

## Section II. SPLICES

### 2-9. Introduction

Splicing is a method of joining rope or wire by unlaying strands of both ends and interweaving these strands together. There are four general types of splices—a short splice, an eye or side splice, a long splice, and a crown or back splice. The methods of making all four types of splices are similar. They generally consist of three basic steps—unlaying the strands of the rope, placing the rope ends together, and interweaving the strands and tucking them into the rope. It is extremely important, in the splicing of wire rope, to use great care in laying the various rope strands firmly into position. Slack strands will not receive their full share of the load and cause excessive stress to be put on the other strands. The unequal stress distribution will decrease the possible ultimate strength of the splice. When splices are to be used in places where their failure may result in material damage or may endanger human lives, the splices should be tested under stresses equal to at least twice their maximum working load before the ropes are placed into service. Table 2-1 shows the amount or length of rope to be unlayed on each of the two ends of the ropes, and the amount of tuck for ropes of different diameters. As a rule of thumb use the following: long splice—40 times the diameter; short splice—20 times the diameter.

Table 2-1. Amount of Wire Rope To Allow for Splice and Tucks

Diameter (inches)	Length of rope to allow in feet			Length of tuck in inches		
	Short splice	Eye splice	Long splice	Short splice	Eye splice	Long splice
¼-⅜	15	1	30	15	1	30
½-⅝	20	2	40	20	2	40
¾-⅞	24	2½	50	24	2½	50
1-1½	28	3	60	28	3	60
1¼-1¾	32	3½	70	32	3½	70
1½	36	4	80	36	4	80

### 2-10. Short Splice for Fiber Rope

The short splice (fig. 2-39) is as strong as the rope in which it is made and will hold as much as a long splice. However, the short splice causes an increase in the diameter of the rope for a short distance and can be used only where this increase in diameter will not affect operations. It is called the short splice because

a minimum reduction in rope length takes place in making the splice. This splice is frequently used to repair damaged ropes when two ropes of the same size are to be joined together permanently. Damaged parts of a rope are cut out and the sound sections are spliced.

### 2-11. Eye or Side Splice for Fiber Rope

The eye or side splice (fig. 2-40) is used for making a permanent loop in the end of a rope. The loops can be used for fastening the rope to a ring or hook and can be made up with or without a thimble. A thimble is used to reduce wear. This splice is also used to splice one rope into the side of another. As a permanent loop or eye, no knot can compare with this splice for neatness and efficiency.

### 2-12. Long Splice for Fiber Rope

The long splice (fig. 2-41) is used when the larger diameter of the short splice has an adverse effect on the use of the rope, and for splicing long ropes that operate under heavy stress. This splice is as strong as the rope itself. A skillfully made long splice will run through sheaves without any difficulty. The ropes to be joined should be the same lay and as nearly the same diameter as possible.

### 2-13. Crown or Back Splice for Fiber Rope

Where the end of a rope is to be spliced to prevent unlaying and a slight enlargement of the end is not objectionable, a crown splice (fig. 2-42) may be used to accomplish this. No length of rope should be put into service without having the ends properly prepared.

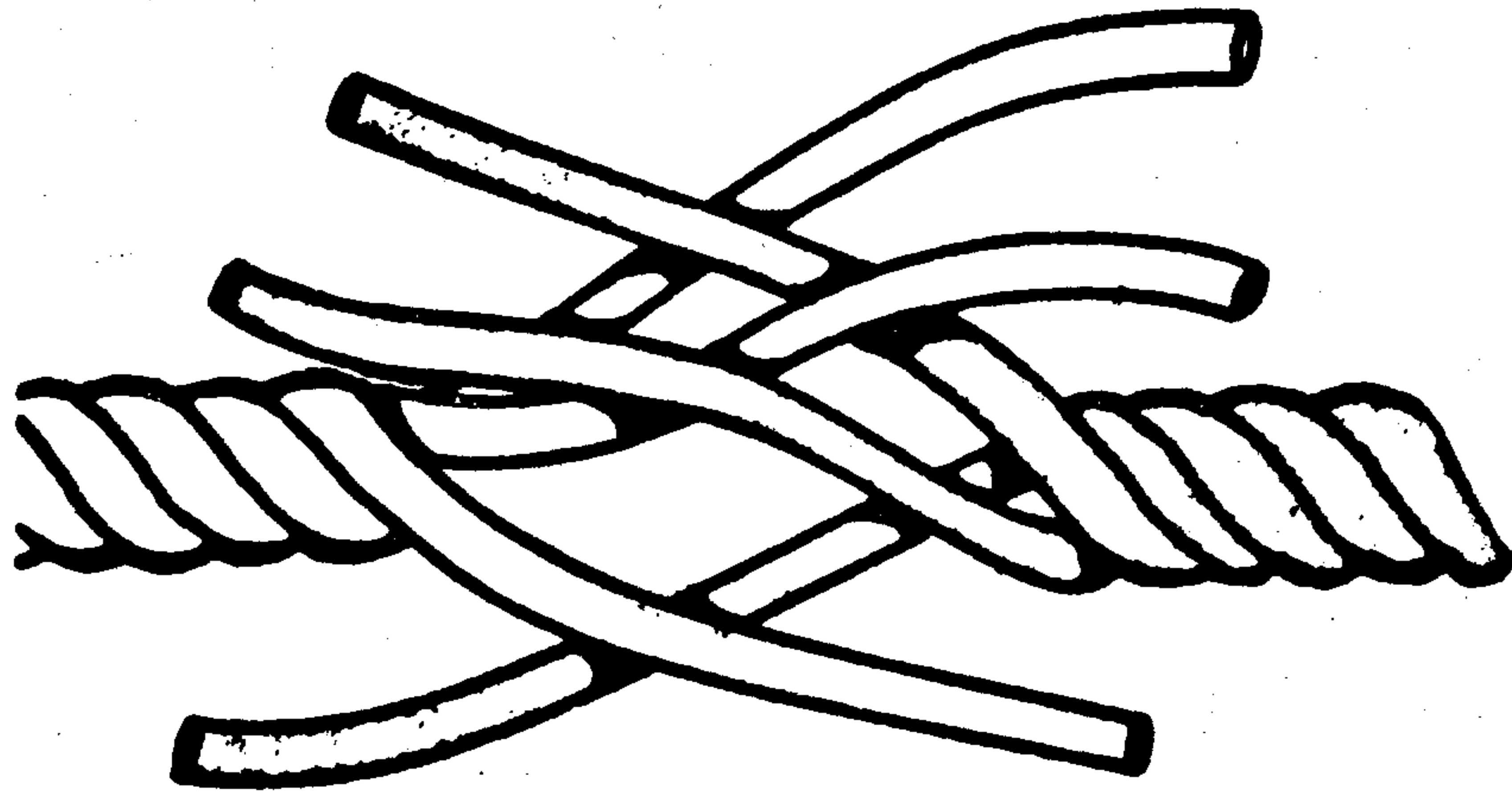
### 2-14. Renewing Strands

When one strand of a rope is broken it cannot be repaired by tying the ends together because this would shorten the strand. The rope can be repaired by inserting a strand longer than the break and tying the ends together (fig. 2-43).

### 2-15. Tools for Splicing

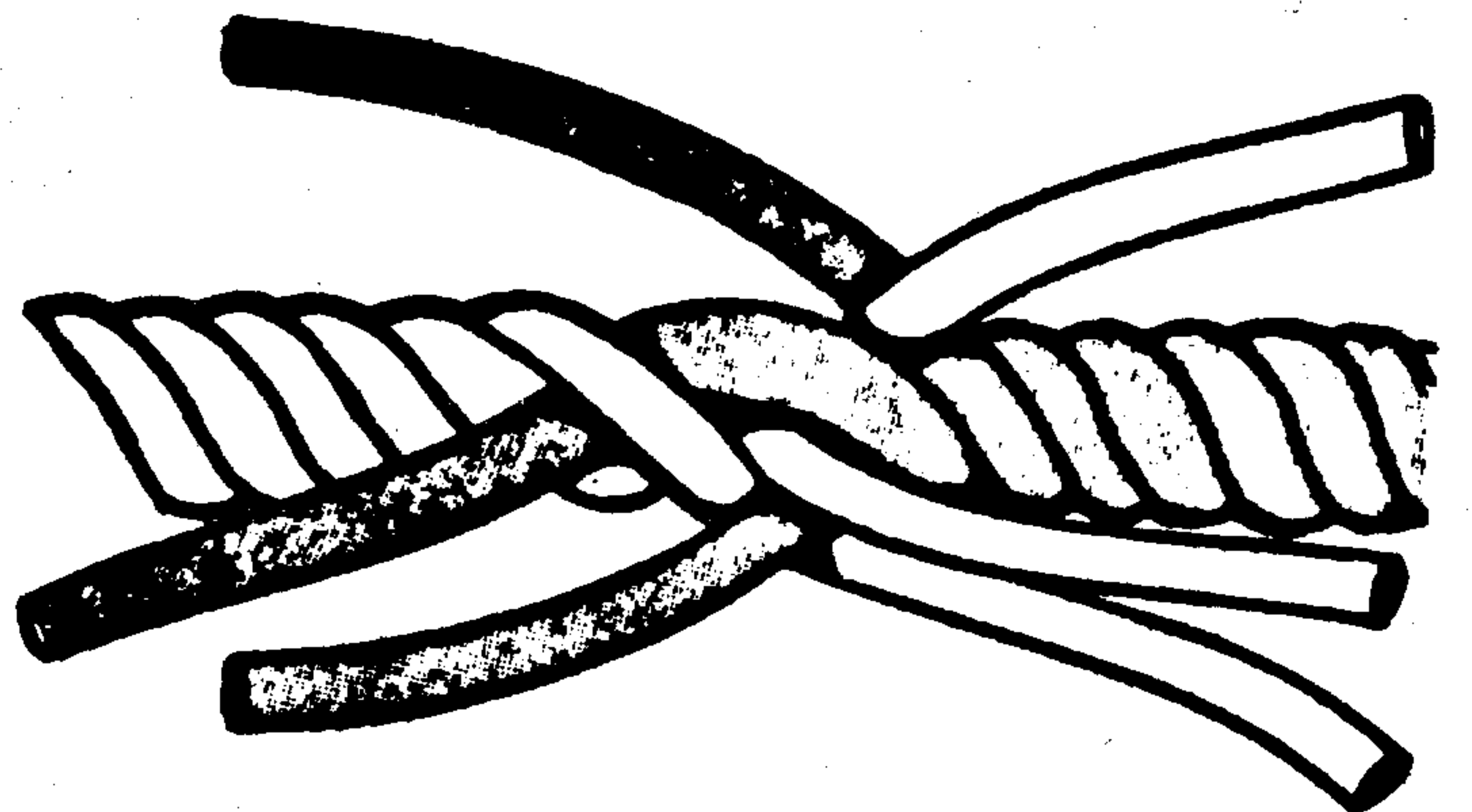
Only a few tools are required for splicing wire rope. In addition to the tools shown in figure 2-44, a hammer and cold chisel are often used for cutting ends of strands. Two slings of marline and two sticks should be used for untwisting the wire. A pocket knife may be needed for cutting the hemp core.

UNLAY SEVEN TURNS AT END OF EACH ROPE AND PLACE ENDS TOGETHER



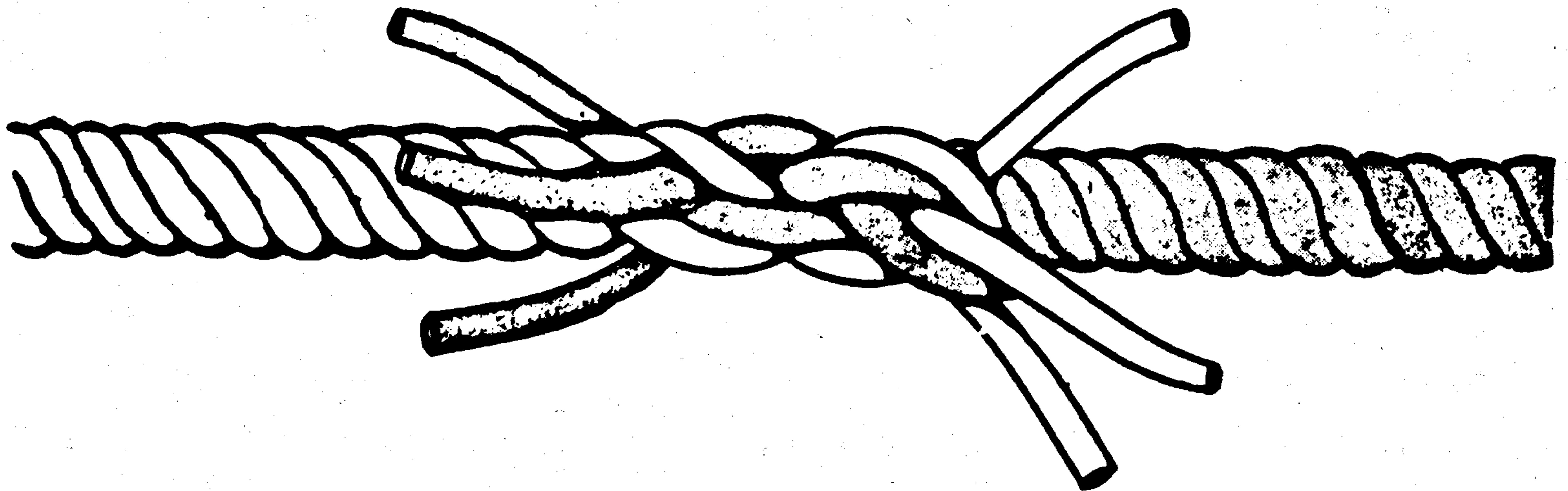
EACH STRAND BETWEEN TWO STRANDS OF THE OPPOSITE END

①



MAKE FIRST TUCK UNDER NEAREST STRAND

②



CROSS AND TUCK EACH STRAND AT NEARLY RIGHT ANGLES

③

DIVIDE EACH STRAND INTO TWO PARTS AND TAKE TWO OR MORE TUCKS WITH EACH HALF STRAND



CUT OFF ALL LOOSE ENDS AND ROLL ON HARD SURFACE

④

Figure 2-39. Short splice for fiber rope.

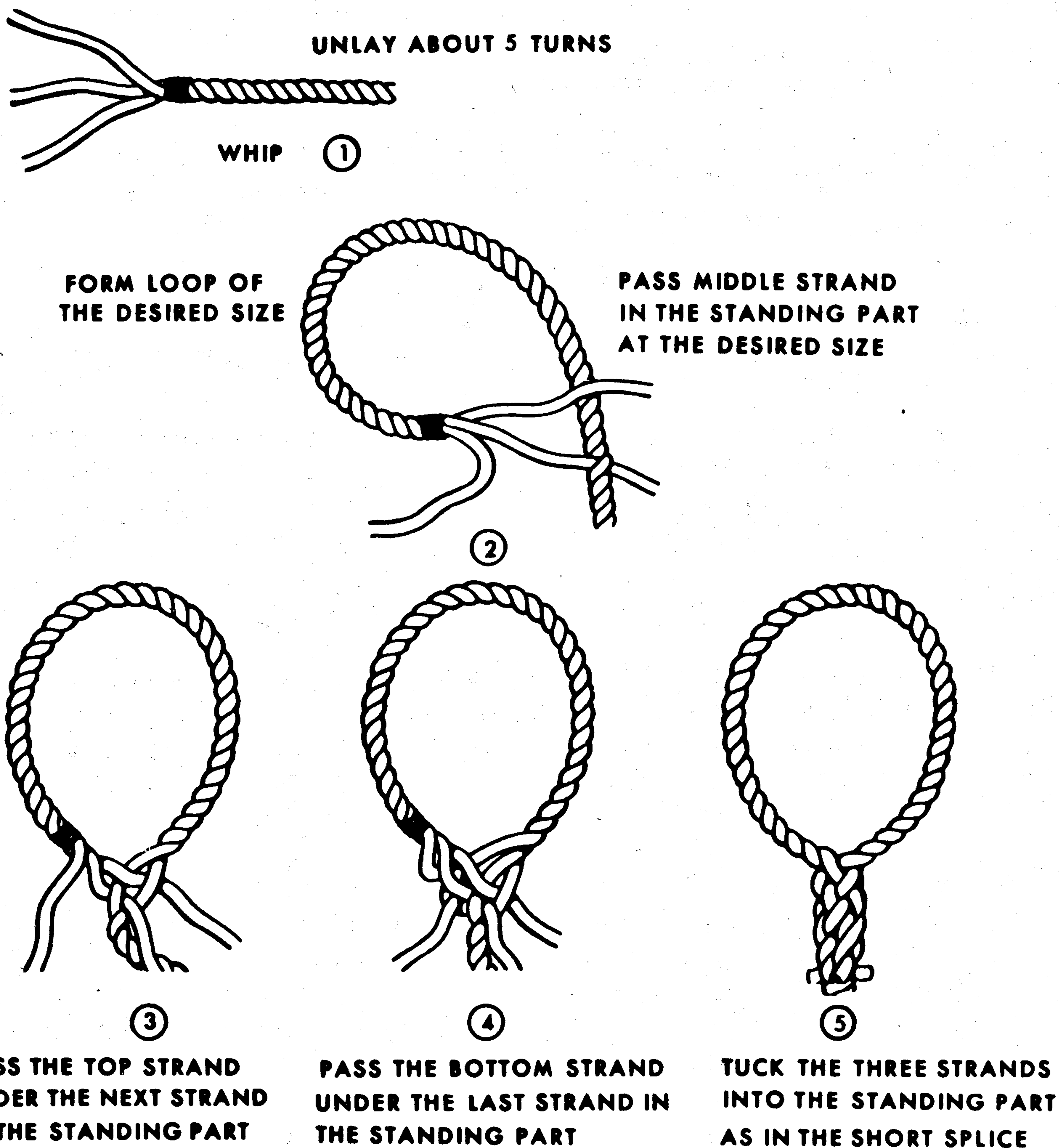


Figure 2-40. Eye or side splice for fiber rope.

### 2-16. Short Splice in Wire Rope

A short splice develops only from 70 to 90 percent of the strength of the rope. A short splice is bulky and used only for block straps, slings, or where an enlargement of the diameter is of no importance. It is not suitable for splicing driving ropes or ropes used in running tackles, and should never be put into a crane or hoist rope. The wire rope splice differs from the

fiber rope splice (fig. 2-39) only in the method of tucking the end strands (fig. 2-45).

### 2-17. Eye Splice in Wire Rope

An eye splice can be made with or without a thimble. A thimble (fig. 2-46) should be used for every rope eye unless special circumstances prohibit it. The thimble protects the rope from sharp bends and abrasive action. The efficiency

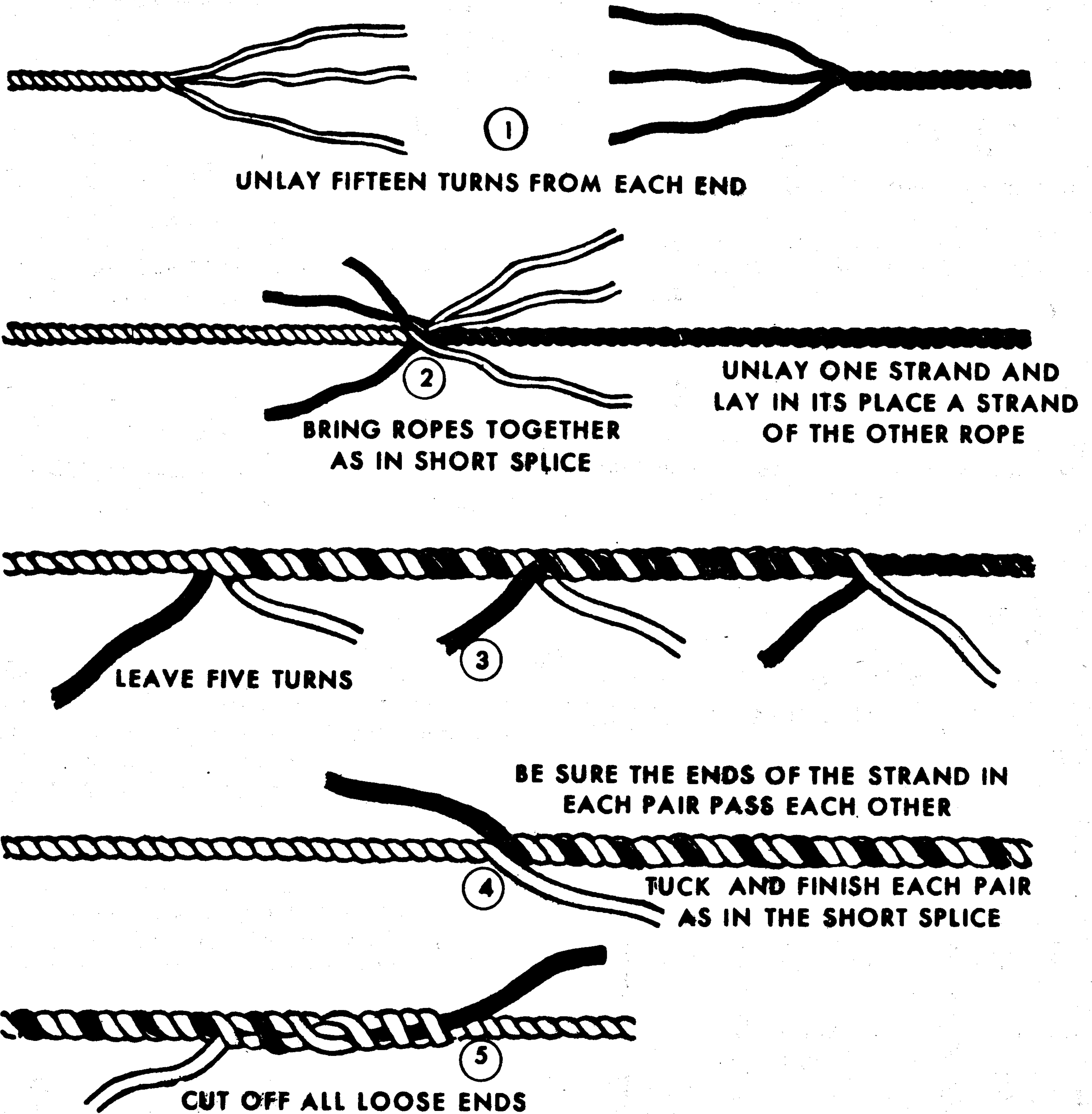


Figure 2-41. Long splice for fiber rope.

of a well-made eye splice with a heavy-duty thimble varies from 70 to 90 percent. Occasionally it becomes necessary to construct a field expedient, called hasty eye (fig. 2-47). The hasty eye can be easily and quickly made, but is limited to about 70 percent of the strength of the rope, and consequently should not be used for hoisting loads.

### 2-18. Long Splice in Wire Rope

The long splice (fig. 2-48) is used for joining two ropes or for making an endless sling without increasing the thickness of the wire rope at the splice. It is the best and most important kind of splice because it is strong and trim.

a. *Round Strand Regular Lay Rope.* The directions given in figure 2-48 are for making a

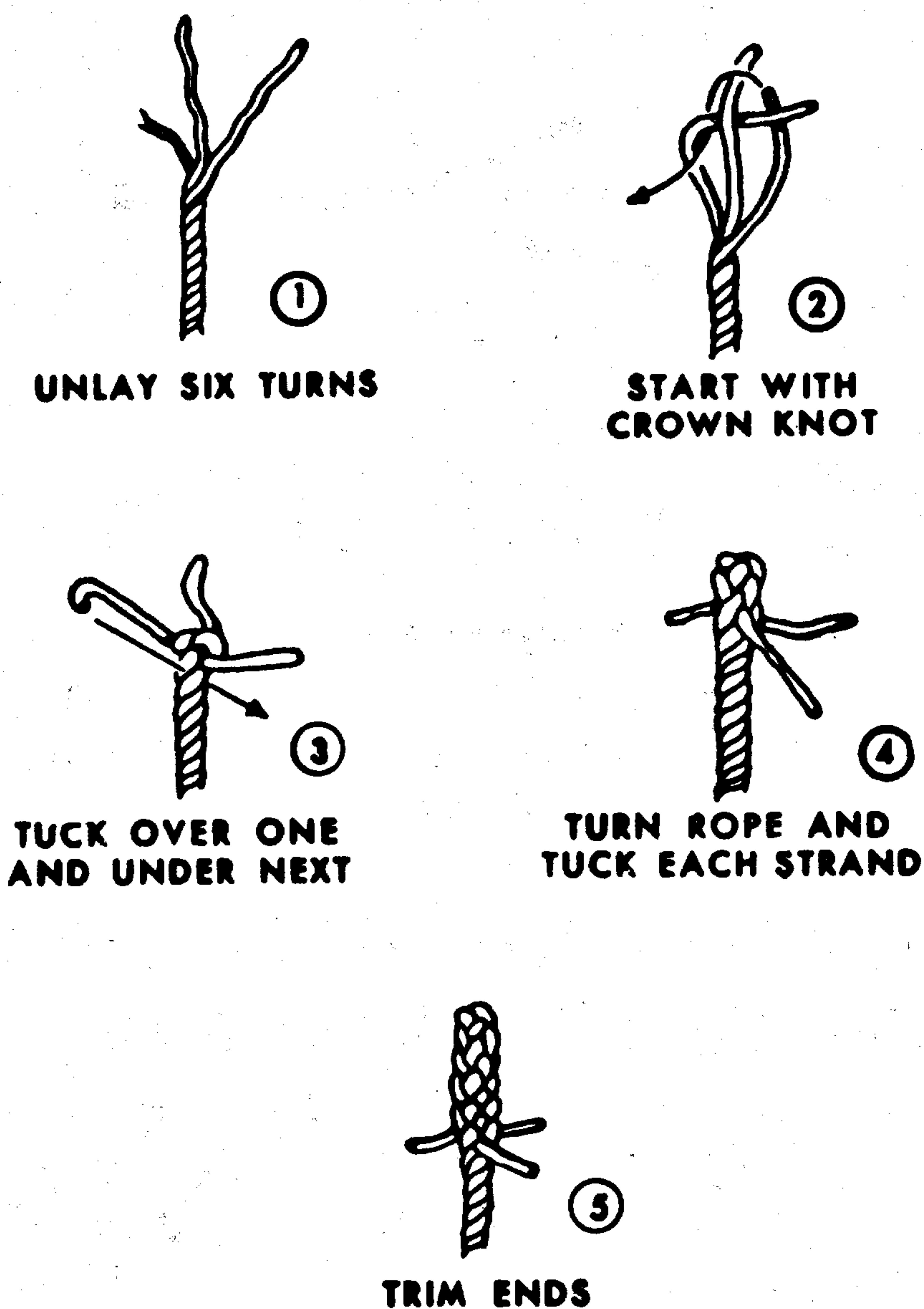


Figure 2-42. Crown or back splice for fiber rope.

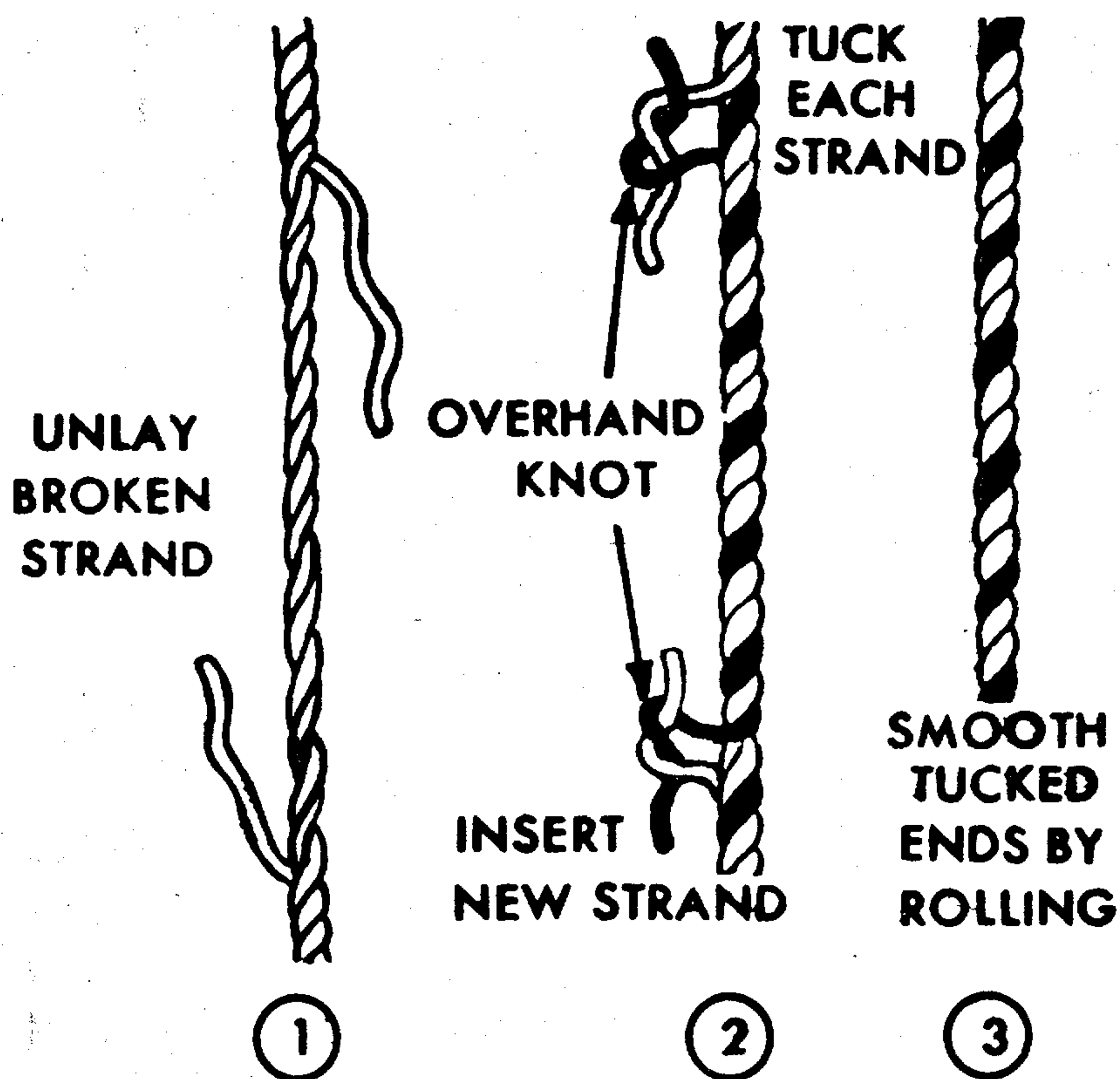


Figure 2-43. Renewing rope strands.

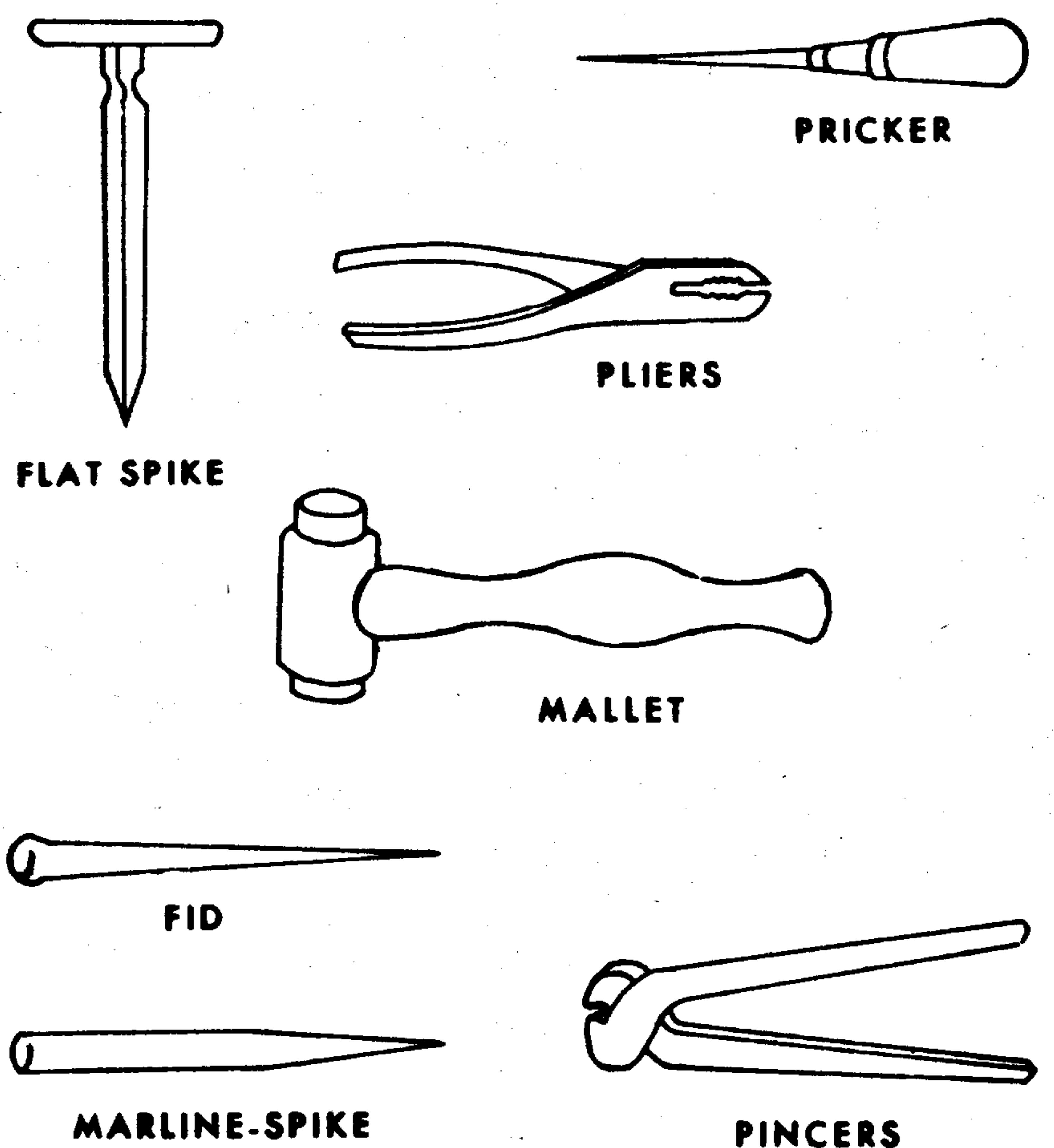


Figure 2-44. Tools for wire splicing.

30-foot splice in a  $\frac{3}{4}$ -inch regular lay, round strand, hemp center wire rope. Other strand combinations differ only when there is an uneven number of strands. In splicing ropes having an odd number of strands, the odd tuck is made at the center of the splice.

b. *Round Strand Lang Lay Rope.* In splicing a round strand Lang lay rope, it is advisable to make a slightly longer splice than for the same size rope of regular lay because of the tendency of the rope to untwist. Up to the point of tucking the ends, the procedure for regular lay is followed. Then, instead of laying the strands side-by-side where they pass each other, they are crossed over to increase the holding power of the splice. At the point where they cross, the strands are untwisted for a length of about 3 inches so they cross over each other without materially increasing the diameter of the rope. Then the tucks are finished in the usual manner.

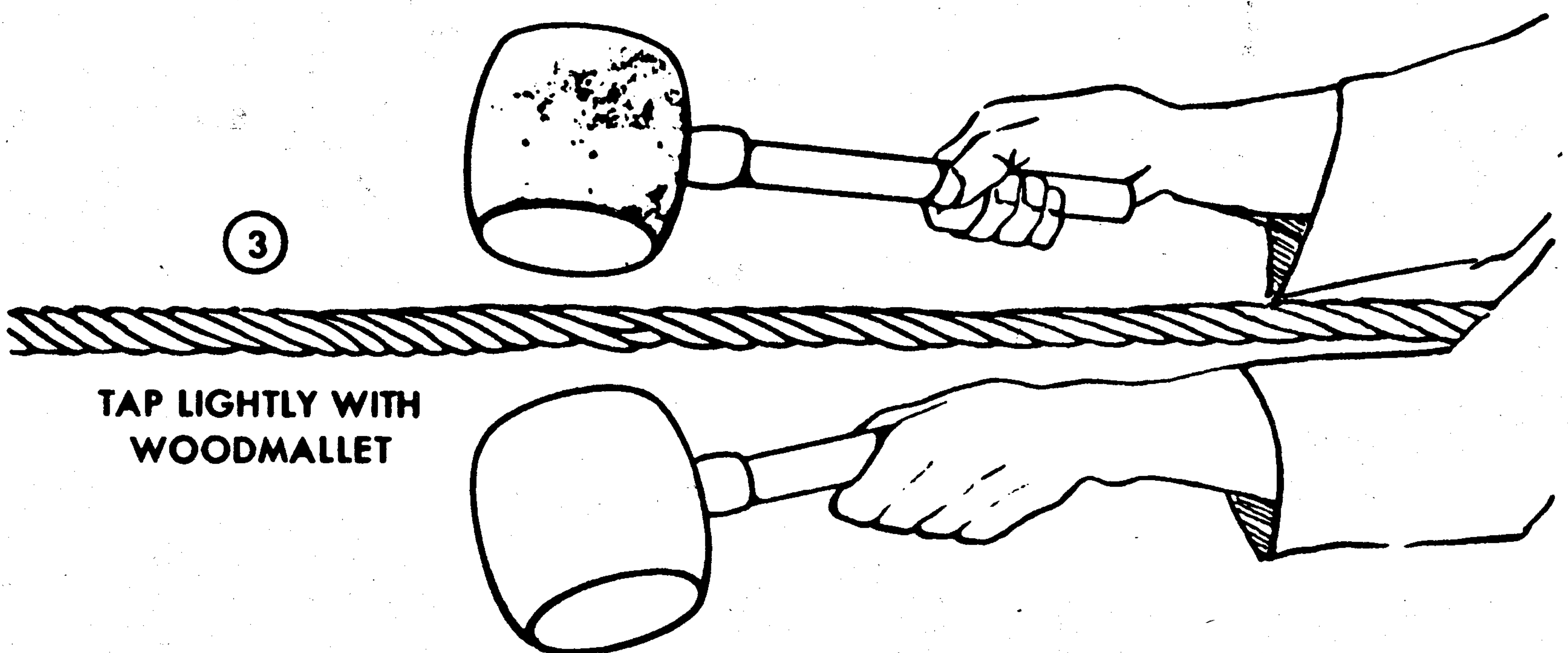
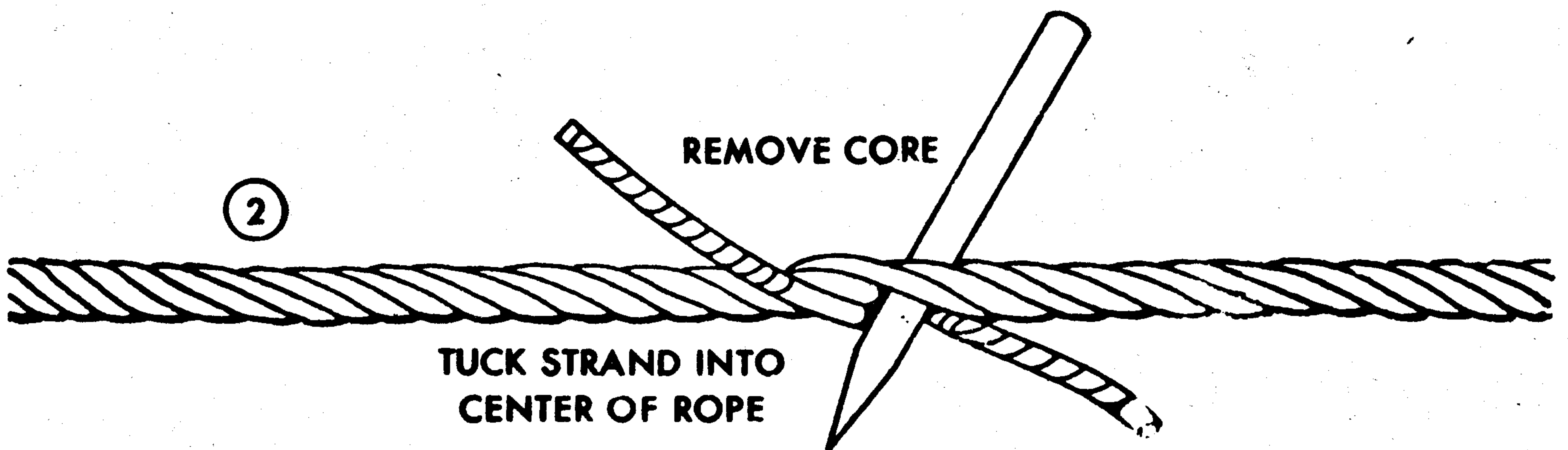
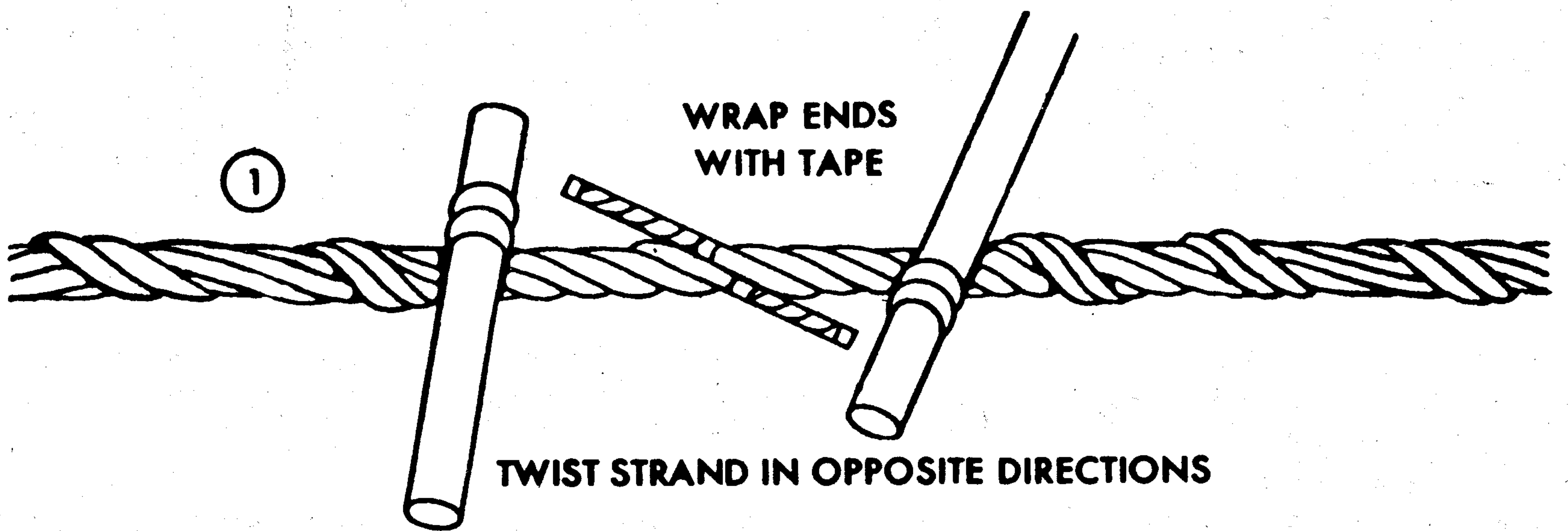


Figure 2-45. Tucking wire rope strands.

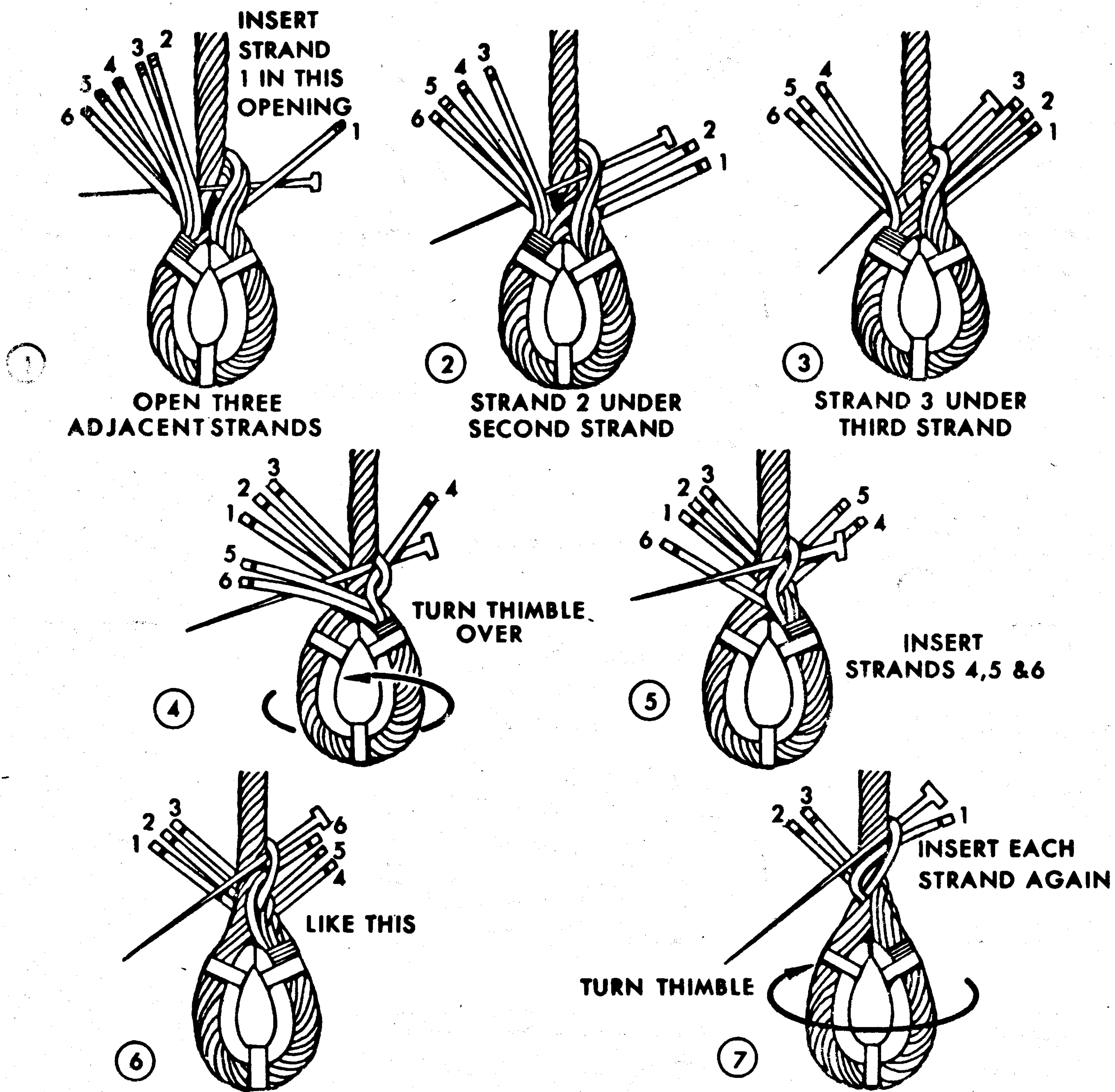
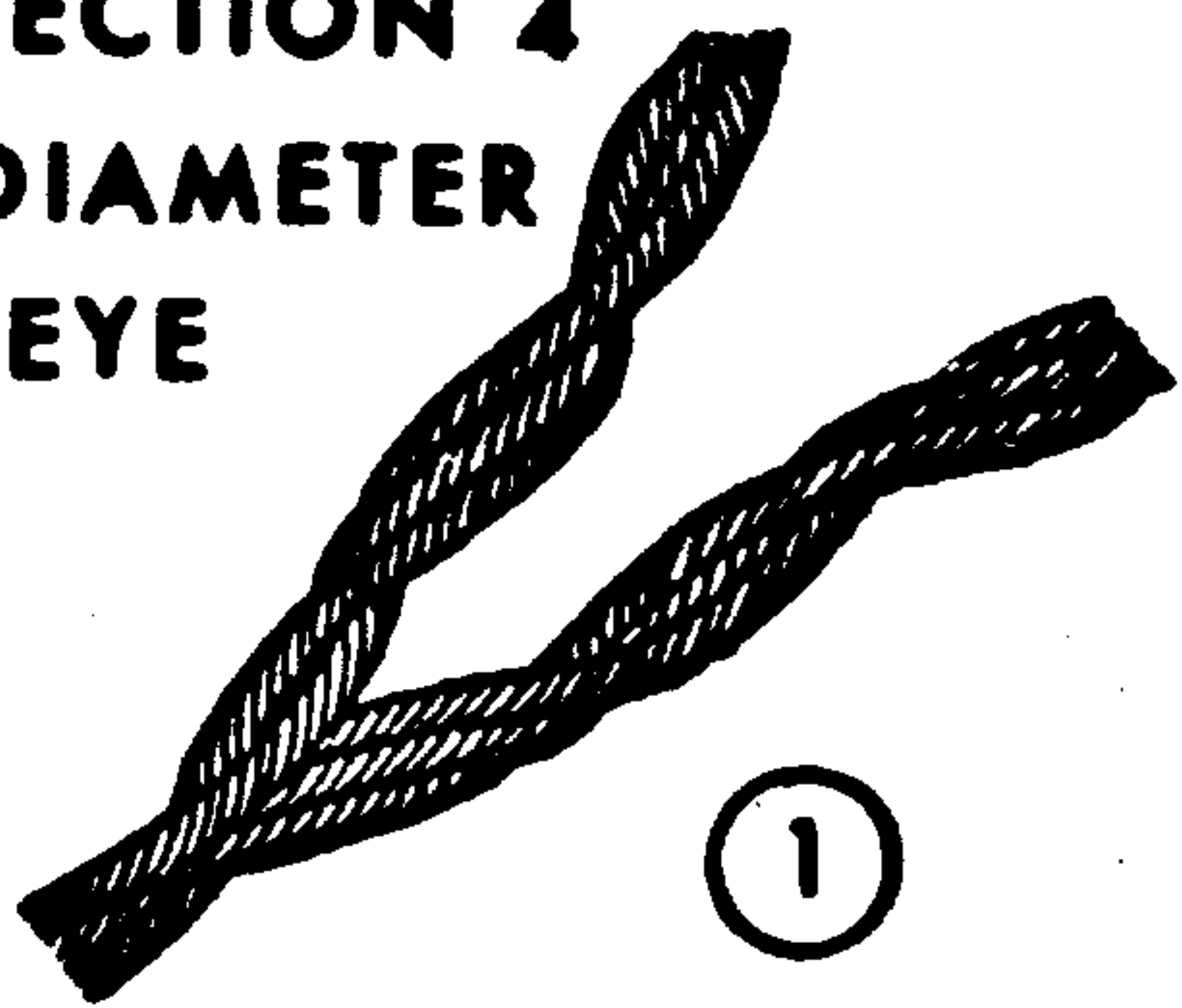


Figure 2-46. Eye splice with thimble.

EACH SECTION 4  
TIMES DIAMETER  
OF EYE

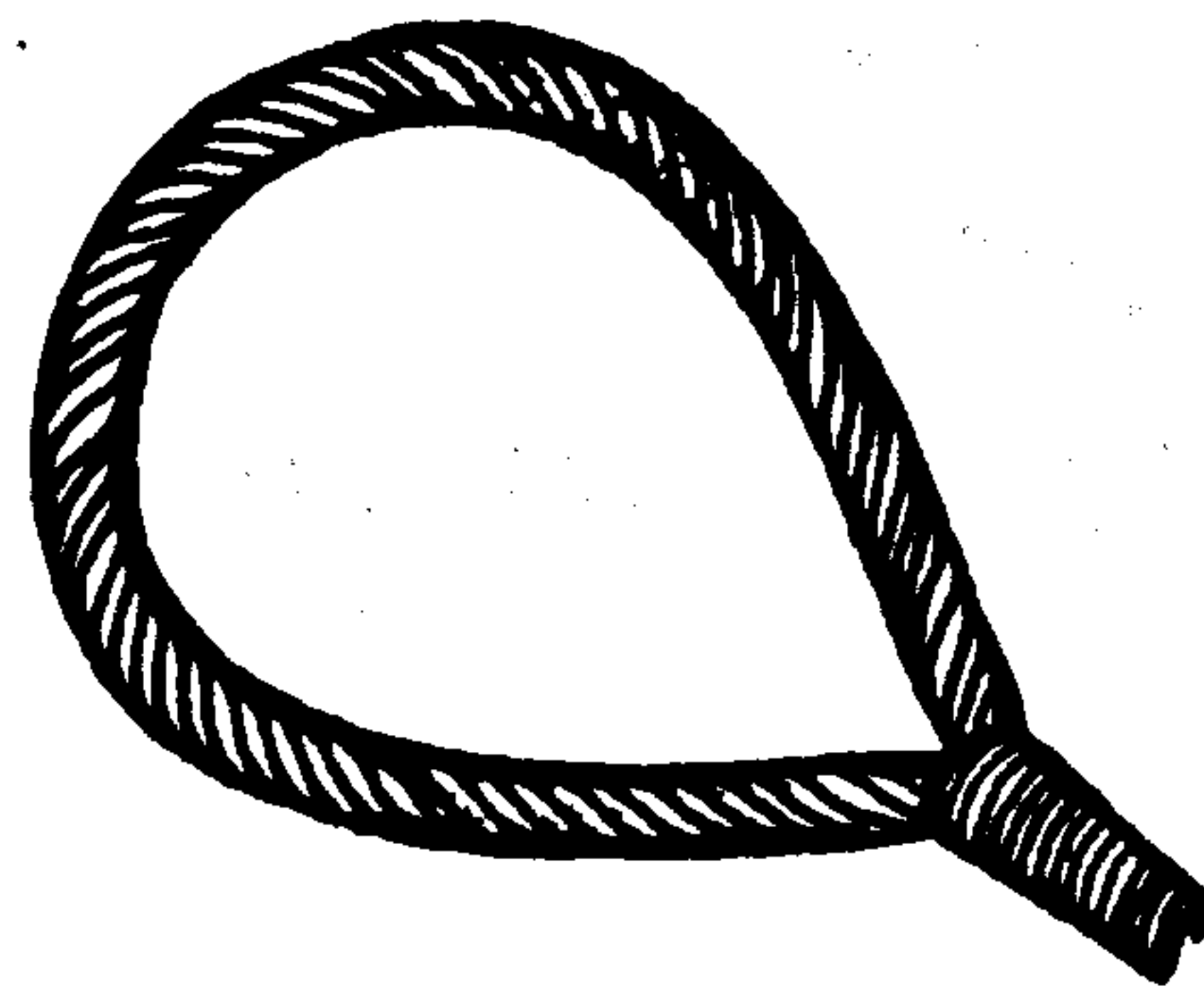


SEPARATE WIRE INTO TWO  
THREE STRAND SECTIONS

FORM A LOOP



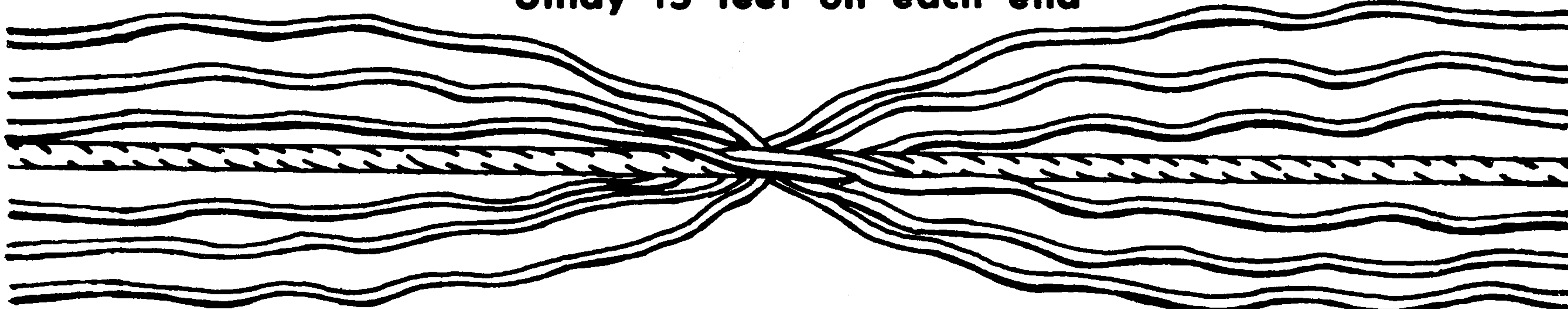
LAY THE STRANDS  
BACK AROUND  
EACH OTHER



SEIZE

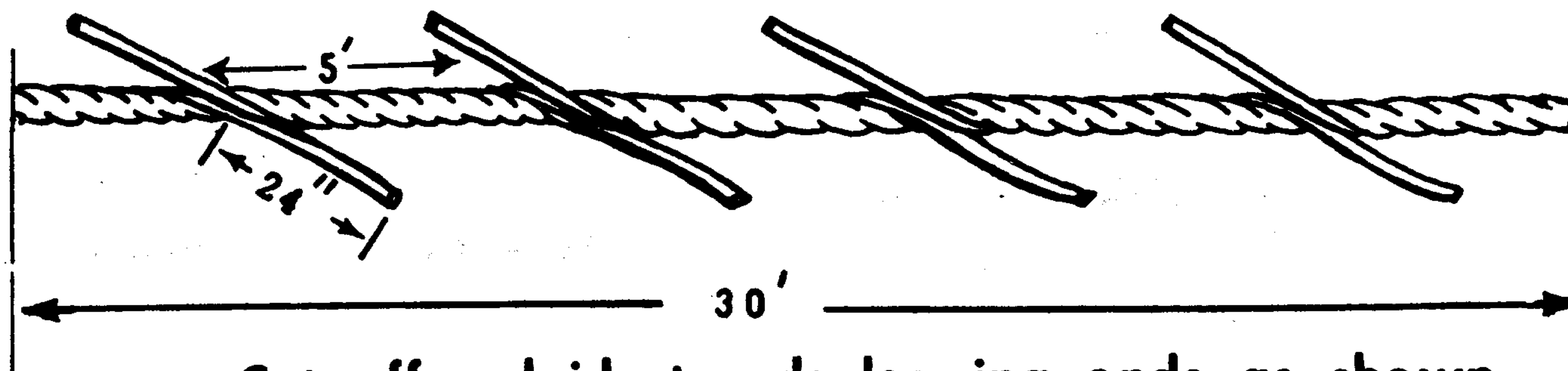
Figure 2-47. Hasty eye splice. (Use only preformed rope).

Unlay 15 feet on each end



Cut cores and interlace strands together

Unlay strands and replace with strands from opposite side



Cut off unlayed strands leaving ends as shown



Tuck the two ends at each point to complete the splice

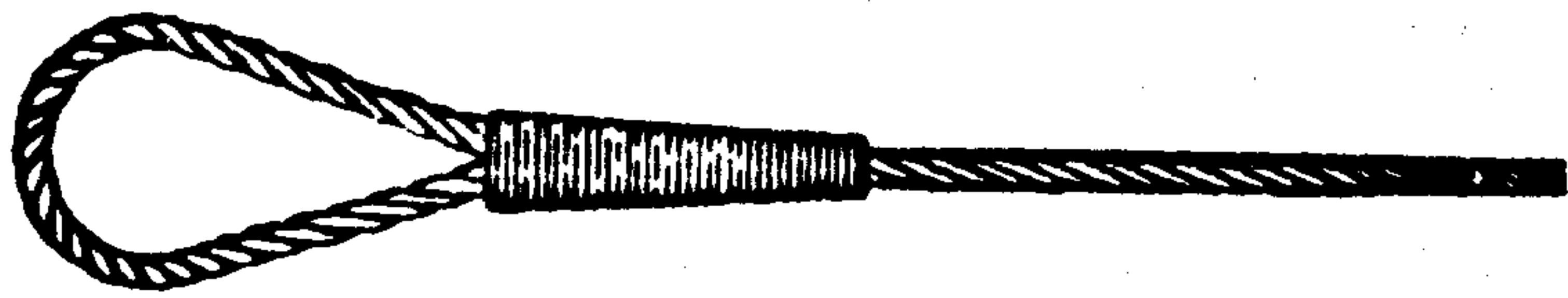
Figure 2-48. Long splice in wire rope.

### Section III. ATTACHMENTS

#### 2-19. Use of Attachments

Most of the attachments used with wire rope are designed to provide an eye on the end of the rope by which maximum strength can be obtained when the rope is connected with another rope, hook, or ring. Figure 2-49 shows a

number of attachments used with the eye splice. Any two of the ends can be joined together, either directly or with the aid of a shackle or end fitting. These attachments for wire rope take the place of knots.



**EYE SPLICE**



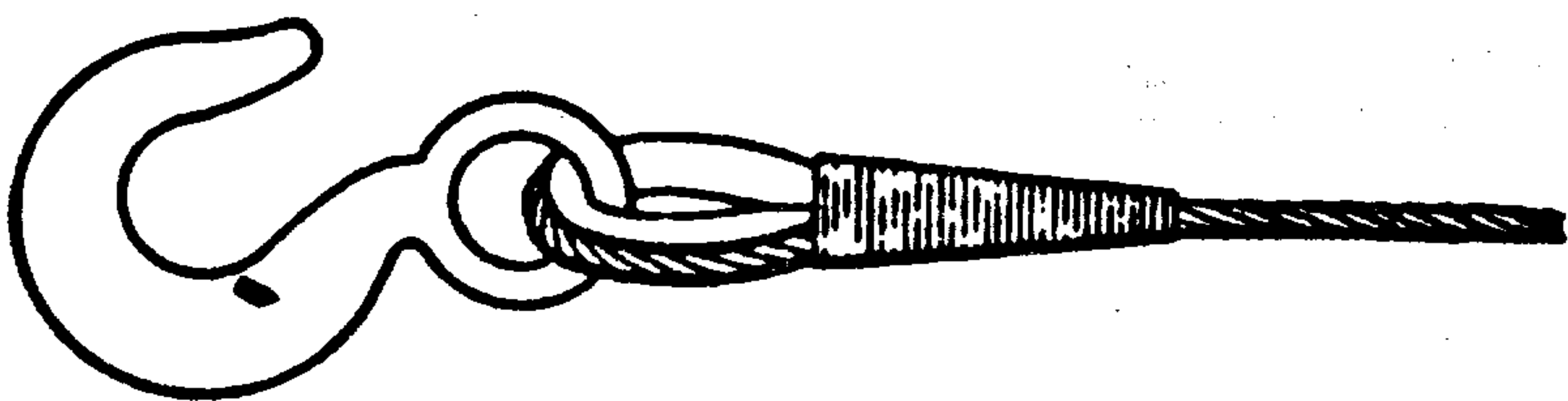
**THIMBLE IN EYE**



**LINK AND THIMBLE**



**SHACKLE AND THIMBLE**



**HOOK AND THIMBLE**

*Figure 2-49. Attachments used with eye splice.*

### 2-20. End Fittings

An end fitting may be placed directly on wire rope. Fittings that are easily and quickly changed are clips, clamps, and wedge sockets. The basket socket end fittings (fig. 2-50) include closed sockets, open sockets, and bridge sockets.

### 2-21. Clips

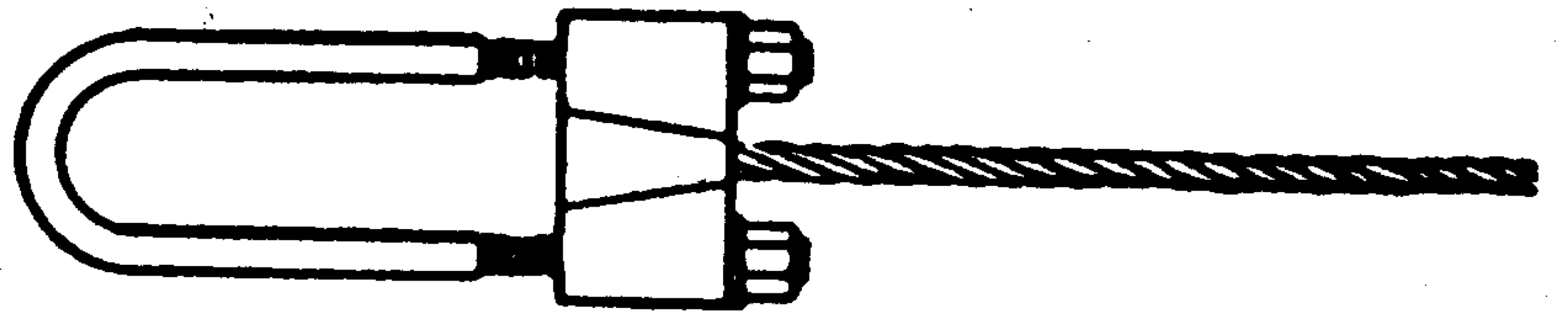
Wire rope clips (fig. 2-51) are reliable and durable. They can be used repeatedly in making eyes in wire rope, either for a simple eye or an eye reinforced with a thimble, or to secure a



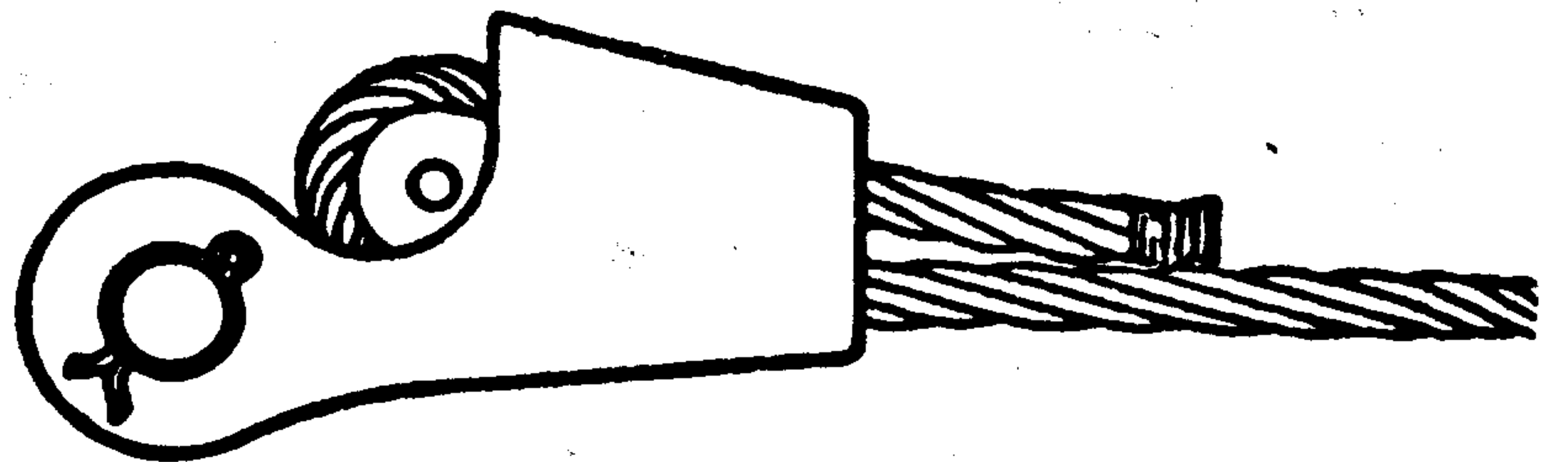
**CLOSED SOCKET**



**OPEN SOCKET**



**BRIDGE SOCKET**



**WEDGE SOCKET**

*Figure 2-50. Basket socket end fittings.*

wire rope line or anchorage. The clips should be spaced about six rope diameters apart. The number of clips to be installed is equal to three times the diameter of the rope plus one. (No. of clips =  $3D + 1$ ) Thus, a 1-inch rope requires four clips. When this calculation results in a fraction the next larger whole number is used. After all clips are installed the clip farthest from the thimble is tightened with a wrench. Then the rope is placed under tension and the nuts are tightened on the clip next to the first clip. The remaining clips are tightened in order, moving toward the thimble. After the rope has been placed in service and has been under tension, the nuts should be tightened again to compensate for any decrease in rope diameter caused by the load. For this

reason, clips should never be placed under ground.

### 2-22. Clamps

A wire clamp (fig. 2-52) can be used with or without a thimble to make an eye in wire rope.

Ordinarily a clamp is used to make an eye without a thimble. It has about 90 percent of the strength of the rope. The two end collars should be tightened with wrenches to force the clamp to a good snug fit. This crushes the pieces of rope firmly against each other.

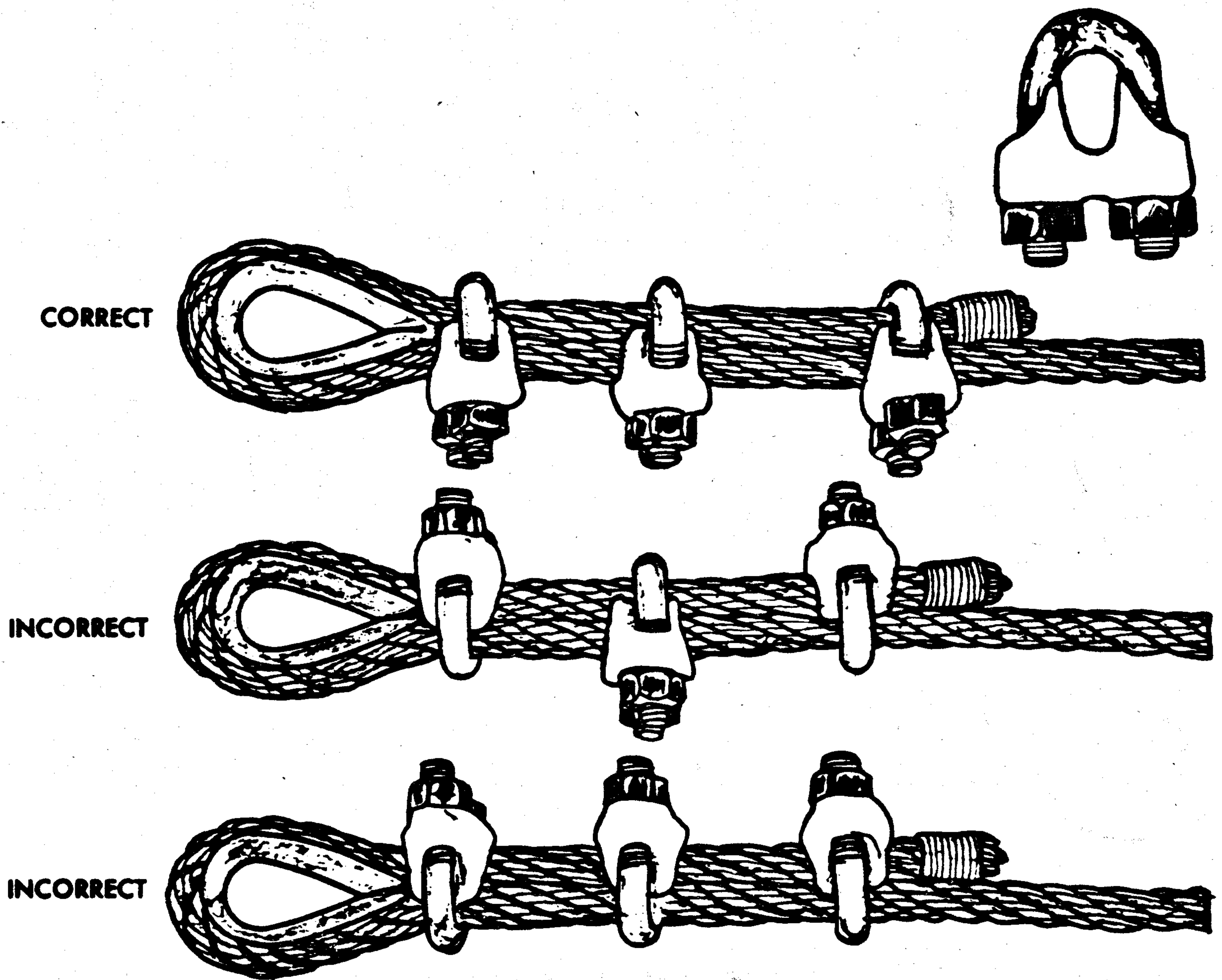


Figure 2-51. Wire rope clips.

### 2-23. Wedge Socket

A wedge socket end fitting (fig. 2-53) is used when it may be necessary to change the fitting at frequent intervals. The efficiency is about

two-thirds the strength of the rope. It is made in two parts. The socket itself has a tapered opening for the wire rope and a small wedge to go into this tapered socket. The loop of wire

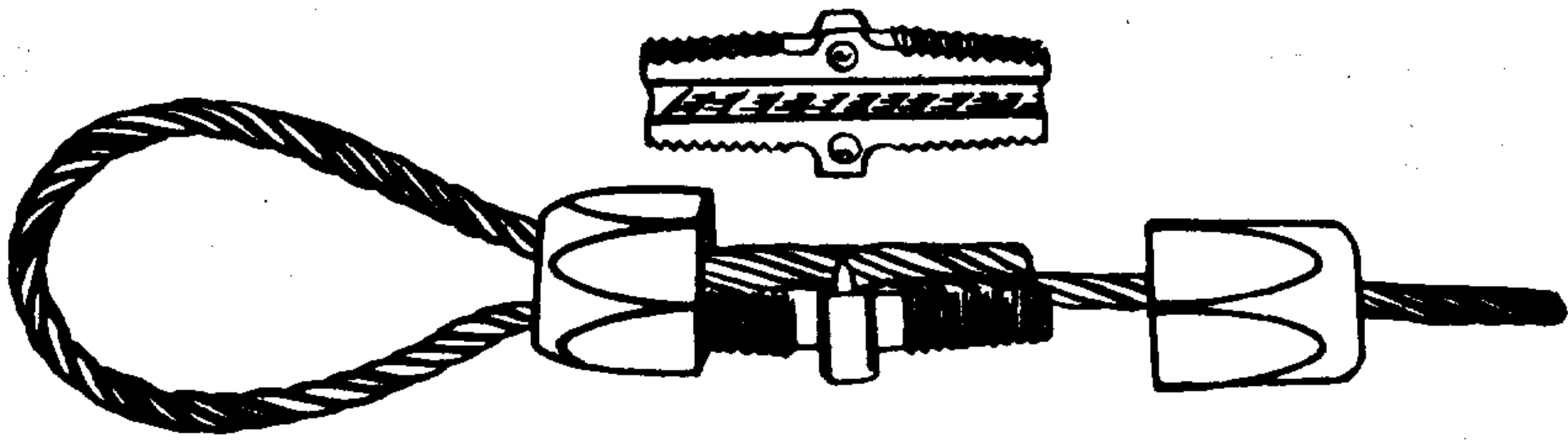


Figure 2-52. Wire rope clamps.

rope must be inserted in the wedge socket so that the standing part of the wire rope will form a nearly direct line to the clevis pin of the fitting. A properly installed wedge socket connection will tighten when a strain is placed on the wire rope.

#### 2-24. Basket Socket

A basket type socket ordinarily is attached to the end of the rope with molten zinc or babbitt

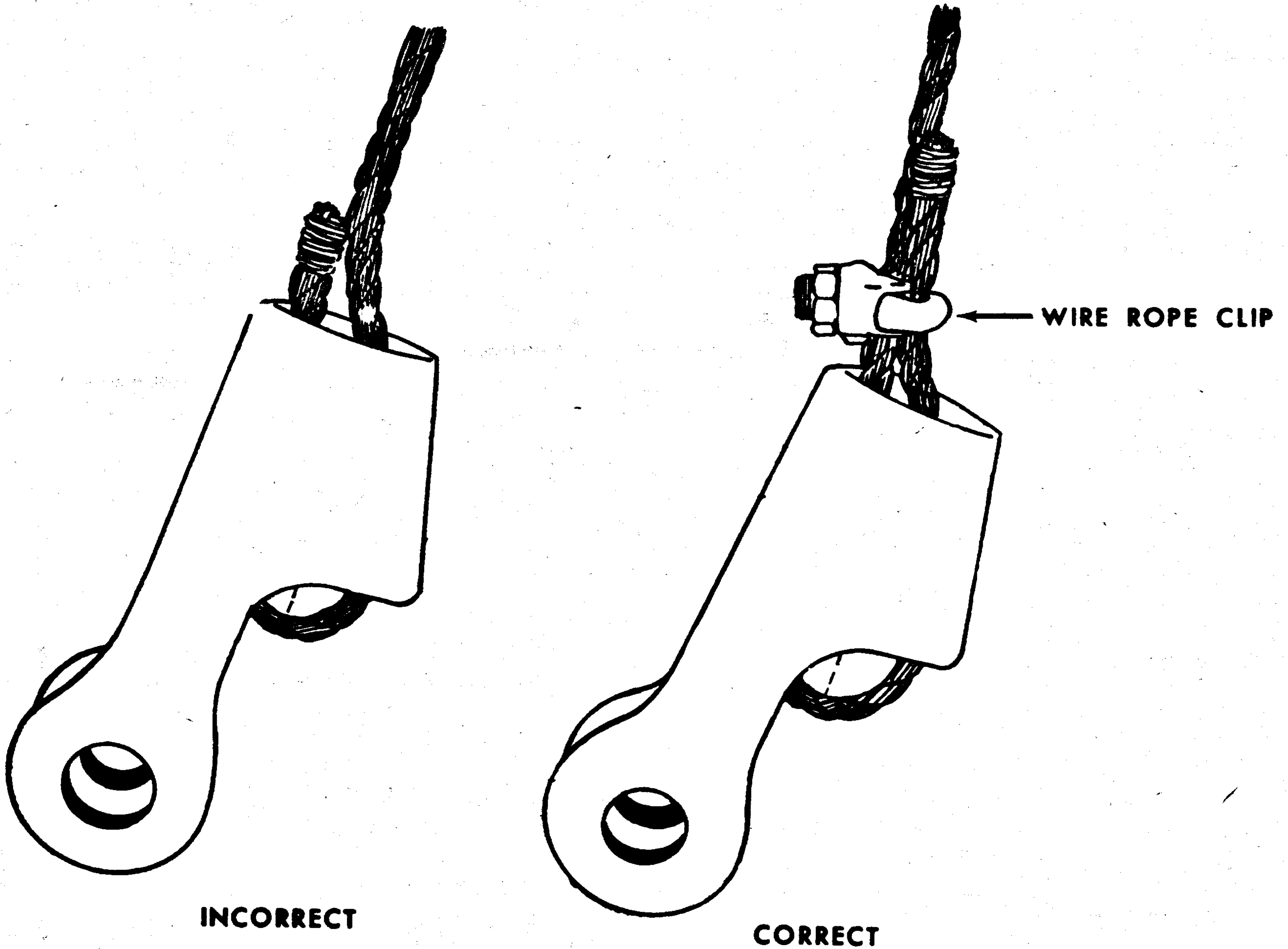


Figure 2-53. Wedge socket.

metal, and is a permanent end fitting. If properly made up, this fitting is as strong as the rope itself. If molten lead is used instead of zinc, the strength of the connection must be assumed to be reduced to one-fourth the strength of a zinc connection. The socket can be made up by the dry method if facilities are not available to make a poured fitting, but its strength

is sharply reduced and must be considered to be about one-sixth the strength of a zinc connection. In all cases the wire rope should lead from the socket in line with the axis of the socket.

*a. Poured Method.* The poured basket socket (fig. 2-54) is the most satisfactory method in use. If the socketing is properly done, when

tested to destruction, a wire rope will break before it will pull out from the socket.

b. *Dry Method.* The dry method (fig. 2-55) should be used only when facilities are not available for the poured method. The strength of the connection must be assumed to be reduced to about one-sixth of the strength of a poured zinc connection.

### 2-25. Stanchions

The standard pipe stanchion (fig. 2-56) is

made up of a 1-inch diameter pipe. Each stanchion is 40 inches long. Two  $\frac{3}{4}$ -inch wire rope clips are fastened through holes in the pipe with the centers of the clips 36-inches apart. Such a stanchion can be used without modification for a suspended walkway which uses two wire ropes on each side, but for handlines the lower wire rope clip is removed or left off. Refer to TM 5-270 for detailed information on types and uses of stanchions.

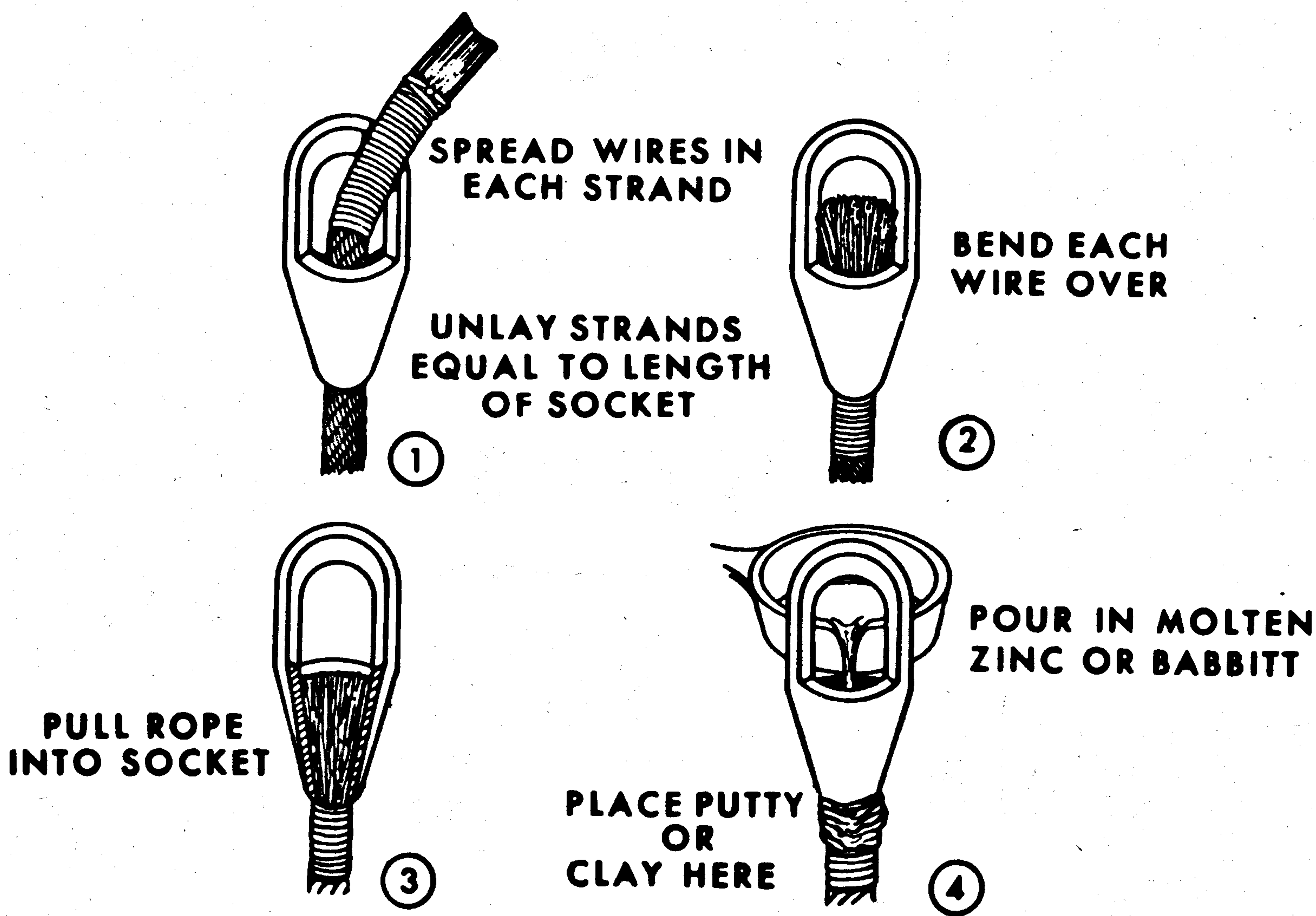


Figure 2-54. Attaching basket sockets by pouring.

