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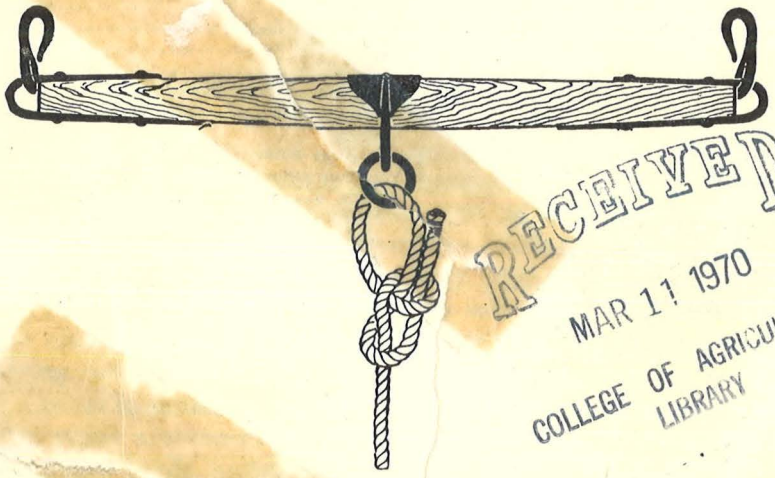
The Use of Rope on the Farm



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SUBJECT INDEX

Acknowledgment

The University of Nebraska Agricultural College Extension Service wishes to express its indebtedness to the Ohio State University Agricultural College Extension Service for the privilege of reprinting this bulletin, and for personal assistance in its accomplishment.

The Use of Rope on the Farm

THIS bulletin is published for the instruction of farmers and students desiring to learn a few of the practical uses to which rope is put on the farm. It is not a complete hand book on rope. There are many knots, hitches, and splices which have not been mentioned. Also there is more than one way of tying most of those knots shown, but only one method is described for each knot. An effort has been made to describe that method which will be most easily understood by a person unfamiliar with the uses of rope.

ROPE MATERIALS

The two principal fibers from which rope is made are sisal and Manila hemp. The former, which is the coarser and the cheaper, comes from Yucatan, and the latter, from the Philippine Islands. Due largely to its lower price, sisal hemp furnishes the raw material for the manufacture of more than half of all binder twine used. It is commonly known as "Standard Twine." Manila rope is softer, more pliable, and stronger than sisal rope. Manila rope is to be recommended wherever its use will justify the added cost. Some manufacturers of high grade rope identify their product by weaving into it a yarn, cord, or strand of a distinctive color.

Cotton is sometimes used in the manufacture of rope. Braided cotton ropes are commonly used about the house for clothes lines and window cords, and twisted cotton rope is frequently made into halters for young animals. Cotton makes an especially valuable rope for this purpose. It is soft and pliable, hence does not irritate the tender skin of a young animal. Other fibers sometimes used in the manufacture of rope are common hemp, flax, jute, and coir, or cocoanut-husk fiber.

Steel cables are rapidly replacing these made of vegetable fibers for use on cranes and derricks.

THE CONSTRUCTION OF ROPE

A rope is made of twisted fibers so intertwined as to form a thick cord capable of withstanding a severe strain. The twisting holds the fibers together by friction, when a strain is applied to the whole; it also has a tendency to prevent moisture from penetrating the rope.

The direction of twist is indicated by the terms "left hand," and "right hand" or "with the sun." To determine the direction of

twist, face the sun and point a portion of the yarn, strand, or rope toward it. If the direction of twist is the same as that of the sun's motion, it is said to be "right hand," or "with the sun," and "left hand," if in the opposite direction.

A weight freely suspended by a rope will tend to untwist and lengthen it. Fig. 1 shows the manner in which this tendency is overcome. A number of fibers are first twisted into a yarn in a "right hand" direction, as shown at C. From two to twenty yarns are formed "left hand" into a strand as shown at B. Three strands are laid up "right hand" into a hawser-laid rope, as shown at A. In each of these successive steps the twisting has been in opposite directions. As soon as the rope as a whole begins to untwist, the individual strands forming it are twisted tighter. The rope can untwist only far enough to bring these opposing forces to equilibrium.

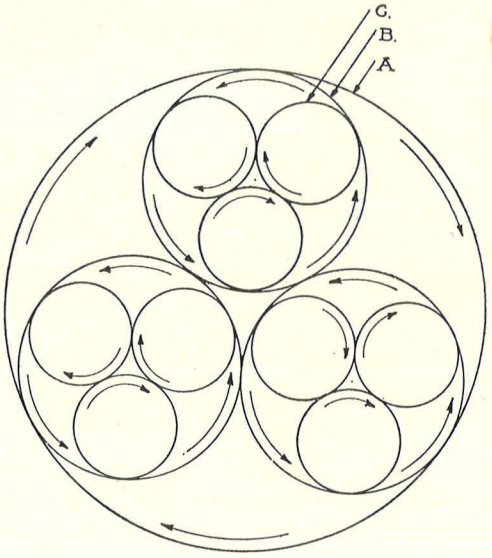


Fig. 1

KINDS OF ROPE

Three strands laid up in a right hand direction, as shown in Fig. 2, form a *hawser-laid* rope.


Fig. 2


Fig. 3

Four strands laid up in a right hand direction around a central core, as illustrated in Fig. 3, form a *shroud-laid* rope.

Three hawser-laid ropes laid up in a left hand direction form a *cable-laid* rope.

Most of the rope used on the farm is hawser-laid. Shroud-laid hay ropes and halters are frequently seen, but the principal use of this type of rope is for power transmission. The larger ropes used in well drilling and mining are cable laid. The size of a given type of rope is varied only by changing the number of yarns in a strand.

THE WEIGHT OF ROPE

Rope of all kinds is usually measured by giving its diameter in inches. It is sold by weight, but is ordered by giving the diameter and number of feet wanted.

To calculate the number of feet per pound of Manila rope, divide 3.4 by the square of the diameter in inches. For example, the number of feet in a pound of ¾-inch rope would be

¾ × ¾ = 9/16
3.4 ÷ 9/16 = 6, the number of feet per pound.

These results will vary as much as 12 per cent from the actual measurements of the weight of new rope. The weight will be considerably increased by storing in a damp cellar or by the addition of preservatives.

TABLE 1—FACTS ABOUT THREE-STRAND MANILA ROPE*

Diameter Inches	Circumference Inches	Weight of 100 Feet of Rope, Pounds	Length of Each Pound of Rope, Feet	Length of Each Pound of Rope, Inches	Safe Load, Pounds	Breaking Load, Pounds	Diameter of Pulley Inches
3/16	9/16	2	50	0	35	230	1½
¼	¾	3	33	4	55	400	2
5/16	1	4	25	0	90	630	2½
⅜	1⅛	5	20	0	130	900	3
7/16	1¼	6	16	8	175	1,240	3½
½	1½	7⅔	13	0	230	1,620	4
⅝	2	13⅓	7	6	410	2,880	5
¾	2¼	16⅓	6	1	520	3,640	6
⅞	2¾	23⅔	4	3	775	5,440	7
1	3	28⅓	3	6	925	6,480	8
1⅛	3½	38	2	7	1,260	8,820	9
1¼	3¾	45	2	2	1,445	10,120	10
1⅜	4¼	58	1	8	1,855	13,000	11
1½	4½	65	1	6	2,085	14,600	12
1¾	5¼	97	1	0	3,070	21,500	14
2	6	113	0	10	3,600	25,200	16
2½	7½	184	0	6½	5,630	39,400	20
3	9	262	0	4½	8,100	56,700	24

* From the rules by C. W. Hunt and Spencer Miller.

THE STRENGTH OF ROPE

In choosing a rope for a given purpose, a large factor of safety should be used. For example, to elevate 775 pounds of hay at a time, do not select a rope whose maximum, or breaking, strength is 775 or even 1000 pounds, but about seven times this amount. Table 1 shows the breaking strength of a new $\frac{7}{8}$-inch Manila rope to be 5440 pounds. One-seventh of 5440 is 777 pounds, or about the same as the load to be lifted. Therefore, a $\frac{7}{8}$-inch rope is the proper size for this purpose.

For a new Manila rope, the breaking strength in pounds may be roughly calculated as follows: Square the diameter in inches and multiply the product by 7200. The safe load can be found by dividing the breaking strength by seven. Thus, the breaking strength in pounds of $\frac{1}{2}$-inch Manila rope would be

$$\frac{1}{2} \times \frac{1}{2} \times 7200 = 1800$$

and the safe load in pounds would be

$$1800 \div 7 = 257$$

Four-strand ropes are slightly stronger than three-strand ropes of the same size. Boiling in water for from 15 to 20 minutes will make a hard rope soft and pliable, but will decrease its strength about 20 per cent. Exposure and wear are the most important factors in decreasing the strength of cordage and a liberal allowance should be made for both when estimating strength of old rope.

INSPECTION OF ROPE

A rope may appear badly worn on the outside and still be much better than another which looks good on the surface. There is chafing of the inner fibers against each other when a rope is bent in going through a pulley. Many of the central fibers become broken into dust and short pieces.

To detect this condition open the rope with the fingers, hold above a light-colored paper and tap. If the rope is chafed badly "rope dust" will fall upon the paper when the rope is tapped. A rope otherwise in excellent condition may have a broken strand. Such a defect can easily be repaired as shown in Figs. 26, 27, and 28. This information is of value in buying a second-hand hay rope.

COILING AND UNCOILING OF ROPE

Rope as it comes from the manufacturers is coiled into bales usually containing 1000 feet each. To uncoil rope from a bale, begin with the end in the center of the coil. When this end is pulled

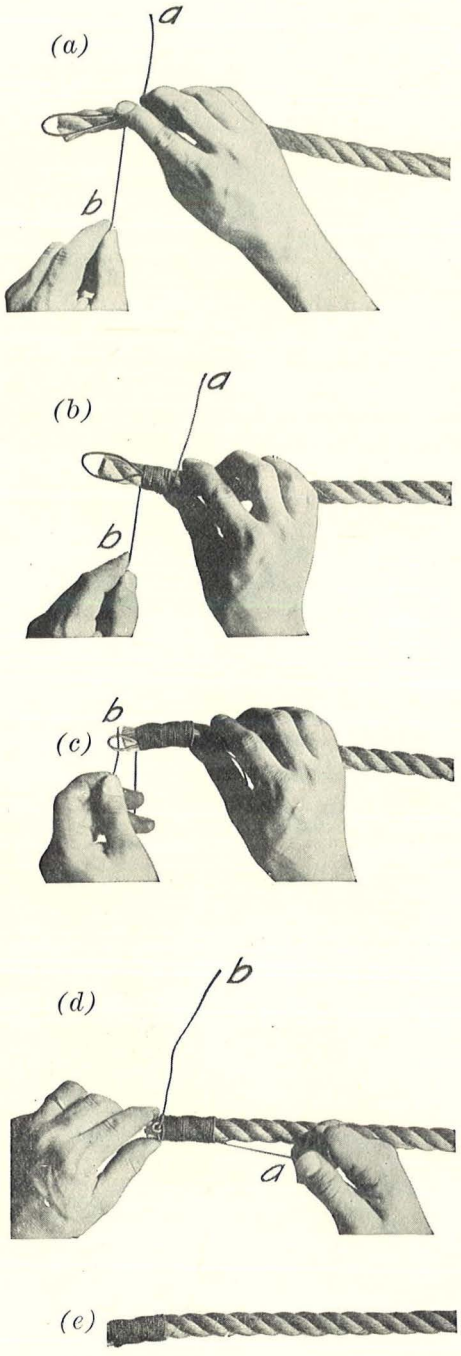


Fig. 4

out it should uncoil in a left hand direction, or opposite to the direction of motion of the hands of a clock. If it uncoils in the wrong direction turn the bale over and pull the end through the center of the coil and uncoil from the opposite side.

In coiling a piece of rope on a floor or on the ground, the direction of motion should be right hand, or with the sun. If rope is coiled and uncoiled in this manner, it will not kink or snarl badly.

WHIPPING THE END OF THE ROPE

Ropes that are to pass through pulleys or other small openings should be finished by whipping. A rope is whipped as follows:

Make a loop in one end of cord. Hold the loop along the rope as shown in Fig. 4 *(a)*. Wrap the long end *b* of the cord tightly about the rope in the same direction in which the strands are twisted, as in *(b)*.

When within about ½ inch of the end of the rope, slip the end *b* of the cord through the loop as shown in *(c)*.

With end *a* pull the loop beneath the whipping as far as possible, as shown in *(d)*. Both ends may now be cut close to the rope. The finished end is shown in *(e)*.

The principal steps in splicing a rope are (1) unlaying the strands, (2) placing the ends together, (3) tucking the ends of the strands. Two splices are here described, a long splice and a short splice. In each of them, and also in the woven crown, spliced eye, and rope halters, the ends of the strands are tucked in exactly the same way. Hence, if one splice is mastered, the others are easily learned. No attempt should be made to learn how to splice a rope without having pieces of rope in the hands and actually performing operations as they are studied from the text and illustrations.

The Short Splice.—Where it is not necessary for a rope to pass through a small pulley or where only a small amount of rope can be spared for making a splice, the short splice is very satisfactory. It is as strong as the long splice. The method of making is as follows:

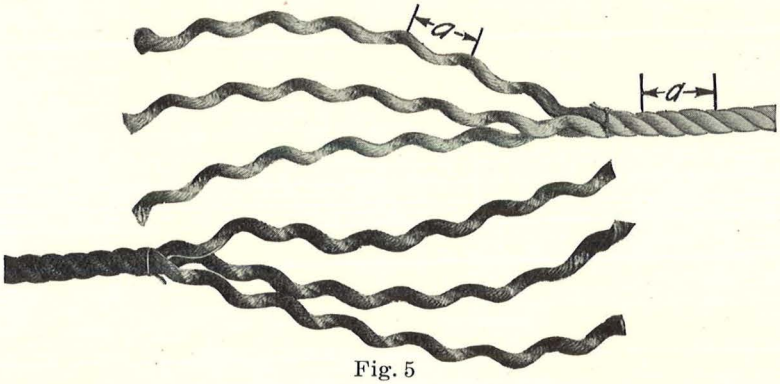


Fig. 5

Count seven turns from the ends to be spliced and tie strings about the ropes at these points. One turn of a rope is that part shown in Fig. 5 at *a*. Unlay the ends back to the points where the

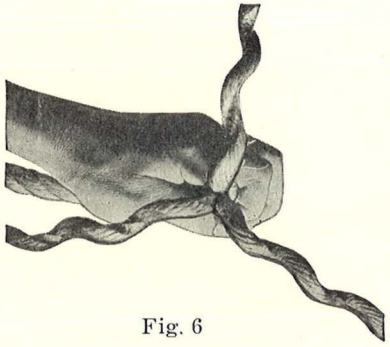


Fig. 6

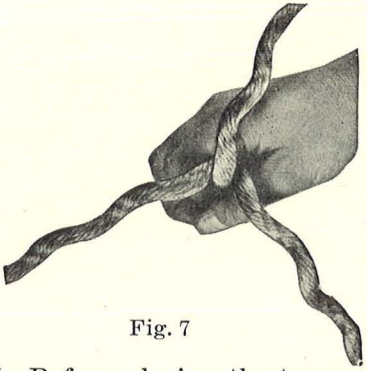


Fig. 7

strings are tied, as shown in Fig. 5. Before placing the two parts together, be sure to open each end as shown in Fig. 6 and not as shown in Fig. 7.

That is, no strand should cross between the other two. Bring the two parts together so that each strand of one part alternates

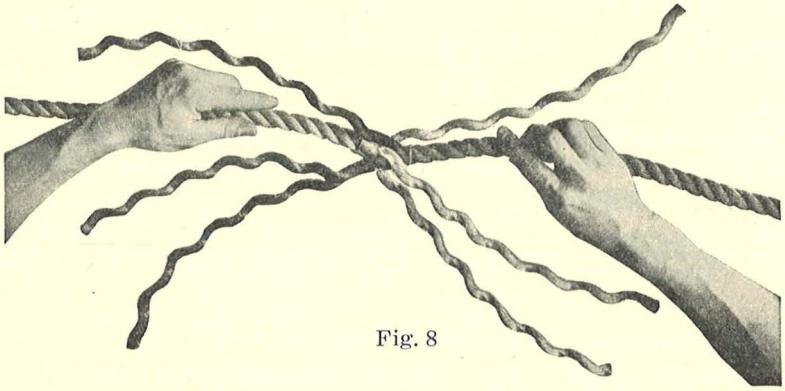


Fig. 8

with a strand of the other as shown in Fig. 8. With a string tie one set of strands about the rope as shown in Fig. 9 at *a*. Next begin tucking the strands from the left side by bringing a strand up over

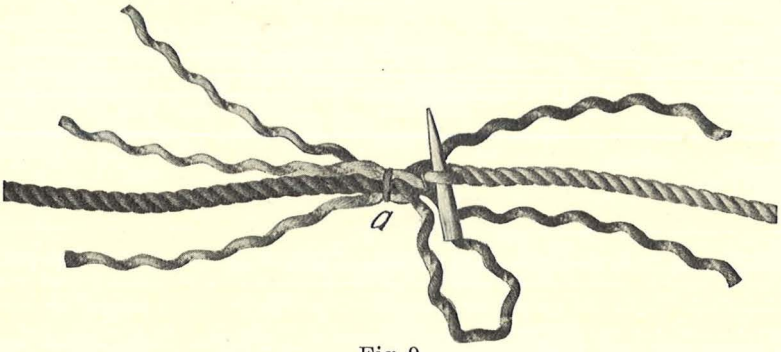


Fig. 9

the nearest strand from the right side and down under the next as shown by the marline spike in Fig. 9. The tucking should be done about at right angles to the direction of twist in the rope. Give

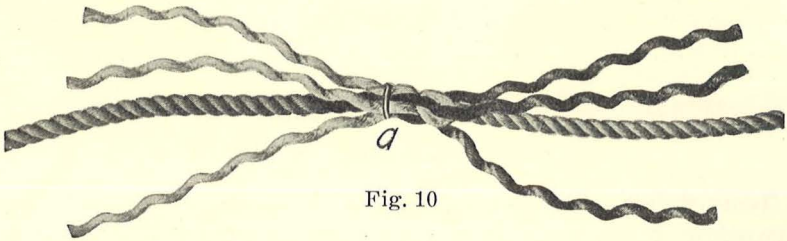


Fig. 10

each of the other two strands, from the left, one tuck in exactly the same manner. The splice should now appear as shown in Fig. 10. Next cut the cord shown in Fig. 10 at *a* and give each strand, from

the right side, one tuck, just as was done with the strands from the left. Fig. 11 shows all strands tucked once. Give each of the six

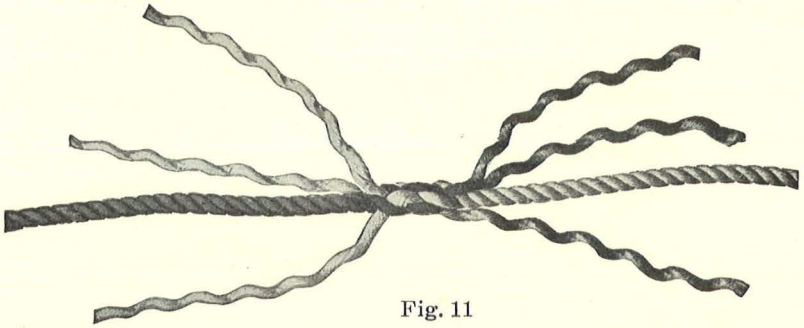


Fig. 11

strands two more tucks, always remembering to bring the strand to be tucked over the nearest one to it and under the second in a direction about at right angles to the direction of twist in the rope.

Next divide each strand into two parts as shown in the left of Fig. 12. Give one part of each strand two more tucks. Cut all the

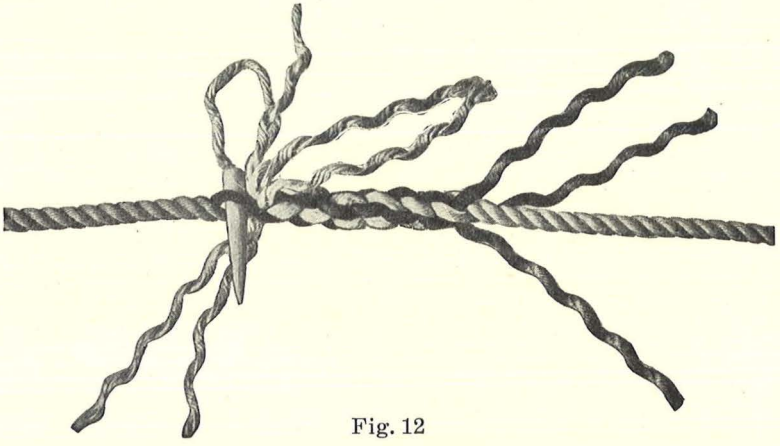


Fig. 12

ends off and roll the splice beneath the shoe or between boards to give a smooth appearance. The finished splice should appear as shown in Fig. 13.

Fig. 13

Long Splice.—The long splice is more desirable than the short splice where it is necessary for the rope to pass through small pulleys. It also has a neater appearance.

To make a **long splice in a three-strand rope,** count fifteen turns from the ends to be spliced and tie string about the rope at the

points thus determined. Unlay the strands back to the strings as shown in the lower part of Fig. 14. Before bringing the two parts

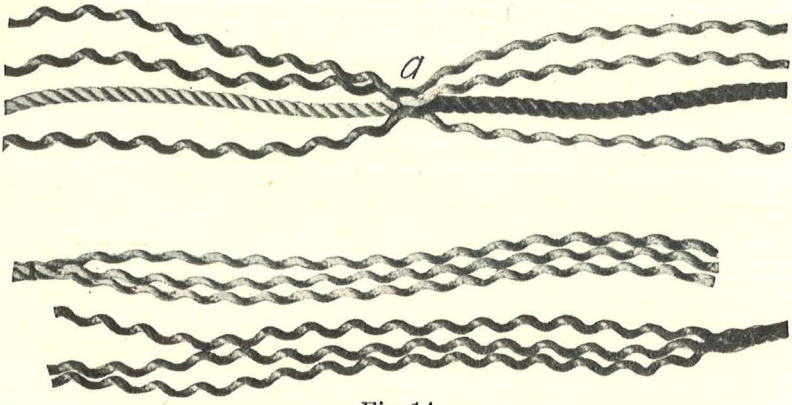


Fig. 14

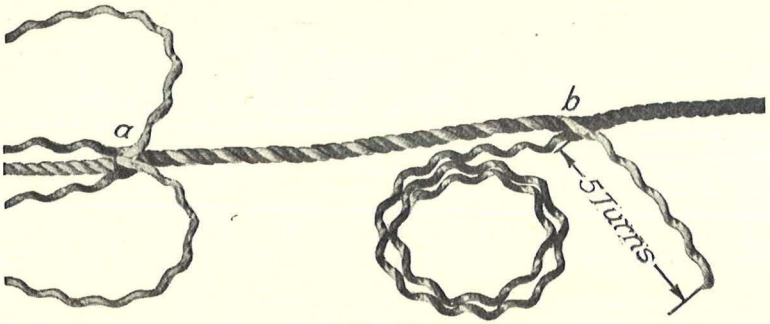


Fig. 15

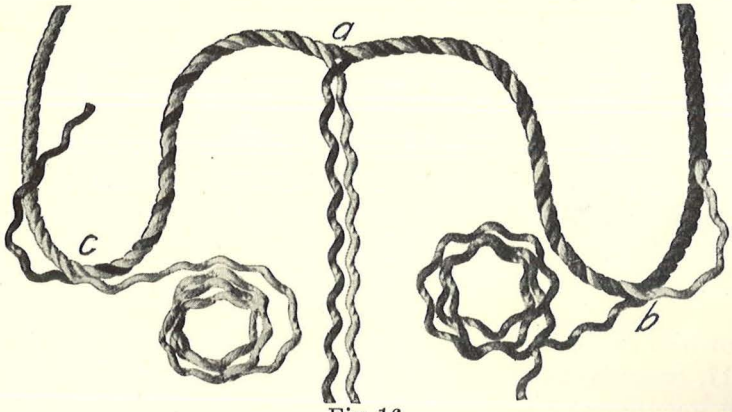


Fig. 16

together be sure to open each end as shown by Fig. 6 of the short splice and not as in Fig. 7, that is, no strand should cross between the other two. Bring the two parts together, making each strand

from one end alternate with a strand from the other, as in Fig. 14 at *a*. Next, beginning at the point where the two parts are placed together, unlay one of the strands to the right. Lay carefully in its place the corresponding strand from the left. This latter operation should follow closely the unlaying of the strand to the right. Stop

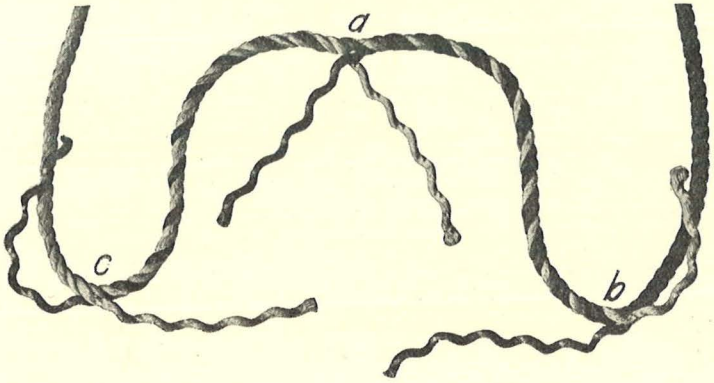


Fig. 17

when within five turns of the end of the strand from the left, as shown in Fig. 15 at *b*. There are still two pairs of strands left at the point *a* where the ends were placed together. Run one of these pairs to the left exactly as we ran the first pair to the right. This

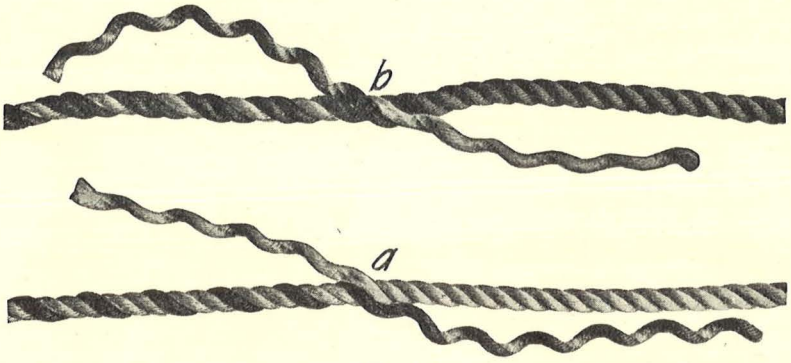


Fig. 18

is shown in Fig. 16 at *c*. Before starting to unlay toward *c*, Figs. 16 and 17, be sure that the two strands remaining at *a*, Figs. 16 and 17, fit together as a pair. Next cut all the long ends of the strands off about five turns from the main rope, as shown in Fig. 17.

The next part of the splicing consists in tucking the ends of the strands. There are three pairs of strands. All are tucked in exactly the same way which is as follows:

Be sure that the ends of the strands pass each other as illustrated in Fig. 18 at *a* and not as at *b*. Bring the strand from the right up over the nearest strand from the left and under the next strand, as in Figs. 19 and 20. Give the strand from the left one

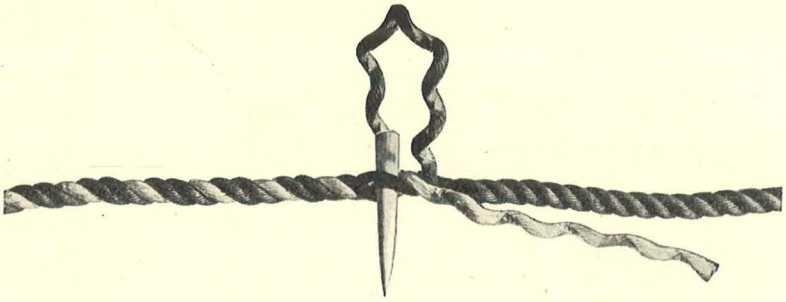


Fig. 19

tuck, as shown by the marline spike in the upper part of Fig. 21. The completed tuck is shown in the lower part, Fig. 21. Each strand should now be given two more tucks in a direction almost at right

Fig. 20

angles to the direction of twist in the rope as shown in Fig. 22. When all three pairs of strands have been tucked, cut the ends off and smooth by rolling beneath the shoe or between two boards. The finished splice should appear as shown in Fig. 23.

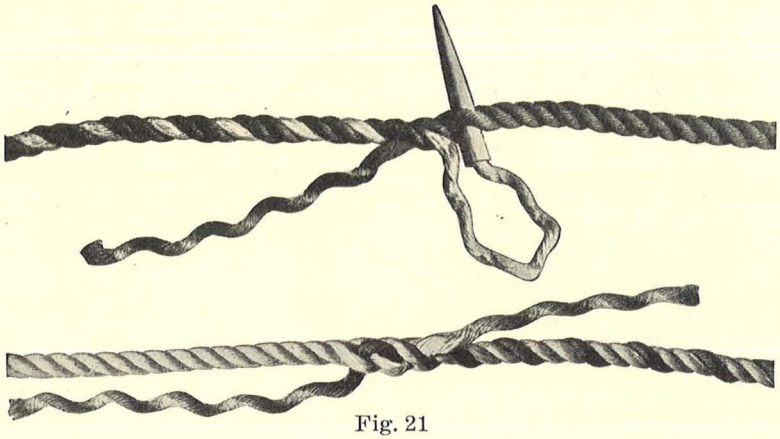


Fig. 21

To make a **long splice in a four-strand rope,** unlay twenty turns and put the two ends together as in splicing a three-strand rope.

Run one pair of strands to the right and another to the left, as shown in Fig. 24 at *a* and *b*. There are now two pairs of strands left where the ends were put together. Run one of these pairs to the

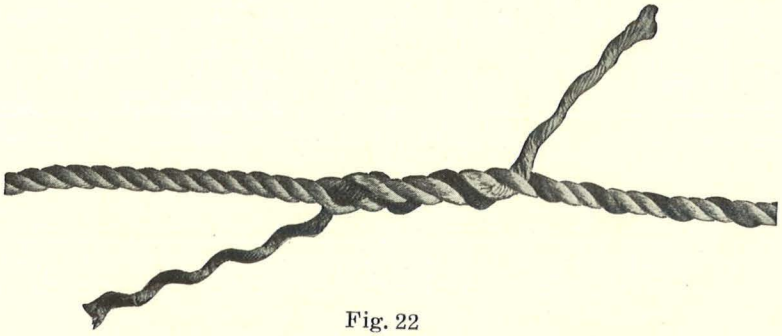


Fig. 22

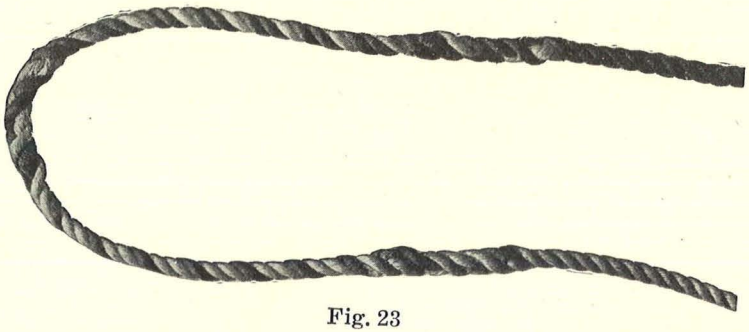


Fig. 23

right and the other to the left about five turns each as shown in Fig. 25. Finish the four pairs by tucking as in splicing a three-

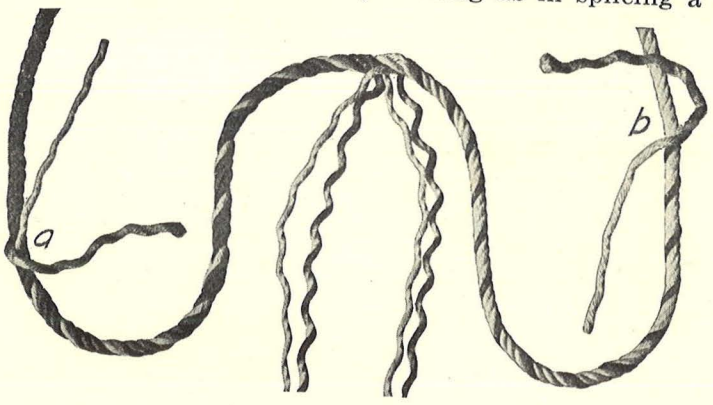


Fig. 24

strand rope. If the rope has a central core it should be cut at the point where the two parts of the rope were put together.

Mending a Broken Strand.—It occasionally happens that one strand of rope breaks while the other two are in good condition, as shown in Fig. 26. It may be repaired as follows:

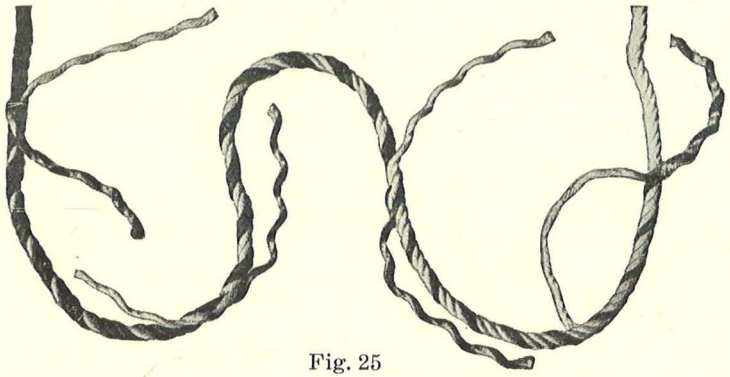


Fig. 25

Unlay each broken portion of the strand about six turns. Secure twenty turns of a strand of rope of the same size as the one to be mended. Lay this strand in the space from which the broken

Fig. 26

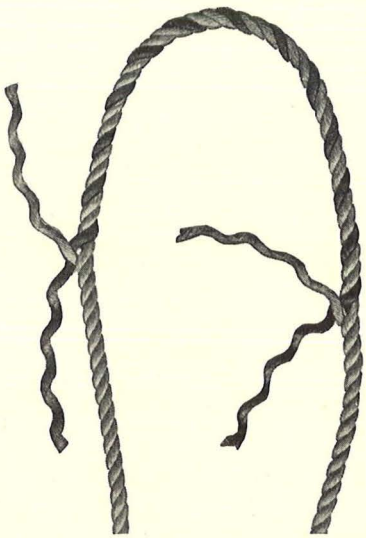


Fig. 27

Fig. 28

strand has been removed as in Fig. 27. Finish the two pairs of strands as in making the long splice, Figs. 18-22. The mended rope is shown in Fig. 28.

The Spliced Eye.—The spliced eye is used for fastening a rope to a ring or for making a permanent loop in the end of a rope. It is made as follows:

Unlay five turns of the rope. Tuck strand *a* beneath a strand in long part of the rope as shown in Fig. 29. Tuck strand *b* by bringing it over the strand under which strand *a* is tucked and

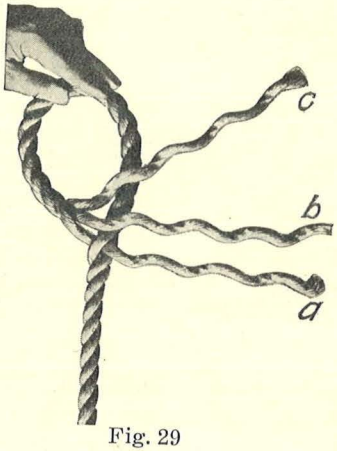


Fig. 29

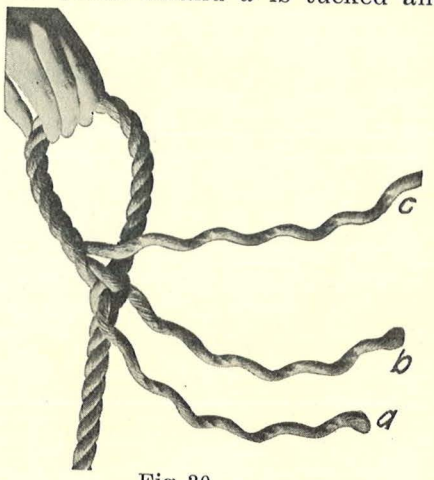


Fig. 30

under the next strand as shown in Fig. 30. Likewise tuck strand *c* by bringing it over the strand under which *b* is tucked and beneath the next strand. The three strands have now been tucked once,

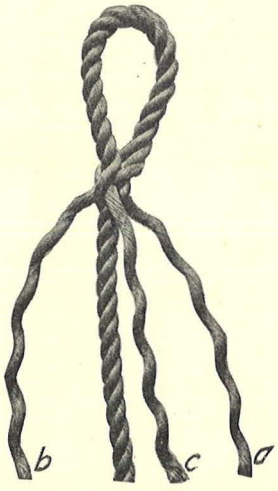


Fig. 31

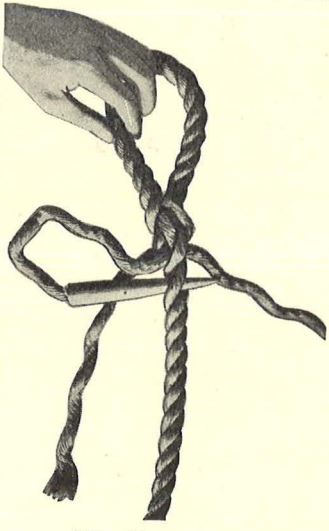


Fig. 32

Fig. 33

each beneath different strands of the main rope. This is shown in Fig. 31. Give each strand two more tucks as in making the short splice. Fig. 32 shows strand *a* being tucked the second time. The finished eye is shown in Fig. 33.

The Spliced Crown.—Where a slight enlargement is not objectionable the spliced crown is a desirable way to finish the end of a rope. It is made as follows:

Unlay six turns of the rope. Form a loop in strand *a*, bringing the end between strands *b* and *c* as shown in Fig. 34. Next move

Fig. 34

Fig. 35

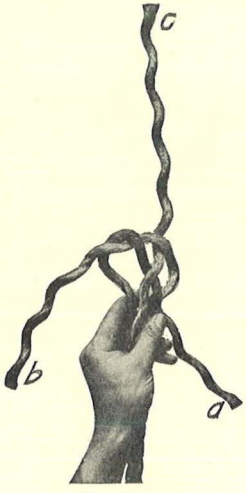


Fig. 36

strand *c* between the loop in strand *a* and strand *b* as in Fig. 35. Pull strand *b* through loop in strand *a* as indicated by arrow in Fig. 35 and shown in Fig. 36. Draw the crown thus formed up tight as in Fig. 37. Give each strand one tuck by bringing it over the

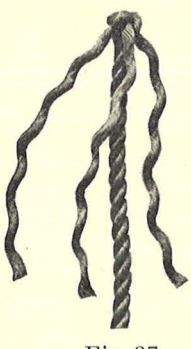


Fig. 37

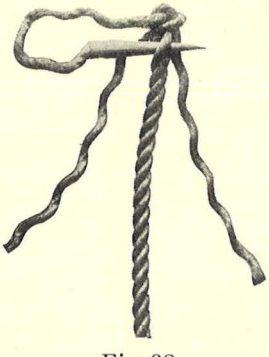


Fig. 38


Fig. 39


Fig. 40

strand nearest to it and under the second, as in rope splicing. This is shown in Fig. 38. Fig. 39 shows the first tuck completed. Give each strand two more tucks and cut the ends of the strands off. Smooth the crown by rolling beneath the shoe. The finished crown is shown in Fig. 40.

ROPE HALTERS

The Non-adjustable Rope Halter.—The non-adjustable rope halter is used for cattle and as a temporary halter for horses and young stock.

TABLE 2—SIZE AND LENGTHS FOR HALTER ROPES

Animal	Diameter of Rope in Inches	Total Length in Feet	Length of Parts in Inches (Fig. 41)			
			a to b	b to c	c to d	d to e
Large horse	5/8	15	7	44	10	18
Medium horse	1/2	14	6	40	8	16
Small horse	1/2	14	6	36	8	14
Large cattle	1/2	12	6	34	7	14
Medium cattle	3/8	12	5	32	6	12

Determine the total length of rope and the length of the different parts of the halter from Table 2. Tie strings about the rope at the points, *b*, *c*, *d*, and *e*, as shown in Fig. 41. After having some

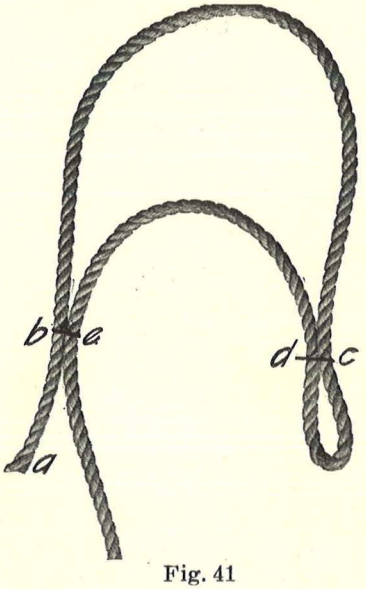


Fig. 41

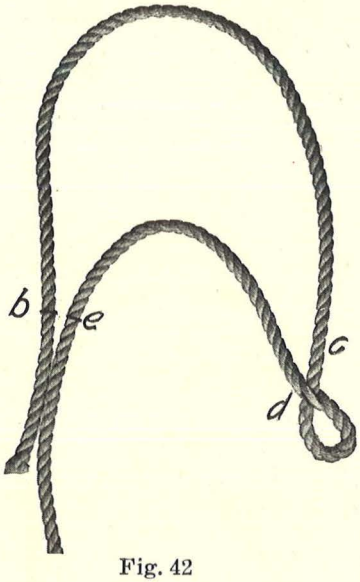


Fig. 42

experience in halter making, fit the halter to the individual animal without reference to the table. Open the rope near *d* and pull the short end of the rope through it as shown by Fig. 42. Next, open the rope near *c* and pull the long end through, thus making an eye shown in Fig. 43, a little larger than the diameter of the rope. Unlay the strands from *a* to *b* as shown in Fig. 44. Tuck strands *a* and *b* beneath the same strand of main rope as shown in Fig. 45. Bring strand *c* between *a* and *b* and tuck it beneath the same strand

as *a* and *b* but in the opposite direction. This is shown in Fig. 46. Give each strand three more tucks, running one strand along each

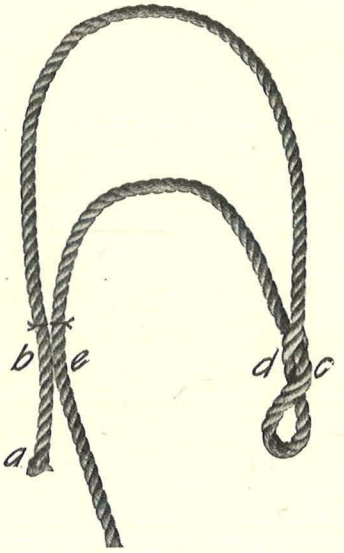


Fig. 43

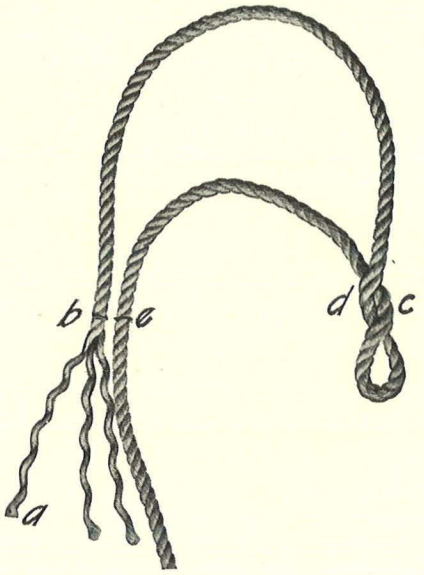


Fig. 44

part of the main rope as shown in Figs. 47, 48, and 49. Use the same method of tucking as in rope splicing. That is, bring the strand to be tucked up over the nearest strand to it and under the

Fig. 45

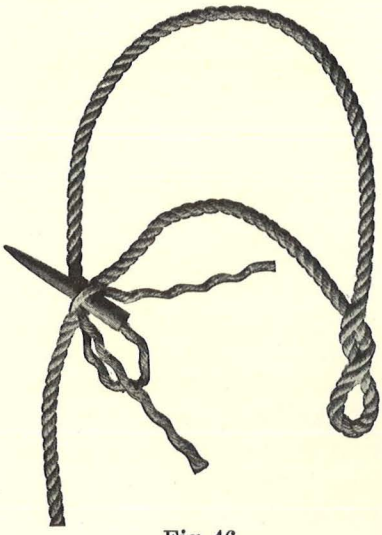


Fig. 46

next one in a direction about at right angles to the direction of the strands. The finished halter is shown in Fig. 50.

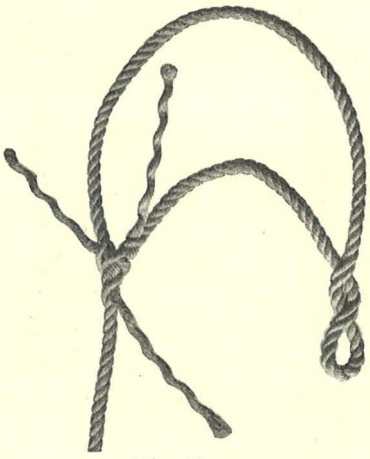


Fig. 47

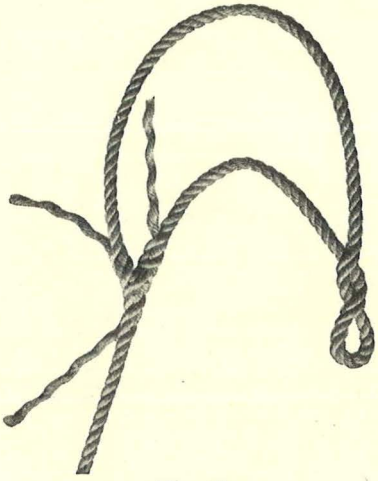


Fig. 48

The Adjustable Halter.—A halter adjustable in size is sometimes desirable especially for horned cattle. It is made as follows:

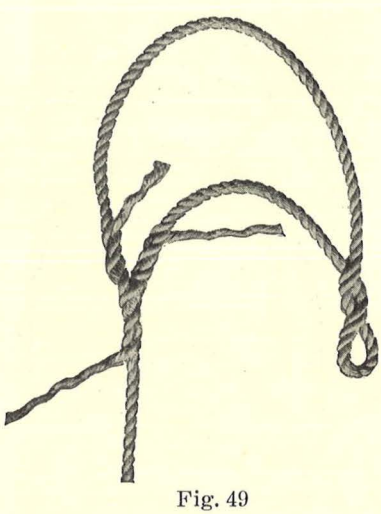


Fig. 49

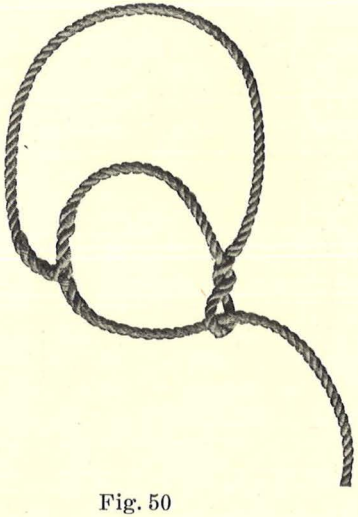


Fig. 50

Make an eye in the rope at the point *a*, Fig. 51, just as in making the non-adjustable halter. Make a spliced eye in the short part of the rope as shown in Fig. 52. The method of making a spliced eye is shown in Figs. 29 to 33, on page 16. Place the long end of the rope through the eyes. The halter thus formed and

shown in Fig. 53 may be adjusted to fit the animal on which it is to be used.

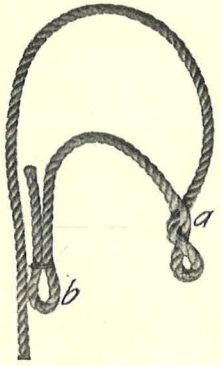


Fig. 51

Fig. 52

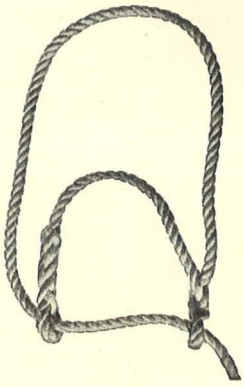


Fig. 53

HALTER TIES

The Slip-Knot Halter Tie.—The slip-knot type of halter tie is used in tying animals to a post or pole where it is necessary to keep the rope from slipping along the post. It may be tied according to the following directions:

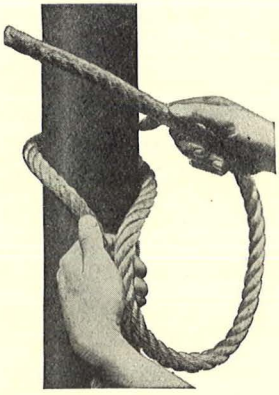


Fig. 54

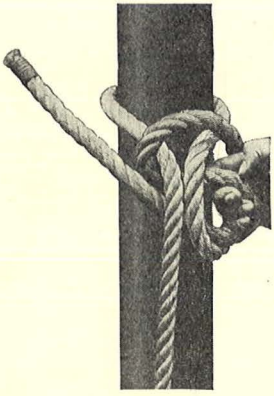


Fig. 55

Fig. 56

Place the rope around the post and with the right hand form a bight in the rope as shown in Fig. 54. Pull a loop in the end of the rope through the bight as shown in Fig. 55. The end of rope should then be pulled through the loop to prevent the knot from coming untied. The completed tie is shown in Fig. 56.

The Non-slipping Halter Tie.—The non-slipping type of halter tie is used in fastening a halter rope to a ring and is tied as follows:

Place the end of the rope through the ring and around beneath the long portion of the rope as shown in Fig. 57. Move the end of the rope as indicated by arrow in Fig. 57 and shown in Fig. 58. Draw the knot tight and it will appear as shown in Fig. 59.

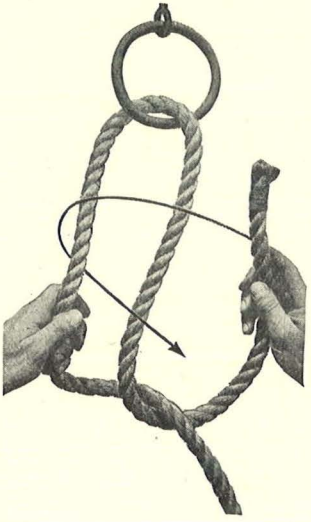


Fig. 57

Fig. 58

Fig. 59

KNOTS, BENDS, AND HITCHES

A **knot** proper is a knob formed in a piece of rope by interweaving its strands and serves as a stopper or a button, as a wall knot, Fig. 74, or a Matthew-Walker knot, Fig. 77. A **bend** is a method of fastening one rope to another, or to a ring, loop, etc., by passing the rope through a loop and fastening it back around itself, as the square knot, Fig. 79 *(a)* or the bowline, Fig. 96. A **hitch** is a temporary knot or noose by which a rope is fastened around a timber, pipe, or post so as to be readily undone, as the timber hitch, Fig. 113. These distinctions are very loose in their application. Most of the knots ordinarily used are stricly speaking, bends.

Fig. 60

Fig. 61

Fig. 62

Knots owe their importance to the frictional resistance of the rope which prevents the parts of the rope from slipping and thus untying the knot. A knot or a hitch must be so devised that the tight part of the rope must bear on the free end in such a manner as to pinch and hold it. In a knot, the free end is held against another tight part of the rope; in a hitch, against the object to which the rope is attached.

The elements entering into the formation of knots, bends, and hitches are the round turn, Fig. 60; the open bight or loop, Fig. 61, and the bight, Fig. 62. The reader should become thoroughly familiar with these three terms for they are frequently used in describing the knots found in this bulletin.

KNOTS AT THE END OF THE ROPE

The Overhand Knot.—The overhand knot is the simplest of all knots. It is used to prevent the ends of the rope from untwisting

Fig. 63

Fig. 64

Fig. 65

and to form a knob in the end of a rope. It is tied by making a bight in the rope and pushing the end through the bight, as shown in Fig. 63.

The Figure Eight Knot.—The figure eight knot is used to form a knob on the end of a rope. It is better for this purpose than the overhand knot which it resembles. The method of tying is shown in Figs. 64 and 65.

The Wall Knot with Crown.—The wall knot with crown is used to prevent the end of a rope from untwisting when a distinct enlargement is not objectionable. It also makes a desirable knot to prevent the end of the rope from slipping through small openings, as when rope handles are used on boxes. It is tied as follows:

Unwrap about five turns of the rope. Make a bight in strand *a* as shown in Fig. 66. Bring strand *b* down around strand *a* as in-

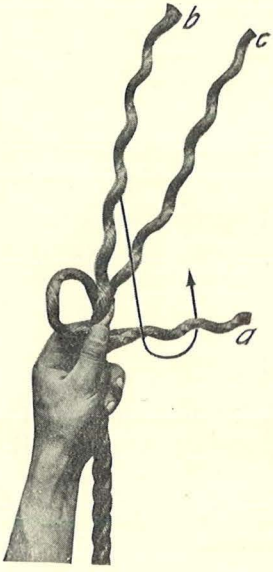


Fig. 66

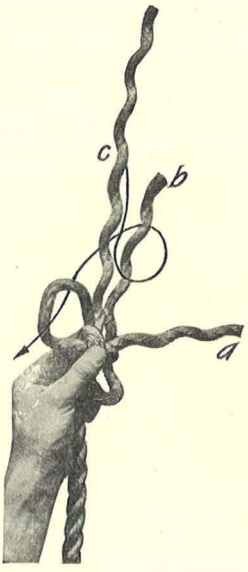


Fig. 67

Fig. 68

Fig. 69

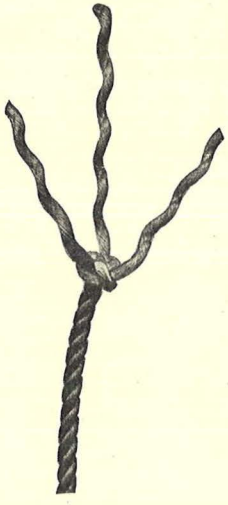


Fig. 70

dicated by arrow in Fig. 66 and shown in Fig. 67. Move strand *c* around strand *b* and through the bight in strand *a*, as indicated

by arrow in Fig. 67 and shown in Fig. 68. Draw the knot up tight by grasping it in one hand as shown in Fig. 69. The finished wall knot is shown in Fig. 70. This is sufficient to prevent the end of

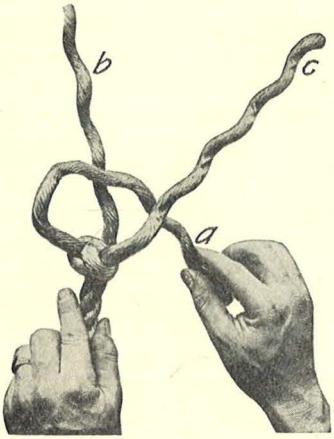


Fig. 71

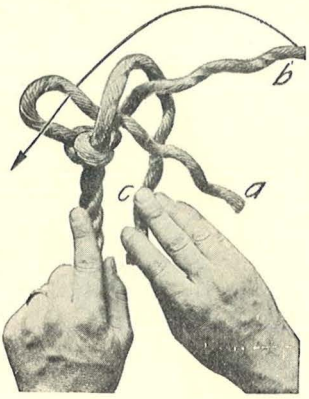


Fig. 72

Fig. 73

Fig. 74

rope from untwisting, but to make a neat round knob the wall knot should be crowned as follows:

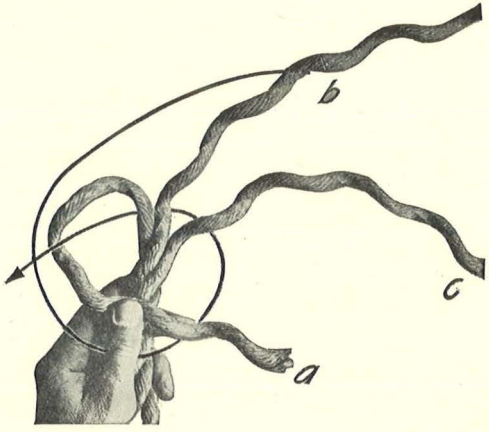
Move end of strand *a* between *b* and *c* as shown in Fig. 71. Bend strand *c* between the strand *b* and loop in strand *a*, as shown in Fig. 72.

Move strand *b* through loop in strand *a*, as indicated by arrow in Fig. 72 and shown in Fig. 73. Draw the knot tight, cut off the loose strands and it should appear as in Fig. 74.

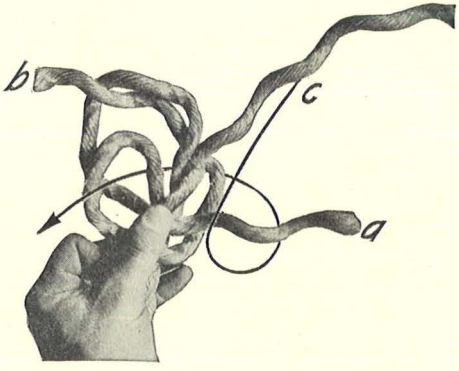
Matthew Walker Knot.—The Matthew Walker knot is used for the same purposes as the wall knot with crown. It is tied as follows:

Unwrap about five turns of the rope. Take the rope in the left hand, holding strand *a* in the position shown in Fig. 75 *(a)*. Move strand *b* as indicated by arrow in *(a)* and shown in *(b)*. Move strand *c* as indicated by arrow in *(b)*. The loose knot is shown in *(c)*. Draw the knot up carefully, as shown in Fig. 76. The finished knot is shown in Fig. 77.

(a)



(b)



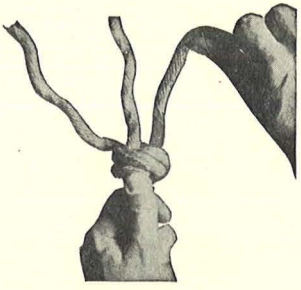


Fig. 76

(c)

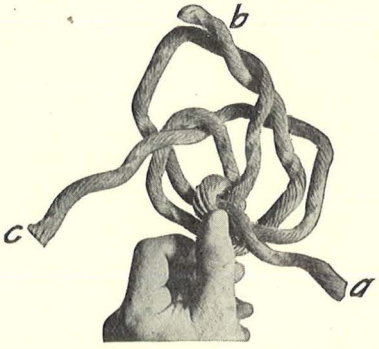


Fig. 75

Fig. 77

The Square Knot.—The square knot is the most common knot used in tying two cords together. It will not slip but draws tight and is often not easily untied. It is a good knot for tying binder twine together. It is tied as follows:

Bring the two ends together and cross them as

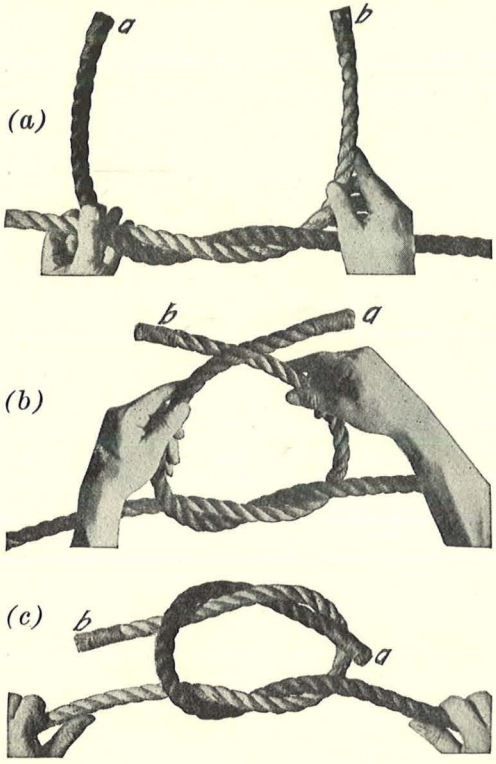


Fig. 78

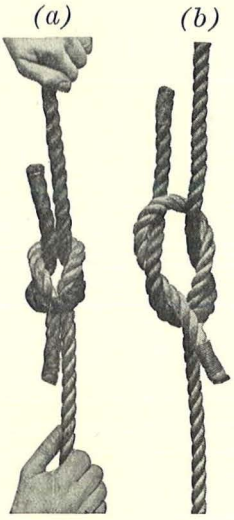


Fig. 79

shown in Fig. 78 *(a)*. Place end *a* across *b* as shown in *(b)* and then move *a* around *b* as shown in *(c)*. Care should be taken to have both parts of one end on the same side of the loop formed in the opposite end, otherwise a granny knot, rather than a square knot, will result. Be sure to observe this difference. The finished square knot is shown in Fig. 79 *(a)* and the granny knot in *(b)*. The granny knot should never be tied. It will often slip and is still harder to untie than the square knot. It is very often tied by those unfamiliar with the difference between the two.

The Surgeon's Knot.—The surgeon's knot, Fig. 80, resembles the square knot except that the first part has been given two twists instead of one. As its name implies, it is used by surgeons in sewing up wounds. It may also be used in tying any small cords

together. The extra twist in the first part prevents the knot from slipping while the second part is being drawn up.

Fig. 80

The Binder Knot. — The binder knot, Fig. 81, is made by placing the ends of two cords beside each other and simply

Fig. 81

tying a knot in them. This is the type of knot tied by the ordinary grain binder. It is also sometimes used in tying two ropes together but will not hold so well as the square knot.

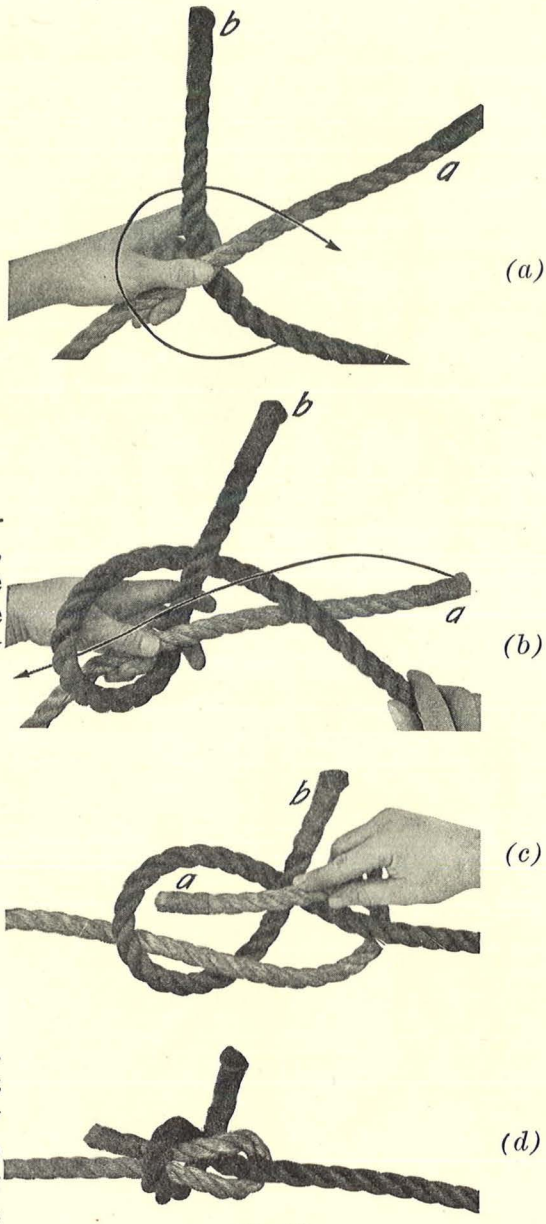


Fig. 82

The Weaver's Knot.—This knot is used by weavers for tying yarn together and is perhaps the best knot known for farmers to use in tying binder twine together. It may be tied as follows:

Place end *a* across end *b* as shown in Fig. 82 *(a)*. With the right hand, move the rope as indicated by the arrow in *(a)* until it is in the position shown in *(b)*. Next move end *a* through bight in end *b*, as indicated by arrow in *(b)* and shown in *(c)*. Draw the knot tight and it should appear as shown in *(d)*.

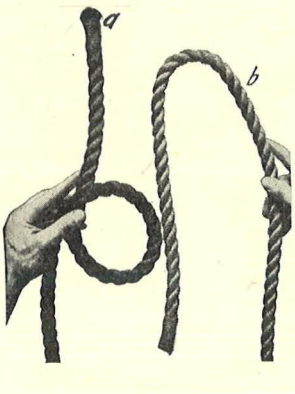


Fig. 83

Fig. 84

Fig. 85

Fig. 86

Fig. 87

The Carrick Bend.—The carrick bend is used for tying two ropes together so that a heavy load may be drawn with them and still the knot is easily untied.

It is tied by throwing a bight in end *a* and a loop in end *b*. Fig. 83. Place end *a* upon end *b* as shown in Fig. 84. Pull a portion of *b* up through the bight in *a*. Push end of *b* through the loop thus formed but keep it on top of the bight in *a* as in Fig. 85. This gives the loose knot, as shown in Fig. 86. Care must be taken to keep the knot in its usual form until drawn tight. The finished knot is shown in Fig. 87.

LOOPS IN THE END OF THE ROPE

The Slip Knot.—The slip knot is used to form a loop that will slip up tight around an object. It may be tied as follows:

Take the rope in the right hand, as shown in Fig. 88. With the left hand, reach through the bight thus formed and grasp the long portion of the rope, as shown in Fig. 89. Pull loop out through the bight, as shown in Fig. 90.

Fig. 88

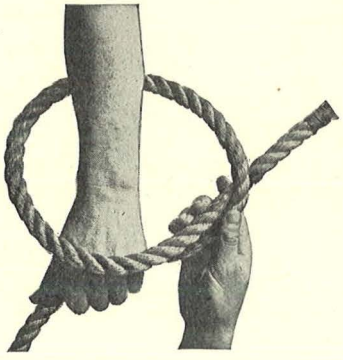


Fig. 89

Fig. 90

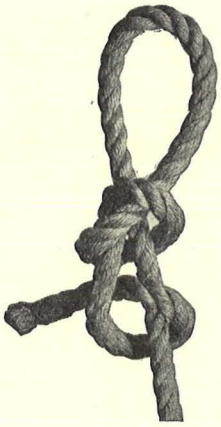


Fig. 91

The Slip Knot and Half-Hitch.—The short end of the rope in a slip knot is sometimes given a half hitch, as shown in Fig. 91. It is more secure than the ordinary slip knot. If heavy loads are lifted with a slip knot, it draws very tight and is difficult to untie. For this reason it is not so desirable as the bowline for forming a loop in the end of a rope.

The Bowline.—The bowline has rightfully been called the king of knots. It can be used wherever a loop is wanted in the end

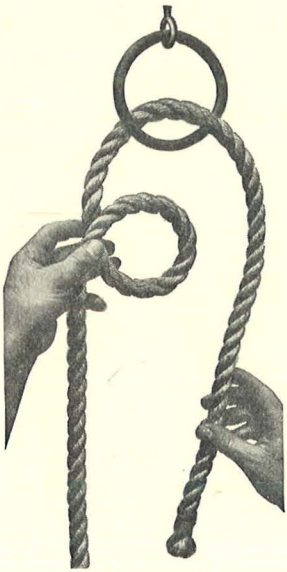


Fig. 92

Fig. 93

Fig. 94

of a rope. It never slips and is always easily untied. These qualities make it a good knot for tying a hay rope to a doubletree. It may be tied as follows:

Place end of rope through a ring or around an object. Throw a bight having the long portion of the rope on side of bight nearest you as shown in Fig. 92. Move end of rope through the bight in the direction shown in Fig. 93. Bring the end of rope around the long portion as shown in Fig. 94. Next push end of rope up through bight as seen in Fig. 95. The finished knot is shown in Fig. 96.

Fig. 95

Fig. 96

The Anchor Bend.—The anchor bend is used to secure a rope to a ring. The rope is given two turns about the ring thus affording a larger wearing surface than with the common hitches. The knot is finished by making two half hitches about the rope as shown in Fig. 97.

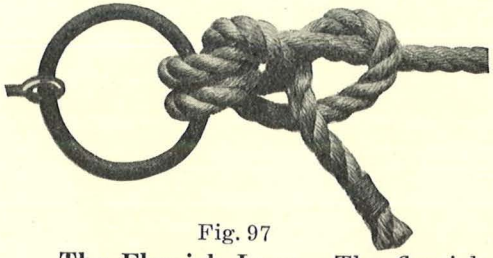


Fig. 97

The Flemish Loop.—The flemish loop is a knot that may be used to form a loop in a rope at any point and will not slip. It is made as follows:

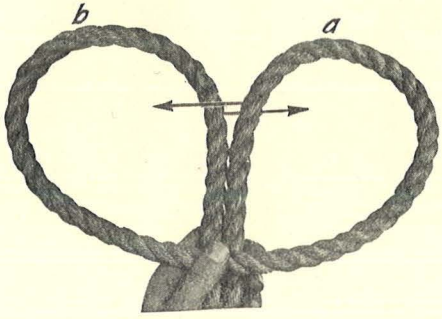


Fig. 98

Fig. 99

Make a double bight in the rope as shown in Fig. 98. Move bight *a* across on top of bight *b*, as shown in Fig. 99, and open out

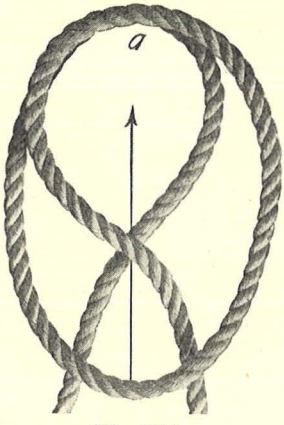


Fig. 100

Fig. 101

as shown in Fig. 100. Place one hand in the position shown in Fig. 101, and pull the rope through as in Fig. 102. After pulling the

hand through it may be necessary to separate the two overhand knots forming the loop. The finished knot is shown in Fig. 103.

The flemish loop is easily and quickly tied and will not slip. It is a desirable knot where a permanent loop is wanted as in securing guy ropes to trees, stakes, or poles. It will draw very tight, however, and it is often almost impossible to untie. The bowline on a bight will usually answer the same purpose and is always easily untied.

Fig. 102

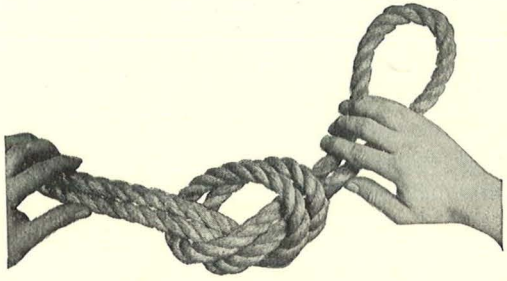
Fig. 103

LOOPS BETWEEN THE ENDS OF THE ROPE

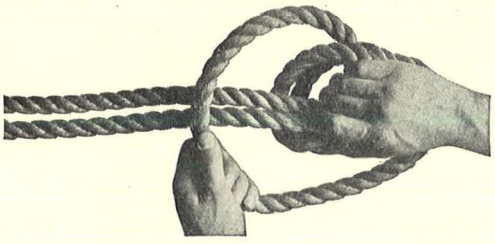
The Bowline on a Bight.—The bowline on a bight is used to form a loop at some point in a rope other than at an end. Like the ordinary bowline, it is easily untied. It is made as follows:

Tie an overhand knot in a doubled portion of the rope, as shown in Fig. 104 *(a)*. Bring the loop back over the knot, as shown in *(b)* and then pull the loop out through the knot as shown by the hand in *(c)*. The finished knot is shown in *(d)*.

The bowline on a bight forms a convenient means of lowering persons from buildings or derricks. When used for this purpose the loop should be made two or three feet long. One part of the double loop can then be used as a seat and the other placed about the body beneath arms so as to form a convenient rest for the back.



(a)



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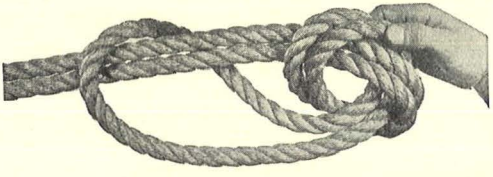
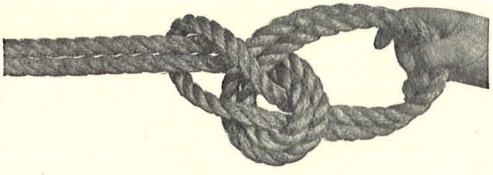


(c)



(d)

Fig. 104

The Spanish Bowline.—The spanish bowline is used to form a double loop at some point along a rope. Each loop may be attached to a separate post or hook or they may both be attached to the same one. To tie it, observe the following directions:

Throw a double bight in the rope as shown in Fig. 105 *(a)*. Next place one bight on top of the other as indicated by arrow in Fig. 105 *(a)* and shown in *(b)*. Take the rope at *a* in Fig. 105 *(b)* with the right hand and double it back on *b*. This step is shown completed in Fig. 106 *(a)*. Move the two long loops, *b* and *c*, through the bights, as indicated by arrows in *(a)* and shown in *(b)*. The finished knot is shown in *(c)*.

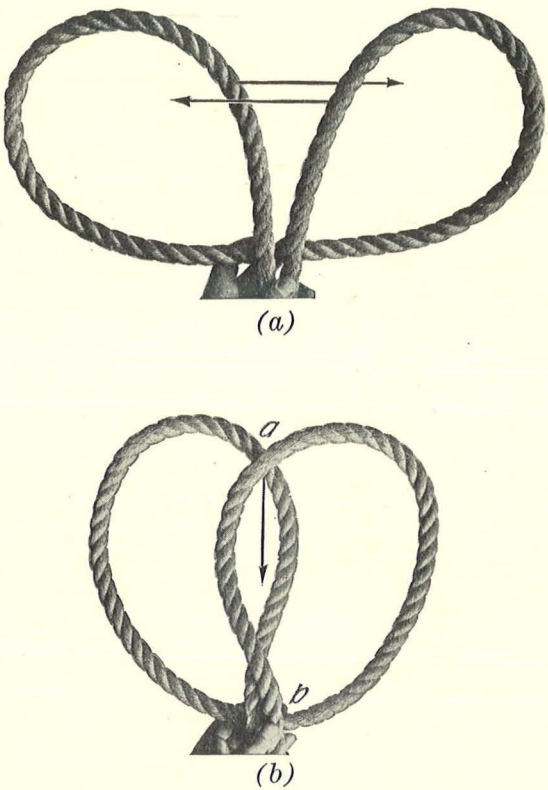


Fig. 105

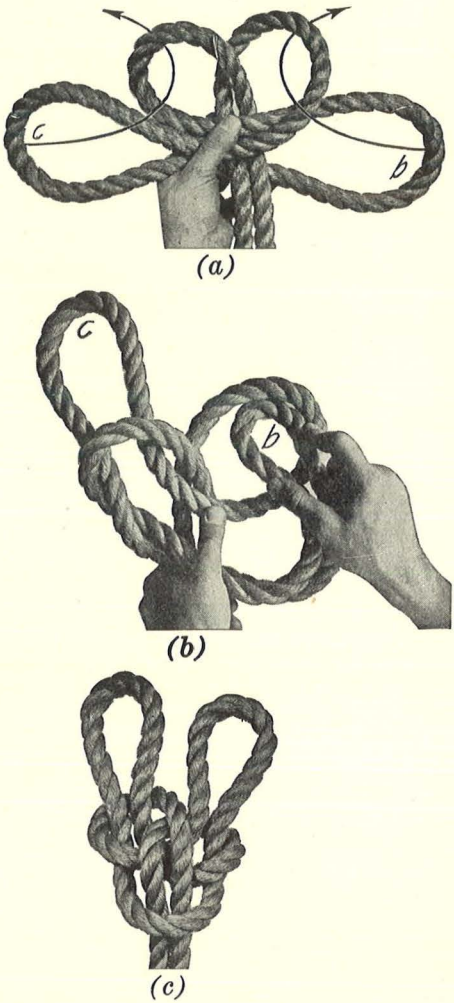


Fig. 106

The Harness Hitch.—The harness hitch is used to make a loop at any point along a rope. It is still possible to pull on both ends

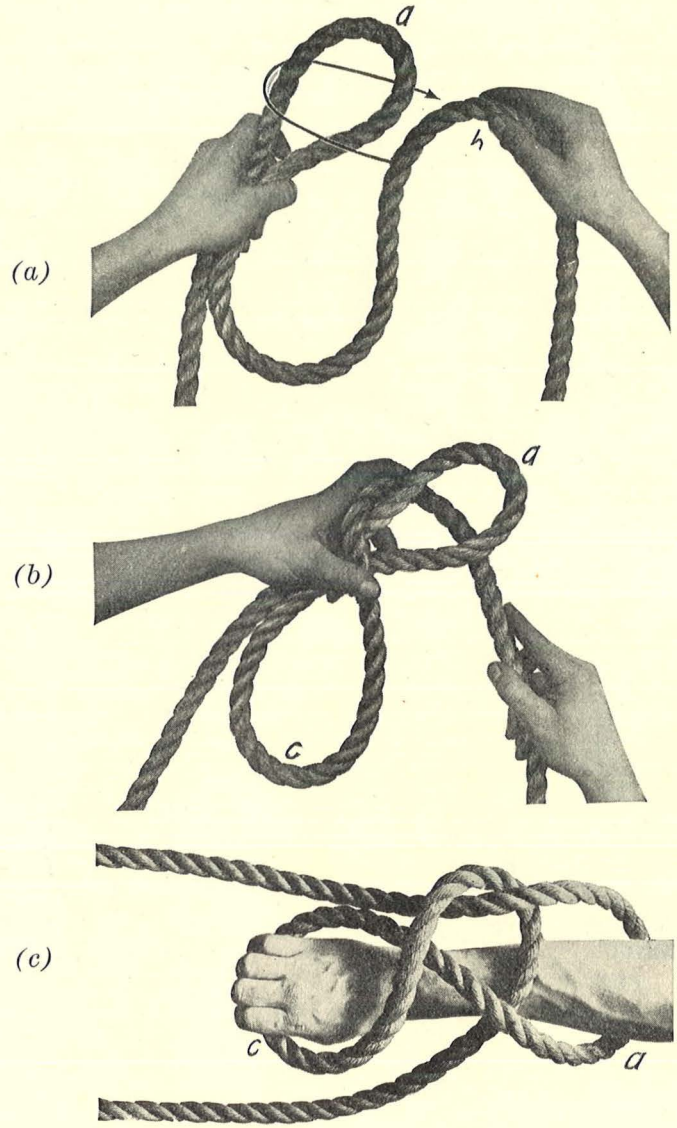


Fig. 107

of the rope or on either end and the loop without affecting the knot. It is tied as follows:

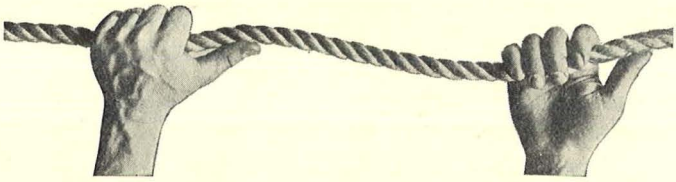
Throw a loop in the rope, as shown in Fig. 107 *(a)* at *a*. Move part *b* around *a* as indicated by the arrow in *(a)* and shown in *(b)*.

Place one hand through the loop *a*, and take hold of rope at *c*, as shown in *(c)*. Pull *c* out through *a*, as shown in Fig. 108. Draw the parts up tight. This gives the finished hitch, Fig. 109.

Fig. 108

Fig. 109

The Tom Fool's Knot.—This knot is often used as a means of amusement. It is very easily and quickly tied but can seldom be learned by merely watching another tie it. It is a good knot for farmers to use in ringing hogs. One of the loops can be slipped over the hog's snout and one end of the rope fastened to a post. To release the hog, untie the knot by pulling on the opposite end of the rope. The knot is tied as follows:



(a)

(b)

(c)

Fig. 110

Take the rope in both hands, the thumbs extending to the right, Fig. 110 *(a)*. Move the right hand toward the left until the rope is in the position shown in Fig. 110 *(b)*. Reach both hands through the round turns thus formed and grasp the rope from the opposite side as shown in Fig. 110 *(c)*. Pull the parts thus grasped through the knot, as shown in Fig. 111 *(a)*. The finished knot is shown in Fig. 111 *(b)*.

(a)

(b)

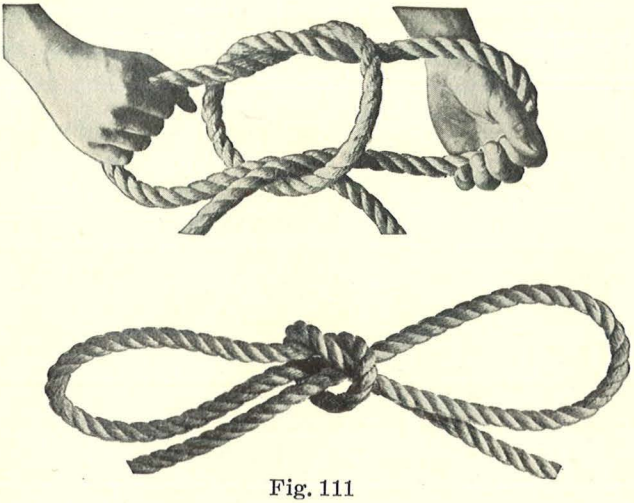


Fig. 111

HITCHES

The Half Hitch.—The half hitch is used to secure a rope to a timber temporarily. It is shown in Fig. 112.

The Timber Hitch.—The timber hitch is used in moving timbers and large pipe. It is more secure than the half hitch and is made in the same manner except that the short end of the rope is given one or two twists about the long portion. This hitch is shown in Fig. 113.

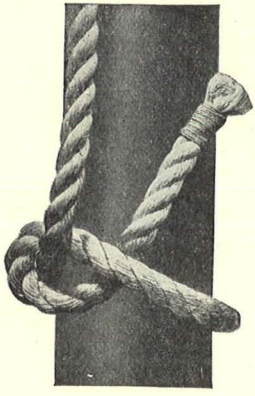


Fig. 112

Fig. 113

Fig. 114

The Timber Hitch and Half Hitch.—For lifting heavy timbers the timber hitch and half hitch are safer than either of the two preceding hitches. It is shown in Fig. 114. The half hitch is made first as shown at *a* and the timber hitch as at *b*.

The Clove Hitch.—The clove hitch is used to fasten a rope to a stake, pipe or post. It is the hitch commonly used for securing ropes to tent stakes. It is tied as follows:

First Method: Give one end of the rope two turns about the post, crossing over the long portion and placing the short end beneath the second turn as shown in Figs. 115 and 116.

Fig. 115

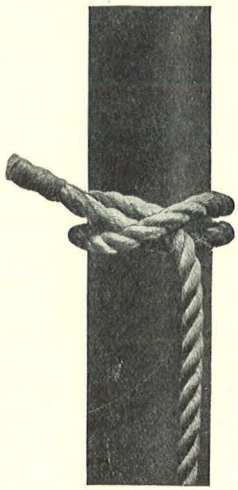


Fig. 116

Second Method: Throw one bight in the rope to right and another to the left as shown in Fig. 117 *(a)*. Move bight *a* over on bight *b* as indicated by the arrow in Fig. 117 *(a)* and shown in *(b)*. Place the hitch over the end of post and pull on long end in any direction.

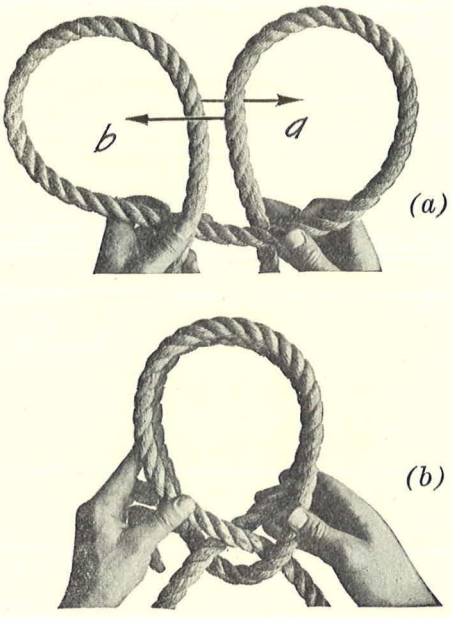


Fig. 117

Two Half Hitches.—Two half hitches constitute a good method of securing a rope to a timber. The incorrect method of tying it is shown in Fig. 118 and the correct method in Fig. 119.

Well Pipe Hitches.—Well pipe hitches are used to secure ropes to pipe in such a manner that they will not slip along the pipe.

Either one of the following methods may be used in making this hitch:

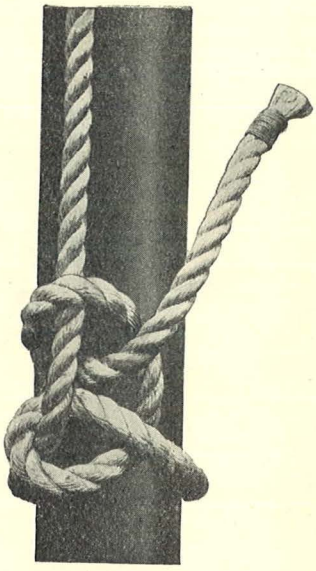


Fig. 118

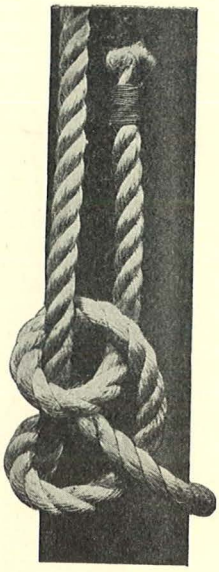


Fig. 119

First Method: —Place the rope along the pipe with the long end extending in the opposite direction from which the pulling is to be done. Give the short end *a* two turns about the pipe as shown in Fig. 120 and Fig. 121. Now extend the long end of the rope in the direction of pull as indicated by arrow in Fig. 121 and shown in Fig. 122. Give the short end a half hitch about the pipe as shown in Figs. 123 and 124. Give the long end a half hitch about the pipe as shown in Fig. 125 at *b*.

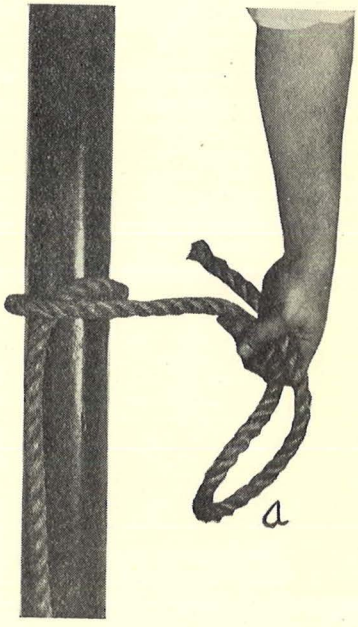


Fig. 120

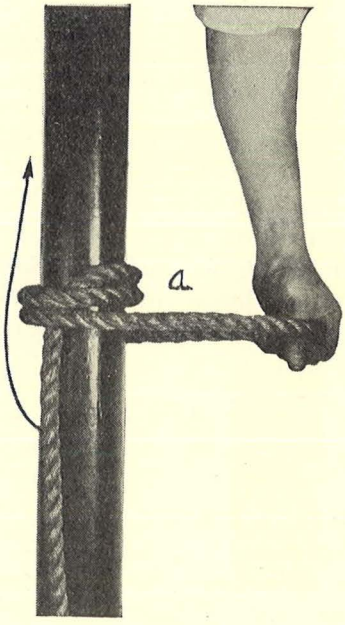


Fig. 121

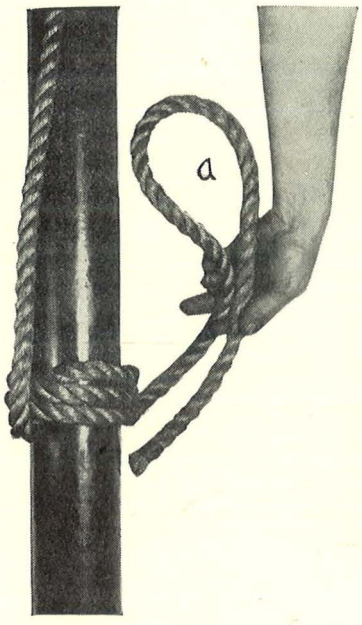


Fig. 122

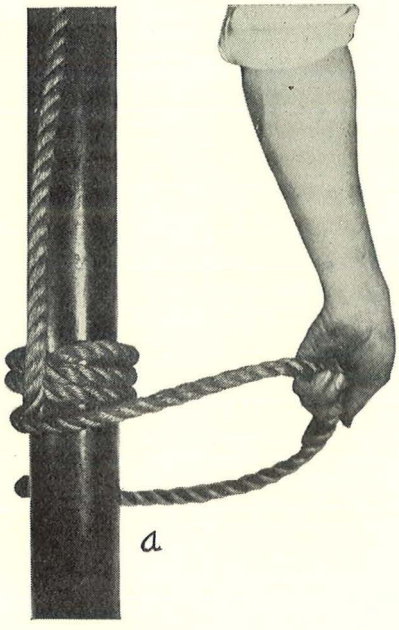


Fig. 123

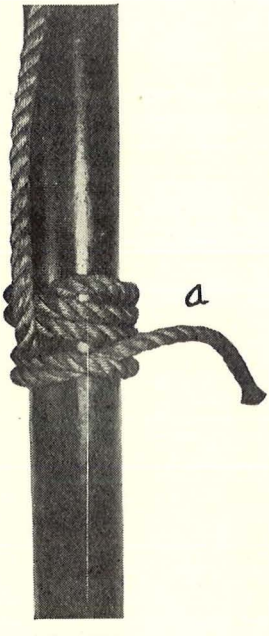


Fig. 124

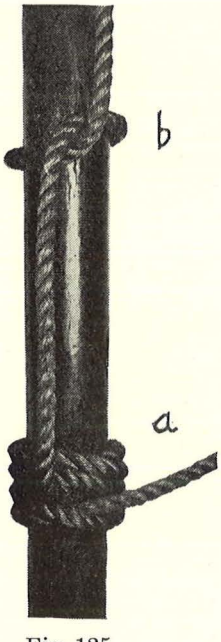


Fig. 125

Second Method: Double a portion of the rope and give it three turns about the pipe as shown in Fig. 126. Pull the free end of the rope through the loop as indicated by arrow in Fig. 126. The finished hitch is shown in Fig. 127.

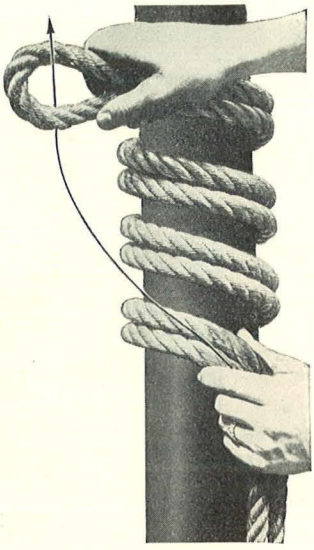


Fig. 126

Fig. 127

The Sheep Shank. — The sheep shank is a hitch used temporarily to shorten a rope, and is tied in the following manner:

Make two loops in the rope, as shown in Fig. 128. Make bight in main part of rope near loop *a*. Push *a* through this bight, as shown in Fig. 129. Likewise make a bight in main part of rope near loop *b* and push *b* through this loop which completes the hitch, as shown in Fig. 130.

Fig. 128

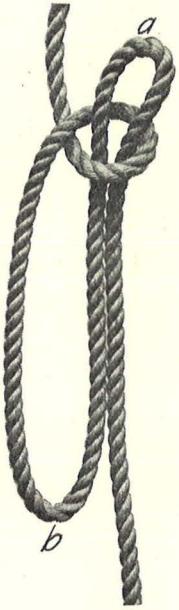


Fig. 129

Fig. 130

The Blackwall Hitch. — The blackwall hitch is used to fasten a rope to a hook. It is made in the following manner: Hold the rope in the position shown in Fig. 131. Place end *a* in the hook as indicated by arrow. Next place *b* in the hook on the top of *a*,

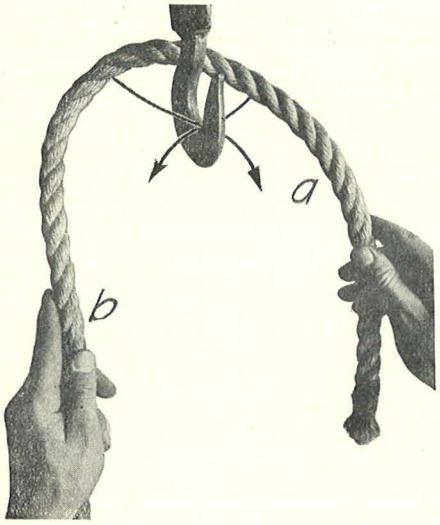


Fig. 131

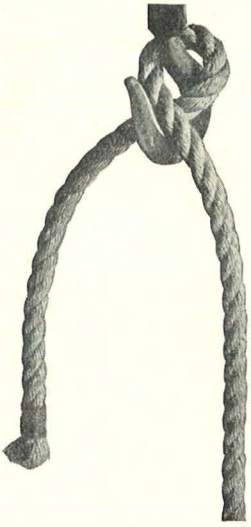


Fig. 132

also as indicated by arrow. The finished hitch is shown in Fig. 132.

The Cat's Paw.—The cat's paw is used for fastening a rope to a hook. The method of tying is shown in Figs. 133 and 134. Throw a double bight in the rope as shown in Fig. 133. Give each bight one and one-half or two turns and place in the hook as shown in Fig. 134.

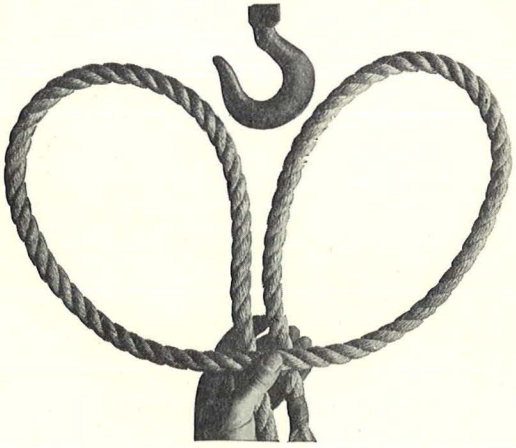


Fig. 133

Fig. 134

The Scaffold Hitch.—This is used for securing rope to a plank to be used as a scaffold.

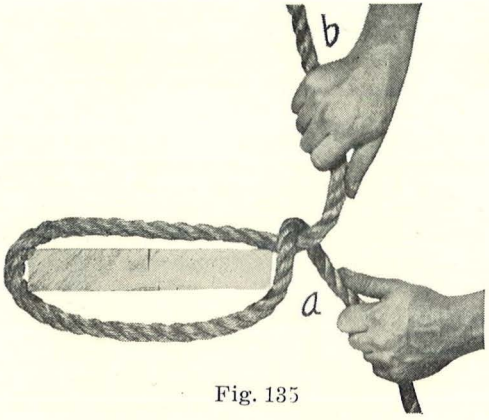


Fig. 135

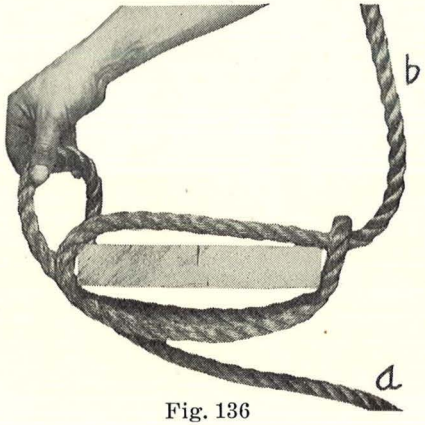


Fig. 136

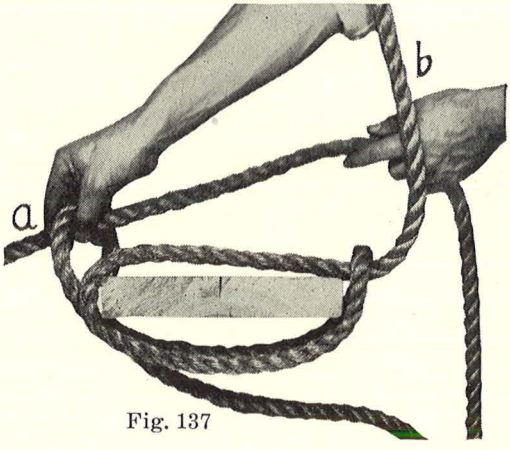


Fig. 137

Lay the rope across the plank with the short end *a* extending to the left as seen from the end of plank. Bring the short end under the plank and around long end *b* as shown in Fig. 135. Bring a doubled portion of short end *a* under plank again to position shown in Fig. 136. Pull short end of rope through loop thus

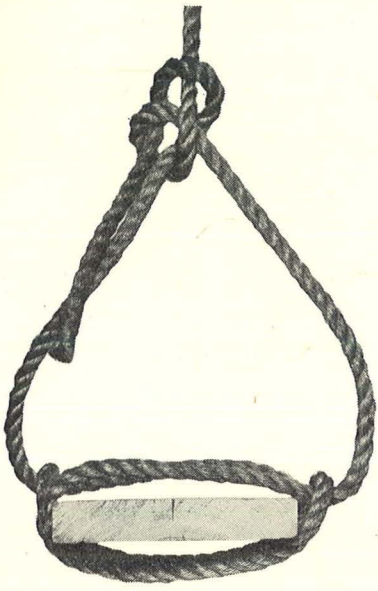


Fig. 138

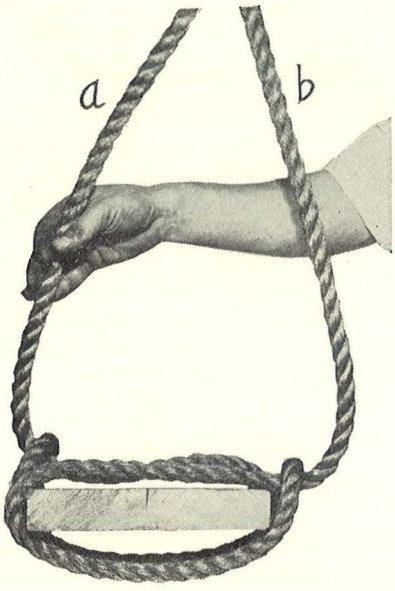


Fig. 139

formed as in Fig. 137. The hitch will then appear as in Fig. 138. Secure short end to the long position of the rope with a bowline knot as shown in Fig. 139.

THE MILLER'S KNOT

This is the best knot for tying sacks and the one universally used by millers. It is tied as follows: Place the top of the sack between the thumb and forefinger of one hand. Place twine in the position shown in Fig. 140. Bring the long end *a* around the sack passing under the arm by which the sack is held as indicated by arrow in Fig. 140 and shown in Fig. 141. Give the long end *a* of twine one more turn, again passing under the arm by which the sack is held as indicated by arrow in Fig. 141 and shown in Fig. 142. Place the end *a* of twine under forefinger of hand by which

the sack is held as shown in Fig. 143. With this finger pull end *a* up under band as shown in Fig. 144. The finished knot is shown in Fig. 145.

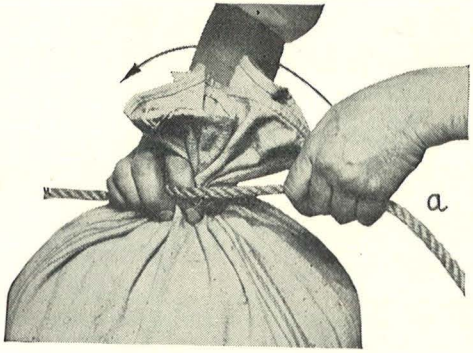


Fig. 140

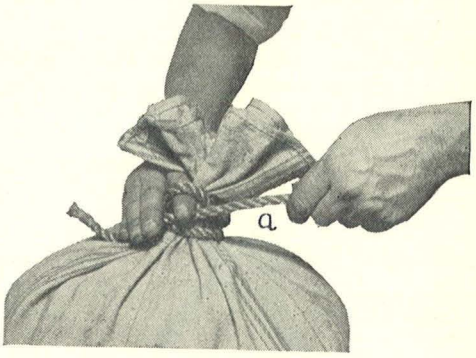


Fig. 143

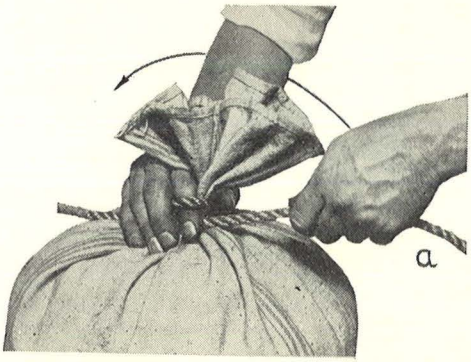


Fig. 141

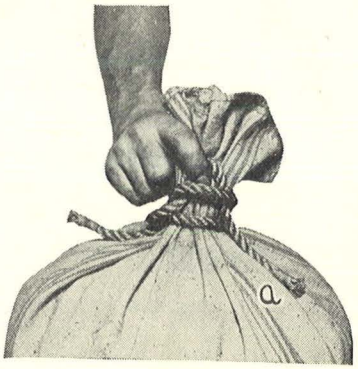


Fig. 144

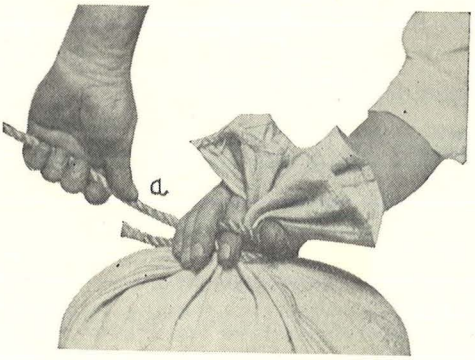


Fig. 142

Fig. 145

A case or shell containing a sheave, or a pulley wheel or set of them, and on one end of which there is a hook, an eye, or a ring for fastening to a fixed or moving object and sometimes a similar fastening called a becket on the other end for attaching the end of the rope, is called a *block.*

A *tackle* is a combination of blocks, hooks, and ropes for raising, lowering, or moving heavy objects.

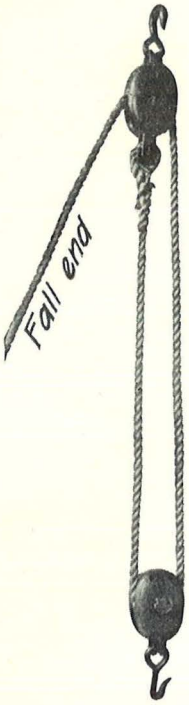


Fig. 146

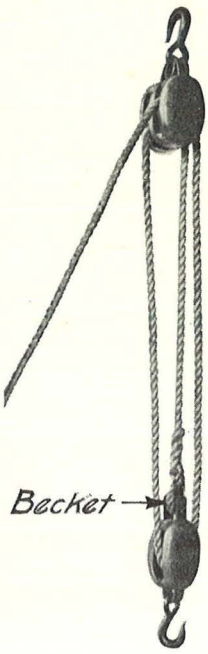


Fig. 147

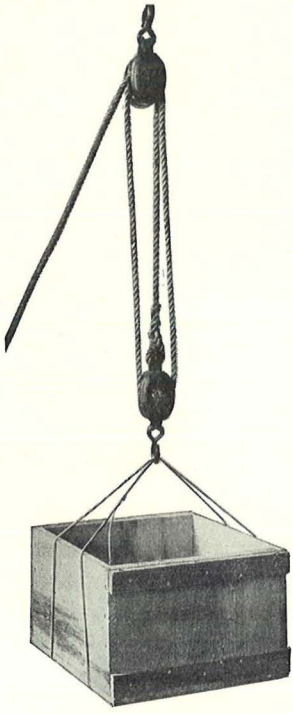


Fig. 148

That part of the tackle to which the power is applied is called the *fall rope.*

The block that is attached to the moving object is called the *fall block* and the other the *fixed block.*

In the tackle shown in Fig. 146 the fall block and the fixed block contain one sheave each. In Fig. 147 the fall block contains one sheave and the fixed block two sheaves. The lifting force of a tackle is equal to the number of times the rope passes to and from the fall block. The rope in Fig. 148 passes to and from the movable

block three times. Suppose it is desired to lift 150 pounds in the box, Fig. 148. Neglecting friction, the force on the fall end of the rope required to lift this load would be one third of 150 pounds or 50 pounds. In Fig. 146 the rope passes to and from the movable block twice. Therefore, one-half of 150 pounds or 75 pounds is the force required on the fall rope to lift the load with this tackle.

●

Three Essentials of a Good Knot

Rapidity with which it can be tied.
Its ability to hold fast when pulled tight.
The readiness with which it can be undone.

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(12/22—10 M.) (2/33—10 M.) (4/36—10 M.)