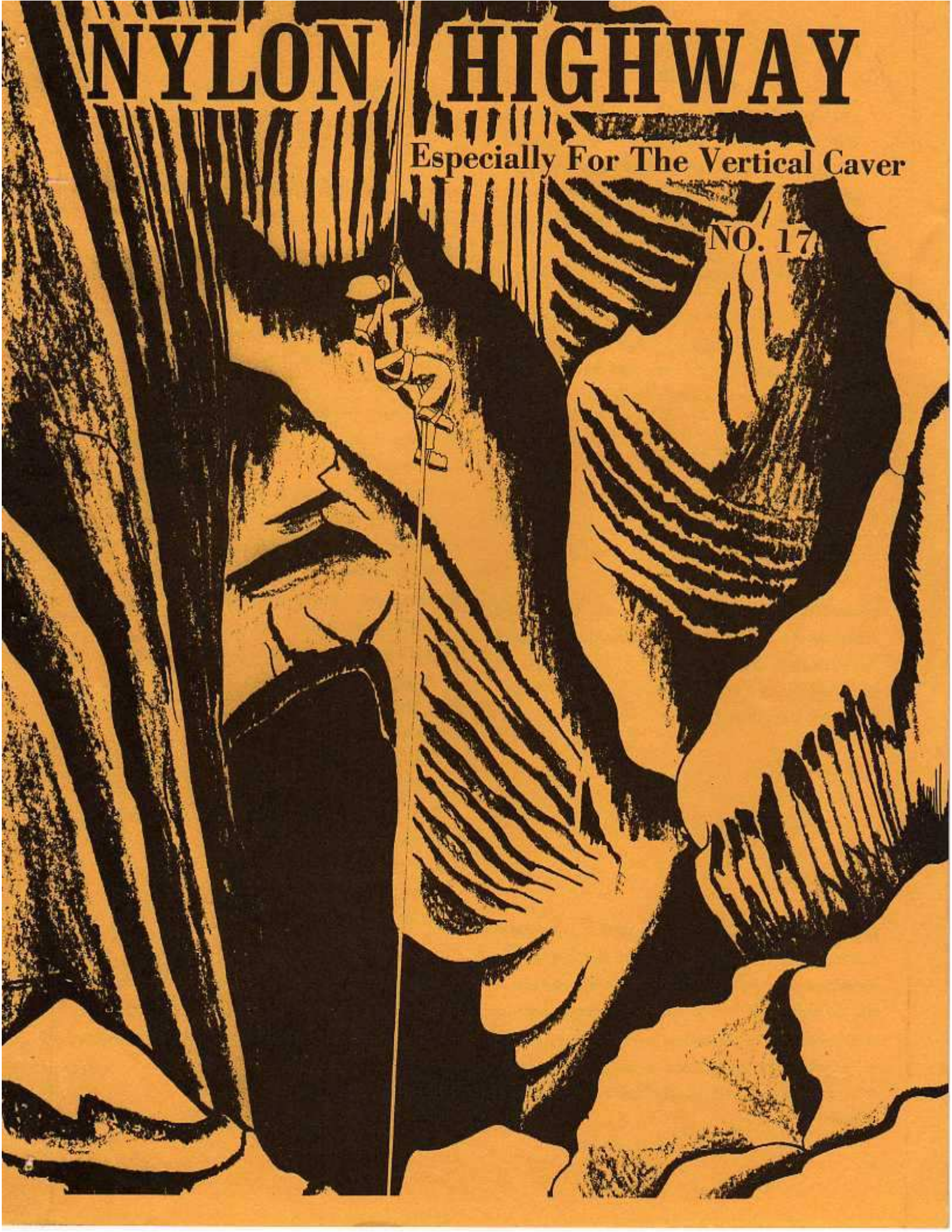
NYLON HIGHWAY

Especially For The Vertical Caver

NO. 17



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NYLON HIGHWAY
NO. 17
December 1983

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COVER Entitled "Final Moments" Ink adaptation by the Editor from a photgraph of Eldon Hole, an English pot.

Illustrations: Unless otherwise indicated are creations of the editor.

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USING A STITCHING AWL

By Darrel Tomer

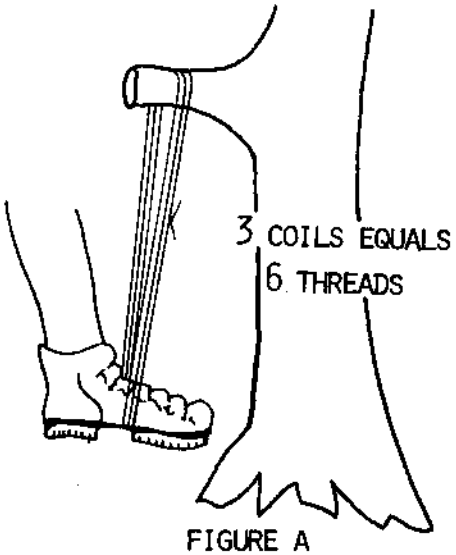


FIGURE A

At our recent convention in Elkins, Bob Liebman mentioned that some of our younger vertical cavers were having trouble with their hand-stitched harnesses ripping out. Many of our old timers have used the stitching awl for years with no difficulty. What follows is a description of methods used by me and my caving associates.

THREAD Use the waxed nylon thread sold for use with the stitching awl. Some prefer 25 lb. braided fishing line. Whatever you use, don't rely on the rated breaking strength as an indication of how many stitches are needed. Test the breaking strength yourself under conditions more like actual use. Start with a 5' piece tied into a loop. Form it into a triple loop and hang it over a smooth support. (See Figure A) Stand in the coil and step up and down a bit about like you were going upstairs. If the thread doesn't break and if you weigh 150 lbs., that indicates a breaking strength of at least 25 lbs. for thread in a new, unused condition. If the thread breaks...

$$\text{THREAD STRENGTH} = \frac{\text{Body Weight}}{2 \times \text{No. of Coils}}$$

...try more coils until you find a number that holds. If it takes more than four coils you are going to spend too much time putting in enough stitches.

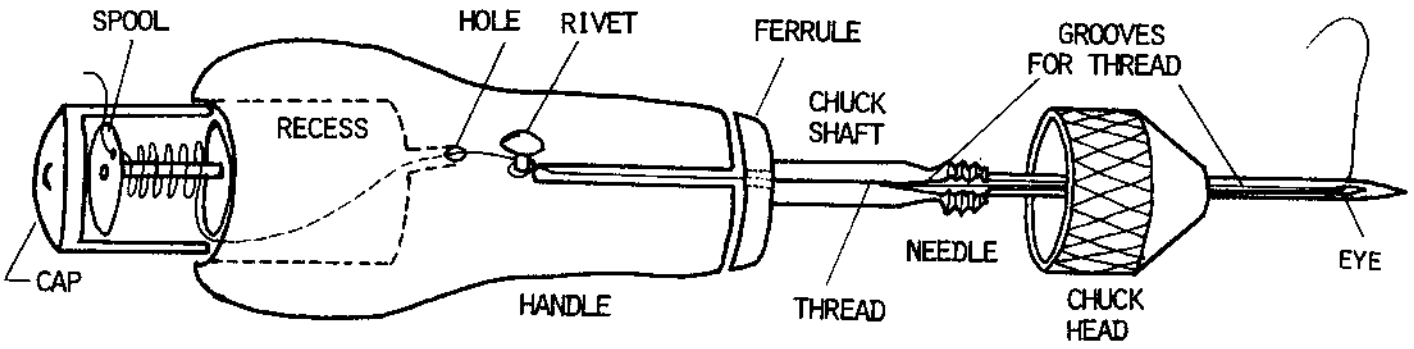
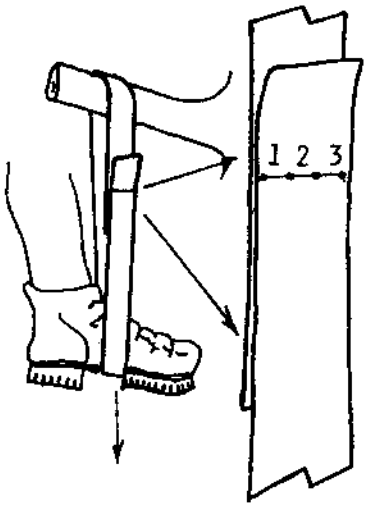


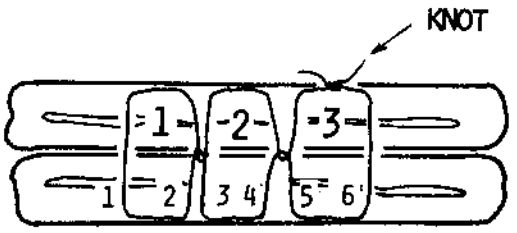
FIGURE B

Illustrations by the author and reinked by the editor.

THE STITCHING AWL When your life depends on the way you use a tool, it is a good idea to look it over and figure out how it works and why. (See figure B) Pry out the cap at the end of the handle and remove the spool. Don't wind too much thread on the spool; it has to turn freely in the recess or you will have trouble. Feed the free end of the thread into the recess and out the hole. Put the spool back in the recess and replace the cap. Take one turn of thread around the rivet. Then push the thread into the slot in the handle and under the ferrule. Unscrew the chuck head and put a needle in the chuck shaft making sure the long groove in the needle lines up with the groove in the chuck shaft. Lay the thread along the groves in the shaft and the needle and run it through the eye. Screw the chuck hed back in place checking to make sure the thread is properly seated in the groove through the chuck shaft threads. Screw the head on firmly, but don't overdo it.

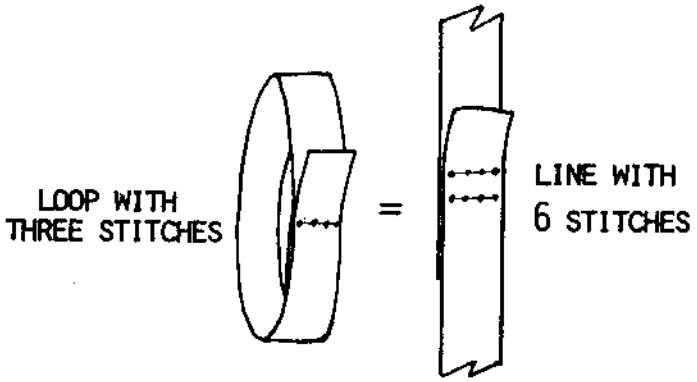
STITCH AND TEST The above test of thread strength was to make sure it had a practical amount of strength for hand stitching. (Machine stitching is another matter) The strength of the sewn joint also depends on the material and how you do the stitching. Select a two-foot length of material and sew it into a loop using only two or three stitches running across the joint, not lengthwise. (But first read the sections below on how to do the stitching) Test this loop in the same manner you did the thread coil, only don't coil the loop, just hang it and step in it. (See Figure C) If in the initial test of thread strength you got 25 lbs. per thread, you might expect a sewn joint with three stitches to hold 150 lbs.; and since the loop has two sides, a 300 lb. man should be able to stand in the loop and step up and down without rupturing the joint. Don't be too surprised if it is only half that strong! The thread suffered some abrasion during stitching, it is





CROSS SECTION OF WEBBING AND 3 STITCHES

FIGURE C



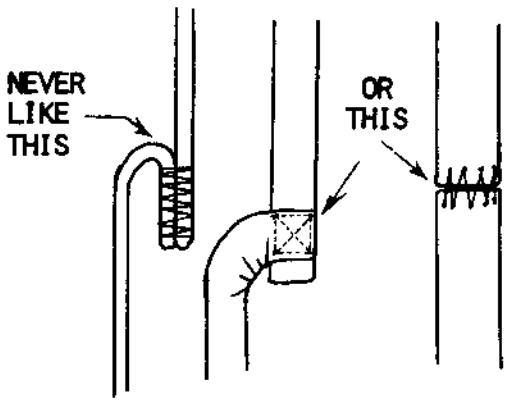


FIGURE D

making very sharp bends, and if the stitches are not all uniformly made, one stitch may be stressed more than the others. If, for example, you find it takes three stitches to support you in the loop test, then; it will take six stitches if your are sewing pieces to make a belay line.(See Figure D)

SAFETY FACTOR Up to this point you have been finding the **MINIMUM** number of stitches to support your weight while making ordinary movements and efforts. What about extreme efforts or falls? What about wear on the threads and the weight of your pack? For a safety factor of ten, the prevous example would indicate using 30 stitches for a loop sling or 60 stitches for a belay line.

STITCHING Holding the pieces together in correct alignment while stitching can be a problem. Cement the parts together first with canvass grip or some other non-hardening cement. Pull several inches of extra thread through the eye of the needle. Then push it through the fabric as far as it will go. Pull the needle back half way and you should get the configuration illustrated in Figure E2. Pull on the loop formed at the side of the needle until the free end comes through. Pull enough extra thread to equal twice the length of the seam to be sewed plus three inches for tieing. (See Figure E3) Withdraw the needle, move it over 1/8th of an inch and start the next stitch. If there is more than a 1/2 inch of slack where the free thread comes out of the needle eye, remove this slack where the free thread comes out of the needle eye. Remove this slack by pulling thread through the eye to the opposite side of the needle. (See Figure E3) Push the needle all the way through and withdraw it half way. Run the free end of the thread through the loop that forms at the side of the needle and pull it all the way. (See Figure E4) Withdraw the needle and you should get a result similiar to Figure E5. Grab the threads on opposite sides of the fabric and pull as needed to move the point of thread crossing to the middle of the fabric layers. (See Figure E6) Give another final balanced hard pull on both threads to tighten the stitch enough that it depresses the fabric and lies below the general surface...This works only with soft webbing. If you take too long a stitch, this condition will be difficult to realize. Consider 1/4th of an inch to be the extreme upper limit to stitch length.

Getting the stitches to cross over and lock in the middle as in Figure E7 is the standard way as done by a properly adjusted sewing machine. The sharp bends

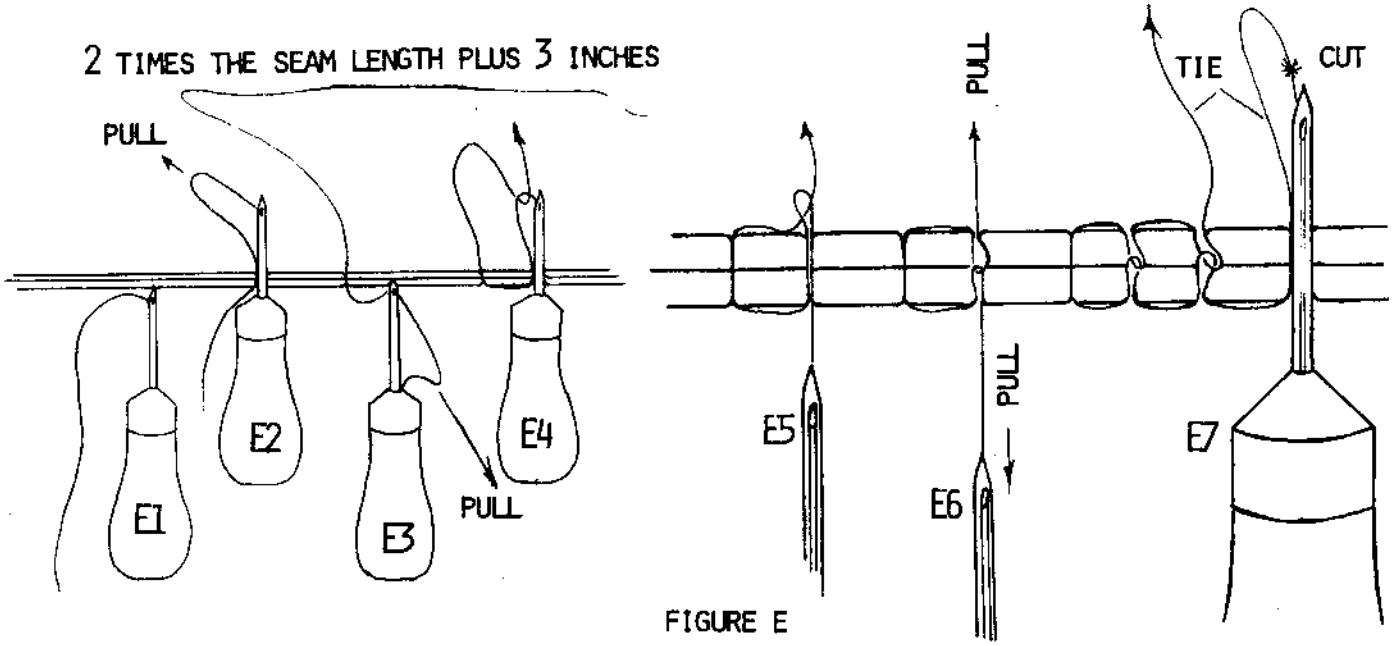


FIGURE E

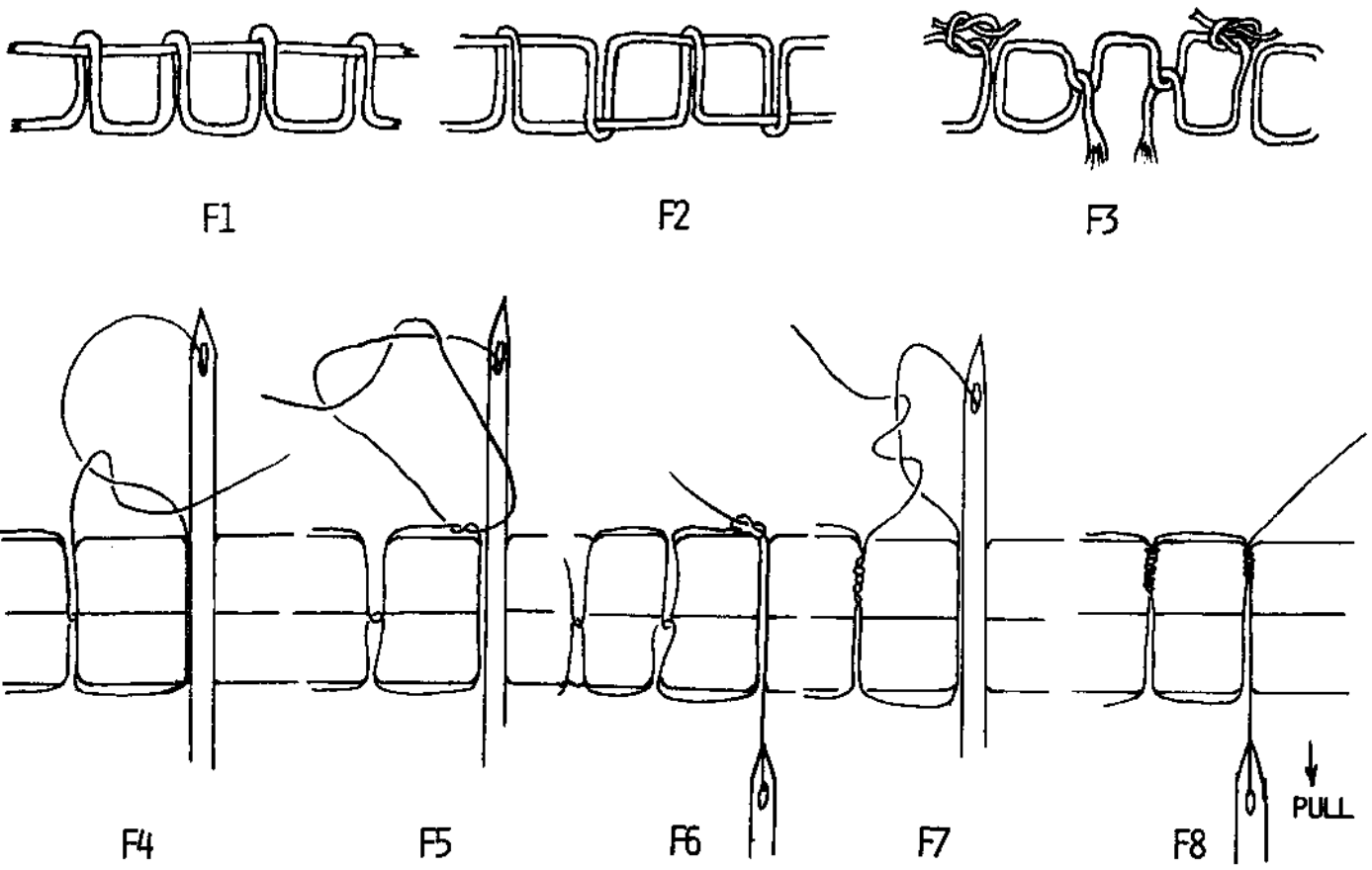


FIGURE F

are squeezed by the material making it less likely that there be slippage allowing the stitches to loosen in case a thread breaks. That's theory. In practice it is difficult to do it right with a stitching awl. If you don't take care you might get the result shown in Figure F1. The top thread will pull out easily if it gets broken.

An easier alternative is shown in Figure F2 with the sharp bends alternating between top and bottom. Some cavers tie knots every few stitches and start over again so a broken thread can't spread its effect very far. (See Figure F3) A square knot can be tied without cutting the thread. (See Figure F4, 5, & 6) Not quite so effective, but easier is the method shown in Figure F7. When you pull the free end through the loop, as shown back in Figure E4, do it two or three times. Withdraw the needle and pull hard on the lower thread to pull the twisted part below the surface as in Figure F8.

ENDING AND SECURING When you get to the last stitch, instead of putting the free end through the loop, pull on the loop to draw through several inches of extra thread for tieing. Cut the thread and withdraw the needle. (See Figure E7) Pull the two ends of thread tight and tie a triple square knot. This knot can be made secure by melting it down with a solder gun. Some cavers paint the knot and all of the stitching with non-hardening cement.

WHICH DIRECTION TO STITCH Tubular nylon webbing is a woven fabric. The "warp" consists of a single-strand helix wound 14 turns to the inch. This forms a non-load-bearing frame through which the longitudinal loadbearing strands, or "woof" are woven at 40 per inch. (See Figure G) Seat belt webbing is a litle fancier, but has the same structure in effect. If you run your stitching parallel to the woof, it will sink down between the strands and be protected from

abrasion. But this way only gets a grip on the warp and a longer over-lap of material is needed to get strength. Stitching cross-wise the webbing binds together the load-bearing strands of the two pieces of webbing...and that is exactly what needs to be done. The exposure of the cross-stitched threads will be minimized if you use short, tight stitches.

If you run your stitching parallel to the webbing you may discover that the length of sewn loops or straps turns out to be shorter than planned. Take a look at Figure H and you will see why. Imagine joining two pieces of webbing with a single, very long stitch as in Figure H1. When this stitch is tightened you get the inevitable result shown in Figure H2. When this joint is stressed the threads will bear the whole load. Cross-wise stitching results in narrowing the webbing instead of shortening it, and it binds the load-bearing strands together with friction so they take the load.

However you do it, don't wait until the last minute before going caving. Take plenty of time to think about it, do it right, test it, and if in doubt take it down to the harness shop and have it gone over with a sewing machine.

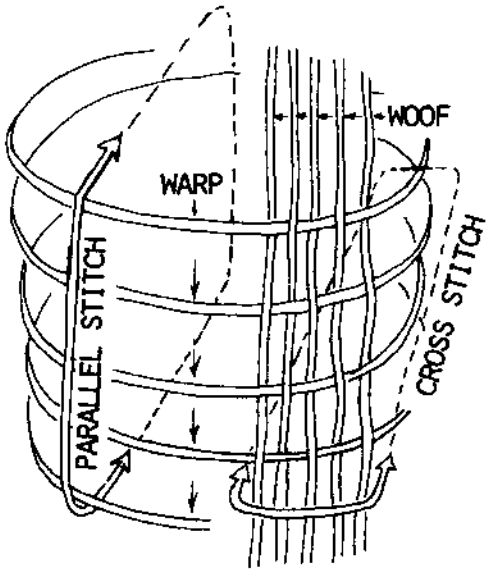


FIGURE G

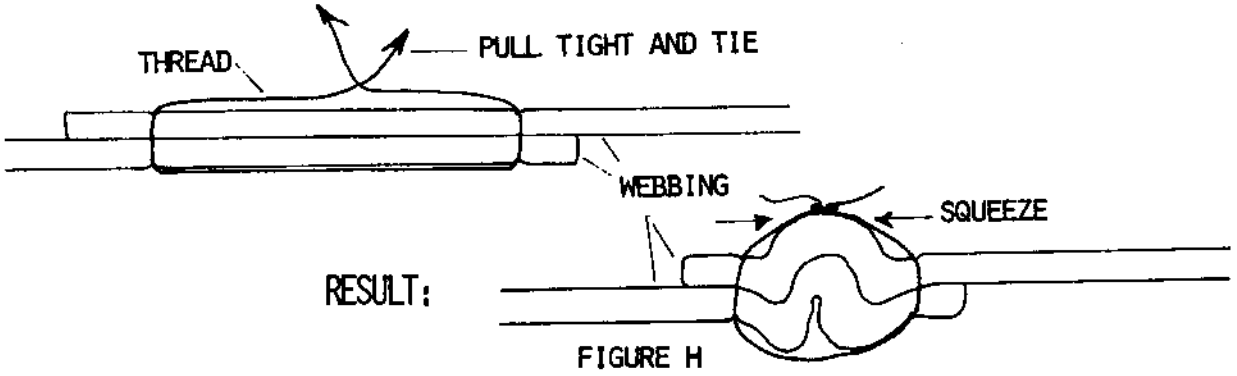


FIGURE H

FIGURE EIGHT DESCENDERS—SHOP WISELY

BY PETER S. SPROUSE

The **Figure Eight** is a safe and easy to use descender for drops up to 80 meters. It is lightweight and compact, making it an ideal replacement for the rappel rack when no long drops are to be encountered. It provides sufficient friction when tethering a dufle of gear below the seat sling (a bit fast, maybe, on a new rope).

Since there are ten or more different models of **Figure Eights** currently being produced, the choice can

Figure Eight Descenders

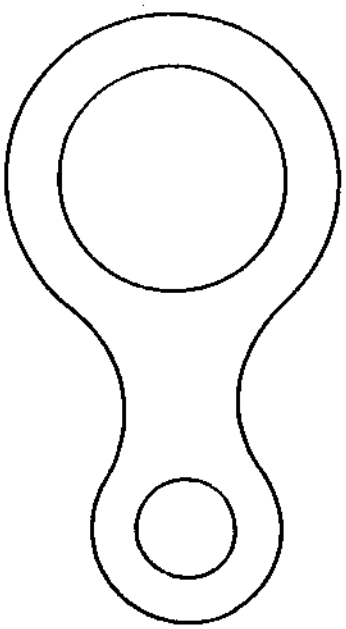


Figure Eight

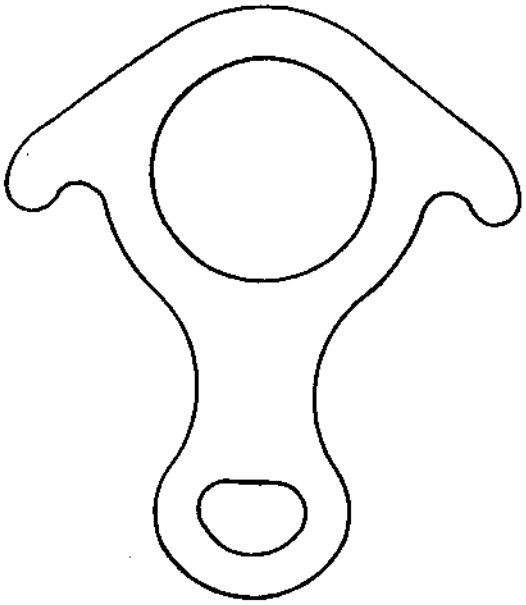
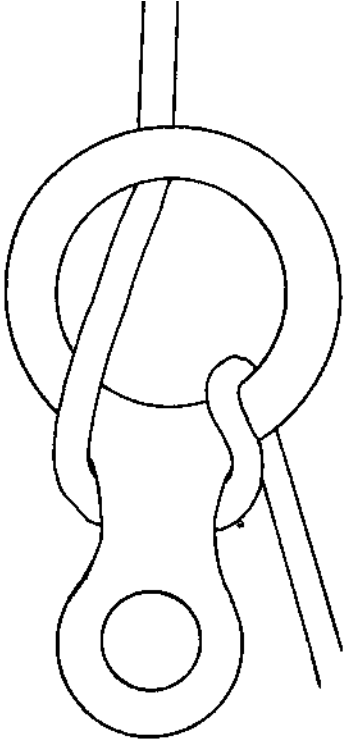


Figure Eight With Ears



Normal Rope Position

be perplexing. But despite their similarity, there are several major diferences to be considered.

Figure Eights come in two basic forms coated and uncoated aluminum. There are also two basic sizes--large and small. The larger units are about 16cm as opposed to the smaller which average 13cm long. The larger descenders are more massive in the main eye and neck, where wear occurs, which means a longer lifespan. Large Eights usually cost several dollars more than the small ones also.

Some of these descenders, including the CMI and SMC models, have a hard black coating on them to retard wear. While the coating is intact, the rope doesn't wear grooves in the descender. The life of this coating is shortened when used on dirty ropes. Once the coating is breached, it creates a sharp edge on the sides of the developing groove in the aluminum body. These sharp edges cause rapid wear on the rope surface. A descender in this condition will abrade off a large ball of nylon fur on drops as short as 20 meters. This does not occur with uncoated descenders, since bare aluminum wears smoothly. At least one large size uncoated Figure Eight is available made by Clogwyn. Wear rates on this uncoated Eight do not seem to be excessive, due to its greater thickness.

Some descenders, such as the Russ Anderson large Eight, have an anodized coating on them. The orange colored anodization on the Anderson is thin and comparatively soft, and does not cause any sharp edges when worn.

On rare occasions, Figure Eights have been known to "lock-off" accidently, jamming such that the rope will not slide through. A lock-off position occurs when the rope, normally wrapped at the neck and base of the main eye, slips up to the top of the eye. Since slack must be created before this happens, accidental lock-offs are liable to occur on unusual maneuvers only, such as when working on a ledge. In such a case a lock-off would be no problem, because it would be an easy matter to recreate the slack to slide the rope back into its normal position. But in certain situations it could be trouble, like after penduluming free off a ledge, or in a waterfall. (James Jasek, Editor comment: A lock-off in a dangerous situation is even the more

reason to rappel with your climbing rig on. This would enable you to remove tension from the rope and reposition the rope.)

Several models are available with **ears** on the main eye, which serve to prevent the rope from sliding up into an accidental lock-off. The rope can be manually maneuvered into the lock position when desired, which is handy as a safety when working on ledges or at the top of drops. Russ Anderson currently offers two models of eared Figure Eights (one with the addition of a belay slot for rockclimbing).

Any descender that has been dropped a long way could develop internal cracks. Cast units are probably more susceptible to this than those milled out of plate aluminum.

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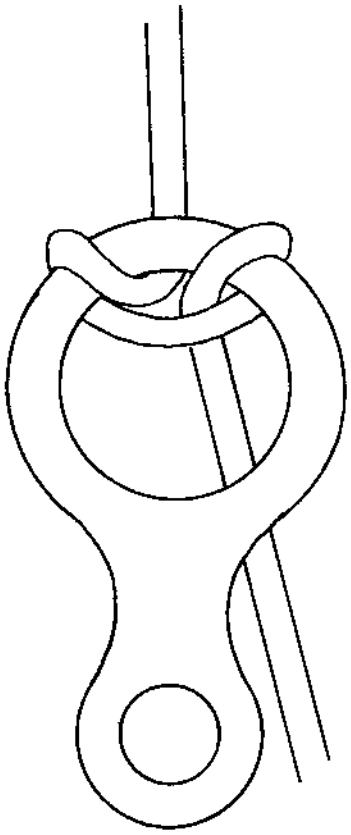


LOCK-OFF POSITION

A SAFETY HINT

BY MARION VITTETOE

Recently I read an article (CRF Manual) on figure 8 descenders. I would like to pass on a safety hint concerning this article that I feel is worth thinking about.

The article stated that the correct way to rig the Figure 8 ring is to push a bend of the rigged rope through the large hole, (Fig. 1) then loop it **under** and **over** the small hole. (Fig. 2). The rigged 8 ring is then clipped to the seat harness with a locking carabiner making sure the loop around the waist of the 8 ring is in the up position. (Fig. 3)

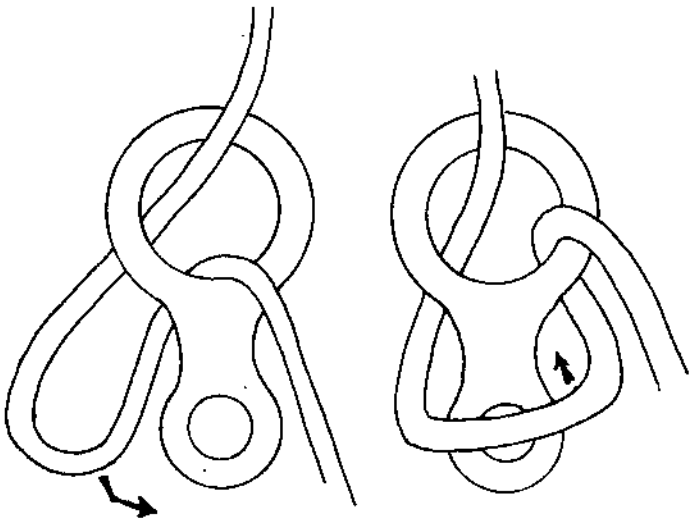


FIGURE # 1 FIGURE # 2

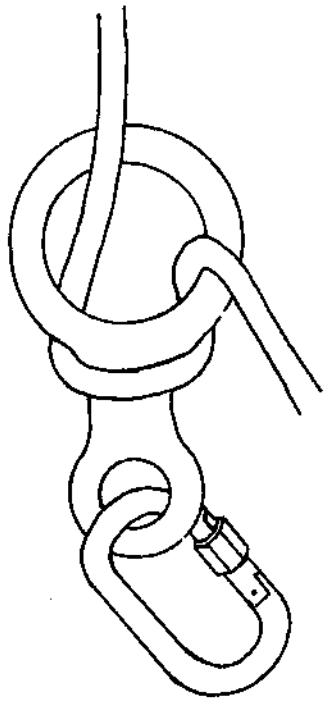


FIGURE # 3

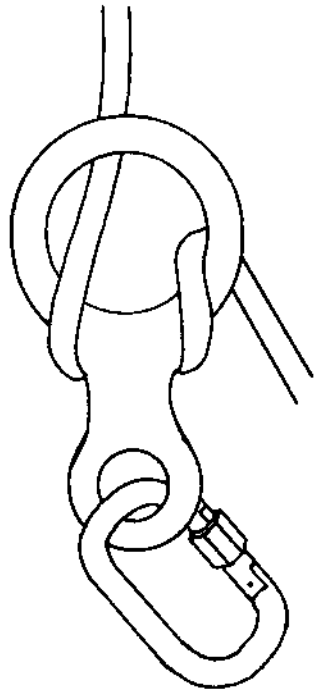


FIGURE # 4

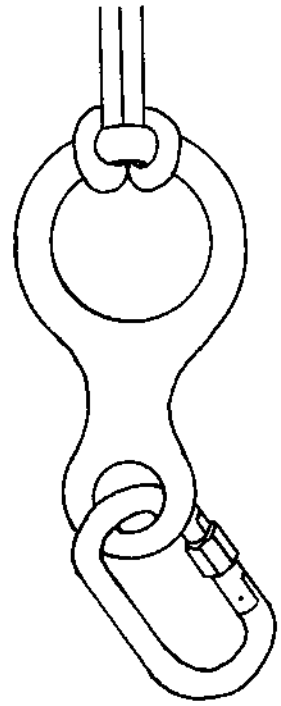


FIGURE # 5

WARNING! If the 8 ring is turned to where the loop around the waist is down, (Fig. 4) the rope can flip and form a half hitch, larks head knot or what ever you call it. (Fig. 5) This tends to stop your rappel, making it impossible to continue or untie the knot without ascending gear. The circumstance that the 8 ring is most apt to lock up is when a rappel is done over a lip or overhang.

This may be the reason a group caving in Mexico had so much trouble with their figure 8 rings. (See the July 1982 NSS News).

THE BIKINI HARNESS

BY BRUCE W. SMITH

"Damn this harness!" I said to myself several months back during a Schoolhouse Cave, W.VA. trip. Realizing that not only was I sick and tired of this harness, but every seat harness I'd ever used. They've squeezed my pelvis until it was black and blue, they've ridden up on my back and cut my flesh, they fall down around my thighs making walking, climbing and maneuvering difficult. The list of problems with harnesses I have encountered over my 23 years of caving seems to go on and on!

Was there no answer...? I determined that the "Fit-all" harness (a harness that fits everybody) was nolonger the answer for me...So I asked myself a question..."What fits my lower torso snugly, is comfortable, provides good ass support and allows for complete freedom of movement..." Answer! "My **bikini** underwear." So I set about designing a harness that follows the lines of a pair of bikini underwear.

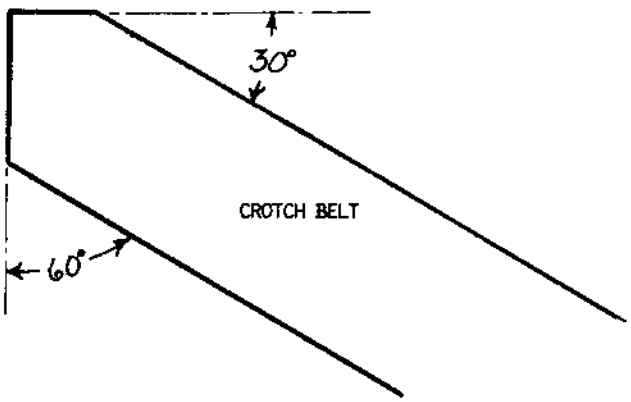
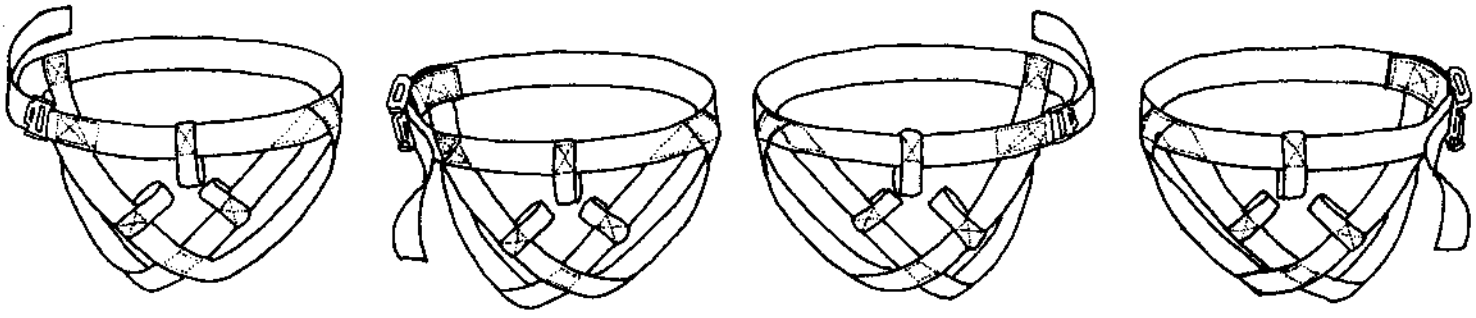


FIGURE # 1

With the remaining strap cut the end so that it forms a 60° degree angle as shown in figure # 1. Burn or seal the ends. This becomes one end of the **Crotch Belt.**

At this point you have to make a decision! Realizing that this harness is tightened by a cinch buckle at your hip (See figure # 2) Which side do you prefer and do you prefer tightening by pulling up or pulling down... You have 4 options, so design your harness accordingly.

Sew the **Waist Belt**, the **Crotch Belt** and the **Cinch Buckle** as shown in Figure # 3.



4 OPTIONS; BUTT SUPPORTS NOT SHOWN

FIGURE # 2

MATERIALS NEEDED

3 feet of 1" inch tubular webbing
15 feet of 2" seat belt strap(may need as little as 11')
1 2" Cinch buckle
Sewing awl or machine
2 1" **ID** Rings can be added if equipment attachment clip-on points are desired.

START WITH THE **WAIST BELT**

Cut a piece of strap that totals the circumference at the top of your hip bone plus 2 feet...Add 6" if you cave with coveralls or other thick clothing. Put this piece aside.

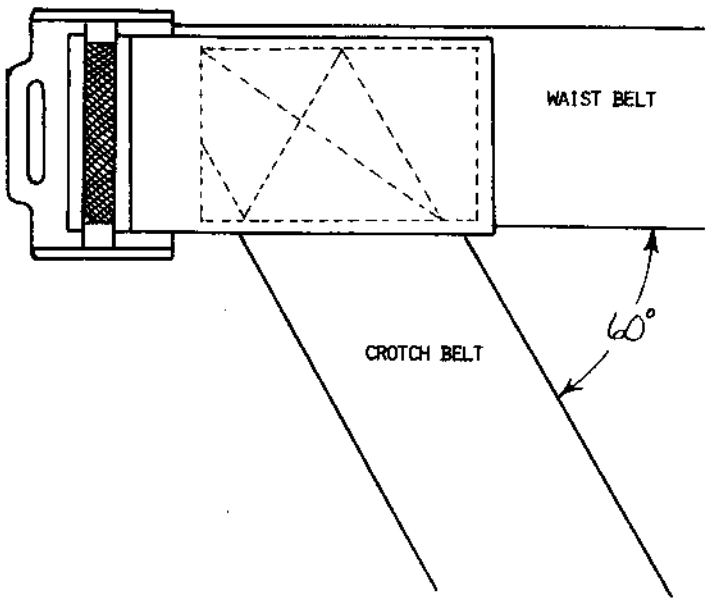
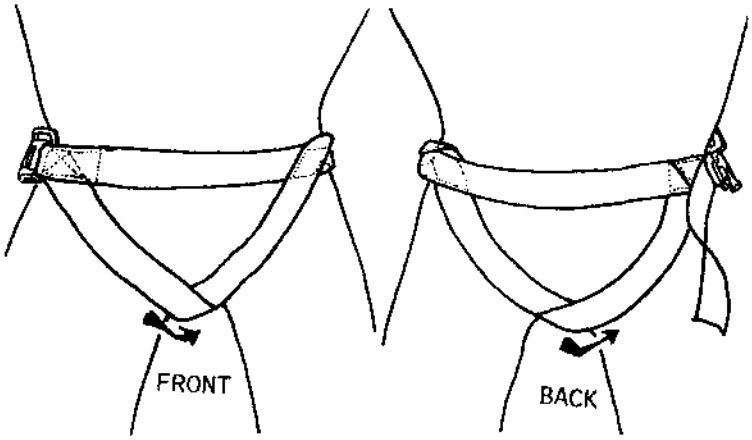


FIGURE # 3



FITTING THE CROTCH BELT

FIGURE # 4

COMPLETE THE FITTING OF THE **CROTCH BELT**

This part will require the assistance of a close personal friend....Position the **Waist Belt** on your hips where it feels most comfortable.(Usually the same place you'd put a belt in a pair of pants) Snugly wrap the **Crotch Belt** as shown in Figure # 4. Have a friend mark with a pen/pencil as well as staple or tape all seam junctions. Loosen the **Waist Belt**....carefully remove the harness and sew all the seams except where the crotch belts cross.

Put the harness back on and verify exactly in the crotch where it crosses. Have your close friend mark where the harness should be sewn.(See Figure # 4) Verify by standing up, feeling the snugness on each leg, that the tension is equal and proportional everywhere. Remove and sew.

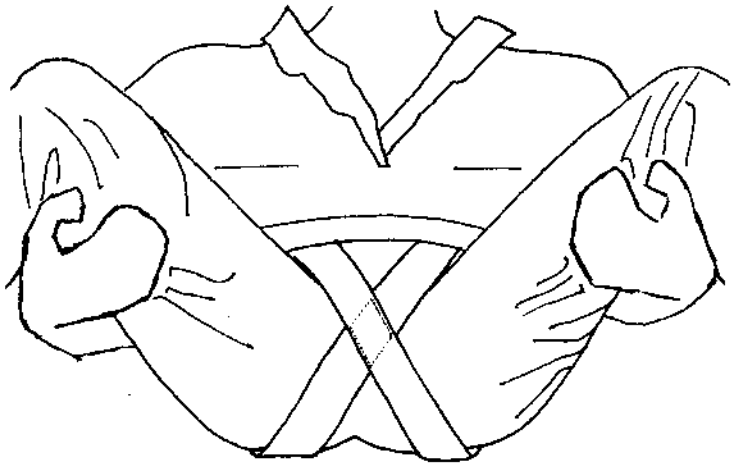


FIGURE # 5 MARKING THE CROTCH CROSS

MEASURE AND MARK THE **BUTT SUPPORTS**

Put your harness on and have your close friend thread and mark the **Butt Supports**. See Figure 5. Remove and sew.

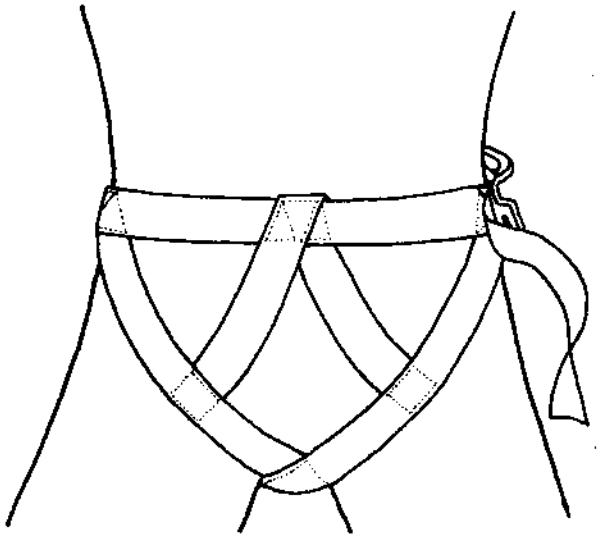


FIGURE # 6

BUTT SUPPORTS

CONNECTION LOOPS

Finally, measure, cut and sew the **Connection Loops**. Using the one inch webbing, place a loop equadistant on each leg of the front triangle. See Figure # 6 for the proper positioning and orientation of the loops. Be sure the sewing on each loop is your best quality.

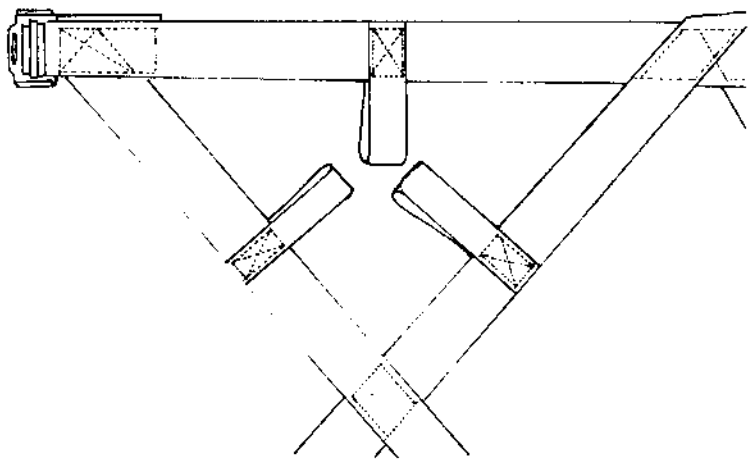


FIGURE # 7

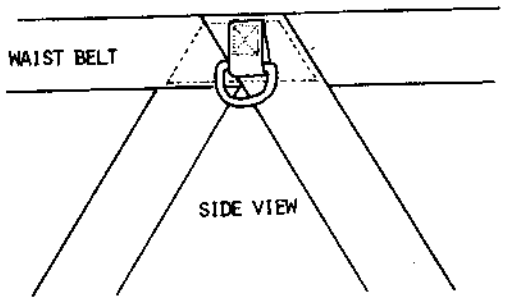
CONNECTION LOOPS

EQUIPMENT CLIP-ON POINTS

Use the one inch webbing and 1" "D" Rings and sew them to the harness where you wish. See Figure # 7 for suggestions.

ADVANTAGES

1. Comfort...Wear it all day--you'll never realize you have a harness on.
2. It never falls down. It fits like underwear.
3. It's fixed in place so any number of additions could be added(i.e. shoulder straps, back straps, bungi cord attachments, etc.)
4. There's only one leg loop. The other leg loop is formed with the cinch buckle. There's only one chance to loose your balance as only one leg must be inserted into a loop.
5. Cut the harness anywhere and you'll still be hanging.
6. For the first time I have room in my Seat Carabiner to put anything and everything while maintaining the vertical orientation of the biner. No more straps pressing against the gate.
7. The Seat Carabiner, while not only being oriented vertically is also in the proper position to receive a standard Rack properly...not sideways.
8. The leg straps don't squeeze your hips and thighs like most harnesses.
9. Freedom of movement. Full movement to climb, walk or crawl. There's no tight strap to inhibit motion. If the crawlway is tight...remove the carabiner, not the harness.
10. Light weight and simple...One buckle.
11. Surprisingly! eventhough I custom fitted mine, dozens of people of various sizes have used it and it fit. Not to mention...they liked it.
12. I couldn't think of any negatives unless sewing and seams are interpreted as negatives



CLIP-ON POINTS
FIGURE # 8

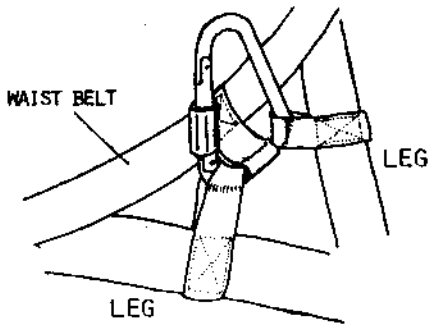
TESTING

I do very scientific testing...I use it. My wife and I both have one and used them extensively on day hike/climb trips, multiple drop caves, long caves, etc. We just put it on when the first opportunity to use it arose and never took it off.

Most recently, I had and opportunity to hang in the harness for over 6 hours. I was rubbed raw on one thigh about the size to a nickel. But the fact remains I hung in it for 6 hours with minimal discomfort.

CONCLUSION

The **Bikini Harness** has proven to be a comforfable, versatile, reliable harness that has answered many of my needs in a harness. I predict that some entrepreneur will pick up on the design and make their mark in caving archives. Until then I plan on caving in comfort...for a change.



THREADING THE CARABINER
FIGURE # 9

AN ANALYSIS OF VERTICAL CAVING ACCIDENTS 1967–1981

By Allen Padgett

It has come to be known that one of the great truisms of mankind is that history repeats itself. With this in mind let us look at vertical caving accidents. By using data from American Caving Accidents (issues of 1967-1981) those reports dealing with some aspects of vertical caving were compiled and will be examined here. A look at the history of accidents will allow us to work at prevention of future accidents.

Of the 132 reports compiled the first obvious difference is the ability of the victims/subjects. There are those Dufus types with no knowledge of vertical caving techniques who do some really stupid things. Then there are those of us who are vertical cavers who happen to have an accident.

First, Let's look at the Dufus accidents. (38 were reported--see The Chart for the totals). The most popular form of insanity is to do a pit hand over hand on any readily available rope of usual dubious quality. This type constitutes 76% of Dufus accidents the other 24% are simple variations on the theme "I got this far, now I don't know what to do". Eventually someone must come and help the hapless innocents.

How might Dufus vertical accidents be prevented? Usually these types have some general caving experience in horizontal caves. If the NSS were to reach out to these people already caving, the transfer of knowledge might take place and prevent insane accidents. The placement of durable signs at certain attractive nuisance type pits might prevent future problems there. Somehow though, there are those whose valuation of life is low and can't be reached no matter how hard you try. But, try, and reach out to inept new cavers you meet because they are tomorrows inept vertical cavers.

Now, for the other type of accident...those involving someone who has knowledge of vertical caving techniques. These should concern us as vertical cavers. As the cartoon character Pogo said, "We have met the enemy and he is us."

There were 94 reports involving 8 fatalities and 48 injuries. (See The Chart for the totals) Three large groups of accident types can be seen in the reports. After these 3 major groups there are 3 more smaller groups and then an accumulation of diverse types to end out the list.

The grouping most prone to injury! is that involving **ROCKFALL**. Almost 20% of vertical caving accidents involve falling rocks. Rocks are dislodged at the top of a drop, by climbers on rope and by the rope itself. Prevention can start by staying out of the rockfall zone whenever possible. Move away after rappelling down and upon ascent do not approach the rockfall zone until the climber ahead has cleared the lip, gotten off rope and moved away totally. When you must be in the rockfall zone proper signals from those above warning cavers below of falling articles is critical. These warnings may help the cavers below to take cover or take evasive action. If all else fails a REAL hard hat (Petzl ecrin, Joe Brown, Ultimate, MSR) can prevent serious injury. Toy hard hats(construction hats, miners caps, etc.) provide a false sense of security and are unfit for any vertical caving activity. In fact, numerous horizontal caving accidents call out for better hard hats and chin straps.

VERTICAL CAVING ACCIDENTS 1967-1981

DUPUY

6 FATAL

- 66% 4 Hand over hand
- 17% 1 Old fence
- 17% 1 Home made ladder

8 INJURY

- 75% 6 Hand over hand
- 12% 1 Old cable broke
- 13% 1 Broke rope pulling with car

34 INCIDENTS

- 79% 19 Hand over hand
- 9% 2 Gear tangles
- 4% 1 Improper gear
- 4% 1 Rope too short, no ascent gear
- 4% 1 Panicked, would not climb

38 TOTALS

- 76.3% 29 Hand over hand
- 7.8% 3 Wrong material for descent means
- 5.2% 2 Gear tangles
- 2.5% 1 Broke rope pulling with car
- 2.5% 1 Improper ascent gear
- 2.5% 1 Rope too short, no ascent gear
- 2.5% 1 Panicked, would not climb

VERTICAL CAVERS

8 FATAL

- 50.0% 4 Harness problems
- 25.0% 2 Slipped at the top w/rope unrigged
- 12.5% 1 Anchor failure
- 12.5% 1 Improper rigging

48 INJURY

- 32.0% 16 Rockfall zone
- 15.0% 7 Anchor point failed
- 13.0% 6 Out of control rappel
- 11.0% 5 Unbelayed ladder climbs
- 8.0% 4 Rope too short (rigging problems)
- 6.0% 3 Rope broke (1 acid, 2 sharp edge)
- 4.0% 2 Ascender slid down rope (Jumar & Knot)
- 4.0% 2 Harness failure (Carabiner & Litter)
- 2.0% 1 Improper belay
- 2.0% 1 Hair in rack
- 2.0% 1 Scaling pole failure

38 INCIDENTS

- 21.0% 8 Harness failure
- 18.5% 7 Rigging problems
- 10.5% 4 Exhaustion
- 8.0% 3 Ascender slid down the rope
- 8.0% 3 High water problems
- 8.0% 3 Belay snarl
- 5.0% 2 Anchor failure
- 5.0% 2 Rockfall zone
- 5.0% 2 Animal problems
- 2.5% 1 Ladder failure
- 2.5% 1 Rope failure (acid)
- 2.5% 1 Scaling pole failure
- 2.5% 1 Fire at the lip

94 TOTALS

- 19.1% 18 Rockfall zone
- 14.9% 14 Harness failure
- 12.8% 12 Rigging problems
- 10.6% 10 Anchor failure
- 6.4% 6 Out of control rappel
- 5.3% 5 Unbelayed ladder climbs
- 5.3% 5 Ascenders slid down the rope
- 4.3% 4 Rope broke
- 4.3% 4 Exhaustion
- 3.2% 3 Belay snarl
- 3.2% 3 High water problems
- 2.1% 2 Slip at the top of the drop
- 2.1% 2 Animal problems
- 6.4% 6 Other

The second major group of reports involve **anchor and rigging** problems. This includes anchor failure and various problems with the rigging of ropes. Improper placement or even the wrong length of rope. Often rigging problems result in simply getting stuck half way down a pit. There were 10 anchor failure reports and 12 rigging problem reports. The most common problem in anchor failure is the use of a natural projection and then the rock failed, moved or the rope slipped off. In many instances serious injury was averted by the proper backing up of the primary rig point. An area showing several problems in rigging is the horizontal traverse. Caution as to the direction of pull on anchors is needed.

The most common rigging problem that could be prevented is rigging a rope too short, then rappelling off the end. A knot every time on the end prevents this accident type that tends to concentrate on experienced vertical cavers. There was only one reported knot failure. A rope of soft construction when loaded on climbing halfway up a pit came untied at the knot resulting in injuries. The other common rigging problem is that the rope is somehow pulled up the pit and left on a ledge or hung up and does not reach the bottom anymore...stranding cavers below a drop.

There were 14 **harness related problems**. Harness failures resulted in 50% of the fatal reports, but only 4% of the injuries. So, a harness failure tends to be a serious affair. The most common problem is stitching coming unsewn. The next is webbing coming untied then the last is poorly designed or ill fitting harnesses that result in failure. The most room for prevention is in the maintenence of sewn harnesses with particular attention to the type of thread used to sew the rig. Sewing machines have 2 bobbins...make sure BOTH are holding nylon thread.

Chicken loops...an often overlooked system component that can so often avert a serious accident when a major system component fails. There were several reports of harness failure where chicken loops saved the subject and several reports where if chicken loops had been used a fatality would not have occurred.

Rappels are supposed to be controlled descents, but there were 6 reports of **out-of-control rappels** and all resulted in some injury...several serious. There are two causes.... First, not being familiar with the proper use of the rappel device and Second, not being familiar with the changing friction on a long drop (300 foot+... the Long Drop Phenemonon). Bottom belays prevented several serious accidents. But where not effective the common injury is a compression fracture of the spine...a serious thought.

Comprehensive training of novices in the use of a rappel device is needed. Not merely letting them use the device with limited practice, but thorough training in the use of and theory of operation. With the safety factor of the bottom belay we shouldn't think of the unbelayed rappel like we think of the unbelayed ladder climb...a dangerous folly. Even though there were 5 reports dealing with unbelayed ladder climbs. There were 4 reports of improper or snarled belays. Essentially ALL ladder climbs should be belayed properly. Several injuries were reported from less than 20 foot climbs.

The last major catagory is **rope failure**. There were four reports...two resulting from acid exposure and two from being abraded. The two abrasion cases were different. One was Polish rope (less abrasion resistance than cotton undershorts), the other was essentially cut by basalt rock at a very sharp edge.

The acid cases were not obvious until failure occurred. The most obvious cure here is to keep those cave light batteries away from rope at ALL times. Acid failure is the invisible villian.

The above discussed accident reports account for 69% of all reports and deserve our special attention. There are however the other 31%. Of particular note are the two fatalities as a result of falling into a pit before/after being roped up. There were several instances(5) of ascenders sliding down the rope. There were also 4 reports of just pure exhaustion rendering the caver unable to climb. Look at the chart and read your copies of American Caving Accidents. Then learn from history and if you have or see an accident, report it properly to ACA, so that others may learn from history and avoid becoming a victim of ignorance. If we learn from our mistakes we have come a long way, but only if we are aware of what the mistakes were.

A QUICK INSTALLATION CHICKEN LOOP

BY JOHN GANTER

Although many vertical rigs have their chicken loops built in (adjustable with D-rings, etc.) there are situations where a seperate loop works well.(i.e. illus.# 1).

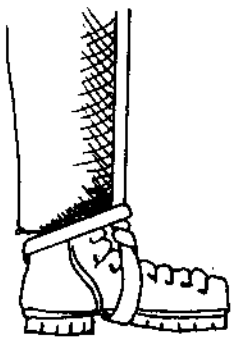


ILLUSTRATION # 1

I used to use a solid sewn loop which just barely fit over my foot and ankle. Invariably, I would awaken before a cave trip, put on socks, clothes coveralls, some more socks, lace up 25 speed-laces and then, while standing in a muddy pasture, realize that I had not installed the chicken loops!

Now I use a sewn loop with a small Quick-Link to close it. This retains the advantages of a snug loop while allowing quick installation. Of course, you can do the same thing with a water knot but it is not as fast and convenient. (see illus. # 2).

One more tip! when you sew this up, be sure to allow for long underwear, socks, wetsuits, etc. which will increase your ankle diameter.

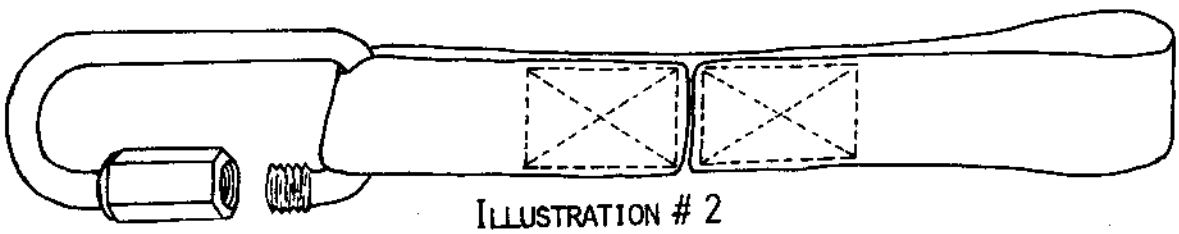


ILLUSTRATION # 2

THE LAZY CAVER'S SIMMON'S ROLLER HARNESS

By CJ Rushin-Bell

So, you just got your Simmon's Roller and are ready to try it out - only now you are faced with the problem of having to make a special chest harness before you can use it? This can be a problem if A. You are lazy, B.You don't have access to a heavy duty sewing machine, C. You don't have the time anyway, or D. None of your friends have B or C . Take heart, there is a solution, if you happen to have a few extra bucks.....

While at the '83 NSS Convention in Elkins, W. Va., I noticed Karen Wark (NSS #20537, from Florida) had an unusual harness for attaching her Simmon's Roller. Karen, both a sailor and caver, had adapted a sailor's polypropylene webbing safety harness to use with the roller. She provided me with the address of a marine products supplier and I ordered the same harness on sale for $16.89, plus postage and handling. It normally retails for $23.95.

I adapted my new harness to the Simmon's Roller as Karen had done and have been happily ascending ever since. Here's all you do:

1) Remove the "D" rings and lifeline supplied with the harness.

2) Rethread the webbing through the flat buckles as shown in Figure C.

3) If you normally attach your shock cord at the shoulder, sew a "D" ring on the shoulder strap.

4) Slip your Simmon's Roller through the buckles.

That's it! The harness is light, comfortable (2 1/2" wide main belt), totally adjustable, and once set up to your size is quick (one step) to get in and out of. It also eliminates any concern of nylon (webbing) rubbing on nylon (rope) through the roller during ascent.

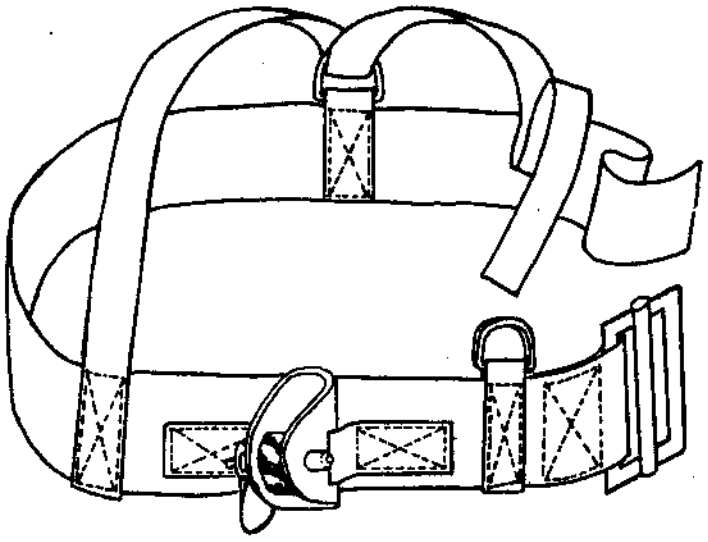


FIGURE A
HARNESS POPULARLY USED WITH SIMMON'S ROLLER.

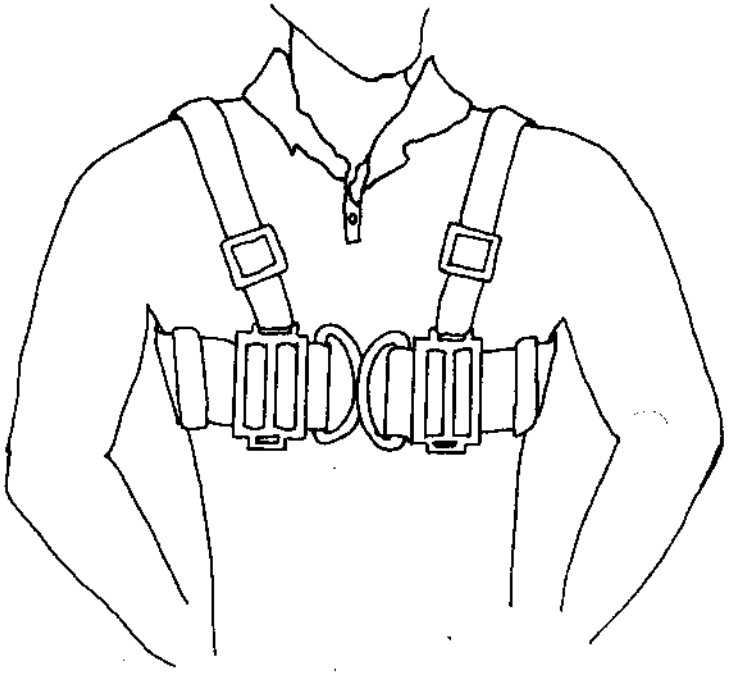


FIGURE B
JIM-BUOY SAFETY HARNESS. REMOVE "D" RINGS AND LIFELINE.

The disadvantages are... Its cost, relative lack of strength compared to a harness made of nylon webbing, and its lack of resistance to abrasion. The manufacturer states that all components are "7 times the required safety factor" - for sailing. As with any ascending system, it is wise to have 3 points of attachment. I run a Gibbs safety from my seat harness to just above the Roller.

The harness, marketed under the name Jim-Buoy, may be purchased from Goldberg's Marine, 202 Market St., Philadelphia, Pa. 19106. (No. 922, Adult Safety Harness with Life line, Sh. Wt. 2 lbs). Give them a call at 1-215-627-3700 for the current price and ordering information

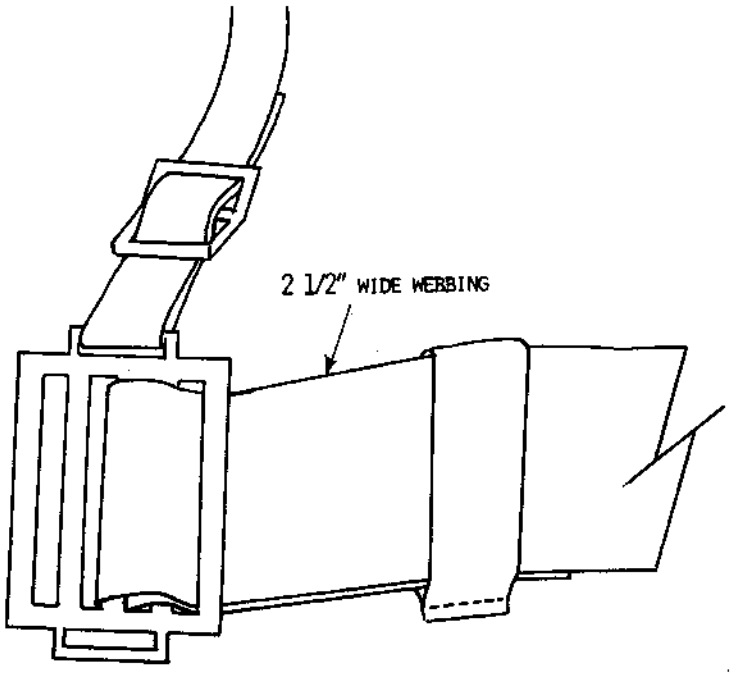


FIGURE C

RETHREAD MAIN BELT WEBBING THROUGH BUCKLES AS INDICATED.

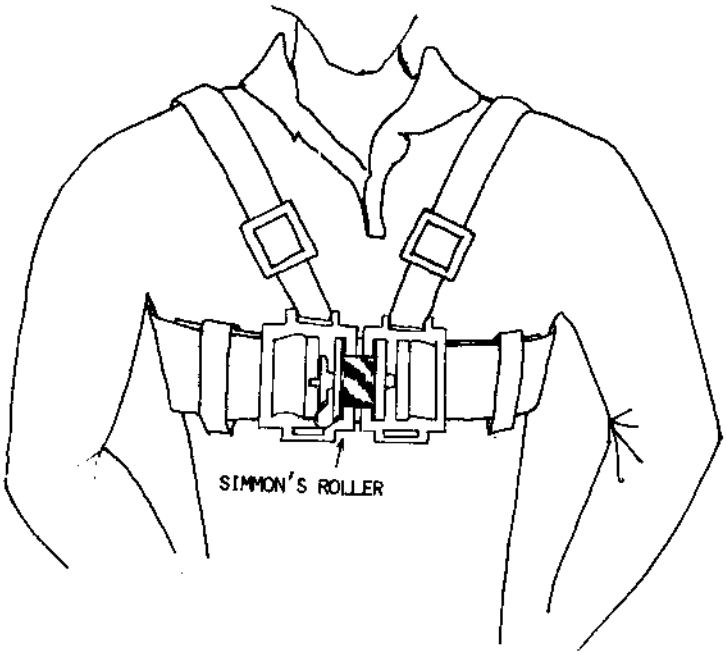


FIGURE D

COMPLETED HARNESS. NO ADJUSTMENT NECESSARY ONCE HARNESS FITS...JUST SLIP ON ROLLER AND GO.

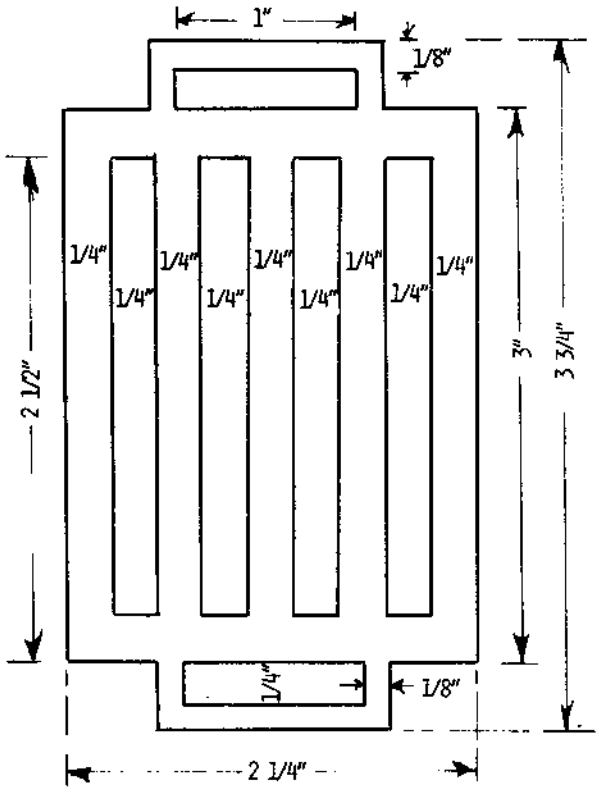


FIGURE E WORKING DRAWING OF THE BUCKLE

THE ASCENDER KNOT

By Bruce W. Smith

Have you ever watched knot racers...Some struggle and loosen each knot one by one while others seem to be able to maneuver their knots like they were Jumars. What are these people doing? First of all they're not using prusik knots...Chances are they're using Ascender knots, (a commonly excepted name for a knot referred to for years as the Helical Knot). This knot has received the attention of numerous articles over the years including a terrific historical account of the evolution and use of the knot in Bob Thrun's PRUSIKING book. Because of its ever increasing use it's important to touch base with some of these old articles and verify that we're tieing it right. For those new would-be racers out there this may be the research you've been looking for.

Bill Plummer in his NSS News article June, 1961 makes some very valid points. He claims the material that the knot is made of should be rope(not webbing) about 3/4's the size of rope your going to climb. Equal sizes tend to slip. Soft rope works best. There has been a lot of controversy over the use of polypropylene. Many tests have born out the fact that it slips under certain conditions and loads, and it tends to disintegrate after climbing a short distance... say 1000 feet.(that is 1000 feet total distance) As for racing it seems to fall in the same classification as hemp(manila)...adequate. The reason I bring it up is that it is a long known fact that whenever you wish a knot to grip the rope you put the cards in your favor if you can vary the materials and sizes. (i.e.manila slings on PMI or Samson 2-in-1 slings on Bluewater, etc.)

Plummer also suggests that the knots work well in mud, if you're inclined to climb through that stuff. There biggest advantage is that they loosen easier than any other knot and can be raised easily each time with your thumb and forefinger. At one time there was a lot of discussion as to the direction the wraps should be made (because of their use on laid ropes). This rarely becomes an issue anymore as most cavers use kernmantle ropes. If you do find yourself using a laid rope the wraps of the knot should follow the same lay.

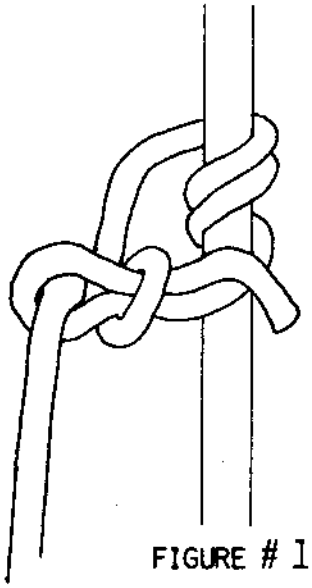


FIGURE # 1

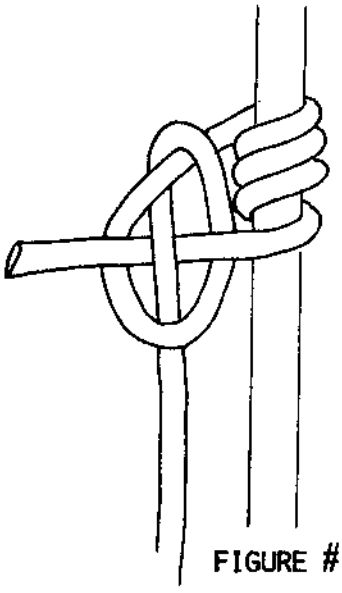


FIGURE # 2

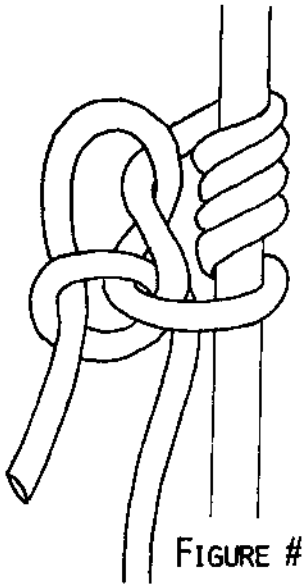


FIGURE # 3

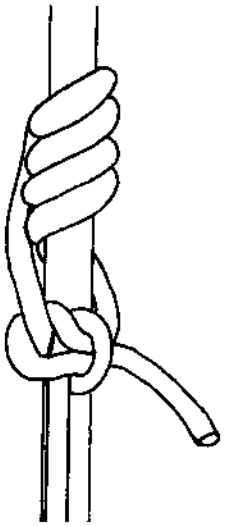


FIGURE # 4

THE ASCENDER KNOT

The tie off of the Ascender knot is critical. In every case it is some distorted form of a bowline, sheet bend or becket hitch. Studying and copying the various ways to form acceptable tie-offs is critical to your success with this knot.

Figure # 1 shows the original helical knot developed by Clarence Cook and Tony Marchi(Thrun, Prusicking 1971) Figure # 2 shows another tie-off that Thrun points out can be adjusted to take in or take out the appropriate slack. Figure # 3 indicates probably the most popular of all the tie-offs. While Figure # 4 shows what the knot looks like when it is loaded.

NUMBER 14 REPRINTED

NYLON HIGHWAY # 14 has been reprinted and is availble from either Kirk MacGregor or the Editor for $2.00. If you paid for one and didn't receive it contact either Kirk or the Editor by phone or letter.

ASCENDER FLOTATION

BY JOHN GANTOR

Many cavers use elastic "bungie cord" to float their ascenders. Unfortunately, this material has low abrasion resistance and often is not stretchy enough to give the ascender a firm pull.

One alternative is to use surgical tubing, as shown in the illustration on page 23 of this publication. I've found that the very heavy 7/16" stuff, which is used to make saltwater fishing lures, is nearly indestructible. It is super-stretchy and cave coral, chert ledges and liquid mud have no effect on it. The only place I've seen it sold is tackle shops...be sure to get natural latex rubber; the synthetic stuff is cheaper but not very stretchy. Also note that a mini Quick-Link can certainly be used instead of the rivet shown.

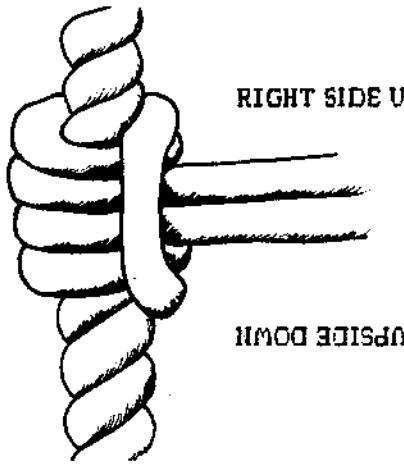
Reprinted from the Sligo Grotto's Subterranean Sun.

I guess the biggest caution I hear when I talk to ascender knot users is the possibility to top loaded pressure. If you're slipping don't grab the knot. If an upper knot slips onto a lower knot it will push it down the rope. One well known close call occured when a glove was caught in an upper Jumar...slid down the rope...releasing the top ascender knot...it inturn slid into the next knot. The climber slid rather swiftly several feet before she was able to free the glove from the Jumar. All three ascenders regripped the rope sequentially

MYTHS

BY BRUCE W. SMITH

Let's put an age old myth to rest. At a recent grotto meeting one of the members asked me what exactly is the difference between a right and wrong Prusik knot. I proceeded to do some research and discovered that in the days of laid rope, how a prusik knot was formed was important to its holding power. Today with the extensive use of kernmantle rope, my research tells me there is **No Difference**. Let's put this myth to rest.



This illustration shows the proper orientation of a prusik knot when it is **used with laid rope.**

TREASURER'S REPORT

NSS VERTICAL SECTION

1983 JUNE 22

INCOME:

Memberships	$150.15
Subscriptions	43.00
Back Issue Sales	105.40
Bank Interest	37.95
Other	0.20
Total	$336.70

EXPENSES:

EDITOR:

Initial Bulk Mailing Fee	$40.00
1983 Bulk Mailing Fee	40.00
Mailing Nylon Highway # 15	33.10
Mailing Nylon Highway # 16	39.97
Other Postage	53.89
Printing Nylon Highway # 15	210.00
Printing Nylon Highway # 16	250.00
Mailing Envelopes	74.36
Other	20.23

SECRETARY-TREASURER:

Postage	$21.53
Supplies	9.75
Other	3.00
Total	$795.83
NET EXPENSES	$459.13
BALANCE AS OF 1982 JUNE 22	$1217.24
BALANCE AS OF 1983 JUNE 22	$758.11

SECRETARY'S REPORT

NSS VERTICAL SECTION

1983 JUNE 22

Number of Single Members	187
Number of Family Members (# people)	20
Number of Nylon Highway Subscribers	23
Number of Paid Grotto Subscriptions	4
Number of NH's free or exchanged	102
Total Number of Section Members	207
Total Number of NH's Mailed	326

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GRAND RAPPEL - TOROWEEP POINT
GRAND CANYON, ARIZONA

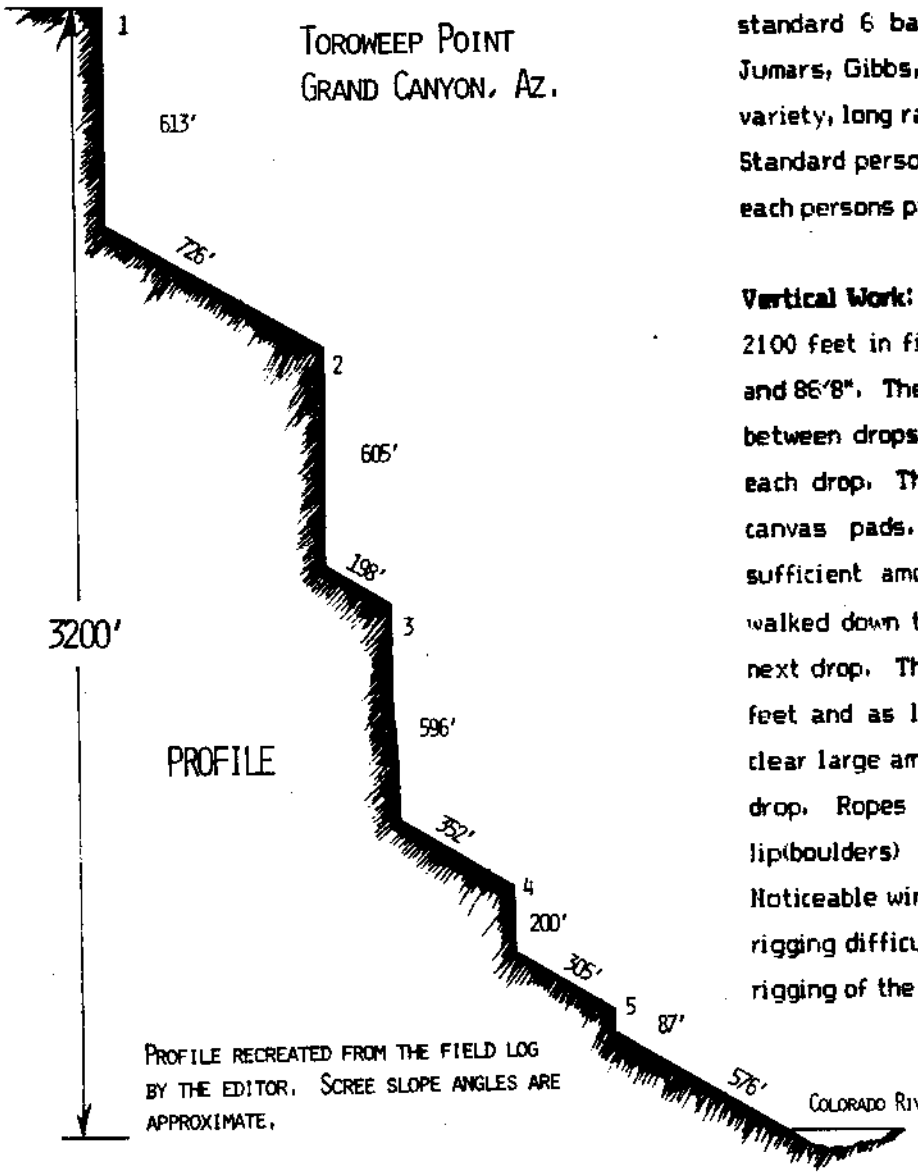
BY RICHARD SCHREIBER

October 28 - November 2, 1979

Permission was required and obtained from the National Park Service, Grand Canyon National Park months in advance.

Personnel:

Climbers: Richard Schreiber, leader; Jon Dragan, Brad Johnson, Jim Rodemaker, Steve Holmes, Anthony Williams (National Forest Service).



PROFILE RECREATED FROM THE FIELD LOG BY THE EDITOR. SCREE SLOPE ANGLES ARE APPROXIMATE.

Support: Sara Corrie, co-leader; Allen Limb, D. C. Province, George Corrie, Ike Campbell, Barbara Cannon, Judy Elsley, John Piffey (National Park Service).

Equipment:

4600 feet of 7/16" PMI low stretch, high abrasion resistant rope...one continuous piece. Rappel rack standard 6 bar, 12" and 8 bar long 16-18" length. Jumars, Gibbs, and Prusik knots. Walkie talkies (FM variety, long range). Generator electric powered winch. Standard personal vertical gear was used depending on each persons preference.

Vertical Work:

2100 feet in five drops: 613'3", 605'3", 594'6", 200'7", and 86'8". There existed extensive talus/scree slopes between drops. The rope was tied off at the top of each drop. The rope was padded with carpet and/or canvas pads. The rope was rigged by feeding sufficient amounts down each respective drop, then walked down the talus/scree slopes to the top of the next drop. The slope distances were as short as 200 feet and as long as 726 feet. It was necessary to clear large amounts of loose rock from the top of each drop. Ropes were rigged to natural tie-offs at each lip(boulders) - no artificial aids were needed. Noticeable wind currents in the canyon, at times, made rigging difficult. The rope hung on the wall during the rigging of the third drop and a rope tangle resulted. Rigging, otherwise, went smoothly. We were able to rig the entire series of drops in one day.

The drops ranged from mostly free (1 & 2) to semi-free (3) to against wall (4 & 5). Schreiber, Dragan, Williams, Holmes, Rodemaker, and Johnson (arm in a cast) descended during the rigging day. All party members walked out of the canyon via Lava Falls trail except Johnson who spent the night at the river's edge near the rope. The next day, Schreiber, and Holmes descended. All three then ascended! Schreiber (3 prussik knots in 4 hours), Holmes (Jumars in 3 hours), and Johnson (Gibbs & two Jumars).

Derigging the Rope:

As the last person reached each successive upper lip on the way up, the rope was untied and the excess was lowered down. (Ed. Recall, the rope was a contiuous piece but still rigged at the top of each drop) The rope pads were left in place at the top of the second drop. The rope was then pulled from the canyon by an electric capstan winch system. Derigging went smoothly. It took a total of 10 hours. The lengths of the drops were measured as the rope was brought up(Holmes had placed tape on the rope at the top and bottom of each drop).

Observations:

This was an experiment in long, multi-drop vertical work with single static climbing rope. The equipment worked well. The electric capstan winch hauling system proved invaluable in derigging due to the weight of the rope and the friction against many, many rock surfaces. It could have been used in rescue efforts if needed. Time and effort was saved many times over. The number of participants proved to be almost ideal. A lot of team work was required and present. No injuries, however small, occurred. The timing of the expedition went like clockwork. Emergency rescue plans were worked out prior to the trip, but were never needed. The walkie-talkie transceivers(Motorola FM receivers) were necessary for communications and activity coordination. They worked well despite lack of line-of-sight transmission. Each climber had one. The air temperature varied from 50's to 70's during the actual climbing activities. The weather for the most part cooperated during the whole event. Excellent working relationships existed with the National Park Service.

THE FLOATING CAM AND THE CHINESE FINGER TRAP by John Ganter

Shown below is an ingenious way to make a stretch cord for the floating cam. The latex tubing holds itself firmly to the pieces of copper tubing simply by being stretched over them.

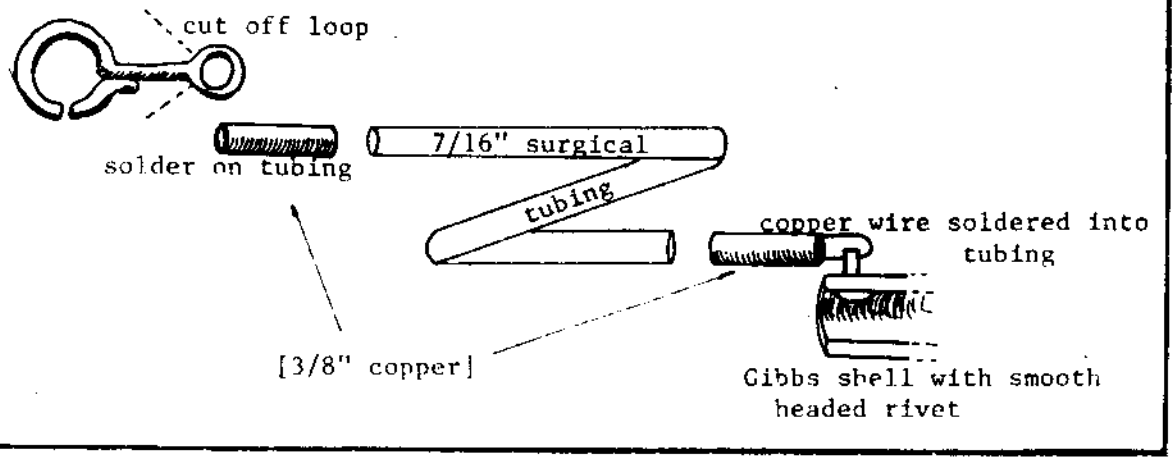


Illustration is referred to on page 20...Ascender Flotation