Knot News

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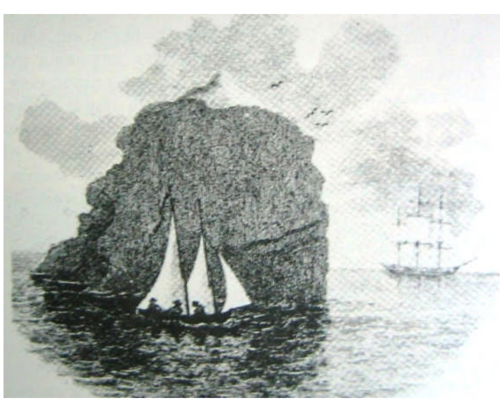
Nagem Knots (2) - Rockall Ruby

Pieter van de Griend

Seadistrict Rockall SW severe gale force 10. Imminent. Veering NW, increasing to force 12.
BBC Shipping Forecast

Prologue

Any mariner, who ever found himself midwinter on the North Atlantic Ocean, knows how jolly understating the BBC can be while updating their weather forecast for the Rockall Seadistrict. Inclement local climate has given this endlessly void patch of ocean to the Northwest of Scotland its infamous reputation. The seadistrict's name comes from a slippery guano-covered rocklet. This summit of a burnt-out volcano has a 100 meter circumference and a height of 20 meters. Despite its remoteness and the fact that it stands out conspicuously on a clear day has not prevented it from being the scene of horrendous disaster, taking a toll in excess of 800 lives so far.



In Gaelic the rock is known as *Sgeir Rocail*, which translates into "Roaring Rock". Rockall has an interesting geology, birdlife and some pages of history. Up to this day it is firmly centered in many an international territorial dispute [3], [5].

When constructing a theory, there are always certain facts which cannot be ignored. Therefore I picked Rockall to symbolize the "annoying facts" phenomenon in this article. Rock-solid arguments are convincing because they hit hard.

Sphere Covering Explorations

The fact that Symmetrical Nested Grids ($B=4,A,x,y$) cover spheres, in an overtly pretty way, is seldom challenged in the knotting literature. Let's sketch a proof, showing how Nested Grids emerge as natural sphere coverings, by digging up a number of annoying facts.

Try to cover a sphere with 3 *identical* bands of Regular Grid. You can wrap a sphere (or a cube) pretty neatly by placing three of such bands perpendicular to each other as is shown in the image below. In the following we shall call this a **Composite Spherical Grid**.

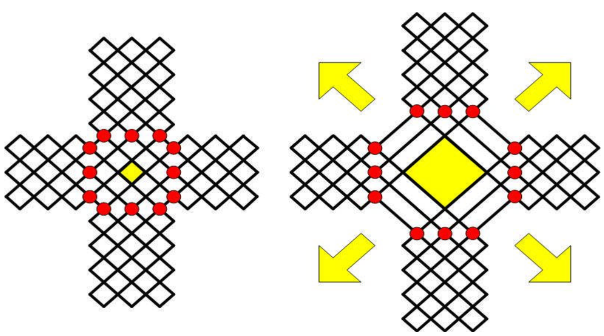
Assume the bands of Regular Grid have a width of p parts and a length of b bights. Our only demands are (1) that p is an even number to facilitate well-defined transition-points and (2) there are at least 4 times more bights than half the number of parts. As we assume to have an excess of bights, as compared to the number of parts, 4 Triangular Gaps per hemisphere can be identified. For our purposes these

Triangular Gaps are equilateral spherical triangles, i.e. all sides have the same length. We shall denote this side length by the letter *c*. This length is measured in bights and, due to symmetries, must comply with some conditions. The value of *c* can be found by observing that each band of *p/b* Regular Grid in our Composite Spherical Grid has 4 identical segments. From each segment the number of transition-points must be subtracted

$$c = b/4 - p/2$$

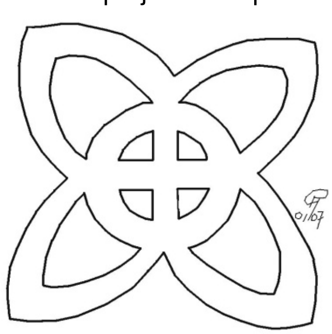
Clearly *p* is bound to a maximum namely when $c = 0$, i.e. when $p = b/2$.

Having all of this, now try finding a projection which enables us to traverse the entire grid. At each of the 6 intersections our Composite Spherical Grid looks something like what is given to the left in the illustration below.

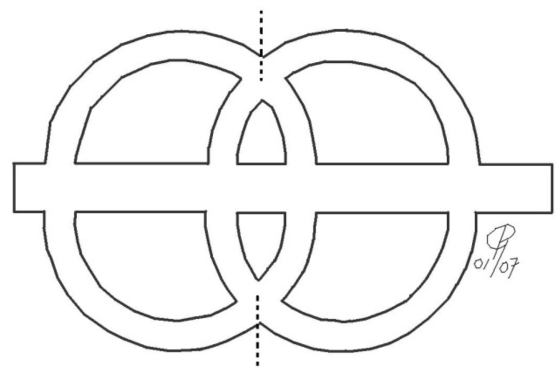


Coaxing the order 4 Polar Openness to cooperate may yield enough slack to deform the grid. This is shown to the right in the illustration above.

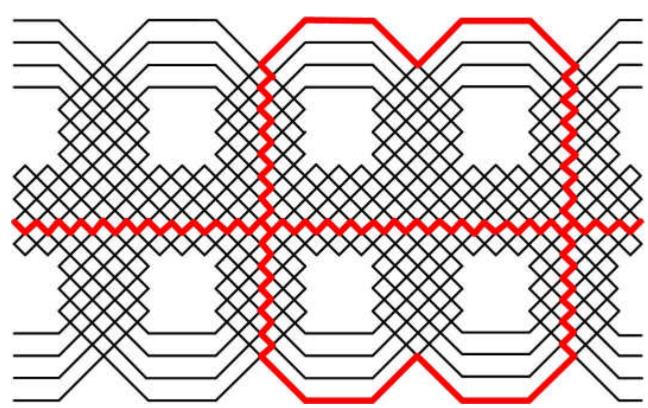
With sufficient slack around one of the Polar Opennesses, the Composite Spherical Grid can be flattened into a disc-representation. This, however, will not be an easy task. You should reproduce this experiment in deformation. Make a sphere with three narrow paper strips and see for yourself how this disc-like representation can be obtained. Not only will it yield an appreciation of the effort involved, but also convince you that this projection is possible.



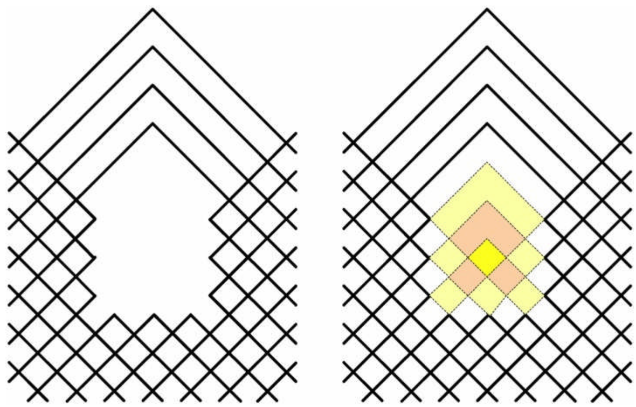
So, the entire Composite Spherical Grid can be flattened into a diagram – a so-called disc-representation. This may appear useful, but beware that using such a diagram comes at a price. First it is hard to see how (and which) principal grid-aspects can be extended. Secondly you'll have quite some task getting the knot fashioned, once you leave the disc-phase. Is it possible to find something less cumbersome? Allowing one single perpendicular slice through the Equatorial Grid leads to the obscure representation below. There is still a lot of deforming required in 2 specific parts of the grid.



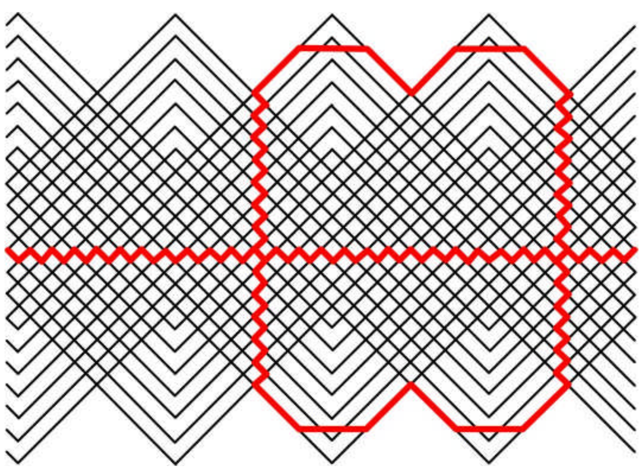
Scissor one of the triangular gaps and open the Composite Spherical Grid even further. The result has drastically improved. Placing this representation in a more convenient grid-representation format, one gets a sequential concatenation of 4 Length Block sections, which are illustrated below for the case where $p = 8$, $b = 28$ and $c = 3$. Check out the trajectories of the arcs along the Meridional and Equatorial Grids. Note that our three bands are identical by checking the rims of bights. They have been outlined in bold for 2 bands in the illustration below.



The only things, which are still sickening our happiness, are those 8 pesky Triangular Gaps. How can we fill any such an equilateral triangle?



Note that there are equally many bights in each spherical triangle's side. In that case, and only in that case, can we link up bights to obtain a structure which retains the maximum degree of symmetry. The illustration above shows this for one Triangular Gap. What does such a filled in Composite Spherical Grid look like? Look below, where we created the Symmetrical Nested Grid (4, 7, 16, 0).



In our setup we assumed that *b* must be a multiple of 4, but is this an absolute requirement? Nope. Our special case arose due to the fact that we have Polar Opennesses of order 4. A different order Polar Openness would have given a different number of Length Blocks. Hence the *B*-value of the resulting Symmetrical Nested Grid will change.

Above we have shown that Composite Spherical Grids cover spheres and lead to Symmetrical Nested Grids. Our 3 bands of *p/b* Regular Grid lead to a Symmetrical Nested Grid (*B*, *A*, *x*, *y*), given by parameters, which are now easily explained:

$$(4,\ p/2 + c,\ p + 2(c+1),\ 0) = (4,\ b/4,\ b/2 + 2,\ 0)$$

Note how the value of *p* hardly plays a role in the final product's dimensions.

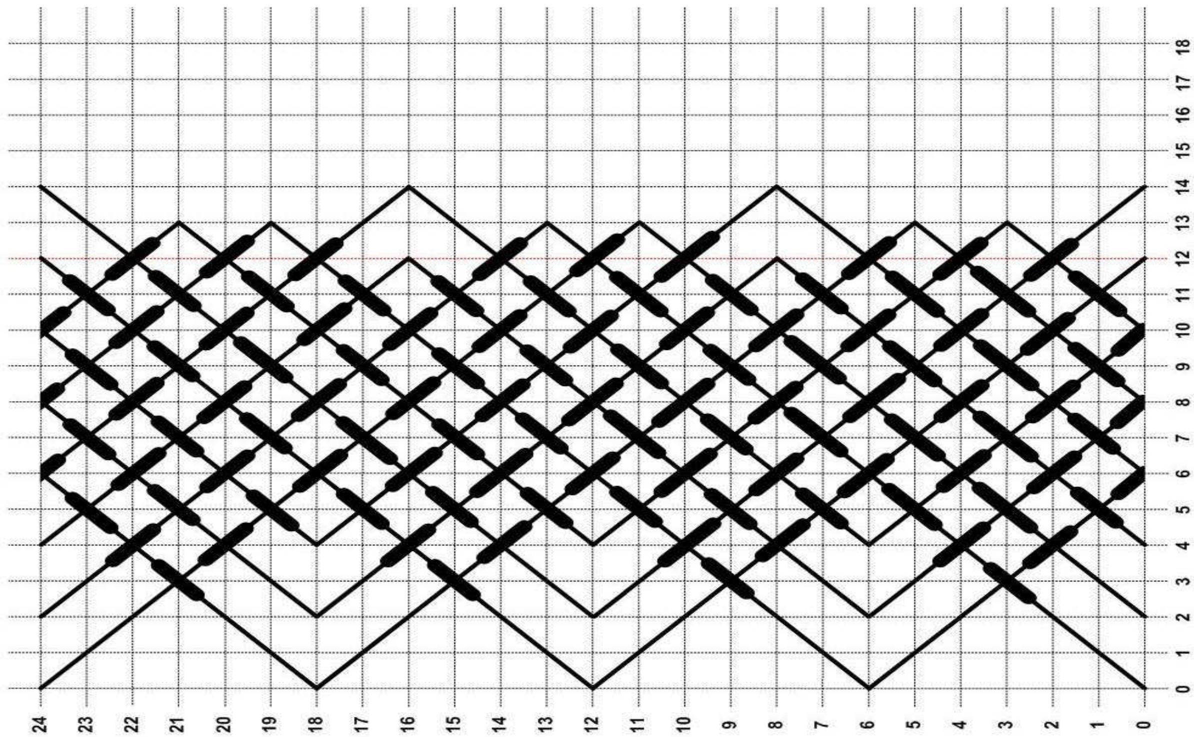
Symmetrical Nested Grids allow for easier parameter manipulations and enable the discovery of coverings, which ascend our initial setup, than squashed Composite Spherical Grids. We can do lots of funny stuff with this grid-type. For example, one of the fascinating things about a sphere is that, no matter where you measure its circumference, you will always find the same figure. This means that you will need a grid which is about as wide as it is long. The length of the circumference will be known as the Equatorial Grid Length. Check that it has *A* times *B* bights. The question how to make the grid as wide as it is long, is easily answered when the grid is given in Symmetrical Nested Grid format, namely $x = 2(A+1)$. In the following we shall call this the **squareness criterium**.

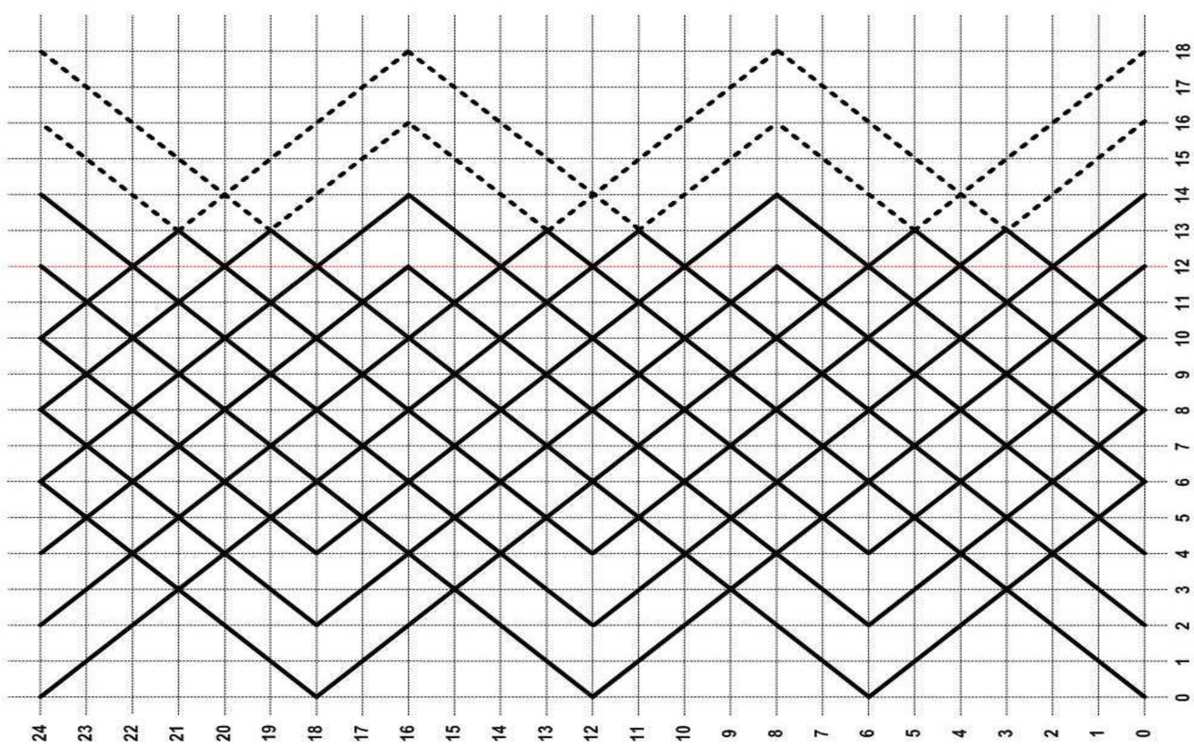
We have just shown that Symmetric Nested Grids cover spherical surfaces. In the following all of our Nested Grids will be Symmetrical, unless stated otherwise. Before we set off designing Rockall Ruby let us recap how we moved through the various representations to see what we can learn.

Representations

A most annoying problem in decorative knotting is the perpetual switch between grid- and disc-represention for identical knots, but it seems unavoidable. This plague also leads to confusion in the literature where there are few sources on the design of Spherical Covering Knots. They all use a different approach to discuss the same type of objects [1], [2], [4]. The representational switch seems to be due to the nature of the beast. Of course there are advantages and disadvantages to each format. On our journey so far, we also have passed various representational formats. Starting with 3-dimensional ones of the Composite Spherical Grid, we moved to flattened grids in disc-representation and continued to move on to the Length Blocks in the grids. Why do these different representations occur? For one the Composite Spherical Grid defies easy detection of extendable principle(s). The grid-representation's length blocks are more accommodating than disc-representation. However, seldom is there any grand unifying scheme. With Rockall Ruby's Polar Cap we have the grid-disc antagonism here again. It is all a matter of global versus local focus during the construction.

Having all this machinery in place, let us chart a course to Rockall Ruby and aim for a successful landfall.





Design of grid and proposed coding for Rockall Ruby.

Designing Rockall Ruby

To acquire proficiency with Punctured Sphere Coverings (**PSC**), let us make one camouflaged as a bellpull (keyfob) project. From now on we focus solely on the covering of the terminating blob. I assume that you have sufficient experience to make all other components.

In the Nagem Knots' Overture we have seen that the Little Lump Knot (**LLK**) had no well-defined 1-Holey Cap. Let's attempt a non-trivial one this time.

Knot design is serious business. Tremendous waste of time and materials takes place when the design phase is not properly conducted. This is especially true in the case of a relatively complex PSC. So, before weighing the anchor, we first present our shopping list of relevant questions, which set goals to aim our design at.

First question. We obviously want a PSC, but which one? What are the smallest PSC which remain comparable to Knob Knots? The LLK is one of the smallest PSC (*A*=2). Which gem is next in line? Incrementing the *A*-value yields *A*=3. Combined with a *B*=4 (polar openess demand) this results in a 12-bighted Equatorial Grid length. Do our choices automatically mean we need 12 strands? Nope, it all comes down to where the stends and the wend linkages are scattered.

Second question. What Hemispherical Grids can we fit in? Must the resultant PSC grid be an Asymmetric Nested Grid or a Hooded Nested Grid? Let us decide on the latter. We already established an Equatorial Grid length of twelve. This is an interesting number. It is 4 times 3, but also 3 times 4. This affords us a Southern Hemispherical Grid with order 4 polar openness. The Northern Hemispherical Grid will have nestingnumber 4 and number of nests 3. Next we Hood the 1-Holey Cap's rim twice to get 9 bights. Note that we obtain an Asymmetric Nested Grid consisting of 4 components.

Third question. We say nothing (yet) about coding and shall keep it simple by applying a Casa coding (U1O1) onto our grid.

All of these decisions make Rockall Ruby an Asymmetric Nested Grid (4/3, 8/0, 3/4), which has been Hooded twice along its 1-Holey Cap's rim to obtain 9 bights.

Constructing Rockall Ruby

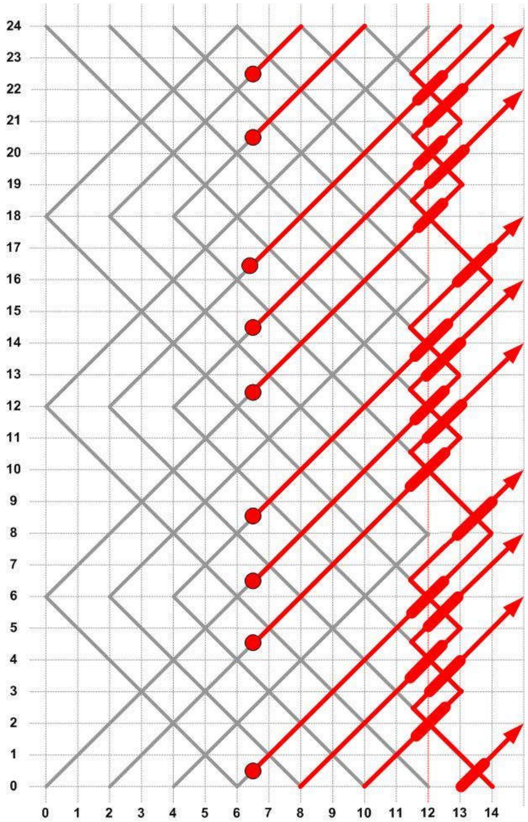
Waving our Rockall Ruby blueprint let's commence the construction. We first put down some conventions by which we shall abide during all of our Nagem Knot Projects.

1. Our PSC is aligned with the South Pole being the Polar Cap. The North Polar Cap is our 1-Holey Cap.
2. We assume our strands exit the mouse at approximately 60 degrees South.
3. We always start with the 1-Holey Cap, i.e. the rim around the North Polar excision.

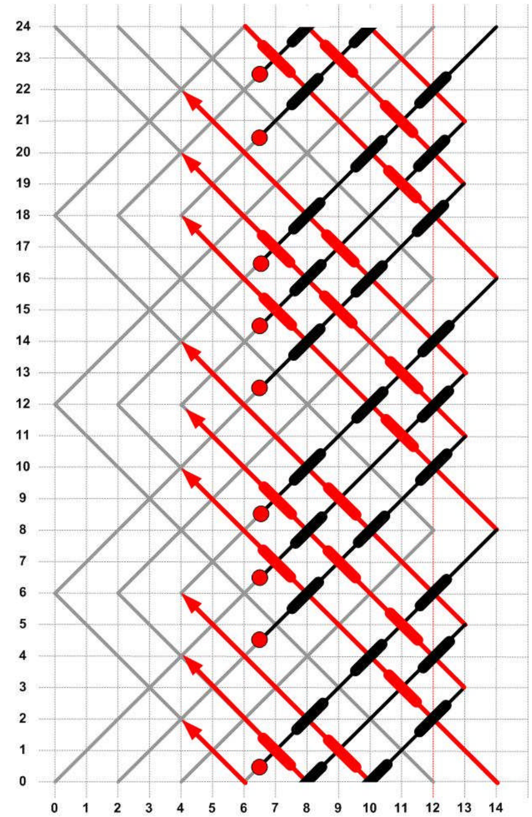
Our project will be a 12 stringer (for reasons outlined above), however bellpulls or keyfobs are often made with 8 strands. Terminating with a 12-stranded Rockall Ruby will require the insertion of 4 extra strands somewhere. I always insert 2 lengths of extra material into the construction before making the mouse, but there are many ways to kill a cat too. Aim at making a spheroid mouse which will support the covering. Do ensure that your mouse is a gripper! It should be impossible to pull Rockall Ruby from the bellpull. Have the 12 strands fan out of the structure at evenly spaced angles.

Hold the mouse upside down, i.e. have the South Polar region facing up towards you. We shall first tackle the North Polar 1-Holey Cap. It will be slightly more complicated than commencing an LLK. Make the 9-stranded Wall Knot, which is shown in Fig A below. Work the strands as shown in Fig.B. The remaining 3 strands are worked as shown in Fig.C. Finally Fig.D shows the start configuration wherefrom the South Polar Cap is made.

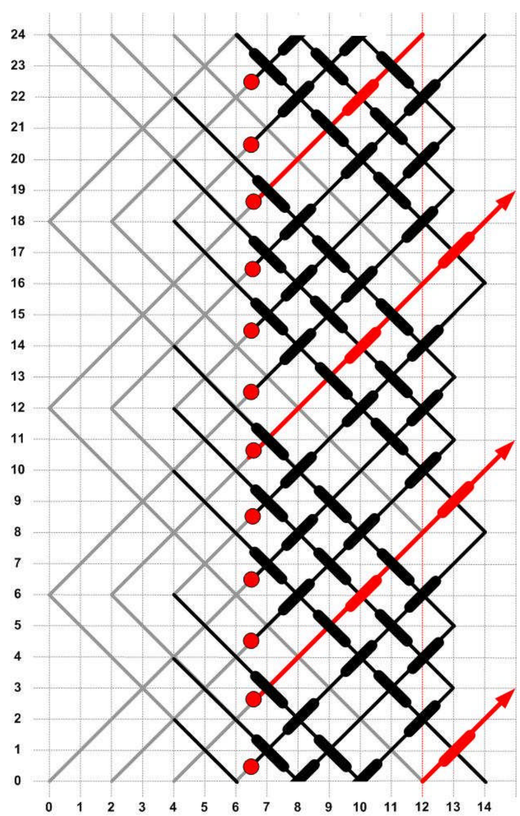
The 4 images (E,F,G,H) at the top of the next page show how to make the Casa Coded (U1O1) Hemispherical Cap on 12 strands. Very much like we did in the LLK, let the 12 strands, which exit the Equatorial Grid, fan out evenly in the plane. First make two successive interlocking Crowns. The last run consists of the crossfidarcs, completing the Hemispherical Cap.



A



B



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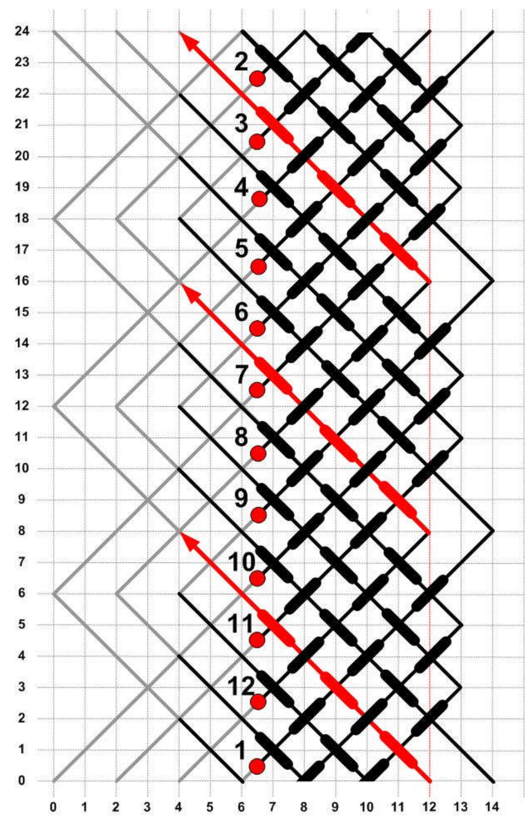

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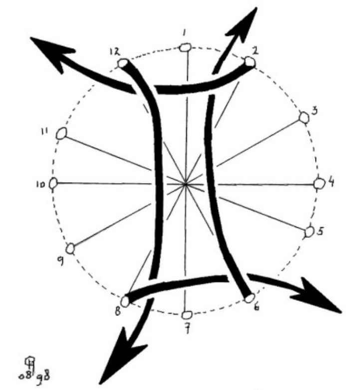
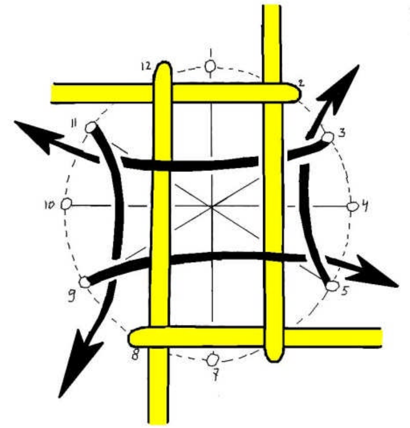
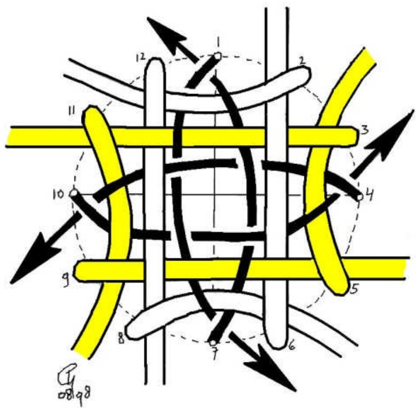


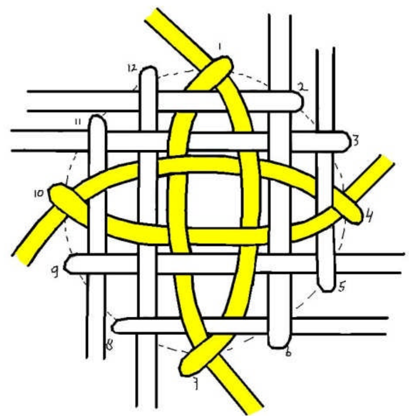
E



F



G



H

Assuming you battled your way up to this point, you now have a choice! You can either double the weave, which is the easiest, or option for some exotic interweave.

System Checking

Check the product of your endeavors before starting tensioning. I have found that methodically checking weave-segments to be the most reliable way for detecting possible errors. Pin the weave to the mouse by driving nails or needles into strategic opennesses, e.g. the South Pole and the Spherical Triangles. This simple trick will save you many hours of re-tensioning.

System Tensioning

When **tensioning**, do not operate on one strand first by getting all slack out and then proceeding to the next. This will most certainly pull your design askew and be hard – if not impossible – to repair! Starting at all stends simultaneously and working the slack of each strand towards the wend in a systematic fashion frequently upsets the weave too. Best practice is to symmetrically work every umpteenth stend and propagate a part of the slack from stend towards the wend. This implies you will need several (more than one) tensioning séances!

Epilogue

We showed that Symmetrical Nested Grids emerge as natural sphere covering gridstypes. Rockall Ruby's design message is that part of the PSC trickery lays in getting an Equatorial Grid with a neatly factoring number of bights to construct the caps.

Each Nagem Knots' project paper is envisaged to address some decorative knotting aspect. In the next installment, on the Skye Sapphire, we look at solutions to counter the gapping- and bulging-effects when respectively stretching and crunching a piece of Regular Grid to forcibly fit onto a spherical surface.

References

1. J. **Coleman**, "More ways to design Spherical Covering Knots", *Knotting Matters*, issn 0959-2881, no.79, pp28-36, June 2003.
2. P. **Ducey**, "Spherical Turk's Heads", *Knotting Matters*, issn 0959-2881, no.54, pp16-18, December 1996.
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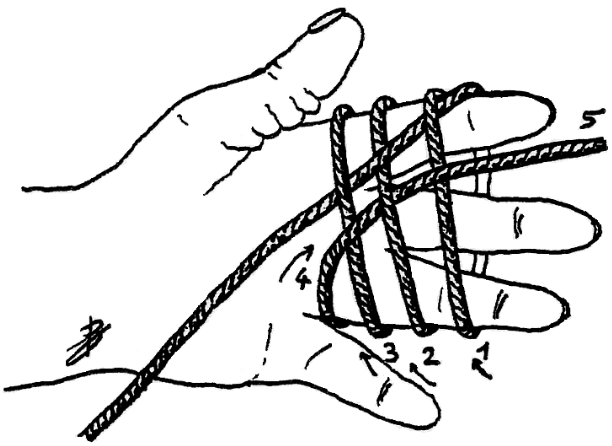
Stiphout March 2007.

Sphere of 18 Faces

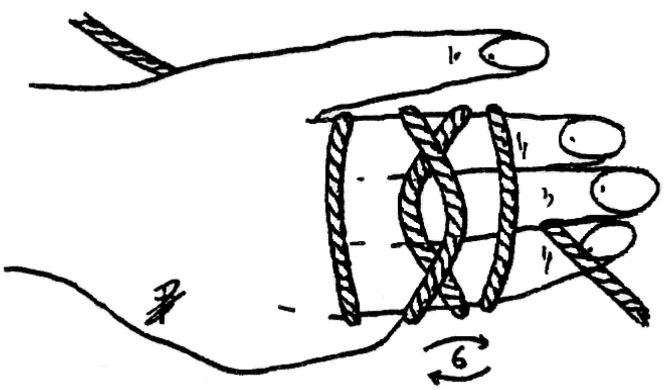
by Luc Pouveur, translated by Charles Hamel

This article first appeared in IGKT-France's *Sac de Nœuds* #2 and is reprinted here by kind permission of the author

This Turk's Head, very smooth, has the advantage of being easily and quickly thrown in the hand (at least for the first passage, to cover the central ball of this Turk's Head requires it to be doubled or tripled to be fair).



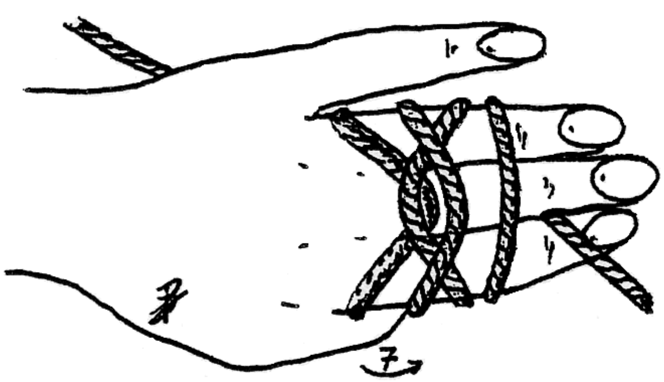
Take in your nimblest hand a length of cordage sufficient to cover the ball, which will constitute the center of the Turk's Head. Place your other hand in front of you, palm towards you. Hold the Standing Part (Spart) in your palm using your thumb.



1. Make a first turn around your hand, the Working End (Wend) going over the Standing Part.

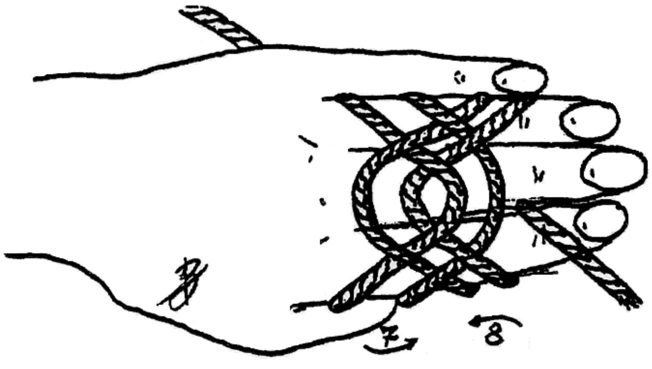
2. Make a second turn, without crossing the preceding one, the Wend crossing Under the Spart.

3. Make a third turn, without crossing the previously laid ones, the Wend passing Over the Spart.



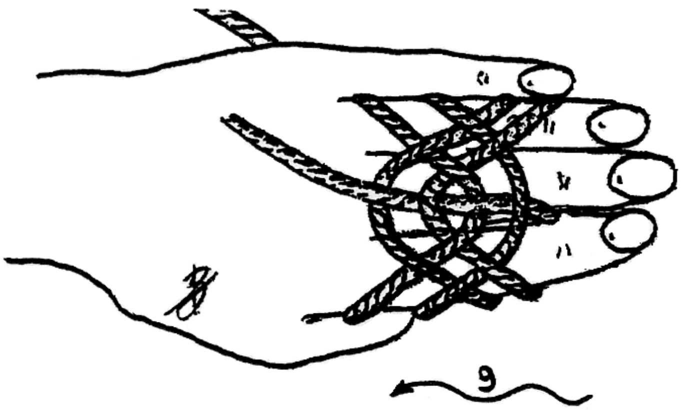
4. Make a fourth turn, without crossing the previous ones and, without crossing the Spart, go back towards the ends of the fingers while crossing Over the third turn, Under the second and Over the first.

On your hand now are four turns, not overlapping, the Spart and Wend go back towards the other end of the spiral, without crossing each other and crossing the turns in an Over-Under sequence.



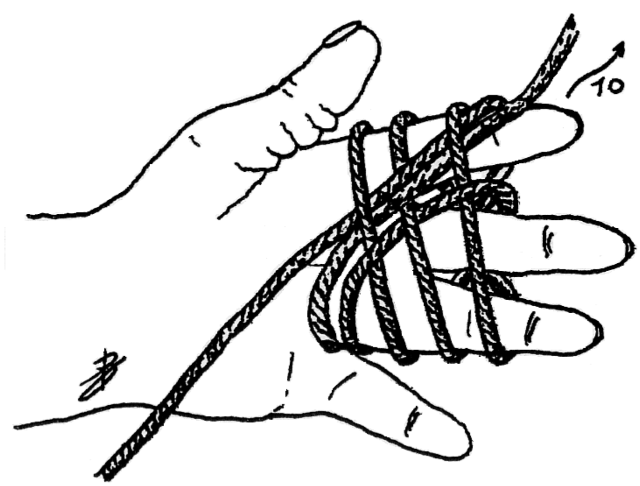
5. Hold the Wend between two fingers, your thumb maintaining the Spart on the turns. Turn your hand to see the back of it. There are 4 turns side by side not crossing each other.

6 & 7. Take hold of the second turn (counting from the ends of your fingers), make it go Under the third turn and Over the fourth pushing towards the wrist.



8. Take hold of the first turn, pass it on the third turn (which is now in second position, since you have changed places with the second turn) Under the fourth turn (which is now in the third position, having already been moved).

9. Take hold of the Wend, make it cross Under-Over, Under-Over in the order you come to them.



10. Keep going back towards the Spart, always turning in the same direction, your first passage is finished.

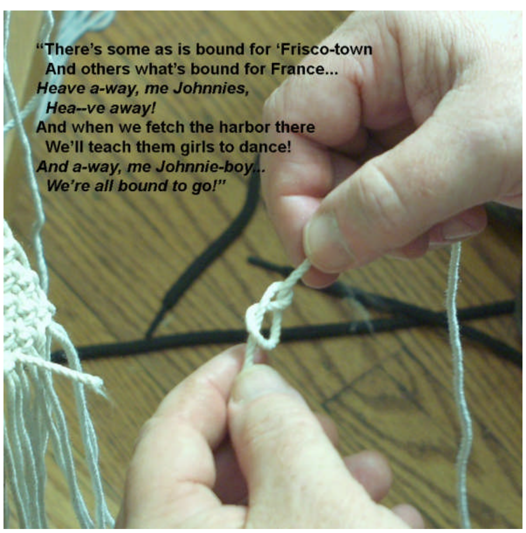
To finish this Turk's Head, there remains nothing more but to double (triple) the passages then dress and set.

Repairing a Broken Line While Making a Macrame Belt

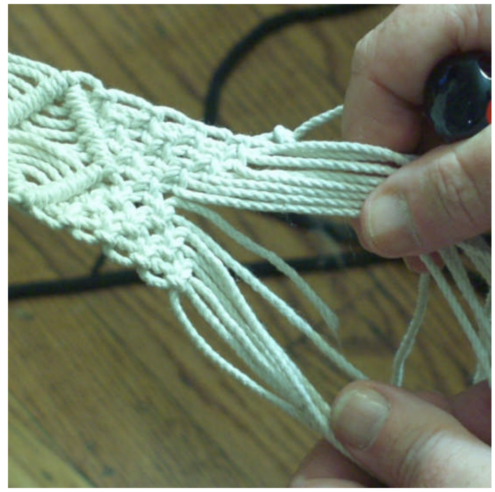
by Vince Brennan from *frayedknotarts.com*

Here we have a line which has broken in mid-belt. Not the disaster you may think it is, but still a bit tricky to fix:

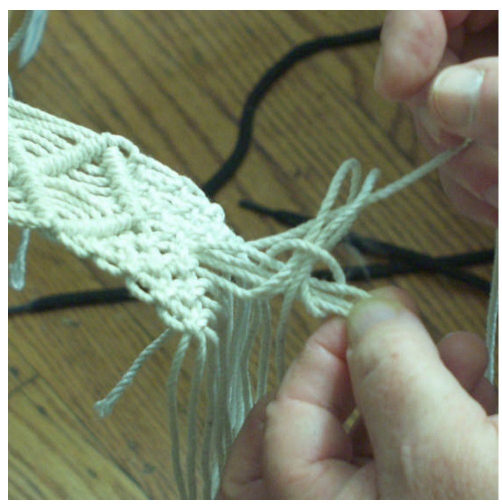
Take the line which has broken (or a new line, if you're not sure of the integrity of the broken line) and put in a figure-eight knot in the end. [Note: *One broken line is OK... the repair will cover the weak spot just fine, but two or three start to make you wonder about the quality of the line you bought and the honesty of the feathermerchants that made or sold it.*]



Unlay enough knots (I like to do at least two complete rows so that I have enough line to grip on the broken stub) until you have the broken line prepared to be a filler line. (Remember, the two outer lines are the working knot lines and the two inner lines are the filler lines). The stub should be at least three or four inches long to provide you with enough to grip well.



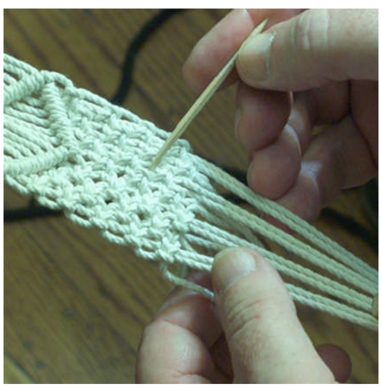
Put the knotted end of the new line inbetween the two fillers and then grasp all three (broken, new and good filler line) and treat them all as though there were only two lines. Cast your square knot around all three lines (broken, replacement and filler) in the proper direction to maintain the pattern and pull things tight, making a knot. A bit of extra tension here will keep the knot from being a lot larger than the rest of them: a little larger is unavoidable.



As you pull the top of the knot together you will notice the broken stub has a tendency to roll under the knot and be the bottom of the three filler lines. If it does not do so, try to position it so that it is the bottom of the three filler lines. This will contribute to a cleaner appearance when trimmed off.

Continue knotting as though nothin' has happened for at least THREE full rows, then turn the work over and trim off the new line and the stub close aboard the knot. You do NOT want to nick the knot while doing this but you DO want the trimmed parts to be fairly level with the edges of the knot so that it "disappears".

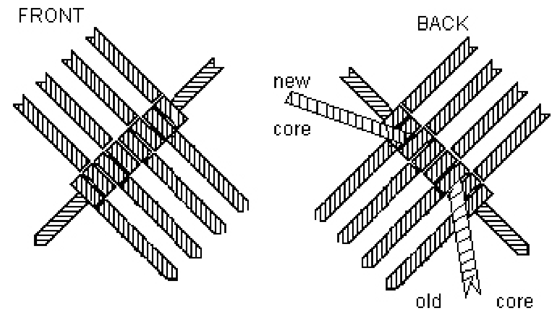
Here is the FRONT of the knot with the toothpick pointing to the repair knot.

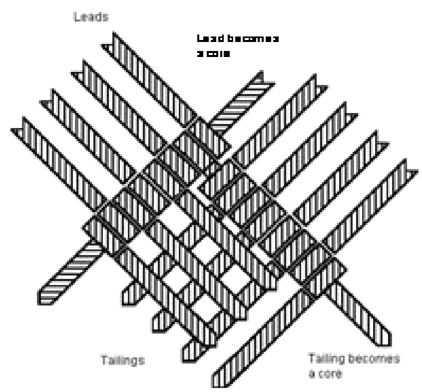


The BACK of the knot with the toothpick pushed through from the other side. The nice thing about this repair method is that it is strong, fairly undetectable and permanent.

For a broken line while doing halfhitching, there are two methods:

If a tailing breaks, simply unlay the halfhitches until you come to a square knotted portion then proceed as above until your stub is long enough to grasp. Do the repair as per above and proceed on course from that point





If (more likely) a core breaks, unlay the hitches until you have enough stub to allow you to bend it out below the work and grasp it firmly (one inch is usually sufficient), then take a new line and lay it alongside the broken line and cast a set of hitches around BOTH the old and the new cores with the NEW core sticking out the back of the work between hitches. Cast one or two more sets of hitches, then lead the OLD core out the back and continue casting onto the new core.

Again, after proceeding on course for a few rows, go back and trim off the "loosers" so that they'll be hard to find, but don't nick or shave the hitches or you'll be doing this again very soon.

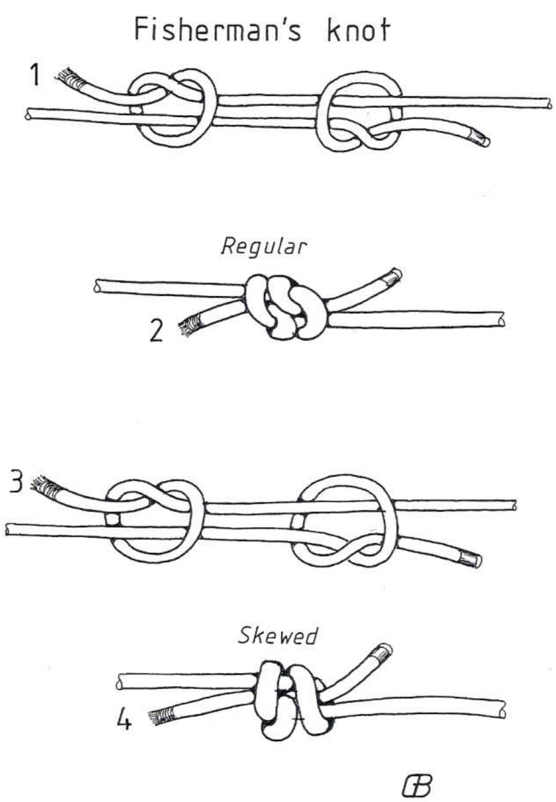
INTERNATIONAL GUILD OF KNOT TYERS

The Handedness of Knots

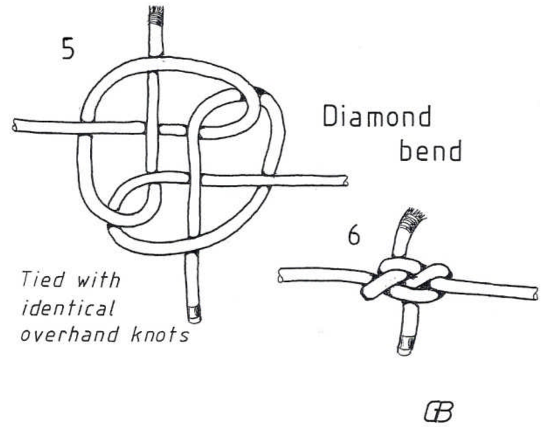
written and illustrated By Geoffrey Budworth

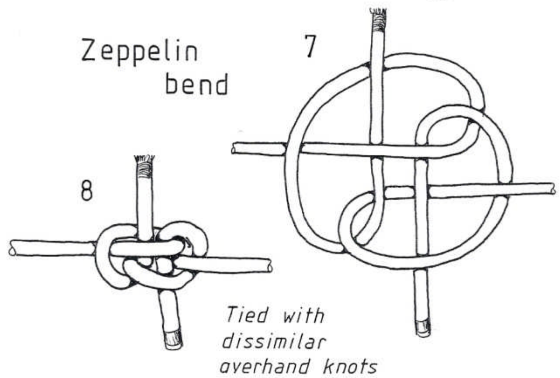
At the 21st Annual General Meeting of the IGKT, held on Saturday 10th May 2003 in the English seaside resort of Weston Super Mare, a newcomer to the Guild – Barry Brown – displayed an immaculate pair of chest beckets (since featured on page 25 of *Knotting Matters* #80). Apparently identical, they are in fact left and right-handed. The knotting, needle-hitching, coach-whipping, *et cetera* on one, have all been painstakingly reversed on the other to create mirror images. It is a subtle contrivance.

Most knotting is asymmetric and so can be tied in two forms. The version of (say) the sheet bend or bowline that I tie instinctively may be the opposite of how you do it, and each of us would have to concentrate in order to reproduce the version that we find unnatural. As such handedness does not affect how an individual knot performs, does it matter? No – but it can be crucial to differentiate between the handedness of knots so as to combine them. For instance, the fisherman's knot is best tied with identical twin overhand knots so as to combine them (1, 2). If they are dissimilar (3, 4), then the resulting knot is inelegant and perhaps less reliable.



To cite another instance, both the diamond and zeppelin bends are tied with a pair of interlocked knots and seem identical to the undiscerning eye; but, upon closer examination, the diamond bend (5, 6) is made from *identical* overhand knots, while the zeppelin bend (7, 8) is made from *dissimilar* overhand knots. In use, the zeppelin is pliant and preferable, easy to tie and tighten, while the diamond is awkward and troublesome.





Those Guild members who appear as expert witnesses in judicial hearings, to elucidate and expound upon knotted exhibits, have learned the hard way how misleading the terms 'left-handed' and 'right-handed' can be in writing and speaking about knots, since judges, lawyers and juries may be mislead into assuming wrongly that the person who ties the knots was left or right-handed.

A 'left-handed' bowline is something else. The sobriquet is an intentional slur, no mere label but a loaded term (from a time when left-handed individuals were deemed to be perverse), which implies that the knot is in some ways sinister and suspect. The same reproach is inherent in the 'left-handed' coils or flakes (unless done for a specific purpose) which indicate lubberly lack of ability.

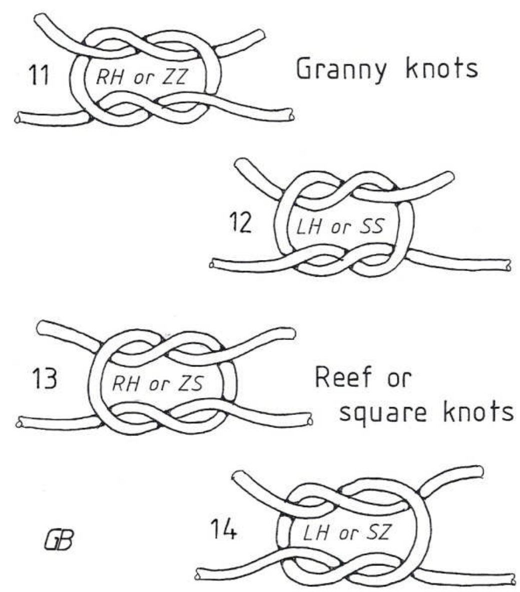
We knot tyers ought to agree and adopt useful alternatives to LH and RH which are neither insulting to left-handers nor ambiguous in meaning. Scientific and technical terms for handedness already exist and they include:

Left Handed	**Right Handed**
Sinistral	Dextral
Laevo (or levo)	Destro
N	Z
Counter-Clockwise	Clockwise
S	Z

Dismiss the Latinate words as too pretentious. N and Z can be confused (if one turns a drawing on its side, for instance). 'Clockwise' and 'counter-clockwise' are inadvisable, as analogue clocks and watches with hour and minute hands could be ousted in due course by digital ones, rendering the expressions as archaic to future generations as 'with, or against, the sun' are now to us.

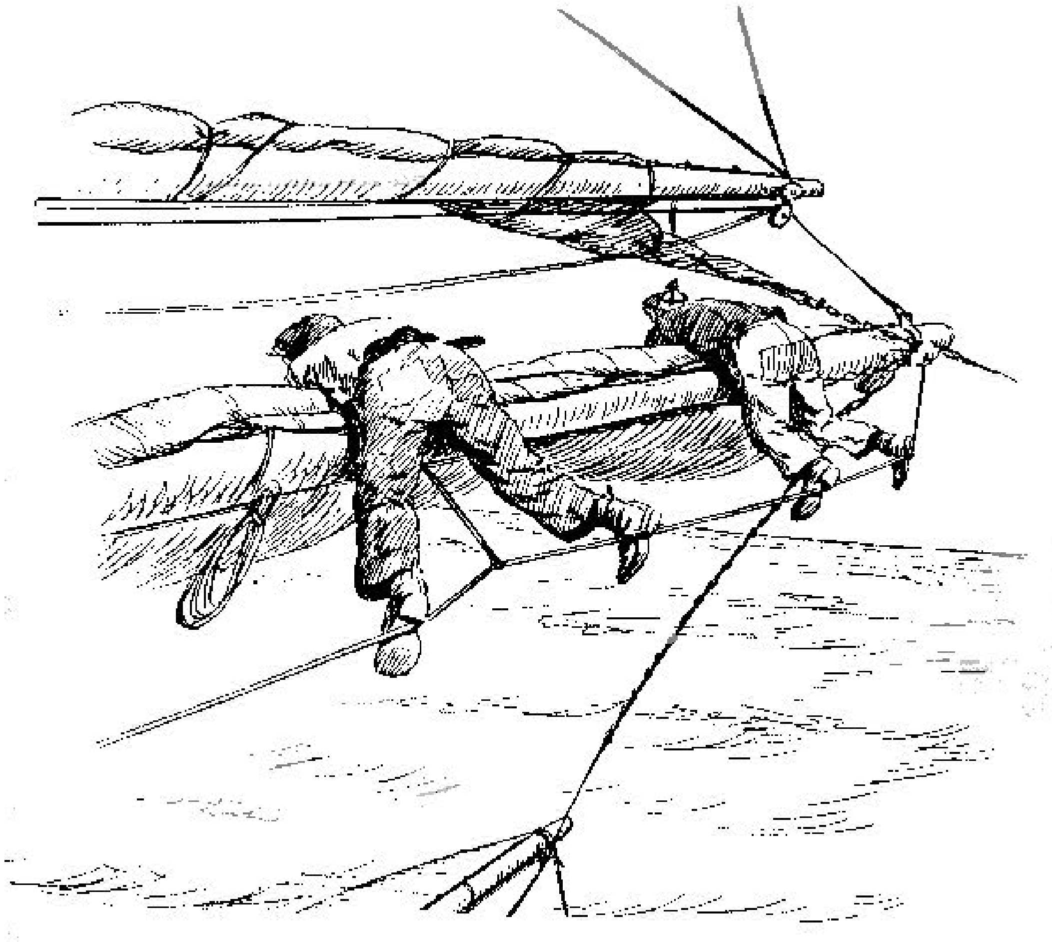
Which leaves 'S' and 'Z'. More and more English-speaking knot tyers and rope workers now use the terms S-laid and Z-laid – once confined to the yarns and twines of weavers and other textile workers – to designate the lay of hawsers and cables. To picture which is which, superimpose the letter 'S' on a left-handed piece of rope and see how the middle section of the letter lies more or less along the angle of the laid strand (9); and, similarly, see how the letter 'Z' fits right-handed rope (10).

Overhand knots may be identified as S-laid or Z-laid by the way the two parts intertwine, to the left or right. Similarly, reef and granny knots are labeled according to which way the *first* of their paired half-knots spirals. A granny knot that starts RH is ZZ (11), while one starting LH is SS (12). A RH reef or square is ZS (13) and the LH version is SZ (14).



For a somewhat fuller and more scholarly discussion on chirality (the academic word, adopted from organic chemistry, for handedness) see *The Forensic Analysis of Knots and Ligatures* by IGKT past-President Robert Chisnall, BSc., BEd., M.Ed. published in 2000 by the Lightening Powder Company; Salem, Oregon, USA. (ISBN 0-9622305-2-9)

Symmetry is also discussed and illustrated by IGKT member Roger E. Miles in *Symmetric Bends*, published 1995 by World Scientific Publishing Co. Pte.Ltd. ISBN 981-02-2194-0.



Aloft - Furling Sail on the Yard [contributed by Darrell Ausherman; , California]

16-strand Braid of Bread from the Black Widow Bakery [sent in by Charles Hamel; France]