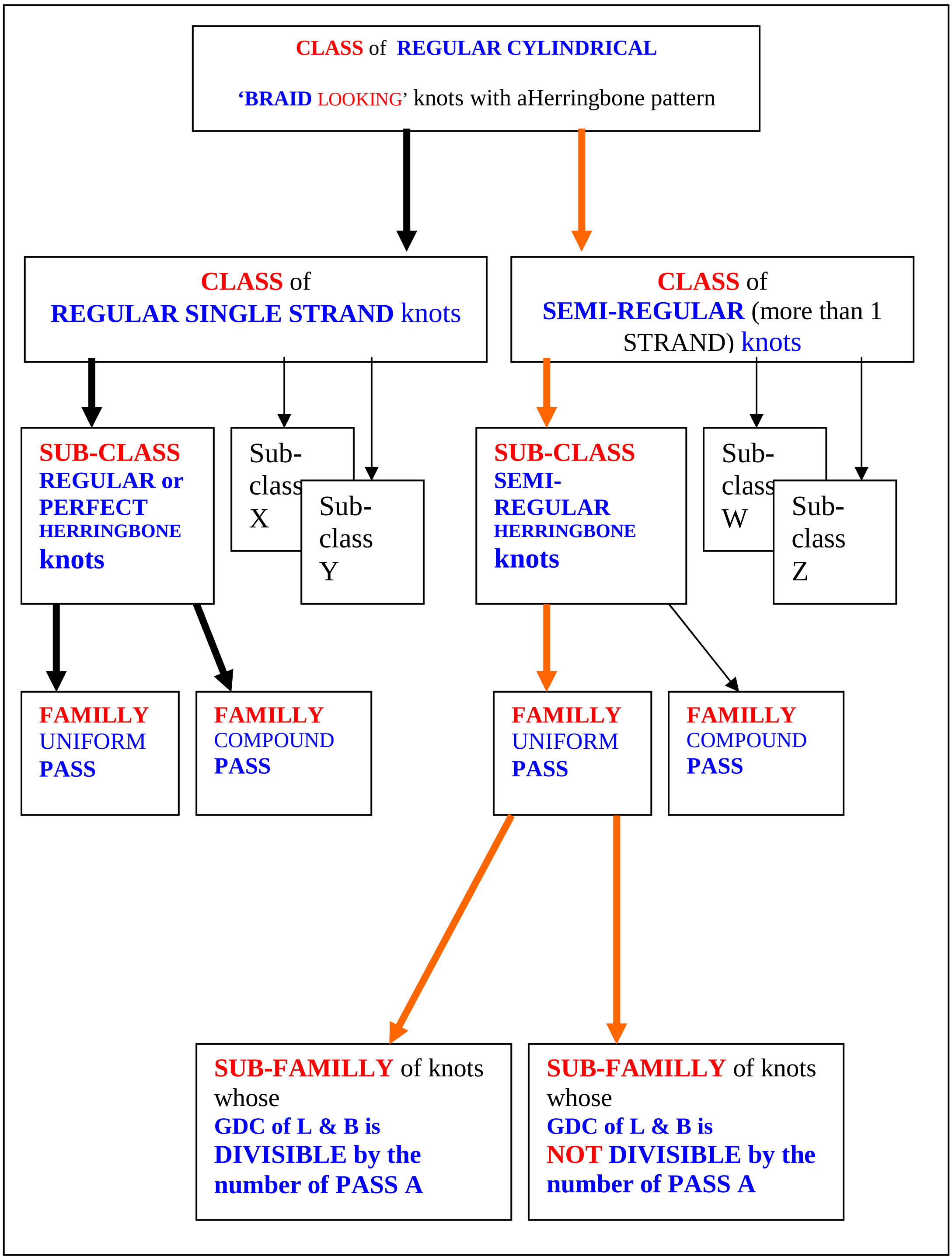
STANDARD HERRINGBONE KNOTS (SHK)

It was difficult to summarize in less than 3 dozens of pages hundreds of pages so, pray, forgive me if this is a bit of a shamble to read.

Sources ;
- my own observations and reflection
- *THE BRAIDER* (Schaake & Turner)
- *BRAIDING STANDARD **HERRINGBONE** KNOTS* (Schaake & Turner)
- *BRAIDING STANDARD **HERRINGBONE PINEAPPLE** KNOTS* (Schaake & Turner)

I made this diagram from the way Schaake dismembered the SHK



The knots we are speaking about here, the **STANDARD HERRINGBONE KNOTS** (SHK), are assemblies of Turk's-Head knots THK) , just as Standard Herringbone **Pineapple** knots (SHPAK) are assemblies of Turk's-Head knots, and just as are many interweaves of THK that are neither SHK or SHPAK.

BUT (a big, a very BIG BUT) in the SHK the components THK are **ALL IDENTICAL** plus those THK are ***not*** using several staged BIGHT RIM as Pineapple do.
SHK use only one rim as THK do.
The immediate implication is that there is **NO NESTED-BIGHT in a SHK** while those nested-bights are a 'must have' for a SHPAK.

The first step in the making of an ***A-PASS*** SHK (***A*** being a positive integer number, 1 to *N*) is the laying of a **foundation knot**, in other word the making of a first THK.

When this first laid knot is finished then a second THK of identical dimensions in **Lead** and **Bight** is interwoven with it following a particular coding.

This make 2 THK assembled so it is a ***2-PASS*** SHK. That is the biggest PASS dimension I was able to find published before Schaake & Turner.

If a third THK is put in this will gives a ***3-PASS*** SHK and so on.

2-PASS	***3-PASS***	***4-PASS***	***5-PASS***	***6-PASS***	***7-PASS***	is
even-*PASS*	**odd**-*PASS*	**even**-*PASS*	**odd**-*PASS*	**even**-*PASS*	**odd**-PASS	

1, 2, 3,7, 8…, n-3, n-2 .n-1, n is called by Schaake the **sequence numbers *A*** in the making of the knot.

As we shall see, when "**using a pair of universal algorithm-tables**» to make a SHK one of the pair of tables is for the **even-*PASS*** and the other for the **odd** –***PASS.***

THE INTERWOVEN THK HAVE TO BE POSITIONED RELATIVE TO THE FOUNDATION THK ACCORDING TO A CERTAIN ORDER.
This order is given by the **SEQUENCE RULE**.

Of course as regular as possible a physical interval positioning of the start points of the component THK around the rim of the SHK is the best to do.

Schaake made a distinction between (horizontal mandrel frame of reference) two """"braiding"""" (how I hate that word in this context !) direction:
One laying direction is UPWARD, he other is DOWNWARD.

After this very short introduction let us dig just a bit deeper.

'Lifted' straight fromSCHAAKE & TURNER in fair quote as this cannot be told better and illustrated better. **A GENERAL HERRINGBONE CODING**

In the Introduction we have already mentioned that a **herringbone-coding** is a **row-coding**. It consists of sets of $2A_i$ adjacent rows, with i equal to $1, 2, 3, \cdots$. An example of such a coding is illustrated in Fig. 1, where, reading from top to bottom, A_1 is equal to 3 (hence $2A_i = 2A_1 = 6$), A_2 is equal to 2 (hence $2A_i = 2A_2 = 4$), A_3 is equal to 5 (hence $2A_i = 2A_3 = 10$), A_4 is equal to 2 (hence $2A_i = 2A_4 = 4$), and A_5 is equal to 4 (hence $2A_i = 2A_5 = 8$). Each set of $2A_i$ adjacent rows consists of two sub-sets A_{i_1} and A_{i_2}, each with A_i adjacent rows. The rows within a sub-set all have the same coding. The coding in all the sub-sets A_{i_1} is the same, and opposite to the coding in the sub-sets A_{i_2}. When the value of A_i is the same (say $A_i = A$) for all $2A_i$ sets, the coding is an A-pass herringbone-coding; such a herringbone-coding is illustrated in Fig. 2 (a 3-pass herringbone-coding).

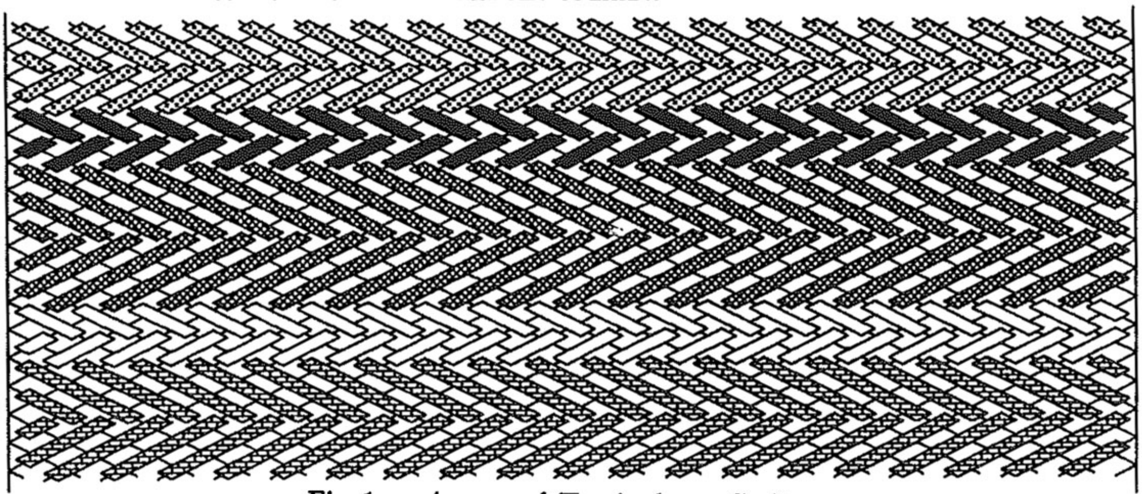


Fig. 1 — A general Herringbone Coding.

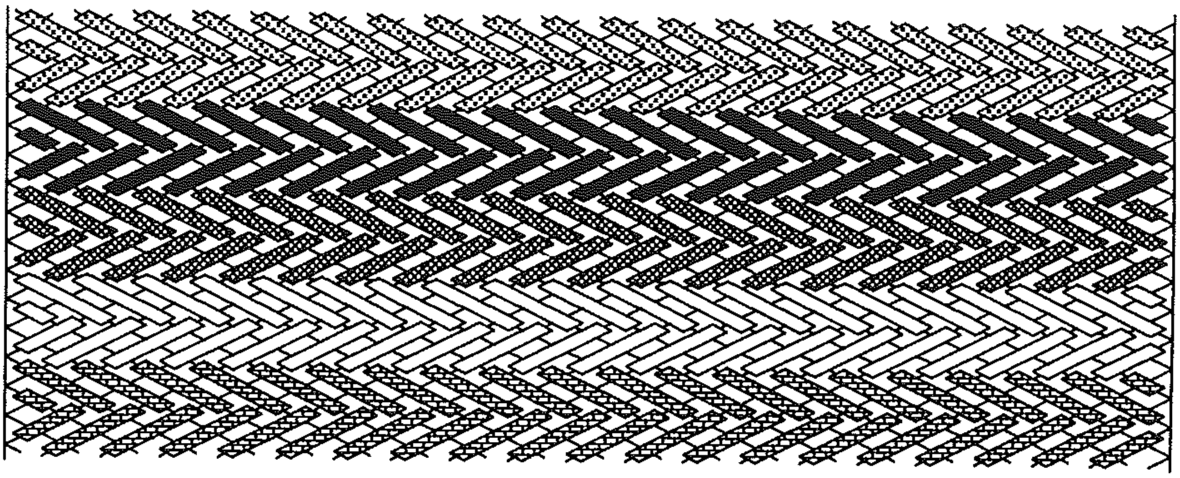


Fig. 2 — A 3-pass Herringbone Coding.

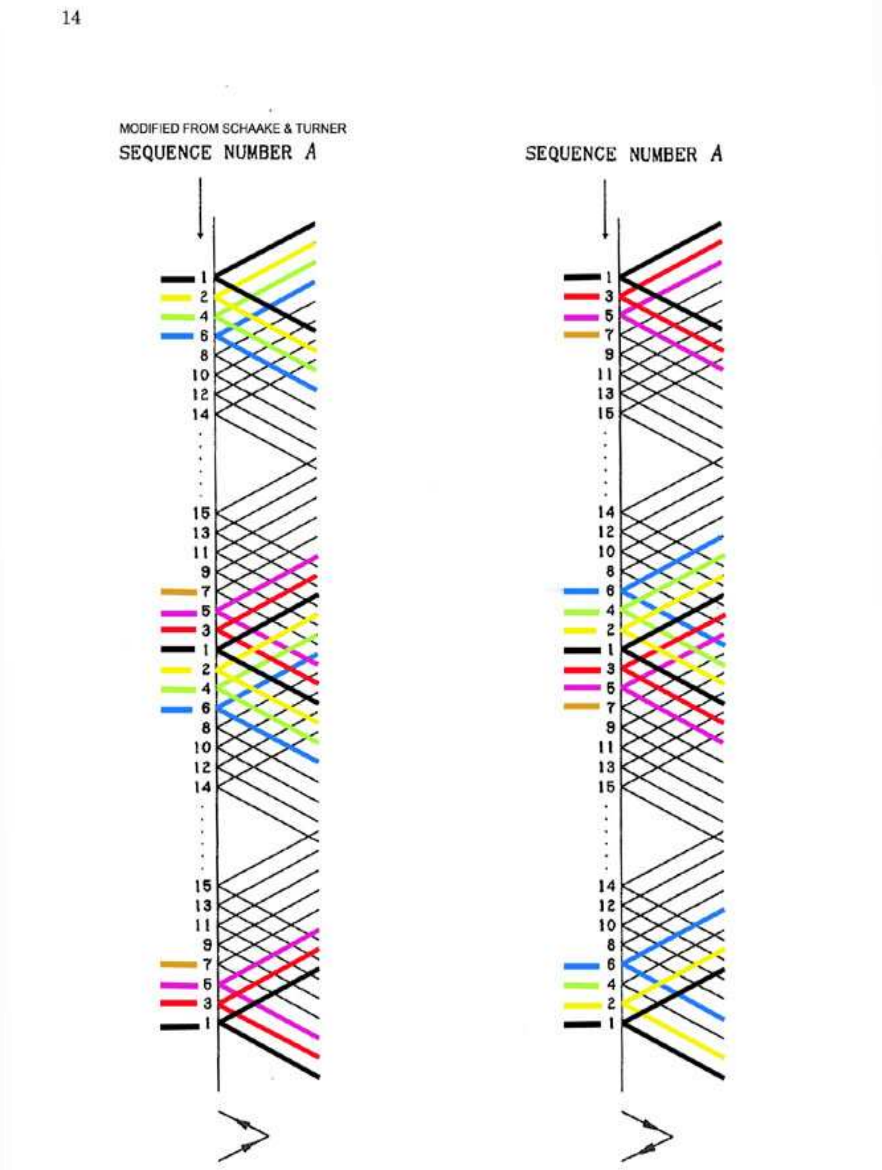


Fig. 11 — The Sequence Rule for the upwards and the downwards braiding direction.

Schaake remarked that "it is impossible to discover general rules if we don't go beyond this 2-PASS barrier to realize the existence of what he call "the ***fascinating sequence rule***". (GRANT left it at 2-PASS)
This is probably the reason why there is no SHK over 2-PASS having been published

This sequence is the sequence of the position of each of the component Turk's-head knots forming the SHK ***relative*** to the very first laid one: the foundation knot.

Obviously any S**H**K has a **HERRINGBONE PATTERN**, one that is **INTER-BIGHT CODED.** (ROW CODED for SCHAAKE's frame of reference = horizontal mandrel, **but is** COLUMN CODED on the vertical cylinder ; that is why I dislike these appellations that are much too frame-dependent. What I propose is not = INTER-BIGHT and PARALLEL BIGHT but I have expounded on that point elsewhere in my web pages)

You can see that *sequence rule* in the pattern when using colours:

The above and under illustration are modifications in a fair quote of SCHAAKE & TURNER:
I colorized them not to make them prettier or different but to make them clearer.
To quote the authors themselves of BRAIDING STANDARD HERRINGBONE KNOTS
"We do know that the presentation of the various grid-diagrams *would be considerably improved* (my emphasis with *italics*) by the use of colour printing; however, the very small demand for these books, and hence the small number of copies printed (a maximum of 50), unfortunately prohibits this."

SHK are an assembly, an interweave, of 2 to *n* *(that is what define the number of* **PASS** *: '**A**')* **Turk's head knots that are ALL of the same dimension in LEAD and BIGHT** (contrary to Herringbone Pineapple who have TWO SET of THK , even if one of the SET can be "empty") so there will be **NO nested bight possible in a SHK** as must exist in Herringbone **Pineapple**.

The sequence rule implies a rhythm, a 'predictability' that allows the construction of tables giving the construction of SHK.

In a SHK the total number of BIGHT will be ***A*** (the number of PASS) time B^* (number of BIGHT of the component THK.)

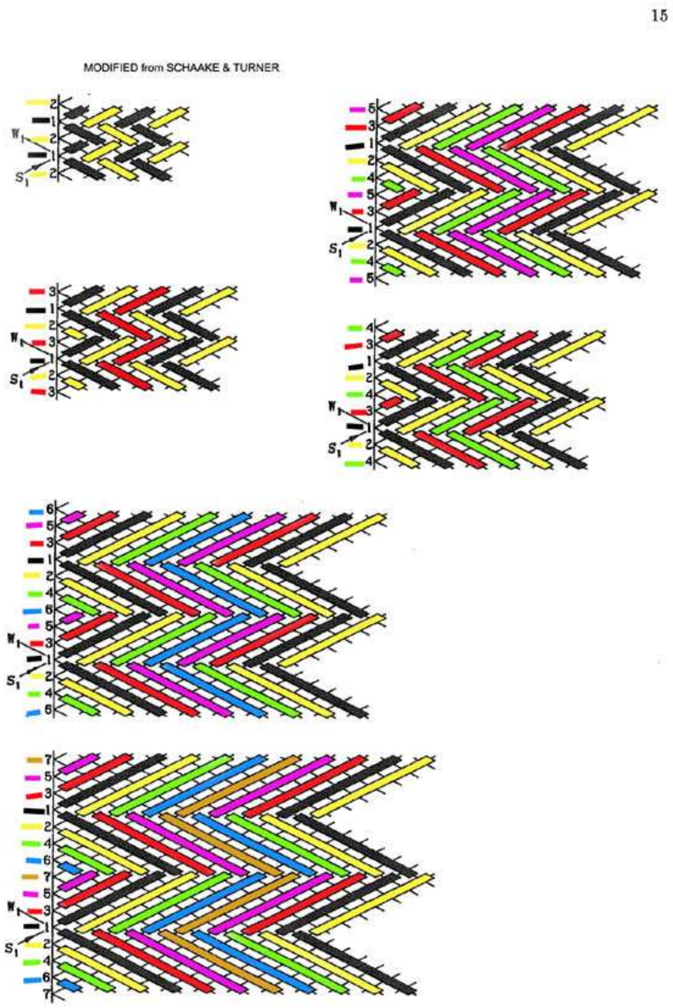


Fig. 12 — The Coding-Patterns associated with the upwards braiding direction.

A 3 PASS SHK with THK components of $4L^*$ $5B^*$ dimension will have $3 * 5 B^* = 15 B$ (B^* is for component, ***B*** is for SHK)

As there are 2 **ROW** (Schaake's frame of reference = horizontal mandrel I will use all along this article) per BIGHT there will be a total of $2 * 15 = 30$ rows

As (contrary to what exist in a Herringbone Pineapple) all the BIGHT of the SHK are on a unique BIGHT-RIM (or bight-boundary to speak like S & T) there will $L = 2 * L^*$
Total number of leads in the SHK
In this case $4 * 3 = 12$ LEAD.
So **L-1** or ($12 – 1 = 11$) columns of crossings alignment in the SHK.

UNIFORM-PASS == all A_i *are have the same value* ***A*** ***(all the PASS are equal)***
COMPOUND == there are several dimensions (at least two different) of SET of PASS
At least two A_i have different numerical value (see at the very end of this document.

Of course the components THK have their **L*** and **B*** complying with the GDC=1 rule to be single-strand knots.

For a single strand THK , which the component THK are in our **UNIFORM A-PASS SEMI-REGULAR SHK**, the GDC of L* and B* is **'1'** but the SHK will have
L = (***A*** * **L***) and **B** = (***A*** * **B***) .

Obviously the **L** & **B** do not comply with the GDC=1 rule. (I hope it is startlingly evident for every one; unless you count the foundation THK as a 1-PASS SHK which would be ridiculous in the "real 3D world" if acceptable in "the theory")

So **L** and **B** of the SHK have a **GDC$_{(SHK)}$ > 1** for the SHK with ***A*>=2 *PASS***

This **GDC$_{(SHK)}$**
Either IS divisible by ***A*** (number of ***PASS***)
Or IS NOT divisible by ***A***

That makes for **two different sub-families**. (see first diagram illustration given)

If GDC$_{(SHK)}$ **IS** divisible by ***A***

Then that means that GDC$_{(SHK)}$ = *n* * ***A*** (n being a positive integer +1 to as great a number as you want ; that is obvious)
3-PASS 24 L 15B GDC= 3 n=1 |||| 2-PASS 30L 24B GDC=6 n=3
2-PASS 24L 20B GDC= 4 n=2

A SHK made with *n*****A*** strands (with n****A*** >1 of course) will be a
UNIFORM *A*-PASS SEMI-REGULAR nA* STRANDS HERRINGBONE KNOTS**

BUT there is still a dichotomy in those knot to be observed :

Those where *n* is an **ODD** number : they will have *n*****A*** **TURK'S-HEAD KNOT COMPONENT**
and
Those where *n* is and **EVEN** number : they will have *n*****A*** ***MATTHEW WALKER KNOT COMPONENT***) -see illustration on next page-

SCHAAKE insists on this point:
"We emphasize that the interwoven knots of a Semi-Regular Herringbone Knot play an important role in its classification"

Let us stay with SCHAAKE
"In this book we shall limit our discussion to the 'A-pass nA_string Herringbone Knots' for which the value of n is equal to 1 (hence the value of A is greater than 1) ; these knots are called the **Standard Herringbone Knots**. Since 1 is an ***odd*** positive integer, an A-pass Standard Herringbone Knot with *p*-parts and *b*-bights consists of *A* interwoven Turk's-head knots, each of which has *p*=p/A* parts and *b*=b/A* bights "

(**BRAIDING STANDARD HERRINGBONE KNOTS** does not treat of the COMPOUND-PASS semi-regular herringbone knots or the UNIFORM-PASS semi-regular herringbone knots). The Authors treat differently the **UPWARD** and the **DOWNWARD** ways to make these knots. I will keep only the UPWARD (mandrel frame)

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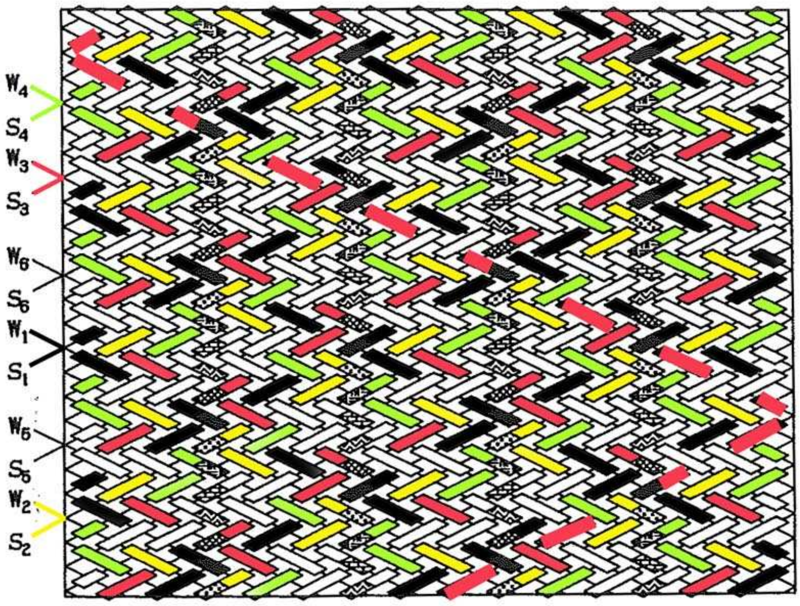
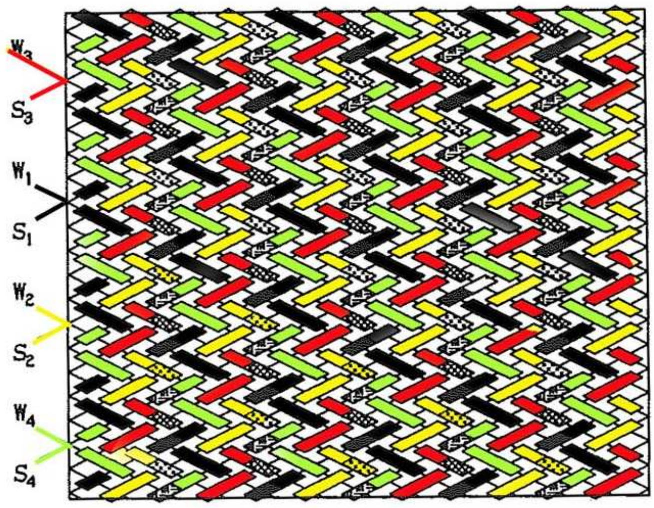


TURK's HEAD KNOTS COMPONENTS

Fig. 6 — 2-pass Semi-Regular Herringbone Knot; 30-parts/24-bights, $n = 3$.

GDC (30 , 24) == 3



MATTHEW WALKER KNOTS COMPONENTS

Fig. 7 — 2-pass Semi-Regular Herringbone Knot; 24-parts/20-bights, $n = 2$.

GDC (24, 20) == 2

17

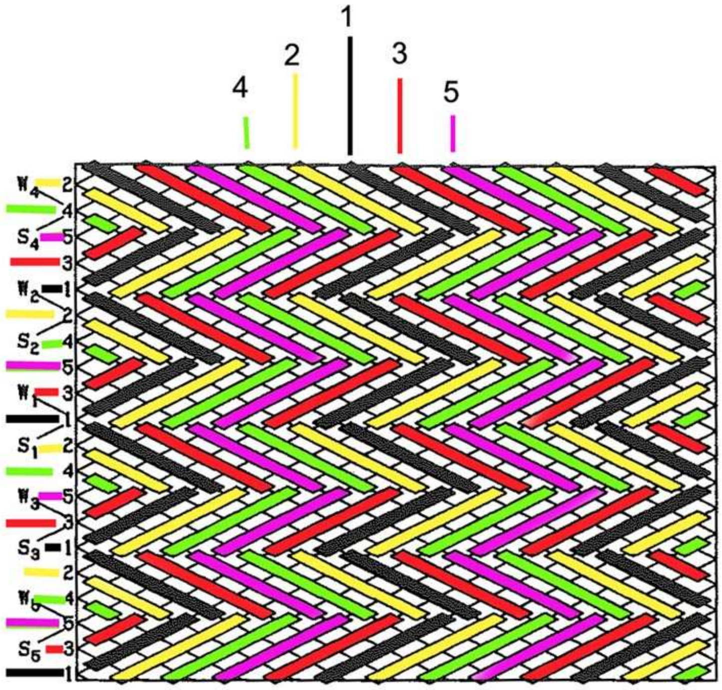


Fig. 14 — The regular positioning of the starting-points (upwards braiding method).
THERE IS ALSO AN ILLUSTRATION FOR THE DOWNWARDS BRAIDING METHOD. Get yourself a copy of the book (over 200 pages)

Tables will be for **L* and B* values of the component THK.**

We will have to distinguish **L* (odd)** and **L* (even)**

For **each pair of L*$_{ODD}$ & B* values** there will be **a pair of S_O tables** :
One for the **ODD** numbered **PASS**
One for the **EVEN** numbered **PASS**

For **each pair of L*$_{EVEN}$ & B* values** there will be **a pair of S_E tables** :
One for the **ODD** numbered **PASS**
One for the **EVEN** numbered **PASS**

In the book there are 32 PAIRS of READY-MADE tables looking like the one down here in page 14.

How does one draw the **LAYOUT** of the cells of the **ALGORITHM TABLES** ?
Here is some tips.

SET NUMBER						……..			
L to R reference						……..			
R to L reference						……..			
Half-period 1	L to R					……..			
Half-period 2	R to L					……..			
Half-period 3	L to R					……..			
						……..			
Half-period 2B* - 1	L to R					……..			
Half-period 2B*	R to L					……..			

ALL the tables will be drawn like this one just above.

Now for the particular **TYPES** : TYPE S_O and TYPE S_E

S_O THK **component** (that is NOT the whole SHK) with **ODD** number of **LEAD**

S_E THK **component** with **EVEN** number of LEAD

The following template applies to both TYPE S_O and TYPE S_E as **far as drawing their "frame" is concerned but the value to be entered in each of the yellow cells depends on the** S_O or S_E **nature.**

S_O (or S_E) L^*_{ODD} (or L^*_{EVEN}) with B* such that GDC = 1

ODD numbered *A*

SET NUMBER		1	2	3	4	……..	L*- 2	L*- 1	
L to R reference						……..			
R to L reference						……..			
Half-period 1	L to R					……..			
Half-period 2	R to L					……..			
Half-period 3	L to R					……..			
						……..			
Half-period 2B* - 1	L to R					……..			
Half-period 2B*	R to L					……..			

EVEN numbered *A*

SET NUMBER			1	2	3	……..	L*- 3	L*- 2	L*- 1
L to R reference						……..			
R to L reference						……..			
Half-period 1	L to R					……..			
Half-period 2	R to L					……..			
Half-period 3	L to R					……..			
						……..			
Half-period 2B* - 1	L to R					……..			
Half-period 2B*	R to L					……..			

Let us be slow in our progress: **READ VERY ATTENTIVELY, DECIPHER COMPLETELY BEFORE PROCEEDING ALONG.**
DON'T RUSH THE VERY SOFT LEARNING CURVE I AM TRYING TO BUILD FOR YOU.

S_o L^*_{ODD} with B^* such that GDC = 1

ODD numbered *A*

SET NUMBER	1	2	3	4	……..	L*- 2	L*- 1	
L to R reference	*A -1* *U*	*A –1* *O*	*A -1* *U*	*A –1* *O*	……..	*A -1* *U*	*A –1* *O*	*A -1* *U*
R to L reference	*A -1* *U*	*A –1* *O*	*A -1* *U*	*A –1* *O*	……..	*A -1* *U*	*A –1* *O*	*A -1* *U*

EVEN numbered *A*

SET NUMBER		1	2	3	……..	L*- 3	L*- 2	L*- 1
L to R reference	*A -1* *U*	*A –1* *O*	*A -1* *U*	*A –1* *O*	……..	*A -1* *U*	*A –1* *O*	*A -1* *U*
R to L reference	*A -1* *U*	*A –1* *O*	*A -1* *U*	*A –1* *O*	……..	*A -1* *U*	*A –1* *O*	*A -1* *U*

S_E L^*_{EVEN} with B^* such that GDC = 1

ODD numbered *A*

SET NUMBER	1	2	3	4	……..	L*- 2	L*- 1	
L to R reference	*A -1* *U*	*A –1* *O*	*A -1* *U*	*A –1* *O*	… … . .	*A –1* *O*	*A -1* *U*	*A –1* *O*
R to L reference	*A –1* *O*	*A -1* *U*	*A –1* *O*	*A -1* *U*	… … . .	*A -1* *U*	*A –1* *O*	*A -1* *U*

EVEN numbered *A*

SET NUMBER		1	2	3	……..	L*- 3	L*- 2	L*- 1
L to R reference	*A -1* *U*	*A –1* *O*	*A -1* *U*		……..	*A –1* *O*	*A -1* *U*	*A –1* *O*
R to L reference	*A –1* *O*	*A -1* *U*	*A –1* *O*	*A -1* *U*	……..	*A -1* *U*	*A –1* *O*	*A -1* *U*

Now a pair of whole tables

S_o L^{*}_{ODD} with B^* such that GDC = 1

ODD numbered *A*

SET NUMBER		1	2	3	4	……..	L*- 2	L*- 1	
L to R reference		*A -1 U*	*A –1 O*	*A -1 U*	*A –1 O*	……..	*A -1 U*	*A –1 O*	*A -1 U*
R to L reference		*A -1 U*	*A –1 O*	*A -1 U*	*A –1 O*	……..	*A -1 U*	*A –1 O*	*A -1 U*
Half-period 1	L to R	*A - 1*	*A - 1*	*A - 1*	*A - 1*	……..	*A - 1*	*A - 1*	*A - 1*
Half-period 2	R to L					……..			*A - 1*
Half-period 3	L to R					……..			*A - 1*
….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..
Half-period 2B* - 1	L to R					……..			*A - 1*
Half-period 2B*	R to L					……..			*A - 1*

EVEN numbered *A*

SET NUMBER			1	2	3	……..	L*- 3	L*- 2	L*- 1
L to R reference		*A -1 U*	*A –1 O*	*A -1 U*	*A –1 O*	……..	*A -1 U*	*A –1 O*	*A -1 U*
R to L reference		*A -1 U*	*A –1 O*	*A -1 U*	*A –1 O*	……..	*A -1 U*	*A –1 O*	*A -1 U*
Half-period 1	L to R	*A - 1*	*A - 1*	*A - 1*	*A - 1*	……..	*A - 1*	*A - 1*	*A - 1*
Half-period 2	R to L	*A - 1*				……..			
Half-period 3	L to R	*A - 1*				……..			
….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..
Half-period 2B* - 1	L to R	*A - 1*				……..			
Half-period 2B*	R to L	*A - 1*				……..			

SE L*EVEN with B* such that GDC = 1

ODD numbered *A*

SET NUMBER		1	2	3	4	……..	L*- 2	L*- 1	
L to R reference		*A -1 U*	*A –1 O*	*A -1 U*	*A –1 O*	… … . .	*A –1 O*	*A -1 U*	*A –1 O*
R to L reference		*A –1 O*	*A -1 U*	*A –1 O*	*A -1 U*	… … . .	*A -1 U*	*A –1 O*	*A -1 U*
Half-period 1	L to R	*A - 1*	*A - 1*	*A - 1*	*A - 1*	……..	*A - 1*	*A - 1*	*A -1*
Half-period 2	R to L					……..			*A -1*
Half-period 3	L to R					……..			*A - 1*
….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..
Half-period 2B* - 1	L to R					……..			*A -1*
Half-period 2B*	R to L					……..			*A - 1*

EVEN numbered *A*

SET NUMBER			1	2	3	……..	L*- 3	L*- 2	L*- 1
L to R reference		*A -1 U*	*A –1 O*	*A -1 U*		……..	*A –1 O*	*A -1 U*	*A –1 O*
R to L reference		*A –1 O*	*A -1 U*	*A –1 O*	*A -1 U*	……..	*A -1 U*	*A –1 O*	*A -1 U*
Half-period 1	L to R	*A - 1*	*A - 1*	*A - 1*	*A - 1*	……..	*A - 1*	*A - 1*	*A - 1*
Half-period 2	R to L	*A - 1*				……..			
Half-period 3	L to R	*A - 1*				……..			
….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..	….. ….. ….. …..
Half-period 2B* - 1	L to R	*A - 1*				……..			
Half-period 2B*	R to L	*A - 1*				……..			

Now for an example of how to put a table to use:

S_o ——— $p^* = 5$; $b^* = 4$

Sequence Number $A = odd$

Set-number		1	2	3	4	
$L \longrightarrow R$ Reference		$A-1$ u	$A-1$ o	$A-1$ u	$A-1$ o	$A-1$ u
$R \longrightarrow L$ Reference		$A-1$ u	$A-1$ o	$A-1$ u	$A-1$ o	$A-1$ u
1	$L \longrightarrow R$	$A-1$	$A-1$	$A-1$	$A-1$	$A-1$
2	$R \longrightarrow L$	$A-1$	$A-1$	$A-1$	A	$A-1$
3	$L \longrightarrow R$	$A-1$	$A-1$	$A-1$	A	$A-1$
4	$R \longrightarrow L$	$A-1$	$A-1$	A	A	$A-1$
5	$L \longrightarrow R$	$A-1$	$A-1$	A	A	$A-1$
6	$R \longrightarrow L$	$A-1$	A	A	A	$A-1$
7	$L \longrightarrow R$	$A-1$	A	A	A	$A-1$
8	$R \longrightarrow L$	A	A	A	A	$A-1$

Table above and under are quoted directly, unmodified, from Schaake

Let us say A =1 then that read:

Set number 1		1	2	3	4	
HP 1	L to R	0	0	0	0	0
HP 2	R to L	0	0	0	0	0
HP 3	L to R	0	0	0	1	0
HP 4	R to L	0	0	1	1	0
HP 5	L to R	0	0	1	1	0
HP 6	R to L	0	1	1	1	0
HP 7	L to R	0	1	1	1	0
HP 8	R to L	1	1	1	1	0

Set number 1		1	2	3	4	
HP 1	L to R	U0	O0	U0	O0	U0
HP 2	R to L	U0	O0	U0	O0	U0
HP 3	L to R	U0	O0	U0	O1	U0
HP 4	R to L	U0	O0	U1	O1	U0
HP 5	L to R	U0	O0	U1	O1	U0
HP 6	R to L	U0	O1	U1	O1	U0
HP 7	L to R	U0	O1	U1	O1	U0
HP 8	R to L	U1	O1	U1	O1	U0

S_o —— $p^* = 5$; $b^* = 4$

Sequence Number $A = even$

Set-number		1	2	3	4
L⟶R Reference	$A-1$ u	$A-1$ o	$A-1$ u	$A-1$ o	$A-1$ u
R⟶L Reference	$A-1$ u	$A-1$ o	$A-1$ u	$A-1$ o	$A-1$ u
1 L⟶R	$A-1$	$A-1$	$A-1$	$A-1$	$A-1$
2 R⟶L	$A-1$	$A-1$	$A-1$	$A-1$	A
3 L⟶R	$A-1$	$A-1$	$A-1$	$A-1$	A
4 R⟶L	$A-1$	$A-1$	$A-1$	A	A
5 L⟶R	$A-1$	$A-1$	$A-1$	A	A
6 R⟶L	$A-1$	$A-1$	A	A	A
7 L⟶R	$A-1$	$A-1$	A	A	A
8 R⟶L	$A-1$	A	A	A	A

Let us say that A = 4 then that read:

Set number		1	2	3	4	5
HP 1	L to R	3	3	3	3	3
HP 2	R to L	3	3	3	3	4
HP 3	L to R	3	3	3	3	4
HP 4	R to L	3	3	3	4	4
HP 5	L to R	3	3	3	4	4
HP 6	R to L	3	3	4	4	4
HP 7	L to R	3	3	4	4	4
HP 8	R to L	3	4	4	4	4

Set number		1	2	3	4	5
H P 1	L to R	U3	O3	U3	O3	U3
H P 2	R to L	U3	O3	U3	O3	U4
H P 3	L to R	U3	O3	U3	O3	U4
H P 4	R to L	U3	O3	U3	O4	U4
H P 5	L to R	U3	O3	U3	O4	U4
H P 6	R to L	U3	O3	U4	O4	U4
H P 7	L to R	U3	O3	U4	O4	U4
H P 8	R to L	U3	O4	U4	O4	U4

Calculate the value of ***A*** and **(*A*-1)** and search the **U** / **O** coding in the second or third row as is the case (**L** to **R** for ***odd*** numbered Half-Period and **R** to **L** for ***even*** numbered H-P)

Using algorithm tables you can make any *A-PASS* STANDARD HERRINGBONE KNOT

About the **SET NUMBER :**

In ***a completely finished*** SHK, for each half-period, it is possible to separate the crossing existing along this half-period in **SET OF CROSSINGS in such a way that IN A GIVEN SET ALL THE ADJACENT CROSSINGS IN IT ARE OF THE SAME TYPE : OVER / UNDER.**

IN ALL CASES THE NUMBER OF SETS IS EQUAL TO L*, the number of LEAD in any one of the component THK (components are all of identical dimension.) BUT we *do not* give a number to ALL of these SET (think about the BLACK CELL either at the beginning or the end of the row of set number)

The set without number, the one with the caviar-ed (a term from French printed-matter censure meaning “covered with black ink” as if a toast with caviar) cell is **THE ONE WHERE THE NUMBER OF CROSSING WILL NOT CHANGE WHEN MAKING THE KNOT.**

THE CELL / SET WHICH WILL NOT BE NUMBERED AND WILL GET THE BLACK CELL IS *IN THE TABLES*:
THE VERY **LAST** ONE in the case of the NUMBER SEQUENCE of ***A*** being **ODD.**
THE VERY **FIRST** ONE in the case of the NUMBER SEQUENCE of ***A*** being **EVEN.**

So only (L* – 1) sets will get a number but there will be L* cells in the SET NUMBER row, the discrepancy being the “black cell”.

The same SET NUMBER (say 3) figures in both and **ODD**-numbered HP **L** to **R** and in an **EVEN**-numbered HP **R** to L **BUT** that set <u>number</u> DOES NOT GO with the same crossings so NOT to the same SET of crossing.

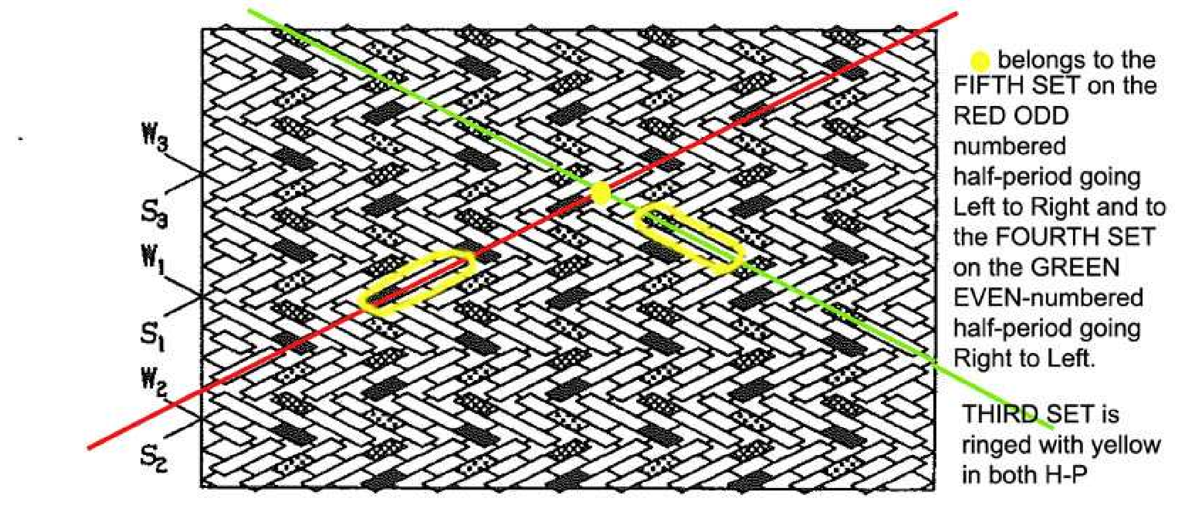


Fig. 5 — 3-pass Semi-Regular Herringbone Knot; 24-parts/15-bights, $n = 1$.

The second and third rows give the **REFERENCE QUANTITY (*A*-1)** and the **TYPE OVER / UNDER of the CROSSING**

SET NUMBER	1	2	3	4	……..	L*- 2	L*- 1	
L to R reference	*A -1 U*	*A –1 O*	*A -1 U*	*A –1 O*	……..	*A -1 U*	*A –1 O*	*A -1 U*
R to L reference	*A -1 U*	*A –1 O*	*A -1 U*	*A –1 O*	……..	*A -1 U*	*A –1 O*	*A -1 U*

SET NUMBER		1	2	3	……..	L*- 3	L*- 2	L*- 1
L to R reference	*A -1 U*	*A –1 O*	*A -1 U*		……..	*A –1 O*	*A -1 U*	*A –1 O*
R to L reference	*A –1 O*	*A -1 U*	*A –1 O*	*A -1 U*	……..	*A -1 U*	*A –1 O*	*A -1 U*

The algorithm tables previously given were entered with the NON-CHANGING values

As for the remainder of the cells they *may stay* at (*A*-1) value or *may have to be push up* to (*A*) value.
Which cells are affected by the change depend on L* and B*

We have to address the calculation of the SET NUMBERS which are to be increased.

HOW TO CALCULATE THE ALGORITHM TABLES

SCHAAKE offers **THREE METHODS** : **(A)** (do not mix that with ***A*** for PASS !) **(B)** and **(C)**

METHOD **(A)** and METHOD **(B)** : " [quote] " are essentially the same ; (A) does not use mathematics, whereas (B) does. Method (C) also uses some mathematics " [/quote]

METHOD **(A)** and METHOD **(B)** use **" the complementary cyclic bight-number scheme "** of the interwoven THK component. That scheme we have seen else where.

Combining this complementary-cyclic with the set-numbers we can determine for a given half-period which of its set number are increased from (***A***-1) to (***A***).

MODULAR ARITHMETICS are in use of course ! ;-)

BE REMINDED that in publications_3 are my HP48 programs.
They calculate all that will be used here so I will not go again on that well trodden ground, Just go back to the necessary pages and PDF in Publication and in Turkshead pages. **Study the *books* and *THE BRAIDER* to be fully enlightened**.

METHOD (A) & METHOD (B)

They differ from one another by the method used to write the complementary cyclic:
--- METHOD (**A**) use the slow slogging method of **(-L*)modulo B***
--- METHOD (**B**) use the **DELTA** and **DELTA*** where

This formula gives DELTA*

$$\Delta^* = \left| \frac{m^* \cdot b^* + 1}{|-p^*|_{b^*}} \right|_{b^*}.$$

with **m*** being of such value integer value (negative, zero or positive) that the quantity is the smallest possible.

$$\left| \frac{m^* \cdot |b^*|_{|-p^*|_{b^*}} + 1}{|-p^*|_{b^*}} \right|$$

Let us say that we were able to write the **complementary cyclic** for **L* = 9 B* = 4** using either the programs I gave or the equations that SCHAAKE gave in ***THE BRAIDER*** and other books.

0	3	2	1
*	*	*	*

Then we write

#	*	*	*	*	*	*	*	*
0	1	2	3	4	5	6	7	8

Then

0	3	2	1					
#	*	*	*	*	*	*	*	*
0	1	2	3	4	5	6	7	8

Then

0	3	2	1	0	3	2	1	0
#	*	*	*	*	*	*	*	*
0	1	2	3	4	5	6	7	8

This last is called the **SET DIAGRAM**
It is all that is necessary to be able to get the algorithm-tables entries HAVE TO BE INCREASED FROM (A-1) to (A). We address that a bit later.

(this **set-diagram** can be extended to **algorithm-diagrams** which make the **algorithm-tables** 'discard-able' as it is possible to make the SHK directly from them)

In SCHAAKE's own words " **However this method is generally not recommended for the novice ; he should first master all the procedures outlined in all the other Chapters** "

Given that most persons I encountered in the flesh, by mail or on Net forum don't seem to be easily able to grasp how to use the simpler methods then this is a very dire warning indeed ! ;-)
Brains will over-fry for sure! ROTFLOL

First (this is also given as an HP48GX program of mine and explained in some Turks head pages) it is necessary to call back to mind the relationship between ***half-periods*** and ***bight-numbers***

We need to calculate the bight-number associated with the half-period
(I have pity on you : recall $\boldsymbol{i = (h_{even} - 2) / 2}$ and $\boldsymbol{i = (h_{odd} - 3) / 2}$ where ***h*** is the number attributed to the half-period)

METHOD (C) use

Calculation of the *SET-NUMBERS* where an *ADDITIONAL* intersection occurs (*additional* to *reference* quantity):

Half-cycle	set-numbers
1.	NONE
2.	mb* .
3.	" .
4.	" ; mb* - p* .
5.	" ; " .
6.	" ; " ; mb* - 2p* .
7.	" ; " ; " .
8.	" ; " ; " ; mb* - 3p* .
9.	" ; " ; " ; " .
10.	" ; " ; " ; " ; mb* - 4p* .
11.	" ; " ; " ; " ; " .
12.	" ; " ; " ; " ; " ; mb* - 5p* .
13.	" ; " ; " ; " ; " ; " .
14.	" ; " ; " ; " ; " ; " ; mb* - 6p* .
15.	" ; " ; " ; " ; " ; " ; " .
etc.	*etc.*
last half-cycle is 2b*	*where* m = 1,2,3, . . . , *discard* set-numbers *outside the range* 1,2,3, . . . ,(p* - 1) .
2n	mb* - rp* , *where* m = 1,2,3, . . . *and* r = 0,1,2, . . . ,(n - 1) .
2n + 1	*as for half-cycle* 2n
where n = 1,2, . .	*discard* set-numbers *outside the range* 1,2,3, . . . ,(p* - 1).

This table looks a lot like the table in use for STANDARD REGULAR KNOT (knot on a THK cordage route). For the Standard Herringbone PINEAPPLE knots a table built along those lines is used.

The 3 TABLES GIVEN HERE ARE QUOTED FROM SCHAAKE & TURNER (you will have them and their full User-Manual by buying the CD with the 5 PDF of the books.)

Calculation-table for additional set-number intersections for **Herringbone PINEAPPLE knots**

Calculation of the *SET-NUMBERS* where an *ADDITIONAL* intersection occurs (*additional* to *reference* quantity):

For Standard Herringbone PINEAPPLE KNOTS*

Half-cycle	set-numbers
1.	NONE
2.	mB* .
3.	" .
4.	" ; mB* - s .
5.	" ; " .
6.	" ; " ; mB* - 2s .
7.	" ; " ; " .
8.	" ; " ; " ; mB* - 3s .
9.	" ; " ; " ; " .
10.	" ; " ; " ; " ; mB* - 4s .
11.	" ; " ; " ; " ; " .
12.	" ; " ; " ; " ; " ; mB* - 5s .
13.	" ; " ; " ; " ; " ; " .
14.	" ; " ; " ; " ; " ; " ; mB* - 6s .
15.	" ; " ; " ; " ; " ; " ; " .
etc.	***etc.***
last half-cycle is* 2B	***where* m = 1,2,3, . . . ,** ***discard* set-numbers *<u>outside</u> the range* 1,2,3, . . . ,(s - 1) .**
2n	mB* - rs , *where* m = 1,2,3, . . . *and* r = 0,1,2, . . . ,(n - 1) .
2n + 1	*as for half-cycle* **2n**
where n = 1,2, . .	***discard* set-numbers *<u>outside</u> the range* 1,2,3, . . . ,(s - 1).**

Calculation-table for **REGULAR KNOTS** (those made on a THK cordage route)

Calculation of the *COLUMN-NUMBERS* where an intersection occurs:

Half-cycle	column-numbers						
1.	NONE						
2.	mb .						
3.	" .						
4.	"	; mb - p .					
5.	"	; " .					
6.	"	; "	; mb - 2p .				
7.	"	; "	; " .				
8.	"	; "	; "	; mb - 3p .			
9.	"	; "	; "	; " .			
10.	"	; "	; "	; "	; mb - 4p .		
11.	"	; "	; "	; "	; " .		
12.	"	; "	; "	; "	; "	; mb - 5p .	
13.	"	; "	; "	; "	; "	; " .	
14.	"	; "	; "	; "	; "	; "	; mb - 6p .
15.	"	; "	; "	; "	; "	; "	; " .
etc.	***etc.***						
***last half-cycle is* 2b**	***where* m = 1,2,3, . . . , *discard* column-numbers *<u>outside</u> the range* 1,2,3, . . . ,(p - 1) .**						
2n	mb - rp , *where* m = 1,2,3,. . . *and* r = 0,1,2, . . . ,(n - 1) .						
2n + 1	*as for half-cycle* **2n**						
where n = 1,2, . .	***discard column-numbers <u>outside</u> the range* 1,2,3, . . . ,(p - 1).**						

For REGULAR KNOTS (knots made on a Turk's-Head cordage route)

With any of those methods (**A**), (**B**) and (**C**) you should be able to draw the algorithm tables for any STANDARD HERRINGBONE KNOT you care to make. SCHAAKE & TURNER provided a LOT of tables pairs in their book on those knots and Tom HALL provided the hand drawings helping the untrained brains and eyes with interpreting the isometric grid diagrams.

Now let us see how to get the algorithm-tables entries THAT HAVE TO BE INCREASED FROM **(*A*-1)** to **(*A*).**

Reminder :
The *reference* algorithm for any **ODD** numbered half-periods is :

(***L*** – 1) ***U*** *(A* – 1 *)* ***O*** *(A* – 1 *)* ***U*** *(A* – 1 *)* ***O*** *(A* – 1 *)* ***U ....***
(A – 1 *)* ***O*** *(A* – 1 *) U* *(A* – 1 *)* ***O*** *(**R** –* 1 *)* ***U***

The *reference* algorithm for any **EVEN** numbered half-periods is :

(***R*** – 1) ***U*** *(A* – 1 *)* ***O*** *(A* – 1 *)* ***U*** *(A* – 1 *)* ***O*** *(A* – 1 *)* ***U ....***
(A – 1 *)* ***O*** *(A* – 1 *) U* *(A* – 1 *)* ***O*** *(**L** –* 1 *)* ***U***

The algorithm for **Half-Period ONE** is **always identical to the reference algorithm for an ODD half-period. NO CHANGE OCCURS.**
So half-period 1 has each of its cells with the value of (***A*** – 1)

As for the rest of the half-periods the reference values (***L*** – 1) and (***R*** – 1) **may have increased by ONE for some cells in set-number 1, and the *(A* –** 1 ***)* may have increased by ONE for some cells in some set-number.**
So (***L*** – 1) becomes (***L***) and (***R*** – 1) becomes (***R***) , while ***(A*** – 1*)* becomes (***A***)

In the last column (in the reading direction L to **R and R** to **L respectively) no change occurs.**

Look at the table in page 19, the first table given for METHOD (**C**), which allows to calculate in which cells (set-number) those changes have to be done.

This is what my HP48 **HER3** program does.

..

Let us let go of the **algorithm-tables** and attempt to look at the **algorithm-diagrams** (using a set-diagram) that were overflown quite swiftly in METHOD (**A**) and METHOD (**B**)

ALGORITHM-DIAGRAMS FOR THE SHK

Remember ? :

We need a **PAIR** of tables (one for **ODD** numbered **PASS** , one for **EVEN** numbered **PASS**) for EACH type $\mathbf{S_0}$ (S_{odd}) and $\mathbf{S_E}$ (S_{even}) of SHK depending on the parity of L*, the component THK number of LEAD.

I do hope that Schaake was not mistaken (given my experience with persons saying they are knot-tyer I fear he was!) when he wrote what looks like wishful thinking :

"Most braiders will eventually use the *algorithm-diagram method* exclusively, due to its overall compactness and simplicity. Especially with regard to the Standard Herringbone Knot of Type S_o, a very compact and simple algorithm-diagram can be constructed. This type of Standard Herringbone Knot is the most universally applicable one since it always create a symmetrical colour-pattern when colour strings are used in its construction. ……. ….. We must stress that there are a number of applications where the aesthetic quality of the braided artifact would be considerably enhanced by using a Type S_E instead of a type S_O Standard Herringbone Knot. **For this reason we shall not discuss the most simple and compact form of the algorithm-diagram that can be constructed for the Type S_O Standard Herringbone Knot, but rather discuss the form which is similar to the one used for the Type S_E Standard Herringbone Knot** "

As we have seen previously in this document **we need the complementary-cyclic bight numbers** of the THK components that are interwoven to build a SHK.
I treated that complementary-cyclic at length in other web pages on Turk's head knots and gave personal HP48 programs that deal with all that is necessary.

The algorithm-diagram being a PRACTICAL TOOL it will be made in such a manner that the **(L** to **R)** **ODD** numbered half-periods that are read **(L** to **R)** will be indeed read **(L** to **R)** and that the **(R** to **L)** **EVEN** numbered half-periods that must be read **(R** to **L)** will indeed be read **(R** to **L)**.

This is a very important point to keep in mind. Many persons find that difficult even with the simple Regular Knots (THK for example)

Mind to not forget to comply with the sequence rule.

ALGORITHM-DIAGRAM FOR S_O

A real example from which you will infer the general procedure.
L* = 7 B*=6

First we get the complementary-cyclic bight number sequence
(-7)mod 6 = 5 (also usable are m*and DELTA*)

So . . . . . . (as many '.' as B*)

0						0					1
.	.	.	.	.	.	.	.	.	.	.	.

0				2	1	0	5	3	4	2	1
.	.	.	.	.	.	.	.	.	.	.	.

We have now to put that complementary cyclic in
(as many * than **L*-1** and one # at each extremity)

L to **R** :		**U**	**O**	**U**	**O**	**U**	**O**	(**A**-1) **U**
	0	**5**	**4**	**3**	**2**	**1**	**0**	
***A* ODD**								
	#	*	*	*	*	*	*	#
		0	**1**	**2**	**3**	**4**	**5**	**0**
R to **L**	(**A**-1) **U**	**O**	**U**	**O**	**U**	**O**	**U**	

L to **R** :	(**A**-1) **U**	**O**	**U**	**O**	**U**	**O**	**U**	
	0	**5**	**4**	**3**	**2**	**1**	**0**	
***A* EVEN**								
	#	*	*	*	*	*	*	#
		0	**1**	**2**	**3**	**4**	**5**	**0**
R to **L**		**U**	**O**	**U**	**O**	**U**	**O**	(**A**-1) **U**

You are set to go !

PASS = 5 (5th THK component, 4th after the foundation knot) so **ODD** **PASS** so UPPER part, above the line.
We want the half-period 7. **ODD** numbered **half-period** so **L** to **R**
Compute the bight-number *i*= (7 – 3) / 2 = 2

SCHAAKE's reading rules

"all the unspecified number of crossing belonging to a coding type and corresponding with a bight-number is equal to (*A* – 1) unless this bight-number is smaller than or equal to the bight-number associated with the half-cycle under consideration, in which case the number of crossings is equal to *A*"

For this 7th half-period (I have explained elsewhere why I prefer "period" to "cycle")

We get **U4 - O4 - U4 - O5 - U5 - O5 - U4**

Now the 10th half-period in this 5th PASS
EVEN numbered H-P so **R** to **L** with bight-index (10 – 2) / 2 = 4
We get

	#	*	*	*	*	*	*	#
		0	**1**	**2**	**3**	**4**	**5**	**0**
R to **L**	(**A**-1) **U**	**O**	**U**	**O**	**U**	**O**	**U**	
	4	5	5	5	5	5	4	
Or	(**A**-1)	(**A**)	(**A**)	(**A**)	(**A**)	(**A**)	(**A**-1)	

U4 - O5 - U5 - O5 - U5 - O5 - U4

It is the same thing for an EVEN numbered PASS and its ODD or EVEN H-P only you then use the part UNDER the horizontal line.

It is pretty much the way to use the THK algorithm we have seen in my other web pages Turkshead and in my HP48GX programs for knot made along a THK cordage route.

ALGORITHM-DIAGRAM FOR S_E

A real example from which you will infer the general procedure
L* = 8 B*=5

(-8)mod 5 = 2 (or use m*=-1 and DELTA*=3 after calculating them with the formulas)
Complementary-cyclic bight-number sequence is
0 3 1 4 2

MIND THAT the **reference values** for **L** to **R** and **R** to **L** are different from the Type S_O

L to **R** :		**U**	**O**	**U**	**O**	**U**	**O**	**U**	(**A**-1) **O**
	0	**3**	**1**	**4**	**2**	**0**	**3**	**1**	
***A* ODD**									
	#	*	*	*	*	*	*	*	#
		1	**3**	**0**	**2**	**4**	**1**	**3**	**0**
R to **L**	(**A**-1) **U**	**O**	**U**	**O**	**U**	**O**	**U**	**O**	

L to **R** :	(**A**-1) **U**	**O**	**U**	**O**	**U**	**O**	**U**	**O**	
	0	**5**	**4**	**3**	**2**	**1**	**0**		
***A* EVEN**									
	#	*	*	*	*	*	*	*	#
		1	**3**	**0**	**2**	**4**	**1**	**3**	**0**
R to **L**		**U**	**O**	**U**	**O**	**U**	**O**	**U**	(**A**-1) **O**

Just one example

3rd PASS (3rd THK in the SHK) 5th Half-Period
So ODD numbered PASS and **L** to **R** ODD numbered H-P so upper part above the horizontal line

i=(5-3)/2 = 1 *A* = 3 (*A*-1) = 2

so

U2 – O3 - U2 - O2 - U3 - O2 - U3 - O2

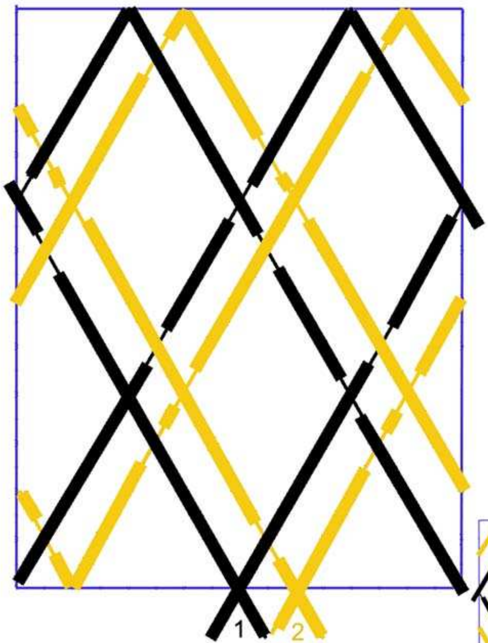
		2	3	2	2	3	2	3	2
		(A-1)	A	(A-1)	(A-1)	A	(A-1)	A-1)	(A-1)
L to **R** :		**U**	**O**	**U**	**O**	**U**	**O**	**U**	(**A**-1) **O**
	0	**3**	**1**	**4**	**2**	**0**	**3**	**1**	
***A* ODD**									
	#	*	*	*	*	*	*	*	#

and so on.

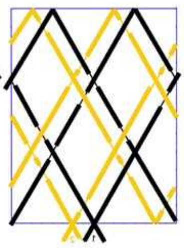
Last word is left to my source of inspiration : SCHAAKE & TURNER.

" The algorithm-diagrams provide a much more compact form of the instructions for the execution of the required steps in the construction of the Standard Herringbone Knots. Furthermore, the relative position of the component algorithm-diagrams, associated with the odd and even sequence numbers, within the overall algorithm-diagram, provides a simple mnemonic for the relative bight positions of the interbraided Turk's Head knots in accordance with the *sequence rule*, when the *upwards braiding direction* is used."

As I am not sure that some persons will not miss some points here are some diagrams of mine in the hope of helping those who can only understand visually.



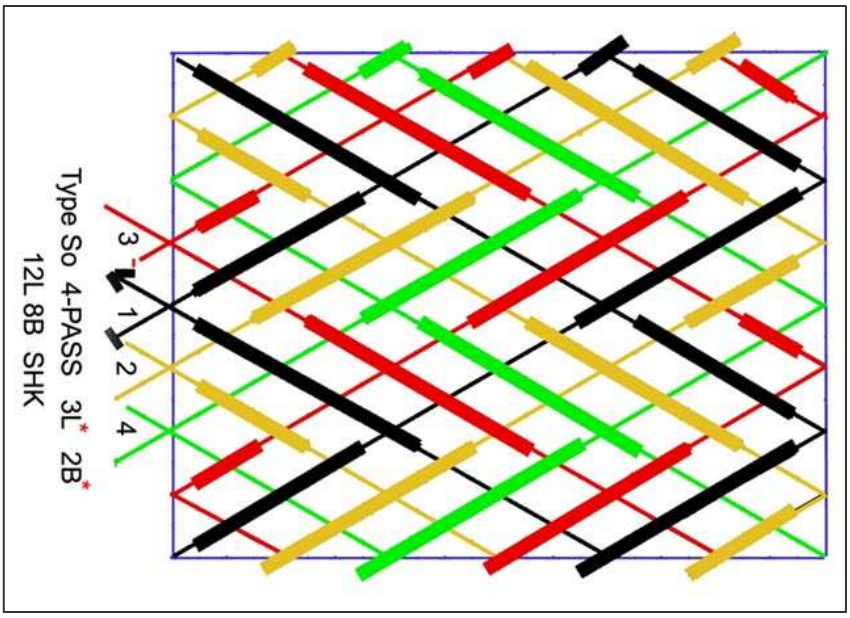
2-PASS Type So
2-PASS are not near enough to show the SEQUENCE RULE



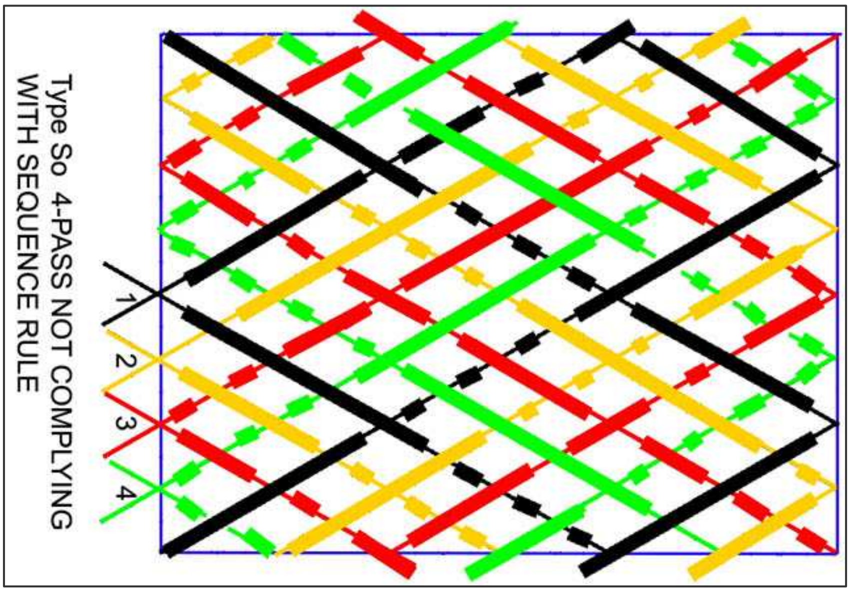
As can be seen "as a nose in the middle of the face" 2-PASS have no "discrimination"

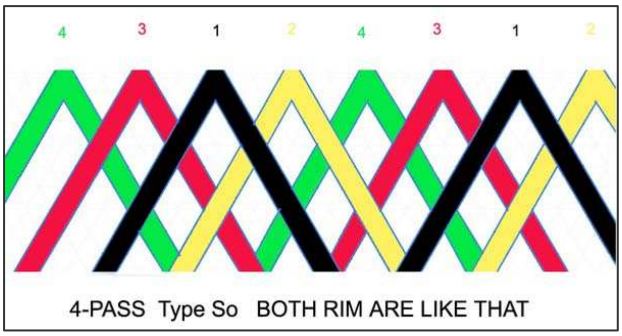
1 2 or **2 1** are similar.
BUT
IF
5 3 1 2 4 is similar to **4 2 1 3 5**
BOTH ARE WILDLY AND WIDELY DIFFERENT FROM
1 2 3 4 5 or **5 4 3 2 1** that do not comply with the SEQUENCE RULE

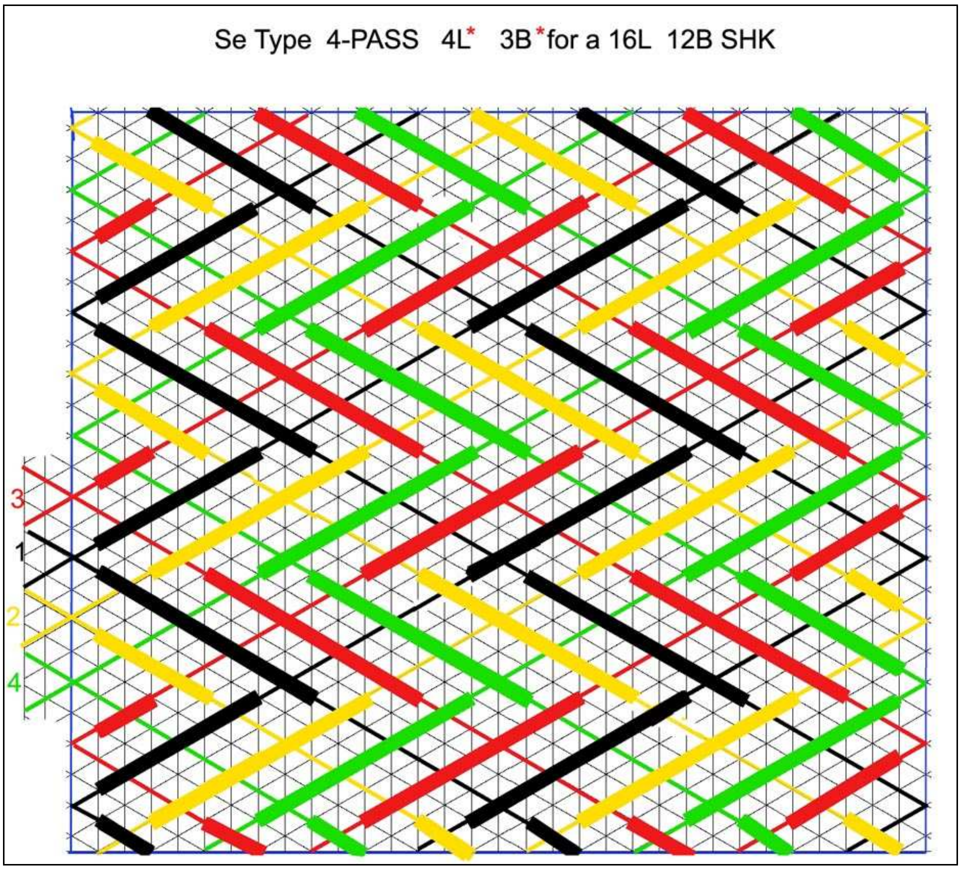
…/…

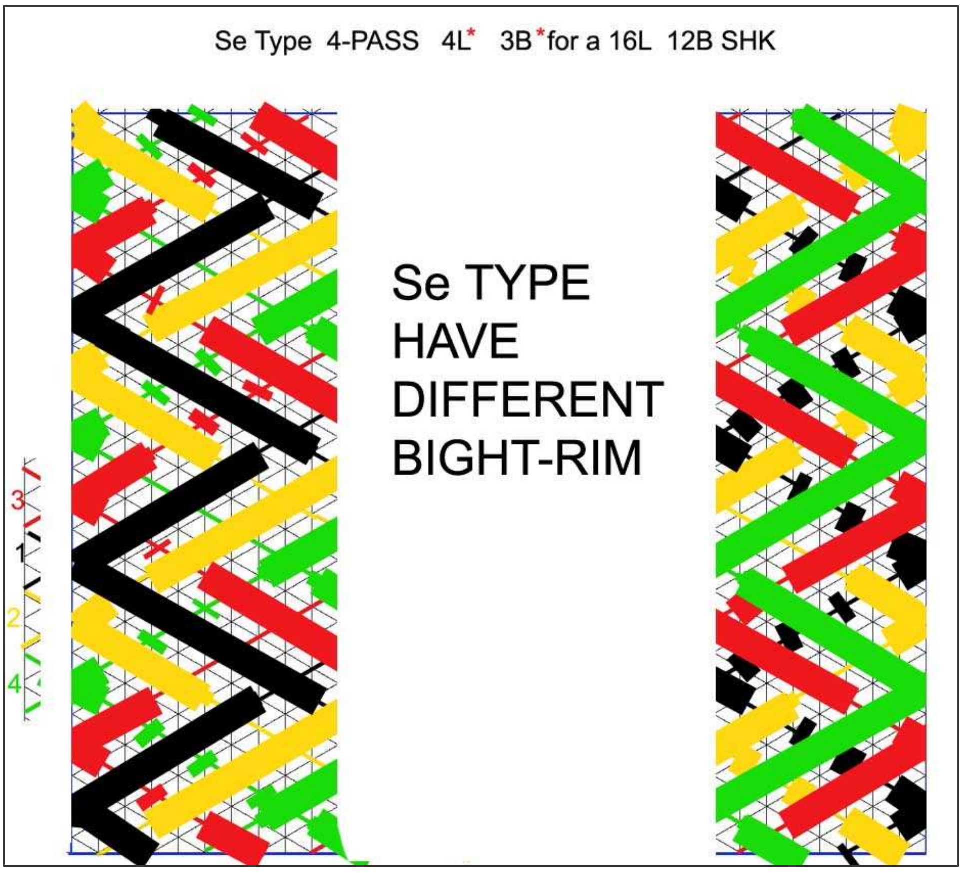


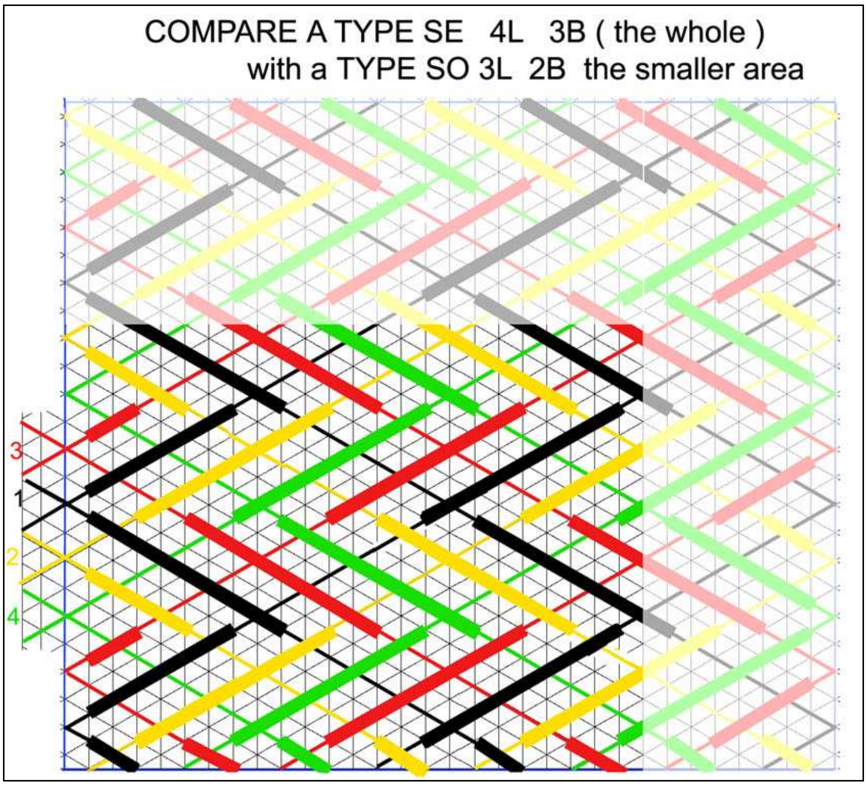
With these two diagrams it is easy to **compare** two 4-PASS SHK, **one complying** with the SEQUENCE RULE and the **other NOT**.






Se Type 4-PASS 4L* 3B* for a 16L 12B SHK
3
1
2
4


Se Type 4-PASS 4L* 3B* for a 16L 12B SHK
Se TYPE
HAVE
DIFFERENT
BIGHT-RIM
3
1
2
4



This diagram allows to see at one glance a **Type S_O** AND a **Type S_E**

Here are two tables with the coding of those two knots so that you may verify "in the cordage"

TYPE S_O 4-PASS 3L* 2B* for a 12L 8B SHK

	PASS 1		PASS 2
H-P 1	Free run	H-P 1	U1 – O1 – U1
H-P 2	O1	H-P 2	U1 – O1 – U2
H-P 3	O1	H-P 3	U1 – O1 – U2
H-P 4	U1 – O1	H-P 4	U1 – O2 – U1
	PASS 3		PASS 4
H-P 1	U2 – O2 – U2	H-P 1	U3 – O3 – U3
H-P 2	U2 – O3 – U2	H-P 2	U3 – O3 – U4
H-P 3	U2 – O3 – U2	H-P 3	U3 – O3 – U4
H-P 4	U3 – O3 – U2	H-P 4	U3 – O4 – U4

TYPE S_E 4-PASS 4L* 3B* for a 16L 12B SHK

	PASS 1		PASS 2
H-P 1	Free run	H-P 1	U1 – O1 – U1 – O1
H-P 2	O1	H-P 2	O1 – U1 – O1 – U2
H-P 3	U1	H-P 3	U1 – O1 – U1 – O2
H-P 4	U1 – O1	H-P 4	O1 – U1 – O2 – U2
H-P 5	O1 – U1	H-P 5	U1 – O1 – U2 – O2
H-P 6	O1 - U1 – O1	H-P 6	O1 – U2 – O2 – U2
	PASS 3		PASS 4
H-P 1	U2 – O2 – U2 – O2	H-P 1	U3 – O3 – U3 – O3
H-P 2	O2 – U2 – O3 – U2	H-P 2	O3 – U3 – O3 – U4
H-P 3	U2 – O2 – U3 – O2	H-P 3	U3 – O3 – U3 – O4
H-P 4	O2 – U3 – O3 – U2	H-P 4	O3 – U3 – O4 – U4
H-P 5	U2 – O3 - U3 – O2	H-P 5	U3 – O3 – U4 – O4
H-P 6	O3 – U3 – O3 – U2	H-P 6	O3 – U4 – O4 – U4

A curiosity 'stolen' from SCHAAKE & TURNER with the high respect I have for those men.

You will get dozens of grids and a lot of drawings by Tom HALL illustrating those grids.
The grids on the influence of colours on pattern are mesmerizing I will give just 'sample" to entice you to buy the CD (mind you the pdf book on SHK has a few printing mistakes and a handful of pages (illustration not text) are missing.)

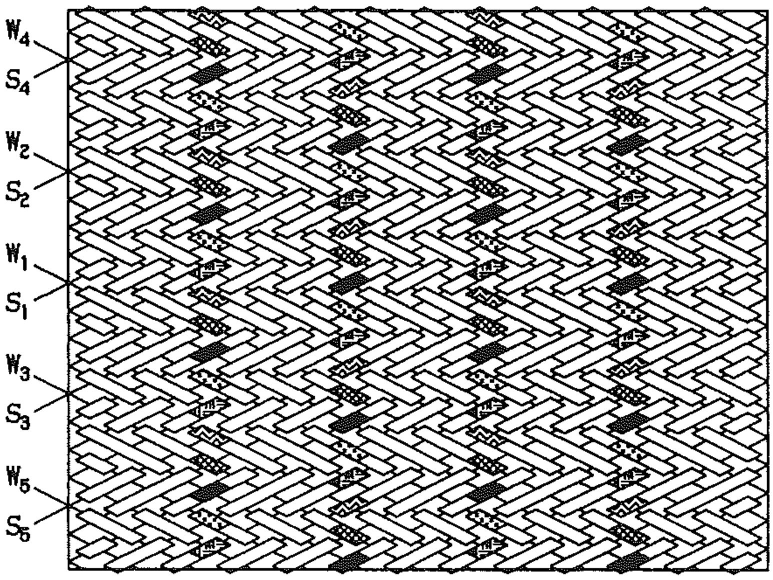
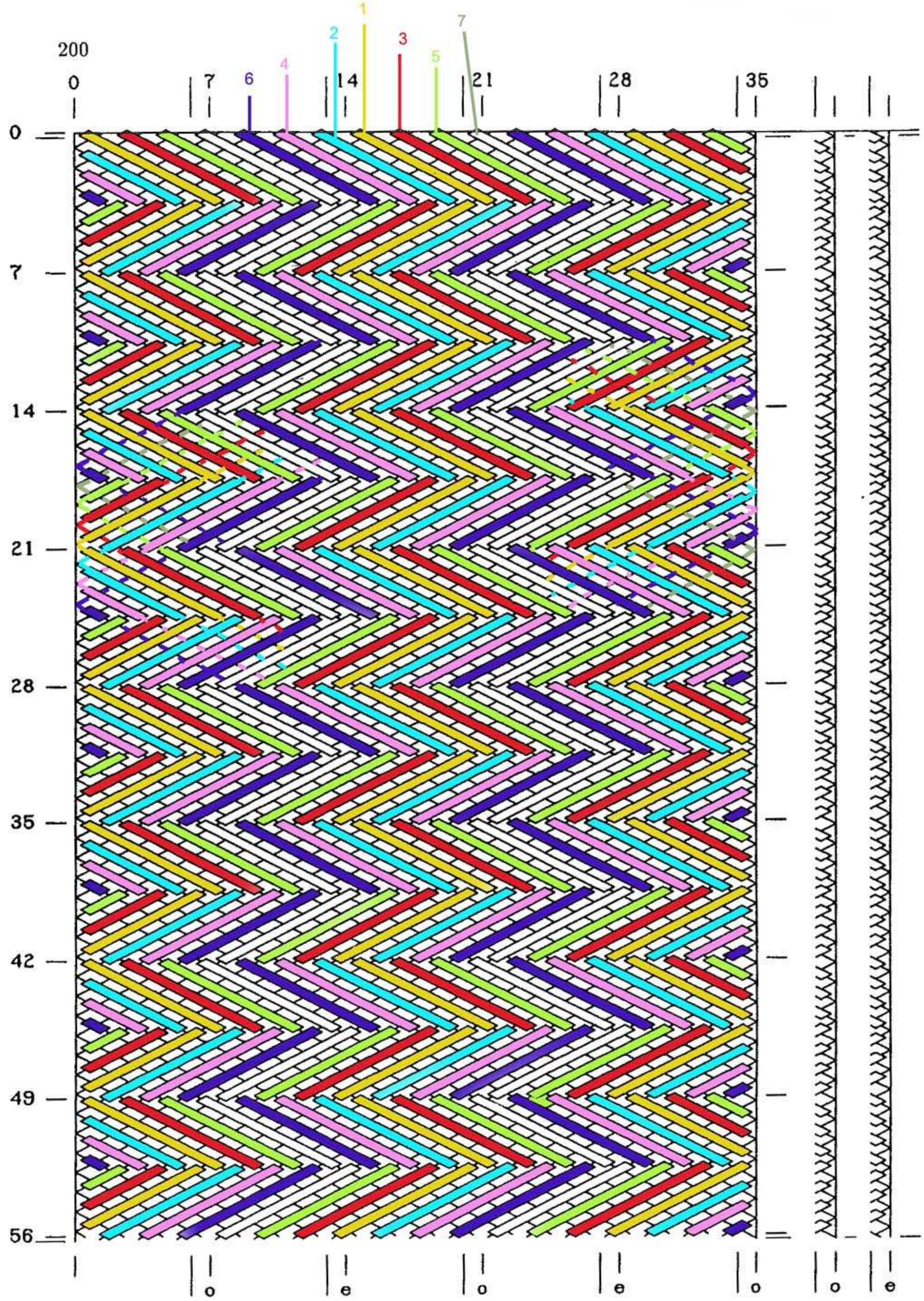


Fig. 9 — (2–3)-pass Semi-Regular Herringbone Knot; 25-parts/20-bights.

Note the MIXED PASS : COMPOUND-PASS



7-Pass

STUDY THE S_E and S_E BIGHT RIM AND THEIR CHARACTERISTICS

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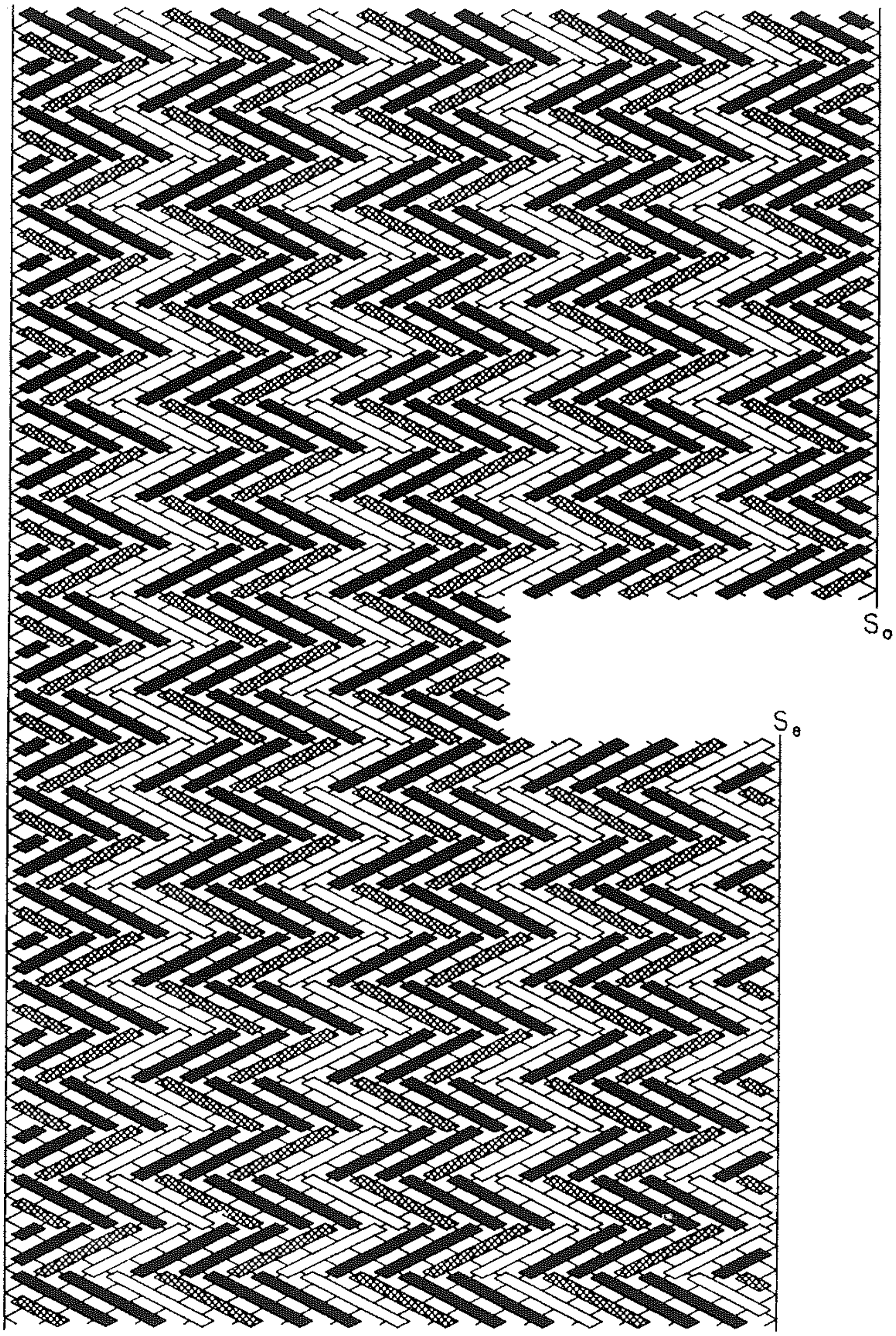

4-Pass — No. 6.