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CONTENTS

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for
the braiding artisan

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Solution to the question in Issue No. 43

Question on pg. 1030.

Fig. 804 shows two rows of pictorial diagrams of under-over coded UT-OT braids with their UT-OT grid-diagrams immediately below them. In each of these two rows the first two diagrams from the left are associated with under-over coded UT-OT braids where $\frac{\text{leads}}{2}$ = odd, and the last two diagrams from the left are associated with under-over coded UT-OT braids where $\frac{\text{leads}}{2}$ = even. In the upper-row of pictorial UT-OT braids the first and third UT-OT braid from the left look towards the front of the braid while the second and fourth UT-OT braid from the left look towards the associated back of the braid. In the lower-row of pictorial UT-OT braids the first and third UT-OT braid from the left look towards the front of the braid while the second and fourth UT-OT braid from the left look towards the front of the associated braid turned through 180°.

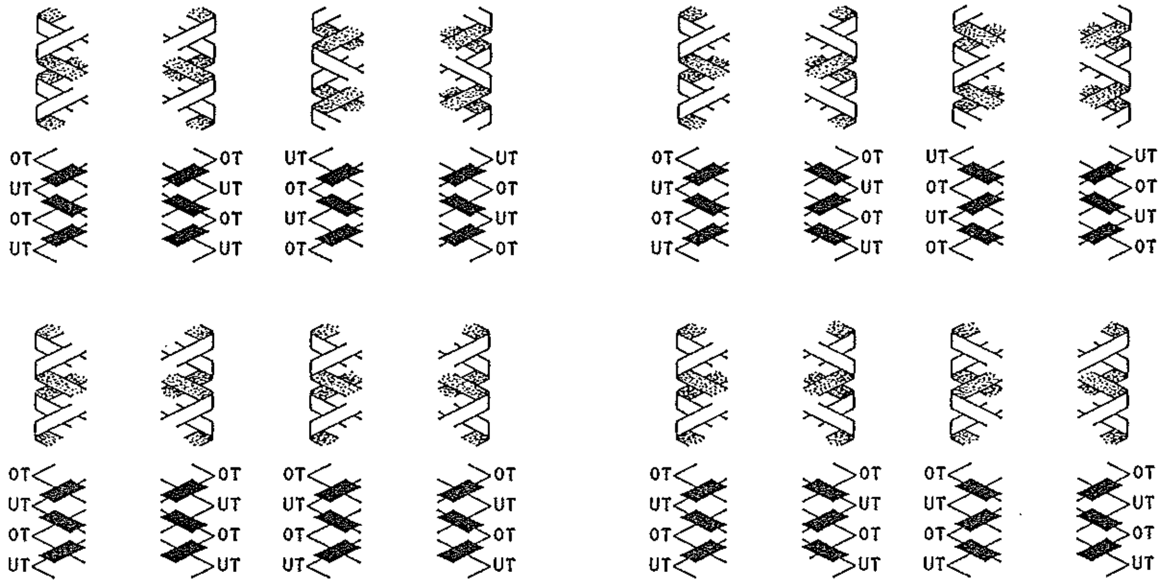


Fig. 804 — The under-over coded UT-OT braids.

Hence when in an under-over coded UT-OT braid the $\frac{\text{leads}}{2}$ = odd a front-facing left helix strand on the front of the braid starts at the left with an under, then when turning the back of this braid to the front, a front-facing left helix strand on the front of the braid starts at the left with an over (see upper left set of two diagrams); and when in an under-over coded UT-OT braid the $\frac{\text{leads}}{2}$ = even a front-facing left helix strand on the front of the braid starts at the left with an under, then when turning the front of this braid through 180°, a front-facing left helix strand on the front of the braid starts at the left with an over (see lower right set of two diagrams).

Braid Design

In issue No. 43 of *The Braider* we have seen on pp. 1023-1030 how we can design simple, but beautiful, 'new' braids with the aid of the diagrams of the **primitive flat tubular braids**. The reader will of course have realised that further 'new' braids can be designed by combining the diagrams of primitive flat tubular braids in other ways.

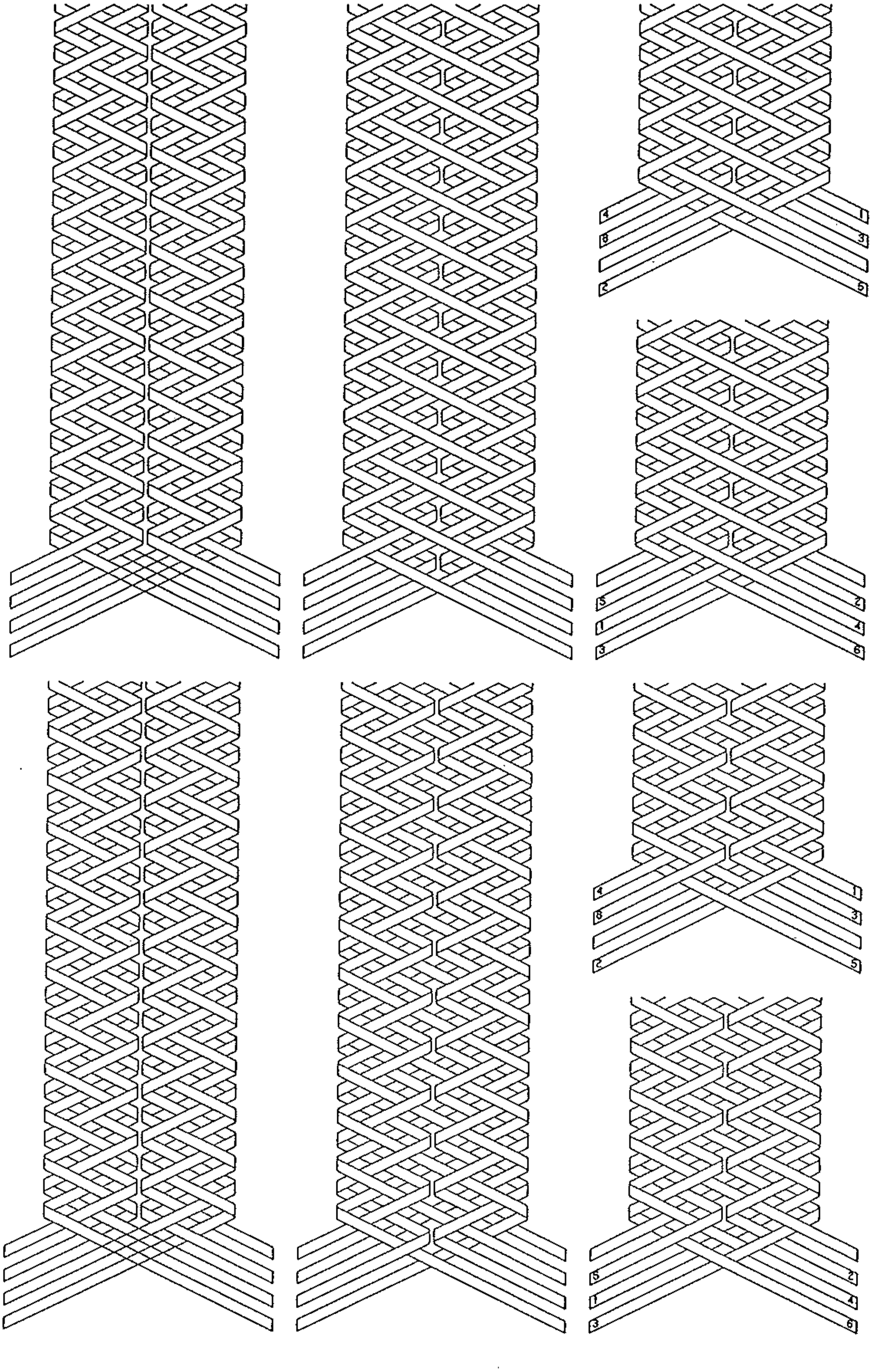


Fig. 805 — The designing of another 'new' braid.

We can, for example, design another 'new' braid by combining two under–over coded primitive flat tubular braid diagrams as depicted by the upper two left diagrams, or as depicted by the lower left two diagrams, in Fig. 805. Both methods give us the same 'new' braid (one is the other turned back to front). Again it is a beautiful 'new' braid, although a little harder to braid. Whether we use the upper or the lower braiding procedure depends on which surface of the final braid we want uppermost. Note that in this braid only the grainside of the strings is outermost.

We can design a large number of 'new' braids by combining more than two primitive flat tubular braids as well as by combining bigger ones, in fact the possibilities are limitless, however, the braiding of them becomes more and more difficult.

Let's now look at another way again to combine two four-string under–over coded primitive flat tubular braid diagrams.

The braid in Fig. 806 shows a flat front-side and two adjacent round braids on the back-side. An alternative braiding sequence for this braid is shown in Fig. 806A.

If we want to have the back-side of this braid on the front, hence the two adjacent round braids on the front, we braid it as depicted in Fig. 807; an alternative braiding sequence is shown in Fig. 807A. This beautiful braid is not difficult to produce, it should be braided nice and tight.

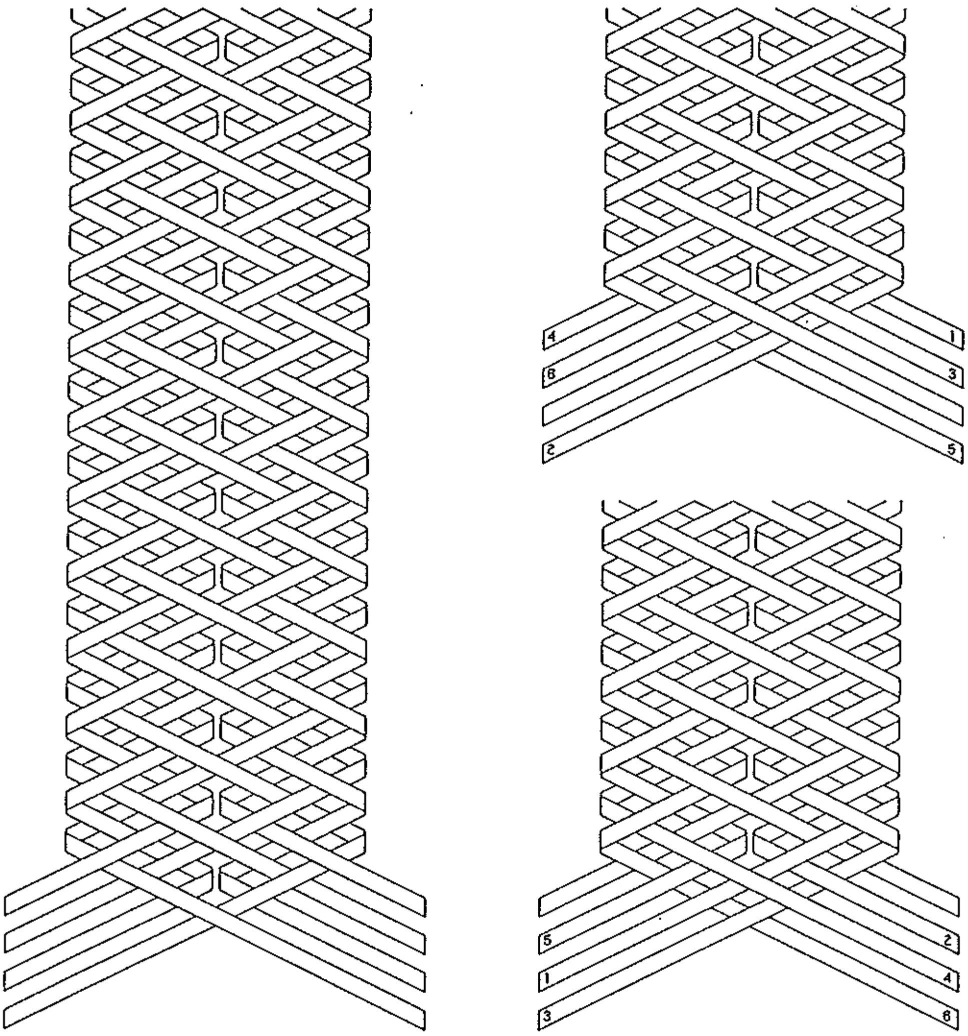


Fig. 806 — Designing a 'new' braid.

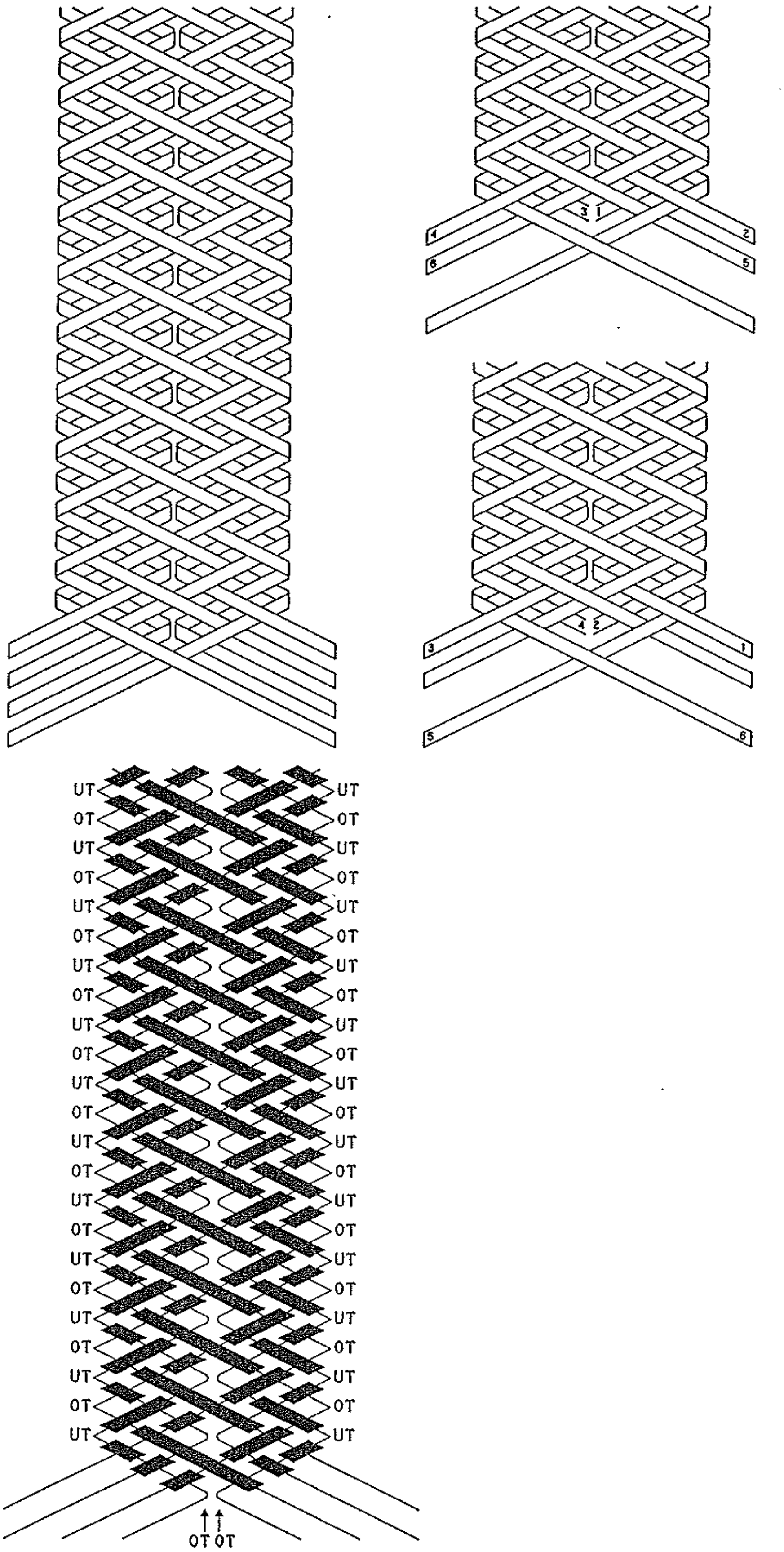


Fig. 806A — Designing a 'new' braid.

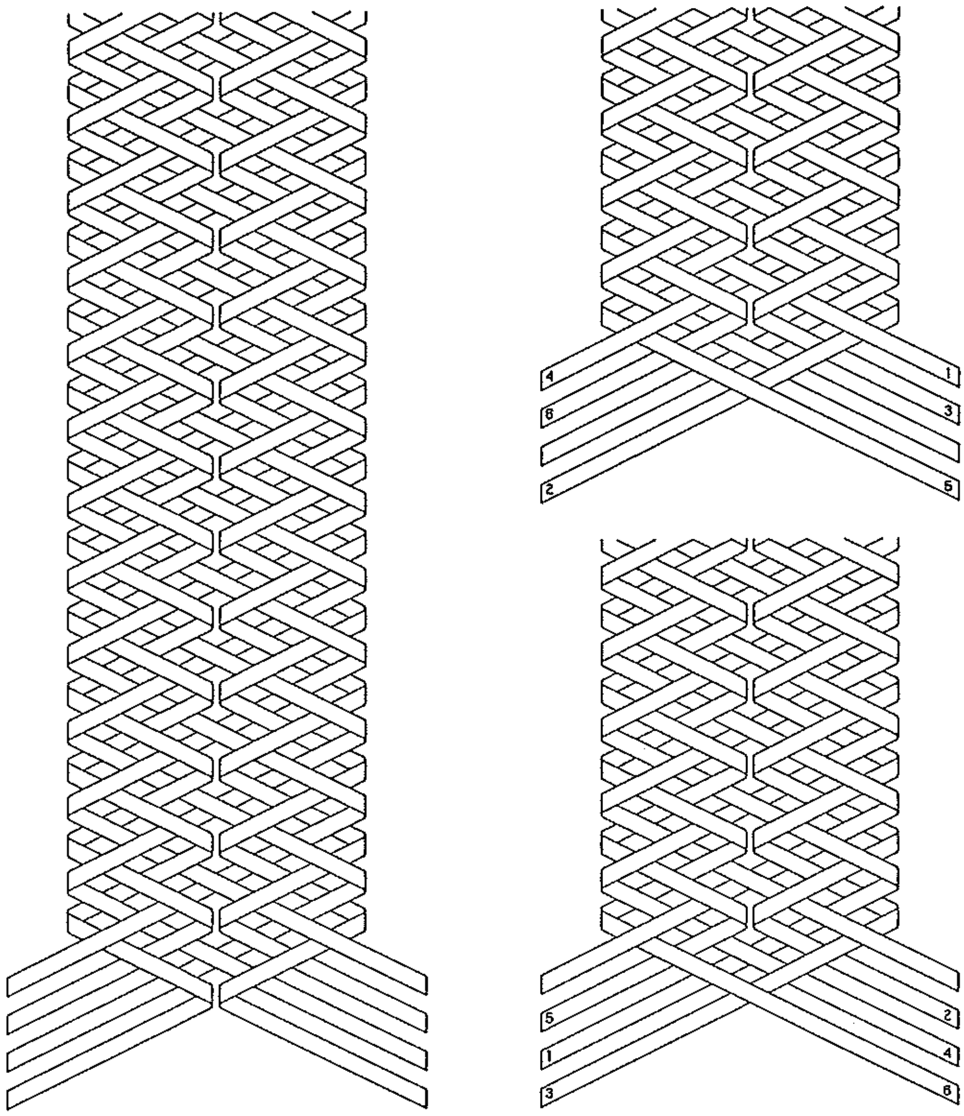


Fig. 807 — Designing a 'new' braid.

Note that not everywhere the grainside of the strings can be on the outside of the final braid, hence it is important to arrange the various strings in such a way that their grainsides and hence their fleshsides show a symmetric pattern. The same should be observed when, by combining more than two primitive flat tubular braids, it is not possible for the grainside of the strings to be everywhere on the outside of the final braid. Furthermore, by combining primitive flat tubular braids an overall balanced coding-pattern should be ensured.

The appearance of the braid in Fig. 806 (and hence the appearance of the braid associated with the alternative construction procedure in Fig. 806A) is similar to the appearance of the braid in Fig. 808 (and hence the appearance of the braid associated with the alternative construction procedure in Fig. 808A). Consequently the appearance of the braid in Fig. 807 (and hence the appearance of the braid associated with the alternative construction procedure in Fig. 807A) is similar to the appearance of the braid in Fig. 809 (and hence the appearance of the braid associated with the alternative construction procedure in Fig. 809A).

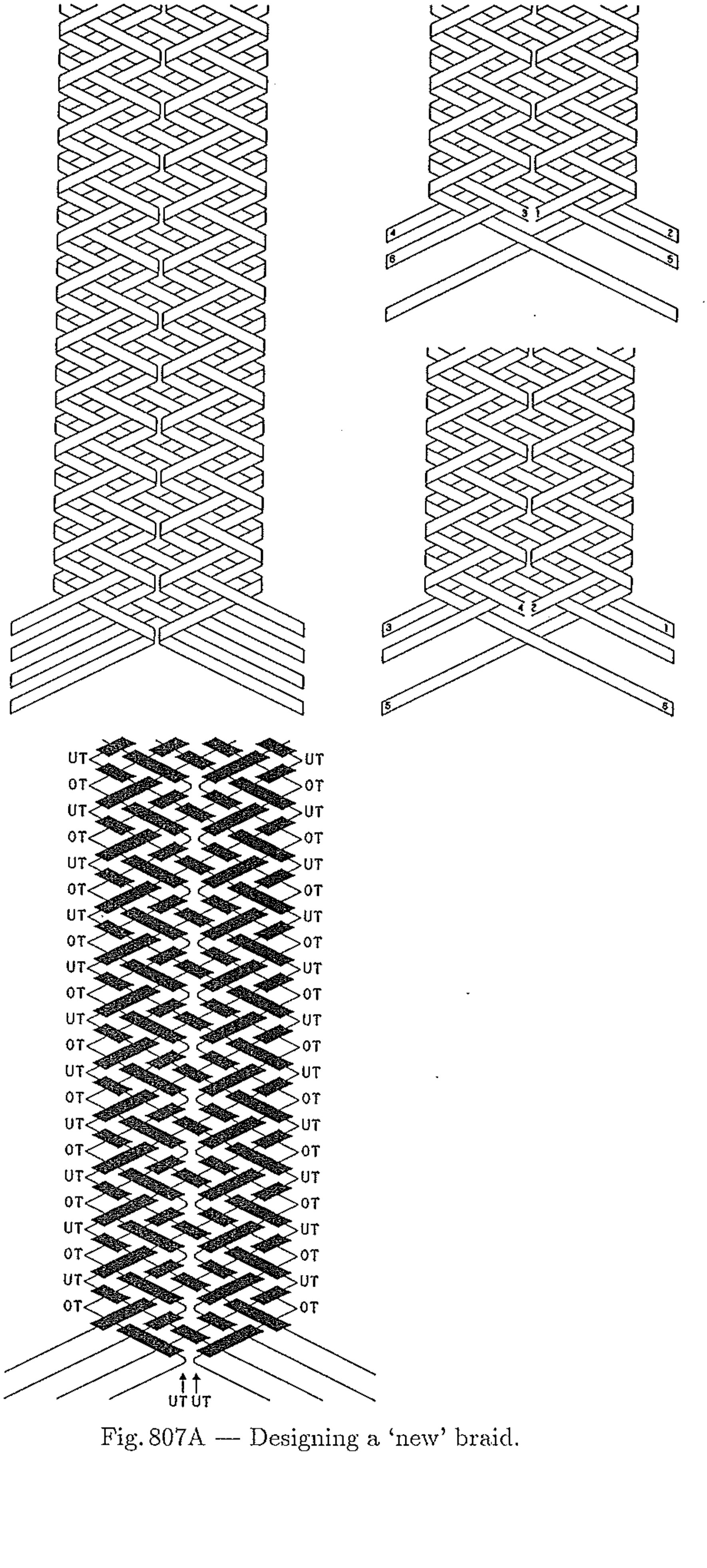


Fig. 807A — Designing a 'new' braid.

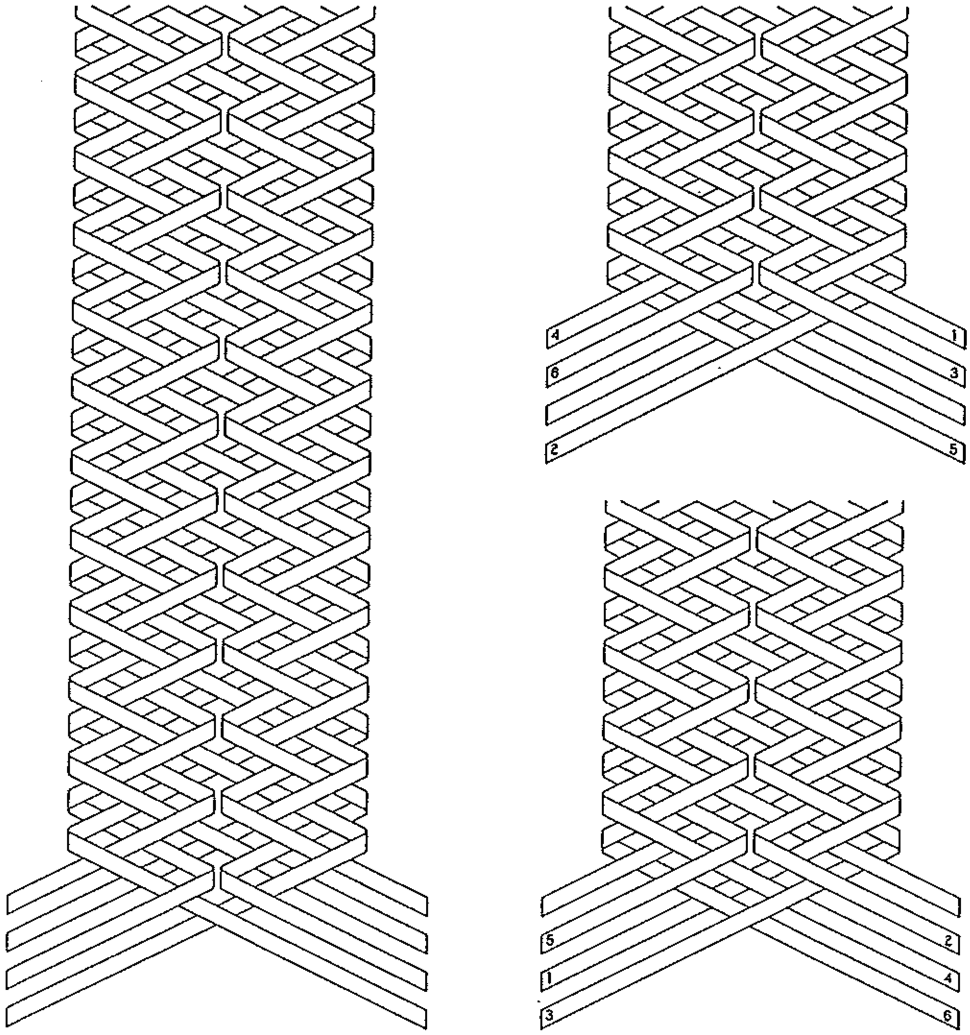


Fig. 808 — Designing a 'new' braid.

Since the appearance of the braid in Fig. 808 is similar to the appearance of the braid in Fig. 806 (and hence the appearance of the braid associated with its alternative construction procedure in Fig. 806A), the braid in Fig. 808 shows a flat front-side and two adjacent round braids on the back-side. An alternative braiding sequence for this braid is shown in Fig. 808A.

If we want to have the back-side of this braid on the front, hence the two adjacent round braids on the front, we braid it as depicted in Fig. 809; an alternative braiding sequence is shown in Fig. 809A.

The above discussed braids are small and hence their practical application is very limited. They are discussed here as an introduction to bigger similar braids of great practical value, formed by joining more and/or bigger primitive flat tubular braids of various coding arrangements. In addition, very attractive colour-patterns can be created. Although in our discussion here we have mainly used a pictorial representation of the UT-OT braids, in practice, however, we use of course UT-OT braid-diagrams. Any bigger round braid which forms an integral part of the created UT-OT braid should be provided with a braided core. The more complicated UT-OT braids so designed can be quite difficult to braid, but the serious braiding artisan will find here an eldorado of unlimited scope.

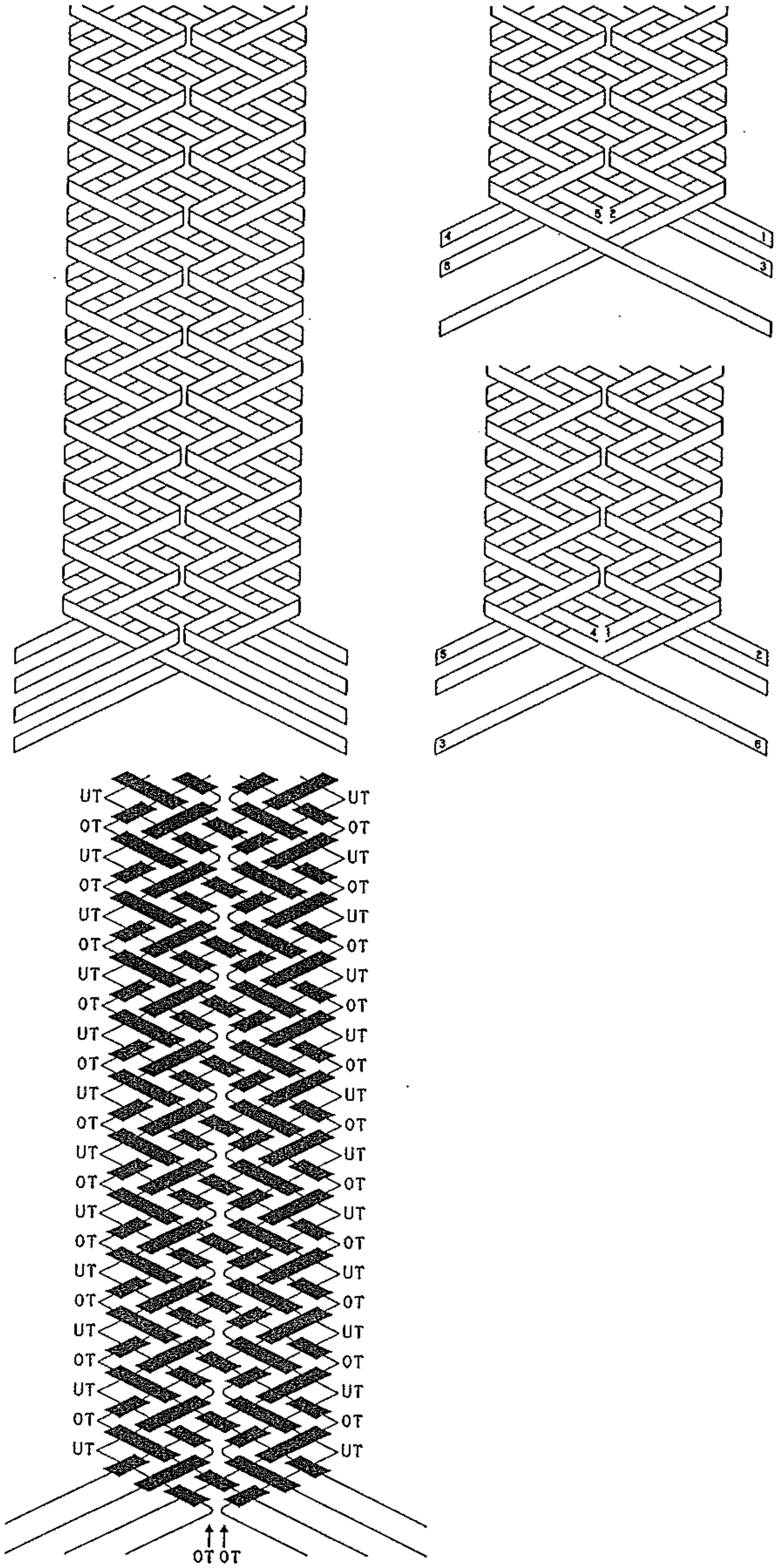


Fig. 808A — Designing a 'new' braid.

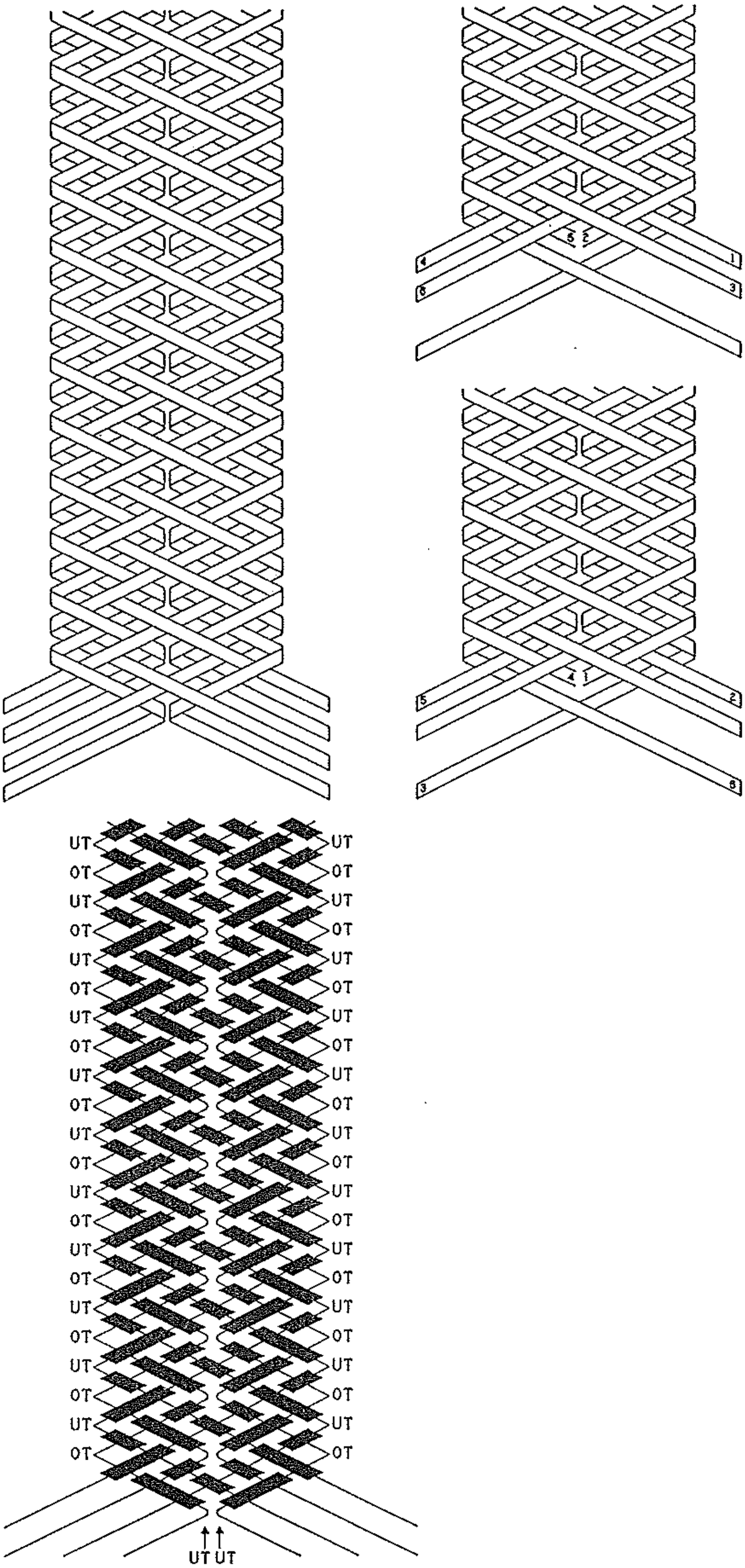


Fig. 809A — Designing a 'new' braid.

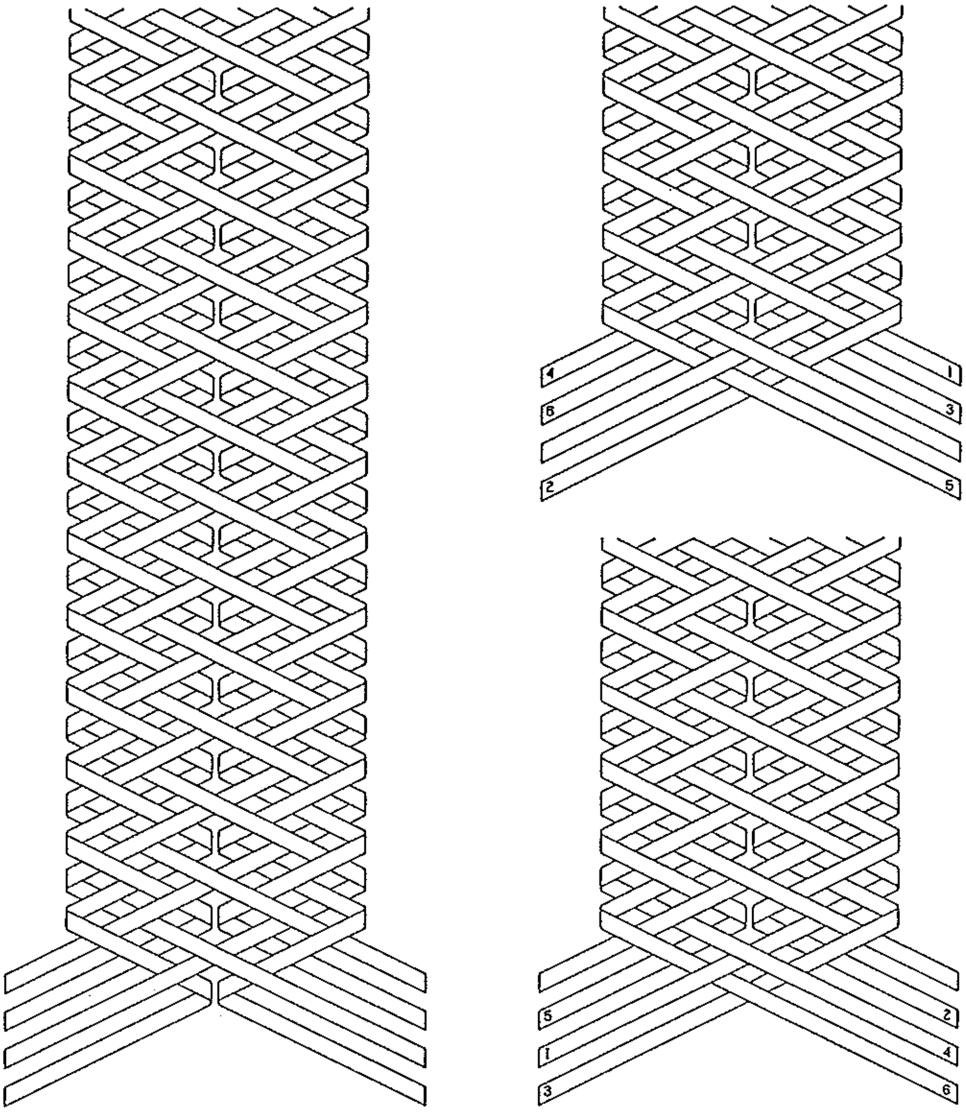


Fig. 809 — Designing a 'new' braid.

Checkered Pineapple Knots

The **essential** coding of Pineapple braids is shown in Fig. 810.† We shall again assume that the braiding-material is a flat string which has for each opposite face pair identical faces in size, shape, texture and colour.

The coding-patterns of Checkered Pineapple braids are depicted in Fig. 811. From these coding-patterns it follows that there are three types of Checkered Pineapple braids:

type 1. At the left bight-edge a coding-pattern as in the first row of diagrams in Fig. 811 and at the right bight-edge a coding-pattern as in the third row of diagrams in

† Don't confuse the essential coding of Pineapple braids with the essential coding of **Herringbone** Pineapple braids. See *The Braider*, Issue No. 23, pg. 523, Fig. 444.

Fig. 811. Note that this braid is its own mirror image, and that the same braid results with at the left bight-edge a coding-pattern as in the second row of diagrams in Fig. 811 and at the right bight-edge a coding-pattern as in the fourth row of diagrams in Fig. 811 (turn through 180°).

type 2. At the left bight-edge a coding-pattern as in the first row of diagrams in Fig. 811 and at the right bight-edge a coding-pattern as in the fourth row of diagrams in Fig. 811.

type 3. At the left bight-edge a coding-pattern as in the second row of diagrams in Fig. 811 and at the right bight-edge a coding-pattern as in the third row of diagrams in Fig. 811. Note that type 2 and type 3 are each others mirror image.

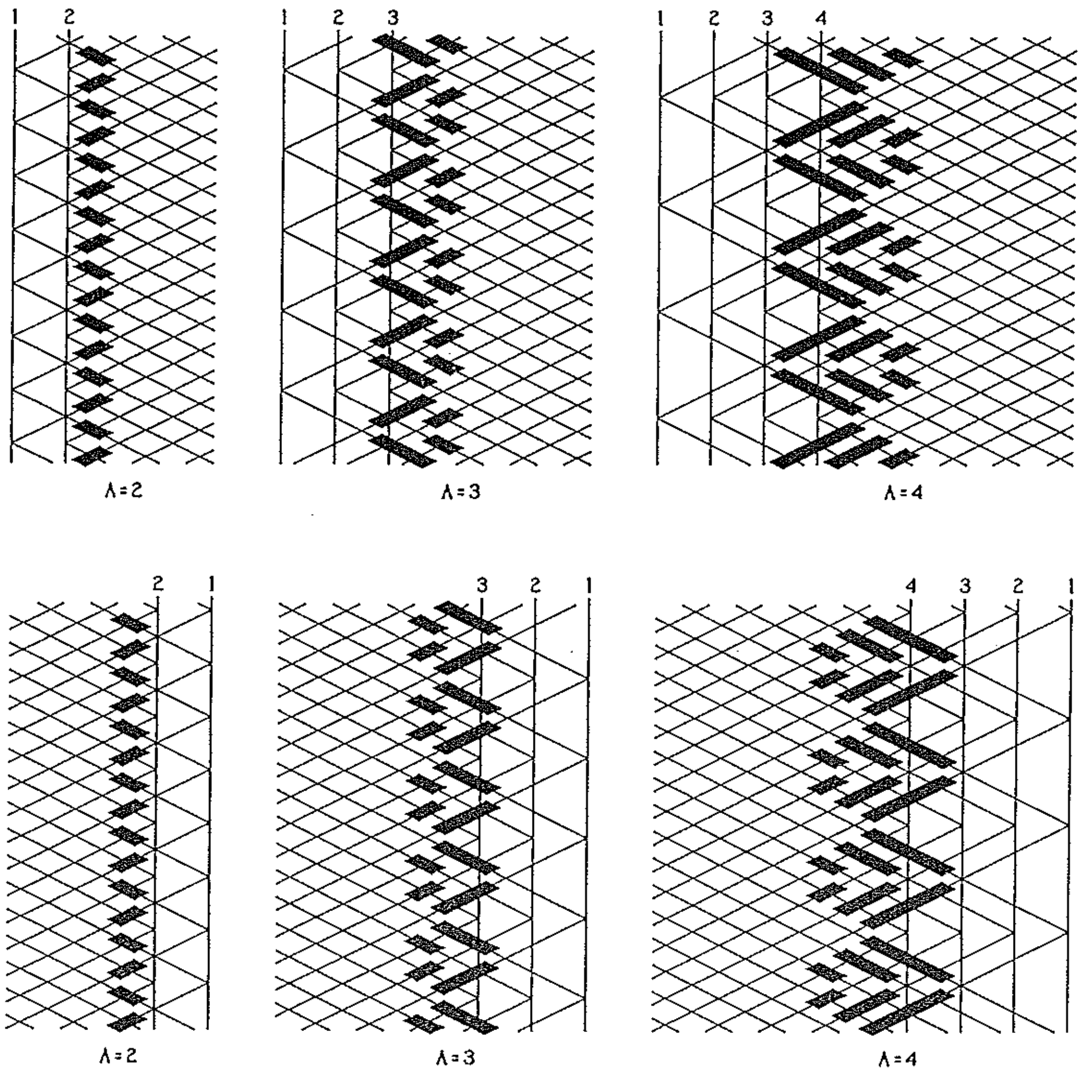


Fig. 810 — The essential Pineapple coding.

From the diagrams in Fig. 811 it immediately follows that the string-run of Checkered Pineapple Knots is the string-run of the Regular Nested Cylindrical Braids

$$(\underbrace{222\cdots2}_{(A-1)\text{ elements}}/3A+2+nA/\underbrace{222\cdots2}_{(A-1)\text{ elements}})\{1(A)(A-1)(A-2)\cdots2/(A)123\cdots(A-1)\}B\,,$$

where n is a whole number.†

Hence the Checkered Pineapple Knots are interbraids of A Regular Cylindrical

† See *The Braider*, Issue No. 22, pg. 502.

Braids, each with $P_c = 5 + n$ parts, and thus have a total of $P = A(5+n)$ parts.

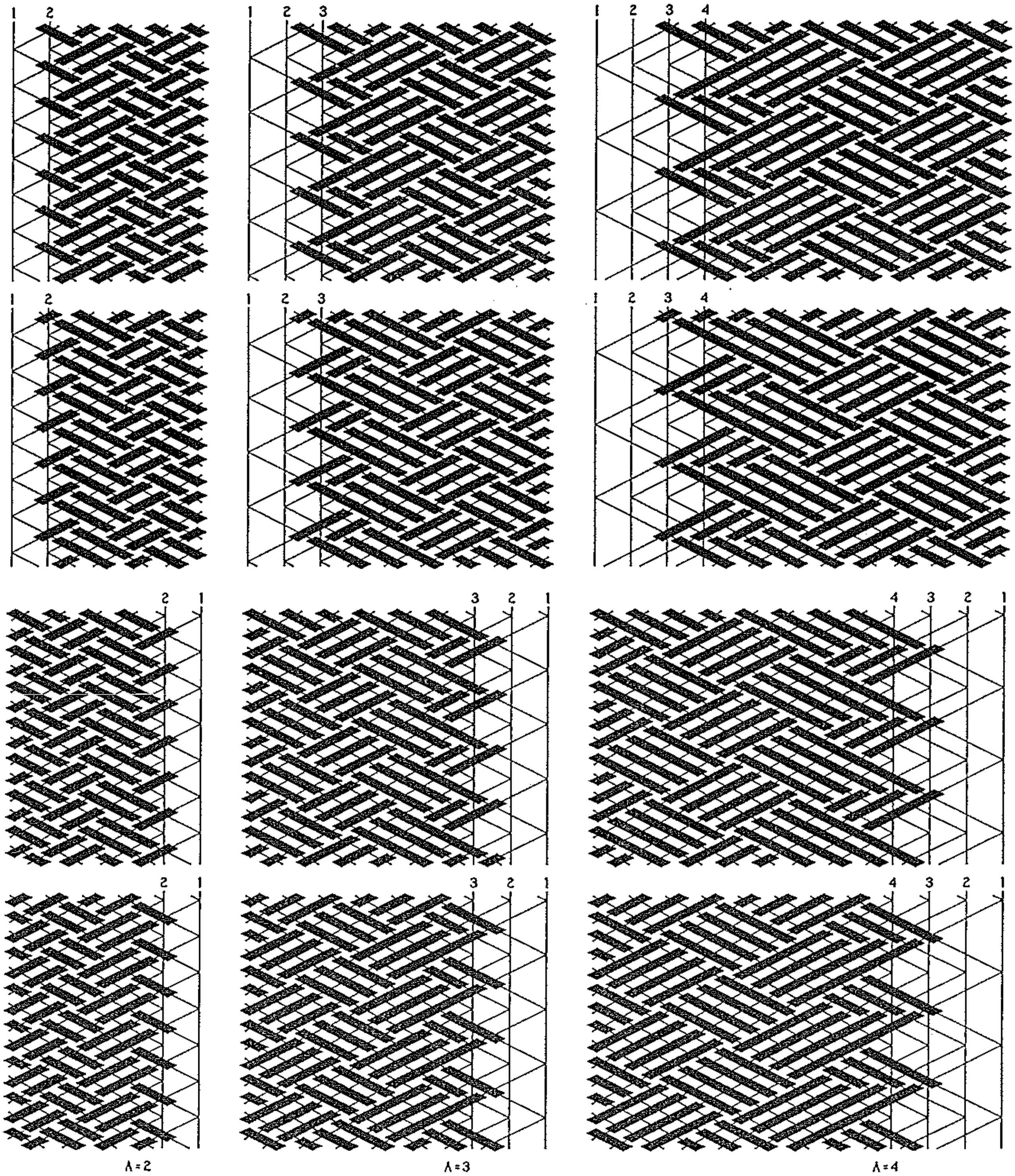


Fig. 811 — The coding-patterns of Checkered Pineapple braids.

$n =$ odd for types 2 & 3, thus $y = |2(A-1)+x|_{2A} = |x-2|_{2A} = |3A+nA|_{2A} = 0$.
$n =$ even for type 1, thus $y = |2(A-1)+x|_{2A} = |x-2|_{2A} = |3A+nA|_{2A} = A$.

From the diagrams in Fig. 811 it can readily be seen that the best way to braid an A-pass Checkered Pineapple Knot is to braid first a 2-pass Checkered Pineapple Knot and then progressively to enlarge it to a 3-pass, 4-pass, ... , $(A-1)$-pass, A-pass Checkered Pineapple Knot by respectively interbraiding the Regular Cylindrical Braid component associated with the left to right bight-boundary pair 2—2, a left to right bight-boundary pair which belongs to the set 2—3 to 3—2, ... , a left to right bight-boundary pair which belongs to the set 2—$(A-2)$ to $(A-2)$—2, a left to right bight-boundary pair which belongs to the set 2—$(A-1)$ to $(A-1)$—2.

Let P_c and B^* be coprime, hence g.c.d.$(P_c, B^*) = 1$, thus the interbraided Regular Cylindrical Braids are Regular Knots.

Type 1:

For a 2-pass type 1 Checkered Pineapple Knot the algorithm diagram for the foundation knot between left bight-boundary 1 and right bight-boundary 2 is:

Δ^*	$\lvert 2\Delta^*\rvert_{B^*}$	$\lvert 3\Delta^*\rvert_{B^*}$	$\lvert 4\Delta^*\rvert_{B^*}$	$\lvert (n+3)\Delta^*\rvert_{B^*}$	$\lvert (n+4)\Delta^*\rvert_{B^*}$
0	0	0	0	0	0
u	o	u	o	u	u
·	·	·	·	·	·
o	u	o	u	o	o
0	0	0	0	0	0
$\lvert (n+4)\Delta^*\rvert_{B^*}$	$\lvert (n+3)\Delta^*\rvert_{B^*}$	$\lvert (n+2)\Delta^*\rvert_{B^*}$	$\lvert (n+1)\Delta^*\rvert_{B^*}$	$\lvert 2\Delta^*\rvert_{B^*}$	Δ^*

n columns; $n = P_c - 5 = \text{even} \geq 0$

0	0	
u	o	
·	·	repeats.
o	u	
0	0	

For the half-cycles from lower left to upper right the first line gives the i-values, the second line the reference quantities, the third line the coding and the fourth line the intersection columns. For the half-cycles from lower right to upper left the fourth line gives the intersection columns, the fifth line the coding, the sixth line the reference quantities and the seventh line the i-values. Each reference quantity is increased by 1 when its associated i-value is applicable for the half-cycle concerned.

For a 2-pass type 1 Checkered Pineapple Knot the algorithm diagram for the interbraided component between left bight-boundary 2 and right bight-boundary 1 is:

	Δ^*	$\lvert 2\Delta^*\rvert_{B^*}$	$\lvert 3\Delta^*\rvert_{B^*}$	$\lvert 4\Delta^*\rvert_{B^*}$	$\lvert (n+3)\Delta^*\rvert_{B^*}$	$\lvert (n+4)\Delta^*\rvert_{B^*}$
1	0	1	1	1	1	1
u	o	o	u	o	u	o
·	·	·	·	·	·	·
	u	u	o	u	o	u
	1	1	1	1	2	0
	$\lvert (n+4)\Delta^*\rvert_{B^*}$	$\lvert (n+3)\Delta^*\rvert_{B^*}$	$\lvert (n+2)\Delta^*\rvert_{B^*}$	$\lvert (n+1)\Delta^*\rvert_{B^*}$	$\lvert 2\Delta^*\rvert_{B^*}$	Δ^*

n columns; $n = P_c - 5 = \text{even} \geq 0$

1	1	
u	o	
·	·	repeats.
o	u	
1	1	

For the lower left to upper right half-cycles, the first line gives the i-values where applicable, the second line the reference quantities, the third line the coding and the fourth line the intersection sets. For the lower right to upper left half-cycles, the fourth line gives the intersection sets, the fifth line the coding, the sixth line the reference quantities and the seventh line the i-values where applicable. Each reference quantity is increased by 1 when its associated i-value is applicable for the half-cycle concerned.

As mentioned earlier on pg. 1043 an A-pass type 1 Checkered Pineapple Knot with $A \geq 3$ is enlarged from a 2-pass type 1 Checkered Pineapple Knot by interbraiding the Regular Knot components between the left and right bight-boundary pairs $2—(A-1)$ to and including $(A-1)—2$. The algorithm diagram for these interbraids is:

	Δ^*	$\lvert 2\Delta^*\rvert_{B^*}$	$\lvert 3\Delta^*\rvert_{B^*}$	$\lvert 4\Delta^*\rvert_{B^*}$	$\lvert (n+3)\Delta^*\rvert_{B^*}$	$\lvert (n+4)\Delta^*\rvert_{B^*}$	
	$l-1$	$2A-1-l$	$A-1$	$A-1$	$A-1$	$l-1$	$A-l$
	u	o	u	o	u	o	u
·	·	·	·	·	·	·	·
u	o	u	o	u	o	u	
$A-r$	$r-1$	$A-1$	$A-1$	$A-1$	$2A-1-r$	$r-1$	
	$\lvert (n+4)\Delta^*\rvert_{B^*}$	$\lvert (n+3)\Delta^*\rvert_{B^*}$	$\lvert (n+2)\Delta^*\rvert_{B^*}$	$\lvert (n+1)\Delta^*\rvert_{B^*}$	$\lvert 2\Delta^*\rvert_{B^*}$	Δ^*	

n columns; $n = P_c - 5 = \text{even} \geq 0$

$A-1$	$A-1$	
u	o	
·	·	repeats.
o	u	
$A-1$	$A-1$	

$$A \geq 3\,;\ 2 \leq l \leq A-1\,;\ 2 \leq r \leq A-1\,;\ r = A+1-l\,;\ l = A+1-r\,.$$

For the half-cycles from lower left to upper right the first line gives the i-values where applicable, the second line the reference quantities, the third line the coding and the fourth line the intersection sets. For the half-cycles from lower right to upper left the fourth line gives the intersection sets, the fifth line the coding, the sixth line the reference quantities and the seventh line the i-values where applicable. Each reference quantity is increased by 1 when its associated i-value is applicable for the half-cycle concerned.

Type 2:

For a 2-pass type 2 Checkered Pineapple Knot the algorithm diagram for the foundation knot between left bight-boundary 1 and right bight-boundary 2 is:

Δ^*	$\lvert 2\Delta^*\rvert_{B^*}$	$\lvert 3\Delta^*\rvert_{B^*}$	$\lvert 4\Delta^*\rvert_{B^*}$	$\lvert 5\Delta^*\rvert_{B^*}$	$\lvert (n+3)\Delta^*\rvert_{B^*}$	$\lvert (n+4)\Delta^*\rvert_{B^*}$
0	0	0	0	0	0	0
u	o	u	o	u	o	o
·	·	·	·	·	·	·
o	u	o	u	o	u	u
0	0	0	0	0	0	0
$\lvert (n+4)\Delta^*\rvert_{B^*}$	$\lvert (n+3)\Delta^*\rvert_{B^*}$	$\lvert (n+2)\Delta^*\rvert_{B^*}$	$\lvert (n+1)\Delta^*\rvert_{B^*}$	$\lvert n\Delta^*\rvert_{B^*}$	$\lvert 2\Delta^*\rvert_{B^*}$	Δ^*

$(n-1)$ columns; $n = P_c - 5 = \text{odd} \geq 1$

0	0	
o	u	
·	·	repeats.
u	o	
0	0	

For the half-cycles from lower left to upper right the first line gives the i-values, the second line the reference quantities, the third line the coding and the fourth line the intersection columns. For the half-cycles from lower right to upper left the fourth line gives the intersection columns, the fifth line the coding, the sixth line the reference quantities and the seventh line the i-values. Each reference quantity is increased by 1 when its associated i-value is applicable for the half-cycle concerned.

For a 2-pass type 2 Checkered Pineapple Knot the algorithm diagram for the interbraided component between left bight-boundary 2 and right bight-boundary 1 is:

	Δ^*	$\lvert 2\Delta^*\rvert_{B^*}$	$\lvert 3\Delta^*\rvert_{B^*}$	$\lvert 4\Delta^*\rvert_{B^*}$	$\lvert 5\Delta^*\rvert_{B^*}$	$\lvert (n+3)\Delta^*\rvert_{B^*}$	$\lvert (n+4)\Delta^*\rvert_{B^*}$
1	0	1	1	1	1	2	0
u	o	o	u	o	u	o	u
.	.	.	.	.	.	.	.
	u	u	o	u	o	u	o
	1	1	1	1	1	1	1
	$\lvert (n+4)\Delta^*\rvert_{B^*}$	$\lvert (n+3)\Delta^*\rvert_{B^*}$	$\lvert (n+2)\Delta^*\rvert_{B^*}$	$\lvert (n+1)\Delta^*\rvert_{B^*}$	$\lvert n\Delta^*\rvert_{B^*}$	$\lvert 2\Delta^*\rvert_{B^*}$	Δ^*

$(n-1)$ columns; $n = P_c - 5 = \text{odd} \geq 1$

1	1	
o	u	
.	.	repeats.
u	o	
1	1	

For the half-cycles from lower left to upper right the first line gives the i-values where applicable, the second line the reference quantities, the third line the coding and the fourth line the intersection sets. For the half-cycles from lower right to upper left the fourth line gives the intersection sets, the fifth line the coding, the sixth line the reference quantities and the seventh line the i-values where applicable. Each reference quantity is increased by 1 when its associated i-value is applicable for the half-cycle concerned.

An A-pass type 2 Checkered Pineapple Knot ($A \geq 3$) is enlarged from a 2-pass type 2 Checkered Pineapple Knot by interbraiding the Regular Knot components between the left and right bight-boundary pairs $2 — (A-1)$ to and including $(A-1) — 2$. The algorithm diagram for these interbraids is:

	⋆	⋆	⋆	⋆	⋆	⋆	⋆	
	$l-1$	$2A-1-l$	$A-1$	$A-1$	$A-1$	$A-2+l$	$A-l$	
	u	o	u	o	u	o	u	
.	.	.	.	.	.	.	.	.
u	o	u	o	u	o	u	o	u
$A-r$	$r-1$	$A-1$	$A-1$	$A-1$	$A-1$	$A-1$	$A-r$	$r-1$
	⋆	⋆	⋆	⋆	⋆	⋆	⋆	

$(n-1)$ columns; $n = P_c - 5 = \text{odd} \geq 1$

$A-1$	$A-1$	
o	u	
.	.	repeats.
u	o	
$A-1$	$A-1$	

$$A \geq 3\,;\; 2 \leq l \leq A-1\,;\; 2 \leq r \leq A-1\,;\; r = A+1-l\,;\; l = A+1-r\,.$$

For the half-cycles from lower left to upper right the stars in the first line give the i-values where applicable, the second line gives the reference quantities, the third line the coding and the fourth line the intersection sets. For the half-cycles from lower right to upper left the fourth line gives the intersection sets, the fifth line the coding, the sixth line the reference quantities and the stars in the seventh line give the i-values where applicable. Each reference quantity is increased by 1 when its associated i-value is applicable for the half-cycle concerned.

Type 3:

For a 2-pass type 3 Checkered Pineapple Knot the algorithm diagram for the foundation knot between left bight-boundary 1 and right bight-boundary 2 is:

Δ^*	$\|2\Delta^*\|_{B^*}$	$\|3\Delta^*\|_{B^*}$	$\|4\Delta^*\|_{B^*}$	$\|5\Delta^*\|_{B^*}$	$\|(n+3)\Delta^*\|_{B^*}$	$\|(n+4)\Delta^*\|_{B^*}$
0	0	0	0	0	0	0
u	u	o	u	o	u	o
·	·	·	·	·	·	·
o	o	u	o	u	o	u
0	0	0	0	0	0	0
$\|(n+4)\Delta^*\|_{B^*}$	$\|(n+3)\Delta^*\|_{B^*}$	$\|(n+2)\Delta^*\|_{B^*}$	$\|(n+1)\Delta^*\|_{B^*}$	$\|n\Delta^*\|_{B^*}$	$\|2\Delta^*\|_{B^*}$	Δ^*

$(n-1)$ columns; $n=P_c-5=\text{odd}\geq 1$

0	0	
u	o	
·	·	repeats.
o	u	
0	0	

For the half-cycles from lower left to upper right the first line gives the i-values, the second line gives the reference quantities of the coding associated with the intersection columns, the third line the coding of the intersection columns and the fourth line the intersection columns. For the half-cycles from lower right to upper left the fourth line gives the intersection columns, the fifth line the coding of the intersection columns, the sixth line the reference quantities of the coding associated with the intersection columns and the seventh line the i-values. Each reference quantity is increased by 1 when its associated i-value is applicable for the half-cycle concerned.

For a 2-pass type 3 Checkered Pineapple Knot the algorithm diagram for the interbraided component between left bight-boundary 2 and right bight-boundary 1 is:

Δ^*	$\|2\Delta^*\|_{B^*}$	$\|3\Delta^*\|_{B^*}$	$\|4\Delta^*\|_{B^*}$	$\|5\Delta^*\|_{B^*}$	$\|(n+3)\Delta^*\|_{B^*}$	$\|(n+4)\Delta^*\|_{B^*}$	
1	1	1	1	1	1	1	
o	u	o	u	o	u	u	
·	·	·	·	·	·	·	·
u	o	u	o	u	o	o	u
0	2	1	1	1	1	0	1
$\|(n+4)\Delta^*\|_{B^*}$	$\|(n+3)\Delta^*\|_{B^*}$	$\|(n+2)\Delta^*\|_{B^*}$	$\|(n+1)\Delta^*\|_{B^*}$	$\|n\Delta^*\|_{B^*}$	$\|2\Delta^*\|_{B^*}$	Δ^*	

$(n-1)$ columns; $n=P_c-5=\text{odd}\geq 1$

1	1	
u	o	
·	·	repeats.
o	u	
1	1	

For the half-cycles from lower left to upper right the first line gives the i-values where applicable, the second line gives the reference quantities of the coding associated with the intersection sets, the third line the coding associated with the intersection sets and the fourth line the intersection sets. For the half-cycles from lower right to upper left the fourth line gives the intersection sets, the fifth line the coding associated with the intersection sets, the sixth line the reference quantities of the coding associated with the intersection sets and the seventh line the i-values where applicable. Each reference quantity is increased by 1 when its associated i-value is applicable for the half-cycle concerned.

An A-pass type 3 Checkered Pineapple Knot ($A \geq 3$) is enlarged from a 2-pass type 3 Checkered Pineapple Knot by interbraiding the Regular Knot components between the left and right bight-boundary pairs $2—(A-1)$ to and including $(A-1)—2$. The algorithm diagram for these interbraids is:

$$\begin{array}{ccccc|cc|ccc}
 & \star & \star & \star & \star & \star & \star & \star & \\
l-1 & A-l & A-1 & A-1 & A-1 & A-1 & A-1 & l-1 & A-l \\
u & o & u & o & u & o & u & o & u \\
\cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\
 & u & o & u & o & u & o & u & \\
 & A-r & A-2+r & A-1 & A-1 & A-1 & 2A-1-r & r-1 & \\
 & \star & \star & \star & \star & \star & \star & \star &
\end{array}$$

$(n-1)$ columns; $n = P_c - 5 = \text{odd} \geq 1$

$$\begin{array}{cc}
A-1 & A-1 \\
u & o \\
\cdot & \cdot \\
o & u \\
A-1 & A-1
\end{array} \quad \text{repeats.}$$

$$A \geq 3\,;\; 2 \leq l \leq A-1\,;\; 2 \leq r \leq A-1\,;\; r = A+1-l\,;\; l = A+1-r\,.$$

For the half-cycles from lower left to upper right the stars in the first line give the i-values where applicable, the second line gives the reference quantities, the third line the coding and the fourth line the intersection sets. For the half-cycles from lower right to upper left the fourth line gives the intersection sets, the fifth line the coding, the sixth line the reference quantities and the stars in the seventh line give the i-values where applicable. Each reference quantity is increased by 1 when its associated i-value is applicable for the half-cycle concerned.

Example 1: type 1

Let $A = 2$; $B^* = 4$ and $n = 4$. Hence $P_c = n + 5 = 9$; $x = 3A + 2 + nA = 6 + 2 + 8 = 16$ and $\text{g.c.d.}(P_c, B^*) = \text{g.c.d.}(9, 4) = 1$.

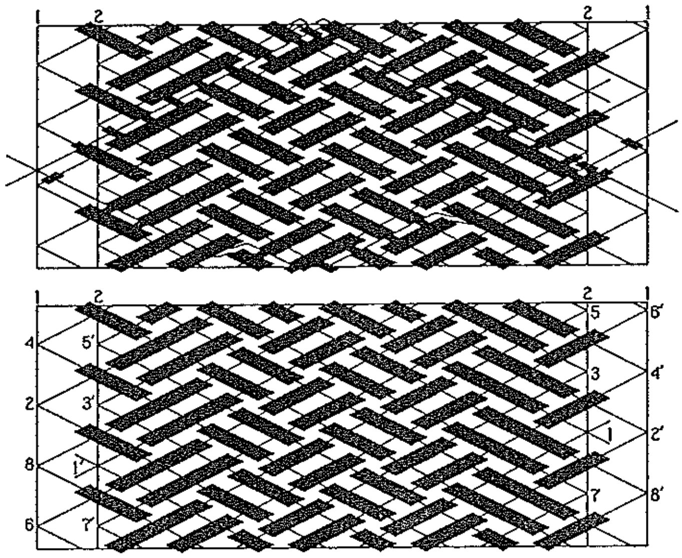
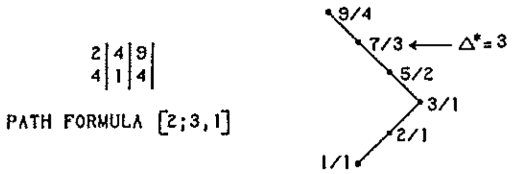


Fig. 812 — 2-pass Checkered Pineapple Knot of Example 1.

If we want to work away the string-ends as shown in the upper diagram of Fig. 812 then we braid the knot as shown in the lower diagram of Fig. 812. First we braid the foundation knot (a Regular Knot with $P_c/B^* = 9/4$) between left bight-boundary 1 and right bight-boundary 2, next we interbraid the component (a Regular Knot with $P_c/B^* = 9/4$) between left bight-boundary 2 and right bight-boundary 1. Before we can draw up the algorithm diagrams for these two components we need to know their

Δ^*-values (their Δ^*-values are the same since their P_c/B^*-values are the same), which we obtain from their path in the RKT:



The algorithm diagram for the foundation knot is then:

3	2	1	0	3	2	1	0
0	0	0	0	0	0	0	0
u	o	u	o	u	o	u	u
.	.	.	.	.	.	.	.
o	u	o	u	o	u	o	o
0	0	0	0	0	0	0	0
0	1	2	3	0	1	2	3

From this algorithm diagram we read its half-cycle braiding algorithms:

half-cycle 1	$L \longleftarrow R$		:	Free run.
half-cycle 2	$L \longrightarrow R$	$i=0$	:	$o-u$.
half-cycle 3	$L \longleftarrow R$	$i=0$	:	$2o$.
half-cycle 4	$L \longrightarrow R$	$i \leq 1$	:	$u-o-2u$.
half-cycle 5	$L \longleftarrow R$	$i \leq 1$	:	$u-o-u-o$.
half-cycle 6	$L \longrightarrow R$	$i \leq 2$	:	$o-u-2o-2u$.
half-cycle 7	$L \longleftarrow R$	$i \leq 2$	:	$o-u-2o-u-o$.
half-cycle 8	$L \longrightarrow R$	$i \leq 3$	:	$u-o-u-o-u-o-2u$.

And the algorithm diagram for the interbraided knot is:

	3	2	1	0	3	2	1	0
1	0	1	1	1	1	1	1	1
u	o	o	u	o	u	o	u	o
.	.	.	.	.	.	.	.	.
	u	u	o	u	o	u	o	u
	1	1	1	1	1	1	2	0
	0	1	2	3	0	1	2	3

From this algorithm diagram we read its half-cycle braiding algorithms:

half-cycle 1′	$L \longrightarrow R$		:	$u-o-u-o-u-o-u-o$.
half-cycle 2′	$L \longleftarrow R$	$i=0$	:	$2o-u-2o-u-o-3u$.
half-cycle 3′	$L \longrightarrow R$	$i=0$	:	$u-o-u-2o-u-o-u-2o$.
half-cycle 4′	$L \longleftarrow R$	$i \leq 1$	:	$2o-2u-2o-u-o-4u$.
half-cycle 5′	$L \longrightarrow R$	$i \leq 1$	:	$u-o-2u-2o-u-o-2u-2o$.
half-cycle 6′	$L \longleftarrow R$	$i \leq 2$	:	$3o-2u-2o-u-2o-4u$.
half-cycle 7′	$L \longrightarrow R$	$i \leq 2$	:	$u-2o-2u-2o-u-2o-2u-2o$.
half-cycle 8′	$L \longleftarrow R$	$i \leq 3$	:	$u-3o-2u-2o-2u-2o-4u$.

Example 2: type 1

Let $A=5$; $B^*=4$ and $n=2$. Hence $P_c=n+5=7$; $x=3A+2+nA=15+2+10=27$ and g.c.d.$(P_c,B^*)=$ g.c.d.$(7,4)=1$.

First we braid the foundation knot (a Regular Knot with $P_c/B^*=7/4$) between left bight-boundary 1 and right bight-boundary 5, next we interbraid the component (a Regular Knot with $P_c/B^* = 7/4$) between left bight-boundary 5 and right bight-boundary 1. Say we then interbraid the component (a Regular Knot with $P_c/B^* = 7/4$) between left bight-boundary 4 and right bight-boundary 2, next the component (a Regular Knot with $P_c/B^* = 7/4$) between left bight-boundary 2 and right bight-boundary 4 and then the component (a Regular Knot with $P_c/B^* = 7/4$) between left bight-boundary 3 and right bight-boundary 3.

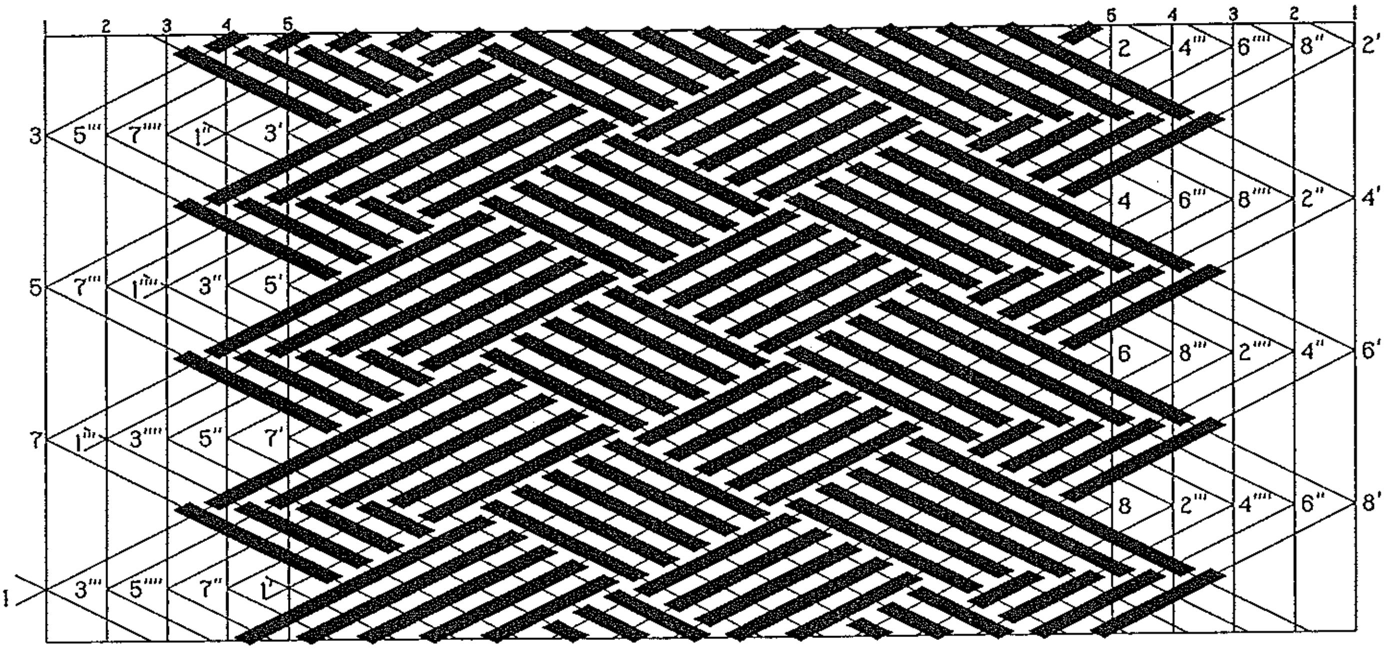
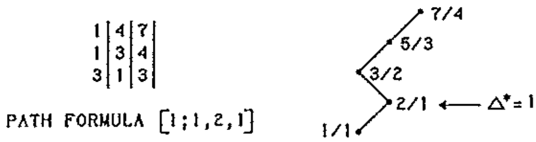


Fig. 813 — 5-pass Checkered Pineapple Knot of Example 2.

The Δ^*-values for the algorithm diagrams of these five components are obtained from their path in the RKT (Δ^*-values are the same since P_c/B^*-values are the same):



The algorithm diagram for the foundation knot is:

1	2	3	0	1	2
0	0	0	0	0	0
u	o	u	o	u	u
.	.	.	.	.	.
o	u	o	u	o	o
0	0	0	0	0	0
2	1	0	3	2	1

From this algorithm diagram we read its half-cycle braiding algorithms:

half-cycle 1	$L \longleftarrow R$		:	Free run.
half-cycle 2	$L \longrightarrow R$	$i = 0$	:	o.
half-cycle 3	$L \longleftarrow R$	$i = 0$	:	o.
half-cycle 4	$L \longrightarrow R$	$i \leq 1$	:	$2o - u$.
half-cycle 5	$L \longleftarrow R$	$i \leq 1$	:	$u - o - u$.
half-cycle 6	$L \longrightarrow R$	$i \leq 2$	:	$3o - u - o$.
half-cycle 7	$L \longleftarrow R$	$i \leq 2$	:	$u - 2o - 2u$.
half-cycle 8	$L \longrightarrow R$	$i \leq 3$	:	$2o - u - o - u - o$.

The algorithm diagram for the interbraided knot between left bight-boundary 5 and right bight-boundary 1 in the 5-pass Checkered Pineapple Knot (left bight-boundary 2 and right bight-boundary 1 in 2-pass Checkered Pineapple Knot) is:

	1	2	3	0	1	2
1	0	1	1	1	1	1
u	o	o	u	o	u	o
.	.	.	.	.	.	.
	u	u	o	u	o	u
	1	1	1	1	2	0
	2	1	0	3	2	1

From this algorithm diagram we read its half-cycle braiding algorithms:

half-cycle $1'$ $L \longrightarrow R$: $u - o - u - o - u - o$.
half-cycle $2'$ $L \longleftarrow R$ $i = 0$: $2o - u - 2o - 2u$.
half-cycle $3'$ $L \longrightarrow R$ $i = 0$: $u - o - u - 2o - u - o$.
half-cycle $4'$ $L \longleftarrow R$ $i \leq 1$: $u - 2o - u - 2o - 3u$.
half-cycle $5'$ $L \longrightarrow R$ $i \leq 1$: $u - 2o - u - 2o - 2u - o$.
half-cycle $6'$ $L \longleftarrow R$ $i \leq 2$: $u - 3o - u - 2o - 4u$.
half-cycle $7'$ $L \longrightarrow R$ $i \leq 2$: $u - 3o - u - 2o - 2u - 2o$.
half-cycle $8'$ $L \longleftarrow R$ $i \leq 3$: $u - 3o - 2u - 2o - 4u$.

The algorithm diagram for the interbraided knot between left bight-boundary 4 and right bight-boundary 2 in the 5-pass Checkered Pineapple Knot (left bight-boundary 2 ($l = 2$) and right bight-boundary 2 ($r = 2$) in 3-pass Checkered Pineapple Knot) is:

	1	2	3	0	1	2	
	1	3	2	2	2	1	1
	u	o	u	o	u	o	u
.	.	.	.	.	.	.	.
u	o	u	o	u	o	u	
1	1	2	2	2	3	1	
	2	1	0	3	2	1	

From this algorithm diagram we read its half-cycle braiding algorithms:

half-cycle $1''$ $L \longrightarrow R$: $u - 3o - 2u - 2o - 2u - o - u$.
half-cycle $2''$ $L \longleftarrow R$ $i = 0$: $u - 3o - 2u - 3o - 2u - o - u$.
half-cycle $3''$ $L \longrightarrow R$ $i = 0$: $u - 3o - 2u - 3o - 2u - o - u$.
half-cycle $4''$ $L \longleftarrow R$ $i \leq 1$: $2u - 3o - 2u - 3o - 3u - o - u$.
half-cycle $5''$ $L \longrightarrow R$ $i \leq 1$: $2u - 3o - 2u - 3o - 3u - o - u$.
half-cycle $6''$ $L \longleftarrow R$ $i \leq 2$: $2u - 4o - 2u - 3o - 3u - 2o - u$.
half-cycle $7''$ $L \longrightarrow R$ $i \leq 2$: $2u - 4o - 2u - 3o - 3u - 2o - u$.
half-cycle $8''$ $L \longleftarrow R$ $i \leq 3$: $2u - 4o - 3u - 3o - 3u - 2o - u$.

The algorithm diagram for the interbraided knot between left bight-boundary 2 and right bight-boundary 4 in the 5-pass Checkered Pineapple Knot (left bight-boundary 2 ($l = 2$) and right bight-boundary 3 ($r = 3$) in 4-pass Checkered Pineapple Knot) is:

	1	2	3	0	1	2	
	1	5	3	3	3	1	2
	u	o	u	o	u	o	u
.	.	.	.	.	.	.	.
u	o	u	o	u	o	u	
1	2	3	3	3	4	2	
	2	1	0	3	2	1	

From this algorithm diagram we read its half-cycle braiding algorithms:

half-cycle $1'''$ $L \longrightarrow R$: $u - 5o - 3u - 3o - 3u - o - 2u$.
half-cycle $2'''$ $L \longleftarrow R$ $i = 0$: $2u - 4o - 3u - 4o - 3u - 2o - u$.
half-cycle $3'''$ $L \longrightarrow R$ $i = 0$: $u - 5o - 3u - 4o - 3u - o - 2u$.
half-cycle $4'''$ $L \longleftarrow R$ $i \leq 1$: $3u - 4o - 3u - 4o - 4u - 2o - u$.
half-cycle $5'''$ $L \longrightarrow R$ $i \leq 1$: $2u - 5o - 3u - 4o - 4u - o - 2u$.
half-cycle $6'''$ $L \longleftarrow R$ $i \leq 2$: $3u - 5o - 3u - 4o - 4u - 3o - u$.
half-cycle $7'''$ $L \longrightarrow R$ $i \leq 2$: $2u - 6o - 3u - 4o - 4u - 2o - 2u$.
half-cycle $8'''$ $L \longleftarrow R$ $i \leq 3$: $3u - 5o - 4u - 4o - 4u - 3o - u$.

The algorithm diagram for the interbraided knot between left bight-boundary 3 and right bight-boundary 3 in the 5-pass Checkered Pineapple Knot (hence $l = 3$ and $r = 3$ since this ends the interbraiding) is:

	1	2	3	0	1	2	
	2	6	4	4	4	2	2
	u	o	u	o	u	o	u
.	.	.	.	.	.	.	.
u	o	u	o	u	o	u	
2	2	4	4	4	6	2	
	2	1	0	3	2	1	

From this algorithm diagram we read its half-cycle braiding algorithms:

half-cycle $1''''$ $L \longrightarrow R$: $2u - 6o - 4u - 4o - 4u - 2o - 2u$.
half-cycle $2''''$ $L \longleftarrow R$ $i = 0$: $2u - 6o - 4u - 5o - 4u - 2o - 2u$.
half-cycle $3''''$ $L \longrightarrow R$ $i = 0$: $2u - 6o - 4u - 5o - 4u - 2o - 2u$.
half-cycle $4''''$ $L \longleftarrow R$ $i \leq 1$: $3u - 6o - 4u - 5o - 5u - 2o - 2u$.
half-cycle $5''''$ $L \longrightarrow R$ $i \leq 1$: $3u - 6o - 4u - 5o - 5u - 2o - 2u$.
half-cycle $6''''$ $L \longleftarrow R$ $i \leq 2$: $3u - 7o - 4u - 5o - 5u - 3o - 2u$.
half-cycle $7''''$ $L \longrightarrow R$ $i \leq 2$: $3u - 7o - 4u - 5o - 5u - 3o - 2u$.
half-cycle $8''''$ $L \longleftarrow R$ $i \leq 3$: $3u - 7o - 5u - 5o - 5u - 3o - 2u$.

Example 3: type 2

Let $A = 3$; $B^* = 5$ and $n = 3$. Hence $P_c = n + 5 = 8$; $x = 3A + 2 + nA = 9 + 2 + 9 = 20$ and $\text{g.c.d.}(P_c, B^*) = \text{g.c.d.}(8, 5) = 1$.

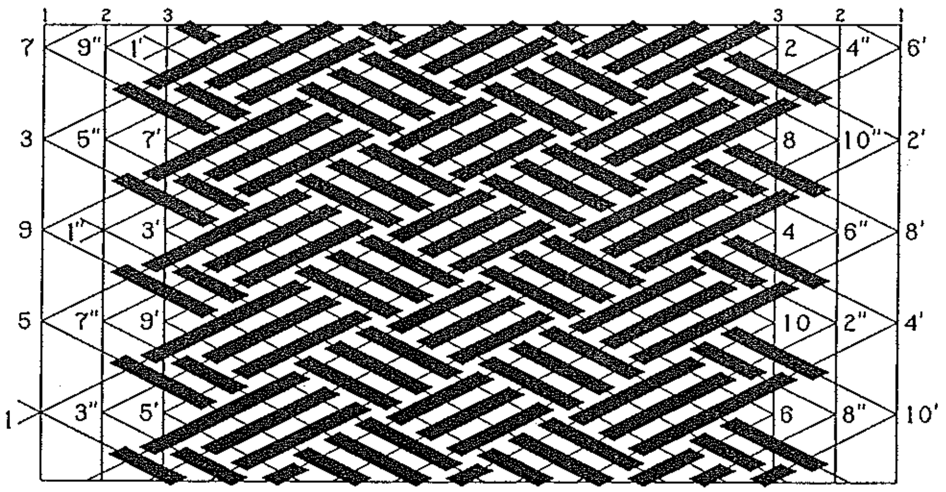


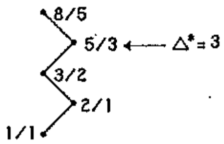
Fig. 814 — 3-pass Checkered Pineapple Knot of Example 3.

First we braid the foundation knot (a Regular Knot with $P_c/B^* = 8/5$) between left bight-boundary 1 and right bight-boundary 3, next we interbraid the component (a Regular Knot with $P_c/B^* = 8/5$) between left bight-boundary 3 and right bight-boundary 1. Next we interbraid the component (a Regular Knot with $P_c/B^* = 8/5$) between left bight-boundary 2 and right bight-boundary 2.

Again, before we can draw up the algorithm diagrams for these three components we need to know their Δ^*-values (their Δ^*-values are the same since their P_c/B^*-values are the same), which we obtain from their path in the RKT:

1	5	8
1	3	5
1	2	3
2	1	2

PATH FORMULA [1;1,1,1,1]



The algorithm diagram for the foundation knot is:

3	1	4	2	0	3	1
0	0	0	0	0	0	0
u	o	u	o	u	o	o
.	.	.	.	.	.	.
o	u	o	u	o	u	u
0	0	0	0	0	0	0
1	3	0	2	4	1	3

From this algorithm diagram we read its half-cycle braiding algorithms:

half-cycle 1	$L \longleftarrow R$		:	Free run.
half-cycle 2	$L \longrightarrow R$	$i = 0$	:	o.
half-cycle 3	$L \longleftarrow R$	$i = 0$	:	u.
half-cycle 4	$L \longrightarrow R$	$i \leq 1$	:	$u - 2o$.
half-cycle 5	$L \longleftarrow R$	$i \leq 1$	:	$o - u - o$.
half-cycle 6	$L \longrightarrow R$	$i \leq 2$	:	$2u - 2o$.
half-cycle 7	$L \longleftarrow R$	$i \leq 2$	:	$2o - u - o$.
half-cycle 8	$L \longrightarrow R$	$i \leq 3$	:	$3u - o - u - o$.
half-cycle 9	$L \longleftarrow R$	$i \leq 3$	:	$u - 2o - u - 2o$.
half-cycle 10	$L \longrightarrow R$	$i \leq 4$	:	$2u - o - u - o - u - o$.

The algorithm diagram for the interbraided knot between left bight-boundary 3 and right bight-boundary 1 in the 3-pass Checkered Pineapple Knot (left bight-boundary 2 and right bight-boundary 1 in 2-pass Checkered Pineapple Knot) is:

	3	1	4	2	0	3	1
1	0	1	1	1	1	2	0
u	o	o	u	o	u	o	u
.	.	.	.	.	.	.	.
	u	u	o	u	o	u	o
	1	1	1	1	1	1	1
	1	3	0	2	4	1	3

From this algorithm diagram we read its half-cycle braiding algorithms:

half-cycle 1′	$L \longrightarrow R$		:	$u - o - u - o - u - 2o$.
half-cycle 2′	$L \longleftarrow R$	$i = 0$	:	$o - u - o - u - 2o - 2u$.
half-cycle 3′	$L \longrightarrow R$	$i = 0$	:	$u - o - u - o - 2u - 2o$.
half-cycle 4′	$L \longleftarrow R$	$i \leq 1$	:	$o - 2u - o - u - 2o - 3u$.
half-cycle 5′	$L \longrightarrow R$	$i \leq 1$	:	$u - 2o - u - o - 2u - 2o - u$.

half-cycle 6′ $L \longleftarrow R \quad i \leq 2 \quad : \quad o - 2u - o - 2u - 2o - 3u\,.$
half-cycle 7′ $L \longrightarrow R \quad i \leq 2 \quad : \quad u - 2o - u - 2o - 2u - 2o - u\,.$
half-cycle 8′ $L \longleftarrow R \quad i \leq 3 \quad : \quad 2o - 2u - o - 2u - 2o - 4u\,.$
half-cycle 9′ $L \longrightarrow R \quad i \leq 3 \quad : \quad u - 3o - u - 2o - 2u - 3o - u\,.$
half-cycle 10′ $L \longleftarrow R \quad i \leq 4 \quad : \quad 2o - 2u - 2o - 2u - 2o - 4u\,.$

The algorithm diagram for the interbraided knot between left bight-boundary 2 and right bight-boundary 2 in the 3-pass Checkered Pineapple Knot (hence $l = 2$ and $r = 2$ since this ends the interbraiding) is:

	3	1	4	2	0	3	1	
	1	3	2	2	2	3	1	
	u	*o*	*u*	*o*	*u*	*o*	*u*	
.	.	.	.	.	.	.	.	.
u	*o*	*u*	*o*	*u*	*o*	*u*	*o*	*u*
1	1	2	2	2	2	2	1	1
	1	3	0	2	4	1	3	

From this algorithm diagram we read its half-cycle braiding algorithms:

half-cycle 1″ $L \longrightarrow R \quad : \quad u - 3o - 2u - 2o - 2u - 3o - u\,.$
half-cycle 2″ $L \longleftarrow R \quad i = 0 \quad : \quad u - o - 2u - 2o - 2u - 3o - 2u - o - u\,.$
half-cycle 3″ $L \longrightarrow R \quad i = 0 \quad : \quad u - 3o - 2u - 2o - 3u - 3o - u\,.$
half-cycle 4″ $L \longleftarrow R \quad i \leq 1 \quad : \quad u - o - 3u - 2o - 2u - 3o - 2u - 2o - u\,.$
half-cycle 5″ $L \longrightarrow R \quad i \leq 1 \quad : \quad u - 4o - 2u - 2o - 3u - 3o - 2u\,.$
half-cycle 6″ $L \longleftarrow R \quad i \leq 2 \quad : \quad u - o - 3u - 2o - 3u - 3o - 2u - 2o - u\,.$
half-cycle 7″ $L \longrightarrow R \quad i \leq 2 \quad : \quad u - 4o - 2u - 3o - 3u - 3o - 2u\,.$
half-cycle 8″ $L \longleftarrow R \quad i \leq 3 \quad : \quad u - 2o - 3u - 2o - 3u - 3o - 3u - 2o - u\,.$
half-cycle 9″ $L \longrightarrow R \quad i \leq 3 \quad : \quad 2u - 4o - 2u - 3o - 3u - 4o - 2u\,.$
half-cycle 10″ $L \longleftarrow R \quad i \leq 4 \quad : \quad u - 2o - 3u - 3o - 3u - 3o - 3u - 2o - u\,.$

Round Braids and their string sizes

The helix-angle of a helix on a cylinder is the angle between the helix and a line parallel to the centreline. In our calculations, however, we shall use its complement, indicated by α (see Fig. 815).

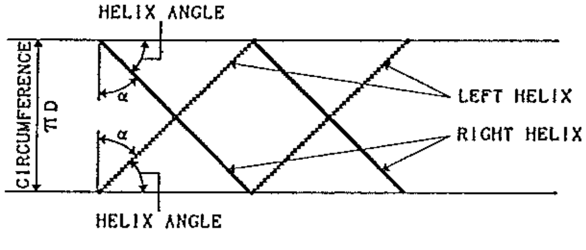


Fig. 815 — The helix angle and its complement α.

Say the core round braid has to be braided over a diameter D. Let for the core round braid the string-width be w, the string-thickness be t, the number of strings be $2b$ and the complement of the helix-angle be α. Then $bw = \pi(D + 2t)sin\alpha$, and with $\alpha = 45°$, hence $sin\alpha = \frac{1}{2}\sqrt{2} = 0.707$ we obtain $bw = 2.22(D + 2t)$. When we take $bw = 2(D + 2t)$, the angle between a right helix and a left helix is a little greater than

$90°$. Normally we choose a value for $2b$ and w, calculate the value for t and if that value is unsuitable we change $2b$ or w or both.

For two round braids over each other let for the core round braid the diameter over which it has to be braided be D. Let for the core round braid the string-width be w, the string-thickness be t and the number of strings be $2b_1$. For the mantle round braid let the string-width be w', the string-thickness be t' and the number of strings be $2b_2$. Let $w = rw'$ and $t = r^*t'$. Let the complement of the helix-angle for both braids be α. Then $b_2 - b_1 = \frac{\pi D(r-1)sin\alpha}{w} + \frac{2\pi t[2r+(\frac{r}{r^*}-1)]sin\alpha}{w}$. When the strings of both braids are identical in width and thickness, then $r = 1$ and $r^* = 1$, hence $b_2 - b_1 = \frac{4\pi t sin\alpha}{w} = n$. Thus the difference in the number of strings for the mantle and core round braids is equal to $2n$. These relationships are quite accurate in practice, provided the string preparation has been done properly. For thick string we have to take some off the width or the thickness to compensate for the discrepancy between theory and practice, and for thin string we add some to the width or the thickness. The string material is a more or less compressible medium which due to the tension during braiding decreases somewhat in width; furthermore it is not a homogeneous material and hence its properties are not constant along the entire string-length.

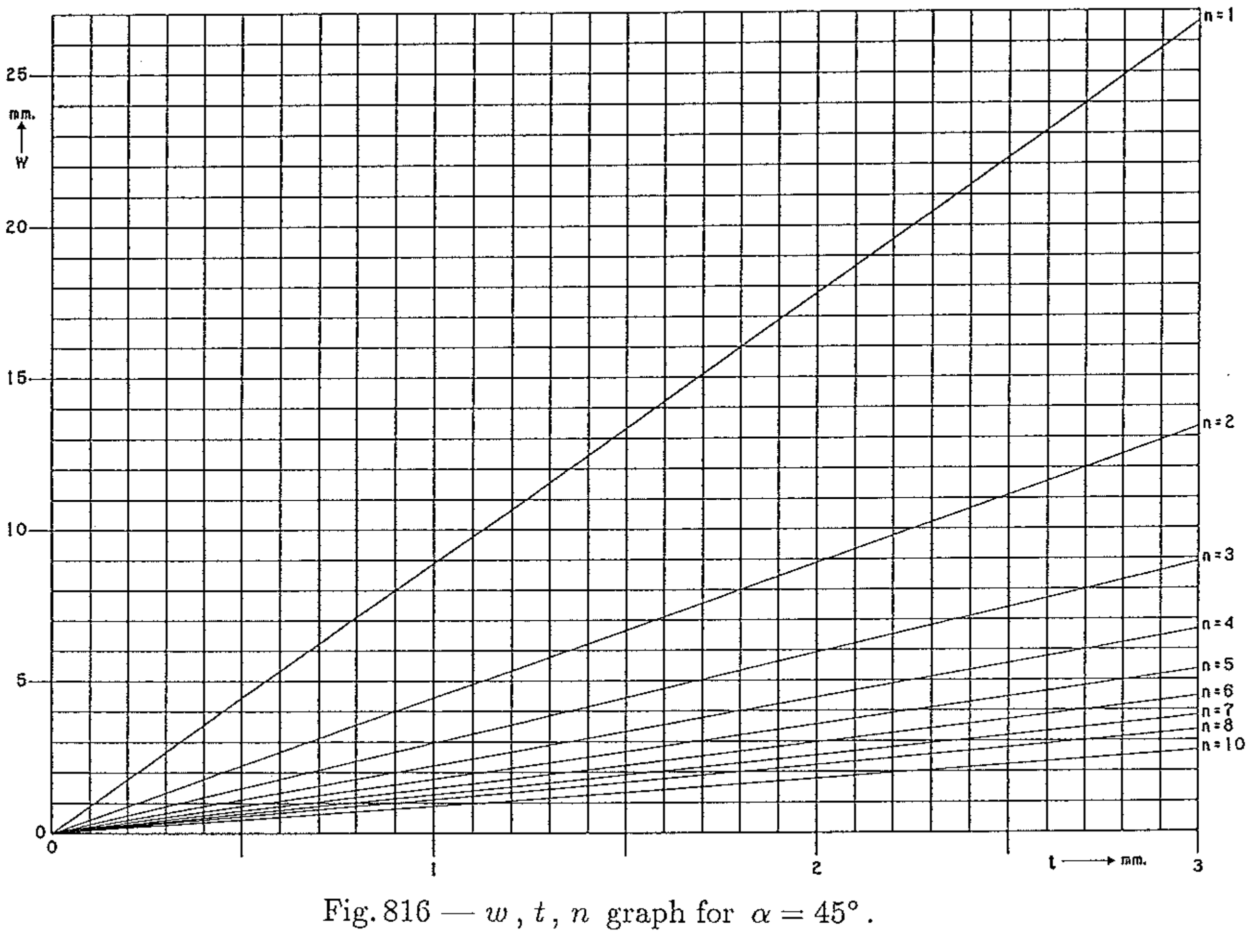


Fig. 816 — w, t, n graph for $\alpha = 45°$.

For a round braid over a core with varying diameters we first take the average diameter for the calculation of b_2, w', t', then we calculate the actual helix-pattern over the core and transfer that pattern to the core and lay the strings accordingly. Make sure that the string for building the various diameters of the core is relatively thin in order to prevent sudden steps.