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A.G. Schaake; 21 Sundown Cresc.; Hamilton; New Zealand.
D. Van Tassel; Box 335; Craig, Co 81626-0335; U.S.A.
F.J.M. Masurel; Ganzenzijde 4; 2317 XG Leiden; Nederland.

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Copies may be obtained from:

A.G. Schaake,
21 Sundown Cresc.,
Hamilton,
New Zealand.

Solutions to the Questions in Issue No. 24

Question on pg. 545.

Consider the development of the string-run in the case where $p < b$. By laying down the string-run, we lay down the consecutive half-cycles. Let the first half-cycle (the Standing-End half-cycle) run from lower-left to upper-right. Only lower-right to upper-left half-cycles may be able to intersect the Standing-End half-cycle, but since $p < b$ and a cycle encompasses p bights, not all lower-right to upper-left half-cycles will intersect the Standing-End half-cycle, furthermore, each of those which does intersect the Standing-End half-cycle will intersect it only once. Since $p < b$, the number of **free-run** half-cycles will thus be equal to:

$$2\left\lfloor \frac{b}{p} \right\rfloor + 1 .$$

A half-cycle which intersects the Standing-End half-cycle and its consecutive half-cycles to, but not including, the next half-cycle which intersects the Standing-End half-cycle, form a set of half-cycles each of which intersects the same number of half-cycles (strands). The number of intersected strands per half-cycle increases by one for the next such set of half-cycles.

As we have already seen above, the number of half-cycles in the first set (the free-run half-cycles, the half-cycles which intersect zero strings) is equal to:

$$2\left\lfloor \frac{b}{p} \right\rfloor + 1 .$$

The number of half-cycles in the subsequent consecutive sets greater equal 2 and less than p, hence excepting the last set (the p^{th} set), is thus equal to:

$$2\left(\left\lfloor \frac{(n+1)b}{p} \right\rfloor - \left\lfloor \frac{nb}{p} \right\rfloor\right), \qquad \text{where} \quad n = 1\,,\, 2\,,\, 3\,,\, \cdots\,,\, (p-2)\,.$$

The number of half-cycles in the last set (the p^{th} set) is equal to:

$$2\left(b - \left\lfloor \frac{(p-1)b}{p} \right\rfloor\right) - 1 = 2\left\lfloor \frac{b}{p} \right\rfloor + 1 .$$

With these formulae we can readily prove that the sequence of the number of half-cycles in the sequential sets is palindromic:

As the above formulae show, the first set and the last set contain each the same number of half-cycles.

The set j, where $j = 2\,,\, 3\,,\, 4\,,\, \cdots\,,\, (p-1)$ contains:

$$2\left(\left\lfloor \frac{jb}{p} \right\rfloor - \left\lfloor \frac{(j-1)b}{p} \right\rfloor\right) \text{ half-cycles.}$$

Then the set $p-(j-1)$ contains:

$$2\left(\left\lfloor \frac{\{p-(j-1)\}b}{p} \right\rfloor - \left\lfloor \frac{(p-j)b}{p} \right\rfloor\right) = 2\left(\left\lfloor \frac{jb}{p} \right\rfloor - \left\lfloor \frac{(j-1)b}{p} \right\rfloor\right) \text{ half-cycles.}$$

Hence the sets j and $p-(j-1)$ contain each the same number of half-cycles.

Thus the sequence of the number of half-cycles in the sequential sets is palindromic.

Question on pg. 557.

The proof is shown in the Figs. 464, 465 & 466, where the left-hand bight-boundaries and bights are drawn in solid lines, while the right-hand bight-boundaries and bights are drawn in dotted lines.

Note that in Fig. 464 we must have the conditions $y_{max} \geq A$, and $y_{min} \leq A$. Consequently $x \geq 2 - A$; and since $x < 0$ it follows that $A > 2$.

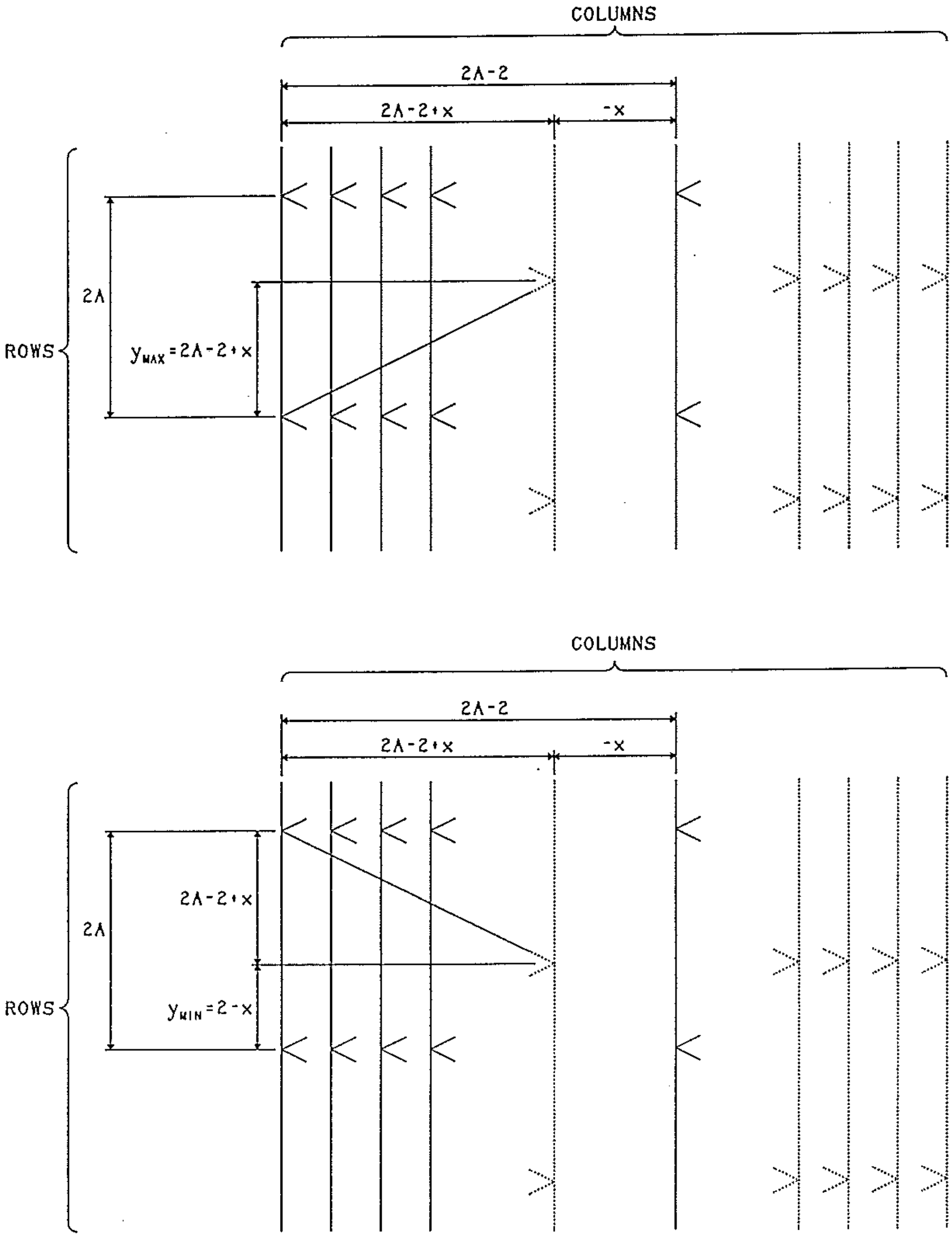


Fig. 464 — y_{max} and y_{min} for $2 - A \leq x < 0$.

Note that in Fig. 465 we must have the conditions $y_{max} \geq A$, and $y_{min} \leq A$. Consequently $A \geq 2$.

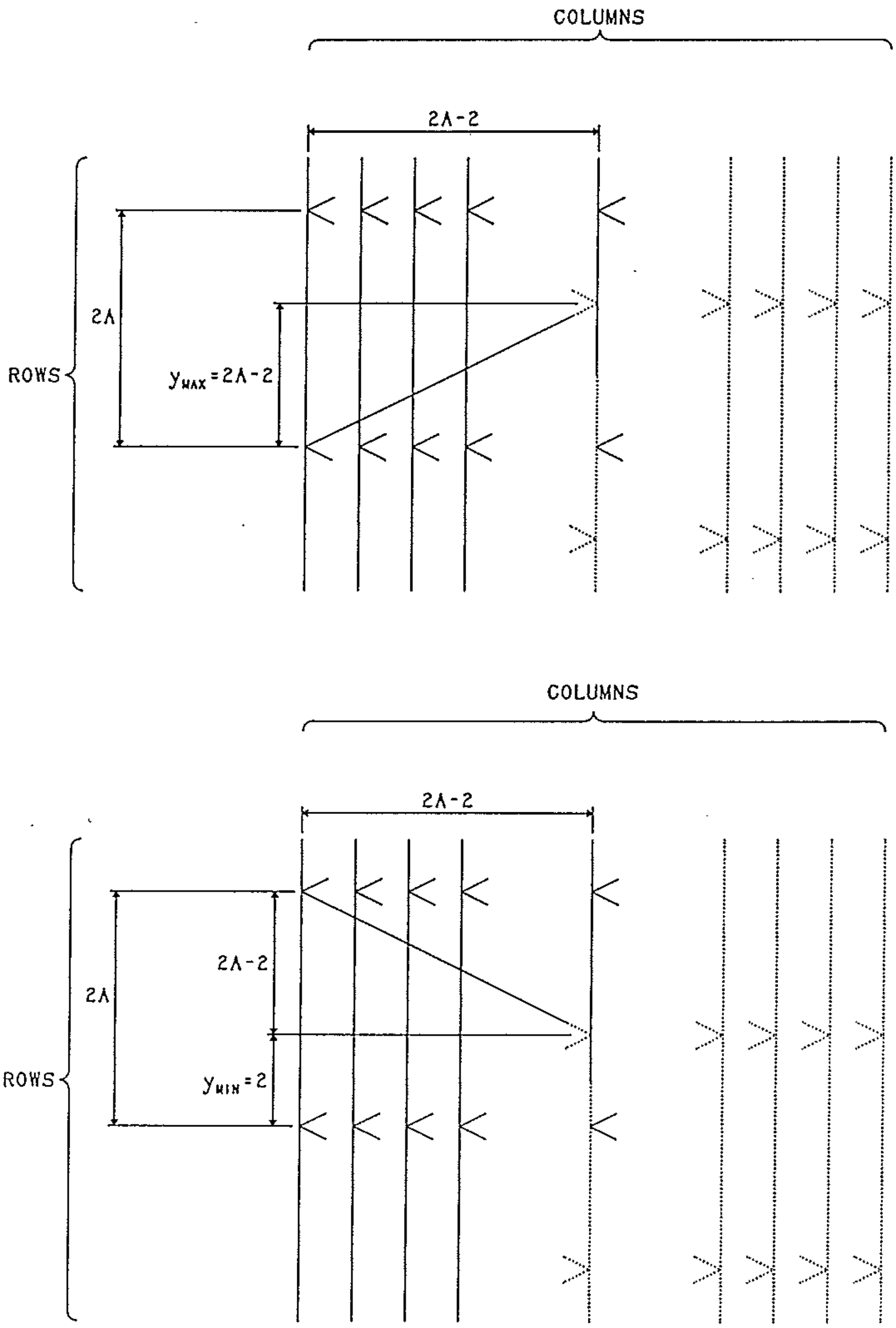
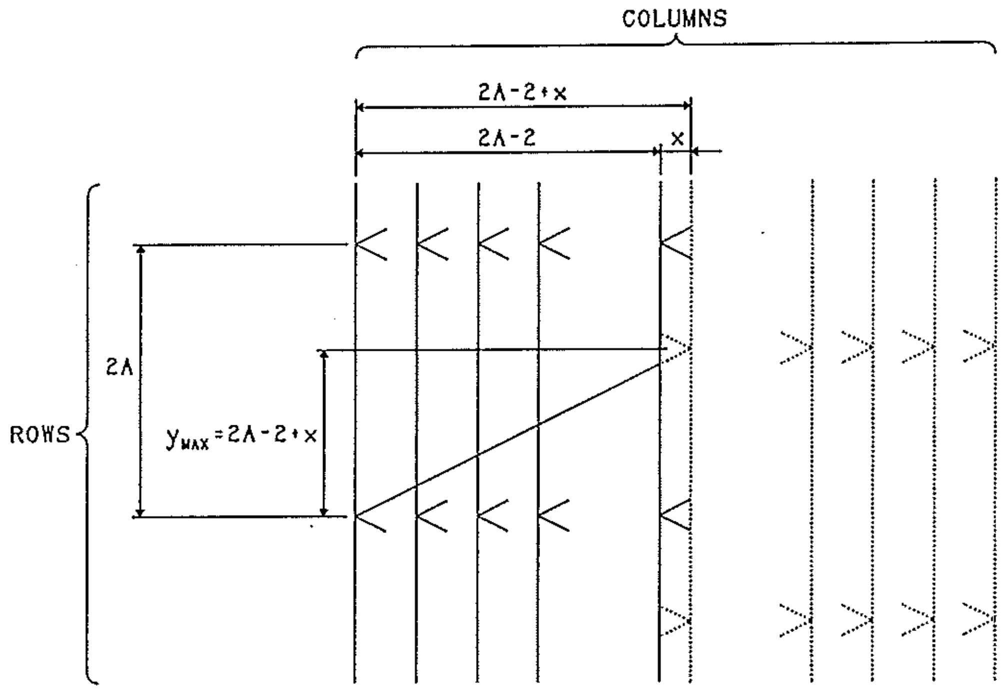


Fig. 465 — y_{max} and y_{min} for $x = 0$.

Note that in Fig. 466 for $x = 2$ we obtain $y_{max} = 2A$ and $y_{min} = 0$. This are also the maximum, respectively minimum values possible for $x > 2$. For $0 < x < 2$ we obtain $2A - 2 < y_{max} < 2A$, and $2 > y_{min} > 0$. This fulfils for $A \geq 2$ the necessary condition $y_{max} \geq A$, and $y_{min} \leq A$.



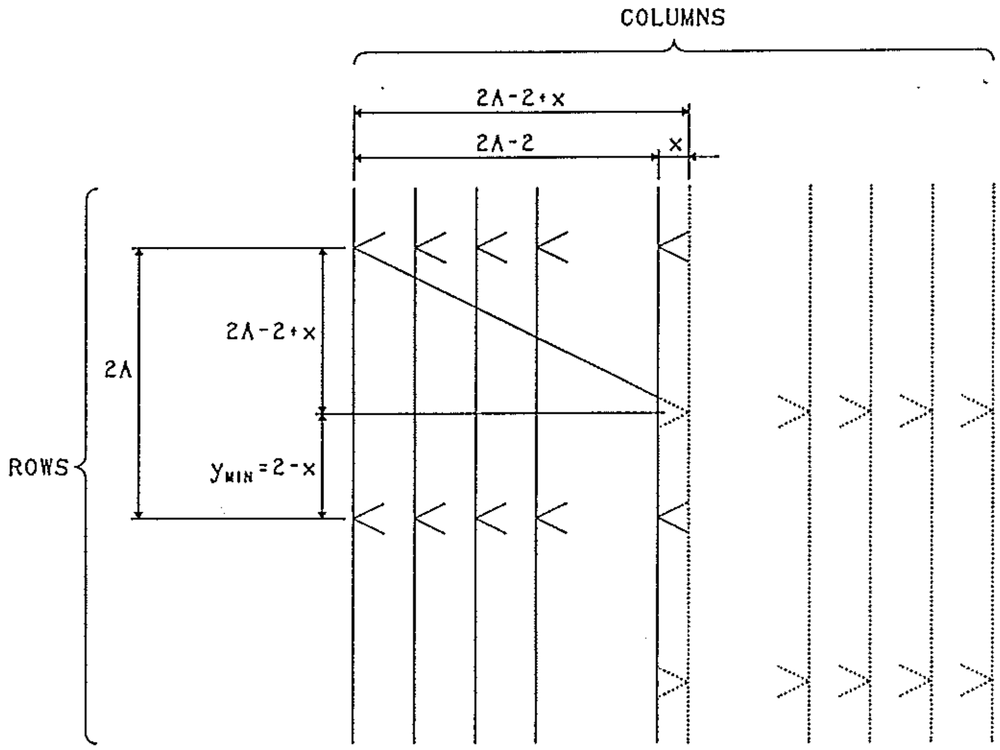


Fig. 466 — y_{max} and y_{min} for $0 < x \leq 2$.

Nested Cylindrical Braids

From the relationships $\Delta = |x - 2(k+1)|_A$ and $y = |x - 2(k+1)|_{2A}$ we obtain:

$$\Delta = |y|_A\,.$$

Furthermore, from the relationship $y = |x - 2(k+1)|_{2A}$ we obtain:

$$k = \left|\frac{x - y - 2}{2}\right|_A,$$

hence x and y must both have the same parity (both **odd** or both **even**). Consequently, there are two types of (A, x, y)-tables, one for $A =$ odd and one for $A =$ even. An example of each type is shown in respectively Fig. 467 and Fig. 468. Note the two different kinds of hatched x-lines in the tables for $A =$ odd.

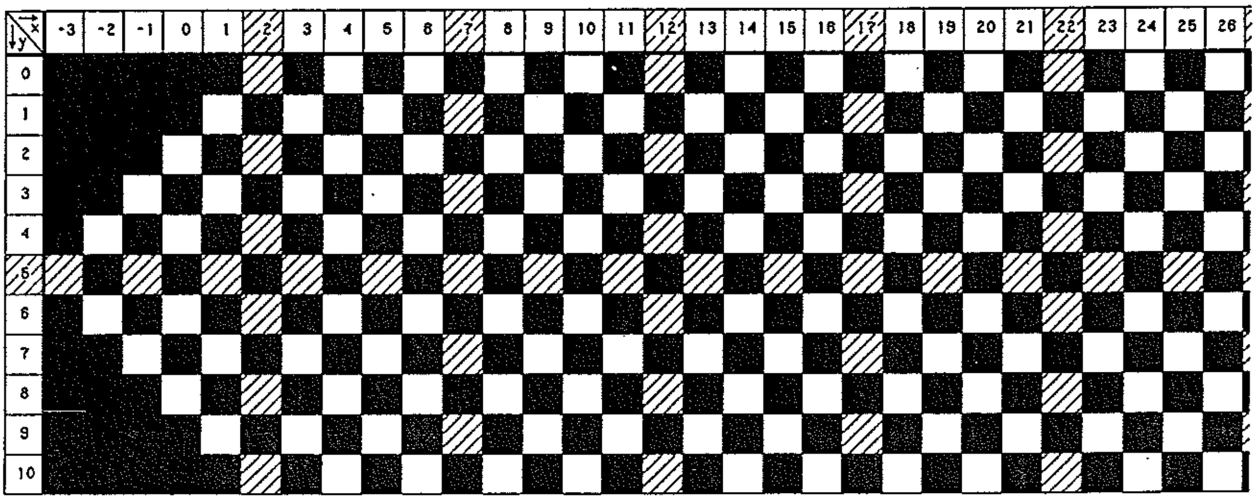


Fig. 467 — The $(A = 5, x, y)$-table.

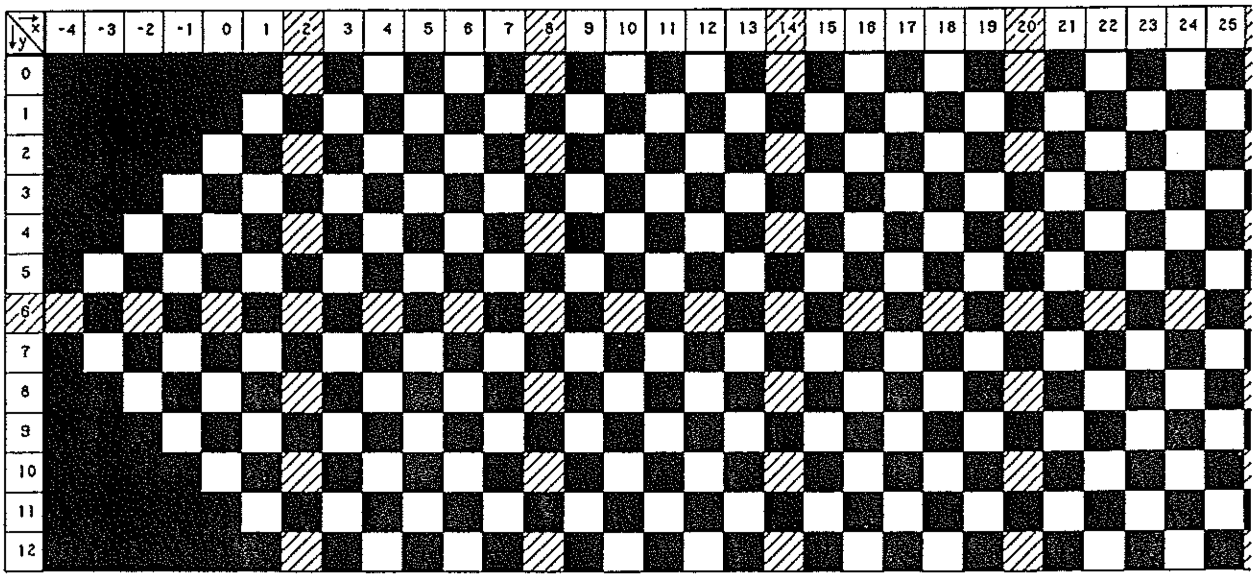


Fig. 468 — The $(A = 6, x, y)$-table.

In each non-black cell of an (A, x, y)-table we enter the associated k-value. This is shown in Fig. 469 for the table in Fig. 467, and in Fig. 470 for the table in Fig. 468.

y \ x	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
0						5		1		2		3		4		5		1		2		3		4		5		1		2
1					4		5		1		2		3		4		5		1		2		3		4		5		1	
2				3		4		5		1		2		3		4		5		1		2		3		4		5		1
3			2		3		4		5		1		2		3		4		5		1		2		3		4		5	
4		1		2		3		4		5		1		2		3		4		5		1		2		3		4		5
5	5		1		2		3		4		5		1		2		3		4		5		1		2		3		4	
6		5		1		2		3		4		5		1		2		3		4		5		1		2		3		4
7			5		1		2		3		4		5		1		2		3		4		5		1		2		3	
8				5		1		2		3		4		5		1		2		3		4		5		1		2		3
9					5		1		2		3		4		5		1		2		3		4		5		1		2	
10						5		1		2		3		4		5		1		2		3		4		5		1		2

Fig. 469 — The $(A=5, x, y)$-table with k-values.

y \ x	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
0							6		1		2		3		4		5		6		1		2		3		4		5	
1						5		6		1		2		3		4		5		6		1		2		3		4		5
2					4		5		6		1		2		3		4		5		6		1		2		3		4	
3				3		4		5		6		1		2		3		4		5		6		1		2		3		4
4			2		3		4		5		6		1		2		3		4		5		6		1		2		3	
5		1		2		3		4		5		6		1		2		3		4		5		6		1		2		3
6	6		1		2		3		4		5		6		1		2		3		4		5		6		1		2	
7		6		1		2		3		4		5		6		1		2		3		4		5		6		1		2
8			6		1		2		3		4		5		6		1		2		3		4		5		6		1	
9				6		1		2		3		4		5		6		1		2		3		4		5		6		1
10					6		1		2		3		4		5		6		1		2		3		4		5		6	
11						6		1		2		3		4		5		6		1		2		3		4		5		6
12							6		1		2		3		4		5		6		1		2		3		4		5	

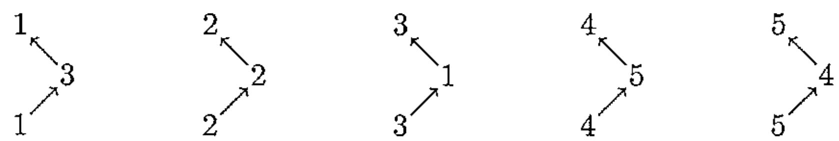
Fig. 470 — The $(A=6, x, y)$-table with k-values.

From the relationships we derived and discussed in the previous issue, it follows that for a Regular Nested Cylindrical Braid associated with a cell in the row $y = A$, its set of first-return string-runs is the set of their mirror images. The same applies for the set of first-return string-runs of a Regular Nested Cylindrical Braid associated with a cell in the row $y = 0 = 2A$.

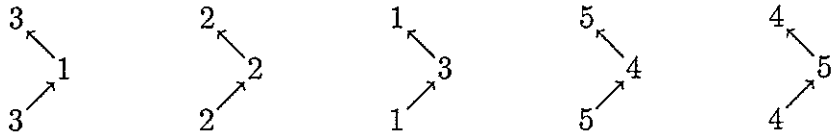
Example 1: $A = 5$; $y = 5$; $x = 13$.

Hence $k = 3$. The value of k can be calculated with the formula $k = \left|\dfrac{x-y-2}{2}\right|_A$, or may be obtained from the table in Fig. 469.

Since $y = 5$, it follows that $\Delta = |y|_A = 0$. Hence the set of first-return string-runs is:



The mirror image set is thus:



which is identical to the previous set of first-return string-runs.

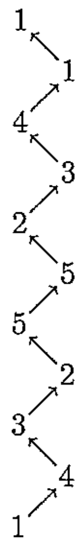
Note that $\Delta = 0$ is associated with the Standard and Semi-Standard Regular Nested Cylindrical Braids (see *The Braider*, Issues No. 23 & No. 24, pp. 513–515, pp. 519–531, pg. 555; and **Braiding**, book 4/1, Standard Herringbone Pineapple Knots).

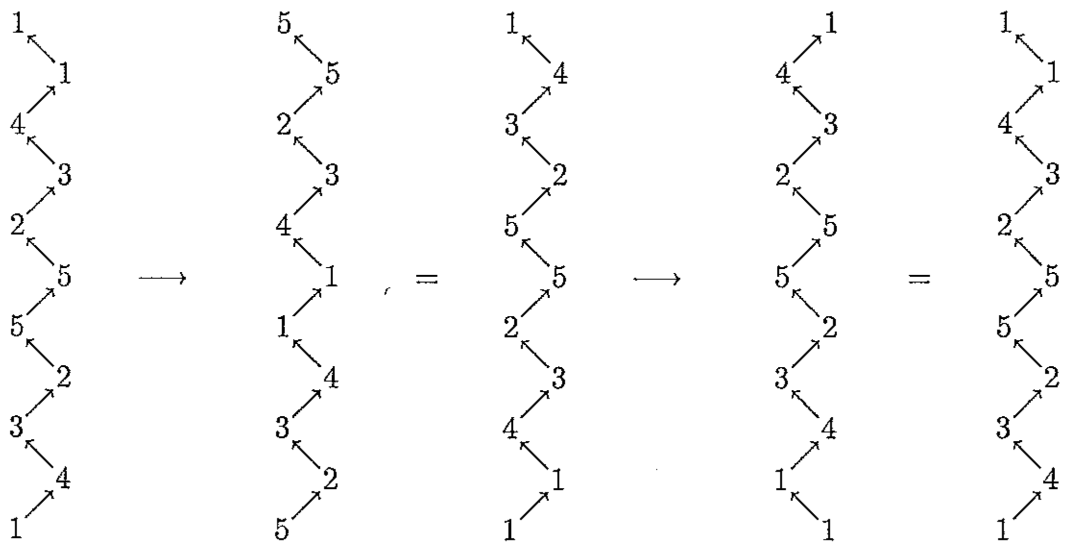
The set of first-return string-runs of a Regular Nested Cylindrical Braid associated with a cell in the column $x = 2 + nA$ is also the set of their mirror imaged (A, A)-complements.

Example 2: $A = 5\,;\ x = 17\,;\ y = 7\,.$

Hence $k = 4$. Again, k can be calculated with the formula $k = \left|\dfrac{x-y-2}{2}\right|_A$, or may be obtained from the table in Fig. 469.

Since $y = 7$, it follows that $\Delta = |y|_A = 2$. The number of Components is equal to g.c.d. (Δ, A), and hence the set of first-return string-runs consists of only one first-return string-run (g.c.d. $(\Delta, A) = 1$):



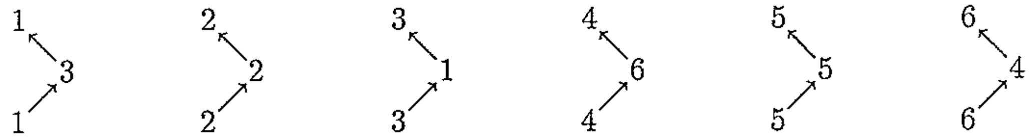


The set of first-return string-runs of a Regular Nested Cylindrical Braid associated with a cell in the column $x = 2 + nA$ and row $y = A$ or $y = 0 = 2A$ is also the set of their mirror image, the set of their (A, A)-complements, as well as the set of their mirror imaged (A, A)-complements.

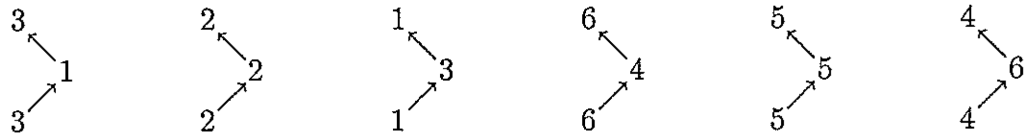
Example 3: $A = 6$; $x = 14$; $y = 6$.

Hence $k = 3$. The value of k can be calculated with the formula $k = \left|\dfrac{x - y - 2}{2}\right|_A$, or may be obtained from the table in Fig. 470.

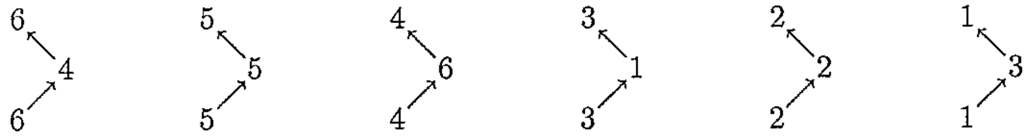
Since $y = 6$, it follows that $\Delta = |y|_A = 0$. Hence the set of first-return string-runs is:



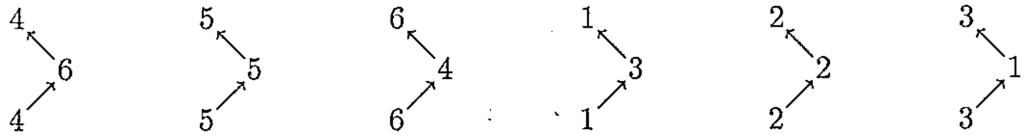
The mirror image set is thus:



The (A, A)-complemental set is thus:



The mirror imaged (A, A)-complemental set is thus:



Note that all these four sets of first-return string-runs are identical.

Since $l_{i+1} = |l_i + \Delta|_A$ and $r_{i+1} = |r_i - \Delta|_A$, it follows that Δ is an **invariant** for the Regular Nested Cylindrical Braid concerned. Consequently α (the number of bights in a first-return string-run, hence the number of bights in a **component**) is also an **invariant** for the Regular Nested Cylindrical Braid concerned.

Let $\gamma = \text{g.c.d.}(\Delta, A) =$ number of first-return string-runs $=$ number of components. Then $\alpha = \dfrac{A}{\gamma}$. It will thus be evident that, in the sequence of the γ first-return string-runs of a Regular Nested Cylindrical Braid, we can take for the first lower-left to upper-right half-cycle the respective half-cycles:

$$1 \longrightarrow k \; ; \; 2 \longrightarrow |k-1|_A \; ; \; 3 \longrightarrow |k-2|_A \; ; \; \cdots\cdots \; ; \; \gamma \longrightarrow |k+1-\gamma|_A \, .$$

This sequence of γ first-return string-runs, and hence their associated components, forms two sets of components. **It suffices to consider $0 \le y \le A$ due to the mirror-image complementary relationship. Hence $y' = y$ with $\Delta' = |y'|_A = |y|_A = \Delta$ for $0 \le y < A$, and $y' = 2A - y$ with $\Delta' = |y'|_A = |-\Delta|_A$ for $A \le y \le 2A$.**

The first set contains

$$\left|\frac{x + \Delta' - 2}{2}\right|_\gamma \quad \text{components,}$$

with each component having a number of parts equal to

$$P_c = \frac{2A-\Delta'}{\gamma} + 2\left\lceil \frac{x+\Delta'-2}{2\gamma} \right\rceil = \frac{x+2A-2-2\left|\frac{x+\Delta'-2}{2}\right|_\gamma}{\gamma} + 2\,.$$

The second set contains

$$\gamma - \left|\frac{x+\Delta'-2}{2}\right|_\gamma \text{ components,}$$

with each component having a number of parts equal to

$$P_c = \frac{2A-\Delta'}{\gamma} + 2\left\lfloor \frac{x+\Delta'-2}{2\gamma} \right\rfloor = \frac{x+2A-2-2\left|\frac{x+\Delta'-2}{2}\right|_\gamma}{\gamma}\,.$$

In these formulae $\Delta' = |y'|_A$ for $y' \neq A$; $\gamma = A$ when $\Delta' = 0$; $\Delta' = A$ when $y' = A$.

Example 4: $A = 8$; $y = 12$; $x = 56$.

$y' = 2A - y = 16 - 12 = 4$ (mirror-immage complementary relationship), hence $\Delta' = |y'|_A = |4|_8 = 4$. Furthermore $\gamma = \text{g.c.d.}(\Delta, A) = \text{g.c.d.}(4,8) = 4$; $\alpha = \frac{A}{\gamma} = \frac{8}{4} = 2$;
$k = \left|\frac{x-y-2}{2}\right|_A = \left|\frac{56-12-2}{2}\right|_8 = |21|_8 = 5$ with $\Delta = |y|_A = |12|_8 = 4$.

$$\#\text{ of components in }1^{\text{st}}\text{ set} = \left|\frac{x+\Delta'-2}{2}\right|_\gamma = \left|\frac{56+4-2}{2}\right|_4 = |29|_4 = 1\,.$$

$$P_c = \frac{2A-\Delta'}{\gamma} + 2\left\lceil \frac{x+\Delta'-2}{2\gamma} \right\rceil = \frac{16-4}{4} + 2\left\lceil \frac{56+4-2}{8} \right\rceil = 3 + 16 = 19\,.$$

$$P_c = \frac{x+2A-2-2\left|\frac{x+\Delta'-2}{2}\right|_\gamma}{\gamma} + 2 = \frac{56+16-2-2\left|\frac{56+4-2}{2}\right|_4}{4} + 2 = 17 + 2 = 19\,.$$

$$\#\text{ of components in }2^{\text{st}}\text{ set} = \gamma - \left|\frac{x+\Delta'-2}{2}\right|_\gamma = 4 - \left|\frac{56+4-2}{2}\right|_4 = 4 - 1 = 3\,.$$

$$P_c = \frac{2A-\Delta'}{\gamma} + 2\left\lfloor \frac{x+\Delta'-2}{2\gamma} \right\rfloor = \frac{16-4}{4} + 2\left\lfloor \frac{56+4-2}{8} \right\rfloor = 3 + 14 = 17\,.$$

$$P_c = \frac{x+2A-2-2\left|\frac{x+\Delta'-2}{2}\right|_\gamma}{\gamma} = \frac{56+16-2-2\left|\frac{56+4-2}{2}\right|_4}{4} = 17\,.$$

Thus the first set of components consists of one component with $P_c = 19$ parts, and the second set of components consists of three components with $P_c = 17$ parts each.

Note that a useful check may be made with the formula:
$[(\#\text{ of components in }1^{\text{st}}\text{ set}) \times (P_c\text{ in }1^{\text{st}}\text{ set})] + [(\#\text{ of components in }2^{\text{nd}}\text{ set}) \times (P_c\text{ in }2^{\text{nd}}\text{ set})] = x + 2A - 2$.

Hence in our case: $1 \times 19 + 3 \times 17 = 19 + 51 = 70 = x + 2A - 2 = 56 + 16 - 2 = 70$.

Example 5: $A = 8$; $y = 8$; $x = 56$.

Hence $\Delta' = A = 8$ $(y' = A)$; $\gamma = \text{g.c.d.}(\Delta, A) = \text{g.c.d.}(8,8) = 8$; $\alpha = \frac{A}{\gamma} = \frac{8}{8} = 1$;
$k = \left|\frac{x-y-2}{2}\right|_A = \left|\frac{56-8-2}{2}\right|_8 = |23|_8 = 7$ with $\Delta = |y|_A$.

$$\#\text{ of components in }1^{\text{st}}\text{ set} = \left|\frac{x+\Delta'-2}{2}\right|_\gamma = \left|\frac{56+8-2}{2}\right|_8 = |31|_8 = 7\,.$$

$$P_c = \frac{2A - \Delta'}{\gamma} + 2\left\lceil \frac{x + \Delta' - 2}{2\gamma} \right\rceil = \frac{16 - 8}{8} + 2\left\lceil \frac{56 + 8 - 2}{16} \right\rceil = 1 + 8 = 9\,.$$

$$P_c = \frac{x + 2A - 2 - 2\left|\frac{x+\Delta'-2}{2}\right|_{\gamma}}{\gamma} + 2 = \frac{56 + 16 - 2 - 2\left|\frac{56+8-2}{2}\right|_{8}}{8} + 2 = 7 + 2 = 9\,.$$

$$\#\text{ of components in } 2^{\text{nd}} \text{ set} = \gamma - \left|\frac{x + \Delta' - 2}{2}\right|_{\gamma} = 8 - \left|\frac{56 + 8 - 2}{2}\right|_{8} = 8 - 7 = 1\,.$$

$$P_c = \frac{2A - \Delta'}{\gamma} + 2\left\lfloor \frac{x + \Delta' - 2}{2\gamma} \right\rfloor = \frac{16 - 8}{8} + 2\left\lfloor \frac{56 + 8 - 2}{16} \right\rfloor = 1 + 6 = 7\,.$$

$$P_c = \frac{x + 2A - 2 - 2\left|\frac{x+\Delta'-2}{2}\right|_{\gamma}}{\gamma} = \frac{56 + 16 - 2 - 2\left|\frac{56+8-2}{2}\right|_{8}}{8} = 7\,.$$

Hence the first set of components consists of seven components, each of which has $P_c = 9$ parts, and the second set of components consists of one component with $P_c = 7$ parts.

Check: $7 \times 9 + 1 \times 7 = 63 + 7 = 70 = x + 2A - 2 = 56 + 16 - 2 = 70\,.$

We can of course also readily tabulate in the cells of the (A, x, y)-table the number of components in the first set with the number of parts for each component in that set and the number of components in the second set with the number of parts for each component in that set. Since the first cell in each row has always an empty first set, we can readily calculate for these cells their P_c-values by means of the formula:

$$P_c = \frac{P_{total}}{\gamma}\,.$$

An example for $A = 12$ is shown in Fig. 471. Since the row $y = A$ is the row of mirror-image, it is the row of symmetry for these cell-entries.

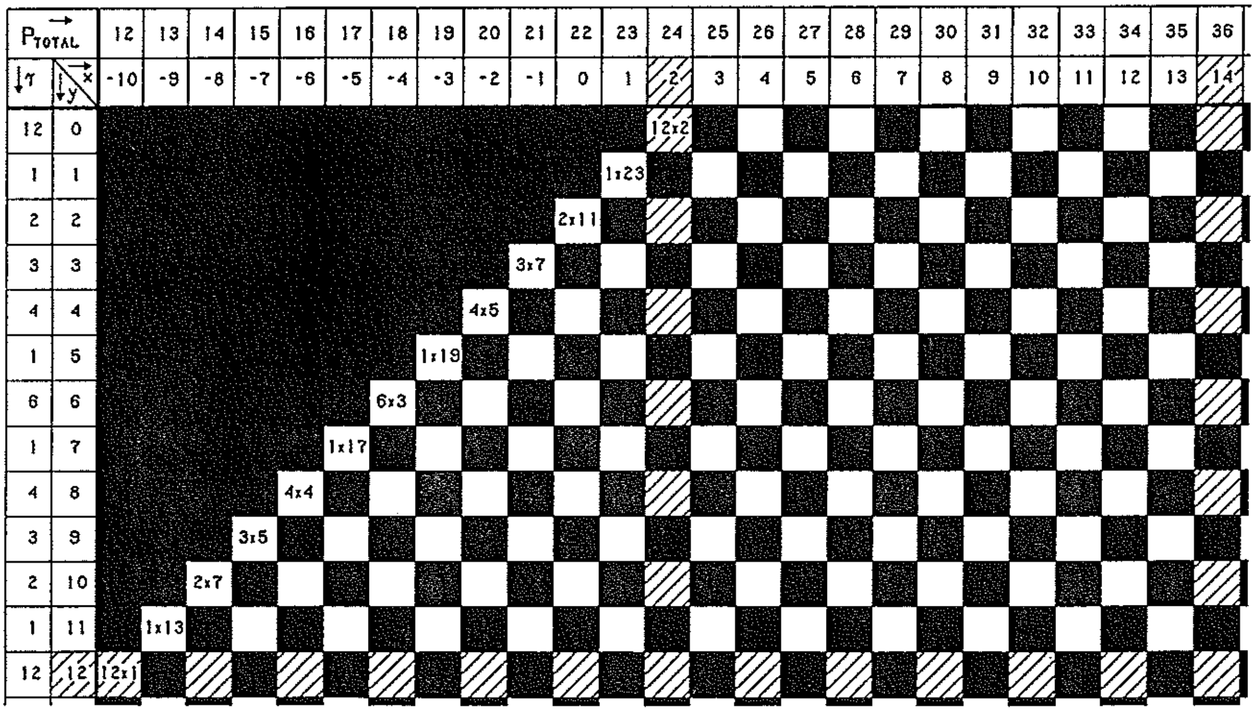


Fig. 471 — The entry in each first row-cell for $A = 12$.

The further consecutive cell-entries for each row can now be entered; a few examples are shown in Fig. 472.

y \ x	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0													12×2		1×4 11×2		2×4 10×2		3×4 9×2		4×4 8×2		5×4 7×2		6×4 6×2	
1												1×23		1×25		1×27		1×29		1×31		1×33		1×35		1×37
2											2×11															
3										3×7		1×9 2×7		2×9 1×7		3×9		1×11 2×9		2×11 1×9		3×11		1×13 2×11		2×13 1×11
4									4×5																	
5								1×19																		
6							6×3		1×5 5×3		2×5 4×3		3×5 3×3		4×5 2×3		5×5 1×3		6×5		1×7 5×5		2×7 4×5		3×7 3×5	
7						1×17																				
8					4×4																					
9				3×5																						
10			2×7		1×9 1×7		2×9		1×11 1×9		2×11		1×13 1×11		2×13		1×15 1×13		2×15		1×17 1×15		2×17		1×19 1×17	
11		1×13																								
12	12×1																									
13		1×13																								
14			2×7		1×9 1×7		2×9		1×11 1×9		2×11		1×13 1×11		2×13		1×15 1×13		2×15		1×17 1×15		2×17		1×19 1×17	
15				3×5																						
16					4×4																					
17						1×17																				
18							6×3		1×5 5×3		2×5 4×3		3×5 3×3		4×5 2×3		5×5 1×3		6×5		1×7 5×5		2×7 4×5		3×7 3×5	
19								1×19																		
20									4×5																	
21										3×7		1×9 2×7		2×9 1×7		3×9		1×11 2×9		2×11 1×9		3×11		1×13 2×11		2×13 1×11
22											2×11															
23												1×23		1×25		1×27		1×29		1×31		1×33		1×35		1×37
24													12×2		1×4 11×2		2×4 10×2		3×4 9×2		4×4 8×2		5×4 7×2		6×4 6×2	

Fig. 472 — A few example rows showing the further cell-entries for $A = 12$.

⋆⋆ *Complete the cell-entries in the above table (Fig. 472). What do you observe, and what can you deduce for other A-values?*

When we know for a set of (A, x, y)-values its associated component-set and the number of components, we can readily determine for a B^*-value, the total number of essential strings required.

Example 6: $A = 8$; $x = 12$; $y = 4$; $B^* = 5$.

Hence the associated component-set is $P_c = 7$ and $Pc = 5$ with the respective number of components 3 and 1 (thus 3×7 and 1×5). Then $\text{g.c.d.}(P_c, B^*) = \text{g.c.d.}(7,5) = 1$ and $\text{g.c.d.}(P_c, B^*) = \text{g.c.d.}(5,5) = 5$. Consequently the number of essential strings is $3 \times 1 + 1 \times 5 = 8$.

Note that an (A, x, y)-table with cell-entries for the essential number of strings associated with a specific B^*-value has little or no value since an (A, x, y)-table with cell-entries for $\{(\#\text{ of components}) \times P_c\}$ is applicable to all B^*-values and the calculation $\{\text{g.c.d.}(P_c, B^*)\}$ is a simple one.

Transitions from two Round Braids to one Round Braid, and vice versa

In applications where such transitions are called for (for example in the formation of loops or eyes) it is important that the transition presents a pleasing appearance, hence does not show disturbing irregularities. The reader be reminded that some aspects of round braids were discussed in *The Braider*, Issue No. 7, pp. 146–153, and Issue No. 10, pp. 216–222.

Transitions between two 4-string round braids and one 8-string round braid.

BRAIDING TYPE											
8 STRING								4 STRING			
→				←				→		←	
U	O	U	O	O	U	O	U	U	O	O	U
1	1	1	1	1	1	1	1	1	1	1	1

We have here four good transition combinations; they are respectively depicted in Figs. 473, 474, 475 and 476.

Fig. 473:

The 4-string round braid has at one end the strings A, B, C, D and at the other end the strings 1, 2, 3, 4.

Form the crossings between the strings A, C, 2, 4.

Bring 1 from the right around the back to the left, then along the front from left to right under B, over D, under 2, over 4.

Bring B from the left around the back to the right, then along the front from right to left under 3, over A, under C, over 1.

Bring 3 from the right around the back to the left, then along the front from left to right under D, over 2, under 4, over B.

Bring D from the left around the back to the right, then along the front from right to left under A, over C, under 1, over 3.

Bring A from the right around the back to the left, then along the front from left to right under 2, over 4, under B, over D.

Bring 2 from the left around the back to the right, then along the front from right to left under C, over 1, under 3, over A.

Bring C from the right around the back to the left, then along the front from left to right under 4, over B, under D, over 2.

Bring 4 from the left around the back to the right, then along the front from right to left under 1, over 3, under A, over C.

And so on.

The 8-string round braid has the strings 1, 2, 3, 4, 5, 6, 7, 8.

Bring 1 from the right around the back to the left, then along the front from left to right under 2, over 4, under 6, over 8.

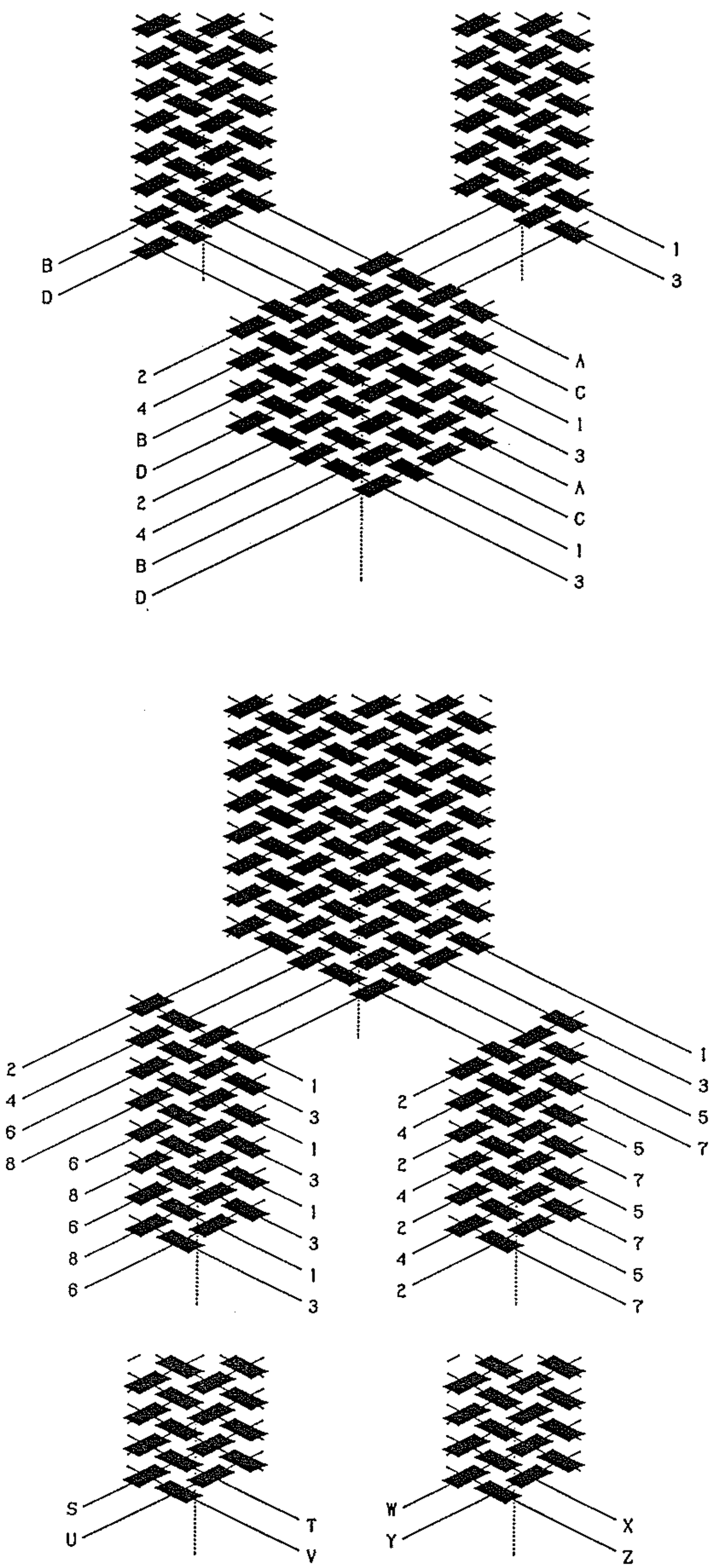


Fig. 473 — Transitions between two 4-string round braids and one 8-string round braid.

Bring 2 from the left around the back to the right, then along the front from right to left under 3, over 5, under 7.

Bring 3 from the right around the back to the left, then along the front from left to right under 4, over 6, under 8.

Bring 4 from the left around the back to the right, then along the front from right to left under 5, over 7.

Braid the left-hand round braid of 4-strings:

Bring 1 from the right around the back to the left, then along the front from left to right under 6, over 8.

Bring 6 from the left around the back to the right, then along the front from right to left under 3, over 1.

Bring 3 from the right around the back to the left, then along the front from left to right under 8, over 6.

Bring 8 from the left around the back to the right, then along the front from right to left under 1, over 3.

And so on.

Braid the right-hand round braid of 4-strings:

Bring 5 from the right around the back to the left, then along the front from left to right under 2, over 4.

Bring 2 from the left around the back to the right, then along the front from right to left under 7, over 5.

Bring 7 from the right around the back to the left, then along the front from left to right under 4, over 2.

Bring 4 from the left around the back to the right, then along the front from right to left under 5, over 7.

And so on.

Fig. 474:

The 4-string round braid has at one end the strings A, B, C, D and at the other end the strings 1, 2, 3, 4.

Form the crossings between the strings B, D, 1, 3.

Bring A from the left around the back to the right, then along the front from right to left under 2, over 4, under B, over D.

Bring 2 from the right around the back to the left, then along the front from left to right under C, over 1, under 3, over A.

Bring C from the left around the back to the right, then along the front from right to left under 4, over B, under D, over 2.

Bring 4 from the right around the back to the left, then along the front from left to right under 1, over 3, under A, over C.

Bring 1 from the left around the back to the right, then along the front from right to left under B, over D, under 2, over 4.

Bring B from the right around the back to the left, then along the front from left to right under 3, over A, under C, over 1.

Bring 3 from the left around the back to the right, then along the front from right to left under D, over 2, under 4, over B.

Bring D from the right around the back to the left, then along the front from left to right under A, over C, under 1, over 3.

And so on.

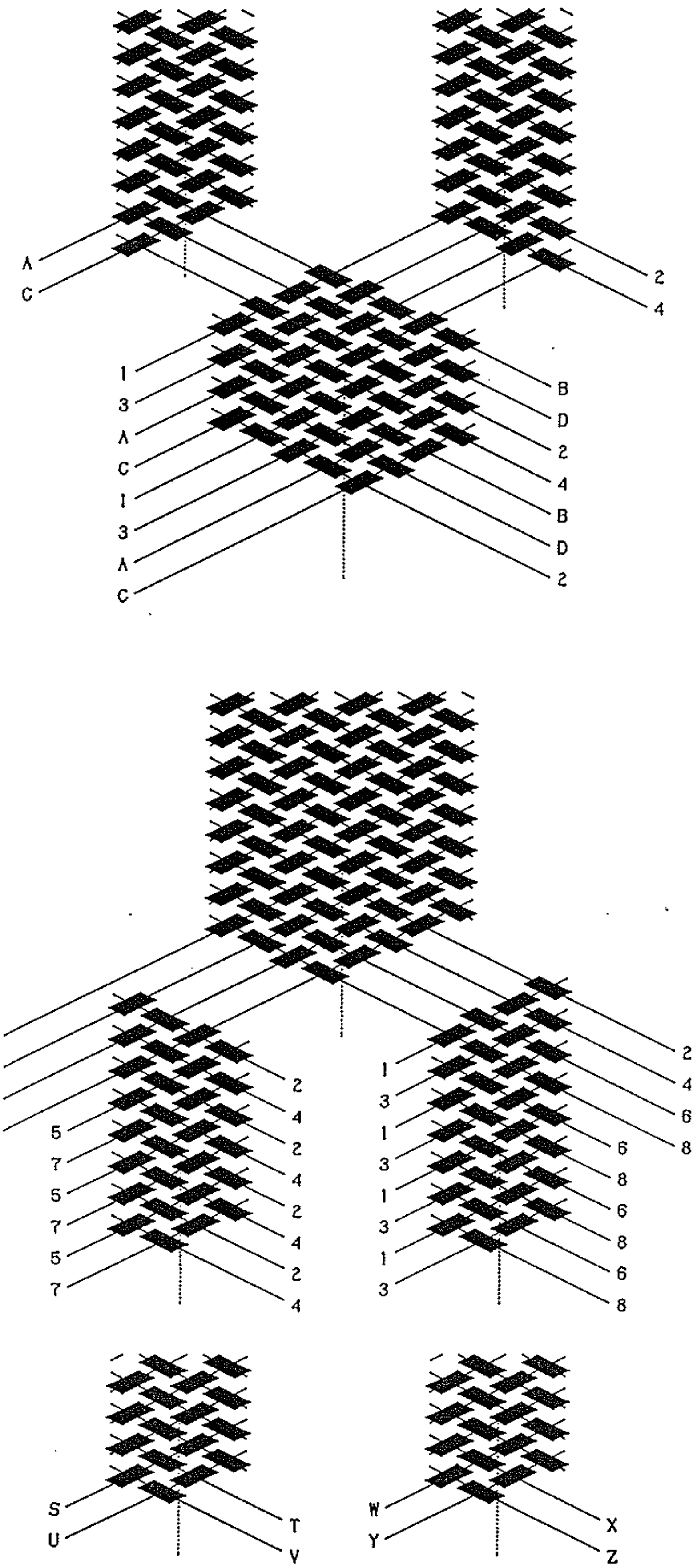


Fig. 474 — Transitions between two 4-string round braids and one 8-string round braid.

The 8-string round braid has the strings 1, 2, 3, 4, 5, 6, 7, 8.

Bring 1 from the left around the back to the right, then along the front from right to left under 2, over 4, under 6, over 8.

Bring 2 from the right around the back to the left, then along the front from left to right under 3, over 5, under 7.

Bring 3 from the left around the back to the right, then along the front from right to left under 4, over 6, under 8.

Bring 4 from the right around the back to the left, then along the front from left to right under 5, over 7.

Braid the left-hand round braid of 4-strings:

Bring 5 from the left around the back to the right, then along the front from right to left under 2, over 4.

Bring 2 from the right around the back to the left, then along the front from left to right under 7, over 5.

Bring 7 from the left around the back to the right, then along the front from right to left under 4, over 2.

Bring 4 from the right around the back to the left, then along the front from left to right under 5, over 7.

And so on.

Braid the right-hand round braid of 4-strings:

Bring 1 from the left around the back to the right, then along the front from right to left under 6, over 8.

Bring 6 from the right around the back to the left, then along the front from left to right under 3, over 1.

Bring 3 from the left around the back to the right, then along the front from right to left under 8, over 6.

Bring 8 from the right around the back to the left, then along the front from left to right under 1, over 3.

And so on.

Fig. 475:

The transition from the two 4-string round braids to the one 8-string round braid is in accordance with Fig. 473, and the transition from the one 8-string round braid to the two 4-string round braids is in accordance with Fig. 474.

Fig. 476:

The transition from the two 4-string round braids to the one 8-string round braid is in accordance with Fig. 474, and the transition from the one 8-string round braid to the two 4-string round braids is in accordance with Fig. 473.

BRAIDING TYPE							
8 STRING				4 STRING			
→		←		→		←	
U	O	O	U	U	O	O	U
2	2	2	2	1	1	1	1

The transition combinations in Figs. 477 & 478 have a 3-over set of crossings. Especially in colour-work they are less preferable than the transition combinations in Figs. 479 & 480 which have a 3-under set of crossings.

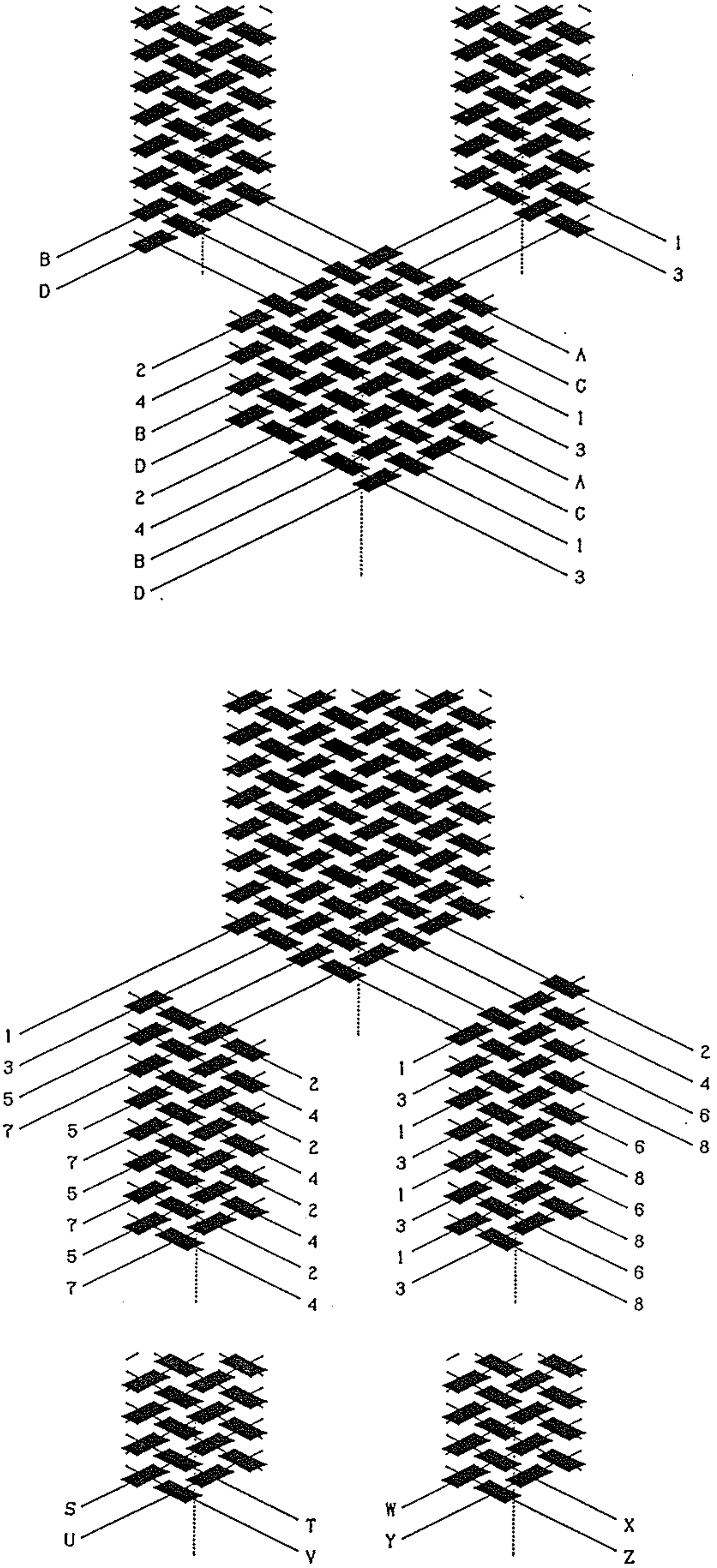


Fig. 475 — Transitions between two 4-string round braids and one 8-string round braid.

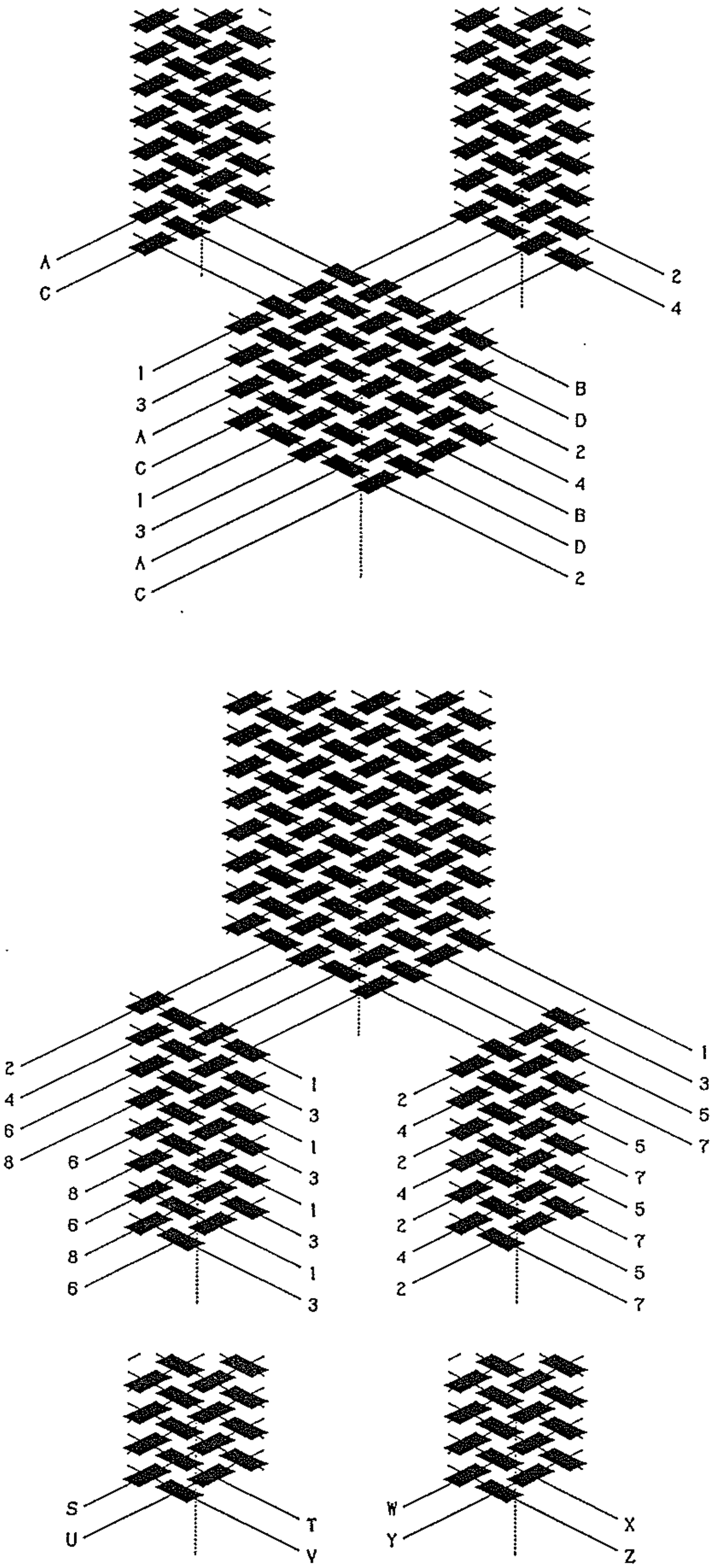


Fig. 476 — Transitions between two 4-string round braids and one 8-string round braid.

Fig. 477:

The 4-string round braid has at one end the strings A, B, C, D and at the other end the strings 1, 2, 3, 4.

Form the crossings between the strings B, D, 1, 3.

Bring 2 from the right around the back to the left, then along the front from left to right under A, over C, over 1, under 3.

Bring 4 from the right around the back to the left, then along the front from left to right under A, under C, over 1, over 3.

Bring A from the left around the back to the right, then along the front from right to left under B, under D, over 2, over 4.

Bring B from the right around the back to the left, then along the front from left to right under C, under 1, over 3, over A.

Bring C from the left around the back to the right, then along the front from right to left under D, under 2, over 4, over B.

Bring D from the right around the back to the left, then along the front from left to right under 1, under 3, over A, over C.

Bring 1 from the left around the back to the right, then along the front from right to left under 2, under 4, over B, over D.

Bring 2 from the right around the back to the left, then along the front from left to right under 3, under A, over C, over 1.

And so on.

The 8-string round braid has the strings 1, 2, 3, 4, 5, 6, 7, 8.

Bring 1 from the right around the back to the left, then along the front from left to right under 2, under 4, over 6, under 8.

Bring 2 from the left around the back to the right, then along the front from right to left under 3, under 5, over 7.

Bring 3 from the right around the back to the left, then along the front from left to right under 4, under 6, over 8.

Bring 4 from the left around the back to the right, then along the front from right to left over 5, under 7.

Braid the left-hand round braid of 4-strings:

Bring 6 from the left around the back to the right, then along the front from right to left under 1, over 3.

Bring 1 from the right around the back to the left, then along the front from left to right under 8, over 6.

Bring 8 from the left around the back to the right, then along the front from right to left under 3, over 1.

Bring 3 from the right around the back to the left, then along the front from left to right under 6, over 8.

And so on.

Braid the right-hand round braid of 4-strings:

Bring 2 from the left around the back to the right, then along the front from right to left under 5, over 7.

Bring 5 from the right around the back to the left, then along the front from left to right under 4, over 2.

Bring 4 from the left around the back to the right, then along the front from right to left under 7, over 5.

Bring 7 from the right around the back to the left, then along the front from left to right under 2, over 4.

And so on.

Fig. 478:

The 4-string round braid has at one end the strings *A*, *B*, *C*, *D* and at the other end the strings 1, 2, 3, 4.

Form the crossings between the strings *A*, *C*, 2, 4.

Bring *B* from the left around the back to the right, then along the front from right to left under 1, over 3, over *A*, under *C*.

Bring *D* from the left around the back to the right, then along the front from right to left under 1, under 3, over *A*, over *C*.

Bring 1 from the right around the back to the left, then along the front from left to right under 2, under 4, over *B*, over *D*.

Bring 2 from the left around the back to the right, then along the front from right to left under 3, under *A*, over *C*, over 1.

Bring 3 from the right around the back to the left, then along the front from left to right under 4, under *B*, over *D*, over 2.

Bring 4 from the left around the back to the right, then along the front from right to left under *A*, under *C*, over 1, over 3.

Bring *A* from the right around the back to the left, then along the front from left to right under *B*, under *D*, over 2, over 4.

Bring *B* from the left around the back to the right, then along the front from right to left under *C*, under 1, over 3, over *A*.

And so on.

The 8-string round braid has the strings 1, 2, 3, 4, 5, 6, 7, 8.

Bring 1 from the left around the back to the right, then along the front from right to left under 2, under 4, over 6, under 8.

Bring 2 from the right around the back to the left, then along the front from left to right under 3, under 5, over 7.

Bring 3 from the left around the back to the right, then along the front from right to left under 4, under 6, over 8.

Bring 4 from the right around the back to the left, then along the front from left to right over 5, under 7.

Braid the left-hand round braid of 4-strings:

Bring 2 from the right around the back to the left, then along the front from left to right under 5, over 7.

Bring 5 from the left around the back to the right, then along the front from right to left under 4, over 2.

Bring 4 from the right around the back to the left, then along the front from left to right under 7, over 5.

Bring 7 from the left around the back to the right, then along the front from right to left under 2, over 4.

And so on.

Braid the right-hand round braid of 4-strings:

Bring 6 from the right around the back to the left, then along the front from left to right under 1, over 3.

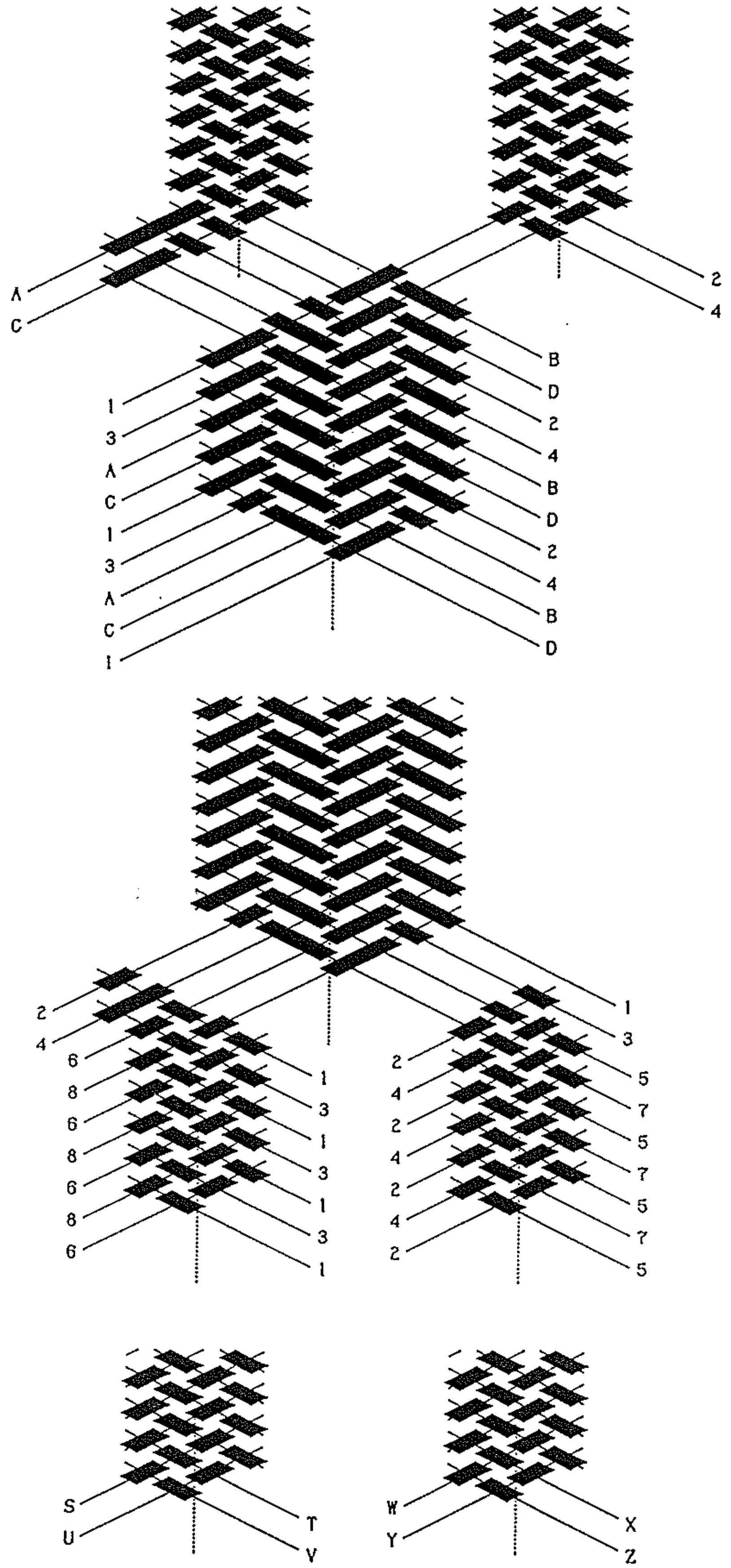


Fig. 477 — Transitions between two 4-string round braids and one 8-string round braid.

Bring 1 from the left around the back to the right, then along the front from right to left under 8, over 6.

Bring 8 from the right around the back to the left, then along the front from left to right under 3, over 1.

Bring 3 from the left around the back to the right, then along the front from right to left under 6, over 8.

And so on.

Fig. 479:

The 4-string round braid has at one end the strings A, B, C, D and at the other end the strings 1, 2, 3, 4.

Form the crossings between the strings A, C, 2, 4.

Bring B from the left around the back to the right, then along the front from right to left under 1, over 3, over A, under C.

Bring 1 from the right around the back to the left, then along the front from left to right under D, under 2, over 4, over B.

Bring D from the left around the back to the right, then along the front from right to left under 3, under A, over C, over 1.

Bring 3 from the right around the back to the left, then along the front from left to right under 2, under 4, over B, over D.

Bring 2 from the left around the back to the right, then along the front from right to left under A, under C, over 1, over 3.

Bring A from the right around the back to the left, then along the front from left to right under 4, under B, over D, over 2.

Bring 4 from the left around the back to the right, then along the front from right to left under C, under 1, over 3, over A.

Bring C from the right around the back to the left, then along the front from left to right under B, under D, over 2, over 4.

And so on.

The 8-string round braid has the strings 1, 2, 3, 4, 5, 6, 7, 8.

Bring 1 from the left around the back to the right, then along the front from right to left under 2, under 4, over 6, over 8.

Bring 2 from the right around the back to the left, then along the front from left to right under 3, under 5, over 7, over 1.

Bring 3 from the left around the back to the right, then along the front from right to left under 4, under 6, under 8, over 2.

Bring 4 from the right around the back to the left, then along the front from left to right under 5, over 7.

Bring 6 from the right around the back to the left, then along the front from left to right over 5, under 7.

Braid the left-hand round braid of 4-strings:

Bring 4 from the right around the back to the left, then along the front from left to right under 5, over 7.

Bring 5 from the left around the back to the right, then along the front from right to left under 6, over 4.

Bring 6 from the right around the back to the left, then along the front from left to right under 7, over 5.

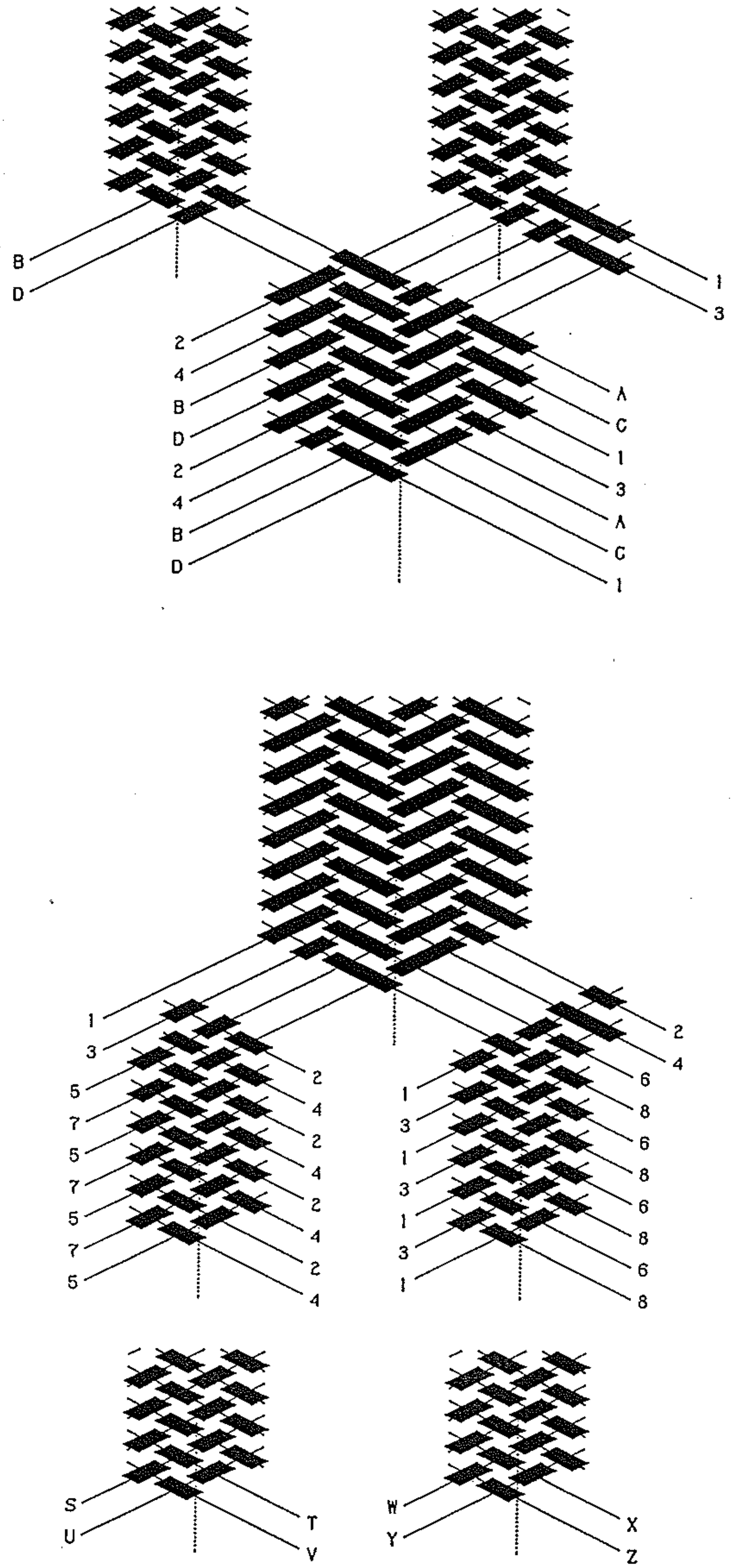


Fig. 478 — Transitions between two 4-string round braids and one 8-string round braid.

Bring 7 from the left around the back to the right, then along the front from right to left under 4, over 6.

And so on.

Braid the right-hand round braid of 4-strings:

Bring 8 from the right around the back to the left, then along the front from left to right under 1, over 3.

Bring 1 from the left around the back to the right, then along the front from right to left under 2, over 8.

Bring 2 from the right around the back to the left, then along the front from left to right under 3, over 1.

Bring 3 from the left around the back to the right, then along the front from right to left under 8, over 2.

And so on.

Fig. 480:

The 4-string round braid has at one end the strings A, B, C, D and at the other end the strings 1, 2, 3, 4.

Form the crossings between the strings B, D, 1, 3.

Bring 2 from the right around the back to the left, then along the front from left to right under A, under C, over 1, over 3.

Bring A from the left around the back to the right, then along the front from right to left under 4, under B, over D, over 2.

Bring 4 from the right around the back to the left, then along the front from left to right under C, under 1, over 3, over A.

Bring C from the left around the back to the right, then along the front from right to left under B, under D, over 2, over 4.

Bring B from the right around the back to the left, then along the front from left to right under 1, under 3, over A, over C.

Bring 1 from the left around the back to the right, then along the front from right to left under D, under 2, over 4, over B.

Bring D from the right around the back to the left, then along the front from left to right under 3, under A, over C, over 1.

Bring 3 from the left around the back to the right, then along the front from right to left under 2, under 4, over B, over D.

And so on.

The 8-string round braid has the strings 1, 2, 3, 4, 5, 6, 7, 8.

Bring 1 from the right around the back to the left, then along the front from left to right under 2, under 4, over 6, over 8.

Bring 2 from the left around the back to the right, then along the front from right to left under 3, under 5, over 7, over 1.

Bring 3 from the right around the back to the left, then along the front from left to right under 4, under 6, under 8, over 2.

Bring 4 from the left around the back to the right, then along the front from right to left under 5, over 7.

Bring 6 from the left around the back to the right, then along the front from right to left over 5, under 7.

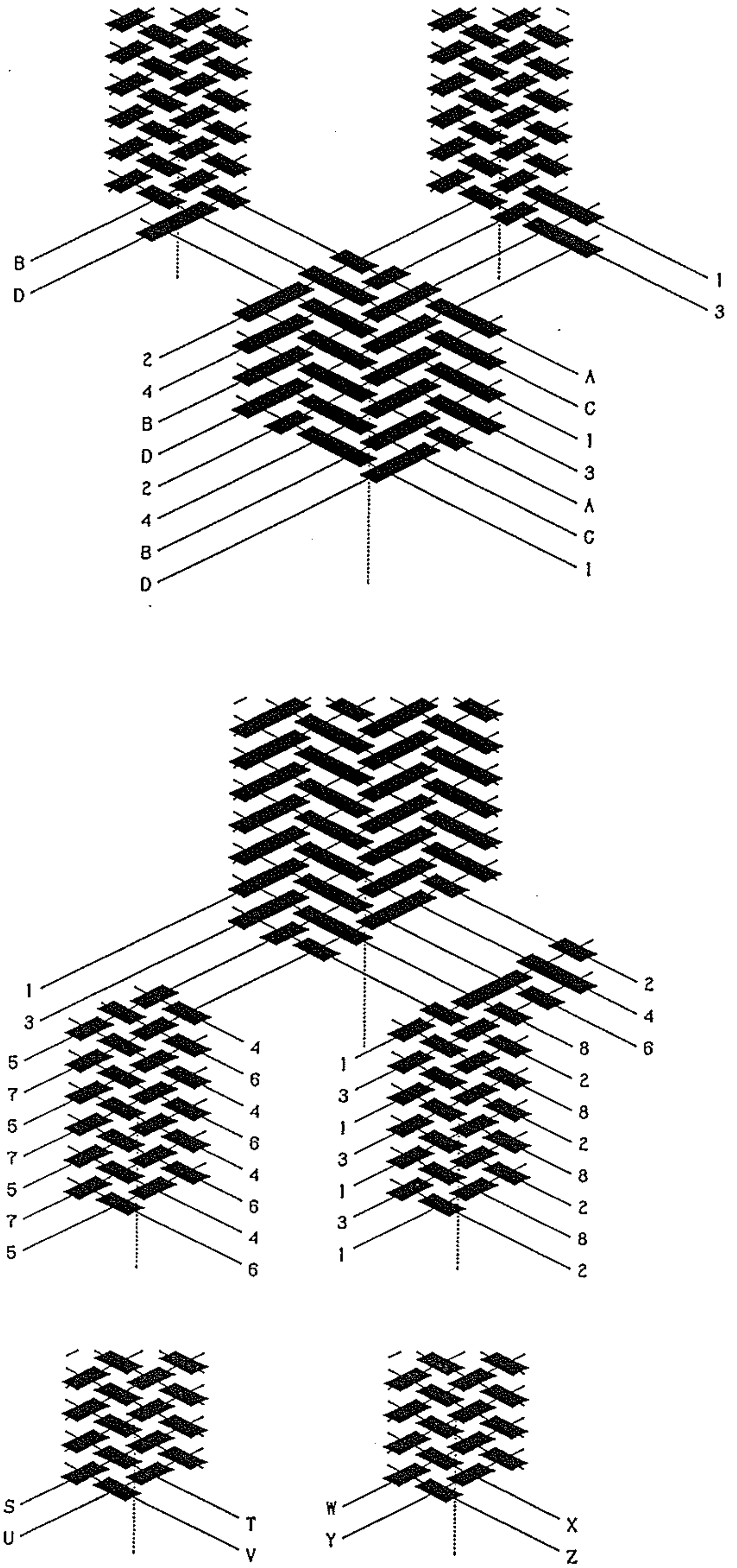


Fig. 479 — Transitions between two 4-string round braids and one 8-string round braid.

Braid the left-hand round braid of 4-strings:

Bring 8 from the left around the back to the right, then along the front from right to left under 1, over 3.

Bring 1 from the right around the back to the left, then along the front from left to right under 2, over 8.

Bring 2 from the left around the back to the right, then along the front from right to left under 3, over 1.

Bring 3 from the right around the back to the left, then along the front from left to right under 8, over 2.

And so on.

Braid the right-hand round braid of 4-strings:

Bring 4 from the left around the back to the right, then along the front from right to left under 5, over 7.

Bring 5 from the right around the back to the left, then along the front from left to right under 6, over 4.

Bring 6 from the left around the back to the right, then along the front from right to left under 7, over 5.

Bring 7 from the right around the back to the left, then along the front from left to right under 4, over 6.

And so on.

Reviews

the Century Guide to KNOTS ISBN 0 7126 0089 2 255 pages 197x136mm., hard cover, sewn and glued spine.

Authors: Mario Bigon and Guido Regazzoni.

Publisher: Century Publishing Co. Ltd., Portland House, 12/13 Greek Street, London W1V 5LE, England.

The book contains a brief description of the various rope materials and gives their recommended usage. It gives clear illustrations of how to coil a rope and how it should be hung up. The book gives excellent illustations and descriptions of four stopper knots (Overhand knot, Multiple overhand knot, Figure-eight knot, Heaving line knot), nine hitches (Half hitch, Clove hitch, Bill hitch, Cow hitch, Cat's paw, Fisherman's bend, Rolling hitch, Highwayman's hitch, Constrictor knot), eight loops (Bowline, Portuguese bowline, Spanish bowline, Jury mast knot, True-lover's knot, Three-part crown, Angler's loop, Artillery loop), four nooses (Noose, Running bowline, Hangman's knot, Tarbuck knot), three loop knots (Loop knot, Sheepshank, Knotted sheepshank), two tackles (Simple and complex tackle, Poldo tackle), nine bends (Sheet bend, Thief knot, Reef knot, Hunter's bend, Surgeon's knot, Japanese bend, Carrick bend, Water knot, Grapevine knot), twenty knots for fishermen (Seven knots for eye hooks, Five knots for flatted hooks, Barrel knot, Dropper knot, Double overhand bend, Stopper knot, Dropper loop, Loop on the bight, Two swivel hitches), twenty three decorative knots (Four-strand crown sennit, Six-strand crown sennit, Woven sennit, Turk's head, Monkey's fist, Two multi-strand lanyard knots, Two-strand diamond knot, Chinese button knot, Chain sennit, Ocean plat, Round mat, Square mat, Flat sennit, Double braid, Four types of four-strand sennits, Five-strand sennit, Six-strand sennit, Crown sennit,

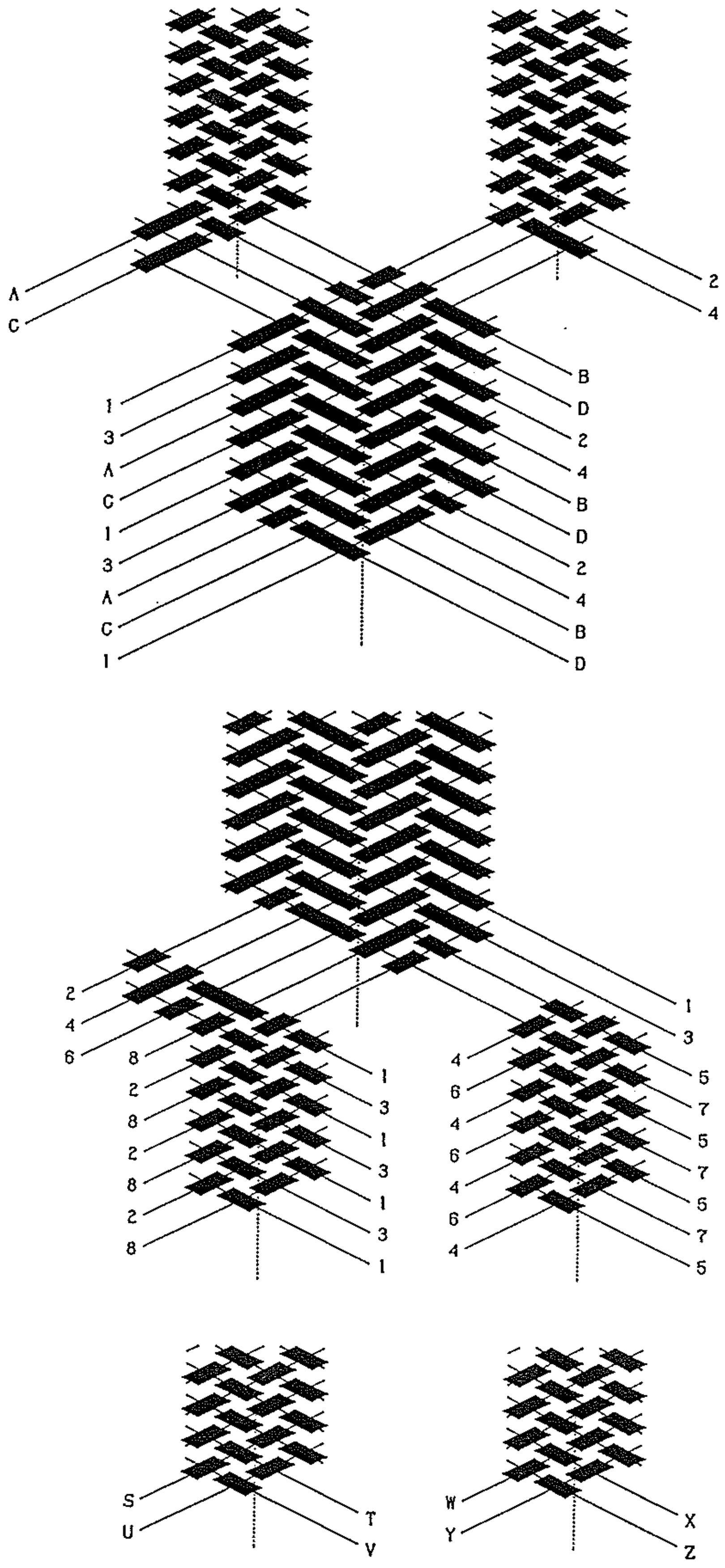


Fig. 480 — Transitions between two 4-string round braids and one 8-string round braid.

Figure-eight chain), five knot applications (Ladder, Nets, Scaffolds, Mountaineering guide knot, Safety harness).

All illustrations consist of very clear colour photographs. A good glossary is provided, as well as a listing for the uses of the knots discussed. It is one of the very best books on the knots dealt with.

A fresh approach to Knotting and Ropework ISBN 0 9592036 3 *X*
272 pages 212x135mm., soft cover, sewn and glued spine.
Author: Charles Warner.
Publisher: Charles Warner, Glenellen, Hume Highway, Yanderra, NSW 2574, Australia.

This is a rather peculiar book on knots and ropework. We find on the title-page the statement "*Knots arranged according to their structure*", and in the preface the statement "*Now, there is a logic in the construction of knots, and I have tried to follow that logic in the writing of this book*". The author has, in the whole, not only failed to arrange according to their structure several of the discussed knots, but has in general also failed to follow 'a logic' in their construction. The many illustrations are of a shoddy nature (obviously the author has little or no artistic ability, and hence should have engaged someone who has), the layout of the book is furthermore very cramped and hence most unattractive. One might also wonder what the chapter (No. 23) on "*Surveying or Practical Geometry*" has to do with knotting and ropework. The book contains virtually no information that cannot be found in very much better books (technically as well as in their layout) on knotting and ropework; nothing can be seen at a glance.

Knots ISBN 1-85348-900-*X* 80 pages 201x151mm., hard cover, sewn spine.
Author: Peter Owen.
Publisher: New Burlington Books, 6 Blundell Street, London N7 9BH, England.

This is another delightful booklet on knots. It briefly discusses rope construction and gives for the various rope materials their recommended use. All illustrations are exceptionably well done, and for each knot its use can be seen at a glance. A very useful feature is that alternative knot names are given immediately below the heading of each knot. There are described six stopper knots (Overhand knot, Overhand loop, Multiple overhand knot, Heaving line knot, Figure-of-eight knot, Figure-of-eight chain), fourteen hitches (Highwayman's hitch, Half hitch, Transom knot, Constrictor knot, Cow hitch, Timber hitch, Clove hitch, Fishermen's bend, Cat's paw, Bill hitch, Rolling hitch, Round turn and two half hitches, Prussic knot, Italian hitch), five loops (Figure-of-eight loop, Threaded figure-of-eight, bowline, Spanish bowline, Angler's loop), ten bends (Reef knot, Capsized reef knot, Thief knot, Surgeon's knot, Fisherman's knot, Double fisherman's knot, Hunter's bend, Sheet bend, Figure-of-eight bend, Carrick bend), three running knots (Running bowline, Hangman's knot, Noose), two shortenings (Sheepshank, Loop knot), nine fishing knots (Blood knot, Blood loop dropper knot, Half-tucked blood knot, Turle knot, Water knot, Grinner knot, Double grinner knot, Double loop knot, Needle knot).

A good glossary is provided. It is one of the very best booklets on the knots dealt with.