

***KNOTS, HITCHES AND COILS***

INTRODUCTION .....	1
CAUTIONS ABOUT KNOTS .....	1
KNOT TERMINOLOGY .....	1
THE KNOTS .....	2
Overhand Knot.....	2
Water Knot .....	2
Figure Eight On A Bight .....	3
Figure Eight On A Follow-Through .....	3
Grapevine Knot and Stopper Knot .....	4
Girth Hitch .....	5
Prusik Hitch .....	5
ROPE COILING FOR STORING OR TRANSPORT .....	6
Backpack Coil—Single Strand Version .....	6
Backpack Coil—Double Strand Version .....	6
Mountaineer’s Coil .....	6
Rope Bags .....	7
Rope Throwing .....	7

**INTRODUCTION**

A climbing rope is a wonderful thing. It is flexible, light, durable, pretty, strong and shock absorbent. But, without a good knot tied to set the anchor and to tie you in, the rope is just pretty. One of the goals of this climbing class is to teach you to tie secure “climbing” knots and hitches quickly and correctly.

**CAUTIONS ABOUT KNOTS**

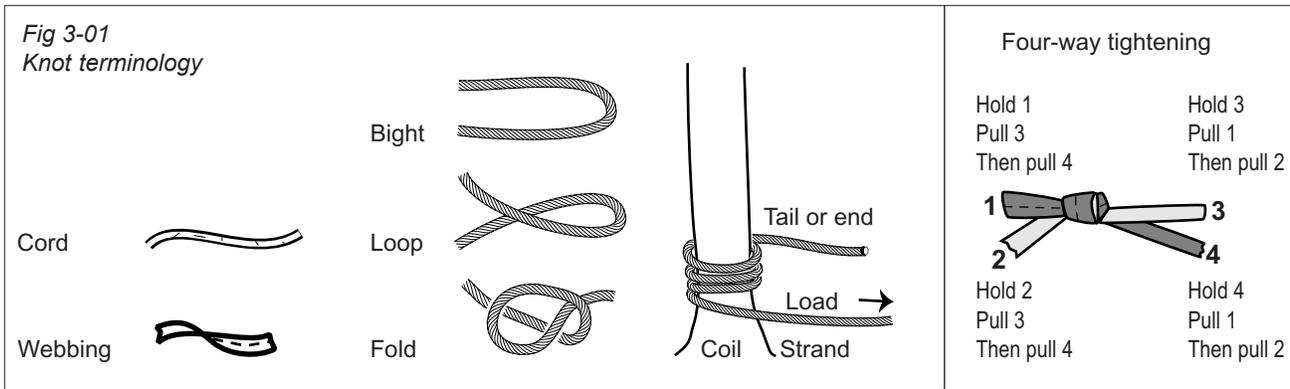
- **Tie knots correctly; don’t allow them to be sloppy.** A properly tied knot is stronger, won’t shake loose as easily, and will be easier to untie after holding falls.
- **Check all knots often,** especially any that are left unattended like those in a slingshot anchor, or tied webbing which may have loosened up while riding in your pack.
- **Make a habit of finishing any knots you start, including buckling your harness completely before starting another task.** Although you should check any knot as a last-minute review before trusting yourself to it, this habit will prevent you from accidentally using an incomplete knot.

**KNOT TERMINOLOGY**

First, here are some knot tying terms (fig 3-01):

- A **knot** grips the rope or webbing and is stationary.
- A **hitch** is tied around rope, webbing or an object and can move. Some hitches require a backup knot to be safe.
- A **bight** is a bend in the rope, with two strands of rope parallel to each other.
- A **loop** is a round “doughnut” in the rope.
- A **coil** is a loop that goes around a tree, leg or other solid thing.
- A **strand** is a single rope (among several rope loops or bights).
- A **tail** is a free end of the rope that you are either poking through a hole, loop or bight.
- The **load rope** is rope other than the tail (it is the one that sustains a load).
- **Four-way tightening** is a technique used to tighten water knots, figure-8 knots and grapevine knots.

You will use **rope, prusik cord and 1-inch tubular webbing** to tie climbing knots. Rope and cord are round and webbing is flat. Figure-8 knots and grapevine knots work better in rope, prusik hitches work best in prusik cord and water knots work best in webbing.



**THE KNOTS**

**Overhand Knot**

An overhand knot (fig 3-02) is a basic knot. The overhand is also used as the first part of a water knot.

**Water Knot**

Use a water knot (fig 3-03) to join the ends of webbing together. Water knots sometimes work themselves loose after being jostled around in your pack, or when unloaded. Check the knot before every use. The tail always should be at least 3 inches long. Tests have shown that water knots eventually untie after repeated loading and unloading. It is critical to have at least a three-inch tail.

**Figure-8-On-A-Bight**

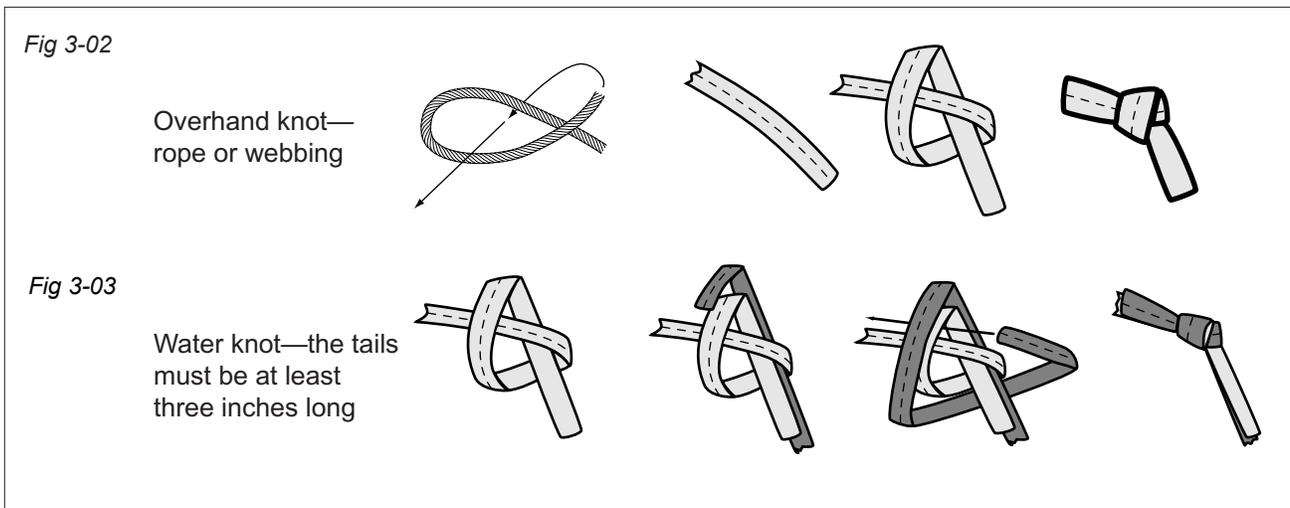
This knot (fig 3-04) is easy to untie after being loaded. Since it is tied “on a bight,” it cannot untie while in use and can be tied at any point along the rope. Use it as a “middle-of-the-rope” tie-in for a climber on short climbs and to isolate bad spots in the rope in emergencies.

**Figure-8-On-A-Follow-Through**

Use this figure-8 knot (fig 3-05) to tie directly into your harness. The tail should be 6–9 inches long. It is not incorrect to end up with a longer tail, but there may be times on a multi-pitch climb when you need all the rope length you can get, so practice tying the knot with a 6–9-inch tail. Always tie this knot through the rope tie-in area exactly where the belay loop goes, encircling the waist loop and the leg loop connector; never tie it through the belay loop.

**Grapevine Knot**

Use the grapevine knot to join two ends of rope together (fig 3-06). Tying “one-half” of this knot on the end of a rope makes an excellent **stopper knot**—a knot on the end of a rappel rope that will jam in the rappel device to prevent you from rappelling off the end of the rope. The tails should be at least the length of the entire knot.



**Girth Hitch**

A girth hitch is used for many purposes (fig 3-07), and is easily done using cord or webbing. When making a girth hitch around an anchor, align the hitch in the center of the anchor point, so that it does not want to rotate around and damage either the anchor (such as a tree) or the rope (by rubbing against the anchor point).

**Prusik Hitch**

The prusik hitch (fig 3-07) is used to attach prusik loops or webbing to a rope, allowing you to ascend a rope or use the prusik as a safety belay. Practice this knot with two hands, then learn to tie it with one hand.

Fig 3-04  
Figure-eight-on-a-bight

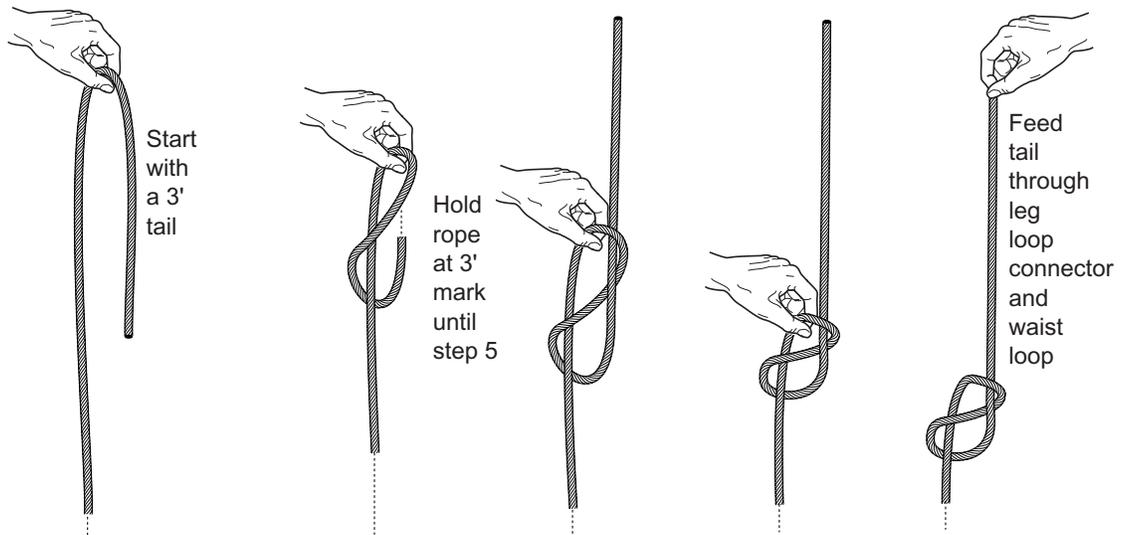
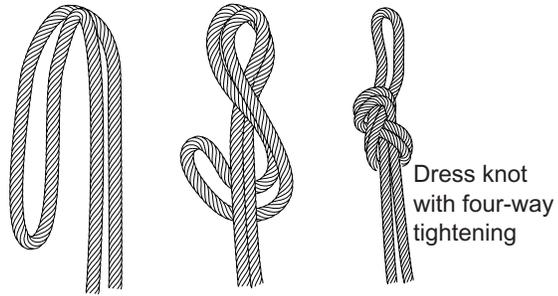


Fig 3-05  
Figure-eight-on-a-follow-through

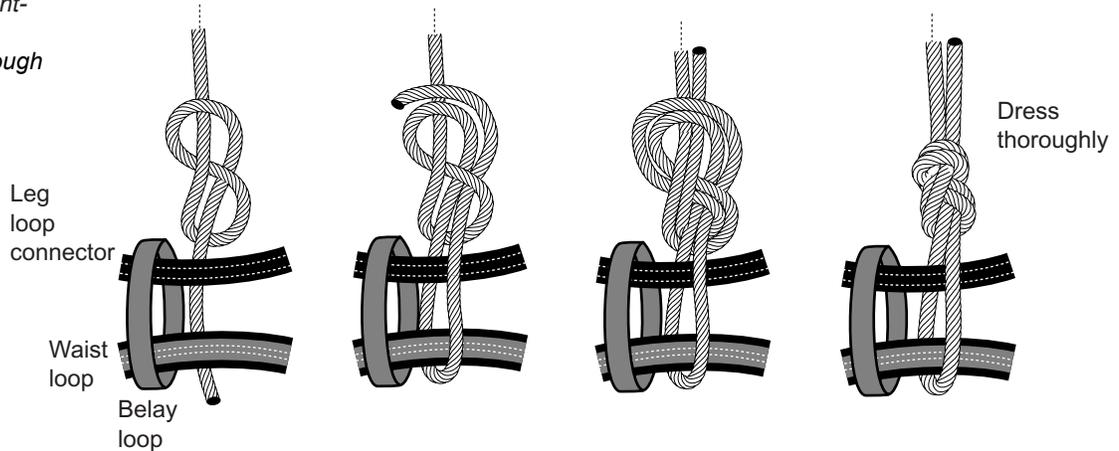
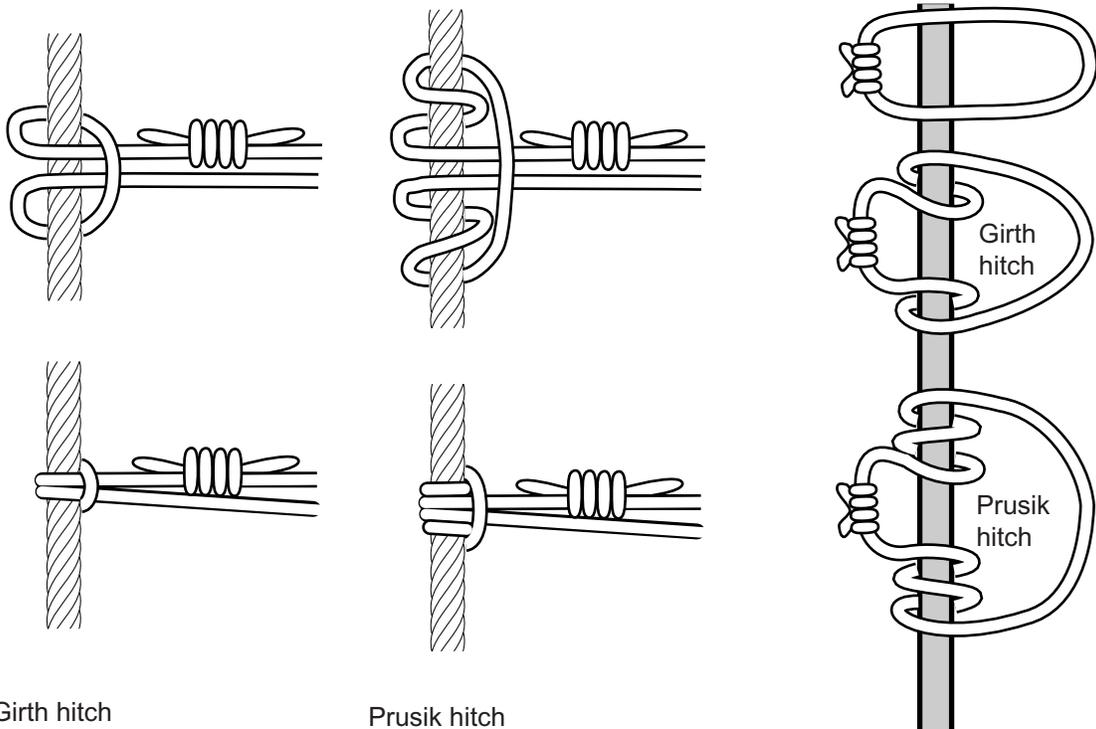
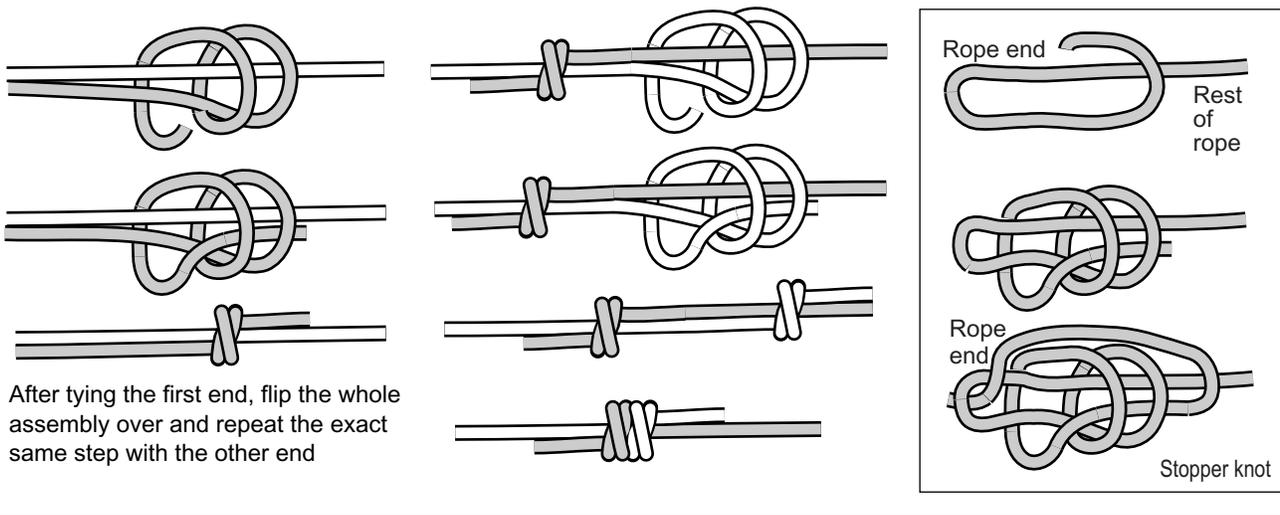


Fig 3-06—The grapevine knot or double fisherman's knot. Also shown is a stopper knot at the end of a rappel line, made with double fisherman's knot as the base.



Girth hitch

Prusik hitch



Girth hitch around a tree

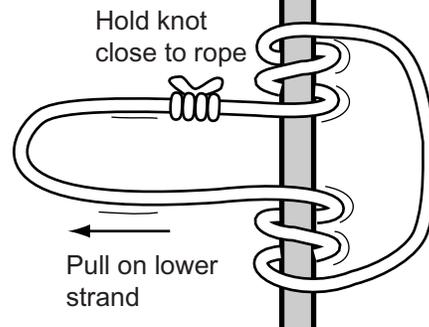


Fig 3-07  
The girth hitch and prusik hitch

## ROPE COILING FOR STORING OR TRANSPORT

There are three main methods of storing or transporting a rope: the backpack or butterfly coil, the mountaineer's coil, and a rope bag.

The backpack coil does not impart kinks to the rope. It can be tied on like a backpack for easy carrying. Of the two versions, the single strand method takes longer to coil, but flakes more easily when ready for use. The double strand method takes less time, but is harder to flake; however, it can be ideal when moving short distances between climbs.

The mountaineer's coil is easy to carry over a shoulder but can put twists in the rope.

A rope bag is easy to stuff, stores the rope already flaked, and avoids kinks. It protects the rope from UV rays, dust, dirt and vegetation. This is the recommended method for your personal rope.

Regardless of the method you choose, start by **flaking** the rope on the ground. This means stacking the rope on the ground, starting from one end, and laying coils and loops on top of each other in a random manner until the entire rope is in a heap. Try to find a rocky surface that will avoid getting the rope dirty. After the rope is flaked, start coiling. Note: don't flake a brand new rope right out of its plastic bag. Unwind it as if it just came off a sewing-machine bobbin—which it did.

### Backpack Coil—Double Strand Version (fig 3-08)

1. Flake the rope.
2. Take both ends in your hand.
3. Measure out three arm-spans of rope from the end (15–20 feet). This will be the tail.
4. Start looping both strands of the rope back and forth over your hand. The bights should be about 2.5–3 feet long, or half your arm-span. Short-armed people should add some extra to each bight, and long-armed people should not extend their arms fully. You will get used to the right length after awhile.
5. When you reach the doubled end of the rope (actually the middle of the rope), wrap the tail three times about one-third of the way down from your hand.
7. Push a bight of the tail through the opening made by the top of the loops in your hand and the three wraps.
8. Feed the end of the tail through the bight and cinch it down. The tail can now be used to tie the coil on as a backpack.

### Backpack Coil—Single Strand

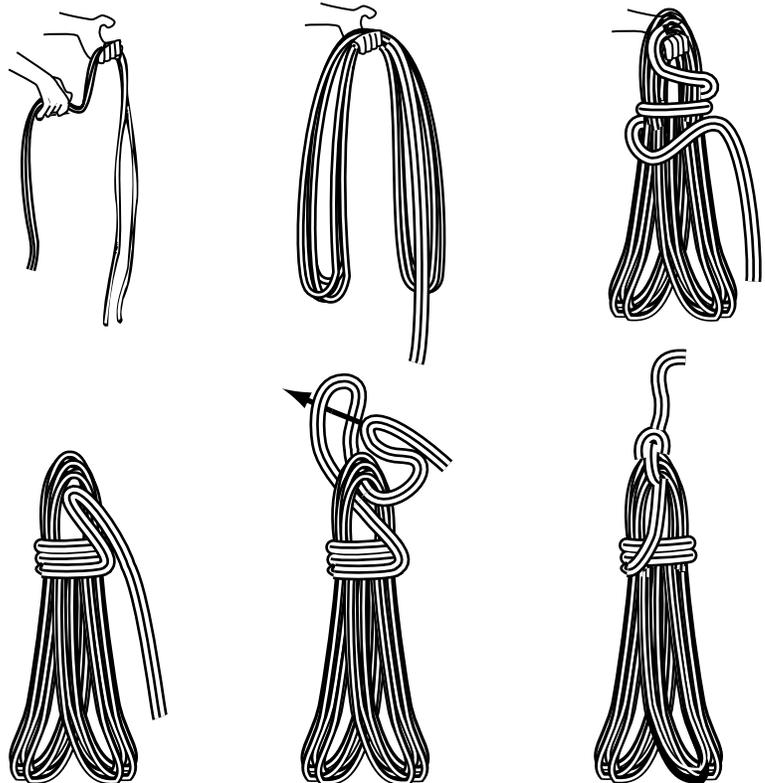
Follow the same procedure as the double strand except start with 15–20 feet of one end. Flake back and forth but stop about 15–20 feet from the other end. Finish as with the double strand.

### Mountaineer's Coil

This is described for right-handers (fig 3-09).

1. Flake the rope.
2. Hold the rope about 18 inches from the end with your left hand. The "tail" of rope should be pointing toward you, and your palm should be facing inward.
3. Measure out a 5–6 foot length of rope by doing the following: Don't let go with the LEFT. Slide your RIGHT hand along the rope and when your arms are extended straight out, grab the rope with your RIGHT hand. People with a smaller arm-spread may need grab more than one arm-span.

Fig 3-08—The backpacker's coil or butterfly coil



4. Hold the rope in the palm of your right hand, palm-up, as if you are holding a waiter's tray. Grip it.
5. Swing your hand forward (like throwing a ball) and flip your wrist forward at the same time. You have just put a half twist in the rope and made a coil at the same time.
6. Lay that coil of rope in your left hand, next to the tail of rope. Re-grip the growing rope bundle with your left hand.
7. Repeat the measuring, gripping, swinging, flipping and laying a few more times. You need to insure that the coils are nearly equal in size. Do this by occasionally reaching down and giving a "karate chop" to the bottom of the coils (use your right hand).
8. Repeat steps 3-6 until about 8 feet from the end.
9. Take the long tail and flip it over the top of the coils. Reach through the coils with your right hand and grab the rope. Notice that you have just made a "lock stitch" over the bundle of coils.
10. Make the lock stitch as tight as possible. Pull the rope with the fingers of your right hand while pushing with the thumb.
11. Repeat steps 10-11, putting the new lock stitch on the left of the first stitch. Each successive stitch is closer to your left hand. Tighten each stitch as you put it on.
12. You should be able to get at least 6 lock stitches around the coils. Stop when you have 1.5-2 feet of tail remaining. Shove that tail through the bight you made with the other tail.
13. Pull on the first tail to close up the bight around the second tail. Tie the two tails together with a square knot. If you pulled tight on each lock stitch, you did it right. If not, the entire thing falls apart after being carried once or twice.

### Rope Bags

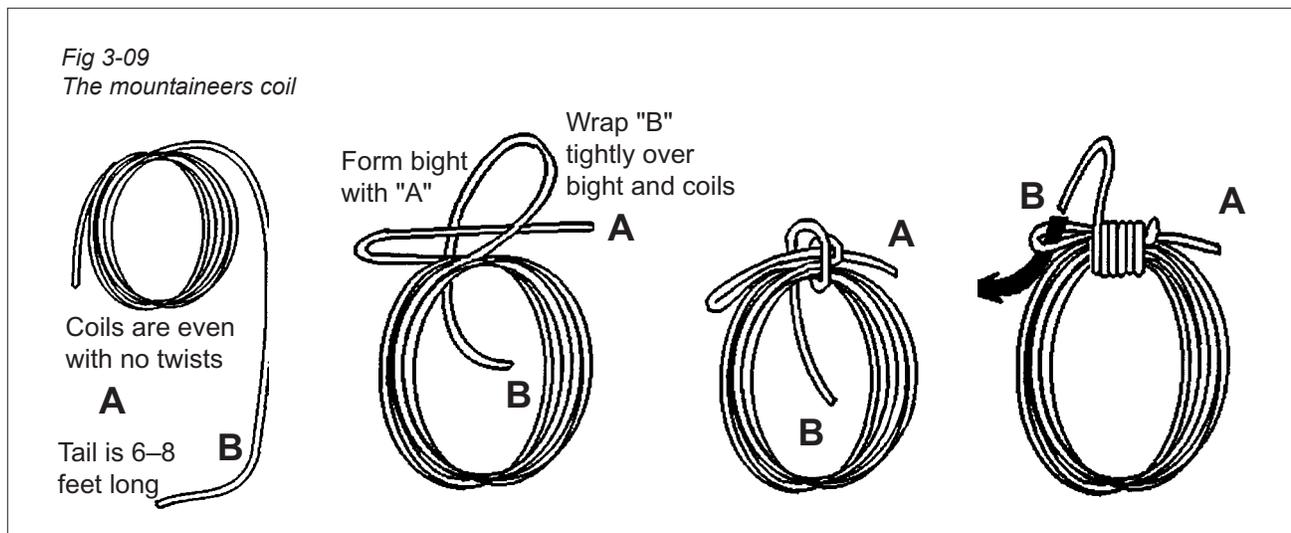
The rope bag is the simplest and safest way to store ropes. There are several versions on the market, from a simple bag to a bag that unfolds on the ground and becomes a tarp for the rope to sit on while being used. Simply feed the rope into the bag from one end and keep feeding until it is all inside. There is usually a loop to tie the end to so that you can find it easily when taking the rope out. This protects the rope from ultra-violet rays and dirt.

With a bag that does not unfold, you can simply belay or rappel right out of the bag.

### Rope Throwing

When you set up a climb or a rappel, you must be able to throw the rope down the cliff. This is often more complicated than it sounds. Wind, tangled ropes and snags such as cracks are all problems. You will have your share of epics. There are any number of ways to throw, but the following way avoids the coil-snag problems that often occur, even in perfect conditions. Whatever you do, anchor yourself and the rope before throwing.

1. Anchor yourself.
2. Anchor the rope by tying a figure-8-on-a-bight at the end of the rope. Clip that knot into your anchor with any biner available. This keeps the rope from being yanked completely over the side after you throw it.
3. Flake out the rope, starting from the anchored end.
4. Make a throwing "coil" by looping the rope back and forth over your hand with 18-24" bights of rope. This is similar to the butterfly or backpack coil. Take up about 50' of rope in this manner. Put this down, taking care not to bundle it into a mess.
5. Make a second throwing "coil" by moving down the rope 30-40' and looping the rope back and forth over your hand.



6. Check your anchor tie-in again. Step out to the edge, leaning out if your tie-in permits it. Get away from tree branches, packs, other people or anything that would snag the rope as you throw it. Face away from the rock with the second throwing “coil” in your throwing hand. Hold the first throwing coil stationary.
7. Yell ROPE and wait for climbers below to take cover.
8. Yell ROPE again. Throw this second “coil” straight out from the line of the rappel or climb. When it stops, throw the first “coil” down.
9. If the rope becomes snarled, tying itself into a knot, pull it back up and repeat. If the rope stacks on a ledge, try whipping the rope away from the cliff to snap it off the ledge. If the rope doesn’t come off the ledge, or is caught in a crack, pull it back up and try again.
10. On windy days, a normal throw may not end up where you want it. Try these alternate methods.
  - a. Throw the coil into the wind to account for the drift, or throw overhand directly down the cliff. This may cause problems such as getting hung up, but may be the only way to get the rope down.
  - b. On climbs where there is a water chute or similar “channel-like” feature (not a crack) without obstruction, just let the rope trickle down the chute, end first.