THE

BOOK OF KNOTS

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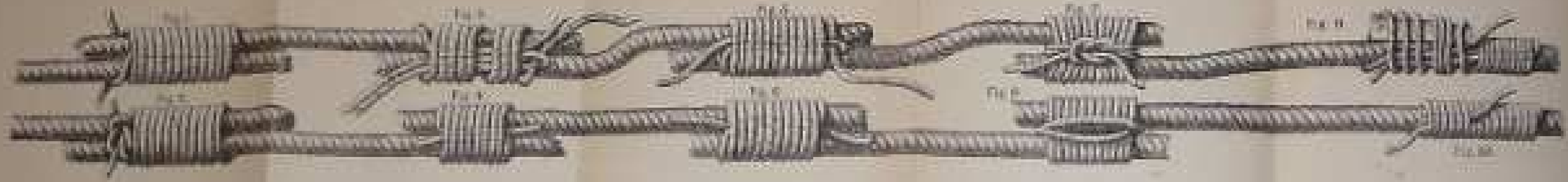

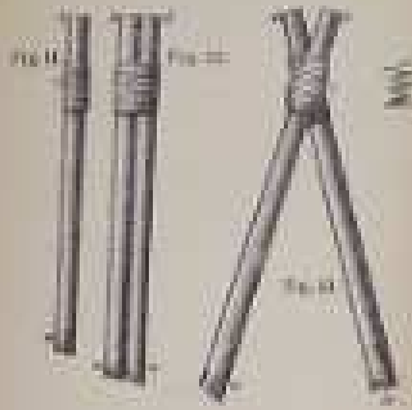

THE BOOK OF KNOTS

BEING A COMPLETE TREATISE ON

THE ART OF CORDAGE

ILLUSTRATED BY 172 DIAGRAMS

SHOWING THE

MANNER OF MAKING EVERY KNOT, TIE, AND SPLICE

BY 'TOM BOWLING'

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1890

TO

HIS ROYAL HIGHNESS

ALFRED ERNEST ALBERT

DUKE OF EDINBURGH,

EARL OF KENT AND EARL OF ULSTER,

K.G., K.T.

CAPTAIN IN THE ROYAL NAVY,

This Book of Knots

IS,

BY THE GRACIOUS PERMISSION OF HIS ROYAL HIGHNESS,

RESPECTFULLY DEDICATED.

INTRODUCTION.

THE GREAT USES to which Cordage is applied, render it necessary that some work of reference should be in the hands of every one employed in professions requiring its use in any form. It is not often that cords can be used without connecting them with other ropes or cords, or with the materials which form part of the operation. This renders it necessary that the connection or interlocking of Knots should be thoroughly studied. Knots are more or less complex, according to the purpose for which they are to be used; not only is it necessary to study their various interlockings, but also their especial uses. A knowledge of the materials of which cordage is composed is also essential, as in the various combinations, such as splicing, the work has to be tempered in the manner best fitted to the description of cordage used, as it often occurs that the operator has to 'unlay' and 'lay up' again for the various combinations in which Knots are necessary. A great variety of materials is employed in making ropes, but those in general use on board ships are composed principally of the filaments of hemp. A cord, therefore, is a combination of such filaments entwined with each other throughout their length,

and they are not knotted; the simple friction of the parts enables it to resist a strain.

If a long rope be made by uniting several small cords, it will be necessary to cross them for the greater part of their length, also twisting them together to a certain extent. The torsion tightens these filaments, and prevents them slipping one upon another. A line thus made can bear a great strain so long as it is twisted, but if the parts of which it is composed were left to their natural elasticity, the cord would untwist, the connection of its elementary parts be destroyed, and all its strength lost. It is therefore necessary, in ropemaking, to employ some means of maintaining the torsion which united the component parts. By combining several cords already twisted, this important object is attained, and is the groundwork of the art of cordage.

If we twist two cords of the same length separately more than is necessary for the union of their parts, and place them side by side (knotting together the corresponding ends), and then leave them to their own elasticity, they will each recover themselves in the same time and with equal force; and we should find that as the two untwist, they will lay themselves together in the opposite direction to that of their original turn, until the strength of each is equalised—thus forming a single rope which will not untwist further.

Ropemakers use a machine which spins the fibre into yarn. Other machines unite these yarns by laying their twist in

opposite directions to each other; and by laying them up together, this second operation produces small cord. 'Marline' is made in the same way, only with three parts. A larger number of yarns laid up make 'strands,' and by uniting these in precisely the same way, ropes are made bearing different names, according to their size and the number of strands used in their manufacture. These names vary according to the place and use to which such cordage may be applied; but we usually call a rope made of several strands a 'hawser,' and one composed of several hawsers a 'cable.' It is evident that the strong twist in opposite directions, which produces the connection of the strands, so entwines the filaments of hemp one with the other, that their friction alone enables them to bear a great strain, and that the strength of each fibre contributes to that of the rope, which will be the sum of the power of the several constituent parts.

The knots used in cordage may be classed as follows:—

1st. Simple or elementary knots.
2nd. Knots for uniting rope.
3rd. Ties and lashings.
4th. Shortenings.
5th. Anchor and mooring fastenings.
6th. Fastenings to piers or posts.
7th. Fastenings of small rope, shrouds, and ratlines.
8th. The ends of ropes.
9th. Splices.
10th. Bands or ligatures.

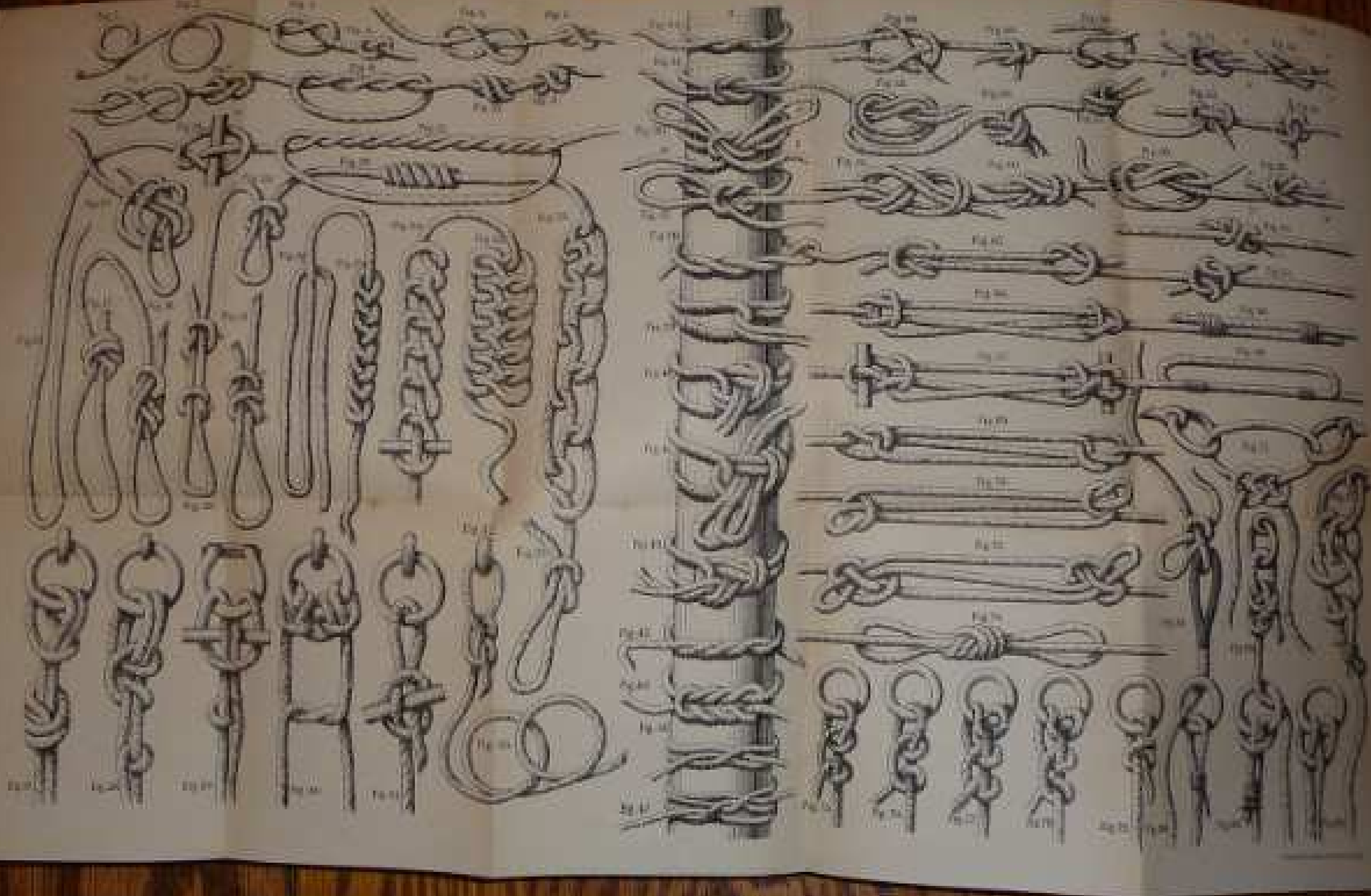

Fig. 1.

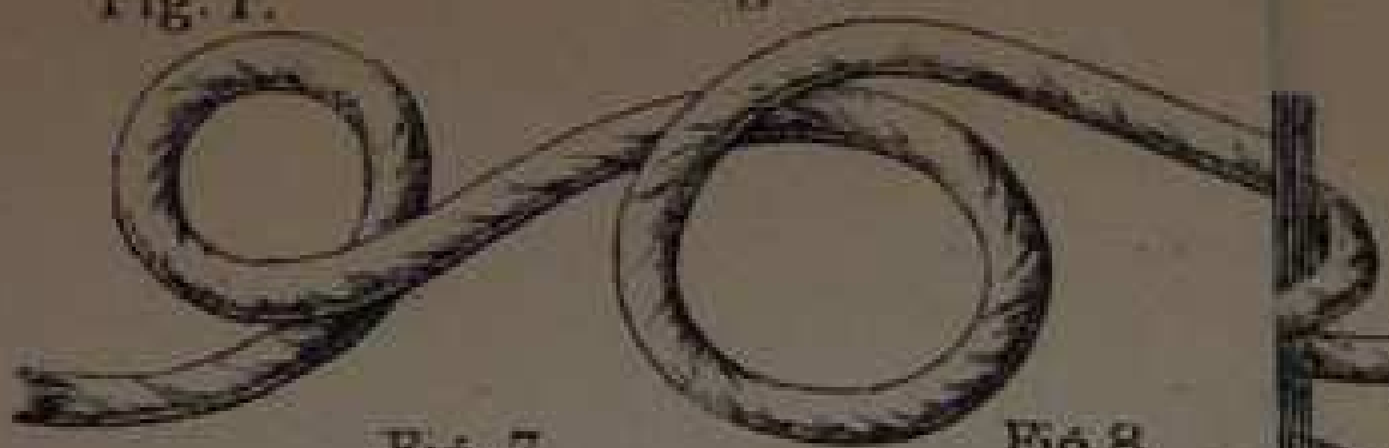

Fig. 2.

Fig. 7.

Fig. 8.

Fig. 14.

THE

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CHAPTER I.

SIMPLE OR ELEMENTARY KNOTS.

[*As kindred Knots sometimes necessitate a reference to more than one Plate, the numerals within brackets indicate the Plate.*]

FIGURES 1 and 2 [1] are loops shown in two ways. Most knots begin with a loop.

Fig. 3 [1]. A simple knot, commenced.

Fig. 4 [1]. Ditto, completed.

Fig. 5 [1]. Flemish knot, commenced.

Fig. 6 [1]. Ditto, completed.

Fig. 7 [1]. Knot in a rope, commenced.

Fig. 8 [1]. Ditto, completed.

Fig. 9 [1]. Double knot, commenced; the cord is twisted twice, passing twice through the loop.

Fig. 10 [1]. Double knot, finished (front view).

Fig. 11 [1]. Ditto (back view).

Fig. 12 [1]. Sixfold knot, commenced: the end is passed through the bight six times, or as often as may be necessary, according to the strength and length we wish to give the knot.

Fig. 13 [1]. Sixfold knot, complete; it is closed (or nipped), drawing the two ends with equal force.

Fig. 14 [1]. Boat knot: the line does not pass through the loop, but is held by a piece of wood (*a*), which passes under the cords (*b*), and which is held by its resting on the two sides (*c*, *d*) of the loop.

Fig. 15 [1]. Simple hitch: often used, like the loop, at the commencement of a knot.

Fig. 16 [1]. Loop knot, commenced.

Fig. 17 [1]. Ditto, finished.

Fig. 18 [1]. Flemish knot. The simple Flemish knot shown in figs. 5 and 6 is used in this.

Fig. 19 [1]. Running knot.

Fig. 20 [1]. Running knot to hold (*a*): the check knot is shown free of the knot (*b*) of the splice.

Fig. 21 [1]. Running knots fixed by the knot *a*, jamming against the knot *b*, of the bight. When a hitch is drawn so as to bite the parts (as in fig. 38), it is called a slipknot. We shall explain the uses to which it is applied.

Fig. 26 [2]. Bowline knot, for a man to sit in at his work.

Fig. 27 [1]. A slipknot (*a*), and check (*b*), to keep the tie in its place.

Fig. 28 [1]. Slipknot tied.

Fig. 33 [1]. Knotted loop for end of a rope.

Fig. 48 [2]. Loop for slipping other lines.

Fig. 49 [2]. A 'bend,' which is only used for fear of the stoppers snapping.

Fig. 50 [2]. Bastard loop, made on the end of the rope, and whipped with yarns.

CHAPTER II.

KNOTS FOR UNITING ROPES.

Fig. 48 [1]. Weaver's knot. Lay the ends of the two cords to be united between the thumb and first finger of the left hand (the right-hand end undermost), so as to touch the left-hand first finger; pass the right-hand cord *back* over the thumb to form a loop; bring it back *under* the thumb, and hold it fast, while the end of the other cord is put under and through it, thus making a second loop between the thumb and finger of the same hand; tighten it by drawing the right hand.

Fig. 49 [1]. Weaver's knot, completed.

Fig. 50 [1]. True or 'reef' knot, commenced.

Fig. 51 [1]. Ditto, complete. This is called a 'sailor's' or 'true' knot, and is most useful in working with small ropes, but is not applicable for uniting ropes of different sizes; as it will slip by drawing one of the ends a' in the direction of the cord a; it then takes the form shown in fig. 52, in which the part a slips freely in the two loops formed by the part b. To obviate this inconvenience, it is necessary to fasten the end a' to the cord b, and the end b' to b, by yarn or twine.

Fig. 53 [1]. False or 'granny' knot, in which the ends do not lay alongside each other.

Fig. 54 [1]. Shows this knot when there is a strain upon it, and it is evident that it is comparatively useless. If even we tie

the ends, it has not the same strength as the reef knot, because the ends are not laid fairly alongside their main parts.

Figs. 55, 56, and 57 [1]. Show what is termed an 'open-hand' knot.

Fig. 55 [1]. Shows the commencement of it.

Figs. 56 and 57 [1]. Show it complete or fast, the one being a front, the other a back view of the separate cords to be united. This knot is used for joining the ends of two ropes quickly; it will never slip nor untie. But when ropes are required to stand a great strain, as they are plaited three-strand, it is likely they may part at the knot.

Fig. 58 [1]. Tie, with an ordinary knot.

Fig. 59 [1]. The knot begun, but not drawn taut. In commencing a simple knot on the end of a rope, such as in fig. 3 [1], it must not be tightened, as we have still to pass the end of the *other* cord through the first loop of the last, making with it a second loop; thus interlaced, the knot is fixed by drawing the two ropes, and there is no better method of uniting cords. This has the advantage of being very strong, easy to make, without straining or 'unlaying' the fibres; and when hauled upon, it keeps the two ropes in a line, with their ends as they lay in the knot. We can, in addition, finish off the ends by 'whipping' them with small twine (at u' and x'); and though this may not be necessary for strength, it gives a neater appearance to the knot.

Fig. 60 [1]. Knot used for the same purpose as the simple Flemish knot, shown in fig. 5 [1].

Fig. 61 [1]. The same, before it is tightened.

Fig. 62 [1]. English knot, commenced.

Fig. 63 [1]. Ditto, drawn taut, seen in front.

Fig. 64 [1]. Ditto, at the back.

Fig. 65 [1]. Splice with two ties: this is very useful, but takes time.

Fig. 32 [1]. Shroud splice, or knot: it is made by means of two rings; we shall explain this knot in Chap. 8.

Fig. 60 [2]. 'Wedding' knot; *a* and *b*, eyelets; *c d*, the join; *e*, the fastening.

Fig. 62 [2]. A round turn; the cord *a* is passed through the bight of the cord *b*, over the button *c*, where it is secured by an ordinary knot.

Fig. 64 [2]. Round button.

Fig. 63 [2]. Belaying-pin splice. The cord *b* 'stops' the pin *e*, its end being spliced upon itself and 'served' with yarn; this rope, with its pin, is passed through the spliced eye *f*, of the line *g*.

Fig. 66 [2]. The belaying-pin shown separately, before being stoppered.

Fig. 40 [2]. Belaying-pin opened to serve as a button; these are used where it is necessary to stop or check velocity.

Fig. 58 [2]. Iron 'shell,' in two views.

Fig. 71 [2]. Wooden shell.

Fig. 69. Section of ditto.

Fig. 65 [2]. Joint by a spherical shell, each loop, *a*, and *b*, being made by ties or splices, and surrounding the shell *c*.

Figs. 10 and 11 [2]. Shell in two views, showing the disposition

of it at the 'throat.' This join is advantageous, as it does not strain the cords, and prevents them cutting each other: so that the rings pass one into the other, and are joined outside the intermediate shell.

Fig. 73 [2]. Lashing for 'Ram' block or 'Dead Eye.' The ram blocks, *a* and *b*, are strapped by the cords *c*, *e*, which hold them; the small lanyards, *d*, pass through the holes to make the connection, and as they are tightened give the requisite tension to the cordage; the ends are fastened to the main rope. Usually one of these dead-eyes is held by an iron strap to the point where it is required to fix and strain the cordage, which is ordinarily a shroud.

Fig. 19 [2]. Dead-eye, shown in two views.

CHAPTER III.

TIES AND LASHINGS.

Fig. 34 [1]. Simple knot, commenced.

Fig. 35 [1]. Ditto, finished. This knot is similar to that in fig. 51 [1], except that it surrounds and holds the object A. In making this knot, it is necessary to use an auxiliary pressure, to keep the first simple knot tight.

Fig. 36 [1]. The same knot with two turns, vulgarly called a 'rosette.' This method makes it easy to untie, as it is only

necessary to pull the ends, *a b*, to undo the loops, *c d*, and reduce the knot to the simple form of that shown in fig. 34.

Fig. 37 [1]. Knot with single turn, which unties with equal facility. Whether we make a 'true' knot with or without hitches, it is necessary to lay the strands exactly as in the ordinary reef knot; otherwise a 'granny' or 'calf' knot will be produced, which will not hold.

Fig. 38 [1]. Timber hitch, or slipknot with a double hitch. We have already said that a hitch is a turn over the 'standing part;' it may be double or treble, as it may be twisted twice or thrice. The strain on the rope makes the cord underneath hold fast, because of the friction between it and the object it is round. This friction increasing in the same ratio as the strain, no force will *untie* it.

Fig. 39 [1]. Running knot with two ends.

Fig. 40 [1]. Running knot with two ends, with a check knot, which cannot be untied without using a marlinspike. See figs. 34 and 35 [2].

Fig. 41 [1]. Running knot at both ends, with check knot to running loops, which can be untied by drawing both ends of the cord.

Fig. 42 [1]. Running knot, fixed by a Flemish knot. When an object is to be encircled by a running knot, it is necessary to pass the end on which the check knot is to be through the cords, as that cannot be done after they are drawn tight.

Fig. 43 [1]. Ordinary twist knot. The twist that is given to the two ends of the cord, in this case, produces between them a

friction, such that the knot will hold long enough to make the second turn which completes the tie.

Fig. 44 [1]. Double twist knot, which will sufficiently hold by itself.

Fig. 46 [1]. Builder's knot. This knot is used by workmen in securing building materials, as when it is tied it cannot come undone, because of the great friction of the parts.

Fig. 45 [1]. The form of the loops for a builder's knot previous to placing it on the object to be secured.

Fig. 47 [1]. Double builder's knot, whch is considerably stronger. The Gunner's knot (of which we do not give a diagram) only differs from the builder's knot, by the ends of the cords being simply knotted before being brought from under the loop which crosses them.

Fig. 13 [3]. Portuguese knot. This name is given to a lashing for shear legs, and must be sufficiently tight to prevent the spars slipping on each other; the crossing of the two legs gives the means of completely securing the knot.

Figs. 11 and 12 [3] show the commencement of this knot. In fig. 11 the legs are shown in elevation, fig. 12 being a front view. An ordinary band, made by several turns of a small rope, is lapped around them and hauled taut, and then interlaced at the ends. This done, we shift the legs into the shape of a St. Andrew's cross. By this means the lashing is tightened, and to further secure it, we pass the line several times over the tie and between the spars, knotting the ends.

Fig. 14 [3]. Packing knots are used for binding timbers together; *a*, knot commenced. Take several turns of the rope

round the timbers, and fasten the ends by passing them under the turns; *b*, knot completed. We pass the end of a round stick, *m n*, termed a 'packing stick,' under the knot, the cord having been left a little slack to allow of this. Then by turning the stick, *m n*, we tauten all the turns (on which it acts like a lever) to any required extent · when sufficiently tight, we fasten the longer arm of this lever to some fixed point by a rope, *p q*, so that it cannot fly back. We must be careful not to give the stick more turns than is really necessary to secure the timbers, or the rope would be broken. As the timber dries, and consequently shrinks, the lever can be again twisted as much as may be necessary.

CHAPTER IV.

SHORTENINGS.

It is often found in the course of the work that the rope is too long, and must be at once shortened, without however cutting it; in such cases shortening knots are used.

Fig. 22 [1]. Double loop for the commencement of a 'twist' knot.

Fig. 23 [1]. The same, completed. To make this knot, take a half turn, on both the right-hand and left-hand cords, *a* and *b*, and pass the end *c* through each of these bights.

Fig. 24 [1]. Chain knots. This is made by a series of loops

passing one through the other, and is fastened by putting the end through the last loop, or with a belaying-pin, as in fig. 14.

Fig. 25 [1]. Double chain knot.

Fig. 26 [1]. Ditto, secured. This knot is made by successive loops, formed by passing the end right and left alternately into the preceding loop.

Fig. 66 [1]. Shortening by loops and turns. This can only be used where the end of the rope is free.

Fig. 67 [1]. Shortening knot. This can be made when *either* of the two ends is loose.

Fig. 68 [1]. The same, with double bend and ties.

Fig. 69 [1]. Ditto, passing through the knots. This knot can only be used when one end is free.

Fig. 70 [1]. Dogshank or 'sheepshank.' This can be used when the ends are fast, but it is not advisable, as the loops may allow the shanks to 'give,' and consequently to slip or perhaps break; to secure it, we must therefore 'seize' the shanks to the ropes with stout yarn.

Fig. 73 [1]. Dogshank, 'seizing' being unnecessary.

Fig. 74 [1]. Ordinary knot of three parts, forming two loops. This can only be made where the ends are free.

CHAPTER V.

ANCHOR AND MOORING FASTENINGS

An anchor has a large ring, to which the end of a line is attached, for the purpose of holding fast the object to which the other end is fixed.

Fig. 27 [1]. Lark's head.

Fig. 83 [1]. Ditto, stoppered.

Fig. 84 [1]. Ditto, crossed.

Fig. 28 [1]. Ditto, double-looped.

Fig. 29 [1]. Ditto, on the ring of a boat. This knot is advantageous, as it can be released *instantly* by withdrawing the pin which constitutes the 'lark' knot.

Fig. 30 [1]. Treble lark's head.

Fig. 31 [1]. Simple boat knot with one turn

Fig. 32 [1]. Crossed running knot.

Fig. 71 [1]. Knot connecting two rings, called by gunners a 'check' or 'delay' knot.

Fig. 81 [1]. Fastening of running knot on a bight

Fig. 82 [1]. Capstan knot.

Fig. 72 [1]. Slipknot.

Fig. 23 [2]. Slip clinch to sailor's knot.

Fig. 24 [2]. Ditto, secured.

Figs. 75 and 76 [1]. Sailor's knot.

Figs. 77 and 78 [1]. Reverse or back-handed knot.

Fig. 79 [1]. Fastening of simple running knot.

Fig. 80 [1]. Fastening stoppered.

CHAPTER VI.

FASTENINGS TO PIERS OR POSTS.

FIG. 56 [2]. Simple fastening to tie.
Fig. 61 [2]. Lark's-head fastening to running knot.
Fig. 53 [2]. Waterman's knot.
Fig. 55 [2]. Tie or bend to pier.
Fig. 74 [2]. Chain fastening.
Fig. 72 [2]. Double ditto.
Fig. 67 [2]. Fastening to shears.
Fig. 57 [2]. Fastening by a loop. This can be tied or untied without loosening the loop itself: it is made by following, towards the longer loop, the direction as numbered 1, 2, 3, 4, 5, and is terminated by the loop 6, 7, 6, finally passing it over the head of the post, A. This knot holds itself, the turns being in opposite directions. To untie it, we slack the turns of the cable sufficiently to again pass the loop 6, 7, 6, over the post A, and turn the ends in the contrary direction to that in which they were made (as 5, 4, 3, 2, 1).

Fig. 68 [2]. Square mooring. When the cable is round the post A, and the piece *c*, without being crossed, it lays in the direction 1, 2, 3, 4, 5, 6, 7, and the end is fastened by tying.

Fig. 70 [2]. Crossed fastening. The turns of the cable, passing in front of the post B, are crossed at the back of C, in the direction 1, 2, 3, 4, 5, 6, 7, 8, the end 8 being secured to the cable.

CHAPTER VII.

FASTENINGS OF SMALL LINES.

FIG. 51 [2]. Tie to pins: *a*, the pin; *b*, small cords fixed by a cross-tie.

Fig. 52 [2]. Cleet fixed to the 'rail' either with screws or nails, to which the lines are belayed.

Fig. 47 [2]. The same, to be fixed to a stay.

Fig. 43 [2]. Ditto, with three ties.

Fig. 44 [2]. Cleet, showing the mode of belaying the cord.

Fig. 42 [2]. Variable, or regulating lashing. By laying the piece, *a f*, horizontally, it can be slipped along the rope, *b*; by raising or lowering this, we shall raise or depress the weight, *c*, the cord (*b*) running over the two pulleys, *d*, from the piece *a f* (to which it is attached by the knot *f*) in the direction shown in the figure. The friction of the cord *b*, passing through the hole *e*, sufficiently fixes the piece *a f*, and holds the weight *c* securely.

Fig. 45 [2]. The piece *a*, *f*, of the preceding figure, showing manner in which the cord is passed.

Fig. 46 [2]. Fair-leader.

Fig. 54 [2]. Fair-leader.

Fig. 31 [2]. Simple fastening on a rope.

Fig. 41 [2]. Chain knot or fastening.

Fig. 37 [2]. Fastening when a lever is used. These three are employed when hauling upon large ropes, where the strength of several men is necessary.

CHAPTER VIII.

THE ENDS OF ROPES.

When we make constant use of cordage, the ends will separate and untwist, and in fact become unserviceable. To prevent this deterioration, we may use various means, according to the purpose for which the cordage is required. We may simply tie the ends tightly with twine, as in fig. 6 [2], passing the ends under the whipping.

Fig. 9 [2] shows this tie commenced, as also the manner in which the two ends of the twine which form the ligature are worked into the rope, and held under the tie. The first turns of the ligature are taken under one end of the rope, thus holding it securely, the second end being held by the turns in the same manner: these we lay over the pin *p*, so that by loosing the turns of the rope, we can put the other end under and through the first; having taken a sufficient number of turns, and passed the end of the rope through them, we remove the pin, tighten the turns one by one, draw the end fast, and cut off the superfluous parts.

Fig. 1 [2]. Turn used in making up ropes.

Fig. 4 [2]. Double ditto, for the same purpose.

Fig. 5 [2]. Eyesplice. The strands of the cable are brought back over themselves, and interlaced with their original turns, as in a splice.

Fig. 2 [2]. End tapered, for the purpose of passing it readily

through a loop. To make this, we unlay the rope for the necessary length, reducing the strands and laying the ends together, so as to produce a rope diminishing in diameter towards the end, which is finished by interlacing the ends *without cutting them*, or we should weaken the work; it is lastly 'whipped' with small twine.

Fig. 3 [2]. Tapered end, covered with interlaced cordage, for the purpose of making it stronger. This is done with very small twine, attached at one end to the small eye, and at the other to the strands of the rope, thus making a strong 'webbing' around the end.

Fig. 6 [2]. Tie for the end of a four-strand rope.

Fig. 7 [2]. The same, completed: the strands are tied together, forming loops, laying one over the other.

Fig. 13 [2]. Another mode of finishing the end, by several turns of the twine continued over the cable.

Fig. 8 [2]. Commencement for making the end by interlacing the strands.

Fig. 14 [2]. Interlacing commenced in *one* direction.

Fig. 12 [2]. Ditto, continued in two directions.

Fig. 9 [2]. Ditto, complete but not fastened.

Fig. 17 [2]. The same, fastened.

Fig. 15 [2]. The same, finished, the ends being worked under the strands as in a splice.

Fig. 16 [2]. 'Pigtail,' commenced.

Fig. 18 [2]. Ditto, with the strands taut.

Fig. 20 [2]. Ditto, finished. We pass the ends of the strands one under the other, in the same way as if we were making a

'pudding;' thus bringing it in a line with the rope, to which it is seized fast, and the ends cut off fair.

Fig. 21 [2]. Skull pigtail; instead of holding the ends by a tie, we interlace them again, as in fig. 16 [2], the one under the other.

Fig. 22 [2]. 'Pigtail,' or 'lark's nest.' We make this to the 'pennant' of a cable, which has several strands, by taking the requisite number of turns over the pudding, in such a manner that the strands shall lay under each other. This 'pigtail' forms a knot at the end of the rope. It thus draws together two ropes, as we have shown in fig. 32, forming a 'shroud' knot. In these two pigtails the strands are *crossed* before finishing the ends, so that the 'button' a' is made with the strands a and b' with those of the rope b.

Fig. 25 [2]. Ordinary knot upon a double rope.

CHAPTER IX.

SPLICES.

It is often requisite in the course of the work to 'piece' a rope; where, however, knots would be troublesome, or perhaps make it impossible to use a cord joined in that manner, when it has to go through such openings as we have described in Chap. 2, where a knot could not pass. In such cases we make the connection by means of a 'splice,' which forms a

joint but little larger than the cord itself, and sometimes of exactly the same size; of these there are various sorts, named according to the manner in which they are made.

Fig. 29 [2] is called a 'short splice,' as it is not of great length, and besides can be made quickly.

Fig. 33 [2]. The ends of the ropes are prepared for making the splice (fig. 29), in the same manner as for the shroud knot in fig. 32 [2]. When the strands are untwisted, we put the ends of the two cords together as close as possible, and place the ends of the one between the strands of the other, above and below alternately, so as to interlace them (as shown in fig. 29). This splice is not, however, very strong, and is only used when there is not time to make a long splice, which is much the best.

Fig. 30 [2]. Long splice. This extends from A to B. We unlay the strands of each of the ropes we intend to join, for about half the length that the splice will be, putting each strand of the one between two strands of the other.

Fig. 36 [2] shows the strands arranged as we have described.

Fig. 39 [2] shows two strands, a and b, of the ropes, A B, knotted together, being drawn as tight as possible; we unlay the strand a' of the rope A for half the length of the splice, and twist the strand b' of the rope B strongly in its place, tying a' and b' together tightly. The same process is again gone through on the rope B, the strand a'' of the rope A being knotted to the strand b'' of the rope B. When all the strands are thus knotted together, we interlace them with the strands of the cable. Thus the strands a, a', a'' are interlocked by being passed alternately above and below the turns of the cord B, the ends being also

sometimes 'whipped.' In the same manner the strands b, b', b'' pass alternately over and under the strands of the rope A, and are in like manner 'whipped.' It is important that the several interlacings and knots should not meet at one point; we reduce the size of the strands towards the end, so that they lose themselves in the body of the splice, cutting off such parts as may project. This splice is employed for joining the ends of a rope where a *chafed* part has been cut out, and is quite as strong as the rope itself.

Fig. 38 [2] is a 'pudding' splice. This is commenced, like the others, by placing the ropes end to end, the turns of the one being passed between those of the other: having first swelled out the yarns by a rat's-tail, we put them two by two, one over the other, twisting them tightly, and opening a way for them with the marlinspike. The inconvenience of this splice is, that it is larger in diameter than the rope itself; but when made sufficiently long, and gradually reducing the size of the strands, it has great strength.

Figs. 34 and 35 [2]. Marlinspikes. Tools made of wood, or iron, used to open out a rope, to pass the strands of another through it.

CHAPTER X.

BANDS OR LIGATURES.

Fig. 1 [3]. Simple band, showing the upper side.
Fig. 2 [3]. The same, showing the under side and the knot.

Fig. 3 [3]. Tie with crossed ends, commenced; a turn is taken under the strands, to hold the ends of the cord.

Fig. 4 [3]. The same, completed.

Fig. 5 [3]. Bend with crossed strands, commenced, the one end being looped over the other.

Fig. 6 [3]. Ditto, complete.

Fig. 7 [3]. Necklace tie, seen on the upper side.

Fig. 8 [3]. Ditto, seen underneath. The greater the strain on the cords, the tighter this knot becomes.

ROUND WIRE ROPES

FOR INCLINED PLANES, MINES, COLLIERIES, SHIPS' STANDING RIGGING, ETC.

Hemp		Iron		Steel		Equivalent strength	
Circumference	lbs. weight pr. fathom	Circumference	lbs. weight pr. fathom	Circumference	lbs. weight pr. fathom	Working load	Breaking strain.
						cwt.	tons
2¾	2	1	1	. .	. .	6	2
		1¼	1½	1	1	9	3
3¾	4	1½	2	. .	. .	12	4
		1¾	2½	1½	1½	15	5
4½	5	1¾	3	. .	. .	18	6
		2	3½	1⅝	2	21	7
5½	7	2⅛	4	1¾	2½	24	8
		2¼	4½	. .	. .	27	9
6	9	2⅜	5	1⅞	3	30	10
		2½	5½	. .	. .	33	11
6½	10	2⅝	6	2	3½	36	12
		2¾	6½	2⅛	4	39	13
7	12	2⅞	7	2¼	4½	42	14
		3	7½	. .	. .	45	15
7½	14	3⅛	8	2	5	48	16
		3¼	8½	. .	. .	51	17
8	16	3⅜	9	2⅜	5½	54	18
		3½	10	2½	6	60	20
8½	18	3⅝	11	2¾	6½	66	22
		3¾	12	. .	. .	72	24
9½	22	3⅞	13	3⅛	8	78	26
10	26	4	14	. .	. .	84	28
		4⅛	15	3⅜	9	90	30
11	30	4¼	16	. .	. .	96	32
		4⅜	18	3½	10	108	36
12	34	4½	20	3¾	12	120	40

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FLAT WIRE ROPES.

FOR PITS' HOISTS, ETC.

Hemp		Iron		Steel		Equivalent strength	
Size in inches	lbs. weight pr. fathom	Size in inches	lbs. weight pr. fathom	Size in inches	lbs. weight pr. fathom	Working load	Breaking strain
						cwt.	tons
4 + 1 1/2	20	2 1/4 + 1/2	11	. .	. .	44	20
5 + 1 1/2	24	2 1/2	13	. .	. .	52	23
5 1/4 + 1 1/2	26	2 3/4 + 3/8	15	. .	. .	60	27
5 3/4 + 1 1/2	28	3	16	2 + 1/2	10	64	28
6 + 1 1/2	30	3 1/4	18	2 1/4 + 1/2	11	72	32
7 + 1 1/2	36	3 1/2	20	2 1/2 + 1/2	12	80	36
8 1/2 + 2 1/2	40	3 3/4 + 11/16	22	2 3/4 + 1/2	13	88	40
8 1/2 + 2 1/2	45	4	25	2 3/4 + 5/8	15	100	45
9 + 2 1/2	50	4 1/4 + 3/4	28	3 + 5/8	16	112	50
9 1/2 + 2 1/2	55	4 1/2	32	3 1/4	18	128	56
10 + 2 1/2	60	4 7/8	34	3 1/2	20	136	60

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