12

ANCHOR POINTS

INTRODUCTION

Anchor points are the fixed points from which you hang the anchor system. An anchor point can be a tree, a rock, a bolt hanger, or any of a number of other objects. They fall into three categories: **natural anchor points, artificial fixed anchor points** and **artificial removable anchor points**. Whatever type of anchor point you choose, remember that it must be "**Solid**."

NATURAL ANCHOR POINTS

Natural anchor points include trees (fig 12-01a) and rocks (fig 12-01b).

Trees

Trees are one of the most common anchor points. They are easily girth-hitched, strong, and readily available, at least at higher elevations. Look for trees that are at least 4 inches in diameter, have deep roots, are alive, and don't have sharp bark where you are going to wrap your webbing or rope around it. Dead trees can often be used, but you must check to see how solid the root system is before doing so. Check the ground around small trees to see if it is wet, as it is possible for normal climbing forces to pull a tree out of wet ground. There are a number of stories in climbing literature about trees that have been uprooted, including trees that have been used for years as solid anchors but that one day suddenly gave way.

Be careful that you do as little damage to the tree as possible. If you destroy it, future generations may not have an anchor available. Girth hitch webbing or tie a candy-stripe bowline with your rope. This will tend to prevent the movement of the material around the tree and the subsequent chafing against the bark.

There is also a growing concern among land managers about the damage done to vegetation by climbing anchors. In some areas, fixed anchors have been installed as substitutes to prevent damage to the trees. Be as environmentally friendly as you can.

Attach your rope or webbing as close to the base of the tree as possible. This will reduce leverage, enough of which can pull the tree out of the ground or break it. In some cases, however, with very large, living, healthy trees, you may want to attach the rope to a large branch to avoid running the rope over an edge. Just remember to ensure that the tree branch and tree can handle it. In these cases, it may be safer to back up the anchor on the branch with a sling around the base. If you do use a branch, attach the rope or webbing as close to the tree trunk as possible.

When you can, it is better to use a sling to girth hitch the tree. Clip reversed and opposed biners to the sling, and attach the rope to the biners. Tree sap and rough tree bark can be tough on ropes and since rope costs more than webbing, you can save money by using up your inexpensive webbing first.

When choosing a tree among several, remember that if you choose the largest diameter tree, you will use up more of your anchor material. It may be worth it to use a one-foot diameter tree rather than a two-foot diameter tree for this reason.

In order to provide redundancy, you may want to use more than one tree. This is good, but if the tree is solid enough, there is no problem with using it as its own "redundant" anchor point; in other words, it is safe to run two sets of webbing off the same incredibly strong tree. If there is any doubt at all about the tree's strength, however, find a second, separate anchor point.

We have seen shrubs used for rappelling before, but they should be used only as a last resort. The trick is to include as many of the smaller shrubbery branches as possible with the sling or rope, to increase the overall strength of the shrub. The sling should be as close to the ground as possible. Shrubs are not appropriate for top belays or sling shot anchors.

Boulders, rock horns, or chockstones

Boulders, rock horns, or chockstones can be used as anchor points, also. Boulders are large, detached pieces of rock. Rock horns are attached protrusions of rock that can be encircled with a piece of webbing. Chockstones are rocks that have wedged in between other rocks or in cracks and are stuck so that they can't come out. If a chockstone is made of crumbly rock, don't trust it.

The easiest way to use rocks as an anchor point is to put webbing around them (girth hitch, slip hitch, loop over the top) and attach the rope to the downhill end of the webbing using two reversed and opposed biners. Again, the webbing will take the abrasion of the rock crystals and save the wear and tear on your rope. However, if the rock is big and you don't have enough webbing, you may have to use your rope as part of the anchor.

A boulder must be heavy enough not to move. Step on it. Jump up and down on it. However, do not jump on rocks that are lying on a downhill slope. It may not take much to start such a rock rolling. A climber was killed at Tahquitz Rock in California because he jumped up on a rock to take a picture at the end of a climb, and the rock went over the edge with him on top. Rocks that have to roll up and over a bulge or edge to fall down the cliff are much safer, as you probably can't apply enough force to the rock to roll it uphill (fig 12-01c).

If the rock moves when you jump on it, do not use it. Even if it is safely back from the edge with no danger of going over, it may shift when loaded and roll on to your webbing or rope, cutting it. Check to see that there are no sharp edges for the webbing or rope to sit on. The best rocks have a lip that prevents the webbing or rope from being pulled up on top of the boulder and then free of the anchor. If the webbing around the backside of the rock settles in underneath the rock, check the settling-in point for sharp edges. If you can't tell, you should avoid using the rock or put something soft (a jacket, shirt, pack, or excess webbing) in between the rope and rock to prevent problems. Webbing and rope can get wedged so tightly in narrow spaces under rocks that they cannot be removed.

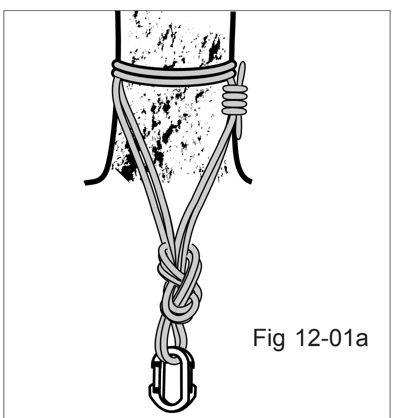


Fig 12-01a

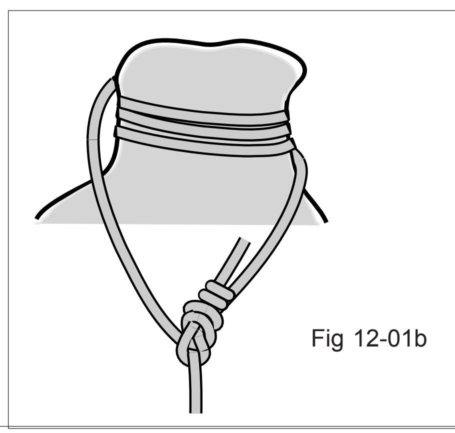


Fig 12-01b

Fig 12-01a
A tree used as a natural anchor

Fig 12-01b
A rock used as a natural anchor

Fig 12-01c
Don't use boulders that can be pulled downhill

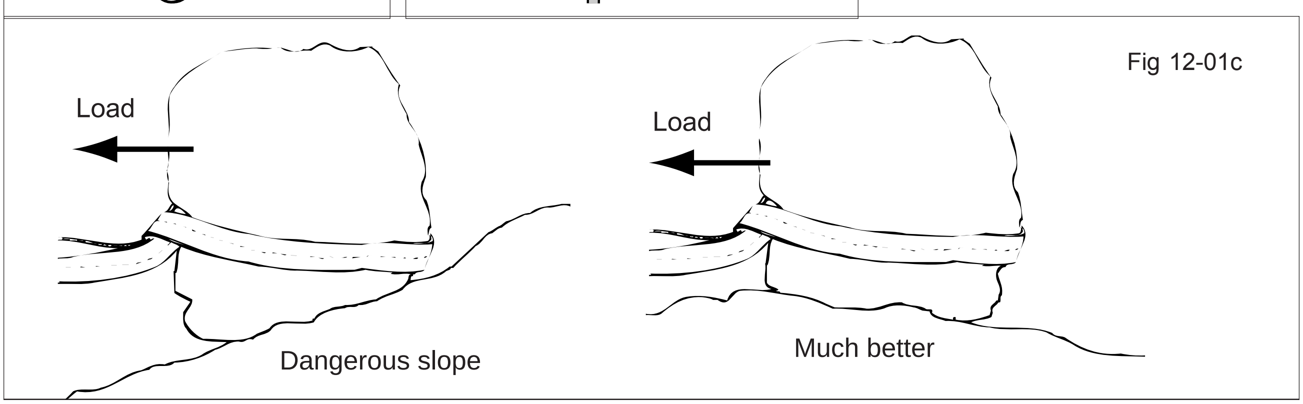


Fig 12-01c

ARTIFICIAL FIXED ANCHOR POINTS

Fixed anchor points include bolts, pitons, cold shuts, chains, replacement chain links, quick links and a variety of non-climbing materials.

Bolts with hangers

Bolts with hangers are the most common fixed anchors. They are typically installed by boring a hole with either a hand drill or a power drill and inserting the bolt and tightening it down to expand a sleeve against the inside of the hole. Early bolts were made of non-stainless steel ¼-inch stock. Most bolts placed now are stainless steel masonry bolts of 3/8-inch or ½-inch stock. Early hangers were often made of thin steel; today's hangers are thicker and rated at loads of over 5000 pounds.

Some bolts are also glued in. Gluing can help prevent water from seeping in and thereby delay the freeze-thaw cycle, thus lengthening the life of the placement.

Some bolts have a hex or Allen head, while others have protruding threads on which a nut is screwed down to hold the hanger in place. This has the advantage of allowing the removal of hangers so they are not stolen, and minimizing the visual impact of the bolts in places where there is controversy over their placement. If you know there are bolt threads with no hangers, you can bring your own bolts and wrench, and install the necessary pieces. Occasionally, you will run across a missing hanger when on lead. The AMC Lead School manual describes how to use a wired nut to stand in for the missing hanger. You should never do this in a toprope situation.

Bolts are designed to be loaded perpendicularly to the shaft. The resulting force from a bolt loaded in this manner is called "shear" force. Bolts are rated for shear strength although the ratings are not for climbing uses. They are not rated for "pullout strength," as this depends on the quality of the rock in which they are placed. Today's bolts are usually rated from 8,000-10,000 pounds shear strength, but pullout strength is often less than one thousand pounds. This means that bolts should be placed so they are perpendicular to the direction of force on the bolt. For example, on a perfectly vertical wall, the bolt should be placed horizontally.

The bolt hanger is designed to be loaded in one direction only: along its major (longest) axis (fig 12-02a). The bolt hanger is sometimes rotated so that it is not in a proper alignment. The long end of the hanger and the biner in the hanger's opening should extend in the direction of the force to be applied to the bolt.

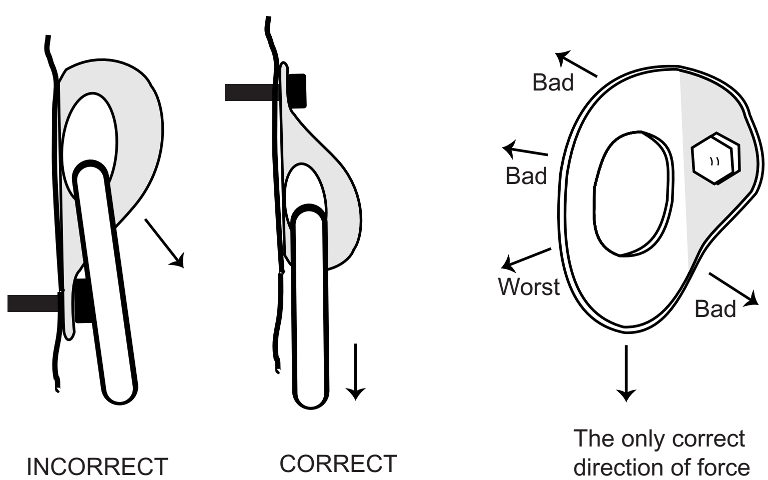


Fig 12-02a
There is only one proper orientation for a bolt hanger—along its major axis

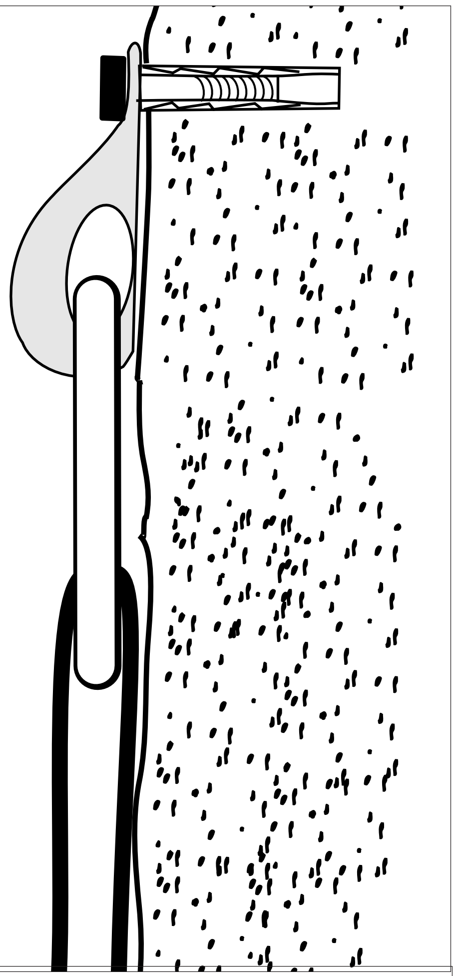
All "bolt placements" should be inspected before use (fig 12-02b). Check the rock, the hanger, the bolt head and the nut, if any. Also, remember that you usually don't know who placed the bolt. Some people who should know better place bad bolts and everyone had to place a first ("training") bolt. If the bolt is to be used in a toprope anchor, it should be backed up if possible by at least one natural or removable anchor.

The rock should be solid around the placement. Processed cement or concrete is mixed and is generally predictable in its consistency; naturally occurring rock is not. The lava that created the granite or basalt had concentrations of minerals here and there and pockets of hot gases, creating pockets of strong rock, weak rock, and air. Veins of minerals often are eroded away, creating cracks in both granite and basalt. Volcanic rhyolite is made of molten rock with more hot gas pockets than basalt. Limestone is made primarily of calcium carbonate, "nature's cement," formed from dead sea creatures. Some of this cement is denser than the rest, allowing pockets to form when water dissolves the less dense portions first. Quartzite is hard sandstone with hard and soft concentrations of cement. Sandstone, the softest and scariest of the rocks, often won't even hold a bolt. Stories abound of bolts and pitons that worked loose under the people who had just placed them. The upshot is that when you look at a bolt, you don't know if it was placed in strong rock or weak rock.

Tap the rock around the bolt using a biner or your hand (not a hammer). If it is hollow, you will be able to hear it. Tap in several places to hear how it is supposed to sound. Look for the distance between bolts. If boltholes are drilled too close together, the vibrations can create thin cracks connecting them, rendering the entire anchor suspect. A general rule is that bolts should be at least a foot apart. The bolt should be perpendicular to the ground. If the bolt is placed at an angle, it has more of a chance to come out. Bolts should not be placed vertically in a roof, for example, where a fall straight down will pull the bolt out of its placement. These bolts are usually placed on the sides of bulges under the roof, so that the shear force can be brought into play.

Next, check the bolt placement itself. The bolt should not be protruding out of the rock, unless it has a threaded shaft for a nut. The bolt head should be flush with the rock. If it is a threaded shaft, the nut should be able to screw down and securely flatten the hanger against the rock. There are old ¼-inch bolts in Yosemite that not only protrude but are bent from decades of falling climbers. The danger is that leverage increases the force on the bolt, wiggling it from side to side and thus enlarging the hole. Eventually, the bolt will slide out of the hole.

Fig 12-02b Good bolt placement



1. Wiggle the bolt
2. If it is loose, don't use for top-roping
3. Check the rock for cracks
4. Check the hanger for cracks and rust
5. Bolt should be 3/8" not 1/4"
6. Bolt head should not protrude
7. Sleeve and bolthead should be flush with rock
8. Hanger should be using long axis

If the rock is good and the bolt is good, check the hanger. It should be oriented in the direction of any force to be placed on it. If oriented in any other direction, leverage may contribute to the hanger pulling the bolt out of the rock. The hanger should not be rusty. A "rusty" patina is normal on all old bolts, but it is just surface rust. Rusty bolts that look like old tin cans should not be trusted.

Lastly, check the nut or bolt to make sure it is tightened down on the hanger. Nuts have a tendency to loosen with weathering. While disconcerting, it is usually easy to tighten the nut and go about your business. If you are toproping, you need to ensure that it is tightened and that you have backed up the bolt before using it.

Pitons

Pitons are not used much any more, except on big walls. However, there are a number of pitons still in the rock all over the country. Almost all of them are in use as lead protection, rather than toprope anchor protection. If you encounter these, you should leave them in place. Most guidebooks mention fixed pitons on routes, and people expect these to be there when they do the route. Removing them can be dangerous to these people.

Proper piton placement is best explained through pictures (fig 12-02c). If a piton protrudes from the wall, do not just clip a biner through it. Tie it off short, or close to the wall, with a girth hitch or slip hitch. This will reduce the chance of a fall levering the piton out of the wall.

Cold shuts

Cold shuts are a relatively new addition to the climbing scene. These are made of round stock, are usually welded shut and are a cheaper form of bolt hanger. They have an additional apparent advantage over regular bolt hangers. Since they are made of rounded stock, a rope can be passed through to lower a climber without leaving any gear on the climb. However, the force applied to a cold shut generally levers slightly outward on the bolt. The difference in how the force is applied to a regular bolt hanger and a cold shut is similar to the difference in the way forces are applied to a

D-shaped biner and an oval biner. The bolt hanger forces the load to be applied 90 degrees to the shaft of the bolt, whereas the cold shut settles the load in the center of the bottom, exerting a slight outward pull.

Some cold shuts are made specifically for climbing by a company that specializes in climbing anchor gear (such as Fixe), but many are made locally, or are bought at a hardware store. A study in *Climbing* magazine (Dec. 1997) by Sandor Nagay, a mechanical engineer employed by Crowe Rope in Maine, presented results of testing that compared cold shuts pulled from actual climbs. Some of these broke with as little as 2120 pounds of force. This is adequate for toproping, but not for leading. It is probable that cold shuts are safe when made by a climbing gear manufacturer that has a production line, quality control, and liability insurance requirements. Any other cold shuts should be regarded as suspect, as there is no assurance of consistent quality control. In the testing, non-welded cold shuts failed at as little as 800 pounds of force, which is nowhere near sufficient for toproping, and are considered dangerous for climbing purposes.

Follow the same rules for inspecting cold shuts as for inspecting bolt hangers. When using cold shut anchors for toproping, extend the system with quick draws to limit the wearing through of the cold shut by the rope when lowering. This will extend the life of the anchors, especially when a large number of people are going to climb.

Chains

Chains are often installed in rappel anchors. The advantage is that they are permanent, almost invisible (color-wise) components. Avoid passing the rope directly through the chain links unless the links are large enough to be able to pull the rope through. Most chains have “quick links” at the end of the chain which are intended to be used for threading the rope.

Replacement chain links and quick links

Replacement chain links and quick links are often used to attach rappel rings to bolt hangers or chains. Some replacement links have sharp edges on the inside; be careful of how they are used. They should be sufficiently strong to handle any climbing loads. Quick links are similar to oval carabiners, except that there is no swinging gate, just a gate nut to lock the link. They have smooth surfaces all the way around, and so are rope-friendly in usage. These are not made specifically for climbing, but the rated

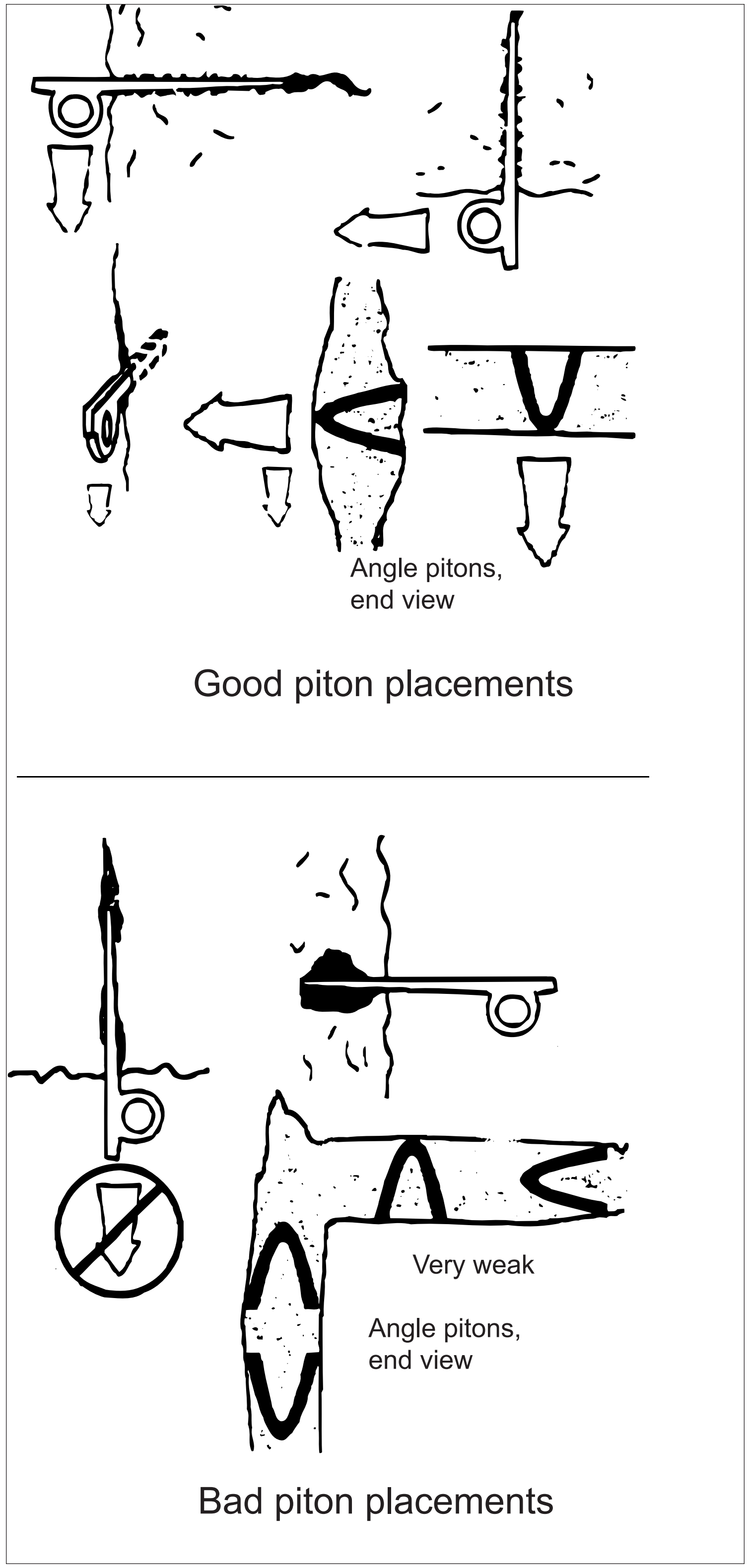


Fig 12-02c—Piton placements

strength when buying them from hardware stores is usually sufficient. In the store, some will be marked or have the package marked with the initials "SWL" and a number. The initials stand for Safe Working Load, and the number will be a fraction of the actual strength of the link. As long as the link will fit the chain or bolt hanger, the bigger the SWL number, the better.

Rappel rings

Rappel rings are used to hold the rope during a rappel (fig 12-02d). They allow for easy pulling of the rope after the rappel is complete. They are usually connected to chains via quick links or tied to the end of rappel slings. There are at least two types sold for climbing purposes. One is rated at 3000 pounds, is formed from sheet aluminum, and the stock is about seven mm in diameter. The other is rated at 5000 pounds, is formed from a solid block of aluminum, and is larger in diameter. Either ring's strength far exceeds the forces that can be generated in a rappel.

Due to the small seven-mm diameter of the ring, many people won't rappel on only one ring, feeling that the rope is bending over too small a surface, thus putting too much stress on the rope. While this is true, the forces generated in a rappel are too small to cause damage to the rope. Rappel rings should never be used to toprope, however, because the forces generated in climbing falls can be much greater than those in rappelling. Also, the rings are made of aluminum, and wear away fairly easily. You should inspect each ring before using it; if the ring is worn, replace it.

Fig 12-02d
Rappel ring

ARTIFICIAL REMOVABLE ANCHOR POINTS

Removable anchor points are created as needed by placing protection ("pro") in cracks, pockets or constrictions in the rock. When using pro as an anchor point for a toprope anchor (top belay, slingshot, or rappel), we recommend that you use at least three pieces, and never use only one. The following discussion contains some references to how pro is used in lead situations. A more complete discussion is covered in the lead school.

There are two types of removable anchor gear—wedges and cams—and there are passive and active versions of each (fig 12-03). A **wedge** creates friction (holding power) by being pulled into a constriction and applying outward force to both sides. It "wedges" itself into the constriction until it can't be pulled any farther in the direction of force. A fall simply applies greater outward force against the walls of the constriction, increasing the friction. Wedges don't work in parallel-sided cracks.

A **cam** employs a rotational force to jam one side of the piece against the wall. The camming motion allows the piece to be used in a parallel-sided crack where there is no constriction, although a cam can be also be used in most constrictions.

Passive pro has no moving parts; it is a single piece of material that sits in the placement. **Active pro** consists of multiple parts, and is usually spring-loaded. By contracting the spring, active pro is made smaller and inserted into a placement, and then the spring is released, allowing the pro to contact the walls of the placement with the components put under tension. This tension keeps the piece in place.

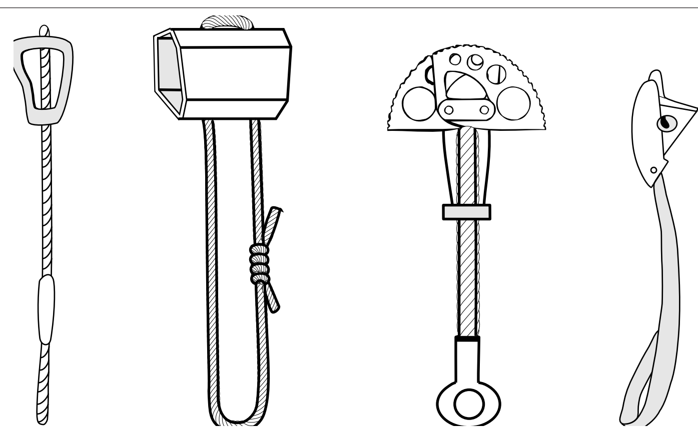


Fig 12-03
From left to right:
Stopper (passive), hex (passive, wedge and cam), camming unit or SLCD (active), Tri-cam (passive, wedge and cam)

12-02c–Piton placements

Passive Wedges

Wedges are also called "**nuts**," "**chocks**," or "**tapers**" (fig 12-04a) The category of wedges includes Black Diamond Stoppers™, DMM Wallnuts™, Wild Country Wired Rocks™, Hugh Banner Brass Offset Nuts™, Black Diamond Hexentrics™, Wild Country Rockcentrics™ and several other brands. Some of these pieces are squared off, with flat faces. Some have opposing convex and concave surfaces to try to fit undulations in the rock better. Most can be turned sideways to add a different size selection to your rack.

Wedges work best when more surface area contacts the rock. The leader must often "set" a wedge by giving it a tug; this helps to prevent the piece from wriggling or "**walking**" out of its placement, especially as the leader moves up past the piece and potentially carries its rope-bearing biner up as well. Too hard a "set," though, can jam the piece too tightly to remove. This danger increases as the sides of the crack approach parallel.

The wire cable is rated in the manufacturer's literature. It is usually made of stainless steel and swaged to connect the ends. The smallest cables may be rated at only 500 pounds of force, which can easily break in a hard lead fall; these are not intended for leading, but for aid climbing. The cable usually breaks at the bend where the cable turns into the two holes in the nut, just like rope breaks most easily at a bend. Since the cable is made of several strands, it is also possible to cut one strand, thus weakening the cable for the next placement. You should get into the habit of automatically checking the cable for broken strands as you place it. The cable on a brass or steel nut is usually silver-soldered, instead of swaged, which strengthens the cable. This cable should never be girth-hitched with a sling, as the small diameter of the cable can cut the sling instantly in a fall; always use a biner to clip into the cable.

In addition to the strength ratings, you must consider how the nut works in a particular kind of rock. The smallest nuts, marginal in granite, are almost useless in sandstone or other soft rock. There is such a small surface contact area that it just pulls out, leaving a groove where it scrapes away the rock. Nuts should generally be placed farther back in a crack, not near the edge, which may break off.

Nuts are sometimes difficult to remove because of their small size. The sharper the edges of the nut, the harder it may be to remove from the rock. Rounded edges make it easier to take out.

Hexentrics™ (**hexes**) are non-equilateral, hexagonal aluminum barrels (fig. 12-04b). Opposing sides are not equal lengths or angles. Today's hexes have swaged wire cables. Older, larger hexes have 5.5-mm cord threaded through pairs of holes in opposing faces. Hexes also can be turned 90 degrees and placed sideways.

Wild Country Rockcentrics™ and some other recently introduced pieces combine the concavity of nuts on one side with the size and hexagonal shape of Hexentrics™ on the other, claiming cross-functionality.

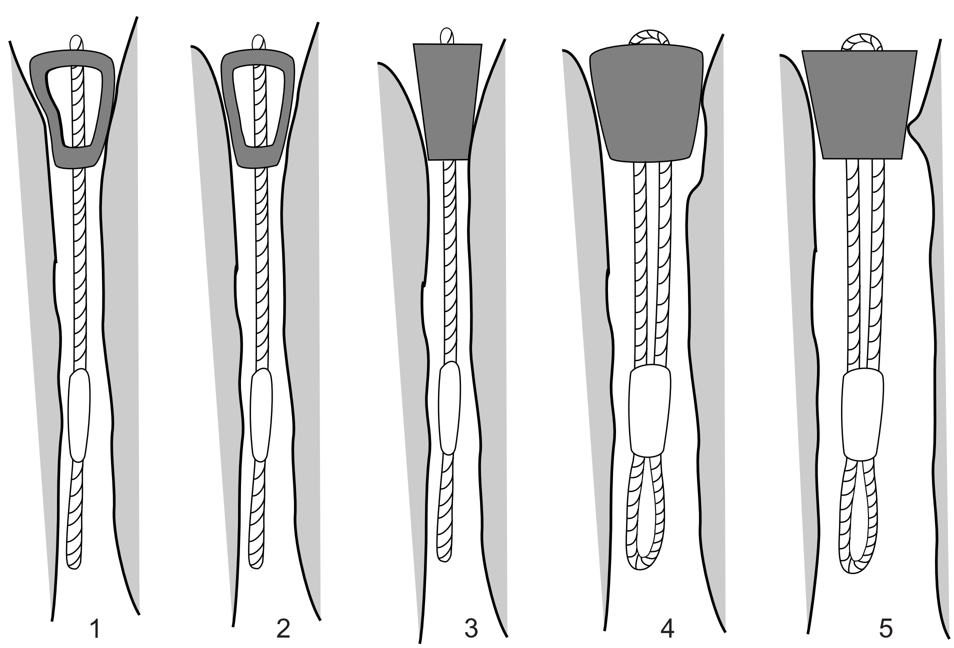


Fig 12-04a
Wedge placements—surface contact is key:
1—Wedge with a concave surface on one side and convex surface on the other
2—Excellent placement
3—Smaller wedges with no curves sometimes don't fit very well; there is only slight contact on the left side, but it will hold anyway
4 and 5—Wedges placed sideways with very little contact on the right side; if wedge number 5 breaks the rock nubbin, the wedge will slide a long way

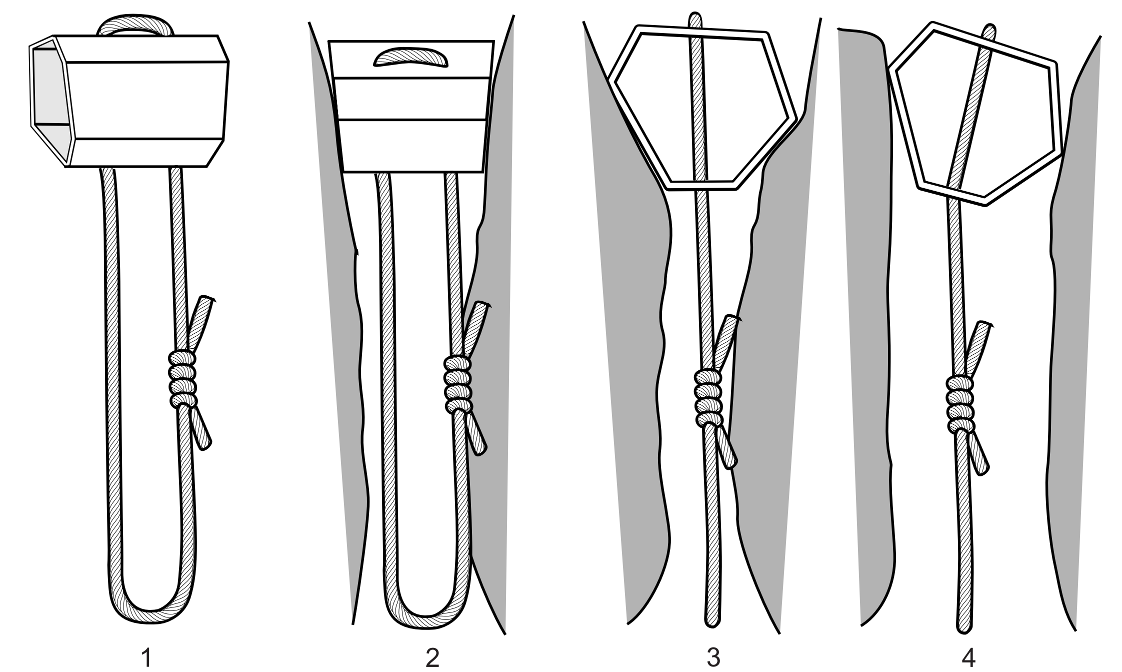


Fig 12-04b—Hexes
1—A hex with cord tied in a grapevine knot; some people tie the knot so that it stays inside the body of the hex
2—A hex placed sideways, with excellent surface contact
3—A hex placed normally, wedged in the crack
4—A hex placed in camming position; force pulling on the cord (such as a falling climber) rotates the hex to the left, providing a secure placement even though the crack is mostly vertical

Active Wedges

Active wedges consist of components that wedge between each other or between one of the components and the rock. This pro includes sliders, like Lowe Balls™, and stacked passive wedges. In addition, Black Diamond advertises that their Camalots™ can be used as chocks, although they are not true wedges.

Passive Cams

The two most commonly used passive cams are Lowe Tri-Cams™ and Black Diamond Hexentrics™. Tri-Cams™ have a pointed side and a rounded side. Most people either love them or hate them. They take a little longer to set properly, and if you don't know the secret to taking them out, it can be frustrating to try and remove them. On the other hand, they make bomber placements when set and weigh and cost less than the equivalent SLCD's. They are also the best protection for pockets where nuts and SLCD's don't work. The placement can be made stronger by placing the point in a small depression or behind a nubbin (fig 12-05).

By placing hexes so the cord hangs to one side, you get a camming motion against the wall (fig. 12-04b).

Active Cams

Spring-loaded camming devices (SLCD's) are made of either three or four "**cams**" with **springs** that are retracted around an **axle** (fig. 12-06a). The springs are strong enough to exert a force that pushes the cams outward. By pulling the "**trigger**" bar that moves parallel to the **stem** to retract the springs, and placing the SLCD into a crack, you set a piece that stays in place on its own, but is easy to remove by again pulling the trigger. In the case of a fall, the force simply pulls harder on the stem and exerts more force in an outward direction, increasing the holding power in proportion to the increased impact force of a fall.

SLCD materials and construction. The cams themselves are made of the same 6061 or 7075 aluminum as passive nuts. The same arguments apply to these cams as to nuts: the 6061 is softer so the rock bites it better, but the 7075 lasts longer. The cams are usually designed with grooves or teeth on their contact surfaces to better handle irregularities in the rock. Smaller cams, however, tend to be smooth to maximize their already tiny surface areas. Some bigger cams have holes drilled in them to reduce weight and allow a purchase point for helping to remove them when stuck. Most SLCD's have four cams, which provides a more stable placement, but a three-cam unit takes up less lateral space, and

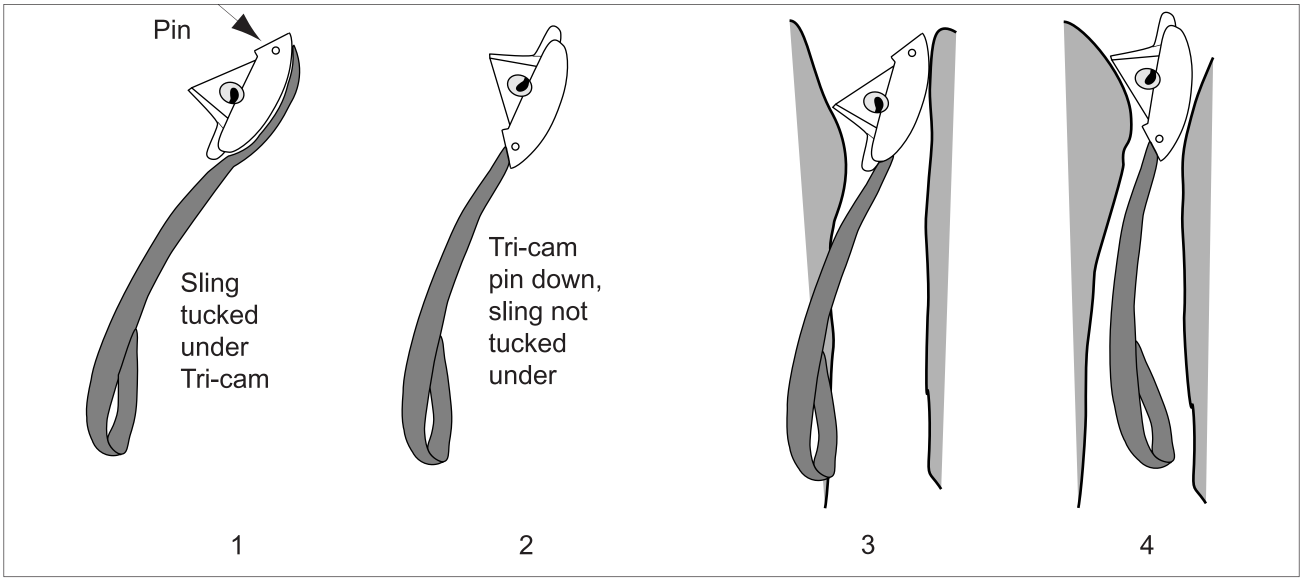


Fig 12-05—Tri-cams
1—Tri-cam in camming position; the sling pulls down on the upper end of the body where the pin is, rotating the piece to the right
2—Tri-cam in wedge position, with the pin on the bottom
3—Tri-cam in camming position; placing the point against a hole, nubbin or undulation in the rock keeps the piece solidly in place. To remove, push the bottom of the metal body to the right and up
4—Tri-cam in wedge position

can fit into narrower placements. Colorado Custom Hardware's Aliens™ are built with internal springs, which narrows their profile even more.

The SLCD stem is either a single flexible cable, a flexible U-shaped cable, or a rigid stem. The thick, stiff cable stem facilitates placement and bends easily over an edge. The rigid stem can break if levered over an edge; you must "tie it off" close to the edge with a short sling to reduce this leverage. The U-shaped cable is too small a diameter to be girth-hitched with a sling, just as with wired nuts. The trigger bar pulls the cams toward each other, retracting the spring. There are a number of different trigger designs, and the best one is the one you feel comfortable with and can use the fastest. The axle around which the cams rotate is engineered to hold the brunt of the fall; if it were to break, the whole piece would fail. Black Diamond Camalots™ are built with two axles, resulting in a larger range of placement sizes but a little more weight.

SLCD placement. Place SLCD's so that the direction of force in a fall is parallel to the stem and away from the cams (fig 12-06b). The ideal placement is when the cams are retracted about two-thirds of the way through the advertised range of the piece, or something that looks like a "Pacman." One study found that cams are safest when retracted (closed) 50-90%. (An SLCD hanging from your rack is 0% retracted; fully retracted cams are 100% retracted.) The wider open the cams are, the less stable the piece is; however, when the cams are almost closed, they still exert excellent holding power.

Ideally, all cams should engage the rock. The cams' holding power is based on friction between the rock and the cam surface; if the rock is slippery, like in some limestone, the cams will slip. In some sandstones, the cams slide until the cam digs into the rock. There are cam tracks on the insides of many Indian Creek cracks.

If all cams are not retracted equally, there is less outward force on the more open cams. Although not always possible, it is better to minimize the disparity between the cam angles.

In an absolutely parallel crack, the cams are engaged at the same angle. Most placement walls are irregular, resulting in a different angle of engagement for each individual cam. This sometimes leads to problems where three of the cams are nicely positioned, but the fourth opens up all the way. These should be reset if possible. However, sometimes a placement allows only 2 or 3 of the cams to engage. The worst case is if one of the end lobes is the one not engaged, which causes a less stable placement. At least try to shift the SLCD so the "floating" cam is one of the inner two. If this is the case and no better placement is found, consider it a marginal placement and pro again as soon as you can.

In horizontal placements, position the SLCD's stem or sling to bend over the edge toward the direction of the fall without pulling the SLCD to one side or the other. Be careful in horizontal placements. The stem should rest on the edge it will be pulled over and still be centered between the two sets of cams. If it isn't, the upper two cams will be opening wider than the lower two cams. Cams that are wider open are not as stable.

An "over-cammed" SLCD (one with fully retracted springs) that is placed in a crack the exact width of the retracted unit will probably hold, but may be impossible to get out. There is no room to pull the trigger to retract the springs and cams to allow enough slack to slide the unit out. The opposite effect, the "umbrella," is where a SLCD is placed in the crack with no retraction of springs, turning it into a chock, which will probably slide out. Although it may be hard to conceive of someone placing it this way, it can happen when a normal placement "walks" farther back in an inward flaring crack and the cams open up.

A cam placement can be made stronger and more "walk" resistant by seating one or more of the cam lobes in a depression or behind a nubbin.

Trango Big Bros™ are another type of active cam called expandable tube chocks. Pushing the button releases the spring and forces the inner tube out. A screw collar holds the outer and inner tube in place. A rope-bearing biner is clipped to the cord slung through the other end of the tube. Any fall will exert the force on the slung end, camming it downward. One big advantage of a tube chock is its use in a crack leading out from under a roof. After you have turned the roof and are in a vertical crack, the rope wants to slip into the crack (path of least resistance). If you have placed an SLCD, the rope tends to turn it or get caught up in it, whereas the rope slides effortlessly over the smooth tube without changing its position.

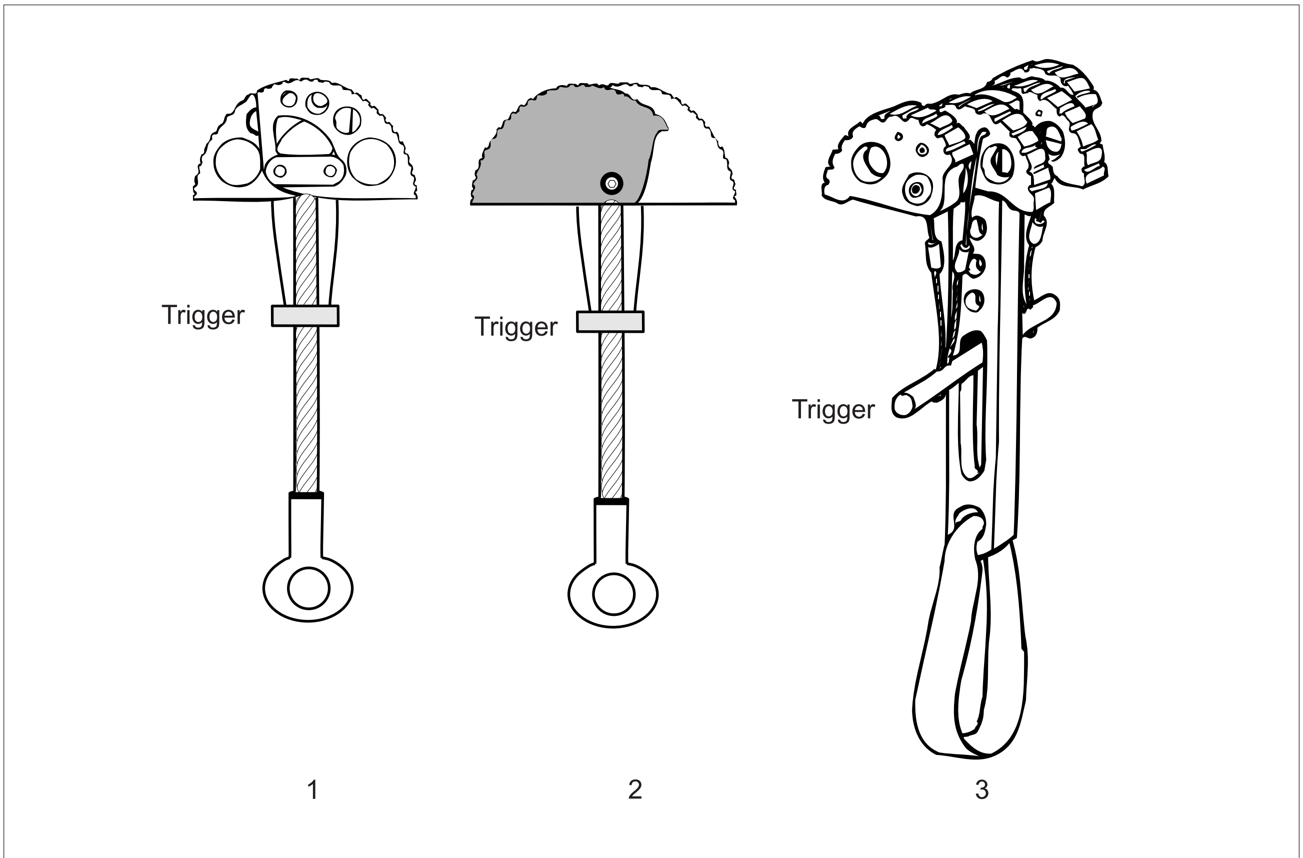


Fig 12-06a—Spring-loaded camming devices (SLCD's), or cams
1—The double-axle Camalot; the cam lobes are retracted by pulling the trigger. Spring-loading returns the lobes to their unretracted position
2—A single-axle SLCD
3—A rigid-stem SLCD

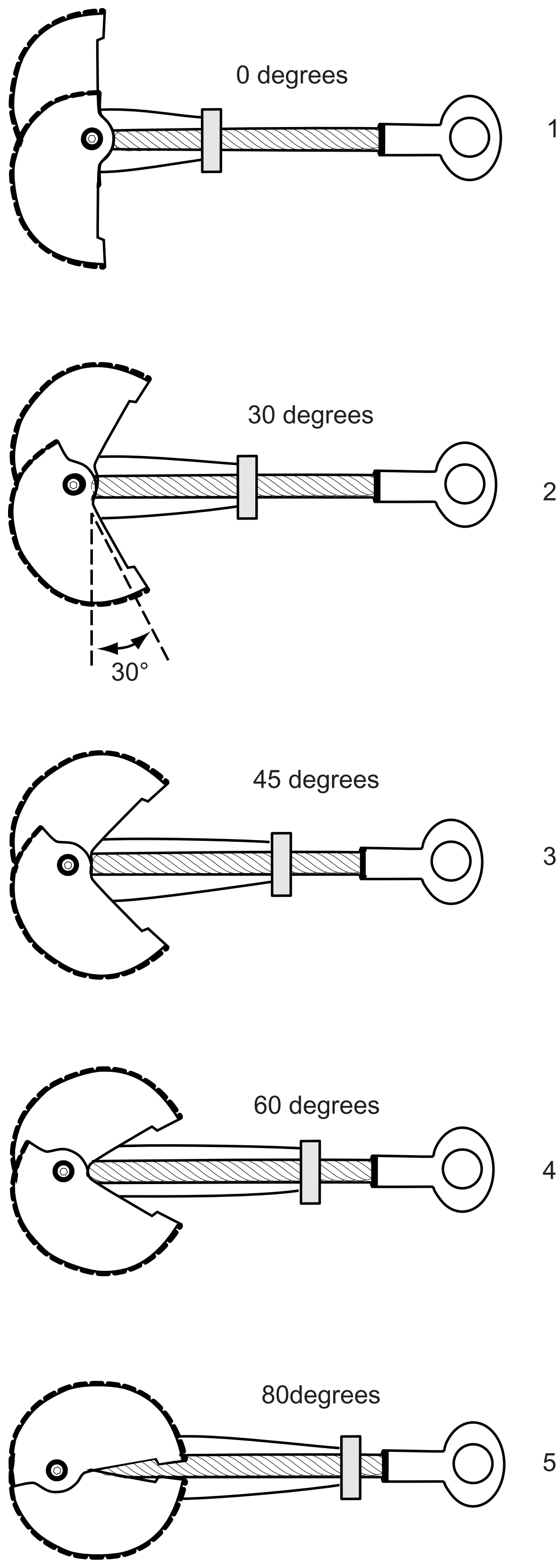


Fig 12-06b—SLCD placements
1—Cams not retracted at all, the SLCD in a storage position
2—Cams retracted 30° each; the cams are too wide open for this to be a safe placement
3—Cams retracted 45°; this is approximately the beginning of the safety zone
4—Cams retracted 60°; this is a solid placement
5—Cams retracted 80°; this is a very solid placement, and may be too solid. If the cams are retracted all the way, there may not be enough room to pull the trigger and loosen the cam to remove it