NYLON HIGHWAY NO. 29

...ESPECIALLY FOR THE VERTICAL CAVER

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NO. 29

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Bruce Smith, Editor
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Bill Bussey
120 Manhaten Court
Cary, N.C. 27511
(919) 460-8968 Home
(919) 542-3142 Work

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 intentions and self direction that I have tried to accomplish during the 1988-89 VS year.

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COVER: Steve Collins ascending using a crude version of a Texas Rig. Original photo by Scott Fee, drawing by Linda Heslop.

COMMENTS AND QUESTIONS ON VERTICAL HARDWARE

by John Ganter

Rusting steel carabiners

Lately cavers have been getting interested in steel carabiners for seat closures and descender attachments. These particular attachment points can take lots of abuse. Inherently tough steel seems like a reasonable idea since aluminum carabiners are more prone to deterioration and have weaker gates which could break if loaded and twisted in the wrong way (e.g. when getting on rope). The problem that I find in wet muddy caving is that most steel carabiners (e.g. Bonaiti, Stubai) are very nicely made but rust soon unless lubricated religiously.

One exception is a carabiner which I bought in 1983 from a defunct dealer. It is stamped HIATT—ENGLAND and it is gleaming after 6 years of regular use. Bill Storage says that it is stainless steel, but it looks plated to me. The quality is outstanding, with heavy threads and a removable locking collar for cleaning.

So I have two questions. First, where can I get more Hiatt carabiners? None of the US cave gear dealers carry them, nor Caving Supplies, Inglesport and BAT Products in England. Second, why don't some of the other manufacturers make stainless carabiners? Stainless steels are not particularly cheap, but I'm sure that many would pay extra for carabiners that don't rust. I have not, for example, heard anyone saying that they would prefer the old rusty racks over the stainless models that we pay extra for today.

Non-removable locking collars

Another problem with aluminum carabiners is that suddenly there don't seem to be any with removable locking collars. This is an important feature for cleaning out mud and grit. SMC changed their design sometime in 1988. I wrote and pointed out that a feature of value to cavers had been lost. SMC wrote a nice letter in reply, but the message was basically "Sorry." Does anyone know of any aluminum carabiners with removable collars?

[I think we cavers should make sure that manufacturers of vertical gear know we exist. We may not be rock climbers interested in buying high-fashion beachwear to match our sunglasses, but we do spend a significant amount of money each year.]

Buckles

How should 2-inch buckles for seat and chest harnesses be threaded? There seem to be two types commonly used (Figure 1). The "Quick-Fit Adapter" (MS22040) is usually configured as shown on p. 138 of On Rope (Figure 2). This allows quick one-handed tightening, especially since only one side of the slider in the buckle is knurled. However, the webbing must be backed up with a hitch (or an overhand "stopper knot") to keep it from loosening when used with a seat harness. Even so, I have found that it can loosen to an alarming degree particularly when worn in water.

As a result, I have begun to rig the Quick-Fit adapter in a manner similar to Petzl gear. This takes two hands and a little longer to adjust, but it will not slip. It is particularly useful on seat harnesses that are closed with a maillon at the front, since here the buckle is rarely adjusted. Even if this "thread-back" method reduces the tensile strength of the buckle/webbing, I believe that the increase in reliability under adverse conditions is well worth it. (Note that the more compact MS22019 is probably too small for the thickness of webbing in the thread-back configuration.)

The other buckle is the MS22007-1 (Figure 1). This has raised sides which protect the webbing from abrasion and impact somewhat. I like to use it on foot Gibbs and foot Crolls for this reason. On this buckle the thread-back configuration is bulky. However the whole slider of the

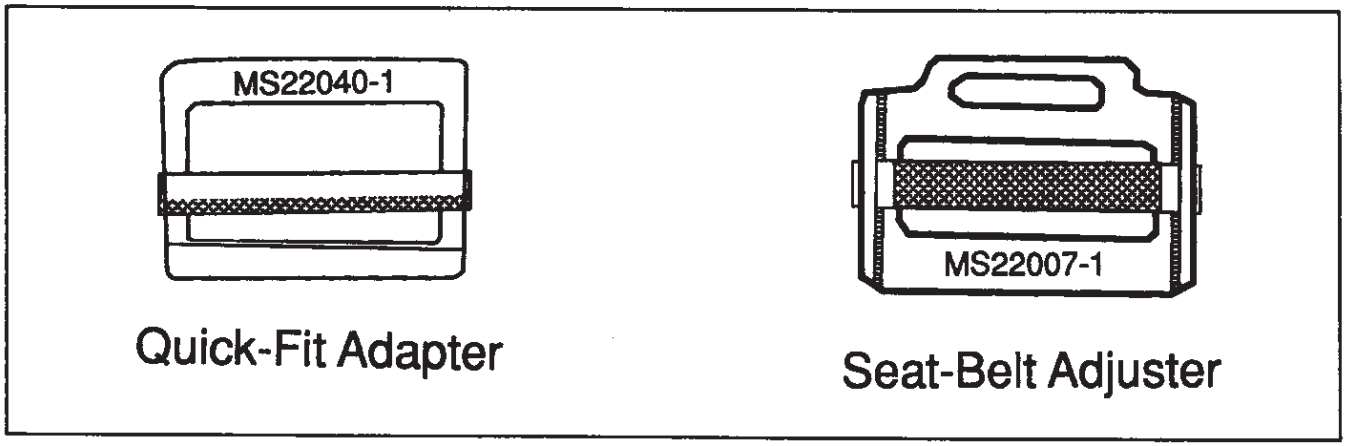


FIGURE 1: THE QUICK-FIT ADAPTER AND SEAT-BELT ADJUSTER

buckle is knurled, so it is less likely to slip. In fact, I recently used one of these on a chest harness and had to replace it because I could not remove the harness by myself when the webbing got wet and muddy. A Quick-Fit, rigged in the traditional way with no thread-back, gave the correct balance between easy tightening/releasing and reliability.

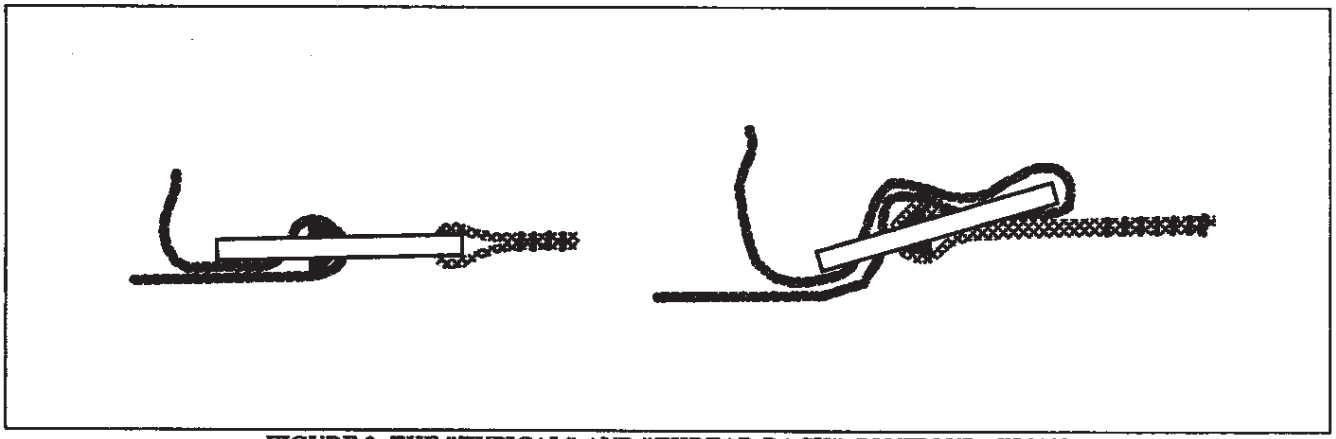


FIGURE 2: THE "TYPICAL" AND "THREAD-BACK" CONFIGURATIONS

COMMENTS ON THE DOUBLE BUNGIE SYSTEM

By Maureen Handler

In **Nylon Highway 28,** I published an article on a double bungie system I had been developing over the past few years. At the NSS Convention in Sewanee, I was surprised and pleased at how many of these systems I was seeing in use. However, there were some items of which I became aware and felt worth sharing with those of you who have chosen to use this system.

The first, and most important, is that the general nature and design of the Petzl ascenders can cause them to unexpectedly pop off the rope. This is especially true of the Petzl Jammer. The design of the thumb catch used to release the cam from the rope can inadvertently catch on a cock when climbing against the wall. Given the proper pull, the catch will pull down and out releasing the ascender from the rope. This can also occur if the bungie is improperly tensioned. If the bungie is improperly tensioned. If the bungie is not tight enough, there will be slack in each step and the sling going to the knee ascender can catch on the foot ascender and again release the cam. This does not appear to be a problem on the newer Petzl Crolls which have a thumb loop release instead of a pin.

Should any ascender pop off the rope, there is enough redundancy designed into the system to prevent anything other than a minor inconvenience. Simply pop the ascender back onto the rope and continue climbing.

The other problem that also arose has to do with proper tension in the bungie cord. If the bungie is not tight enough, slack can develop in the system as you step. When this happens, the bungie on the foot ascender side can accidentally feed into the knee ascender jamming the system. The bungie should be tensioned to allow a few inches more than the maximum step you would take. This will prevent the bungie from feeding into the knee ascender and allow you to realize the full efficiency of the system. Any slack in the system will result in system inefficiency.

System Design Comments

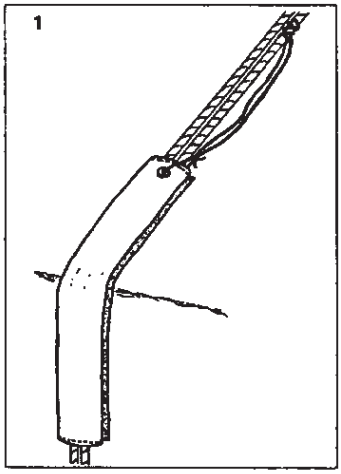
Many people came up to me at convention complaining that the foot ascender dragged uncomfortably. The following my help prevent this. Do Not sew the ascender directly to the foot loop. Doing this changes the orientation of the ascender by 90 degrees as opposed to using a #6 Delta Maillon for the connection. Also the orientation of Jammer should be perpendicular to the long axis of your foot. The open side of the Jammer should be away from your leg, assuming it is rigged on the right foot. This will look odd and it will appear that the rope will ride on the outside of your foot. However, just run the rope inside across your instep and the ascender will ride smoothly with bottom tension required for only a few feet. This orientation also allows on and off the rope using your left hand.

If anyone who is now using this system, discovers any additional problems or advantages, please contact me. I am very interested in hearing about any developments in the system.

RAVEN ROPE GUARD

The RAVEN ROPE GUARD is a special pad made of three layers of heavy cotton canvas. It is designed to protect ropes from abrasion when they are stretched across rough edges, as occurs during rappelling, rescue, high-rise window cleaning and other operations.

To use the ROPE GUARD, it should be opened up, places around the rope, and then tightly closed by means of the hook and loop fastener. For maximum padding, the hook and loop side should be placed next to the edge, as shown in Fig. 1.

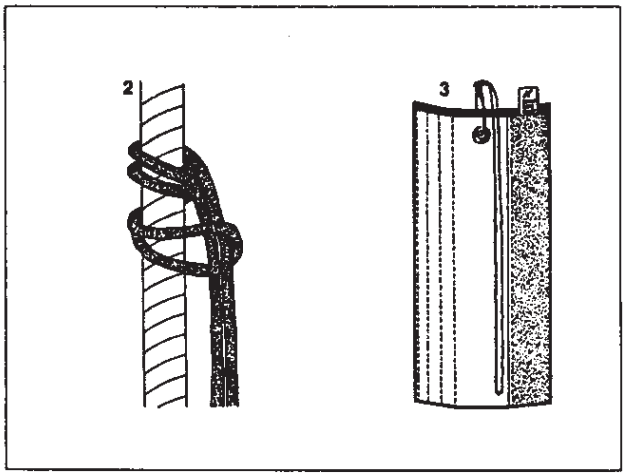


In order to keep the ROPE GUARD from sliding down the rope, a short lanyard (three to four feet in length) should be tied into the grommet and secured to the rope or another anchor point. A Heddon Knot is very useful for attaching the lanyard to the rope (Fig. 2).

When securing the ROPE GUARD to the rapel rope, bear in mind that very elastic (dynamic) ropes stretch considerably during use. Make sure that this stretch does not allow the GUARD to move from its position against the rough edge, thereby leaving the rope with no protection.

In some situations, it may be useful to place the GUARD on the edge, like a pad, instead of around the rope.

When not in use, the ROPE GUARD can be hung from your harness by means of the small loop formed in the lanyard, above the grommet. The rest of the lanyard can be stored inside of the closed GUARD (Fig. 3).



WARNING: The RAVEN ROPE GUARD can be cut by sharp edges, such as metal flashing, sharp rocks, etc. If the GUARD gets cut, your rope can be cut too! If you have any doubt about the intended placement, trust your instincts and don't go over!

For safety, the RAVEN ROPE GUARD should be discarded when the threads or fabric show moderate amounts of wear. For maximum life, it should not be stored wet.

Do not use the RAVEN ROPE GUARD or any other rappel equipment, without proper instruction.

ROPE ABRASION PROTECTION

RG-12 RAVEN Rope Guard, 12" ..... $ 18.95
RG-18 RAVEN Rope Guard, 18" 19.95
P-Cord Black nylon parachute cord for RG lanyard.....05
RG lanyard—6' length of black parachute cord tied onto RAVEN Rope Guard 1.00
into a loop for you. Cord is tied together with a Grapevine knot, then a Figure 8 knot is tied near the grommet to give you a small loop to clip in a carabiner for carrying on your harness or chair.

FURTHER COMMENTS ON THE PETZL CROLL ASCENDER

By David M. Doolin

In "Vertical Caving Hardware," *Nylon Highway #27*, Mr. Storrick states that the Petzl Croll can be used in almost any situation where other handleless cam ascenders are used. They can be, but probably shouldn't be the first choice. This ascender is specifically designed for the Frog System. In the context of the Frog System the Croll is a right hand operated ascender and is very simple to operate single handedly, even with gloves on.

Version A of the Croll (Illus. p. 25, NH #27) has a prominent thumb knob on the safety bar; Version B has a large thumb hole and a small "ripcord" hole on the safety bar. It is customary among cavers who climb Frog style to thread a 6-8" 6 mm cord through a gas tube and attach it to the hole in the safety bar. This "ripcord" provides an ease of operation that is unparalleled, but it can be dangerous in one situation.

On short wall drops, or with sticky or limp rope, the Croll will not feed itself. Generally, the caver will then just grab some rope below the Croll, and pull it through as he or she stands. It is important to do this left handed. It is really easy to grab the short "ripcord" along with or instead of the standing line. The feeding motion pulls down and away. Pulling down and away to the right opens the Croll and leaves the caver dangling from his top ascender only. The advantage of having this "ripcord" is so great it is worth a little extra training time to learn to use properly.

As for the attachment hole, the bottom one should be directly to the steel seat maillon, either a delta or dee. The upper hole accepts a chest sling of webbing, 9 mm rope, bicycle inner tube or whatever. The chest sling carries virtually no weight so abrasion is not a real problem. A Steel maillon works much better because they seem to stay screwed shut much better. Maillons handle the stress in the Frog system better than most all carabiners.

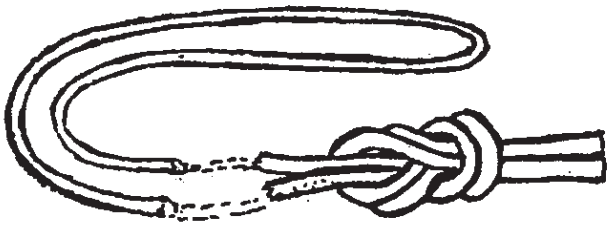
THE LOAD RELEASING HITCH

Developed by Arnor Larson

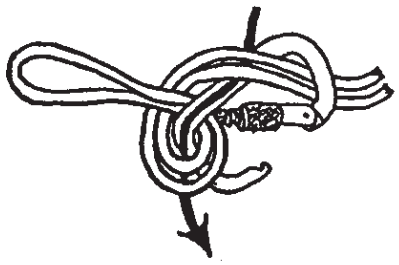
The Load Releasing Hitch (LR Hitch) was developed by Arnor Larson, in the late 70's for use in British Columbia rescue work. It is useful for passing joined ropes through brakes or pulleys or anytime a set prusik, still under tension, needs to be released. It also acts to a degree as a shock absorber. It is the only releasing hitch known that can easily exceed the British Columbia Council of Technical Rescue's (BCCTR) minimum standard: "With 3 meters (9.8 ft) of 11.1mm nylon kernmantle low stretch rope tied between a 200kg mass (440 lbs), to be dropped and the released hitch secured to anchor, a 1 meter (3.3 ft) fall must be sustained and the release hitch, afterwards, easily undone and used to lower the weight under the control of one person."

To make the LR Hitch, you will need 8 to 10 meters (26 to 33 ft) of 8 MM, low stretch accessory cord and two large carabiners.

1. Double the 8 MM rope to form a bight in the center. The ends are tied together with a figure 8 knot.

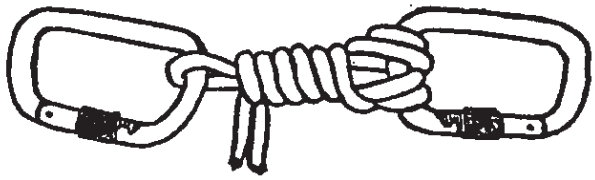


2. Twist the rope as shown and pass the carabiner through the rope following the arrow to form a Munter Hitch.

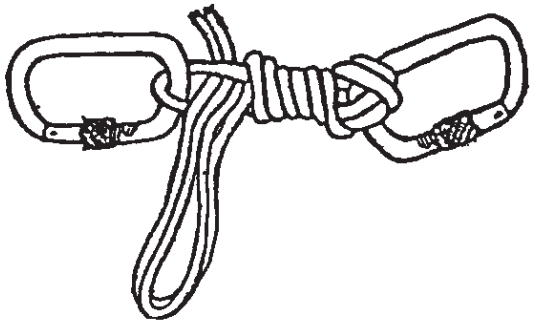


3. Smooth and shape the rope so that about 15cm (6 inches) or less of the bight extends beyond the carabiner.

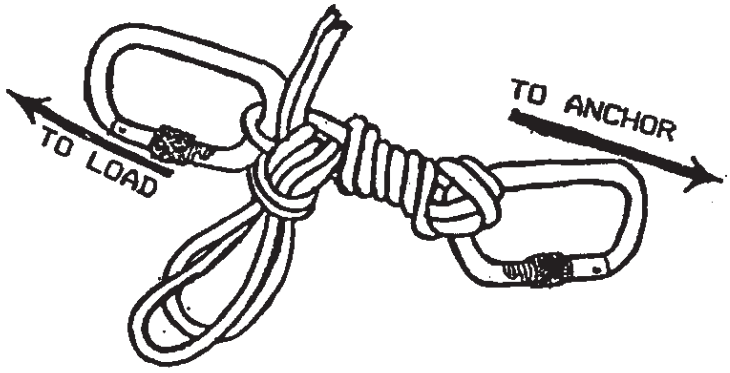
4. Add the second carabiner. Smoothly and tightly, wrap the rope around the bight three times.



5. Now tuck a portion of the doubled cord through the bight.



6. Tie off with one or more overhand knots. In normal operation the Munter Hitch is on the anchor side and the bight is on the load side.



To release the LR Hitch, first untie the backup overhand knot, while holding one hand tightly over the three wraps, pull the rope out of the bight joining the two carabiners. Once you have control of the ropes coming off of the hitch, you may begin to lower by feeding the ropes toward the hitch. I believe that you will find it simple and effective.

Reprinted from NCRC Newsletter, July/October 1988.

THE VERSATILE GIBBS:
SPELEAN SHUNT/FLOATING GIBBS

By Jim Hall

To make a spelean shunt for a rappel safety (fig. #2), use a Gibbs with a steel non-locking carabiner thru its eye and use about an 18" long webbing loop to your seat sling. The ideal knot to tie the webbing loop is the PLAB* knot (fig. #1) as there are no loose ends to get caught in the rack. Going over lips it may be necessary to hold the carabiner/cam assembly open. However once in a vertical position the shunt will ride smoothly on the top of the rack and any touch of the attachment webbing will instantly stop you.

If you use an aluminum carabiner instead of steel it is necessary to tie webbing or accessory cord to the release side of the carabiner to get enough weight to hold the cam open. I don't like this because in an emergency one might grab the webbing on the release side and hold the cam open while falling out of control.

FLOATING CAM SAFETY

To change the spelean shunt to a floating safety cam for use with a box or a Simmon's roller, just remove the carabiner and run the attachment webbing behind your chest harness (Fig. #3).

It will ride above the box or roller giving you an additional attachment point to the rope plus an instant rest position by just sitting down in your seat sling. This same Gibbs with tied webbing is also very adaptable for hauling systems.

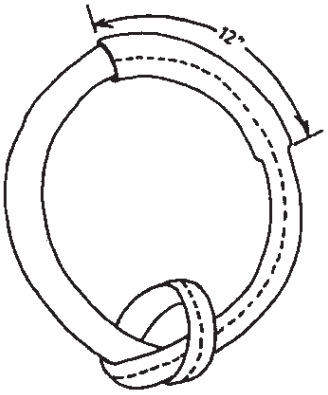


Fig. #1 The PLAB* knot (Peter Ludwig Austrian Beer knot)
To make this 18" loop take a piece of 1" tubular webbing 48" long. Pull about 24" thru the eye of a Gibb's cam. Tie a loose overhand knot close to the eye of the Gibbs. Insert one of the loose ends inside the other end about 12". Roll the overhand knot onto the doubled webbing and pull tight. You now have a knot with no loose ends.

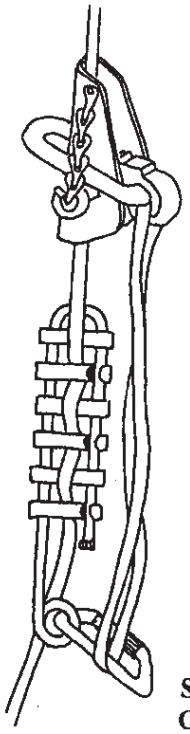


Fig. #2 Spelean Shunt

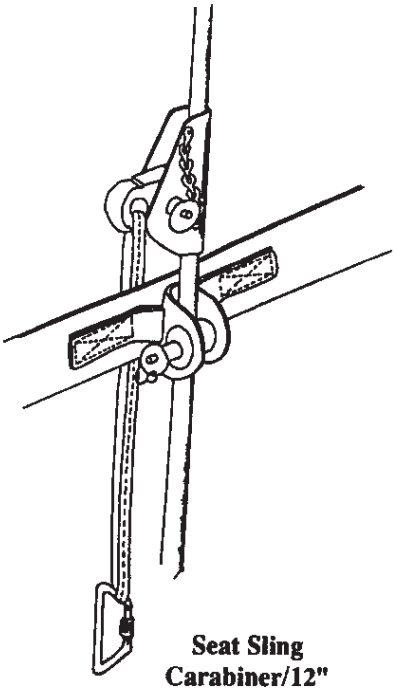


Fig. #3 Floating Safety Cam

Vertical Caving Hardware 3:
Handled Eccentric Cam & Lever Cam Ascenders

Introduction

This is the third 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 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. I hope that those of you that are designing new devices will also keep me in mind, I'm sure we can work out some mutually beneficial arrangements.

One of the vendors who acquired a number of devices for me pointed out that it may make the vendors "look bad" if I give them credit for selling me a device, but then write that I don't like it. Many of the devices in my collection were available from a number of sources, and in those cases I tried to be fair to everyone and spread the business evenly. Other devices were special orders, and not recommended by the vendors. I've even been sold devices on the condition that I don't ever use them because they are too unsafe! I'm identifying my sources for information only, and such an identification doesn't imply the vendor endorses the device. I'm also not selectively endorsing any particular vendor, since I have had good relations with all of them.

For legal reasons my opinions are strictly limited to my personal devices only, but they could often apply to identical devices from the same manufacturing lot, and sometimes, but not always, could apply to similar models. One important thing to remember is that there is the chance that either I have a lemon, and hence will rate a product poorly; conversely, I may have acquired a particularly good version of a device, and you may get a lemon which will kill you. The bottom line is simple: don't follow my advice blindly. Along similar lines, I think price is almost completely irrelevant in choosing vertical caving equipment, particularly since almost everything reasonable sells for a similar price. Choose the best, then buy it. Its your life that depends on your equipment.

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. Originally I was going to dedicate this article to something more unusual than handled ascenders in order to break up the pace of the series, but three things persuaded me to write about handled ascenders in this article. First, Bruce Smith has been asking for such an article for over a year now. Second, he managed to get the vertical section to request it at the 1989 N.S.S. Convention. Finally, I realized that an article on more practical devices ought to take higher priority, at least for once. I hope to write the next article about more esoteric devices.

Definition of a "Handled Eccentric Cam Ascender"

This article will consider mechanical ascenders consisting of a shell or frame and an eccentric cam assembly attached to the shell/frame at a single pivot point. (I will use the term "shell" when constructed of stamped or pressed sheet metal and "frame" when constructed by casting, milling, or other more "3 dimensional" techniques). The shell/frame is open on one side to allow admittance of the standing rope. The shell/frame below the cam is enlarged to provide a handle. No sling attachment points are provided on the cam.

In addition to the handled eccentric cam ascenders, the Kong–Bonaiti handled type 1 lever cam ascender will also be discussed. This is a unique device falling into its own category, which I will define below. I'm discussing it here with other handled ascenders so I don't have to lump it in with a bunch of miscellaneous devices later.

General Comments on Handled Eccentric Cam Ascenders

I am familiar with handled eccentric cam ascenders manufactured by five companies and one Grotto. This article discusses two versions by Clog, six versions by C.M.I., six versions by Jumar,

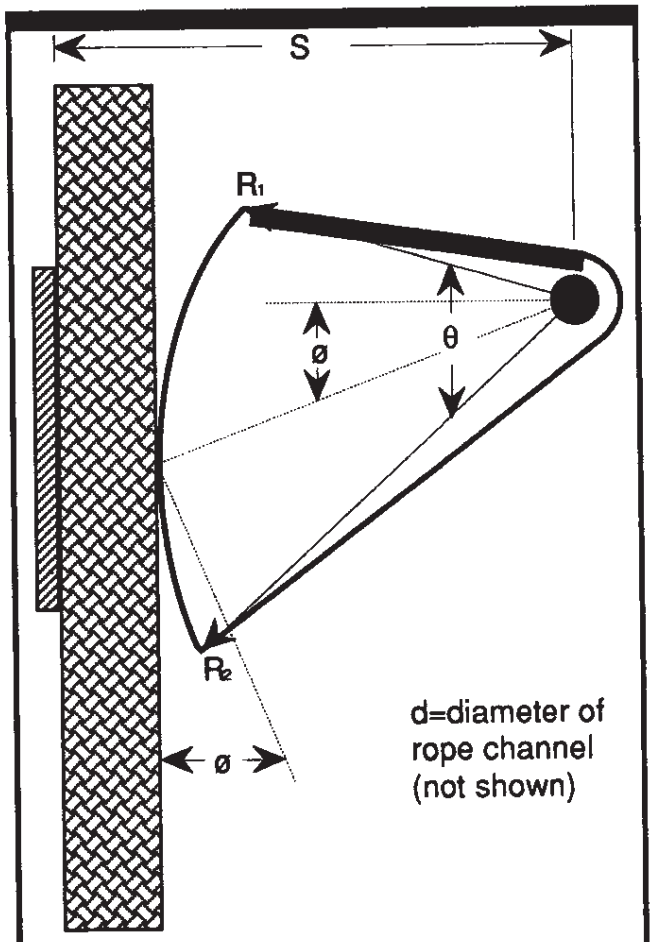


Figure 1
Cam dimensions defined

four versions by Petzl, three versions by Single Rope Technique, and the Mother Lode Grotto's Roloff ascender.

These ascenders are generally larger and heavier than the handleless eccentric cam ascenders considered in the first article; conversely, they are easier to manipulate, particularly with gloved hands. (I don't recommend ascending with gloves on except in cold conditions). The major dimensions for each ascender are given in Table 1. These ascenders are asymmetrical, and can be classified as left–handed and right–handed. Holding the ascender vertically with the open side of the shell towards you, a left–handed ascender has the cam to the left of the rope channel while in a right–handed ascender the cam lies to the right. All ascenders considered in this article are made in both left and right hand versions; naturally one normally acquires a pair of one each.

The eccentric cam ascenders use a toothed cam which is spring loaded towards closing. All eccentric cam ascenders in this article appear to use use an equiangular spiral as the basis for the cam design. The equiangular spiral is a logical choice for two reasons. First, the locus of rope–cam contact points for different rope thicknesses is a straight line segment. This segment, if extended, passes through the cam pivot, and makes an angle with the horizontal equal to the expansion angle of the spiral. For small variations in rope diameter, the elevation of the rope–cam contact changes very little. These features simplify the structural design of the ascender. In addition, this arrangement results in a nearly constant cam to rope pressure for different size ropes. These two features help make ascender performance relatively insensitive to the diameter of the main line.

The cam teeth are essential for proper operation. Abrasion of the cam teeth is a problem, particularly with some of the softer cam materials. An ascender with worn cam teeth may not hold; neither will one whose teeth are caked with mud or ice. Cave mud appears ideally suited for ruining the performance of this class of ascender, so extra care should be taken to keep ropes clean. The teeth appear to have little or no effect on the life of the ropes the ascenders are used on. As weight is applied to the ascender, the teeth provide the friction necessary to keep the cam from slipping down the rope. Since the shell tends to slide initially, the eccentric cam closes until further closure is prevented by the thickness of the now distorted climbing rope. At this point the ascender stops its downward motion and begins to support the load. Note that there is an inherent slippage in the operation of these ascenders. This creates some loss of climbing efficiency, although the loss is usually small.

All of these ascenders have a problem with horizontal and diagonal ropes such as one might find on Tyrolean traverses. Since the attachment point is located at the base of the ascender, it exerts a torque about the rope channel when loaded. This can generate substantial forces between the rope and the rope channel. Since the rope channel is open on one side, the rope may be forced out of the rope channel, even if the cam is not fully open. Because of the large forces, the rope can sometimes pass through the small gap between the cam and the shell or frame. The accepted method of preventing this involves clipping a carabiner through both the lower attachment hole and the sling, and then clip this carabiner around the main line. This keeps the ascender from rotating so the large torque is not applied to the rope channel.

THIS IS NOT A COMPLETE DESCRIPTION SO DO NOT TRY THIS WITHOUT INSTRUCTION!

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 ascending ropes within the 9 to 11 mm. diameter range. Comments do not apply to ascender abuse, such as use in rescue hauling systems.

Handled Eccentric Cam Ascenders

Clog

Expedition Ascender, Version A

Technical details

I acquired this pair in Driggs, Idaho in August, 1980, but I believe the ascender is at least five years older than that, since version B was available in 1976.

The ascender shell is a roughly "D" shaped piece of unfinished 4.2 mm. thick aluminum bent to form a rope groove on one side and to hold the cam pivot and safety on the other. The handle opening is fairly large, and a molded rubber hand grip is glued to the shell. A 15.3 mm. hole at the base of the shell serves as a rope attachment point. A second 15.3 mm. hole provides a means to attach non–load-bearing slings to the shell above the cam.

The cam is a skeletonized steel casting with a $(4.5)^4(4.3)^4$ conical tooth count. (See the first article in this series for an explanation of my tooth count conventions). The teeth are well made compared to those of some other toothed ascenders. The inner cam face radius reduces from top to bottom to accommodate various sized ropes. The cam and cam spring are mounted on a solid 7 mm. steel pin. The pin is expanded at both ends to keep it in place. The cam safety is a crudely machined aluminum lever mounted on a 3 mm. roll pin in the same shell channel as the cam. A second spring serves as a safety spring. Normally this spring holds the safety where it blocks the cam from opening. When the end of the safety lever is depressed, the opposite end pivots upwards so that the cam is no longer obstructed.

The words "CLOG WALES" are stamped on the inner shell surface, and "CLOG" is cast on top of the cam.

Comments

This ascender combines a very well made cam with a poorly executed shell and safety. The cam is identical to the cam on the handleless Clog version C of the first article. I have seen photos of two earlier Clog handled ascenders with cams corresponding to versions A and B of the first article, but to date I have not been able to locate any for my collection. There are no sharp edges on the ascender in either the rope channel or the sling attachment holes, but the cam pin does have a sharp lip. I don't like the way the cam pin is expanded, I would prefer to see round head rivets used here. Clog ascenders are quite large. This makes them popular among snow and ice climbers, who must wear heavy mittens while climbing fixed ropes. Of course, the large size is a disadvantage for caving. The ascender is easily opened with one hand, but only the wrong hand. It is very difficult to open the right hand ascender with one's right hand without going through some severe contortions.

The ascender can be removed from the rope by simply depressing the safety with one's thumb and lifting up on the handle. It is much more difficult to put the ascender on the rope with one hand, particularly the proper hand. Normally it becomes a two handed operation.

The rubber hand grip is very comfortable, but is excessively heavy. The hand grip provides some insulation in winter conditions, but there is a rib of the aluminum shell exposed next to one's palm so the protection is not complete. In many climbing systems (e.g.,, the lower ascender in the Mitchell System) ascenders are pulled up the rope from above. Clog ascenders are not as easy to grasp from above as some others (such as the Jumar).

The ascender is attached to the harness by a carabiner through the bottom attachment hole. Clog eliminated carabiner attachment holes from later expedition ascenders because of two cases of carabiner failure. These were caused by sideways gate loading on carabiners lodged incorrectly in the attachment hole. This could happen also occur with Petzl's, S.R.T.'s, handled C.M.I.'s, etc. I caution against using carabiners for attaching slings to ascenders. Clog ascenders also have a disadvantage shared by all handled ascenders using a sheet metal shell. When crossing a sharp lip, it is very easy to carelessly place the ascender so that the cam grips the rope just above the lip, while the base of the handle sticks out over the pit lip. When weight is transferred to the ascender sling, the shell tends to bend 90°. This effectively destroys the ascender. Milled or cast frame ascenders, such as the C.M.I., Jumar, and S.R.T. are more likely to survive this mistake.

Expedition Ascender, Version B

Technical details

I acquired this pair of ascenders from Avalanche in Pittsburgh, Pa. in April, 1978. At the time it was the current production model.

The ascender is very similar to version A, so only the differences will be noted. The cam safety is a more elegantly shaped steel casting, and is mounted with a steel round head rivet. It functions in the same manner as the safety for version A. The hand grip is plastic molded onto the shell. A small extension on the base of the plastic hand grip protects the inside bottom of the handle opening so that slings can be tied directly through the handle. "CLOG–WALES" is molded into both sides of the plastic hand grip. The lower attachment hole was eliminated due to the safety concerns mentioned above. The shell is blue anodized, and the shell markings are eliminated.

Comments

All of these changes are improvements, except one. Elimination of the lower attachment hole was done for safety reasons, but without the hole there is no easy way to prevent ascender rotation on horizontal or sloping ropes. I still wish the cam pivot had been changed. The resulting design is something of a nuisance, since slings must now be tied through the handle. Unfortunately, the slings pull towards the outside of the ascender, i.e., away from the rope and towards the hand. This causes the ascender to pivot slightly when loaded, leading to lost efficiency. The hand grip is less comfortable than the rubber one of version A, but is superior in terms of weight and durability. It also completely surrounds the aluminum shell, providing better cold weather protection.

Colorado Mountain Industries (C.M.I.)

5000 Series

There have been several versions of the C.M.I. 5000 series ascender, but the differences appear to be fairly minor so I did not acquire each version when it was available. As a result, I am missing the "5001".The "5001" was apparently never given a new number, instead there were two versions of the 5000. Ian Ellis read me a press release indicating the "5001" was scheduled to have a stronger cam spring, a cam change to accommodate the new spring, a repositioned safety, and radiused versus chamfered tie–in holes. The 5002 has all these features except the repositioned safety, and my 5000 does not have chamfered tie–in holes. If someone wants to trade a pair of "5001" ascenders for a new pair, I may be interested in accommodating you. Similarly, I'm looking for a right hand 5002 and a pair of C.M.I. Shorti IIs.

Ian Ellis of Speleoshoppe kindly went through his old purchase records to find the approximate time frame for each of the C.M.I. 5000 series ascenders. Apparently the 5000 was introduced in mid 1979, the "5001" in early 1980, the 5002 in late 1980, the 5003 in mid 1984, and the 5004 in mid 1986.

C.M.I. 5000

Technical details

I acquired this pair of ascenders from Speleoshoppe in 1979.

C.M.I. ascender frames are made by milling an aircraft alloy extrusion. The extrusion direction is oriented parallel to the vertical axis of the ascender. The frame contains two opposing channels. One channel is rounded and becomes the rope channel., the other is square and holds the cam. Starting with a length of extrusion, everything that doesn't look like ascender frame is machined away. In particular, the rope channel is shortened, the handle hole is cut, two 15.6 mm. sling attachment holes are drilled at the bottom and a third is drilled at the top, the unused lower portion of the cam channel is cut back, and all the sharp corners are rounded. My ascenders have a red anodized finish. This was a custom color made specially for Speleoshoppe, the standard color is dark gray.

The cam is identical to the C.M.I. Shorti cam described in the first article. The cam is a skeletonized casting with a $(2)(5.4)^4(3.4)^2(3.2)^2$ conical tooth count. According to an undated C.M.I. brochure acquired with the ascender, the cam material is 17–4ph stainless steel. The inner cam face radius reduces from top to bottom of the cam in order to match different diameter ropes. "CMI" is cast on the side of the cam. The cam pivot is a solid 6.4 mm. round head pin held by an external retaining ring. The cam safety is an elbow shaped nylon(?) lever mounted on a roll pin in the cam. A single spring serves as cam spring and safety spring. Normally this spring holds the safety where it protrudes from both the top and bottom of the cam. The bottom protrusion interferes with the shell's cam channel and prevents opening the cam. When the top of the lever is pushed towards the cam teeth, the lower protrusion rotates into a recess in the cam, thus allowing the cam to open.

Comments

The shell on this ascender is very strong, but a competitor pointed out that this C.M.I. cam was weaker than some of the competition's. Personally I feel the C.M.I. cam strength is more than adequate for my purposes. Since the cam channel is extended to form a handle, the frame is well reinforced against lateral bending, so the pit lip scenario described for the Clog should not destroy the ascender (but it is still very bad technique!). The ascender can be opened with one hand, but the safety is awkward, particularly when used in the "wrong" hand. The extra bulk of the handle makes it slightly easier to open than the C.M.I. Shorti. The cam pin is excellent, and allows one to easily replace a worn cam at home. The cam spring is too weak, so the ascender occasionally fails to grip the rope. I have heard reports of 11 mm. rope becoming wedged in the channel below the cam (i.e., the "handle" part of the frame) but have not observed this problem myself. The handle is not as comfortable as most, but is certainly adequate. Like the Clog, the C.M.I. 5000 is not an easy ascender to grip from above.

C.M.I. 5002

Technical details

I acquired two left-handed C.M.I. 5002 ascenders from Speleoshoppe in October, 1989. I'm willing to trade one for a right handed model.

There are several changes between the 5000 and 5002. The cam was redesigned with somewhat more reinforcing than the 5000 cam. The spring channel in the cam has been enlarger to accommodate a stronger cam spring. The cam pin has a smaller head, and the safety pivot diameter was increased. The 5002 cam is also plated, while the 5000 cam was unfinished.

The two 5002 ascenders in my collection have slightly different tooth patterns. One has a $(2)(5.4)^4(3.4)(3.2)^3$ conical tooth count, the other a $(3)(5.4)^4(3.4)(3.2)^3$ count. Evidence for the missing tooth on the first one is obscured by the plating. The teeth are well formed, more so than on the 5000. The teeth are still perpendicular to the cam face. "Cmi" is cast on the side of the cam.

The frame is essentially identical except for the rope channel, which has been increased in height and given a pentagonal shape. The lower and upper tie–in holes are radiused on one side only. This ascender has the typical dark gray anodizing of most early C.M.I. ascenders.

Comments

The stronger cam spring is an improvement which causes the cam to grip more reliably, although it also makes operating the cam safety and opening the cam more difficult. There are too many cam teeth. Too many teeth causes the 5002 (and similarly the 5000) to perform less satisfactorily in mud than the 5003 and 5004. The missing tooth on the one ascender can be viewed rather amusing statement about quality control.

The increased height for the rope channel is more than a cosmetic improvement. One strange feature of the 5000 was that the rope–cam contact point was well below the center elevation of the rope channel. The 5002 design places the contact point much closer to channel mid–elevation. This is a much cleaner design than the original and indicates at least some attention to detail; however, tool marks on the frame are very prominent. In general the workmanship on this ascender is inferior to that on my 5000s.

The raduised tie–in holes are a nice improvement, but the job was only half completed. Both sides of the holes should be radiused.

C.M.I. 5003

Technical details

I acquired this pair of ascenders from Bob & Bob at the 1987 N.S.S. Convention.

This ascender is very similar to the C.M.I. 5000, even though it is three versions later. The frame extrusion has been substantially thickened in the rope channel area, and is now finished in a black epoxy(?) paint. The remainder of the frame appears to have been beefed up, but the extra thickness may only be paint. The three sling holes are now beveled. The cam and cam safety are the same as those on the C.M.I. Shorti III described in the first article. The cam has been modified in several ways. A reinforcing bar now extends from the back of the cam face arc to the mid–bottom of the cam, providing better cam face support under load. The conical teeth are larger, sharper, and better made, and the tooth count has been changed to $(5.4)^2(3.4)^3(3.2)$. The teeth are now oriented parallel to the top of the cam. The cam finish appears to be plated, but this may be just a change in alloy or heat treating. "Cmi" is cast on the side of the cam. The cam safety is now molded, and the enlarged actuating lever lies along the top of the cam rather than sticking up from the cam.The cam pivot head is flatter than on the C.M.I. 5000, and the safety pivot is larger in diameter.

Comments

The ascender is very well made. In my opinion, the extra frame thickness is superfluous since the C.M.I. 5000 frame was already very strong. The cam spring is stronger than the C.M.I. 5000 spring and functions adequately. Orienting the cam teeth axes parallel to the top of the ascender cam is an improvement. This design gives the teeth a slight downwards alignment with respect to the climbing rope. This increases their grip, reduces tooth friction while raising the ascender, and provides a small self cleaning action at the same time. The ascender can be opened with one hand, but the safety is is even more awkward than on the C.M.I. 5000. I suspect that the new design was developed to reduce the risk of accidentally opening the ascender, but I don't find this to be a problem. My safety is cracked on one ascender, and Ken Kramer reports that his safeties broke on the way to their first cave trip. Obviously a tougher plastic is needed for the cam safeties.

C.M.I. 5004

Technical details

I acquired a right handed C.M.I. 5004 ascender from Bob & Bob at the 1989 O.T.R. I acquired a left handed ascender from Speleoshoppe two weeks later.

The only discernable difference between this ascender and the 5003 is in the rope channel design. The 5004 rope channel extends farther towards the cam pivot and has a small lip inside.
Comments

In 1986 C.M.I. issued a press release noting that "under some unusual circumstances... [the C.M.I.] 5003 and Shorti III ascenders can be forced off the rope". It is possible to get some thinner, soft lay ropes to pull out between the cam and the side of the rope channel if one works at it a while, but I have been completely unsuccessful in pulling 11 mm. P.M.I. out of my pair of 5003s under any reasonable circumstances. There is no doubt that the 5004 provides a great deal more rope security than the 5003, but I have no practical worries about either one of my ascenders.

Colorado Mountain Industries (C.M.I.)

UltrAscender Series

C.M.I. UltrAscender (Large)

I received the following notice from C.M.I. on October 9, 1989:

"Recall Notice

"CMI has discovered that a [sic] one of our ascenders was inadvertently subjected to excessive heat during the painting process. While we have recovered this ascender it is possible that other ascenders may have been subjected to these same high temperatures. That temperature to which they may have been exposed is high enough to anneal the material possibly reducing its strength. This error occurred after March 1, 1989. CMI requests that any ascenders purchased after March 1, 1989 be returned to us for strength testing. All ascenders shipped by us after June 22, 1989 have received a final strength test and are being labeled appropriately; they are not subject to this recall".

Since the problem has been identified and addressed in a very reasonable manner, there is no reason to avoid C.M.I. products because of this incident.

Technical details

I acquired this pair of ascenders from J. E. Weinel, Inc. in June, 1989.

This ascender uses the same frame extrusion design as the C.M.I. 5004. Several colors are available, mine is red and uses a non-epoxy paint. The remainder of the ascender has been extensively modified. The cam is a skeletonized steel casting. The conical teeth are oriented perpendicular to the cam face and are set in a $(4.3)^3(4)$ pattern. The safety has been removed from the cam and is now located in the traditional Jumar position. The molded plastic cam safety has seven teeth which can engage the lower cam teeth, providing a number of positions for holding the cam partially open. Two checkered ears on the safety for give one's thumb or finger something to reach to open the safety. A cutout between the two ears provides clearance for the cam to function. A roll pin holds the safety and safety spring in position. Below the safety is a hand grip assembly consisting of two black plastic pieces pinned to the frame with a single roll pin. The larger piece has three molded finger grooves, and a broad shelf at the bottom to keep the little finger off the frame. The other piece is a spacer whose sole purpose appears to be so that the same hand grip molding could be used on both right and left hand ascenders.

Comments

This ascender has some major improvements over the C.M.I. 5000 series, but it has some disappointing features as well. The new safety location is a big improvement, since the old design was, to put it bluntly, abysmal. The new safety is vastly superior, but the execution of the new safety still leaves something to be desired. The ascender can be operated with both hands, but once the ears break off (and I have no doubt they will) there will be very little exposed safety left to reach. Even in its original condition, the ears are located too high and too close to the handle to be reached easily. The cutout between the ears is completely unnecessary, since there would be adequate room for the cam to operate even if this area were completely filled in. This would also strengthen the ears.

I do not like cam safeties which can hold a cam partially open. I can understand holding the cam full open while waiting for your turn on rope, for example, but partial hold-opens are next to useless. In fact, they present a potential hazard if the cam does not close completely when rigging in, particularly if the ascender is being used as a safety at the pit lip. My philosophy is simple: if an ascender is on rope, it should be capable of holding weight. Most situations where a hold-open are useful (e.g.., rescue hauling systems) constitute some form of ascender abuse. If desired, the safety can be replaced with a home made aluminum substitute.

The finger grooves on the hand grip are simply too small, and should be eliminated entirely. I have large hands and find them uncomfortable. In order to get some other opinions, I went out in search of petite women with small hands to see if the ascender fit their hands. To date I have not found any adult of either gender with small enough hands to fit the finger grooves. Furthermore, the shelf at the base of the hand grip serves no essential function, and simply reduces the usable size of the handle. Even without the shelf, the hand grip would keep the rope from jamming in the cam groove as noted above. Fortunately, both the finger grooves and the shelf can easily be filed off.

The paint is far less durable than on the C.M.I. 5004, and chips off very quickly.

The cam is much more strongly reinforced than the 5000 series cams, and the overall workmanship is excellent. I prefer cam teeth oriented either parallel to the top of the cam, or pointed downwards, because they tend to be self-cleaning, but there is really nothing wrong with teeth set perpendicular to the cam face.

Don't misunderstand these comments; most of them are related to minor considerations. I like the UltrAscender far more than the previous C.M.I. versions. The UltrAscender has an extremely strong frame, and although I haven't tested one, looking at the design I suspect the cam strength is also very high. In general, this is a very usable ascender as manufactured and can easily be modified into an excellent ascender.

C.M.I. UltrAscender (Small)

In the interest of safety, I'll repeat myself. I received the following notice from C.M.I. on October 9, 1989:

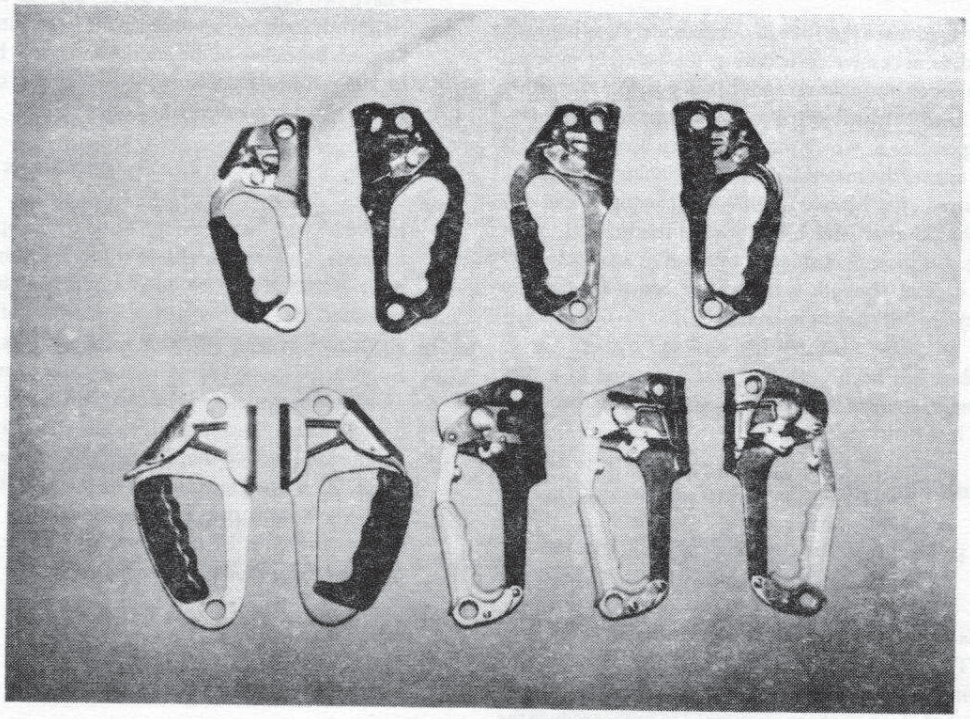


Plate 1: Top Row: Petzl Expedition versions A, B1, B2 and C.
Bottom Row: Clog Expedition versions A and B; Bonaiti versions A, B1 (without extended safety), and B2 (with extended safety).

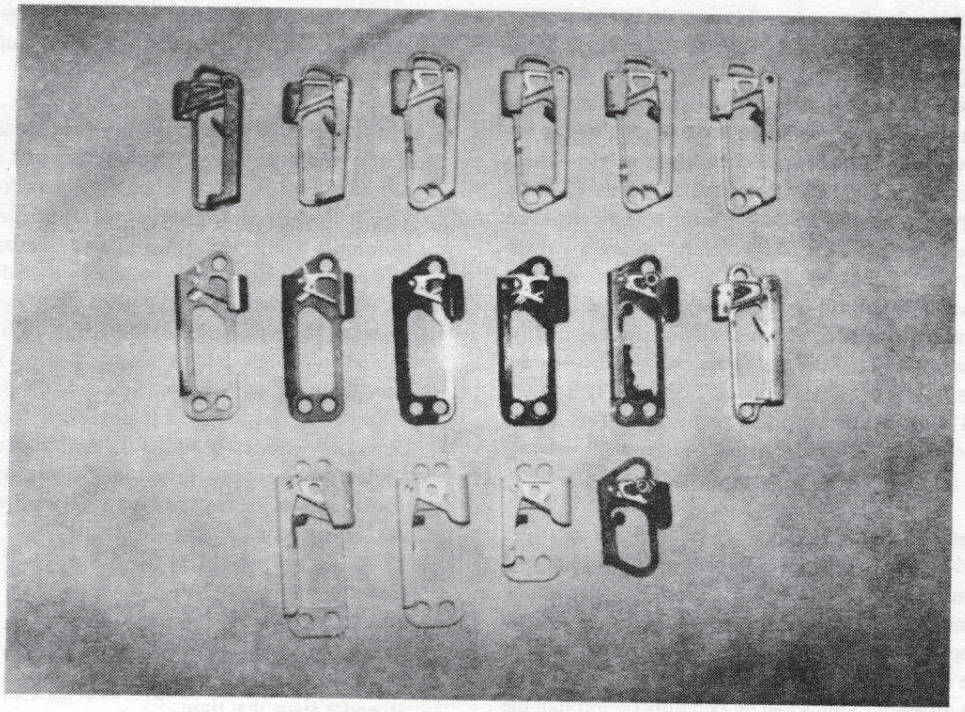


Plate 2: Top Row: Jumar gray series versions A and B; Jumar yellow series version A, B, C, and D.
Middle Row: C.M.I. 5000, 5002, 5003 and 5004; C.M.I. large UltrAscender; Roloff.
Bottom Row: S.R.T. Caver 8-16 mm., S.R.T. Caver 8-11 mm., S.R.T. Climber; C.M.I. small UltrAscender.

"Recall Notice

"CMI has discovered that a [sic] one of our ascenders was inadvertently subjected to excessive heat during the painting process. While we have recovered this ascender it is possible that other ascenders may have been subjected to these same high temperatures. That temperature to which they may have been exposed is high enough to anneal the material possibly reducing its strength. This error occurred after March 1, 1989. CMI requests that any ascenders purchased after March 1, 1989 be returned to us for strength testing. All ascenders shipped by us after June 22, 1989 have received a final strength test and are being labeled appropriately; they are not subject to this recall".

Since the problem has been identified and addressed in a very reasonable manner, there is no reason to avoid C.M.I. products because of this incident.

Technical details

I acquired this pair of ascenders from J. E. Weinel, Inc. in June, 1989.

This ascender is milled from the same shape extrusion as the large UltrAscender. The obvious difference is that the small version is much more compact. The handle is much smaller, and the two bottom attachment holes have been eliminated to further reduce the overall size. The upper attachment hole has been enlarger into a 33 by 26 mm. rounded right triangular opening. The cam and cam safety are identical to those on the large UltrAscender, but the hand grip has been eliminated for lack of space.

Comments

Upon receiving this pair of ascenders, I immediately added some 6 mm. sling and put the pair into my vertical caving pack for normal use. Needless to say, I usually don't react that way to a new piece of hardware. This is one of the nicest ascenders I've ever seen, and with a few minor changes could be truly outstanding. It has been 15 years since Bob Thrun described the Jumar as "needlessly bulky"; now there are finally some small handled ascenders on the market. Normally I don't mind the bulk of a full size ascender, so for everyday use I don't think I'll completely replace my main ascenders with a compact model. On the other hand, there are a lot of occasions where weight and bulk are important, and in these cases the C.M.I. small UltrAscender is a fine choice. The size of the ascender has been reduced by 30%, but there is still room to use the frame as a three handle for three fingers if desired. This is the lightest handled ascender described in this article. The S.R.T. Climber described below has a slightly smaller standard volume, but most people perceive the C.M.I. as the smaller of the two.

The frame design of the C.M.I. UltrAscender is its strong point, both literally and figuratively. The frame is much more substantial than the shells on most sheet metal handled ascenders. The handle is still large enough for three of my large fingers if desired. The enlarged hole above the cam is much easier to grasp than the small hole in the large model, so the small model makes a better lower Mitchell system ascender. Slings can be tied directly through the "handle", and the slope in the bottom of the handle keeps the sling attachment close to the main rope so the ascender remains vertical when loaded.

I have two suggestions for improving this ascender. First, fix the cam safety deficiencies noted in the large UltrAscender discussion. Second, the inside of the handle and upper hole could be rounded for sling attachment. Using a concave cutter on the milling machine would provide the desired effect.

Jumar, Gray Series

In 1982 I was lucky enough to be in Europe for a few weeks on business. One weekend I drove to Reichenbach, Switzerland to meet Walter Marti, the designer and manufacturer of the Jumar ascender. Mr. Marti shared a great deal of information with me about his ascenders while his secretary, Mrs. Baumann, translated. Both Mr. Marti and Mrs Baumann were very friendly. One of the most impressive things I learned during the visit was that there are many, many variations of Jumar that have not been put into commercial production. For example, I saw Jumar cams with the same "Z" shaped teeth found on the early Clog ascenders. (Does anybody have a pair they are willing to trade?) The coverage presented here is by no means exhaustive. As usual, I will only describe those models I own and use.

Version A

Technical details

I acquired this pair of ascenders used from Roy Jameson at the 1980 N.S.S. Convention. They were originally purchased in the early 1970s.

The Jumar frame is an aluminum allow casting covered with a gray epoxy(?) paint. The frame has a rope channel cast into one side. The handle is roughly rectangular. A 21.6 by 13.8 mm. rectangular hole in the base of the handle provides access for the sling ropes. A triangular hole above the cam provides an upper attachment point for auxiliary slings.

The cam is a skeletonized stainless steel casting. The cam and cam spring are attached by a 5 mm. roll rivet. A steel washer keeps the roll rivet from pulling into the aluminum frame. The cam face is very well designed, with a concave surface whose radius decreases from top to bottom along the cam surface in order to compensate for different size ropes. The conical cam teeth are aligned perpendicular to the cam face. The tooth count is $(4.5)^5(4.3)^3$. The cam safety and safety spring are mounted on a 4.5 mm pin located about half way down the handle. The cam safety is a piece of anodized aluminum, red for left handed ascenders and blue for right. This color coding has been maintained on all later model Jumars. The cam safety physically blocks the cam from opening far enough to allow the main rope to slip out of the rope channel. Rotating the cam safety towards the base of the ascender provides clearance for the cam to open completely.

Comments

The Jumar began to appear in American caving circles in the early 1960s, and has probably remained the most popular mechanical ascender since that time.

This model, like all Jumars, is very well made. All parts are finished, and there are no sharp edges exposed anywhere. "Gray"

series Jumars are probably the easiest handled ascender to operate one handed. There is little if any difference in difficulty in using either hand. My technique is to open the safety with the middle finger, then open the cam with the thumb (of the matching hand) or forefinger (of the opposite hand). The entire sequence reduces to one fast, fluid motion with very little practice.

The major drawback of the early Jumars is the method provided for sling attachment. The correct method involves bringing the slings up through the square hole in the base of the Jumar and around the back of the handle. **THIS IS NOT A COMPLETE DESCRIPTION SO DO NOT TRY THIS WITHOUT INSTRUCTION!** It is unsafe to simply loop the sling through the handle, since this places the load on the thin, weak area at the base of the front strap. The front strap (brace) can then break under tension. There have been several reports of ascender failure resulting from this mistake. Eventually the 78 (yellow) series Jumar was developed to eliminate this perceived problem.

Version B

Technical details

I acquired this pair of ascenders from Speleoshoppe at the 1976 N.S.S. Convention.

This version is very similar to the previous one. There are some minor variations in the frame design. The rope channel is mounted lower on version B, and so the force generated by the cam on the rope is more nearly centered. The area behind the cam leading to the rope channel was changed. Version A had a concavity behind the cam and a corresponding arch on the back side of the frame. Version B is flat behind the cam, and concave between two reinforcing ribs on the back side of the frame. "++K9681" is cast in this concavity. The upper end of the cam channel is cast over in version A, but in version B it is open, and a stamped sheet metal cam housing is used instead. The handle area has been made smaller in depth. The details around the sling attachment hole are changed, with version B being less bulky. The hole has been reduced to 24.5 by 10.4 mm.

The cam safety has been changed from aluminum to plastic, and is slightly smaller.

Comments

None of the changes mentioned seem to have a significant impact on any of the performance characteristics of the ascender. The only advantage version B has over version A is a slightly lighter weight. It is not clear whether the broken Jumars described above were version A, version B, or some other version.

Jumar, 78 (Yellow) Series

Version A

Technical details

I acquired this pair of ascenders from Speleoshoppe in 1979.
In 1979 Jumar the Jumar 78 became available. The most distinctive difference is the color. The old light gray was replaces by a new bright yellow. In addition to the color change, numerous other changes were made to the rest of the ascender.

The frame had numerous modifications, but the general Jumar pattern remains. The most important change is the use of a new, tougher alloy. This alloy does not appear subject to brittle fracture like the gray frames were. Most of the frame has been made heavier. The rope channel is taller, and a third reinforcing rib is cast into the back of the rope channel and the back of the frame. The front strap and the strap over the upper attachment hole were thickened. The lower portion of the ascender was completely redesigned. The sling attachment hole is a 16 mm. circular hole oriented horizontally. The frame is 10.3 mm thick at this point, giving a very good surface for attaching slings.

The cam was also redesigned. A reinforcing bar was added to the inside of the cam. The cam teeth were enlarger, and the tooth pattern was changed to $(4.5)^3(4.3)^3$. The entire cam, including the teeth, is very well made.

The plastic cam safety is also new. Instead of the old "straight" design, the new design has a 135° elbow. The safety to pivots at a similar location as the old safety, so the effectiveness as a safety is unchanged. The elbow allows half of the safety to sit inside the handle when not activated, so it does not interfere as easily with one's hand. A "beak" on the end of the cam safety can hold the cam in the half open position if desired. Similarly, a tab at the elbow can hold the cam 3/4 open (the rope can slip out here), and the flat between the elbow and pivot provides a full open hold.

Comments

This ascender was developed in response to reports of "gray" Jumar failures such as the ones mentioned above. The new design is substantially heavier and more rugged than the older models. When I visited Walter Marti, he let me pound on a Jumar with a sledge hammer. I gave it a number of hard blows, blows that were far worse than one would ever reasonably expect to deliver on even the hardest caving trip. The Jumar was severely mangled and distorted after I was through, but it did not crack.

The larger, more widely spaced cam teeth are less sensitive to mud than the old ones were. The "Gray" series Jumars had a partially deserved reputation for poor performance in muddy conditions. The "Yellow" series Jumars do not seem to have this stigma attached to them. I find that the "Yellow" Jumars perform better in mud than the "Gray", but I suspect that the bad reputation of the old Jumars was partly due to their being compared to knots rather than other ascenders; after all, one can virtually always get knots to work.

The elbow in the safety makes the Jumar slightly harder to use one–handed than the older gray models, but the difference probably isn't worth worrying about. The same motion can be used as on the polder versions. On the other hand, the new design is much harder to open accidentally. This is a persuasive argument in favor of the elbow design. I don't like the beak on the safety, for the same reasons I don't like the teeth on the new C.M.I. safety. A penknife solves the problem on this model, the improved safety on the later Jumars eliminates it completely. A few of the earlier Jumar 78s had a defective cam safety spring. One end of the spring was too short, so the spring tended to pull through and unwind, losing its ability

to function in the process. These were replaced under warranty by a newer, 1.5 mm. longer spring which cured the problem.

When the Jumar 78 came out, I bought a pair. Version B came out very shortly thereafter, and I bought a second pair. I took three of the ascenders and a Gossett Box and made a climbing system based on the Cuddington 3–phase. Since then I have done virtually all of my vertical work with this system, or the Texas System obtained by leaving one Jumar and the box in the truck. Because Jumars are my normal caving ascender, I have more experience with them than with any other devices in my collection. I have been happy with their performance under a wide range of caving conditions, including clean ropes, dust, mud, snow, ice, and waterfalls. I've used them on ropes ranging from 7 mm. to 13.5 mm. including Goldline, Samson, Blue Water II and III, PMI of various flavors, Mammut, Edelrid, and even an oil soaked piece of manila hanging from an 1898 vintage oil derrick. In every case, they have worked, although climbing an iced Edelrid rope took a bit of special effort. Recently I retired the version A ascenders, but I haven't given up on Jumars – I'm using version D now. The Jumar 78 series ascenders remain my favorite for most applications. Many other ascenders are smaller and lighter, but in most cases I'll sacrifice space and weight in favor of versatility and ease of use. The Jumar is strong, well made, reliable, comfortable, easy to use, easy on ropes, versatile, rugged, fast, and just plain feels right. Other ascenders have many of these properties, but the Jumar puts them together in a package that I am very happy with.

Version B

Technical details

I acquired this pair of ascenders from Speleoshoppe in 1979.

The cam safety was modified in late 1979. The new design moved the beak from the tip of the safety to the elbow. The beak is shielded by two breakaway tabs. If the tabs are not removed, the beak is nonfunctional and the only cam hold open position is full open. If the breakaway tabs are removed, the beak is exposed and can be used to hold the cam half open. The full hold open feature remains functional.

Comments

This change eliminates my one complaint with the original version A. Naturally, I leave the tabs in place.

Version C

Technical details

This left handed ascender was a gift received during my visit with Walter Marti in 1982. This ascender was a prototype, and had been developed for and used on an Austrian caving expedition.
This version is identical to version B except two holes have been drilled near the top and bottom of the rope channel, and a 4 mm. stainless steel is press fit into each hole. The pins are partially exposed on the inside of the rope channel.

Comments

There pins are added as wear resistors. Europeans usually use the Frog System for caving, and the chest ascender in the Frog tends to wear rapidly since it is moved up the rope while the cavers weight is pulling the ascender rope channel back against the rope. This causes far more ascender wear than most U.S. climbing systems. The steel pins will have to wear away before the aluminum rope channel can wear significantly. These pins are an excellent example of a very simple design modification which has no real disadvantages and significantly improves the overall ascender.

Version D

Technical details

I acquired this pair of ascenders directly from Jumar in March, 1989. They are identical to version C except a "5" is stamped on them, and a faint semicircle is visible inside the lower rope attachment hole.

Comments

The "7" indicated the ascender was made in 1987. The semicircle is the impression left by proof–testing the ascenders with an 400 kN (1100 lbf) load.

These are the Jumars I recently put into commission as my normal caving ascenders. In my opinion, they are the best ascender available for my purpose: progressive dry cave exploration in the U.S., Mexico, and Central America.

Petzl Expedition Series

Petzl is constantly making modifications to all of their ascenders. Most of the modifications are fairly minor. I have acquired four versions which are fairly representative of their designs over the past decade.

Version A

Technical details

I acquired this pair of ascenders from Speleoshoppe in October, 1979.

The shell is a tall irregular shaped stamping made from 4.2 mm. aluminum alloy sheet metal. A rope channel is formed in the upper portion of one side and a smaller cam channel lies opposite the first. A hole drilled through both sides of the cam channel accepts a 5.5 mm. roll rivet. The cam and cam spring are mounted on this rivet. The head of the rivet sits into a stamped depression on the back of the cam, while the roll is exposed on the open side. The handle below the cam has a soft black plastic hand grip molded into place. The hand grip has four finger grooves. A 13.1 mm. sling attachment hole is punched below the handle opening. This hole is slightly beveled. A 14.1 mm. hole through both sides of the rope channel provide an attachment point just above the cam. This hole is very well beveled.

The cam is a plated skeletonized steel casting. The cam has number of small conical teeth, all of which have their axes approximately parallel to the lower surface of the cam. The tooth pattern is $(F)(3.4)^3(3.2)^2(3)$. The F stands for a short flat area designed to allow the user to cant the ascender and slide it down the rope without opening the cam. The outside two bottom teeth are almost ground away. Like the other ascenders, the inner cam face radius reduces from top to bottom to accommodate various sized ropes. A spring–loaded manual safety bar is mounted on the bottom of the cam with a somewhat cracked steel roll rivet. The normal action of the spring holds the safety against the cam. When the cam is opened, the shell interferes with the safety bar, thus preventing opening the cam. If the safety bar is moved away from the cam (opposing the spring), it will clear the shell and the cam will open. At full open the safety can be released and the spring will hold the safety against the back of the shell. This provides a means of locking the cam open. A knob on the safety bar assists in operating the safety mechanism.

The plastic hand grip has "Poignée PETZL France" molded into one side and "breveté", "France_Etranger", and "MAXI: 400 kgs" molded into the other. Left–handed Petzl ascenders are gold anodized, right handed Petzls are blue. This color convention was followed for all Petzl ascenders discussed in this article.

Comments

I feel that this is a well made ascender. All sharp edges have been removed. The cam teeth are very well done. The attachment points are simply holes in the shell, and although well rounded I consider their small radius too sharp for directly attaching sling ropes. They are probably acceptably rounded for webbing, but considering the proximity of the attachment points to the main rope, I would recommend using a small maillon for most attachments in order to reduce the risk of sling abrasion. The lower attachment hole could theoretically have the same safety problems as the one on Clog version A. The upper rope attachment hole is located very close to the main rope. A carabiner through the upper attachment hole may drag on the main line. Note that such a carabiner will prevent putting the Petzl on or off rope, so one's climbing system must be designed accordingly.

Single handed operation of this ascender is fairly easy with the proper hand, but is rather difficult with the opposite hand. Closing an locked open ascender is much easier than opening, since the strong cam spring assists the user. The cam is very well made. The teeth are oriented more steeply than on the C.M.I. or the Jumar, so they tend to be even more self cleaning. The flat area on the cam has caused some confusion. Some cavers think this was a design defect, but actually it was provided as a feature. The flat area allows one to cant the ascender then slide it down the rope without opening the cam, provided there is not a carabiner in the top shell holes. This feature did not work very well and was later abandoned.

This ascender has the same pit lip disadvantage as the Clog. The shell is crushed at the top edge of the hand grip due to some clamping during the manufacturing process. This crushed point is located at precisely the point that one would expect the shell to bend in the pit lip scenario described previously.

The Petzl expedition series is a very popular among handled ascender users, particularly in Europe. Undoubtedly much of this popularity is due to its light weight and good workmanship.

Version B1

Technical Details

I acquired this ascender from Inner Mountain Outfitters at O.T.R. in 1989, but it represents the design of about two years earlier. Version B1 and B2 are from the same pair; the difference is that the ascender is supplied with two types of safety knobs, so the buyer can choose which type he prefers.

The shell has been substantially enlarged. A cylindrical cam closing stop is riveted to the shell just above the cam. The original pair of upper carabiner holes have been enlarged to 13.6 by 19.5 mm. oval holes, and an additional 15.8 mm. hole is punched beside the first pair. The handle opening is larger than version A's. The hand grip is unchanged.

The cam assembly has been changed in several ways. The flat area on the cam was eliminated and the tooth pattern changed to $(3.4)^2(3.2)^2(1.2)$. The cam safety has a slightly different shape, but functions in the same manner. The safety knob is the same shape as version A's, but is threaded and attached to the safety by a hex nut rather than riveted.

The hand grip is very similar to version A's, with a slight change in finish. The handle markings are the same as version A's. The cam has "PETZL" cast in each side. The cam safety has "OIL" stamped into it with an arrow pointing to the safety pivot.

Comments

This ascender is bulkier than the earlier version. I don't see any compelling justification for the increased bulk. The larger frame provides more hand room, but increases the bulk of the ascender. I have rather large hands, and with the cam locked open, the cam teeth in version A dug into my finger. In this version there is adequate clearance, but the minutely improved comfort hardly justifies the size increase. The extra sling hole above the cam is a welcome addition, and the enlargement of the previous version's upper hole reduces the drag imposed by a carabiner in that hole. The crushed area noted on version A is also present here.

The workmanship of the cam does not appear to be as good as on version A, but is certainly adequate. The cam mounting is sloppy, with about 2 mm. of lateral play. The cam safety mounting is also loose. I doubt there is any strength problem, but one expects better workmanship in assembling a modern ascender.

The cylindrical cam closing stop is located with about 0.7 mm. clearance between the stop and the cam, so is accomplishes nothing in normal use. Presumably this stop prevents the cam from pulling through during strength tests. I'm no fan of gimmicks designed exclusively to pass some regulatory standard, but which serve no function in the real world. Unless I'm missing some other useful function, I'd suggest eliminating the stop as a cost savings.

Version B2

Technical Details

Version B1 is converted to version B2 by unbolting the mushroom shaped thumb knob on the cam safety and replacing it with the cylindrical knob supplied with the ascender.

Comments

The mushroom shaped (B1) knob is less bulky and would normally be used for caving. The cylindrical knob is longer, and easier to operate with gloved hands typical in winter mountaineering conditions. I recommend selecting the one you want and epoxying it in place.

Version C

Technical details

I acquired this pair of ascenders from Bob & Bob at the 1989 N.S.S. Convention.

The shell is essentially the same size as in versions B1/B2. An indentation stamped into the frame extends across the upper portion of the shell and down both sides of the hand hole, ending just above the plastic hand grip on one side and about 22 mm. above the lower sling attachment hole on the other. A cylindrical cam closing stop is riveted to the shell just above the cam. The new Petzl Expedition ascenders are available in several colors, mine is anodized dark blue.

The hand grip is very similar to version B's, with a slight change in finish.

The cam is a revised skeletonized casting, plated as before. The cam face is divided by a vertical slot designed to provide clearance for mud. The face is supported by more elaborate bracing than version A. The conical cam teeth have their axes approximately parallel to the lower surface of the cam. The tooth pattern is $(2.3)(2S2.1S1)^2(1S1)^3(1.2)$, where the "S"s stand for the single longitudinal mud removal slot. The cam safety has a revised shape, but functions in the same manner as version A's. It is now anodized red rather than left unfinished. The thumb knob has been replaced by a two piece mechanism consisting of a threaded rivet fixed to the safety, and a knurled cylinder which screws onto the rivet. This allows the cylinder to be screwed down against the safety where it does not project very far, or unscrewed about 7.8 mm. to make it easier to operate with gloved hands.
A human figure and the U. I. A. A. approval logo are stamped onto the front of the rope channel portion of the shell. The hand grip markings are the same as version A's except that "MAXI: 400 Kgs" is not present. "PETZL" is cast into both sides of the cam, and "OIL" and an arrow are stamper into the cam safety. The arrow points to the cam safety pivot.

Comments

The stamped indentations should add some resistance to bending in the pit lip scenario described in the Clog discussion, but the indentation on the hand grip side ends right where the maximum bending moment would be expected. The crushed area noted on version A is also present here.

The cam and cam safety mounting are just as sloppy as in version B1/B2. The cam stop is just as useless as it is there.

The slot in the cam is intended to reduce the risk of ascender slippage due to mud-caked cam teeth. This may be of some benefit under certain caving conditions, particularly with wet non-cohesive silty muds. My experience is that caves that have enough mud to clog ascender teeth usually have enough mud to stop a bulldozer. I suspect that most ropes muddy enough to stop other ascenders will stop this one too, despite the mud holes. Although I have not tried this ascender in the appropriate conditions, I suspect that the holes will not eliminate the icing problems common to other toothed cam ascenders.

Like the other versions, the ascender is easy to operate with the proper hand, but still difficult to operate with the opposite hand. The human figure shows which way is up for certain uses. Anyone who needs this assistance, particularly on a handled ascender, shouldn't be using the ascender anyhow. Petzl's literature shows their ascenders being used in hauling systems, in which case the figure is upside down.

This is the only U. I. A. A. approved ascender described in this article. Looking at the U. I. A. A. criteria for ascenders explains why the handle opening was enlarged: there is a minimum size for acceptance. The Petzl Expedition version A opening was too small. I made a template conforming to the dimensions of U. I. A. A. requirement M4.1.4 to check various ascenders. This ascender passes, but barely. There is a lot of extra room in the handle, but it is located in the wrong place. The protrusions between the finger grooves just miss interfering with my template. Of course, in the real world, the opening is certainly adequately sized on any of these versions.

I am amused by the fact that the hand grip no longer gives a strength figure, particularly since it was clearly molded with one. In the place where "MAXI 400 Kgs" was molded in version A, one finds a depressed groove with obvious milling machine marks. Only the descender on the letter "g" in "Kgs" is still visible.

Once again, this ascender is quite popular in Europe. I've found that I use my handleless Petzl's far more than the handled ones.

Single Rope Technique (S.R.T.)

Caver, 811 mm. Version

Technical details

I acquired this pair of ascenders from K.H.S. Sales at the 1988 Old Timers Reunion.

The shell is milled from a custom aluminum extrusion which appears to be a direct copy of the C.M.I. 5000 extrusion. Like the C.M.I., the extrusion direction is oriented parallel to the vertical axis of the ascender, and contains two opposing channels. One channel is rounded and becomes the rope channel., the other is square and holds the cam. The manufacturing process is similar to C.M.I.'s, but the shape of the final ascender varies somewhat. The hand hole is nearly rectangular rather than sloped at the top, and the top of the frame is not sloped like the C.M.I. 5000. Two 15.6 mm holes are drilled at the bottom and a two more are drilled at the top of the frame. The hand hole is made a little wider than on the C.M.I. 5000., so the rope channel does no protrude as far from the ascender body as on the C.M.I. 5000.

The cam is a plated skeletonized, reinforced stainless steel casting with a $(4.5)^3(4.3)^3$ conical tooth count. The tooth axes are perpen-

dicular to the cam face The cam, cam spring, and a cam housing are mounted on a 6.4 mm. roll rivet. The cam housing is a piece of thin sheet metal bent to cover the top of the cam channel and serve as a spacer along the sides of the cam. The top of the housing is indented; this limits cam closing so that the teeth do not hit the inside of the rope channel. The cam safety is a piece of green anodized aluminum mounted on a 4 mm. stainless steel roll rivet located half way up the handle. A second stainless steel pin provides a thumb grip on the safety. The ends of this pin are well rounded. The safety is designed to sit almost completely inside the cam/safety channel, so it does not interfere with one's hand in the handle.

The inside of the frame (behind the cam) is stamped "S.R.T", "AUSTRALIA", and "EQUIP" A kangaroo logo is cast on each side of the cam.

Comments

The S.R.T. is a very well made ascender. I have not broken an S.R.T. ascender, but the frame is undoubtedly very strong. The sling attachment holes are nicely beveled. The sling attachment holes could theoretically have the same safety problem described for the Clog ascender, so I don't recommend using carabiners in them. There is one more upper sling attachment hole than C.M.I. provides. Unfortunately, the upper frame is still more difficult to grasp from above than either the Jumar or the small C.M.I. UltrAscender. This latter point is more important than the number of attachment holes available. Like the C.M.I.s, the main rope could get caught in the cam/safety channel, but I've never seen this happen in practice.

The cam is very well made, reminiscent of Jumar's. I suspect that it is also quite strong. I'm not thrilled with roll rivets for cam pivots, but at least the S.R.T.'s are not cracked. S.R.T. should consider using a grooved pin and external retaining ring similar to the C.M.I. design. The cam housing is lightweight and crude, but it doesn't serve any critical function so I'm not too concerned with its design. It may even be possible to eliminate the cam housing completely and substitute two washers, or even widen the cam a bit and eliminate them too. The main drawback is that the cam housing helps keep mud out of the cam pivot, and eliminating the housing might cause the ascender to jam more easily in muddy conditions. The cam safety is designed to be out of the way, so it is a little more difficult to operate than the Jumar's, but not by much. The ascender is still easily operated by either hand. I like having metal cam safeties like the S.R.T.'s. I've seen too many broken plastic ones on other ascenders to enjoy that technological "improvement". There is no partial cam hold open feature, nor is one needed. The safety design does allow holding the cam in the full open position if desired.

In general, this is a very well made, rugged ascender which is suitable for a wide variety of uses.

Caver, 816 mm. Version

Technical details

I acquired a left handed ascender from J. E. Weinel, Inc. in June, 1989, and a right handed ascender from Single Rope Techniques in October, 1989.

This is a larger version of the preceding model. It is designed for ropes up to 16 mm. in diameter. The frame is larger and the cam, cam housing, and cam safety are wider. The cam tooth count is reduced to $(4.5)^3(4.3)^2(4)$, and the teeth are not nearly as well formed as in the smaller model.

Comments

All comments applying to the preceding model apply here too. This ascender is more appropriate if you anticipate needing to climb ropes larger than about 13 mm., but the price paid is an increase in weight and bulk.

Climber

Technical details

I acquired this pair of ascenders from Inner Mountain Outfitters at the 1988 Old Timers Reunion.

This ascender is a shortened version of the Caver version A. The only significant difference is in the frame, which has been shortened by about 50 mm. The cam safety on mine is red instead of green, and a punch was made to help hold the thumb pin in place.

Comments

Once again, most of the comments on the Caver version A apply here. This ascender is very well made. The small size makes it a desirable alternative handled ascender to the full size ascenders in many situations. In those cases the S.R.T. Climber and the C.M.I. small UltrAscender are the two options available. The small C.M.I. UltrAscender is smaller and lighter, but the S.R.T. has a better safety design. The C.M.I. is easier to grasp from above The C.M.I. has a larger handle opening, but the sling must go through that opening. The C.M.I. cam is easier to replace, but the paint on the S.R.T. is more durable. In short, there are a number of things to consider. Although I prefer the C.M.I. (particularly after making some modifications to the safety), the decision boils down to personal preference; either one is acceptable.

Mother Lode Grotto

Roloff Ascender

Technical details

I acquired this pair of ascenders from Darrell Tomer in 1985, but they were made in the late 1960s, and by the time Prusiking was written (1973) they were no longer available. Roloff Ascenders were developed as a cheap alternative to the "expensive" Jumar, which cost about $15.00 at the time. They should be viewed as ambitious homemade devices. A significant number appear to have been made; I'd be very interested in knowing how many. Mine appear to be serial number 17, which is stamped on the inside. Darrell Tomer loves to modify equipment, and his two Roloff ascenders were recipients of substantial modification. Fortunately he saved all the parts he removed, so I was able to restore them to something resembling their original condition.

The Roloff ascender uses a cast aluminum frame, cam, and cam

safety, and are assembled with two machine screws, washers, and nuts. None of the parts are finished. The frame is patterned after the old Jumar frame, but the rope attachments have been changed to one 16 mm. hole below the handle and a second 16 mm. hole above the cam. The holes in the rope channel and the handle portion of the frame seen in the photographs are later additions due to Darrell's tinkering, as is the steel sheet metal wear plate added inside the channel. One of the cam springs is very strong, the second is very weak. I think the former is original and the latter is a replacement, since the two cam safety springs are similar to the strong one. The cam and cam spring are mounted on a standard 3/16 inch machine screw with a washer and fluted nut. The screw is center punched so the nut won't accidentally come off.The cam teeth are hand filed in a $(4.3)^5$ pattern. Needless to say the teeth are crude by commercial standards. The cam safety is cast in the Jumar gray series version A pattern. The safety and safety spring are mounted on a 3/16 inch machine screw which was originally threaded directly into the frame. The threads are stripped out on my left hand ascender, so a longer screw and hex nut have been substituted.

Comments

The Roloff frame is not as nicely finished as the Jumar. Thrun quotes some anonymous test results indicating that the Roloff is weaker than the same vintage Jumar. The lower sling attachment point is superior to the gray series Jumars that the design was based on, but the upper is not. The Jumar design is easier to grip from above. The cam is definitely inferior to all other cams discussed in this article. The teeth are very poorly formed, uneven, dull, and wear quickly. The cam casting and subsequent machining is very crude The cam safety is also poorly finished. The workmanship on this ascender is definitely not up to commercial standards, but remember, this was not a commercial ascender. The cam is very loosely mounted on the cam pivot, and with slight sideways pressure the cam can hang up on the side of the rope channel. This keeps the cam from closing, and can ruin your day if it happens at an inopportune moment.

Like the early Jumars, the Roloff is very easy to use. The cam can be opened easily with either hand. I find the Roloff occasionally slips, undoubtedly since the teeth on mine are heavily worn. My Roloff ascenders have hand filed cam teeth, but at the 1989 O.T.R., Bob Leibman showed me a pair of "original" Roloff Cams with cast conical teeth. The teeth were quite long (perhaps 1.5 to 2.0 mm). I do not know whether there were several cam versions, whether one of us does not have true Roloff cams, or whether Darrell hand filed the teeth on his pair once the original teeth wore out.

I find it amazing that anyone would actually attempt to duplicate a Jumar rather than buy one. Since the Roloff has been out of production for 20 years, I doubt that too many can be found. The Jumar is a better device anyhow, so I don't recommend the Roloff for caving use. It makes an excellent museum piece, and belongs in the hands of a collector.

Definition of a "Handled Lever Cam Ascender"

This section will consider mechanical ascenders consisting of a shell or frame and a cam assembly attached to the shell/frame at a single pivot point. The shell is open on one side to allow admittance of the standing rope. The shell/frame below the cam is enlarged to provide a handle. The shell is designed so that the climber's weight is transferred directly to the cam, rather than the cam pivot, so that the cam acts like a lever when viewed from the shell's frame of reference. The shell does not support the climber's weight directly.

General comments on Handled Lever Cam Ascenders

The only ascenders I have seen in this category are made by Kong–Bonaiti. (There are many handleless lever cam ascenders, the best known in the U. S. is the Gibbs Ascender. Handleless lever cam ascenders will be discussed in a future article). These ascenders use a type I lever arrangement for the cam. These ascenders are are also relatively large and heavy compared to handleless ascenders. Dimensions are given in Tables 3 and 4. These ascenders are asymmetrical, and can be classified as left–handed and right–handed just like the eccentric cam ascenders. Kong–Bonaiti ascenders are made in both left and right hand versions; naturally one normally acquires a pair of one each.

Lever cam ascenders generally rely on the mechanical advantage of the lever arrangement to provide sufficient force to keep the cam from slipping. Specifically, the lever acts to provide a higher normal force between the cam face and the standing rope, so the friction generated parallel to the standing rope is sufficient to hold the load. As load is increased, the normal force increases, and so does the parallel frictional force. The cam teeth are secondary in importance to proper lever design, and so lever cam ascenders can often withstand severe tooth wear without losing their ability to hold a load.

The comment on horizontal and diagonal ropes given above for handled eccentric cam ascenders also applies to these ascenders. 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 ascending ropes within the 9 to 11 mm. diameter range. Comments do not apply to ascender abuse, such as use in rescue hauling systems.

Handled Lever Cam Ascenders

Kong–Bonaiti

Version A

Technical details

I acquired this pair of ascenders from Speleoshoppe in 1982.

The Kong–Bonaiti ascender shell consists of a number of parts. The main piece is a black painted 2.7 mm. aluminum stamping which forms the rope channel, the upper portion of the ascender, and the side of the hand hole opposite the hand grip. Two reinforcing ribs are stamped into the upper part of this piece and reinforce the rope channel. A 13.5 mm. hole through the top part of the rope channel provides an upper sling attachment point.

The cam is mounted on the upper shell using a special 8 mm. shoulder bolt and special nut. The nut is center punched on the back side of the ascender to keep the bolt from unscrewing. A cam spring mounted on this bolt tends to close the cam. This spring is not visible without disassembling the ascender. The cam is a plated steel casting. The cam face is convex, not concave, and has 8 cast

teeth. The top tooth has a "Z" profile, but the lower teeth become progressively more rounded until the lowest tooth has an almost semicircular profile. The cam extends past the pivot and downwards at a ≈40° angle to a second pivot pin located about 29 mm. from the main pivot. A second "L" shaped 2.7 mm. aluminum frame piece extends downwards from this pivot, forming the hand grip side and bottom of the hand hole. A well rounded 13.9 mm. hole at the bottom of this piece forms the main sling attachment point. This piece has a phosphorescent plastic hand grip with four finger grooves molded onto it. It also has a small metal tab riveted in place above the hand grip. This tab engages the cam safety to hold the cam open.

The bottom of the main shell and the bottom of the "L" shaped piece are connected by a short, curved piece of 2.7 mm. aluminum. This piece is connected to the other two by one rivet each. The rivets are set loosely so the connections are free to rotate.

The cam and three frame pieces form a parallelogram where all four corners are free to rotate. As a result, raising the hand grip raises the end of the cam opposite the rope, thus lowering the end near the rope and pivoting the cam open. During this operation, the hand grip ("L" shaped piece) moves upwards with respect to the main frame piece. The cam spring opposes this motion, so it acts to raise the main shell. At first friction against the rope prevents this and the cam starts to open, but eventually the cam no longer has enough friction on the rope, and the ascender moves upwards. When weight is applied, the cam spring acts to close the cam, and this action coupled with the climber's weight moves the "L" shaped piece downwards. The climbers weight is transferred to the cam by the "L" shaped piece. The cam exerts enough normal force on the rope to prevent sliding, and the climbers weight is held.

The cam safety is a small lever mounted on the bottom of the cam with a 3 mm. solid rivet. A small coil spring connects a second pin in the cam with a hole in the cam safety and pulls the safety upwards. This arrangement is opposite that used in the Petzl where the cam safety spring is in compression. A small cylinder mounted on the safety acts as a thumb knob. Under normal operation the cam safety hits the tab on the "L" shaped piece when the cam opens, thus limiting the amount the cam can open. By pulling down on the thumb knob, the safety can clear the tab. If desired a hook on the top of the safety can be latched around the tab to keep the cam open. The main shell piece is stamped "´ KG. 650" with the double arrow aligned vertically. The hand grip has "PHOSPHORESCENT" molded in one side and "BONAITI–KONG–ITALY" molded in the other.

Comments

This is a very unusual ascender which operates on an entirely different set of principles than handled eccentric cam ascenders. The moving frame takes some time to get used to if you are accustomed to other handled ascenders. One disadvantage is that this ascender is more difficult to push up the rope, particularly if the rope is hanging against a wall with one's weight on it. This situation can often be avoided by proper pit rigging. The two lower rivets appear rather small to the uninitiated, but they do not carry any weight so there is little cause for concern. The sheet metal shell has the same potential bending problem as all other sheet metal shells discussed in this article. The sling attachment holes could have the same safety problem described for the Clog ascender. Like the Petzl Expedition, a carabiner through the top hole prevents putting the ascender on or off rope.

The workmanship on this ascender appears to be quite good. All frame edges are rounded. The two lower rivets have some sharp edges, but they are on the side opposite the rope so there is little chance for rope damage here. I like the phosphorescent handle, even if it really doesn't offer any substantial practical advantage. This ascender gives a little more lost motion than the other handled ascenders for two reasons. The first is the pivoting action of the handle. The other is that the sling attachment point is located farther from the main rope, so the ascender cants away from the vertical with each step. On the other hand, the lever cam design is less sensitive to rope conditions than eccentric cam designs. In particular, the Kong–Bonaiti ascenders can be expected to hold under some mud and ice conditions where the handled eccentric cam ascenders slip.

Version B

Technical details

I acquired this pair of ascenders from Speleoshoppe in 1985. It is essentially identical to the current production model as of March, 1989.

This ascender is very similar to the previous version; only the cam assembly has changed. The cam now uses a combination tooth design. The top 60% of the cam face is a concave surface with some poorly formed conical teeth oriented parallel to the top of the cam. The tooth pattern is $(4.3)^2(2.1)$. Below these are four convex "Z" shaped teeth. The conical teeth are in contact with the rope, even for excessively small (e.g., 6 mm.) main lines.

The cam safety has been modified slightly. The tension spring has been replaced by a compression spring located below the safety. The thumb knob is now drilled and tapped, and an auxiliary pin extension is available to screw into this hole. This extends the thumb knob by 12.2 mm.

The ascender shell is now anodized (mine is orange) and the shell markings are different. "STATIC ROPE Ø 12 KG ´ 650" and "UIAA ROPE Ø 9 KG ´ 650" are stamped on the open side of the shell, and "BONAITI–KONG–ITALY' is stamped on the back. The hand grip markings are unchanged.

Comments

This is an improved ascender compared to version A. The conical teeth help improve holding ability when the ropes are not too muddy or icy. The compression spring is stronger than the old cam safety spring, and does its job a little better. The optional pin extension is nice. I consider it better than the knurled one on the Petzl Expedition. I prefer not to use the extension since it tends to catch on things, but with winter gloves on some type of extension is helpful. If you choose to use it, I recommend using a little epoxy to make the pin a permanent addition to the ascender.

Conclusions

In many ways this has been a very limited discussion of a two very

specific types of ascender. The discussion was kept short for reasons of space, and much more could be said about each of the ascenders discussed. Undoubtedly there are other ascenders omitted because I lack familiarity with them, and I apologize to their manufacturers. In particular, I have not discussed the Jumar Combi. The Combi was developed in 1978 and advertised for sale, but the design was subsequently dropped and the Combi never went into production. The Combi had a lot of extremely innovative ideas in its design, but was considered too radical to risk marketing. I've tried very hard to obtain a pair, and would greatly appreciate any help anyone could give me.

The classic movie "Godzilla versus Gigan" shows a Jumar look-alike being used by the good guys in a successful escape from the Godzilla tower where they were being held captive by the cock-roach space aliens. Their escape technique is shear nonsense, but I'm intrigued by the ascender. It appears very similar to a Jumar, but the casting differs in several respects. This is either a version of the gray Jumar that I've never seen, or possibly a Japanese copy. Are there any Nylon Highway readers who can provide more information, or even an ascender?

I have not discussed the use of handled ascenders, nor do I intend to here. Instead, I urge anyone considering using any of these devices is strongly advised to get proper instruction before doing so.

Addenda to the first article

1) Bob Thrun pointed out that I had neglected to mention that all the ascenders mentioned in the first article had cam designs based on an equiangular spiral, except for the Clog Versions A and B which utilize a circular profile cam. The equiangular spiral is a logical choice for the same reasons discussed in this article.

2) Single Rope Techniques makes a handleless eccentric cam chest ascender. I have just received one from S.R.T. and will evaluate it in a future article.

3) I have acquired a pair of CMI Shorti IV ascenders. The rope channel was changed from the Shorti III in the same way the 5004 rope channel was changed from the 5003. Similar comments apply. I'm still looking for a pair of Shorti IIs.

Addenda to the second article

1) I intentionally omitted the double rope S.R.T. bobbin (model D2) from the second article because I did not own one and so was not familiar with its performance. Since then I have acquired a double rope S.R.T. bobbin (model D2DB) with an interesting double brake attachment. This attachment definitely requires discussion! This series deserved further investigation, so I now have a single rope bobbin with double brake attachment (modem D1DB) and one of the double rope version without the attachment. I will postpone discussing these new bobbins until I finish field testing them.

2) At the 1989 N.S.S. Convention, Alex Sproul told me that when he tried his Tracson, he experienced the same failures I did with mine. Either we both have lemons or...

3) At the 1989 N.S.S. Convention, Bill Storage pointed out that the increase in friction associated with a bottom belay almost always dominates the decrease in friction due to the decrease in q. Since this contradicted my field experience, I went home and did a more careful analysis of the Bobbin. Bill's comment is correct except for strong bottom belays. Each bobbin and caver combination has a critical T_{belay} which causes the bobbin to rotate beyond 90°, at which point only the bobbin frame prevents further rotation. Incidentally, Bill agrees with the conclusion: a second maillon is essential for safety.

Errata

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

p. 28: In the details of the S.R.T. G.P., delete the sentence "A single spring serves as cam spring and safety spring". This was a word processing typo, there is no safety on the G.P.

The following error appeared in the second article in Nylon Highway #28:

p. 16: Right after I condemned the seat carabiner, I referred to an extension maillon as an extra carabiner. OOPS!

Storrick, G. D., Vertical Caving Hardware 1: Handleless Eccentric Cam Ascenders, Nylon Highway #27, Dec. 1988, pp. 14-25.

Storrick, G. D., Vertical Caving Hardware 2:Bobbins, Nylon Highway #28, July 1989, pp. 16-29.

Thrun, R. Prusiking, National Speleological Society, 1973, p. 16.

Storrick, op. cit. (1988).

D. Moorhouse, Clog Climbing Gear, Off Belay #30, Dec. 76, pp. 54-55.

Storrick, op. cit. (1988).

C.M.I. press release, Nylon Highway #22, May, 1986, back cover.

Thrun, op. cit., p. 18.

The color coded safety on the Jumar is nice, and suggests an even more practical idea: color coding one's left and right foot slings. Because of the universal availability of the Jumar, the red=left, blue=right scheme is the obvious choice. Petzl users might prefer a yellow left sling instead.

Davison, Don Jr., Hits and Near Misses, N.S.S. News, v 34, #5, May, 1976, p. 80.

Davison, Don Jr., Hits and Near Misses, N.S.S. News, v 35, #4, April, 1977, p. 73.

Montgomery, N. and D. Mrozkowski, A Note on the Jumar, N.S.S. News, v. 39, # 1, Jan., 1981, p. 20.

Montgomery, N. and D. Mrozkowski, The New Jumar, Caving International Magazine, #10, Jan., 1981, pp. 42-46.

After 10 years of use, during which I wore out a dozen brake bars on my racks and several figure 8s, I did not even finish wearing through the paint on the inside of the rope channel of my version A Jumars. The reason is twofold: using clean ropes whenever possible, and an ascending system where ascenders are not raised while they are loaded.

The following ascenders PASSED the minimum handle opening standard: the Petzl Expedition versions B1/B2 and C, the SRT Caver 8-11 mm. version (the frame passes, but the safety interferes with the template), and the SRT Caver 8-16 mm.version.

The following ascenders FAILED the minimum handle opening standard: both Clogs, all six C.M.I.s, all six Jumars, the Petzl Expedition version A, the SRT Climber, the Roloff, and both Kong-Bonaitis.

Frankly, I don't think it really matters either way, particularly since virtually every ascender failed the test. After all, even handleless ascenders are quite usable. I have very large hands, and I have no problem fitting my hand in any of these ascenders unless I'm wearing expedition climbing mitts. In that case the Clogs have the most usable room.

See Johnston, J. and D. Myrick, Homemade Ascender Cams, The Huntsville Grotto Newsletter, v. IX, # 6, June-July, 1968, pp. 81-85 for one way to do this.

Thrun, op. cit., p. 19.

Anonymous, Tests on the Gibbs Ascender, Speleo-thems, v. 17, no. 3, 1969, p. 2. I do not have a copy of this article.

In elementary physics, type I levers have a force-fulcrum-load arrangement, type II levers have force-load-fulcrum, and type III have load-force-fulcrum. In this context, I view the force as the climber's weight, the fulcrum as the pivot, and the load as the cam pressure on the climbing rope. One could argue for reversing my definitions of load and force, but priority goes to the first to publish!

Godzilla versus Gigan, Toho Co., Ltd., available on New World Video.

Table 1: Handled Eccentric Cam Ascenders

Ascender	Height	Width	Thickness	Std. volume	Weight
Clog version A	195 mm	109 mm	25 mm	521	237
Clog version B	195 mm	107 mm	25 mm	511	230
CMI 5000	183 mm	76 mm	31 mm	430	226
CMI 5002	184 mm	76 mm	28 mm	388	220
CMI 5003	183 mm	77 mm	27 mm	383	236
CMI 5004	183 mm	78 mm	29 mm	404	245
CMI Small Ultracender	129 mm	78 mm	29 mm	288	187
CMI Large Ultracender	186 mm	78 mm	29 mm	415	267
Jumar	161 mm	76 mm	38 mm	467	211
Jumar	157 mm	74 mm	36 mm	418	206
Jumar	179 mm	77 mm	36 mm	498	263
Jumar	179 mm	78 mm	37 mm	507	273
Jumar	179 mm	78 mm	37 mm	507	271
Jumar	179 mm	78 mm	37 mm	507	274
Petzl	180 mm	87 mm	34 mm	522	187
Petzl	192 mm	87 mm	35 mm	593	197
Petzl	192 mm	87 mm	42 mm	707	199
Petzl	192 mm	88 mm	35 mm	588	201
/extended	194 mm	88 mm	43 mm	728	201
Roloff	175 mm	77 mm	39 mm	519	208
SRT Climber	135 mm	76 mm	25 mm	261	213
SRT Caver, 8-11 mm	185 mm	76 mm	25 mm	358	251
SRT Caver, 8-15mm	196 mm	80 mm	31 mm	487	340

Table 2: Handled Eccentric Cam Ascenders, Cam Dimensions

Ascender	Dmax	S	Rmin	Rmax	Theta	Eta
Clog version A	14.7 mm	54 mm	43 mm	57 mm	41°	22° (±2°)
Clog version B	14.3 mm	53 mm	43 mm	57 mm	41°	22° (±2°)
CMI 5000	14.3 mm	47 mm	32 mm	51 mm	48°	28° (±2°)
CMI 5002	14.3 mm	47 mm	33 mm	51 mm	48°	28° (±2°)
CMI 5003	17.4 mm	47 mm	32 mm	51 mm	48°	29° (±2°)
CMI 5004	17.5 mm	47 mm	32 mm	51 mm	48°	29° (±2°)
CMI Small Ultracender	17.5 mm	54 mm	41 mm	57 mm	42°	25° (±2°)
CMI Large Ultracender	17.5 mm	54 mm	41 mm	57 mm	42°	25° (±2°)
Jumar	14.1 mm	57 mm	42 mm	60 mm	41°	27° (±2°)
Jumar	14.0 mm	57 mm	42 mm	60 mm	41°	27° (±2°)
Jumar	14.9 mm	57 mm	39 mm	58 mm	44°	27° (±2°)
Jumar	14.9 mm	57 mm	39 mm	58 mm	44°	27° (±2°)
Jumar	14.9 mm	57 mm	39 mm	58 mm	44°	27° (±2°)
Jumar	14.9 mm	57 mm	39 mm	58 mm	44°	27° (±2°)
Petzl	15.6 mm	49 mm	38 mm	51 mm	36°	25° (±2°)
Petzl	16.8 mm	47 mm	38 mm	53 mm	36°	28° (±2°)
Petzl	"	"	"	"	"	"
Petzl /extended	14.8 mm	49 mm	36 mm	53 mm	39°	30° (±2°)
	"	"	"	"	"	"
Roloff	14.6 mm	57 mm	41 mm	58 mm	39°	26° (±2°)
SRT Climber	13.9 mm	55 mm	40 mm	58 mm	44°	26° (±2°)
SRT Caver, 8-11 mm	13.9 mm	55 mm	40 mm	58 mm	44°	26° (±2°)
SRT Caver, 8-15mm	17.6 mm	55 mm	38 mm	56 mm	43°	28° (±2°)

Table 3: Handled Type 1 Lever Cam Ascenders, Cam Dimensions

Ascender	Height	Width	Thickness	Std. volume	Weight
Kong-Bonaiti	206 mm	94 mm	30 mm	578	240
Kong-Bonaiti /with extension	206 mm	95 mm	30 mm	587	259
	206 mm	95 mm	42 mm	822	263

Table 4: Handled Type 1 Lever Cam Ascenders, Cam Dimensions

Ascender	Dmax	S	R1	R2	Theta	Eta	L1	Phi
Kong-Bonaiti (to teeth)	14.4 mm	47 mm	41 mm	51 mm	35°	20° (±2°)	29 mm	20°
Kong-Bonaiti (toothed section	13.8 mm	47 mm	42 mm	48 mm	18°	23° (±2°)	230 mm	22°
(total cam face)	"	"	42 mm	52 mm	33°	21° (±2°)	"	"

L1 = length of lever arm between outer frame pivot and cam pivot
Phi = drop angle of lever arm below extension of cam top

CAN WE IMPROVE THE BOBBIN?

by Bill Storage

The small size of rappel bobbins, described by Gary Storrick in the Spring *Nylon Highway*, makes them attractive to cavers. They seem to be the subject of a lot of complaints though, and are not very popular in these parts. I wondered if they could be improved so I took a look at the underlying physics. The following is an overview, not a thorough investigation or detailed discussion. Perhaps a starting ground for the scientists; Bob Thrun and Fred Wefer can continue.

As Gary mentioned, when you wrap a rope around a spool and apply a load, W, to one end, the tension, T on the other end is $T=We^{-\mu\phi}$, where ϕ is the angle of wrap and μ is the effective coefficient of friction. For a V-groove, $\mu=\mu_A/\cos(\alpha)$, where α is the V angle, and μ_A is the actual coefficient.

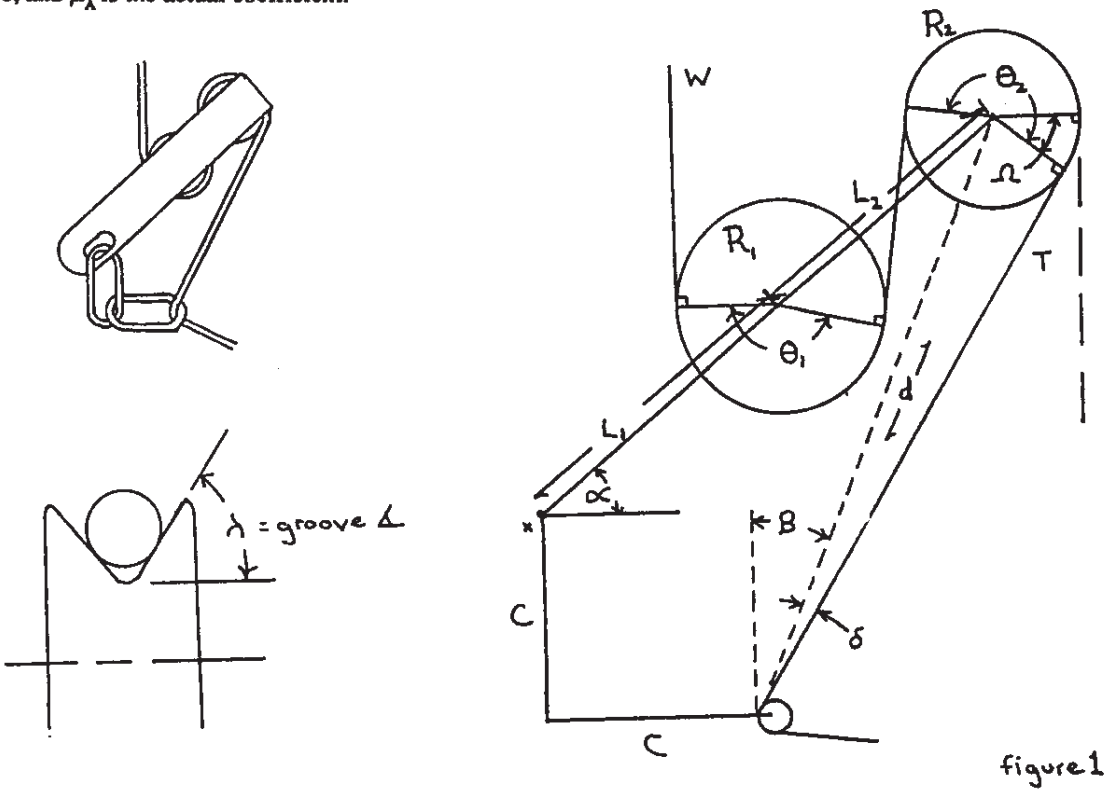


figure 1

Those who use bobbins and write books say to run the rope through an extra carabiner as shown in figure 1. With that I make several observations as follows:

$$d = \sqrt{(C+(L_1+L_2)\sin\alpha)^2 + (C-(L_1+L_2)\cos\alpha)^2}$$

$$\tan\beta = ((L_1+L_2)\cos\alpha - C) \quad ((L_1+L_2)\sin\alpha + C)$$

$$\sin\delta = R_2/d$$

$$\theta_2 = \theta_1 + \Omega = \theta_1 + \delta + \beta \qquad \text{which yields}$$

$$\theta_2 = \theta_1 + \arcsin\left(\frac{R_2}{\sqrt{(C+(L_1+L_2)\sin\alpha)^2 + (C+(L_1+L_2\cos\alpha))^2}}\right) + \arctan\frac{(L_1+L_2)\cos\alpha - C}{(L_1+L_2)\sin\alpha - C}.$$

This I find fairly offensive. Being lazy I will note that if the bobbin is really optimized, ϕ_2 will be maximized and α will approach 90°, and the extra carabiner will not touch the rope during steady state descent. During a rapid deceleration, that applied braking force will be high, α will be reduced and the extra biner will serve to keep ϕ_2 high, which is desirable. But for optimizing the bobbin's geometry it is reasonable to let $\phi_1 = \phi_2$.

Now let's look at two situations; one at the top of the rappel and the other at bottom. Since the bobbin is essentially a non-variable friction device (unlike a rack), we must face that the maximum grip force ("braking force") we are comfortable with will be the weight of the rope for the deepest drop the bobbin can be used on. A bobbin in these two situations is shown in figure 2.

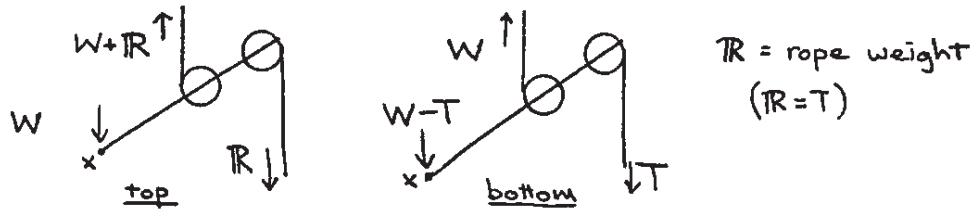


Fig. 2

To a small extent the bobbin has variable friction since, as you descend, the grip force supplied by rope weight decreases, the force supplied by hand increases, and that force subtracts from your effective weight hanging from the bobbin. That means that the bobbin, contrary to popular belief, actually unwraps a bit as you descend. While this is really undesirable, the effect is small as long as the grip force is small—which is the aim of this exercise.

What grip force is reasonable? I didn't ask around but I don't think I feel comfortable with more that 5% of my body weight. For a 170 pound person, that is about nine pounds, or 180 feet of rope. Unless you want to pull harder, that is going to be it for this type of device, optimized or not.

The tricky part of this analysis comes when you try to relate α and ϕ to bobbin dimensions. First I will note that by figure 1 and mere trigonometry, we have:

$$\theta = \alpha + \pi - \arccos\frac{R_1+R_2}{L_2} \qquad (1)$$

From figure 2 (bottom of rope), ϕ and α can be related by taking moments around point x, which, in steady descent will sum to zero:

$$\sum M_{x_{bottom}} = 0 = W(\cos\alpha L_1 - R_1) - T(\cos\alpha(L_1+L_2)+R_2) \qquad \text{yielding}$$

$$\cos\alpha = \frac{WR_1 + TR_2}{WL_1 - T(L_1+L_2)} \qquad \text{or} \qquad \alpha = \underset{bottom}{\arccos}\frac{R_1 + R_2 e^{-\mu_1\theta - \mu_2\theta}}{L_1 - (L_1+L_2)e^{-\mu_1\theta - \mu_2\theta}} \qquad (2)$$

Noting that $R_1, R_2, L_1, L_2, \mu_1, \mu_2$ are "constants", that is we build them into the bobbin, then 1 and 2 are two equations in two unknowns and can be solved for α and ϕ by iteration. At this point I will note that when $\phi_1 = \phi_2$, we can lump μ_1 and μ_2 together as a sum, $2\mu_{AV}$ (and adjust the actual values of each later, maintaining their sum to "tune" the bobbin). Take a look at this example, something like one of the commercial bobbins:

$R_1 = R_2 = 1$ inch $\qquad L_1 = L_2 = 3$ inches $\qquad \mu_{AV} = \mu = .4$

$e^{-\mu_1\theta - \mu_2\theta}$ becomes $e^{-2\mu\theta}$

Initial guess at $\theta = \pi = 3.14 = 180°$, $e^{-2\mu\theta} = .081$, $\arccos\frac{R_1+R_2}{L_2} = .841$

$\alpha = 1.126$	$\theta = 3.427$	$e^{-2\mu\theta} = .064$
$\alpha = 1.151$	$\theta = 3.452$	$e^{-2\mu\theta} = .063$
$\alpha = 1.153$	$\theta = 3.454$	$e^{-2\mu\theta} = .063$

See, it converges quickly and we have $\phi = 3.45 = 198°$ and T/W = .063. That means a 170 pound caver must be capable of exerting a rope tension of 11 pounds at the bottom of the rappel, and that the maximum weight of the hanging rope can be 11 pounds (about 200 feet of 10 mm rope). Actually, slightly longer drops will work, provided you lift the rope below your brake hand and feed it into the bobbin. Note that the physics of a bobbin will not simultaneously allow long drop capability and small braking forces.

The only optimization that can be done is to make the best use of a given amount of material and a desired braking force. For instance, if we allow the bobbin to be 8 inches long, what are the best values of L_1, L_2, R_1, and R_2?

One way to do this would be to pick values of these dimensions and insert 1 and 2 and iterate away. A computer would be useful. Also useful is a little punk calculus; applied maxima and minima for the man on the streets.

For instance, we can see that in equation 1 , ϕ can be maximized by maximizing α and minimizing arccos $[(R_1 + R_2)/L_2]$. Since $(R_1 + R_2)/L_2$ has less terms, I will start there (noting that maximizing $(R_1 + R_2)/L_2$ will minimize arccos $(R_1 + R_2)/L_2$ for reasonable values of R_1 etc.). The upper limit (best we can do) for that quotient is obviously equal to 1-(rope diameter/L_2). It follows then that $R_1 + R_2$ and L_2 want to be as large as possible. With that we can return to the expression for α (2) and get a feel for where to head with L_1 and R_1 and R_2 independent of their sum.

Since α must always be less than $\pi/2$, the goal is to minimize $R_1 + R_2 e^{-2\mu\theta}$ and maximize $L_1-(L_1 + L_2)e^{-2\mu\theta}$. Then, since $e^{-2\mu\theta}$ is nearly zero, we are left trying to minimize R_1/L_1. And since there are practical limitations on how small R_1 can be, that tells us to make L_1 large. Finally, remembering that $R_1 + R_2 e^{-2\mu\theta}$ is to make R_2 large and R_1 relatively small.

A good check of this reasoning is to look at the expression for α at the top of the rappel. I will spare you the math:

$$\alpha_{top} = \frac{R_1 - (R_1+R_2)\, e^{-2\mu\theta}}{L_1 - L_2\, e^{-2\mu\theta}}$$

A similar exercise in maxima and minima produces the same conclusions: big L_1, small L_2, small R_1, big R_2.

Here a big problem arises: heat dissipation. The heat (q) produced at each spool is proportional to its frictional force. Thus:

$$\frac{q_1}{q_2} = \frac{W - We^{-\mu_1\theta}}{We^{-\mu_1\theta} - We^{-\mu_1\theta-\mu_2\theta}} = \frac{1 - e^{-\mu_1\theta}}{e^{-\mu_1\theta}(1 - e^{-\mu_2\theta})} = \frac{e^{\mu_1\theta} - 1}{1 - e^{-\mu_2\theta}}$$

$e^{-2\mu\theta}$ is much closer to zero than it is to one so it is reasonable to approximate the heat ratio as $q_1/q_2 = e^{\mu_1\phi}-1$. The tremendous effect of $\mu 1$ is obvious. If μ_1 is .3, the heat ratio is 1.5. If μ_1 = .4, the ratio is 2.5. Thermally, R_1 wants to be large- the opposite conclusion from the statics optimization.

Several possibilities exist. One is to accept thermal inefficiency (as does the rappel rack) and shoot for minimum bobbin size, with a small R_1, and a moderate groove angle, yielding $\mu_{av} \approx .4$. Another is to compromise size and try to balance heat using a small groove angle on R_1, and a larger groove angle on R_2 (Petzl logic). Another possibility is to deviate from the basic geometry we started with, e.g. eccentrically mounted oval spools (hard to make).

With the basic geometry of figure 1 and our knowledge of where to head with R, L, and μ, we can pick an overall size and tune the thing reasonably well. Setting the spool groove angle will depend on the actual coefficient of friction between rope and spools. Fred Wefer once measured μ in the range of 0.25. It is fairly obvious that a high groove angle can not be maintained on R_1. The spool will easily be worn away with a corresponding rapid decrease in friction.

Ron Simmons and Matt Oliphant are working with me on fabricating a few possibly improved versions. We'll wait to see how they perform.

NOTE:

$\phi = \theta$

SECRETARY'S REPORT
NSS VERTICAL SECTION
FOR PERIOD BEGINNING JUNE 17, 1988 AND ENDING JULY 21, 1989

Number of Single Members	739
Number of Family Members (Number of People)	69
Total Number of Vertical Section Voting Members	803
Number of Nylon Highway Subscribers	69
Number of Nylon Highways Sent Free (ex. libraries)	10
Number of Nylon Highways Exchanged	25
Total Number of Nylon Highways to be Mailed	875

Number of Members or Subscribers Paid through 1989	387
(This number of 1988 members or subscribers have NOT YET renewed)	
Number of Members or Subscribers Paid Through 1990	213
Number of Members or Subscribers Paid Through 1991	173
Number of Members or Subscribers Paid Through 1992	37
Number of Members or Subscribers Paid After 1992	23

Number of Members who desire the Vertical Section to represent them at the NSS Congress of Grottos Meeting 108

Income:

Memberships	$2624.00
Subscriptions	283.00
Back Issue Sales	971.00
Symbolic Item Sales	2065.00
Vertical Techniques Workshop (88)	310.00
Bank Interest	332.36
Interest on CD's to date	59.32
Advertisements	60.00
Total Income	**$6,704.68**

Expenses:

Editor:

Printing *Nylon Highway #27*		1042.14
Mailing *Nylon Highway #27*	Internat	122.90
	Domestic	48.60
	Resends	10.35
		$181.85
Printing *Nylon Highway #28*		1530.20
Mailing *Nylon Highway #28*	Internat	107.33
	Domestic	103.86
		$211.19
88 Climbing Contest Expenses		41.99
Typesetting		10.73
Other Postage		65.53
Bulk Permit		60.00
Mailing Envelopes		239.95
Supplies		53.34
Photos for *NH #28*		58.45
Section owes Editor		50.25
Total Editor Expenses		**$3,543.62**

Secretary/Treasurer:	
Postage	$401.90
Supplies:	
Dues Renewal Notice	26.90
Envelopes	30.74
Printer Ribbon	21.37
Membership Forms	50.72
Other	17.20
	146.93
Vertical Techniques Workshop Expenses	178.72
Advertisements	60.00
Symbolic Items Cost	1181.23
Pulley and Carabiner for Contest	46.25
On Rope for Overseas Member	25.00
Reprint *NH #11*	98.18
Reprint *NH #1*	20.00
Refund	5.00
Reimbursement for Patch Change	18.00
Total Secretary/Treasurer Expenses	**$2,181.21**
Total Expenses	**$5,724.83**
Net Income	**979.85**
Balance as of June 16, 1988	**4324.07**
Net Income	**979.85**
Balance as of July 21, 1989	**$5,303.92**

Supplementary Treasurer's Report

July 21, 1989

Amount of Funds Dedicated to Future Years Via Multi-Memberships

Balance as of July 21, 1989 (from Treasurer's Report)	$5303.92
Funds Dedicated through 1990	1338.00
Funds Dedicated through 1991	699.00
Funds Dedicated through 1992	180.00
Funds Dedicated beyond 1992	207.00
Total	$2424.00
Balance of Funds Available for Immediate Use	**$2879.92**

1989 MEETING MINUTES

The 1989 meeting of the NSS Vertical Section was held Monday, July 31, 1989 in Guerry Hall of The University of the South at Sewanee, Tennessee. Executive Committee members present were Allen Padgett, who presided, Jim Hall, Sara Gayle, Bruce Smith and Bill Bussey. Scott Fee was absent. Approximately 60 members were in attendance.

Allen Padgett opened the meeting at 12:49 p.m. by describing the Vertical Forum and Session to be held after the meeting.

Treasurer's Report: Balance $5303.92. $2424 is devoted to future years due to multi-year memberships. $2879.92 available now.

Secretary's Report: 803 voting members in the Vertical Section. The Section has grown four-fold in the last five years. We are the largest Section in terms of membership.

Vertical Techniques Workshop: Ed Sira said Workshop to be held Thursday was full. Needs instructors.

Editor's Report: Nylon Highway #27 won Medal Award in 1989 Graphic Arts Salon. Mail of Nylon Highway weighs 300 lbs. Likes quality of articles he's been getting. Maureen Handler was recognized as Assistant Editor this year.

Training Committee Report: Jim Hall said committee still at work. They have an outline.

Caver Information Series Report: Gary Bush named committee of Shari Lydy, Paul Smith, Jim Hall and himself. Described status of each article the committee reviewed. After discussion with Executive Committee, decided that with membership approval, committee would write a bibliography, for insertion in the CIS, which would list which publication(s) information on specific items could be found.

Contest Committee Report: Bill Cuddington said contest will run as usual. Workers would get priority to climb. Need help. Bill and Miriam were congratulated on running the contest over the years.

Bylaws Research Committee Report: Bill Bussey named committee of Gary Bush, Shari Lydy, Dick Desjardins and himself. Gary Bush finished report by describing how proposed bylaws were developed. Bussey said Executive Committee has approved bylaws as reported by committee and will be published in upcoming Nylon Highway.

Allen Padgett offered the motion: the VS Secretary send a letter to the Chair of the Caver Information Series Committee that the Vertical Section recommends that copies of the CIS articles dealing with Vertical Techniques be allowed to lapse with the current print run. A single CIS document would be prepared as a Bibliography and Source List for information related to Vertical Techniques. The Vertical Sections chair would appoint a committee to write such bibliography. Maureen Handler seconded. After discussion, the motion was adopted unanimously.

In response to a members question, Padgett discussed the function of Vertical Training Committee project.

Under New Business: Padgett gave background on the contest and the situation involved. It was to be moved during Friday's BOG meeting that the Vertical Contest become a separate committee under the NSS Administrative Vice President (AVP). (Note: the motion was withdrawn from consideration at that meeting.) Padgett proposed that the following questions need to be asked of Vertical Section membership:

1. Do we (the Vertical Section) want (to run) a contest at all?

2. Do we want the Vertical Contest to continue the Contest as it is now?

3. Do we want the Contest Committee to become a separate committee under the NSS AVP?

Padgett also asked: Should we conduct a mail poll of the entire Vertical Section membership or should we argue the above questions here?

Bill Cuddington objected to some of the proposed bylaws and supported the Contest Committee under the NSS AVP and gave his reasons.

Padgett moved that the newly elected Executive Committee develop an unbiased poll of the membership (of the Vertical Section) within 30 days, mail to membership within 60 days. Membership would have a deadline of two months from the time mailed to reply. The purpose is to poll the membership about the status of the contest, (the three above numbered questions) and other functions of the VS. The poll would be unbinding.

It was noted that before considering this motion, a straw poll of the above noted three questions be taken of membership at the meeting.

The vote on Question 1 (to keep the Contest) was unanimously approved.

The vote on Question 2 (to continue the Contest as it is now) the vote: Yes 32; No 15.

The next question was determined to be: Do we keep the Contest under the Vertical Section but change the Contest? Vote was: Yes 21; No 0.

The following question was Question three above (the Contest would be under the AVP). The vote: Yes 11; No 43.

The question was called to poll the membership (as written above Padgett moved above). Notion passed Yes 45; No 9.

Bill Frantz moved that: Pending the outcome of the poll, an unbiased committee be formed to prepare a list of considerations for changes in the contest. The committee would report to the Executive Committee within 30 days after formation. Maureen Handler seconded. Motion was passed: For 35; Opposed 2.

Bruce Smith moved that: For a member of the Executive Committee of the Vertical Section to be re-elected, they must fulfill the duties and obligations associated with that position during their term of office, specifically: Correspond as needed; arrange for significant articles to *Nylon Highway*; act as council on committees as assigned; review and critique Vertical Information as requested; act responsibly to represent the desires and concerns of the majority of the Section; perform other duties as defined in the Bylaws as needed. Performance would be determined by the chair.

Seconded by Maureen Handler. Vote failed: For 1; Opposed Rest. The meeting concluded with elections. Those elected were:

Bill Bussey	Secretary/Treasurer
Bruce Smith	Editor
Gary Bush	
Bill Cuddington	
Maureen Handler	
Allen Padgett	

The meeting ended at 2:43 p.m.

Later that day, the Executive Committee met and elected Allen Padgett as Chairman. Maureen Handler will organize and emcee the Vertical Session at the 1990 convention.

Respectfully Submitted,

Bill Bussey

LETTERS TO THE EDITOR

In reading the *Nylon Highway No. 28* there were several articles by Bruce Smith that I do not agree with. The first article was "Gloves and Prusiking Don't Mix".

In the article it is stated that cavers should not wear gloves while prusiking. I do not agree with this blanket statement. A caver with proper gloves does not need to take them off while climbing. Many cavers like myself want to keep their hands clean for sketching or for photography. So I almost never take my gloves off while in a cave. Most any caver should be able to learn how to do everything necessary for vertical caving including tying knots while wearing gloves. It is not that hard now that it is possible to buy good fitting gloves. Even in the old days of poor fitting gloves I could assemble a Gibbs, thumb cams etc. with my gloves on. So I do not believe that it can be stated that cavers should not wear gloves while prusiking. If a caver wants to prusik without gloves that it is his choice but it is not a hazard if a caver wants to wear gloves while prusiking.

The second article that I had trouble with was "Vertically Orient Your Rack and 8". Again Mr. Smith makes a statement that only one way of doing something is right. He states that the rack or figure 8 should only be oriented in a vertical position and not in a horizontal position. I have used racks in the vertical position but do not like it. I find the rack is much easier to use when mounted horizontally. Even long drops are not a problem. Bars can easily be added or removed by pushing the rope away from the seat or pulling it to one's side.

My main problem with both of these articles is not that Mr. Smith suggests that cavers use these techniques but that he states that other ways of doing the same thing are wrong. In both of these caves, whether or not to wear gloves while prusiking and how to mount your rack, it is not which method you use but what works well for you. Everyone does not have to do things the same way. The important thing is what works for that particular caver.

Deepest caving,

Ron Simmons

Ron Simmons
NSS 16894F

In regard to your article, "Gloves and Prusiking Don't Mix", in *Nylon Highway No. 28*, I think it is important to point out that in cold, wet caves, cavers should wear waterproof gloves while ascending wet pitches. In these circumstances, the hands can become numb and essentially useless if unprotected. This is especially important if there are any re-belays on the pitch. I have heard of one cave, in a 1 degree Centigrade Swiss cave, where a caver lost his gloves and attempted to ascend a very wet pitch without them. His hands became too numb to work his vertical gear and he died from hypothermia. While most U.S. caves do not present such unpleasant conditions. The alpine caves of northern California, Idaho, Wyoming, Colorado and Montana often contain cold, wet pitches. When snow is melting, the water can be close to 0° C. Waterproof gloves are mandatory on drops such as these.

Vertically yours,

Peter Bosted

P.S. I like your idea for restructuring the vertical contest.