

ROPES AND KNOT TYING

It is not surprising that rope handling skills are very important to stagehand work, considering that sailors were the originators of our craft. Knowledge about rope selection; coiling skills; and quick, accurate knot tying should be learned early in your training. Poorly executed knots can lead to serious injury for anyone unfortunate enough to be underneath a falling piece of scenery or lighting equipment. Rope lines should be selected with an understanding of the capabilities of the line as they relate to what you want to use them for. Knots should be tied with the same understanding. There are literally hundreds of different kinds of knots. It is best to begin with a few of the most common, so that they can be appropriately mastered. Videos of tying some of these knots, and others, are available on the Web site for this book.



THIS TWO-COLOR NYLON ROPE HAS A BRAIDED EXTERIOR WOVEN OVER LINEAR INTERIOR STRANDS. THE END HAS BEEN MELTED TO KEEP IT FROM FRAYING.



TRADITIONAL HEMP ROPE IS MADE BY TWISTING FIBERS TOGETHER. THE END OF THIS LINE HAS BEEN INTENTIONALLY FRAYED TO EXPOSE THE INDIVIDUAL YARNS.

TWO METHODS OF ROPE CONSTRUCTION

ROPES

A good knot should be easy to tie, hold well, be easy to untie, and not place undue stress on the line. Some types of knots, especially if misused, may dangerously reduce the load limit of

a rope. When overstressed, ropes almost always break at the point where a knot has been tied or some other kink has disturbed the straight passage of the line. Ropes are said to be *de-rated* when knots, bends, or kinks have made them more likely to break.



A SIMPLE OVERHAND KNOT CAN DE-RATE THE BREAKING STRENGTH OF A LINE BY AS MUCH AS 50%

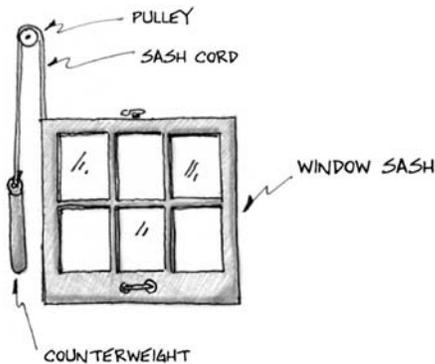
Two basic types of cordage are used in the theatre: those made of stranded fibers that are *twisted* together, and those that are *woven* or *braided* together. Twisted ropes are made from fibers that are spun into loose strands known as *yarns*, which are then twisted together to form the line. The size and weight rating of the rope depends upon the number and size of the yarns, as well as the material used in making the rope. Yarns are usually twisted together in a right-handed orientation (clockwise as you look toward the end), making it easiest to coil ropes in a clockwise direction. Twisting is the oldest form of rope making, and has existed for thousands of years. It requires only a moderate amount of technology to manufacture twisted ropes. Rope fibers of this type may consist of *sisal*, *Manila hemp*, or synthetics like *polypropylene* or *polyester*.

Manila, a variety of the hemp plant, is the best choice for a hemp line used to carry weight over the stage. The grade-one type is easily spotted by the blue fiber that runs through it. Polypropylene and/or polyester ropes have become much more common in recent years. These synthetics start as very long strands and are more easily manufactured into rope. They are somewhat stronger and rot-resistant in most situations that do not include a large amount of ultraviolet (UV) radiation from sunlight. Hemp is rapidly falling out of favor for rigging applications, but there is still a lot of it around.

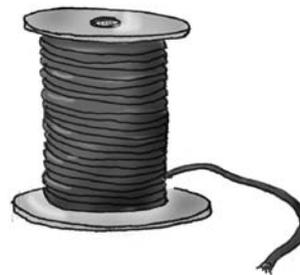
Braided lines are formed by weaving together many very small yarns to form a cover, or sheath, that fits over an interior group of strands. Because they are not twisted together, these ropes are easier to work with and less likely to become kinked. Cotton was historically used for this type of rope, which requires some fairly complex machinery to create. Hemp fibers come from the stalks of that plant, which are pulverized into individual strands. The fibers are very long and are easy to twist

together, which is why they have been used to make rope for centuries. Although the fibers are long, they are also very stiff, so rope made from them is stiff as well. It is much easier to tie knots with a more flexible line, which is why cotton sash cord became popular in the theatre. It is harder to twist the short cotton fibers into yarns, so rather than make traditional rope from it, the braided exterior concept was developed. Nylon rigging ropes are also made in this way, and so is cotton tie line. Tie line is really just very small-diameter sash cord.

Sash cord gets its name from its original intended use as a line meant to connect the counterbalancing weights used in old-style windows. The sash is the part of a window that moves up and down when it opens and closes. The same properties that make sash cord bend well around a small-diameter window pulley also make it an excellent choice for tying knots. It is very supple and is often used where great strength in a line is not required but 1/8" tie line is not strong enough.



Number 4 black *tie line* is the most popular choice for securing cable to an electric or for the ties on top of a curtain. Jute tie line was used in the past, but it is so loosely put together that it does not last very long and has fallen into disfavor. It is not at all suitable for use on drapes or other goods that must be frequently tied and untied. The #4 designation comes from an older way of determining the size of a braided line with a gauge number, much like with electrical wires. White is also available, but black is more easily hidden.



BRAIDED TIE LINE COMES ON A 3,000 FOOT SPOOL

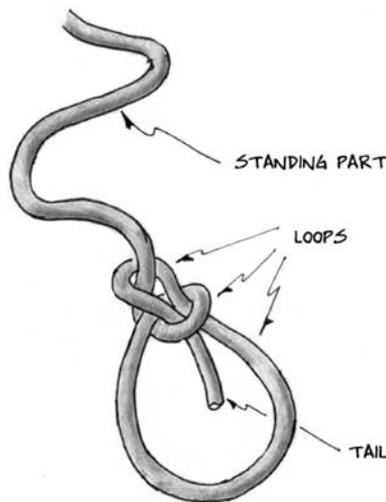
Sash cord has become increasingly hard to find in recent years, as the windows it was designed to rig have been mostly replaced by more energy-efficient ones. It is still available from some theatrical suppliers. Newer versions of this same basic type of line, but made from synthetic materials, are readily available from local hardware stores. They come in various sizes, but 3/8" is frequently the most useful, and can be used to rig a traveler track. Twisted lines don't work at all well on a traveler, because the twist tends to kink up at the pulleys.

More information about ropes, aircraft cable, and chains can be found in Chapter 14.

KNOTS

You should learn some basic terms used in tying knots in order to better understand the descriptions in this chapter. The free end of a line is called the *tail*. It is the part that you actually manipulate to tie the knot. The *standing part* is the long length of a rope that may be formed into a coil, or be tied to the grid, or laid out in some other fashion. It is important to visualize which is which, especially if you are using a short length of cord to learn how to tie the knots in this chapter.

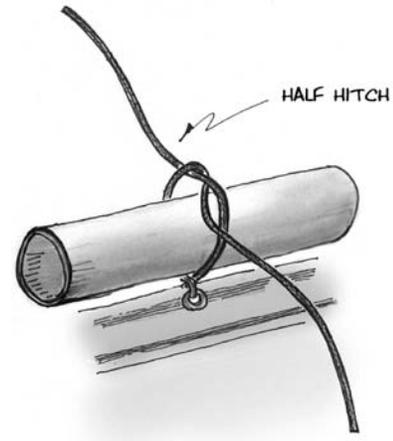
Most knots begin with a *loop* of some sort, which is a rounded turn of the line. To *double-over* means to bend the line over itself so that it runs back, thus creating an artificial tail in the middle of the line.



The bow knot

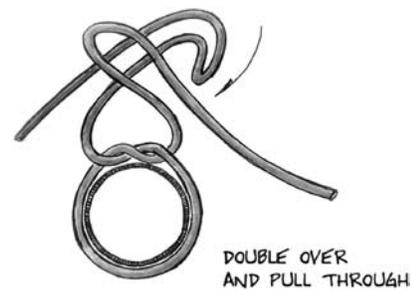
You probably already know how to tie your shoe. But if you start off with an easy knot, it will build confidence for the harder ones ahead. The same actions are used to tie all knots, so working with the bow first will give you an understanding of the terminology. The *bow* is actu-

ally the most-often-used knot in theatre, because it is used to hang drops and curtains. Drapes are traditionally manufactured with a tie every 12 inches, so a 40-foot-long border has 41 knots to tie. Multiply this number by however many curtains are in a show, and the importance of the bow knot becomes clear. The bow contains the same basic building blocks that are used in all knots. It is essentially a square knot in which the two tails are doubled over before making the final half hitch. Pulling on the very end of the tails slides the two loops back through the knot and the bow is untied. If you can visualize that process, it will make it much easier for you to understand more complex knots.



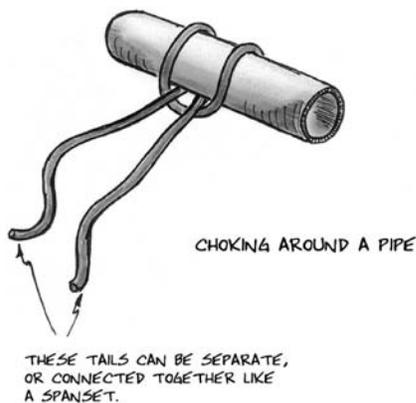
The bow knot requires two tails, or ends. The first part of the knot involves tying a half hitch, which is simply wrapping the two tails around one another, and tightening. The friction of the two lines rubbing against one another tends to make them stay tightly together. But a half hitch will not stay tied on its own; the friction is not great enough.

Double over the two tails so that they are about half of their original length. Now tie a second half hitch using the doubled-over tails. This completes the knot. It is easy to tie, and it is very easy to untie, by pulling on one of the tails. The bow is an excellent example of how a good knot is *easy to tie, and easy to untie*. When you are untying curtains from a batten, pull one tail all the way straight up, and then down to the side; this action will loosen the entire knot in one easy motion.



The choke

This very simple knot is quite useful for attaching a piece of tie line to a pipe or lighting cable so that it grips with holding force and will not slide down. The *choke* is one member of a family of knots that uses a double wrap around a pipe for extra gripping power. It is also the most common manner of attaching a sling, as discussed in Chapter 3. Slings or Spansets are endless nylon bands often used in rigging.

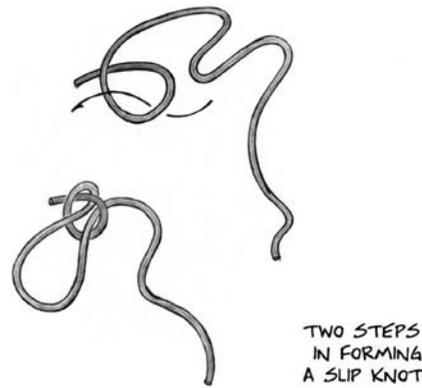


As an example, a choke works well if you want to tie up some lighting cable onto a boom so that it is up off the deck. Apply the choke so that it is about chest-high off the floor. Then coil the cable and secure it with a bow knot.

The greater the force exerted on the choke, the tighter its grip becomes, preventing it from sliding down the pipe and lowering the coil to the deck. This method also works for tying cable (or any other reasonable object) to a truss, handrail, rope, or other tubular item.

The slip knot

The *slip knot* can be used to make a loop in the end of a line that will tighten when force is exerted. It has many useful applications for attaching tie line when speed is essential. The slip knot is also used in tying another knot, the trucker's hitch. Knitters may recognize it as the same knot that is used to start yarn onto a knitting needle.

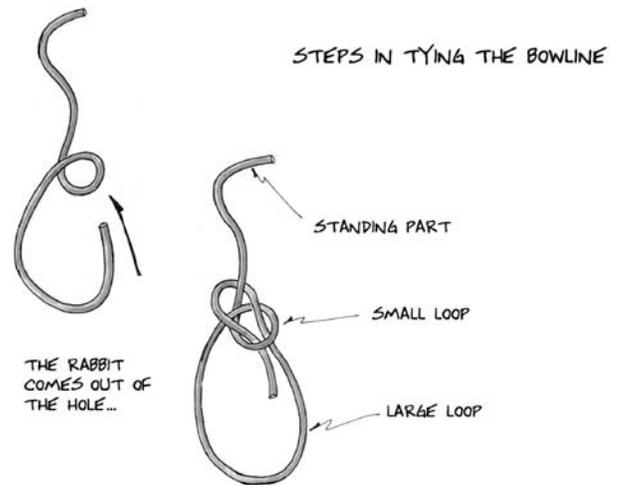
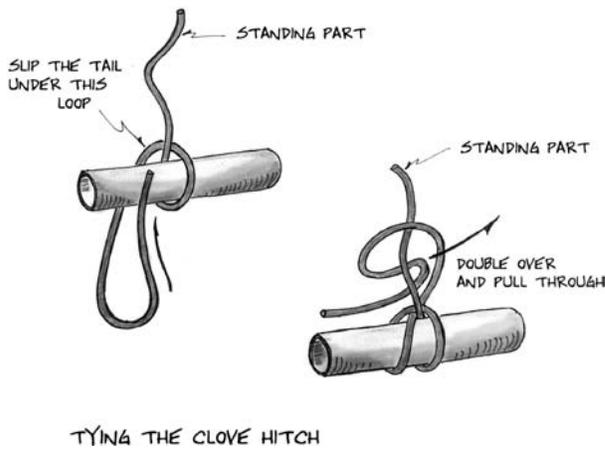


Make a small loop in the tail near its end. Double the standing part and draw it through the loop. (Remember that the standing part is the long end.) Hold the doubled-over loop and pull on the tail to secure the knot. If the knot has been properly tied, pulling on the standing part makes the loop smaller, while pulling on the loop itself makes it larger. If you tug on the loop and the tail pulls through and the knot is lost, you have tied the knot backward and it will not work properly. An easy way to avoid this problem is to make sure that your first loop is formed very close to the end of the tail. Then there will not be enough of the tail sticking out to make the mistake of pulling it rather than the standing part through the loop.

The clove hitch

The *clove hitch* is used to fasten a line around a pipe, handrail, or other rounded object. It's an important theatrical knot that every stagehand should know and be able to tie without thinking. Like the choke, this knot grips more tightly when force is applied. Unlike the choke, the clove is meant for use with a long line, and especially one that is under load while the knot is tied. One example of that is dead-hanging a drape or a piece of scenery. In that situation, weight is on the line as you haul it up into the air, and a clove hitch is easy to tie under these circumstances, because you can take a wrap around the pipe to safety the line while you tie the knot. The clove hitch would also be a good knot to tie on the hanging pipe.

The clove hitch is a very simple knot to tie. Drape the line over the pipe, and wrap it around the right side of itself. Bring the line around the pipe and wrap it to the left side. Slip it under the first wrap that you took. That's all there is to the clove hitch. However, the clove will hold better if you take an extra half hitch around the standing part to ensure that the line will not accidentally untie itself under stress, especially when the load is repeatedly shifted.



Quite often, there is a great deal of excess rope on the floor after hauling something into the air for a dead hang. When this happens, the clove hitch can be tied in the center of the rope by doubling over a few feet of the line and using this doubled-over part as though it were the end. That avoids pulling a huge amount of excess line through the knot. Doubling over to create an end in the middle of a line is a common practice with many different kinds of knots, and is similar to what happens when tying a bow.

The bowline

This knot is pronounced “bowlyn” and not “bow line.” If you mispronounce it, you run the risk of becoming an object of ridicule by your fellow stagehands and/or climbing enthusiasts. The *bowline* is used to create a fixed loop in the end of a rope. It is another of the quintessential stagehand knots that everyone must know. It is the basic knot used by rock-and-roll riggers to hang chain motors. The bowline’s popularity stems from the fact that it is easy to tie, it is very safe, and it is also easy to untie, which are all essential elements of a good knot. It will be much easier to tie the bowline if you keep these two ideas in mind: make the first loop small, and make the second loop (the one you want to keep) much larger.

The following method of tying a bowline is probably the easiest, although there are others. These instructions are intended for a right-handed person. If you are left-handed, it is probably best to try the right-handed method first, and then adapt it to your own style later. Basically, the left-handed approach is a mirror image of the right and will work just as well.

Hold the line across your left palm so that the long, standing part is lying away from you and the tail is several feet long. The length of the rope making up the tail dictates the size of the loop in the finished knot. For some rigging jobs, the size of the loop is critical. If you need a 2-foot loop in the bowline, start with a bit more than 4 feet of tail.

Coil the rope counterclockwise so that one small loop is in your hand. Pass the tail through the loop from back to front, around the back of the standing part, and then through the small loop, so that the line passes back along itself. Tighten the knot by pulling on the tail in opposition to the standing part.

A story is often told to make it easier to remember the steps in tying the bowline. “There is a hole in the ground (the small loop). A rabbit (the tail) comes up out of the hole and runs behind a tree (the standing part). The rabbit circles the tree and runs back down into the hole.” This is a silly story—I didn’t make it up!—but it is the traditional method of teaching the bowline. Feel free to embellish it, and adapt it to any animals and/or objects you feel are appropriate.

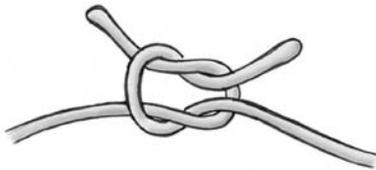


A LEFT-HANDED
BOWLINE

The left-handed approach is really just a mirror image of the instructions that were just given for a regular bowline. Notice that in either version, the tail should wind up to the inside of the large loop rather than to the outside. If you are a left-handed person, you are already aware that lefties are generally shafted by tool manufacturers, so enjoy something technical that works just as well left-handed as it does right-handed.

The square knot

The *square knot* is another very basic knot used in a variety of different situations, such as tying two lines together, tying a bundle, or in combination with other knots.



THE SQUARE KNOT

Tying the square knot requires two tails. Holding one tail in either hand, lay the right tail over the left and twist it around to make a half hitch. Then take the left tail and pass it over the right, making another half hitch. Right over left, left over right, as the saying goes. Tighten this up and you will have a square knot. Right over left twice, or left over right twice will make a granny knot that is harder to untie and is prone to slipping. A true square knot appears as two loops choked over one another and is easily recognizable.



A GRANNY KNOT

The trucker's hitch or snub and loop

The most complicated knot of this chapter has been saved for last. The *trucker's hitch* is a popular knot to use when you need to put a great deal of tension on a line. It is often used to tie down loads for trucking, hence its name. Of course in a modern trailer used for touring, straps and load bars are the preferred method, but there are still plenty of other uses for the trucker's hitch. This knot is excellent for stretching a cyclorama, holding scenery tight to a wall, or making small changes in the trim of a dead-hung piece. I have included two methods of tying the trucker's hitch, using either one piece of rope or two, depending on the situation at hand.

It is easier to learn the two-rope method first. A practical illustration may make it easier to understand how the trucker's hitch is used. Visualize a cyclorama that needs to be stretched to remove its wrinkles. First, clamps must be fastened to the edges of the cyc so that lines can be tied between the clamps and the offstage wall of the theatre. By applying tension to the lines, you can stretch the wrinkles out of the fabric.



STRETCHING CLAMPS AND LINES
ON A CYCLORAMA

Attach a piece of tie line to the clamp with a bowline. At a convenient distance from the clamp, tie another bowline in the other end of the line. That second bowline creates an eye for the line to pass through. Tie a second piece of tie line to a structure to the side of the stage. Bring the two lines together and pass the tail of the second line through the loop of the first. If you then pull this tail back in the direction of the wall, tension will be placed on the line, and the friction of the tie line doubling back through the loop will keep it from slipping as long as tension is kept on the tail you are holding.