

evidence of having been in contact with a hot pipe or other source of heat, or it may be discolored as the result of exposure to acid fumes, in which cases it should be discarded.

Condemning an Unsafe Rope. When a rope has been condemned, it should be destroyed at once or cut up into short hand lines so that it cannot again be used for hoisting purposes. Some organizations even prohibit the use of rope over 2 years old for scaffold falls. To ensure that older rope will not be used, their pulley blocks are painted a different color each time a new rope is installed, in order to indicate which are new and which are last year's ropes. Also the date of reroping is stamped on the lower or single block. Judging the condition and strength of a manila rope is not so simple as you may have been led to believe. It takes a lot of experience and good judgment, and even then the chances of error are very great.

TABLE IV. ELECTRICAL CONDUCTIVITY OF MANILA ROPE
(5 ft between electrodes)

Rope	Exposure to rain, hr	Current leakage observed at, volts	Severe leakage at, volts
Ordinary.....	Dry (no exposure)	160,000	
Waterproofed.....	Dry (no exposure)	160,000	
Ordinary.....	2½	8,000	11,000
Waterproofed.....	2½	21,000	25,500
Ordinary.....	4	5,000	7,000
Waterproofed.....	4	17,000	19,000

General Notes. Manila rope, when dry, is an excellent electrical insulator. The dielectric strength or insulating ability of a wet rope depends upon the percentage of moisture in the rope. Inasmuch as waterproofed rope absorbs less moisture than ordinary rope, it is a better insulator and therefore is safer for use when material must be hoisted in the vicinity of live electrical apparatus. Data in Table IV were furnished by Columbian Rope Company and are the result of tests made on 5-ft-long samples of manila rope suspended vertically with a 6-lb weight attached to the lower end.

Manila rope which is loaded to 50 per cent of its breaking strength (a safety factor of 2) may be expected to fail within a

few hours; if loaded to 75 per cent it may fail within a few minutes. This is due to the creepage of the fibers on each other.

Synthetic ropes have rather slippery fibers. Therefore, all splices in such ropes should have at least five tucks. Braided sash cord is not intended for hoisting. This cotton cord, however, is frequently used for signal cords, etc. The breaking strength is about 320 lb for ¼-in. and 780 lb for ¾-in. sash cord.

Knots, Bends, and Hitches. There are hundreds, if not thousands, of different rope knots, bends, and hitches, but the average rigger can get along with the knowledge of a comparatively few. Technically speaking a "knot" is the intertwining of the end of a rope with a portion of the rope. A "bend" is the intertwining of the ends of two ropes to make one continuous rope. A "hitch" is the attachment of a rope to a post, pole, ring, hook, or other object. A "splice" is the joining of the ends of two ropes or of the end of a rope with the body of the rope by weaving the strands over and under the strands of the other part. Actually, the names are not always correct designations; for instance, the bucket hitch is also known as the fisherman's bend or the anchor knot. A few of the most important fastenings are shown in Figs. 4 to 108, inclusive, those marked by a star (*) being the most commonly used.

There is one little trick to remember in tying any knot if you do not want it to slip; if two parts of the rope are squeezed together, they should be arranged so as to have a tendency to pull in *opposite* directions. For instance, compare the reef knot with the granny.



FIG. 4. Bight, or simple loop. A loop in a rope, as distinguished from its ends. A part of all knots.



FIG. 6. Figure-eight knot. To prevent unreeving.



FIG. 5. Overhand knot, or single knot. To prevent unreeving. Forms eccentrically on rope. Part of many knots. Efficiency 45 per cent of strength of straight rope.



FIG. 7. Marline spike hitch, or boat knot. For drawing seizing tight.



FIG. 8. Reef knot, square knot, sailor's knot, or flat knot.* For joining two ropes of same size, but not safe for ropes of different sizes. Will not hold if ropes are wet. Efficiency 50 per cent.



UNSAFE

FIG. 9. Granny knot, or lubber's knot. Improperly made reef knot. May slip or jam. *Unsafe.*



UNSAFE

FIG. 10. Thief knot. Improperly made reef knot. Will slip. *Unsafe.*

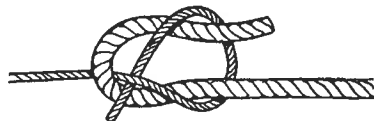


FIG. 11. Sheet bend, becket bend, hawser bend, or weaver's knot.* Shown as used for joining ropes of different sizes. More secure than reef knot. Difficult to untie.



FIG. 12. Sheet bend in eye splice. For securing rope to permanent eye or loop.



FIG. 13. Double becket hitch. To secure rope to permanent eye or loop. More secure than sheet bend when used in spliced eye.



FIG. 14. Fisherman's knot. Not dependable except in very flexible twine or cord. For use with cordage of different sizes.



FIG. 15. Overhand knot, or rosette knot. For joining two ropes. Will not slip but is of low efficiency.



FIG. 16. Hawser bend. For joining large hawsers.



FIG. 17. Reeving-line bend. For joining ropes of different sizes.



FIG. 18. Surgeon's knot. For tying up a compressible bundle, such as canvas.

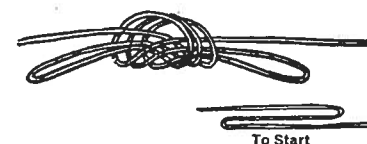


FIG. 19. Knot shortening. For shortening a rope without cutting it. An overhand knot using all three parts of the rope. Knot cannot be tied unless one end of the rope is free.



FIG. 20. Sheepshank.* For shortening a rope without cutting it.

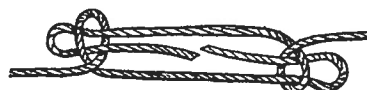


FIG. 21. Sheepshank cut. A knot of average strength when under a steady pull but one that will part if slackened and jerked. Made by forming sheepshank and cutting the center part.

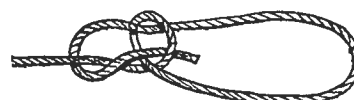


FIG. 22. Bowline.* A nonslipping eye. Will not jam. Easily untied. Efficiency 60 per cent.

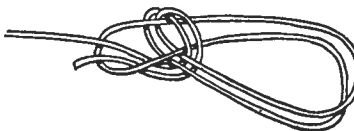


FIG. 23. Bowline on a bight. A non-slipping eye. Begin as an ordinary bowline, using two parts of the rope. After passing bight through loop, open it up and slip it over the entire loop.

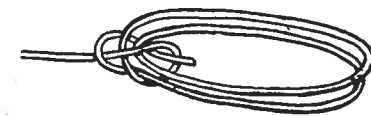


FIG. 24. Double bowline. A nonslipping eye. A comfortable sling to sit in.



FIG. 25. Running bowline. A strong running loop or noose.

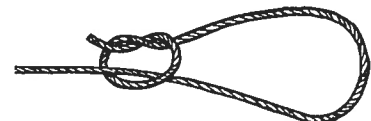


FIG. 26. Slip knot, or running knot. Not safe for heavy loads. Sometimes made with overhand knot at short end of rope.



FIG. 27. Midshipman's knot. An adjustable noose.



FIG. 28. Fisherman's eye knot, Flemish loop. A fixed loop. Used on small-size cord, etc.



FIG. 29. Double overhand knot, or loop knot. A fixed eye. Lacks strength. Will not slip, but jams.



FIG. 30. Two half hitches, or studding-sail tack bend.* For attaching rope to a ring.

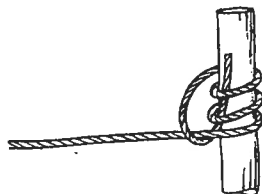


FIG. 35. Studding-sail hitch. For fastening a rope at right angle to a post. For hoisting timber, etc.



FIG. 31. Round turn and double hitch. For securing a rope to a ring. Should not be used for hoisting.

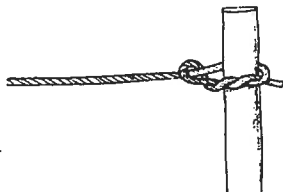


FIG. 36. Timber hitch. For fastening a rope at right angle to a post. Will not slip under load, but will readily loosen when strain is relieved. Efficiency 65 per cent.

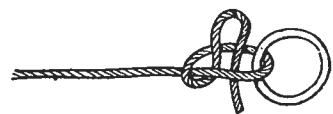


FIG. 32. Slippery ring. For temporarily securing a rope to a ring. Easily untied by pulling end of rope.

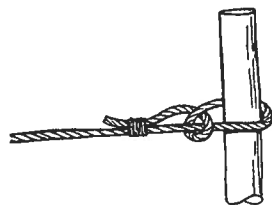


FIG. 33. Half hitch and seizing. Not recommended unless end of rope is strongly seized to standing part.

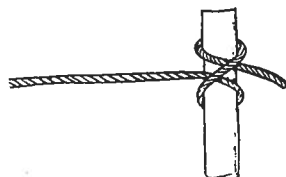


FIG. 37. Clove hitch, two half hitches, heaving line bend, or builders' knot.* For securing a rope at right angle to a post.

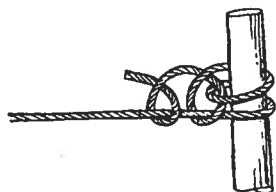


FIG. 34. Fisherman's bend, anchor knot, or bucket hitch. For fastening a rope to a ring or post.

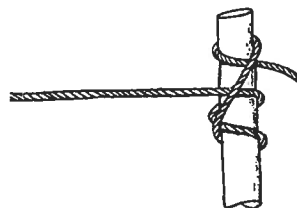


FIG. 38. Mooring knot, or magnus hitch (also see rolling hitch). For fastening a rope at right angle to a post.



FIG. 39. Mousing.* Rope yarn placed on hook to prevent load from becoming detached.

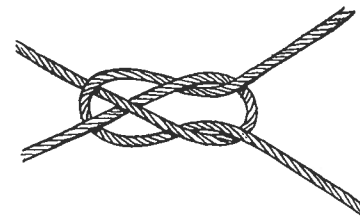


FIG. 44. Sheet bend, hawser bend, weaver's knot, mesh knot, or netting knot. Method of joining ropes or cords in a net.

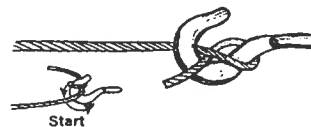


FIG. 40. Blackwall hitch.* For temporarily attaching a rope to a hook. Will not slip if rope is dry.

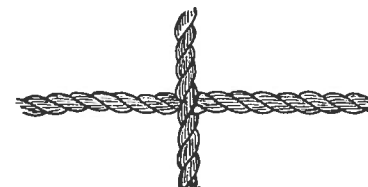


FIG. 45. 90-deg net splice. For joining ropes of a net that run at 90-deg angle to each other. Unlay one strand of one of the ropes, tuck this strand under one strand of the other rope, and then re-lay in its original position in the rope.

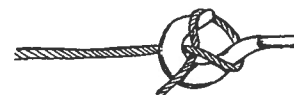


FIG. 41. Midshipman's hitch. For temporarily attaching a rope to a hook. Will hold even if rope is wet.



FIG. 42. Double Blackwall hitch. For temporarily attaching a rope to a hook. Will not slip even if rope is wet or greasy.

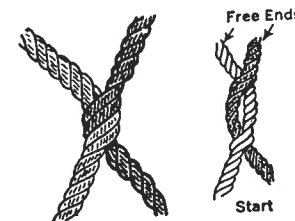


FIG. 46. 60-deg net splice. For joining ropes of a net that run at 60-deg angle to each other. With free end of ropes toward top of sketch, open up the white rope and pass shaded rope under two strands of the former. Then open up the shaded rope and pass the end of the white rope under two strands of the shaded rope. Then pull together as shown.



FIG. 43. Cat's-paw, or rocking hitch. For attaching a rope to a tackle block.



FIG. 47. Strap on a rope. A means of securing a grip on a rope under strain.

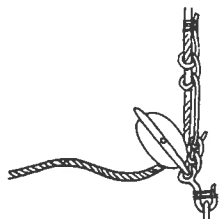


FIG. 48. Strap on a rope. A means of securing a grip on a rope temporarily so as to relieve the strain on the latter.



FIG. 49. Rolling hitch.* For fastening a rope to another rope or a pole parallel to it. For attaching a life-belt rope to a hanging life line. Grips tightly if pulled in direction shown, but is easily moved along rope or pole when strain is relieved.

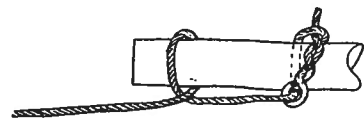


FIG. 50. Timber hitch and half hitch.* For hoisting or hauling poles, pipes, etc. Easily released when strain is relieved.



FIG. 51. Well pipe hitch. For hoisting or hauling pipes and poles.



FIG. 52. Telegraph hitch. For hauling poles and logs.

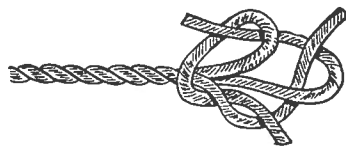


FIG. 53. Wall knot. A stopper, to prevent unlaying of strands at end of rope. Generally used in combination with crown knot.



FIG. 54. Crown knot.* A stopper, to prevent unlaying of strands at end of rope. Generally used in combination with wall knot.



FIG. 55. Stevedore's knot. To prevent unreeving of rope.

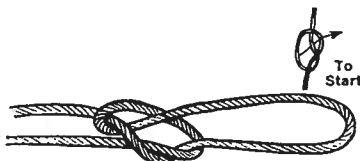


FIG. 56. Harness hitch. For attaching men to a toe line, loops being placed over the men's bodies. If only one end of rope is subject to pull, knot will slip.

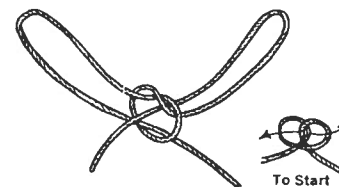


FIG. 57. Single pitcher knot, or rope handcuffs. A sling for handling balls, round rocks, etc. Also loops may be used as handcuffs.

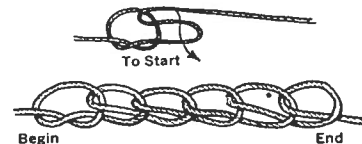


FIG. 58. Chain knot. For shortening a rope without cutting it. For forming a hand grip on a rope.

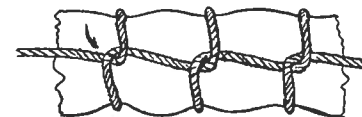


FIG. 59. Marling hitch. For bundling up canvas, etc.

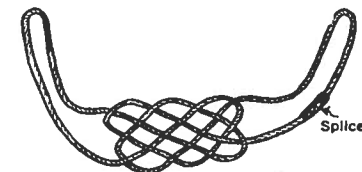


FIG. 60. Western ocean plant. A sling for handling shafts, armatures, etc.



FIG. 61. Whipping.* To prevent unlaying of strands at end of rope. For binding a split pole or for locking two poles together. Start by placing bight along rope, then wind cord on rope starting from bight end A. Finish by passing end of cord B through bight, which is under whipping. Then pull on end A until interlocked bights are under middle of whipping. Cut off loose ends.



FIG. 62. Grommet. An endless rope of one strand only, it makes three complete loops. To terminate, divide strands as shown and tuck as in short splice.



FIG. 63. Eye splice.* Tuck each strand four times. Then, if desired, divide each strand in half and cut off one end. Tuck the other, and then divide; cut, and tuck again to make a neater job.

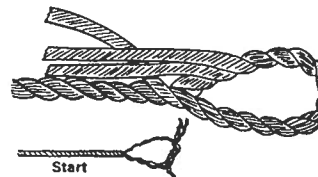


FIG. 64. Flemish eye splice. Unlay one strand the required distance. Then form a loop of the two remaining strands, and lay the first strand back in its former place in the rope but in the reversed position relative to the other strands. Terminate by tucking as in ordinary eye splice.

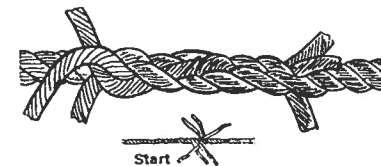


FIG. 65. Short splice.* For joining two ropes together. Splice will not pass through pulley blocks. Unlay each rope fifteen times its diameter. Place ropes together as shown. Tuck each strand under one strand in the other rope, then over one strand and under one strand. This makes two tucks each side of center.

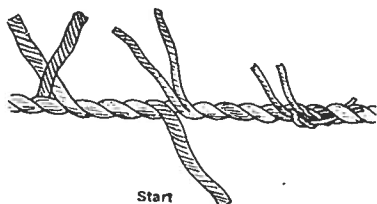


FIG. 66. Long splice. For joining two ropes together (three-strand rope shown). Will pass through pulley blocks. Unlay each rope for a distance equal to twenty-five times its diameter, and place together as shown. Unlay one strand in the left-hand rope, and wind in its place one strand from the right-hand rope. Repeat on other rope. To terminate, divide adjacent strands in half, tie half strands of left-hand rope to half strands of right-hand rope, and then tuck ends under strands.

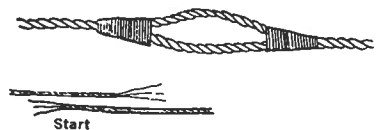


FIG. 67. Cut splice. An eye in the middle of a continuous rope. Place ropes as shown, and tuck as in eye splice.

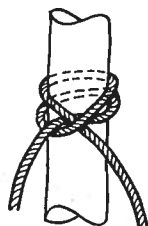


FIG. 68. Flagpole hitch. Similar to a clove hitch. For attaching a boatswain's chair to a pole.

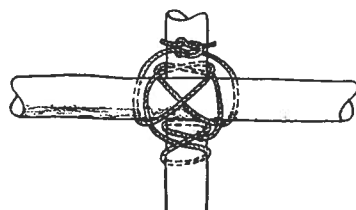


FIG. 69. Pole and ledger lashing. For lashing poles at right angles to each other.



FIG. 70. Pole lashing. For lashing two poles together. Two such lashings should be used.

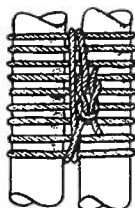


FIG. 71. Portuguese knot, or necklace tie. For lashing shear legs together. Spreading of legs puts strain on knot.

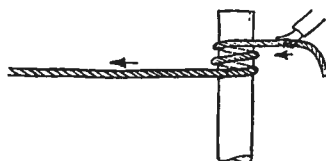


FIG. 72. Snubber.* For holding or slowly lowering a heavy load. Strain on hand line is only a fraction of strain on load line. Three or four turns should be taken.

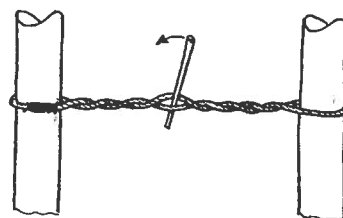


FIG. 73. Spanish windlass.* An endless rope used to pull two objects toward each other, similar to a turnbuckle. Stick is placed between parts of rope and rotated. To hold strain, the end of the stick is lashed to a fixed object.

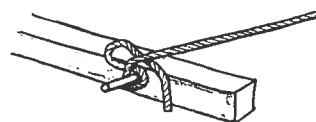


FIG. 74. Slippery hitch. A rope anchorage that is readily released by pulling on short end of rope.

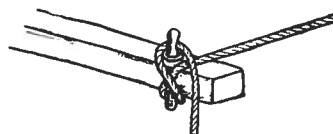


FIG. 75. Belaying-pin hitch. An anchorage for securing a rope. Several figure-eight turns may be required to hold the load. Easily cast off.

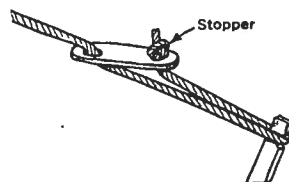


FIG. 76. Regulating lashing. For regulating the length of tent ropes.

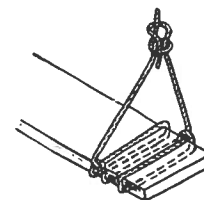


FIG. 77. Scaffold hitch. For suspending a scaffold plank. Will prevent plank from tilting. Can also be used on plank on edge.

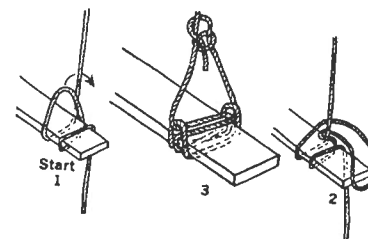


FIG. 78. Scaffold hitch. For suspending a scaffold plank. Will prevent plank from tilting. Can also be used on plank on edge.

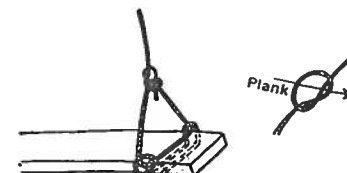


FIG. 79. Scaffold hitch. For suspending a scaffold plank. Will prevent plank from tilting. Can also be used on plank on edge.

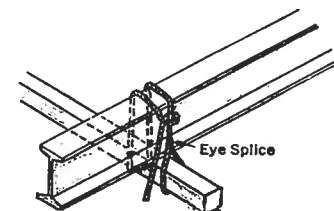


FIG. 80. Rivet scaffold hitch. For supporting needle beam of riveter's scaffold. Loose end of rope should be several feet long.



FIG. 81. Back hitch, or painter's scaffold hitch.* For securing hoist rope to scaffold stirrup.

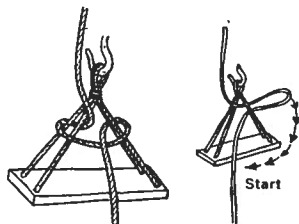


FIG. 82. Safety hitch for boatswain's chair. Make as shown, and slip loop under man's feet and up over his head. Cannot slip out of man's hands. To lower chair, feed rope into hitch.

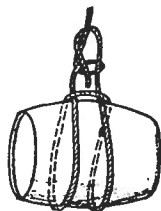


FIG. 83. Barrel hitch, horizontal. For hoisting a barrel or similar object.

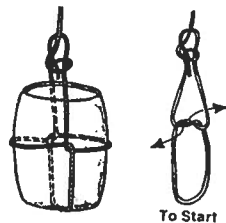


FIG. 84. Barrel hitch, vertical. For hoisting a barrel or similar object. Tie rope as shown, then pull parts as indicated by arrows.



FIG. 85. Sling for hoisting injured man. A cross lashing arranged as shown, and terminated with a bowline above the man's head.



FIG. 86. Back splice. A stopper to prevent unlaying of strands at end of rope. Also used as a handle. Start as a crown knot, then take several additional tucks.



FIG. 87. Crossed running knot. A slipknot.



FIG. 88. Reef knot on the bight. For shortening a rope without cutting. Both ends of rope may be anchored before tying knot.



FIG. 89. Buntline hitch. An adjustable noose.

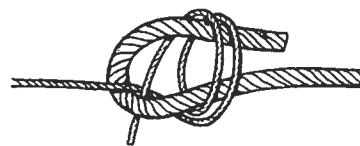


FIG. 90. Double sheet bend. For joining ropes of different sizes.

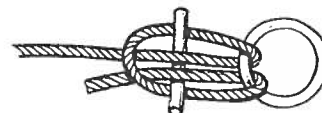


FIG. 91. Lark's head with toggle. Used as a boat fastening. Released by removing toggle.



FIG. 92. Carrick bend. For joining large hawsers. Will not jam.



FIG. 93. Sheet bend with toggle. For joining ropes of different sizes. Will not jam.

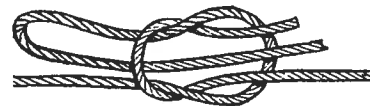


FIG. 94. Single bowknot. For joining cords. Readily untied by pulling on end of looped cord.

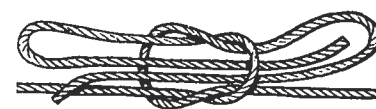


FIG. 95. Double bowknot. For joining cords. Readily untied by pulling end of either cord.



FIG. 96. Flemish knot. For joining two ropes.

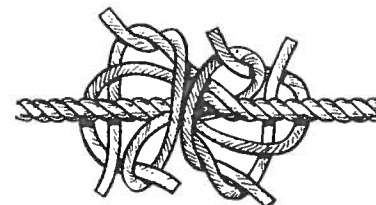


FIG. 97. Shroud knot. A type of splice for joining two ropes. Place ropes together as in making short splice. Make wall knot in end of each rope about the other rope. Taper strands and serve rope.



FIG. 98. Single Carrick bend. Similar to sheet bend. For joining two ropes of same or different sizes.



FIG. 99. Back-handed sailor's knot. For attaching a rope to a ring.



FIG. 100. Flemish eye knot. Safer than double overhand knot.

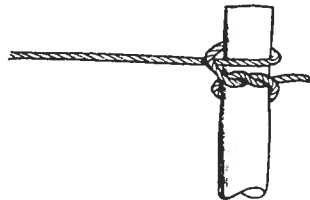


FIG. 101. Killick hitch. For securing a rope to a post. Formerly used to attach rope to a stone anchor.

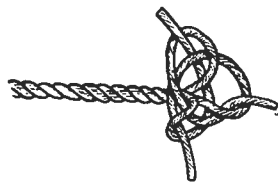


FIG. 102. Diamond knot. A stopper to prevent unlaying of the strands at the end of a rope.



FIG. 103. Sheepshank, knotted. For shortening a rope without cutting it. More secure than ordinary sheepshank.

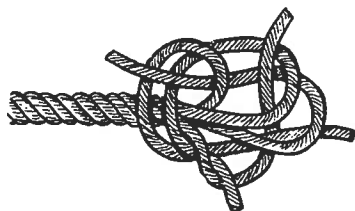


FIG. 104. Lanyard knot. To prevent unlaying of strands of a four-strand rope.

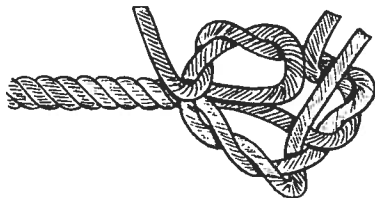


FIG. 105. Stopper knot. To prevent unlaying of strands.



FIG. 106. Rope yarn knot. For splicing yarns used for seizing and other purposes.

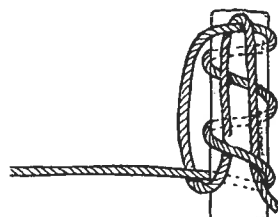


FIG. 107. Topsail halyard bend. For fastening a rope to a spar.



FIG. 108. Bell-ringer's knot. For temporarily tying up the lower end of a hanging rope.



FIG. 109. Coiling a rope, first position.



FIG. 110. Coiling a rope, second position.

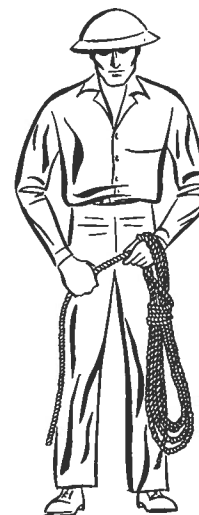


FIG. 111. Coiling a rope, third position.



FIG. 112. Coiling a rope, fourth position.