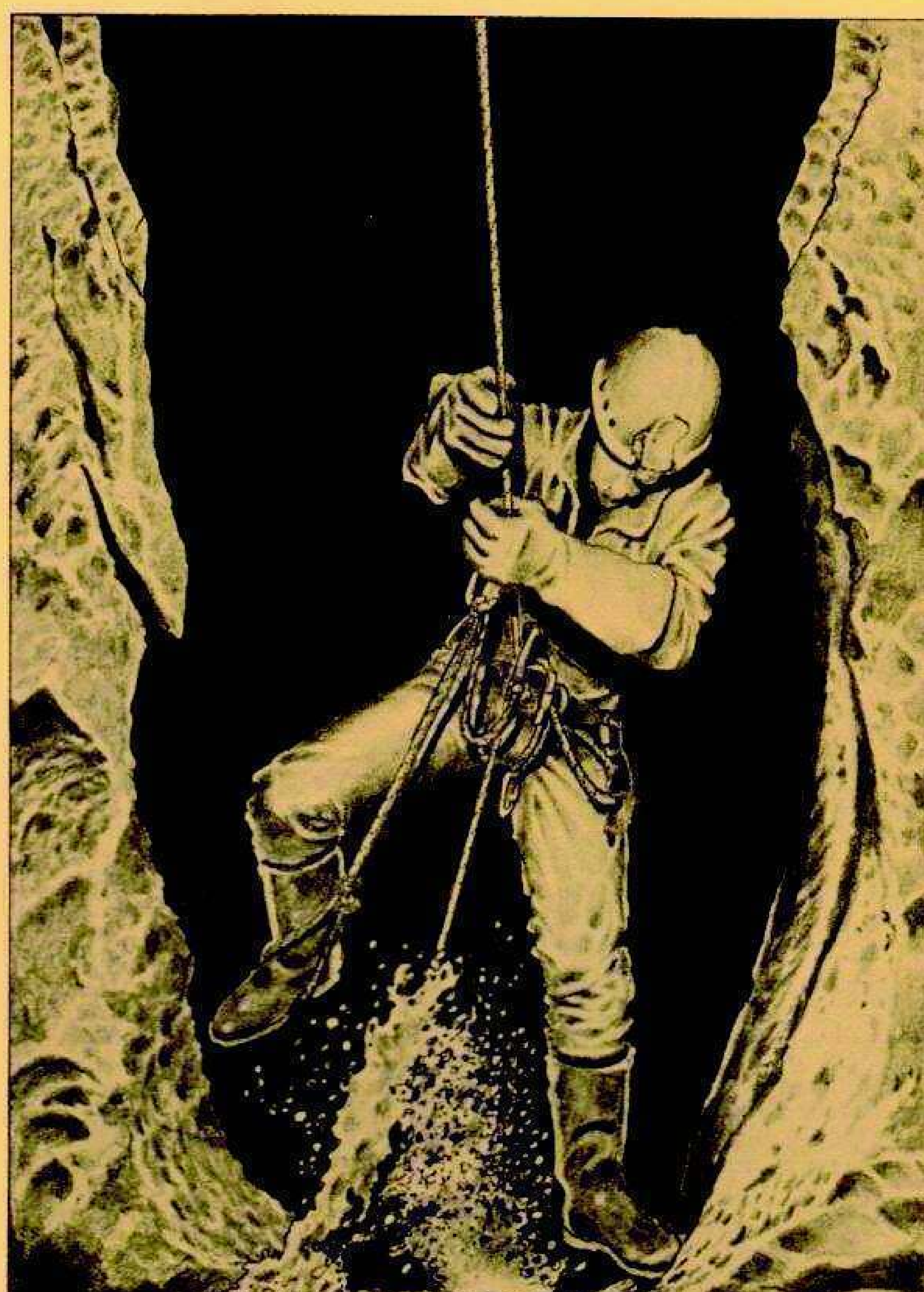
NYLON HIGHWAY NO. 28



...ESPECIALLY FOR THE VERTICAL CAVER

NYLON HIGHWAY

Assistant Editor appointed Maureen Handler after dedicating 400+ hours to the word processing, and fabrication of **Highway's 27 and 28** has been given the justly deserved title. Thank you Maureen for your committment and dedication to the "Highway".

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EDITOR COMMENT With this issue, the Vertical Section is more than 850 members strong, making us the largest section in the NSS. As Editor, with an audience this large, I feel particularly responsible for providing meaty, substantial, and responsible articles in your **NYLON HIGHWAY** I have found myself, in an "Editorship" role more than ever before. I am not, nor claim to be an expert, but proven unsafe practices that appear in my mail with a wish for publication, I find it necessary to Edit or send back. Likewise, I feel it is more important now than ever before that "filler" type articles find their way to a grotto publication. These are my intensions and self direction that I've tried to accomplish during the 1988-89 VS year.

JULY 1989

NO. 28

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PRINTED BY: Terry Raines, P.O. Box 7037, Austin, Texas 78713

COVER "Vertical Splash" Another terrific drawing by Linda Heslop. Thank you Linda.

DOUBLE BUNGIE: THE MODERN CLIMBING SYSTEM

By Maureen Handler

For every 1/2" of climbing effort, the climber ascends the same distance. No other rig can boast this efficiency. First written about in Nylon Highway #14, by Kathy Williams, this rig, with certain modifications, has catapulted this system into one of the leading and preferred climbing rigs of the day.

Introduction

How many times have you been stuck on a particularly nasty lip, swearing at your foot Gibbs because you can't get the pin out and you have a 200 pound climber below you? Have you ever tried to pass a knot, another climber or a rebelay using a foot Gibbs?

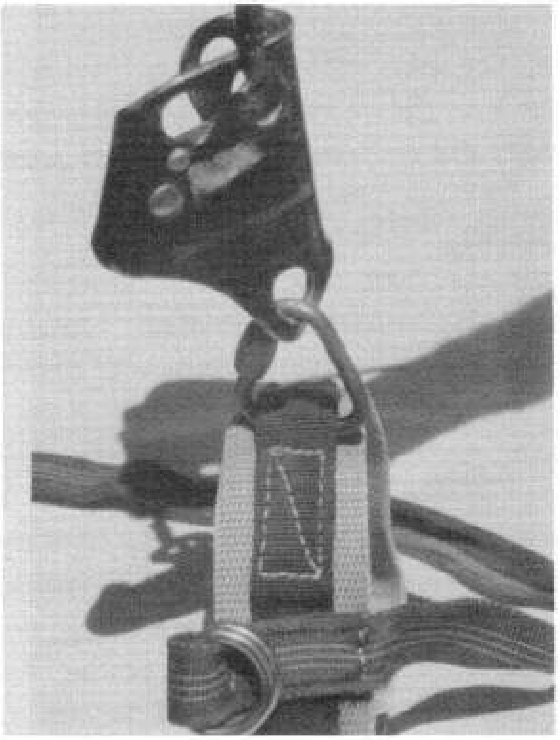
A number of cavers are now using Petzl Jammers in place of a knee Gibbs, however, a universally comfortable method for using a Jammer (or Croll) on the foot has yet to be discussed. Since the Petzl attachment is on the shell instead of on the cam, the ascender will not ride up the rope when attached to the top of a foot loop like a standard foot Gibbs. One method, recently published in Nylon Highway is to tie the Croll onto the instep of the foot. This can be done either with one inch webbing or with a sewn foot loop. I have been wanting to convert my rig using all Petzls for some time, so I tried this set up. I found it to work for short drops of 100 feet or less but since the ascender is on the side of the foot instead of on top, the climbing motion tends to twist the ankle with every step. So, now I was back to square one since I usually use a Mitchell rig or Texas for short drops anyway.

The Basics

During the 1987 Old Timer's Reunion, I decided to try something else. Sometimes climbers racing in the contests will attach a short bungie cord to the foot Gibbs to prevent missteps. I had also seen double bungie systems using one bungie cord, run through a small pulley attached to the chest harness, to keep both Gibbs running smoothly. I had a foot harness sewn with a Petzl Croll attached at the top of the arch of the foot. This keeps the direction of pull in line with the vertical plane of the leg and causes no twist to the ankle. I then ran a bungie cord from my knee Petzl, through a pulley on my chest harness and down to the foot Croll.

I tried my new system on a rope rigged at the local YMCA and it ran beautifully. Confident with the functional ability of the system, I decided it was time for a practical application test. I decided the best place to put a climbing rig to the real test was TAG country. So, in November I flew into Atlanta for some pit bouncing. The first test was at Mystery Well. The climb was great and the rig even better. The whole system worked beautifully and all ascenders ran smoothly. The next day came the ultimate test. Eight of us went to Ellisons cave for a tourist trip. The climb up 510' Fantastic

Pit was one of the best climbs I have ever had. My confidence in the rig was such that I was more than ready to use it on my upcoming Mexico trip.



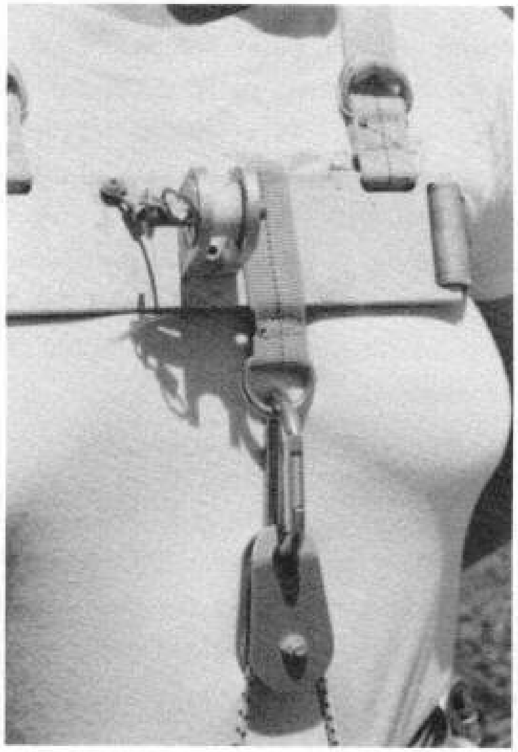
Foot Ascender. Notice the 1" webbing wrapped around the 2" with a Delta Maillon connection to the ascender from the foot loop.

Two foot loops from 2 rigs. The left one uses a #3 Maillon to connect bungie cord, while the other uses a pear shaped snaplink.

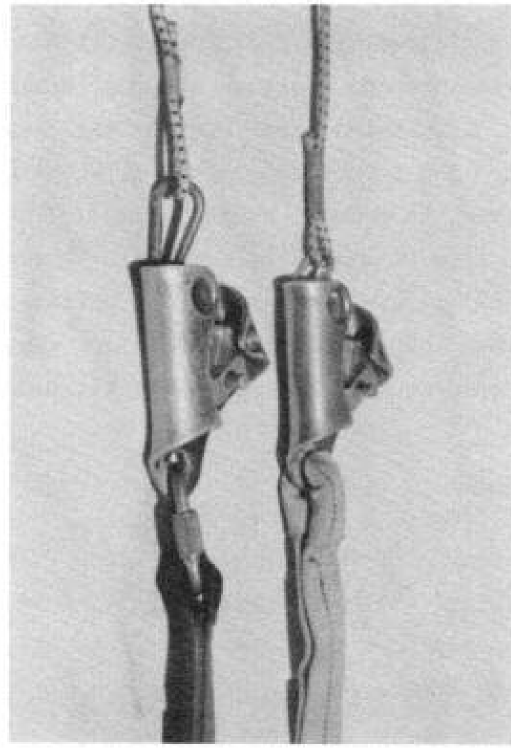
Rig Set Up

To set up the rig, I had a foot loop sewn out of 2 inch webbing. To the foot loop, a # 6 steel locking delta Millon was attached with short pieces of one inch webbing. The Croll was secured to the locking delta. To attach the pulley to the chest harness, a D ring on a short loop can be slipped right over the two inch webbing of the harness. The pulley is then attached to the D ring with a small carabiner. With this set-up, the pulley rides flat against the chest and there is no binding of the bungie cord. The knee Petzl is constructed similar to a knee Gibbs and an additional ascender is used above the chest harness and attached to the seat. This third ascender provided a resting position as well as a safety to prevent a double heel hang should the chest harness come off the rope.

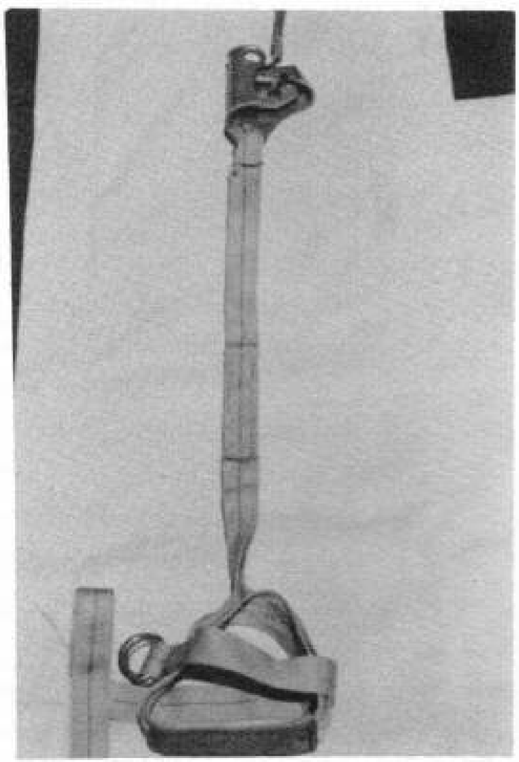
To convert the system to a Mitchell rig, simply tie a piece of rope to the upper ascender, pass it through a carabiner on the chest harness and tie the other end onto the foot loop and release the foot Croll. (Editor's note: I've grown partial to this system, but prefer a double roller chest plate. During normal operation, I put the upper ascender through the second roller. If down climbing or when Mitchell conversion is preferred, I already have the double roller in place. Also, during climbing, the double roller keeps me very tight to the rope; an added feeling of security. With this system, I was able to climb almost twice as far as my lifetime record climb with minimal fatigue.) This conversion method may need to be modified if there is a failure in the rig. If the foot loop has blown out, a new one



Chest Pulley attachment (one method)



Two knee ascenders from 2 Double Bungie Rigs. Notice the different bungie attachments and lower webbing/ascender connections.



An entire knee ascender, complete with the foot loop and sewn chicken loop. All the foot loops in these pictures have a 3/4" wide steel plate sewn into the foot loop to keep the loops from pinching the sides of the climber's feet.

Full rig with safety running from the seat harness to the climber's right hand.

will need to be tied and if the upper ascender has failed, the foot Croll will need to be moved into the position of the upper ascender. Should the chest harness fail on the system, The 6 foot long piece of webbing can be used to make a chest sling. The system can also be used like a classic three knot system with no system modifications, during times of excessive fatigue or when different muscles need to share the climbing stress.

System Efficiency

The efficiency of the rig comes from the double bungie. With a single bungie, extra effort is expended with every step to re-stretch the bungie cord, plus the 1 1/2" - 2" of upward movement to unlock the cam is lost every time you step down. Since the double bungie is an opposing system, the bungie cord is never really re-stretched. As the one foot steps down, the other foot is already being raised and minimal effort is being exerted to stretch the cord.

Practical Experience

To date, it has been used extensively on two Mexico trips. The climbing included passing knots, rebelays, changeovers and a few particularly nasty lips, both tandem and solo. The rig worked perfectly in all applications. For short drops, the rig is easily converted to a Texas system by not using the foot ascender. Should there be a failure of any part of the system (except chest harness), the rig can easily be changed to a Mitchell system using a six foot piece of webbing or 3/8" rope. To climb up a face of 80 degrees or less, simply release the chest harness and continue climbing.

(Editor's note: This single point was a significant selling point for me. I've been using the Cuddington, third phase for years to climb slopes. This system allows the climber to remain upright while finishing the sloped lip. It does not require the climber's hands to be on the lower ascenders during sloped climbing. This keeps the hands free for maintaining balance during those awkward climbs.)

Reasons for System Development

Gibbs are very versatile and are excellent for rescue hauling systems. However, one of their major draw backs is the quick release pin. The pin cannot be pulled using one hand or while weight is on the Gibbs. For the most part, this does not cause a problem with the knee Gibbs because the ascender is easily within reach. But, on the foot Gibbs it can be a real pain in the neck at lips (especially when climbing tandem) and doing changeovers.

System Advantages

The advantages of this rig are numerous. The biggest one I have found so far, is the ease with which the foot ascender can be taken off the rope at a lip when climbing tandem. Passing knots, rebelays and changeovers are much easier with one hand operation and no quick release pin to deal with. If the short cord between the cam and shell on a Gibbs breaks, the cam can easily be dropped during a changeover or crossing the lip. Also, with a foot Croll, bottom tension is only needed for about 5 feet, after that the ascender rides freely.

System Disadvantages

As with any rig, there are disadvantages to this system. The double bungie gives an extra cord riding at the knee which can be tangled and I have found the foot Croll to rub against my shin. I wear an athletic knee pad on my lower leg to prevent the gear from chafing. (The new Petzl Jammers, however, seem to ride well on the foot with no chaffing. The slight offset of the shell at the lower attachment seems to have eliminated all of the rubbing.) Another disadvantage (as with any rig having a foot attachment), down climbing is somewhat difficult. To over come this, I detach the foot Croll and use the rig like a Texas system for down climbing.

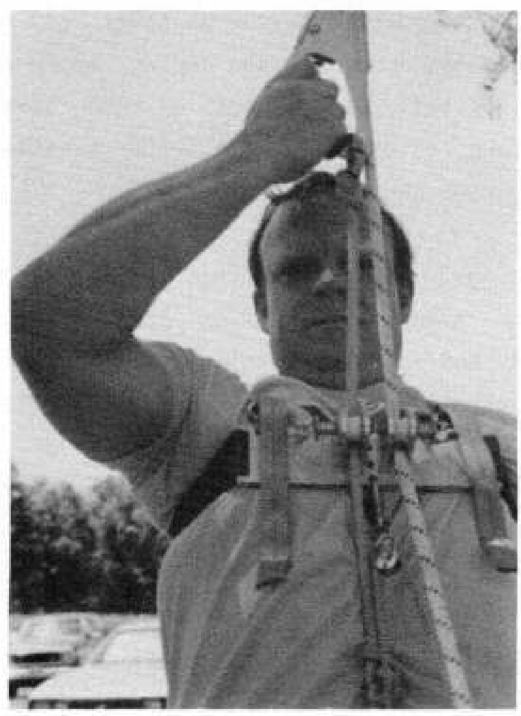
Conclusions

As cavers explore deeper into more difficult caves, the need for a versatile climbing rig will be on the forefront of system development. This rig combines the advantages of many rigs. The efficiency of the double bungie combined with the versatility of changing to other rigs with little work, makes this rig one of the best available. The option of easy conversion to Mitchell, conventional sit/stand, Texas or even Frog yields the advantage of virtually any rig for any given situation.

Overall, I have found this system to be one of the most comfortable ones I have ever used and will continue to use it until I find something more comfortable and/or more efficient.

(Editor's Testimonial: After climbing with a Mitchell rig for 16 years, I have changed systems. The innovations that Maureen Handler has added to this system have, in my estimation, made it the most progressive climbing system available. This system is truly a superb climbing rig. ◻

Full rig converted to a Mitchell System.



Detail of the Double chest roller. Safety goes through the second roller.

GLOVES AND PRUSIKING DON'T MIX

By Bruce Smith

Invariably, it seem like a rule-of-thumb is adopted and a caver feels like he no longer has to think! Rules-of thumb like, Cavers should wear gloves!

Unfortunately, time and again, I have seen close calls, accidents and frustration encountered when people wear gloves while climbing rope. Prusiking could and should be considered an art and requires dexterity. A climber needs to be able to thumb cams, maneuver safety latches, activate quick release pins, free up snagging bungie cords, catching carabiners and loose clothing. There is no question that gloves provide excellent protection for a caver and are often recommended for use during most cave trips. But there comes a time (while prusiking or climbing rope with ascenders) when gloves should be discouraged.

Exception: For all things there is the obvious exception. During long sit-stand climbs and when using knots, the advantages of gloves ou- weigh bare hands. The gloves being used should be tight-fitting and I've found the ones with a tacky or rubber coating provide a great grip.

I believe the climber's safety depends on his/her ability to be able to use accurately the equipment attached to the rope. Crossing a knot, changing over, rescue, etc., all depend on the climber's ability to be able to efficiently use his/her gear. For the most part, gloves inhibit that ability.

I have seen and experienced a repeated nightmare while climbing with gloves; that is the tip of a glove finger snagging between the teeth of an ascender cam and the rope. Invariably the cam will not grab the rope normally and the climber will slide uncontrolled down the rope to the extremes of his other ascender(s) or belay. I have seen repeatedly, when precision rope maneuvers were necessary and the climber(s) could not reach their full ability in a timely, expeditious manner because gloves made the event bulky and clumsy. I get nervous asking a person with gloves for assistance while they're on rope, because it appears as if it is all they can do just to help themselves.

This argument extends to rock climbing also. Numerous times, during cave events, I observe people attempting to make delicate rock climbing moves while wearing gloves. Often it is only a single step, but in rock climbing terms, may equate to a 5.4 or 5.7 or something along the line calling for a belay and/or safety considerations. I think the argument is obvious, let's ask the rock climbers. How many climbers choose to wear loose fitting leather gloves or gloves of any kind while negotiating a difficult climb? Gloves and climbing, for the most part, put the climber and all of his/her companions in unnecessary jeopardy and danger. I strongly urge that those who heard the rule-of thumb, Cavers Should Wear Gloves, reconsider and remember this rule-of-thumb, **Climbers, while on a rock or using mechanical gear to ascend, SHOULD NOT wear gloves.** □

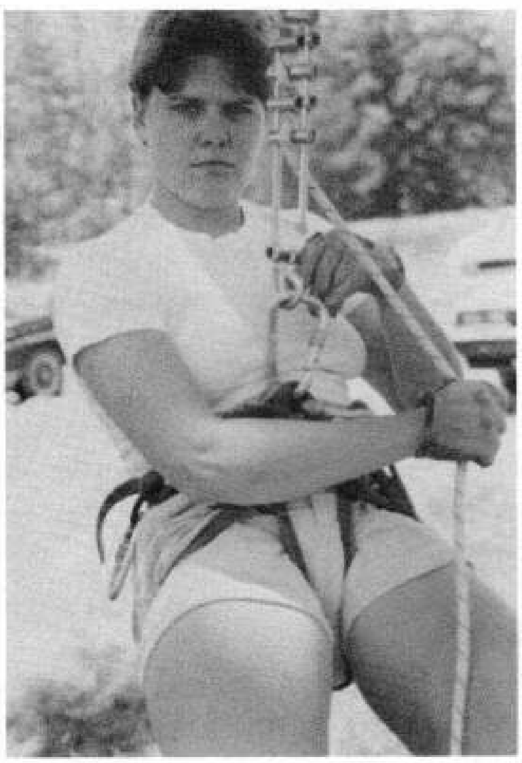
VERTICALLY ORIENT YOUR RACK AND 8

By Bruce Smith

It is alarming to discover that over the generations of vertical training, the proper use of racks and 8's has gotten confused with opinion and "I think this is right".

THE RACK

Back in the late 1960's, when John Cole developed the rack, he left it open at the bottom for one primary reason; to enable someone to easily add or reduce friction by adding or removing bars as brake points between the long and short legs of a rack. This activity requires the simultaneous rocking of the rope back and forth, left to right, or right to left in front of the rappeller. On long drops over 200 feet, which is primarily what the rack was designed for, the ability to add and subtract bars (rock the rope) becomes most important as the weight of the rope becomes a significant problem and difficult to lift.

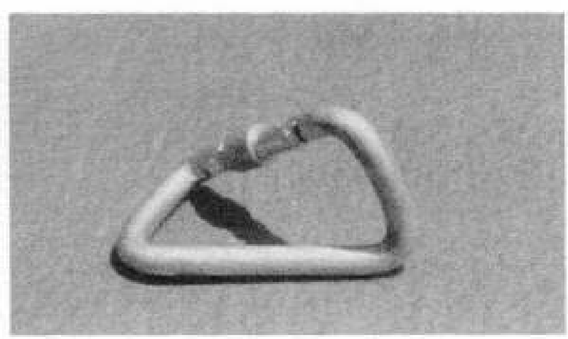


The rack was designed so that the rappeller could "Rock" a heavy rope back and forth when adding or subtracting bars and friction, especially during a sliding bar change.

Many rack users, I find, are orienting the racks flat. This couldn't be more incorrect. Rack temperatures on long rappels, especially with aluminum bars, reach dangerous levels and require a sliding brake bar change if a brake bar addition is required. Stopping on hot bars could easily glaze or burn a nylon rope, thus the necessary sliding change. This takes practice to perfect, and is all but impossible on a horizontally oriented rack when one has to lift the rope and then drop it back into position.

SOLUTIONS

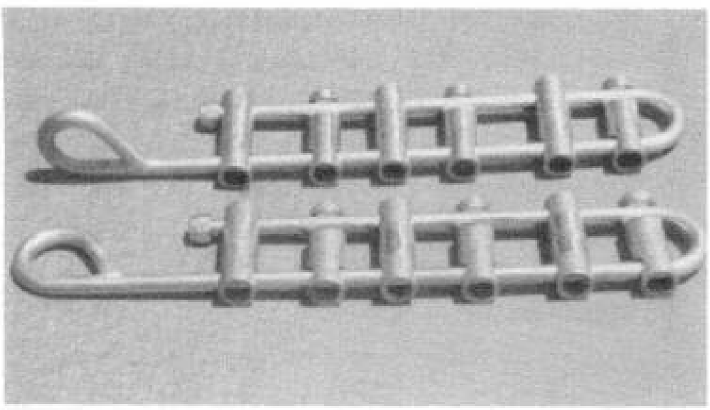
There currently are four easy solutions to horizontally oriented racks. For the most part it is the harness attachment point that causes the rack to be attached improperly.



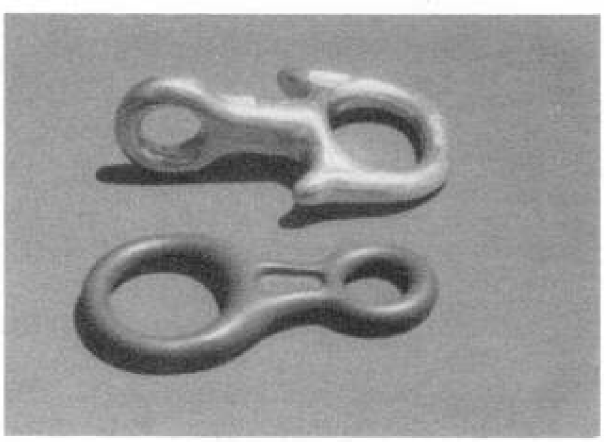
Stubai's new twist link carabiner can provide the desired vertical orientation. This piece of equipment is available from Rescue System, Inc. 1-800-552-1133 or 1-614-989-2860.

1. A new harness which allows for a horizontal carabiner will translate into a vertically oriented rack.
2. Two locking carabiners. This can extend the rack's final operating position to a point too high to comfortably manipulate.
3. Stubai has a new twisted carabiner which gives you 7000 lbs. of protection and the 90 degree twist you've been looking for.
4. SMC also makes a rack with a 90 degree rotated frame. (Fig. #3)
5 Wales also makes an 8 with a 90 degree twist in its construction. (Fig. #4)

All these problems and solutions apply for a figure 8 descender, which is next under our discussion.



SMC's twisted eye rack is another excellent option to use when vertically orienting your rack.



Twisted 8 construction allows for a vertical 8.

THE FIGURE 8

The Figure 8 was also designed to be used in a vertical fashion. In fact, in the early days, when it was coming of its own, users recommended girth-hitching the 8 to affect a stop activity. If the 8 is used properly (vertically), it is relatively easy to "ungirth" a girth-hitch. The chance of accidentally girth-hitching the 8 in the vertical position is next to none. The "ears" that someone later put on the 8 had to be added by someone who wasn't completely familiar with the 8's proper use, as they are truly useless and add extra weight and size to a competent user's gear.

Girth-hitching commonly occurs when the 8 is rigged horizontally and the lower loop gets dragged across the pit edge, window ledge or helicopter strut.

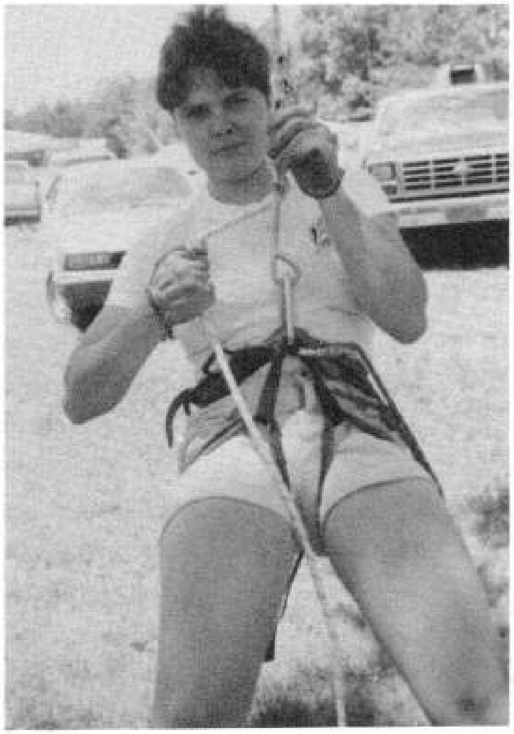
RIGGING AN 8

Remember, a properly rigged 8 starts with the 8 in a vertical position. A bight of rope is pushed through the big hole of the 8 <u>from the direction of the brake hand</u>. The rest, most everyone picks up from pictures and common sense.

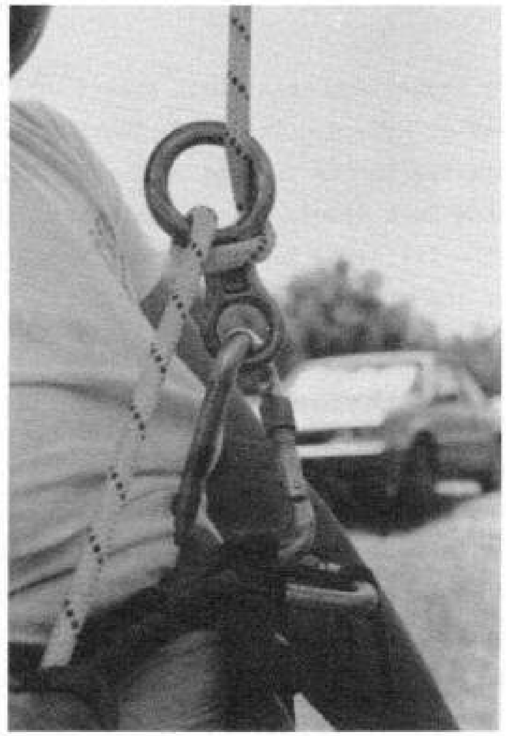
<u>Again</u>, if your seat harness prevents you from vertically orienting your 8, refer back to the four options presented earlier for rack vertical orientation.

TRAINING

Equipment use innovation, I feel, is a good thing, but not out of ignorance of the proper operating methods as the equipment was designed. Even worse is the people whom teach other people the wrong procedure. The problem is not that they don't know; the problem is that they don't know they don't know.



A twisted eye rack properly oriented.



Vertically orienting your figure 8 is equally important. □

LETTER TO THE EDITOR

Last year I had the enlightening experience of having the sling on my safety (top) Jumar snap forcibly against the quick-release button on my Simmons' Roller, actually releasing the pin, so that the rope came out of the chest roller. Nothing significant happened at the time because the Jumar was above me with most of the slack out of the sling. I noticed that my upper body was pulling away from the rope more than usual, looked down, and saw why. I reattached the rope in the roller and finished my climb. At the time, I wasn't 100% certain that I had initially put the pin in the roller securely, so my next trip up rope I observed the mechanics of the sling and roller. Sure enough, when I shoved the Jumar up, slack was rapidly taken out of the sling, and as it tightened, the sling had a tendency to snap laterally against the head of the quick-release pin and eventually popped it loose again.

The situation was easily remedied by changing the orientation of the roller on the chest harness (rotating it 180 degrees). Other cavers, like me, who didn't think as closely about the finer details of their vertical systems might take heed.

Sincerely,
Jill McMahon
NSS 26731

ARMY RAPPEL TECHNIQUES

By Duncan Lill

Military rappelling is a small subset of the many uses of SRT, and its worth looking into. I am Special Forces trained and qualified, and am now in a Special Forces National Guard unit. The following is some thoughts on the state of the art ropework of the U.S. Army.

To begin with, the equipment used is one steel non-locking oval carabiner (snaplink), helmet, leather gloves and a swami seat tied from ten feet of Army Greenline. The rope used is the standard 120', 7/16", 3-strand, laid Greenline rope. The usual ascending technique is hand-over-hand. I realize some special Forces, Ranger, and other units use modern equipment and techniques, but very few others do.

The essence of military rappelling is speed, since the best way to avoid bad guys with automatic weapons is to get on the ground as soon as possible. Dual ropes are used, with one wrap of each around the snap link for friction. Bottom belays are generally used in practice. A variable friction rappel device is not needed since the maximum rappel distance is 120'. (Plus the occasional distance from the end of the rope to the ground. Pain is desirable.) The usual technique is to rappel at maximum speed until about twenty feet off the ground, then to apply the brakes around the thigh and buttocks, This method is hard on the rope, hard on the equipment, but its been around forever so, there's no need to change it.

In May my unit was called to make two demonstrations at an air show. One was a freefall parachute display (HAHO), and one was an Air Assault rappel insertion from a helicopter, which I was picked for. The day before the demonstration was our practice day. We've all done this before, so this was more of a "fine-tuning." day. We did three rappels off a ninety foot tower with a mock chopper skid, then over to the airfield to practice from the chopper itself. We used a UH-IH (Huey) helicopter, with two rappellers per side and a rappelmaster inside responsible for rigging and coordinating with the flight crew. We all hooked up to the primary and backup anchors, then ascended to ninety feet over the field and kicked out over the skids and then jumped two at a time for a blistering descent.

The main problem in Air Assault in a non-combat situation is a chopper pilot with a sense of humor pulling the bottom belayers off the ground, and stranding the rappellers in mid-rope. But we can get back at the pilots setting off smoke bombs under their seats. All went flawlessly on the first two rides. We kept putting more and more duct tape on our hands under the gloves as the ropes quickly cause second degree burns otherwise.

The third ride would have been a real crowd pleaser, had there been any crowds to please that day. One guy, on his climb out of the chopper, must have rotated his carabiner and loaded the gate because when he put on the brake after a fast descent the gate bent outward and downward at the hinge, popping loose the wrap. His fourth point of contact promptly slammed shut, perhaps permanently, and he fell straight into the rappeller on the rope next to him. He did, however, remembered to call out the universally recognized signal for falling: "Oh Shit!!" The lower rappeller was able to put on a scorching brake right before they both piled to the ground amidst a storm of colorful expletives. Not only had one carabiner broken, but the bottom rappeller's swami rope had been burned two thirds through over his braking thigh, leaving him attached by only one strand. The bottom belay was not able to react in time to soften the fall significantly.

The next day's Air Show went off anticlimactically. We flew around for a half hour below tree top level so the crowd wouldn't see us, then popped up over the trees in front of the crowd. The announcer on the PA said something about the Green Berets not having permission to land but they're coming in anyway. The rappels were fine and the chopper didn't lift the rope ends off the ground. There weren't even many good looking girls in the crowd to impress, so it was pretty much a routine exercise.

Why is the Army thirty years behind the times in SRT? I guess it has to do with simplicity of technique and standardization in teaching thousands of soldiers over the years. Every time I talk about modern techniques or equipment I get glazed looks or my favorite: "Write it down." It looks like if it was good enough for our boys in Vietnam, it'll be good enough for our boys in the next century. I think I'll sneak in a figure eight on my next rappel though. □

ROPE SNOBS

By Bruce Smith

Bill Cuddington, over the years, has taught me many things about vertical work. But some years back, I was truly taken back when he refused to let me rappel on his rope at the New River Gorge Bridge unless I had steel bars on my rack. I balked! He loaned me a steel rack and I satisfied his wishes.

For years I thought Bill was being too protective of his rope, afraid of the aluminum oxide. He was definitely in a category I called a "rope snob".

Recently, I ordered and purchased my first "Custom" rope. This rope is, in my estimation, beautiful (black with a barber pole of rainbow colors).

Guess what? I'm going to to do everything I can to keep it looking like new, including bagging it for transport, padding it properly and only allowing steel bars to rappel on it. Yep!!! I too am a rope snob. Bill, you were right and I was wrong. It just takes some of us longer to realize it. Besides, what's wrong with attempting to keep a substantial investment looking like new. I say nothing. □

PUBLIC APOLOGY: In Nylon Highway #27, I reported that the Wellington Puritan rope testing had been performed with their coated Rhino Rope. I had misread the report and wish to apologize for the inaccurate summary and assessment of their work. Please see this issue for the complete and accurate reporting of the tests performed by James Frank, president of California Mountain Co. and his companions.

Bruce Smith
Editor

Fabric Softener & Rescue Rope

by James A. Frank

Rescuers take good care of their life support equipment, but some may be taking too good of care of their rescue rope. The desire to keep the ropes as clean as possible has created a concern among the manufacturers that ropes are being washed too much.

The fiber used in rescue rope comes from the nylon manufacturer with a lubricant on it. This lubricant allows the yarn to run smoothly through the rope making machines. When the rope is used, the lubricant lets the fibers slide smoothly as the rope is loaded. Without this lubricant, the fibers tend to cut each other, decreasing the strength of the rope. When washing a rescue rope, some or most of the lubricant is lost.

In the first edition of "On Rope", Allen Padgett and Bruce Smith stated what many of us felt was a solution to this problem:

All indications point to the fact that fabric softeners are a good idea. Instead of actually making the fibers soft, these products work by coating the fibers and lubricating them. This allows the fibers to slip past each other making the rope more flexible. These products added to a clean rope will help reduce internal abrasion and grit build-up.

Wellington Puritan, the manufacturer of Rhino Rescue Rope®, has long advocated using a small amount of fabric softener in the rinse cycle when the rope is washed to replace the lost lubrication.

In his article "Old Rope Never Dies" in the March/April 1988 issue of Response!, Bruce Smith reported the results from tensile tests of a length of PMI rope that had been soaked in a concentrated solution of Downy fabric softener. He concluded that "it is evident that soaking rope in Downy is an undesirable practice." During his presentation of his article at the 1987 North American Technical Rescue Symposium, the recommendation was made that fabric softener should not be used at all.

Bruce Smith stated that Pigeon Mountain Industries and Columbian Cordage Works both "highly discouraged the use of artificial fabric softeners *in any form and at any strength level.*" (empahsis is Smith's). At the Symposium, Steve Hudson of Pigeon Mountain Industries stated that while they felt a capful of fabric softener when washing was beneficial, their official position was against the use of fabric softeners. They were concerned that someone would decide that if a capful was good, then a washer full would be even better.

DuPont, the manufacturer of the high grade cordage nylon, Type 6,6, Super 707, used by Wellington Puritan and Pigeon Mountain Industries, was quoted as recommending that a rope not be soaked in a 100% solution of anything, including water. This sounds like blanket disclaimer and raises the question of how to wash a rope at all. Bruce Smith's article further stated that as for "compounds like Downy, they [DuPont] had not specifically tested their ropes with this product."

Does a small amount of fabric softener benefit a rescue rope by replacing the lubricant lost while washing? Jerry Smith, Vice President and Senior Instructor at California Mountain Company, Ltd. and Terry McMichael, Marketing Manager at Wellington Puritan felt that while the results from Bruce Smith's testing of a single piece of rope raised some good questions, it did not support the conclusions drawn regarding the use of a small amount of fabric softener. They decided a test program to answer this question would benefit the rescue community and that a test could be designed that would produce worthwhile data and reproducible results. The test was published in Wellington Puritan's Technical Bulletin 3-24-88, "Effect of Downy Brand Fabric Softener on Static Kernmantle Rope Tensile".

TEST SET UP. The tests were conducted on a Lucker Flat Bed Break Test Machine of 150,000 pound capacity located at Wellington Puritan's Madison, Georgia plant. Federal Test Method 191A was used. Testing was conducted on March 18 and 20 of 1988. All tests were overseen by Gladys Thomas, Quality Control Manager at Wellington Puritan.

TEST #1

Test #1 used two lengths of 1/2 inch diameter Wellington Puritan Rhino Rescue Rope® (static kernmantle) with Rhino-Kote™ (Flourescent Yellow). The ropes were put in service January 1985. Both ropes had been used in six California Mountain Company, Ltd. rescue courses conducted by Jerry Smith. The rope history indicated over 600 rappels on each rope as well as numerous uses as haul and belay lines for stretcher evolutions. After each class the ropes were washed and Downy fabric softener was added to the wash cycle in a ratio of 3 ounces Downy to 10 gallons of water. Both ropes were well worn. Breaks were made in the middle sections of the ropes since that is where the most wear occurs.

TEST #1 Results

Rope #	Tensile Strength	Percent[1]
1	8,680 lbs. (avg. of 5 breaks)	96.4
2	9,050 lbs. (avg. of 6 breaks)	100.5

[1] Percent of tensile strength remaining based on manufacturer's rated new rope tensile strength of 9,000 pounds.

From this test it was concluded that the use of Downy fabric softener in the rinse cycle when washing a rope had not adversely effected its tensile strength. While this test compared the washed ropes to the manufacturer's standard, it did not compare the effect of the fabric softener to a control sample, therefore a second test was conducted.

TEST #2

Test #2 used new 1/2 inch diameter Wellington Puritan Rhino Rescue Rope®, white in color. These lengths of static kernmantle rope were not coated with Rhino Kote™ For consistancy all test samples were taken from the same spool. In the first part of the test, the ropes were soaked then broken while still wet. For the second part of the test, the ropes were allowed to dry for 48 hours.

TEST #2 Results

Sample	Tensile[1]	Percent Lost[2]	Comments
Control	11,240	-	Dry rope.
Wet Rope Tests			
100% Water	9,840	12.5	Expected loss from a wet rope.
Downy mix[3]	10,040	10.7	1.8% improvement over 100% water.
100% Downy	10,000	10.9	1.6% improvement over 100% water.
Dry Rope Tests			
100% Water	10,700	4.8	7.7% improvement over wet rope.
Downy mix[3]	10,820	3.7	8.8% improvement over wet rope.
100% Downy[4]	9,420	16.2	5.3% decrease over wet rope.

[1] Tensile strength in pounds, based on an average of five breaks.

[2] Percent of strength lost as compared to the control.

[3] Ratio of 1 oz. Downy to 3 gallons of water.

[4] Core of rope remained damp after rope was let dry 48 hours.

The results of TEST#2 indicate that the use of a small amount of Downy fabric softener when washing a rescue rope is beneficial. The test supports the theory that the fabric softener replaces the lubricant removed by the water. The results using a 100% solution of Downy agree with Bruce Smith's test sample soaked in a concentrated solution of Downy that such high concentrations are harmful to the rope. In both cases it appeared that the core of the ropes remained effectively wet.

CONCLUSIONS. Test #1 used rope that had been in service for several years and had seen heavy use. This tested the adverse effects of Downy when washing a rope over a period of time. Test #2 used new rope for consistant samples so rope soaked in a small amount of Downy could be compared to rope soaked in 100% water and 100% Downy as well as to a control sample. From the results of both tests, Wellington Puritan continues to recommend the use of a small amount (approximately 1 oz. Downy to 3 gallons of water) of Downy in the rinse cycle when washing a rescue rope.

Thanks are due to Wellington Puritan for providing the test facilities, rope samples and large quantities of Downy fabric softener and to Jerry Smith of California Mountain Company, Ltd. and Terry McMichael of Wellington Puritan for conducting the tests.

James A. Frank is President of California Mountain Company, Ltd. and past president and current board member of Los Padres Search & Rescue Team.

Vertical Caving Hardware
2: Bobbins

Introduction

This is the second article in a series presenting some personal opinions on the ascenders and descenders I am familiar with, specifically those device versions I personally own and use. Since the first article on short handleless eccentric cam ascenders is just hitting the streets as I write this article, there hasn't been any time to receive comments, but I welcome them and hope to discuss comments in future articles. In addition, I plan to review any omitted devices in future articles as I obtain them. Since my interest in vertical devices exceeds my income, anyone wishing to insure discussion of a particular device is welcome to donate a copy of the device to my collection; duplicates will be returned if desired.

Bruce Smith suggested that the first article may have been a little dry. To most people I would simply reply "write your own", but I think I'd lose that argument with Bruce. What can I say? I want to present as many facts and opinions as concisely as possible, a difficult task, particularly in this lawsuit crazed society. The use of so many numbers may have been the biggest culprit. I think that dimensions by themselves are not too relevant, yet they are a useful way of comparing devices. In this article I will relegate most of them to tables. Some of the other details are presented to show exactly which model I am discussing. For legal reasons my opinions are strictly limited to my personal devices only, but they often apply to identical devices from the same manufacturing lot, and sometimes, but not always, could apply to similar models.

The order of the articles follows no particular pattern, in fact, I am attempting to vary the subjects of consecutive articles as much as possible. I elected to do this article on bobbins as a result of a discussion with Ken Kramer held in the waterfalls of Canadian Hole a few weeks ago.

Definition of a "bobbin"

This article will consider mechanical descenders where the rope path follows the S-shaped path shown in figure 1. In general the braking surface consists of two non-rotating bollards fixed to a sideplate, with a second pivoting sideplate provided to keep the rope from jumping off the other end of the bollards. A third (usually smaller) bollard may be provided. The seat maillon[1] usually attaches to holes in extensions of the two sideplates; these holes are aligned when the sideplates pivot to the closed position.

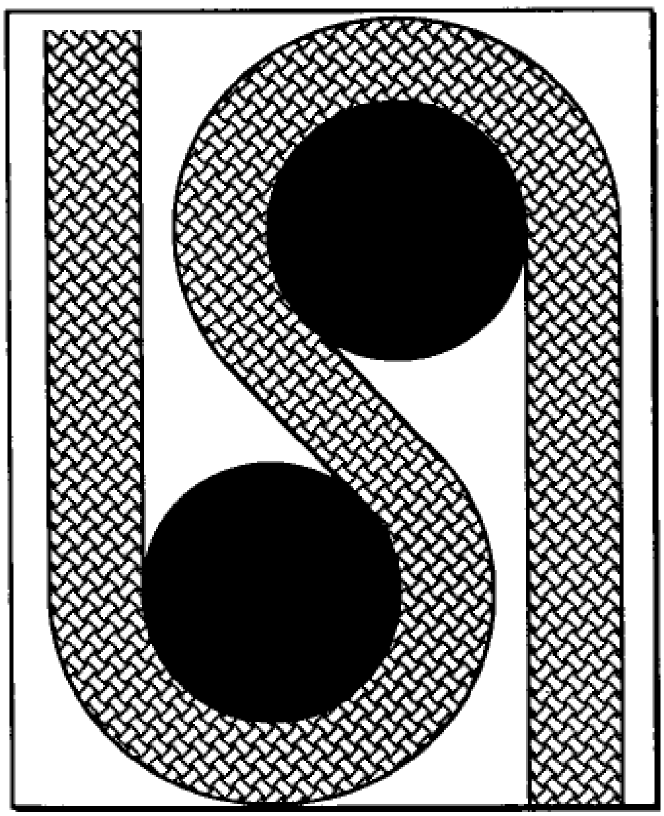


Figure 1: Rope path characteristic of a bobbin

General comments

Bobbins were illustrated in the N.S.S. News over

[1] I consider the use of a seat carabiner rather than a maillon rapide or other "quick-link" type screw fastener as an unnecessary safety sacrifice. I have a collection of failed seat carabiners, all with the gates ripped out, to substantiate my opinion.

twenty years ago[1], but it took a number of years before they were readily available in the USA. Petzl dominates the American bobbin market, and many cavers equate bobbins with the Petzl name, but there are several other bobbin manufacturers and so the buyer should investigate several options before deciding which bobbin, if any, to purchase.

Bobbins are constant friction rappel devices, with a friction angle of about 480°. Some of the newer models have a rod which can be used as a third bollard. This allows the rappeler to add an incremental amount of friction during a rappel, but I have never been too satisfied with the performance offered by this approach. I consider the amount of friction provided by a bobbin to be too small for many American cavers. The bobbin is a European device, and in general most European cavers and climbers are lighter than their larger Americans. I've had many discussions with people claiming the bobbin's friction is adequate. I've also noted that most of those individuals weigh less than 150 pounds. Heavier cavers may want a device with more friction, as will cavers hauling heavy loads down ropes. Personally[2] I find that the bobbins low friction and lack of adjustable friction causes me to use it only on drops of 15-20 meters or less, and only when traveling light. On these drops the old type Petzl stop is perhaps the device I use most often, but on longer drops I prefer to find a more suitable device.

There are several ways to rig a double rope bobbin on a single rope for extra friction during a rappel. Each of these methods involves making extra turns around the bollards where the second rope would normally run. When rigged in this manner double rope bobbins provide substantially more friction than the normal "S" rigging. Some of these methods have the highly undesirable side effect of forcing the main rope to rub against itself, and can not be recommended. On the other hand, a "C" rigging can be used on either type of bobbin to reduce friction if desired.

The diameter (D) of the bollards is chosen as a compromise between the desire for compactness and the need to provide a large enough bending radius to prevent damaging the main rope. Most bobbin bollards are about 30-35 mm. in diameter, or three times the diameter of a standard 11 mm. caving rope. Since the rope takes a 240° bend over each bollard, these may appear to be rather sharp bends; however, tests performed by Tomaz Planina[3,4] indicate that bobbins may damage the rope less than several other common devices, including rappel racks and figure eights. Although Mr. Planina's tests results are very informative, a few devices were rigged in nonstandard fashion, and so any conclusions should consider the anomalous arrangements.

I find that most bobbins work best on flexible 9 mm. ropes, although they tend to be faster on these thinner, more flexible lines. The larger 11 mm. ropes can be used, but larger ropes do not fit well in several of the bobbins. Furthermore, stiff ropes such as PMI are more difficult to rig, although they are still quite usable.

It is convenient to divide bobbin bollards into two categories. The subdivision is somewhat arbitrary; essentially determined by the inside diameter (d) of the rope groove. If this diameter is larger than the rope diameter we have a U-groove; if it is smaller the sides of the groove are formed into a V, yielding a V-groove. The essential difference is that other factors being equal, V-groove bollards have a higher effective coefficient of friction due to ropes wedging between the walls of the groove. As a result, a V-groove bollard increases the braking friction of the bobbin. Now both bollards on a bobbin have essentially the same friction angle. Since the friction (and hence heating) is higher on the bottom bollard (with the higher rope tension), most manufacturers attempt to even out the load by using a U-groove for the lower bollard and a V-groove on the upper.

The bobbin has one unusual characteristic which may present a hazard to the unwary. A number of cavers utilize the highly questionable practice of providing "bottom belays", where a caver positioned in the rockfall zone at the base of a drop stands ready to apply tension to the rappel line if the rappeler seems to accelerate out of control. This works for most devices where the braking friction

[1]Cole, J., W. Heller and J. Chester, "The Pierre Saint Martin", N.S.S. News, v.26 #2, Feb., 1968, p.22-27.

[2]I'm 1.93 m. (6' 4") tall, and at 82 kg. (180 lb) I'm a bit heavier than many Europeans.

[3]Planina, Tomaz, "Obraba vrvi pri spuscanju z vrvnimi zavorami," Nase jame, 17, 1976, pp. 15-22.

[4]Planina, Tomaz, "Climbing ropes wearing out with rope brakes," Nase jame, 19, 1978, pp. 15-22.

of a device is given by

$$F_{brake}=(W_{caver}+W_{rope}+T_{belay})(1-e^{-\mu\theta})$$

where F is the braking force created by the device, W_{caver} and W_{rope} are the weights of the caver and the rope below the device respectively, T_{belay} is the tension supplied by the bottom belayer until he gets killed by a falling rock, μ is the dynamic coefficient of friction and θ is the friction angle of the device. In most devices the bottom belay merely increases T_{belay}, thus slowing the caver, but with bobbins the increased tension can result in the bobbin rotating, which reduces θ and hence reduces the braking force. This could lead to the rappeler accelerating even faster. Note that the additional tension might also arise from the rappeler's own braking effort[1]. For this reason, it is essential that the rappeler use a second maillon to clip the rope below the descender to the main seat maillon, as illustrated in Petzl's and Voynnet's instructions.

I prefer to attach bobbins to my seat harness so that the rope comes out to one side, rather than away from or towards me. Since my seat harness is designed for use with standard rappel racks, the seat maillon sits in a "horizontal" position. This necessitates the use of an additional maillon between the bobbin and the main seat maillon in order to turn the bobbin 90°. The extra carabiner also provides clearance for the mandatory safety carabiner connecting the trailing end of the main line to the seat maillon. The major drawback to this arrangement is that it lengthens the hardware chain. Other descenders, such as the figure 8, do not require all this extra hardware. When comparing the bulk of the bobbin to other devices one should really penalize the bobbin by the size and weight of a maillon and a carabiner.

Under no circumstances should the autostop feature of so-equipped bobbins be used to control one's rate of descent! First, the amount of control provided is generally insufficient. Second, to increase friction one must release the control handle. This is contrary to natural instinct, particularly if one starts accelerating out of control. For this reason, one should never rely on the autostop feature as a safety device. There is too much chance of responding in the natural, instinctive manner rather than the proper one. Finally, the autostop feature should not be relied on to hold one stopped in mid-rappel, since it is too easy to bump the handle causing an unintended descent[2]. In fact, most of my autostop bobbins slip under my own weight. Frankly, I'm not sure what I can recommend the stop feature for, even though I use a Petzl stop descender far more than the non-stop models.

All my comments are oriented towards using these devices for their design purpose. Unless I specify otherwise, this is limited to a single person plus equipment descending ropes within the 9 to 11 mm. diameter range. Comments do not apply to descender abuse, such as use in rescue lowering systems.

Bobbins can be divided into three categories. The first category are the standard bobbins, which have no autostop feature. I will discuss[3] three single rope and two double rope standard bobbins, all manufactured Petzl. The second category includes the autostop bobbins. I will discuss one version[4] by BO.VE, one version by Dressler, one version by Kong-Bonaiti, three versions by Petzl, and one version by Single Rope Technique. Finally there is the Tracson, an unusual device by Voynett S.A.R.L.

Standard bobbins - single rope

Petzl

Version A

Technical details

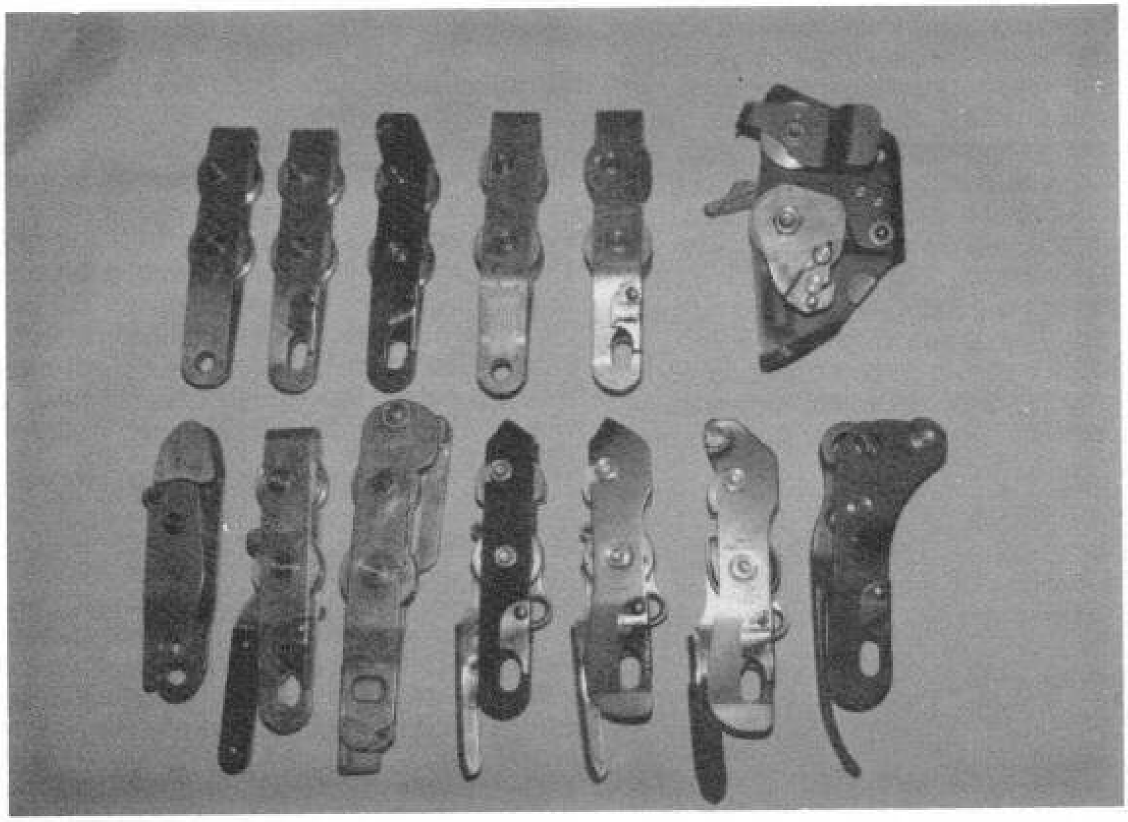
I acquired this descender from Speleoshoppe in 1979. The two sideplates are made of 32 by 3.3 mm. aluminum. The upper end of each sideplate is bent inwards in a quarter circle so that when the bobbin is in use the sideplates keep the rope on the top bollard. The lower ends of the sideplates are bent to converge at the attachment

[1] In this case the formula is modified slightly.

[2] The Tracson is the only device discussed here where the handle is not easily bumped, in fact, it requires lifting one's weight off the device before the stop feature can be released!

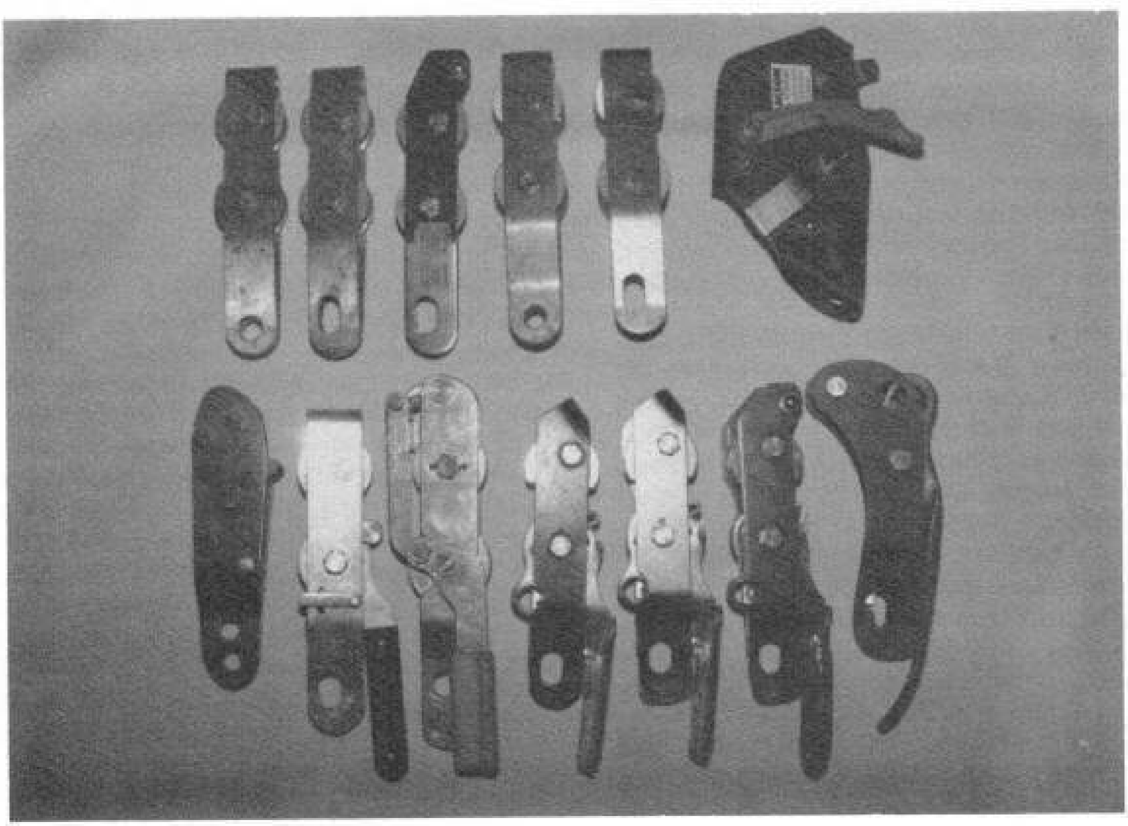
[3] I will only discuss models I am familiar with, specifically limited to those which I own, have tested and have used.

[4] Apologies to manufacturers if these identifications are in error. I only have some sketchy data sheets to work with, and I speak neither French nor Italian.



Top row: Petzl single rope version A, Petzl single rope version B, Petzl single rope version C, Petzl double rope version A, Petzl double rope version B, Tracson

Bottom row: Diablo, Dressler, Kong-Bonaiti, Petzl Stop version A, Petzl Stop version B, Petzl Stop version C, Single Rope Technique single rope bobbin.



point, which consists of a 14 mm. beveled hole in each sideplate. One sideplate pivots to allow threading the rope. The bollards are turned aluminum with a milled slot to keep them from rotating on the fixed sideplate. The bollards are drilled and tapped then bolted to the fixed sideplate with 7 mm. A2 bolts. Shoulder nuts lock the bollards in place and also retain the pivoting sideplate. The pivoting sideplate pivots on the lower shoulder nut and has a slot to allow clearing the upper nut. The lower U-groove bollard is mounted through a hole in its center, but the upper V-groove bollard uses an off-centered arrangement to allow a smaller clearance slot in the upper sideplate.

The pivoting sideplate is stamped with an icon illustrating how the descender is threaded, but anyone who needs this assistance shouldn't be using a bobbin anyhow. It is also stamped "PETZL", "MAXI 1500 KG", and "FRANCE". The bolt heads are marked "THIEL" and "A2".

Comments

The attachment point on the pivoting sideplate is beveled on the inside, rather than the outside. This is an obvious oversight in manufacturing, since the beveling serves no purpose there. Otherwise, the bobbin is fairly well made. The threaded bollards provide a much stronger mounting than if they had been just bolted on through a cylindrical hole with bolt and nut. Since only about one half of each bollard is exposed to the rope, the bollards wear unevenly. Most bobbins are designed to allow reversing the bollards, effectively doubling the life of the descender. The lower bollard is symmetrical and requires no modification to allow reversing. The upper bollard could have been left asymmetrical, but Petzl provided a second threaded mounting hole to allow reversing the upper bollard.

This is the simplest bobbin in my collection, and although I don't use it as often as others, it probably is also the best for those who prefer simplicity. There is really nothing extra on this bobbin, and also very little to fail. Even if the user were foolish enough to rig in backwards, the closed attachment hole on the pivoting sideplate would almost certainly prevent the bobbin from opening. After doing the research for this article, I'm tempted to make this my primary bobbin in the future.

<u>Version B</u>

Technical details

I obtained this descender at the same time as version A. It differs from version A by having a quick-attachment feature. The attachment point on the fixed sideplate is enlarged to a 23 mm. high by 13 mm. wide hole located 3 mm. off center. A similar hole on the pivoting sideplate has been cut open on the narrow side, so the sideplate resembles a hook. The opening of the hook is covered by a spring loaded, stamped steel, sheet metal guard which is roll riveted to the sideplate.

The markings are identical to version A's.

Comments

The quick attach feature allows the user to keep the descender attached to the seat maillon while rigging into or derigging from the main line. This is a nice feature, but usually I find that the limited clearances provided may the task more hassle than it is worth. In addition, the guard tends to get fouled with mud, thus defeating the closing action of the safety spring. Corrosion is also a problem, which is why mine won't function. The roll rivet is installed incorrectly, with the relatively smooth rivet head on the outside and the sharp, poorly formed roll crimp on the inside next to the rope path. Furthermore, the attachment point is not beveled. In general, I find the idea of a quick attach feature very desirable, but the execution of the idea could be substantially improved on both this descender and all others considered in this article.

<u>Version C</u>

Technical details

I obtained this descender from J. E. Weinel Inc. in 1984. The major difference between this and the preceding design is the inclusion of a third auxiliary rod and modification of the side plates to accommodate the third rod . A reduced diameter end of the steel rod passes through the upper end of the fixed sideplate. A steel washer is then placed over the outside end of the rod and the end formed into a round rivet head. The opposite end of the rod has a flange to engage the pivoting sideplate. The sideplates are cut out of 3 mm. aluminum and red anodized. The upper end of the sideplates are offset to place the auxiliary bollard closer to the "up" side of the main rope. The pivoting sideplate is notched to clear the auxiliary bollard as well as the upper main bollard nut. The pivoting sideplate has a quick attack feature similar to version B's. None of the attachment points are beveled.

Comments

The auxiliary bollard works very well for keeping the rope on the upper main bollard without binding, but is less satisfactory when used as part of the braking system. The rod is too small to function well as a third braking surface, has no means to insure that the rope stays on the rod reliably, and is located where it forces the rope into an inconvenient position. This last point is particularly noticeable if the trailing rope passes through a maillon clipped to the seat maillon as indicated in the Petzl instructions and required for safety. In this case it requires too many contortions to switch from the two bollard mode to the three bollard mode.

Standard bobbins - double rope

Petzl

Version A

Technical details

I acquired this descender from Rocksport in Somerset, U.K. in 1981. As in the single rope bobbin version A, there is a fixed and a pivoting sideplate made of 32 by 3.3 mm. aluminum. The upper end of the fixed sideplate is bent inwards in a quarter circle, while the upper end of the pivoting sideplate is bent into an 11.4 mm. I.D. inverted U-shaped channel. The end of the sideplate is cut so that when closed, approximately 2/3 of the width of the sideplate is in contact with the upper bobbin,. The remainder is cut away to allow clearance for opening the bobbin. When the bobbin is in use the sideplates keep the rope on the top bollard, and the end of the top sideplate keeps the rope from jumping between the two grooves in the top bollard. The lower ends of the sideplates are bent to converge at the attachment point, which consists of a 13 mm. hole in each sideplate. These holes are beveled on both sides. The bollards are turned aluminum with a milled slot to keep them from rotating on the fixed sideplate. The lower bollard has a single wide rope groove, while the upper bollard has independent grooves for the two ropes. The bollards are bolted to the fixed sideplate with 7 mm. A2 bolts. The pivoting sideplate pivots on the lower bolt and has a slot to allow clearing the upper hole. The lower U-groove bollard is mounted through a hole in its center, but the upper V-groove bollard uses an off-centered arrangement to allow a smaller clearance slot in the upper sideplate.

The pivoting sideplate is stamped "PETZL", and "FRANCE". The bolt heads are marked "UV" and "A2".

Comments

This bobbin is substantially larger than its single rope equivalent, and so one may be inclined to choose the smaller version on weight considerations alone. The disadvantage of this choice is that single rope bobbins effectively can not be used on double rope rappels, and hence can not be relied on when conditions are not known with absolute certainty in advance. My experience suggests that one will eventually encounter situations where a double rope rappel is needed. Single rope bobbin users will not be able to deal with these situations unless they have a second rappel device available. This is a strong argument against using bobbins as opposed to other devices. Double rope bobbins do not have this disadvantage, and can be used on single ropes as well.

Version B

Technical details

I obtained this descender at the same time as version A. It differs from version A in two ways. First, it has a quick-attachment feature similar to that on the single rope Petzl bobbin version B. Second, the lower bollard has a U-groove for each rope rather than a large common one. The bolts are about 1 mm. too short to completely extend through the nuts.

The pivoting sideplate is stamped with an icon illustrating how the descender is threaded, but anyone who needs this assistance shouldn't be using a bobbin anyhow. It is also stamped "PETZL", "MAXI 1500 KG", and "FRANCE". The bolt heads are unmarked.

Comments

All of the comments on the single rope version B quick attachment feature apply here as well. The lower bollard design is substantially different than that of double rope version A, but I find very little difference in the performance characteristics of the two, since they are both too fast for my taste. Lighter cavers might notice a difference. When a double rope bobbin is rigged for extra friction during a single rope rappel, the two groove design has the advantage of keeping the rope paths separated on the lower bollard, where the directions of rope motion may be opposite.

Autostop bobbins

BO.VE

Diablo

Technical details

I acquired this descender (#1227) from Repeto Sport in Genova, Italy in 1982. The two sideplates are made of 33 by 3.0 mm. aluminum. The sideplates are very similar to the Petzl version B design, and a quick attachment feature nearly identical to Petzl's is provided. The attachment points are not beveled. The upper bollard is very similar to Petzl's, complete with off-center mounting and provision of a threaded 7 mm. hole for reversing the bollard. The lower bollard is part of an autostop device. The bollard has a 15 mm. diameter toothed cylinder attached at the 10 o'clock position[1]. The cylinder is screwed onto a 5 mm. connecting pin which is then pinned to the bollard with a 1 mm. roll pin. A handle is attached to the bollard with two 3.5 mm. screws. The fixed sideplate prevents these screws from backing out.The lower bollard and attached handle assembly house a bronze bushing and pivot on the lower 7 mm. bolt. Friction from the main rope's passage tends to turn the lower bollard and force the toothed cylinder towards the upper bollard, thus locking the rope and ideally arresting the descent. The rappeler uses the handle to keep the autostop feature disengaged.

The handle assembly has two other features. Plastic plates are riveted to the two sides of the handle to increase its thickness, mainly for comfort and aesthetic reasons. In addition, there is a small lever attached to the back of the fixed sideplate with a 3 mm. countersunk head machine screw. A turned pin riveted to this lever extends through an arcuate slot in the fixed sideplate and can engage a slot in the handle when the autostop feature is disengaged, thus holding the descender in this position.

The pivoting sideplate is stamped "diablo" and "brevettato". The lower bolt head is marked "RS" and "A2", the upper "C" and "A2".

Comments

In general this is a well made descender. The manufacturer paid attention to minor details, such as center punching the bolts so the nuts would not loosen. The use of a bronze bushing rather than the tempting omission is another commendable practice. The one oversight I noticed is that the roll rivet on the attachment point guard is barely expanded and had a very sharp end on the inside near the rope path, but probably far enough away to be of no concern.

Unfortunately, I find the autostop feature is rather insecure. In fact, I have used this descender for normal rappeling with the autostop fully engaged, and find the friction provided to be preferable to the normal amount. The lever provided for disengaging the autostop feature works, but it appears to be rather weak, so I do not use it.

Dressler

Descendeur Autobloquant Dressler (DAD)

Technical details

I acquired this descender from Repeto Sport in Genova, Italy in 1982. The fixed sideplate is an elongated piece of 4 mm. aluminum bent inwards in a dogleg at the lower end. Two beveled 13 mm. holes below the dogleg serve as attachment points. The upper bollard is an aluminum casting bolted to the fixed sideplate with two 6 mm. bolts. This bollard is not circular, but more airfoil shaped with the concavity in the lower surface provided to work in conjunction with the autostop role of the lower bollard. The lower bollard is a spiral shaped aluminum casting bolted to the pivoting sideplate. This sideplate extends upwards only to the bottom of the upper bollard, with a sub-millimeter clearance provided. The lower end of the pivoting sideplate doglegs inwards and has one 13 mm. beveled attachment hole aligned with the upper hole on the fixed sideplate. A projection extending below this hole limits rotation of the pivoting sideplate if a carabiner or maillon is in the fixed sideplate's lower hole. The lower bollard and pivoting sideplate rotate on an 8 mm. bolt through

[1]orientation is with the descender handle on the left side of the descender

the fixed sideplate. A 6 mm. bolt keeps the lower bollard from rotating with respect to the pivoting sideplate. Finally, a 10 mm. diameter by 14 mm. cylinder is riveted to the inside of the fixed sideplate below the lower bollard. This pin is necessary to keep small ropes in the device when the lower bollard and pivoting sideplate are rotated to the fully engaged position.

The pivoting sideplate is stamped "DAD" and "BREVETE". The bolt heads are marked with "A2" and an "L" inside a diamond.

Comments

The DAD departs from traditional bobbin design in several ways. By using castings, the manufacturer is able to use more complex shapes for the bollards at the probable sacrifice of some superfluous strength. This gives the designer more control over the characteristics of the device. The airfoil shape to the upper bollard reduced the height of the descender by several centimeters. The autostop feature on the DAD is more secure than on the Dressler, but is easily disengaged by accidentally bumping the pivoting sideplate. The autostop feature is easily overridden by rigging into the upper, rather than lower attachment hole. My biggest objection to the DAD is the lack of any means to keep the rope running over the top of the upper bollard. I find that stiff ropes, such as PMI standard, are particularly willing to leave their appointed path.

Kong-Bonaiti

Technical details

I acquired this descender from Speleoshoppe in about 1982.The sideplates are very long, with a cast iron autostop cam mounted above the two bollards. The pivoting sideplate pivots about the cam bolt rather than the lower bollard bolt as in most other designs. The upper bollard is bolted through its center to the fixed sideplate, with two roll pins provided to prevent rotation. The lower bollard rotates on a custom axle bolt bolted to the fixed sideplate. A handle assembly mounted on the outside of the fixed sideplate rotates on the shoulder nut attached to this bolt. A shim serves as a spacer between the sideplate and handle assembly. The handle grip is moulded phosphorescent green plastic. A second bolt passes through the handle, a connecting arm, a shim, and into a threaded steel insert in the lower bollard. A second insert is provided for reversing the bollard. The other end of the connecting arm is riveted to the autostop cam. Friction from the passage of the main rope causes the lower bollard to rotate, rotating the handle and pulling the connecting rod down. This pulls the autostop cam against the rope above the upper bollard, thus ideally arresting the descent. The handle is used to keep the cam disengaged during normal descent.

The attachment point os a 15 by 22 mm. oval hole near the bottom of the two sideplates. The hole is oriented horizontally, allowing two maillons to ride side-by-side. Below these holes is a 6 mm. hole in the fixed sideplate for attaching a piece of accessory cord. A cutout in the pivoting sideplate provides clearance.

The pivoting sideplate is stamped "KONG", "BONAITI-ITALY" and "Kg 1500". The plastic handle has "PHOSPHORESCENT".

Comments

The autostop feature on this descender differs from the others, and has several disadvantages. First, and most important, I find that it simply does not work. I can easily rappel with the autostop feature fully engaged. Second, it greatly increases the length of the descender. Finally, it is too complicated, with too many pivoting joints for mud and sand to enter.On the positive side, the workmanship is good, and I like the idea of a phosphorescent handle, even if its practical utility is negligible. The accessory cord hole should be used to tie the descender to one's harness, since there is no quick attach feature.

Petzl

<u>Stop, Version A</u>

Technical details

I acquired this descender from Repeto Sport in Genova, Italy in 1982. The sideplates are black anodized aluminum similar to those in the single rope Petzl version B. A quick attach feature similar to that same version is present.

The lower bollard is part of an autostop assembly. The upper surface of the bollard is milled flat and a J-shaped of 3 mm. steel is inset and screwed to the bollard. This protrudes at the 10 o'clock position and acts as a cam much like the cylinder attached to the Diablo. A aluminum handle is riveted to the fixed sideplate side of the lower bollard. The handle portion is bent into a U to increase thickness for comfort. The lower bollard and handle assembly rotates on a shoulder nut on the lower bolt. A concealed spring tries to keep the handle in the disengaged position, but is weak enough to function only during storage. Friction from the main rope's passage tends to turn the lower bollard and force the toothed cylinder towards the upper bollard, thus locking the rope and ideally arresting the descent. The rappeler uses the handle to keep the autostop feature disengaged. Alternately, a hole in the handle plate opposite the handle itself allows one to clip a carabiner in, thus disabling the autostop feature by preventing rotation of the lower bollard assembly. A small cutout in the fixed sideplate provides clearance for this carabiner.

The upper bollard is cut away on its lower side to provide a flat surface to act as an anvil for the cam action of the autostop feature. A rounded 10 mm. steel cylinder is pressed into a hole in the lower surface of this bollard, and acts as a wear resisting bar.

The pivoting sideplate is stamped with an icon illustrating how the descender is threaded, but anyone who needs this assistance shouldn't be using a bobbin anyhow. It is also stamped "STOP", "BREVETE", "FRANCE_Etranger", "PETZL", "MAXI 1500 KG", and "FRANCE". The bolt heads are marked "A2" twice.

Comments

This bobbin is one of the three descenders in my normal caving set[1], so I have used it extensively in a wide variety of conditions. Unlike most autostop bobbins, the Petzl design works well, perhaps due to the flat cutout on the bottom of the upper bollard. I prefer this bobbin over any other autostop descender (bobbin or other) in my collection. Despite this, one must realize that the availability of an autostop feature may encourage one to rely on it. Since the required action in an emergency situation is letting go of the descender, the autostop feature should never be relied on.

The handle spring is a nice idea. Its only function is to keep the handle from flopping around inside one's pack. It is far to weak to have any adverse effect while on rappel. Petzl does not use a bronze bollard bushing like in the Diablo, and I have never missed having one. All in all, I feel that this device is very well made, and aside from its inability to function on doubled ropes it has served me very well.

<u>Stop, Version B</u>

Technical details

I acquired this descender from Caves Unlimited in 1984. It differs from Stop version A in the pivoting sideplates and bolts only. The pivoting sideplate has been made about 6 mm. wider in the area of the upper bollard nut clearance notch and approximately 8 mm. wider in the quick-attachment area. Both sideplates are blue anodized. The pivoting sideplate markings are identical except for the omission of "MAXI 1500KG".The bolts are marked with "A2" and an "L" inside a diamond.

Comments

Performance is identical to Stop version A's. The beefed up sideplate may increase strength, but I doubt that anything is wrong with the strength of version A, so I consider the extra weight superfluous. The use of a different lot of bolts is unimportant. I almost never use this bobbin since I see no advantage over version A.

<u>Stop, Version C</u>

Technical details

I acquired this descender from J. E. Weinel Inc. in about 1987. This bobbin functions on the same principles as the previous two Stop models, so I'll keep the description brief. The major differences between versions B and C are: 1) version C incorporates a third auxiliary rod similar to the single rope Petzl version C. 2) the lower bollard is now a skeletonized casting, and the cam is an integral part of the casting. 3) the handle is no longer screwed to the lower bollard. It now fits into a recess in the casting. 4) the handle now has a loose fit red plastic cover. 5) the roll rivet holding the attachment point guard on now has the smooth head on the inside next to the rope.

Comments

There are a number of things about this bobbin which I like less than in the previous two. Mostly I dislike the lower bollard. The skeletonized casting may be lighter, but it does not have nearly the wearing capacity that the machined bollards had.

[1]The other two are a Russ Anderson figure 8 with slot and a Speleoshoppe Rack with Seaman style brake bars.

There is no internal bracing in the casting, and it is undoubtedly weaker than the machined bollards. The handle attachment does not appear to be as secure as the riveted ones. The auxiliary bollard has all the disadvantages as in the case of the single rope standard bobbin version C. The red handle looks pretty, but serves no useful purpose except in extreme cold, and will probably be destroyed after a few exposures to the harsh cave environment. All in all, I think this model is a significant step backwards for Petzl.

People who are into strength ratings of vertical gear should read the descriptions of the sideplate markings for the three Petzl Stop descenders carefully. I am not sure if this model is really any weaker than the others. If it is, then its probably due to the design change in the lower bollard, and hence the change was for the worst. On the other hand, if the older Stops are not stronger, then why did Petzl claim they were? If there is a legitimate explanation for the differences it should be made public. It is this sort of nonsense which prompted my fourth synapse firing in Nylon Highway #26[1].

Single Rope Technique

Technical details

I acquired this descender from Inner Mountain at OTR, 1988. The SRT differs from other bobbins in that both bollards and the autostop handle are part of a single ferrous casting. This casting is mounted between a fixed and a pivoting sideplate. The sideplates are 3.3 mm. red anodized aluminum. The attachment points are essentially the same as those on the quick attach bobbins, and feature a similar guard on the pivoting sideplate. The sideplates extend outwards (opposite the handle side) at the top, and a 16 mm. cylinder is bolted to the fixed sideplate. A notch in the pivoting sideplate mates with a notch in this cylinder when the sideplate is closed. The bollard casting pivots about a nut passing through the lower bollard. On rappel the bollard casting tends to pivot and force the upper bollard towards the anvil, squeezing the rope and ideally arresting the descent. The required torque is provided by the friction generated by the ropes passage augmented by the asymmetrical loading resulting from the "S" curve in the rope. A hole at the top of each sideplate is aligned with a hole in the upper bollard, and allows insertion of a carabiner to prevent this rotation and deactivate the autostop feature.

The pivot deserves some special discussion. Rather than simply drill a pivot hole in the lower bollard, SRT casts a hexagonal cavity into the bollard. A hexagonal aluminum bushing with an off center hole can be placed into this cavity in six different ways, thus moving the fulcrum with respect to the handle. A spring is also provided to hold the handle open during storage, and functions in the same manner as on the Petzl Stop.

The pivoting sideplate is stamped with an icon illustrating how the descender is threaded, but anyone who needs this assistance shouldn't be using a bobbin anyhow. It is also stamped "PAT. PEND", "MAX. 800 Kg", "ROGELJA", and "AUSTRALIA". The pivot bolt head is marked "IVS" and "A2". The anvil bolt head is marked "A2-70".

Comments

The descender seems to provide about the same amount of friction as most bobbins, so is fast for my taste. The good news is the autostop feature holds securely. The bad news is that it takes quite a bit of effort to hold the handle to keep the autostop disengaged. The reason is that squeezing the handle causes rotation which lifts the upper bollard, and the trailing rope with it. In fact, if one stops then uses the other hand to apply a strong hip brake, squeezing the handle actually lifts the rappeler upwards. The result is that one's handle hand becomes tired very quickly.

I tried varying the friction by rotating the internal hex bushing as indicated in the instructions. It is a fairly easy task to make the switch, but I could notice no differences on rappel. Despite the documentation, I doubt that the hex bushing affects friction much at all, since the relative location of the two bollards is fixed, and that should control the friction. I was hoping that the force required to hold the handle down would vary, since the fulcrum is being moved, but in all cases the force required was so high that I could not notice any change. If I were redesigning this bobbin I would consider moving the third anvil up and closer to the other two, possibly sacrificing some holding power for ease of use.

The bollards themselves are ferrous rather than aluminum, so they should be expected to heat

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[1]Storrick, Gary D., "Random Synapse Firings", Nylon Highway, 26, 1988, p.12.

more. I noticed this in qualitative testing, but have not had the opportunity to quantify the difference.

In general this bobbin is very well made, and the autostop functions well, but it is very tiring to use. There is a double rope version of this descender, but I could not obtain one in time for this article. If I can get one I will review it in a future article. I hope that the handle on the double rope model is not twice as hard to hold open!

Miscellaneous bobbins

Voynett S.A.R.L.

Tracson

Technical details

I acquired this descender from Repeto Sport in Genova, Italy in 1982. The device incorporates features of both an eccentric cam ascender and a bobbin; I elected to discuss it here rather than in the first article because of my subconscious view of the device.

The Tracson consists of a number of parts mounted on a roughly trapezoidal 3.9 mm. thick red anodized aluminum backplate. A 15 mm. hole is drilled in the lower left corner of the backplate, then the corner is bent inwards at a 90° angle. This hole is the main attachment point. The upper left corner is also bent in slightly to serve as a rope guide for the upper bollard. A second 15 mm. attachment hole is cut in the upper right, then the right side of the plate is bent around 180° to form a channel for mounting a cam.

The upper bollard and an irregular shaped rope guide is attached near the upper left corner of the backplate with a 8 mm. bolt, nut, and washer. A 5 mm. steel pin through the backplate keeps the bollard from rotating and a second pin keeps the rope guide from turning.

Below this is the lower bollard assembly. A 9.5 mm. bolt and shoulder nut secure the bollard and a pivoting cover plate assembly, as well as a flat steel spring in the outside of the backplate. A 5 mm. steel pin through the backplate keeps the bollard from rotating. The cover plate is an irregular hexagonal 3 mm. aluminum plate which keeps the rope from slipping off the lower bollard. It has a spring loaded latch which engages a post riveted to the backplate below the lower bollard. Also present on the cover plate are an 8 mm. pin provided as a finger grip and a very small pin with no obvious function.

The cam assembly consists of a steel cam, cam spring, and cam pivot. The cam is very similar to a Jumar cam, with a $(3)(4.3)^6$ conical tooth pattern. The tooth axes are perpendicular to the cam face. Above the cam is the cam actuator, a two piece cog pinned to its own pivot. On the outside of the backplate a lever is pinned to this pivot, so it actuates the cog. A spring keeps the lever in the raised position, where it does not interact with the cam. A third pin through the backplate channel prevents cog over-rotation. The lever can be rotated downwards, thus opening the cam. An allen setscrew in the lever handle can engage a hole in the flat spring, thus locking the cam open. A piece of foam is placed between the flat spring and the backplate, but its function is not immediately apparent. The cam itself acts against the rope, with the lower bollard acting as the anvil. The lower bollard has a flat area machined into the rope travel surface to improve its performance in this function.

The Tracson bears no markings other than a sticker giving the name of the device and some information on the manufacturer.

Comments

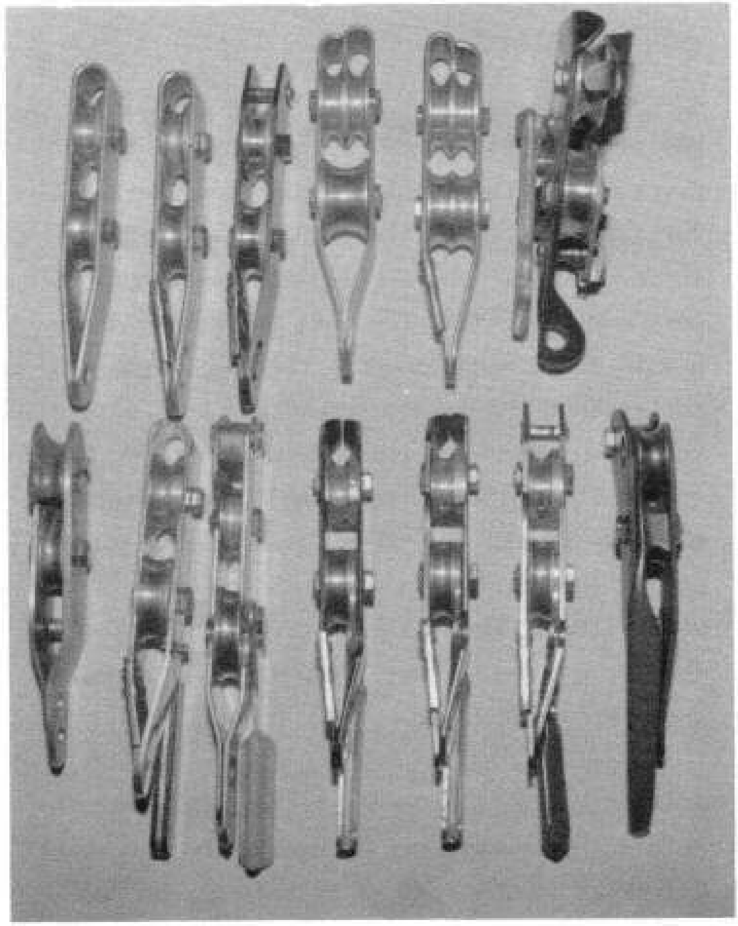
This device is an attempt to make an ascender and descender out of one piece of equipment, and the result is needlessly complicated. I count no less than 37 parts to this device, and I may have missed a few. The idea of a combination ascender-descender is appealing, but since the functional requirements for the two types of device are so different, attempts to devise a combined apparatus have been mostly unsuccessful. The Tracson is designed to be used as a bobbin and as a chest ascender in the Frog system. It fails to achieve an advantage over, say, a Petzl single rope bobbin and a Petzl Croll ascender used in the same manner.

When I first tested the device, I found that the rappel characteristics were much like other bobbins. Fearing rope damage from the sudden closure of the toothed cam, I stopped before engaging the autostop feature. When I tried to disengage the cam under load by using the lever, the lever pivot bent and the lever would no longer engage the hole in the flat spring. The applied force did not seem excessive, but damage resulted anyhow. I managed to repair the device, then I tried using it as an ascender and the cam pivot bent again. Either I have a lemon or the material in the cam pivot is inadequate. I no longer use the Tracson for fear of destroying my collection's only copy.

Although I find this device fascinating, I can not recommend it for caving use.

Conclusions

In many ways this has been a very limited discussion of a single, very specific type of descender. The discussion was kept short for reasons of space, and much more could be said about each of the descenders discussed. There are other bobbin type descenders, such as the Yugoslavian Butkovic and the double rope SRT, which I had to omit for lack of familiarity with them. I suspect the Butkovic is not commercially available, but it is a very intriguing design which would be very easy to manufacture. I can supply drawings for making one, and if someone with access to a machine shop could make one for me I would greatly appreciate it. As for the SRT, I hope to be able to obtain one for a later review. I have not discusses the uses of bobbins, nor do I intend to here. Instead, I urge anyone considering using any of these devices to get proper instruction before doing so.



Addendum to the first article

Since I wrote the first article, Ken Kramer showed me a CMI ascender with the same safety as the Shorti III. The safety lever has broken off in normal caving use, making the cam rather difficult to open. I suspect that the plastic chosen for the safety was too brittle.

Errata

The following errors appeared in the first article in Nylon Highway #27:

p. 19: In the photo caption, the upper right ascender should be labeled "Clog version C".

Bobbin Data

Bobbins / Descender	Height h	Width w	Thickness t	Std volume	Weight m	Top bollard D	Top bollard d	Bottom bollard D	Bottom bollard d	Third bollard D
Petzl, single rope version A	188 mm	44 mm	31 mm	256 ml	230 g	33 mm	6 mm	37 mm	13 mm	-
Petzl, single rope version B	188 mm	44 mm	31 mm	256 ml	241 g	33 mm	6 mm	37 mm	13 mm	-
Petzl, single rope version C	195 mm	44 mm	31 mm	266 ml	248 g	33 mm	7 mm	37 mm	13 mm	7.6 mm
Petzl, double rope version A	197 mm	45 mm	41 mm	363 ml	312 g	33 mm	5 mm, 5 mm	34 mm	26 mm	-
Petzl, double rope version B	194 mm	45 mm	41 mm	358 ml	324 g	33 mm	5 mm, 6 mm	37 mm	12 mm, 11 mm	-
Diablo	226 mm	56 mm	32 mm	405 ml	328 g	34 mm	7 mm	40 mm	17 mm	-
Dressler DAD	182 mm	52 mm	32 mm	303 ml	248 g	16-31 mm	13 mm	10-≈50 mm	2-11mm	-
Kong-Bonaiti	239 mm	57 mm	32 mm	436 ml	400 g	35 mm	7 mm	45 mm	13 mm	-
Petzl Stop, version A	225 mm	63 mm	33 mm	468 ml	290 g	34 mm	6 mm	41 mm	14 mm	-
Petzl Stop, version B	227 mm	63 mm	32 mm	458 ml	302 g	34 mm	7 mm	41 mm	14 mm	-
Petzl Stop, version C	237 mm	64 mm	33 mm	501 ml	327 g	34 mm	7 mm	42 mm	14 mm	7.6 mm
SRT	218 mm	73 mm	35 mm	557 ml	407 g	28 mm	10 mm	31 mm	15 mm	16 mm
Tracson	190 mm	106 mm	50 mm	1007 ml	581 g	34 mm	5 mm	44 mm	19 mm	-

Note: Standard volume is height*width*thickness/1000

THE ROPE HOPPER: AN AMERICAN FROG

By Bill Farr

Why is it that the cavers who do the fewest drops have the most complicated sets of vertical gear? As I moved into expedition-style caving, where it is not uncommon to have to negotiate from one to three dozen drops on a normal survey trip, I began to notice that the people around me, who seemed to know what they were doing, always had vertical rigs that were simpler and lighter than my trusty ropewalker system and always had their system on and off quicker than mine. The epitome of this trend seemed to be the Frog system, the staple of virtually every European caver.

I first saw the Frog system in use in Golondrinas, where two German cavers we met, sit-stood up the drop as fast as anyone with a ropewalker. I started using the system myself while caving in Austria, where it was necessary to use a system with all ascenders mounted high, where they can be easily manipulated to pass omnipresent rebelays quickly and efficiently. By the end of my first trip to -600 m, I was a convert. At the last regional, I talked with a visiting French caver about the vertical techniques he used. He talked about survey trips of only 20 hours to -1000m. The vertical system he used -- the Frog.

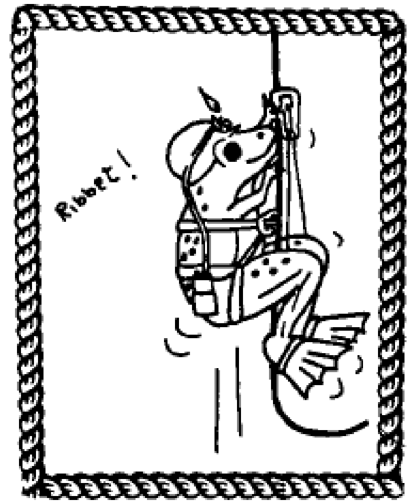
The advantages of the Frog system are as follows:

1. It's simple and light weight. On long trips, every extra piece of metal, every extra length of webbing soaking up mud and water, adds weight and increases the energy expenditure necessary to move through the cave.
2. Both ascenders are mounted high and safetied to the seat harness. This makes them easy to place on and off rope and no matter which one fails, you won't flip upside down.
3. The system is more restful than a ropewalker. When you are exhausted and have to make that next step up the drop with a heavy pack tethered beneath you, you can use both legs to lift. After the step, you are automatically in a restful sitting position.
4. It is fast on and off the rope. In multi-pitch caves, where you can wear your seat harness between drops, you can have ascenders out of your pack, onto your body and on the rope in about a minute. For short drops (20m or so) you can be up the drop and have your ascenders back in your pack before your buddy, with a full blown ropewalker, even has his system on.

However, it still is a sit-stand system, and hence not as efficient (even though more restful) on long free drops, and still, it has only two ascenders. Thus, in the eternal pursuit for the perfect vertical system, I believe I have come up with a couple of additions to the frog that allow it to be used as a rope walking system while still maintaining its other advantages. I call this versatile system a "Rope-Hopper".

The system begins as a standard Frog. It is comprised of a seat harness, a Jumar with two foot slings (no chicken loops) and a safety to the seat, a second ascender attached directly to the seat with a small sling to a simple chest harness. The chest harness is comprised of a loop of webbing twisted into a figure eight with a light weight, non-locking 'biner across the front to clip into the top of the seat Jumar. The foot ascender rides above the seat ascender. In actual practice, I use a CMI as the upper ascender with the foot slings constructed from a single piece of 5.5mm Kevlar. At each end is a figure eight loop attaching a foot stirrup constructed from a sewn loop of 1" webbing. In the middle of the sling, I tie another figure eight loop and then attach the sling to the ascender via a small quicklink. For the safety, I use another loop of Kevlar tied directly to the ascender, adjusted in length such that I can take a full length stride while still being able to thumb the ascender when hanging from this loop alone (this is necessary for changeovers).

Use of the quicklink allows me to disconnect the foot slings and use the ascender as a safety for rappelling without them flopping around. For the lower ascender, I use a Petzl Croll with the bottom clipped directly into my seat harness. At the top, I tie a 5 cm loop of 7/16" supertape webbing. For my chest harness, I use a loop of 9/16 supertape and a lightweight offset D 'biner. This chest harness is a breeze to put on as there are no buckles to deal with. The biner then clips into the 7/16 loop. When not on rope, I am slightly hunched over, but when on rope it is very comfortable.



This is all I use for drops to about 20m. For ascending handline drops, I discard the upper ascender and slings and extend the spacing from the Croll ascender to the chest harness with a second 'biner (for comfort). Rigging the rope through the chest harness then allows me to ascend with both hands free while safetied, as I do not have to hassle with pushing a loose Jumar up the rope as is normally done. For longer drops, I add two more small pieces of gear to complete the Rope-Hopper System.

First I add a conventional foot Gibbs. Second, I take a Simmons roller on 20 cm 1" webbing with a pair of D rings on one end and strap this assembly to the chest harness at the same place as the 'biner goes through. Removing the one sling to my foot with the Gibbs, I can now ropewalk in a configuration somewhat reminiscent of a Mitchell system. This is the full blown Rope-Hopper. Volumewise, it occupies less space than a standard ropewalker by eliminating most of the slings and it weighs less too. But the real hallmark of the Rope-Hopper is its versatility.

Rope Hopper continued on page 42

LETTER FROM THE EDITOR

Years ago, when the Vertical Contest was first initiated, its primary purpose and focus was to demonstrate the efficiency of various climbing systems. In the early 70's, I can remember on-lookers crowding around finished climbers taking notes, copying rigs, and interviewing the climbers. Since the categories have been in place and there exists only 2 (knots and mechanical), coupled with the multiple age groups, it has become purely an athletic contest. I feel this pulls significantly away from the original intent of the contest. I see creativity stifled and the same knee-foot Gibbs ropewalker winning every year. Boring!!!

I think a contest focused on climbing rigs and technique, rather than physical stamina and athletic ability need to be put in place to save the contest from its built in obsolescence.

The age groups, I feel, have not really served their purpose, as I see many older age categories with times better than younger ages. Perhaps only 3 age groups are necessary; Young, 0-16, Gladiator, 17-39; and Geriatric, 40-old.

I think the biggest problem with the current contest format is the limit of only 2 categories (knots and mechanical). We all know that in reality, all the various mechanical systems are not comparable, yet in a cave and in practical use, almost all have their important moments on a rope. Speed has never been a criteria for caving enjoyment. The contest should reflect what cavers really do. After carefully reviewing each of the classic systems, I feel there should be 5 categories.

-<u>Knots</u> (Classic 3-Knot system)

-Chest Croll category (Includes: Inchworm, Frog, Wisconsin and Mao)

-Knee-Foot Ropewalker category (Includes: Classic Gibbs, Single and Double Bungie, Howie rig, Chest rollers and Shoulder Gibbs configurations.

-Mitchell System category (Includes Classic Mitchell, Jumar method, Gossett system, APS and Pygmy)

-Sit-Stand category (Includes Texas, Texas long step, Plumber system, Portly and Misc.)

Adding these 5 categories and reducing the age categories actually reduces the number of climbing categories from 64 to 60. (Currently 8 age groups, 2 categories, 30 and 100 meters, men and women)

I also feel that the contest officials need to reconsider their decision 2 years ago which demanded that each knot during a Classic 3-knot climb be moved separately and independently. At the time this rule was put into place in order to preserve the 3-Knot Classic system. I feel the 3-Knot System preserves itself just by climbing with 3 knots attached to a chest and each foot. If someone comes along with a developed technique to use it more efficiently, GREAT!! That was the the whole reason the contest was established in the first place, innovation and system efficiency. Currently, I feel the climbing contest, as currently structured, stifles all creativity, innovation and is losing caver appeal. □

Bruce W. Smith NSS12458F

ELECTRIC DRILLING—HAMMERS FOR CAVING

By Peter Ludwig

ETHICS

Some cavers believe that drilling holes in cave walls is bad. This article is only technical information. Many European Grottos (especially German and Austrian) use this "hi-tech" method with excellent results, for safety and other reasons. It made many explorations possible. All European Grottos use bolting for cave rescue.

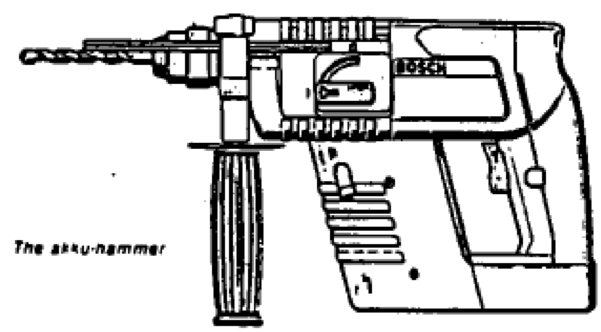
GENERAL

Drilling-hammer technology was invented by the firm HILTI in Liechtenstein, a country between Austria and Switzerland. The main difference between a drilling hammer and a standard impact drill like everyone has at home, is that the energy from the motor goes mainly into the impact and not into rotation. It is therefore much more efficient for drilling in rock and concrete. On the other hand, this principle is much more expensive to make and was covered until a few years ago by HILTI's patents. They are now offered by many manufacturers.

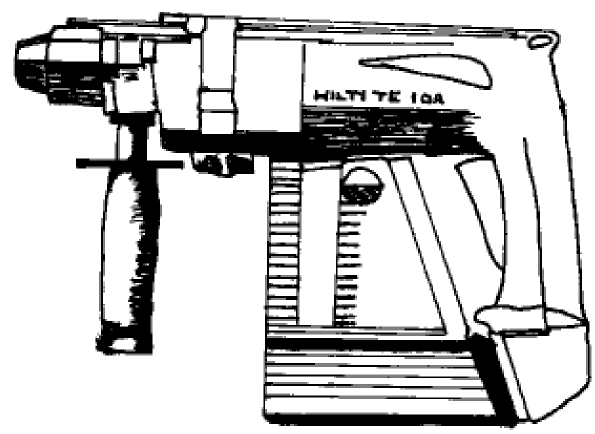
In a standard impact drill, only two serrated disks are pressed together to produce the impact, so you must press very hard to get acceptable results. A drilling hammer needs only minimal force (Editor: 8 - 12 lbs.) to press the drill against the rock; a pneumatic piston works like an air compressor and forces a secondary piston to impact the drill. The air between them is only a medium to store energy for a short time. The impacts are much harder and so most of the drilling hammers use special inserts instead of standard rock drills. These inserts have a standard-sized shaft of approximately 10mm dia., and 4 slots (two of them are round, the other two have edges), and are called SDS-Plus (except the original Hilti, which have only the two round slots). It is possible to use SDS-Plus inserts in HILTI machines but not vice-versa. On most hammers you can disable the impact and use them for normal drilling (with a special adapter and a standard head). On some very few types you can also disable the rotation and use the whole thing as a power chisel.

BATTERY-POWERED HAMMER DRILLS

There are now four brands available



The Bosch AKKU-Hammer



The Hilti TE-10A

Bosch GBH 24 V

The Bosch was the first battery-powered hammer drill on the market. It has a 24V, 1.2 Ah NiCad power pack and works very well. Its power consumption is 265 W and weighs 3.6 kg (8lbs.) with power pack. In very cold Austrian cave conditions, one charge can usually drill twelve 8mm anchor holes in the rock. The charger charges in 2 hours at 0.8 Amps, independent of the charging state. Deep discharge has caused many power pack failures in commercial use. The whole set is sold in Western Germany for about $350. There are sometimes special offers of the same price with two power packs and some drills.

HILTI TE7A

The HILTI appeared later than the Bosch on the caving market, but I think HILTI started the development first and did more research. I asked at HILTI many years ago, why there was no battery-powered drilling hammer. They told me that the available power packs were not good enough for this extreme high-power application. The HILTI uses a 36V, 1.2 Ah power pack (30 sub-C cells) and has a built-in power cutoff against deep discharge. The power pack is also electronically protected against high-temperature charging and overheating (this is not a problem in our caves, typically 2 deg C). There is a small SMD plate in the power pack. The HILTI seems to be much more efficient than the others; you can usually drill about twice the holes at with the Bosch (but the power pack is only 50% larger). Its power consumption is about 360 W. It's charger seems to be slightly more intelligent than the Bosch; I think it controls charging by measuring the temperature. The power pack has two additional terminals, one for charging and one for switching on while doing the job.

HILTI TE-10A

Editor: An incredible modern field drill. Power input is 350 watts; 36 volts AC; full load speed is 750 RPM; percussion is 4200 impacts/min.; Weight 9.3 lbs. It will drill approximately 100 to 150 2 1/2" deep, 1/4" dia. holes in hard limestone per charge. The battery recharges in 2 hours. It has a safety against deep discharging and will stop working with 10% battery life left. The drill costs between $400 and $600. I strongly recommend Kwik Bolt II stud anchors. The size of the hole drilled is the size of the bolt shaft bearing the load. Over drilling allows the stud to be driven into the rock, mudded over and the rock left almost as it was found. Field performance is incredible.

The BBC

This drilling hammer is comparable to the Bosch but works at 12 V. I have no further information about it, and it seems to have no advantage.

Makita

Editor: Makita also makes a battery powered drill. As of this writing, little is known of the specifications or performance.

USING THEM IN A CAVE

The best description of this is West German caver Daniel Gebauer's article in Caves & Caving #34 pg. 30. We use 8mm bolts with great success; they must be used intelligently. If you consider your life worth larger bolts, use them; choice of bolts also depends upon the rock. The rock in our alpine caves is very hard and solid, so an 8mm anchor is good for some 14 kN (3000 lb) on shear load and 17 kN (3800 lb) on rectangular load. We usually place locking nuts instead of standard nuts. I think it's better to use more small bolts at the same anchor instead of using larger bolts. It also seems that efficiency is higher with smaller drills. If you have weaker rock, then longer and thicker bolts may be required; but then less energy is needed to drill soft rock.

Artificial steps

Since we have the drilling hammers, we use artificial steps and grips more often in cave passages which we have to traverse many times. For this purpose we use 100mm (4") long, 10mm (7/16") bolts. The first 25mm (1") are covered with several layers of duct tape. A 10mm (1/16") hole is drilled and the now oversized bolt is driven in with a hammer. This system works very well but you need another drill size. We now try to use special (homemade) hangers which we can use as steps too (with an anchor).

Chisel work

We have a pointed chisel insert which we have never needed in a cave, but we performed some tests. It should be advantageous in very tight ares where it is not possible to use a hammer. There is now a new blade chisel available which disables the rotation.

Drilling blasting holes

Although the user's manual says that you cans use them only up to 16mm (5/8"), we tried the HILTI and the Bosch with a 20mm (7/8") drill. They did well, but needed a lot of energy because it is hard for the machine to accelerate the large and heavy drill. This is only usable if large quantities of electricity are available (read on for more details).

Funny things

I want to make a small propeller for our grotto's caving raft and drive around underground lakes if we have leftover energy in the power packs.

GENERAL HINTS

Drilling points

Our experience is that more expensive high quality drills are worth their cost. They weigh the same as the cheap ones, but can drill more holes with the same power pack. (Editor: A 3/8" bit costs about $60.00)

Backup

Try not to depend on your machine; as with all technical things, it may have trouble. Take along a star drill for the same hole diameter (you usually have a small hammer with you for testing the rock before drilling).

Terminal maintenance

At high current and relatively low voltage, it is especially important that connectors be in good condition and covered with contact grease.

IMPROVEMENTS

I made several power packs of different sized for our Bosch and HILTI machines. Don't try to make a power pack with the original terminals; it's not worth the work. For this reason, I attached a cable to the machine and made belt mounted power packs. There are several advantages:

1. You have less weight in your hand (great) and can work better while hanging on the rope.
2. You can use larger power packs, shaped as desired.

3. You can put them under your suit and get more holes per power pack because it's warmer there.
4. You need an attachment from the machine to your harness, so the cable is no drawback.

I made power packs with 24V/4.5Ah (for long technical trips and 24V/1.5Ah for the bosch. I use 2.5mm high flexibility loudspeaker cable inside 3/4" tubular webbing, which is also the machine's attachment to the harness. I use AMP connectors which are usually for remote control cars. The connectors are now nearly standard among Austrian and West German cavers.

If you make your own power packs, you can use inexpensive special offers and higher capacity (at the same size) nicads. Because these are not as well matched as the cells from original power packs, it is much more important to avoid deep discharging. The best solution for cavers will be to contact other grottos which use drilling hammers, buy a larger quantity of cells and select them for different power packs.

Charging improvements

Usually the original chargers are the quick type (some with ridiculous methods like time counting or thermal shutoff). Fast charge is usually not necessary for caving. Try to change the charging current to a lower value (or better, install a switch for both possibilities), and you will have a longer battery life and maybe a fuller power pack. This is especially important when charging from an unknown charge state. An AC/DC converter for charging them from a car battery would be very nice. For expedition use, I would like solar cells for charging. In our underground camps, we use large kerosene lanterns which produce heat in addition to light, so I'm working on a thermogenerator for charging the power packs underground.

Circuits in the machine

Anti-deep-discharge cutoff: Deep discharge is very bad for your power pack's life cycle, especially if you use homemade power packs. If you have a machine with no built in cutoff, try to make one from a standard (multiple) operational amplifier. If you think it too complex to cut off the high current, use a deep discharge alarm and hope that the caver using the machine is smart enough to stop at that moment. A flashing LED is also useful for pre-warning (so you can see that there is not enough energy left for a new hole). I make the thresholds for the cutoff at 0.95V per cell, and the warning at 1V under load.

Power control: If you make a built in power control, it will also be possible to use small power packs which are not able to give very high power (or something like the Molicell batteries). Power packs usually have better efficiency at lower loads, so you may desire to drill more slowly (which is still much faster than manual drilling).

Miscellaneous

For using the machine in very tight spaces, you can make an additional cord for using the machine alone, with the power pack behind.

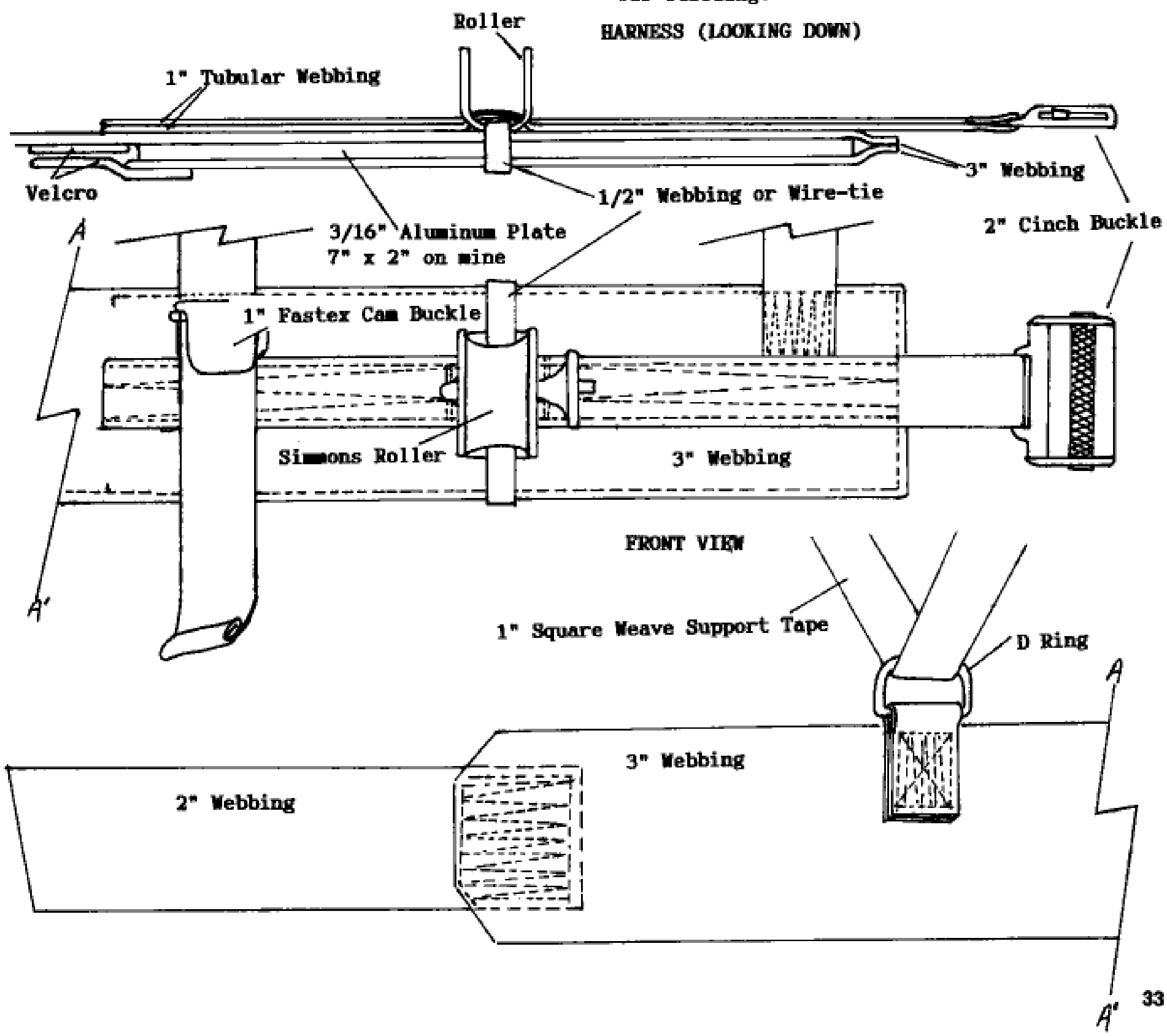
Hammer Drills Continued on Page 36

ANOTHER SIMMONS ROLLER HARNESS

By John Ganter

The traditional problem with the Simmons' Roller, or any chest block, has been keeping the user close to the rope. A partial solution involves a plate or frame (see **ON ROPE**, p. 171) which stiffens the part of the harness carrying the roller and thus reduces compression of the rib cage. This works fine for climbing contests or big airy drops, but adds excessive bulk and weight for caving.

At OTR 1897, I noticed that Paul W. Smith, who builds and sells BAT SEW webbing products, was making a new (at least to me) plate utilizing a piece of aluminum sheet sandwiched behind the roller. f($60.00 including the roller from Bat Sew Products, 2842 NE 14th Dr., Gainesville, FL 32609. This is very good, very expensive work. If you have more money than time, Paul can sell you nearly a 'turnkey' SRT system). This was obviously small, light and easier to build then my previous frame design (see Nylon Highway #21; **ON ROPE**, p. 171), so I decided to incorporate it into a new harness that I was building.



In ascending long drops (300 feet and up), particularly when tethering heavy loads, I had noticed pain across my aback where the harness webbing crossed. It usually was not a problem, but became quite annoying during day in/day out caving. The 2-inch webbing was causing a lot of pressure (force/area) in a narrow band across my rib cage, so it seemed logical that wider webbing would reduce this.

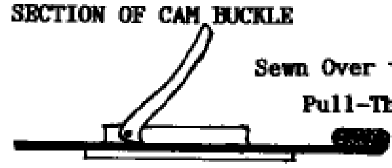
Three-inch webbing (Type 9) and buckles are readily available from Para-Gear (3839 W. Oakton St., Skokie IL 60076. 1-800-323-0437.) But the buckles are large and heavy (about 1/4 lb.) in order to match the 9000 lb. strength of the webbing for use in crash-restraints. This kind of strength was not needed, so I simply switched from 3-inch to 2-inch webbing at the front of the harness (see figure).

The plate is made from a piece of 3/16-inch thick aluminum sheet. Mine measures 7 by 2 inches, and fits snugly into a pocket which is closed with velcro. When I first tried the harness, this pocket pulled open, so that the plate did nothing! Whoops. Since the thing was already put together, I took a heavy-duty nylon wire tie and ran this through the roller and around the back of the harness. Paul must have made a similar discovery, since I notice that his models now (1988) have a tight loop of very narrow (1/2-inch or smaller) webbing serving the same purpose as the wire-tie.

Some other goodies from Para-Gear completed the harness. Since the shoulder straps are not load-bearing, I used lightweight 1-inch Square Weave Support Tape here, with a 1-inch Fastex Cam Buckle for quick adjustment.

The harness is a noticeable improvement in comfort over my other versions made with 2-inch webbing. The plate is nice; it has bent in an arc but still seems to be serving its purpose. By adding corrugations to either steel or aluminum sheet, a much more rigid frame could be made out of even thinner material, but this would require metal stamping equipment.

CROSS SECTION OF CAM BUCKLE



□

DOUBLE ROPE TECHNIQUES (DRT)

By Dave Shurtz

This is not a scientific treatise of DRT (Double Rope Technique) but is intended only as a brief discussion and possibly as a prompter for further discussion.

Single Rope Technique (SRT) has been the standard in the caving community now for many years and rightfully so. SRT is simple, requires a minimum of gear and is generally within safety margins for most cavers and most situations cavers find themselves in. However, there are a few cavers changing over to what I jokingly refer to as DiRT - Double independent Rope Technique.

It seems that one of the major differences between the vertical techniques of the climbing and caving worlds is safety.

Climbers like to do it with style and finesse. They seem to like to use the lightest equipment and as little of it as possible. The thrill is to hang from the world with only their strength and skill as a climber between them and a fall. Cavers, on the other hand, seem to appreciate safety. We like things like back-up anchors, locking carabiners and other equipment that has been tested to the limits. After all, it's our lives hanging in the balance. We maintain our ropes meticulously and are always thinking of safety first. This is one of the reasons my wife lets me go into those scary dark holes and was glad to see me switch from climbing.

DRT was first introduced to me by Jerry Trout of the Lincoln National Forest, Guadalupe Ranger District in New Mexico. Some of us were on a work trip in Hell Below Cave and Jerry insisted on the use of this technique. He told us horror stories of ropes breaking and cavers plunging to unhappy results and stranding them for long periods of time (if I must be stranded, let it be in a large Guad. cave). This brought to mind The NSS Vertical Secton demo of 1988, where four cavers stretched a length of brand new 7/16" PMI maxiwear caving rope between them and another took a pocket knife and placed the edge against the rope and without applying pressure, drew the blade toward him instantly severing the rope and dropping the cavers to the ground. With this picture in mind, imagine rappelling that deep pit in your favorite vertical cave. Can you remember all those rough places the rope had to go over because you just can't pad the whole pit. Remember all those innocent looking chert or limestone edges, often of a sharp nature? Well, needless to say, it made me rethink my vertical caving practices.

What is DRT? Simply the rigging of a second rope along the side of the first, usually from a separate anchor. This allows one to place an ascender on the second rope. This ascender is then tethered directly to your seat harness. This way, if either rope fails, the second rope is there to keep you from falling. There are many possible alternate methods that can be used. You could place a descender on each rope for rappelling. You could alternate your ascenders on the two ropes during the climb. With proper set-up, one could ascend one rope as with SRT and have the other rope free running through an ascender on the back of the seat harness and never be slowed down. Imagination is the only limit to the possibilities.

Advantages of DRT could include the fact that you have twice as much rope carrying your life. Imagine the ease of passing knots or rebelays. Think of the ability to avoid some of the difficult lips to cross and other difficult areas by being able to move laterally by rigging the ropes a little further apart. You could move more than one person at a time up each pit, each safetying off the other's rope. There are many other possibilities.

Disadvantages could include the fact that twice the gear must be hauled to each pit. You could possibly be slowed down by the fact that one more thing must be moved up and down the rope. Rappelling with your (Ed. fist gripping a Prusik knot) would only leave one hand for controlling your rappel. The ropes could become tangled, etc.

In my mind, the bottom line to this discussion is again, SAFETY! We will have to answer many questions such as, does the situation indicate the need for a larger safety margin than one rope affords? Is safety more of an issue than energy output or man power used in hauling the extra gear? Do we have adequate rope pads for the situation as well as the ability to deploy them correctly and keep them in place? Do we have enough rope to double rig all the pits or just the worst ones?

I hope this short discussion will cause you to think about safety in caving. I would love to see other cavers ideas and thoughts on this subject. Thanks for the ideas Jerry. □

Hammer Drills continued from page 32

For rescue purposes, you can make a special cable to connect the machine to two (Bosch or 3 (HILTI) small car or motorcycle batteries, if you need a lot of holes (blasting) and have enough people for support. I also make a hand held 24V 60W halogen light for the same connector, so I can use the Bosch power pack for it. This device is relatively light weight (less than one pound) and help a lot for discussing (artificial) climbing routes and for demystifying the huge passage starting high in a dome. It is best to install a momentary switch and to use it only for short periods. A better (high-tech) solution will be an overrated 12V bulb and a switching regulator. For cold caves, I thought of using a small liquid fueled hand warmer to warm the power pack, especially large packs (3% more weight yields 10% more capacity).

Making your own hammer drill

It is also possible to take (buy, steal, find) an old or broken 120V or 220V drilling hammer and replace the AC motor with a low voltage DC motor. There are excellent motors available for remote control racing cars, with ball bearing and high-tech design. They are extremely lightweight for their power output, and highly efficient. The lightest drilling hammer now offered is a Bosch weighing 1.8 kg (4 lb). With a light motor (that also can be high power), a weight without powerpack of 1.3kg (3 lb) will be possible.

Future

I hope that in the future better powerpacks will be available. Molicell rechargeable lithium cells would offer not only more energy at the same weight, but a possibility to make a "fuel gauge". A non-rechargeable lithium power pack would be a useful thing for emergency use (rescue operations), producing a huge number of hole with a light weight power pack. For these you will need a low power drill or a power control, because they give only some 40 Watts/lb (90W/kg) (state of the art in 1987, maybe they are better now).

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STRENGTH, RELIABILITY & SAFETY

By William Storage

Entering caves should cause concern over safety since caves contain a variety of uncommon hazards. We try to select our equipment and techniques on the basis of the relative degrees of safety that they provide. Vertical equipment is usually tested for strength as in indication of safety. The idea that higher strength means more safety is not totally valid, however, and a look at the relationships between strength, reliability and safety can be beneficial for selecting equipment and developing techniques.

First, we need a common understanding of safety concepts. Safety is generally understood to mean freedom from hazards and their effects. Obviously, safety can only be measured in relative terms. Hazards are conditions with potential to cause injury. A look at the cave accident reports reveals common hazards of caves - things like flooding, loss of light, loss of route, falling objects and falling cavers. Associated injuries would be things like drowning, hypothermia and impact trauma. Other forms of hazards result from using equipment, such as mechanical failures and certain inherently dangerous characteristics of the equipment.

Viewing inherent characteristics of equipment as hazards, requires consideration of human errors. Unfortunately, preventing human failures is much more complex and difficult than preventing mechanical ones. Vertical technique must be designed to prevent human errors from exposing inherently hazardous characteristics of vertical gear.

It is important to note that the consequences, or criticality, of exposure to hazards may vary for different equipment performing the same functions. You would much rather tear a wetsuit than a drysuit at the bottom of a deep, cold cave. To be safe, we balance equipment reliability against the criticality of its failure.

Reliability is the probability that a piece of equipment will perform its function for a prescribed interval under stipulated environmental conditions. Stated differently, it is the likelihood that a piece will not fail. The underlying concept is that properties vary between seemingly identical specimens in a predictable manner, when considered statistically.

The reliability of devices like carabiners, rappel racks and ascenders is of particular interest, since a single failure might cause death. It would be little comfort to know that your rack, out of thousands manufactured, was the only one to break under body weight.

Tests to establish reliability, on a statistical basis, is expensive. For example, to establish a reliability of 99% with a confidence level of 99%, would require destroying 460 samples, assuming a normal distribution (the familiar bell curve) of failures. So to test the reliability of vertical components is obviously beyond the capability of most manufacturers and the NSS.

Thus, we tend to rely strictly on average values of component strength as an indicator of safety. This error has led to serious accidents. Vertical gear almost never fails because it is loaded beyond established, published breaking strength. Reliability is strongly related to strength, but is also a factor of other material properties.

For example, metal castings generally have much lower reliability than forging with the same average strength. That means the variation in strength between apparently identical samples is much greater for castings than it is for forgings. If everything else is equal, a forging is a safer choice than a casting.

Other mechanical properties effect the suitability of materials and designs for a given piece of gear. Properties like toughness, susceptibility to corrosion, stiffness, resilience, ductility and brittleness should be considered. Most of these, while beyond the scope of this article, are easily quantified by tests. They are important to reliability and safety, particularly since they help to define the losses of strength that occur with age, due to environmental factors.

Certainly, the difference between the average new strength of a type of carabiner and the weight of the caver is an indication of the margin of safety, by virtue of the amount of loss of strength sustainable through degradation before failure. (Formerly, factor of safety equals strength divided by load times reducing factors related to other material properties.) However, the rate of that strength loss is very dependent on the other properties mentioned above.

Toughness, for example, is a measurement of a material's ability to release distortion energy. It is important for selecting a material and design tolerant to nicks and dents. And toughness is not proportional to strength.

The strength of rope has been another area of confusion. The force that a rope sees when you take a fall is determined by characteristics of the rope and has nothing to do with the rope's tensile strength. The force is proportional to the rate at which you decelerate as the fall is arrested. A very stiff rope, like a chain, would stop a fall very suddenly. The force on the rope, which equals the force on your body, would be very high. If it exceeded the rope's tensile strength, the rope would break. A big bungie cord, however, would decelerate you slowly, and the force might barely exceed your weight. So you would probably rather take a ten foot fall belayed by a bungie cord of 500 pound tensile strength than a chain of 2000 pound strength. Physicists may note that the force is proportional to the square root of the stiffness. Obviously, stiffness is at least as important as strength for selecting a rope.

Rope stiffness is easily determined by measuring the stretch resulting from a variety of loads. Stiffness is the slope of a graph of load versus stretch. The slope may vary for different ranges of load. Ideally, a caving rope might have varying stiffness - no stretch for loads up to a few hundred pounds, very stretchy at higher loads to provide slow deceleration of falls and damping to avoid rebound.

In a recent study, the effects of fabric softener on rope strength were examined. Clearly, concentrated fabric softener reduces rope strength. It would be worthwhile, in establishing such treatment's effect of safety, to consider a few other factors. We should look at the effect on stiffness. A change in stiffness might make the strength inconsequential, because the load the rope sees is dependent on the stiffness.

It is also possible that softened ropes are easier to clean, and removing trapped dirt would provide for less degradation of strength with age. Stress concentration from knots might be less. Abrasion resistance is certainly affected.

I'm definitely not advocating softening your rope. My point is that strength measurements are insufficient to make that decision. Damage tolerance needs a harder look. There are many treatments, such as anodizing aluminum, that reduce strength but enhance damage tolerance and safety.

A look at the relationships between strength, reliability and safety would be incomplete with considering human error. Even without changing strength of components, it is possible to increase a system's reliability by adding redundancy. But if that redundancy leaves the caver carrying heaps of gear, alters his decision making ability or requires great effort and skill to use, the chance of error will be increased. It is easy to make a system more reliable at the expense of complexity.

Consider the rappel shunt. It tremendously increases the reliability of the mechanical rappelling system, but requires operation by another hand. The brain must deal with a separate function in each hand. It is complicated by the fact that much of our training involves things stopped by squeezing or pushing - auto brakes, bicycles and motorcycles, for instance. The shunt requires releasing to brake. It involves a significant new work load. Many speculate that accident victims who lose control and scream to the bottom of the pit, would never have lost control in the first place if not distracted by the shunt. The shunt requires training.

The dilemma of redundancy versus complexity revolves around the interaction of humans and equipment. That means training and user testing are as important as measurement and analysis.

Historically, technique has evolved slowly with diverse inputs from those who employ it. Recently, many new pieces of equipment, particularly vertical gear, have become available, bringing a multitude of techniques. We desire to use science to improve safety so we measure strength; but that simplistic approach is a failure of the scientific method, particularly when human abilities and limitations are involved. Better science is needed.

Good scientists should ask questions, not recite rules, Truisms abound; always use a belay, never dive solo, use locking carabiners, don't soften your rope, inelastic chinstraps... Science and strength testing can direct us in these matters. But let's not forget what science entails: proceed cautiously, with vigorous skepticism and the scrutiny of a jury of peers. BE SAFE. ◘

FACTS, FICTION AND FANTASY ABOUT THE ANNUAL VERTICAL WORKSHOP

By David McClurg
Vertical Workshop Coordinator

As many of you know, the Vertical Section conducts an annual workshop on basic vertical techniques each year at the NSS Convention. This workshop - along with our publication of Nylon Highway - are the two most important ways that the NSS Vertical Section promotes safe and responsible vertical caving. The workshop is a four hour marathon designed to teach the basics of the latest vertical techniques and equipment. We don't guarantee anyone will come away ready to tackle Valhalla, Surprise or Golondrinas. But they will be familiar with the more commonly used systems and know enough to be able to choose the one they like best. Then, they can get further training in a grotto or regional training program. We charge a course fee of $10.00. This covers a printed course outline, a length of one-inch nylon sling, wear and tear on the instructors' ropes and equipment, and a small contribution to the Section treasury. We advise all students to bring their own sewn seat harness, as the first essential for safe and comfortable vertical rope work.

Have you ever wondered how the workshop began and how it works its special magic every year at the convention? Maybe you've watched us putting the beginners through their paces at a convention and wondered if you could help us out.

For the information and edification of all concerned (and to satisfy the historical record), here is some background and recent history of our annual Vertical Workshop.

The Beginning. It all began, as they say, back in 1981 with a conversation between Phil Whitfield and myself during the International Congress of Speleology in Bowling Green, Kentucky. From that conversation, came the idea of a caver's short course to be offered at the 1982 Convention in Bend, Oregon. The course would consist of classroom sessions in the morning on caving basics - lamps, helmets, safety and conservation, horizontal techniques and the like. In the afternoon, we would have a vertical workshop to teach the essentials of vertical caving, enlisting the help of Vertical Section members as instructors.

To pull it off, it fell upon me to come up with a curriculum and a printed handbook, and to recruit a whole bunch of willing instructors. Besides the morning caving course, the afternoon workshop calls for about 15 experienced vertical cavers.

But bring it off we did. And it was - and continues to be - a big success. In fact, it's one of the most popular workshops at the annual convention. In 1986, I decided to simplify things (and quit testing the patience of overworked instructors) by cutting it to a half-day rather than a full-day and just have the vertical workshop in the afternoon.

Some instructors have remained with us from the beginning, including my wife who teaches cable ladders. She claims it's either that or get a divorce! Actually, being a teacher by profession, Janet enjoys being part of the workshop every year. And having a cadre of five or six regulars is certainly a big help when I start to round up likely prospects every year. In total, some 51 volunteers have given an afternoon of their lives over the years at one convention or another in the cause of safe vertical caving. (A complete list is appended below by way of saying thank you to each of them again for their help.)

The workshop begins with a short lecture by the coordinator (that's me). First I tell them what the course is all about and what to expect during the next four hours. Then I describe the various ascending and descending systems and their pros and cons. A demonstration of each technique follows given by the instructors. During the demo, we again go over the advantages and disadvantages of each system and the students are invited to ask questions. Finally, we break into groups of six students each and move over to the learning centers.

Individual Learning Centers. The key to the success of the vertical workshop is our individual learning centers or station. We have one for each basic vertical skill with two ropes and at least two instructors. Each student gets a chance to have a real hands-on learning experience:

- Rappelling with rack and spelean shunt.
- Rappelling with figure 8 and the Petzl descender (new in 1989).
- Mitchell Jumar system.
- Gibbs ropewalker system.
- European ascending system - the Frog system (new in 1989).
- Three-knot prusiking.
- Cable ladder techniques.
- Knots for vertical caving

Total class size is limited to 36 students so that at any one time we have about six students at each station. Learning time at each station is about 30 minutes. At the end of each learning period, I blow a whistle (it's the only reward I get for taking on the coordinator's job every year). Students stay together and move to the next station as a group.

Cable ladder techniques and knots are taught continuously, so that when students finish at a given station, they can leave their group temporarily and come over to climb the ladder or learn another caving knot. That way, waiting time is cut down and time on specific learning tasks is maximized. We encourage people to come several times to these stations to learn all the knots and climb the cable ladder at least twice. When the whistle blows, cable ladder climbers and caving knot learners return to their original companions and move to the next station with their group. Instructors usually end up loaning their own equipment for student use, another sign of their commitment to our educational goals.

It's an exhausting afternoon for everybody - students and instructors. But for us, it's rewarding to fan that spark of interest and watch as it bursts into a flame of enthusiasm as the session progresses. Students do learn, and best of all, they learn the safe way to enjoy vertical rope work the way we do. If any of you can help this year or next year or the year after, we always need committed vertical cavers that we can depend on. Please contact us:

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Sherman Jenkins
Nancy Smith
Vern Smith
Janet Sowers
John Tinsley
Marilyn Tinsley
David Trumm

NSS Vertical Workshops

Year	Location	Vertical Workshop	Short Course
1982	Bend, Oregon	•	•
1983	Elkins, West Virginia[1]	•	•
1984	Sheridan, Wyoming	•	•
1985	Frankfort, Kentucky	•	•[2]
1986	Tularosa, New Mexico	•	
1987	Sault Ste. Marie, Michigan	•	
1988	Hot Springs, South Dakota	•	
1989	Sewanee, Tennessee	•	

[1]This year the workshop and short course were coordinated by Barbara Schomer and Bo Randall.
[2]This was the last year that the caving short course (morning session) was offered.

Frog Hopper Continued from page 27

For example, to start a long drop, I initially rig all gear onto the rope. From bottom to top, the rope runs first through the foot gibbs, then the Croll, then the Simmons'roller and finally the CMI. I begin the ascent with both feet in the upper ascender stirrups. Ignoring the foot Gibbs, I can easily self start, as I am climbing on two ascenders mounted high and it is easy to pull the rope through. After ascending a few meters, I reach down and pull off the stirrup from the foot with the Gibbs on it, shake any slack rope through the Gibbs and begin ropewalking. Now let us assume that somewhere above, the rope breaks over a lip and hits a long sloping section. Above the lip, I pull the pin out of the Simmons' roller and continue ascending with my body vertical, as now it is possible to be further away from the rope. Say the slope lessens even more. Now I would reach down and remove the pin from my foot Gibbs and climb with my feet free until I reached the top. Here I can complete derigging, leaving the top ascender on as a safety to my seat sling until the very last.

That's all there is to it. All in all, I would estimate the rig to be about 90% as efficient as a full blown rope walker on free sections. But in the varied terrain of most caving, I find it much less energy consuming as it is easy to optimize for the situation at hand. Besides, even on free sections, I find this system much more comfortable than a standard ropewalker when exiting a cave after a long and tiring survey, as it is easier to take small steps and rest. In these situations, I often find myself ascending in a typical Frog fashion, using both feet simultaneously rather than having to raise my entire weight with one leg at a time. Try it!

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LETTER TO THE EDITOR

I'd like to respond to John Ganter's article "The Gibbs Ascender: A Healthy Dinosaur" in Nylon Highway No. 27 and present a differing perspective.

First, John elaborates on how speed and time constraints aren't the most important factors in choosing an ascender system. Yet he creates a hypothetical graph comparing a 3-Jammer caver verses a 3-Gibbs caver on a 6 drop trip relating attachment time and speed of climbing. While he concludes that a hybridized system of 2 Jammers and 1 Gibbs might be best, several of his statements indicate the Jammer caver to be overall faster and superior. My conclusions, when examining his graph, are that up to the 5th drop, Gibbs are overall as fast or faster than Jammers. More importantly, I wonder what a 4% overall time advantage means since speed is not the overriding element to be considered in choosing a climbing system. Not very much, I suspect.

A lot of discussion by John and others focuses on the hassle of attaching a Gibbs ascender to a rope. Undoubtedly, the Jammer is easier to attach, however, I personally don't find Gibbs particularly difficult. I must admit, though, that I'm a western caver where we don't have to struggle with muddy or wet conditions. Also. the hole in the cam of my foot Gibbs is countersunk making attachment easier.

Toward the end of his article, John lists 6 applications where the Gibbs probably are the best choice. On the contrary, I can only think of one category of caving where the "easy on" characteristic of the Jammer is of overriding significance and that is on hard-core, multi-drop push trips.

So does all this mean that I didn't like the article and that I'm a stodgy old caver resistant to change? Not at all. John did a very fine job detailing the pros and cons of the two ascenders. He made some balanced observations (such as his article "does not suggest that anyone rush out and replace their vertical equipment" and that a hybrid system may be best). I concur that the jammers have much to recommend themselves. Also, I'm glad to see efforts made to progress and spur a little controversy. Stagnation is never good.

My purpose in writing is only to suggest that, although John pointed out several times that a number of factors should be considered in choosing ascenders, The idea that Gibbs are obsolete seems overstated. I believe climbing systems should be selected and modified based on the personal preferences of the caver. For instance, I now climb with two Gibbs and a Prusik knot (!!!) riding above by Simmons' Roller. It works great and I have no desire to switch to anything else. I might also mention that the amount of time I take hooking onto rope is dwarfed by the time it takes me to put all my slings and harness on. 'Nuff said!

Sincerely

Barbara

Barbara Anne am Ende

ADMINISTRATIVE

NYLON HIGHWAY is published by the NSS Vertical Section and is available to Subscribers and Vertical Section Members for $3.00 per year. For delivery outside North America, add $4.00 to the subscription rate for postage.

For spouse memberships, add $1.00. Please insure that these payments are in U.S. dollars. Frequency of the publication is based on the availability of material. All material that is submitted must be readable. The Editor is able to arrange, upon request, relatively good quality drawings explaining your topic. As many of the articles published in the **Nylon Highway** are experimental, the NSS, Vertical Section, the Editor, as well as any and all authors whose names appear in the **Nylon Highway** absolve themselves of all responsibility. It should be understood by the reader that the responsibility lies with those who choose to experiment further with the information contained here. The **Nylon Highway** attempts to screen and publish reliable, high quality material that in the Author's and Editor's best judgment appears to be sound in principle and is backed up with supportive testing or facts. The science of SRT is ever changing because cavers and climbers are constantly finding better, safer and more efficient ways of achieving our goals. Always experiment using good judgment and adequate caution. **...THE EDITOR**

DUES ARE DUE

With this issue, the 1988-89 vertical section fiscal year comes to an end. If the mailing label that appears on your mailing envelope has an 89 above your name, then your dues are due. To renew for an additional year, please send $3.00 and fill out the enclosed renewal form.

VERTICAL SESSION WILL BE DIFFERENT

This year, the 1989 Vertical Session, to be held at the NSS Convention, on Monday afternoon, will take on an entirely new format. Organized similar to open forum talk show, a panel of well known vertical personalities will engage in lively debate over many of the key vertical issues of significant concern to vertical cavers. There will still be time set aside for the traditional show and tell presentations as in previous years.

GIBB ASCENDER PROBLEMS

Some problems with the large, stainless steel, rescue type Gibbs (able to accommodate 3/4" rope) have recently surfaced. The shape of the cam and its orientation within the shell, can tend to cause the rope to slip when used with smaller diameter ropes. From a discussion with Dick Clark, of KHS equipment sales, Peter Gibbs will replace the existing cam with a newly designed cam which seems to eliminate this problem. For further information contact Peter Gibbs at 202 Hampton Ave, Salt Lake City, Utah 84111.