Simple rope halters are used by many farmers. They are serviceable and inexpensive, and when well made do not detract in the least from an animal's appearance.
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Practical Uses of Rope on the Farm

By I. P. Blauser, First Assistant in Farm Mechanics

The information in this circular has been compiled for the convenience of farmers and students who wish to learn a few of the practical uses of rope and methods of caring for it on the farm. Only the more common knots and hitches are described and illustrated. Usually there are several methods of tying the same knot or hitch, but only the simplest method is given.

A large amount of cordage is purchased by farmers. It is used for binder twine, for hay ropes, derrick hoists, halters, block and tackle riggings, package binders, guy ropes, and in other ways. In order to get satisfactory service from rope with the least expense and trouble, the farmer must be able to select rope properly in regard to size and quality, use the correct size of pulleys, know how to care for rope to prevent breakage and deterioration, and how to tie knots and hitches and make repairs quickly and efficiently.

Almost every type of farm work requires facility in tying a few simple knots. The farmer who can make a good splice quickly suffers very little loss in time and money when a hay rope breaks. Even by knowing the correct knot to use for tying two balls of binder twine together, he will avoid no small amount of trouble and annoyance which is often caused by using a less suitable knot for the place.

Not only is a correctly tied knot more secure than one incorrectly tied, but it is as a rule easier to untie. More time is often lost in the struggle to untie an incorrectly made knot than would have been needed to tie it correctly. Greater than time losses, however, are the damages to machinery and the losses of life and limb which occur as the result of ropes breaking, knots coming untied, or hitches slipping. Farm animals are frequently strangled by improperly made knots. A little time devoted to acquiring skill in this phase of farm work will be many times repaid in convenience and safety.

In learning to tie knots and hitches, it is important actually to use a piece of rope and to go thru the various steps as described and illustrated. Several trials will usually give a working knowledge of the knot or hitch, but proficiency is obtained only by continuous practice.

Many of the illustrations used in this circular were prepared by Dr. E. A. White, formerly Associate Professor of Farm Mechanics.
ROPE IS MADE FROM VEGETABLE FIBERS

Rope is made from a number of different vegetable fibers, including manila, sisal, cotton, jute, and coir. Practically all the rope used on the farm is made either of manila or sisal fiber or a combination of the two, and is commonly known as hemp rope.

Manila Fiber. Manila fiber, a product of the Philippine Islands, is obtained from the outer layers of the Abaca plant, which closely resembles the banana plant. The best grade of manila fiber is light buff in color, lustrous, fine, flexible, uniform in size, and from 6 to 12 feet in length. The poorer grades of manila fiber are shorter in length, coarser, yellow or brown in color, and lacking in strength and flexibility. The glossy appearance is a distinguishing characteristic of the best quality of manila fiber.

Sisal Fiber. Sisal fiber, obtained from the leaves of a plant grown in Yucatan, is from 2½ to 5 feet in length, slightly yellowish white in color, straight, and smooth. It is heavier, coarser, stiffer, and weaker than manila fiber.

METHOD OF MANUFACTURING ROPE

The parts making up a three-strand rope are illustrated in Fig. 1. In manufacturing rope, a number of fibers (D) are twisted together in a right-hand direction to form the yarns (C). (The direction of twist for fibers, yarns, or strands, is said to be right-handed when they go in the same direction as the hands of a clock when they are pointed toward the clock. If the twist is counterclockwise, it is said to be left-handed.)
Yarns are twisted together in a left-hand direction to form the strand $B$. Three or four strands are then twisted together in a right-hand direction to form a rope $(A)$.

The alternate right and left twisting of the fibers, yarns, and strands, produces a balance which tends to keep the rope in proper form.

**Rope Terms**

- **Fiber**—Material as obtained from plant ($D$, Fig. 1)
- **Yarn**—Fibers twisted together ($C$, Fig. 1)
- **Thread**—Two or more small yarns twisted together
- **String or twine**—The same as thread, but of larger yarns
- **Strand**—Two or more large yarns twisted together ($B$, Fig. 1)
- **Cord**—Two or more threads or strings twisted together
- **Rope**—Two or more strands twisted together ($A$, Fig. 1)
- **Hawser**—A rope of three strands, laid up right-handed
- **Shroud laid**—A rope of four strands, laid up right-handed
- **Cable**—Three hawsers twisted together left-handed
- **Standing part**—Long end of rope not used

![Diagram of a Knot](image)

**Fig. 2.—Elements of a Knot**

$A$ is a bight, $B$ a loop, and $C$ a round turn. It is important to know the meanings of these terms before trying to follow directions for tying knots.

- **Bight**—Made by turning the rope back on itself, forming the letter U ($A$, Fig. 2)
- **Loop**—Formed by crossing the sides of a bight ($B$, Fig 2)
- **Lay**—To twist the strands of a rope together
- **Unlay**—To untwist the strands of a rope
- **Relay**—To twist strands together that have become untwisted
- **Whip**—To bind the end of a rope to prevent untwisting
- **Splice**—To join the ends of ropes together by interweaving the strands
- **Spliced crown**—To interweave the strands at the end of a rope (Fig. 29)

**WEIGHT AND STRENGTH OF ROPE**

Rope is usually sold by weight but is ordered by diameter and length. A 1-inch rope runs about 3.4 feet to a pound. The number of
feet to a pound of rope of other diameters is obtained, therefore, by dividing 3.4 by the square of the diameter of the rope in inches.\textsuperscript{1} For example, the number of feet in a pound of $\frac{7}{8}$-inch manila rope would be $3.4 \div \left( \frac{7}{8} \times \frac{7}{8} \right)$, or 4.4. These results may vary considerably if the rope is damp or has been treated with preservatives.

The breaking strength, in pounds, for new manila rope may be found approximately by squaring the diameter of the rope in inches and multiplying the result by 7,200. Thus the breaking strength for a $\frac{7}{8}$-inch rope would be $\frac{7}{8} \times \frac{7}{8} \times 7,200$ pounds, or 5,440 pounds. If allowance be made for a factor of safety of 7, the safe load would be $5,440 \div 7$, or 777 pounds. Rope made from sisal hemp weighs about the same per foot as manila rope but is only about three-fourths as strong. Four-strand ropes are a little stronger than three-strand ropes.

The tensile strength of ropes varies greatly with quality and kind of fiber and the degree and method of twist. The harder-twisted ropes have less strength per pound but stand up better under farm conditions than those with less twist. A rope should not carry a working load of more than one-fifth to one-eighth of its tensile strength. This allowance, called a factor of safety, is provided to take care of unexpected strains, wear, and mishaps where part of the fibers are accidentally cut or broken.

A good grade of manila fiber is the best rope for nearly all farm purposes, on account of its greater length per pound, tensile strength, and flexibility.

**WEAR LENGTHENED BY CAREFUL USE**

There are three general ways in which rope wears out—by internal wear, external wear, and rotting.

**Internal wear** (Fig. 3) is detected by the presence of rope dust, a large number of fiber ends, and distinct edges on the strands. It is caused chiefly by the fibers slipping back and forth over each other whenever the rope is bent, as when it is run over a pulley. Internal wear may be prevented by using pulleys of proper size and by applications of rope lubricants. The diameter of the pulley should be at least eight times the diameter of the rope. The correct sizes of pulleys for the different sizes of rope are given in Table 1.

**External wear** is caused by drawing the rope over a rough surface or projections which tear the fibers. It can usually be prevented by exercising a little care and using exterior coatings.

**Rotting of the fibers** is caused by exposure to unfavorable conditions, such as dampness, and can be prevented to some extent by the application of lubricants and exterior coatings.

\textsuperscript{1}Manufacturer's rule.
**FIG. 3.—THE INTERIOR OF A WORN ROPE**

Note the many fiber ends, and also the distinct edges on the inside of the strands.

**TABLE 1.—SAFE LOAD, BREAKING LOAD, AND DIAMETER OF PULLEY FOR VARIOUS SIZES OF THREE-STRAND MANILA ROPE**

<table>
<thead>
<tr>
<th>Diameter (inches)</th>
<th>Weight of 100 feet of rope in pounds</th>
<th>Length of rope per pound in feet and inches</th>
<th>Safe load in pounds</th>
<th>Breaking load in pounds</th>
<th>Diameter of pulley in inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/16</td>
<td>2</td>
<td>50 0</td>
<td>35</td>
<td>230</td>
<td>1 1/2</td>
</tr>
<tr>
<td>1/4</td>
<td>3</td>
<td>33 4</td>
<td>55</td>
<td>400</td>
<td>2</td>
</tr>
<tr>
<td>5/16</td>
<td>4</td>
<td>25 0</td>
<td>90</td>
<td>630</td>
<td>2 1/2</td>
</tr>
<tr>
<td>3/8</td>
<td>5</td>
<td>20 0</td>
<td>130</td>
<td>900</td>
<td>3</td>
</tr>
<tr>
<td>7/16</td>
<td>6</td>
<td>16 8</td>
<td>175</td>
<td>1 240</td>
<td>3 1/2</td>
</tr>
<tr>
<td>1/2</td>
<td>7 1/2</td>
<td>13 0</td>
<td>230</td>
<td>1 620</td>
<td>4</td>
</tr>
<tr>
<td>5/8</td>
<td>13 1/2</td>
<td>7 6</td>
<td>410</td>
<td>2 880</td>
<td>5</td>
</tr>
<tr>
<td>3/4</td>
<td>16 1/2</td>
<td>6 1</td>
<td>520</td>
<td>3 640</td>
<td>6</td>
</tr>
<tr>
<td>7/8</td>
<td>23 3/4</td>
<td>4 3</td>
<td>775</td>
<td>5 440</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>28 1/2</td>
<td>3 6</td>
<td>925</td>
<td>6 480</td>
<td>8</td>
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<tr>
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<td>38</td>
<td>2 7</td>
<td>1 260</td>
<td>8 820</td>
<td>9</td>
</tr>
<tr>
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<td>45</td>
<td>2 2</td>
<td>1 445</td>
<td>10 120</td>
<td>10</td>
</tr>
<tr>
<td>1 3/8</td>
<td>58</td>
<td>1 8</td>
<td>1 850</td>
<td>13 000</td>
<td>11</td>
</tr>
<tr>
<td>1 1/2</td>
<td>65</td>
<td>1 6</td>
<td>2 085</td>
<td>14 600</td>
<td>12</td>
</tr>
<tr>
<td>1 3/4</td>
<td>97</td>
<td>1 0</td>
<td>3 070</td>
<td>21 500</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>113</td>
<td>0 10</td>
<td>3 600</td>
<td>25 200</td>
<td>16</td>
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<td>2 1/2</td>
<td>184</td>
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<td>5 630</td>
<td>39 400</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>262</td>
<td>0 4 1/2</td>
<td>8 100</td>
<td>56 700</td>
<td>24</td>
</tr>
</tbody>
</table>

*C. W. Hunt and Spencer Miller.*
CARE AND TREATMENT OF ROPE

Uncoiling New Rope. In taking a new rope from a coil it is essential, in order to prevent many troublesome kinks, to start with the right end and uncoil in such a manner as will tend to untwist the strands. Start with the end of the rope in the center of the coil, and uncoil in a counterclockwise direction (Fig. 4). If the rope uncoils in a clockwise direction, the coil should be turned over and the same end of the rope pulled thru the center and uncoiled from the other side.

Coiling a Used Rope. A quick and effective method of arranging a used rope for storage or handling is to throw it in circular coil (Fig. 5). The rope should be coiled in a clockwise direction (Fig. 5, B), which will tend to untwist the strands and prevent kinks.

A new rope is often kinky when uncoiled, because of the unbalanced twisting in the fibers, yarns, and strands. The kinks may be taken out by dragging the rope over a floor or sod-covered field.

Lubrication and Exterior Coatings. Rope lubricants and coatings are divided into three classes according to the manner in which they protect the rope:

1. Those which form only an exterior coating, protecting the rope from external wear and dampness.
2. Those which penetrate the interior and reduce internal wear.
3. Those which both protect the exterior and lubricate the interior.
Mineral oils possess excellent penetrating qualities and give good protection against dampness but cause rapid deterioration of the fibers, thereby greatly lessening the working life of the rope.

The most useful lubricants listed according to the above classification are:

*Exterior coatings*
- Beeswax, black lead, and tallow
- Resin, black lead, and tallow
- Pine tar

*Lubricants*
- Tallow
- Lard
- Boiled linseed oil

*Exterior coatings and lubricants*
- Tallow and black lead
- Tallow and graphite

As most of the wear on farm rope, especially hay rope, is internal, lubricants which penetrate the interior prove serviceable, but owing to the hard twist of the rope they are difficult to apply so they will do any good. Sometimes the heated lubricant is poured on the rope as it runs over a pulley. Quite frequently the rope is boiled in raw linseed oil. All lubricants penetrate much better if applied hot.

Rope may be purchased in which the fibers have been coated before being laid up, a treatment which insures as perfect lubrication as it is possible to obtain but adds greatly to the expense. Treating rope with any of the above mentioned materials always lessens its ultimate tensile strength but should lengthen its working life.

**Relaying Untwisted Rope.** When the end of a rope is either accidentally or purposely untwisted, it can be relaid. Grasp the rope with the left hand (Fig. 6), and taking the first strand (C) with the right hand, lay it across the face of the rope, giving it a twisting motion at the same time to tighten the strand. Place the left thumb on this strand to hold it in place before loosening the grasp of the right hand. Then grasp the next strand on top (A), and repeat as with C. Put strand B in place, then C, and then A again, and so on to the end of the rope. Do not allow the rope to twist in the left hand.
FINISHING THE END OF A ROPE

**Whipping.** When the end of a rope must pass thru a small opening, the end should be whipped to prevent untwisting. Follow these directions carefully and note Fig. 7. (The numbering of the directions coincides with the numbers on the figure):

1. Unlay one strand of the rope a little more than one turn. Lay the whipping twine under this strand, leaving end A about 8 or 10 inches long. Relay the strand into the rope, keeping it tightly twisted, as directed for relaying, page 9.

2. Let the short end A of the twine hang down the rope, and give end B one right-hand turn around the rope just above the short end of the twine. Then fold the short end A over the turn made with B, making a bight at C reaching slightly beyond the end of the rope. Lay the sides of the bight in a groove of the rope.

![Fig. 7.—Whipping the End of a Rope](image)

3. Wind the long end B around the rope and the doubled twine, keeping the whipping twine B pulled up tight, with no vacant spaces between the turns. Continue the winding, or whipping, until the work appears as shown in 3.

4. Pass the long end of the twine B thru the bight at C and pull B up tight. Then by pulling on the free end A, draw the long end B downward and underneath the whipping to about the center. Do not pull the bight at C all the way thru.

5. Finish by cutting off ends A and B as close as possible. The completed whipping appears as shown in this figure.

**Wall Knot with Crown.** This is a desirable knot to use in preventing the end of a rope from slipping thru small openings, and to prevent the end of a rope from untwisting when a knot on the end is not objectionable.

1. Unlay the end of the rope five turns.
2. Wet the strands and they will hold better when drawn up.
3. Place A between B and C, forming a bight at 1 (Fig. 8).
4. Place B around behind C (Fig. 9).
5. Bring C around back of and under B and A, then in front of rope D and up thru the bight, I (Fig. 10).

6. Pull the ends up firmly by pulling the strands at right angles to the rope, working the knot down against the twisted part of the rope (Fig 11).

7. This completes the wall knot and is sufficient to keep the rope from untwisting; but to make a neat round knot, put a crown on top according to directions given on pages 13 and 14 (Figs. 19-23).

8. Cut off the ends quite close. The finished work should appear as shown in Fig. 12.
Matthew Walker Knot. This knot may be used in the place of the wall knot with crown, to prevent the end of a rope from untwisting. It is quickly tied, and when properly drawn down does not loosen easily.

1. The first five steps are the same as for the wall knot (Figs. 8-10).
2. Beginning with the rope as in Fig. 13, complete by putting ends B, C, and A around thru bights 1, 2, and 3 respectively (Figs. 14, 15, 16).
3. Draw up tight (Fig. 17).
4. Cut the strands about one-half inch long to prevent them from pulling out (Fig. 18).
Spliced Crown. This is used to prevent the end of a rope from untwisting, and makes a neat, secure, and permanent method where the enlargement is not objectionable.

1. Unlay the rope five turns.
2. Cross end $B$ in front of end $A$ (Fig. 19).
3. Bring end $C$ down in front of $B$, under $A$, and thru the opening (Figs. 20, 21).
4. Form the crown by pulling all the strands up tight. A solid, three-cornered knot, with the ends pointing down the rope, as shown in Figs. 22 and 23, will be the result.

5. Weave the ends back into the rope. Start with any end such as C, put it over strand 1 and under strand 2, keeping it at approximately a right angle to 1 and 2 (Fig. 24).

6. Draw strand C down tight and give the rope one-third turn to the left. Put end A over strand 2 and under strand 3 (Fig. 25).
7. Give the rope another third turn to the left, and put end B over strand 3 and under strand 1 (Fig. 26).

8. Pull the ends down firmly (Fig. 27), and weave all the ends in at least once more.

9. Cut the strands about ¼ inch from the rope, giving the completed crown as shown in Fig. 28.
How to Break Twine. Binder twine can be broken easily by making two interlocking bights at C, Fig. 29. For heavy twine or cord give the part A several turns around the first finger. To break the twine give the part B a quick jerk.

Fig. 29

KNOTS AND BENDS

Elements of a Knot. Fig. 2 illustrates the fundamental parts of ordinary knots and hitches; A is a bight; B, a loop; and C, a round turn.

Overhand Knot. An overhand knot, which is the simplest of all knots, is shown in Fig. 30. It is used to form a knot on the end of a rope and also to prevent the ends of a rope from untwisting. To tie an overhand knot, make a loop in the rope and pass the end thru the loop (Fig. 30). Note that this same knot can be tied by crossing the ends of two separate ropes, and giving one a complete turn around the other.

Figure-Eight Knot. This knot also is used for making a knot at the end of a rope or for preventing the strands from untwisting. To tie the figure-eight knot, form a bight near the end of the rope, and give the short end A one complete turn around B; then pass A thru the loop C (Fig. 31).

Stevedore’s Knot. This knot is quite similar to the figure-eight knot, and is tied in the same way except that two turns are made with the short end A around the rope B, instead of one turn (Fig. 32).

Binder Knot. The binder knot is the simplest way of tying two ropes together, and is the one tied by the automatic tier of grain harvesting machinery. To tie the binder knot, lay the two ends together and tie an overhand knot in them (Fig. 33). This knot is usually difficult to untie.

Square Knot. This is the knot most commonly used in tying two cords together (Fig. 34). It holds well and can usually be untied without much difficulty. Tie an ordinary overhand knot with the two ends. Then bring end C back against its own rope D, and tie another overhand knot with end A.
Fig. 30.—Overhand Knot

Fig. 31.—Figure-Eight

Fig. 32.—Stevedore

Fig. 33.—Binder

Fig. 34.—Square Knot
Granny Knot. The granny (Fig. 35) knot slips under strain and should never be used. It differs from the square knot, shown in Fig. 34, by $C$ and $D$ being separated by the bight $F$, and $A$ and $B$ by the bight $E$.

![Fig. 35](image)

Weaver's Knot. This knot (Figs. 36, 37) is somewhat similar to the square knot. Throw a bight ($AC$, Fig. 37) in one end. Bring end $B$ up thru the bight at 1 made by $AC$. Make a loop around $A$ and $C$ with end $B$ passing under itself. Note that both ends $A$ and $B$ can be made to point backwards when passing thru an opening, making a very good knot for fastening the ends of binder twine together.

![Fig. 36](image)

![Fig. 37](image)

Surgeon's Knot. The surgeon's knot (Fig. 38) is a modified form of the square knot. In tying the first overhand knot, give the ends two turns instead of one. To finish, tie another overhand knot, keeping $A$ and $C$ together and $B$ and $D$ together.
Carrick Bend. This is used in tying heavy ropes together where heavy loads are drawn and easy untying is necessary. Throw a loop in end $A$ and a bight in end $B$ (Fig. 39). Place $A$ upon $B$ as shown in Fig. 40. Pull a portion of $B$ down thru the loop of $A$ (Fig. 41), and put the end of $B$ up thru the bight formed. This gives the loose knot.
(Fig. 42). Be careful to keep the knot in its natural position until it is drawn tight as shown in Fig. 43.

**Slip Knot.** This is the simplest loop possible and is used to slip up tight around an object. Put end A (Fig. 44) around behind B and in front of D. Then put A thru the loop at 1 (Fig. 45) and draw up tight.

**Manger Knot.** This knot (Figs. 46, 47) is quite similar in construction to the slip knot, but is much easier to untie. Throw a loop at 1 (Fig. 46), in front of rope C. Bring the bight at B around back of C and thru the loop at 1. Finish by putting end A thru bight 3 (Fig. 47) and draw up tight.
**Lariat Knot.** As the name indicates, this knot is used in forming a lariat. Tie an overhand knot at A and C (Fig. 48), drawing the overhand knot at A up tight. Put end A around the standing part of rope B and bring it twice thru the loop at 1 (Figs. 49, 50). Then draw the overhand knot C tight to prevent end A from slipping back thru it. The completed knot appears in Fig. 51.
Bowline Knot. This knot, often called the king of knots, is one of the most useful to know. It can be used whenever a loop that will
not slip and that can be untied easily is wanted at the end of a rope. Throw a loop (1, Fig. 52) at B. Then bring A up thru loop 1, around back of C, and down thru loop 1 again (Figs. 53, 54). The completed knot is shown in Fig. 55.

**Bowline Around Post.** A similar method of tying a bowline knot around an object is shown in Figs. 56 to 59. The important point to observe in tying these knots is to put end A (Figs. 56, 57) thru the loop *from the same side* as rope C, in order to bind the knot together when A is brought around C and back thru the loop.
Anchor Bend. The anchor bend (Figs. 60-63) is a knot well adapted to fastening the end of a rope into a ring. The knot is easily tied, does not draw excessively tight, and is sure. Excessive wear on the rope is prevented by the rope being put twice thru the ring. To make the anchor bend, give the rope two turns thru the ring (Figs. 60, 61). Then bring end A (Fig. 62) around in front of the standing part of the rope and put it thru the loop of the rope which is around the ring. Complete by making another half-hitch around the rope (Fig.
Miller's Knot. This knot is used in tying grain and flour sacks. It is tied quickly and is very easily loosened.

Gather the open end of the bag in the usual way and hold it between the thumb and first finger of the right hand (Fig. 64). Take the bag string in the left hand, and draw it across the top of the bag, under the last three fingers, and over the first finger of the right hand. Leave end A (Fig. 64) about 4 inches long.

With the left hand bring end B (Fig. 65) around the gathered portion of the bag, over A, and under all the fingers of the right hand. Make another complete turn and pull up tight. With the first finger of the right hand draw B (Fig. 66) under the part of the string that was placed over the finger in starting the knot. Draw the knot up tight by pulling on ends A and B (Fig. 67), and the knot is complete (Fig. 68).

To untie the knot, pull end B in the reverse direction, which loosens end A. Then pull end A backwards out of the knot.
LOOPS BETWEEN THE ENDS OF A ROPE

**Bowline on a Bight.** The double bowline knot is an effective knot to tie in the middle of a rope. It holds well and is easily untied.

Tie an overhand knot in the doubled portion of the rope at $B$ (Fig. 69). Throw bight $A$ up to $C$ (Fig. 70) and pull the two ropes indicated by the arrow to the position shown at $D$ (Fig. 71). The completed knot appears in Fig. 72.
Harness Hitch. This hitch is useful in making a loop at any point along a rope. Both ends of the rope may still be pulled on, or either end and the loop, without affecting the knot. Throw a bight in rope A (Fig. 73) and move B around bight A as indicated by the arrow in Fig. 73 and shown further in Fig. 74. Pull loop C thru bight A as indicated by the arrow in Fig. 74 and as shown further in Fig. 75. Finish the hitch by drawing it up tight (Fig. 76).
Spanish Bowline. This is used to form a double loop between the ends of a rope. The loop may be attached to separate hooks or to the same hook. To tie it, throw a double loop in the rope (Fig. 77) and put one loop on top of the other (Fig. 78). Take the rope at A (Fig. 78) and double it back on B (Fig. 79). Then put bights A and B thru loops C and D respectively (Fig. 80). The finished knot is shown in Fig. 81.
Tom Fool's Knot. This is a good knot to use in ringing hogs. One loop is slipped over the hog's snout and the free end of that loop fastened to a post. The knot is untied and the hog released by pulling on the opposite end of the rope. To tie this knot, throw a round turn in the rope and push the two standing parts of the rope towards each other (Fig. 82.) Then pull B thru loop A, and C thru loop D, as shown in Figs. 82 and 83. The completed knot is shown in Fig. 84.

Cat's Paw. The cat's paw is a good means of attaching a rope to a hook without the use of the ends. To tie it, throw a double loop (BC, Fig. 85). Give each loop one and one-half or two turns (Fig. 86), and place on hook as shown in Fig. 87.
A hitch is a temporary knot used to fasten a rope around a timber, pipe, or post in such a manner that it is easily undone. The hitches here described are for temporary use only, and each has its own special use.

**Half-Hitch.** The half-hitch is used temporarily to fasten a rope to a timber and is not very secure unless the pull is constant. Its greatest use is found in connection with other hitches. Figs. 88 and 89 show the half-hitch without the end of the rope and Fig. 90 with the end of the rope.

**Timber Hitch.** The timber hitch (Fig. 91), which is much more secure than the half-hitch, is used in moving timbers, boards, or large pipes. It is made similarly to the half-hitch but is made more secure by giving the short end A one or two more twists back on itself.
Timber-Hitch and Half Hitch. A combination of the timber-hitch and the half-hitch (Fig. 92) is much safer for heavy timbers than either the half-hitch or the timber-hitch. Make the half-hitch first (A, Fig. 92) and then the timber-hitch B.

Clove Hitch with End of Rope. The clove hitch is very useful in attaching a rope to a pole or a stake. When properly tied, it will not slip and is easily untied. Give the end of rope A (Fig. 93) two turns about the post, crossing it over the long part of rope B, and placing end A beneath the second turn C (Fig. 94). The completed hitch is shown in Fig. 95.

Clove Hitch Without End of Rope. To make a clove hitch without the end of a rope, throw two loops in the rope—one to the left and the other to the right (Fig. 96). Move loop A over loop B, as indicated by the arrows in Fig. 96 and shown further in Fig. 97. Place the hitch over the end of the pole or stake and draw it up tight (Fig. 98).
Pipe Hitch. This hitch is especially adapted to fastening a rope or chain to a wet pipe in order to lift it. Wrap the short end of rope A (Figs. 99, 100) around the pipe twice, crossing over rope B at C. The third time around bring end A below B and then thru the loop at C, as indicated in Fig. 101 and shown further in Fig. 102. To insure the hitch’s holding, dampen the rope and pull A and B as tight as possible in the directions shown by the arrows (Fig. 103). Finish
by tying a clove hitch with end A at D (Fig. 104). To work successfully, the pull on B must be parallel to the pipe in order to bind the two loops at C between B and the pipe.
Blackwall Hitch. This is a method of temporarily fastening the end of a rope to an iron hook. A single blackwall hitch is shown in Fig. 105 and a double blackwall hitch in Fig. 106. Either of these is very effective if properly tied. Be sure to have the short end of the rope between the long end and the iron hook.

Toggle or Chain Hitch. This hitch is used to take up temporarily the slack in a rope. Tie an overhand knot in the rope without using the ends (Fig. 107). Then pass B thru the bight at 2, as indicated in Fig.
107 and shown further in Fig. 108. Pass C thru the bight at 3 (Fig. 108). Continue the process until the rope is shortened to the desired length. Finish by putting a stick thru the last bight formed (Fig. 109).

**Sheep Shank.** The sheep shank is another easy method of temporarily taking up the slack in rope. Make an oblong loop (Fig. 110), taking up most of the slack. Make another loop (Fig. 111) and slip it over the end of the long loop (Fig. 112). Make the same half-hitch at the other end of the long loop; this completes the hitch (Fig. 113).
Scaffold Hitch. This hitch is used to support scaffolding and is easily tied. Place the rope around the plank (Fig. 114), forming a bight at C, thru which A passes at the edge of the plank towards you. Take end D underneath the plank and make a bight back of the plank (B, Fig. 115). Bring D in front of the plank and up thru bight B, as indicated by the arrow in Fig. 115 and shown further in Fig. 116. Complete the hitch by tying an ordinary bowline knot (see page 22) at E (Fig. 117). To prevent slipping, keep the half-hitches C and B near the edges of the timber.
ROPE SPLICING

Splicing is used to join ends of rope and also to make crowns, eyes, etc. Two splices, known as the short splice and the long splice, are used in joining ropes. In making a splice there are three steps: (1) unlaying the strands, (2) placing the ends together, and (3) tucking or weaving the ends of the strands into the rope. The weaving of the strands is done in the same manner for both kinds of splices.

Short Splice. This splice is just as strong as the long splice but practically doubles the size of the rope at the splice. It is used when the rope does not have to pass thru a small pulley, or when only a short length of the rope can be spared for the splice. It is made as follows:

1. Unlay the strands for 5 to 7 turns (Fig. 118).
2. Bring the two ends together (Fig. 120) so that the strands of one end alternate with the strands of the other end. In doing this be sure the strands of each rope are spread out as shown in Fig. 119, A, and not as in Fig. 119, B, where one strand is crossed between the other two.
3. Next weave the strands into the rope. Put B over E and under D, as indicated in Fig. 120 and shown further in Fig. 121, coming out at a right angle to D.
4. Give the rope one-third of a turn, as indicated by the arrow (Fig. 121), and put A over D and under F and to the left of strand B (Fig. 122).
5. Give the rope another third of a turn and put $C$ over $F$ and under $E$ to the left of $A$ (Fig. 123) but to the right of $B$, which has previously been put over $E$. 
6. After weaving in strands $A$, $B$, and $C$, pull them up tight so there is no slack at $G$ (Fig. 124).
7. Next weave strands $D$, $E$, and $F$ (Fig. 124) into the rope to the left of $G$, in exactly the same manner as the strands $A$, $B$, and $C$ were woven into the rope to the right of $G$.
8. Draw the strands up tight again, and the partial splice will appear as shown in Fig. 125.
9. Weave each of the six strands under twice more, being sure to put each strand over the one next to it and under the second in a direction nearly at right angles to the direction of the twist in the rope.
10. Cut all the ends off, and roll the splice beneath the foot or between boards to give it a smooth appearance. The finished splice is shown in Fig. 126.

Fig. 126
*(Short Splice, completed)*

11. If a particularly smooth splice is desired, each strand, after it has been woven under twice, may be divided into parts and one of the parts left out the next time the strand is woven under. This gives a tapering finish.

**Long Splice.** Where a spliced rope is to pass thru a pulley, the long splice is more desirable. The rope is shortened 5 or 6 feet but its diameter is not appreciably increased. This splice is much neater than the short splice. Directions for making the long splice with a three-strand rope are given under Figs. 127-138 on the following pages.
1. Unlay the strands of each rope 15 turns (Fig. 127). With the strands spread out as shown in Fig. 119, A, place the ropes together in such a way that the strands of each rope are separated by the strands of the other (Fig. 128).
2. Pull the two ropes as close together as possible, and take any end, as \( A \) (Fig. 129), and unlay it from the rope. Relay \( D \) in place of \( A \), being careful to give \( D \) the same twist and tension as the strands of the rope into which it is being laid. Continue to unlay \( A \) and relay \( D \) until within 5 turns of the end of \( D \) (Fig. 130). Then cut off \( A \) the same length as \( D \).
3. Next unlay strand $F$ and relay strand $C$ in its place until $C$ is only 5 turns long. Then cut off $F$ the same length as $C$ (Fig. 131). In selecting the second pair of strands—that is, $F$ and $C$—be sure to leave the remaining two strands, $B$ and $E$, side by side and not separated by a strand.

4. Cut off strands $B$ and $E$, which have been left in the center, 5 turns long (Fig. 132).
5. Tie overhand knots in each pair of strands at N, G, and M, (Fig. 132), as shown in Fig. 133 and not as in Fig. 134.

6. Next weave the ends of the strands at N, G, and M (Fig. 135) into the rope. Fig. 136 shows the way to start to weave the ends. In order to have ends A and C (Fig. 136) come out on opposite sides of the rope, for the first weaving put A and C over the knot and immediately under the next two strands.
7. Draw the strands up tight (Fig. 137), and then weave them over one and under one at least once more as in the short splice.

8. After the ends have been woven the required number of times and pulled up tight, cut off the ends, leaving them about \( \frac{3}{8} \) inch long. The completed splice is shown in Fig. 138.
Repairing a Broken Strand. Sometimes one strand (Fig. 139) of a rope will be damaged and it is desired to repair it without shortening or increasing the size of the rope. This can be done as follows:

1. Unlay ends $A$ and $B$ of the broken strand about 6 turns (Fig. 140). Secure 20 turns of a strand ($CD$) of rope of the same size as the one to be mended.
2. Lay the strand CD (Fig. 141) in the space from which the broken strand was removed, being careful to give it the same degree of twist as the other strands of the rope and to see that it lies smoothly in the rope (Fig. 142).

3. Tie overhand knots in both pairs of strands (Fig. 143) and weave the ends into the rope the same as for the long splice (Figs. 133, 136, 137).

4. Cut off the ends, leaving them about \( \frac{3}{8} \) inch long. The completed repair is shown in Fig. 144.
Spliced Eye. The spliced eye is used to make a loop in the end of a rope or to fasten a rope to a ring. The same method is used in splicing the end of one rope into the side of another. The spliced eye is not difficult to make after the short splice is mastered.
1. Unlay the rope 5 turns, and put middle end A under strand 1 (Fig. 145).

2. Pull up tight, and put strand B over strand 1 and under strand 2 (Fig. 146).

3. Give the loop one-half turn, and put strand C under strand 3 (Fig. 147) from the left side.

4. Weave the ends A, B, and C down the rope, over and under the strands, exactly the same as for the spliced crown (Fig. 28). Weave the ends at least three times, and then cut off, giving the completed spliced eye shown in Fig. 148.

**ROPE HALTERS**

**Nonadjustable Halter.** The nonadjustable rope halter is used for cattle without horns and as a temporary halter for horses and young stock.

The diameter of rope, total length, and length of the different parts of the halter can be determined from Table 2 and Fig. 149. How-

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**Table 2.---Correct Sizes and Lengths for Rope Halters**

<table>
<thead>
<tr>
<th>Animal</th>
<th>Diameter of rope</th>
<th>Total length</th>
<th>Length of parts (Fig. 149)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>inches</td>
<td>feet</td>
<td>A to B</td>
</tr>
<tr>
<td>Large horse</td>
<td>5/8</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>Medium horse</td>
<td>1/2</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Small horse</td>
<td>1/2</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Large cattle</td>
<td>1/2</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Medium cattle</td>
<td>3/8</td>
<td>12</td>
<td>5</td>
</tr>
</tbody>
</table>

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**Fig. 149**

**Fig. 150**
ever, a much better fit can be secured by measuring the animal for which the halter is to be used.

1. Open the rope at C (Fig. 150) and put the long end B thru A at C, leaving a loop 1 to 1½ inches in diameter.
2. Then open rope B at D and put A thru it (Fig. 151).
3. Put A thru B again at E (Fig. 152) and pull the whole up tight, as shown in Fig. 153.
PRACTICAL USES OF ROPE ON THE FARM

4. Unlay end A of the rope 5 turns and weave it into rope B at K (Fig. 154) in the same manner as in making the spliced eye explained on page 48 (Figs. 145 to 148).

5. Put the long end thru the loop H (Fig. 155) and the halter is completed.

Fig. 155

Adjustable Halter. This halter can be adjusted for different sizes of animals and is especially desirable for horned cattle. To make an adjustable halter, start in the same way as for the nonadjustable halter (Figs. 150, 151, 152, 153). Then put a spliced eye about 1 inch in diameter in the end A (Fig. 156), following the direction for the spliced eye given on page 48. Put the long end of the rope thru the loops 1 and 2 (Fig. 157), and the halter is completed.

Fig. 156

Fig. 157
Nonadjustable Halter with Guard Loop. This halter is made so that it will not pinch the head or nose of the animal. It is especially recommended for horses. About 15 feet of rope is required. The length $A$ to $C$ (Fig. 158) for a medium-sized horse is 34 inches. The other measurements are the same as for the nonadjustable halter.

Form a loop at 2 (Fig. 158), as illustrated in Figs. 150 and 151. Unlay end $A$ until $EL$ (Fig. 158) is 13 inches long. Weave the strands
of A into the rope three times at K (Fig. 159), which is 38 inches from E. Then relay the strands of A as far as N (Fig. 160), which is 6 inches from M. Put the long end of the rope thru loop 2 and weave the strands of A into the rope (Fig. 161).

Emergency Halter. This halter is easily and quickly made. Tie an overhand knot in the doubled rope at C (Fig. 162), and a bowline knot at K (Figs. 163 and 164). The completed halter is shown in Fig. 165. Another emergency halter that is even simpler and more quickly made is shown in Fig. 166. Tie a bowline knot in end A. Put
the long end of the rope over the head, around in front of the nose, thru the loop of the bowline, around behind the jaw, and then cross at \( B \).

![Fig. 166.—Emergency Halter](image)

**Halter Recommended for Use by Calf Club Members.** This halter was designed primarily for calves. Because of the non-adjustable headpiece the young animal cannot work it off the head or cause it to slip back on the neck.

Take twelve feet of three-ply, one-half-inch Manila rope. About 33 inches from one end raise two strands and push thru the opening the shorter end \( B \), as shown in Fig. 167. Pull down until a loop about one inch in diameter is formed. Raise two strands of the shorter end \( B \) immediately above the loop, as shown in Fig. 168, and push thru the opening the longer end \( A \). Draw up firmly against the loop.

Unravel the shorter end \( B \) about 8 inches. Keeping the loop to the right, place the center strand (2) in back of the longer portion of the rope, and the outer strands (1 and 3) in front of it, as shown in Fig. 169. Carry the two outer strands (1 and 3) back under \( A \) and up thru the triangle formed by the strands and \( A \), as shown in Fig. 170. Bring the center strand (2) forward under \( A \) and up on the left and under strand 1 (Fig. 170). Draw the strands tight, twisting each so as to tighten the weave. Put strand 2 over one strand and under the next; do the same with strand 1, and put strand 3 under one strand. Draw the strands tight, twisting so as to tighten the weave. Complete by weaving each strand over one and under the next, exactly the same as

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\(^1\)Beef Calf Club Manual, Circular No. 296.
for the spliced crown (see Figs. 23-28 on pages 14, 15). After putting each thru three or four times, cut off the unused ends about half an inch above where they came out the last time.

Put end A thru the loop, as shown in Fig. 171. The free end of the rope A should then be whipped, as described and illustrated on page 10, with waxed cord to prevent raveling.

**FIG. 167**

**FIG. 168**

**FIG. 169**

**FIG. 170**

**FIG. 171**

**HARNESS FOR CASTING CATTLE**

A simple and effective method of casting cattle is shown in Fig. 172. A rope about 40 feet long is needed. With one end of the rope tie a bowline knot (Figs. 56-59) around the animal's neck (a, Fig. 172). Put the rope around the animal's body just back of the forelegs and make a half-hitch over the withers at b. Make another half-hitch at c, allowing the rope to draw up into the flanks. See that rope c is in front of the left hip bone and rope d back of the right hip bone, to
hold the rope in the proper place. To throw the animal, pull to the rear and to the side upon which the animal is to be thrown.

**FIG. 172.—ROPE HARNESS FOR CASTING CATTLE**