



# **Mountaineering Manual**

Troop 45, Daniel Webster Council, BSA

Hanover, NH

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## **INTRODUCTION**

Troop 45 offers an outdoor adventure program in mountaineering intended to help you learn the sport and enjoy its many rewards safely. Since mountaineering practice varies widely among different climbing areas, and among different climbers, there really is no single standard method or body of technique. We have therefore adopted a unified and comprehensive approach to basic mountaineering skills that we believe meets the particular needs of inexperienced Scouts, but which can also serve as a firm foundation for the Scout who wishes to develop advanced skills, and pursue advanced challenges. The techniques we teach are somewhat conservative, but at the same time are realistic for the true alpine environment, not just for the local practice crags. If you have some experience, particularly in institutional rock climbing courses, you may find a few surprises in the way we do things. Keep in mind that we're aiming at the broader target of alpine climbing rather than sport rock climbing. We need to work together, and we're counting on you to adopt the techniques we teach while climbing with Troop 45.

Please understand that this manual is not a text. It constitutes the technical standards Troop 45 will follow in conducting the Mountaineering Program and outlines the fundamental skills necessary to participate in mountaineering outings. It should serve you well as a summary of the material covered in training, and as a guide for study and practice, but it cannot substitute for attendance and attention at training sessions.

Mountaineering is a uniquely challenging and uniquely rewarding endeavor. The alpine environment is at once alien and beautiful, threatening and inspiring. The challenge of finding the beauty of snow, rock, ice, and sky can only be met by those prepared to travel, live, and work in an environment unsuited to support the fragile human constitution. The inspiration of the peaks, the exaltation of surmounting the steep terrain of the mountains and the steeper terrain of the mind, comes only to those prepared to explore their inner selves as well as the outer world, prepared to dig deep for inner resources of will, skill, and trust. The comradeship of the rope, the transcendent trust among ropemates that both allows and demands commitment to the enterprise, binds only those prepared to be worthy of that trust. Study, train, practice. Understand the techniques, master the skills, perfect the art. The mountains call, and you can answer, if you will Be Prepared.

## **GENERAL SAFETY RULES**

1. Think! A cliff or a steep snow slope is a dangerous place. Stay alert and think before you act.
2. Never drop or throw anything off a cliff for fun. Normally the only thing that ever gets deliberately thrown off a cliff is one end of the rope.
3. If you should accidentally drop anything off the cliff, shout "Rock!" in a loud voice. Cultivate this habit as a reflexive response. If you hear the call "Rock," take cover immediately.
4. Don't stand directly below (on the "fall line") of a climber who might accidentally drop a rock or

some item of equipment on you.

5. Wear a helmet whenever you are "roped up" or when you are on terrain where rockfall or ice fall might be a hazard.
6. Belay any climb, no matter how easy, if you are not willing to accept the consequences of a fall. (This rule will change as our experience grows.)
7. Don't bug the belayer. He has more important things to do than chat.
8. Take care of the equipment so it will take care of you.
9. A qualified leader must check every anchor and tie-in before use.

## **ROPE HANDLING**

1. Always stack the rope before using it. Pile it on the ground in a random "stack" with both ends showing. A stack will run free, preventing "rope salad." Use the stacking process as an opportunity to inspect the rope.
2. Speed Coil to throw the rope. Fold armlengths of rope back and forth across your hand. Throwing a coiled rope usually results in rope salad. A speed-coiled rope unfolds like an accordion and falls freely.
3. When throwing a rope (to set up a top belay or rappel, for example) first call "Rope!" and listen for a response. If it is clear, aim, and throw overhand, hard, at the target. Wind will blow a rope a long way in the course of a fifty-foot drop. Before throwing make sure that both you and your end of the rope are secure. Throwing away the rope is very embarrassing. Throwing yourself off the cliff is contrary to the aims of mountaineering.
4. If you hear the call "Rope" and all is clear, shout "Clear!" If you are not ready to have the rope thrown, shout "Don't throw!"
5. The easiest coil for storage and transport is the Mountaineer's Coil: kneel on one leg and coil the rope between the knee and instep of the other. The rope will coil more easily if it is stretched out or even hanging off the cliff. Take advantage of coiling as an opportunity to inspect the rope for damage. Finish off the coil by tying it off as shown in Figure 1. Fold one end of the rope back to make a loop lying on the coil. Then tightly wrap the other end back towards the loop. Insert the end through the loop and tighten the loop by pulling on its end.
6. Keep the rope clean and, when possible, dry.
7. Don't step on the rope!!!

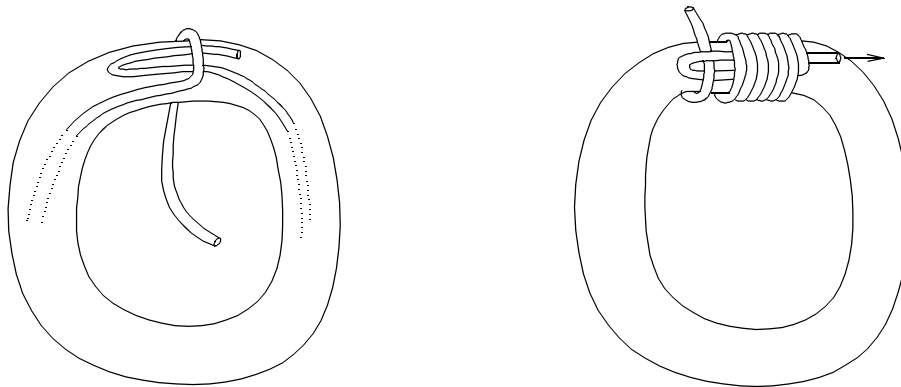


Figure 1. Tying off a coiled rope. Lay out a bight with one end of the rope, then wrap the other end tightly around the coil and the bight. Pass the free end through the bight and pull tight.

## ANCHORAGE

1. Be aware of the weld-abrasion phenomenon. Never allow nylon to slide against nylon under load. All sliding connections must be to biners.

2. Make runners from one-inch tubular webbing, tied into a loop with a ring bend (also known as a water knot or overhand bend) as shown in Figure 2. Check the knot frequently for loosening. A stronger knot for runners is the double fisherman's bend (also known as the barrel knot or grapevine knot). If you use this knot, however, consider it to be permanent. Commercial sewn runners are very strong and an excellent alternative to tied runners. Do not attempt to make or repair a sewn runner.

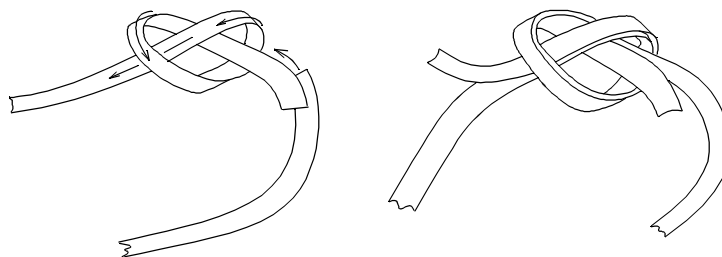


Figure 2. The Ring Bend. Tie a neat overhand knot, and then trace it around with the other end of the webbing.

2. Be aware of the possibility of a biner gate being pushed open. Place a single biner with the gate

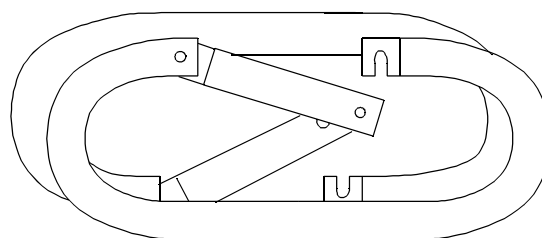


Figure 3. Carabiners with gates opposed. Note that if one biner is rotated, the hinges are at opposite ends.

"down and out." If in doubt about the security of a single biner, use two biners with gates opposed as shown in Figure 3, or use a locker.

3. Beware of cross-loaded carabiners. Carabiners are designed to withstand very large forces when loaded along the long axis. They are not nearly so strong when loaded across the short axis, or "cross-loaded."

4. The anchor for a top belay must be bombproof. If good trees (alive and well rooted) are available, attach a runner to a tree with a girth hitch (also know as a lark's head or cat's paw) as show in Figure 4. Without trees, a runner to a rock outcrop or boulder is good. Use a girth hitch, if that's practical. Use two biners, gates opposed, or a locker to carry the rope. Whenever practical (essentially always in practice situations), rig a separate backup anchor.

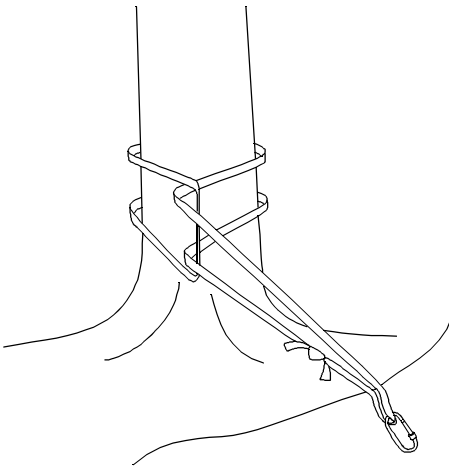


Figure 4. Tree anchor made from a double runner tied to a tree with a girth hitch. The locking carabiner hangs over the edge of the cliff.

5. Set a top anchor so that the anchor rope or webbing will not be cut on the rock. Set the biners just over the edge of the cliff to minimize friction and allow inspection from the bottom.

6. The belay anchor must also be bombproof. When belaying from the bottom at a practice cliff, a runner to a tree with a girth hitch is best. On the mountain, the best anchor is a runner attached to a rock outcrop or boulder with a girth hitch.

7. More advanced climbers will also use chocks to construct anchors on rock. To use an ice axe for an anchor, plunge the shaft all the way to the head in solid snow. In softer snow resort to a snow fluke. In harder snow, where you can't get the ice axe all the way in, construct a snow bollard.

In general we will not use pitons, bolts, active camming devices, ice pitons, or ice screws. These devices are to be used only by qualified personnel under special circumstances.

8. Construct a snow bollard by trenching the snow with the ice axe to reveal a mushroom shaped hump as shown in Figure 5. The trench must be teardrop shaped and opening downhill so that a pull on the carabiner will not pull the runner off the bollard.

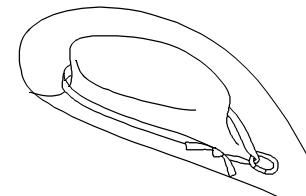


Figure 5. Snow bollard.

9. The belay anchor must either be very short or it must be effectively "aimed" so that it does not move away from the belayer under the load of a fall.

## BELAYING

1. In general, use a mechanical belay to an anchor, not to the seat harness. Our standard is the Munter hitch, shown in Figure 6, although commercial belay devices or the small end of a Figure Eight are acceptable. It's okay to clip the belay brake to your seat in order to stabilize it as long as there is a direct line from the belay device to the belay anchor. The belayer's tie-in, when required, must be made to a separate anchor. (Use your personal tie-in sling for this purpose.) Occasionally, qualified personnel may belay to the seat harness without an anchor when it is safe and expeditious to do so.

2. Hip belays are to be used only by qualified personnel under appropriate circumstances.

3. Belay to a locking carabiner placed near the anchor. If the belay anchor must be longer than a foot or so, the belay must be aimed so that a fall will not pull the belay device away from the belayer.

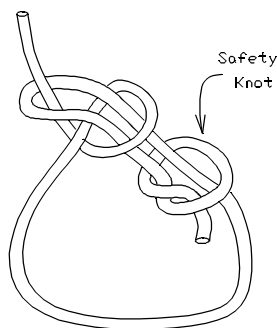


Figure 7. The Bowline. Note the use of an overhand as a safety knot. Make the loop small when tying in to a seat.

know how to tie a bowline-on-a-coil around your waist for emergency belays, but body tie-ins will not be used routinely.

6. Use the belaying signals shown in the table below.

7. When belaying, use the proper technique. Distinguish the braking hand from the feeling hand and **never let the braking hand leave the rope while the belay is on.** As shown in Figure 9, the three steps of Up Rope proceed in a distinct dactylic rhythm: ONE, two, three; ONE, two, three...

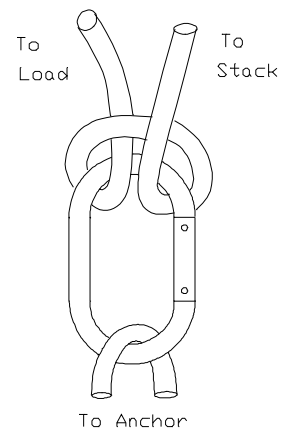


Figure 6. The Munter Hitch. The hitch will reverse on the carabiner depending on which direction the rope is moving. The position shown is for Slack.

4. When climbing, tie in directly to your seat harness, not to a carabiner. Carabiner tie-ins threaten carabiner cross-loading. A biner is also just one more unnecessary link in the belay chain. The simplest tie-in is a bowline (see Figure 7). Use a small loop to avoid weld-abrasion. A figure-eight loop is a better tie-in knot than a bowline, but more difficult to tie. Always back up your tie-in knot with an overhand safety knot.

5. When climbing, always use either a commercial seat harness or a harness tied from fourteen feet of one-inch tubular webbing as shown in Figure 8. It is useful to

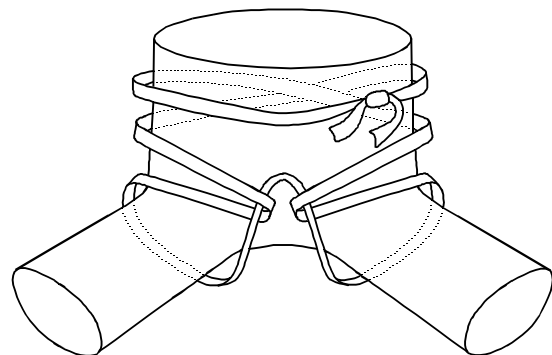


Figure 8. Seat harness tied from fourteen feet of one-inch tubular webbing. Tie with a square knot and overhand safety knots.

Counting out loud or singing a waltz helps to maintain a good rhythm while mastering the technique. Learn to belay both right-handed and left-handed. Keep your elbows in and don't let your elbows get behind your hips.

8. On technical terrain, when not climbing or belaying, you must be tied in to a secure anchor. Use a runner or your personal tie-in sling to clip to a suitable anchor.

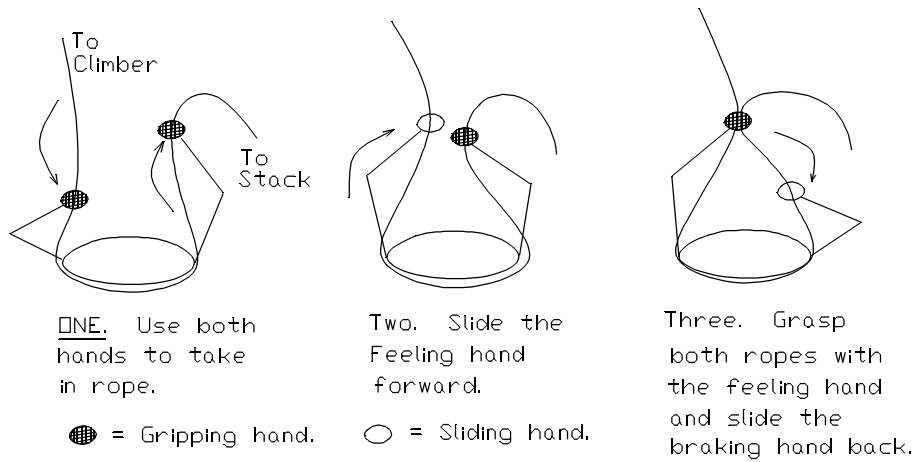


Figure 9. Belaying procedure. A hip belay is illustrated, but the procedure is the same for mechanical belays.

<b>BASIC BELAYING SIGNALS</b>		
<b>CLIMBER</b>	<b>BELAYER</b>	<b>USAGE</b>
ON BELAY		"I'm tied in and ready to climb." The climber is on belay.
	BELAY ON	"I'm ready to belay you." The belay is turned on.
		(NOTE: ON BELAY and BELAY ON may be issued in either order depending on who is ready first. Neither is a question.
CLIMBING		"I'm moving. Be prepared to adjust the rope length." Used whenever the climber first begins climbing or after any interruption in his progress. After recovery from a fall, for instance.
	CLIMB AWAY	"I understand that you are moving." Used to acknowledge CLIMBING.
FALLING		"I'm falling! Catch me!" Used whenever a fall occurs. Get in the habit of using this call. There are many mountaineering circumstances where it is not obvious that a fall is occurring.
UP ROPE		"There is too much slack in the rope. Take some in."
SLACK		"The rope is too tight. Pay some out."
THAT'S ME		"The reason the rope is tight is that you are pulling on me." Used to let the belayer know that the rope is not jammed.
OFF BELAY		"I'm secure and no longer need a belay." The climber is off belay.
	BELAY OFF	"I'm not belaying you." The belay is turned off.

Note: This is a highly simplified system of belay signals comprising only those signals that are essential to elementary climbing operations.

## RAPPELLING

1. Rappelling is not a sport; it is a method of descending a steep slope.
2. Make your rappel anchor bombproof! Construct it using the same techniques as a top-rope belay anchor. In placing the rappel anchor, consider the difficulty of beginning the rappel (high anchors are easier), and the potential for damage to the rope where it passes over the lip. We will use only double-rope rappels, both for safety and for bottom retrievability. Make sure the rope reaches the bottom!
3. Our standard rappel brake is the carabiner wrap, but personally owned commercial brakes such as the CMI-8 or the Black Diamond ATC are fine.
4. Learn the dulfersitz ("hotseat") rappel before learning to use a mechanical brake. The dulfersitz demands good technique and will teach you to respect the forces and energies involved in a rappel. It's also a handy thing to know if you ever need to rappel but you don't have a brake. The dulfer is bit tricky, so until you can do it reliably, practice it only on short slopes!
5. Wear gloves and a helmet. Tie back long hair and loose clothing, and remove any ornamentation or equipment that may get caught in the brake. Getting a finger pinched in a rappel brake hurts; getting your hair caught in the brake really interferes with progress.
6. Connect the brake to the seat harness with a locking carabiner, gate locked and up so you can see it.
7. Double check all knots and buckles before starting the rappel.
8. Whatever brake you use, pass the rope under the leg of the braking hand, and orient the braking hand "palm up, thumb down." This configuration gives you good control, prevents the braking hand from getting fouled in the brake, and gives you the ability to revert to a dulfersitz if the brake or seat should fail. (The friction of the rope against the seat harness leg loops is not dangerous.)
9. Call "On Rappel" before beginning a rappel. Call "Off Rappel" when you are free of the rope.
10. Descend smoothly, slowly, and deliberately. A bounding rappel puts tremendous strain on the system, and threatens loss of control. A fast rappel can cause the brake to overheat and damage the rope.
11. Lean back! Keep your feet wide apart and your legs nearly perpendicular to the face of the cliff. Figure 10 shows good form.

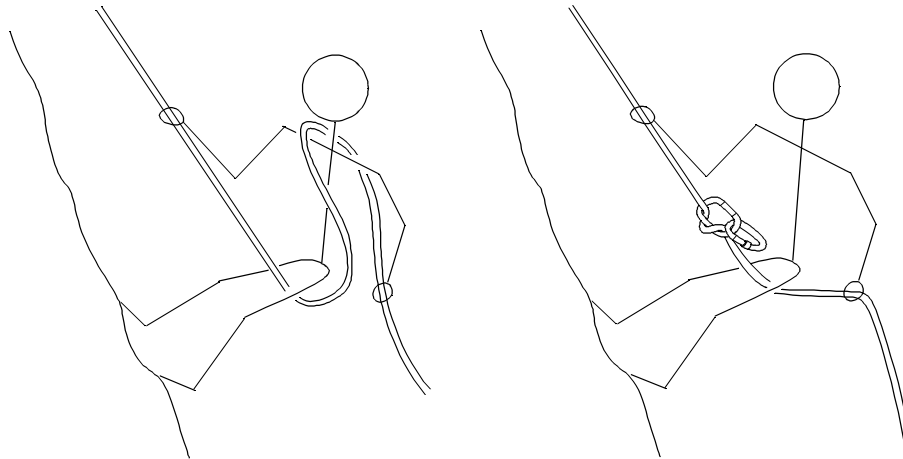


Figure 10. Rappel technique. The left figure shows the dulfersitz ("hotseat"); the right shows the carabiner wrap. Rappel on a doubled rope.

## ICE AXE USE

1. Select a modern ice axe with a metal shaft. Most wood shaft ice axes are not reliably strong enough for belaying. Use an ice axe leash, either commercially made, or made up from six feet of 9/16 inch tubular webbing. Attach the leash to the carabiner hole in the head of the axe. Figure 11 shows the parts of the axe.

2. Keep your ice axe sharp and don't forget that it's a deadly weapon. Responsible climbers do not treat their ice axes as toys, but respect them as fine tools.

3. In general, keep your ice axe leash attached to your wrist using a girth hitch. If you need your hands free while the ice axe is plunged into the snow, clip the leash to your seat harness. When you don't want your ice axe in your hands, slip the shaft diagonally between your pack and your back with the head resting on your pack straps. This carrying method is remarkably comfortable, and leaves the axe ready for quick withdrawal.

4. When traveling on snow, grasp the head of the axe with the pick pointing rearward, ready for self-arrest.

5. Execute a self-arrest by grasping the shaft with your free hand, planting the pick (never the spike) on the *uphill* side of your body, and swinging around to head-

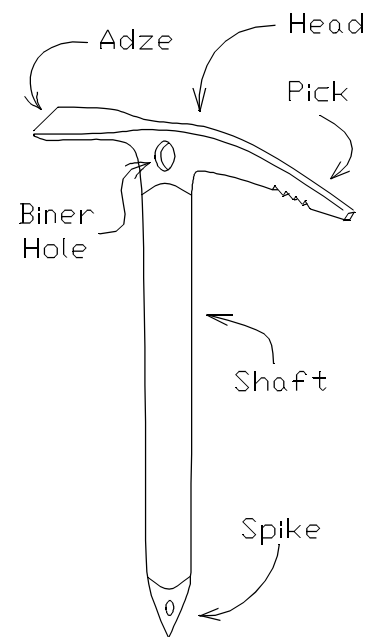


Figure 11. The ice axe. The head is forged or stamped steel and the shaft is aluminum. Total length is 65 or 70 cm.

uphill, belly down, feet together, toes out of the snow (don't snag your crampons!), and ice axe diagonally across your chest. Figure 12 shows a typical example of the maneuver. In a safe place, practice self-arresting from all falling positions: face up, face down, head up, head down, and all combinations. Hang on to the axe!

6. Self-belay with the ice axe by plunging the shaft into the snow and using the head for a handhold.

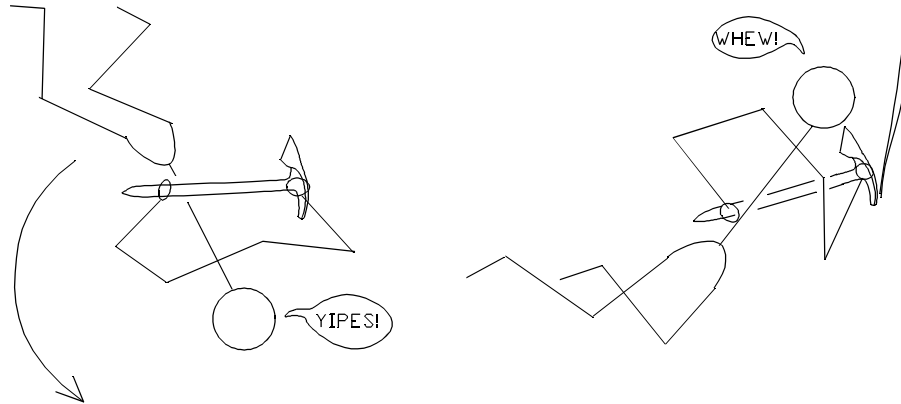


Figure 12. Self arrest. The key is to get the pick in uphill of the body so that the body swings around below the ice axe.

## TIPS ON CLIMBING TECHNIQUE

1. Stand on your feet. Most climbing, whether on rock or snow, is done "in balance," with your weight over your feet and your hands (or your ice axe) used principally to stabilize your stance and to provide support while your feet do the work of moving you up. You don't need the arms of a gorilla to be a good climber; rather, you need the skill to find holds that allow you to stay in balance while you move up. Climbing is a mind game.
2. Don't hug the rock. If the slope is anything less than dead vertical, you must keep your body away from the surface in order to remain in balance. Staying away from the rock also allows you to see the next move more easily.
3. Move one limb at a time; maintain three-point contact. On easy terrain, good moves come naturally, but on steep terrain, where you need your hands for balance and support, practice moving only one foot or one hand at a time. Make every move controlled and deliberate; don't lunge for the next hold.
4. Edge on the inside of your foot. "Edging" means stepping on tiny rock ledges. If you step on the inside of the ball of your foot, you will have better control, more strength, and you can stave off "sewing machine leg" for a longer time.

5. Stay off your knees. Knees are delicate and unstable. You can usually get your foot anywhere you can get your knee, and you'll be much better off if you do.

6. Hook your thumb over your forefinger to increase the strength of a cling hold. A cling hold is a hold with fingertips on a little ledge. An "undercling" is a cling hold on the underside of a downward-facing ledge.

7. Don't neglect downpressure. Downpressure means pushing downward (usually with the heel of your hand) to support yourself. Since downpressure holds are always below your shoulders, and are often below your knees, they aren't obvious--but they are surprisingly useful.

8. Use jams to save your strength. A jam hold is a hold in which you wedge a limb into a crack. They are often very secure because you don't have to hold your weight directly with the muscles involved. In a hand jam, you stick your hand into the crack flat, and then flex the palm to get friction. Fist jams are especially solid. Put your hand in a crack or slot, and make a fist to wedge it in place. Foot jams usually involve twisting your foot to jam it in the crack.

9. Use counterpressure to gain friction. Counterpressure means pushing (or pulling) in opposite directions at the same time. You can apply counterpressure directly, or you can use leverage to magnify the effect. For instance, if you have your hands in two big buckets, but there's just nothing for your feet, pull outward on your handholds while walking up the face with your feet using only the friction generated by leverage and counterpressure. This maneuver may get you high enough for another move. Maybe you can pull up and convert to downpressure long enough to reach up for the next handhold. Or, if you are working the edge of a ledge, you can "mantle shelf" up just like getting out of the pool. An extreme case of counterpressure is the "layback." To climb a narrow vertical crack, you put your shoulder and hip against the face with your hands pulling sideways on the near side of the crack and your feet pushing on the far side. To climb a "chimney"--a crack wide enough to get your whole body into--use the counterpressure technique called "stemming." Put your back on one wall and your feet on the other, using counterpressure between your feet and back to hold you up. Using your two hands on opposite walls for balance, put one foot on the wall your body is on, push out with both feet in counterpressure and move up the chimney a few inches. Now put your near foot back on the far wall, but higher up. Then move the lower foot back under your body, and repeat the procedure. It's all done using counterpressure to gain friction.

10. Kick steps in soft snow. When moving up soft or moderately hard snow, you can kick your foot into the surface to make steps. Those following simply climb the steps you've made. It's often wise to go up on a diagonal, both because it is easier, and because those below can stay off your fall line. As in edging, it's best to kick the step so that you end up standing on the inside of your foot.

11. Cut steps with your ice axe in hard snow or ice. (Or else get out your crampons.) Step cutting is just plain work, but it makes for a secure ascent. Plan the ladder to go on the diagonal if you can, switchbacking up the slope.

12. Walk flat-footed on crampons. Crampons work by poking their spikes into the ice or hard snow under your foot. Your natural urge to gain a purchase on the slope by "edging" pulls the spikes out and makes the stance less secure rather than more secure. The trick is to keep your feet flat against the surface. As you attempt to flat-foot steeper and steeper slopes, you will naturally turn more and more sideways to the slope--maybe even a little past sideways so your toes are actually pointing downhill. Flex those ankles! (There's actually quite a lot to this flat-footing business. The whole, subtle art of flat-footed cramponing and the ice axe work that goes with it comprises an elegant skill called "French technique" by the French and "Eckenstein technique" by the Germans.)

12. Save front points for short, steep pitches. Front points are great for avoiding step cutting and avoiding all that ankle flexing that goes along with flat-footing. But because of the amount of leverage it puts on your calf muscles, front-pointing can wear you out pretty fast. Be careful not to get overextended.

13. Descend soft snow with the "plunge step." Step onto your heel with each stride, digging it into the snow.

14. Descend hard snow by glissading. Glissading just means sliding down the slope. In a seated glissade, you control your descent with your heels and the spike of your ice axe. In a standing glissade, you ski or skate on your boot soles. Use your ice axe like a ski pole, or hold it in the ready position. Like rappelling, glissading is great fun and very efficient, but use your head. Be sure that if you should stumble, you can self-arrest within the space available.

And, finally, no matter where you are or what the climb,

15. Never give up. In the top-belayed practice environment, falling is all part of the game. But don't just fall: fall *trying*. Going all the way in practice is how you learn your capabilities and how you stretch your limits. If the only move available seems impossible, try it anyway. You might be surprised at what you can do. On the other hand, when you're out on the sharp end of the rope and falling is not such a great idea, perseverance has a different flavor. Prudence will limit your options, but whether you press on or back off, you *must* find a move you can do. Keep searching. Retreat is often the better part of valor, but don't just quit. Every problem has a solution. Find it. Don't ever give up!

## EQUIPMENT CARE

1. Inspect all software frequently. Retire it immediately (or cut out the damaged section) if you find any of the following conditions:
  - A. Cut sheath.
  - B. "Puffs" of core fiber showing through the sheath.
  - C. A thin spot.
  - D. A thick spot.
  - E. A stiff spot.
  - F. More than half of a rope's sheath fibers worn to fuzz.
  - G. Webbing with more than minimal fuzziness.
  - H. Any signs of weld-abrasion.
  - I. Rope or webbing is noticeably sun-bleached.
2. A rope should easily last about five years in the type of service we anticipate. Early retirement must be considered if the rope shows unusual signs of wear, or if it has been subjected to unusual stresses. A rope that has sustained a truly hard fall should be honorably discharged no matter what its UIAA fall rating.
3. Depending on service, webbing will be highly variable in life expectancy. Use good judgement to decide when to retire most webbing items, but replace any webbing in regular use as top-rope anchors and seat harnesses annually.
4. Immediately retire any software struck by rockfall. And don't let it happen again.
5. Vigilantly protect nylon from solvents (like paint and paint thinner), oil, acids (like battery acid), chlorine (like laundry bleach), and the vapors of these chemicals. Remember that cars used to transport ropes, and garages used to store them, often harbor solvents, oil, and battery acid.
6. Don't oil carabiner gates! They don't need it and the oil damages the rope. If a gate is sticky and can't be cleared by cleaning and working it, retire the biner.
7. Check your carabiners and other hardware for corrosion and retire them if you find any. Corrosion can spawn microscopic cracks that may cause the equipment to fail under shock loads. (The idea that dropping a biner causes cracking is myth.)
8. Using a laundry marker or other permanent felt-tipped marker, mark each piece of webbing on its extreme end (on the tail of the knot in a permanently tied runner or chock sling) with the legend "T45" followed by a four-number date code "MMYY" for the date the item was placed in service.

## PERSONAL EQUIPMENT

Selecting the right gear for any particular outing is difficult for even the most experienced of mountaineers. It's hard to know what any particular climb will demand, what the weather will be, or what the terrain will be like. You must be prepared for whatever the adventure might bring, but not weigh yourself down unnecessarily. Here are a few hints about principles to follow in selecting your gear.

1. Pack light. Weight is the enemy. Mountaineering is the sport of defying gravity, after all, so don't give gravity anything extra to hold on to. If you don't need it, don't bring it. If you can make it lighter, do it.
2. Value simplicity. Simple equipment is easier to use, and, as often as not, works better than fancy gadgets. It has fewer ways of failing. A plethora of zippers and flaps and vents looks great on the model in the catalog, but will you really use all that stuff on the mountain? Would two plain pockets work just as well?
3. Make a single item of equipment do multiple duty. A single cooking pot can handle all your cooking tasks. All you need for eating is a cup and a spoon.
4. Bring spares of critical items. You must have two hats. You must have a spare pair of mittens. If your only pair of gloves blow away in the summer, it means clumsy fingers that make disastrous mistakes. In the winter it means frostbite.
5. Aim to be well prepared for the most likely conditions, but be at least minimally prepared to survive the worst weather or conditions that are possible. Always be prepared for rain, no matter what the season or the forecast.
6. Select your clothing carefully with an eye toward insulation value and moisture retention properties. Even in summer, the alpine environment is cold, wet, and windy. Select wool (or a suitable synthetic wool substitute) rather than cotton. Wool is a better insulator, absorbs less moisture, and retains more insulating value than cotton when it gets wet. Sweatshirts and blue jeans are out. Really. Many experts claim that you are actually better off naked than wearing wet cotton. The classic shivering Boy Scout is wearing blue jeans, two flannel shirts, and a sweatshirt.
7. Dress in layers, mixing and matching to suit the conditions. The innermost layer should be polypro (not cotton!) longjohns. Middle insulating layers are things like wool shirts, sweaters, fleece jackets, wool pants (or polyester blend pants in warm seasons). The "warm layer" is major insulation like a down parka in winter, or a thick sweater in summer. The final layer is the wind shell or rain shell. The wind shell must be breathable and windproof; the rainshell must be waterproof. A lightweight nylon parka is good for wind; a rain parka or a cagoule is better than a poncho for rain. Gore-Tex and similar fabrics make it possible to combine waterproofness and breathability into a single garment.

Don't forget leg protection in the form of wind pants, rain pants, or both. Gaiters will keep water and snow out of the tops of your boots.

8. Protect your head. Always bring two hats: your favorite climbing hat and a spare balaclava for full head coverage. Even in the summer. Really.

9. A pair of light knitted gloves is great for general purpose hand protection. In colder weather you will need mittens. Always (even in summer) have a spare pair of mittens stashed away somewhere. Mitten shells are essential for winter and often very useful in summer.

10. Waterproof your boots. Wear at least two pairs of socks: a lightweight wool, acrylic, or polypro liner sock; and a heavy wool sock. Don't wear cotton socks. In winter beware of wearing too much sock: your boot must fit comfortably so as not to restrict circulation to your feet. In cold weather, vapor barrier liners (plastic bread bags work fine) keep foot perspiration from wetting your heavy socks.

11. Be organized. A place for everything and everything in its place. Remember that losing a tiny piece of critical gear can put you in a jam. Put most of your little stuff in a "junk bag" kept near the top of your pack. Assemble other categories of equipment and food into other drawstring bags to keep them unlost.

12. Use a checklist. The checklist below is for a typical summer overnight climb. For a day trip, you can leave off or simplify the cooking and camping gear. For a winter trip you will want to beef up your clothing and sleeping gear and add items from the winter supplement checklist. By all means, develop your own personal system of technique and equipment, but think it through--and make a checklist!

## MOUNTAINEERING EQUIPMENT CHECKLIST SUMMER OVERNIGHT CLIMB

### CLOTHING

Hat (wool or polypro)  
Spare Hat  
Gloves or Mittens  
Spare Mittens  
Rainshell (eg, Poncho, Rain Parka, or Cagoule)  
Windshell (lightweight, with hood)  
Gaiters  
Wind Pants  
Sweater or Fleece Jacket (*No Sweatshirts!*)  
Long Johns (*No Cotton!* Polypro is best.)  
Long Pants  
    (Something wind resistant.  
    *No Jeans or Sweatpants!*)  
Long Sleeved Shirt  
Warm Layer (eg, a second sweater)  
Wool Socks (two layers plus a spare pair)  
Boots

### COOKING EQUIPMENT

Stove (one per tent)  
Fuel (one bottle per tent)  
Matches (in waterproof container)  
Cook Pot (3 quart; one per tent)  
Cup, Spoon  
    (No Forks, Knives, Bowls, Plates...)  
Food (as planned with your buddies)  
Hydroperoxide Tabs  
One-ounce squeeze bottle of detergent

### CAMPING EQUIPMENT

Tent (one per buddy group)  
Sleeping Bag (in stuff sack)  
Sleeping Pad  
Backpack (Nothing in your hands!)

### PERSONAL STUFF

Toothbrush and Toothpaste  
Toilet Paper (in a baggie)  
First Aid Kit (including any  
    personal medications)  
Sunscreen  
Insect Repellent

### SURVIVAL EQUIPMENT

(Put most of this in your junk bag.)  
  
Compass and Whistle (on lanyard)  
Waterproof Matches (or matches in  
    waterproof container)  
Flashlight (*Small!* Preferably a headlamp)  
Candle (emergency fire starter)  
Sunglasses  
Pocket Knife  
    (No Sheath Knives, Axes...)  
P-Cord (25 feet or so)  
Garbage Bag (survival shelter)  
Water Bottle

### WINTER SUPPLEMENT

Wool (or Fleece) Pants  
Wool Shirt  
Heavy Mittens  
Mitten Shells

Adequate Warm Layer  
Winter Boots  
Vapor Barrier Liner Socks  
Enough Fuel (to melt snow)

### TECHNICAL EQUIPMENT

Seat Harness  
Helmet  
Personal Tie-In  
Belaying Gloves

Rack  
Ice Axe  
Crampons  
Assigned group gear

## GLOSSARY

**Anchor.** Any means or device for fastening something securely to the surface. A belay anchor is an anchor used to secure the belay brake (or the belayer) against being pulled off by the force of a fall. A typical belay system has the rope running from the belayer through one or more anchors to the climber. A top anchor is an anchor placed at the top of the pitch so that the climber will always be belayed from above (see Top Belay). The climber constructs anchors from runners, chocks, pitons, ice screws, and ice axes. The rope is clipped to the anchor with a carabiner.

**Arm Rappel.** A rappel technique in which the climber loops the rope over his arms and back to provide friction. The arm rappel is useful only on relatively shallow slopes where other methods provide too much friction.

**Belay.** The practice and the methods of protecting a climb using a rope to catch the climber in the event of a fall. The belay system must provide a secure tie-in to the climber, anchors through which the rope runs freely, a belayer to manage the amount of rope in the system, a belay brake which can reliably stop the rope and withstand the forces of the fall, and a belay anchor to secure the belayer and the belay brake. See also Protection, Hip Belay, Ice Axe Belay, Belay Brake, Anchor.

**Belay Brake.** A device for providing friction on the rope in belaying. Modern belay brakes (such as the Black Diamond ATC) allow broad control of the amount of friction provided, but modern practice is that all belays are belayed statically, so a good brake must be able to completely and instantly stop the rope under worst case conditions. The Munter hitch is a knot that turns a carabiner into an effective belay brake.

**Bollard.** See Snow Bollard.

**Brake.** See Rappel Brake, Belay Brake.

**Brake Bar.** A rappel brake consisting of a metal bar that fastens to the gate of a carabiner.

**Carabiner.** A metal ring with a spring-loaded gate used to make strong connections between ropes. Colloquially called a biner or, sometimes, a crab or snap-link.

**Chimney.** A vertical crack with parallel walls, large enough for a climber to get inside.

**Chock.** A metal device for jamming into a crack to make an anchor. Chocks (originally "artificial chockstones") come in a very wide variety of shapes, sizes, materials, and functions.

**Dihedral.** A pair of faces meeting at an angle. Often called an "open book."

**Dulfersitz Rappel.** A classic rappel method using friction between the rope and the climber's body to provide braking. In German, dulfersitz means "hot seat," an apt description of the technique.

**Dynamic Belay.** A belay which absorbs the energy of a fall gradually enough to limit the impact force. Originally, the dynamic belay was a technique in which the belayer allowed a certain amount of rope to slip through the belay while catching the fall. This practice is now considered obsolete because modern dynamic ropes automatically provide appropriate cushioning. See also Dynamic Rope, Static Rope, Static Belay.

**Dynamic Rope.** A rope manufactured to have a certain elasticity intended to provide cushioning when stopping a fall. Also called an Energy Rope because its function is to absorb energy from a fall. See also Static Rope, Dynamic Belay.

**Glissade.** Rapid descent of a snow slope made by sliding on the seat of the pants (sitting glissade) or skiing on the soles of the boots (standing glissade). From the French word *glisser*, to slide.

**Hip Belay.** The classical belay method in which the belayer provides friction by passing the rope over his hips.

**Ice Axe.** A specialized tool used to assist the climber in climbing snow and ice. Modern ice axes have a head with a long, drooping pick, and a short adze. The shaft is now universally made of metal, perhaps with a rubber or plastic coating (older wooden or composite shafts were not strong enough for belaying service), and a spike at the end. Next to the rope, the ice axe is the quintessential mountaineering tool. See also Self Arrest, Ice Axe Belay.

**Ice Axe Belay.** Any of a number of techniques for using the ice axe as a belay anchor on snow. The simplest, the ice axe self belay, is just the practice of plunging the axe into the snow and hanging on. For a rope belay, the ice axe shaft is plunged into snow and used as a belay anchor. In the boot-axe belay, the climber plunges the shaft into the snow, places his foot just downhill of the head, and belays directly to the axe and the boot.

**Ice Screw.** A specialized screw (usually tubular with the threads on the outside of the tube) with a carabiner eye on its head, which may be screwed into ice to make an anchor.

**Kernmantel.** A rope construction consisting of a core of parallel or loosely woven fibers surrounded by a woven protective sheath. From German, meaning core-sheath.

**Perlon.** Brand name for a type of nylon often used in making kernmantel climbing ropes. Often used to mean kernmantel construction.

**Pitch.** A discrete section of a climb. In technical climbing, the term usually refers to the interval (always less than one rope length) from one belay site to the next.

**Piton.** A specialized device that may be driven into a crack in the rock to create an anchor. The classic piton is a steel spike with an eye for clipping a carabiner, but pitons come in many forms and

have been made from wood as well as aluminum, iron, and steel. Because of their propensity for damaging rock on popular routes, pitons are now seldom used except in special circumstances or as fixed protection.

**Protection.** The means used by climbers to provide safety against falling. The term has also come to mean the particular devices (such as runners, cams, chocks, and pitons) used to form anchors in a protection system. In this context the term is often colloquially abbreviated as "pro." "Placing pro" means setting anchors as part of a protection system. To "protect a climb" means to set up an effective system of protection, generally a belay. The most vexing aspect of providing protection is usually the selection and placement of intermediate anchors.

**Rack.** A loop of webbing slung over the shoulder and used to carry equipment. The term is also used to refer to a particular selection of equipment carried. "Racking your gear" is arranging your equipment in an organized way on the rack.

**Rappel.** Any of several techniques for descending by sliding down a fixed rope. From the French rappeler, to recall.

**Rappel Brake.** A device used to control friction on a rappel rope so as to control descent in a rappel.

**Rockfall.** Falling rocks. Rockfall is a severe threat, never to be taken lightly.

**Rope Salad.** A tangled rope.

**Runner.** A loop of rope or (much more usually) webbing, chiefly used to make anchors. Commercially made runners are usually fastened into a loop by sewing. A single-length runner is about two feet long; a double length runner is about four feet long, and so forth. A very short runner is called a hero loop, and a very short runner used to "stretch" a carabiner is often called a quick-draw. A runner is sometimes called a sling. Some climbers distinguish a runner as a sling used for protection.

**Safety Knot.** An extra knot (usually an overhand knot) used to secure the rope end after tying a knot thereby preventing the main knot from coming untied.

**Seat Harness.** A harness fastened around the waist and legs of a climber. Many commercial models are available, and very effective seat harnesses may be made in the field from webbing. A seat harness is much more comfortable and much safer than a simple waist loop or swami belt since it distributes load to the bones and muscles of the hips rather than concentrating it on the soft tissues and internal organs of the abdomen.

**Self Arrest.** A maneuver in which a fallen climber arrests a sliding fall on snow or ice by dragging the pick of the ice axe. The self arrest is the essential skill of elementary snow climbing.

**Snow Bollard.** A mushroom-shaped hump of snow carved with an ice axe to serve as an anchor.

**Snow Fluke.** A metal sheet folded into a shallow dihedral used as an anchor in snow. The snow fluke is usually fitted with a steel cable for attaching a carabiner.

**Stack.** The supply of rope randomly piled or laid in overlapping folds rather than coiled. A stacked rope will run freely, whereas a coiled rope will often tangle.

**Static Belay.** A belay which provides no dynamic energy absorption, or the technique of belaying in which the fall is stopped without any rope slipping through the belay. In modern practice, belaying is performed statically, but using a dynamic rope, to provide a dynamic belay. See also Dynamic Belay, Dynamic Rope, Static Rope.

**Static Rope.** A rope manufactured to have minimal elasticity and intended for use in static applications such as ascending, rappelling, and hauling. Because of its high maximum impact force, use of a static rope for belaying can be extremely dangerous if the climber falls any distance. Also called a Power Rope because its function is to deliver power to a hauled load. See also Dynamic Rope, Dynamic Belay.

**Stitch Plate.** Common misspelling (and mispronunciation) of Sticht Plate.

**Sticht Plate.** A mechanical belaying device ( originally the Sticht-Salewa Belay Plate) consisting of a flat aluminum plate pierced with an oval hole to accept a loop of rope (a model for double-rope technique has two holes).

**Swami Belt.** A waist loop made by wrapping webbing several turns about the waist to increase the settling area of the loop, thereby making it more comfortable in a fall. The swami belt is an obsolete technique. A seat harness is much more comfortable and much safer.

**Tie-in.** The connection between the climber and the belaying system. For example, the tie-in between a seat harness and a belay rope is a bowline knot tied to the seat. A tie-in to a fixed anchor might be a runner clipped between the seat and the anchor.

**Top Belay.** A belay in which the climber is supported from above, that is, with a top rope. Practice climbing and introductory instruction are always performed with a top belay. The practice of climbing with a top belay is often called "top roping" and is something of a sport in itself.

**Top Rope.** See Top Belay.

**Traverse.** A maneuver (or a route) that crosses the surface without gaining elevation.

**UIAA.** *Union International d'Associations d'Alpinisme*, that is, the International Union of Mountaineering Associations. The UIAA conducts research on mountaineering safety and technique

and publishes standards for mountaineering equipment.

**Waist Loop.** A loop of rope (usually a bowline or bowline-on-a-coil) or a loop of webbing (a Swami Belt), taken around the waist of a climber and used as a tie-in. Although waist loops have some usefulness (particularly in emergencies), the Seat Harness is much safer and more comfortable as a belay tie-in. See also Tie-In, Swami Belt, Seat Harness.

**Webbing.** A flat rope or woven tape. Generally, webbing comes in two forms: flat and tubular. Flat webbing is fairly stiff and is good for making equipment straps which must hold buckles and for equipment which must hold its shape. Tubular webbing, which is woven in a tubular shape, is considerably softer than flat webbing, withstands abrasion better, and takes knots well. Webbing is very strong--about 4,000 pounds for the ubiquitous one-inch tubular webbing.

## APPENDIX A. Acquiring Personal Equipment

The Troop is supplying all the specialized technical equipment we need for basic rock climbing and basic snow climbing, but Scouts who take a real interest in mountaineering will inevitably wish to own some of their own climbing gear. Here is a list of useful items with suggestions on what to get. The list is more or less in a suggested order of acquisition.

You can rely on the safety and effectiveness of new equipment from reputable manufacturers. Local suppliers such as EMS and the Dartmouth Coop sell only good quality equipment. Mail order houses such as REI and Campmor also have good selections and reasonable prices. In general, unless you know that you want some specific item for a certain reason, go for the simplest (and usually least expensive) item you can find. Please don't go gizmo crazy. Keep your gear simple and effective.

In addition to the technical items described in the list below, you will also need clothing and camping equipment suitable for the alpine environment.

1. Seat Harness. A commercial seat harness is a nice idea, but certainly not necessary. You can make a very usable seat harness from 15 feet of 1-inch tubular webbing. The REI On Sight harness is inexpensive and plenty good enough. Ditto for the Misty Mountain Intro from Campmor.
2. Helmet. We will always require a helmet for steep rock climbing. Having your own will speed things up. The Edelrid Ultralight is good (that's what the Troop has); the Cassin or the Petzl Ecrin Roc are also excellent choices.
3. Carabiners. Start with a locking carabiner (Such as REI Gold Series Locking D) to use with your seat harness. Then get a couple of light modified D carabiners such as REI Gold Series D.
4. Rack. If you own any carabiners, you're going to need a rack. The easiest thing is to make one from 1-inch tubular webbing. Most people need about 5 feet.
5. Personal Tie-In Sling. This item is a sling made from six feet of 6 mm accessory cord and clipped to a carabiner.
6. Ice Axe. As we move into winter, the first new set of skills we'll learn is the use of the ice axe for travel on snow and ice. Look around for something you like, but be careful not to get a toy or an ultralight axe not suitable for ice climbing. The REI Mountain Axe is an excellent choice. The Grivel Pamir (distributed by Climb High), available from Campmor is a fine choice (and better than the other low-priced Grivel models). You'll read lots of conflicting advice on length. Our recommendation is to go short: get the 65 or 70 cm length. You won't regret getting a head guard and a point guard for transport and storage. You'll also need an ice axe leash. You can buy one or you can make one from six feet of 9/16-inch tubular webbing.
7. Rappel/Belay Brake. There's lots to choose from here, but like the seat harness, you might be

interested to know that many experienced climbers generally don't carry one. But then again, most people do. The Black Diamond ATC is a very popular and practical device. The classic Figure Eight Descendeur is also popular, but a bit heavy for alpine climbing, and has the distressing characteristic that you must unclip it to attach it to the rappel rope.

8. Crampons. Once you get a taste of life above treeline in the winter, you're going to want crampons. But don't jump too quickly in this direction. Before crampons come boots, and now we're talking about a serious major investment. But... if you are going to buy a pair of good hiking boots anyway, think about getting a pair of relatively heavy boots that you can wear in the mountains in the winter--and that could accept crampons in the future. If you decide that you do want to buy crampons, your best bet is a pair of adjustable, hinged, 12-pointers. Suitable candidates are SMC Hinged Crampons from REI, and Camp K2 Crampons from Campmor, although step-in crampons such as the Grivel G-10 are popular and easy to use. If you get strap-ons, don't forget straps. If you get step-ins, make sure your boots accept them.