A REVIEW
SOME RECENT ADVANCES IN CAVING EQUIPMENT AND TECHNIQUES

by

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Synopsis

A review of new equipment and techniques, which covers karabiners; tape; anchor devices—pitons and jam nuts; abseiling—brake bars and variations; prussiking—knots and mechanical devices, their use, with particular emphasis on Jumar techniques; belaying—glove belay and mechanical devices, Sticht brake, brake bar, Jumar.

Introduction

The aim of this review is to acquaint Australian cavers with some of the advances, in both equipment and manufacture and use, made by climbers in recent years. These techniques and equipment usually percolate through to the Australian caver extremely slowly—due partly to isolation and partly to conservatism.

A Karabiners

The most important development in karabiner manufacture has been the production of light alloy karabiners which are as strong (and in some cases much stronger than) steel karabiners, whilst being much lighter. They are manufactured by several reputable companies – Cassin, Stubai, Chouinard. Strengths are approximately 2000 Kg – e.g. Cassin have two models, red gate – 1800 Kg, blue gate – 2200 Kg. They are available with screw gates, but these do not seem popular.

British Mountaineering Council tests in 1963-4 revealed the following Karabiners with a minimum strength of over 3000 lbs with *gate closed:*

1. ASMU 'D' (8,800 lbs), Simmond 10mm Oval (3780 lbs), Cassin 1800 Kg 'D' (3770 lbs), ALLOY 'D' (NA), 1300 Kg 'D', Hiatt 'D' (5750 lbs), Marwa Kidney (3065 lbs) Stubai 'D'.
2. ONLY the ASMU 'D' exceeded 2000 lbs sideways.
3. ONLY ASMU 'D' (2840 lbs), Marwa Kidney (2780 lbs), Hiatt 'D' (2600 lbs) approached requirement of 3000 lbs with gate open (Blackshaw 1965).

Many of these brands showed variations over several karabiners. Some of the karabiners tested broke with loads as small as 300 lbs.

B Tape

Tape is available in two basic constructions – stiff (i.e. solid) and tubular (i.e. hollow tube, usually flattened).

Type	Size	Material	Strength	Use
Solid	½"	Nylon	1000 lbs	Tie-offs on pitons
	1"	Nylon	2000 lbs	Abseil slings, etriers etc.
	2"	Terylene	4000 lbs	Waistlines (Fig. 1)
Tubular	½"	Nylon	1750 lbs	Crackers, tie-offs etc.
	1"	Nylon	4000 lbs	Anchor slings, etc.

The most useful to cavers are the 2" terylene (seatbelt webbing) which is used for waistlines. 1" nylon for abseil slings, prussik loops, etc. The tubular tapes are generally softer and stronger. All tapes abrade fairly easily so care is essential. 'Tiger's Web' which is coloured pink has a safety weave such that when it has lost 35% of its strength white flecks show through the pink.

Tapes should always be joined by the 'tape knot' (Fig. 2). This knot should be tightened under load before use.

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Fig. 1
Waist harness—constructed from 2" webbing waistband and 1" webbing thigh loop (Swami Seat). Karabiner links two together. Webbing tied with tape knot.

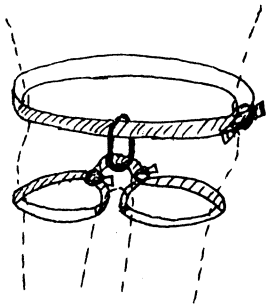
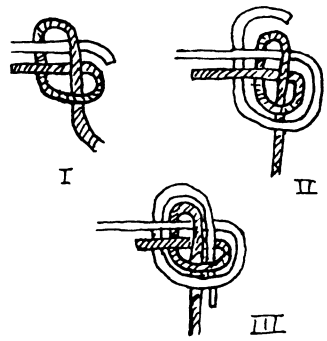


Fig. 2
Tape Knot, tighten before use.



C Anchor devices

1. Jam Nuts

The latest concept is that of the 'jam'. This usually takes the form of a metal block which is inserted in a crack which narrows in the direction of the expected loading. Thus the block is easily inserted in the wide section of the crack (and removed) but under loading it jams in the crack.

The strength of this arrangement is very high, during testing it is usual for the sling through the jam to break first.

These jams are available in a large variety of sizes, shapes, etc. The most common is the cracker which consists of a piece of hexagonal duralium rod, with tapered ends and with holes for a sling through the short axis. The larger sizes have lightening holes to reduce their weight. The slings can be tape (stiff or tubular), rope or wire rope. A certain stiffness in the sling can be a great aid in placing jams in difficult cracks, for this purpose the wire slings are best, followed by stiff tape. A large selection can be carried varying in size from ½" x ¼" up to 4" x 2". The size is limited only by the imagination of the manufacturer and the ability of the caver to carry it. The larger the number the better the chance that you will have one that fits the crack that you are standing next to. For illustration of use, see Figure 3.

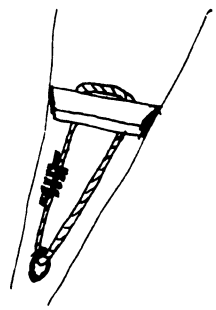
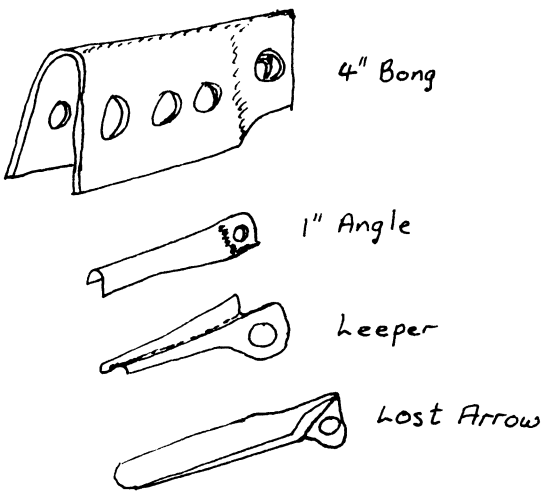


Fig. 3
Artificial chockstone placed in narrowing crack.

2. Pitons

Fig. 4 — Modern Chromolly Pitons



Recent development (mainly by the Americans, Yvon Chouinard and Ed Leeper) in piton design and materials have produced incredibly strong modern pitons. These are made of (aircraft quality) chromium molybdenum steels, which combined with high quality control have produced pitons which may be re-used perhaps 50 times (unlike the older soft steel types which may be re-used often only once or twice). Despite exhaustive searches, it would appear that nobody has reported a Leeper piton broken in service in the years since they were introduced.

Piton shapes have also changed slightly. Angles and their larger stablemate 'Bongs' are essentially 'U' section. Leepers have a 'Z' section (Fig. 4). The four bearing surfaces of these give enhanced grip in difficult situations. Angles should always be placed with the 'U' upside down (in horizontal cracks), never sideways—due to the springiness you will have difficulty in removing them.

Chromolly pitons are produced by Chouinard ('Lost Arrow', 'Bugaboo', 'Bongs', 'Angles'), Leeper, Dolt, Stubai and Hiatt.

Hitens pitons are of nickel-chromolly steel.

Prices vary with size and manufacturer—generally in the range $A2—$3.

3. Bolts

These are an essentially Australian contribution, especially the keyhole bracket (Thrutch, Sept/Oct 1967). See Figure 5.

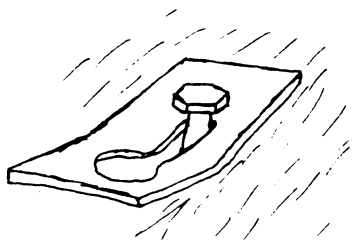


Fig. 5
Keyhole bracket on bolt.

The 'Bolt' is simply a high tensile bolt hammered into a hole in the rock slightly smaller than itself. If part of the thread is filed off the lower end, placement is easier. It is also useful to use a small piece of plastic pipe to blow the rock dust out of the hole after you finish with the rock drill. The strength depends on the quality of placement and on the rock strength. Ideal loading is transverse.

D Abseiling

The traditional method of 'Classic' and 'Over the Shoulder' have been superseded by the use of brake bars. These cause far less damage to the rope and provide more control of descent rate. The brake bar derives its frictional braking effect from bending (not twisting) the rope.

The brake-bar itself is an aluminium bar which is slid on to the karabiner so that the rope can be quickly inserted and once in place cannot be removed under tension (see Fig. 6). Either ½" or 1" angle pitons or two karabiners clipped across one another can also be used (see Fig. 7 and 8).

Gloves (leather) are recommended. Fast abseiling is possible but should be avoided, the heating effect on karabiners etc. is quite high and could easily cause thermal damage to the rope. The brake-bars should not be used on non-monofilament ropes – especially Manilla.

Should a caver lose control during an abseil it is possible to stop the fall by pulling down on the abseil rope from the bottom (see Fig. 9).

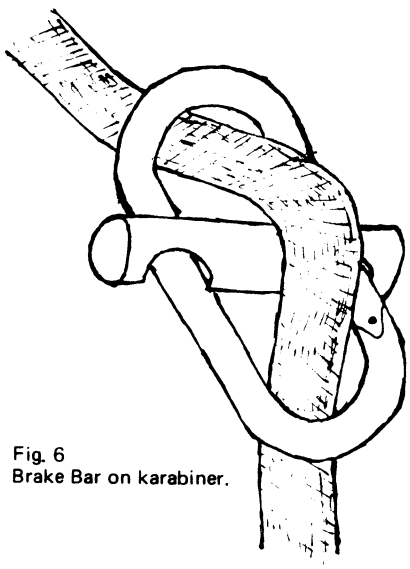


Fig. 6
Brake Bar on karabiner.

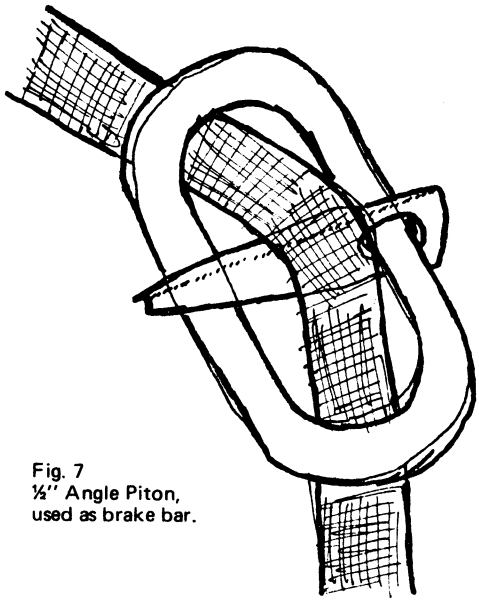


Fig. 7
½" Angle Piton,
used as brake bar.

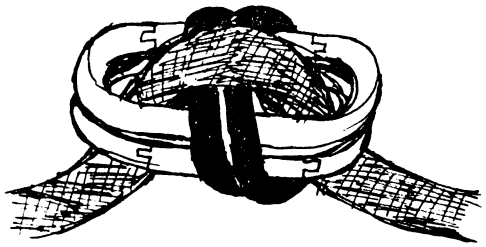


Fig. 8
Crossed Karabiners.
Note reversal of gates
of the karabiners.

Fig. 9
Stopping an uncontrolled abseil
by applying downward force to
rope from below.

E Ascending

The traditional method of safely ascending a rope was to use three prussik knots. These have now been augmented by other knots such as the Pemberthy knot and by mechanical devices. The main reason for this seems to be ease of use. The prussik knot is often slow and difficult to loosen.

1. Knots

(i) Prussik knot
Attributed to a Prussian (Dr Prussik). See Figure 10. It is safest in the 6 strand form (as shown) but can be used with only four turns. It is often difficult to loosen after is has been heavily loaded.

(ii) Bachmann knot
This uses a karabiner as a handle (see Fig. 11), very easy to loosen hence better than a standard prussik knot.

(iii) Pemberthy knot
This is a relatively recent addition by Larry Pemberthy of Mountain Safety Research(USA), loosens easily, has excellent grip. Its main disadvantage is that it must be tied in a length of rope—the ends of which are joined to make a sling.

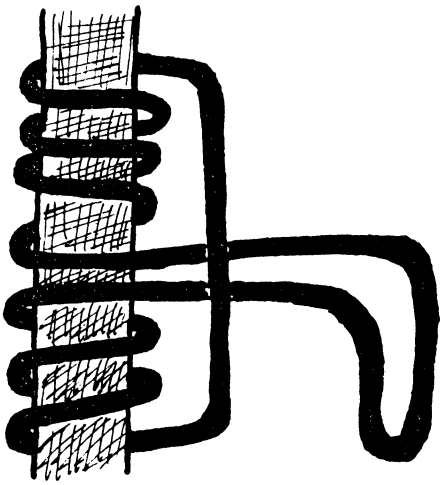


Fig. 10
Prussik Knot –
6 loop version.

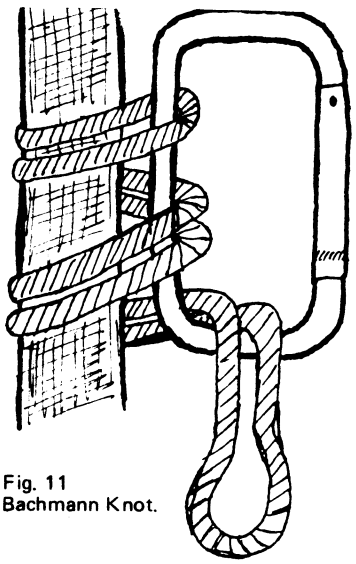


Fig. 11
Bachmann Knot.

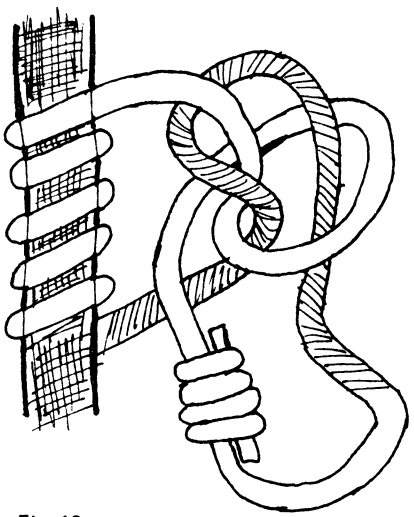


Fig. 12
Pemberthy Knot.

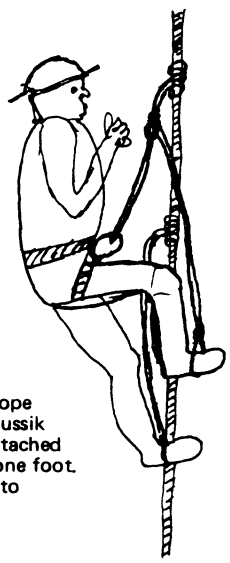


Fig. 13
Method of attachment to rope using 3 slings but only 2 prussik devices. Top ascender is attached to both waist harness and one foot. Other ascender is attached to remaining foot.

2. Mechanical devices

(i) Hieblers (Austrian)
These are the simplest and least safe, also the lightest and cheapest (see Fig. 14). Grip is essentially by bending the rope whilst under load. There are no 'teeth' or 'ridges' to enhance grip. Later models have a 'safety lock' which is a most insecure piece of wire (hopefully) designed to stop the main rope from slipping out.

(ii) Jumars (Swiss)
The most complicated, expensive but useful of the mechanical prussikers. Their leading advantage is the ease with which they can be removed to continue past knots etc. on the main rope. Also, due to the handle, they protect the knuckles whilst prussiking against the face. Grip is partly by bending of the rope, but mainly by an eccentric cam covered with 'teeth'. These are (nominally) softer than the rope and should not damage it. The safety clamp is spring loaded and easily manipulated with the fingers. They are tested to a load of 660 pounds (?? NSS News Feb 1969). See Figure 15. (Cost $21 a pair, includes airfreight from Scotland.)

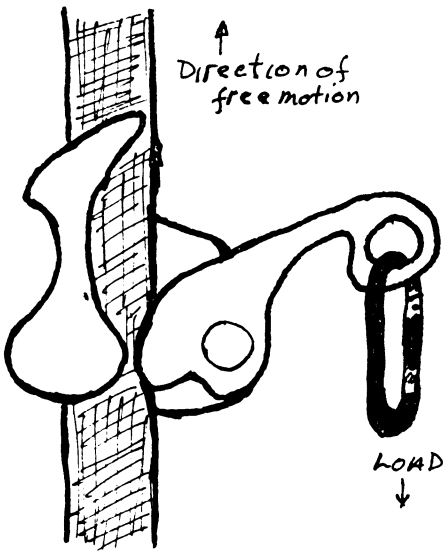


Fig. 14
Hiebler prussiker.
When weight is applied to the karabiner the eccentric cam is forced to clamp the rope.

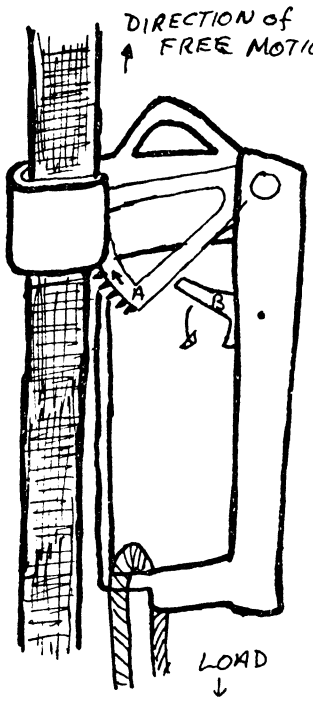


Fig. 15
Jumar ascender.
When loaded the toothed eccentric cam (A) engages and clamps on the rope. The rope cannot be removed until safety catch (B) is pulled down, as indicated.

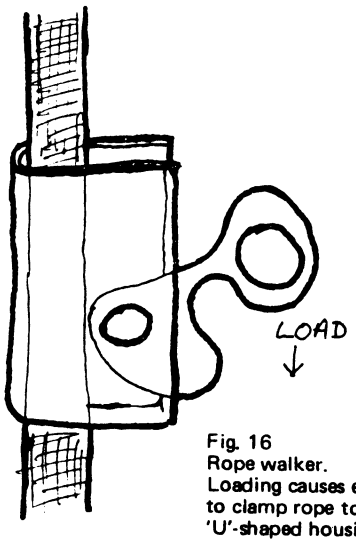
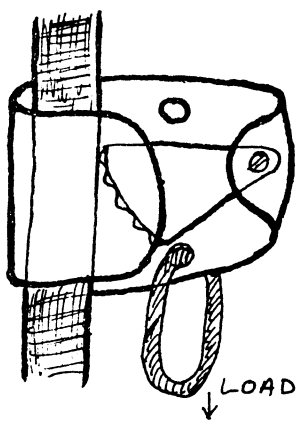


Fig. 16
Rope walker.
Loading causes eccentric cam to clamp rope to inside of 'U'-shaped housing.

Fig. 17
Clogger ascender.
Eccentric cam clamps rope inside 'C'-shaped housing under load. The rope cannot be removed whilst karabiner is clipped in.



(iii) 'Rope walkers' (USA)
The more popular of the American attempts to 'build a better prussiker'. These were originally designed for cave conditions, in contrast to (i), (ii), (iv) which were designed for mountaineering. They consist of a 'U' section aluminium plate, with an eccentric cam with 'one or two' ridges. The cams must be removed to insert the rope—the most major disadvantage. They are tested to 1000 pounds. (Cost $US14.50 a pair, add freight.)

(iv) Cloggers (British)
These are very similar to the 'rope walker' (see (iii) above), however the use of 'C' section aluminium plate enables the rope to be inserted without removing the eccentric cam. They cannot be removed from the rope when a karabiner is in place. (Cost $A8.50 each.)

(v) Mechanical ascending device (USA)
This is a 'one-off' device at present and is mentioned here for comparison. The MAD is powered by a 2HP, 2-cycle gasoline motor. It has an integral centrifugal clutch and gearbox, and a home-built transmission driving a Vee groove pully. For control there is a twist trip throttle and an instant stop button. There is also a built in Jumar cam to stop any descent. Technical figures are: 2 mpg; 150 lbs load @ 37 ft/min.; weight 23 lbs. (Cost approximately $US120.)

3. Comments on techniques of use

We thus have many methods of attachment to a rope such that force in one direction results in gripping, whilst force in the opposite direction produces sliding motion. Hence using two slings with the appropriate knot or device at the top we can ascend a rope (see Fig. 13).

Jumars are very popular with mountaineers and are the most useful of the mechanical devices.

Although speeds as high as 80 ft a minute have been claimed for the prussik knot, the mechanical devices can be used to attain much higher speeds. Using Jumars in the 'ropewalking' position (see Fig. 20), we have attained speeds of 150 ft/min. It should be noted that these high speeds cannot be continued for any distance due to physical fatigue. If used correctly, however, there can be considerable saving in energy by prussiking as opposed to ladder climbing.

The method we (UNSWSS) have developed is a combination of 'rope-walking' and the 'Yosemite' methods (Appendix 1).

One Jumar is attached directly to the foot (Fig. 18), as closely and tightly as is comfortable, the other is held in both hands and has two slings – one to the waist harness, the other to the remaining foot (see Fig. 19).

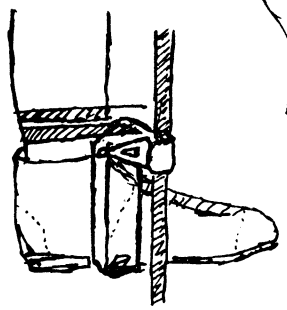


Fig. 18
Detail of attachment of Jumar to foot.

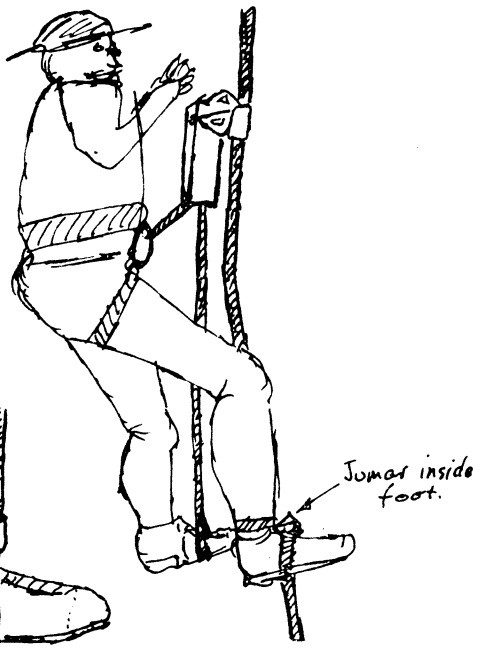


Fig. 19
UNSWSS method of prussiking using Jumers. One Jumar on foot (right), other foot in sling from upper Jumar.

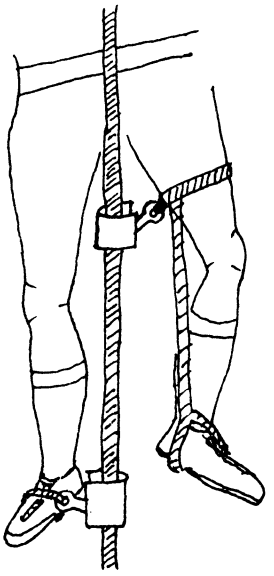
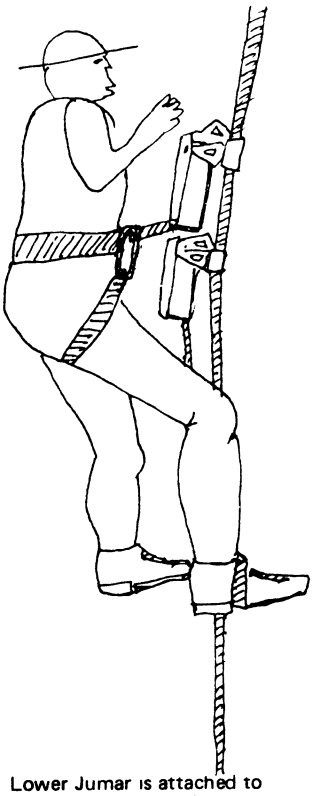


Fig. 20
'Rope Walker' set-up.



Lower Jumar is attached to lower foot. Upper Jumar to waist harness only.

The sequence of movement is to grip the upper Jumar and move the lower foot up, then stand up whilst pushing upper Jumar up till the waistline pulls tight, then move lower foot again. A good rhythm can be maintained and resting on the waistline is very comfortable, should it be necessary.

4. Rope

For prussiking on long face walls it is necessary to have a rope with zero twist and stretch. We use a Terylene multiple plait rope (i.e. a 'kernmantle' construction) 1½" circumference, breaking strain 38 cwt. The stretch of the rope is 4' in 300' (i.e. 1½%).

5. Comparison of abseil/prussik *vs* ladders

Abseiling/prussiking in caves is only for the experienced. It involves costly specialist equipment and to be effective all members of the group should own their own equipment. The abseil/prussik method is of considerable advantage – both in bulk and weight – over the ladder technique and becomes more so as the lengths of individual pitches become greater and caves become harder of access – especially in mountainous regions.

If we neglect common factors such as waist harness and two karabiners plus rope (for belaying on the ladder or prussiking) the weight of equipment necessary for each technique is:

(i) Prussiking – brake bars and karabiners for abseil,
Jumars and slings for prussiking,
weight: 3 pounds (regardless of length of pitch)

(ii) Laddering – ladders and traces, weight: 12 pounds per 100 ft.

It is obvious that where weight is a factor the abseil/prussik method must be preferable.

On a cost basis:

(i) Abseil/prussik – terylene rope: $27/100'
Jumars: $21 a pair
tape: $3
5 karabiners: $11.50

(ii) Ladder – (Bonwick) ladders are $75 a hundred feet (at cost)
Manilla rope: $3/100'.

Hence the longer the pitch the cheaper it is to use the abseil/prussik technique.

F Belaying

The latest belay techniques have taken away the emphasis on taking the strain on the belayer's body and have transferred it to the belay anchor. It is therefore necessary when using these techniques to be confident of the security of the anchors.

(i) Glove belay.
The belay rope is passed through a karabiner attached to the anchor and then back parallel to itself. The two strands of rope are gripped by gloved hands. Frictional braking is achieved by the rope rubbing against itself and also in the small radius around the karabiner. The closer the hands are to the karabiner and the tighter the grip the greater the braking effect. The heat is spread along the rope and does not cause local heating problems in synthetic ropes (see Fig. 22).

(ii) Sticht brake.
The sticht brake (a German innovation) is merely an aluminium plate with a slot of the size appropriate to the rope in use (approximately 3 diam. long and 1 diam. wide). The loop of rope is pushed through the slot and clipped into the anchor karabiner. The brake plate normally has a light cord to stop it sliding down the main rope. Braking is obtained simply by separating the two (parallel) parts of the belay rope, friction is developed on the plate and karabiner (Fig. 23).

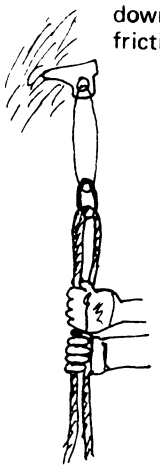
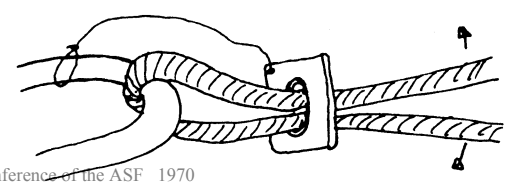


Fig. 22
Glove Belay.
Rope is gripped in both gloved hands—close to karabiner.

Fig. 23
Sticht Brake.
Braking effect increases as ends of main rope moved apart.



Both (i) and (ii) are essentially dynamic methods which can also be effectively used for second belaying as well. They are easier to use for leader belaying however.

(iii) Brake Bar.
A brake bar can be used for belaying. The brake bar and karabiner are attached to the anchor and rope is easily paid out or stopped. This method is best used for belaying down a pitch – taking in is inconvenient (see Fig. 24).

(iv) Jumar.
A Jumar can be used for belaying up a pitch. A weight must be attached to the 'top' of the Jumar so that the rope slides through the Jumar when taking in (see Fig. 25). The Jumar will naturally grip as soon as any downward force is exerted on the rope.

Fig. 24
Brake bar used as belay

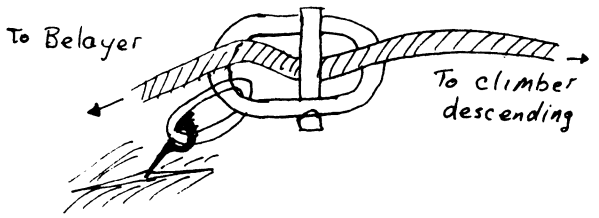
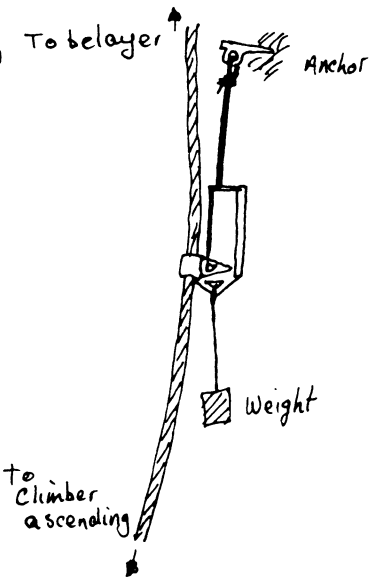


Fig. 25
Jumar used for belaying



APPENDICES

1. Ropewalking technique

One of the ropewalkers (see (iii)) is attached closely to one foot, the other is strapped (elastically) to the other knee with a sling to the foot. The knee attachment is only to keep the ropewalker in place – the foot takes all the weight. A third sling is placed between the waistharness and a prussik knot on the rope (for safety reasons). See Figure 20.

The technique is to 'walk up' the rope using the arms to maintain balance. It is only recommended for about 40 ft. before resting. The technique seems to be very tiring on the arms.

2. Yosemite method

One Jumar is connected directly to the waistharness, the other is a long sling to one (or both) foot.

The technique is – stand up on a foot sling, sliding waist Jumar up, sit back on waistharness and move other Jumar up, then stand up etc. See Figure 21.

Notes

1. Tests by the Americans (NSS News, Feb 1969) suggests that the ropewalkers are best for caving, they are cheap, virtually failsafe, carry higher test loads and cause less damage to rope.

However, they are not nearly so useful for general purpose outdoor sports. Jumars have extensive use in hauling, rescues, belaying etc. They are easier and quicker to use and have several attachment points.

2. Americans use 3/8" (diam.) polypropylene hard-solid braided rope (Sampson 2 in 1?).

3. Load-unload cycle tests show that for the ropewalkers (at least) most of the weight when prussiking is taken up by the outer sheath of the rope. The cam reduced the strength of the rope by 50% and eventually broke the outer sheath of the rope. This is attributed to unequal support by the housing and the cam ridges on each side of the rope.

4. Never wear a pack whilst prussiking – it is extremely tiring.

5. 'Cable laid' refers to rope constructed of several strands (usually 3) twisted around each other).
'Kernmantle' construction is a central core surrounded by a braided sheath (to protect the core from abrasion).

6. Jumars can be used for hauling equipment (or bodies etc.) in the following manner. One Jumar hangs upside down held in position by a weight, the rope passes through this Jumar and thence through a karabiner above. A second Jumar with a foot sling is used to pull the rope through the karabiner. The leg muscles do all the work. The first Jumar holds the load between movements of the second Jumar (Fig. 26).

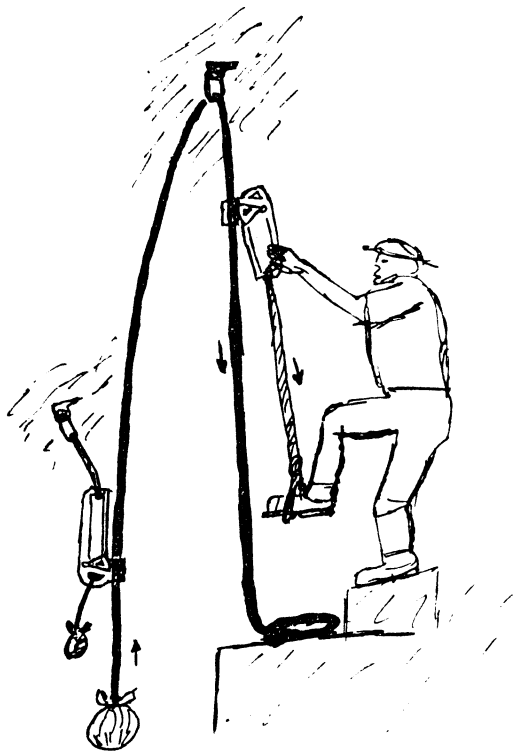


Fig. 26
Use of Jumars for equipment hauling. Leg muscles do the work. The lower Jumar supports the load whilst upper Jumar is moved up.

3. Availability of equipment

All the techniques referred to in this review require items of modern specialist (rockclimbing) equipment. Duty on many of these items was recently relaxed, so that lower prices at Australian retailers have generally resulted.

Equipment may be obtained from:

Infinity Equipment
P.O. Box 137,
Toowong, Qld, 4066
— Extensive stocks of tape, crackers, pitons, karabiners, cloggers, ropes, etc. Good mail order service.

Paddy Pallin Pty Ltd
69 Liverpool St,
Sydney, NSW, 2000
— Small selection of karabiners, tape, crackers, rope, etc.

Mountain Equipment Pty Ltd
167 Pacific Highway,
North Sydney, NSW, 2060
— small selection of karabiners, tape, crackers, rope, etc.

Graham Tiso
44 Rodney St,
Edinburgh 7, UK.
— Jumars, tape, karabiners, rope, Hieblers, etc. Excellent, fast air mail order service.

Gibbs Product Co.
854 Padley St,
Salt Lake City, Utah 84108, USA.
— rope walkers

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DISCUSSION

Q *I noticed you tend to use pigskin gloves exclusively in belaying. Do you find there is any danger of the natural oils in the gloves reducing friction? The oil makes it sort of slippery on the surface especially when they are wet.*

A We haven't experienced any troubles with this at all. Gloves are highly recommended especially for belaying.

Q *Are they leather or pigskin?*

A These are leather.

C *I have used pigskin gloves for rockclimbing and in practice it is safe. We have dropped a 150 lb odd weight over a cliff and stopped it within feet using the dynamic belay so there are no worries.*

A I usually wear gloves when I go caving mainly to keep my hands clean to take pictures. I have found it extremely useful. Even if you get mud on the gloves you can still very effectively use them on belays so there is no problem.

C *One more thing about these dynamic belays, we have had a bit of practice with B.R.C. in Brisbane, belaying lengths of rail and nearly everyone made the mistake of stopping the piece of rail too sharply which in actual use would probably break their patient's back.*

A I agree with this entirely. If you are going to use the dynamic system of belaying and make it dynamic you have to let the rope run through for a while. This makes it much easier on the person.

C *Alloy karabiners – there are three or four brands on the market that won't open under load. This would be convenient but could also be inconvenient and very dangerous too. The Simmond especially and the Cassin you have illustrated would be very difficult to open. Pitons– I have a report from National Engineering and one of the things pointed out is that chromium-molybdenum pitons in hard rock such as limestone can't be used anywhere near the number of times that you have mentioned – perhaps four or five times.*

C If you hammer a bolt into a hole and keep on hammering you will notice that the head starts to rock back and forth when you get it in too far. It seems a lot of people keep on pounding it, setting up a nice little stressed area near the head of the bolt exactly where the stress is going to come onto it if anything happens. Brake bars emphasize twist in a rope. They push it down the rope till you get to the bottom end and if it is a big drop you have yards of rope twisted around itself and this can be quite inconvenient. I have used brake bars extensively now for four or five years and this is a major disadvantage.

Q *What type of rope were you using them on?*

A Both kernmantle and nylon.

C The karabiner brake bar is a bit doubtful. There is a danger of the karabiner sliding up into the opposite gate unless you are using screwed ones which I noticed you weren't in the photograph.

C In Queensland we use four karabiners and oppose the gates on both pairs.

C I would like to emphasize that this type of thing is for experienced people. This goes for virtually all the techniques that have been described – you have to practice them first.

Q *I noticed that you were using kernmantle perlon for prussicking. Have you any views on this? Most people tend to think it is not wise.*

A I wasn't using kernmantle perlon for prussicking. The rope we were using for prussicking is terylene of kernmantle construction.

C *It is this kernmantle construction that is worrying me. I am concerned about the outer sheath removing itself.*

A I agree. This is brought out in the written paper. I decided not to cover several of these minor points in the talk since the details are in the published version. The Americans did tests on their rope walkers which showed that the outer sheath breaks leaving the inner sheath virtually untouched, but all the stress is on the outer sheath when you are using one of these devices.

C *I have been using pigskin gloves extensively on an Outward Bound course and taking numerous falls over three or four weeks. After a while the gloves glaze which can be most embarrassing.*

A I would expect the glaze to be removed if you were using them for caving.

C Terylene ropes can produce a fair amount of friction on the hands and whilst there are techniques of using brake bars it is very easy to pick up the end of the rope and produce a large increase in friction which can be very painful if you are not wearing gloves.

Q *Is there much likelihood of banging your knees continuously against the walls when prussicking with these clamps on a straight wall without any overhang?*

A It depends on the technique. If you are multiple limbed you can get away with it quite easily. We noticed this at the top of Big Hole. The Jumars are especially handy as opposed to the cams because of the handle construction, you can just move the Jumar up without smashing your knuckles. When you are using them on your legs you have to develop a different technique (demonstrated). This in effect produced a greater gain in height per

movement when near the rock because I was only pulling the bottom leg up till it was straight and then leaving it, whereas when on the upper section you lift your foot higher to get your knee around the wall and therefore you gain over a foot on each movement which speeds things up tremendously.

C *I have been using the Black's figure of eight, it is a beauty for twisting the rope though it is about the only one I know that you can lock very easily which does prove rather useful, especially if you have somebody in trouble on a ladder. Has any work been done on figure of eights, whether they are good or bad?*

A I don't think anyone has actually done tests on them. My personal view is that I don't like them because they put the rope through too much of a bend.

C With brake bar abseiling if something does happen to someone while they are abseiling, there are two techniques you can use to get around this problem. If you have a Jumar, a cam or something else on the rope above you to which you are attached when you get hit and become unconscious your natural reaction is to let go and if this device is attached to your waistline it will stop you immediately. Alternatively if there is someone standing at the bottom and they haul heavily down on the rope while someone is using a brake bar or figure of eight this will effectively slow them down. The Americans have averted several major accidents and turned them into minor ones by using this technique.

Q *Do you think there is a danger of excessive stress by three way load to the karabiner from the abseiling sling waist loop connection?*

A No, three way load never develops because of the tape. When you arrange it you have to set it for your own shape. My things are set to fit me. When you put the karabiner in the two inch tape the one inch tape will sit in the bottom of the karabiner. There is no problem with three way loading. If you try to put it on someone else with a bigger waist say, the slings may be a bit too short and then you have a possibility of three way loading.

Q *It is not excessive three way loading, is it?*

A It shouldn't be. It is only your body weight.

C *The point about using a terylene rope as opposed to kernmantle is that terylene stretches very much less than nylon and therefore the problems of the rope abrading on the rock in the time that you come up are reduced.*

A I had 120 feet of kernmantle Mammutt climbing rope about 11 mm (standard climbing perlon ropes stretch about 25% under loading) and I was prussicking about 70 feet. It was running over a sandstone edge and very little attempt had been made to pad the edge. By the time I reached the top there was a horrible hole in the sheath and it had started to cut into the core – this worried me. We avoid this here by using protectors around them. They are lengths of water hose which are hung on the rock at the point where you expect wear. After the last person has abseiled you insert the rope in it for prussicking up. You usually don't get any wear when abseiling as long as you move smoothly. The rope is simply put into this piece of hose where it will rub over the rock. This ensures that you don't rub the rope on the rock while you are prussicking because virtually all prussicking techniques will involve a constant rhythmic loading on the rope. Terylene rope stretches about 1½% which is pretty good compared to 25% for kernmantle and about 40% for nylon. So you get very little bounce.

Q *I notice your protector is split directly along its length. Would it not be better to put a helical split in it?*

A I wouldn't be sure about this.

Q *Do you use plain bolts rather than expansion bolts?*

A We rarely use expansion bolts.

Q *Do you find it quite safe for ladders?*

A Yes. The only person I saw who did any tests on this was Bryden Allen from the Sydney Rock Climbing Club, who privately circulated a short paper on it in which he maintained that a standard high tensile bolt driven into a hole was better than an expansion bolt.

Q *Have you found that the driving fatigues the bolt?*

A They have found that this doesn't essentially weaken the bolt driven straight in. The other point is that Terriers, Rawl plugs etc. are highly expensive whereas you can get the standard high tensile bolt for 5 cents at the local hardware store, which makes it incredibly cheap. There has been a big controversy in Sydney climbing circles over placing bolts. They consider that they deface the rock as they are a permanent feature which is why they recommend crackers.