

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Historical Materials from University of
Nebraska-Lincoln Extension

Extension

12-1922

EC700 The use of Rope on the Farm

Virgil Overholt

Follow this and additional works at: <https://digitalcommons.unl.edu/extensionhist>

Overholt, Virgil, "EC700 The use of Rope on the Farm" (1922). *Historical Materials from University of Nebraska-Lincoln Extension*. 2183.

<https://digitalcommons.unl.edu/extensionhist/2183>

This Article is brought to you for free and open access by the Extension at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Historical Materials from University of Nebraska-Lincoln Extension by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

THE UNIVERSITY OF NEBRASKA
AGRICULTURAL COLLEGE EXTENSION SERVICE

December, 1922

Extension Circular 700

THE USE OF ROPE ON THE FARM

By

VIRGIL OVERHOLT

The Ohio State University
Agricultural College Extension Service

At some time, almost every one
has had occasion to regret his lack
of knowledge about tying knots.

THE USE OF ROPE ON THE FARM

By VIRGIL OVERHOLT
Ohio State University

EVERY farmer finds many occasions for using rope. Therefore, time spent in learning to tie a few of the simple knots, to make some common hitches, that are reliable under strain but are easy to untie, or to make a strong splice yet small enough to pass thru a common pulley, will never be regretted. More time is frequently wasted in trying to untie a knot than would be required to learn how to tie it properly. If the hay rope breaks at a critical moment, the ability to splice it may mean the saving of much time and several dollars. The correct knot will enable the grain binder to change from one ball to another without entangling and breaking the twine. Such delays are not only a loss of valuable time, but a source of great annoyance. Animals have been strangled to death, because they were improperly tied and even human lives often have been endangered by ropes insecurely fastened.

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 and hitches 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.

No attempt should be made to learn a new knot or splice without having a piece of rope in the hands and actually performing the operations as they are studied from the text and illustrations. The study of knots will be greatly facilitated by first becoming familiar with the principles of a knot as discussed on page 21. Remember that practice is worth as much in becoming proficient in knot tying and rope splicing as in other things.

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 about 85 percent of all binder twine used. It is commonly known as "Standard Twine." Sisal hemp is also used largely in the manufacture of ship cables, as it seems to withstand the action of the sea water better than does Manila fiber. But for ordinary usage on

the farm, Manila rope is to be preferred. It is softer, more pliable and stronger than sisal rope.

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 those 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

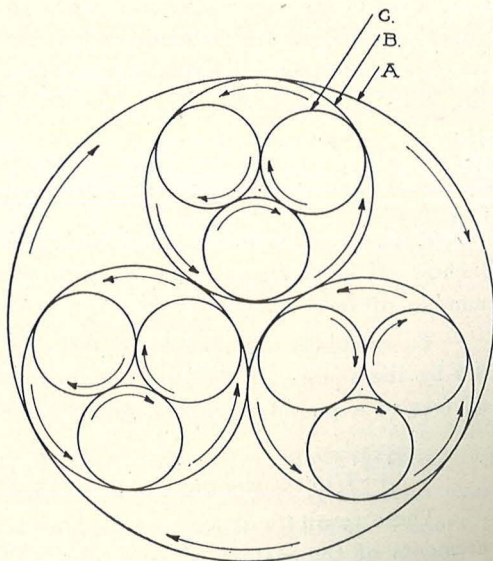


Fig. 1

to untwist, the individual strands forming it are twisted tighter. The rope can untwist only far enough to bring these opposing forces to equilibrium.

KINDS OF ROPE

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

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

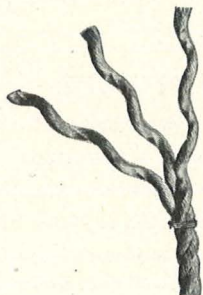


Fig. 2



Fig. 3

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 $\frac{3}{4}$ -inch rope would be

$$\frac{3}{4} \times \frac{3}{4} = 9/16$$

$$3.4 \div 9/16 = 6, \text{ the number of feet per pound.}$$

These results will vary as much as 12 percent 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	Circum- ference Inches	Weight of 100 Feet of Rope, Pounds	Length of Each Pound of Rope		Safe Load, Pounds	Breaking Load, Pounds	Diameter of Pulley Inches
			Feet	Inches			
$\frac{3}{16}$	$\frac{9}{16}$	2	50	0	35	230	$1\frac{1}{2}$
$\frac{1}{4}$	$\frac{3}{4}$	3	33	4	55	400	2
$\frac{5}{16}$	1	4	25	0	90	630	$2\frac{1}{2}$
$\frac{3}{8}$	$1\frac{1}{8}$	5	20	0	130	900	3
$\frac{7}{16}$	$1\frac{1}{4}$	6	16	8	175	1,240	$3\frac{1}{2}$
$\frac{1}{2}$	$1\frac{1}{2}$	$7\frac{3}{8}$	13	0	230	1,620	4
$\frac{5}{8}$	2	$13\frac{1}{8}$	7	6	410	2,880	5
$\frac{3}{4}$	$2\frac{1}{4}$	$16\frac{1}{8}$	6	1	520	3,640	6
$\frac{7}{8}$	$2\frac{3}{4}$	$23\frac{3}{8}$	4	3	775	5,440	7
1	3	$28\frac{1}{8}$	3	6	925	6,480	8
$1\frac{1}{8}$	$3\frac{1}{2}$	38	2	7	1,260	8,820	9
$1\frac{1}{4}$	$3\frac{3}{4}$	45	2	2	1,445	10,120	10
$1\frac{3}{8}$	$4\frac{1}{4}$	58	1	8	1,855	13,000	11
$1\frac{1}{2}$	$4\frac{1}{2}$	65	1	6	2,085	14,600	12
$1\frac{3}{4}$	$5\frac{1}{4}$	97	1	0	3,070	21,500	14
2	6	113	0	10	3,600	25,200	16
$2\frac{1}{2}$	$7\frac{1}{2}$	184	0	$6\frac{1}{2}$	5,630	39,400	20
3	9	262	0	$4\frac{1}{2}$	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. If we wish to elevate say 775 pounds of hay at a time, we would not select a rope whose maximum, or breaking, strength is 775 or even 1000 pounds, but about seven times this amount. Referring to Table 1, we find that the breaking strength of a new $\frac{7}{8}$ -inch Manila rope is 5440 pounds. One-seventh of 5440 is 777 pounds, or about the same as the load we wish to lift. 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

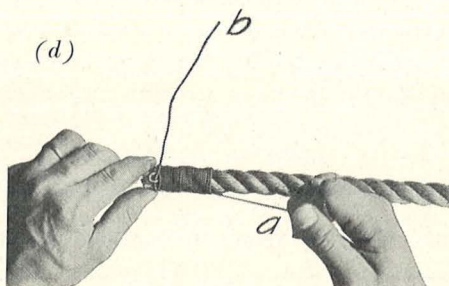
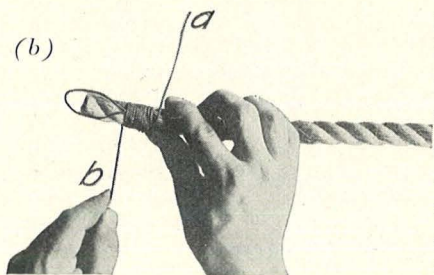
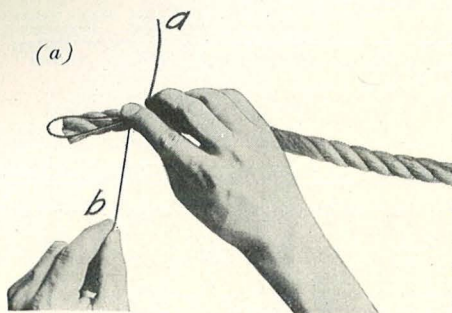
$$\frac{1}{2} \times \frac{1}{2} \times 7200 = 1800$$

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 30 minutes will make a hard rope soft and pliable, but will decrease its strength about 20 percent. 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 the strength of old 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 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 thru 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 thru pulleys or other small openings should be finished by whipping. A rope is whipped as follows:

Make a loop in one end of a 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 $\frac{1}{2}$ inch of the end of the rope, slip the end *b* of the cord thru 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 loose to the rope. The finished end is shown in (e).

Fig. 4

ROPE SPLICING

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 the operations as they are studied from the text and illustrations.

The Short Splice.—Where it is not necessary for a rope to pass thru 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:

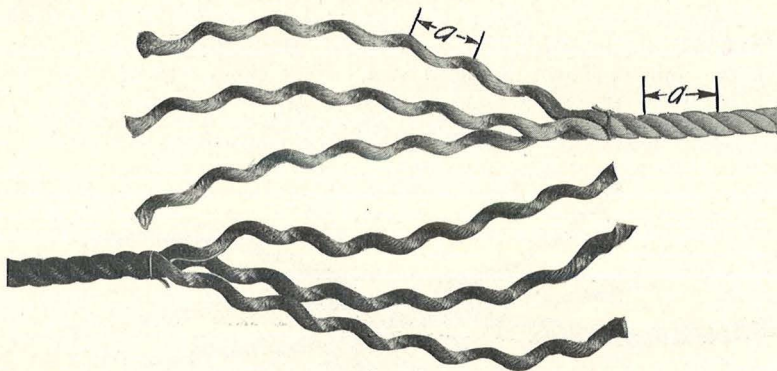


Fig. 5

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 strings are



Fig. 6

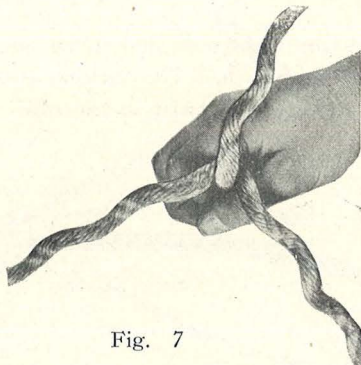


Fig. 7

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 with a strand

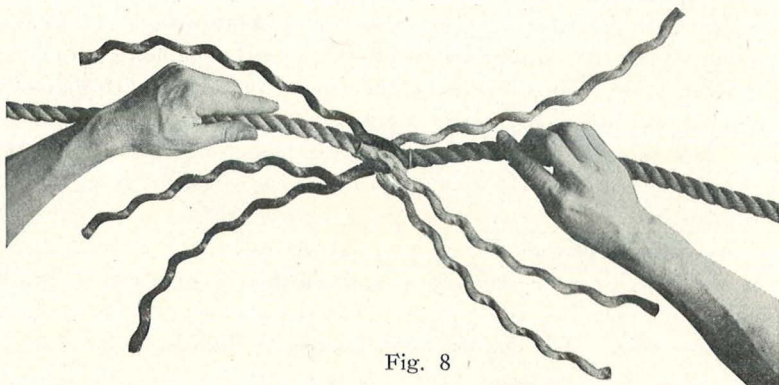


Fig. 8

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 the nearest strand

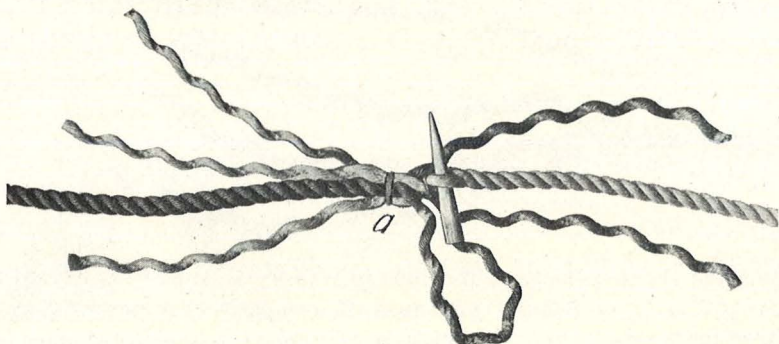


Fig. 9

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 each of the other two strands,

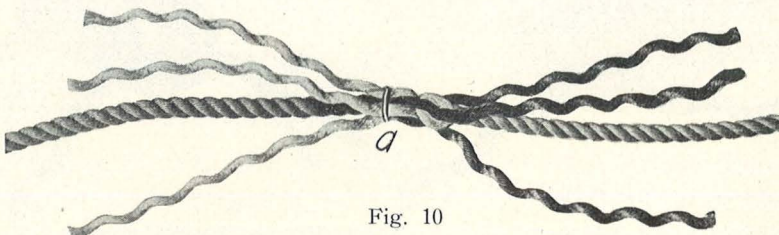


Fig. 10

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 we did the strands from the left. Fig. 11 shows all strands tucked once. Give

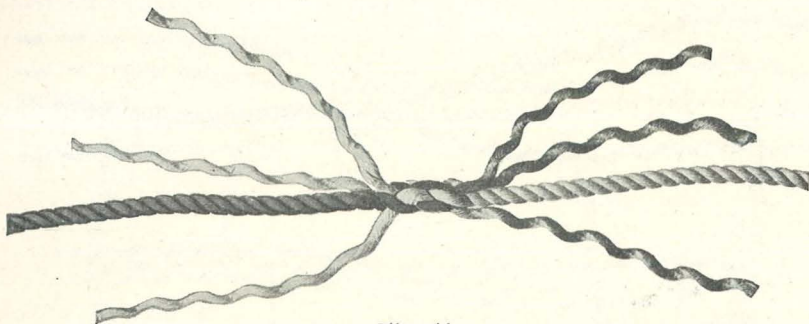


Fig. 11

each of the six 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 ends off

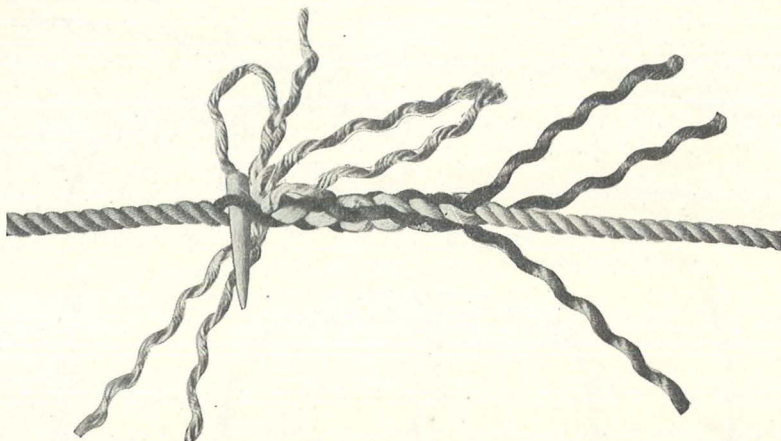


Fig. 12

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 thru 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 strings about the rope at the points thus determined. Unlay the strands back to the strings as shown in

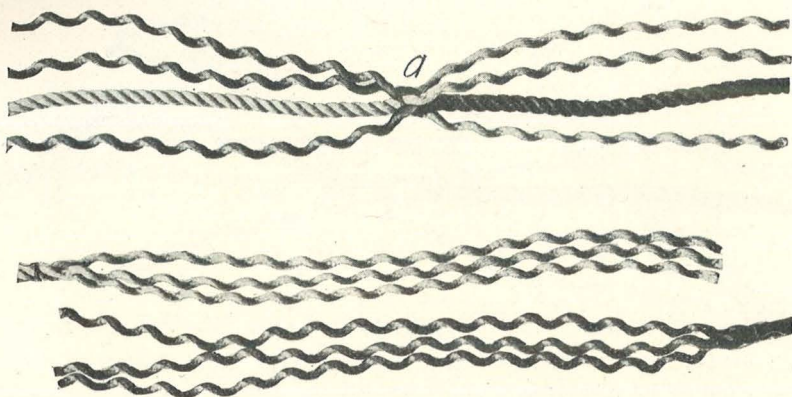


Fig. 14

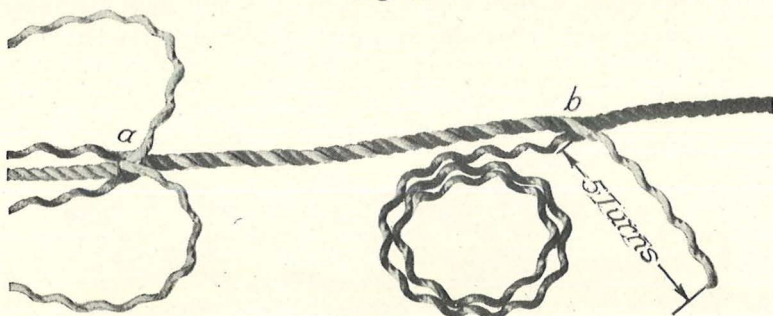


Fig. 15

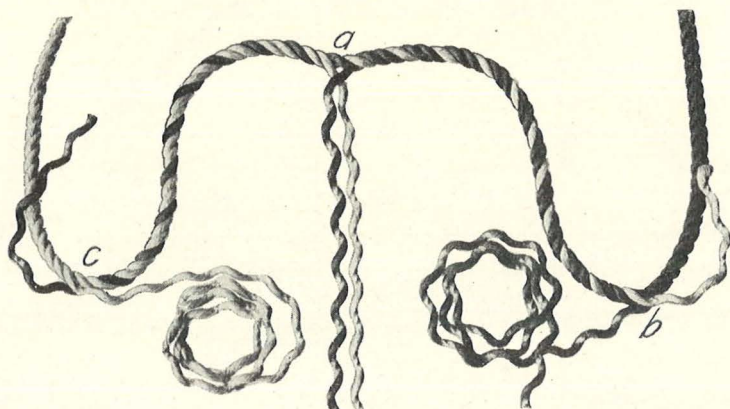


Fig. 16

the lower part of Fig. 14. Before bringing the two parts 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.

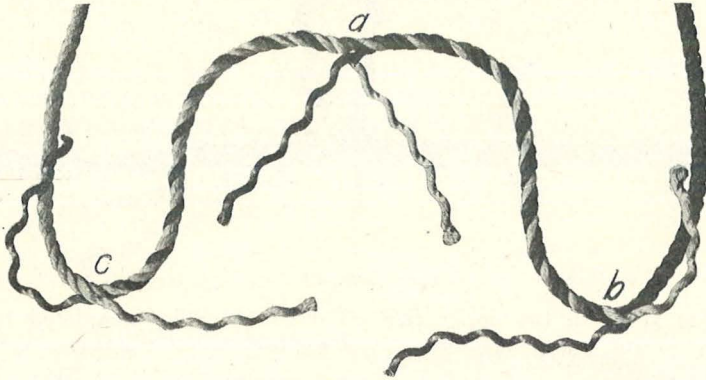


Fig. 17

This latter operation should follow closely the unlaying of the strand to the right. Stop 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

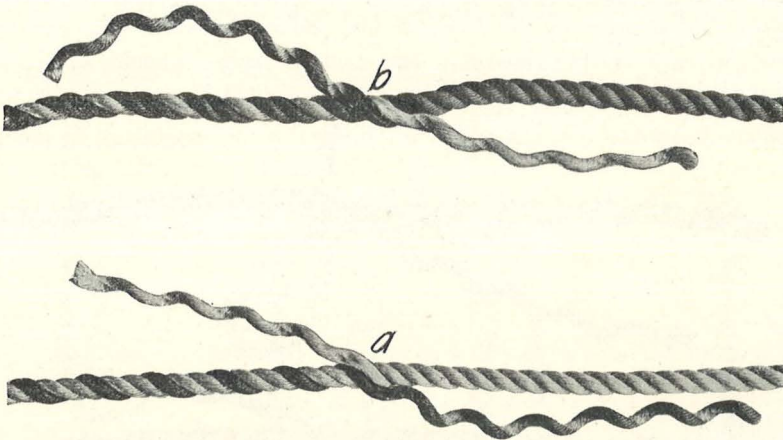


Fig. 18

is shown in Fig. 16 at *c*. 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 tuck, as shown by the

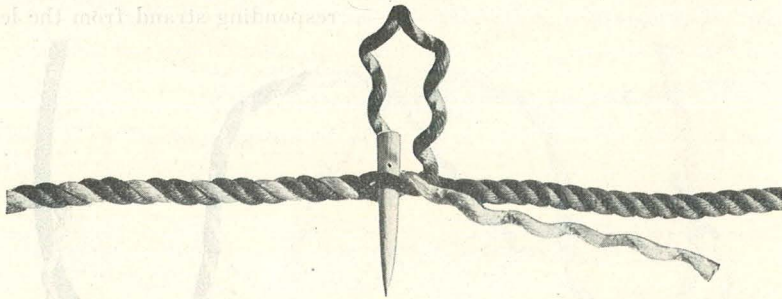


Fig. 19

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 angles to the direction of

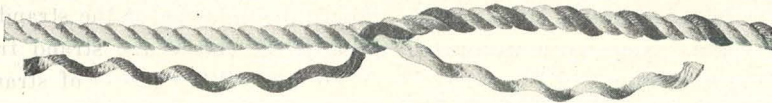


Fig. 20

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.

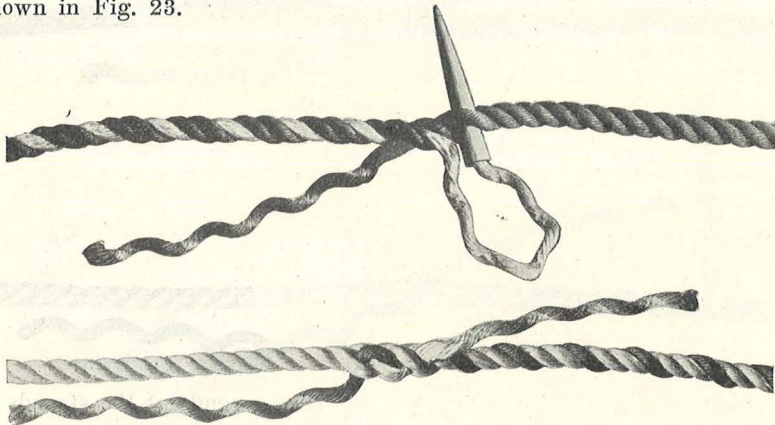


Fig. 21

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*. We now have two pairs of strands left where the ends were put together. Run one of these pairs to the right and the other

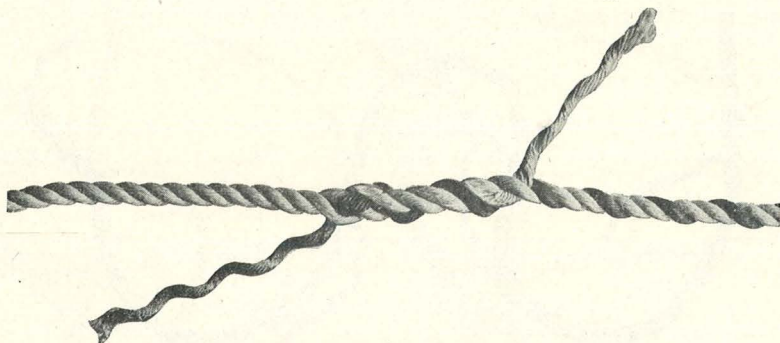


Fig. 22

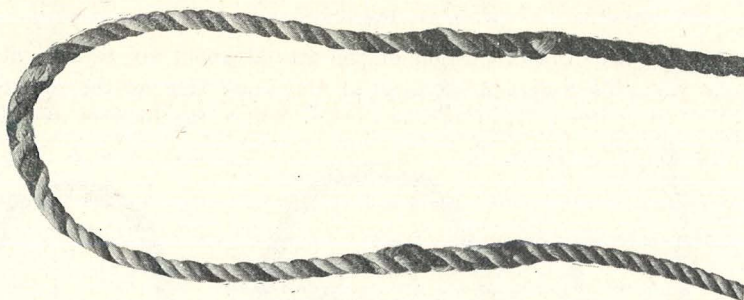


Fig. 23

to the left about five turns each as shown in Fig. 25. Finish the four pairs by tucking as in splicing a three-strand rope. If the rope has a

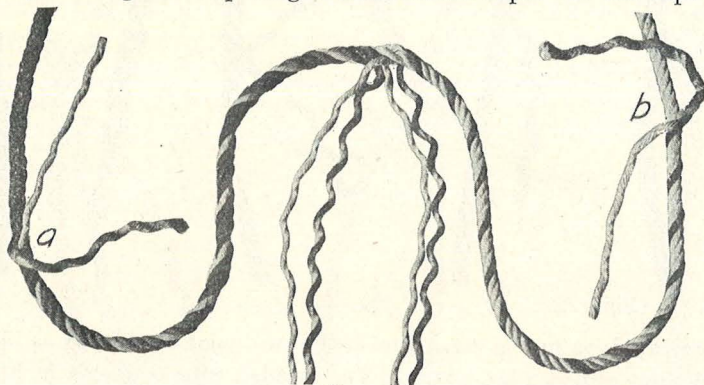


Fig. 24

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:

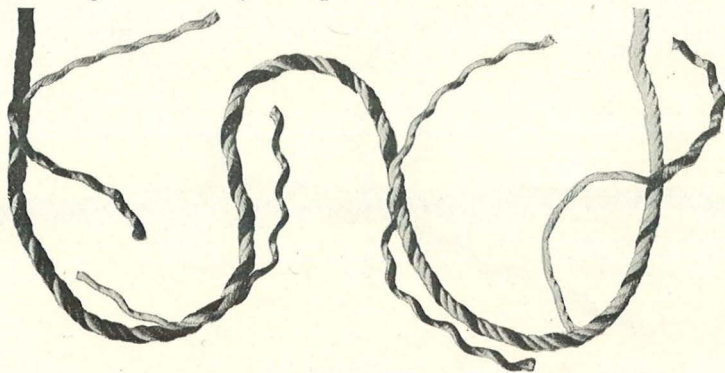


Fig. 25

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 space from which the broken strand has



Fig. 26

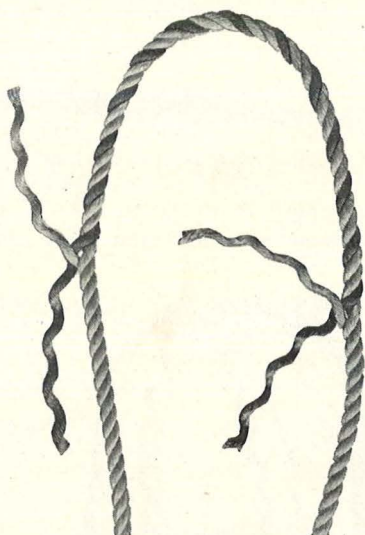


Fig. 27

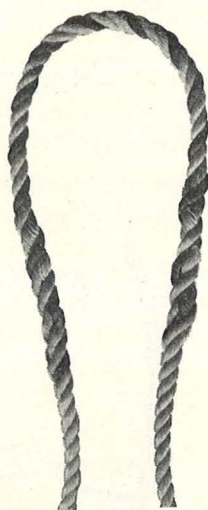


Fig. 28

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 under the next

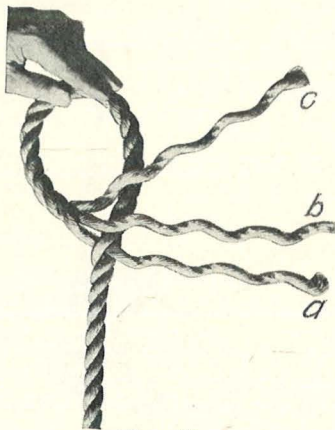


Fig. 29

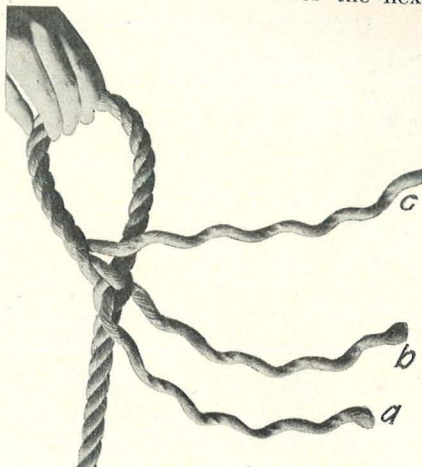


Fig. 30

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

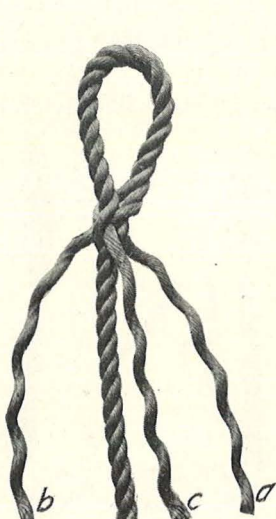


Fig. 31

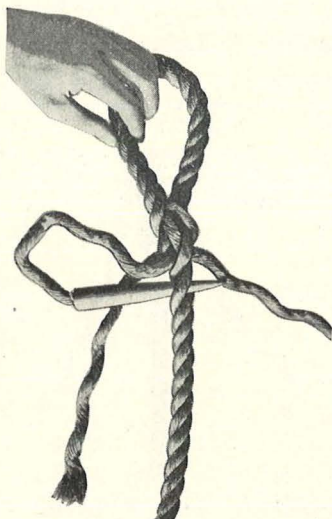


Fig. 32



Fig. 33

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 strand *c*



Fig. 34

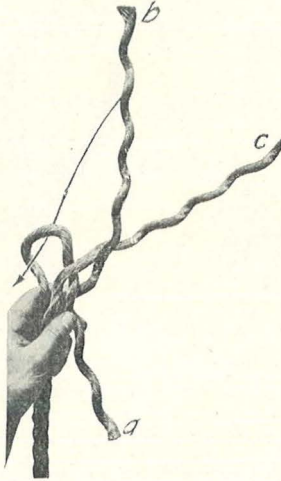


Fig. 35

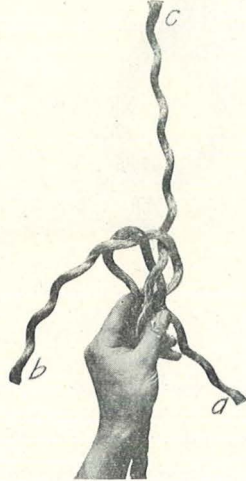


Fig. 36

between the loop in strand *a* and strand *b* as in Fig. 35. Pull strand *b* thru 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 strand nearest to it and under

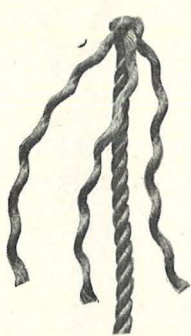


Fig. 37

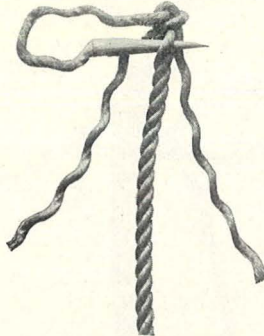


Fig. 38

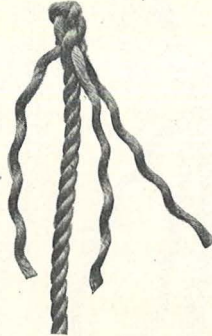


Fig. 39



Fig. 40

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.....	$\frac{5}{8}$	15	7	44	10	18
Medium horse.....	$\frac{1}{2}$	14	6	40	8	16
Small horse.....	$\frac{1}{2}$	14	6	36	8	14
Large cattle.....	$\frac{1}{2}$	12	6	34	7	14
Medium cattle.....	$\frac{3}{8}$	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 experi-

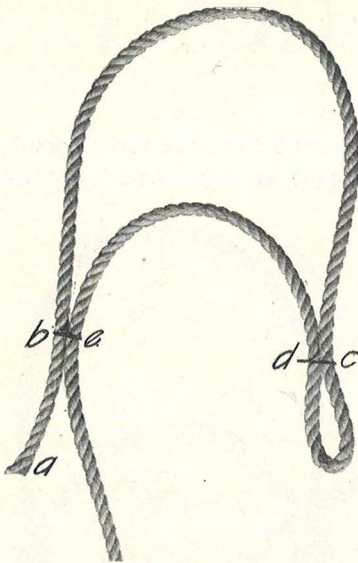


Fig. 41

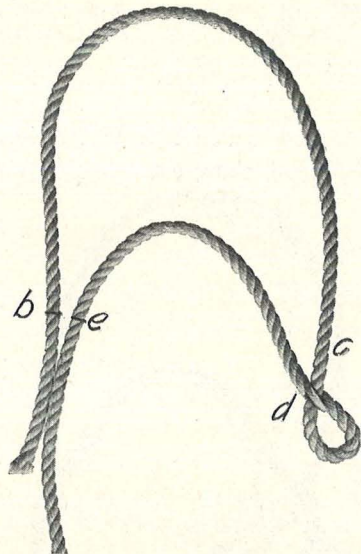


Fig. 42

ence 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 thru it as shown by Fig. 42. Next, open the rope near *c* and pull the long end thru, 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.

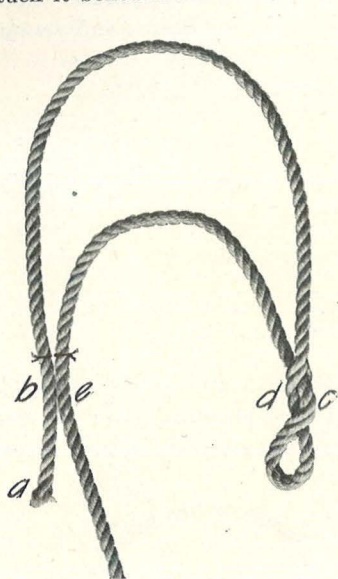


Fig. 43

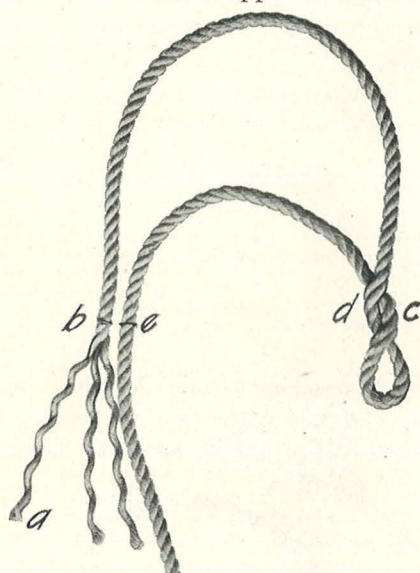


Fig. 44

This is shown in Fig. 46. Give each strand three more tucks, running one strand along each part of the main rope as shown in Figs. 47, 48

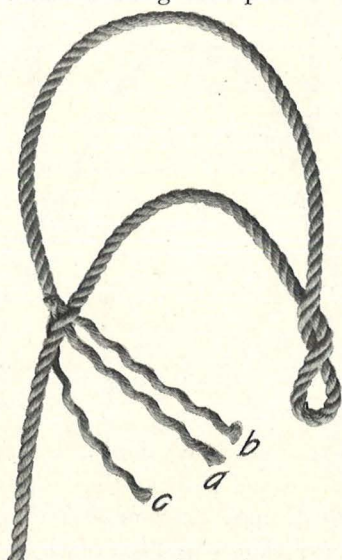


Fig. 45

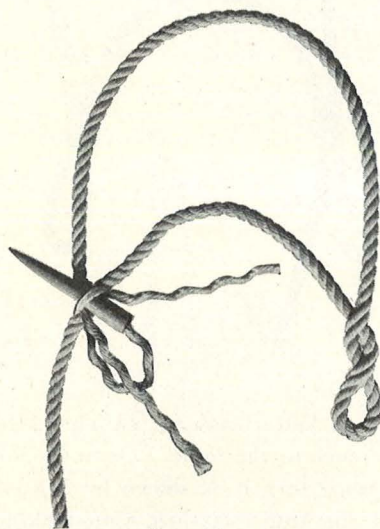


Fig. 46

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

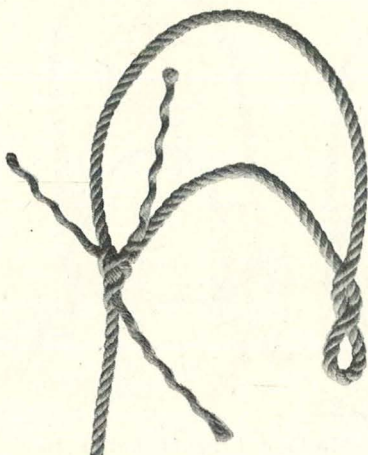


Fig. 47

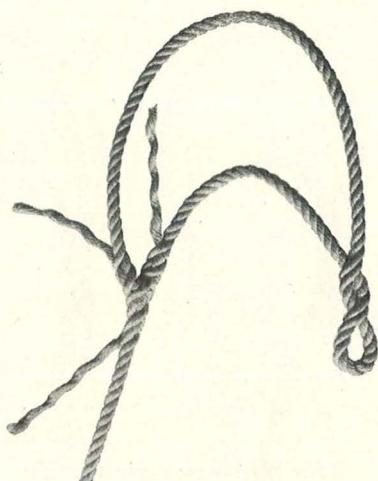


Fig. 48

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

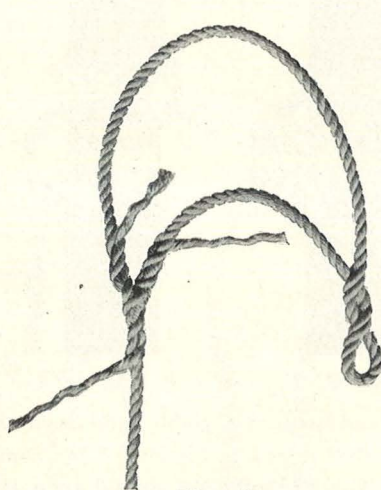


Fig. 49

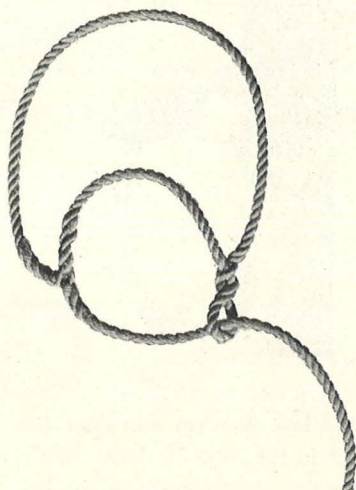


Fig. 50

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. Place the long end of the rope thru the eyes thus formed. The halter thus formed and shown in Fig. 53 may be adjusted to fit the animal on which it is to be used.

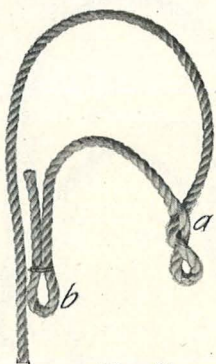


Fig. 51



Fig. 52

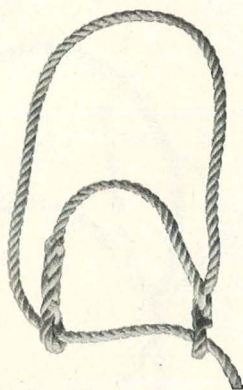


Fig. 53

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

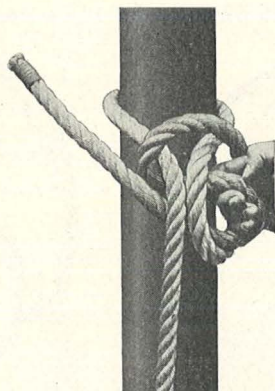


Fig. 55



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 thru the bight as shown in Fig. 55. The end of rope should then be pulled thru 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 thru 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.

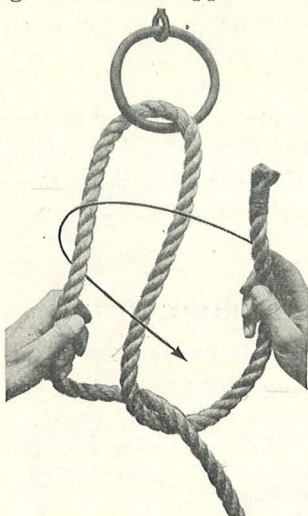


Fig. 57

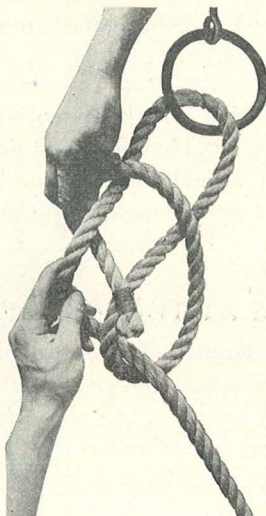


Fig. 58



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 thru a



Fig. 60

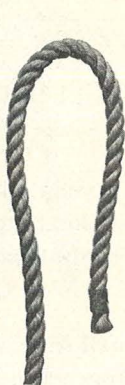


Fig. 61



Fig. 62

loop and fastening it back around itself, as the Square Knot, Fig. 79 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 strictly speaking, bends.

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 thoroly 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 and



Fig. 63



Fig. 64



Fig. 65

to form a knob in the end of a rope. It is tied by making a bight in the rope and pushing the end thru 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 thru 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 indicated

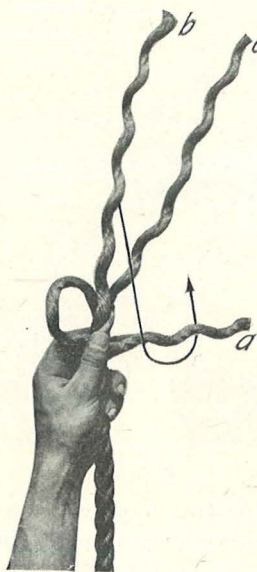


Fig. 66

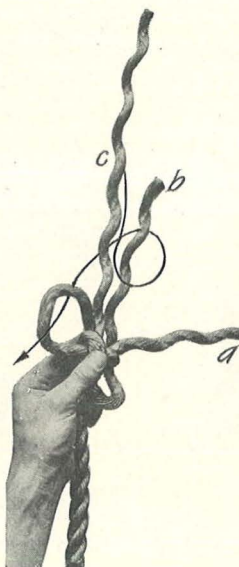


Fig. 67



Fig. 68



Fig. 69

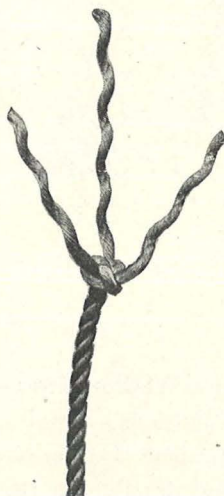


Fig. 70

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

and shown in Fig. 69. Draw the knot up tight by grasping it in one hand as shown in Fig. 69. The finished wall knot as shown in Fig. 70.

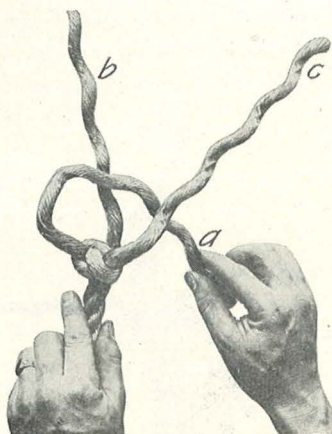


Fig. 71

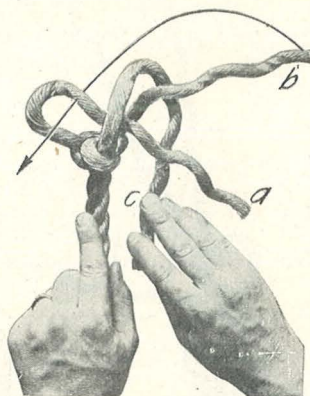


Fig. 72



Fig. 73



Fig. 74

This is sufficient to prevent the end of 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* thru 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.

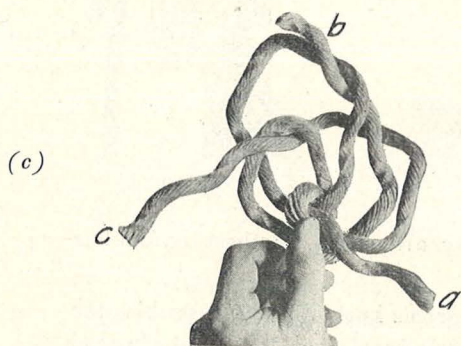
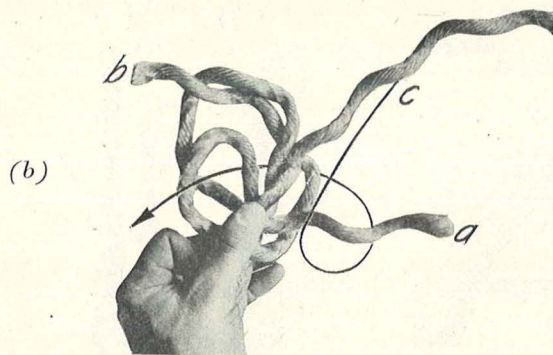
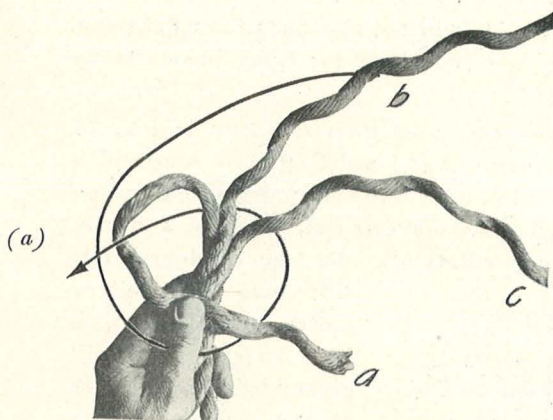


Fig. 75

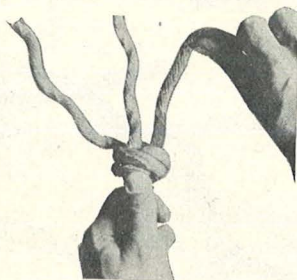


Fig. 76



Fig. 77

KNOTS FOR TYING TWO ROPES TOGETHER

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 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

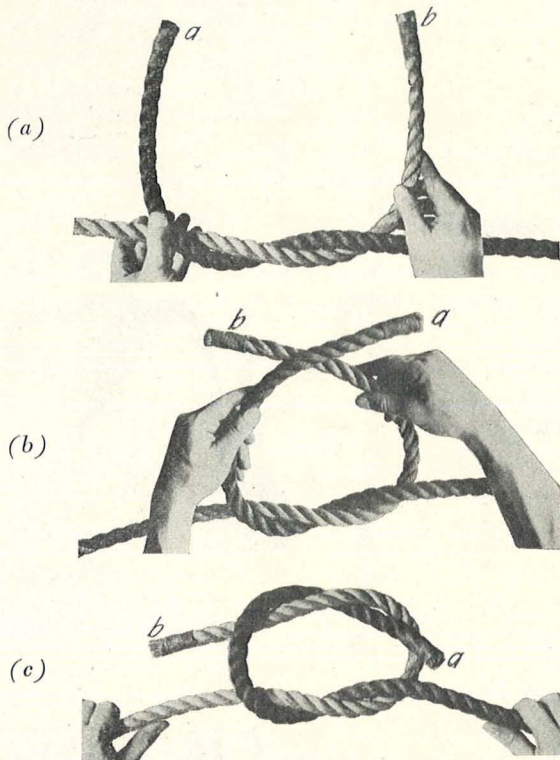


Fig. 78

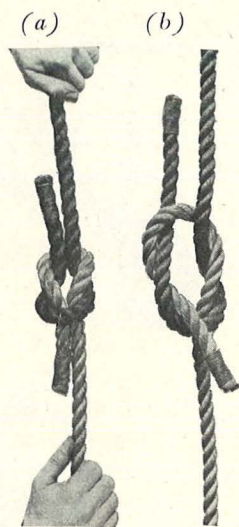


Fig. 79

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 tying an

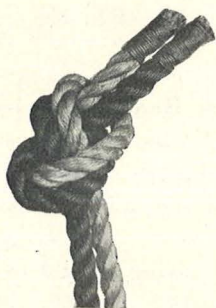


Fig. 81

overhand 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.

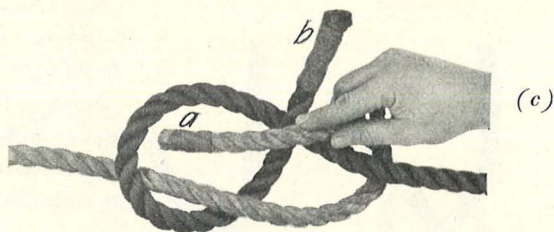
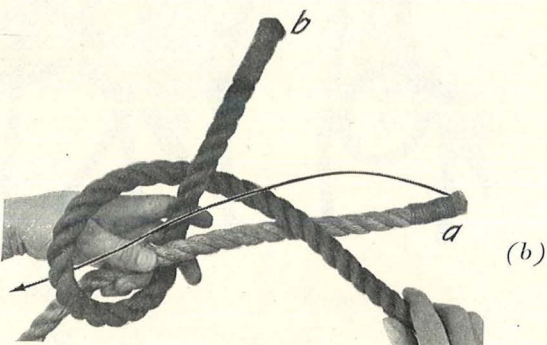
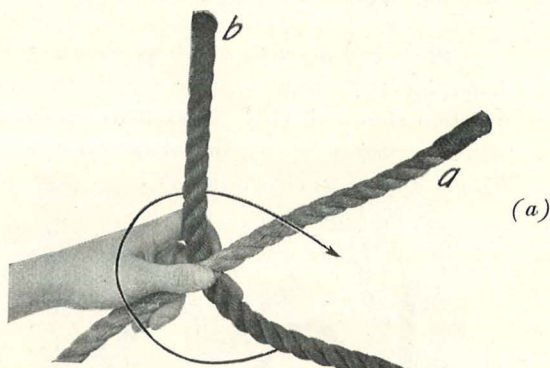


Fig. 82

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* thru 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*).

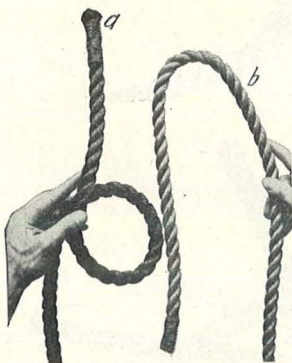


Fig. 83



Fig. 84

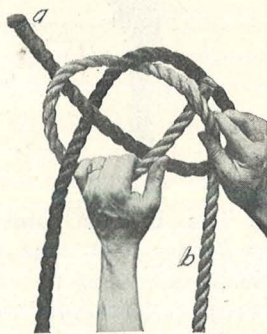


Fig. 85

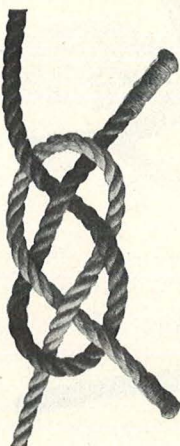


Fig. 86



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 thru the bight in *a*. Push end of *b* thru 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 natural 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 thru the bight thus formed and grasp the long portion of the rope, as shown in Fig. 89. Pull loop out thru the bight, as shown in Fig. 90.



Fig. 88



Fig. 89



Fig. 90

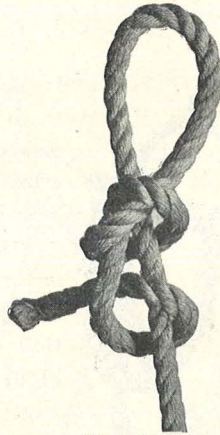


Fig. 91

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 of a rope.



Fig. 92

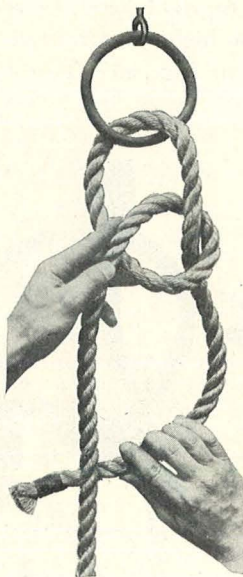


Fig. 93

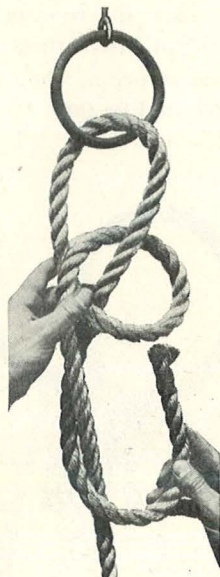


Fig. 94

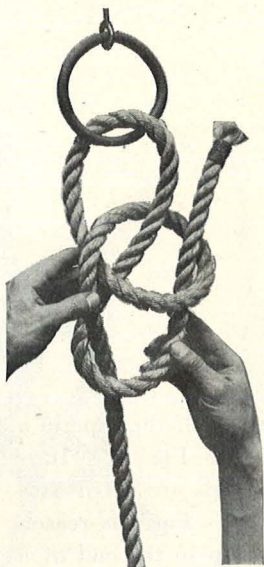


Fig. 95



Fig. 96

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 thru 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 thru 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 thru bight as seen in Fig. 95. The finished knot is shown in 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.

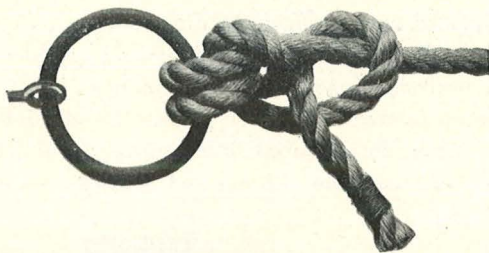


Fig. 97

The Flemish Loop.—The flemish loop is a knot that may be used

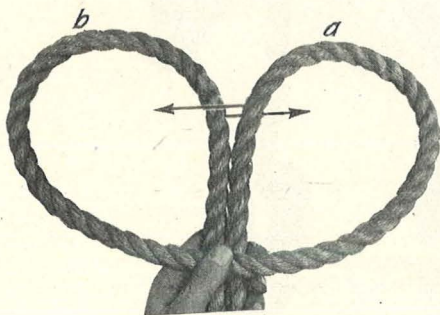


Fig. 98



Fig. 99

to form a loop in a rope at any point and will not slip. It is made as follows:

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 as shown

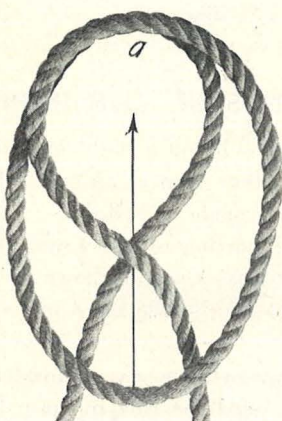


Fig. 100

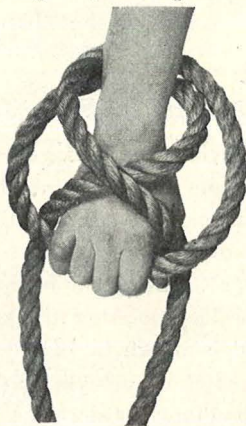


Fig. 101

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

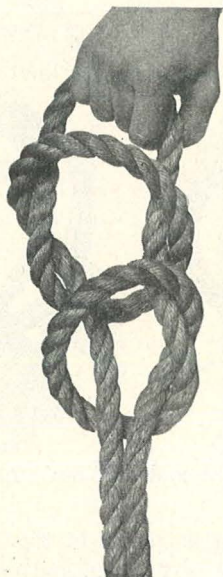


Fig. 102



Fig. 103

LOOPS BETWEEN THE ENDS OF THE ROPE

The Bowline on a Bight.—The bowline on a bight is used where we desire 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 thru 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 the arms so as to form a convenient rest for the back.

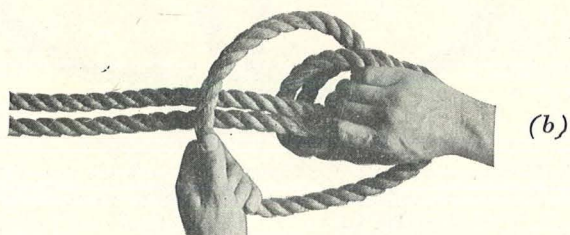
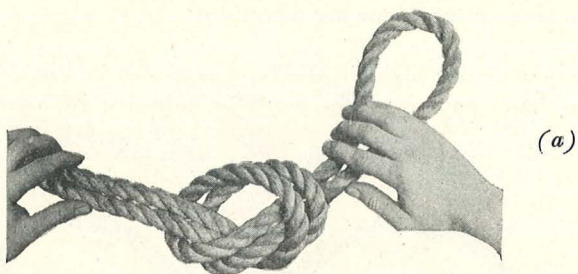


Fig. 104

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

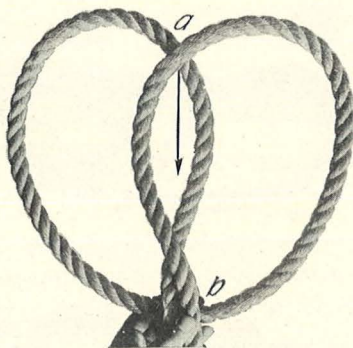
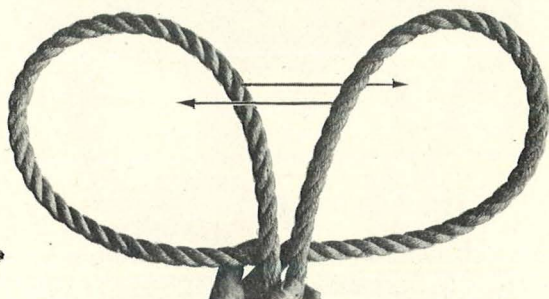


Fig. 105

(*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*, thru the bights., as indicated by arrows in (*a*) and shown in (*b*). The finished knot is shown in (*c*).

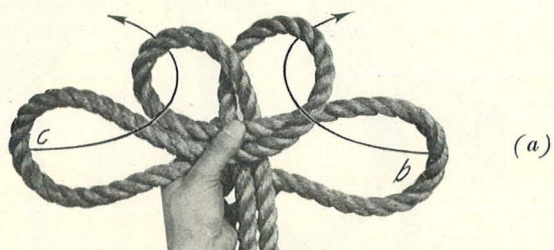


Fig. 106

The Harness Hitch.—The harness hitch is used to make a loop at any point along a rope. We may still pull on both ends of the rope or

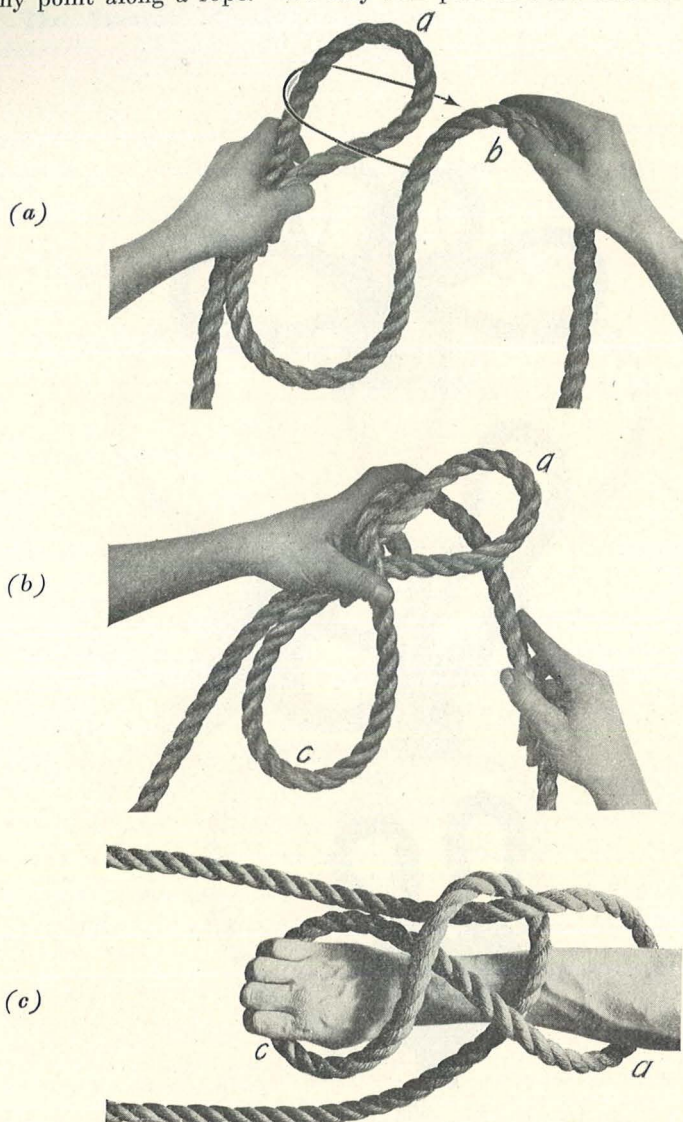


Fig. 107

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

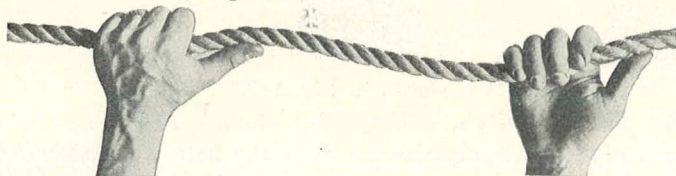


Fig. 108

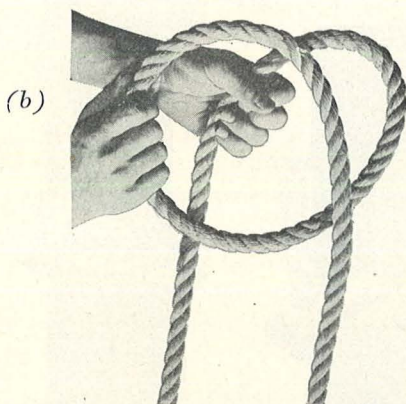


Fig. 109

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 thru the round turns thus formed and grasp the rope from the opposite side as shown in Fig. 110 (c). Pull the parts thus grasped thru the knot, as shown in Fig. 111 (a). The finished knot is shown in Fig. 111 (b).

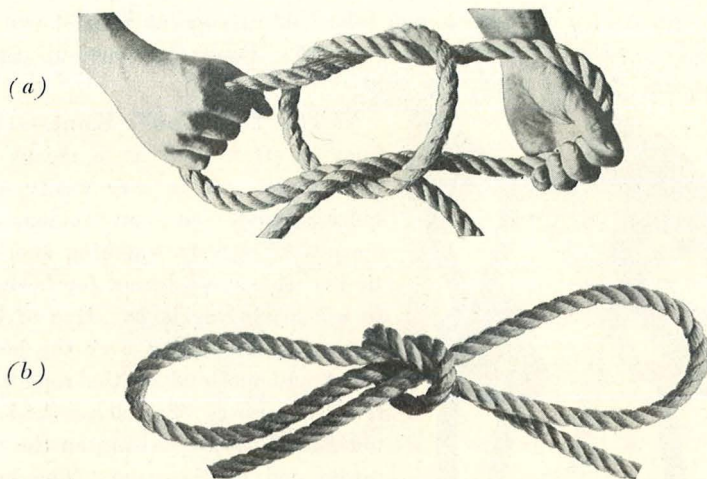


Fig. 111

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

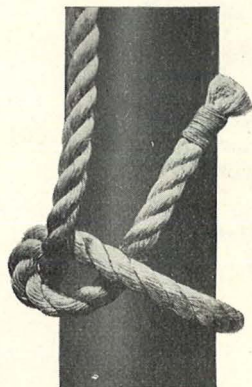


Fig. 112

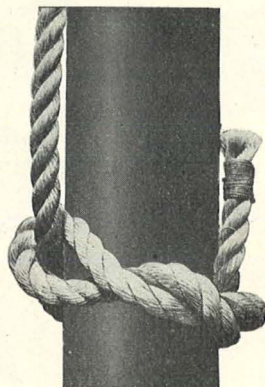


Fig. 113

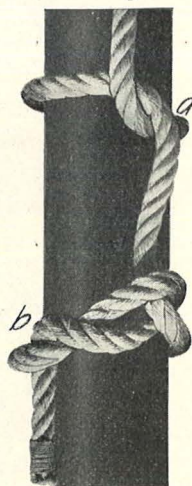


Fig. 114

about the long portion. The timber hitch is shown in Fig. 113.

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.

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.

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.

First Method: Double a portion of the rope and give it three turns about the pipe as shown in Fig. 120. Pull the free end of the rope thru the loop as



Fig. 115

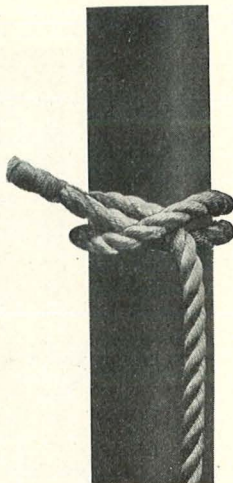


Fig. 116

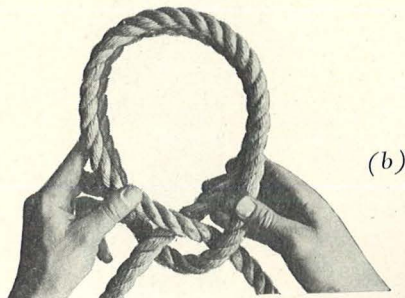
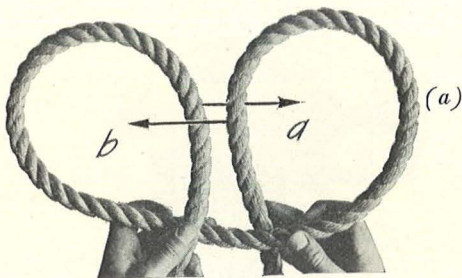


Fig. 117

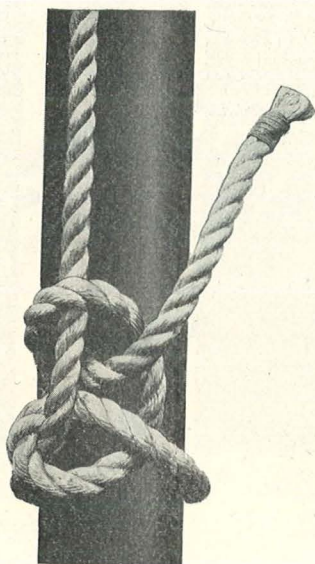


Fig. 118

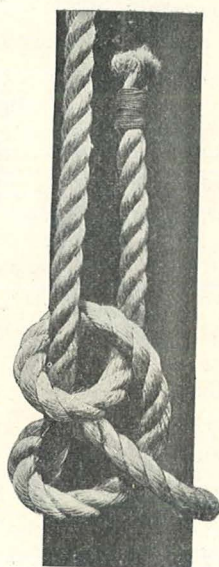


Fig. 119

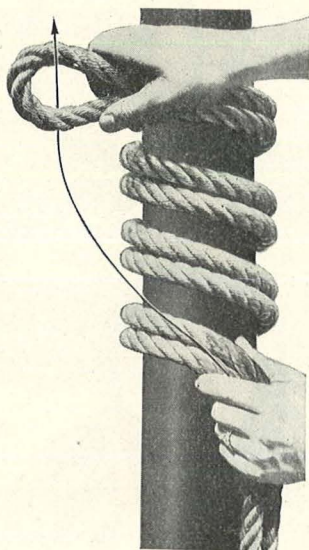


Fig. 120



Fig. 121

indicated by arrow in Fig. 120. The finished hitch is shown in Fig 121.

Second Method: Give one end of the rope about four turns about the pipe as shown in Fig. 122. Next give the short end two half-hitches



Fig. 122



Fig. 123



Fig. 124



Fig. 125

about the long end, as shown in Figs. 123 and 124. The finished hitch is shown in Fig. 125.

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. 126. Make bight in main part of rope near loop *a*. Push *a* thru this bight, as shown in Fig. 127. Likewise make a bight in main part of rope near loop *b* and push *b* thru this loop which completes the hitch, as shown in Fig. 128.

The Blackwall

Hitch.—The black-wall hitch is used to fasten a rope to a hook. It may be tied in the following manner: Hold the rope in the position shown in Fig. 129. Place end *a* in the hook as indicated by arrow. Next place *b* in the hook on the top of *a*, also indicated by arrow. The finished hitch is shown in Fig. 130.



Fig. 126

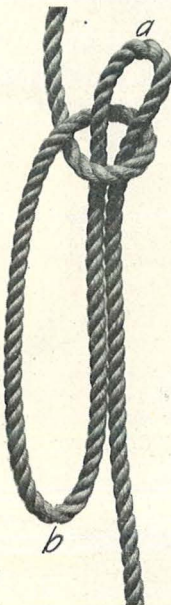


Fig. 127



Fig. 128

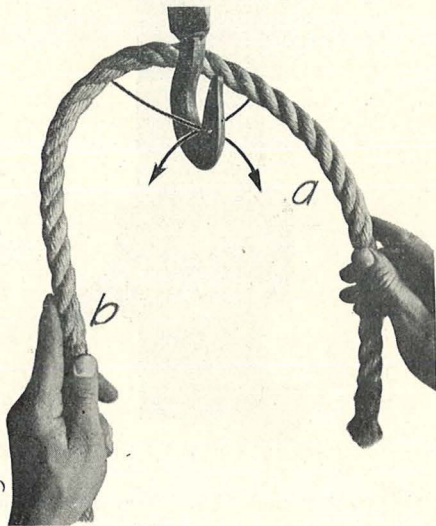


Fig. 129



Fig. 130

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. 131 and 132. Throw a

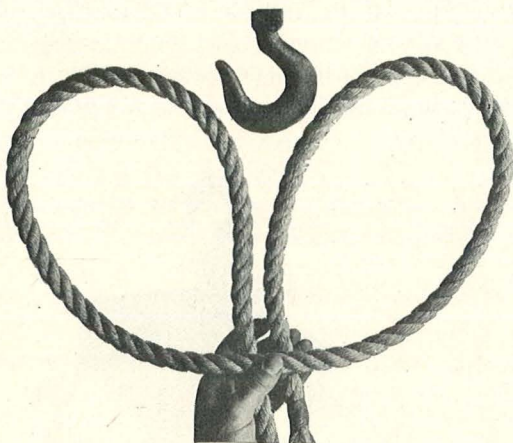


Fig. 131



Fig. 132

double bight in the rope as shown in Fig. 131. Give each bight one and one-half or two turns and place in the hook as in Fig. 132.

BLOCKS AND TACKLE

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.

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

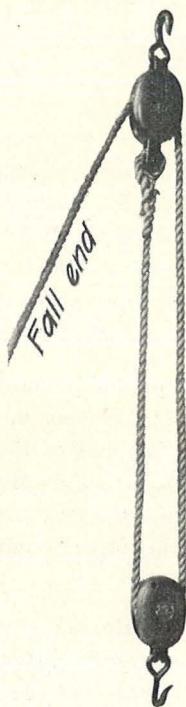


Fig. 133

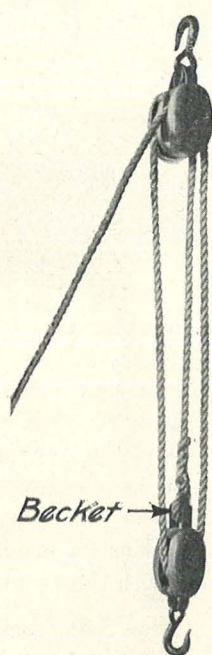


Fig. 134

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. 133 the fall block and the fixed block contain one sheave each. In Fig. 134 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

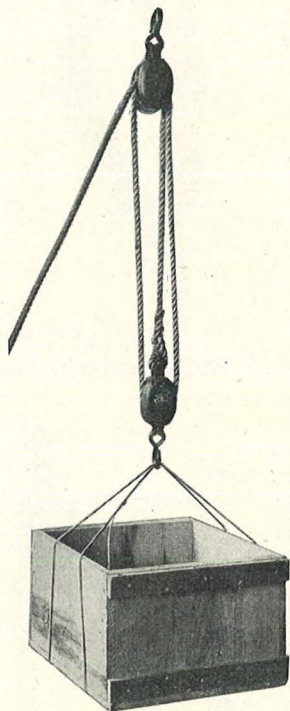


Fig. 135

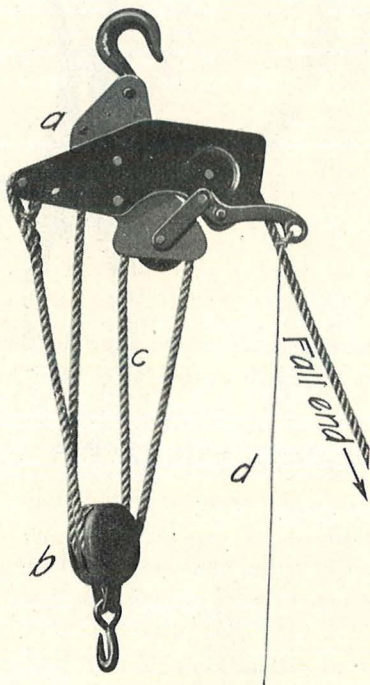


Fig. 136

rope in Fig. 135 passes to and from the movable block three times. Suppose we wish to lift 150 pounds in the box, Fig. 135. 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. 133 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.

The Self-Locking Tackle.—A self-locking tackle, such as shown in Fig. 136, is used about the farmstead for such work as lifting the wagon box, stretching barbed wire or moving heavy objects of any kind.

It consists of a fixed block *a*, a movable block *b*, the rope *c*, and trip cord *d*. Before leaving the fixed block, the fall end of the rope passes under a small catch so arranged as to engage the rope and hold it from slipping back whenever we stop pulling on the fall end. If we wish to lower the load again, all that is necessary is to pull on the trip cord *d* which releases the catch and allows the rope to pass back.

One type of self-locking tackle eliminates the separate cord entirely. In this type the fall end of the rope passes thru an eye in a short trip arm. The catch is engaged by pulling on the fall end from directly beneath the block and released by pulling on it from some other point than directly beneath the block.

The Differential Chain Hoist.—In connection with a discussion of blocks and tackle a brief description of the differential chain hoist is here given.

This is a very efficient device for lifting heavy loads. It consists of a fixed block, *a*, Fig. 137, a movable block *b*, and an endless chain. The fixed block contains two sheaves of slightly different diameters, but cast together. The chain passes over the larger sheave of the fixed block, down thru the movable block and up over the smaller sheave of the fixed block. Due to the slight difference in the diameter of the sheaves in the fixed block, any motion imparted to the free part of the chain will cause the movable block to slowly rise or descend, depending on which side of the free portion of the chain the force is exerted.

The lifting force or mechanical advantage of the differential chain hoist is

$$\frac{2R}{R-r}$$

R—radius of large fixed sheave

r—radius of small fixed sheave

For example, if the radius of the large sheave is 6 inches and that of the small sheave 4 inches, we would have

$$\frac{2 \times 6}{6 - 4} = 6,$$

the mechanical advantage of the hoist. That is, for every pound of force exerted on the free part of the chain a load of six pounds could be lifted.

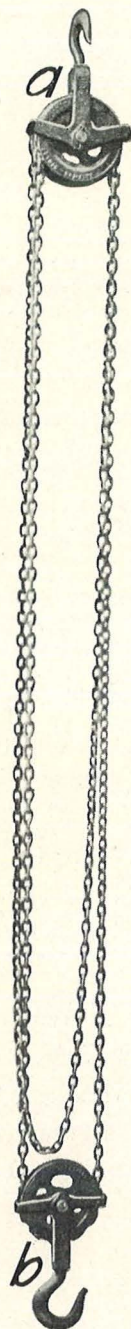


Fig. 137

BIBLIOGRAPHY

Information on the subject of knots and rope work may be secured from the following sources:

Knots, Splices and Rope Work—

By A. Hyatt Verrill, Manual Arts Press, Peoria, Ill.

Rope and Its Use on the Farm—

By J. B. Frear, Agricultural Experiment Station, Bulletin 136.
University of Minnesota, University Farm, St. Paul, Minnesota.

Knots, Hitches and Splices—

By H. W. Riley, The Cornell Reading Courses, Vol. 1, No. 8, New York State College of Agriculture, Ithaca, N. Y.

Rural School Agriculture—

Bulletin No. 1, University of Minnesota, University Farm, St. Paul, Minnesota.

Equipment for the Farm and Farmstead—

By H. C. Ramsower, Ohio State University, Ginn and Company, Chicago, Ill.

Rope and Its Uses—

By A. A. Burger, Extension Bulletin No. 24, Extension Department, Iowa State College of Agriculture, Ames, Iowa.

Kent's Mechanical Engineers' Hand Book.

John Wiley and Sons, New York.

The Blue Book of Rope Transmission—

American Manufacturing Company, New York.

Knotting and Splicing—

David McKay, Philadelphia.

The Standard Dictionary

Webster's International Dictionary

The Encyclopedia Britannica

The Standard Encyclopedia

INDEX

Adjustable halter	19	Hitches (Continued)	
Amount of rope, feet per pound	5	Half	
Anchor bend	31	One	38
Becket	43	Two	39
Bends	21	Harness	36
Bibliography	46	Pipe	39
Bight	22	Sheep shank	42
Binder knot	27	Timber	38
Blackwall hitch	42	Timber and half hitch	38
Blocks and tackle	43	Information about three strand	
Bowline		rope	5
Single	30	Jute	3
Bowline on bight	32	Kinds of rope	4
Spanish	34	Knots, principles and elements	
Breaking strength of rope	5	of	21
Cable-laid rope	4	Knots at end of rope	22
Calculation of strength of rope	5	Overhand	22
Carrick bend	28	Figure eight	22
Cat's paw	43	Wall knot with crown	22
Chain hoist	45	Matthew Walker knot	24
Clove hitch	39	Knots for tying two ropes to-	
Coiling rope	6	gether	26
Coir fibre	3	Square knot	26
Construction of rope	3	Surgeon's knot	26
Cotton rope	3	Binder knot	27
Crown, spliced	16	Weaver's knot	28
Crowning wall knot	24	Carrick bend	28
Diameter of pulleys	5	Length of rope, feet per pound	5
Diameter of rope	5	Lifting force of tackle	44
Differential chain hoist	45	Long splices	
Eye splice	14	Three strand rope	9
Fall block	44	Four strand rope	12
Fall rope	43	Loops in end of rope	29
Fibers	2	Slip knot	29
Figure eight knot	22	Slip knot and half hitch	29
Fixed block	44	Bowline	30
Flax	3	Anchor Bend	31
Flemish loop	31	Flemish loop	31
Granny knot	26	Manila fiber	2
Half hitch		Marline spike	8
One	38	Materials, rope	2
Two	39	Matthew Walker knot	24
Halters		Maximum and safe load	5
Adjustable type	19	Mending broken strand	14
Non-adjustable type	17	Moving heavy objects	44
Halter ties		Open bight	22
Slip knot type	20	Overhand knot	22
Non-slipping type	20	Pipe hitches	39
Harness hitch	36	Rope	
Hawser laid rope	4	Three strand	4
Hemp	3	Four strand	4
Hitches	21, 38	Cable laid	4
Blackwall	42	Rope materials	2
Cat's paw	43	Safe load	5
Clove Hitch	39	Round turn	22