherein deployment of the support line requires a readily viewable alteration of the indicator. The indicator can, for example, be a tag that is wrapped around a portion of the support line.

**[0013]** In another aspect, a rescue garment is provided to be worn by a user, including: a shock absorbing descender attached to the rescue garment, a support line passing through the shock absorbing descender, an anchor connection attached to a first end of the support line in the vicinity of the shock absorbing descender, and an assembly for holding the support line. The second end of the support line is not attached to the assembly, and the support line has formed in the vicinity of the second end a termination knot that prevents passage of the second end of the support line through the descender device. As described above, the termination knot can be released one time so that the support line can pass through the descender and thereby be operatively disengaged from descender device.

**[0014]** In another aspect, the present invention provides a self-contained breathing apparatus carrier, including: a waist belt, a shock absorbing descender in operative connection with the waist belt, a support line passing through the shock absorbing descender, an an-

chor connection attached to a first end of the support line in the vicinity of the shock absorbing descender, and an assembly for holding the support line. The shock absorbing descender includes a shock absorbing element and a descender device. In one embodiment, as described above, the assembly includes a plurality of holders in which intermediate loops of the support line are retained near the terminus of each of the looped ends.

## **10** Brief Description Of The Drawings

**[0015]** Figures 1A through 1F illustrate an embodiment of an emergency decent system of the present invention designed to be incorporated into or attached to an SCBA carrier.

**[0016]** Figures 2A through 2H illustrate the packing of a support line into the support line pad assembly of the system of Figures 1A through 1F.

**[0017]** Figures 3A through 3F illustrate the attachment of the system of Figures 1A through 1F to an SCBA carrier.

**[0018]** Figure 4 illustrates the emergency descent system of the present invention as worn with an SCBA carrier.

**[0019]** Figures 5A through 5G illustrate another embodiment of an emergency decent system of the present invention designed to be incorporated into or attached to an SCBA carrier.

**[0020]** Figures 6A and 6B illustrate a preferred embodiment of a shock absorbing descender used in the systems and devices of the present invention.

## Detailed Description Of The Invention

**[0021]** In general, the present invention provides a personal emergency escape or descent system which, can for example, be integrated into a firefighter's existing gear. In one embodiment, the emergency descent system of the present invention is integrated into an SCBA carrier such as the AIRFRAME™ SCBA carrier or the VULCAN™ SCBA carrier, both available from Mine Safety Appliances Company of Pittsburgh, Pennsylvania. The emergency descent systems of the present invention provide the user with a means of escape from an elevated position. Typically, the systems of the present invention are used as emergency devices when all other escape options have been exhausted. Although representative embodiments of the descent systems of the present invention are discussed for incorporation into an SCBA carrier as a lumbar pad, one skilled in the art appreciates that the systems of the present invention are readily incorporated into other equipment or garments.

**[0022]** Figures 1A through 1F illustrate the components of one embodiment of a descent system 10 (see, for example, Fig. 2H for assembled system 10) of the present invention that can be incorporated into an SCBA carrier as a lumbar pad. Descent system 10 includes a waist belt 100 (see Figure 1A), a support line storage/

lumbar pad assembly 200 (see Figure 1B) and a cover 300 (see Figure 1C). Waist belt 100 includes a descender device or belay 110 in operative connection therewith, through which a support or descent line 120 passes. Descender device 110 is attached to waist belt 100 via a shock absorbing element 112, which can, for example, include a pair of rings and loops of material that are closed by stitching. Support line 120 is preferably of sufficient length to allow descent from a substantial height (for example, 50 to 75 feet in length). In general, a flattened ribbon shape or webbing shape for support line 120 is preferable to provide strength while minimizing packing size and overall weight. Support line 120 must also have a relatively high temperature resistance. A suitable fabric for support line 120 is, for example, KEVLAR® available from E. I. du Pont de Nemours and Company of Wilmington, Delaware. KEVLAR is a polymer material that comprises long molecular chains produced from polyparaphenylene terephthalamide. The chains are highly oriented with strong interchain bonding which result in a unique combination of properties. A suitable ribbon-shaped or web-shaped KEVLAR fabric is readily commercially available.

**[0023]** Support line 120 includes a first end 122 which is attached to a carabiner 130 via a knot 124. After passing through descender device 110, support line 120 preferably terminates in a second, free or unattached end 126. In that regard, second end 126 is not attached to waist belt 100 or other component of system 10. A termination knot 128 (for example, a slip knot) is formed near second end 126 which prevents second end 126 from passing through descender device 110.

**[0024]** Waist belt 100 further includes a mechanism to secure waist belt 100 around the user. In the embodiment of Figures 1A through 1F, the securing mechanism includes a locking hook 140 that cooperates with a D-ring 150 that is preferably adjustably attached to waist belt 100.

**[0025]** Waist belt 100 passes through a passage 205 formed in support line pad assembly 200. Support line pad assembly 200 is designed to hold support line 120 as described below in connection with Figures 2A through 2H. Once support line 120 is packed within support line pad assembly 200 as described below, support line pad assembly 200, support line 120 held thereby and waist belt 100 are removably placed inside a generally tubular cover 300. Waist belt 100 and support line pad assembly 200 are slid within cover 300 from the right side (in the orientation of Figure 1C). The end of waist belt 100, including D-ring 150, is passed through an opening on the left side of cover 300. This opening is large enough to enable passing of that end of waist belt 100 therethrough, but is not large enough to allow support line pad assembly 200 to pass therethrough. Support line pad assembly 200 is secured within cover 300 by, for example, a releasable closing mechanism such as snaps 310.

**[0026]** To pack support line 120 in support line pad assembly 200, support line pad assembly 200 is prefer-

ably first placed upon a generally flat surface. Support line 120 is first passed through descender device 110 until descender device 110 is within approximately six inches of carabiner 130. In several embodiments of the present invention, support line pad assembly 200 is designed to accommodate either a 50-foot line or a 75-foot line (see, for example, Figures 7A and 7B, as described below). For a 50-foot line, a fourth holding position or holder 210 (counting from the center in the top row or group of holders - see, for example, Figure 2B) is first located. Each holder 210 is formed generally as a loop or arc created by spaced stitching along a length of webbing material connecting the webbing material to support line pad assembly 200. Support line 120 is laid on support line pad assembly 200 and an intermediate loop is formed at fourth holder 210 in a first group of holders. The looped support line 120 is passed through first position straps 220 (see Figure 2A) and then through a second, generally central, position strap 222 (see Figure 2B). The intermediate loop of support line 120 is passed through fourth holder 210 so that end of the intermediate loop protrudes approximately one-half inch through holder 210 (see, for example, Figure 2B). For a 75-five foot support line, the intermediate loop of support line 120 is passed through the first holding position or holder 210 (see, for example, Figure 7B). Support line 120 is then threaded through positioning strap 224 and positioning strap 226 on the opposite side of support line pad assembly 200 as illustrated in Figure 2C, forming a u-shaped loop in support line 120. An intermediate loop is then formed in support line 120 at the end of the u-shaped loop, and the intermediate loop is passed through holder 210 of a second group of holders, positioned, for example, adjacent the first group of holder (see Figure 2C). Once again, the intermediate loop protrudes at least half an inch through holder 210. Support line 120 is then threaded through positioning straps 220 and 222 and an intermediate loop formed in support line 120 is passed through the next holder 210 of the first group of holders (that is, the fifth holder 210 for a 50-foot line). Support line 120 is then threaded back through the positioning straps 224 and 226 and an intermediate loop passed through the fifth holder 210 of the second group of holders (for a 50-line). One continues threading support line 120 as described above until all holding positions or holders 210 are occupied with intermediate loops (see Figure 2D). After a final loop 120a (see Figure 2E) is made in support line 120, holding straps or webs 230 are passed through it. Holding webs 230 are then passed through each of the half-inch loops formed as described above (see Figures 2F and 2G). Holding webs 230 are then passed through the holding web holding positions or holders 240. Holding webs 230 assist in preventing support line 120 from coming out of holders 210 during normal (that is, use other than use in emergency descent) use of system 10. When force is applied to carabiner 130 to deploy support line 120, holding webs 230 are pulled from within the intermediate loops. The intermediate loops are then pulled from hold-

ers 210 generally sequentially to extend support line 120 without tangling of support line 120.

**[0027]** A tamper-evident tag 250 (see, for example, Figures 1E, 1F and 4) can be placed around support line 120. Descender device 110 is then secured, for example with a hook and loop fastener or snaps. At this point, support line pad assembly 200, support line 120 held thereby and waist belt 100 are inserted into cover 300. Carabiner 130 can, for example, be positioned within cover 300, and cover 300 closed via, for example, snaps 310. Support line 120 of the present invention can be packed as described above quickly and without the use of tools.

**[0028]** Figures 3A through 3H illustrate the attachment of system 10 to an SCBA carrier/harness 500 (see Figure 5E). To retrofit/attach system 10 to act as a swiveling lumbar pad (see Figures 3A through 3F) in an existing SCBA carrier such as the AIRFRAME carrier available from Mine Safety Appliances Company of Pittsburgh, Pennsylvania, one first disassembles the pull straps of the existing lumbar support pad from the left and right shoulder straps of the carrier by weaving the pull straps through the friction buckles of the carrier. The pull straps are then disassembled from the carrier by removing the tribar slides thereof from the backplate assembly. There is no need to reuse the removed waist belt and pull straps as a waist belt and pull straps are provided with system 10. System 10 is then oriented so that loops 320 and tribar slides 330 on the outer portion of cover 300 are facing swiveling lumbar pad 510. One end of swiveling lumbar pad 510 is passed through loop 320 of the outer portion of cover 300. (see Figure 3A) Loop 320 of outer cover 300 is moved toward the center of swiveling lumbar pad 510 until second loop 320 can be secured (see Figure 3B) Tribar slides 330 are then passed through respective slots 520 in swiveling lumbar pad 510 by turning them at an angle as known in the art. (see Figure 3C) Tribar slides 330 should be confirmed to be fully seated against swiveling lumbar pad 510. (see Figure 3D) Integrated pull straps 340 are then installed onto the shoulder straps of the carrier by weaving them through friction buckles 530. System 10 can be attached to a standard or non-swiveling lumbar pad in a similar manner. After attachment of system 10 to SCBA carrier 500, the SCBA carrier can be donned and doffed generally in accordance with the relevant user's manual as shown in Figure 4.

**[0029]** Figures 5A through 5G illustrate another embodiment of a system 10' of the present invention which is similar, in many respects, to system 10. Components of system 10' are numbered similarly to corresponding components of system 10 with the addition of the designation "' ". Although KEVLAR webs or ribbons exhibit excellent tensile strength and ultimate tensile load, KEVLAR can act as a brittle material and break under a large, quickly applied force or shock force. System 10' of the present invention thus includes a shock absorbing descender that limits the shock force applied to support line 120 (for example, the force experienced at the beginning

of a descent). In the embodiment of Figures 5A through 5G, the shock absorbing descender includes descender device 110' which preferably is a plate with a plurality of holes therein through which the support line 120' is threaded, and shock absorbing element 112' which preferably includes a pair of rings 116 and a section of "rip" stitching 114' that rips or tears upon application of a shock force. Rip stitching section 114' and rings 116 act to absorb some of the shock force and prevents damage to the KEVLAR material of support line 120'.

**[0030]** As illustrated more clearly in Figures 6A and 6B, shock absorbing element 112' preferably includes a section of webbing which is doubled back over itself through rings 116. Rip stitching section 114' sews the two layers of extending member 112' together in this section. Rip stitching 114' begins to rip or tear so that the two layers of extending member 112' begin to separate and the apparent length of extending member 112' increases when a quick load or shock force is applied to descender device 110' as, for example, in the case of a fall. Once the rip stitching 114' is completely torn, rings 116 act to further absorb energy by deforming because one ring is forced into the other. It is desirable that rip stitching 114' stay intact during normal use of system 10', but begin to rip or tear under a shock force associated with a fall to absorb some of the shock force, thereby protecting the KEVLAR support line 120 from breakage. Rip stitching 114' can, for example, begin to rip or tear under a shock force in the range of 500 to 1000 pounds. Of course, other shock absorbing elements such as partially oriented yarn or tear tape can be used as the shock absorbing element in the shock absorbing descender of the present invention.

**[0031]** As illustrated, for example, in Figures 5A and 5B, a cover such as a shrink wrap covering 128a' can be formed over at least a portion of termination knot 128' of support line 120'. Figure 5A illustrates support line pad assembly 200' holding a 50-foot support line 120', while Figure 5B illustrates support line pad assembly 200' holding a 75-foot support line 120'. Second or terminal end 126' of support line 120' can also be folded over on itself and shrink wrap 126a' formed as a cover thereover. A "double action" or dual action is thereby required to allow passage of second end 126' of support line 120' through descender device 110' to operatively disengage support line 120' from descender device 110'. The user first grasps second end 126' and applies force to open shrink wrap covering 128a'. The user can then remove termination knot 128'. The requirement of a double action assists in ensuring that termination knot 128' is not inadvertently untied or removed.

**[0032]** As discussed above in connection with system 10, a tamper-evident tag 250' can be placed around support line 120' of system 10'. A tamper-evident tag 252 can also be placed upon termination knot 128'. Tamper-evident tags 250' and 252' provide confirmation upon very quick inspection as to whether support line 120' has ever been deployed. In that regard, tamper-evident tags

250' and 252' (which can, for example, be formed from a length of self-adhesive material that is wrapped around portions of support line 120') must be torn or ripped to deploy support line 120'. If support line 120' has been previously deployed, it is preferably replaced. In that regard, waist belt 100, including shock absorbing element 112' and descender device 110', as well as support line 120' can be replaced after a single deployment thereof.

## Claims

1. An article to be worn by a user, comprising: a shock absorbing descender device (110) attached to a waist belt of the article, a support line (120) passing through the descender device (110), an anchor connection (130) attached to a first end (122) of the support line (120) in the vicinity of the descender device (110) and an assembly (200) for holding the support line (120), wherein the assembly (200) comprises a plurality of holders (210) in which intermediate loops of the support line (120) are retained near the terminus of each of the intermediate loops.
2. An article according to claim 1, wherein the assembly (200) includes a first group of holders (210) and a second group of holders (210), each group of holders (210) including at least two holders, a first intermediate loop of the support line (120) being passed through a first holder of the first group of holders (210) and the support line (120) then being looped in an extended, generally u-shaped loop, a second intermediate loop of the support line (120) being passed through a first holder of the second group of holders (210), the support line (120) then being looped back in an extended, generally u-shaped loop and a third intermediate loop of the support line (120) being passed through a second holder of the first group of holders (210), the support line (120) then being looped in an extended u-shaped loop and a fourth intermediate loop of the support line (120) being passed through a second holder of the second group of holders (210).
3. An article according to claim 2, wherein the assembly (200) further comprises a first retainer (230) and a second retainer (230), the first retainer (230) comprising a first length of material attached to the assembly (200) that is adapted to be threaded through the intermediate loops passing through the holders of the first group of holders (210), the second retainer (230) comprising a second length of material attached to the assembly that is adapted to be threaded through the intermediate loops passing through the holders of the second group of holders (210).
4. An article according to claim 3, wherein the support line (120) is in operative connection with each of the

first retainer (230) and the second retainer (230) so that application of force to the first end (122) of the support line (120) causes the first retainer (230) to be withdrawn from the intermediate loops passing through the first group of holders (210) and the second retainer (230) to be withdrawn from the intermediate loops passing through the second group of holders (210).

5. An article according to claim 4, wherein further application of force to the first end (122) of the support line (120) after the first retainer (230) and the second retainer (230) are withdrawn from the intermediate loops, causes the intermediate loops to be withdrawn from the holders (210) of the first group of holders (210) and the second group of holders (210).
6. An article according to any preceding claim, further comprising a shock absorbing element (112), the descender device (110) comprising a plate with a plurality of holes therein, the shock absorbing element (112) comprising an extending section of material being threaded through a pair of rings and being doubled over itself and stitched together with rip stitching, the rip stitching being adapted to rip under a certain force to absorb energy and the rings being adapted to deform and thereby absorb energy.
7. An article according to claim 6, wherein the a second end (126) of the support line (120) is unattached and the support line (120) has formed in the vicinity of the second end (126) a termination knot (128) that prevents passage of the second end (126) of the support line (120) through the descender device (110).
8. An article according to claim 7, wherein the termination knot (128) can be released so that the support line (120) can pass through the descender device (110) and thereby be operatively disengaged from descender device (110).
9. An article according to claim R, wherein a cover (300) is formed over at least a portion of the knotted section of the termination knot (128) of the support line (120) so that the cover (300) must be removed before the termination knot (128) is released.
10. A self-contained breathing apparatus carrier (500), comprising: a waist belt (100'), a shock absorbing descender (10') in operative connection with the waist belt (100'), a support line (120') passing through the shock absorbing descender (10'), an anchor connection attached to a first end (122') of the support line (120') in the vicinity of the shock absorbing descender (10'), and an assembly (200') for holding the support line (120'), wherein the assembly (200') comprises a plurality of holders (210') in which

intermediate loops of the support line (120') are retained near the terminus of each of the looped ends.

11. A carrier according to claim 10, wherein the assembly (200') includes a first group of holders (210') and a second group of holders (210') including at least two holders, a first intermediate loop of the support line (120') being passed through a first holder of the first group of holders (210') and the support line (120') then being looped in an extended, generally u-shaped loop, a second intermediate loop of the support line (120') being passed through a first holder of the second group of holders (210'), the support line (120') then being looped back in an extended, generally u-shaped loop and a third intermediate loop of the support line (120') being passed through a second holder of the first group of holders (210'), the support line (120') then being looped in an extended u-shaped loop and a fourth intermediate loop of the support line (120') being passed through a second holder of the second group of holders (210').
12. A carrier according to claim 11, wherein the assembly (200') further comprises a first retainer (230') and a second retainer (230'), the first retainer (230') comprising a first length of material attached to the assembly (300) that is adapted to be threaded through the intermediate loops passing through the holders of the first group of holders (210'), the second retainer (230') comprising a second length of material attached to the assembly that is adapted to be threaded through the intermediate loops passing through the holders of the second group of holders (210').
13. A carrier according to claim 12, wherein the support line (120') is in operative connection with each of the first retainer (230') and the second retainer (230') so that application of force to the first end (122') of the support line (120') causes the first retainer (230') to be withdrawn from the intermediate loops passing through the first group of holders (210') and the second retainer to be withdrawn from the intermediate loops passing through the second group of holders (210').
14. A carrier according to claim 13, wherein further application of force to the first end (122') of the support line (120') after the first retainer (230') and the second retainer (230') are withdrawn from the intermediate loops, causes the intermediate loops to be withdrawn from the holders of the first group of holders (210') and the second group of holders (210').
15. A carrier according to any one of claims 10-14, wherein the shock absorbing descender (10') is attached to the waist belt (100') and comprises a descender device (110') and a shock absorbing element (112'), the descender device (110') comprising

a plate with a plurality of holes therein and the shock absorbing element (112') comprising an extending section of material threaded through a plurality of rings and being doubled over itself and stitched together with rip stitching, the rip stitching being adapted to rip under a certain force to absorb energy and the rings being adapted to deform and thereby absorb energy.

16. A carrier according to claim 15, wherein second end (126') of the support line (120') is unattached and the support line (120') has formed in the vicinity of the second end (126') a termination knot (128') that prevents passage of the second end (126') of the support line (120') through the descender device (110').
17. A carrier according to claim 16, wherein the termination knot (128') can be released so that the support line (120') can pass through the descender device (10') and the support line (120') can be operatively disengaged from the descender device (110').
18. A carrier according to claim 17, wherein a cover (300') is formed over at least a portion of the knotted section of the termination knot (128') of the support line (120') so that the cover (300') must be removed before the termination knot (128') is released.

## Patentansprüche

1. Ein von einem Anwender zu tragender Gegenstand umfassend:  
  
Ein stossabsorbierende Abseilvorrichtung (110), die an einem Hüftgurt des Gegenstandes befestigt ist, ein Stützseil (120), das durch die Abseilvorrichtung (110) verläuft, eine Verankerungsverbindung (130), die an einem ersten Ende (122) des Stützseiles (120) in der Nähe der Abseilvorrichtung (110) angebracht ist und eine Anordnung (200) zum Halten des Stützseiles (120), wobei die Anordnung (200) eine Vielzahl von Halterungen (210) umfasst, in welchen zwischenliegende Schlingen des Stützseiles (120) nahe dem Ende einer jeden zwischenliegenden Schlinge gehalten werden.
2. Ein Gegenstand gemäß Anspruch 1, wobei die Anordnung (200) eine erste Gruppe von Halterungen (210) und eine zweite Gruppe von Halterungen (210) enthält, wobei jede Gruppe von Halterungen (210) mindestens zwei Halterungen enthält, wobei eine erste zwischenliegende Schlinge des Stützseiles (120) durch eine erste Halterung der ersten Gruppe von Halterungen (210) durchgeführt wird, wobei das Stützseil (120) folgend in eine erweiterte, allgemein

- U-förmige Schlinge gelegt wird, wobei eine zweite zwischenliegende Schlinge des Stützseiles (120) durch eine erste Halterung der zweiten Gruppe von Halterungen (210) durchgeführt wird, wobei das Stützseil (120) anschließend in eine erweiterte, allgemein U-förmige Schlinge zurückgelegt wird, und eine dritte zwischenliegende Schlinge des Stützseiles (120) durch eine zweite Halterung der ersten Gruppe von Halterungen (210) durchgeführt wird, wobei das Stützseil (120) anschließend in eine erweiterte U-förmige Schlinge gelegt wird, und eine vierte zwischenliegende Schlinge des Stützseiles (120) durch eine zweite Halterung der zweiten Gruppe von Halterungen (210) durchgeführt wird.
3. Ein Gegenstand gemäß Anspruch 2, wobei die Anordnung (200) des weiteren eine erste Aufnahme (230) und eine zweite Aufnahme (230) umfasst, wobei die erste Aufnahme (230) eine erste Länge eines an der Anordnung (200) befestigtes Material umfasst, das zum Durchfädeln durch die zwischenliegende Schlinge, die durch die Halterungen der ersten Gruppe von Halterungen (210) durchgeführt ist, angepasst ist, wobei die zweite Aufnahme (230) eine zweite Länge eines an der Anordnung befestigten Materials umfasst, das zum Durchfädeln durch die zwischenliegenden Schlingen, die durch die Halterungen der zweiten Gruppe von Halterungen (210) durchführen, angepasst ist.
4. Ein Gegenstand gemäß Anspruch 3, wobei das Stützseil (120) in Wirkverbindung mit jedem der ersten Aufnahme (230) und der zweiten Aufnahme (230) steht, so dass die Krafteinleitung in das erste Ende (122) des Stützseiles (120) ein Zurückziehen der ersten Aufnahme (230) von der zwischenliegenden Schlinge, die durch die erste Gruppe von Halterungen (210) durchgezogen ist, und ein Zurückziehen der zweiten Aufnahme (230) von der zwischenliegenden Schlinge, die durch die zweite Gruppe von Halterungen (210) durchgezogen ist, verursacht.
5. Ein Gegenstand gemäß Anspruch 4, wobei die weitere Krafteinleitung in das erste Ende (122) des Stützseiles (120) nach dem die erste Aufnahme (130) und die zweite Aufnahme (230) von den zwischenliegenden Schlingen zurückgezogen sind, ein Zurückziehen der zwischenliegenden Schlingen von der Halterung (210) der ersten Gruppe von Halterungen (210) und der zweiten Gruppe von Halterungen (210) verursacht.
6. Ein Gegenstand gemäß einen der vorhergehenden Ansprüche, des weiteren ein stoßabsorbierendes Element (112) umfassend, wobei die Abseilvorrichtung (110) eine Platte mit einer Vielzahl von Löchern umfasst, wobei das stoßabsorbierende Element (112) einen verlängerten Bereich eines Materials umfasst, das durch ein Ringpaar gefädelt ist und sich mit sich selbst verdoppelt und mit Reißnähten zusammen vernäht ist, wobei die Reißnähte so angepasst sind, um bei einer bestimmten Kraft zur Absorption von Energie aufzureißen, und die Ringe derart angepasst sind, um sich zu Verformen und dabei Energie zu absorbieren.
7. Ein Gegenstand gemäß Anspruch 6, wobei das eine zweite Ende (126) des Stützseiles (120) unbefestigt ist und das Stützseil (120) in der Nähe des zweiten Endes (126) einen Endknoten (128) ausgebildet hat, der die Passage des zweiten Endes (126) des Stützseiles (120) durch die Abseilvorrichtung (110) verhindert.
8. Ein Gegenstand gemäß Anspruch 7, wobei der Endknoten (128) aufgelöst werden kann, so dass das Stützseil (120) durch die Abseilvorrichtung (110) durchgeführt werden kann und dabei wirksam von der Abseilvorrichtung (110) ausgelöst wird.
9. Ein Gegenstand gemäß Anspruch 8, wobei eine Abdeckung (300) mindestens über einem Bereich des verknoteten Abschnittes des Endknotens (128) des Stützseiles (120) ausgebildet wird, so dass die Abdeckung (300) vor Auslösung des Endknotens (128) entfernt werden muss.
10. Ein eigenständiger Träger (500) für ein Atemschutzgerät umfassend: einen Hüftgürtel (1'), ein stoßabsorbierendes Abseilgerät (10') in Wirkverbindung mit dem Hüftgurt (100'), ein Stützseil (120'), das durch das stoßabsorbierende Abseilgerät (10') geführt wird, eine Verankerungsverbindung, die an einem ersten Ende (122') des Stützseiles (120') in der Umgebung des stoßabsorbierenden Abseilgerätes (10') befestigt ist, und eine Anordnung (200') zum Halten des Stützseiles (120'), wobei die Anordnung (200') eine Vielzahl von Halterungen (210') umfasst, in welcher zwischenliegende Schlingen des Stützseiles (120') nahe dem Ende jeder der Schlingenenden aufgenommen sind.
11. Ein Träger gemäß Anspruch 10, wobei die Anordnung (200') eine erste Gruppe von Halterungen (210') und eine zweite Gruppe von Halterungen (210') enthält, die mindestens zwei Halterungen enthalten, wobei eine erste zwischenliegende Schlinge des Stützseiles (120') durch eine erste Halterung der ersten Gruppe von Halterungen (210') geführt wird und wobei das Stützseil (120') dann in eine erweiterte, allgemein U-förmige Schlinge gelegt wird, wobei eine zweite zwischenliegende Schlinge des Stützseiles (120') durch eine erste Halterung der zweiten Gruppe von Halterungen (210') geführt wird, wobei das Stützseil (120') anschließend in eine er-

weiterte, allgemein U-förmige Schlinge zurückgelegt wird und eine dritte zwischenliegende Schlinge des Stützseiles (120') durch eine zweite Halterung der ersten Gruppe von Halterungen (210') geführt wird, wobei das Stützseil (120') anschließend in eine erweiterte U-förmige Schlinge gelegt wird, und eine vierte zwischenliegende Schlinge des Stützseiles (120') durch eine zweite Halterung der zweiten Gruppe von Halterungen (210') geführt wird.

12. Ein Träger gemäß Anspruch 11, wobei die Anordnung (200') des weiteren eine erste Aufnahme (230') und eine zweite Aufnahme (230') umfasst, wobei die erste Aufnahme (230') eine erste Länge eines an der Anordnung (300) befestigten Materiales umfasst, das zum Fädeln durch die zwischenliegenden Schlingen, die durch die Halterung der ersten Gruppe von Halterungen (210') geführt sind, angepasst ist, wobei die zweite Aufnahme (230') eine zweite Länge eines an der Anordnung befestigten Materiales umfasst, das zum Fädeln durch die zwischenliegenden Schlingen, die durch die Halterungen der zweiten Gruppe von Halterungen (210') geführt sind, angepasst ist.
13. Ein Träger gemäß Anspruch 12, wobei das Stützseil (120') in Wirkverbindung mit jeder der ersten Aufnahme (230') und der zweiten Aufnahme (230') steht, so dass eine Krafteinleitung in das erste Ende (122') des Stützseiles (120') ein zurückziehen der ersten Aufnahme (230') von der zwischenliegenden Schlinge, die durch die erste Gruppe von Halterungen (210') geführt ist, verursacht, und ein Zurückziehen der zweiten Aufnahme von der zwischenliegenden Schlinge, die durch die zweite Gruppe von Halterungen (210') geführt ist, verursacht.
14. Ein Träger gemäß Anspruch 13, wobei eine weitere Krafteinleitung in das erste Ende (122') des Stützseiles (120') nach dem Zurückziehen der ersten Aufnahme (230') und der zweiten Aufnahme (230') von den zwischenliegenden Schlingen ein Zurückziehen der zwischenliegenden Schlingen von den Halterungen der ersten Gruppe von Halterungen (210') und der zweiten Gruppe von Halterungen (210') verursacht.
15. Ein Träger gemäß einem der Ansprüche 10 bis 14, wobei das stoßabsorbierende Abseilgerät (10') an dem Hüftgut (100') befestigt ist und eine Abseilvorrichtung (110') und ein stoßabsorbierendes Element (112') umfasst, wobei die Abseilvorrichtung (110') eine Platte mit einer Vielzahl von Löchern umfasst, und das stoßabsorbierende Element (112') einen erweiterten Abschnitt eines Materials umfasst, dass durch eine Vielzahl von Ringen gefädelt ist und sich selbst verdoppelt und mittels Aufreißnähten zusammen vernäht ist, wobei die Aufreißnähte derart aus-

gelegt sind, um bei einer bestimmten Kraft zur Absorption von Energie aufzureißen, und die Ringe derart angepasst sind, um sich zu verformen und dabei Energie zu absorbieren.

16. Ein Träger gemäß Anspruch 15, wobei ein zweites Ende (126') des Stützseiles (120') unbefestigt ist und wobei das Stützseil (120') in der Nähe des zweiten Endes (126') einen Endknoten (128') ausgebildet hat, der eine Passage des zweiten Endes (126') des Stützseiles (120') durch die Abseilvorrichtung (110') verhindert.
17. Ein Träger gemäß Anspruch 16, wobei der Endknoten (128') ausgelöst werden kann, so dass das Stützseil (120') durch die Abseilvorrichtung (110') geführt wird, und das Stützseil (120') wirksam von der Abseilvorrichtung (110') ausgelöst werden kann.
18. Ein Träger gemäß Anspruch 17, wobei eine Abdeckung (300') über mindestens einem Bereich des geknoteten Abschnittes des Endknotens (128') des Stützseiles (120') ausgebildet ist, so dass die Abdeckung (300') vor Auslösung des Endknotens (128') entfernt werden muss.

## Revendications

1. Article destiné à être porté par un utilisateur, comportant : un dispositif descendeur absorbant les chocs (110) fixé à une ceinture de l'article, une corde solidaire (120) qui passe dans le dispositif descendeur (110), une liaison d'ancrage (130) fixée à une première extrémité (122) de la corde solidaire (120) au voisinage du dispositif descendeur (110) et un assemblage (200) pour tenir la corde solidaire (120), dans lequel l'assemblage (200) comporte une pluralité de supports (210) dans lesquels des boucles intermédiaires de la corde solidaire (120) sont retenues près de la terminaison de chacune des boucles intermédiaires.
2. Article selon la revendication 1, dans lequel l'assemblage (200) comprend un premier groupe de supports (210) et un deuxième groupe de supports (210), chaque groupe de supports (210) comprenant au moins deux supports, une première boucle intermédiaire de la corde solidaire (120) étant passée dans un premier support du premier groupe de supports (210) et la corde solidaire (120) étant ensuite enroulée en une boucle étendue de forme générale en U, une deuxième boucle intermédiaire de la corde solidaire (120) étant passée dans un premier support du deuxième groupe de supports (210), la corde solidaire (120) revenant ensuite en une boucle étendue de forme générale en U et une troisième boucle intermédiaire de la corde solidaire (120) étant passée

dans un deuxième support du premier groupe de supports (210), la corde solidaire (120) étant ensuite enroulée en une boucle étendue de forme générale en U et une quatrième boucle intermédiaire de la corde solidaire (120) étant passée dans un deuxième support du deuxième groupe de supports (210).

3. Article selon la revendication 2, dans lequel l'assemblage (200) comporte en outre un premier dispositif de retenue (230) et un deuxième dispositif de retenue (230), le premier dispositif de retenue (230) comportant une première longueur de tissu fixé à l'assemblage (200) qui est conçu pour être enfilé dans les boucles intermédiaires passant dans les supports du premier groupe de supports (210), le deuxième dispositif de retenue (230) comportant une deuxième longueur de tissu fixé à l'assemblage qui est conçu pour être enfilé dans les boucles intermédiaires passant dans les supports du deuxième groupe de supports (210).

4. Article selon la revendication 3, dans lequel la corde solidaire (120) est liée opérationnellement à la fois au premier dispositif de retenue (230) et au deuxième dispositif de retenue (230) de sorte que l'application d'une force sur la première extrémité (122) de la corde solidaire (120) fait en sorte que le premier dispositif de retenue (230) est retiré des boucles intermédiaires qui passent dans les premiers groupes de supports (210) et le deuxième dispositif de retenue (230) est retiré des boucles intermédiaires qui passent dans le deuxième groupe de supports (210).

5. Article selon la revendication 4, dans lequel une application supplémentaire d'une force sur la première extrémité (122) de la corde solidaire (120) après le retrait du premier dispositif de retenue (230) et du deuxième dispositif de retenue (230) des boucles intermédiaires, fait en sorte que les boucles intermédiaires sont retirées des supports (210) du premier groupe de supports (210) et du deuxième groupe de supports (210).

6. Article selon l'une quelconque des revendications précédentes, comportant en outre un élément absorbant les chocs (112), le dispositif descendeur (110) comportant une plaquette munie d'une pluralité de trous la traversant, l'élément absorbant les chocs (112) comportant une section extensible de tissu enfilée dans une paire d'anneaux et doublée sur elle-même et cousue ensemble avec une couture de déchirement, la couture de déchirement étant conçue pour se déchirer sous une certaine force afin d'absorber l'énergie, et les anneaux étant conçus pour se déformer et par conséquent absorber l'énergie.

7. Article selon la revendication 6, dans lequel la

deuxième extrémité (126) de la corde solidaire (120) n'est pas fixée et la corde solidaire (120) a, formé au voisinage de sa deuxième extrémité (126), un noeud de bout (128) qui empêche le passage de la deuxième extrémité (126) de la corde solidaire (120) dans le dispositif descendeur (110).

8. Article selon la revendication 7, dans lequel le noeud de bout (128) peut être libéré de sorte que la corde solidaire (120) peut passer dans le dispositif descendeur (110) et par conséquent être détachée de manière opérationnelle du dispositif descendeur (110).

9. Article selon la revendication 8, dans lequel une bande de recouvrement (300) est formée sur au moins une portion de la section nouée du noeud de bout (128) de la corde solidaire (120) de sorte que la bande de recouvrement (300) doit être retirée avant que le noeud de bout (128) soit libéré.

10. Porte-appareil (500) pour un appareil respiratoire autonome, comportant : une ceinture (100'), un descendeur absorbant les chocs (10') en liaison opérationnelle avec la ceinture (100'), une corde solidaire (120') qui passe dans le descendeur absorbant les chocs (10'), une liaison d'ancrage fixée à une première extrémité (122') de la corde solidaire (120') au voisinage du descendeur absorbant les chocs (10'), et un assemblage (200') pour tenir la corde solidaire (120'), dans lequel l'assemblage (200') comporte une pluralité de supports (210') dans lesquels des boucles intermédiaires de la corde de solidaire (120') sont retenues près de la terminaison de chacune des extrémités enroulées.

11. Porte-appareil selon la revendication 10, dans lequel l'assemblage (200') comprend un premier groupe de supports (210') et un deuxième groupe de supports (210') comprenant au moins deux supports, une première boucle intermédiaire de la corde solidaire (120') étant passée dans un premier support du premier groupe de supports (210') et la corde solidaire (120') étant ensuite enroulée en une boucle étendue de forme générale en U, une deuxième boucle intermédiaire de la corde solidaire (120') étant passée dans un premier support du deuxième groupe de supports (210'), la corde solidaire (120') revenant ensuite en une boucle étendue de forme générale en U et une troisième boucle intermédiaire de la corde solidaire (120') étant passée dans un deuxième support du premier groupe de supports (210'), la corde solidaire (120') étant ensuite enroulée en une boucle étendue de forme générale en U et une quatrième boucle intermédiaire de la corde solidaire (120') étant passée dans un deuxième support du deuxième groupe de supports (210').

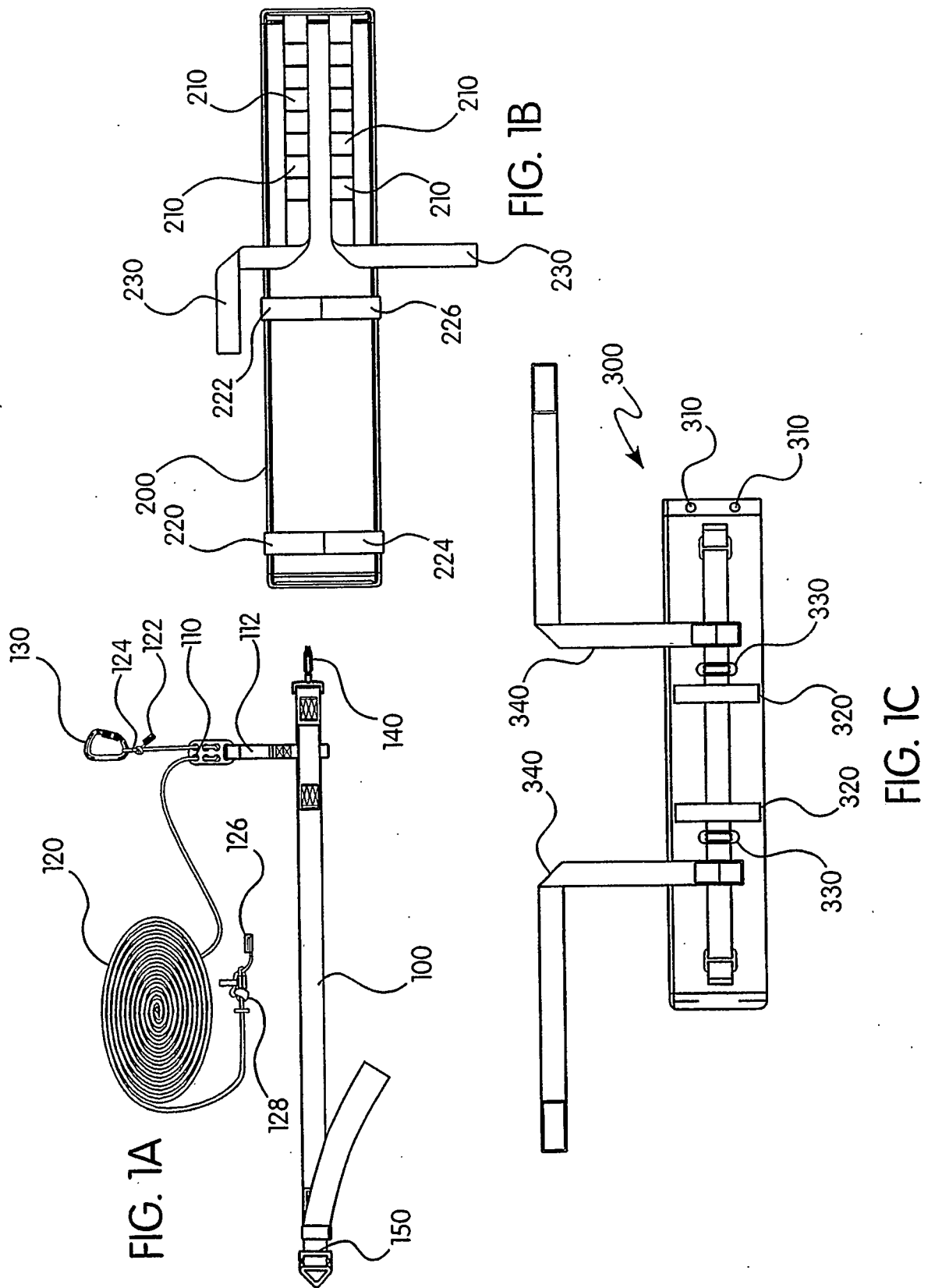
12. Porte-appareil selon la revendication 11, dans lequel

l'assemblage (200') comporte en outre un premier dispositif de retenue (230') et un deuxième dispositif de retenue (230'), le premier dispositif de retenue (230') comportant une première longueur de tissu fixée à l'assemblage (300) qui est conçue pour être enfilée dans les boucles intermédiaires passant dans les supports du premier groupe de supports (210'), le deuxième dispositif de retenue (230') comportant une deuxième longueur de tissu fixée à l'assemblage qui est conçue pour être enfilée dans les boucles intermédiaires passant dans les supports du deuxième groupe de supports (210').

13. Porte-appareil selon la revendication 12, dans lequel la corde solidaire (120') est liée de manière opérationnelle à la fois au premier dispositif de retenue (230') et au deuxième dispositif de retenue (230') de sorte que l'application d'une force sur la première extrémité (122') de la corde solidaire (120') fait en sorte que le premier dispositif de retenue (230') est retiré des premières boucles intermédiaires qui passent dans le premier groupe de supports (210') et le deuxième dispositif de retenue est retiré des boucles intermédiaires qui passent dans le deuxième groupe de supports (210').
14. Porte-appareil selon la revendication 13, dans lequel une application supplémentaire d'une force sur la deuxième extrémité (122') de la corde solidaire (120') après le retrait du premier dispositif de retenue (230') et du deuxième dispositif de retenue (230') des boucles intermédiaires, fait en sorte que les boucles intermédiaires du support sont retirées des supports du premier groupe de supports (210') et du deuxième groupe de supports (210').
15. Porte-appareil selon l'une quelconque des revendications 10 à 14, dans lequel le descendeur absorbant les chocs (10') est fixé à la ceinture (100') et comporte un dispositif descendeur (110') et un élément absorbant les chocs (112'), le descendeur (110') comportant une plaquette munie d'une pluralité de trous la traversant et l'élément absorbant les chocs (112') comportant une section extensible de tissu enfilée dans une pluralité d'anneaux et doublée sur elle-même et cousue ensemble avec une couture de déchirement, la couture de déchirement étant conçue pour se déchirer sous une certaine force afin d'absorber l'énergie, et les anneaux étant conçus pour se déformer et par conséquent absorber l'énergie.
16. Porte-appareil selon la revendication 15, dans lequel la deuxième extrémité (126') de la corde solidaire (120') est libre et la corde solidaire (120') a, formé au voisinage de sa deuxième extrémité (126'), un noeud de bout (128') qui empêche le passage de la deuxième extrémité (126') de la corde solidaire

(120') dans le descendeur (110').

17. Porte-appareil selon la revendication 16, dans lequel le noeud de bout (128') peut être libéré de sorte que la corde solidaire (120') peut passer dans le dispositif descendeur (10') et la corde solidaire (120') peut être détachée de manière opérationnelle du descendeur (110').
18. Porte-appareil selon la revendication 17, dans lequel une bande de recouvrement (300') est formée sur au moins une portion de la section nouée du noeud de bout (128') de la corde solidaire (120') de sorte que la bande de recouvrement (300') doit être retirée avant que le noeud de bout (128') soit libéré.



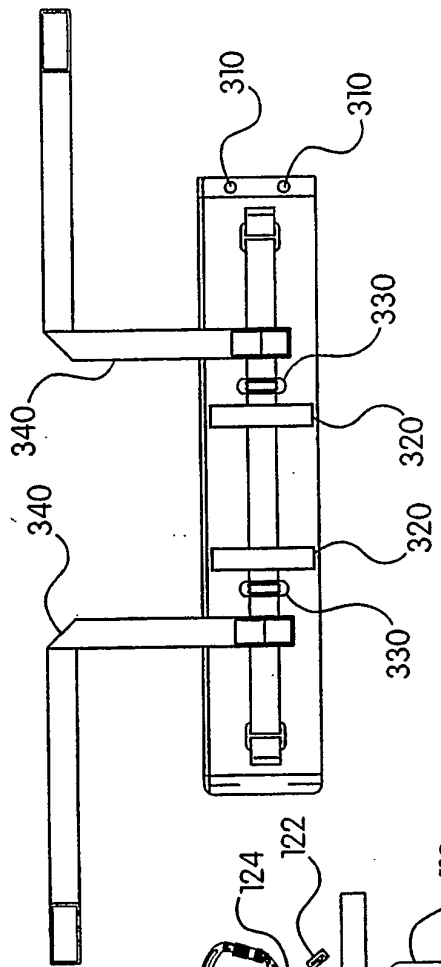


FIG. 1D

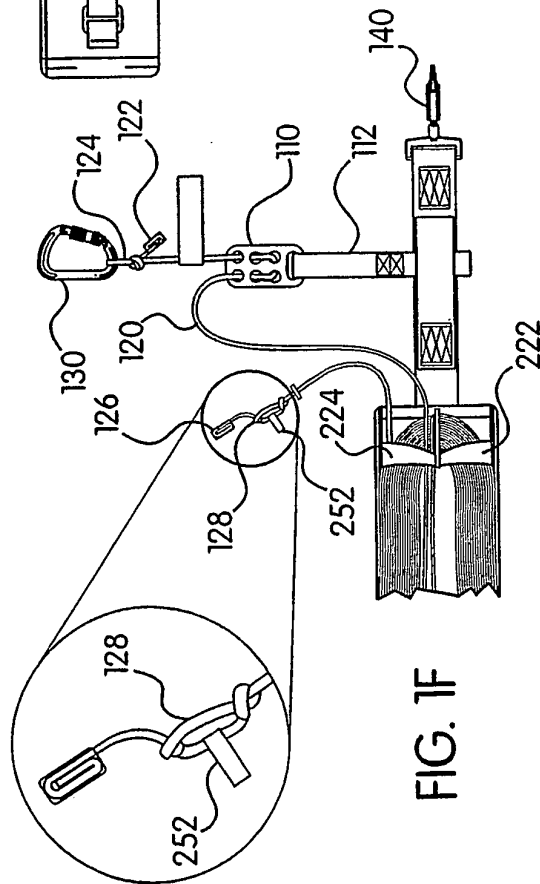


FIG. 1F

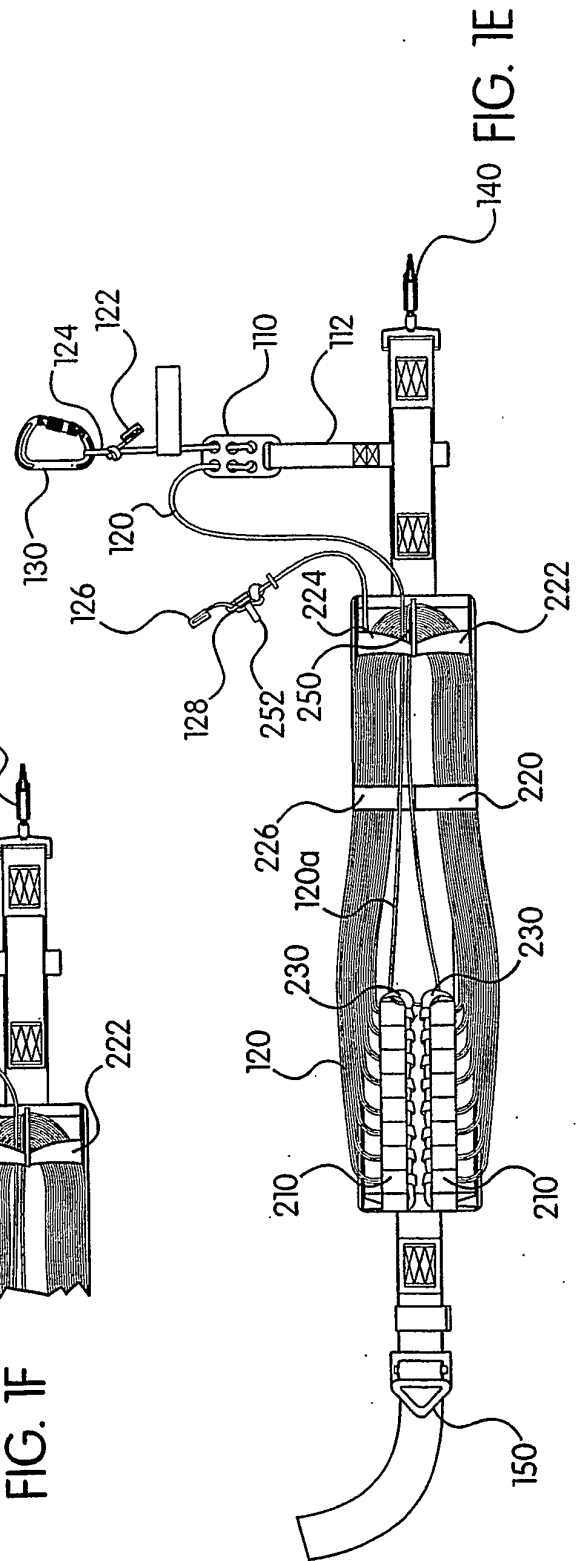
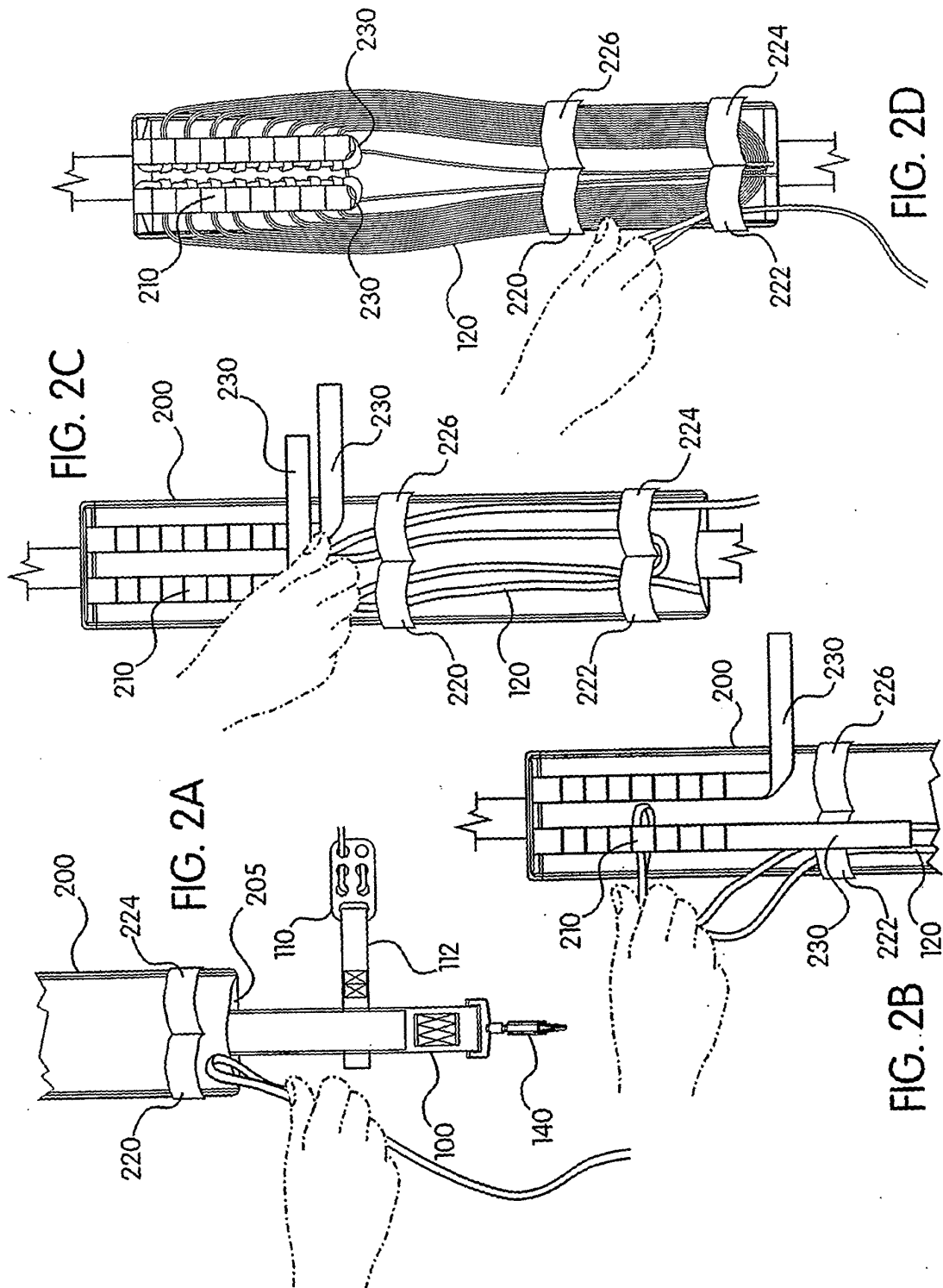
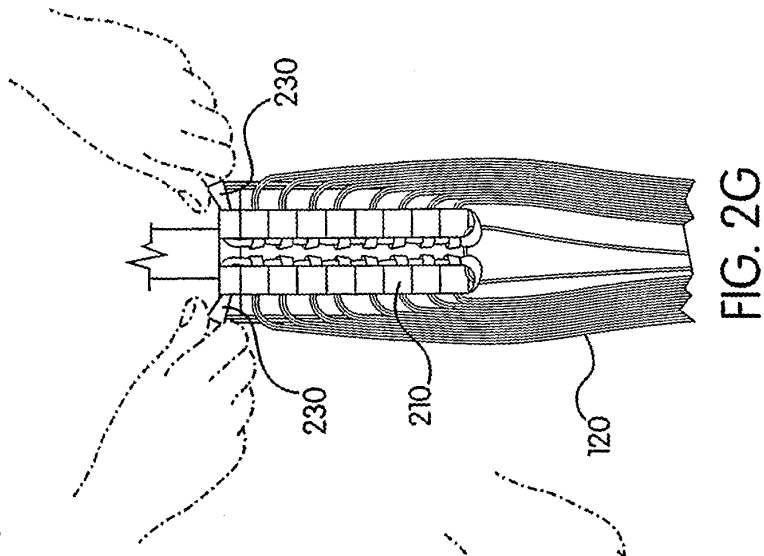
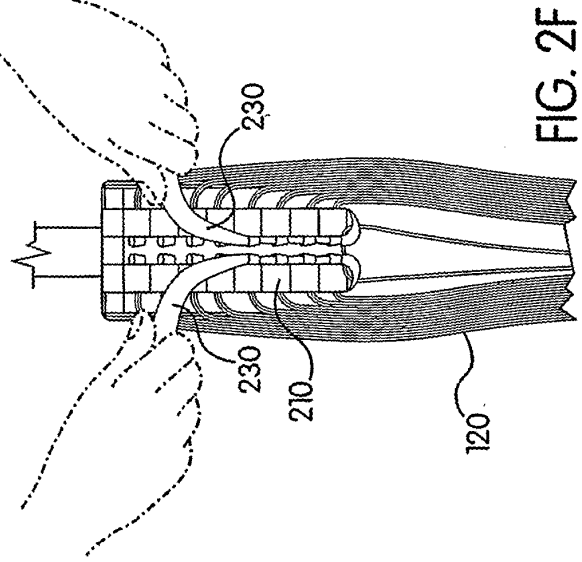
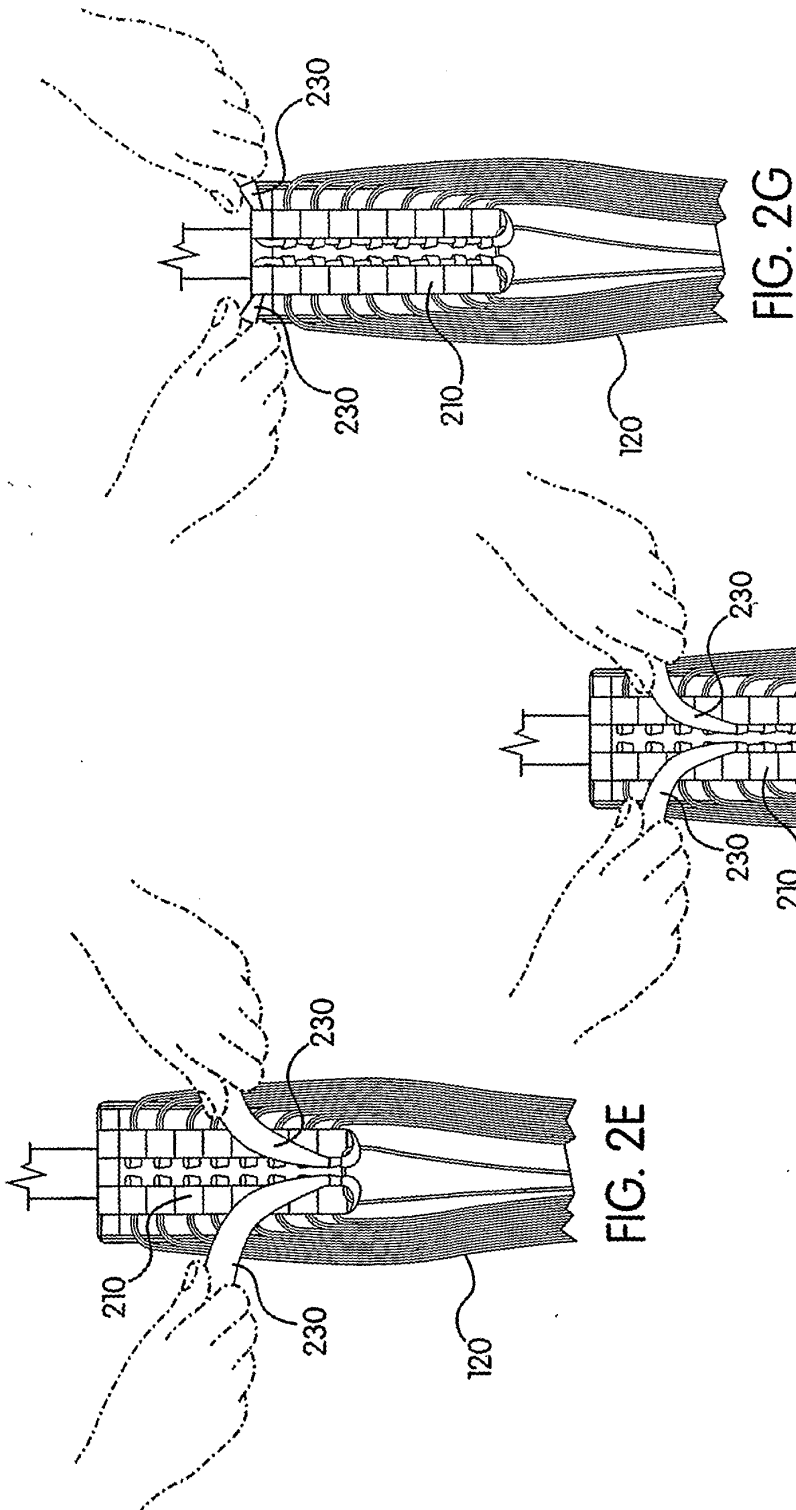
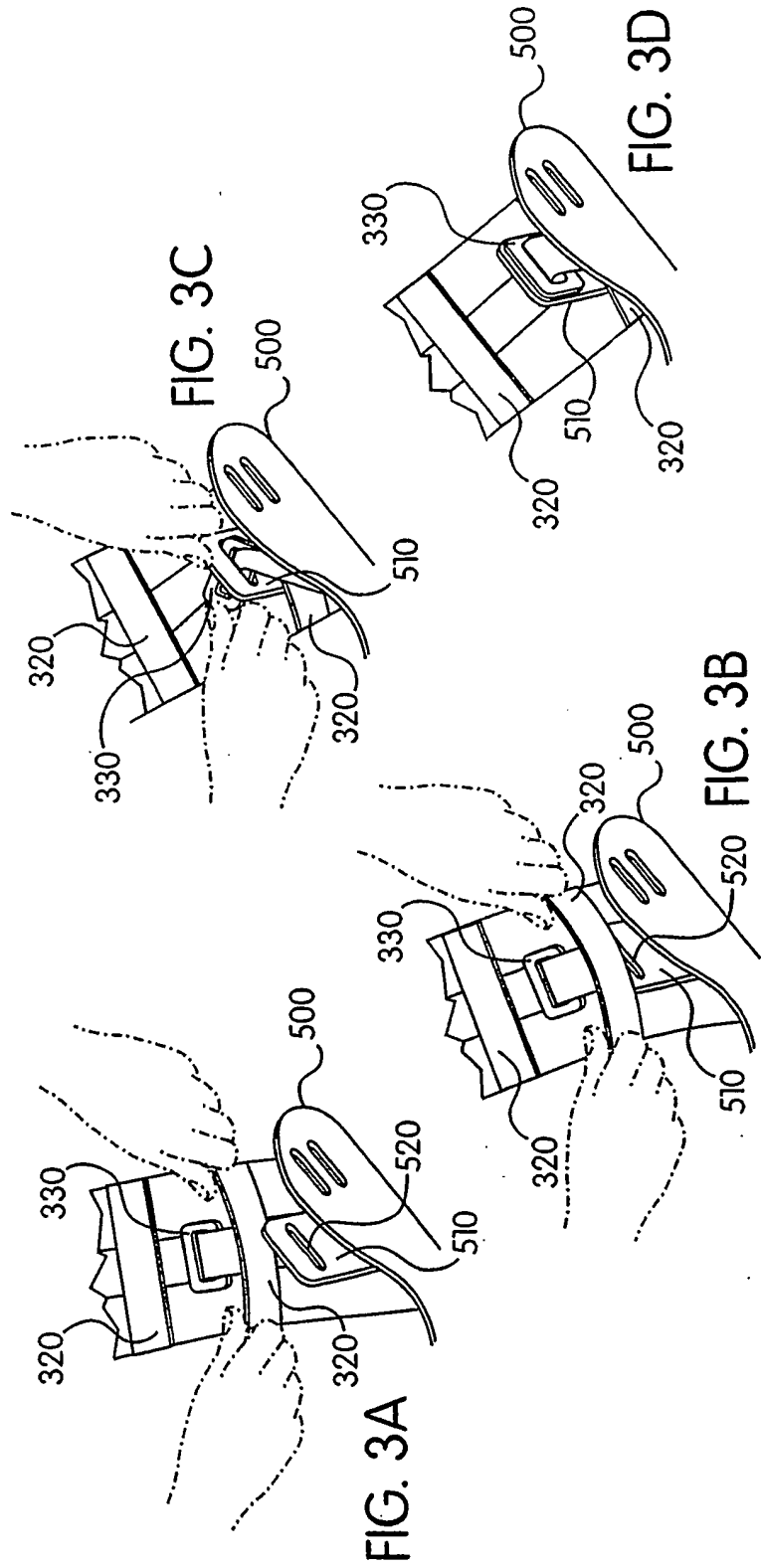
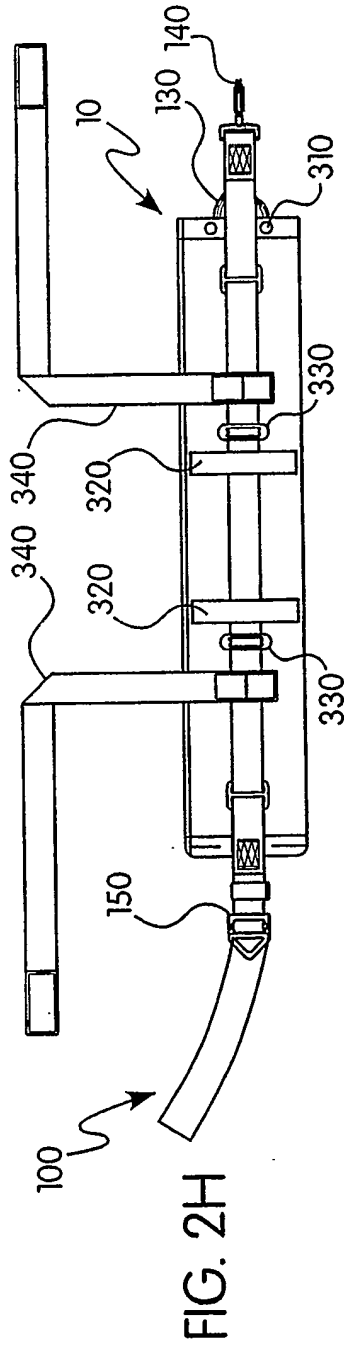


FIG. 1E







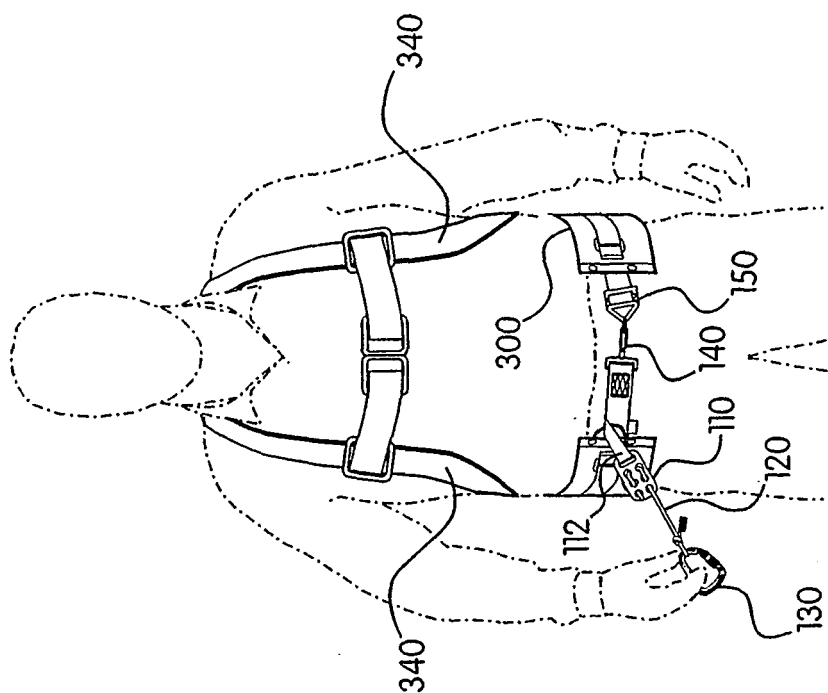


FIG. 4

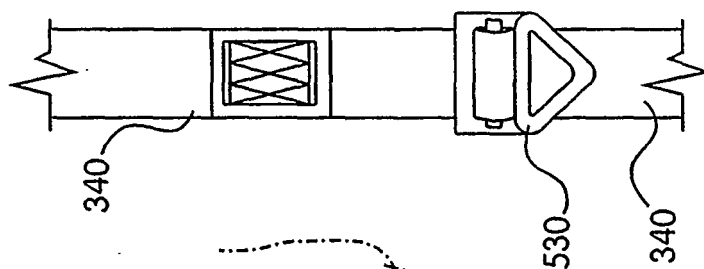


FIG. 3F

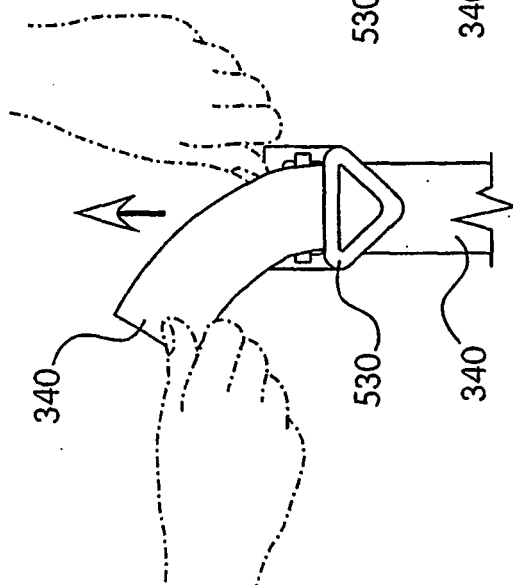


FIG. 3E

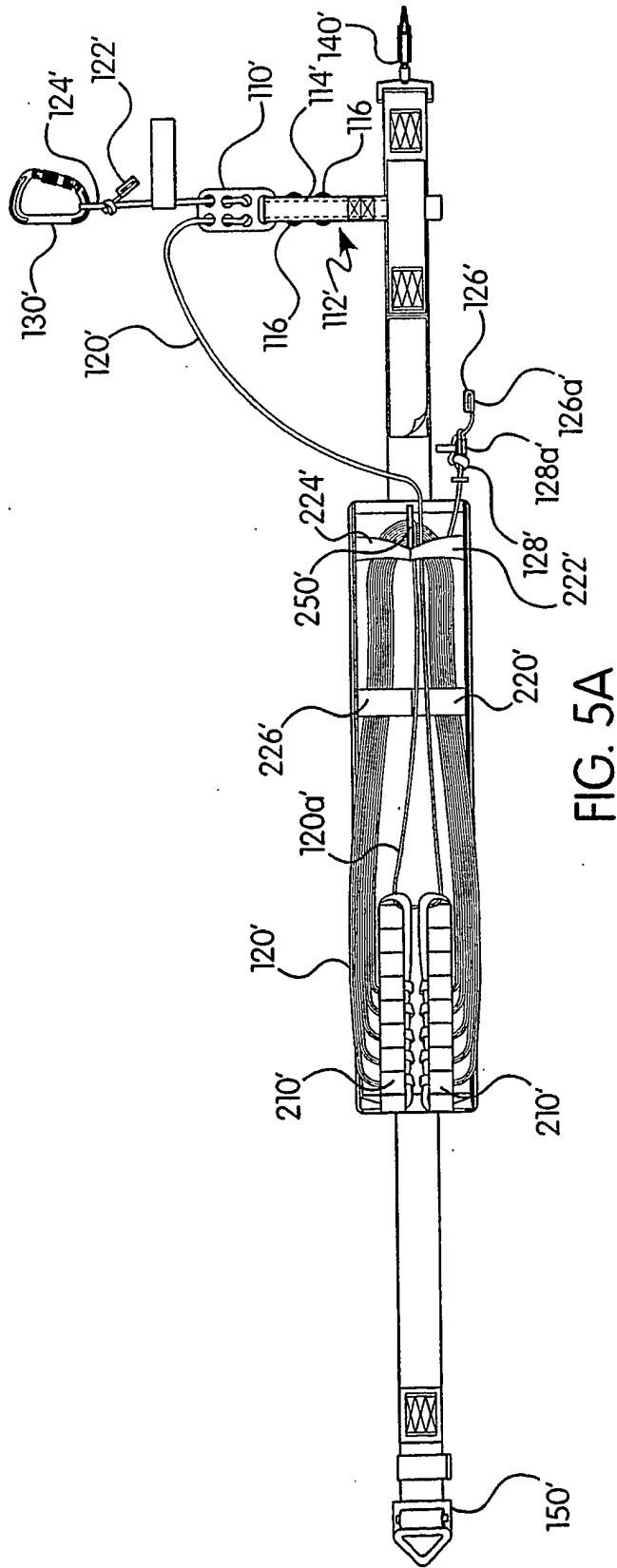


FIG. 5A

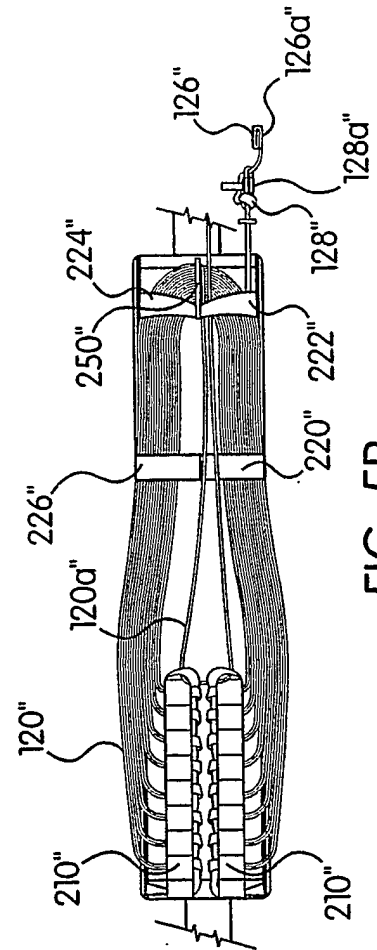


FIG. 5B

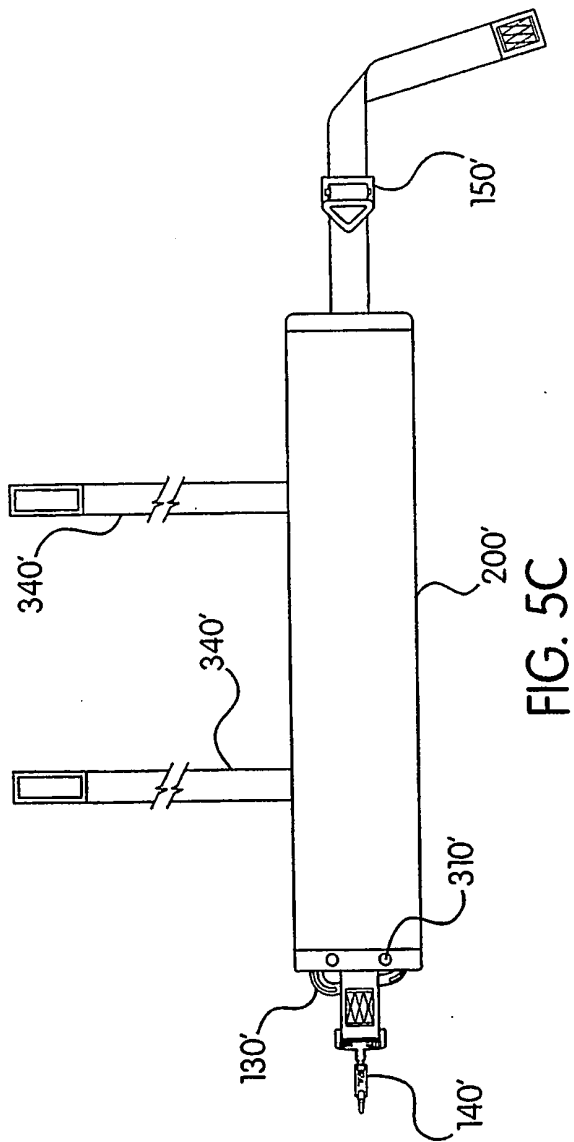


FIG. 5C

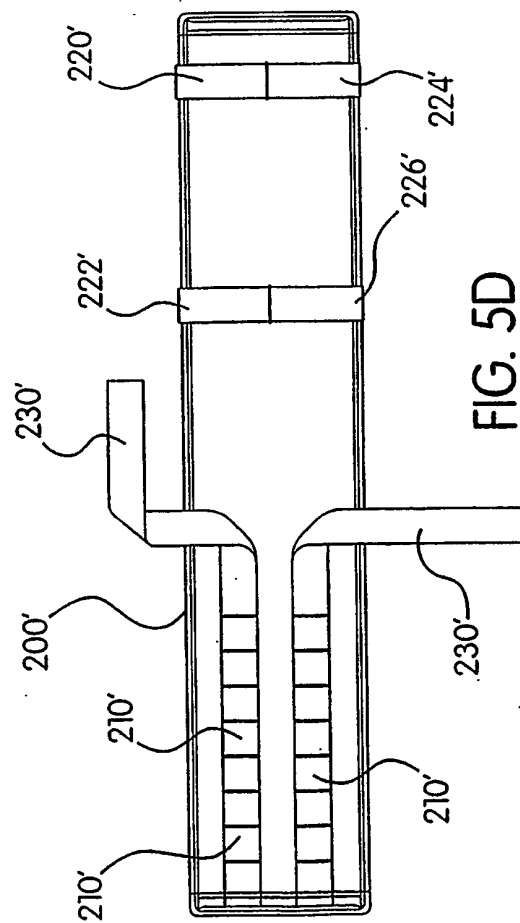


FIG. 5D

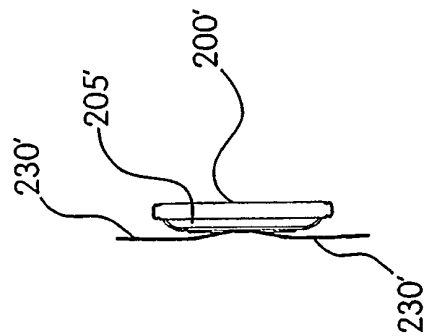


FIG. 5G

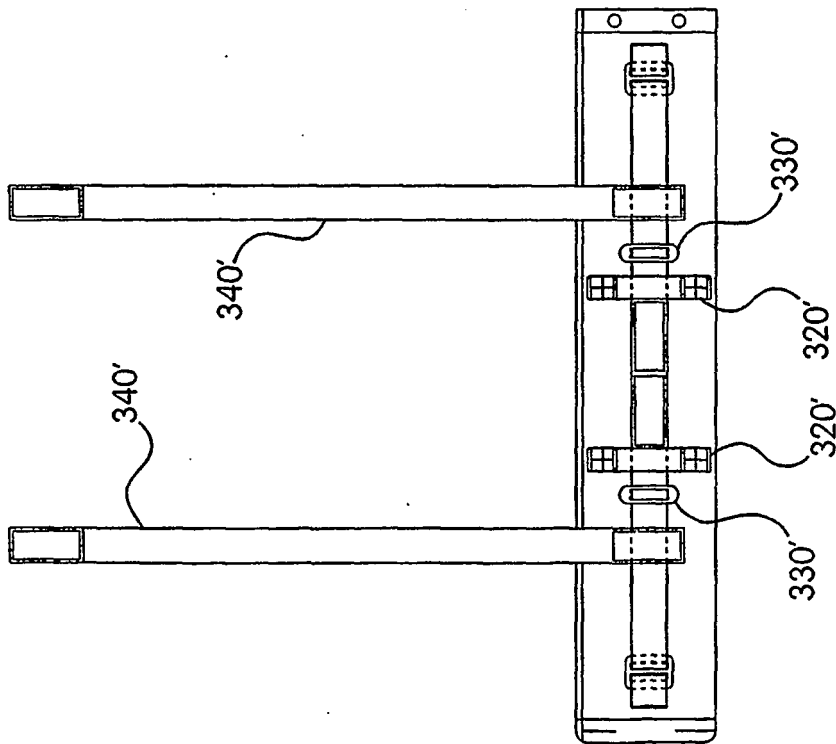


FIG. 5E

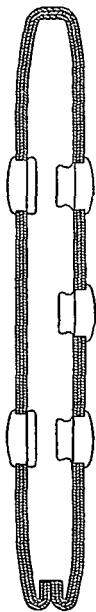


FIG. 5F

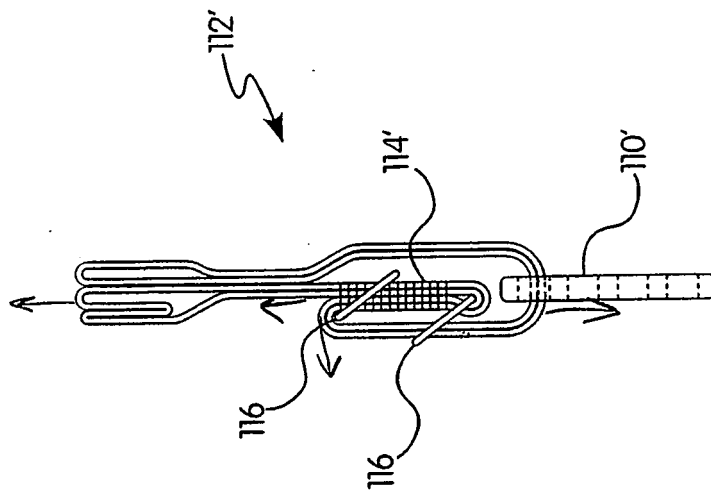


FIG. 6B

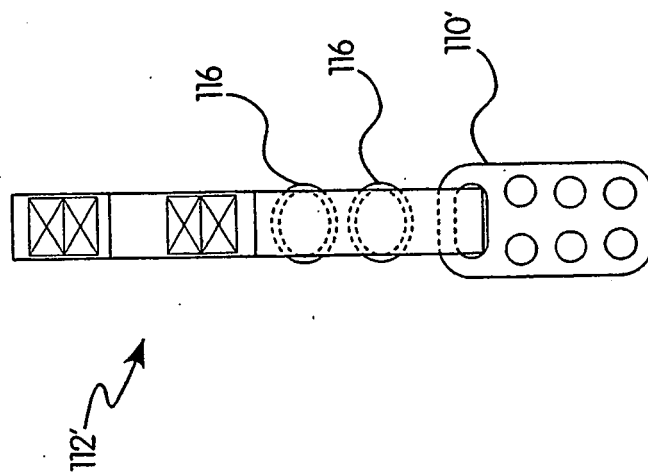


FIG. 6A

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- US 6487725 B [0004] [0006]