MOUNTAIN SAFETY RESEARCH

NEWSLETTER

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Larry Penberthy, Editor & Chief Engineer

Issue 3
May 1970

OUR NEW CLIMBING TOWER

Outside the Electromelt building is a 10-feet square by 40-feet tall steel tower, with stairway and platforms. We have converted it to a testing and climbing tower. There are two drop weights, 176 pounds (80 kg) and 220 pounds (100 kg), having a fall height of 33 feet (10 meters). These can be used for testing ropes, Auto-Belayers, belay devices and techniques, etc. The weights are lifted by an electric hoist. Six fixed-rope anchors extend out from the top for practicing ascending and rappelling. (A bed of wood chips all around the tower is intended to ease your stop if you lose control.) There is also a bolt route for direct-aid practice.

Crampon use can be practiced on some sloping wooden planks, set at 20°, 30°, 40°.

There will be an open house Friday May 22, 5 to 9 pm. Wear climbing clothes and bring practice equipment. This will be a good chance to see (and try) the new belaying techniques.

Please phone Mrs. Norma Levack, 762-4244 or write to say you are coming, so we can provide the right amounts of soda pop and cookies.

After the open house, all Mountain Rescue groups may use the tower without charge. Others, $1 per person donation toward the cost of equipping the tower, each session of use, until paid for. Spectators free, except donations will be accepted, of course, to help pay off the expense sooner.

Every Friday evening, 5 until 9 pm, an instructor will be on hand. Other times by appointment. Call 762-4244, Norma or Bernice. Qualified persons can serve as instructors for their own groups. Bring your own ropes and other equipment.

Safety Rules: No solo activity. All beginners at rappelling to be belayed. No alcoholic beverages. No indecorous behavior. No rope-friction activity without gloves. Otherwise, have fun.

BELAYING

"Falls are fortunately rather uncommon, but unfortunately their very rarity makes climbers all the more poorly equipped to handle them. Some so-called experienced climbers have gone serenely on for years, without belaying properly, and, never having known the sudden terror of a fall, they have never considered the consequences." Mountaineering--Freedom of The Hills, page 147.

Amen! After reading "Belaying The Leader" and holding over a hundred instrumented falls, I agree completely. One hears stories of hard falls held with hands cut to the bone by the running rope, or with rope-burned backs, but this sort of thing isn't necessary any more. New techniques of absorbing energy have moved the hip belay to third choice.

1. Italian Friction Hitch

An Italian guide, Franco Garda, showed me a rope hitch on a carabiner which serves as an energy-absorbing friction system for effective belaying. We have held 25-foot falls of a 200-pound weight, with a stopping factor of 0.3. (This means that the weight was stopped while travelling an additional distance of 7.5 feet after the rope became taut.)

The Italian Hitch is shown in Fig. 17. The carabiner is best connected to a good anchor. Next best, to the seat harness if the belayer is secure. The rope can be passed both in and out through the hitch readily provided the rope isn't too stiff and isn't 3-strand twisted. The hitch inverts on change of direction.

1. Italian Friction Hitch (Cont.)

At the time of a fall, it is only necessary to grip the free end of the rope with the gloved hand to accomplish up to say 500-700 pounds of restraint on the climber's end of the rope. The angle that the control rope makes with the climbing rope changes the restraint only a little.

Providing one is using a reasonably flexible braided rope, I consider the Italian Hitch the best way for a second man to absorb the energy of a fall of the first man. Wear on the rope for single falls is negligible.

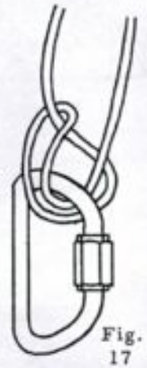

Fig. 17

2. Sticht Belay Plate

The Sticht is also an effective way of absorbing the energy of a fall. It uses an anchored carabiner also. The climbing rope is doubled and pushed through the elongated hole in the Sticht. The carabiner is snapped into the loop of the rope. Fig. 18a. Passing the rope in and out is easy, much easier than when using a hip belay. Note that the hands need to be close together to avoid moving the Sticht close to the carabiner. When holding a fall, the gloved control hand is moved away from the rope going to the falling climber. The Sticht then snaps into contact with the carabiner and the rope takes three bends around metal. With a gloved hand, a restraint of 400-900 pounds can be achieved readily. The actual restraint depends on the size of the slotted hole, the size of the rope, roughness of the rope, and the restraint by the gripping hand. The 11mm size is suitable for both braided 11mm and twisted 7/16" ropes. In the next issue, we will have actual restraint figures for various ropes.

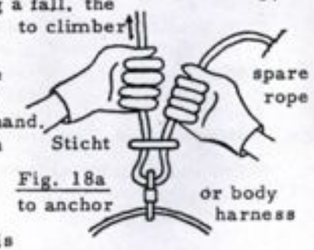

Fig. 18a

3. Sitting Hip Belay

In this commonly-used belay, the belayer sits in the best socket possible and is preferably anchored also. The climbing rope passes around the hips (often the waist). When a fall comes, the control hand on the free end of the rope is moved across the front of the body to increase the angle of wrap, and then (at least in theory) the control hand tightens on the rope. Fig. 19.

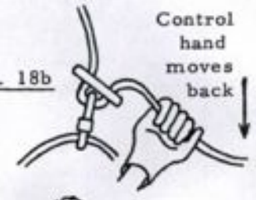

Fig. 18b

In a test setup, Oetzel and Gardner measured a peak restraint of only 300-400 pounds, with the rope running over a well-padded back, using heavy gloves. Summit, July 1969. Our slow-pull tests showed belayers collapsing with pain with a force of only 325 pounds, no pad except the single-layer of a cotton parka. When one remembers that the force of gravity on the climber (his own weight) must be subtracted from the above restraints, a fall of 20 feet would be stopped only with a slipping of another, say 30 feet of rope. This is too far. The total energy to be absorbed is too high and there is danger of hitting a ledge.

Fig. 19

STICHT BELAY PLATE FOR RAPPELLING

At intermediate practice, the instructors tried the Sticht for friction in rappelling on one rope. It worked fine. We also have tried it, and like it as well as or better than a double brake bar. When going down on two ropes, use two Sticht's on one carabiner. But be sure to tie a figure-eight loop knot in each of the rope ends separately before throwing them down. Do not tie them together, to avoid a jam due to twisting.

The friction given by the Sticht changes with the size, stiffness, and type (twisted vs. braided) of rope. Do any of our readers want to make a series of tests for publication? In any case, each person should practice with his own rope before going out in the mountains.

Effect of a Sticht on Strength of The Rope

We have not found any appreciable weakening of nylon rope by four falls on the same portion of rope. The rope does stretch, but shrinks back nearly all the way in a week or two.

The Sticht should not be used repeatedly at the same spot on manila rope. The manila abrades noticeably after 4 falls.

CRAMPON CLOGGING

"Too soon old; too late smart." For 34 years, I have owned and used crampons regularly. For 34 years, I have had trouble in certain snow conditions with clogging of the crampons with snow. Why? Because I never bothered to lift up another person's boot with clogged crampon to see why.

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Issue 2 - Page 1
February 1970

The response to Issue 1 has been wonderful. Thanks for your letters. More reports from you on broken axes, testing techniques, poor equipment, etc. will be welcome.

ICE AXE DESIGN

We want to make a few comments about ice axe design. Since there are many opinions on this subject, we will also print your comments if you wish.

Carabiner Hole One wooden axe in crevasse rescue use broke off at the lower end of the tangs when the pull came on the carabiner hole. If you use the hole, better reinforce the shaft with fiberglass first. Ref: Summit June '69, Letters.

Curvature of the Adze When the adze is too strongly curved downward, there is a kick reaction on the hand when chopping. Sometimes the adze bends even farther due to this kick. It is better, we think, to have a curvature which corresponds to the swinging radius, about 26".

Curvature of the Pick We think the curvature of the pick should correspond with the radius of the strike, and that a 26" radius is about right. Some picks point straight out at 90°, which makes them insecure as a hand-hold and gives the hand a kick when chopping.

Thinness of the Pick When the pick is thin, say .140, you won't find it as easy to stop by self-arrest in medium snow. .250" is better.

Height of the Pick When the pick blade is high, say 1", the pick tends to rotate out of the snow in self-arrest.

Teeth on the Pick Teeth, to be effective, should be about .060" deep, and should extend to the end of the pick, without any flat. A flat at the end tends to nullify the gripping power of the teeth. When properly designed, teeth help greatly to keep the pick in the snow when using it as a dagger during front-pointing, and when driving it in above you for a hand hold. One disadvantage of such teeth is that the pick tends to stick in the ice when chopping steps with the pick. Personally, I use the adze for chopping steps, for better precision.

Spike Some axes have a reduced-diameter tang on the spike, which breaks off under low load. This can usually be seen by careful examination.

Shoulder at the Spike Most axes have a pronounced shoulder at the upper end of the exposed portion of the spike, which makes driving the axe into hard snow more difficult.

Heat Treatment Several manufacturers harden only a few inches of the adze and pick ends, leaving the middle metal soft, 15,000 to 30,000 psi. You can test this on your axe by touch-stroking the metal at various points with a fine-tooth file. If the metal is soft in the middle, you can bend the adze to the curve you like by clamping it in a vise with fitted wooden jaws and leaning on both the pick and the handle equally. A short piece of pipe on the pick helps as a lever.

But don't try this on the MSR axe. The MSR axe head is heat treated throughout to 150,000 psi. The metal still has about 6% elongation, but you would find it tough to bend.

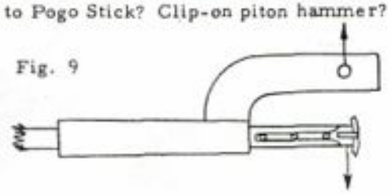
Dismountable Shaft The idea is good, but the strength of available models is low, 150 pounds in Test One. Some day we'll make an axe that has strong joints which can be changed in the field from, say 24" long to 35" long, by adding an extension tube. Maybe we will have a rotatable adze for wood chopping, and a screw-on snow shovel. What else? Internal spring for conversion to Pogo Stick? Clip-on piton hammer?

More on TESTS for ICE AXES

On page 2, we described the test method in field-use terms. There are actually four laboratory tests which we use.

Test One The shaft of the axe is supported in a pair of rope loops, 22" (56 cm.) apart. A loop of webbing hangs from the middle, and is

Fig. 9



Test One (Cont.) used to pull down. The breaking force is measured in the rope loop nearest the head, to correspond with the belaying rope shown in Fig. 1.

Test Two The head half of the broken shaft is then pushed into a padded tubular fixture, to the end of the tangs, leaving all of the metal portion hanging out. A rope loop is placed over the shaft as near as possible to the head, and the head is then pulled off. See Fig. 9.

Test Three The spike is placed in a small tubular socket, and force is applied sideways at the head.

Test Four The metal ferrule over the shank of the spike is placed in another socket and the sideways load is again applied to the head.

TEST RESULTS ON SPECIFIC AXES

Grivel, hickory, good straight grain, 21 per inch, excellent condition. Test One: 250 pounds, green stick break, with some strength still remaining. Two: 500 pounds. Three: 50 pounds, 75° bend, no break. Four: 65 pounds.
This axe donated for test by Bruce Anderson, Altadena, California.

Simond Super D, ash, good straight grain, 11 per inch, used but in good condition. One: 146 pounds, clean complete break, long diagonal, which is typical of ash. Two: no test, because break extended into the tangs. Three: instead of bending the spike, the ferrule broke off at 30 pounds. Four: broke in Test Three.
This axe donated for test by John MacDaniels, Portland, Oregon.

Hope Alpinist, ash (?), good straight grain, 9 per inch, new. One: 150 pounds, long diagonal break. Two: 500 pounds. Three: 30 pounds, spike broke off. Four: 44 pounds.

Stubai Wallner, ash, good straight grain, 9 per inch, new. One: 150 pounds. Two: broke in crevasse rescue practice under weight of climber weighing 180 pounds. He had lowered himself smoothly, and did not fall. Three: 50 pounds. Four: 40 pounds.

Ralling Akademiker, ash, good straight grain, 9 per inch, new. One: 200 pounds, very long diagonal. Two: no test, because diagonal break extended into the tangs. Three: 30 pounds. Four: 44 pounds.

Grivel, laminated, 40 laminations per inch (called Rexilon), new. One: 250 pounds, swift complete break. Two: 500 pounds. Three: 44 pounds. Four: 62 pounds.

MSR, aluminum-fiberglass, new. One: 325 pounds, fiberglass broke, aluminum only bent, much strength remaining. Two: 500 pounds, same comment. Three: 90 pounds. Four: The taper is swaged on the aluminum tubing of the shaft itself, hence no separate ferrule. In the ferrule-test fixture, the tubing bent at 100 pounds.

Comment on WOODEN SHAFTS

The MSR staff has had two wooden-shafted axes break in actual use and about 24 in testing, has many written reports from others of the breaking of ice axes in actual use, and has seen hundreds of broken axes sent in for repair. The conclusion for us is inescapable: WOODEN ICE AXE SHAFTS IN GENERAL ARE NOT UNIFORMLY STRONG ENOUGH FOR RELIABILITY IN ARRESTING FALLS.

When we lead climbs, we take at least five metal-fiberglass shafted axes to lend to other members of the party to be sure at least our belayer will have a good axe, and that reliable axes will be available if rescue is required.

Your own axe can easily be made much stronger and much more reliable by covering the shaft with fiberglass. See page 3 for a description of the kit.

MSR ICE AXE -- Catalog Information

Stainless steel (Type 410) head, heat treated to 150,000 psi, 6% elongation. Radius 26" across the top of the pick and adze to correspond with the swinging radius when chopping steps. The adze is moderately dished sideways, 8" radius. The standard pick has six teeth starting at the point. We will supply picks without teeth on special order Or, you can fill the teeth with two-part epoxy cement and remove it with a knife later if desired. Head length, 11". Fig. 10. The head has a plug tang which fits tightly into the tubing, and is held by press-fit, epoxy, and a 3/16" stainless steel rivet. High-tensile (but not brittle) aluminum alloy tubing shaft covered with fiberglass for added strength, good grip, and insulation. The fiberglass is durable and will last a long time; when eventually worn out, it is replaceable, using the kit, page 3. The spike end of the shaft is swaged down, to a fairly long taper, to avoid having a joint there, and to make driving into hard snow easier. Fig. 11. The shoulder at the spike is small for the same purpose. The spike is sturdy, twice as strong as most spikes. The steel spike is not maximum hardness,

CRAMPON CLOGGING (Cont.)

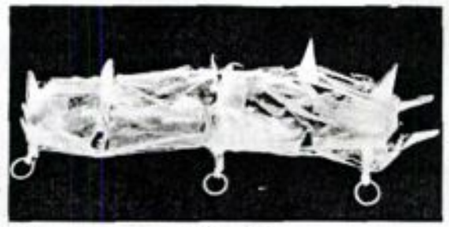


Fig. 20

Two weeks ago we climbed on Mt. St. Helens. At 7500 feet, I noticed that my crampons were clogging only occasionally, but those of my companions were clogging constantly. I raised the question and several companions obligingly sat down in the snow and held their boots up for inspection. The answer was immediately obvious. Snow had locked around the metal cross-bars of the crampon and in the cleats of the Vibram sole. It packed in just as a snowball packs hard in the hands with pressure.

The reason why mine didn't clog so much was also apparent. I was wearing nylon boot bags for warmth. The boot bags prevented snow from getting into the rubber cleats. But they did clog sometimes, and when they did we could see locking of snow around the cross and long bars of the crampon. Obviously boot bags were a help, but it took me until next morning to figure out the complete solution to the problem: wrap the crampon in plastic sheet. Fig. 20. This prevents the snow from getting either around behind the metal bars or into the rubber cleats.

I could hardly wait for the weekend to try out the theory. At Snoqualmie Pass, the idea worked perfectly. For four hours, I climbed with plastic wrapped around one crampon and nothing on the other. The plastic-covered one never clogged even once. The regular crampon clogged every minute or two.

The temperature was a little above freezing, excellent for making snowballs. We will report on tests in other snow next issue.

We have tried PE (polyethylene, regular plastic bag stock) and PVC (polyvinyl chloride, cold weather type). The PVC sheet is far more durable, and should last a whole season. The PE tended to crack at temperatures below freezing. Thick sheet is better, say .004".

Non-clogging PVC plastic for crampons, .004" x 10" x 13.5" Item 83 3 pair $0.70
6 pair $1.25

Why buy more than one pair? To give the other pairs to your rope companions, of course. Your safety may depend on their crampon security.

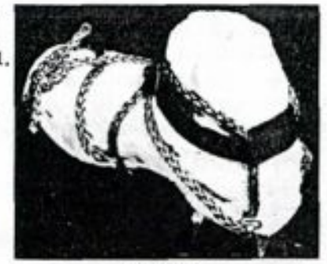


Fig. 21

Another observation: The crampon without plastic kept separating away at the heel. Snow was packing between the heel and the crampon bars, and building up in thickness until the heel arms were able to slip under the heel. Several remedies: tighten the harness cords over the instep and tie a square knot there to prevent slack from the toe portion from working back to the heel. Another, use plastic sheet wrapped around the crampons. This separation did not occur with the crampon which was wrapped. Another, use a collar around the ankle to cause the attachment rope to exert force straight up. Fig. 21. The picture shows a webbing collar with slide buckle. You can make your own from tied cord, but if you want to buy some like mine, order Item 82 (per pair) $1.95

CRAMPONS -- SALEWA

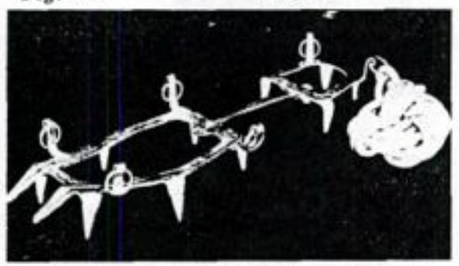


Fig. 22

We are now selling the new model of Salewa crampons. The big advantage is that these crampons are adjustable both for length and width. A well-fitting crampon is a joy to use compared with one which is loose. Another advantage is that they are reasonable in price for an adjustable. Further, they have 12 points, which are helpful on steep slopes. Fig. 22. Note that there are four points which are crosswise, which helps prevent slipping when pointing the feet straight down the slope.

Plated to resist rusting. Special steel, hardened but not brittle. Lightweight, only 23 oz. per pair. Easy to adjust, wrench provided. We think you will like them. Send outline of boot for selection of size. Shipping weight 2 lb. Item 84 $16.15

Crampon Cord

Non-stretching polypropylene, hollow braid which flattens against the shoe to 5/16" wide. With lacing instructions. Item 85 (pair) $0.85

Crampon Protector, 12-point rubber Item 86 (pair) $1.50

Zippers (Cont.)

corrodes. Two sliders are provided on each zipper for convenience in opening the part which is wanted. The pull tabs are large and semi-swivel for ease of operating with gloves.

Summit Pack

Extra shoulder straps are sewed to the bag to permit the bag alone to be used for a summit pack. Fig. 25. The bag is easily removed from the frame by pulling the pins. The load-compressor straps across the back are then tightened to make the bag compact. Safety Note: You can put your feet in the bag for warmth if you are stopped overnight.

Special Note: We believe that all summit packs should contain a Storm Shelter (Plastic Tube Tent) such as made by the Tacoma Mountain Rescue Council, our Item 46, page 2-3, $1.00. For 5 ounces, they are marvelous for warmth. Worth putting on during lunch stops in bad weather to stop wind chill.

MSR Pack, including Frame and Bag. Back cords are strung and ready to go. Net weight only 4 lb. 1 oz.
Shipping weight 6 lb. Item 90-S $58.50
Same, except cords are not strung. With cord and instructions. Item 90-U $52.50

Hip Belt

The hip belt concept is excellent for avoiding aching back and shoulders. Our design has a 2" webbing belt that goes around the waist, and is cone-shaped for comfort. The load straps attach at each hip and extend down to the bottom bar of the frame. This arrangement gives the least constriction of the tummy. Both the 2" belt and load strap have quick-adjustment buckles. Ethafoam pads provide cushion over the hips. We strongly recommend this item. Picture in next issue. Can be used with other pack frames also. Net weight 7 oz. Item 89 $4.75

MSR 10.5 mm ROPE, see page 4

The braid construction used on this rope is called "tugboat braid". Tug boats require heavy lines which have good stretch, high strength, and flexibility. Previous ropes were good for stretch and strength, but very stiff to handle. This new construction was developed to improve the flexibility and easy-handling characteristic while retaining the strength and elasticity. The result was highly successful. We have applied this same construction to our mountain climbing rope.

However, the "tugboat" construction includes fairly long stitches, as compared to European climbing ropes. The initial wear produces a long fuzz that was disturbing to the tugboat crew. When the first trial rope of the new construction had been in tug service only one month, a pronounced fuzz had developed, and the captain predicted the rope wouldn't last three months. Instead, the rope lasted 18 months. The explanation is that the initial fuzz of the tugboat braid serves as a mantle over the underlying fibers and protects them from further wear.

This principle is recognized in the Edelrid rope booklet, page 20, as follows: Resistance to Abrasion "It has always been a problem to find a suitable method for abrasion tests. Up to this date a reproducible test method has not been found. All types of mountaineering ropes are subject to wear and tear, which, however, only affects the sheath of the Edelrid mountaineering rope, while the mainly load-bearing core remains undamaged. After a certain period of use the sheath shows a velvety "fur" which not only increases the good grip but also protects the threads of the undamaged braids lying underneath."

The way to judge when the MSR kernmantel (braid-on-braid) rope is worn out is to examine the strands with a 10-power magnifier, and estimate the proportion of filaments which are cut vs. those which are intact. When 60% of the filaments are cut it is time to get a new rope. At that time, the core still has a strength of 2500 pounds and the cover, say 500 pounds more. Reduced to 60% by the figure-eight loop knots, the net usable strength will still be in the range of 1800 pounds.

If you do not have a magnifier, melt back the fuzz over a 4" long portion by passing the rope over a candle flame. You can tell immediately whether the underlying rope is still sound and suitable for continued use. Since the long fuzz is necessary for long life, you should not melt down the fuzz over the entire rope.

We do suggest washing the rope whenever it gets dirty. The dirt comes out best when the temperature is held under 150°F. Reshrinking the rope for restoration of energy-absorbing properties is best at temperatures nearer boiling. You can also re-dye the rope to make it pretty again. "Rit" dye requires at least 150°F to "set" the dye.

In further support of the above, we quote from the Du Pont nylon rope bulletin X 184, page 3 as follows: "A protective shield of broken fibers forms on the surface of nylon rope during abrasion and prevents damage to the sub-surface fibers." The logic is: nylon is much more resistant to cutting when not under tension, and the fuzz is not under tension.

MSR ICE AXE

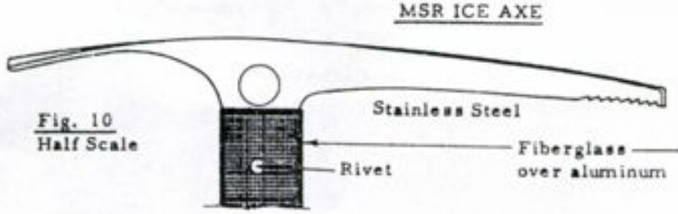


Fig. 10
Half Scale

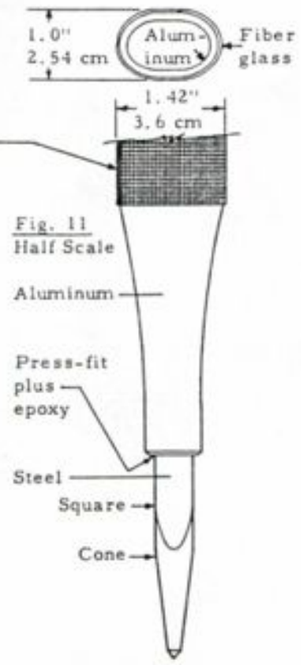


Fig. 11
Half Scale

and thus does not skid readily on rock. It is not sharp as sold, but can be ground by you to any sharpness you want.

The standard shaft strength is 325 pounds, as measured in Test One. Even at this load, the shaft does not break; it only bends, due to the ductility of the aluminum. If bent, you would still be able to use it for self-arrest and chopping steps.

Bright colors: orange, red, yellow, green, blue. Orange in stock. Allow one week for other colors. Lengths: 22", 26", 31.5", 32.5", 33.5", 34.5", 35.5", 36.5". Wt. 2 pounds for 31.5" (80 cm) length. Glide ring and wrist loop included. Item 15 $37.50

We regret that the price is so high, but, honest, we don't make any profit even so. The cost of hand labor for finishing the heads is too high in the USA: we will try to get carbon steel heads made abroad, for next year.

AV-A-LANCHE!

Snow time is here, and the time to be wary of avalanches. Dr. E. R. LaChapelle has written an excellent 47-page small book entitled "The ABC of Avalanche Safety". He describes: snow crystals; formation, mechanical properties, and thermal properties of the snow cover; avalanche characteristics, including loose snow and slab, in relation to terrain. He also gives warning signs of winter avalanche danger and tells why hard slab avalanches are the most dangerous and unpredictable in behavior. He describes wet snow avalanches, climax avalanches (which can be very large and destructive) and lists avalanche dangers in summer mountaineering. The second part of the book covers safety rules and discusses the following 10 steps to rescue: Don't panic; mark last-seen point; quick search; search surface below last-seen point; sole survivor; thorough search; probing; send for help; going for help; first aid. He concludes the book with a discussion of conduct of organized rescue action and a number of case histories. For anyone traveling in steep snow country, this book is a must. Dr. LaChapelle has a substantial background for this work: as snow ranger at Alta, Utah; Professor of Atmospheric Sciences; and glaciologist. Item 50 $1.00

MRC Storm Shelter. 80" circumference x 96" long. Plastic tube to give you shelter from the elements. Reduces wind chilling and the loss of body heat in wet weather. Yellow color increases visibility from the air. Also, the color is partly opaque to infrared for better heat conservation, as compared to transparent film. In actual test, outside air was 13°F with 5 mph wind; inside the tube, the air was 40°F, and, of course, there was no wind. With occasional exercise, the person making the test, lightly-clad otherwise, could have survived the night. Should be in every summit pack. Can also be used over a sleeping bag for extra warmth. Condensation inside is not bothersome, provided you don't breathe inside the tube. Includes whistle and matches. Weight 5 oz. Item 46 $1.00

MRC Storm Kit. Contains plastic tube shelter, survival information, and matches (same as Item 46), and, in addition, candle, sugar, salt, tea, bouillon, wire, signal mirror, and 12 fluid ounces metal cooking can. Weight complete 11 oz. Item 45 $2.00

Items 45 and 46 are designed and assembled by Mountain Rescue, Tacoma Unit, which is a volunteer organization dedicated to saving lives through rescue and mountain safety education. Your purchase of these shelters finances their operation, and, hopefully, decreases the number of times they have to go out on rescue.

It appears there were as many mountain deaths last year from hypothermia (lowered body temperature, sometimes called

exposure) as from direct injury. Special discount of 15% in lots of 20 or more, any mix of Items 45 and 46, for the purpose of encouraging youth groups to have them. Anyone can get the discount: give them to your friends.

Hypothermia, Killer of The Unprepared, by Theodore G. Lathrop, M.D. A classic on death due to body cooling. 13-page booklet. Item 44 $ .75

Frostbite, what is it, how to prevent it, and emergency treatment, by Bradford Washburn. 25-page booklet. Item 48 $1.00

CARABINERS -- GOOD

Our policy on carabiners will be to stock all light-alloy models that are marked with a strength rating, which have no design defect.

Bonaiti (Cassin model). D-shape aluminum alloy, made from 12 mm rod, marked 2200 kg (4850 pounds) MSR test 5900 pounds major axis, 2600 pounds gate open, 2000 pounds minor axis. Each piece is tested during manufacture to 80% of rating. Wt. 2.7 oz. Item 31 $2.50

Bonaiti (Cassin model), locking gate, same as Item 31 except 11 mm rod, 1800 kg (3960 pounds). MSR test 4800 pounds major, 1600 pounds open, 1600 pounds minor. The threads on the gate are raised, and are over solid metal (not drilled out). In this way, the strength is not reduced. This is good design. Wt. 2.2 oz. Item 32 $2.75

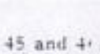
Bonaiti 13 mm rod, coming Meets UIAA specification To be reported next issue.

Stubai 1800 D-shape aluminum alloy. 11 mm rod, marked 1800 kg (3960 pounds), MSR test 5400 pounds. Similar in shape to Item 31. Available end March. Wt. 2.2 oz. Item 77 $2.50

Stubai 2200 Forged aluminum alloy. Meets UIAA specifications, rated 2200 kg (4850 pounds), MSR test 5900 pounds. 3300 pounds open, 1700 pounds minor. Available end March. Wt. 2.6 oz. Item 78 $3.75

Salewa. New model coming, to be reported next issue.

Brake Bar, MSR, designed for Bonaiti Items 31 and 32, Bedayn, REI oval and D, CMI oval, Eiger oval, Stubai 1800, and Army carabiners, for easy rappeling. The hole is large enough to permit the bar to go around the corner of the carabiner to make use easier and more certain. The metal at the open end can be bent (gently) to adjust for a snap fit, if desired. Two of these bars can be used, facing oppositely, on one carabiner for more friction on a single rope. Test over 3000 pounds. Wt. 0.7 oz. Item 27-T $1.95



We realize that our prices are the same as elsewhere, but we hope you will buy at least a few carabiners from us to help pay for the test program. A full report on many models will be in one of the next issues.

Rescue Pulley Wheel, MSR, Red nylon wheel for use on Bonaiti D, Items 31 and 32, and Stubai 1800, Item 77
Non-binding.
Does not break at 4000 pounds.
Item 28 Wt. 0.9 oz. $1.45

Rescue Pulley, Magnusson type.
Nylon wheel with side plates.
3900 pound test.
Can be used with ratchet knot.
Item 58 Wt. 1.3 oz. $1.95

Descending Rings, steel, 1.3" inside diameter, 1/4" rod, logging chain quality welding, 5500 pounds test, chrome finish. Also useful for tied body harnesses. Wt. 1.1 oz Item 35 $ .25

CARABINERS -- UNDESIRABLE

We have tested many dozens of carabiners, looking particularly for dangerous ones. We found some:

Kamet, which has only slanted faces at the gate, Fig. 14. The gate of this carabiner pulls out in minor axis loading at only 275 pounds! Several climbers have reported narrow escapes from serious accidents when this has happened in use. Reference: National Speleological Society News, Sept 1969. (There are other carabiners that have only slanted faces at the gate. Watch out for them; they are to be used only for decoration to impress the tourists.) The locking type is little better. The threads are cut so deep in the gate that the gate breaks in the center at only 550 pounds.

Fig. 14

CARABINERS -- UNDESIRABLE (Cont.)

Recreational Equipment Orange Oval Safety model. Several thousand were sold in 1968 and 1969; sale was stopped in June 1969. The threads are cut so deep that there is little metal holding the pin. Two we tested broke at 1550 and 1600 pounds, and one tested by Seevers & Horn (Summit June 1969) broke at 1300 pounds. Others broke at loads up to 2000 pounds, but this won't help you if you have one of the weaker ones.

Unmarked Steel, dark gray-brown color, 89¢ in the 1969 REI catalog. Broke at 1300 to 1700 pounds. There is a hidden design defect in the hinge.

STICHT BELAY PLATE. A simple belay system invented by Fritz Sticht and made by Salewa. Much better belaying power than a hip belay. A loop of the climbing rope is pushed through the opening in the plate. The loop is then engaged by a carabiner which is either attached to the belayer's anchor or to his waist if he is secure. Passing the rope out or in is normal for the motions of a hip belay, except easier. If the climber falls, the belayer pulls back with his hand on the free end of the rope, the plate snaps close to the carabiner, and friction on the rope is automatic, controlled by the friction of your gloved hand. This size for 11 mm and 7/16" rope. With instruction sheet. Wt. 1.5 oz.

Should have gloves.

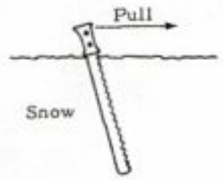
Item 69 $1.75

Instruction Sheet only, in german with english translation. Item 74 $ .25

We have been disillusioned about the holding power of the sitting hip belay during instrumented drop tests. Practice sessions using long stretchy ropes, short falls, and heavy back pads may have misled you as to your ability to hold a fall with a hip belay. We recommend you buy a Sticht and actually practice holding falls of truck tires or concrete blocks. The next issue will be on belaying techniques around the world.

More on IGLOOS

When cutting blocks, the igloo tool, Page 4, is not used as a saw except to get through icy layers. Instead, the blade is plunged into the snow and the handle is pulled parallel to the surface of the snow. See Fig. 16.



The three-block long-house shown in Fig. 17 is fast for a single shelter, and permits you to stretch out and sit up. Being cramped in a snow house which is too small is no fun. Start by cutting out blocks for the head wall to make a hole 24 inches deep, 30 inches wide. Then cut blocks from behind you for the sidewalls and roof. Nearly all the blocks you need will come from the trench thus formed. Note that the three blocks do not need to be set simultaneously. After the head wall is built up as a starter, the sidewall blocks can be set in place one at a time, at the angle shown, by contacting the block to the head wall and packing the vertical joint with snow as a mortar. The block will stay in place if held steady a few seconds. The top block is then lowered gently onto the slant blocks, and the upper joints are pressed lightly with snow. Make the top block long enough to overhang toward you a few inches, and then the next slant blocks can lean on it. After completion, the flat roof is made rounded by patting on more snow for arch stability. Side holes at floor level can be made for pack storage.

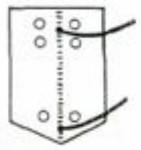
In very dry powder snow, someone told us to pile up a mound of snow six feet in diameter and six feet high. After waiting 20 minutes, the snow particles will have cohered to permit digging in and opening up a room. We haven't tried this; how well does it work?

When the snow is very thin, roll up large snow-balls and slice them to make blocks.

Don't forget the air vent in the roof. If snow is falling, check to be sure it stays open. An accumulation of 4% CO_2 causes headache, dizziness and vomiting. More causes convulsions.

More on SNOW FLUKES

We have now added four more holes, two near the top and two near the bottom for attaching the fluke to an ice axe for use as a shovel. Attachment is by means of hose clamps or multiple turns of cord. Works quite well. See page 3.



Also, Bill Leavens, Seattle, has suggested leaving the fluke on the axe while travelling, for quick driving into the snow for belay. The climbing rope passes through a carabiner

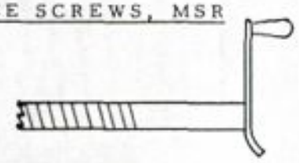
More on SNOW FLUKES (Cont.)

on the cable of the fluke. More on this technique after testing it is summer.

Hose Clamps with thumb screw, stainless steel Item 76 $1.50 pr.

Some persons have asked why the fluke has the cables coming out the convex side instead of the concave side. The reason is flight stability, same as with a kite. If the fluke tips to one side, the projected area on that side is less, the force on that side is less, and the fluke automatically rights itself.

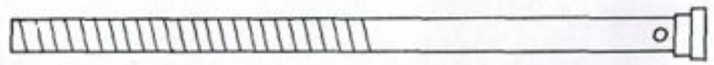
ICE SCREWS, MSR



Tubular aluminum with advanced features. Cutting teeth have ice-chip clearance passages, similar to machine tool cutters. Bore of the tube shank is larger than the ice core which is cut, making removal of core easier. Handle is welded on, for quick and easy driving. Handle has 3 holes for aid carabiners. Handle is also used as a scraper to remove surface snow. Excellent for crevasse-wall climbing, solo. Using three screws, lower rope control not required. Larger diameter for better holding power over a broader range of ice and snow hardness. Test in laboratory fixture, 3000 pounds. We used them last summer, with several people hanging on them, but got only one number with a dynamometer. The 1.2" x 14" screw held 600 pounds in firm corn-snow in June on a cool day. More numbers as soon as we can.

7/8" x 10"	Wt. 7 oz.	Item 16	$8.50
1.2" x 14"	Wt. 10 oz.	Item 17	$8.50

SNOW PICKETS, MSR.



We started experimenting last summer with simple channel and tubular snow pickets but found that they slipped out too easily if the direction of pull got above 90°. Then we found that a buttress thread, 3 per inch, on a 1.2" diameter tube gave good freedom for pounding in but high resistance to pulling out. To remove, you put a carabiner in the cross-hole, put one finger in the free end of the carabiner, and spin the picket counter-clockwise. The picket then unscrews itself from the snow. The tube is high-tensile aluminum tubing; the driving head is steel. Bore of the tube is larger than the snow core which is formed, making removal easier. Strength of carabiner hole and adjacent tubing in laboratory fixture, 3000 pounds. Holding power in snow not yet determined.

1.2" x 20"	Wt. 10 oz.	Item	$7.75
1.2" x 31"	Wt. 16 oz.	Item	$8.00

EDMONT ROCK GLOVES. Light weight, very flexible. Vinyl impregnated for an excellent grip, even on clean, wet rock. Slightly porous for coolness. Saves many of the cuts and abrasions in general rock climbing. Also good on snow on warm days. Sturdy enough to save the hands when holding a fall, if taken through other friction. A pair lasts about three long days of climbing.

Medium, large, extra large Item 62 $1.30

SLING ROPE SET. Dacron braid on polypropylene core 1/4" diameter. One 9-1/2 ft. and one 10-1/2 ft. length. Excellent for Prusik and Ascender slings because of low stretch and high strength. 1700 lbs. test, P-H knots. Ends are melted. Item 1 $2.40

SLING ROPE. Same as Item 1, except ends must be taped and well melted by user over candle flame to secure cover to core. Any length. Item 2 (per ft.) $ .12

MSR BODY HARNESSES. A fall on a bowline-on-coil can fracture ribs and cause other body damage. The MSR harness picks up the impact on five major body points with 2" wide polypropylene webbing throughout, and gives you a better chance to survive. This harness design has been tested successfully on a 220 lb. torso dummy, and has survived 20 falls with peak forces up to 2700 lbs. Full strength stitching with Dacron thread.

The two parts of the harness can be closed with a strong locking-gate carabiner, such as Item 32, or by tying the climbing rope through both rings, using a high-security knot. *Warning: do not allow climbing rope to run under high load across the harness.* Use a brake bar for rappelling and a Sticht Belay Plate for belaying to take the high

MSR BODY HARNESSES (Cont.) load off the body. More about the weld-abrade phenomena in next issue. Seat Harness only. Specify hip measurement. Item 23-1 $4.95
Chest Harness only. Chest measurement under armpits. Item 23-2 $4.95

TIED HARNESSES. The sewed harnesses above are a bit more comfortable but tied harnesses are quite good and less expensive. The kit includes one piece of webbing for the chest, one for the seat, and two metal rings, with instructions for tying. A lock-gate carabiner, minimum 3000 lbs. test, such as Item 32, is required but not included. Specify large or medium.

Black, 2000 lb. test webbing	Item 24-B	$2.95
Red, 3000 lb. test webbing	Item 24-R	3.70
Lock-gate carabiner, Bonaiti	Item 32	2.75

WEBBING. 2" wide.

1 oz./yard, black, polypro, 2000 pound test	Item 42	per ft.	$ .11
1.5 oz./yard, red, polypro, 3000 pound test	Item 43	per ft.	.14
2 oz./yard, green, nylon, 3500 pound test	Item 75	per ft.	.16

NEXT ISSUES

Atmosphere in Tents and Igloos. Warnings are often given about ventilation. Have you noticed a correlation between cooking in a tent at night with headache, excessive fatigue, mountain sickness or pulmonary edema the next day? We have purchased a gas analyzer and will get some data on tent and igloo atmospheres (O_2, CO_2 and CO). Doctors and others, please help on this question.

Belaying. One of the pleasant parts of this job is the friendly and informative letters which have come in. Many have talked about belaying. In the next issue, we will cover different belaying techniques from around the world. Here in the Northwest, the sitting hip belay is considered the ultimate. But after holding 200 practice falls, I doubt it. The testing of that system here has been artificially too easy by having 90 feet of rope in the system when holding a 6-foot fall.

Harnesses. If you tie in to a rope with a waist coil, you are inviting disaster if you fall. There are much better ways to attach your body to a rope. Next issue will show the tied harness, Item 24, which you can make quickly for only the cost of the materials.

Nylon for Climbing Ropes. A semi-technical discussion, with load/elongation curves for six popular climbing ropes.

MSR CABLED CHOCKS. Cabled Chocks increase reliability of anchors in vertical cracks greatly. The chocks are solid-cast aluminum. The cables are joined by a special longer (1.5") sleeve (aluminum) which is swaged so that the cables cannot be pulled out. The cable inside the nut is cemented in place, permitting push for removal. Bi-chocks test over 4000 lbs. The single chock tests about 3000 lbs.

The numbers are in tenths of an inch: for example, 4 x 9 measures four-tenths inch wide by nine-tenths inch long at the top end. Taper is 20° included angle for good grip without excessive jamming.

Size 4, Single Chock,	Item 6	$1.50	6 x 12, Bi-Chock	Item 8	$2.75
4 x 9, Bi-Chock	Item 7	2.75	16 x 20, Bi-Chock	Item 9	2.75
			22 x 26 x 30, Tri-Chock	Item 10	4.50

TEFLPAD. For skiing spiral fracture prevention. Ice sometimes freezes to the ski, making ice cleats corresponding to the grooves on the sole of the boot, thus preventing the boot from twisting out. The Teflpad, a self-adhesive film of Teflon, is adhered, slippery side up, to the ski under the sole of the boot. Any ice which forms cannot stick to the Teflon, thus eliminating interference with normal action of the toe piece. (Will not last long if you have metal plates on the bottom of your boots.)
Reference: Dr. John Outwater, University of Vermont. Item 49 $1.35

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