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for
the braiding artisan

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Solution to the Question in Issue No. 17

Question on pg. 387.

The attentive reader will have realised that the position of the **T**-line in relation to the **S**-line (specified at the bottom of pg. 387) was not really required for the formulae on pg. 388, and hence was obviously intended to give the reader a start in solving the question posed. On pg. 388 we could simply have begun with saying: let $m = \left\lfloor \frac{N+n}{2n^2+2n+1} \right\rfloor$. To explain the question, we need to understand the background to the formulae on pg. 388, and for this reason we have tabulated in the list below the sequential number of crossings in $[(n+1), n]$ Prime Regular Cylindrical Bihelix Braids.

$$\begin{aligned}
 1n+1 &= -n + \{2n+1\} = -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 2n+1 &= -n + \{3n+1\} = -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 3n+2 &= -n + \{4n+2\} = -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 4n+2 &= -n + \{5n+2\} = -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 5n+3 &= -n + \{6n+3\} = -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 6n+3 &= -n + \{7n+3\} = -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 &\vdots \qquad \qquad \qquad \vdots \qquad \qquad \qquad \vdots \\
 2n^2-n-1-n &= -n + \{(2n-2)n+(n-1)\} = -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 2n^2-n-1 &= -n + \{(2n-1)n+(n-1)\} = -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 2n^2+n-n &= 2n^2 = -n + \{(2n)n+n\} = -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 \dots\dots\dots &\dots\dots\dots \\
 2n^2+2n+1-n-1 &= 2n^2+n = -n + \{(2n+1)n+n\} = -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 2n^2+2n+1-n &= 2n^2+n+1 = \{2n^2+2n+1\} -n + \{0n+0\} = \{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 \dots\dots\dots &\dots\dots\dots \\
 2n^2+2n+1 &= \{2n^2+2n+1\} -n + \{n+0\} = \{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 * * * * * & * * * * * \\
 2n^2+2n+1+n+1 &= \{2n^2+2n+1\} -n + \{2n+1\} = \{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 2n^2+2n+1+2n+1 &= \{2n^2+2n+1\} -n + \{3n+1\} = \{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 2n^2+2n+1+3n+2 &= \{2n^2+2n+1\} -n + \{4n+2\} = \{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 2n^2+2n+1+4n+2 &= \{2n^2+2n+1\} -n + \{5n+2\} = \{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 &\vdots \qquad \qquad \qquad \vdots \qquad \qquad \qquad \vdots \\
 \{2n^2+2n+1\}+2n^2-2n-1 &= \{2n^2+2n+1\} -n + \{(2n-2)n+(n-1)\} = \{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 \{2n^2+2n+1\}+2n^2-n-1 &= \{2n^2+2n+1\} -n + \{(2n-1)n+(n-1)\} = \{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 \{2n^2+2n+1\}+2n^2 &= \{2n^2+2n+1\} -n + \{(2n)n+n\} = \{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 \dots\dots\dots &\dots\dots\dots \\
 2\{2n^2+2n+1\}-n-1 &= \{2n^2+2n+1\} -n + \{(2n+1)n+n\} = \{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 2\{2n^2+2n+1\}-n &= 2\{2n^2+2n+1\} -n + \{0n+0\} = 2\{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 \dots\dots\dots &\dots\dots\dots \\
 2\{2n^2+2n+1\} &= 2\{2n^2+2n+1\} -n + \{n+0\} = 2\{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 * * * * * & * * * * * \\
 2\{2n^2+2n+1\}+n+1 &= 2\{2n^2+2n+1\} -n + \{2n+1\} = 2\{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 2\{2n^2+2n+1\}+2n+1 &= 2\{2n^2+2n+1\} -n + \{3n+1\} = 2\{2n^2+2n+1\} -n + \left\{zn + \left\lceil \frac{z-1}{2} \right\rceil\right\}. \\
 &\vdots \qquad \qquad \qquad \vdots \qquad \qquad \qquad \vdots
 \end{aligned}$$

$$2\{2n^2+2n+1\}+2n^2-2n-1=2\{2n^2+2n+1\}-n+\{(2n-2)n+(n-1)\}=2\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$2\{2n^2+2n+1\}+2n^2-n-1=2\{2n^2+2n+1\}-n+\{(2n-1)n+(n-1)\}=2\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$2\{2n^2+2n+1\}+2n^2=2\{2n^2+2n+1\}-n+\{(2n)n+n\}=2\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

.....

$$3\{2n^2+2n+1\}-n-1=2\{2n^2+2n+1\}-n+\{(2n+1)n+n\}=2\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$3\{2n^2+2n+1\}-n=3\{2n^2+2n+1\}-n+\{0n+0\}=3\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

.....

$$3\{2n^2+2n+1\}=3\{2n^2+2n+1\}-n+\{n+0\}=3\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$3\{2n^2+2n+1\}+n+1=3\{2n^2+2n+1\}-n+\{2n+1\}=3\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$3\{2n^2+2n+1\}+2n+1=3\{2n^2+2n+1\}-n+\{3n+1\}=3\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

: : :

$$3\{2n^2+2n+1\}+2n^2-2n-1=3\{2n^2+2n+1\}-n+\{(2n-2)n+(n-1)\}=3\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$3\{2n^2+2n+1\}+2n^2-n-1=3\{2n^2+2n+1\}-n+\{(2n-1)n+(n-1)\}=3\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$3\{2n^2+2n+1\}+2n^2=3\{2n^2+2n+1\}-n+\{(2n)n+n\}=3\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

.....

$$4\{2n^2+2n+1\}-n-1=3\{2n^2+2n+1\}-n+\{(2n+1)n+n\}=3\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$4\{2n^2+2n+1\}-n=4\{2n^2+2n+1\}-n+\{0n+0\}=4\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

.....

$$4\{2n^2+2n+1\}=4\{2n^2+2n+1\}-n+\{n+0\}=4\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

: : :

$$m\{2n^2+2n+1\}+n+1=m\{2n^2+2n+1\}-n+\{2n+1\}=m\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$m\{2n^2+2n+1\}+2n+1=m\{2n^2+2n+1\}-n+\{3n+1\}=m\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$m\{2n^2+2n+1\}+3n+2=m\{2n^2+2n+1\}-n+\{4n+2\}=m\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$m\{2n^2+2n+1\}+4n+2=m\{2n^2+2n+1\}-n+\{5n+2\}=m\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

: : :

$$m\{2n^2+2n+1\}+2n^2-4n-2=m\{2n^2+2n+1\}-n+\{(2n-4)n+(n-2)\}=m\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$m\{2n^2+2n+1\}+2n^2-3n-2=m\{2n^2+2n+1\}-n+\{(2n-3)n+(n-2)\}=m\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$m\{2n^2+2n+1\}+2n^2-2n-1=m\{2n^2+2n+1\}-n+\{(2n-2)n+(n-1)\}=m\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$m\{2n^2+2n+1\}+2n^2-n-1=m\{2n^2+2n+1\}-n+\{(2n-1)n+(n-1)\}=m\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$m\{2n^2+2n+1\}+2n^2=m\{2n^2+2n+1\}-n+\{(2n)n+n\}=m\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

.....

$$(m+1)\{2n^2+2n+1\}-n-1=m\{2n^2+2n+1\}-n+\{(2n+1)n+n\}=m\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$(m+1)\{2n^2+2n+1\}-n=(m+1)\{2n^2+2n+1\}-n+\{0n+0\}=(m+1)\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

.....

$$(m+1)\{2n^2+2n+1\}=(m+1)\{2n^2+2n+1\}-n+\{n+0\}=(m+1)\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$(m+1)\{2n^2+2n+1\}+n+1=(m+1)\{2n^2+2n+1\}-n+\{2n+1\}=(m+1)\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

$$(m+1)\{2n^2+2n+1\}+2n+1=(m+1)\{2n^2+2n+1\}-n+\{3n+1\}=(m+1)\{2n^2+2n+1\}-n+\left\{zn+\left\lceil\frac{z-1}{2}\right\rceil\right\}.$$

: : :

From this tabulation we can readily derive the formulae on pg. 388.

For the construction of the **Extended Premature Regular Cylindrical String-run Diagrams** for the $[(n + 1), n]$ **Prime Regular Cylindrical Bihelix Braids** we need to develop a method which enables us to add the additionally required intersection-points to a **Premature Regular Cylindrical String-run Diagram**. Let the to be extended string-run diagram of the Premature Regular Cylindrical Braid have p columns. Then the number of intersection-points in this Premature Regular Cylindrical Braid is equal to $N = (p - 1)n$. Let N^* (where $N^* \geq N$) be the number of intersection-points in the Extended Premature Regular Cylindrical Braid (the Prime Regular Cylindrical Bihelix Braid). Then :

$$m = \left\lfloor \frac{N+n}{2n^2+2n+1} \right\rfloor = \left\lfloor \frac{np}{2n^2+2n+1} \right\rfloor .$$

$$N = m(2n^2 + 2n + 1) - n + zn + r .$$

$$N^* = m(2n^2 + 2n + 1) - n + z^*n + \left\lceil \frac{z^*-1}{2} \right\rceil .$$

$$\text{For } z^* = z \longrightarrow N^* - N = \left\lceil \frac{z-1}{2} \right\rceil - r = 2 \left\lceil \frac{z-1}{2} \right\rceil - 2r \text{ rows .}$$

$$\text{For } z^* = z+1 \longrightarrow N^* - N = \left\lceil \frac{z}{2} \right\rceil - r + n = 2 \left\lceil \frac{z}{2} \right\rceil - 2r + 2n \text{ rows .}$$

M-line lies $\lfloor -p \rfloor_{2n+2}$ rows above S-line .

T*-line lies T^* rows above S-line .

$$\text{Distance from M-line to T*-line} = |T^* + p|_{2n+2} \Big|_{2n+2} = |T^* + p|_{2n+2} \text{ rows .}$$

$$\text{For } z^* = z \longrightarrow |T^* + p|_{2n+2} = 2 \left\{ \left\lceil \frac{z-1}{2} \right\rceil - r \right\} .$$

$$T^* = \left| 2 \left\lceil \frac{z-1}{2} \right\rceil - 2r - p \right|_{2n+2} .$$

$$\text{For } z^* = z+1 \longrightarrow |T^* + p|_{2n+2} = 2 \left\{ \left\lceil \frac{z}{2} \right\rceil - r + n \right\} .$$

$$T^* = \left| 2 \left\lceil \frac{z}{2} \right\rceil - 2r - p - 2 \right|_{2n+2} .$$

For z is even :

$$z-1 = \text{odd} \longrightarrow \left\lceil \frac{z-1}{2} \right\rceil = \frac{z}{2} ; z = \text{even} \longrightarrow \left\lceil \frac{z}{2} \right\rceil = \frac{z}{2} .$$

$$\text{For } z^* = z : T^* = \left| 2 \left\lceil \frac{z-1}{2} \right\rceil - 2r - p \right|_{2n+2} = |z - 2r - p|_{2n+2} .$$

$$np = m(2n^2 + 2n + 1) + zn + r \longrightarrow 2r = 2n(p - z) - 2m(2n^2 + 2n + 1) .$$

$$z - 2r - p = (2n + 2)(z - p) + (p - z) + 2mn(2n + 2) + 2m .$$

$$T^* = |z - 2r - p|_{2n+2} = |2m + (p - z)|_{2n+2} .$$

$$np = m(2n^2 + 2n + 1) + zn + r \longrightarrow p - z = m(2n + 2) + \frac{m+r}{n} .$$

$$T^* = |2m + (p - z)|_{2n+2} = \left| 2m + \frac{m+r}{n} \right|_{2n+2} .$$

$$\text{For } z^* = z+1 : T^* = \left| 2m + \frac{m+r}{n} - 2 \right|_{2n+2} .$$

For z is odd :

$$z-1 = \text{even} \longrightarrow \left\lceil \frac{z-1}{2} \right\rceil = \frac{z-1}{2} ; z = \text{odd} \longrightarrow \left\lceil \frac{z}{2} \right\rceil = \frac{z+1}{2} .$$

$$\text{For } z^* = z : T^* = \left| 2m + \frac{m+r}{n} - 1 \right|_{2n+2} .$$

$$\text{For } z^* = z+1 : T^* = \left| 2m + \frac{m+r}{n} - 1 \right|_{2n+2} .$$

Since the distance from the M-line to the T*-line must be an even number of rows, it follows that :

$$p = \text{odd} \longrightarrow \text{M-line} = \text{odd number of rows above S-line} \longrightarrow \text{T*-line} = \text{odd number of rows above S-line} .$$

$$p = \text{even} \longrightarrow \text{M-line} = \text{even number of rows above S-line} \longrightarrow \text{T*-line} = \text{even number of rows above S-line} .$$

Furthermore:

$$np = m(2n^2 + 2n + 1) + zn + r.$$

When $m = a$ multiple of n , then: $0 \leq z \leq 2n + 1$ with $r = 0$, or
 $z = 2n + 1$ with $r = n$.

When $m \neq a$ multiple of n , say $m = tn + c$, then: $0 \leq z \leq 2n + 1$ with $r = n - c$.

$$np = m(2n^2 + 2n + 1) + z^*n + r^*, \quad 0 \leq z^* \leq 2n + 1 \text{ with } r^* = \left\lceil \frac{z^* - 1}{2} \right\rceil.$$

$$0 \leq r \leq n, \quad \text{hence } 0 \leq \frac{r}{n} \leq 1.$$

$$\text{For } \frac{m}{n} \neq \text{whole number} \rightarrow \left\lfloor \frac{m}{n} \right\rfloor = \left\lceil \frac{m}{n} \right\rceil - 1 = \frac{m+r}{n} - 1.$$

$$\text{For } \frac{m}{n} = \text{whole number} \rightarrow \left\lfloor \frac{m}{n} \right\rfloor = \left\lceil \frac{m}{n} \right\rceil = \frac{m}{n}.$$

In the procedure envisaged we select a p -value. Then we add an additional δ crossing-points in order to obtain an Extended Premature Regular Cylindrical Braid which is a Prime Regular Cylindrical Bihelix Braid.

Note that when there are two Prime Regular Cylindrical Bihelix Braids for column $p = a$, the number of additional crossing-points are respectively δ and $(\delta + 1)$, and with our above described procedure we will obtain only the first of these two Prime Regular Cylindrical Bihelix Braids for that column. When for the first of these two Prime Regular Cylindrical Bihelix Braids $\delta = n - 1$, then the second will be obtained as the Prime Regular Cylindrical Bihelix Braid with $\delta = 0$ for column $p = a + 1$. The occurrence of two Prime Cylindrical Bihelix Braids for column $p = a$ takes place when, for the first of the two, $z^* = 2n + 1$.

We found for the T^* -line three formulae:

$$\text{A. } T^* = \left| 2m + \frac{m+r}{n} \right|_{2n+2}, \text{ when } z = \text{even}, \text{ and } r \leq \left\lceil \frac{z-1}{2} \right\rceil.$$

$$\text{B. } T^* = \left| 2m + \frac{m+r}{n} - 2 \right|_{2n+2}, \text{ when } z = \text{even}, \text{ and } r > \left\lceil \frac{z-1}{2} \right\rceil.$$

$$\text{C. } T^* = \left| 2m + \frac{m+r}{n} - 1 \right|_{2n+2}, \text{ when } z = \text{odd}.$$

Furthermore we have seen that $\frac{m+r}{n} - 1 = \left\lfloor \frac{m}{n} \right\rfloor$ when $\frac{m}{n} \neq$ whole number. Hence a much more convenient method is to use a single T -line, which is defined by:

$$T = \left| 2m + \left\lfloor \frac{m}{n} \right\rfloor \right|_{2n+2}.$$

When $\frac{m}{n} \neq$ whole number:

- For A, the T -line lies **one row below** the T^* -line.
- For B, the T -line lies **one row above** the T^* -line.
- For C, the T -line coincides with the T^* -line.

When $\frac{m}{n} =$ whole number:

- For A, the T -line coincides with the T^* -line.
- B does not apply.
- For C, the T -line coincides with the T^* -line when $z = 2n + 1$ with $r = n$, and lies **one row above** the T^* -line when $0 \leq z \leq 2n + 1$ with $r = 0$.

Hence the process of adding additional crossing-points requires only the positioning of the T -line relative to the S -line, and all we require for that is to calculate the T -value in accordance with the formula given above. Then it becomes a graphical process in which we draw bights adjacent to the right-hand bight-boundary from the M -line to the T -line with in general no bight-point on the T -line. The only exception to this rule,

when there is a bight-point on the T-line, may occur when the T-line lies one row below the T*-line. As we shall show below, there is however a simple rule for accommodating this event.

$$\text{Let: } pn=(tn+c)(2n^2+2n+1)+zn+(n-c); \quad r=n-c.$$

$$\text{Then: } p=(tn+c)(2n+2)+t+z+1.$$

$$|-p|_{2n+2}=|-(t+z+1)|_{2n+2}.$$

$$r \leq \left\lceil \frac{z-1}{2} \right\rceil \text{ for } 2n-2c \leq z \leq 2n+1.$$

We only have to consider the case A (in which $z=\text{even}$). Hence for the z -values:

$2n-2c, 2n-2c+2, 2n-2c+4, \dots, 2n-4, 2n-2, 2n$. Thus for $z=2n-2c+2s$, where $0 \leq s \leq c$.

Note that the number of z -values involved is equal to $(c+1)$.

$$z=2n-2c+2s \longrightarrow p=(tn+c)(2n+2)+t+2n-2c+1+2s, \quad m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor = tn+c.$$

$$\text{M-line} \rightarrow M = |-p|_{2n+2} = |-t-2n+2c-2s-1|_{2n+2} = |-t+2c-2s+1|_{2n+2}.$$

$$\text{T}^*\text{-line} \rightarrow T^* = |2tn+2c+t+1|_{2n+2} = |-t+2c+1|_{2n+2}.$$

$$\text{T-line} \rightarrow T = |2tn+2c+t|_{2n+2} = |-t+2c|_{2n+2} = |T^*-1|_{2n+2}.$$

$$2\delta = |T^*-M|_{2n+2} = |2s|_{2n+2}.$$

$$|T-M|_{2n+2} = |2s-1|_{2n+2}.$$

Note that for $s=0$ the value of $|T^*-M|_{2n+2}=0$, hence there is no additional intersection, and consequently there is no bight-point on the T-line to the right of the right-hand bight-boundary (note that for $s=0$ the M-line coincides with the T*-line and consequently it is impossible to have immediately to the right of the right-hand bight-boundary a bight-point on the T-line which is one row below the M-line). This leaves us with c z -values for which there is a bight-point on the T-line immediately to the right of the right-hand bight-boundary. Since the number of additional intersections is equal to the number of bight-points adjacent to the right of the right-hand bight-boundary, this number of bight-points are for the respective $z=2n-2c+2s$ equal to s . The maximum value of s is equal to c , and the value for c can be obtained from m by means of $c=|m|_n$. Although we are supposed to add the additional intersection-points from the M-line to the T*-line (0 intersection-points when these lines coincide), the method of adding the additional intersection-points from the M-line to the T-line (n intersection-points when the T-line lies one row below the M-line) gives also a valid solution as readily will be seen from the formulae.

It will now be evident that the rule for adding the additionally required intersection-points to the string-run of a Premature Regular Cylindrical Braid with p columns (the associated Regular Cylindrical Braid has $b = n + 1$ bights), in order to make it the string-run of an $[n + 1, n]$ Prime Regular Cylindrical Bihelix Braid, is as follows:

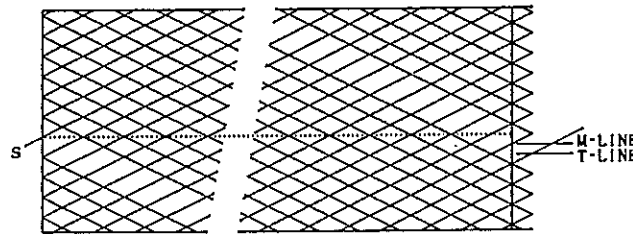
- Draw in the string-run diagram of the Premature Regular Cylindrical Braid the M-line. This line, which is parallel to the S-line, goes trough the last right-hand bight-point on the string-run of the associated Regular Cylindrical Braid.
- Calculate the T -value by means of the formula $T = |2m + \lfloor \frac{m}{n} \rfloor|_{2n+2}$, where $m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor$. Draw in the string-run diagram of the Premature Regular Cylindrical Braid the T-line. This line, which is parallel to the S-line and M-line, lies T rows (or $\frac{T}{2}$ bights) above (in cyclic fashion) the S-line.
- Continue with the Working End and lay down from the M-line to the T-line (in cyclic fashion) a zigzag column of bights immediately adjacent to the right of the right-hand bight-boundary of the Premature Regular Cylindrical Braid. In general the last bight-point in the zigzag column of added bights is below the T-line, and only then is the last bight-point on the T-line (if such a position is possible) when the number of bight-points in the added zigzag column is equal to or less than c .

In order to illustrate the graphical method clearly, we have presented below six Examples for which large p -values have been selected. Since for such large p -values the associated string-run diagrams would be much too long for the width of the paper, we had to remove the major mid-section of their lengths. For this reason we have calculated and listed for each Example the M -value in order to enable us to draw the M -line in its correct position relative to the S -line. For the p -value range which would be used in practical applications, hence for string-run diagrams which would normally fit within the width of the paper, we don't of course require the M -value in order to draw the M -line in its proper position.

Example 1. $[n + 1, n] = [11, 10]$ Prime Regular Cylindrical Bihelix Braid. The Premature Regular Cylindrical Braid has $p = 8559$. $M = |-p|_{2n+2} = |-8559|_{22} = 21$.

$$m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor = \left\lfloor \frac{85590}{221} \right\rfloor = 387.$$

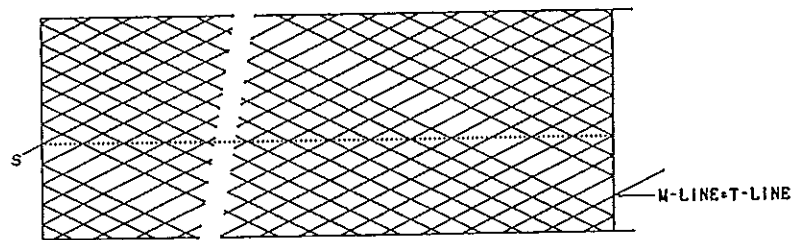
$$T = \left| 2m + \left\lfloor \frac{m}{n} \right\rfloor \right|_{2n+2} = |774 + 38|_{22} = |812|_{22} = 20.$$



Example 2. $[n + 1, n] = [11, 10]$ Prime Regular Cylindrical Bihelix Braid. The Premature Regular Cylindrical Braid has $p = 1326$. $M = |-p|_{2n+2} = |-1326|_{22} = 16$.

$$m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor = \left\lfloor \frac{13260}{221} \right\rfloor = 60.$$

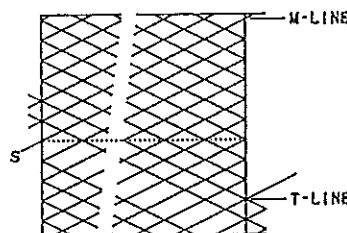
$$T = \left| 2m + \left\lfloor \frac{m}{n} \right\rfloor \right|_{2n+2} = |120 + 6|_{22} = |126|_{22} = 16.$$



Example 3. $[n + 1, n] = [11, 10]$ Prime Regular Cylindrical Bihelix Braid. The Premature Regular Cylindrical Braid has $p = 1330$. $M = |-p|_{2n+2} = |-1330|_{22} = 12$.

$$m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor = \left\lfloor \frac{13300}{221} \right\rfloor = 60.$$

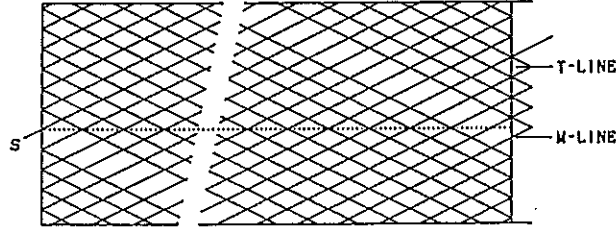
$$T = \left| 2m + \left\lfloor \frac{m}{n} \right\rfloor \right|_{2n+2} = |120 + 6|_{22} = |126|_{22} = 16.$$



Example 4. $[n + 1, n] = [11, 10]$ Prime Regular Cylindrical Bihelix Braid. The Premature Regular Cylindrical Braid has $p = 1475$. $M = |-p|_{2n+2} = |-1475|_{22} = 21$.

$$m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor = \left\lfloor \frac{14750}{221} \right\rfloor = 66.$$

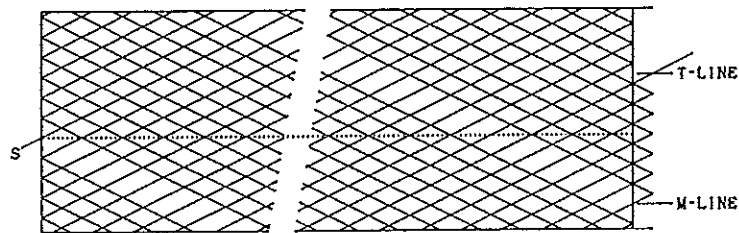
$$T = \left| 2m + \left\lfloor \frac{m}{n} \right\rfloor \right|_{2n+2} = |132 + 6|_{22} = |138|_{22} = 6.$$



Example 5. $[n + 1, n] = [11, 10]$ Prime Regular Cylindrical Bihelix Braid. The Premature Regular Cylindrical Braid has $p = 1459$. $M = |-p|_{2n+2} = |-1459|_{22} = 15$.

$$m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor = \left\lfloor \frac{14590}{221} \right\rfloor = 66.$$

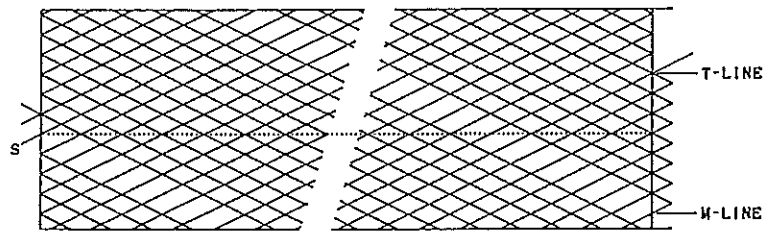
$$T = \left| 2m + \left\lfloor \frac{m}{n} \right\rfloor \right|_{2n+2} = |132 + 6|_{22} = |138|_{22} = 6.$$



Example 6. $[n + 1, n] = [11, 10]$ Prime Regular Cylindrical Bihelix Braid. The Premature Regular Cylindrical Braid has $p = 1460$. $M = |-p|_{2n+2} = |-1460|_{22} = 14$.

$$m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor = \left\lfloor \frac{14600}{221} \right\rfloor = 66.$$

$$T = \left| 2m + \left\lfloor \frac{m}{n} \right\rfloor \right|_{2n+2} = |132 + 6|_{22} = |138|_{22} = 6.$$



We mentioned on pg. 396 that there are sometimes two Prime Regular Cylindrical Bihelix Braids for a column $p = a$, and that this occurs when, for the first of the two, $z^* = 2n + 1$. Our graphical method is not capable of finding this second Prime Regular Cylindrical Bihelix Braid when for the first one $0 \leq \delta < n - 1$. However, since the second one has a number of intersections which is equal to $N = (m + 1)(2n^2 + 2n + 1) - n$ we can, with a simple calculation, readily establish the position of the second one:

$$p = (m + 1)(2n + 2) + \left\lfloor \frac{m + 1}{n} \right\rfloor \quad \text{with } \delta = |m + 1|_n.$$

The reader will undoubtedly have noticed that the graphical procedure also leads to a simple calculation procedure:

- Select a value for p .
- Calculate $m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor$.
- Calculate $z = p - m(2n + 2) - \left\lceil \frac{m}{n} \right\rceil$. When $z = 2n + 2$, take $z = 2n + 1$.
- Calculate $r = \lfloor -m \rfloor_n$. When initially $z = 2n + 2$, take $r = n$.
- When $r \leq \left\lceil \frac{z-1}{2} \right\rceil$, take $z^* = z$ and $r^* = \left\lceil \frac{z-1}{2} \right\rceil$. Then $\delta = r^* - r$.
- When $r > \left\lceil \frac{z-1}{2} \right\rceil$, take $z^* = z + 1$ and $r^* = \left\lceil \frac{z}{2} \right\rceil$. Then $\delta = n - (r - r^*)$.

Example 7. $[n + 1, n] = [11, 10]$ Prime Regular Cylindrical Bihelix Braid. The Premature Regular Cylindrical Braid has $p = 1458$.

$$m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor = \left\lfloor \frac{14580}{221} \right\rfloor = 65.$$

$$z = p - m(2n + 2) - \left\lceil \frac{m}{n} \right\rceil = 1458 - 65 \cdot 22 - \left\lceil \frac{65}{10} \right\rceil = 21.$$

$$r = \lfloor -m \rfloor_n = \lfloor -65 \rfloor_{10} = 5.$$

$$\text{Hence } z^* = z = 21, \text{ and } r^* = \left\lceil \frac{z-1}{2} \right\rceil = \left\lceil \frac{21-1}{2} \right\rceil = 10.$$

$$\delta = r^* - r = 10 - 5 = 5.$$

Note that $p = (m + 1)(2n + 2) + \left\lfloor \frac{m+1}{n} \right\rfloor = 66 \cdot 22 + \left\lfloor \frac{66}{10} \right\rfloor = 1452 + 6 = 1458$ with $\delta = \lfloor m + 1 \rfloor_n = \lfloor 66 \rfloor_{10} = 6$ gives also a Prime Regular Cylindrical Bihelix Braid. Furthermore, since $z^* = 2n + 1$ for the Prime Regular Cylindrical Bihelix Braid we found, it follows that there is a second Prime Regular Cylindrical Bihelix Braid for column $p = 1458$ with one more crossing-point.

Example 8. $[n + 1, n] = [11, 10]$ Prime Regular Cylindrical Bihelix Braid. The Premature Regular Cylindrical Braid has $p = 2587$.

$$m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor = \left\lfloor \frac{25870}{221} \right\rfloor = 117.$$

$$z = p - m(2n + 2) - \left\lceil \frac{m}{n} \right\rceil = 2587 - 117 \cdot 22 - \left\lceil \frac{117}{10} \right\rceil = 1.$$

$$r = \lfloor -m \rfloor_n = \lfloor -117 \rfloor_{10} = 3.$$

$$\text{Hence } z^* = z + 1 = 2, \text{ and } r^* = \left\lceil \frac{z}{2} \right\rceil = \left\lceil \frac{1}{2} \right\rceil = 1.$$

$$\delta = n - (r - r^*) = 10 - (3 - 1) = 8.$$

Example 9. $[n + 1, n] = [11, 10]$ Prime Regular Cylindrical Bihelix Braid. The Premature Regular Cylindrical Braid has $p = 314$.

$$m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor = \left\lfloor \frac{3140}{221} \right\rfloor = 14.$$

$$z = p - m(2n + 2) - \left\lceil \frac{m}{n} \right\rceil = 314 - 14 \cdot 22 - \left\lceil \frac{14}{10} \right\rceil = 4.$$

$$r = \lfloor -m \rfloor_n = \lfloor -14 \rfloor_{10} = 6.$$

$$\text{Hence } z^* = z + 1 = 5, \text{ and } r^* = \left\lceil \frac{z}{2} \right\rceil = \left\lceil \frac{4}{2} \right\rceil = 2.$$

$$\delta = n - (r - r^*) = 10 - (6 - 2) = 6.$$

Example 10. $[n + 1, n] = [11, 10]$ Prime Regular Cylindrical Bihelix Braid. The Premature Regular Cylindrical Braid has $p = 984$.

$$m = \left\lfloor \frac{pn}{2n^2+2n+1} \right\rfloor = \left\lfloor \frac{9840}{221} \right\rfloor = 44.$$

$$z = p - m(2n + 2) - \left\lceil \frac{m}{n} \right\rceil = 984 - 44 \cdot 22 - \left\lceil \frac{44}{10} \right\rceil = 11.$$

$$r = \lfloor -m \rfloor_n = \lfloor -44 \rfloor_{10} = 6.$$

$$\text{Hence } z^* = z + 1 = 12, \text{ and } r^* = \left\lceil \frac{z}{2} \right\rceil = \left\lceil \frac{11}{2} \right\rceil = 6.$$

$$\delta = n - (r - r^*) = 10 - (6 - 6) = 10.$$

Example 11. $[n + 1, n] = [11, 10]$ Prime Regular Cylindrical Bihelix Braid. The Premature Regular Cylindrical Braid has $p = 833$.

$$m = \left\lfloor \frac{pn}{2n^2 + 2n + 1} \right\rfloor = \left\lfloor \frac{8330}{221} \right\rfloor = 37.$$

$$z = p - m(2n + 2) - \left\lceil \frac{m}{n} \right\rceil = 833 - 37 \cdot 22 - \left\lceil \frac{37}{10} \right\rceil = 15.$$

$$r = \lfloor -m \rfloor_n = \lfloor -37 \rfloor_{10} = 3.$$

$$\text{Hence } z^* = z = 15, \text{ and } r^* = \left\lceil \frac{z-1}{2} \right\rceil = \left\lceil \frac{15-1}{2} \right\rceil = 7.$$

$$\delta = r^* - r = 7 - 3 = 4.$$

At least some readers may wonder where the expression $2n^2 + 2n + 1$ comes from. It is in fact a special case of a general expression which belongs to another braidform, namely the **torus braids**. In due course we shall discuss that braidform in some detail, and see in which way the Prime Regular Cylindrical Bihelix Braids are linked to them.

Braids and Diseases

In this article we will look at a property of braids which we discussed more recently and a discovery about some (at the moment) incurable diseases. We have to stress that we do not know whether or not the two phenomena which play the principal role in our discussion are linked, but their similarity is striking nevertheless.

We all know how on the 20th of March 1996 the British Ministry of Health triggered an international panic when it announced that the till then obscure *Spongiform Encephalopathy Advisory Committee* had reported ten unusual cases of *Creutzfeldt-Jakob disease (CJD)*. The unusual aspect of these ten cases was their mean age of onset of 29 years as compared to the usual mean age of onset of 65 years in the 185 cases of *CJD* till then diagnosed in the UK from May 1990. Furthermore, these ten unusual cases did differ somewhat in symptoms and brain pathology from normal *CJD*. The Committee concluded that the most likely explanation for this unusual event was that the affected people had been exposed to *Bovine Spongiform Encephalopathy (BSE)*.

CJD, a rare degenerative disease which is invariably fatal, is one of a group of human and animal diseases which are thought to have similar causes. Others which belong to this group besides *BSE* are *Kuru*, *Fatal Familial Insomnia (FFI)*, *Gerstmann-Sträussler-Scheinker disease (GSS)* and *Scrapie*, the last of which seems to affect certain animals, such as sheep and goats, but not humans.

Scrapie is the most studied of the group, the affected animals show a lack of coordination in their movements (ataxia), wasting and severe itching of the skin which causes the animal to rub (hence the name *Scrapie*).

BSE is thought to have arisen during the late 1970s when *Scrapie* infected sheep meal was incorporated into cattle feed. Diseases similar to *BSE* have been found in domestic cats, captive wild cats (puma, cheetah, ocelot), captive wild ruminants (gemsbok, eland,

Arabian oryx, nyala, greater kudu, scimitar-horned oryx), farmed minks. Experimental injection of brain extracts from *BSE* infected cattle has transferred the disease to mice, cattle, sheep, pigs and marmoset monkeys. The brain of an infected animal shows degenerative changes in the form of clumps of fibrous material (plaques) and small holes which give the brain a spongelike appearance under a microscope (hence the name *spongiform encephalopathies*).

CJD relates to two very similar diseases which were described by respectively Hans Creutzfeldt and Alfons Jacob around the early 1920s. It are diseases of middle to late adult human life characterised by abnormalities of behaviour and intellect, weakness, ataxia, spasticity, tremors and hesitant speech. *CJD* is invariably fatal, death occurring within four to twelve months of the onset of the symptoms.

Kuru appears to be related to *CJD*, but its circumstances are very different. The disease was described by two American medical anthropologists, Gajdusek and Zigas in 1957. The disease occurred at high frequency among the remote Fore people of New Guinea; all age groups were susceptible. *Kuru* means shivering in the Fore language; it is characterised by ataxia and tremors which progress to total physical incapacity and death within a year. The disease is spread by ritual cannibalism in the eating of lightly cooked brains along with other flesh during the rite of mourning and respect for dead kinsmen. It has been suggested that *Kuru* arose from a sporadic case of *CJD* that became an epidemic. With the cessation of cannibalism, the disease has largely disappeared.

FFI is a more recent human disease akin to *CJD* and *Kuru*. It appears to be inherited, and it impairs the autonomic and motor systems. In advanced cases complex hallucinations occur followed by stupor, coma and death. The mean age of onset is 49, and death takes place within about a year.

GSS is like *FFI*. It appears to be inherited. A loss of coordination precedes dementia. Death can take up to six years.

What causes this group of diseases is not known. They are vastly different to the great majority of infectious diseases which are caused by microbes — protozoans, bacteria, viruses and fungi, all very minute but containing the essentials of life, namely nucleic acids and proteins. Identifying the infectious agent which causes *Scrapie* presented a great problem since it was resistant to ultraviolet radiation, radioactivity, heat, formaldehyde, and enzymes that destroy most proteins and nucleic acids; it proved to be resistant to agents which kill all life forms known. In highly infectious brain extracts no virus particles could be detected with electron microscopy. There was no evidence that the host's immune system was even the slightest bit concerned by its owners slow demise; an almost unheard of situation with infectious diseases. Biologists regarded for a long time the elusive agent to be an unconventional slow acting virus, and some biologists still do.

But a few heretics suggested that since no nucleic acid could be detected, the infectious agent simply lacked both DNA and RNA. This suggestion is as fundamentally radical as the idea of a bird without wings that can fly, a horse without legs that can gallop. Stanley Prusiner has been the main proponent of the idea. He has called the infectious agents which underlie all these diseases **prions**. He has obtained strong evidence that the infectious agent is an *altered form* of a single protein. This protein he has called **PrP** (Prion Protein). Normal PrP is a regular protein which is coded by an everyday gene made of DNA. It is common on the surface of braincells. Genetically engineered mice which lack PrP entirely develop, reproduce and learn normally, but

show disturbance of sleep and activity patterns similar to FFL.

The characteristic form of normal PrP is like two parallel coil springs resting on top of two more springs which lean to the left. In patients with spongiform encephalopathies the two top coils of the PrP protein have changed into a flat “sheet-like” structure, and it is the changed structure of this protein which seems to be responsible for the formation of plaques and holes in the brain that eventually leads to dementia and death.

In the previous two issues of *The Braider* we have seen the influence of half twists in a string, and what they represent. Of special interest is that a set number of half twists always represent at least two sets of braids (see pg. 372). The question is: do we with the changed PrP protein (with its “sheet-like” structure) as compared to the normal PrP protein encounter a phenomenon that is similar to that of half-twists in a string???

What's in a Name?

In various publications associated with knots and braids several people have voiced their opinion about the necessity of a “universal” knot and braid classification in order to identify unambiguously a knot or braid. As is generally the case, a desire is the easy part, getting it is the hard part. We agree of course that in order to avoid confusion, a “universal” classification system would be desirable, but unfortunately most, if not all, of its advocates don't realise the complexity of the problems involved. In their, often pragmatic, mind they think that there are only a couple of hundred, or at most a few thousand knots and braids. In reality however, there are at least as many different knots and braids as there are stars in the universe. Furthermore, with respect to a classification system, there are more often than not no distinct boundaries between various knots and braids. Even before a real successful **restricted** classification can be achieved, we need to know a great deal more than we do at the moment about relationships between seemingly different knots and braids.

Whether there is a classification system or not, we will still have various names for the same knot or braid, since these different names will often relate better to a particular application or historical aspect. Unfortunately, historical aspects are sometimes grossly distorted, and it is in this connection that we will have a look at a well-known braidform.

The braidform in question is known under several names, some of which are: Loop Stitch, Loop Lacing, Overlay Stitch, Buttonhole Stitch, Spanish Edge Lacing, Mexican Edge Lacing, Cordovan Stitch, Cordover Stitch, etc. This ‘stitch’ is normally encountered in one of the following three forms: single, double, or triple. It is described in most leathercraft and braiding books (Pamphlet No. 2 gives improved construction procedures for the double Cordovan stitch).

The name *Cordovan* refers to the Spanish town by the name of *Córdoba* in the southern province *Andalusia*. Hence instead of *Cordovan* we should write **Córdoban**. Why then is the name misspelled? The reason is that *Cordova* spells the name *Córdoba* as it is pronounced in Spanish (in Spanish the *v* and the *b* are pronounced in the same way; at the beginning of a phrase or after *m* or *n* they are pronounced as *b* in *boy*, in any other position the sound is softened and the lips do not meet).

As far as we know the name *Cordover* has only been used by Ron Edwards in his booklet “Leather Lacing Manual”, ISBN 0 909901 36 8, published by *The Rams Skull*

Press. In that booklet Ron states: "This is a popular and ancient stitch which may have originated in the Spanish province now known as Cordober. Cordober was once famous for its leatherwork, and the stitch is also known as Spanish Edging." The fact is that there is no Spanish province by the name of Cordober, but that the town Córdoba in the province Andalusia was famous for its leatherwork. It is unlikely however that the stitch originated there, but rather was introduced there by the Moors. The name *Córdoba* can be found back in Argentina: a town in a province by the same name, in Mexico: a town in the province *Durango*, as well as a town in the province *Vera Cruz*, and in Columbia: the province *Córdoba*. Not only is the name *Córdoba* corrupted into *Cordova* for the stitch, but we do also find towns in the United States of America (Alabama, North Carolina, New Mexico and Alaska), and even a bay and a mountain peak in Alaska, with the name *Cordova*.

Attaching a Round Braid to a Ring

A simple attachment of a 4-string Round Braid to a ring is shown in Fig. 336.

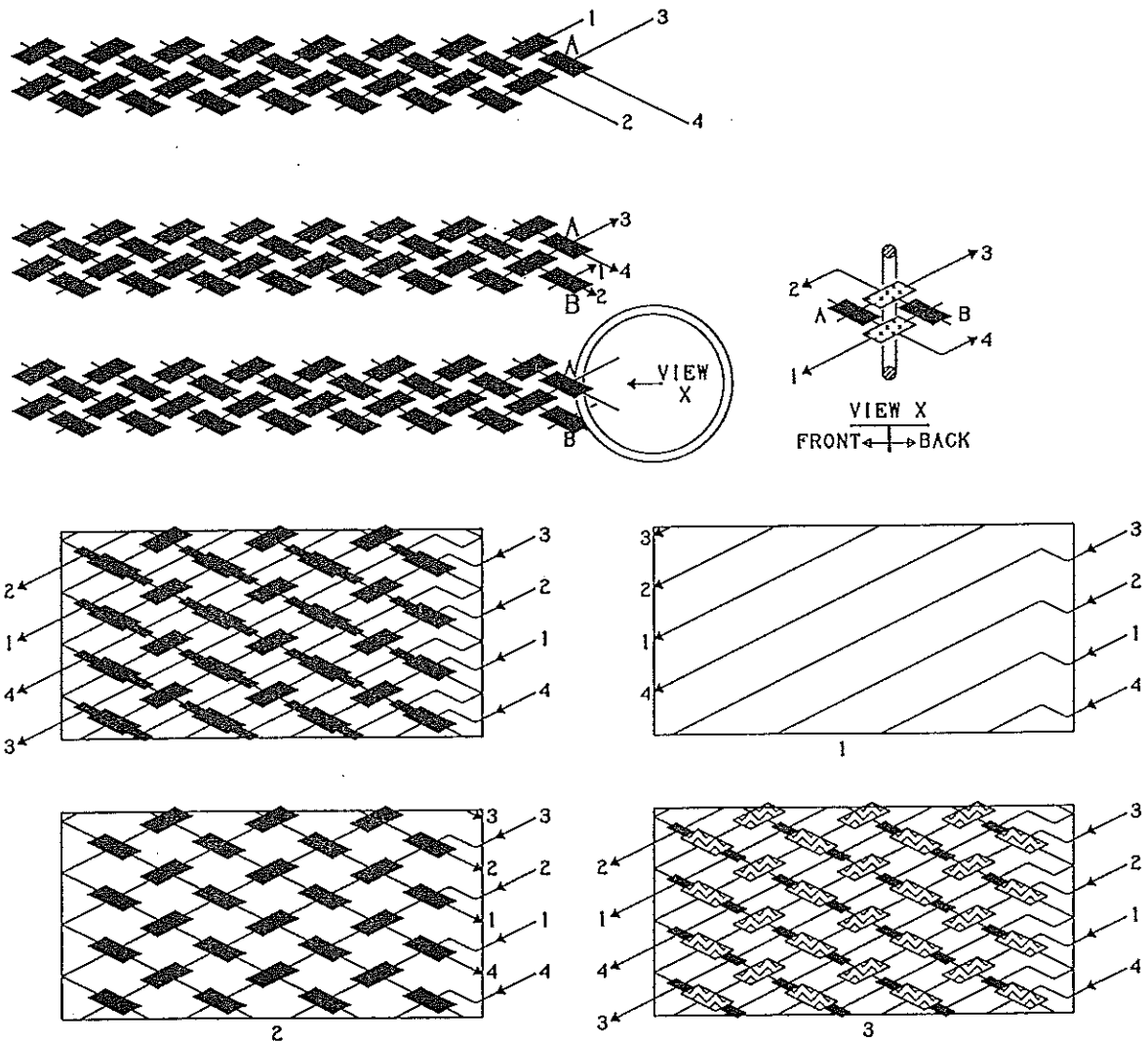


Fig. 336 — Attaching a 4-string Round Braid to a Ring.

Fig. 337 depicts a variation to the previous method; the diameter of the covering knot is a little bigger due to the extra four strings under it.

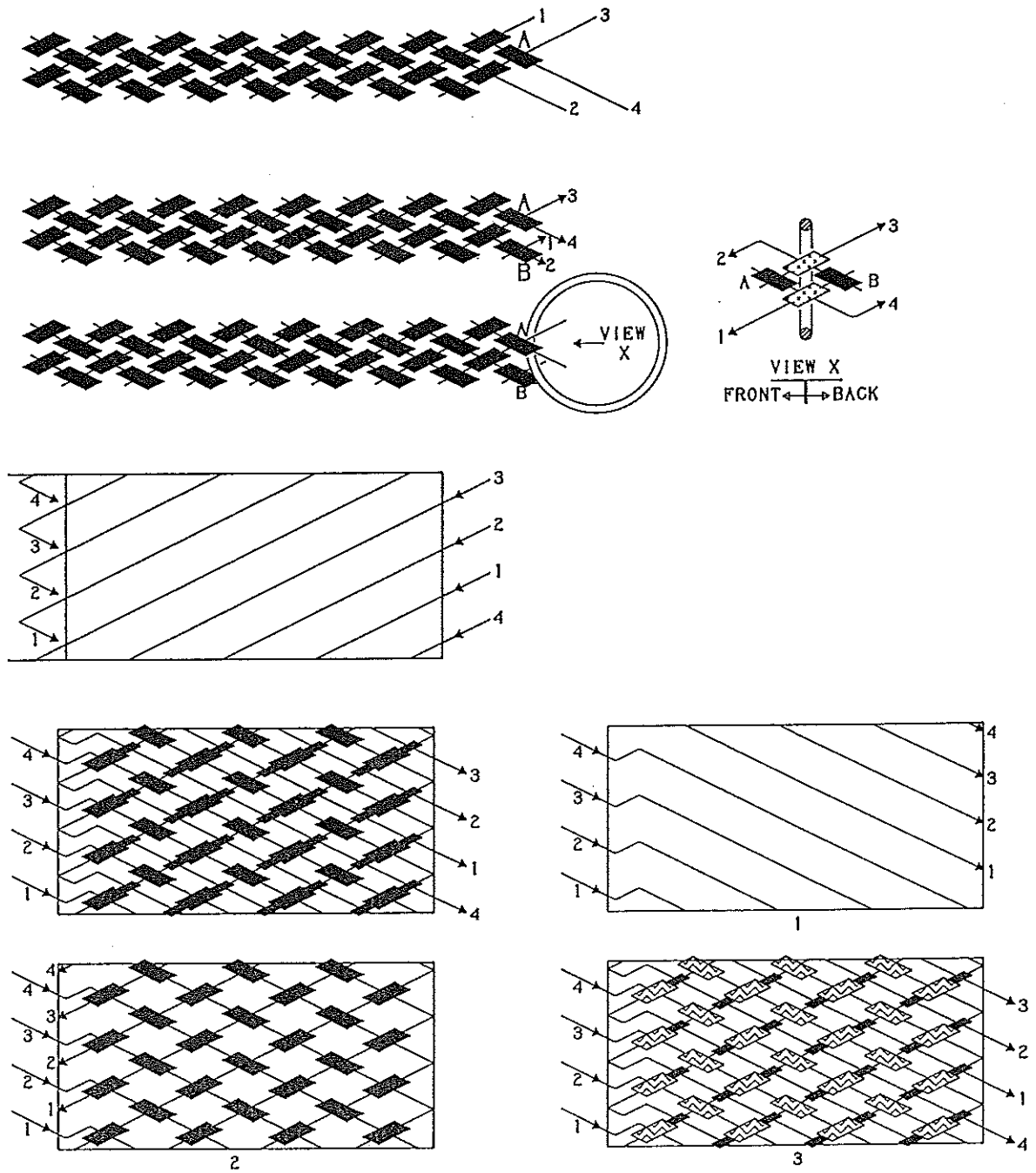


Fig. 337 — Attaching a 4-string Round Braid to a Ring.

When strings 1 & 3 are of the same colour and strings 2 & 4 are of the same but a different colour, the covering knot will have a spiral colour pattern when it has a Casacoding, a lengthwise V-pattern when it has a 2-pass Gaucho or Headhunters coding, and a spiral V-pattern when it has a 3-pass Gaucho or Headhunters coding.

Figs. 338, 339 and 340 show the attachment of a 6-string Round Braid to a ring. For thin ring material we use the construction procedure depicted in Fig. 338, for thick ring material the construction procedure in Fig. 340 is used, and for ring material in between the method in Fig. 339 is the most appropriate.

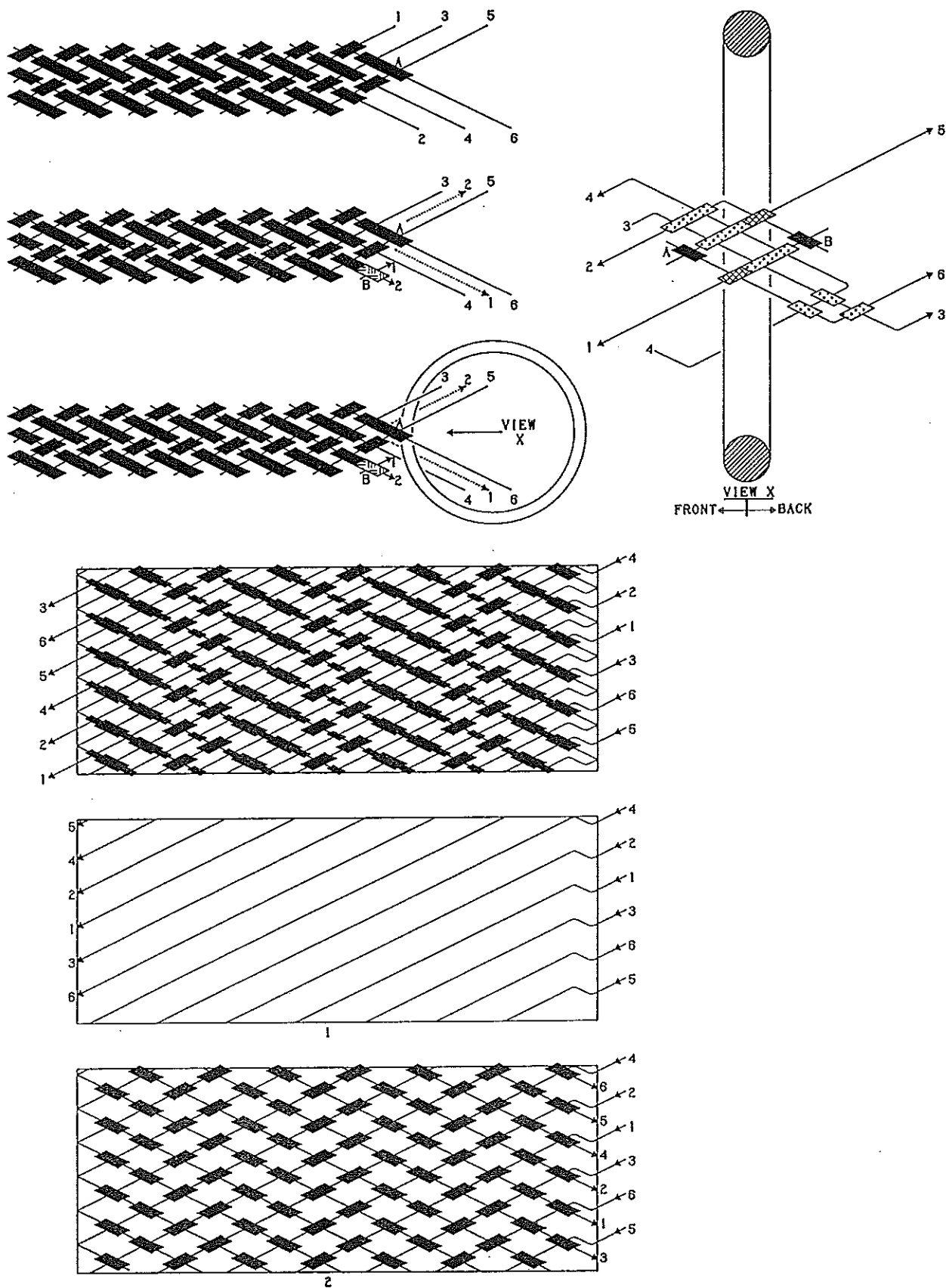


Fig. 338 — Attaching a 6-string Round Braid to a Ring of thin material.

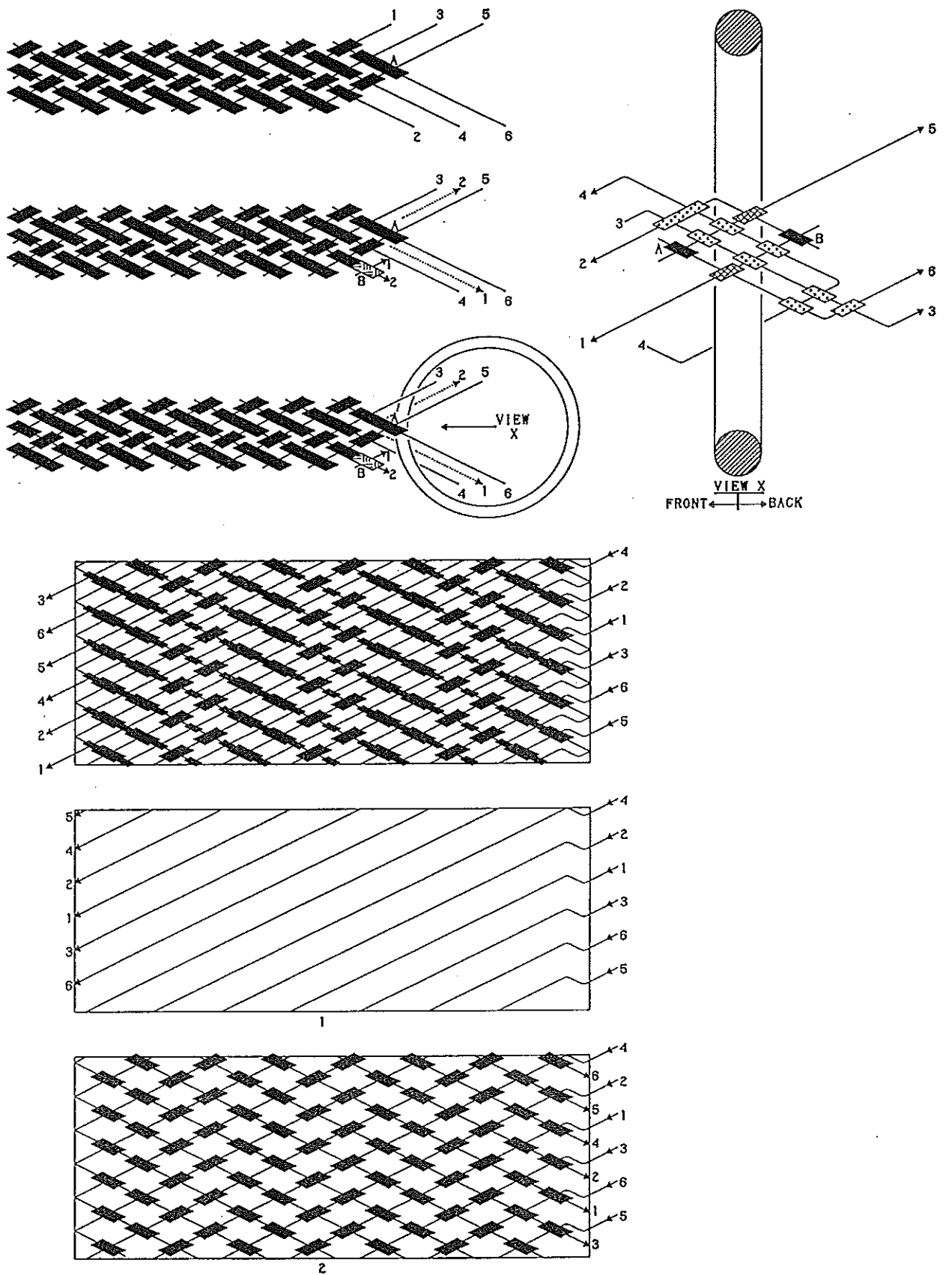


Fig. 339 — Attaching a 6-string Round Braid to a Ring of average thickness.

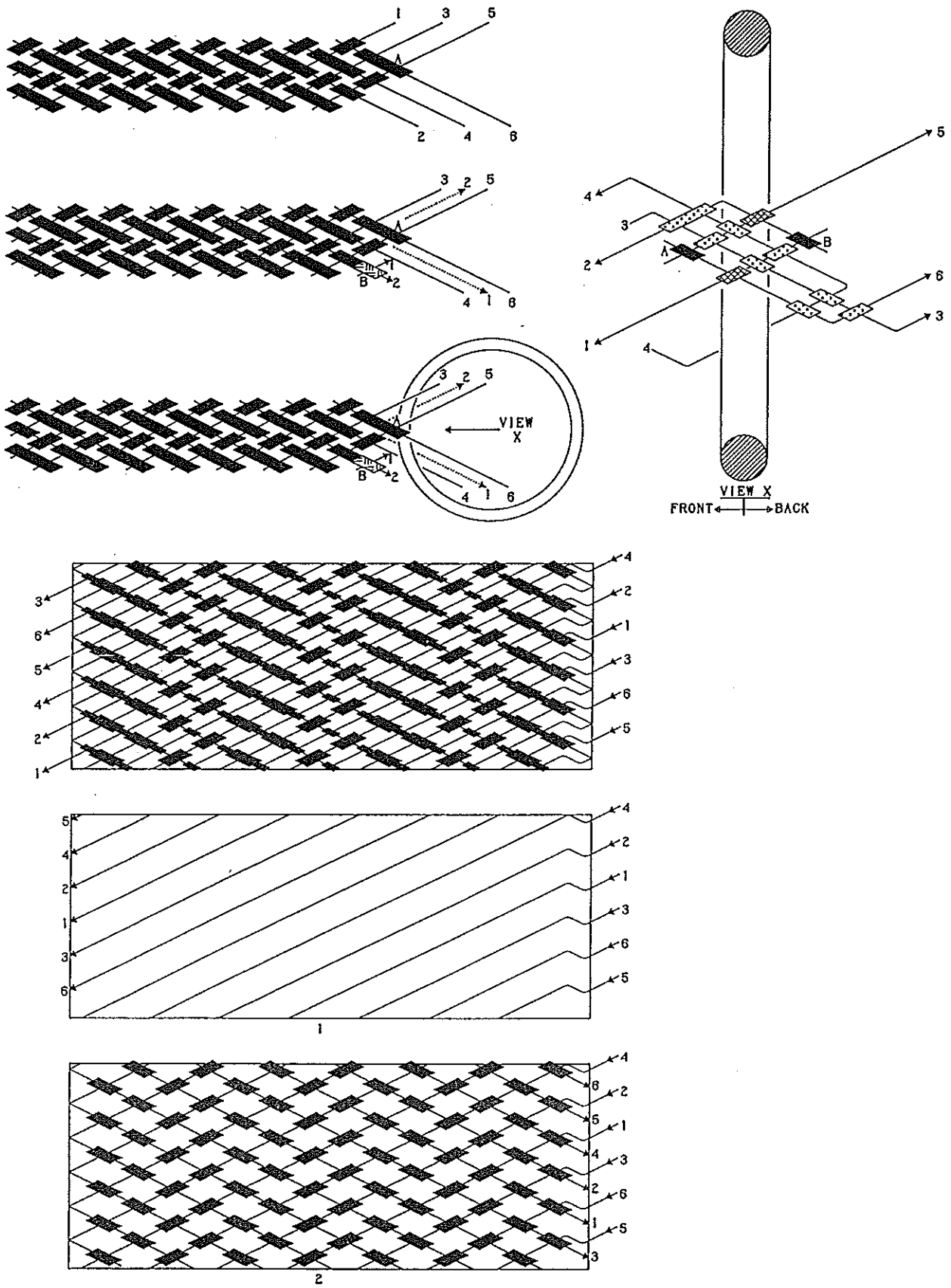


Fig. 340 — Attaching a 6-string Round Braid to a Ring of thick material.

Integrated Braids

An **Integrated Braid** is a braid which forms an integral part with another braid-form, in other words, both braid-forms are made with the same strings. Hence the covering knots in the previous described attachments were in fact *Integrated Braids* since they were a continuation of the Round Braids.

We shall start with a very elementary Integrated Braid used in finishing a 4-string Round Braid. It should be pointed out here that knots which are used to finish a braid with, should always be of the **integrated** type, hence **not** the so often encountered knots whose string(s) are not a part of the braid they are covering the end of.

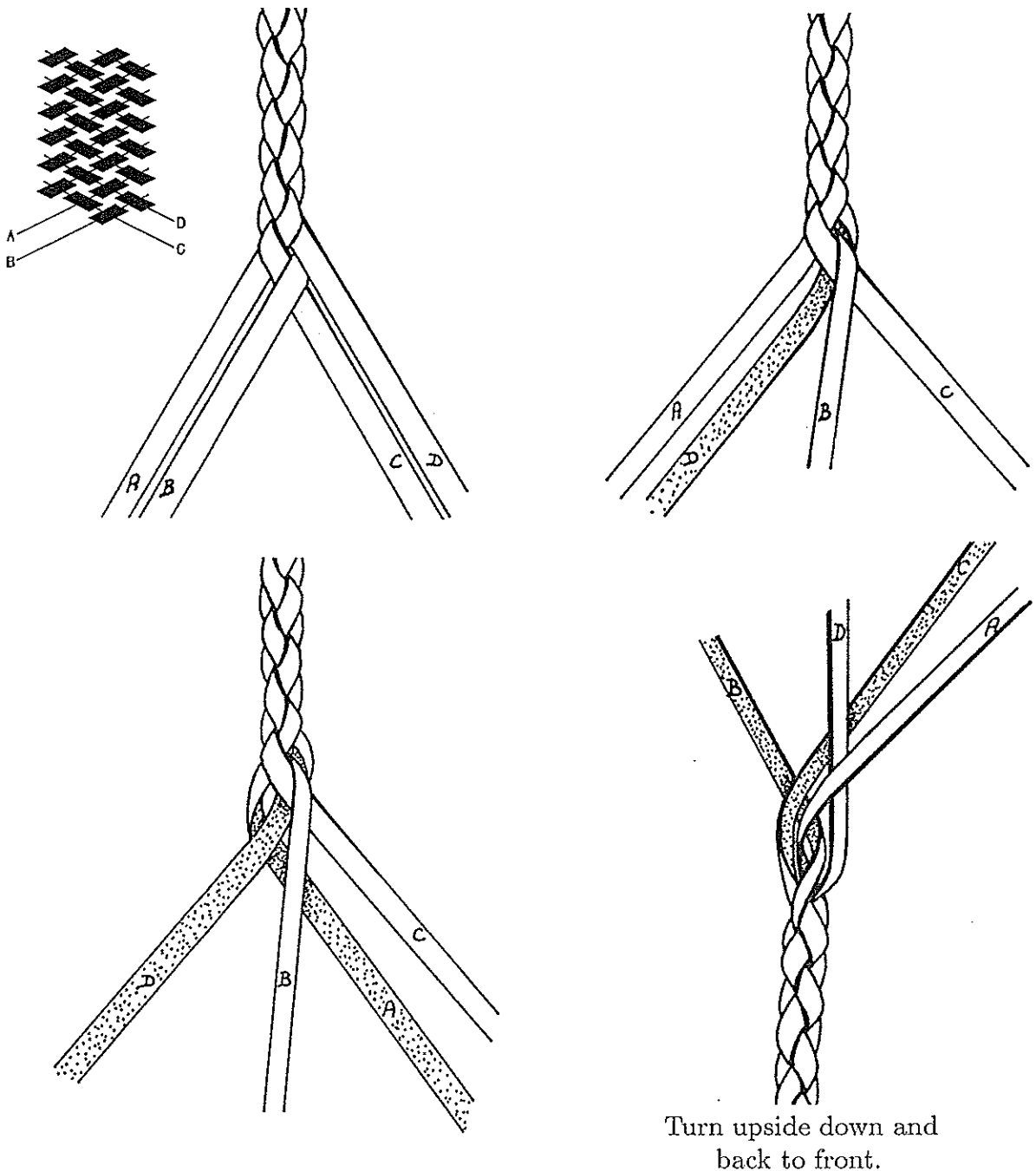
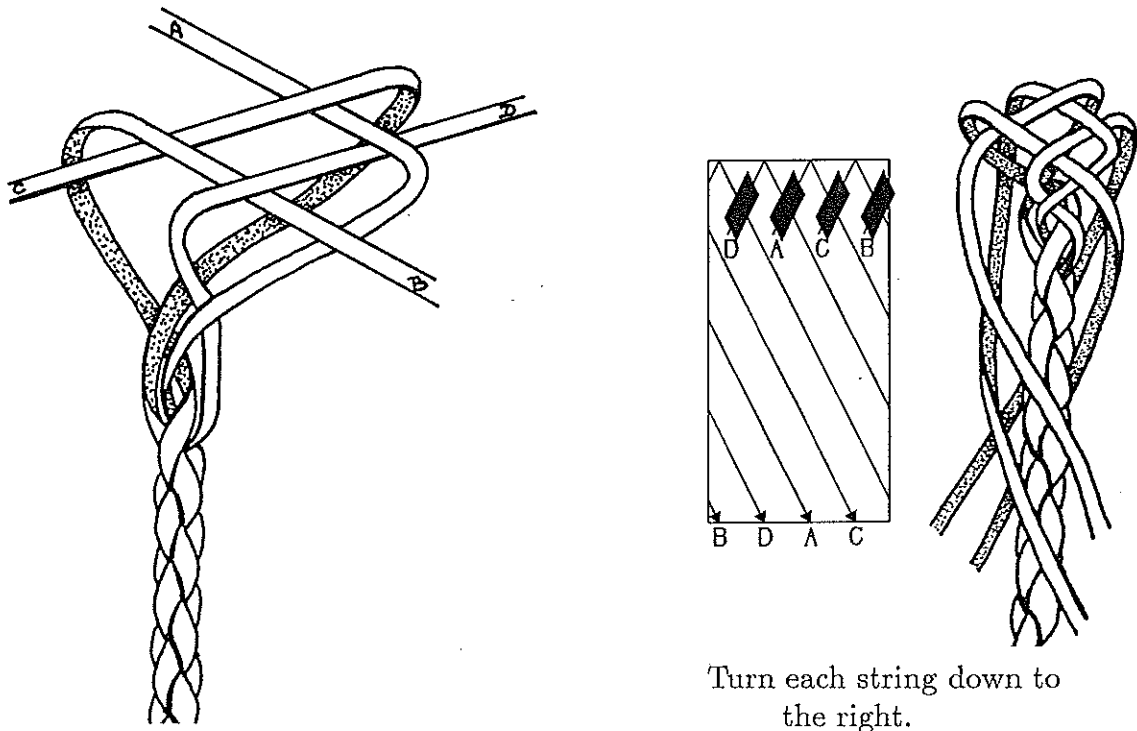
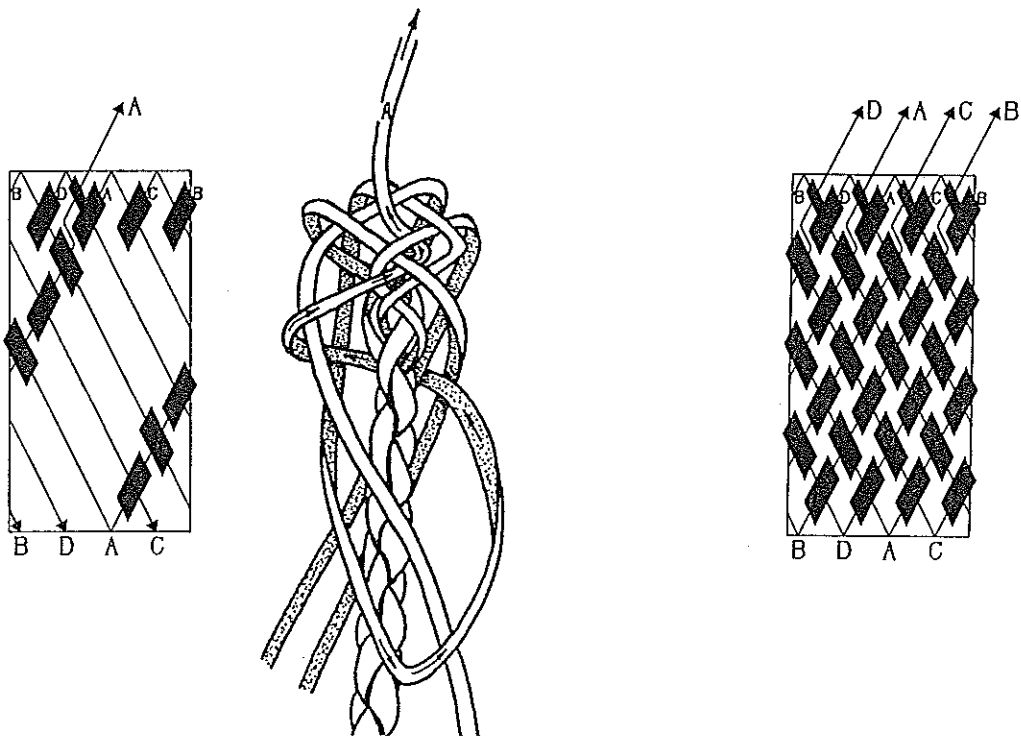


Fig. 341 — Preparation of 4-string Round Braid for $p/b = 8/4$ Terminal Casa Knot.



Turn each string down to the right.

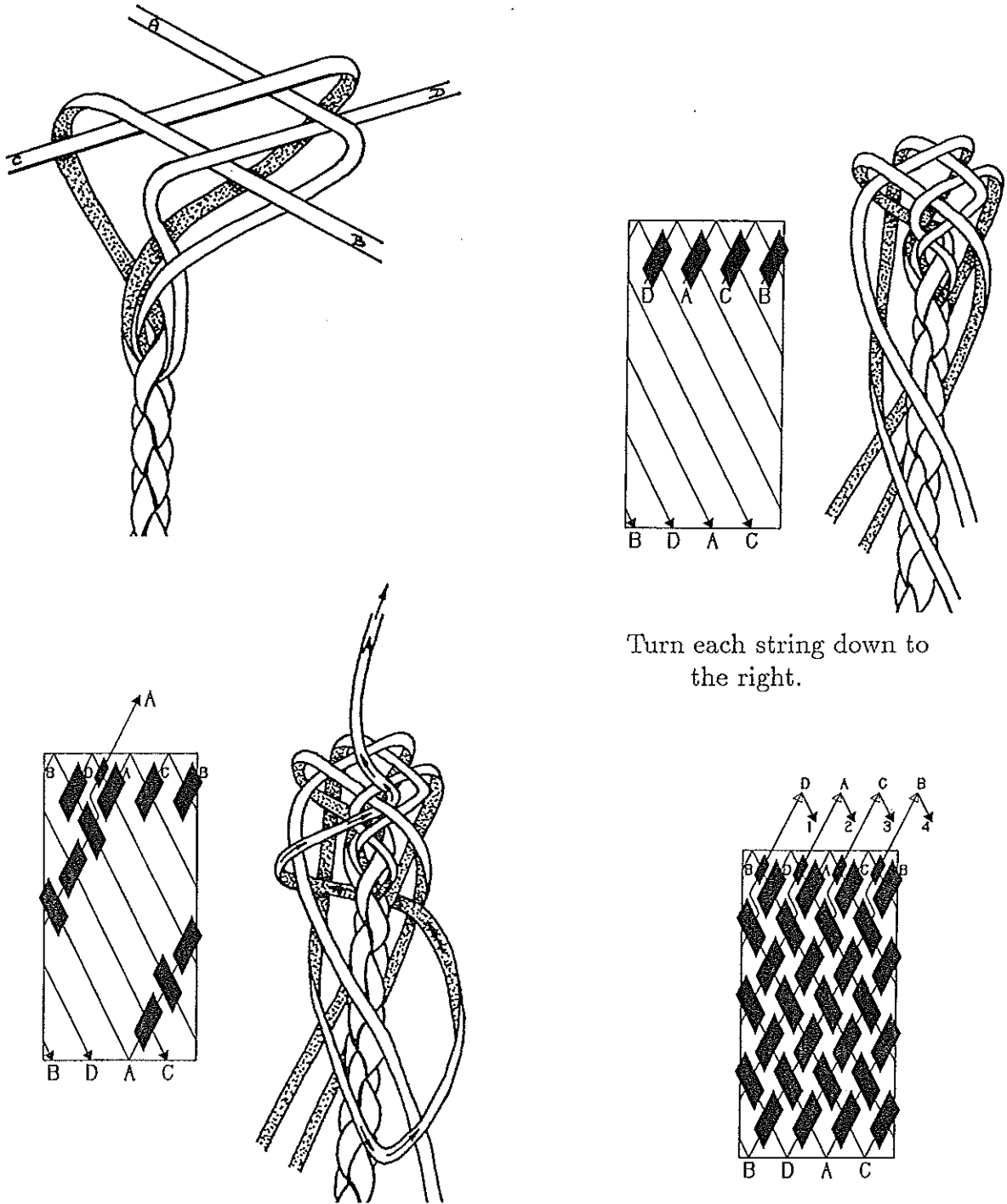


Turn each string up to the right, then $o - u - o - u - o - u$, along the left of the Standing End as indicated for string 'A'. Repeat for strings 'B', 'C', and 'D'.

Fig. 342 — The integrated $p/b = 8/4$ Terminal Casa Knot.

The end of the strings may be cut in order to form a tassel. The length of the integrated knot can be varied to suit.

For many applications a tasselled end would not be appropriate, and in such cases we often want an end-knot of greater diameter. This may readily be done by braiding a second integrated knot over the first one. The string-ends of the first or foundation knot are then not fed through the eye of its crown (see Fig. 343).



Turn each string down to the right.

Turn each string up to the right, then $o - u - o - u - o - u$, along the left of the Standing End as indicated for string 'A'. Repeat for strings 'B', 'C', and 'D'.

Fig. 343 — The integrated $p/b = 8/4$ Foundation Casa Knot.

The second integrated knot, which will cover the foundation knot shown in Fig. 343, is depicted in Fig. 344. Any excess string should be cut off after the second knot has been properly tightened so that no string-ends are visible. Note that the 4-string Round Braid has been turned horizontally with the foundation knot to the right.

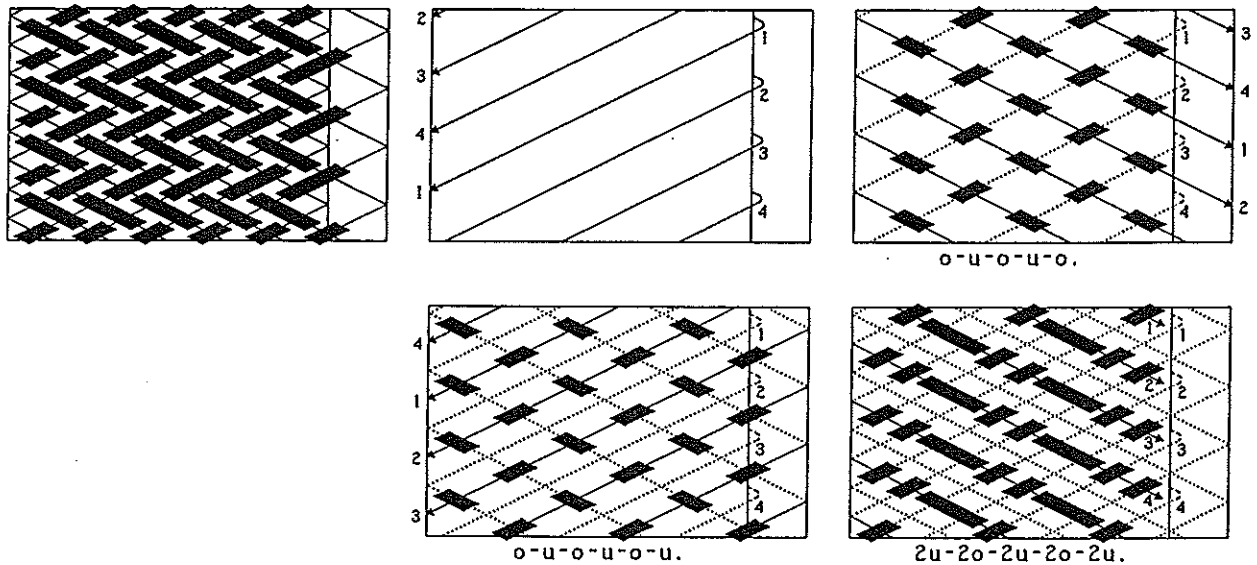


Fig. 344 — The second integrated knot covering the $p/b = 8/4$ Foundation Casa Knot.

In Fig. 345 we have depicted another example of an integrated terminal knot consisting of a foundation knot covered by a second knot.

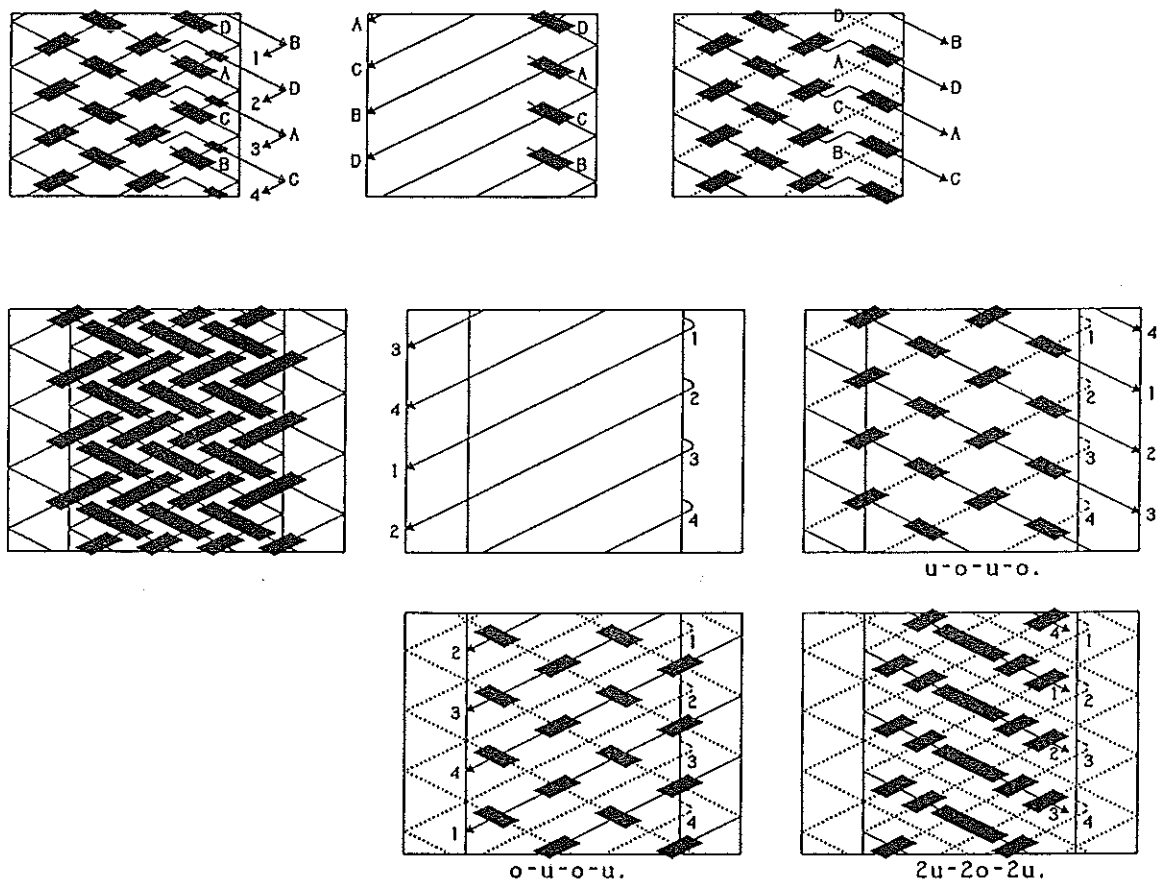


Fig. 345 — An integrated first and second terminal knot for a 4-string Round Braid.

It will be self evident that the sizes of the integrated knots have to be compatible with the string-size. In order to enable the reader to braid the discussed integrated knots as inexpensive exercise pieces, the shown examples are suitable for the fabric-reinforced plastic "Dura Flex" lace.

In the following example the terminal integrated knot is perfectly spherical. This is achieved by using three integrated knots on top of each other.

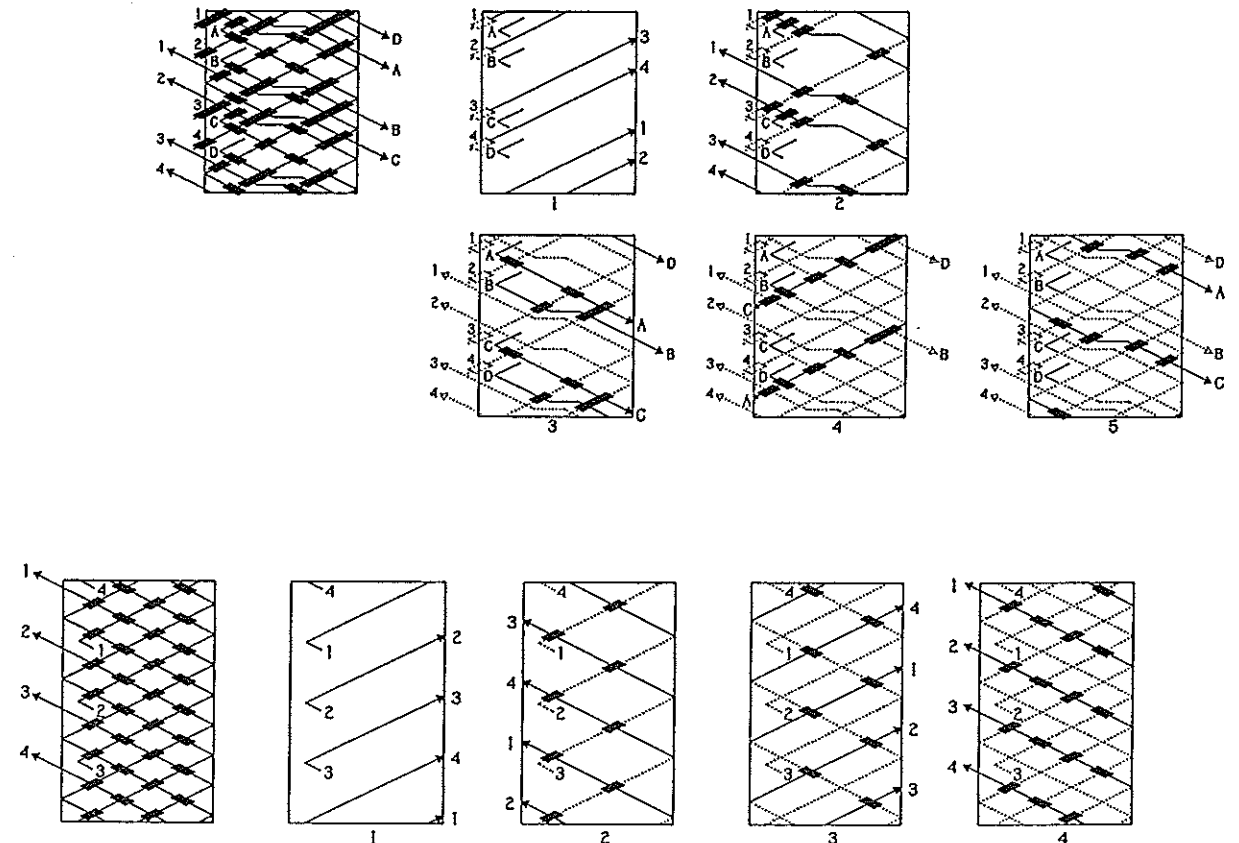
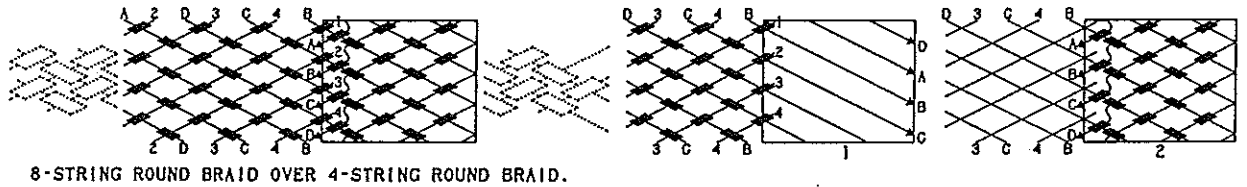


Fig. 346 — The first and second integrated foundation knot.

The 8-string Casa-coded Round Braid over the 4-string Round Braid core is finished off as indicated in the upper row of diagrams (see Fig. 346).

The next two rows of diagrams in Fig. 346 depict the braiding of the first integrated foundation knot, while the last row of diagrams depict the braiding of the second integrated foundation knot.

After the integrated foundation knots have been completed, the 4-string Round Braid core is unbraided up to the integrated foundation knots, and the final integrated knot, depicted in Fig. 347, is then braided over the foundation knots.

Note that all the strings of the 8-string Round Braid take part in the first foundation knot. The strings of the 4-string Round Braid core, which are marked I, II, II, IV, do not partake in the construction of the foundation knots, but only partake in the construction of the final finishing knot, together with all the strings of the 8-string Round Braid.

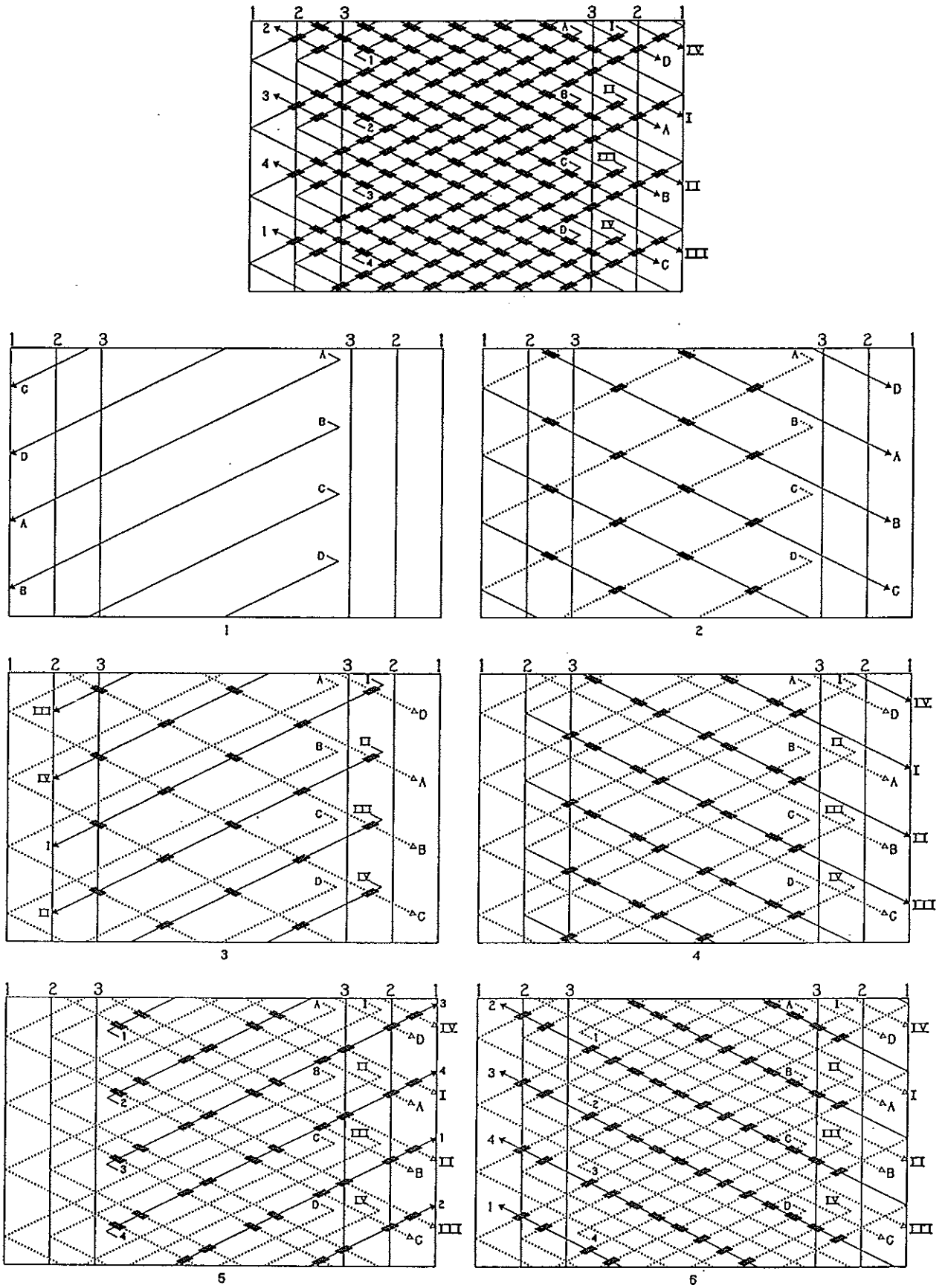


Fig. 347 — The final integrated knot over the integrated foundation knots.