Rope-*Making*, the art of preparing hemp, and spinning it into yarns or threads, and twisting those threads into strands, and laying those strands into cordage of the largest size, as the smallest kind is called *cord* or *twine* spinning.

Before we proceed further, it may be necessary to inform our readers of the different sorts of hemp proper to be made use of in the manufacturing of cordage. Of all the hemps yet produced at our English markets, the Russian hemp has proved to be the best; it is grown in the southernmost parts of Russia, and shipped for England from the ports of St. Petersburgh and Riga. The best sort is Riga rhine hemp: the next in quality is termed Petersburgh clean hemp. These two are considered the best sorts of hemp to be used in making the strongest cordage.

The first process in the art of rope-making is, *Hatchelling the Hemp.*

Hatchelling the hemp, is the combing or clearing the ends, which else, in spinning, would run in with the long hemp, and so preparing it ready for the spinner; in the process of which, care and particular attention must be paid by the hatchellers that they do not use too great a quantity of oil, as in such case it will prevent the yarn from imbibing its proper proportion of tar, and thereby prove a serious injury.

N. B. A small quantity of train-oil, say one pint to every hundred weight, sprinkled or daubed with a wad on the hemp, facilitates the hatcheller's business exceedingly, and is very necessary when the hemp is somewhat too dry, as the spinners are better able to perform their business when it has received such assistance.

The second and principal process to be attended to in the manufacturing of cordage, is *Spinning the Yarn.*

In spinning, particular attention must be paid by the spinner that the yarn be spun even, solid, and round; to accomplish which, he must spin with a strong even grip of the hand, taking care not to make his yarn larger in one place than in another, nor make a practice of spinning too much in a hurry; and the spinning-wheel must be kept turning a constant regular pace, otherwise the yarn so spun will lose its principal support, which is its proper turn, or twist, and will be little stronger than a parcel of straight hemp laid together, which would break in warping or straining up. The following regulations must be attended to in spinning. Every spinner is to spin out of the best hemp six threads, one hundred and sixty fathoms long, for a quarter of a day's work; but he is to spin out of the hemp which compose the bands by which the bales of hemp are bound together, no more than four threads, one hundred and sixty fathoms long, for one quarter of a day's work. To every twelve spinners there are allowed two hatchellers, one wheel-turner, and one wheel-tender: the wheel-tender's business is to splice the threads, and wind them on winches. The latter mentioned persons are paid in the same proportions as the spinners, that is, according to what work is done upon the wheel, only with this difference, the spinners are paid seven-pence *per* quarter for their work, the hatchellers, wheel-turner, and wheel-tender, only sixpence.

Each thread of the under-mentioned sizes of yarn to the spinning mark, (*viz.* 160 fathoms,) should weigh as follows:

	lbs.	oz.	drs.		lbs.	oz.	drs.
16	4	0	0	21	3	0	4
17	3	12	4	22	2	14	9
18	3	8	14	23	2	12	8
19	3	5	14	24	2	10	10
20	3	3	3	25	2	8	15

The third process to be attended to in the manufacturing of cordage, is *Warping the Yarn.*

Warping the yarn, is the stretching the yarns, previously to their being tarred, all to one given length, which, in full length rope grounds, is two hundred fathoms, and putting a slight turn or twist into it. The usual method is to warp the yarn either in whole or half hawls, which is done by putting the number of threads you mean to draw down at once in a bite, into a block with one sheave, (the one end of the bite of yarn being fast at the upper end,) which being drawn down and fixed over the end of a hook made fast to a post at one hundred fathoms distance from the warping post, forms, when opened, a length of two hundred fathoms, as above-mentioned. The number of half bites, or blocks of yarn, contained in a whole or half hawl, is to be governed, in a great measure, by the size of the yarn to be warped,—as, for instance, 16 to 19-thread yarn is warped three hundred and thirty-six threads in a hawl, 20 to 25-thread yarn is warped four hundred threads in a hawl. In winding the yarns on the winches after they are spun, it is most usual to wind them on in companies of four in a company; but as that method can-

not always be purfued, it frequently happens that whole or half hawls of yarn are obliged to be warped in half bites of an odd number.

The following rules and regulations refpecting the warping of yarn muft be particularly attended to.

In a hawl of yarn containing three hundred and thirty-fix threads, there fhould be warped as under-mentioned.

½ Bites.	Threads.			
37	3	of	9	threads in a ½ bite.
33	6		10	ditto.
30	6		11	ditto.
28	0		12	ditto.
25	11		13	ditto.
24	0		14	ditto.
22	6		15	ditto.
21	0		16	ditto.
19	13		17	ditto.
18	12		18	ditto.
17	13		19	ditto.
16	16	,	20	ditto.

In a hawl of yarn containing four hundred threads, there fhould be warped as under-mentioned.

½ Bites.	Threads.			
44	4	of	9	threads in a ½ bite.
40	0		10	ditto.
36	4		11	ditto.
33	9		12	ditto.
30	11		13	ditto.
28	8		14	ditto.
26	10		15	ditto.
25	0		16	ditto.
23	9		17	ditto.
22	4		18	ditto.
21	1		19	ditto.
20	0		20	ditto.

When the yarn is warped in half hawls, it is to be carefully obferved that only half the number of yarns, or threads, above-mentioned, are to be warped, and care fhould be taken to warp the number of threads as near as poffible.

It requires three men to warp a hawl of yarn, who are employed as follows: _viz._ two men to warp (or draw the yarns to their proper diftance), and one man to fet up (that is, to tighten the yarns, and bring each yarn to its proper bearing): each man is allowed twelve threads (or two quarters of a day's work) for his labour.

To take the hawl of yarn up after it is warped, and carry the fame into the tar-houfe, requires ten men, who are each paid one thread (_viz._ one penny) for their labour.

The fourth procefs to be attended to in the manufacturing of cordage, is _Tarring the Yarn._

Tarring the yarn is a procefs which fhould be particularly attended to, being extremely careful that the tar is not boiling too faft nor too flow; if too faft, the tar will not ftay in the yarn, if not hot enough, the tar will not fufficiently penetrate the yarn; therefore a ftrict medium muft be carefully obferved by the kettle-heater, as well as to keep the horfe, or men, which turn the capftan round, going at a gentle, fteady pace, thereby giving the yarn a proper time to imbibe its neceffary proportion of tar, but at the fame time not fuffering it to be kept in the boiling tar too long, which is apt to make the yarn very tender, therefore fhould be very carefully avoided; and fhould the capftan be ftopped by accident, the ftop that keeps the yarn down muft be inftantly raifed, and the yarn taken out. Particular attention

fhould alfo be paid in paying (or coiling) the yarn into the kettle, that too long a length be not payed in at once; if it is fo done, the yarn will, of courfe, touch the bottom of the kettle, which it fhould, by no means, be fuffered to do, as in fuch cafe it will imbibe the dregs and fettlements of the tar appertaining to the bottom of the kettle, and make the yarn in fuch places black, or very much difcoloured, and have a very unpleafing appearance in the rope when made. Yarn for cables requires more tar than for hawfer-laid ropes. For ftanding and running rigging the lefs tar the better, provided the thread is well covered. It fhould be always remembered that the yarn, when tarred, fhould be overfet (or removed) the fame day, as this piece of bufinefs, being omitted, will be likely to prove of a ferious confequence in heating and tendering the yarn, which at all times muft be carefully avoided. In overfetting the yarn it fhould always be remembered that the yarn be well fhook and opened for two or three days, as in fo doing it admits the air, feparates and hardens the yarns, and contributes very much to the ftrength of the cordage. The hawls or half hawls of yarn, when tarred, fhould always be weighed and tallied.

Tarring yarn requires three men, who are employed as follows: _viz._ one to heat the kettle, one to pay (or coil) the yarn in the kettle, and one to haul off and overfet the yarn. They are, in general, paid in proportion to the work the fpinners perform, which is called going by the wheel.

The fifth and laft procefs to be attended to, is _Laying the Cordage._

In laying cables, and all forts of ropes in general, the great art lies in making each yarn to bear alike. For this purpofe it was, particularly in the larger fized cables, that the patent machines have been introduced. Particular attention muft be paid to this point, as therein confifts the grand principle of making a ftrong rope. For all forts of ropes which are to be immerged in the water, the utmoft care muft be taken to give the ftrands their proper hardnefs in their firft procefs, according to the remarks laid down before, which will prevent the water from penetrating the ftrands, and thereby preferve the infide yarns of the cable; as, if this procefs is not regularly attended to, the infide yarns will be always wet, and very foon decay. It frequently happens that when the yarn is tarred fomewhat too deep, that many a cable is fpoiled, though not intentionally; the fear in the perfon who has the direction in making the cable, of turning a very dark coloured rope out of hand, prevents the regular make being given the cordage, as in preffing the yarn to their proper hardnefs, the tar will fpring out, very much difcolour the rope, and thereby give it a very unpleafing appearance, efpecially when the fun is fhining very hot upon the yarn; to prevent which, in a great meafure, care fhould be taken, in the fummer months, to lay cables, and all forts of cordage in general, either early in the morning, before the fun has much power on the yarn, which is alfo apt to tender it, or late in the evening, after the fun has fet, or gone off the ground, or in heavy weather (by no means rainy); in which cafe your cordage will have a bright pleafing appearance, as the fmall fibres of the hemp will all yield to the top, and lay fmooth, which otherwife would look rough, and appear as if the cordage was made of inferior hemp, though in fact it was not fo, as all forts of hemp have fmall fibres appertaining to them, and which it is paft the art of man to prevent the fun from drawing up, and thereby making the rope look rough and unfeemly.

N. B. The above remarks refpecting taking advantage of the time for laying the cordage are only to be obferved in uncovered grounds.

Iu

In *laying cordage*, the yarn for twifting into ftrands is hung on the hooks in the tackle-board, at the upper end of the ground, and upon hooks in the breaft-board of the fledge, at the lower end, which are turned by men at both ends until the ftrands are hard; and are kept up from the ground by the ftake-heads.

Before the turn is put in, the yarn fhould be ftretched to its full extent by means of the tackle fixed from the fledge to the capftern, at twenty yards afunder, at the lower end of the ground; and when ftretched to two hundred fathoms, the prefs is put upon the fledge and drag, before the tackle-fall is caft off; for if the yarn be not properly ftretched before the tackle-fall is caft off, the rope will not be of its fize, nor well made.

The ftrands fhould have a good hardening before the top is put in to lay the rope, and the layer fhould fee that the heavers at the upper end keep the fame hardnefs that the ftrands had before the top fet off, nor fhould he begin to lay the rope until the fledge or wheel is moved by the power of the twift from the upper end.

When twifted fufficiently hard, the ftrands are hung on one hook in the breaft-board of the fledge, but remain feparate on the three hooks at the other end. The top is placed in at the fledge, and the rope twifted by turning the hooks at both ends one way, and, as the rope clofes, the top moves towards the upper end.

When the top is put in, fome of the weight fhould be taken off the fledge or drag, for if laid with as much weight as is ufed in the hardening, it would be too ftiff, but, by removing a part of the weight, the ftrands will couch better.

The ftrength of the men at the hooks being greatly inadequate to the force required for twifting of cables, woolders are ufed, according to the fize of the cable, at equal diftances along the whole length.

Cables fhould be rounded by the lower hook after they are laid, to throw the turn well up. They are generally thought to wear beft when flack-laid; but fome think when fhort-laid.

Cablets ufed for tow-lines or hawfers, require the ftrands to be laid fhorter than cable-ftrands, but not fo fhort-laid in clofing; for being ufed in water, they would become ftiff, hard, unhandy to coil away, and liable to break in cold weather.

In all cable-laid ropes, the proportion of the circumference is to the length of the ftrand in one round, as 11 is to 15; that is, if the circumference be 14½ inches, the length of the ftrand in one circumference is 19⅞ inches. In all hawfer-laid rope, the proportion is as 12 to 16; that is, if the circumference be 7 inches, the length of the ftrand in one circumference is near 9⅗.

The ftrength of ropes depends on the hardening or well manufacturing, and not on the bare ftrength of the hemp; for it ftrengthens through every ftage; *viz.* when firft fpun into yarn it is little better than hemp extended; when twifted into ftrands, it fhortens and ftrengthens as above, and increafes in the fame manner when laid into rope.

Where the diameter and circumference of one rope to another is as two to one, that is, where one rope is twice as big as another, the fquare of the diameter is as four to one; which fhews, that one rope has four times as much yarn in it as the other, and confequently is four times as ftrong, according to the different magnitudes.

Cable-laid ropes fhorten as five to three, and hawfer-laid ropes as three to two; confequently the length of the yarn and ftrength will be accordingly; that is, the ftrength will be in the yarn, after it is laid in the rope, as much as if the rope-maker, in fpinning, had allowed the fame quantity of hemp in two feet as he did in three feet, fo that the ftrength communicated by the procefs is two-thirds.

A rope is the fame fize when laid as the yarns were before twifted; fo that what the yarns are leffened by twifting it is made up by fhortening; from which it is inferred, that the yarns are always of an equal bignefs, fince the hemp is the fame at one time as at another, and not any way diminifhed.

Were the ftrands fingle, without being twifted one about another, the ftrength would then be only in proportion as the area of each particular ftrand is in itfelf; but if the ftrands could poffibly be twifted fo as to be directly perpendicular to the bafe, the ftrength would then be found, by multiplying the diameter of the ftrands and the diameter of the whole rope one into the other, and the half of the product would be the ftrength of the faid ftrands; but more particularly take the area of the fingle ftrand and area of the whole cable, and add them together, and the half of that will fhew the ftrength of each ftrand when they are well twifted together.

But as it may be obferved the ftrands lie at a certain angle between a perpendicular and the bafe, fo that, as the angle of incidence is to radius, fo is the relative to the abfolute ftrength.

Refpecting the *Banding of Cordage.*—In the calculations fpecifying the weights of the different lengths of cordage, fuch weights are to be confidered as the neat weights of the rope without bandage.

N. B. To every hundred weight of cordage the manufacturer is allowed to put on four pounds weight of bands; thofe bands are compofed of the fhakings, flyings, and ftrings with which the hemp is tied together, formed into an inferior kind of cordage; but it is to be obferved thofe are all weighed to the rope-makers as good hemp, and paid for accordingly, therefore if he was not allowed to apply the refufe to fuch purpofe, he muft either put a higher price on his cordage, or be a very confiderable lofer. At the fame time it fhould be confidered, that as it is neceffary that every coil of rope fhould be bound together for the convenience of carriage, ftowage, &c. this kind of bandage anfwers fuch purpofe in every degree, as well as if the coils were bound with bands made from the beft hemp.

ROPE-MAKING.

TABLE I.

Thefe fizes of Yarn are warped 336 Threads, and from 19 are warped 400 Threads in a Hawl.

		16			17			18			19			20			21			22			23			24			25		
		lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.
A	Weight of one thread 200 fathoms long.	5	0	0	4	11	5	4	7	2	4	3	6	4	0	0	3	12	5	3	10	3	3	7	10	3	5	5	3	3	3
B	One-tarred thread 200 fathoms long fhould weigh from	6	3	0	5	13	3	5	8	0	5	3	6	4	15	3	4	11	5	4	8	0	4	4	14	4	2	0	3	15	6
	to	6	4	0	5	14	2	5	8	14	5	4	3	5	0	0	4	12	3	4	8	11	4	5	9	4	2	10	4	0	0
C	Ten fathoms of each fize of B fhould weigh from	0	4	15¼	0	4	10½	0	4	6¼	0	4	2¾	0	3	15¼	0	3	12¼	0	3	9½	0	3	7	0	3	4¾	0	3	2¾
	to	0	5	0	0	4	11¼	0	4	6¾	0	4	3¾	0	4	0	0	3	13	0	3	10¼	0	3	7¾	0	3	5¼	0	3	3¼
		C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.
D	Weight of each hawl before tarred.	15	0	0	14	0	13	13	1	9	12	2	14	14	0	4	13	2	11	12	3	13	12	1	19	11	3	17	11	1	20
E	Weight of each hawl when tarred from	18	2	7	17	1	25	16	2	0	15	2	15	17	2	20	16	3	9	15	3	19	15	1	14	14	2	25	14	0	16
	to	18	3	0	17	2	16	16	2	18	15	3	4	17	3	12	17	0	0	16	0	9	15	2	3	14	3	14	14	1	4

N. B. The calculations of B and C will be found extremely ufeful, provided the yarn be fpun and tarred regular, as by weighing one fingle yarn, or even ten fathoms, the fize of the yarn may be afcertained, without being at the trouble of weighing the hawls.

TABLE II.

Shewing the Number of Threads to work *per* Hook for three-ftrand cable-laid Cordage of 6, 12, 18, and 24 Inches in Circumference, of the undermentioned Sizes of Yarn, with the Girt of each Strand, and Weight of each Cable ; alfo the Number of Men required to lay both Strands and Cable, with the Allowance to each Man for his Labour.

The N° of Threads here mentioned weigh 99 lb. to 100 lb.		Sizes of Yarn										Weight of each Cable 120 Fathoms long.	Men for Strands.	Threads per Strand.	Men for Cables.	Threads per Cable.
Sizes in Inches.	Girt of Strands.	16	17	18	19	20	21	22	23	24	25					
		Threads *per* Hook.														
												C.	qr.	lb.				
6	3 $\frac{12}{18}$	18	19	20	21	22	23	24	25	27	28	9 0 0	7	6	15	6
12	6¼ $\frac{6}{18}$	72	76	80	85	89	94	98	103	107	112	36 0 0	17	6	37	8
18	9¾ $\frac{1}{4}$	162	171	181	191	201	211	221	231	242	252	81 0 0	31	8	73	12
24	12½ $\frac{12}{18}$	288	304	322	340	358	376	394	412	430	448	144 0 0	42	*10	108	18

* Six threads are called a quarter of a day's work, for which each workman is paid 7*d.*, and fo on in proportion for a greater or lefs number.

Remarks and Directions how to apply Tables I. and II.

Example.—Suppofe a cable of 12 inches in circumference is wanted to be made, the hawls of yarn out of which, upon examining the weights, are found to weigh 16 cwt. 2 qr. 10 lb. *per* hawl of 336 threads. A reference is to be made to Table I. line E, and the weight, being between 16 cwt. 2 qr. 0 lb. and 16 cwt. 2 qr. 18 lb. will be found to anfwer to 18-thread yarn. Then look down the 18-thread column, Table II., and upon the line of 12, (the fize in the margin,) is found 80 threads *per* hook, which is the number of threads to be laid up *per* hook for the cable to be made of the weight *per* hawl of yarn of 336 threads above fpecified.

Again, if the hawls of yarn fhould be tarred of fuch a weight (fay for example) requires to be worked between a

17 and an 18-thread yarn, in fuch cafe take the number of threads *per* hook to be worked for the fize of the cable demanded, as fhould be worked both for 17 and 18-thread yarn ; add them together, and take half the number of threads fo added, to work *per* hook for the cable ; but if there fhould happen in dividing to be an odd thread remaining, you muft obferve to which fide the weight of your hawl of yarn is moft inclining, and throw the thread in difpute to the heavieft fide. The fame rules muft be obferved in confulting all the following tables.

Remarks.—In laying three-ftrand cable-laid cordage, if you are in doubt refpecting the fize of your yarn, you muft girt the yarn you purpofe laying in one ftrand, and that fhould be half the fize of your cable.

In hardening the ftrands in the laying of cable-laid cordage,

cordage, you muſt work with (in addition to your ſledge) one preſs-barrel to every 20 threads contained in your ſtrand; but in laying the ſtrand, hardening, and laying the cable, you muſt have only one preſs-barrel to every 40 threads contained in your ſtrand or cable. The above is to be conſidered as a ſtanding rule in covered rope-grounds, but in open grounds, the preſs muſt be varied according to the ſtate of the bottom of the ground, which, after a ſhower of rain, or in damp weather, will be naturally ſoft, and occaſion the ſledge to draw exceedingly heavy, and of courſe want the leſs weight of preſs.

N. B. The weight of a preſs-barrel ſhould be from 3½ to 4 cwt.

TABLE III.

Shewing the different ſhrinking Proportions of the Yarns and Strands in each Proceſs in making the undermentioned Lengths of Cable.

Length in fathoms of cable.	Length of yarns required to be warped.	In hardening the ſtrands, the yarn will ſhrink 1-5th part of the whole length warped, and is called the ſtrand's hardening mark.	In laying the ſtrands, the ſtrand will ſhrink 1-10th part of the whole length warped, and is called the ſtrand's going diſtance.	In hardening the cable-ſtrands previous to laying the cable, the ſtrands will ſhrink 1-30th part of the whole length warped, and is called the cable's hardening mark.	In laying the cable it will ſhrink 1-15th part of the whole length warped, which brings it to the length required.
			The Sledge ſhould move up to the following Diſtances from the Tackle-Poſts.		
	fms.	fms. ft.	fms. ft.	fms. ft.	fms. ft. in.	fms.
⅓ Cable	40	66 4	53 2	46 4	44 2 8	40
½	60	100 0	80 0	70 0	66 4 0	60
⅔	80	133 2	106 4	93 2	88 5 4	80
Whole	120	200 0	160 0	140 0	133 2 0	120

TABLE IV.

Shewing the Weights of three-ſtrand cable-laid Cordage.

	fms.	3-Inch Cable.	6-Inch Cable.	9-Inch Cable.	12-Inch Cable.	15-Inch Cable.	18-Inch Cable.	21-Inch Cable.	24-Inch Cable.
		C. qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.
⅓ Cable	40	0 3 0 0	3 0 0 0	6 3 0 0	12 0 0 0	18 3 0 0	27 0 0 0	36 3 0 0	48 0 0 0
½	60	1 0 14 0	4 2 0 0	10 0 14 0	18 0 0 0	28 0 14 0	40 2 0 0	55 0 14 0	72 0 0 0
⅔	80	1 2 0 0	6 0 0 0	13 2 0 0	24 0 0 0	37 2 0 0	54 0 0 0	73 2 0 0	96 0 0 0
Whole	120	2 1 0 0	9 0 0 0	20 1 0 0	36 0 0 0	56 1 0 0	81 0 0 0	110 1 0 0	144 0 0 0

It is neceſſary to be underſtood, that in rope-making (according to the nature of the rope), weight will give ſize, and ſize will give weight, if properly made.

Rule.—To calculate very nearly the weight of any ſized rope from 3 to 24 inches in circumference, 120 fathoms long, and leſſer lengths in proportion; as may be readily proved by the above table, *viz.* multiply the ſize of the rope by itſelf, and one-fourth of that product is the weight of a hundred of 112 pounds.

Example.—Suppoſe the rope 12 inches in circumference; 12 × 12 :: 144, the fourth of which is 36 hundred weight, or 3732 pounds, the weight of 120 fathoms of rope 12 inches in circumference. Again, 40 fathoms is the third of 120 fathoms; and the third of 36 cwt. is 12 cwt. the weight of 40 fathoms of 12-inch cable, as above.

Directions how to apply the following Tables.

In which is conſidered the four moſt principal ſorts of yarns made uſe of in cable-laid cordage, *viz.* 16, 18, 20, and 25-thread yarn, and in hawſer-laid cordage, to the three principal ſorts of yarn made uſe of, *viz.* 18, 20, and 25-thread yarn, as it is very ſeldom any other ſize yarn is made for either cable or hawſer-laid rope, except very particularly ordered to the contrary. The particulars of every rope of the ſizes mentioned in the tables are fully explained to the length of twenty fathoms, which will be found quite a ſufficient guide for a rope of any length required:

As for Example.—Suppoſe I want a taper cable-laid rope to be made out of 16-thread yarn, 60 fathoms long, and 6 inches in circumference, to be tapered ⅔ds the length, and ⅔ds the ſize of the rope. I refer to Table V., and find under the figure 6, (the ſize demanded,) that it muſt be worked 5 threads *per* hook in the ſhank, the length of yarn to be warped for which, for 20 fathoms (I find in the margin) requires to be 33 fathoms 2 feet, three times which is 100 fathoms, the length of yarn required to be warped for the ſhank of a rope of 60 fathoms long. I then obſerve, in the next column on the right in the margin, the length of yarn required in the head for 20 fathoms is 11 fathoms 0 feet 8 inches, three times which is 33 fathoms 2 feet, the length of yarn required in the head to the firſt taper for a rope of 60 fathoms. Next refer to the number of tapers to be worked, which, upon looking under the figure 6, (the ſize demanded,) I find to be 9, the diſtance between them I find (upon caſting my eye down the column) to be 14 feet 7⅞ inches for 20 fathoms, three times which is 44 feet 5⅜ inches, the diſtance to be obſerved between the tapers for a rope of 60 fathoms, being the length demanded. The ſame rule is be obſerved, either adding or multiplying, according as required in all the tables of a ſimilar deſcription.

TABLE

TABLE V.

Shewing the Number of Threads to work *per* Hook, both in the Shank and Tapers, in making three-strand taper cable-laid Cordage of the following Sizes, and the Lengths thereto prefixed, with the Lengths of Yarn required to be warped for the same, and the Distance to be observed between the Tapers; for 16, 18, 20, and 25-thread Yarn.

To Taper two-thirds the Length, and two-thirds the Size of the Rope

Sizes demanded	Thread Yarn.	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10
		Inches.													

(Table V. is an extensive rope-making reference table, rotated on the page, containing numerous numerical and fractional entries arranged under the sections: "Sizes demanded", "Threads per hook at the head", "Number of threads to be worked in the shank", "Number of threads to be worked in the tapers", "Lengths of Yarn in Shank or whole Parts", "Lengths of Yarn in the Heal to the first Taper", "Lengths of Yarn to Taper", "Distance between the Tapers", and "Fathoms demanded".)

TABLE V.—*continued.*

To Taper half the Length and half the Size of the Rope.

Sizes demanded		Thread Yarn	Inches. 3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10
Threads *per* hook at the head		16	6	8	10	12	15	18	21	24	28	32	36	40	45	50
		18	7	9	11	14	16	20	23	27	31	36	40	45	50	55
		20	8	9	12	15	18	22	26	30	34	40	45	50	56	62
		25	10	12	16	19	23	28	33	38	43	50	56	63	70	78
Number of threads to be worked in the shank		16	3	4	5	6	8	9	11	12	14	16	18	20	23	25
		18	4	5	6	7	8	10	12	14	16	18	20	23	25	28
		20	4	6	6	8	9	11	13	15	17	20	23	25	28	32
		25	5	6	8	10	12	14	17	19	22	25	28	31	35	39
Number of threads to be worked in the tapers		16	3	4	5	6	7	9	10	12	14	16	18	20	22	25
		18	3	4	5	7	8	10	11	13	15	18	20	22	25	27
		20	4	5	6	7	9	11	13	15	17	20	22	25	28	30
		25	5	6	8	9	11	14	16	19	21	25	28	32	35	39

Distance between the Tapers.

Lengths of Yarn in Shank or whole Parts. fms. ft.	Lengths of Yarn in the Head to the first Taper. ft.	Lengths of Yarn to Taper. ft.	Thread Yarn	ft. in.	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10
8 2	25	25	16	8 4	6 3	0 0	4 2	3 6⅔	2 9⅔	2 1	1		1 6¾	1 4²	1 3	1 1⁷/₁₃	1	1
16 4	50	50		16 8	12 6	0 0	8 4	7 1⁴/₇	9 5⁵/₇	4 2	3		3 4¾	4 2²/₇	3 6	3 3¾/₇	2	2
25 0	75	75		25 0	18 9	0 0	12 6	10 8⁴/₇	8 4	6 3	5		4 8⅓	2	9 0	4 1⁰/₁₁	3	3
33 2	100	100		33 4	25 0	0 0	16 8	14 3⁷/₇	11 1⁴/₇	8 4	7		3	6⅔	0	6 6/₁₁	4	4
8 2	25	25	18	8 4	6 3	0 0	3 6⁹/₁₀	3 1½	2 6	2	11 1⅓		4 2²/₃	3	1 7/₁₁	0	0
16 4	50	50		16 8	12 6	0 0	7 1⁵/₇	6 3	5 0	4	3 10⁹/₁₃		9 5¾	6	3 3¾/₇	1	1
25 0	75	75		25 0	18 9	0 0	10 8⁴/₇	9 4¾	7 6	5	5 9³/₁₃		2	9	4 1⁰/₁₁	2	2
33 2	100	100		33 4	25 0	0 0	14 3⁷/₇	12 6	10 0	7	8 4³/₁₃		6⅔	0	6 6/₁₁	3	3
8 2	25	25	20	6 3	5 0	4 2	3 6⁶/₇	2 9½	2 3⁶/₇	1	8		3	3	0	0	0	0
16 4	50	50		12 6	10 0	8 4	7 1⁵/₇	5 6¾	4 6⁶/₇	3	4 0		6	6	0	0	1	1
25 0	75	75		18 9	15 0	12 6	10 8⁴/₇	8 4	6 9⁹/₇	5	0 8		9	9	0	0	2	2
33 2	100	100		25 0	20 0	16 8	14 3⁷/₇	11 1½	9 1¼/₇	7	8		0	0	0	0	3	3
8 2	25	25	25	5 0	3 1½	2 9½	2 3³/₇	1 9¾	1 6¾	1	3 1⁵/₇		10⁵/₇	10⁵/₇	9³/₇	8⁴/₇	7⁷/₇	7⁷/₇
16 4	50	50		10 0	6 3	5 6¾	4 6¾/₇	3 6⁶/₇	1 7	2	7 1⁷/₇		9⅝/₇	9⅝/₇	6⁷/₇	5⁵/₇	3⁵/₇	3⁵/₇
25 0	75	75		15 0	9 4⁴/₇	8 4	6 9⁹/₇	5 4⁸/₇	8⅛	3	11 1⁷/₇		8⁷/₇	8⁷/₇	4⅝	1⅞	11 1⁵/₇	11 1⁵/₇
33 2	100	100		20 0	12 6	11 1⅓	9 1¼/₇	7 1⁵/₇	3	4	3 1⅛		6⅔/₇	6⅔/₇	1⅓	3	6⅞/₇	6⅞/₇

ROPE-MAKING.

TABLE VI.

Shewing the Number of Threads to work *per* Hook and Heart for cable-laid Stays, four Strands and a Heart, of 5, 10, 15, and 19 Inches in Circumference, of the undermentioned Sizes of Yarn, with the Girt of each Strand prefixed againſt each Size.

Number of Threads asunder to weigh from 99 to 100lb.		16	17	18	19	20	21	22	23	24	25
Size in Inches.	Girt of each Strand.	Threads *per* Hook and Heart.									
5	2 ⅜	9	9	10	11	11	12	12	13	13	14
10	4¼ ⅞	35	37	39	41	43	46	48	50	52	55
15	6½ ⅚	79	84	89	94	99	104	109	114	119	124
19	8¼ ⅞	127	135	143	151	159	167	175	183	191	199

The ſhrinking proportions of cable-laid ſtays are exactly the ſame as in three-ſtrand cable-laid cordage, except in the cloſing the ſtay, which being compoſed of four ſtrands, lie much cloſer in the rope than three ſtrands, and having the heart of the ſtay to encompaſs, occaſions the ſtrands to ſhorten in a much greater proportion than in three-ſtrand cable-laid cordage. The ſtay, in cloſing, will ſhorten $\frac{2}{7\frac{1}{4}}$ parts of the length of yarn firſt warped.

TABLE VII.

Shewing the Weight of cable-laid Stays, four Strands and a Heart, from 5 to 19 Inches in Circumference, and from 5 to 30 Fathoms in Length.

Fathoms in Length.	5-Inch Stay.				7-Inch Stay.				9-Inch Stay.				11-Inch Stay.				13-Inch Stay.				15-Inch Stay.				17-Inch Stay.				19-Inch Stay.			
	C.	qr.	lb.	oz.	C.	qr.	lb.	oz.	C.	qr.	lb.	oz.	C.	qr.	lb.	oz.	C.	qr.	lb.	oz.	C.	qr.	lb.	oz.	C.	qr.	lb.	oz.	C.	qr.	lb.	oz.
5	0	1	3	9	0	2	4	5	0	3	16	10	1	1	9	11	1	3	17	2	2	2	2	3	3	0	25	9	4	0	7	10
10	0	2	7	2	1	0	8	10	1	3	5	4	2	2	19	6	3	3	6	4	5	0	4	6	6	1	23	2	8	0	15	4
15	0	3	10	11	1	2	12	15	2	2	21	14	4	0	1	1	5	2	23	6	7	2	6	9	9	2	20	11	12	0	22	14
20	1	0	14	4	2	0	17	4	3	2	10	8	5	1	10	12	7	2	12	8	10	0	8	12	12	3	18	4	16	1	2	8
25	1	1	17	13	2	2	21	9	4	1	27	2	6	2	20	7	9	2	1	10	12	2	10	15	16	0	15	13	20	1	10	2
30	1	2	21	6	3	0	25	14	5	1	15	12	8	0	2	2	11	1	18	12	15	0	13	2	19	1	13	6	24	1	17	12

TABLE VIII.

Shewing the Number of Threads to work *per* Hook for four-ſtrand cable-laid Cordage without a Heart, from 5 to 24 Inches in Circumference, of the Sizes of Yarn undermentioned, with the Weight of each Cable prefixed.

No. of Threads weighing from 99 to 100lb.	16	17	18	19	20	21	22	23	24	25	Weight of each Cable 120 Fathoms long.		
Size in Inches.	Threads *per* Hook.										C.	qr.	lb.
5	9	10	10	11	12	12	13	13	14	15	6	2	10
10	38	40	42	45	47	50	52	54	57	59	25	3	6
15	85	91	96	101	107	112	118	123	128	134	58	3	0
20	152	162	171	181	190	200	209	219	228	238	104	1	9
24	219	233	247	260	274	288	301	315	329	343	150	1	2

ROPE-MAKING.

TABLE IX.

Shewing the Length of Yarn required to be warped, and the different ſhrinking Proportions in making the undermentioned Lengths of four-ſtrand cable-laid Cordage.

Fathoms demanded.	Lengths of Yarn warped.			Strand's Hardening Maik.			Strand's Going Diſtance.			Cable's Hardening Mark.			Cable's Length.
	fms.	ft.	in.	fms.	ft.	in.	fms.	ft.	in.	f.ns.	ft.	in.	
10	17	0	6	13	4	0	11	5	9	11	2	4	10
20	34	1	0	27	2	0	23	5	6	22	4	8	20
40	68	2	0	54	4	0	47	5	0	45	3	4	40
60	102	3	0	82	0	0	71	4	6	68	2	0	60
80	136	4	0	109	2	0	95	4	0	91	0	8	80
120	205	0	0	164	0	0	143	3	0	136	4	0	120

N.B. The ſhrinking proportions of four-ſtrand cable-laid cordage is exactly the ſame as three-ſtrand, except in cloſing the cable, which confiſting of four ſtrands, lie much cloſer in the rope than three ſtrands, but not having a heart to encompaſs it, does not diminiſh in length ſo much as cable-laid ſtays. The cable in cloſing will ſhorten $\frac{10}{113}$ parts of the length of yarn firſt warped.

It being rather unuſual to lay cables with a greater number of ſtrands than four, the above tables are not laid down for a greater proportion,—but to know how to find the number of threads to work *per* hook for a greater number may at ſome time be neceſſary, therefore the following method muſt be purſued to lay a cable in as many ſtrands as may be thought expedient. Suppoſe a five-ſtrand cable-laid rope is wanted to be made, you firſt ſquare the ſize of the rope propoſed to be made, and multiply that product by the ſize yarn you mean to make your cable from, that product divide by 52, and the quotient will be the number of threads to work *per* hook for a five-ſtrand cable-laid rope. If for a ſix-ſtrand, proceed as before, and divide by 62 ; for a ſeven-ſtrand, divide by 72 ; for an eight-ſtrand, divide by 82 ; and ſo on, adding 10 to your diviſor for every ſtrand you mean to increaſe in number in your cable.

TABLE X.

Shewing the Prime Coſt to the Manufacturer in each Proceſs, in making the undermentioned Sizes of three-ſtrand cable-laid Cordage, with the Weight of Hemp and Tar required for each Rope.

Size.	Hatchelling, Wheel-turning, and Tending.	Expence at 6d. per Quarter.			Spinning.	Expence at 7d. per Quarter.			Warping, Taking-up, and Tarring, at 9s. per Hawl.			Laying at 7d. per Quarter.			Total Expence of Manufacturing into Cordage.			Weight of Hemp required for each Rope.			Weight of Tar required for each Rope.		
In.	qr. thds.	L.	s.	d.	qr. thds.	L.	s.	d.	L.	s.	d.	L.	s.	d.	L.	s.	d.	C.	qr.	lb.	C	qr.	lb.
5	7 3	0	3	9	22 3	0	13	1	0	2	10½	0	15	5	1	15	1½	5	0	0	1	1	0
10	31 1½	0	15	7½	93 4½	2	14	7½	0	12	1	2	6	1	6	8	5	20	0	0	5	0	0
15	70 3¾	1	15	3¾	211 5¼	6	3	6¼	1	7	3	5	17	10	15	3	11	45	0	0	11	1	0
20	125 0	3	2	6	375 0	10	18	9	2	8	2	11	18	3	28	7	5	80	0	0	20	0	0
24	180 0	4	10	0	540 0	15	15	0	3	9	5	15	11	6	39	5	11	115	0	23	28	3	5

The above table is calculated according to the uſual mode of rope-making, and is termed by the trade working by the ſquare, which is performed in the following manner : Suppoſe a cable 15 inches in circumference, the ſquare of 15 is 225, the half of which is 112½ ; that is, 113 threads *per* hook muſt be laid up for a 15-inch cable, proceeding in the ſame manner for any ſize demanded, which mode of working anſwers to ſixteen-thread yarn in all ſizes of three-ſtrand cable-laid cordage.

Where the diameter and circumference of one rope to another is as 2 to 1, that is, where one rope is twice as big as another, the ſquare of the diameter is as 4 to 1, which ſhews that one rope has four times as much yarn in it as the other, and conſequently is four times as ſtrong, according to the different magnitudes.

ROPE-MAKING.

TABLE XI.

Shewing the Number of Threads *per* Hook to work for three-ftrand hawfer-laid Cordage, of 3, 6, 9, and 12 Inches in Circumference, of the Sizes of Yarn undermentioned, with the Weight of each Rope, and the Number of Men required to lay the fame, with the Allowance to each Man for his Labour.

N of Threads 99 to 100lb. Weight.	16	17	18	19	20	21	22	23	24	25	Weight of each Rope 133.2 long.	Men for Rope.	Threads per Rope.
Size in Inches.	Threads *per* Hook.										C. qr. lb.		
3	16	17	18	19	20	21	22	23	24	25	2 2 17	8 0	6
6	64	68	72	76	80	84	88	92	96	100	10 2 12	22 0	12
9	144	153	162	171	180	189	198	207	216	225	23 1 13	37 0	15
12	256	272	288	304	320	336	352	368	384	400	42 1 20	45 0	15

Remarks.—In hardening the ftrands, and in laying hawfer-laid cordage, it muft be worked with (in addition to the weight of the fledge) one prefs-barrel for every twenty threads contained in the rope. This is to be confidered as a ftanding rule in covered rope-grounds, but in open grounds the prefs muft be varied according to the ftate of the ground, as mentioned in cable-laid cordage.

In laying three-ftrand hawfer-laid cordage, if there is any doubt refpecting the fize of the yarn, you muft girt the yarn you propofe laying in two of your readys (or ftrands), and that fhould be juft the fize of the rope.

TABLE XII.

Shewing the Length of Yarn required to be warped, and the different fhrinking Proportions of the Yarn in each Procefs, in making the undermentioned Lengths of hawfer-laid Rope, and alfo the Weight.

	Fathoms of Rope in Length.	Length of Yarn to be warped.	The Sledge fhould move to the following Marks from the Tackle-Pofts.		¾-Inch.	1½-Inch.	2-Inch.	4-Inch.	6-Inch.	8-Inch.	10-Inch.	12-Inch.
			Rope's Hardening Mark.	Rope's Length.	Weight.	Weight.	Weight.	Weight.	Weight.	Weight.	Weight.	Weight.
	fms. ft.	fms.	fms.	fms. ft.	qr. lb. oz.	qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.
	10 0	15	12	10 0	0 2 7½	0 4 15	0 0 9 14¼	0 1 11 9½	0 3 5 1½	1 1 18 6¾	2 0 23 8	3 0 20 6
	20 0	30	24	20 0	0 4 15	0 9 4	0 0 19 12½	0 2 23 3	1 2 10 3	2 3 8 12½	4 1 19 0	6 1 12 12
Half Coil	40 0	60	48	40 0	0 9 14	0 19 12	0 1 11 9	1 1 18 6	3 0 20 6	5 2 17 9	8 3 10 0	12 2 25 8
	66 4	100	80	66 4	0 16 8	1 5 0	0 2 10 0	2 1 12 0	5 1 6 0	9 1 20 0	14 2 26 0	21 0 24 0
	80 0	120	96	80 0	0 19 12	1 11 8	0 2 23 2	2 3 8 12	6 1 12 12	11 1 7 2	17 2 20 0	25 1 23 0
	100 0	150	120	100 0	0 24 11	1 21 6	0 3 14 14½	3 2 3 15	7 3 22 15	14 0 15 14½	22 0 11 0	31 3 7 12
	120 0	180	144	120 0	1 1 10	2 3 4	1 0 6 11	4 0 26 2	9 2 5 2	16 3 24 11	26 2 2 0	38 0 20 8
Whole Coil	133 2	200	160	133 2	1 5 0	2 10 0	1 0 20 0	4 2 24 0	10 2 12 0	18 3 12 0	29 1 24 0	42 1 20 0

Remarks.—In hardening the ftrands the yarn will fhrink one-fifth of the whole length, which is called the rope's hardening mark.

In laying the rope the ftrands will fhrink one-fixth of the remaining diftance, which brings the rope to the length required.

TABLE

ROPE-MAKING.

TABLE XIII.

Shewing the exact Coft to the Manufacturer in each different Procefs as undermentioned, in making the following Sizes of three-ftrand hawfer-laid Cordage, with the proper Proportions of Hemp and Tar neceffary for each Rope.

Size in Inches.	Hatchelling, Wheel turning, and Tending.	Expence at 6d. per Quarter.			Spinning.	Expence at 7d. per Quarter.			Warping, Taking-up, and Tarring Expence at 9s. per Hawl.			Laying Expence at 7d. per Quarter.			Total Expence of manufacturing into Cordage.			Weight of Hemp required for each Rope.			Weight of Tar required for each Rope.		
	qr. thds.	L.	s.	d.	qr. thds.	L.	s.	d.	L.	s.	d.	L.	s.	d.	L.	s.	d.	C.	qr.	lb.	C.	qr.	lb.
2	1 4	0	0	10	5 0	0	2	11	0	0	7½	0	1	9	0	6	11½	0	3	22	0	0	26
4	6 4	0	3	4	20 0	0	11	8	0	2	7	0	7	0	1	4	7²	3	3	23	0	3	21
6	15 0	0	7	6	45 0	1	6	3	0	5	8	1	5	8	3	5	1	8	1	27	2	0	13
8	26 4	0	13	4	80 0	2	6	8	0	10	3	1	15	0	5	5	3	15	0	10	3	3	2
10	41 4	1	0	10	125 0	3	12	11	0	16	1	3	5	7	8	15	5	23	2	10	5	3	14
12	60 0	1	10	0	180 0	5	5	0	1	3	2	3	5	7	11	3	9	33	3	22	8	1	26

The foregoing table is grounded (as termed by the trade) upon the principle of the fquare, but the method of working upon this principle differs between cable and hawfer-laid cordage. The mode purfued for making hawfer-laid cordage is as follows : Suppofe it is wanted to make a three-ftrand hawfer-laid rope, fix inches in circumference ; the fquare of 6 is 36, and twice 36 is 72, which is the number of threads to work per hook for a fix-inch three-ftrand hawfer-laid rope. The fame method muft be purfued, according to this way of working, for any other fize, and anfwers to eighteen-thread yarn in all three-ftrand hawfer-laid cordage. See Table XI.

TABLE XIV.

Shewing the Weight of Yarn (of the four moft general Sorts madeufe of) capable of being fpun by each of the following Number of Spinners, at eight Quarters, or 48 Threads per day, in 1 Day, 1 Week of 6 Days, 1 Month of 24 Days, and 1 Year of 13 Months; with the Yield of Cordage at the Year's End prefixed againft each Number of Spinner's Work.

Numb. of Spinners for		Weight of Yarn per Day.			Weight of Yarn per Week.			Weight of Yarn per Month.				Weight of Yarn per Year				Yield of Cordage.			
		Cwt.	qrs.	lbs.	Cwt.	qrs.	lbs.	Tons.	cwt.	qrs.	lbs.	Tons.	cwt.	qrs.	lbs.	Tons.	cwt.	qrs.	lbs.
16-thread Yarn.	2	3	1	20	20	2	8	4	2	1	4	53	9	2	24	66	17	0	16
	4	6	3	12	41	0	16	8	4	2	8	106	19	1	20	133	14	1	4
	6	10	1	4	61	2	24	12	6	3	12	160	9	0	16	200	11	1	20
	8	13	2	24	82	1	4	16	9	0	16	213	18	3	12	267	8	2	8
	10	17	0	16	102	3	12	20	11	1	20	267	8	2	8	334	5	2	24
	12	20	2	8	123	1	20	24	13	2	24	320	18	1	4	401	2	3	12
18-thread Yarn.	2	3	0	0	18	0	0	3	12	0	0	46	16	0	0	58	10	0	0
	4	6	0	0	36	0	0	7	4	0	0	93	12	0	0	117	0	0	0
	6	9	0	0	54	0	0	10	16	0	0	140	8	0	0	175	10	0	0
	8	12	0	0	72	0	0	14	8	0	0	187	4	0	0	234	0	0	0
	10	15	0	0	90	0	0	18	0	0	0	234	0	0	0	292	10	0	0
	12	17	0	0	108	0	0	21	12	0	0	280	16	0	0	351	0	0	0
20-thread Yarn.	2	2	3	4	16	2	24	3	3	3	12	43	9	0	16	55	2	1	20
	4	5	2	8	33	1	20	6	7	2	24	86	18	1	4	111	0	3	12
	6	8	1	12	50	0	16	9	11	2	8	130	7	1	20	166	3	1	4
	8	11	0	16	66	3	12	12	15	1	20	173	16	2	8	222	1	2	24
	10	13	3	20	83	2	8	15	19	1	4	217	5	2	24	277	4	0	16
	12	16	2	24	100	1	4	19	3	0	16	260	14	3	12	332	6	2	8
25-thread Yarn.	2	2	0	22	13	0	20	2	12	2	24	34	5	1	4	42	16	2	12
	4	4	1	16	26	1	12	5	5	1	20	68	10	2	8	85	13	0	24
	6	6	2	10	39	2	4	7	18	0	16	102	15	3	12	128	9	3	8
	8	8	3	4	52	2	24	10	10	3	12	137	1	0	16	171	6	1	20
	10	10	3	26	65	3	16	13	3	2	8	171	6	1	20	214	3	0	4
	12	13	0	20	79	0	8	15	16	1	4	205	11	2	24	256	19	2	16

N.B. By the above table may be found how much yarn can be fpun by any number of fpinners in any given time whatever.

TABLE XV.

Shewing the Number of Threads to work *per* Hook, both in the Shank and Tapers, in making three-strand taper hawser-laid Cordage of the Sizes undermentioned, and the Lengths thereunto prefixed, with the Lengths of Yarn required to be warped for the same, and the Distance to be observed between the Tapers; grounded upon 18, 20, and 25-thread Yarn, and tapered two-thirds the Length, and two-thirds the Size of the Rope.

	Thread Yarn	Inches 2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10
Sizes demanded																		
Threads *per* hook at the head	18	8	12	18	24	32	40	50	60	72	84	98	112	128	144	162	180	200
	20	9	14	20	27	35	45	55	67	80	93	108	125	142	160	180	200	222
	25	11	17	25	34	44	56	69	84	100	117	136	156	177	200	225	250	277
Number of threads to be worked in the shank	18	3	4	6	8	11	14	17	20	24	28	33	38	43	48	54	60	67
	20	3	5	7	9	12	15	19	23	27	31	36	42	48	54	60	67	74
	25	4	6	9	12	15	19	28	28	34	39	46	52	59	67	75	84	93
Number of threads to be worked in the tapers	18	5	8	12	16	21	26	33	40	48	56	65	74	85	96	108	120	133
	20	6	9	13	18	23	30	36	44	53	62	72	83	94	106	120	133	148
	25	7	11	16	22	29	37	46	56	66	78	90	104	118	133	150	166	184

Distance between the Tapers.

Fathoms demanded.	Lengths of Yarn in Shank or whole Parts. fms. ft.	Lengths of Yarn in the Head to the first Taper. fms. ft.	Lengths of Yarn to Taper. fms.
5	7 3	2 3	5
10	15 0	5 0	10
15	22 3	7 3	15
20	30 0	10 0	20
5	7 3	2 3	5
10	15 0	5 0	10
15	22 3	7 3	15
20	30 0	10 0	20
5	7 3	2 3	5
10	15 0	5 0	10
15	22 3	7 3	15
20	30 0	10 0	20

TABLE **XV.**—*continued.*

Tapered half the Length and half the Size of the Rope.

Sizes demanded	Thread Inches	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10
Threads *per* hook at the head	Thread Yarn 18	8	12	18	24	32	40	50	60	72	84	98	112	128	144	162	180	200
	20	9	14	20	27	35	45	55	67	80	93	108	125	142	160	180	200	222
	25	11	17	25	34	44	56	69	84	100	117	136	156	177	200	225	250	277
Number of threads to be worked in the shank	18	4	6	9	12	16	20	25	30	36	42	49	56	64	72	81	90	100
	20	5	7	10	14	18	23	28	34	40	47	54	63	71	80	90	100	111
	25	6	9	13	17	22	28	35	42	50	59	68	78	89	100	113	125	139
Number of threads to be worked in the tapers	18	4	6	9	12	16	20	25	30	36	42	49	56	64	72	81	90	100
	20	4	7	11	13	17	22	27	33	40	46	54	62	71	80	90	100	111
	25	5	8	12	17	22	28	34	42	50	58	68	78	88	100	112	125	138

Distance between the Tapers.

	Lengths of Yarn in Shank or whole Parts.	Lengths of Yarn in the Head to the first Taper.	Lengths of Yarn to Taper.
Fathoms demanded.	fms. ft.	fms. ft. in.	fms. ft. in.
5	7 3	3 4 6	3 4 6
10	15 0	7 3 0	7 3 0
15	22 3	11 1 6	11 1 6
20	30 0	15 0 0	15 0 0
5	7 3	3 4 6	3 4 6
10	15 0	7 3 0	7 3 0
15	22 3	11 1 6	11 1 6
20	30 0	15 0 0	15 0 0
5	7 3	3 4 6	3 4 6
10	15 0	7 3 0	7 3 0
15	22 3	11 1 6	11 1 6
20	30 0	15 0 0	15 0 0

ROPE-MAKING.

Suppofe you want to make a rope either cable or hawfer-laid, to be tapered one-third the length, and one-third the fize; you muſt refer to Table V. or XIV. for making taper-cable, or hawfer-laid cordage, two-thirds the length and two-thirds the fize, which you muſt work almoſt wholly the reverfe way, by working the number of threads there mentioned to be worked in the tapers in the ſhank, and the number of threads in the ſhank muſt be worked in the tapers: the length of yarn there mentioned to be tapered muſt be the length in the head to the firſt taper, and the length there mentioned in the head muſt be the length of the yarn to be tapered: the length of yarn requeſted to be warped for the ſhank will be the fame as there mentioned, and the diſtance between the tapers will, in almoſt all cafes, be the fame as there nominated; but if at any time there ſhould be a difference, and you are at a lofs to find the diſtance between the tapers you muſt divide the length of yarn to be tapered by the number of threads you have to taper, and that will give the exaƈt diſtance between them.

TABLE XVI.

Shewing the Number of Threads to work *per* Hook for fourſtrand hawfer-laid Cordage, from 2 to 12 Inches in Circumference, of the Sizes of Yarn as undermentioned: the Ropes to be laid without Hearts, the Yarns compriſing which being equally divided in the Strands.

No. of Threads here mentioned to weigh 99 to 100lb.	16	17	18	19	20	21	22	23	24	25
Size in Inches.				Threads *per* Hook.						
2	5	6	6	6	7	7	7	8	8	8
4	22	23	24	25	26	27	29	30	32	33
6	48	51	54	57	60	63	66	69	72	75
8	84	90	96	101	107	112	117	122	128	135
10	133	142	150	158	167	175	183	192	200	208
12	192	204	216	228	240	252	264	276	288	300

TABLE XVII.

Shewing the Length of Yarn requeſted to be warped for the undermentioned Lengths of four-ſtrand hawfer-laid Cordage, with the Hardening Mark prefixed againſt each refpeƈtive Length.

Fathoms demanded.	Length of Yarn required.			Hardening Mark.		
	fms.	ft.	in.	fms.	ft.	in.
10	15	2	6	12	2	0
20	30	5	0	24	4	0
40	61	4	0	49	2	0
60	92	3	0	74	0	0
80	123	2	0	98	4	0
100	154	1	0	123	2	0
120	185	0	0	148	0	0
130	200	2	6	160	2	0

Remarks.—It is very feldom that hawfer-laid cordage is compofed of more than four ſtrands, but for the fake of experiment, or otherwife, it might be demanded to contain a greater number: as fuch, the following rule, carefully attended to, will inform our readers how to lay a hawfer-laid rope in as many ſtrands as may be confidered expedient.

Suppofe you want a five-ſtrand hawfer-laid rope, you muſt fquare the fize of the rope propofed to be made; that produƈt multiply by the fize yarn you propofe making your rope from; the produƈt of which, divided by 15, will give the number of threads to work *per* hook for a five-ſtrand hawfer-laid rope   If you want to make a fix-ſtrand hawfer-laid-rope, you muſt proceed as above, and divide by 18; if a feven-ſtrand, divide by 21; if an eight-ſtrand, by 24; and fo on, adding 3 to your divifor for every ſtrand you mean to increafe in the rope.

The ſhrinking proportion in making four-ſtrand hawferlaid cordage, in the firſt procefs, is exaƈtly the fame as in three-ſtrand; the only difference is in clofing the rope, which, being compofed of four ſtrands, occafions the rope to lay more round and clofe than in threeſtrand cordage, which makes the ſhrinkage by in a much greater proportion. The rope, in clofing, will ſhorten $\frac{7}{16}$th parts of the remaining length of yarn, after the rope is hard, inſtead of $\frac{1}{8}$th, as in three-ſtrand hawfer-laid cordage.

The weight of each coil of four-ſtrand hawfer-laid cordage may be nearly afcertained, by referring to the table of the weight of three-ſtrand (Table XII.), there being as near the number of threads in each fize rope as can poſſibly be laid, for each ſtrand to have an equal number. But it ſhould be remembered, that a coil of four-ſtrand hawfer-laid rope, made out of 200 fathoms of yarn, will be only 130 fathoms long, inſtead of 133.2, as in three-ſtrand hawferlaid cordage.

ROPE-MAKING.

TABLE XVIII.

Shewing the fhrinking Proportions of the Yarn, in making the undermentioned Lengths of Bolt-Rope; alfo its Weight (untarred), from 1 to 8 Inches in Circumference.

Length in Fathoms of Rope demanded.	Length of Yarn required in Fathoms.	The Sledge fhould move to the following Marks from the Tackle-Poft, and is called the Rope's Hardening-Mark.	1-Inch. Weight.	2-Inch. Weight.	3-Inch. Weight.	4-Inch. Weight.	5-Inch. Weight.	6-Inch. Weight.	7-Inch. Weight.	8-Inch. Weight.
		Fms. feet.	C.qr. lb. oz.	C.qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.	C. qr. lb. oz.	C.qr. lb. oz.	C.qr. lb. oz.	C. qr. lb. oz.
10	14	11 4	0 0 2 8¾	0 0 7 11	0 0 16 12¼	0 1 1 5¾	0 1 18 2½	0 2 11 2	0 3 6 10	1 0 7 2½
20	28	23 2	0 0 5 0½	0 0 15 6	0 1 5 9¼	0 2 2 11½	0 3 8 5	1 0 22 4	1 2 13 4	2 0 14 5
40	56	46 4	0 0 10 1	0 1 2 12	0 2 11 1½	1 0 5 7	1 2 16 10	2 1 16 8	3 0 26 8	4 1 0 10
60	84	70 0	0 0 15 1½	0 1 18 2	0 3 16 10	1 2 8 2½	2 1 24 15	3 2 10 12	4 3 11 12	6 1 14 5
80	112	93 2	0 0 20 2	0 2 5 8	1 0 22 3	2 0 10 14	3 1 5 4	4 3 5 0	6 1 25 0	8 2 1 4
100	140	116 4	0 0 25 2½	0 2 20 14	1 1 27 11½	2 2 13 9½	4 0 13 9	5 3 27 4	8 0 10 4	10 2 15 9
120	168	140 0	0 1 2 3	0 3 8 4	1 3 5 4	3 0 16 5	4 3 21 14	7 0 21 8	9 2 23 8	12 3 1 14
Coil 143	200	166 4	0 1 8 0	0 3 26 0	2 0 16 0	3 3 0 0	5 3 16 0	8 2 8 0	11 2 8 0	15 0 24 0

Remarks.—In hardening the ſtrands, the yarn will ſhrink one-fixth part of the whole length, which is called the rope's hardening mark.

In laying the rope, the ſtrands will ſhrink one-feventh part of the remaining diſtance, which brings the rope to the length required.

N. B. Bolt-rope is ufually made of 20 or 25-thread yarn, and generally delivered from the rope-maker white;

the procefs of tarring it being ufually performed by the fail-maker, and is called ſtoving it, it being done in a ſtove or oven calculated for the purpofe. In laying up your work, you muſt work with the fame number of threads as in common hawſer-laid cordage. Bolt-rope, for exportation, is fometimes lightly tarred; in which cafe, in calculating the weight, you muſt add one-fixth to the weights hereunto annexed.

TABLE XIX.

Shewing the Number of Threads to work *per* Hook for three-ſtrand hawſer-laid white Cordage, from 1 to 12 Inches in Circumference, of the undermentioned Sizes of Yarn, with the Weight of each Rope prefixed.

No. of Threads here mentioned to weigh 88 lbs.	16	17	18	19	20	21	22	23	24	25	Weight of each Rope 133.2 Fathoms long.
Size in Inches.	Threads *per* Hook.										C. qr. lb.
1	3	3	3	3	3	3	3	4	4	4	0 1 12
2	8	8	9	9	10	10	10	11	12	12	1 0 8
3	18	19	20	21	22	23	24	25	26	27	2 1 12
4	32	33	35	37	39	41	42	44	46	48	4 0 20
6	72	76	80	84	88	92	96	100	104	108	9 1 20
8	128	135	142	149	156	163	170	177	185	192	16 2 24
10	200	211	232	233	244	255	266	277	289	300	26 0 16
12	288	304	320	336	352	368	384	400	416	432	37 2 24

N. B. Efpecial care fhould be taken relative to making white cordage for tackle-falls, crane-ropes, &c. that the hemp be of the very beſt quality; and that the fame be topped, *viz.* all the ſhort hemp taken out by the hatcheller;

and that the fpinner do fpin his yarn for the fame exceeding fmart and even, by no means lighter than the weight fpecified under the article *fpinning the yarn:* if he does, his rope will not anfwer the fize required to be made.

ROPE-MAKING.

TABLE XX.

Shewing the Number of Threads to work *per* Hook for four-ftrand hawfer-laid white
Cordage, without Hearts, from 2 to 12 Inches in Circumference, of the Sizes of Yarn
as undermentioned.

No. of Threads here mentioned to weigh 88 lbs.	16	17	18	19	20	21	22	23	24	25
Size in Inches.	Threads *per* Hook.									
2	6	6	7	7	7	8	8	8	9	9
3	13	14	15	15	16	17	18	19	19	20
4	24	25	26	27	29	30	32	33	35	36
5	37	39	41	43	45	47	49	51	54	56
6	54	57	60	63	66	69	72	75	78	81
8	96	101	107	112	117	122	128	133	139	144
10	150	158	167	175	183	192	200	208	217	225
12	216	228	240	252	264	276	288	300	312	324

N. B. The weight of the above ropes may be found by confulting Table XVII. for three-ftrand hawfer-laid white cordage ; the number of threads in each rope of a fize being of an equal number, as near as poffible.

Cordage made by Contract for the Ufe of His Majefty's Navy.—The under-mentioned fhews the number of threads to work *per* hook ; the loweft weight, allowance in weight, bandage, and higheft weight ; the cordage is to be received and allowed for by the receiving officers of his majefty's refpective dock-yards, under the honourable commiffioners of his majefty's navy, to rope-makers who have made cordage (upon the ufual principle) by contract, in coils, hawfers, cablets, and cables, with the length of yarn to be warped for the fame, and length of cordage when made, as ordered by the honourable navy-board.

N. B. The higheft weight a hawl of yarn for each fort of cordage fhould weigh (and by no means more,) is here noted.

TABLE XXI. Cablets.

Size.	Threads per Hook.	Loweft Weight. C. qr. lb.	Allowance in Weight. C. qr. lb.	Bandage. C. qr. lb.	Higheft Weight. C. qr. lb.
2	3	1 1 4	0 0 4	0 0 4	1 1 12
2½	4	1 3 0	0 0 5	0 0 5	1 3 10
3	6	2 2 1	0 0 7	0 0 8	2 2 16
3½	8	3 1 2	0 0 10	0 0 11	3 1 23
4	10	4 0 18	0 0 12	0 0 13	4 1 15
4½	12	5 0 23	0 0 15	0 0 16	5 1 26
5	15	6 2 1	0 0 18	0 0 20	6 3 11
5½	18	7 3 7	0 0 22	0 0 24	8 0 25
6	21	9 0 12	0 0 26	0 1 0	9 2 10
6½	24	10 1 19	0 1 1	0 1 4	10 3 24
7	28	12 0 18	0 1 6	0 1 9	12 3 5
7½	32	13 3 16	0 1 11	0 1 14	14 2 13
8	37	16 0 6	0 1 17	0 1 21	16 3 16
8½	42	18 0 27	0 1 23	0 2 0	19 0 22
9	47	20 1 17	0 2 1	0 2 7	21 1 25
9½	52	22 2 9	0 2 7	0 2 13	23 3 1

TABLE XXII. Cables.

Size.	Threads per Hook.	Loweft Weight. C. qr. lb.	Allowance in Weight. C. qr. lb.	Higheft Weight. C. qr. lb.
10	58	21 0 23	0 2 3	21 2 26
10½	64	23 1 17	0 2 9	23 3 26
11	70	25 2 10	0 2 15	26 0 25
11½	76	27 3 4	0 2 22	28 1 26
12	83	30 1 10	0 3 1	31 0 11
12½	90	32 3 17	0 3 8	33 2 25
13	98	35 3 9	0 3 16	36 2 25
13½	106	38 3 1	0 3 25	39 2 26
14	114	41 2 20	1 0 5	42 2 25
14½	122	44 2 12	1 0 12	45 2 24
15	130	47 2 3	1 0 21	48 2 24
15½	139	50 3 7	1 1 2	52 0 9
16	148	54 0 13	1 1 11	55 1 24
16½	157	57 1 16	1 1 20	58 3 8

It is to be obferved, that the above fizes in Tab. XX., *viz.* 2 to 9½ inches, are termed, in the navy contracts, cablets, the yarn for which fhould be warped 200 fathoms long, and the cablets, when complete, to be 120 fathoms. A hawl of yarn containing 336 threads, fhould weigh from 16 cwt. 0 qr. 8 lb. to 16 cwt. 1 qr. 25 lb., and no more, allowing one-fixth part of fuch weight for tar, which is the allowance made by the honourable navy-board, and no more.

Cablets from 4 to 9½ inches will not be rejected, if they are half an inch in girt above the dimenfions ordered.

The yarn for the above cables (Tab. XXII.) are warped 166 fms. 4 ft. long, and the cables, when complete, to be 100 fathoms long. A hawl of yarn containing 336 threads, 166 fms. 4 ft. long, fhould weigh from 13 cwt. 2 qr. 6 lb. to 13 cwt. 3 qr. 16 lb., and no more, tarred with the fame proportion of tar as the yarn for the cablets before-mentioned.

Cables

ROPE-MAKING.

Cables 10 inches and upwards, are allowed three-fourths of an inch in girt more than the dimensions given.

In proportions of cordage wherein the cables contained in them do not exceed 13½ inches in circumference, a proportion of 1½ cwt. of spun-yarn is allowed to be sent to every ton of cordage ; but if the cables are 14 inches in circumference and upwards, then 3 cwt. for every ton is allowed, in order to work up the toppings (or hemp) which should be taken out of the hemp agreeable to contract, previous to its being spun into cable-yarn (in particular), as it frequently happens that the great number of lives of some of his majesty's most valuable subjects are at stake upon the dependance of a single cable.

The cables made in the usual mode, by contract, have of late never exceeded 16½ inches in circumference, (Tab. XXII. extends no further) : for all the higher sizes are made by patent machines, by which much manual labour is spared, and the yarns and strands laid much closer and more even, and bear the strain more equally.

Size.	Threads per Hook.	Lowest Weight.			Allowance in Weight.			Bandage.			Highest Weight.		
		C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.
¾	2	0	1	4	0	0	1	0	0	1	0	1	6
1	3	0	1	20	0	0	1	0	0	1	0	1	22
1½	6	0	3	13	0	0	2	0	0	2	0	3	17
2	9	1	1	6	0	0	4	0	0	4	1	1	14
2½	14	2	0	5	0	0	6	0	0	6	2	0	17
3	20	2	3	20	0	0	8	0	0	9	3	0	9
3½	26	3	3	7	0	0	11	0	0	11	4	0	1
4	35	5	0	14	0	0	14	0	0	16	5	1	16
4½	44	6	1	22	0	0	18	0	0	20	6	3	4
5	54	7	3	19	0	0	22	0	0	24	8	1	9
5½	65	9	2	2	0	0	27	0	1	1	10	0	2
6	77	11	1	3	0	1	4	0	1	7	11	3	14
6½	91	13	1	11	0	1	9	0	1	13	14	0	5

The sizes of cordage hereunto annexed, from ¾ to 3½ inches in circumference, are termed, in the navy, contract coils ; all above, viz. 4 to 6½ inch, are called hawsers. The yarn for both coils and hawsers should be warped 195 fathoms long, and the ropes, when completed, are to be 130 fathoms long. A hawl of yarn, consisting of 336 threads, 195 fathoms long, should weigh from 16 cwt. 1 qr. 7 lb. to 16 cwt. 2 qr. 24 lb. and no more, tarred in the same proportion as cablets and cables.

All cordage delivered into his majesty's dock-yards undergo a trial, which is, by proving one strand out of each rope, each thread (or yarn) of which having a weight, weighing one-third of an cwt. made fast to it, which it should lift ; but if a certain number of yarns (according to the size of each rope) should break in the trial, the rope is rejected, otherwise it is received.

Particular attention should be paid not to send any kind of cordage into his majesty's dock-yards above its highest weight, allowed according to contract, as, in such case, all above that weight will be a loss to the manufacturer ; the receiving officer not being authorised to allow any more than is specified in the contract.

N. B. It is to be observed, that, in making cordage by contract for the use of his majesty's navy, his majesty finds his own hemp, the contractor tar and labour at a certain price per ton. All cables and cordage to be tarred with good Stockholm tar, without mixture of any

other, except about one-third part, which may be of Russia tar.

A white thread, twisted the contrary way, (sometimes called the rogue's yarn,) is to be laid in all the strands of the cables and large cordage ; and a twine in the small cordage for the king's mark, so as to be seen on the outside of the strands.

In any of the strands, there is to be no greater number of threads at the ends of the cables or cordage than in the middle.

The only parliamentary regulations, relative to the manufacture of cordage, are contained in the following act ; " An act for more effectually preventing deceits in the manufacturing of cordage for shipping ; and to prevent the illicit importation of foreign-made cordage." 25 Geo. III. c. 56.

In July 1799, a patent was granted to W. Chapman and E. W. Chapman, of Newcastle-upon-Tyne, for their improved method of making cords and ropes, twined and untwined, from the spinning of the yarn inclusive, to the finishing of the rope or cordage. This invention appears, by the specification, to include material improvements in the spinning of rope-yarn, and in the manufacturing of cordage. Rope-yarns are at present spun by men, at an expence of from half a crown to five shillings per day, according to the situation of the place, whether in the out-ports, or on the river Thames. Or it is wholly spun by machinery.

In the practice of the first method rope-walks are necessary, and the fibres of the hemp are drawn into the yarn of different lengths proportionate in a given degree to their position in the outside or inside of the yarn ; accordingly, when this yarn is strained, and its diameter collapses, the inside fibres of hemp bear the greatest strain, and thus they break progressively from the inside.

In the spinning by a mill the fibres are all brought forward in a position parallel to each other, previously to their receiving their twist. They are consequently all of one length ; and, when twisted, the outside fibres are most shortened by forming the same number of spirals round a greater axis than the interior, and thus they must consequently break the first, on the same principle that the outside yarns of strands of ropes manufactured in the old method break before the interior yarns ; and, consequently, with less strain than ropes of the improved principle, where the strands, (or immediate component parts of the rope) have been formed in such a manner as that all the yarns shall bear equally at the time of the rope's breaking.

Nevertheless, yarns spun by a mill have been found stronger than common yarns, on account of the great evenness with which they are spun ; the manual labour in manufacturing is much less than in the common method : but, on the other hand, there is the expence of machinery, and the greater waste of hemp in preparing it for being drawn out in the progressive stages of its advance to the spindle.

The method invented by Messrs. Chapman differs from both the preceding, in having, by an easy and simple contrivance, the fibres of the hemp laid in the yarn in such a manner as the yarns themselves are laid in the strands of the rope manufactured on the new principle.

Their machinery consists only of a spindle, divided into two parts, the upper containing apparatus to draw forward the hemp from the spinner with twist sufficient to combine the fibres ; which enables them to employ women, children, and invalids, and also to appropriate the rope-ground solely to the purpose of laying ropes.

The part we have described is only an improvement on

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the methods of fpinning, granted to Mr. William Chapman on the 8th day of November, 1798.

The remaining parts of their invention confift chiefly in the giving, from a ftationary power, internal motion to a locomotive machine, *viz.* to the roper's fledge, on which the ftrands and the rope itfelf are twifted, by which contrivance they are enabled to apply a water-wheel, or fteam-engine, to the whole procefs of making ropes of all kinds whatever.

Mr. Jofeph Huddart of Iflington obtained a patent in Auguft of the fame year for an improved method of regiftering or forming the ftrands in the machinery for the manufacture of cordage. Having previoufly taken out a patent for this purpofe, he contrived to effect it by the following means :

1. By keeping the yarns feparate from each other, and drawing them from bobbins, which revolve, to keep up the twift whilft the ftrand is forming.

2. By paffing them through a regifter, which divides them by circular fhells of holes ; the number in each fhell being agreeable to the diftance from the centre of the ftrand, and the angle which the yarns make with a line parallel to it, and which gives them a proper pofition to enter.

3. A cylindrical tube, which compreffes the ftrand, and maintains a cylindrical figure to its furface.

4. A gauge to determine the angle which the yarns in the outfide fhell make with a line parallel to the centre of the ftrand when regiftering ; and, according to the angle made by the yarns in this fhell, the length of all the yarns in the ftrand will be determined.

5. By hardening up the ftrand, and thereby increafing the angle in the outfide fhell, which compenfates for the ftretching of the yarns, and the compreffion of the ftrand.

The patent which Mr. Huddart took out in Auguft relates to the invention of a machine that may be worked by men, or any other power, and by means of which the regiftering may be commodioufly and effectually carried on. But figures are neceffary for defcribing intelligibly his peculiar contrivance. Mr. Huddart, in the following year, took out a patent for improvements in the method of turning cordage in the manufacture of it. But our limits forbid our enlarging on this article. The fpecifications of the patents for regiftering, as well as faftening, may be confulted by thofe who are concerned in this manufacture.

ROPE *Walk*, or *Rope-houfe Ground*, is the place where ropes are manufactured. This fhould be 400 yards long, and about 10 broad. At the upper end are fixed the fpinning-wheels, over which is the hatchelling-loft, alfo the back-frame wheels, tackle-boards, and pofts, winches for winding the yarn on as it is fpun, and reels on which to reel the ropes. On each fide are ftake-pofts ; in the middle is fixed the warping-poft, and at the lower end, the capftern and reaching-poft. Back-frame wheels for fmall, and fledges and drags for large ropes, are ufed towards the lower end ; the back-frame wheel, for laying cordage from a fix-thread ratline to a two-inch rope, is about four or five feet in diameter, and is hung between two uprights, fixed by tenons on a truck, and fupported by a knee of wood. Over its top is a femicircular frame, called the head, to contain three whirls (that turns on the braffes) with iron fpindles, fecured by a hafp and pin. They are worked by means of a leather band encircling the whirls and the wheel. Three of the whirls are turned when hardening the ftrands, and one only when clofing the rope, the ftrands being hung together upon it. The truck, on which the back-frame wheel is fixed, runs on four wheels, and is

made of three-inch oak plank, about nine feet long and thirteen inches broad at one end, and eleven inches broad at the other. The capftern, about eight feet high, and fourteen inches in diameter, is turned either by men or horfes ; its ufe is to draw the yarn, when tarring, out of the copper, through the nipper, to be coiled away in the yarn-houfe, and there properly hardened before it is ufed ; otherwife it will kink, *i. e.* twift or curl, by being twifted too hard in clofing. Another capftern, or crab, is fixed at the lower end of the walk, for ftretching the yarn to its fulleft extent, before it is worked into ftrands, by means of the tackle-fall, led from the *fledge* to the capftern ; thefe being about eighteen yards diftant from each other. The crank-wheel, which is ufed for fpinning of lines, box-cord, &c. is fixed on an iron fpindle or axis, with a handle by which to turn it. It hangs between two pofts, and in its upper part, above the wheel, is let in a femicircular board to receive three fets of whirl-bolts, with wheels upon them, on which the fpinners hang their threads : at the front fide of the wheel is a fhort poft, fupported by a knee of oak, on which the fpindle refts. The *drags* refemble the hinder part of the fledge, to which they are faftened by ropes, and they are lined with a board on the upper fide : their weight ferves as a prefs, when the rope requires more than the fledge can carry properly to ftretch the ftrands, and prevent their kinking. The *hatchel* ferves to clear the ends of the hemp, by drawing it through, having forty fharp-pointed iron-teeth, fimilar to the hatchel in the *clearer*, which has finer teeth. Iron-jacks are fometimes ufed inftead of the table-wheel or back-frame wheel, and differ from the latter by having an iron-wheel with cogs, which work in the whirls, that have likewife iron-cogs. The *loper*, which is ufed to lay lines, has two iron fwivel-hooks (running round in a brafs or iron box) at each end, for the line to hang on and work, by the power of the fore-turn, from the wheel at the upper end. The *nipper* is formed of two fteel-plates, with a femi-oval hole in each, which, by the motion of the upper plate, enlarges or contracts as the tarring of the yarn requires. It is thus fixed : a poft is placed between the kettle and the capftern, with a mortife cut eighteen inches long from the kettle's furface, and five inches wide. The under plate is turned up on each fide, to form two grooves, and is let into the front fide of the poft from the lower part of the mortife. The upper plate has a dove-tail on the back, that flides up and down in a groove into the grooves of the lower plate ; and by a ftaff, made faft to its front, it is raifed or lowered, and regulated by a weight fufpended at the other end, fo that the yarn receives no more tar than is required, and that which is fqueezed out drops into a trough, and returns into the kettle. *Prefs-barrels* are old tar-barrels filled with clay, and laid on the fledge or drag to add weight when the rope is clofing. The *reaching-poft* is a poft in the ground at the lower end of the walk ; ufed in ftretching the yarn by means of a tackle, one of the blocks of which is hooked to a ftrap round the poft, the other block to a pendant at the fledge, being about eighteen yards diftant from each other. *Sledges* are frames made of ftrong oak, clamped with iron in different parts ; the two fides are the length of the fledge, made of oak, and tied in with oak bars at each end ; near the front are two uprights, let into the fides, and fupported by two flanting pieces from the upper end. A breaft-board is faftened with iron pins to the uprights, and contains holes for the hooks to pafs through, on which the hooks are hung ; which, being turned by men, is twifted into rope, and fo clofed or finifhed. Thefe fledges are loaded as the occafion of making the rope requires. The *fpinning-wheel* is hung between two pofts fixed

fixed in the ground; over its top is a femicircular **frame**, called the head, which contains twelve whirls, if it be for twelve fpinners to fpin at the fame time; thefe whirls turn on iron fpindles, with hooks to their front ends to hang the hemp on, and are worked by means of a leather band encircling the wheels and whirls. The tools and terms appropriate to rope-making are defcribed in their proper places,

ROPE-*Yarn*, the yarn of any rope untwifted. It commonly confifts of cable-ends which are worn out; and are called *junks of the cables*. It ferves for many purpofes among the failors.

Rope-yarn properly denotes the fmalleft and fimpleft part of any rope, being one of the threads of which a ftrand is compofed; fo that the fize of the latter, and of the rope into which it is twifted, are determined by the number of rope-yarns.