Isaac Newton's Foot Croll and Other Wonders of Cave Science

By William Storage

The Foot Croll Dilemma

A number of cavers have contacted me regarding problems they experienced while using a Petzl Croll ascender with a rope-walker system. The Croll can be tied to the inside of a foot reasonably tightly with webbing. The tighter it is, the less wasted stroke you have with each step. I have no experience with this sort of rig but, apparently, many people are fond of it. The Croll has the advantage of being very easy to get onto the rope in an awkward location such as down at your foot.

Although I haven't tried this rig, I can imagine two possible problems initially. The first deals with what happens when you take a really long stroke with an ascender. With some ascenders, such as Clogs for example, it is possible to angle the ascender —if you're reaching way down for it—so that the gate is forced fully open and the rope then rides against only the top row of cam's teeth. At this point the rope is far out of parallel with its intended path through the ascender. If the teeth are worn, it is conceivable that the cam could essentially be held open for a while, as you attempt to load it. After a bit of slipping, the ascender is lined up properly on the rope, allowing the cam to close down on the rope. Considering the rather aggressive cam curve and teeth of the Croll, this possibility seems unlikely.

A more reasonable explanation may be that the Croll simply is not sliding up the rope at all and the caver is lifting all the rope below him. This, of course, could easily be checked by having some brave soul (with a big hard-hat and body armor) do a bottom belay to keep the climber from lifting the rope.

That Crolls might not work well in this application seems entirely likely to me. If you think about it, tying a rigid ascender (i.e., not like the Gibbs models) directly to a foot is an attempt to defy physics. Caver Isaac Newton often repeats some idea about the sum of forces and moments (twists) on a body adding up to zero.

So what happens if you tie a Croll to the inside of your foot, attach this to the rope and try to stand in it? For forces to add up to zero, the load distributed across the bottom of your foot wants to be underneath the point where this load is reacted—where the rope goes through the foot Croll. This means your ankle is twisted quite a bit, the Croll is then leaning on its side, and you have to pull sideways on the rope, which can get tiring.

The situation could be improved by using an ascender that allows the foot to hang beneath the rope attachment point, such as the Gibbs models. It would also be possible to tie the foot Croll with some slack so that the foot hangs from it, as it does in the Gibbs rig. I haven't seen this done, but there certainly must be such systems in use.

The second problem with using a foot Croll has been reported several times: the ascender becomes completely free from the rope during climbing. I have been unable to simulate this problem in my home laboratory; however, it is certainly conceivable that with the right combination of boots and climbing stride, the cam lock could catch on your other foot and open the ascender mid-stroke.

REI Harness Recall

Jim Pisarowicz recently notified us that REI has recalled their Alpinist and On-Site model harnesses made between 1990 and 1993 *NSS News,* November 1993, pg 311). It may be possible to improperly configure the harness and get it on your body in such a manner that if you tie into the belay loop only, the belay loop will only be attached to the seat by two keeper loops. Most people would realize that in such an arrangement, something was indeed wrong. Nevertheless, to prevent this possibility, REI has offered to replace or reinforce these harnesses at their expense. Those interested in returning harnesses, or in further details can contact REI customer service at 800-626-4734.

Petzl Ecrin Helmet Recall

A manufacturing defect has been detected in a number of Petzl Ecrin (A01) Roc helmets sold since August 1, 1993 (*NSS News,* December 1993, pg. 335). If you possess one of these helmets, PMI asks that you return it to the dealer from which you bought it, or send it directly to Pigeon Mountain Industries, P.O. Box 803, 4466 N. Highway 27, Lafayette, GA 30728. PMI states that they will refund your surface transportation expenses and will send you a free Spirit carabiner for your trouble. If you have questions regarding this recall, you can contact the PMI recall people at 800-282-7673.

On Rope Again

Bruce Smith and Alan Padgett have begun work on a new edition of the very popular *On Rope.*

While the book will not be available for quite some time, they are now collecting comments, suggestions, and requests for the new edition. Correspondence regarding *On Rope* should be directed to Bruce Smith at 6313 Jan Lane, Harrison, Tennessee 37341.

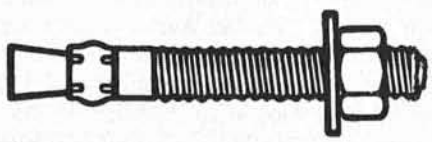
New Batteries

A variety of new rechargeable alkaline batteries have recently appeared on the market, making various claims of environmental greatness. I have yet to hear of caver evaluations of them. In fact, it seems we need a good, current evaluation of bulb brightness, battery life, voltage/time curves and weight efficiency for various battery/bulb combinations. We would like assistance with a study of this type. Any caver interested in performing a thorough and scientific test should contact me at the address given at the end of this article. Previous work on this topic has appeared in "Capacities of Primary Cells," *Speleonics,* vol. III. no. 4, April, 1989, and "Lights and Brightness, Etc." by Will Ray, *Massachusetts Caver,* Jan./Feb. 1992. A comparison of disposable and rechargeable batteries appeared in the November 1991 *Consumer Reports.*

The Continuing Bolt Saga

We have been promising an updated article on bolts (see "Artificial Anchors for the Present and the Future" by John Ganter and William Storage, *NSS News,* May 1990 and "Slippery Ground and Undercurrents," *NSS News,* May 1992) for quite a while. The reason such an article has not appeared is a lack of an alternative to self-drive bolts that will be accepted by cavers. Self-drive bolts, such as the commercial fasteners distributed by Petzl for caving, have the nasty habit of corroding rapidly.

The much preferred bolt is a 2¾" x 3/8" stud anchor such as the Ramset/RedHead



The Rawl Stud

Wedge Anchor, Cat. No. WW-3826, or the Rawl Rawl-Stud, Cat. No. 7312 made from type 303 stainless steel (not the Rawl six-piece bolt endorsed by climbing magazines that never learned physics, by the way). Unfortunately, placing the stainless studs by hand can be anywhere from slightly harder than placing self-drives to an aching-biceps, 45-minute chore, provided that the drill bit doesn't break.

Using an electric drill with self-drives is a foolish waste of money and is environmentally irresponsible. For hand drilling there is no perfect solution at present. A good hand drill was once made by Dakota, now out of business. For a while we got decent performance (good speed, but a fair amount of breakage) from the Five Ten drill. Their quality seems to have declined, as reports of breakage increased greatly in the last two years. In any case, Five Ten no longer sells drills, having apparently sold that business to Fish Products, manufacturer of the very cool portaledges for big wall climbing. Fish can be reached at P.O. Box 685, Sierra Madre, CA 91025 (phone 818-355-8296).

Other ways to avoid self-drives and make holes by hand include the venerable Star drill (slow, but you'll get there and the precious underworld will thank you). Additionally, Matt Oliphant is now experimenting with machining down some commercial impact bits to fit in a Rawl hand drill handle. Matt would appreciate any reports of previous attempts at this. Contact him at 4105 Lowell Ave., La Crescenta, CA 91217 (phone 818-249-1641).

ABC Gemstones

We will keep you informed of progress on the bolting front. Let your conscience be your guide. Wouldn't you rather take a few more minutes to place a bolt that will be usable for generations? In very wet caves, as in Mexico and England, and chemically corrosive or fragile caves, like Lechuguilla and Lechuguilla, there should be no question.

Stress Corrosion

I have received a couple of letters asking what stress corrosion means. Stress corrosion is a condition whereby a material under a constant load or state of stress corrodes rapidly, resulting in brittle fracture. It is accompanied by intergranular fracture, where an otherwise ductile material appears to be brittle. The common cause of stress corrosion is a high-stress condition resulting from residual stresses due to manufacturing errors. A hypothetical example would be a bolt hanger that was not properly bent into its final shape. Some carabiners apparently were reported to have cracked at the gate pins as a result of residual stress from the manufacturing process of inserting the pin.

It is possible, but unlikely, that caving service loads on equipment (as opposed to residual stress from manufacturing) would result in stress corrosion. Caving loads are usually small and exist for a short time. An exception might be a heavily pre-loaded bolt used for rigging. Since bolts are designed to be permanently stressed, their material is chosen to be unsusceptible to stress corrosion.

SRT Equipment

A recent letter from SRT of Australia informed us that several changes have been made to the SRT descender reviewed by Peter Sprouse and me in the December 1992 *NSS News*. They have modified the disarming mechanism, which now includes a quick release pin. The descender also now admits rope up to 12mm in diameter. SRT reports that they are developing a model with a different handle, that will address our complaint of a difficult squeeze and tired hands when using stiff rope. We have received a new version of their descender, which will be evaluated by Peter Sprouse. We will also take a look at their new Explorer ascender.

SRT Descender

SRT also manufactures a combined ascender/pulley for rescue, as well as other equipment. Their American agents are Dan Smith, SSP, P.O. Box 36, Petaluma, CA 94952 (phone 800-772-5948) and Bud Calkin, Skedco, P.O. Box 230487, Portland, OR 97281 (phone 503-639-2119).

Liberty Mountain Sports

Liberty, along with their ABC line of climbing gear, has moved to 9325 SW Barber St., Wilsonville, OR 97070 (wholesale only 800-366-2666). Liberty sells all types of camping and climbing gear as well as rescue equipment. They have also been a regular supplier for Cheve and China caving expeditions, and have expressed a strong interest in developing caving equipment. We have been particularly pleased with their large assortment of carabiners, and ABC's gemstones, which are the best fit we've found in flared cracks.

American Rope Misconception

It was great to see U.K.'s Chris Howes, all-around nice guy and Editor for *Descent* magazine, at the convention in Oregon. He reports (*Descent*, Oct./Nov. '93) that Americans at the convention seemed to have the misconception that Europeans go in for techniques such as rebelays because they use substandard rope. It is senseless to argue about who makes better rope, Americans or Europeans. It depends on what qualities you like. I much prefer the very stiff American ropes such as PMI's Maxwear but I still rig rebelays to avoid knife-edged lips and cold water. Face it folks, only a few fiber materials are used to make rope and they all have roughly the same tensile strength. Abrasion resistance features of American rope have little effect when a loaded rope contacts a really sharp lip.

The reason that rebelays are seldom needed in the U.S. is that our relatively non-vertical caves seldom require them, not because our rope is immortal. American rope companies make no ridiculous claims about their rope, and they warn about sharp edges; for example, PMI's catalog states, "Any rope can fail after poor care or under extreme conditions such as shock loading and sharp edges." Believe it. And learn to use a cowstail. It might come in handy.

Contacting the Techniques and Safety Committee

You have no excuse for failing to reach the Safety and Techniques Committee via its chairperson (me). My address, which also appears on page 3's Masthead in each issue of the *NSS News*, is: 2 Bayside Village, #421, San Francisco, CA 94107-1438. Phone: 415-512-1886. Fax: 415-543-4895. My CompuServe ID is 75250,1360 and I check my electronic mail daily.