THE RAPPEL SYSTEM • SETTING UP RAPPEL ANCHORS • SETTING UP THE ROPE • RAPPEL METHOD • RAPPEL TECHNIQUE • SAFETY BACKUPS • FINISHING THE RAPPEL • MULTIPLE RAPPELS • EXPERIENCING THE FREEDOM OF THE HILLS

CHAPTER 11
RAPPELLING

Indispensable to technical climbing in the mountains, rappelling is the technique of descending an anchored rope by using friction to safely control the rate of descent. Unfortunately, because rappelling is often so easy and routine, climbers may forget or ignore its inherent risks, making it one of the more dangerous techniques they employ. Proper rappelling technique is vital to a safe descent of many climbs.

In the words of climber Ed Viesturs, "Getting to the top is optional; getting down is mandatory." Safe rappelling can be achieved only by using a trustworthy anchor and rope and proper technique. If any element of the rappel system fails, the result will likely be catastrophic. Unlike the belay system, which is a secondary safety system—it is called upon only *if* a fall occurs—the rappel system is the primary fall restraint system, necessarily called upon to absorb the forces exerted by the rappel the entire time it is in use. Consequently, there is no room for error in the setup or use of the rappel system. The 2011 edition of *Accidents in North American Mountaineering* notes most rappelling accidents are preventable: the top three causes are (1)

uneven rope lengths, (2) an inadequate anchor system, and (3) an inadequate rappel backup.

When descending a climb, a team may have the choice to down-climb instead of rappel. Party size and experience, timing, weather, terrain, and available equipment should be factored into the decision regarding how to descend. When down-climbing is within the capability of the climbing party, it can be preferable because it can be faster and pose a lower risk than rappelling. Down-climbing is particularly attractive in terrain rated Class 4 and below, where the slope angle and presence of loose rocks increase the likelihood of getting a rappel rope stuck or of pulling rocks down on climbers while rappelling or retrieving the rope. When there are varying skill levels within a climbing team, it may be appropriate to set up a fixed rope for less-experienced climbers to use as a hand line or to connect to with a prusik while down-climbing (see "Fixed Lines" in Chapter 21, Expedition Climbing). If the team chooses to rappel, safety and efficiency are imperative; this chapter describes best practices to ensure safe and efficient rappels.

THE RAPPEL SYSTEM

A rappel system has four basic elements: an anchor, a rope, a rappel method for applying friction to the rope, and the person rappelling (fig. 11-1). Each element is equally and vitally important. Always remember all four of the rappel elements—especially when you are cold, tired, hungry, or racing to beat the darkness—and double-check that every element is in place, functioning properly, and connected together to make an integrated system.

It is common practice for climbing partners to check each other's equipment setup at the start of a climb; partner checks during descent are equally important and should be routine. The last person to rappel may be able to set up his or her rappel before the second-to-last person leaves the anchor (see "Finishing the Rappel" later in this chapter), but if this is not possible, the last climber should consider him- or herself at elevated risk for mistakes and take extra measures to check, recheck, and test his or her own setup. Another important measure to confirm correct setup of a rappel before heading down is to weight the rappel while maintaining security through use of a personal anchor (fig. 11-2).

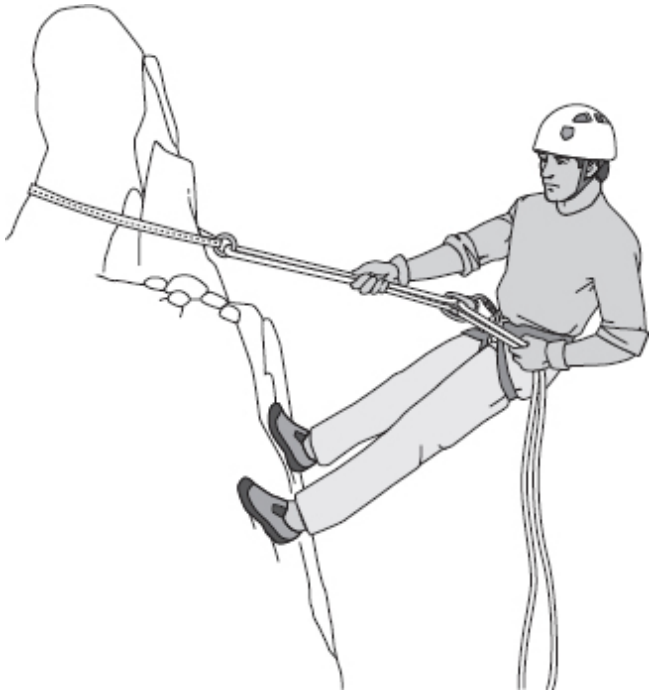

Fig. 11-1. Components of mechanical rappel system: anchor, rope, rappel method for applying friction to the rope, and rappeller. Each element is equally and vitally important.

Following a routine checklist before every rappel can help ensure nothing is missed. One example of a routine that ensures a coherent system involves starting with the rock or mountain and working outward toward the climber: check the anchor attached to the rock, then the rope attached to the anchor, then the rope properly threaded through the rappel device (assuming a mechanical system is being used—see "Rappel Method" below), then the device properly attached to the rappeller's harness, and finally the harness properly fastened to the rappeller. Each of these elements is briefly described below, followed by expanded sections in the rest of this chapter.

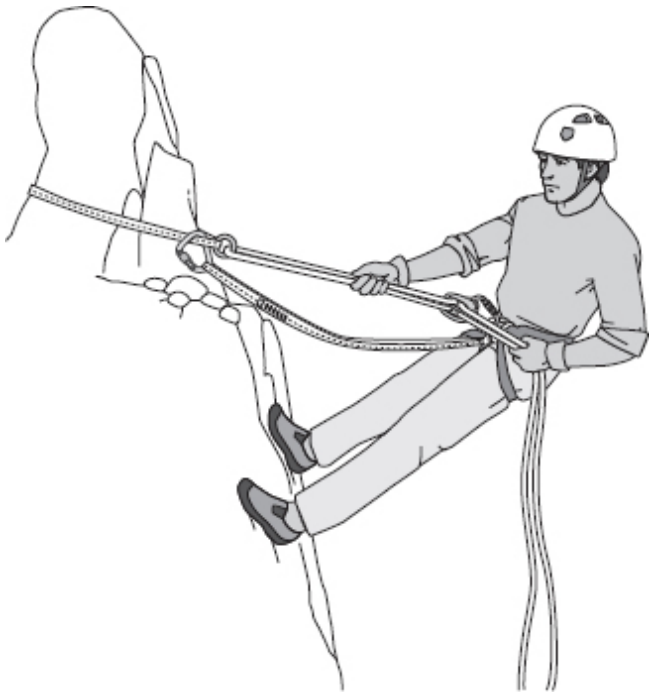

Fig. 11-2. Weighting a rappel setup to test it while attached to anchor with a personal anchor.

RAPPEL ANCHOR

The first element of the rappel system is the anchor: the point on the rock or mountain to which the rest of the system is attached. The anchor must be carefully selected for strength and reliability. Once the rappel has begun, a safe descent depends on the integrity of the anchor, and returning to the anchor to make adjustments can be problematic, if not impossible.

ROPE

The second element is the rope. Typically, the midpoint of the rope is looped through a metal ring (called a *rappel ring*) at the anchor, with the two ends of the rope hanging down the descent route. The rappeller descends both halves of the doubled rope and then retrieves it from below by pulling on one end.

Rappels shorter than half a rope length can be made with just one rope. Longer rappels need the extra length of two ropes tied together. It is necessary to research a route beforehand to determine whether the rappels will require one or two ropes. If two ropes are required (often called a *double-rope rappel*), the knot joining the ropes should be placed near the anchor, with the two equal-length ends hanging down the route. Using two ropes of different

colors can help you remember which rope to pull when retrieving the ropes, for example, “pull on blue.”

RAPPEL METHOD

The third element is the method used to apply friction to the rope to control the rate of descent while the rappeller remains firmly attached to the rope. There are two types of systems for applying friction:

Mechanical systems. The rope passes through a friction device attached to the harness.

Nonmechanical systems. The rope is wrapped around the rappeller’s body to provide the necessary friction.

In either case, the braking hand grasps the rope to control the amount of friction and the rate of descent. Be aware of atypical circumstances that could reduce the friction in the system, such as a new, small-diameter, stiff, or icy rope, a heavier pack, and so forth.

RAPPELLER

The final and most variable element in the rappel system is the rappeller, who must use proper technique both to attach into the rappel system and to descend safely. Transient circumstances such as the rappeller’s attitude, level of fatigue and anxiety, level of attentiveness, level of skill and training, poor weather, impending darkness, and presence of rockfall or icefall can affect the safety of the rappel.

SETTING UP RAPPEL ANCHORS

A rappel anchor attaches the rappel system to the rock, snow, or ice that will be descended. The rappel anchor must be strong enough to support one or more climbers’ full weight as well as any additional forces that may occur, such as the dynamic force of bouncing or a sudden stop during the rappel.

Set up the anchor as near to the edge of the rappel route as possible while ensuring a solid and safe anchor. This affords the longest possible rappel and minimizes risks of getting the rope stuck or inducing rockfall during retrieval of the rope. When looking for an anchor, think about how the rope will route from the anchor location to the ground. Consider any sharp edges that might damage the rope as it is loaded. Choose an anchor location that minimizes

chances of the rope being pulled into a crack or otherwise hanging up on horns or features when it is retrieved from below. Consider these risks when setting up the anchor and then double-check the rappel route after the first rappeller is down. In winter conditions, be aware that if the rope cuts into snow or ice, it can freeze in place.

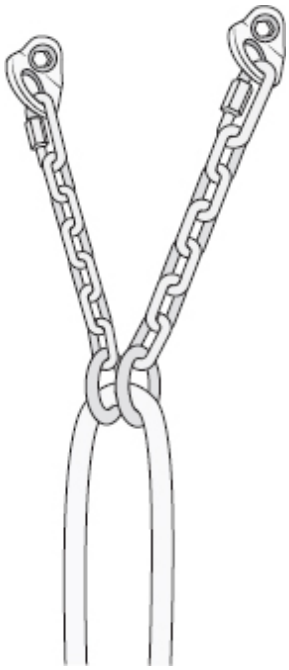

Fig. 11-3. Rope threaded through rappel rings at the ends of bolted chains.

Natural anchors or artificial (manufactured) anchors serve as suitable rappel anchors (see "Selecting an Anchor" in Chapter 10, Belaying). For details on placing removable protection in rock, using natural features, and clipping bolted anchors, see Chapter 13, Rock Protection. For information on anchors for use in snow and ice, see the sections on anchors in Chapters 16, Snow Travel and Climbing; 19, Alpine Ice Climbing; and 20, Waterfall Ice and Mixed Climbing.

A commonly found anchor used for rappelling consists of bolts with chains (fig. 11-3). The rope can be routed directly through the circular rings at the end of the chains for rappelling only—do *not* top-rope this way, it wears out and weakens the rings quickly. If chains and rings are not secured to the bolts at the anchor, add webbing and rappel rings.

On popular climbs, established rappel anchors will have slings (fig. 11-4) and perhaps rappel rings left behind from prior parties, with some parties

adding a newer sling to back up the rappel station; these remnants need to be closely scrutinized for wear and damage:

- Slings with significant wear, damage, nicks, et cetera, should be considered unsafe and removed.
- Slings that are bleached or washed-out in color and have a dry, stiff feel exhibit evidence of damage from ultraviolet light (new slings have saturated color and are supple). However, nylon may be weakened by ultraviolet exposure without visible effects.

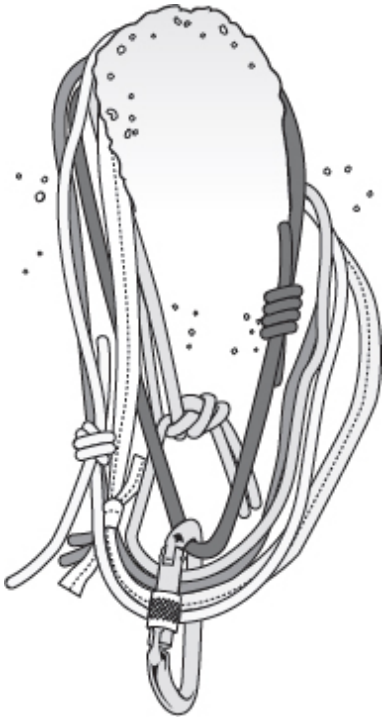

Fig. 11-4. Locking carabiner clipped to layers of webbing and cord tied around a rock horn.

- Inspecting the entire length of slings routed around large boulders may often be difficult since sections of the slings may be hidden. Do not trust existing slings unless the entire length can be inspected.
- Slings not equipped with a rappel ring or carabiner may no longer be safe because rappel ropes have been pulled through them on previous rappels, which generates friction capable of melting and weakening the sling.
- Sometimes so many slings compose an anchor that total failure of every sling is unlikely. Still, a prudent rappeller might cut out a few of the oldest slings and add a new one before attaching the rope.

- If using more than one sling, make them of equal length to help distribute the load and avoid shock-loading the rappel system should one fail.

When two anchor points are used, it is common to run a separate sling from each point, with the slings meeting at the rappel ring. Try to adjust the slings so the force is the same on each anchor point. Keep the V-angle between the two slings narrow (fig. 11-5). See Chapter 10, Belaying, for methods of equalizing anchor points and Figure 10-15 for an explanation of forces at work.

When climbing and belaying, climbers build strong and redundant anchors in case of a fall. But when climbers rappel, their life hangs on the loaded anchor from start to finish. It is essential to build rappel anchors that are SERENE: Solid, Efficient, Redundant, Equalized, and with No Extension (see the "SERENE Anchor Systems" sidebar in Chapter 10, Belaying).

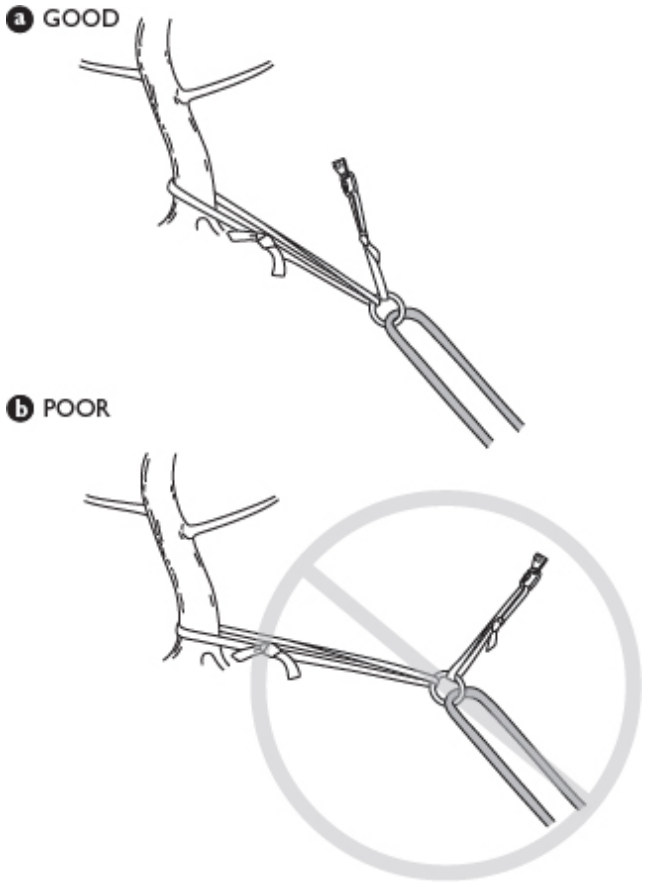

Fig. 11-5. The most common method of attaching the rope to multiple anchors uses a separate sling attached to each of two anchors meeting at the rappel ring; a, a narrow angle between slings provides a stronger overall anchor; b, when the angle between slings is too wide, the load on each anchor point increases significantly.

NATURAL ANCHORS

Often the best natural anchor is a healthy, live, large, well-rooted tree (see "Natural Anchors" in Chapter 10, Belaying). The rope usually goes through a rappel ring attached to a runner (or sling) that is attached to the tree (fig. 11-6a). The rope could be looped directly around a tree without the use of a sling (fig. 11-6b), but this abrades the rope, soils the rope with tree resins, makes it harder to retrieve the rope, and causes unnecessary damage to the tree. Attaching a runner to an unquestionably stout tree branch rather than low on the trunk often helps make it easier to retrieve the rope (the rope runs more directly to the person retrieving it) and reduces the risk of rockfall. However, connecting to a branch rather than the trunk puts more leverage on the tree and should not be practiced unless the trade-offs have been considered.

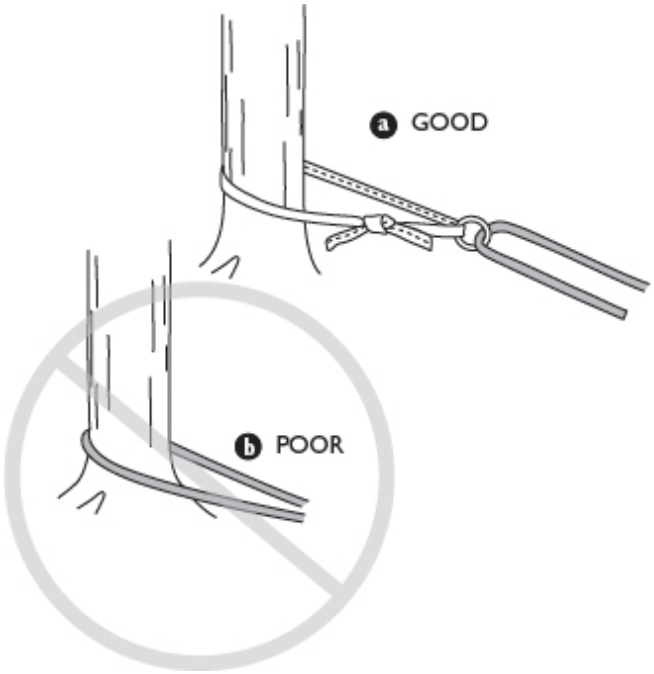

Fig. 11-6. A tree as a natural rappel anchor: a, rappel rope through a rappel ring on a sling tied around a tree (good); b, rappel rope looped directly around tree (poor).

A single anchor point might be used if it is an unquestionably solid, dependable natural anchor. But if there are any doubts, add another equalizing feature or two to the anchor (see "Equalizing the Anchor" in Chapter 10, Belaying). If there are no other natural options for creating a multipoint anchor, the team will gain additional confidence by backing up the anchor with cams or nuts, allowing the heaviest climbers to rappel first, and then removing the backup for the last rappeller if the natural anchor performed

well on the first rappels. Note that the natural anchor must carry all the weight under this test scenario, and thus the backup protection should be extremely robust to handle the excess force should the natural anchor fail and the weight suddenly shift to the backup.

Another useful natural anchor is a rock horn slung with a runner. Never run the rope directly around a rock horn. Always inspect and test the horn carefully to be sure it is not in fact a loose rock masquerading as a solid feature. Guard against the dire possibility that the runner could slide up and come off the horn during a rappel (fig. 11-7).

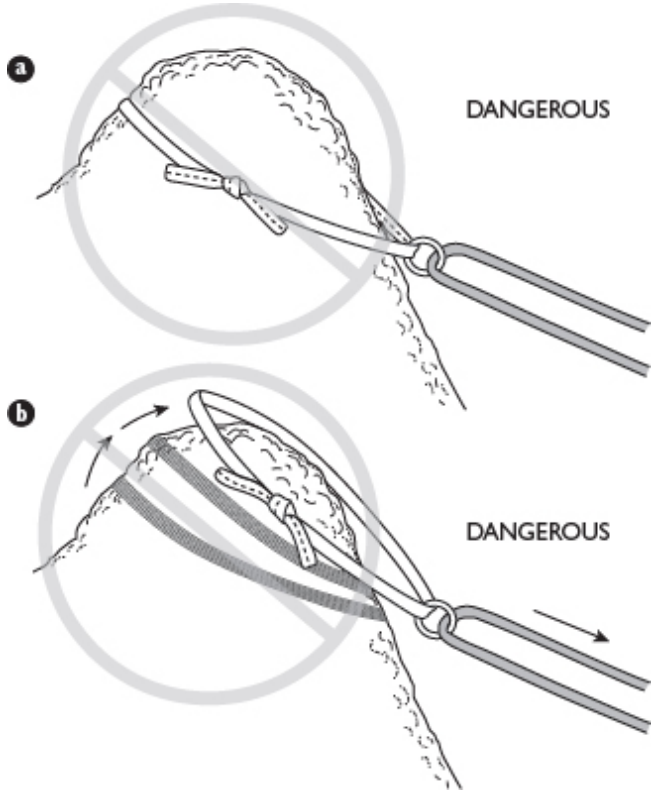

Fig. 11-7. Poor use of a rock horn as a natural rappel anchor: a, dangerous runner placement; b, runner can ride up and slip off rock horn.

Single natural anchors are not recommended if multiple people need to rappel simultaneously, such as in a rescue situation.

ARTIFICIAL ANCHORS

As a rule, when using artificial (manufactured) fixed or removable protection for an anchor, use two or more anchor points and equalize the load between them. The most common artificial rappel anchors are bolts or pitons in the

rock that have been left in place by previous climbers. These must be evaluated for damage, corrosion, and improper installation just as they would if they were being used for belaying or for protection while climbing. Never put the rope directly through the eye of the bolt hanger or piton, because friction may make it impossible to pull the rope back down from below, and the hanger's or piton's sharp edges might damage the rope.

Removable protection such as nuts and hexes are usually used only if no good alternative is available, because it requires leaving behind gear; but it is better to use and leave behind some equipment for added safety than to rely upon a dubious natural anchor. Be suspicious of removable protection found already in place, perhaps left behind by climbers who were unable to remove the pieces. Also be wary of slings attached to such protection, because they may be old, damaged, and unsafe. If fully set and immovable in the rock, an abandoned nut or hex may be used like a natural chockstone by looping a runner directly around it, ignoring the original sling.

SETTING UP THE ROPE

Before setting up the rappel, run through the entire length of the rope to check that no cuts, fraying, or other damage occurred during the climb or on a previous rappel.

ATTACHING THE ROPE TO THE ANCHOR

To prepare the rope for rappelling, attach it to the anchor, in the simplest case suspending the midpoint of the rope from one or more runners or slings that have been attached to the anchor (as shown in Figures 11-1, 11-3, and 11-5a). Some rappellers prefer to use two slings instead of one, for added security. Keep the point of connection between the rappel anchor sling and the rope away from the edge of the rock, snow, or ice of the rappel route (fig. 11-8a) to help prevent abrasion (fig. 11-8b) and binding (fig. 11-8c).

Rappel Rings

Best practice is to use a rappel ring instead of looping the rope directly through the slings; because if the rope rubs significantly on the slings, the friction will create heat that may weaken or melt the slings. Rappel rings (also known as "descending rings" or "rap rings") are simply continuous aluminum, steel, or titanium rings about 1.5 inches (3 centimeters) in diameter, made for

rappelling. Note that instead of rappel rings, quick links—metal ovals with threaded sleeves for opening and closing the link (fig. 11-9)—may be used, but only those that are made specifically for climbing.

The rappel ring (fig. 11-10a) does add another possible point of failure, and some climbers insist on using two rings for redundancy. An alternative is a single ring backed up by a non-weight-bearing sling from the anchor through the rope, ready to hold the rope if the ring fails (fig. 11-10b). Carabiners can be used in place of rappel rings, but as part of the anchor they also must then be left behind.

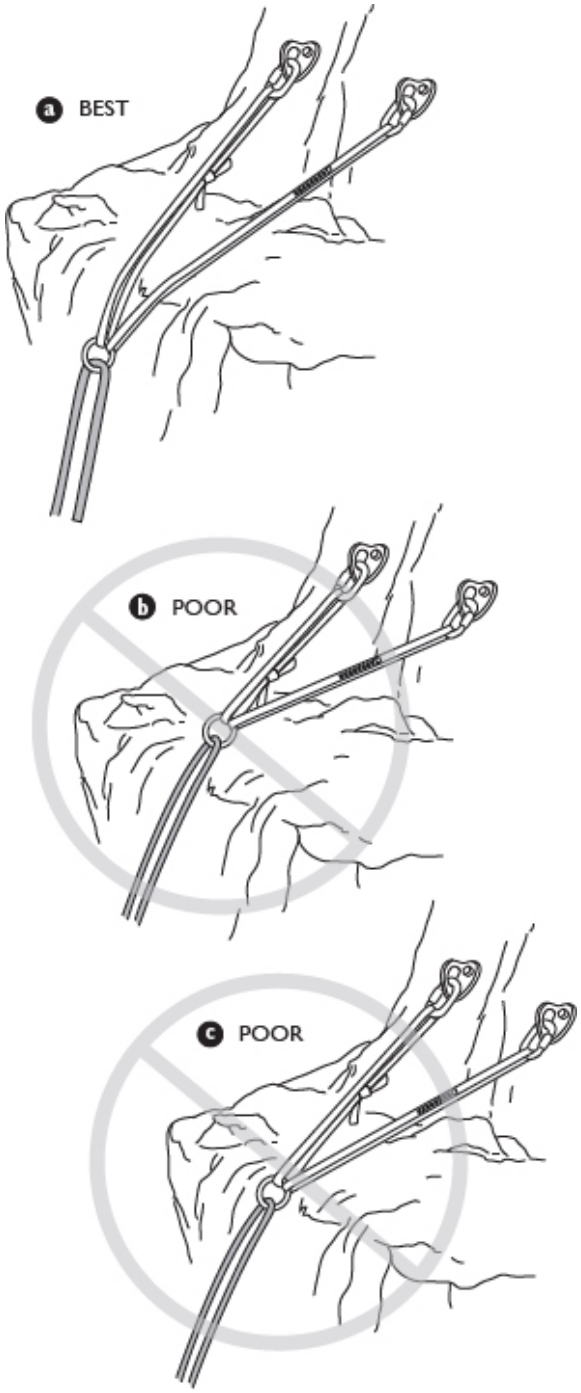

Fig. 11-8. The point of connection between rappel slings with attached ring and rappel rope: a, rope clear of the rock and free to move (good); b, rope will not bind but will still abrade (poor); c, rope, placed at a rock lip or edge, will bind and abrade (dangerous).

Fig. 11-9. Rappel quick link with threaded sleeve.

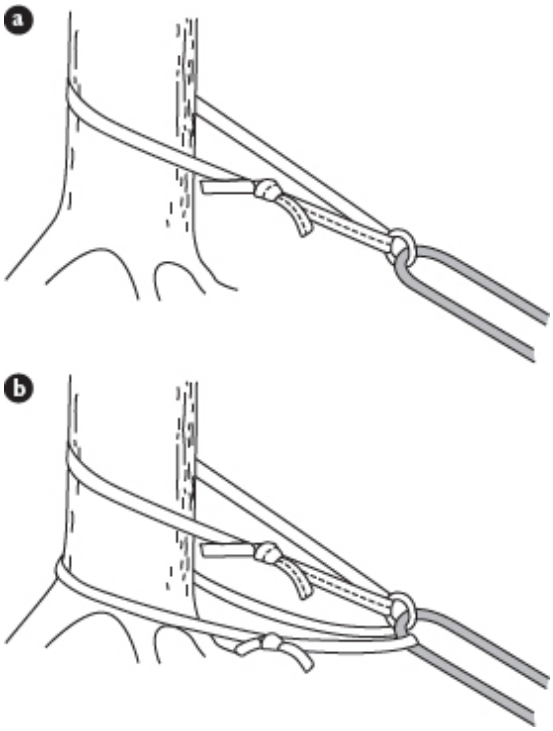

Fig. 11-10. Rappel rope attached to anchor through a rappel ring: a, single ring; b, single ring with loose backup sling.

One Rope

If the rappel is shorter than half a rope length, put one end of the rope through the rappel ring and pull it through until the rope's midpoint is reached and the ends are even.

Two Ropes

For longer rappels, join two ropes together. If the rope lies with one strand against the rock and the other strand on top of the first, friction will impede retrieval, and it may be possible to pull only the strand closest to the rock. When using two ropes, place the knot joining them below the anchor, on the side of the strand to be pulled, which is also the lower of the two strands (fig. 11-11a)—otherwise, the rope may pinch between the rock and the end of the rope being pulled, and retrieval may not be possible (fig. 11-11b).

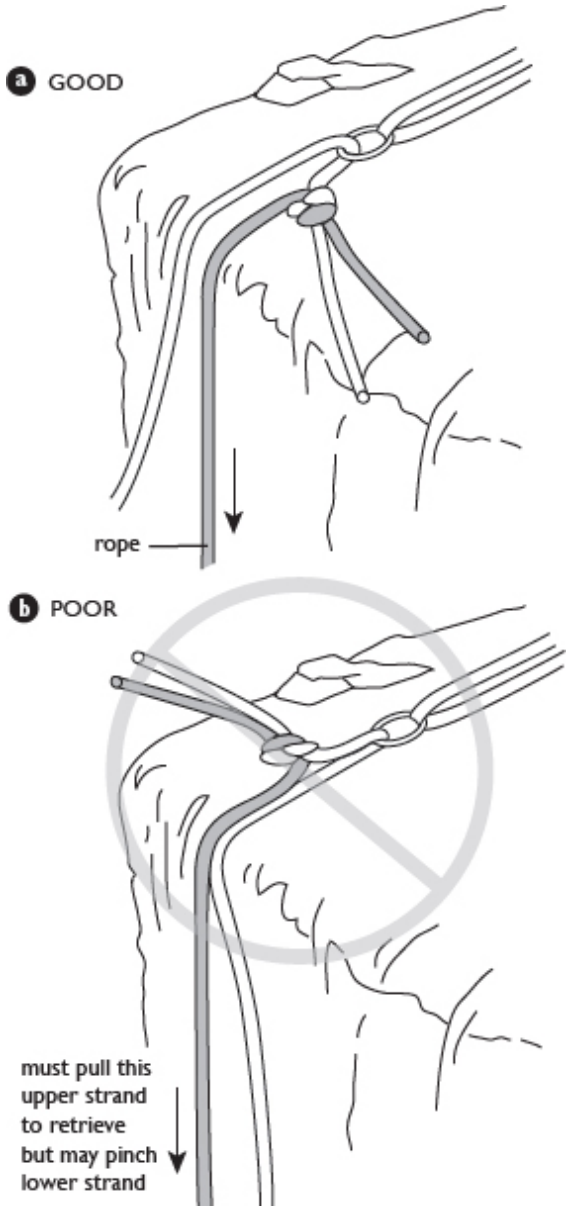

Fig. 11-11. Knot placement with two-rope rappel: a, with the knot on the side of the lower rope, the rope can be retrieved without getting stuck; b, with the knot on the side of the upper rope, the lower rope can be pinched tight (between rock and upper rope) when you try to retrieve the rope by pulling on the top strand.

There are multiple ways to tie the rappel ropes together, each having benefits and drawbacks; "Knots, Bends, and Hitches" in Chapter 9, Basic Safety System, describes all of these knots. Here we highlight knots for joining rappel ropes; these knots are easy to untie following tension.

Flat overhand bend. This knot is also called an offset overhand bend or "European Death Knot" even though it is very safe when tied properly. To tie this knot, hold the tails of the two ropes together and tie an overhand knot.

Dress the knot carefully, taking care to tighten it by pulling on each of the four strands (fig. 11-12a). It is extremely important for the tails to be 12 to 18 inches (30 to 46 centimeters) long, because the knot has been known to roll (or "capsize") under load. When the knot rolls, one side of the knot flips over the other side (toward the tail), shortening the tails. If rolled enough times, the knot will roll off the ends of the rope. The rolled knot is identical to the original knot, but has shorter tails.

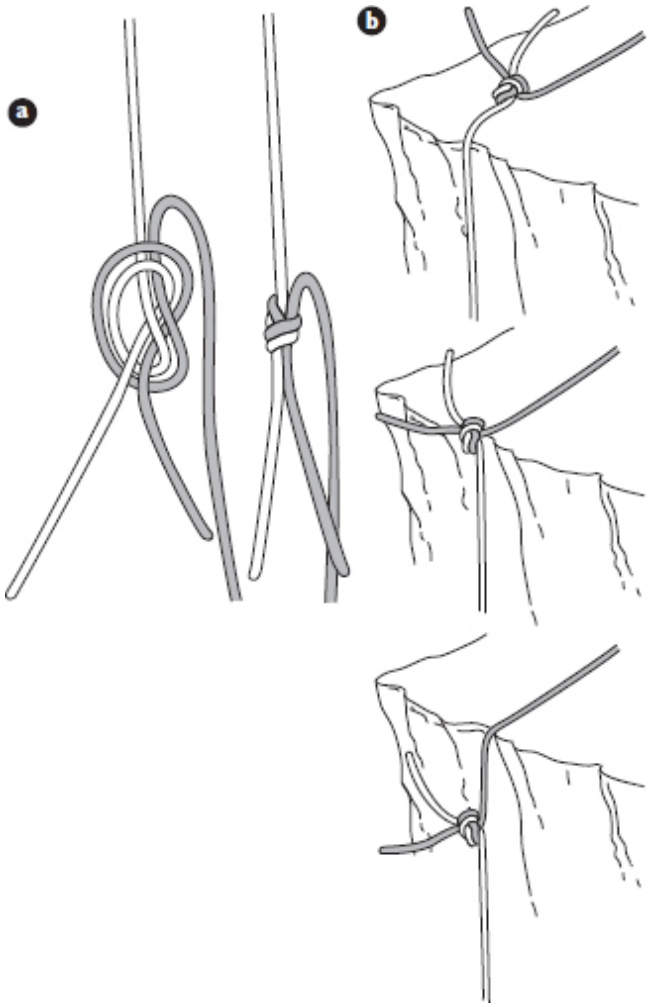

Fig. 11-12. Joining rappel ropes with a flat overhand bend: a, flat overhand bend; b, the bend will rotate, making it less likely to catch on an edge or in a crack.

Because the flat overhand bend's knot lies offset from the axis of the direction of force, it is less likely than other knots to get stuck in cracks (fig. 11-12b). It is a good idea to use a second overhand as a backup knot (see the next section), which could optionally be removed before the last climber rappels

to reduce the chance of the rope getting stuck in a crack when it is retrieved. Note that it is important that this is an overhand, not a figure eight.

Double fisherman's bend. This is a very secure knot, so if more than one person must rappel at the same time, it is the preferred knot. It must be tied with long tails. However, it is bulkier and more likely to become stuck in cracks.

USING BACKUP KNOTS

Even very experienced rappellers have inadvertently rappelled off the end of their ropes, with tragic results. When using a rappel device, put a large knot, such as a double or triple barrel (fig. 11-13), or a figure eight, in the ends of the rope to reduce this danger. If you add knots, do not rely blindly on them; knots might come untied, and in any case, you must keep an eye on the ends of the rope to plan where to stop. Knots also may jam in the rappel device or become lodged in a crack. To prevent the knots from becoming lodged in a crack below the next belay station, knot the ends of the rope and then secure them to the harness while you descend.

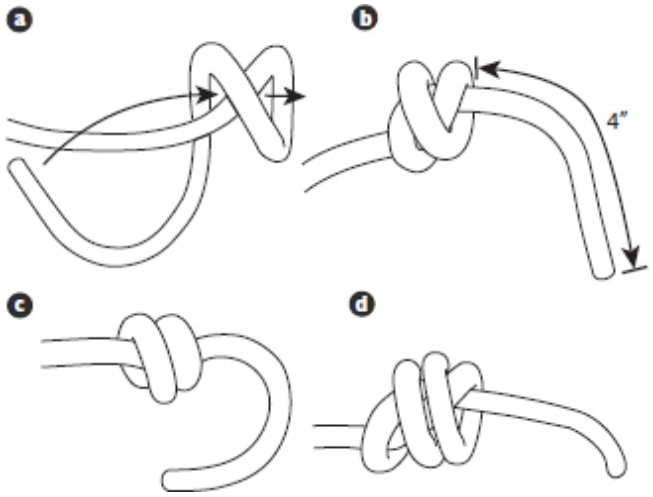

Fig. 11-13. Barrel knot: a, wrap the end of the rope around itself twice, pulling the end through the loops; b, cinch down the loose end and make sure the tail is at least 4 inches long; c, back side of the resulting barrel knot; d, add another wrap for a triple barrel knot.

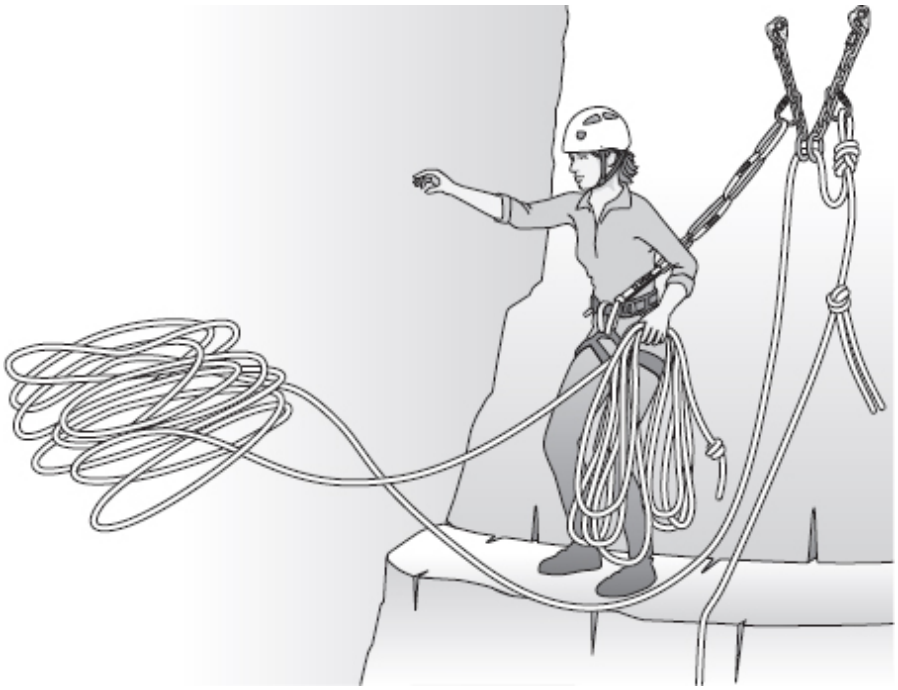

Fig. 11-14. Throwing down the rope: Climber is connected to the anchor for safety while working near the edge; rope (in this case two tied together) is clipped to the anchor with a bight near the middle to prevent losing it and has been threaded through the rappel rings then coiled. Toss the coil nearest the anchor first, then the rope-end coil.

THROWING DOWN THE ROPE

After threading the rappel rope through an anchor and equalizing the ends, prepare the rope for the rappel. There are several methods for tossing, or lowering, the rope down the rappel route. With any method, the goal is to reduce rope snags and tangling, as well as move the rope toward the bottom.

1. Attach yourself to an anchor using a personal anchor to secure yourself, preferably with a locking carabiner (see "Personal Anchors" in Chapter 9, Basic Safety System). Make sure your waist is not above the anchor: a slip could apply significant load to the anchor because the personal anchor system is static (fig. 11-14).
2. Tie an overhand knot on a bight of rope near its midpoint and clip it to the rappel anchor with a carabiner to prevent the disaster of losing the rope when the coils are tossed.
3. Tie backup knots at the ends of the rope (see "Using Backup Knots" above).
4. Beginning from the middle of the rope, coil each half of the rope separately into two butterfly coils, creating a total of four butterfly coils,

two on each side of the anchor.

5. Evaluate the wind and terrain before throwing the coils out. Be sure to compensate for any significant wind. Avoid throwing the coils onto snags, pinch points, or sharp edges below.
6. Before making the toss, alert others below by shouting "Rope!" It is a good idea to shout the word two times and/or wait a moment after the warning before throwing the rope, to give anyone below time to respond.
7. Start on one side of the anchor, tossing the coil nearest the anchor out and down the route, then the rope-end coil. Repeat for the other half of the rope (in Figure 11-14, one half of the rope has already been dropped below).
8. After all the coils have been tossed, remove the carabiner and bight, leaving the rope running free in the rappel rings.

If the rope tangles or hangs up on the rappel route below, it is usually best to pull it back up, recoil it, and toss it again. Sometimes, however, it is possible to free the rope during the rappel.

Instead of throwing the rope, an alternative is to secure the coiled rope to your harness and feed it out as you rappel. This works better than tossing the rope in windy conditions. One method is to simply feed the rope out of a pack or rope bag during the descent.

Another option is to fashion the rope coil into "saddlebags": girth-hitch a single-length runner to the harness wherever it is convenient. Cradle the butterfly coils in the runner next to the harness, and clip the other end of the runner to the harness with a carabiner (fig. 11-15). The butterfly coil should be oriented so that it feeds freely as the climber rappels.

When either feeding rope out of a rope bag or using this saddlebag method, the rappeller may need to actively tend the rope to get it to feed out properly during the rappel.

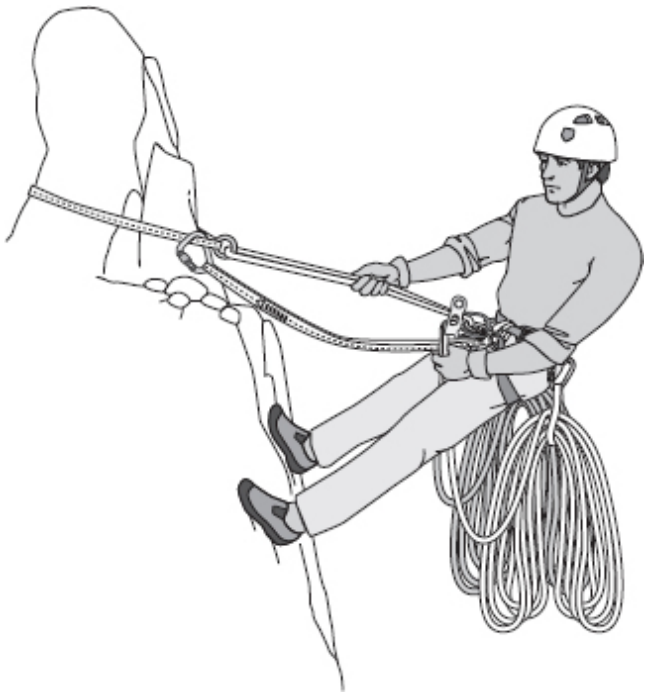

Fig. 11-15. Setting up the rappel with "saddlebags" of rope.

KEEPING ROPE LENGTHS EQUAL

As noted at the start of this chapter, rappelling with ropes of unequal length was found to be the top cause of accidents reported in *Accidents in North American Mountaineering*. Both strands of the rappel rope must either touch the next stance or hang equally. If not, one end may pull through the rappel device before the rappeller reaches a stance at the end of the rappel. Should this occur, the rappeller would lose the ability to control the descent and would free-fall. Watch for the potential problems discussed below. Backup knots at the ends of the rope are strongly recommended (see "Using Backup Knots" above). These stopper knots keep you from rappelling off the ends of the rope should the rope be too short. The correct stopper knot prevents the end of the rope from passing through your rappel device.

When using two ropes of unequal diameters, take extra care to monitor the length of each strand during the rappel. The differing diameters and elastic characteristics of the ropes may cause one rope to advance through the rappel device more quickly than the other, thereby altering the relative lengths of the rope strands. Place the knot on the side of the anchor with the rope that is most likely to slide; usually this is the smaller-diameter rope.

Also, be aware that ropes that are nominally equal in length, even from the same manufacturer, are often actually somewhat different lengths.

RAPPEL METHOD

Once the rappel anchor and the rope are set up, the climber needs a method of connecting to the rope and applying friction to it to control the rappel. Typically, a mechanical device provides a secure means of attachment, but methods of wrapping the rope around the body may also be used. If climbers rely on a mechanical rappel device, it is imperative that they be skilled in a secondary rappel method such as carabiner brake or munter rappel in case they drop their rappel device midclimb.

MECHANICAL RAPPEL SYSTEMS

Most rappellers use a system consisting of their climbing harness and a belay-rappel device as their principal rappelling method. All of the devices operate in essentially the same manner: by applying varying degrees of friction to the rope. With some belay devices, the rope does not feed through the device smoothly on rappel. Some devices may also easily heat up from rope friction. Before using any new device, closely read and follow the manufacturer's instructions.

The two strands of rope at the rappel anchor are inserted into the rappel device, which is then clipped with a locking carabiner to the climber's harness, in much the same way as for belaying. During the rappel, the bends in the rope that pass through the device and around the locking carabiner apply friction, magnifying the force exerted by the climber's braking hand (fig. 11-16). The position of the braking hand, which holds both strands of rope below the device (see Figure 11-15), provides a controlled descent. The rappel device and the braking hand together control the speed of descent and allow the rappeller to halt the descent at any time.

At the top of the rappel, the weight of the rope hanging below the device adds friction, making it easier to control the rate of descent near the top of a rappel than at the bottom. This is especially so on very steep or overhanging rappels where most of the rope hangs free. But no matter how little grip strength may be required to control the descent, the braking hand must never leave the rope. The other hand—the guiding, or uphill, hand—may slide freely along the rope to help maintain balance. With some setups, wrapping the rope partly around your back further increases friction. A leather glove is recommended to protect the braking hand, which is important when a rappel exceeds the desired speed and would otherwise burn a bare hand.

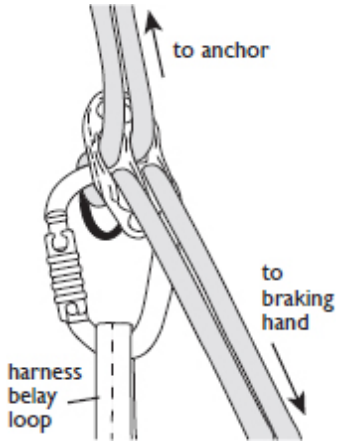

Fig. 11-16. An aperture-style device set up for rappelling.

Rappelling with a mechanical system requires a harness (see Chapter 9, Basic Safety System). Never rappel with just a waist loop (a simple loop of webbing tied around your waist); it can constrict your diaphragm enough to cause you to lose consciousness. In an emergency, an improvised diaper sling may be used for rappelling, even though it would not ordinarily be used for climbing (see "Diaper Sling" in Chapter 9, Basic Safety System).

Carabiner Brake Method

The carabiner brake method for rappelling is somewhat complex to set up but has the virtue of not requiring any special equipment—just carabiners. The carabiner brake system works best with oval carabiners but can also be managed with D-shaped carabiners (see "Carabiners" in Chapter 9, Basic Safety System).

To create the carabiner brake setup, start by attaching one locking or two regular carabiners to the seat harness. Because a harness carabiner could be subjected to a twisting or side load, two carabiners or a locking carabiner should be used. When using two nonlocking carabiners, position the gates to keep them from being forced open and accidentally unclipping. The correct position (called "opposite and opposed") is with the gates on opposing sides, forming an X when they are opened at the same time (see Figure 9-37a in Chapter 9, Basic Safety System).

Next, clip a pair of carabiners—here, a pair is required: a single locking carabiner will not suffice—to the harness belay loop carabiner(s), also with the gates opposite and opposed. Lift a bight of the rappel ropes through the outer carabiner pair, from the bottom—do this facing the anchor to ensure the

system is oriented properly for descent. Take yet another carabiner and clip it across the outer carabiner pair, beneath the bight of rope, so its gate is facing away from the rope loop. The rope then runs across the spine (not the gate!) of this final carabiner, known as the braking carabiner (fig. 11-17a).

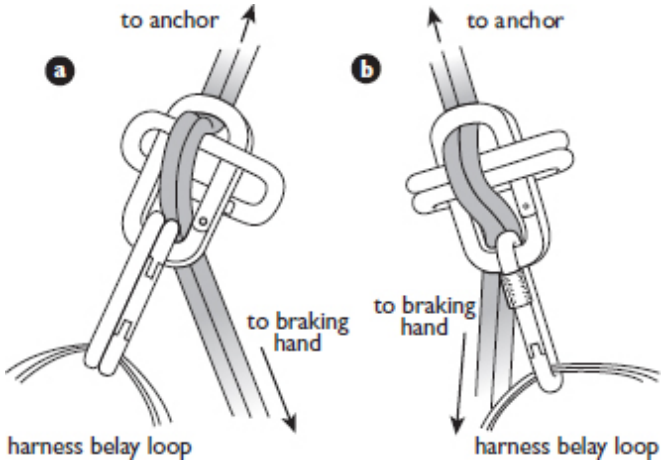

Fig. 11-17. Carabiner brake system: a, with two opposite and opposed carabiners at the harness and one braking carabiner clipped across the outer (opposite and opposed) carabiner pair; b, with one locking carabiner at the harness and two braking carabiners clipped across the outer (opposite and opposed) carabiner pair in order to provide greater friction.

One braking carabiner provides enough friction for most rappels on ropes that are 10 to 11 millimeters in diameter. A second (or even third) braking carabiner will add friction to the system (fig. 11-17b) and might be used for thinner ropes, heavy climbers, heavy packs, or steep or overhanging rappels. The ropes must always run over the solid side of the braking carabiner(s), never across the gate.

The weight of the rope hanging down the cliff may make it very difficult to pull the bight of rope up through the outer pair of carabiners and hold it while you clip in the braking carabiner. It helps to get that weight off the system. Pull up some slack rope and throw a couple of wraps around your leg to take the weight in order to solve this problem. Alternatively, set up an autoblock first (see "Safety Backups" later in this chapter) and pull up the rope, allowing the autoblock to hold the rope's weight.

Improvised Carabiner Brake

A second carabiner brake method, an improvised carabiner brake, is simpler than the carabiner brake method and requires only three locking carabiners.

The steps to setting up this method are outlined below and shown in Figure 11-18.

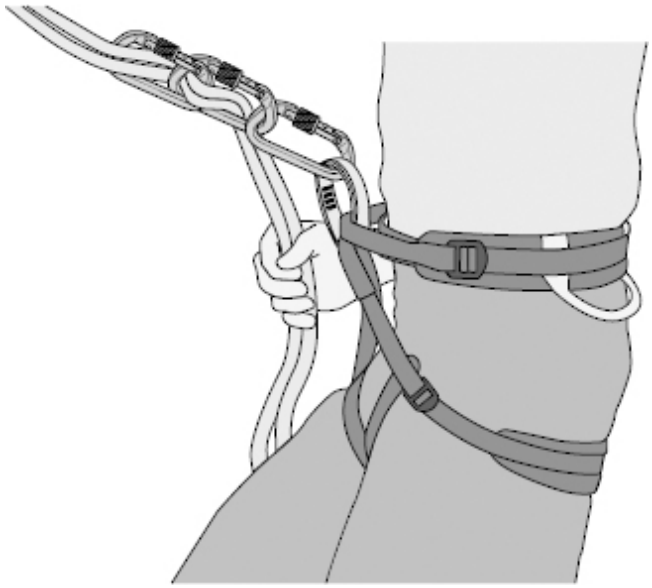

Fig. 11-18. Improvised carabiner brake system.

1. Clip and lock one locking carabiner to the harness belay loop.
2. Clip and lock a second locking carabiner to the first.
3. Pull a bight of rope through the second carabiner.
4. Clip and lock a third locking carabiner to this bight and the rope strand running to the anchor.
5. Ensure all carabiners are locked, and take care that the rope does not run against the screw gates of any of the carabiners.

This approach generally provides less friction than other methods of rappelling but has the advantages of using fewer carabiners than the carabiner brake method and not adding twists to the rope, which is common with the munter hitch shown below.

Munter Hitch

The same hitch that is used for belaying can also be used for rappelling (see Chapter 10, Belaying). It is worthwhile to learn this method as insurance because it requires only one locking carabiner and no other equipment. Though it is easy to set up and very safe, it puts significantly more twists in the rope than other rappel methods do. You must be very sure to keep the brake rope on the spine side of the carabiner (fig. 11-19), because if the rope

runs over the gate, it may unlock the carabiner while you are rappelling. For additional security, a backup is recommended, such as an autoblock or a fireman's belay (see "Safety Backups" later in this chapter).

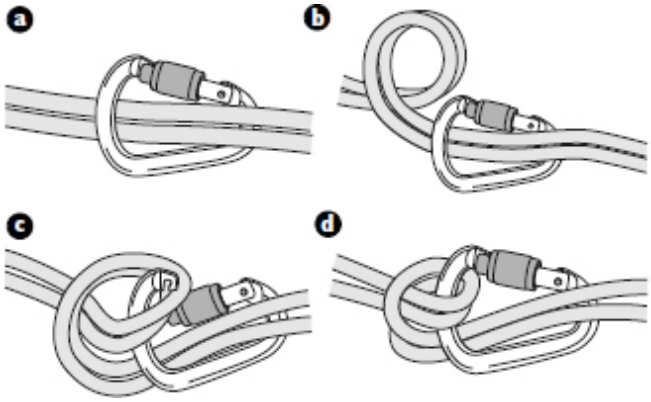

Fig. 11-19. To rappel using a munter hitch: a, clip locking carabiner around rope; b, create loop using both strands of rope above carabiner, with anchor strand of rope behind the climber strand; c, hook carabiner into loop; d, lock carabiner gate.

Rappel Extension

Many climbers extend the rappel device connection to their harness with a personal anchor so that the rappel device rides higher on the rappel rope and in front of their chest (fig. 11-20). Rappel extension is recommended for its advantages:

- The rappeller can comfortably use either hand (or both hands) to brake the rappel and can add—and manage—a superior autoblock (see "Safety Backups" later in this chapter).
- Both ends of the autoblock can be clipped in to the belay loop of the harness, which is better than using the leg loop attachment.
- That way, the autoblock cannot run against the rappel device, which can cause the autoblock to fail.
- The personal anchor is readily available for clipping to anchors.

The disadvantages of rappel extension are that this technique introduces one more piece into the rappel system—the runner used for the extension—and it brings the rappel device closer to long hair, which may get caught in the device; it is essential to have a knife handy to remedy this situation.

Here is how to create the extension with double-length runner, although a personal anchor can be used as well. Tie an overhand knot in the middle of the runner to create two loops of equal length. Girth-hitch the runner to the harness tie-in points, not to the belay loop, keeping its knot or stitching points

clear of the girth hitch or carabiner clipping points. A locking carabiner at the far end of the two-loop runner (fig. 11-20a) serves as the personal anchor (a slipknot at the end keeps the carabiner in place); a locking carabiner attached to both loops of the runner (fig. 11-20b) serves as the attachment for the rappel device. To add an autoblock, attach both of its ends directly to the carabiner on the harness belay loop instead of to the harness leg loop (fig. 11-20c), and loop the cord around the rope below the rappel connection. When the personal-anchor component is not in use, simply "stow it"by clipping and locking the carabiner to the harness belay loop (fig. 11-21).

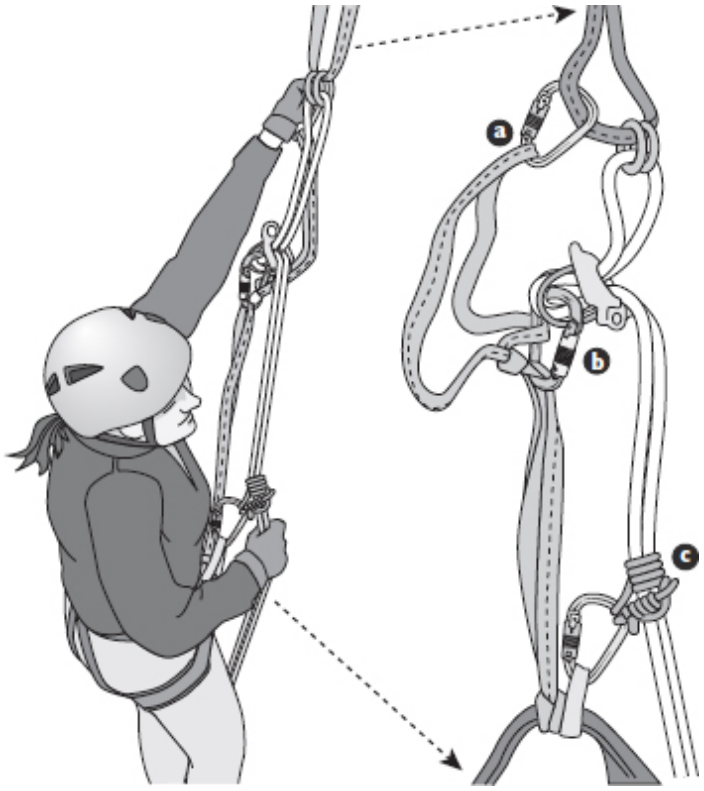

Fig. 11-20. Rappel extension (double-length runner clipped in the middle to the rappel device) with: a, integrated personal anchor (carabiner in climber's left hand, the outer half of the rappel extension); b, carabiner below knot, clipped in to runner and both rope strands; c, autoblock, wrapped around the rappel rope and both ends clipped to the belay loop with a locking carabiner.

NONMECHANICAL METHODS

Two traditional rappel methods use no hardware what-soever to create friction on the rope. Instead, the rope is simply wrapped around parts of the climber's body. These methods can be especially helpful if climbers find themselves without a harness.

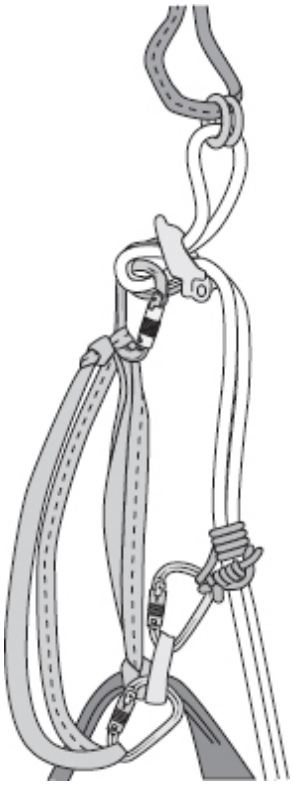

Fig. 11-21. Rappel extension setup with personal anchor stowed on harness belay loop.

Dulfersitz

A simple, all-purpose method, the *dulfersitz* (fig. 11-22) should be mastered by every climber in the event that a harness or carabiners are not available. To set up, face the anchor and straddle the rope. Bring it from behind you and around one hip, up across your chest, over the opposite shoulder, and then down your back to be held by the braking hand (the downhill hand) on the same side as your wrapped hip. Your other hand is the guiding hand, which holds the rope above and keeps you upright. Add padding if possible between your body and the rope.

The *dulfersitz* has a number of drawbacks compared with mechanical rappel systems. It can unwrap from your leg, especially on high-angle rappels; this risk can be mitigated by keeping your wrapped leg slightly lower than your other leg. As with all rappel methods, stay under careful control. If you are wearing a pack, the *dulfersitz* is even more awkward. The *dulfersitz* is used in modern climbing only when there is no reasonable alternative or for short and easy, low-angle rappels to save the trouble of putting a harness back on (though down-climbing should be considered as an alternative in this case).

Fig. 11-22. The dulfersitz: *a nonmechanical rappel method.*

Fig. 11-23. The arm rappel: another nonmechanical rappel method.

Arm Rappel

Though the arm rappel is not used much, it is occasionally helpful for quick descent of a low-angle slope. Lay the rappel rope behind your back, bring it under your armpits, and wrap it once around each arm (fig. 11-23). Be sure the rope does not run over any exposed flesh, which can cause rope burns. Control the rate of descent with your hand grip. For an arm rappel with a pack, be sure the rope goes around your pack rather than on top of or underneath it.

RAPPEL TECHNIQUE

Typically the first rappeller is one of the more experienced members of the group. On the rappel, this first rappeller usually fixes any tangles or problems with the rope and clears the anchor area and route of debris that might be dislodged during rappels.

GETTING STARTED

Just before descending, shout “On rappel!” to warn others that a rappel has begun. Now comes the most nerve-wracking part of many rappels. To gain stability, your legs must be nearly perpendicular to the rock, which means you must lean backward, out over the edge of the cliff (fig. 11-24), and commit to weighting the rope for rappel. If the terrain allows it, ease the transition by down-climbing several feet before leaning out and weighting the rope to start the rappel (fig. 11-25). Take up any slack between you and the anchor before leaning out or weighting the rope.

Fig. 11-24. Starting to rappel from a high anchor.

Fig. 11-25. Down-climbing to get below a low anchor before starting to rappel.

You may be able to sit or crouch on the edge of the rappel ledge (fig. 11-26a) and wiggle gently off (fig. 11-26b), simultaneously turning inward to face the slope (fig. 11-26c). This technique is referred to as a "sit-and-spin."

It is particularly useful when you are starting the rappel above an overhang or when the anchor is located lower than your harness when you are standing on the rappel edge.

MAKING THE RAPPEL

Three things that must be considered during the rappel are position, speed, and movement.

Position

While descending, seek a stable body position: feet shoulder-width apart, knees flexed, body at a comfortable angle to the slope and facing a little toward the braking hand for a view of the route (see Figure 11-26c). Common beginners' mistakes include keeping the feet too close together and not leaning back far enough, which can cause feet to slip off the rock. Some go to the other extreme and lean too far back, increasing their chance of flipping over. If anything should happen, such as tipping over or losing your footing, it is absolutely critical to remember to hold on to the rope with the braking hand.

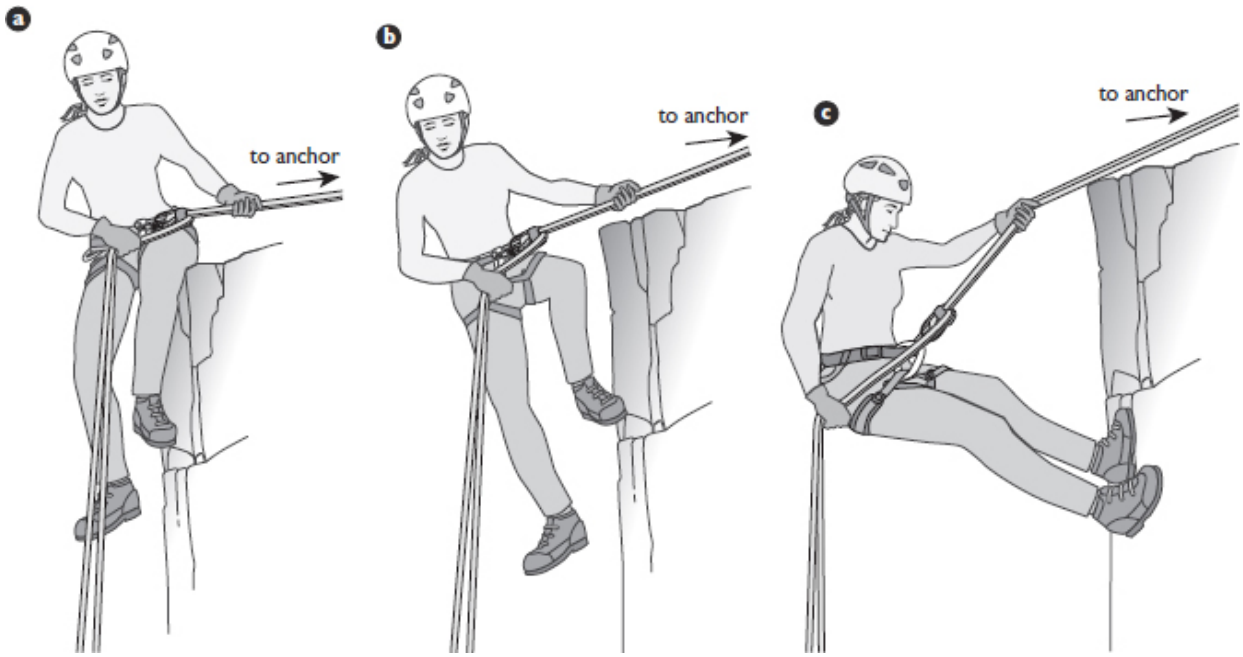

Fig. 11-26. Starting to rappel from a steep ledge and a low anchor: a, sitting down on the ledge; b, squirming off to get started; c, turning inward to face the slope.

POTENTIAL PROBLEMS WHEN RAPPELLING

Climbers have to be aware of the many problems they may encounter when rappelling, especially because climbers are often tired when setting up to rappel. These tips will help you troubleshoot.

Loose rock. Use extreme caution when rappelling a face with loose or rotten rock. Rock may be knocked loose either by you as you descend, or by the rope as it rubs against the rock above you. The loose rock could injure you or damage the rope. Another danger is that the next rappeller could knock rocks down on you. Take care to position yourself in a safe area (out of the fall line or under a rock outcropping) before calling "Off rappel!," and stay there until the entire party has rappelled. Rocks are also often knocked loose when the rope is pulled at the end of the rappel. Keep an eye above you while pulling the rope and make sure no party members remove their helmets until the rope has been safely retrieved after the final rappel.

Overhangs. It is easy to swing into the face below an overhang, smashing your hands and feet. There is also the risk of jamming the brake system on the lip of the overhang. A couple of methods assist in making the difficult transition from above the lip of an overhang to below it.

One method is to bend deeply at your knees with your feet at the uppermost edge of the overhang, then release enough braking tension to slip down 3 or 4 feet (about 1 meter) at once, and then lock off the rappel with sudden braking action, which halts further acceleration once you are past the lip of the overhang. The abrupt halt and resulting bounce stress the rappel system, but this method helps reduce both the chance of a swing into the face below and of jamming the brake system on the lip.

Another method is to place your feet on the lip of the overhang and then lower your waist down below your feet. Then "walk" your feet down the underside of the overhang until the rope above makes contact with the rock face above.

Below an overhang, you will dangle free on the rope. Assume a sitting position, use the guiding hand on the rope above to remain upright, and continue steadily downward. Often you will slowly spin as twists in the rope unwind.

Pendulums. Sometimes reaching the next rappel stance requires you to move to the right or left of the fall line, walking down the face diagonally instead of moving straight down. If a slip occurs, you will pendulum back toward the fall line. After such a fall, it may be difficult to get

reestablished on the proper rappel course without climbing back up the rope with prusik slings or mechanical devices. To avoid this potentially dangerous situation, try to set up rappel routes so that you are rappelling down the fall line as much as possible. A pendulum fall presents a risk of injury and possibly letting go of the brake rope—making a backup method imperative when a diagonal rappel is unavoidable.

Loose ends. Clothing, long hair, pack straps, chin straps from a helmet, and just about anything with a loose end all have the potential to get pulled into the braking system. Keep a knife handy to cut foreign material out of the system, but be extremely careful with a sharp knife around rope, especially a rope under tension, which cuts easily.

Rope tangles. If the rope gets tangled or jammed during your descent, the problem must be corrected before you rappel past it. Stop at the last convenient ledge above the area, or stop with a leg wrap (see "Stopping Midrappel" below). Pull the rope up, correct the problem, then throw it down again. Sometimes there is a simple solution; for instance, when you are rappelling down blank slabs, tangles often may be shaken out as they are encountered. Keep an eye out for tangles or other possible problems below you.

Jammed rappel device. If the rappel brake system jams on something (such as a shirt) despite your precautions, it can most likely be freed by unweighting it. First, free your hands by using a leg wrap or a backup mule knot (see "Stopping Midrappel" below). Next, unweight the brake system by either standing on a ledge or tying a prusik hitch above your brake system and chaining slings together until they are long enough to stand in. In the worst case, you might even Texas-prusik some distance up the rappel ropes (see "Prusik System" in Chapter 18, Glacier Travel and Crevasse Rescue, for information on the Texas prusik) or climb the wall. Then, if you are unable to free the jammed material, cut it away from the brake system, taking care not to nick the rope. A prusik loop, three or four slings, and a knife should always be on hand.

Some climbers prefer to brake with both hands. With two hands, use an alternating, hand-over-hand, shuffle-brake motion to feed the rope through the rappel device. Others feel more secure with a nonbraking hand high on the rope, to help keep them upright and to fend off any hazards (see the "Potential

Problems When Rappelling" sidebar). Either way, what is imperative is that one hand remains on the brake rope at all times.

Speed and Movement

As you rappel, move slowly and steadily, with no bounces or leaps. Feed the rope slowly and steadily into the rappel system, avoiding fast stops and jerks, which shock-load the anchor. A sudden stop during a rapid descent subjects the anchor to additional force. Higher rappel speeds put more heat and stress on the rappel system; very fast rappels can damage a rope. You could also lose control of the rope.

STOPPING MIDRAPPEL

If you need to stop partway down a rappel, you can secure the rope in a couple of ways, described below. Some rappel or belay devices have other ways to stop the rope in the device; consult the manufacturer's instructions or obtain reliable instruction on their use.

Fig. 11-27. Leg wrap: stopping "hands free" midrappel with the rope wrapped around one leg.

Leg Wrap

One method for securing the rope midrappel is to wrap the rope two or three times around one leg. The friction of the wrap, increased by the weight of the rope hanging below the wrap, is usually enough to halt further descent. Keep the braking hand on the rope while passing the rope behind your back, and use the guiding hand to assist with wrapping the rope around your leg (fig. 11-27). Keep the braking hand in position until the wraps are completed and tested. For even more friction, tuck a bight of the loose end of the rope under all the leg wraps.

To continue the descent, be sure to reestablish the braking hand before releasing the leg wraps. On steep rappels, simply remove your foot and leg from contact with the rock and shake the wraps off while holding the rope with the braking hand.

Mule Knot

Another method for securing the rope midrappel is to use a mule knot to tie off the rappel, just like tying off a belay; see "Mule Knot" and Figures 9-20 and 9-21 in Chapter 9, Basic Safety System. The mule knot is a load-releasing knot; other knots may be difficult to remove once they are loaded.

SAFETY BACKUPS

Belay methods and backup knots at the end of rappel ropes can enhance the safety of a rappel. In addition, they add security to particularly risky or unnerving rappels and may save the life of a rappeller hit by rockfall. They also help beginners gain confidence in rappelling.

SELF-BELAY WITH AN AUTOBLOCK OR PRUSIK

Tying a friction hitch (such as an autoblock or a prusik) on to the rope below the rappel device, clipped to a harness belay loop or leg loop, enables you to stop without gripping the ropes. If tied properly, these self-belay hitches will grip the rope and halt your descent any time you do not actively tend them.

To make a self-belay autoblock, use a sewn runner or accessory cord tied in a loop (see "Runners" in Chapter 9, Basic Safety System); the appropriate size of the runner or cord varies with rope diameter—always test compatibility before you use the hitch by making sure the hitch will grab the rope. Attach the runner or loop to the seat-harness leg loop with a carabiner or a girth hitch; wrap the loop around both strands of the rappel rope(s) below

the rappel device—typically, three wraps provide enough (but not too much) friction; then clip the end of the runner or loop to the seat-harness leg loop with the same carabiner (fig. 11-28a). Alternatively, tie the tie-off loop to both strands of the rappel rope(s) with a prusik hitch below the rappel device and clip the free end of the loop to the harness leg loop. The autoblock can be connected to the belay loop on the harness in the case of an extended rappel (see "Rappel Extension" above). If the rappel is not extended, the leg loop must be used to avoid having the cord pulled into the rappel device.

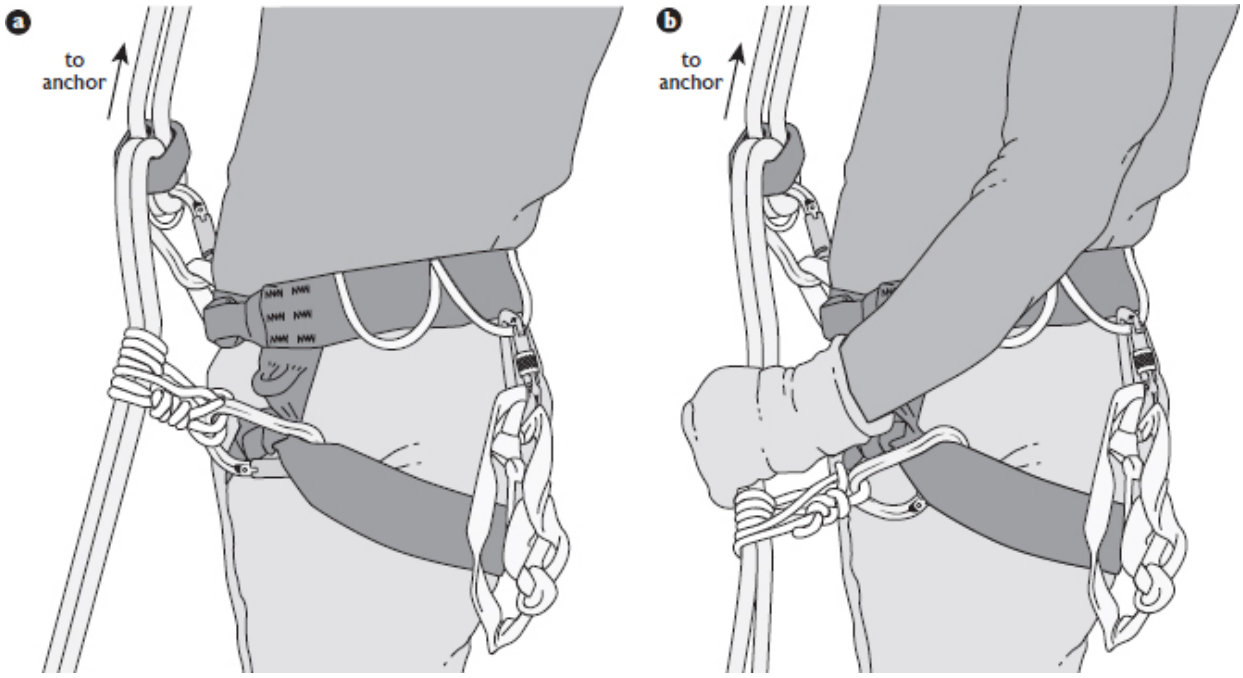

Fig. 11-28. Self-belay autoblock on rappel: a, with an aperture-style device setup; b, tend the friction hitch by manually sliding it down along the rope.

In general, the autoblock is easier than the prusik to release once it has been loaded. For both the autoblock and the prusik, the runner or loop must be short enough that the hitch cannot either jam the rappel device or be tended by the rappel device (which could result in failure of the hitch to hold).

If the braking hand releases the rope—for instance, as the result of rockfall—a self-belay friction hitch can prevent a rappeller from accelerating out of control. Reestablish the braking hand and tend the self-belay hitch by manually sliding it down along the rope to allow the descent to resume (fig. 11-28b).

These hitches require some testing and adjustment before each rappel in order to establish the runner or loop's proper length (so the hitch does not

hang up in the rappel device) and the proper amount of friction (adjusted by the number of wraps) to accommodate the climber's weight, rappel device, comfort, and any other individual considerations.

FIREMAN'S BELAY

A person standing below a rappeller can easily control the rappeller's movement or stop it altogether—thus providing an effective backup—simply by pulling down on the rappel rope(s), which puts friction on the brake system (fig. 11-29). To safeguard the rappeller with this method, the person at the bottom simply holds the rope strands loosely, ready to pull them tight the instant the rappeller has difficulty.

TOP BELAY

A rappeller can also be protected by a belay from above with a separate rope. If the belayer uses a separate anchor, there is redundancy for the entire system, even the rappel anchor. A top belay may be chosen for use with beginners, climbers with minor injuries, and the first person descending on a suspect anchor. Top belays are too time-consuming for routine use.

Fig. 11-29. Fireman's belay: rappel halted by a climber below, who is pulling down on the ends of the rope.

FINISHING THE RAPPEL

Near the end of the rappel, it becomes much easier to feed rope through the rappel device because the extra friction caused by the weight of the rope below the rappeller is now considerably less. The amount of rope stretch, particularly on a two-rope rappel, may be surprising. Be aware of this stretch factor as the rope is cleared from the rappel device after the rappel is completed. If you let go of the rappel rope, it could contract to its normal

length and suddenly be up out of reach. It's better to end the rappel *near* the end of the rope rather than at the very end of it.

As you near the end of the rope, look for a good place to finish the rappel. Establish a good stance and anchor yourself in before clearing the rope from the rappel device. In establishing a secure stance, consider the possibility of rockfall and icefall, and attempt to be out of the way of the next person coming down.

Shout "Off rappel!" only after you are detached from the rope and safely away from the fall line, to avoid rock or ice the next rappeller might dislodge. If you are the first person down a double-rope rappel, test the pull on the rope with the knot to make sure it is running smoothly. Recenter the knot before the second person descends.

THE LAST RAPPELLER

With a double-rope rappel, it is critical to know which rope to pull on from below when the rappel is completed. Pull the wrong one, and the knot will jam in the rappel ring (see Figure 11-11b).

The last rappeller should take a good final look at the rope(s) and the rappel sling to see that everything is in order and that the rope(s) will not catch on the sling or the rock, snow, or ice. Before the last person starts down, a person at the bottom should pull on the proper strand to check that it pulls freely. The rappeller above should confirm that the connecting knot in a double-rope rappel can be pulled free of the edge and that the rope does not bind on itself when pulled (see Figures 11-11b and 11-12).

On a double-rope rappel, the last person who starts down may want to stop at the first convenient ledge and pull enough of the rope down so that the connecting knot is clear of the edge. However, this practice also shortens one rope end, so be sure there is still enough rope to reach the next rappel stance safely and that there are knots in the ends of both ropes.

PULLING THE ROPE(S) DOWN

Once everyone has made the rappel, take out any visible twists in the rope and remove any safety knots in the ends of the strands. Stand away from the rock, if possible, then give the proper strand a slow, steady pull. Before the pulled strand starts to travel freely, yell "Rope!" to warn of falling rope. Others should take shelter to stay out of the way of falling rope, rocks, or other

debris. Until all climbers and ropes are on the ground, everyone should keep their helmets on.

Rope Jams

A jammed rappel rope may be a serious problem, perhaps even stranding a party on a descent that requires further rappels. If the rope hangs up, either before or after the end clears the anchor, try flipping the rope with whipping and circular motions before attempting any extreme pulling. Often a change in angle, back from the face or to the right or left, can free the rope. Sometimes pulling on the other end of the rope (if it is still in reach) or using a seesaw motion to pull on each end alternately can free the rope. Be alert and cautious when pulling a stuck rope; as it springs free, it may be accompanied by rock- or icefall.

If the rope gets stuck and cannot be pulled free, below are some options, in descending order of preference:

1. **Climb with a secured prusik.** If both ends of the rope(s) are still in reach when the hangup occurs, it is possible to safely prusik up both strands (see "The Texas Prusik" in Chapter 18, Glacier Travel and Crevasse Rescue, for one ascending method on a free-hanging rope), clear the jam, and rappel back down. Tie in to the rope at frequent intervals to back up the prusiks.
2. **Climb with a belay.** If only one rope end can be reached, it may be necessary to climb up and free the rope(s). If enough rope is available from the pulled strand, lead climb with a belay to reach the knot. There is a risk you may end up stuck, unable to be lowered or to rappel if you cannot reach the hangup, so don't attempt this if you are unsure whether the available rope will reach.
3. **Climb self-belayed.** If not enough rope is available from the pulled strand, lead climb with a self-belay by attaching to the available rope with a prusik. Anchor the end of the rope at the belay ledge and then further secure it to the mountain with conventional protection as you climb. If the rope suddenly pulls free from above, hopefully the combination of the prusik attachment, the periodic protection, and the anchor will limit the length of the fall.
4. **Climb with an unsecured prusik.** If no belay is possible, and if the party cannot proceed without the rope, a final resort is to attempt the desperate and very dangerous tactic of ascending the stuck rope with a

prusik or mechanical ascenders. The extreme danger of climbing an unsecured rope must be weighed against the consequences of remaining stranded until another rope is available. If it is possible to place protection during the ascent, tie in to the loose end and attach the rope to protection with clove hitches; the consequences of the rope pulling free from above might be mitigated. If the stuck rope is not necessary to complete the descent and cannot be freed, consider leaving it rather than undertaking risky maneuvers to free it.

If the rope available from the pulled strand is not enough, there are some alternative approaches appropriate for advanced climbers, but these alternatives are not described here. Note that climbing up to free a stuck rope may require building a new anchor for the climber to rappel from after freeing the rope. He or she should bring up enough gear to build a new solid anchor.

MULTIPLE RAPPELS

A descent route often involves a series of rappels. These multiple rappels, especially in alpine terrain, present special problems and require maximum efficiency to keep the party moving.

As a party moves through a series of rappels, the first person down each pitch usually carries gear for setting up the next rappel—after finding a secure stance, establishing an anchor, and attaching to it out of the path of icefall and rockfall. More experienced climbers in a party can take turns being first and last. It is best for beginners to be in the middle of the rotation so that assistance is available at the start and end of each rappel.

UNKNOWN TERRAIN

The trickiest multiple rappel is one down an unfamiliar route. Avoid this if possible. If an unfamiliar rappel is necessary, take time to check out the possible rappel lines as carefully as time and terrain permit. If a photo of the rappel route can be found, bring it along for reference. Keep in mind that the first few rappels down an unfamiliar route may, for better or worse, commit the party to that route.

If the bottom of an unfamiliar rappel pitch cannot be seen, the first person down must be prepared to climb back up in case the rappel hangs free at the end of the rope before there is a good stance or anchor. This rappeller should

carry prusik slings or mechanical ascenders for ascending the rope if necessary.

Rappelling down unfamiliar terrain brings an increased risk of getting the rope hung up. Minimize the problem by down-climbing as much as possible instead of rappelling. Also, consider rappels using just one rope, even if two ropes are available. Although this increases the number of rappels and the time spent descending, one rope is less likely to hang up than two. If one rope does get stuck, the second rope is available to protect a climb back up to free the stuck rope. You may then carefully climb back down or establish an intermediate rappel where the hangup occurred.

Although it is efficient to gain the maximum distance from each rappel, do not bypass a good rappel anchor spot—even well before the end of the rope—if there are doubts about finding a good place farther down.

EXPERIENCING THE FREEDOM OF THE HILLS

Rappelling is one of the activities central to climbing; learn it thoroughly and employ it carefully, so that it is safe and works well. Take care to avoid complacency. Rappelling is an essential, specialized technique that enables climbers to experience the freedom of the hills.