THE BRAIDER

No.53 FEBRUARY 2008.

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A quarterly publication
for
the braiding artisan

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Novice versus Craftsman in the Braiding World

To become a craftsman one has to start at the beginning, hence at the novice level. There is however no guarantee that a novice will become a craftsman. In fact very, very few will ever make it to craftsman level, most will stay at the lowest end of the novice level — the copycat level. In order to gradually progress to craftsman level, the novice must have patience and the real desire to fully understand technical properties of braids. Many might initially have great difficulty in understanding at least some of the technical aspects of braids, but a genuine desire to succeed will eventually overcome this. Everybody first learned to crawl before he/she could walk and first learned to walk before he/she could run. Those who in braiding want to run before they can even crawl will, of course, never reach craftsman level. The *typical braider* is a braider who got stuck at a low novice level; to this category belong most if not all those who advertise themselves as expert braiders who make *Collectable Braided articles.* It should be remembered that there is a great deal more to braiding than being able to cut a nice even and properly bevelled rawhide string for example, which is nothing more than one facet only of good workmanship rather than having anything to do with craftsmanship.

In the previous issue of *The Braider* we discussed the story of a copied knot. We discussed there some items which clearly indicated that the braider concerned got stuck at the novice level. This was subsequently confirmed by not understanding why we had placed the Standing Ends of the six strings of his foundation knot temporarily on right bight-boundary 3.† Even a novice soon realises that in good practice the position of the starting point or starting points depends in general on the shape and the coding of the knot in question and hence it would have been obvious why the Standing Ends should temporarely be placed on a right bight-boundary and preferably on right bight-boundary 3 (both considerations are associated with working the string-ends away).

Technical ability is an essential part of craftsmanship. Because of their ignorance it are only the simpletons who think that technical ability and craftsmanship are quite unrelated. It is, however, essential that in order to become a craftsman, a novice must have a genuine desire to master the technical aspects of braiding. Of course, a **desire** to master does not mean to master, in fact none of us might ever be able to master all the technical aspects of braiding since there is still a very great deal indeed to be uncovered. Consequently even the very best craftsman keeps learning and hence any self-proclaimed expert is only an exspurt (ex = has been; spurt = a drip under pressure).

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† As mentioned on pg. 1241, the braider concerned eventually drew the grid-diagram of his foundation knot ($A = 3$, $B^* = 6$, $l_h = 13$, $r_h = 14$, $x = 26$, $k = 2$, $y = A - 1 = 2$). In this grid-diagram he placed the Standing Ends of the six strings of his foundation knot on left bight-boundary 2. We wrote to him that it would be much better to place them temporarely on right bight-boundary 3. He wrote in reply: *I can not come up for any reason that I can think of, for your suggestion that the standing ends be placed on the right. We of course read from left to right here in the U.S. and I start all my knots from left to right so what is the logic behind placing the starting ends on the right?* If reading from left to right compels one to braid from left to right, one would not be able to progress beyond the first half-cycle since by starting from left to right requires all even numbered half-cycles to be braided from right to left unless the braid gets turned through 180° after the completion of every half-cycle.

A Braiding Project — Key-hanger No. 5

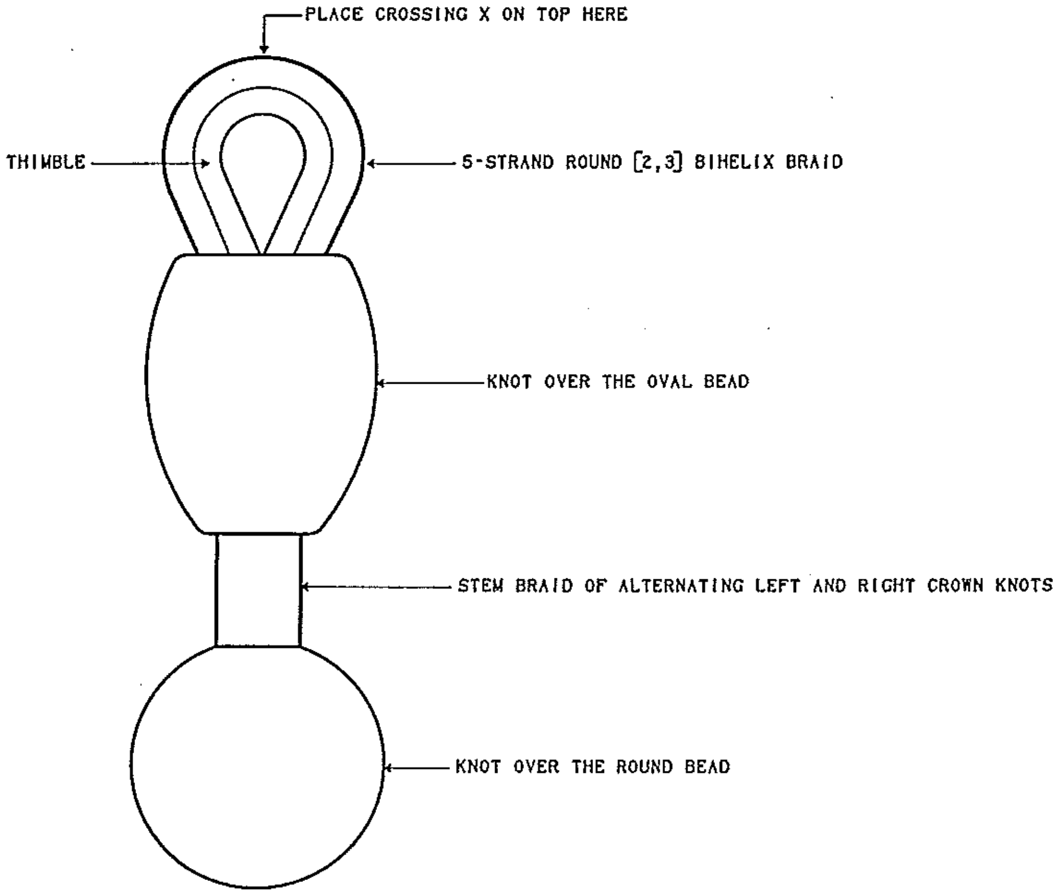

Fig. 977 — Key-hanger No. 5. Cord diameter 2 mm.

The braid forming the eye around the thimble of 25 mm. is a 5-cord [2, 3] Round Bihelix Braid made at the centre of the cord lengths (the two red and the two yellow cords are each approximately 60 cm. in length, the blue cord is approximately 30 cm. in length) as shown in Fig. 979 (the colour scheme for the cords is indicated in Fig. 978).

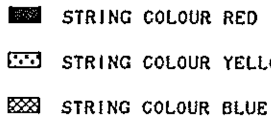

Fig. 978 — Colour scheme for the strings.

After this Round Bihelix Braid has been given an anti-clockwise twist of 11.31°[†] (see the bottom right-most grid-diagram in Fig. 979) we place the flattish side of this braid (the two adjacent left-hand columns in the bottom right-most grid-diagram in Fig. 978) in the bottom of the thimble-channel and ensure that crossing X is positioned as indicated in Fig. 977. The braid is put tightly around the thimble and both its 'ends' are secured by a Double Constrictor Knot[‡] immediately below the thimble. The four red and the four yellow cord 'ends' are used for the braid of the stem while for its core the two blue cord 'ends' are used.

† Refer to *The Braider*, Issue No. 47, pg. 1114.

‡ See *The Braider*, Issue No. 47, pg. 1100, Fig. 845.

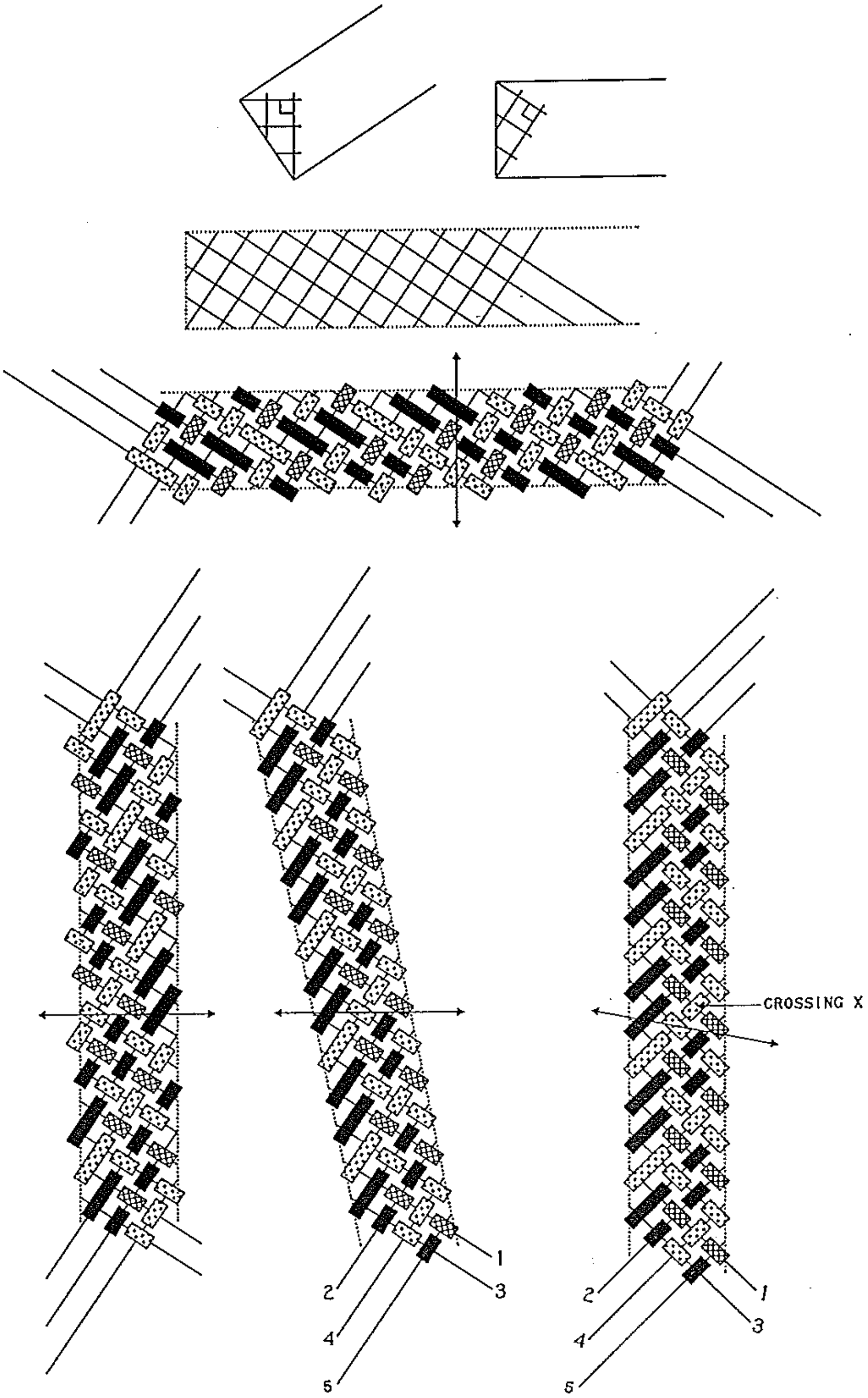

Fig. 979 — The 5-string Round Bihelix Braid with $[n_l, n_r] = [2, 3]$.

The braid of the stem begins immediately below the Double Constrictor Knot and consists of a sequence of Crown Knots, one on top the other as shown in Figs. 980 and 981. The indicated colour scheme for the strings gives the braid of the stem four columns of alternate coloured V's pointing away from the thimble.

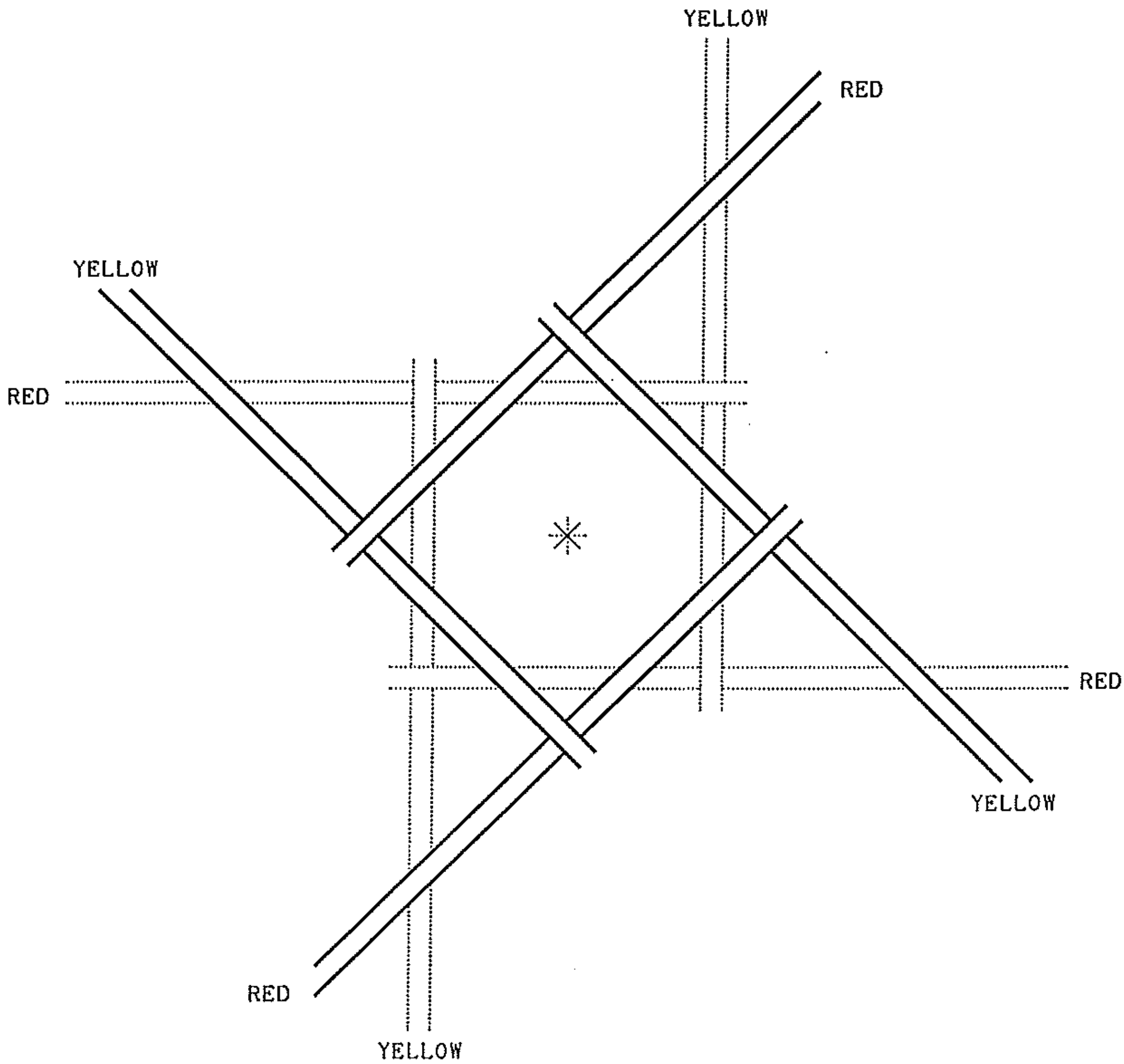

Fig. 980 — The position of two successive Crown Knots.

Fig. 981 shows the successive braiding of the odd and even numbered Crown Knots. When the final stem-length has been reached (final stem-length approximately 75 mm.) and the braid is nice and tight, tie off with a Double Constrictor Knot and melt the string-ends together.

The dimensions of the oval bead over the stem-braid are: meridional diameter is 19 mm., internal diameter after enlarging the hole is 11.5 mm. (that is 0.5 mm. less than the diameter of the stem-braid), length after enlarging the hole is 23 mm.. A small hole of 2 mm. diameter is drilled along the meridional diameter of the oval bead. The oval bead is then pushed over the stem-braid firmly against the thimble and fixed to the stem with a brass nail through this hole. Next the ends of the brass nail are made flush with the surface of the oval bead and the bead painted red since this is the main clour of the knot which will be placed over it.

$(11/22/11)\{1_1 2_3 3_2/3_1 2_2 1_3\}15$ is the string-run specification of the knot over the oval bead with its left bight-edge towards the thimble. It is an interbraid of three under-over coded Regular Knots, each with $p/b = 8/5$. Although their string-runs are identical, the knots are not identical; two have the identical under-over coding and one, the foundation knot, has their complementary under-over coding (see Fig. 982). We shall braid the odd-numbered half-cycles in each of these three components from upper-right to lower-left and the even-numbered half-cycles from upper-left to lower-right. We first braid the half-cycles 1-10 (the foundation knot; red cord 2 mm. diameter), next the half-cycles 1′-10′ (red cord 2 mm. diameter), and then the half-cycles 1″-10″ (yellow cord 2 mm. diameter. Finally we work the string-ends away.

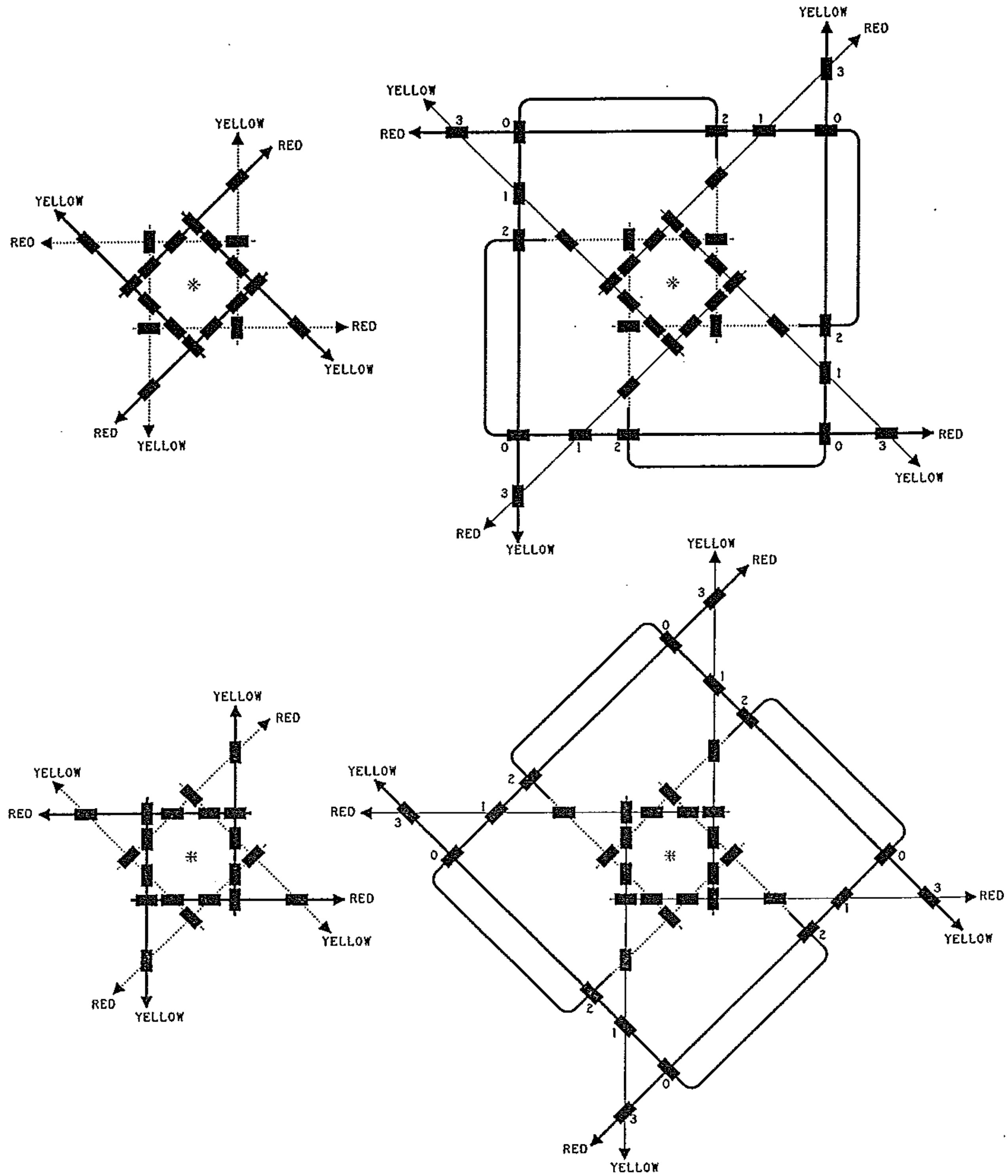

Fig. 981 — Successive braiding stages of the odd and even numbered Crown Knots.

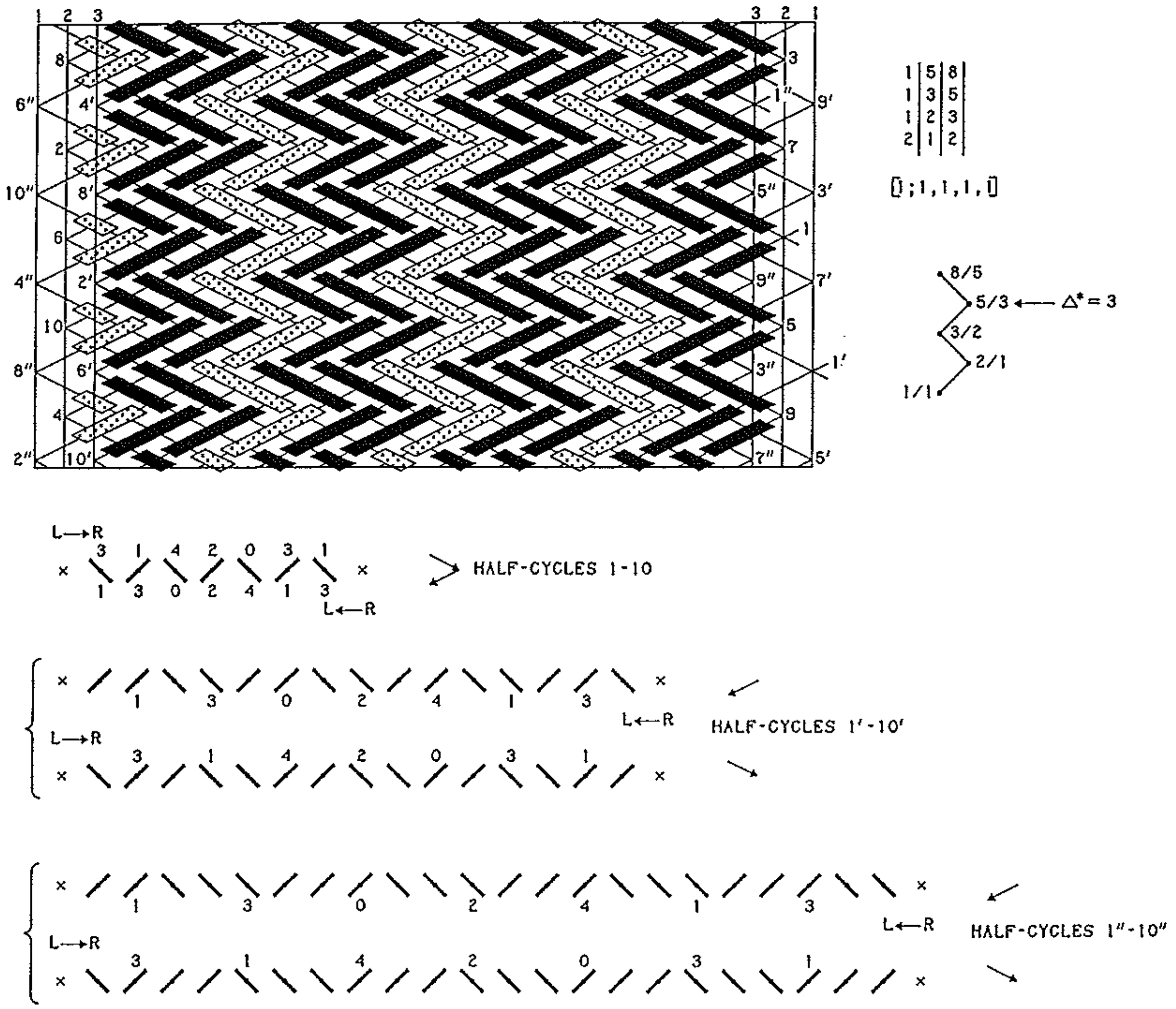

Fig. 982 — The knot over the oval bead.

From the algorithm diagrams in Fig. 982 of the respective components we read the following half-cycle braiding algorithms:

half-cycle 1 :		$R_2 \longrightarrow L_2$:	Free run.
half-cycle 2 :	$i = 0$;	$L_2 \longrightarrow R_2$:	$(s)o$.
half-cycle 3 :	$i = 0$;	$R_2 \longrightarrow L_2$:	u .
half-cycle 4 :	$i \leq 1$;	$L_2 \longrightarrow R_2$:	$(s)u - (1,s)2o$.
half-cycle 5 :	$i \leq 1$;	$R_2 \longrightarrow L_2$:	$o - 2u$.
half-cycle 6 :	$i \leq 2$;	$L_2 \longrightarrow R_2$:	$(1,s)2u - 2o$.
half-cycle 7 :	$i \leq 2$;	$R_2 \longrightarrow L_2$:	$2o - 2u$.
half-cycle 8 :	$i \leq 3$;	$L_2 \longrightarrow R_2$:	$(s)o - 2u - o - (s)u - o$.
half-cycle 9 :	$i \leq 3$;	$R_2 \longrightarrow L_2$:	$u - 2o - u - o - u$.
half-cycle 10 :	$i \leq 4$;	$L_2 \longrightarrow R_2$:	$o - u - (s)o - u - o - u - o$.

half-cycle 1′ :		$R_1 \longrightarrow L_3$:	$u - o - u - o - u - o - u - o$.
half-cycle 2′ :	$i = 0$;	$L_3 \longrightarrow R_1$:	$o - u - o - u - o - (s,1)2u - o - u$.
half-cycle 3′ :	$i = 0$;	$R_1 \longrightarrow L_3$:	$u - o - u - o - u - 2o - u - o$.
half-cycle 4′ :	$i \leq 1$;	$L_3 \longrightarrow R_1$:	$o - u - (s,1)2o - u - o - 2u - o - (s,1)2u$.
half-cycle 5′ :	$i \leq 1$;	$R_1 \longrightarrow L_3$:	$u - o - 2u - o - u - 2o - u - 2o$.
half-cycle 6′ :	$i \leq 2$;	$L_3 \longrightarrow R_1$:	$o - u - 2o - u - (s,1)2o - 2u - o - 2u$.

half-cycle $7'$:	$i \leq 2$;	$R_1 \longrightarrow L_3$:	$u - o - 2u - o - 2u - 2o - u - 2o$.
half-cycle $8'$:	$i \leq 3$;	$L_3 \longrightarrow R_1$:	$o - (s,1)2u - 2o - u - 2o - 2u - (s,1)2o - 2u$.
half-cycle $9'$:	$i \leq 3$;	$R_1 \longrightarrow L_3$:	$u - 2o - 2u - o - 2u - 2o - 2u - 2o$.
half-cycle $10'$:	$i \leq 4$;	$L_3 \longrightarrow R_1$:	$o - 2u - 2o - (s,1)2u - 2o - 2u - 2o - 2u$.

half-cycle $1''$:		$R_3 \longrightarrow L_1$:	$2u - 2o - 2u - 2o - 2u - 2o - 2u - o$.
half-cycle $2''$:	$i = 0$;	$L_1 \longrightarrow R_3$:	$o - 2u - 2o - 2u - 2o - (s,2)3u - 2o - 2u$.
half-cycle $3''$:	$i = 0$;	$R_3 \longrightarrow L_1$:	$2u - 2o - 2u - 2o - 2u - 3o - 2u - o$.
half-cycle $4''$:	$i \leq 1$;	$L_1 \longrightarrow R_3$:	$o - 2u - (s,2)3o - 2u - 2o - 3u - 2o - (s,2)3u$.
half-cycle $5''$:	$i \leq 1$;	$R_3 \longrightarrow L_1$:	$2u - 2o - 3u - 2o - 2u - 3o - 2u - 2o$.
half-cycle $6''$:	$i \leq 2$;	$L_1 \longrightarrow R_3$:	$o - 2u - 3o - 2u - (s,2)3o - 3u - 2o - 3u$.
half-cycle $7''$:	$i \leq 2$;	$R_3 \longrightarrow L_1$:	$2u - 2o - 3u - 2o - 3u - 3o - 2u - 2o$.
half-cycle $8''$:	$i \leq 3$;	$L_1 \longrightarrow R_3$:	$o - (s,2)3u - 3o - 2u - 3o - 3u - (s,2)3o - 3u$.
half-cycle $9''$:	$i \leq 3$;	$R_3 \longrightarrow L_1$:	$2u - 3o - 3u - 2o - 3u - 3o - 3u - 2o$.
half-cycle $10''$:	$i \leq 4$;	$L_1 \longrightarrow R_3$:	$o - 3u - 3o - (s,2)3u - 3o - 3u - 3o - 3u$.

The string-ends are worked away by twisting the string-ends tight under tension followed by cutting the exposed ends off. This will cause the string-ends to retract under the braid.

A round bead with a diameter of 24 mm. is placed at the end of the stem in a similar way as was done for the key-hangers No. 2, No. 3 and No. 4. With a few layers of tape we can accentuate the desired shape after which we give it the main colour of the knot over it (in this case blue). The knot over this round bead is as described in *The Braider*, Issue No. 51, pp. 1197-1206. The colour of the cord of the foundation knot is blue (cord diameter 2 mm.) and the colour of the cord of the interbraided knot is yellow (cord diameter 2 mm.).

THE BRAIDER'S NOTEBOOK

On pp. 278-179 in the *Encyclopedia of Rawhide and Leather Braiding* by Bruce Grant we find described the construction of a *Round Button of Four Thongs*. As described there, its grid-diagram is as depicted by uppermost right-hand grid-diagram in Fig. 983 (the lowermost right-hand grid-diagram in Fig. 983 depicts its complementary form). This Button Knot is the *Boton Redondo* before Fig. Nº 77, pg. 74 in the book *Trenzas Gauchas* by Mario A. Lopez Osornio, and as such is a very unsatisfactory Button Knot since the string-ends are only very loosly held inside the knot. By further laying down the half-cycles 5 in the uppermost (and lowermost) right-hand grid-diagram in Fig. 984, while ensuring that the ends of the half-cycles 4 and the beginnings of the half-cycles 5 extend well past the left bight-edge, we arrive at the *Boton Redondo* (and its complementary form) before the final adjustment. Then, while leaving these extended half-cycle ends, remove all further slack in the Button Knot (the top of the initial Crown Knot depicted in the upper and lower left-most diagrams in Fig. 984 remains just exposed) and only after that has been done remove the extended half-cycle ends of the half-cycles 4 and 5 by pulling the ends of half-cycles 5 tight; thus causing the Wall Knot, formed by laying down the half-cycles 5, to slide under the braid below the initial Crown Knot. Finally the projecting string-ends of the half-cycles 5 above the initial Crown Knot are cut off.

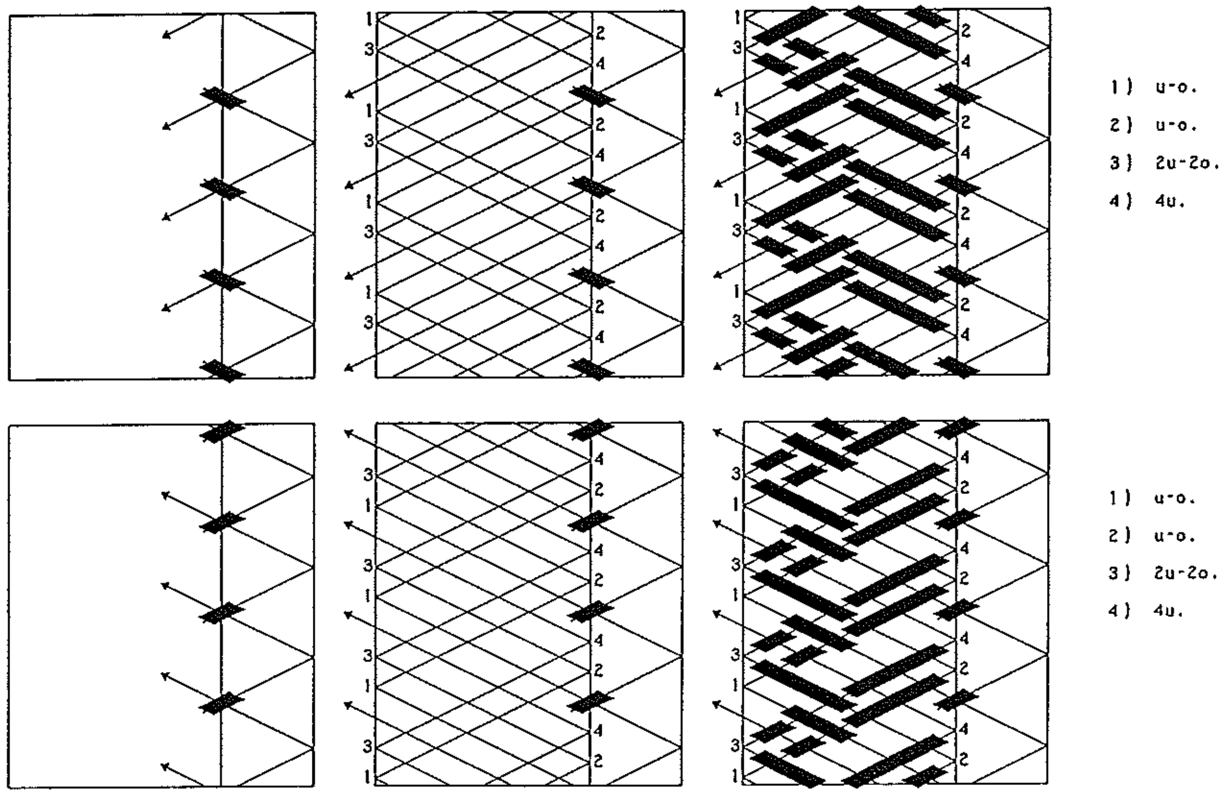

Fig. 983 — The Round Button of Four Thongs as described in the *Encyclopedia of Rawhide and Leather Braiding* by Bruce Grant.

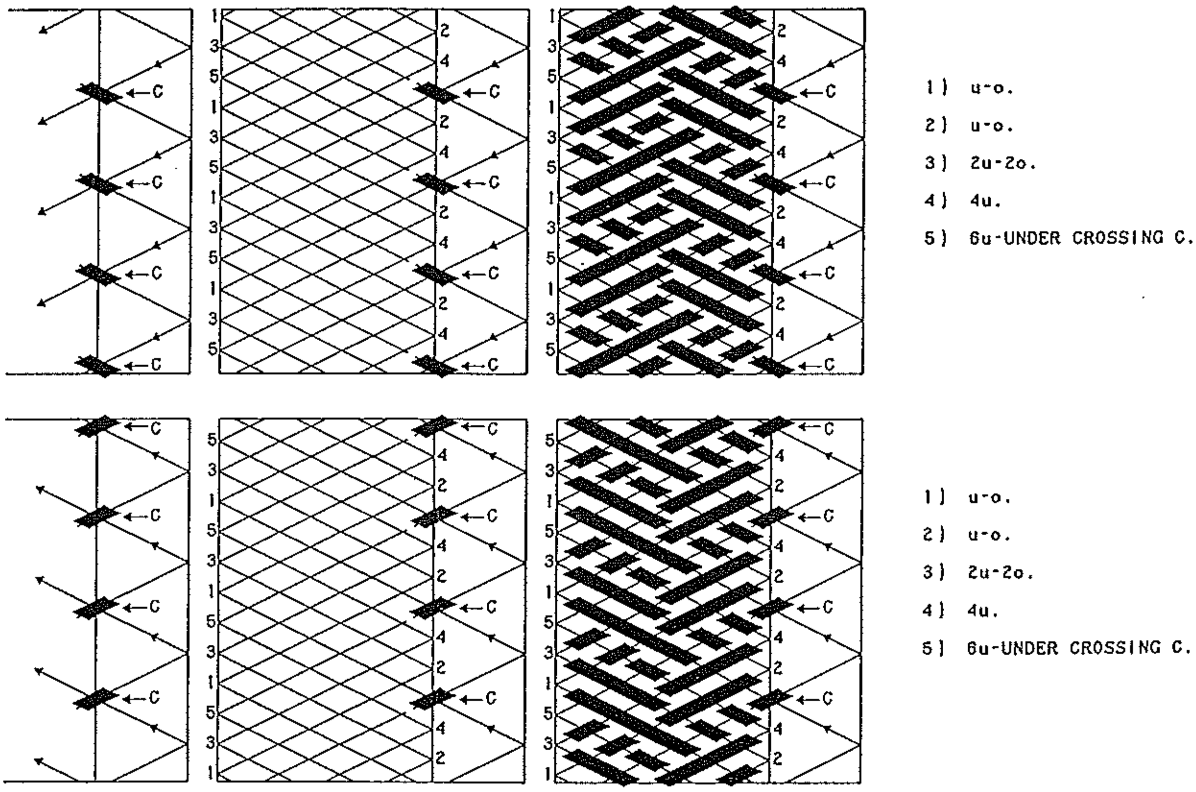

Fig. 984 — The Boton Redondo.

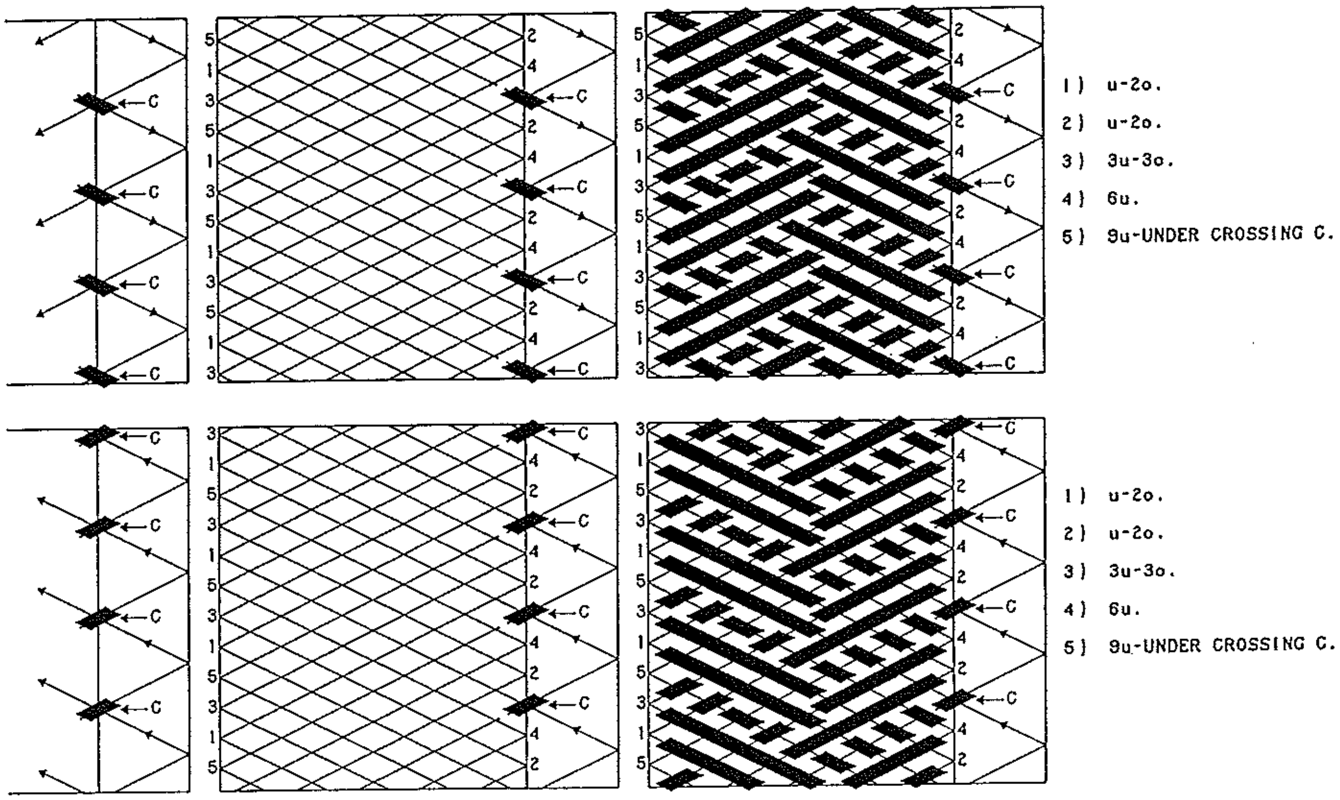

Fig. 985 — The Boton Redondo of Four Thongs with a 3-pass Spanish Ring Knot braid below the initial Crown Knot.

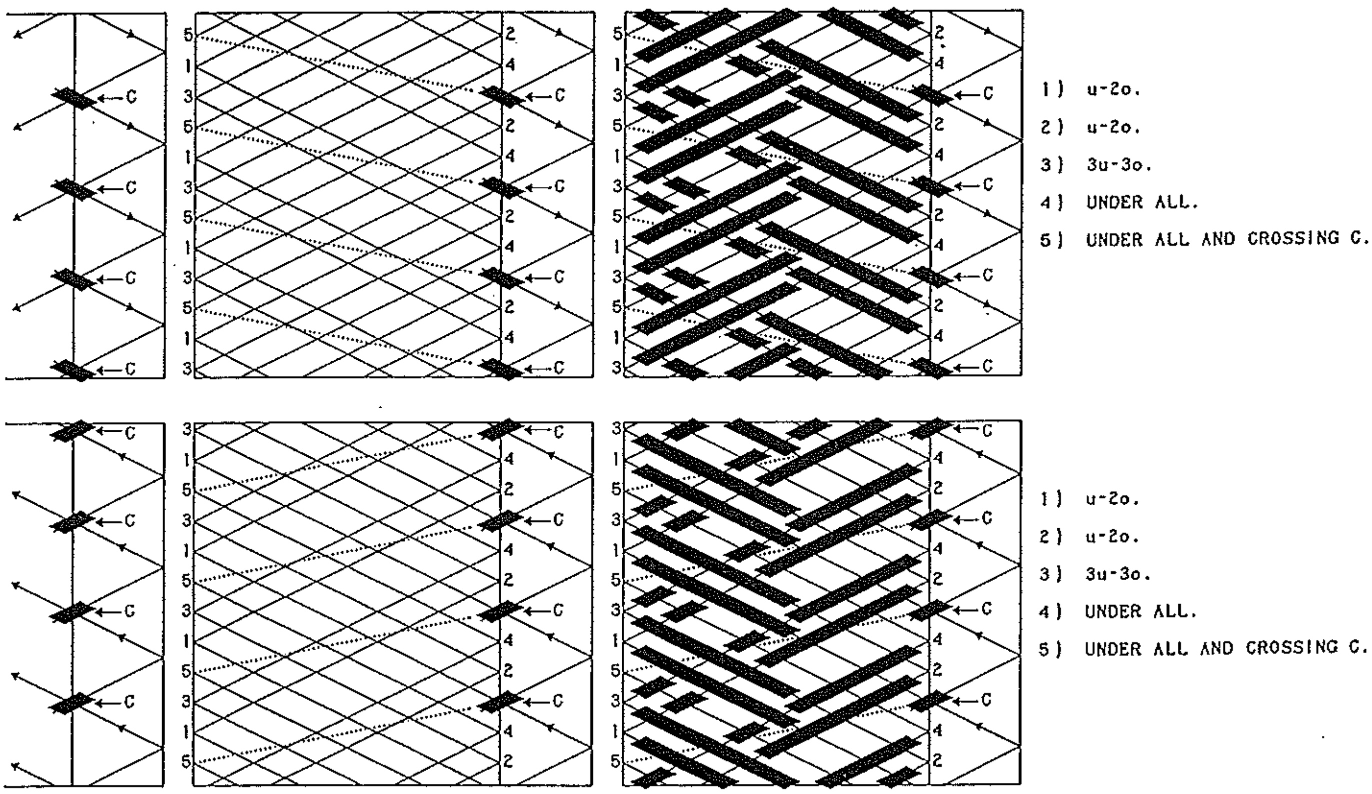

Fig. 986 — A modification of the path of half-cycles 5.

In contrast to the *Round Button of Four Thongs* in the *Encyclopedia of Rawhide and Leather Braiding* by Bruce Grant, the string-ends in the completed Boton Redondo are very tightly locked inside the knot. The braid below the initial Crown Knot is a 2-pass Spanish Ring Knot braid. A bigger and more substantial Button Knot is obtained by having a 3-pass Spanish Ring Knot braid below the initial Crown Knot. Braiding such a Button Knot as depicted in Fig.985 makes the removal of the extended half-cycle ends of the half-cycles 4 and 5, by pulling the ends of half-cycles 5 tight, a little more difficult but applying a little lubrication will aid this process. Alternatively we can modify the path of the half-cycles 5 as depicted in Fig. 986.

The Spanish Ring Knot braid under the Crown Knot has eight bights in the above discussed Button Knots. Such Button Knots can suitably be employed at the end of four string Round Braids. A similar Button Knot from six strings would have under the Crown Knot a Spanish Ring Knot with twelve bights, but would in general not be compatible with a six string Round Braid. For a six string Round Braid proper compatibility would in general be achieved when the Ring Knot has nine bights. Since a six string Round braid has three strings with a left helix and three with a right helix we can use one of these sets for a foundation knot over the six string Round Braid and under the Ring Knot braid. In Fig. 987 the six string Round Braid ends with the three left helix strings outermost and the three right helix strings innermost (left-hand diagram). With the three left helix strings we braid the foundation knot over the six string Round Braid, starting with crowning these strings to the left (turn six string Round Braid upside down, see right-hand diagram). The three right helix strings (which are innermost) we crown to the right. The string-ends of the left helix strings are fed through the eye of the left Crown Knot followed by feeding them through the eye of the right Crown Knot.

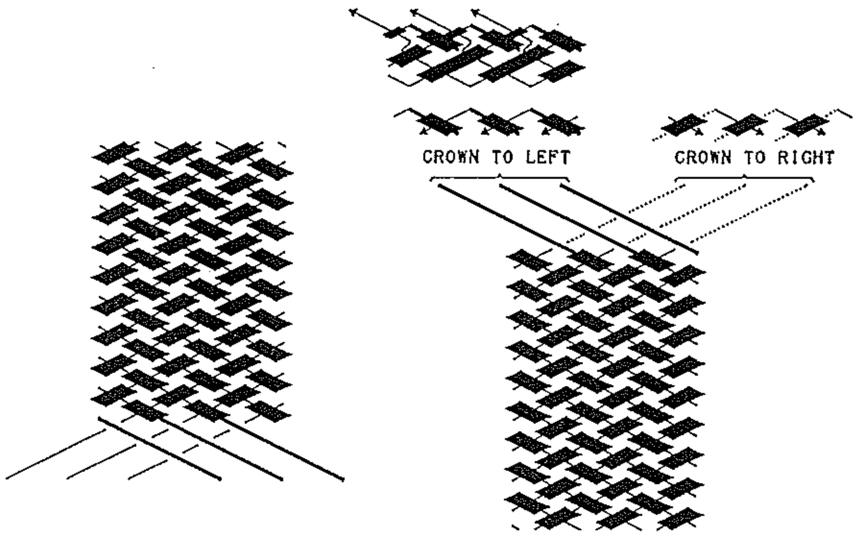

Fig. 987 — Six string Round Braid with foundation knot.

Over the foundation knot we braid the actual Button Knot with its upper end being the right Crown Knot (see the upper three diagrams in Fig. 988). Ensure that the ends of the half-cycles 6 and the beginnings of the half-cycles 7 extend well past the left bight-edge, before the final adjustment takes place. Then, while leaving these extended half-cycle ends, remove all further slack in the Button Knot (the top of the initial right Crown Knot depicted in the uppermost left-hand diagram in Fig. 988 remains just exposed) and only after that has been done remove the extended half-cycle ends of the half-cycles 6 and 7 by pulling the ends of half-cycles 7 tight; thus causing the Wall Knot, formed by laying down the half-cycles 7, to slide under the 'Ring Knot' braid below the initial right Crown Knot. Finally all the projecting string-ends above the initial right Crown Knot are cut off. Note that the 'Ring Knot' braid is not a true Spanish Ring Knot since it has a 4/5-pass.

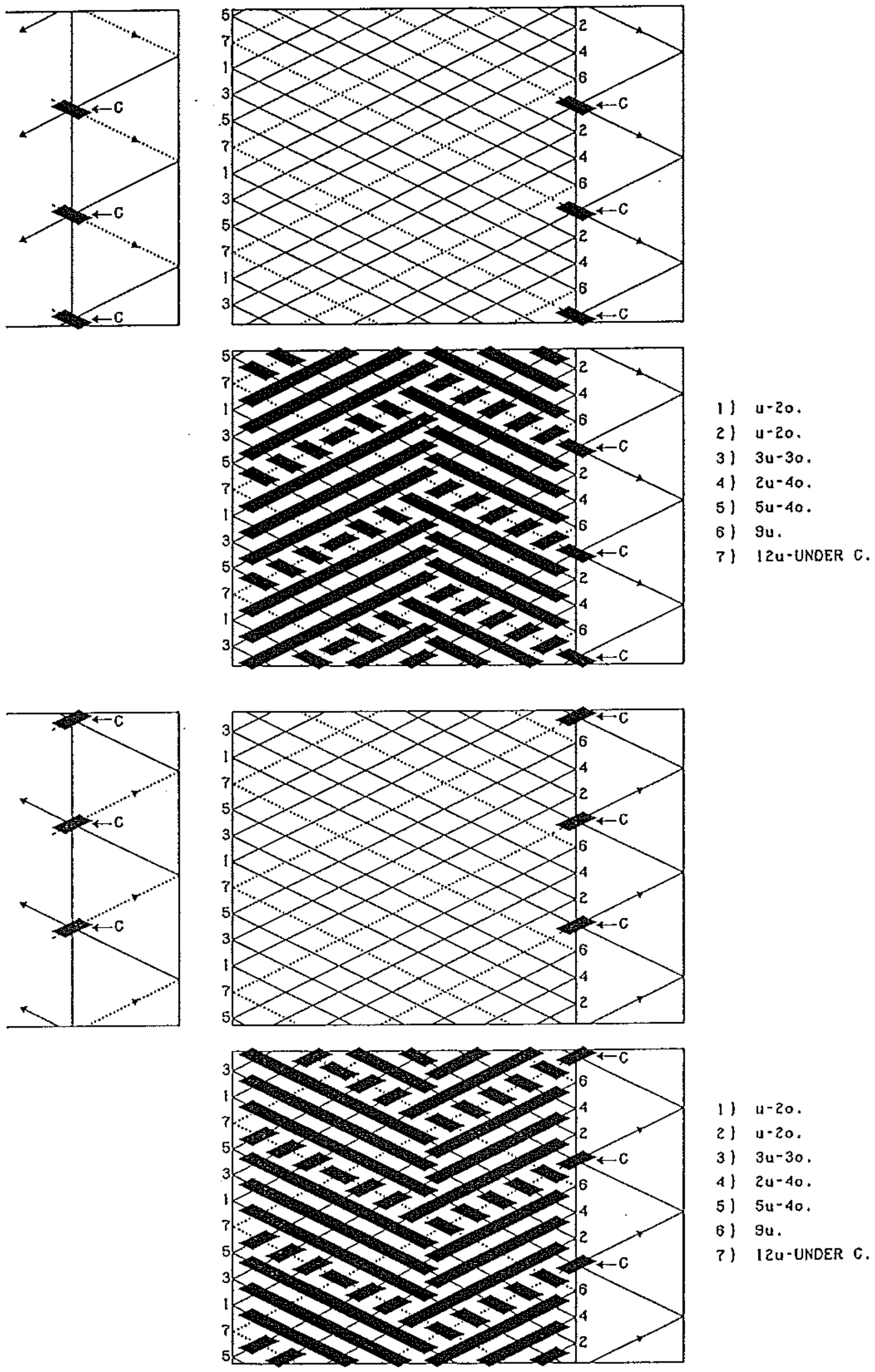

Fig. 988 — The Button Knot over the foundation knot.

The complementary form of this Button Knot is depicted by the lower three diagrams in Fig. 988, while its associated foundation knot over the six string Round Braid is depicted in Fig. 989.

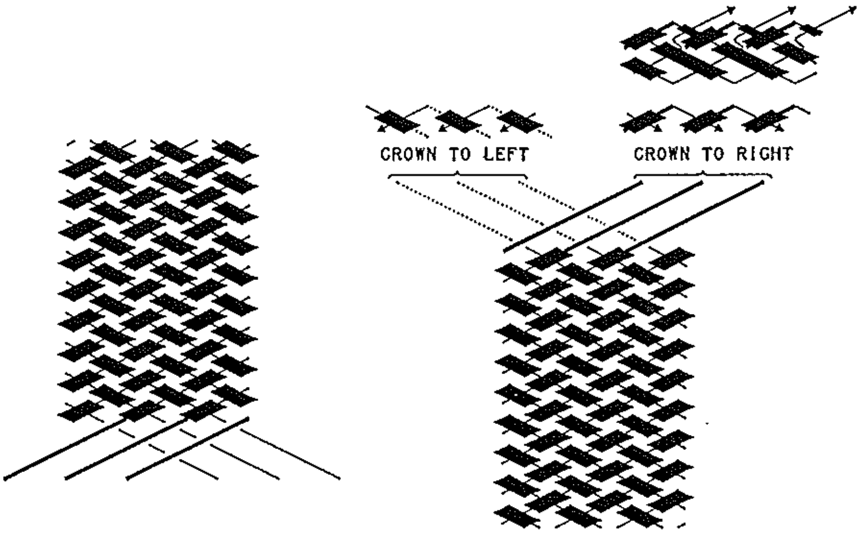

Fig. 989 — Six string Round Braid with foundation knot.

Interbraided Cylindrical Braids

Let in a Cylindrical Braid the values of the left-helix angle and the right-helix angle of the string-run be the same and let the angle α of the string-run be defined as $(90° - \textit{helix angle})$.

The helix angle depends on the number of bights. Refer to *The Braider*, Issue No. 52, pg. 1227 $\longrightarrow b = \frac{C_s \cdot \sin\alpha}{w}$. In theory w is the width or diameter of the string but, depending on the compressibility of the string, in practice $b \cdot w$ is a little more than the theoretical value of $b \cdot w$. In theory C_s is $\pi \cdot (D + 2w)$, where D is the diameter of the cylinder over which the knot is placed but, depending on the compressibility of the string, in practice C_s is a little less than the theoretical value of $\pi \cdot (D + 2w)$. Hence in theory $\alpha = \arcsin\left(\frac{b \cdot w}{C_s}\right) = \arcsin\left(\frac{b \cdot w}{\pi \cdot (D+2w)}\right)$ but in practice α is a little more than $\arcsin\left(\frac{b \cdot w}{\pi \cdot (D+2w)}\right)$. The helix angle of a half-cycle is equal to $90° - \alpha$ and hence in practice the helix angle of a half-cycle is a little less than $90° - \arcsin\left(\frac{b \cdot w}{\pi \cdot (D+2w)}\right)$.

Fig. 990 depicts a small section of the string-run of a Regular Knot with b bights which is interbraided with $(n-1)$ strings between adjacent bights. An intersection-column contains $n \cdot b$ intersection points. Let the braid be made of round string with diameter d over a diameter D at the column concerned. Then:

$$\pi(D + 2d) = \frac{n \cdot b \cdot d}{\sin\alpha}.$$

Hence when n increases to $(n+1)$, while the helix angle (and hence the angle α) of the string-run remains the same, the diameter D at this column is increased by:

$$\frac{b \cdot d}{\pi \cdot \sin\alpha}.$$

When n increases to $(n+1)$, while the diameter D remains the same, the angle α of the string-run at this intersection-column is increased by:

$$\arcsin \frac{(n+1) \cdot b \cdot d}{\pi(D+2d)} - \arcsin \frac{n \cdot b \cdot d}{\pi(D+2d)} \dagger,$$

while the helix angle is decreased by the same amount.

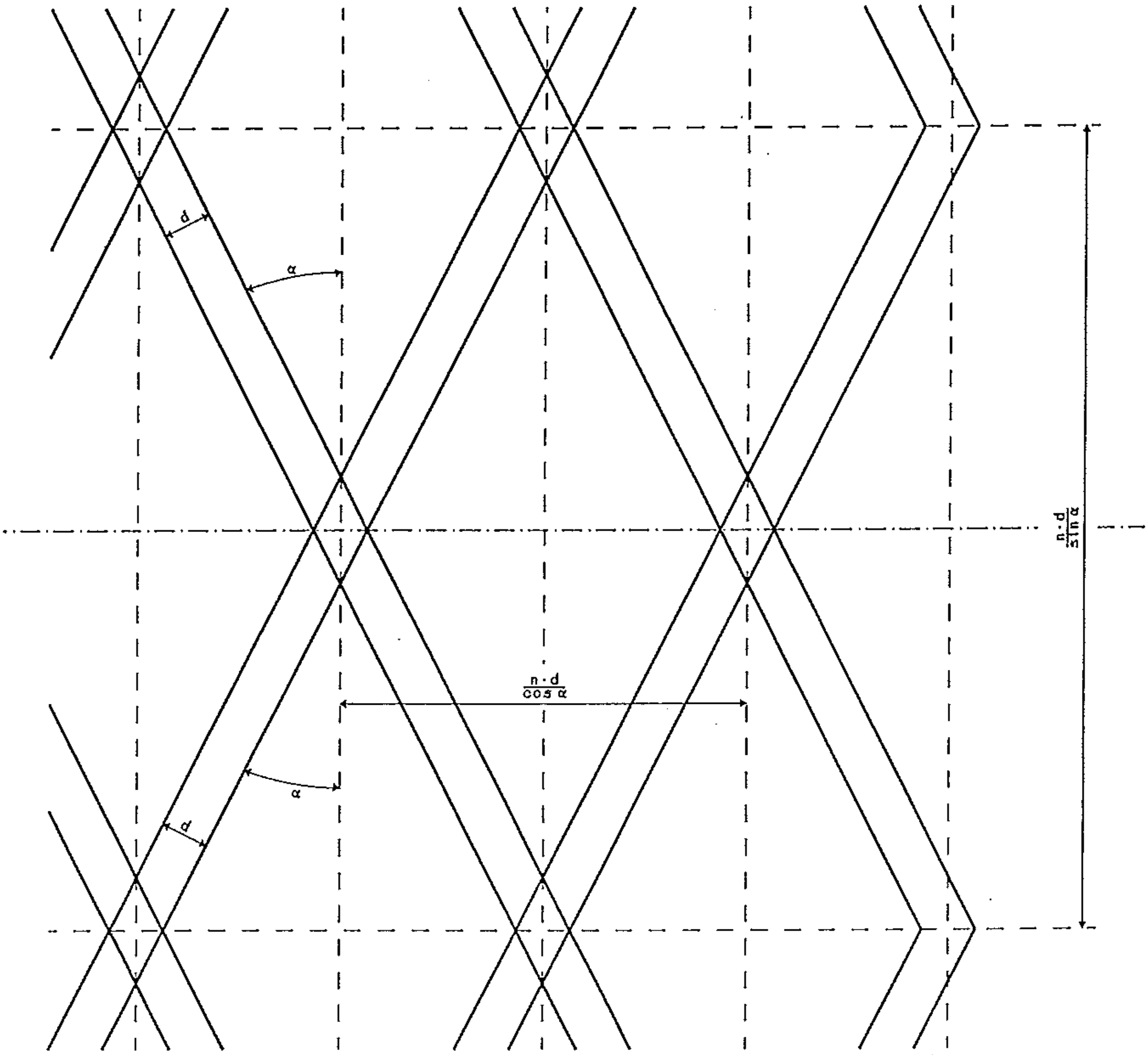

Fig. 990 — A Regular Knot with b bights interbraided with $(n-1)$ strings between adjacent bights.

Example 1.

The foundation knot is a Regular Knot with $p/b = 19/13$. It is interbraided with two Regular Knots, each with $p/b = 6/13$, as shown in Fig. 991. The string diameter of all strings is $d = 2.0$ mm. and the foundation knot is braided over a diameter $D = 24$ mm..

The interbraided knot contains five intersection-column sections, three sections in which each intersection-column contains 13 intersection points (intersection-columns 1,

† arcsin x (also written as $\sin^{-1} x$) is the *arc* of which the *sine* is equal to x.

13-18, 30 from the left) and two sections in which each intersection-column contains 26 intersection points (intersection-columns 2-12, 19-29 from the left).

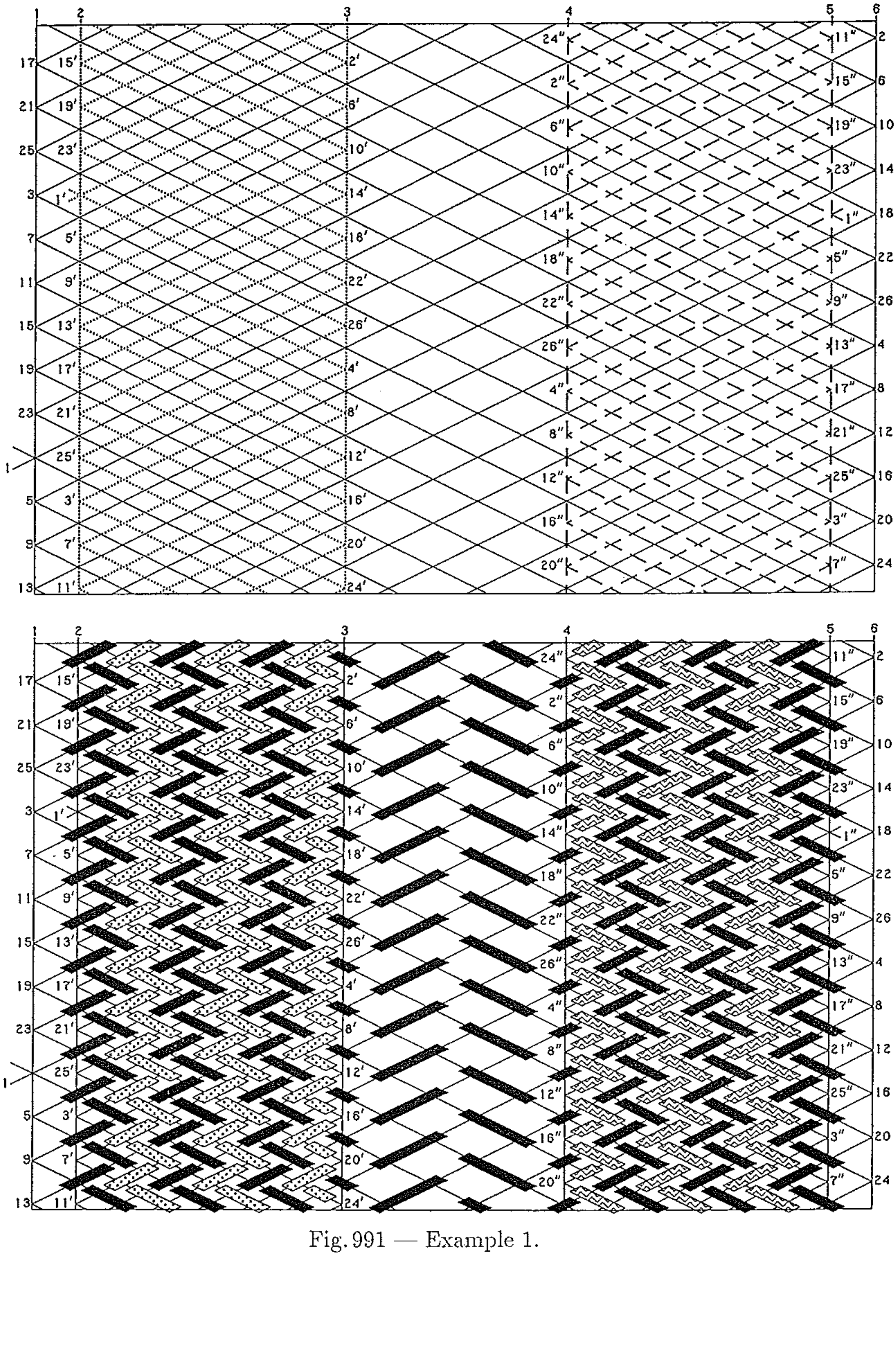

Fig. 991 — Example 1.

The helix angle of the string-run at the intersection-columns with 13 intersection points each is thus:

$$90° - \arcsin \frac{13 \times 2.0}{\pi(24 + 2.0)} = 90° - 18.56° = 71.44° .$$

When the diameter under the braid at the intersection-columns with 26 intersection points each is also 24 mm., then the helix angle of the string-run at these intersection-columns will be:

$$90° - \arcsin \frac{26 \times 2.0}{\pi(24 + 2.0)} = 90° - 39.54° = 50.46° .$$

The intersection columns 2-12 inclusive from the left have each 26 crossing points, hence with the helix angle of 71.44°, the diameter under this section of braid should be:

$$D = \frac{26 \times 2.0}{\pi \times \sin(90° - 71.44°)} - (2 \times 2.0) = 48.0\,\text{mm.},$$

Such a rapid diameter change from 24 mm. to 48 mm. is of course not acceptable.

Note that the bights on bight-boundary 3 and the bights on bight-boundary 4 lie on top of the braid (see Fig. 992) and hence are able to cover at these bight-boundaries the gaps (to the right of bight-boundary 3 and to the left of bight-boundary 4) between the strings of the foundation knot associated with the helix angle change from 50.46° to 71.44°.

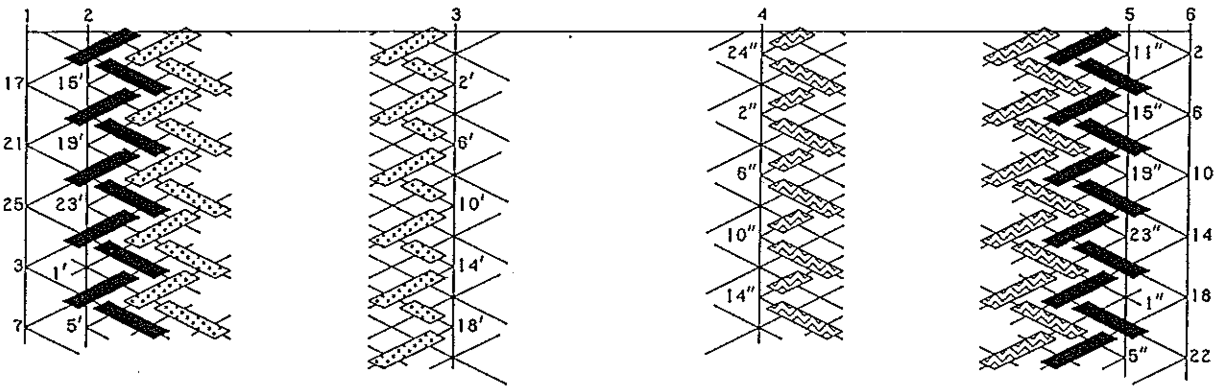

Fig. 992 — The string-runs near the bight-boundaries.

The bights on bight-boundary 2 and the bights on bight-boundary 5 lie under the braid, but since there are no further intersection columns to the left of bight-boundary 2, respectively to the right of bight-boundary 5, the gaps between the strings of the foundation knot, associated with the helix angle change from 50.46° to 71.44°, are covered by the bights on the respective bight-boundaries 1 and 6 (see Fig. 992).

The foundation knot (between bight-boundaries 1 and 6) is a Regular Knot with 19 parts and 13 bights. Euclid's algorithm, its path in the RKT and its algorithm diagram are presented in the upper part of Fig. 993. From its algorithm diagram we read the following half-cycle braiding algorithms:

1.		:	Free run.
2.	$(i = 0)$	:	$(s)o.$
3.	$(i = 0)$	:	$o.$
4.	$(i \leq 1)$	:	$(s)u - o.$
5.	$(i \leq 1)$	:	$u - o.$
6.	$(i \leq 2)$	:	$(s)o - u - o - (s)u.$
7.	$(i \leq 2)$	:	$o - u - o - u.$

8. $(i \leq 3)$: $o - u - (s,1)2o - u.$
9. $(i \leq 3)$: $o - u - 2o - u.$
10. $(i \leq 4)$: $o - (s,1)2u - 2o - u - (s)o.$
11. $(i \leq 4)$: $o - 2u - 2o - u - o.$
12. $(i \leq 5)$: $o - 2u - (1,s,1)3o - u - o.$
13. $(i \leq 5)$: $o - 2u - 3o - u - o.$
14. $(i \leq 6)$: $o - u - (s)o - u - 3o - u - o - (s)u.$
15. $(i \leq 6)$: $o - u - o - u - 3o - u - o - u.$
16. $(i \leq 7)$: $o - u - o - u - 2o - (s)u - o - u - o - u.$
17. $(i \leq 7)$: $o - u - o - u - 2o - u - o - u - o - u.$
18. $(i \leq 8)$: $o - u - o - (s,1)2u - 2o - u - o - u - o - u - (s)o.$
19. $(i \leq 8)$: $o - u - o - 2u - 2o - u - o - u - o - u - o.$
20. $(i \leq 9)$: $o - u - o - 2u - 2o - (1,s)2u - o - u - o - u - o.$
21. $(i \leq 9)$: $o - u - o - 2u - 2o - 2u - o - u - o - u - o.$
22. $(i \leq 10)$: $o - u - o - u - (s)o - u - 2o - 2u - o - u - o - u - o - (s)u.$
23. $(i \leq 10)$: $o - u - o - u - o - u - 2o - 2u - o - u - o - u - o - u.$
24. $(i \leq 11)$: $o - u - o - u - o - u - 2o - 2u - (s,1)2o - u - o - u - o - u.$
25. $(i \leq 11)$: $o - u - o - u - o - u - 2o - 2u - 2o - u - o - u - o - u.$
26. $(i \leq 12)$: $o - u - o - u - o - (s,1)2u - 2o - 2u - 2o - u - o - u - o - u.$

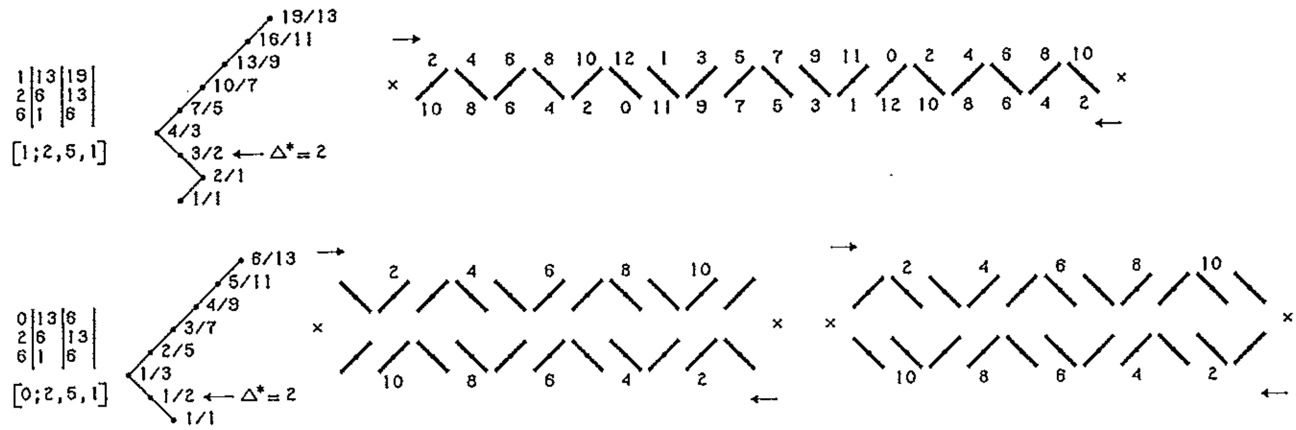

Fig. 993 — Algorithm diagrams associated with Fig. 991.

The left interbraid (between bight-boundary 2 and bight-boundary 3) and the right interbraid (between bight-boundary 4 and bight-boundary 5) are Regular Knots, each with 6 parts and 13 bights. Euclid's algorithm, their path in the RKT and their algorithm diagrams are presented in the lower part of Fig. 993 (left algorithm diagram for left interbraid and right algorithm diagram for right interbraid). From the left algorithm diagram we read for the left interbraid the following half-cycle braiding algorithms:

1′. : $u - o - u - o - u - o.$
2′. $(i = 0)$: $o - u - o - u - o - u.$
3′. $(i = 0)$: $u - o - u - o - u - o.$
4′. $(i \leq 1)$: $o - u - o - u - o - u.$
5′. $(i \leq 1)$: $u - o - u - o - u - o.$
6′. $(i \leq 2)$: $o - (s,1)2u - o - u - o - u.$

$7'$.	$(i \le 2)$	:	$u - 2o - u - o - u - o.$
$8'$.	$(i \le 3)$	:	$o - 2u - o - u - o - u.$
$9'$.	$(i \le 3)$	:	$u - 2o - u - o - u - o.$
$10'$.	$(i \le 4)$	:	$o - 2u - (s,1)2o - u - o - u.$
$11'$.	$(i \le 4)$	:	$u - 2o - 2u - o - u - o.$
$12'$.	$(i \le 5)$	:	$o - 2u - 2o - u - o - u.$
$13'$.	$(i \le 5)$	:	$u - 2o - 2u - o - u - o.$
$14'$.	$(i \le 6)$	:	$o - 2u - 2o - (s,1)2u - o - u.$
$15'$.	$(i \le 6)$	:	$u - 2o - 2u - 2o - u - o.$
$16'$.	$(i \le 7)$	:	$o - 2u - 2o - 2u - o - u.$
$17'$.	$(i \le 7)$	:	$u - 2o - 2u - 2o - u - o.$
$18'$.	$(i \le 8)$	:	$o - 2u - 2o - 2u - (s,1)2o - u.$
$19'$.	$(i \le 8)$	:	$u - 2o - 2u - 2o - 2u - o.$
$20'$.	$(i \le 9)$	:	$o - 2u - 2o - 2u - 2o - u.$
$21'$.	$(i \le 9)$	:	$u - 2o - 2u - 2o - 2u - o.$
$22'$.	$(i \le 10)$	:	$o - 2u - 2o - 2u - 2o - (s,1)2u.$
$23'$.	$(i \le 10)$	:	$u - 2o - 2u - 2o - 2u - 2o.$
$24'$.	$(i \le 11)$	:	$o - 2u - 2o - 2u - 2o - 2u.$
$25'$.	$(i \le 11)$	:	$u - 2o - 2u - 2o - 2u - 2o.$
$26'$.	$(i \le 12)$	:	$o - 2u - 2o - 2u - 2o - 2u.$

From the lower right algorithm diagram in Fig. 993 we read the half-cycle braiding algorithms for the right interbraid:

$1''$.		:	$u - o - u - o - u - o.$
$2''$.	$(i = 0)$	:	$o - u - o - u - o - u.$
$3''$.	$(i = 0)$	:	$u - o - u - o - u - o.$
$4''$.	$(i \le 1)$	:	$o - u - o - u - o - u.$
$5''$.	$(i \le 1)$	:	$u - o - u - o - u - o.$
$6''$.	$(i \le 2)$	:	$o - (s,1)2u - o - u - o - u.$
$7''$.	$(i \le 2)$	:	$u - 2o - u - o - u - o.$
$8''$.	$(i \le 3)$	:	$o - 2u - o - u - o - u.$
$9''$.	$(i \le 3)$	:	$u - 2o - u - o - u - o.$
$10''$.	$(i \le 4)$	:	$o - 2u - (s,1)2o - u - o - u.$
$11''$.	$(i \le 4)$	:	$u - 2o - 2u - o - u - o.$
$12''$.	$(i \le 5)$	:	$o - 2u - 2o - u - o - u.$
$13''$.	$(i \le 5)$	:	$u - 2o - 2u - o - u - o.$
$14''$.	$(i \le 6)$	:	$o - 2u - 2o - (s,1)2u - o - u.$
$15''$.	$(i \le 6)$	:	$u - 2o - 2u - 2o - u - o.$
$16''$.	$(i \le 7)$	:	$o - 2u - 2o - 2u - o - u.$
$17''$.	$(i \le 7)$	:	$u - 2o - 2u - 2o - u - o.$
$18''$.	$(i \le 8)$	:	$o - 2u - 2o - 2u - (s,1)2o - u.$
$19''$.	$(i \le 8)$	:	$u - 2o - 2u - 2o - 2u - o.$
$20''$.	$(i \le 9)$	:	$o - 2u - 2o - 2u - 2o - u.$
$21''$.	$(i \le 9)$	:	$u - 2o - 2u - 2o - 2u - o.$
$22''$.	$(i \le 10)$	:	$o - 2u - 2o - 2u - 2o - (s,1)2u.$
$23''$.	$(i \le 10)$	:	$u - 2o - 2u - 2o - 2u - 2o.$
$24''$.	$(i \le 11)$	:	$o - 2u - 2o - 2u - 2o - 2u.$
$25''$.	$(i \le 11)$	:	$u - 2o - 2u - 2o - 2u - 2o.$
$26''$.	$(i \le 12)$	:	$o - 2u - 2o - 2u - 2o - 2u.$

Note that the half-cycle braiding algorithms for the right interbraid are identical to the half-cycle braiding algorithms for the left interbraid.

Example 2.

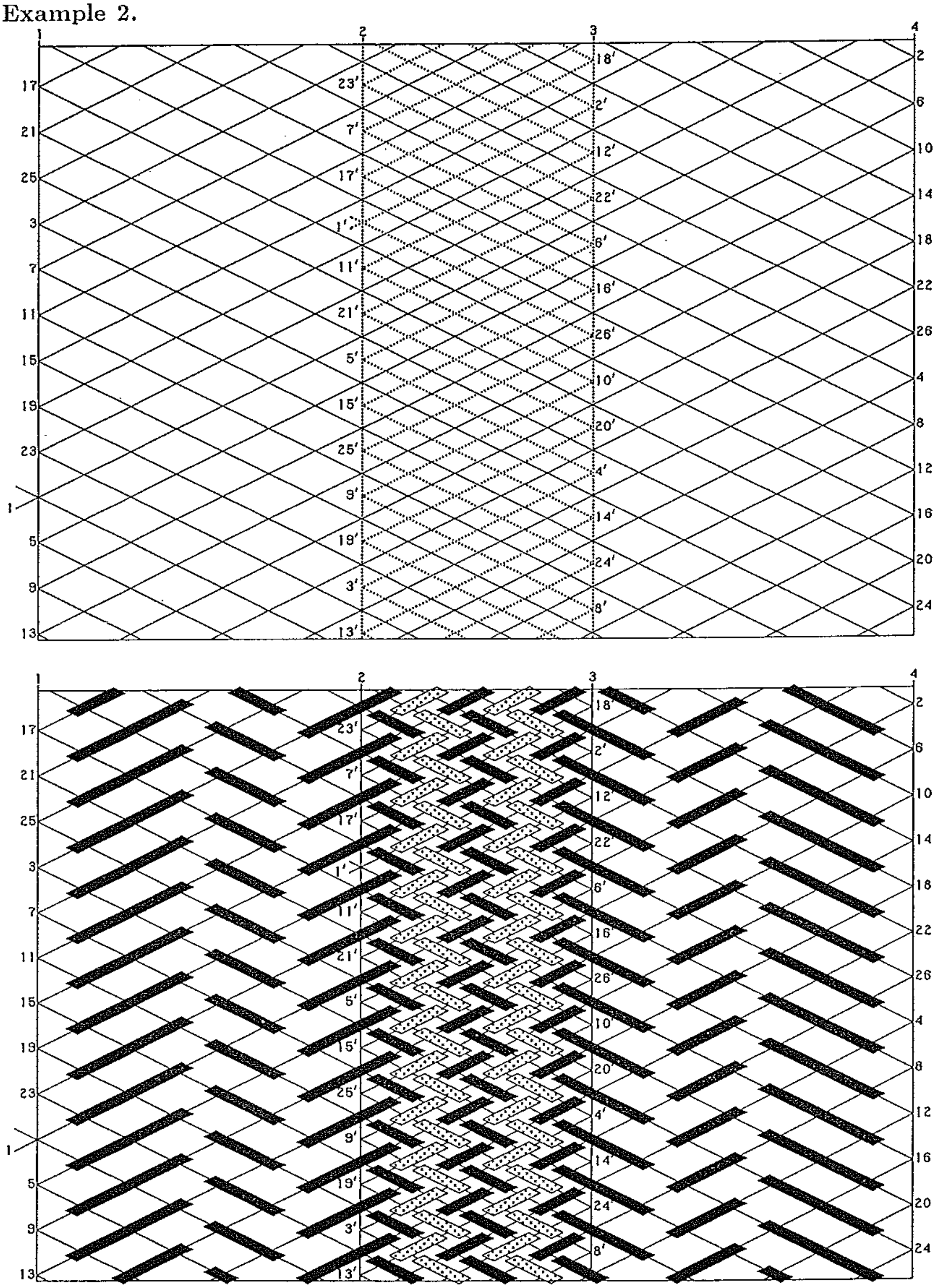

Fig. 994 — Example 2.

The foundation knot is a Regular Knot with $p/b = 19/13$. It is interbraided with one Regular Knot with $p/b = 5/13$, as shown in Fig. 994. The string diameter of all strings is $d = 2.0$ mm. and the foundation knot is braided over a diameter $D = 24$ mm..

The interbraided knot contains three intersection-column sections, two sections in which each intersection-column contains 13 intersection points (intersection-columns 1-7 and 17-23), and one section in which each intersection-column contains 26 intersection points (intersection-columns 8-16).

The helix angle of the string-run at the intersection-columns with 13 intersection points each is thus:

$$90° - \arcsin \frac{13 \times 2.0}{\pi(24 + 2.0)} = 90° - 18.56° = 71.44° .$$

When the diameter under the braid at the intersection-columns with 26 intersection points each is also 24 mm., then the helix angle of the string-run at these intersection-columns will be:

$$90° - \arcsin \frac{26 \times 2.0}{\pi(24 + 2.0)} = 90° - 39.54° = 50.46° .$$

The bights on bight-boundary 2 and the bights on bight-boundary 3 lie under the braid. The resulting gaps between the strings of the foundation knot, associated with the helix angle change from 50.46° to 71.44°, cannot here be covered by bights and hence in good braidwork this situation must be avoided.

The foundation knot (between bight-boundaries 1 and 4) is a Regular Knot with 19 parts and 13 bights. Euclid's algorithm, its path in the RKT and its algorithm diagram are presented in the upper part of Fig. 995.

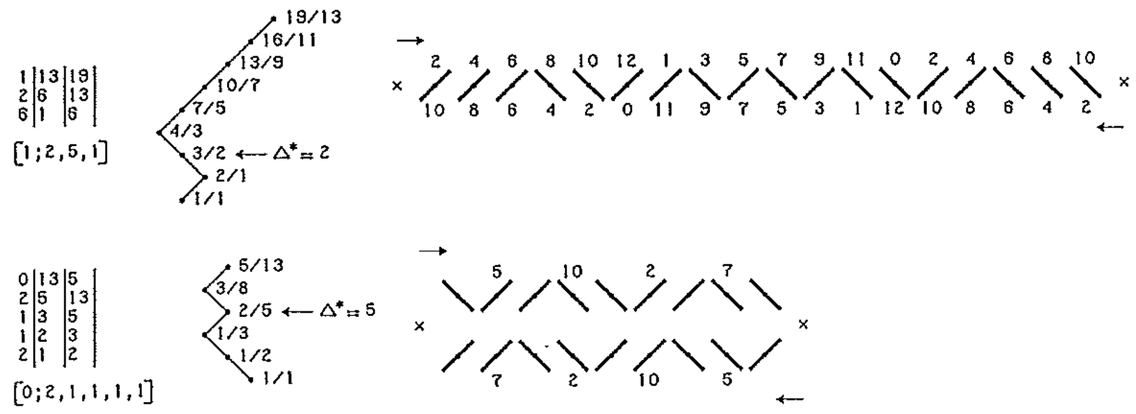

Fig. 995 — Algorithm diagrams associated with Fig. 994.

The half-cycle braiding algorithms for the foundation knot, read from its algorithm diagram, are as follows:

1.		:	Free run.
2.	$(i = 0)$	:	$(s)u$.
3.	$(i = 0)$	:	u.
4.	$(i \leq 1)$	:	$(s)o - u$.
5.	$(i \leq 1)$	:	$o - u$.
6.	$(i \leq 2)$	:	$(s,1)2o - u - (s)o$.
7.	$(i \leq 2)$	:	$2o - u - o$.
8.	$(i \leq 3)$	:	$2o - (s,1)2u - o$.
9.	$(i \leq 3)$	:	$2o - 2u - o$.
10.	$(i \leq 4)$	:	$(1,s,1)3o - 2u - (1,s)2o$.

11.	$(i \leq 4)$	:	$3o - 2u - 2o.$
12.	$(i \leq 5)$	:	$3o - u - (s)o - u - 2o.$
13.	$(i \leq 5)$	:	$3o - u - o - u - 2o.$
14.	$(i \leq 6)$	:	$(2, s, 1)4o - u - o - u - 2o - (s)u.$
15.	$(i \leq 6)$	:	$4o - u - o - u - 2o - u.$
16.	$(i \leq 7)$	:	$4o - u - o - (s, 1)2u - 2o - u.$
17.	$(i \leq 7)$	:	$4o - u - o - 2u - 2o - u.$
18.	$(i \leq 8)$	:	$3o - (s)u - o - u - o - 2u - 2o - (1, s)2u.$
19.	$(i \leq 8)$	:	$3o - u - o - u - o - 2u - 2o - 2u.$
20.	$(i \leq 9)$	:	$3o - u - o - u - o - u - (s)o - u - 2o - 2u.$
21.	$(i \leq 9)$	:	$3o - u - o - u - o - u - o - u - 2o - 2u.$
22.	$(i \leq 10)$	:	$3o - (1, s)2u - o - u - o - u - o - u - 2o - (2, s)3u.$
23.	$(i \leq 10)$	:	$3o - 2u - o - u - o - u - o - u - 2o - 3u.$
24.	$(i \leq 11)$	:	$3o - 2u - o - u - o - u - o - (s, 1)2u - 2o - 3u.$
25.	$(i \leq 11)$	:	$3o - 2u - o - u - o - u - o - 2u - 2o - 3u.$
26.	$(i \leq 12)$	:	$3o - 2u - (s, 1)2o - u - o - u - o - 2u - 2o - 3u.$

The interbraid (between bight-boundary 2 and bight-boundary 3) is a Regular Knot with 5 parts and 13 bights. Euclid's algorithm, its path in the RKT and its algorithm diagram is presented in the lower part of Fig. 995. From this algorithm diagram we read the following half-cycle braiding algorithms for the interbraid:

1′.		:	$u - o - u - o - u.$
2′.	$(i = 0)$	:	$u - o - u - o - u.$
3′.	$(i = 0)$	:	$u - o - u - o - u.$
4′.	$(i \leq 1)$	:	$u - o - u - o - u.$
5′.	$(i \leq 1)$	:	$u - o - u - o - u.$
6′.	$(i \leq 2)$	:	$u - o - u - (s, 1)2o - u.$
7′.	$(i \leq 2)$	:	$u - o - u - 2o - u.$
8′.	$(i \leq 3)$	:	$u - o - u - 2o - u.$
9′.	$(i \leq 3)$	:	$u - o - u - 2o - u.$
10′.	$(i \leq 4)$	:	$u - o - u - 2o - u.$
11′.	$(i \leq 4)$	:	$u - o - u - 2o - u.$
12′.	$(i \leq 5)$	:	$u - (s, 1)2o - u - 2o - u.$
13′.	$(i \leq 5)$	:	$u - 2o - u - 2o - u.$
14′.	$(i \leq 6)$	:	$u - 2o - u - 2o - u.$
15′.	$(i \leq 6)$	:	$u - 2o - u - 2o - u.$
16′.	$(i \leq 7)$	:	$u - 2o - u - 2o - (s, 1)2u.$
17′.	$(i \leq 7)$	:	$u - 2o - u - 2o - 2u.$
18′.	$(i \leq 8)$	:	$u - 2o - u - 2o - 2u.$
19′.	$(i \leq 8)$	:	$u - 2o - u - 2o - 2u.$
20′.	$(i \leq 9)$	:	$u - 2o - u - 2o - 2u.$
21′.	$(i \leq 9)$	:	$u - 2o - u - 2o - 2u.$
22′.	$(i \leq 10)$	:	$u - 2o - (s, 1)2u - 2o - 2u.$
23′.	$(i \leq 10)$	:	$u - 2o - 2u - 2o - 2u.$
24′.	$(i \leq 11)$	:	$u - 2o - 2u - 2o - 2u.$
25′.	$(i \leq 11)$	:	$u - 2o - 2u - 2o - 2u.$
26′.	$(i \leq 12)$	:	$u - 2o - 2u - 2o - 2u.$

In *The Braider*, Issue No. 29, pg. 682, we derived the general law of the greatest common divisor:

$$\lambda = \text{g.c.d.}\left(\frac{\beta}{\alpha}, \frac{B_c}{\alpha}\right),$$

where α is the number of bights in the component's first-return string-run, β is the number of bights the first-return string-run spans in the component, and B_c is the component's number of bights.†

Note that the general law of the greatest common divisor dictates that both β and B_c must be divisible by α.

Let the first-return string-run of a component in a cylindrical braid be as shown in Fig. 996.

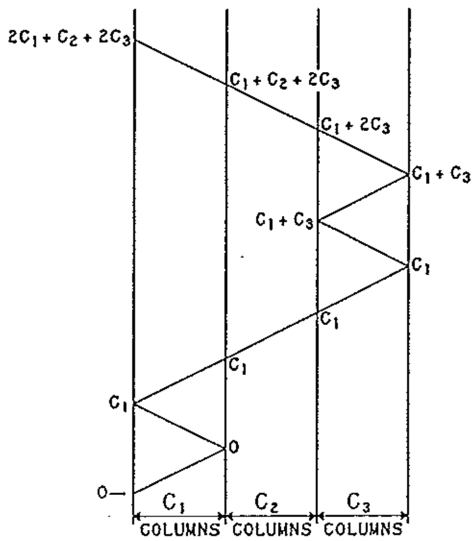

Fig. 996 — The first-return string-run of a component in a cylindrical braid.

In this diagram the bight-index numbers of the intersection points between the first-return string-run and the bight-boundaries are indicated. Thus for this component $\beta = 2C_1 + C_2 + 2C_3$ while $\alpha = 3$. Let's take $C_1 = C_3$, then $\beta = 4C_1 + C_2 = 4C_3 + C_2$.

Example 3.

Let $C_1 = C_3 = 14$ and $C_2 = 10$, then $\beta = 4 \times 14 + 10 = 66$. Note that C_1, C_2 and C_3 must be chosen so that β is divisible by $\alpha = 3$.

Let $B_c = 27$. Note that B_c must be chosen so that B_c is divisible by $\alpha = 3$.

Thus for this component we obtain:

$$\lambda = \text{g.c.d.}\left(\frac{\beta}{\alpha}, \frac{B_c}{\alpha}\right) = \text{g.c.d.}\left(\frac{66}{3}, \frac{27}{3}\right) = \text{g.c.d.}\ (22, 9) = 1,$$

and hence only one essential string is required.

The string-run of this component consist of $\left(\frac{B_c}{\alpha}\right) = \left(\frac{27}{3}\right) = 9$ consecutive first-return string-runs.

The successively occupied bight-index numbers by the string-run of this component are:

On the leftmost bight-boundary:

† See *The Braider*, Issue No. 30, pp. 683-690 for Examples.

$0.$	$\|23+66\|_{27}=8.$	$\|24+66\|_{27}=9.$
$\|14\|_{27}=14.$	$\|21+66\|_{27}=6.$	$\|5+66\|_{27}=17.$
$\|66\|_{27}=12.$	$\|8+66\|_{27}=20.$	$\|11+66\|_{27}=23.$
$\|14+66\|_{27}=26.$	$\|6+66\|_{27}=18.$	$\|3+66\|_{27}=15.$
$\|12+66\|_{27}=24.$	$\|20+66\|_{27}=5.$	$\|9+66\|_{27}=21.$
$\|26+66\|_{27}=11.$	$\|18+66\|_{27}=3.$	$\|17+66\|_{27}=2.$

On the second bight-boundary from the left:

$0.$	$\|23+66\|_{27}=8.$	$\|24+66\|_{27}=9.$
$\nearrow\ \|14\|_{27}=14.$	$\nearrow\ \|21+66\|_{27}=6.$	$\nearrow\ \|5+66\|_{27}=17.$
$\nwarrow\ \|52\|_{27}=25.$	$\nwarrow\ \|22+66\|_{27}=7.$	$\nwarrow\ \|4+66\|_{27}=16.$
$\|66\|_{27}=12.$	$\|8+66\|_{27}=20.$	$\|11+66\|_{27}=23.$
$\nearrow\ \|14+66\|_{27}=26.$	$\nearrow\ \|6+66\|_{27}=18.$	$\nearrow\ \|3+66\|_{27}=15.$
$\nwarrow\ \|25+66\|_{27}=10.$	$\nwarrow\ \|7+66\|_{27}=19.$	$\nwarrow\ \|16+66\|_{27}=1.$
$\|12+66\|_{27}=24.$	$\|20+66\|_{27}=5.$	$\|9+66\|_{27}=21.$
$\nearrow\ \|26+66\|_{27}=11.$	$\nearrow\ \|18+66\|_{27}=3.$	$\nearrow\ \|17+66\|_{27}=2.$
$\nwarrow\ \|10+66\|_{27}=22.$	$\nwarrow\ \|19+66\|_{27}=4.$	$\nwarrow\ \|1+66\|_{27}=13.$

On the third bight-boundary from the left:

$\nearrow\ \|14\|_{27}=14.$	$\nearrow\ \|11+66\|_{27}=23.$	$\nearrow\ \|20+66\|_{27}=5.$
$\|28\|_{27}=1.$	$\|25+66\|_{27}=10.$	$\|7+66\|_{27}=19.$
$\nwarrow\ \|42\|_{27}=15.$	$\nwarrow\ \|12+66\|_{27}=24.$	$\nwarrow\ \|21+66\|_{27}=6.$
$\nearrow\ \|14+66\|_{27}=26.$	$\nearrow\ \|23+66\|_{27}=8.$	$\nearrow\ \|5+66\|_{27}=17.$
$\|1+66\|_{27}=13.$	$\|10+66\|_{27}=22.$	$\|19+66\|_{27}=4.$
$\nwarrow\ \|15+66\|_{27}=0.$	$\nwarrow\ \|24+66\|_{27}=9.$	$\nwarrow\ \|6+66\|_{27}=18.$
$\nearrow\ \|26+66\|_{27}=11.$	$\nearrow\ \|8+66\|_{27}=20.$	$\nearrow\ \|17+66\|_{27}=2.$
$\|13+66\|_{27}=25.$	$\|22+66\|_{27}=7.$	$\|4+66\|_{27}=16.$
$\nwarrow\ \|0+66\|_{27}=12.$	$\nwarrow\ \|9+66\|_{27}=21.$	$\nwarrow\ \|18+66\|_{27}=3.$

On the rightmost bight-boundary:

$\|14\|_{27}=14.$	$\|11+66\|_{27}=23.$	$\|20+66\|_{27}=5.$
$\|28\|_{27}=1.$	$\|25+66\|_{27}=10.$	$\|7+66\|_{27}=19.$
$\|14+66\|_{27}=26.$	$\|23+66\|_{27}=8.$	$\|5+66\|_{27}=17.$
$\|1+66\|_{27}=13.$	$\|10+66\|_{27}=22.$	$\|19+66\|_{27}=4.$
$\|26+66\|_{27}=11.$	$\|8+66\|_{27}=20.$	$\|17+66\|_{27}=2.$
$\|13+66\|_{27}=25.$	$\|22+66\|_{27}=7.$	$\|4+66\|_{27}=16.$

In the tables above, the arrows in front of the bight-index numbers indicate the direction of the half-cycle at the bight-index number concerned. Note that on the leftmost bight-boundary the bight-index numbers 1 , 4 , 7 , 10 , 13 , 16 , 19 , 22 , 25 are still free, and that on the rightmost bight-boundary the bight-index numbers 0 , 3 , 6 , 9 , 12 , 15 , 18 , 21 , 24 are still free. The tables further indicate that we can interbraid this braid (the foundation braid) with two Regular Cylindrical Braids, one between the leftmost bight-boundary and the third bight-boundary from left, and one between the rightmost bight-boundary and the second bight-boundary from the left. For each of these braids $\alpha = 1$, $\beta = 8$ and $B_c = 9$. Hence:

$$\lambda = \text{g.c.d. } \left(\frac{\beta}{\alpha}, \frac{B_c}{\alpha}\right) = \text{g.c.d. } \left(\frac{8}{1}, \frac{9}{1}\right) = \text{g.c.d. } (8, 9) = 1 ,$$

and hence each braid is a Regular Knot, hence requires only one essential string.

In Fig. 997 the upper diagram depicts the string-run of the foundation braid and the lower diagram depicts the string-run of the two interbraided Regular Knots.

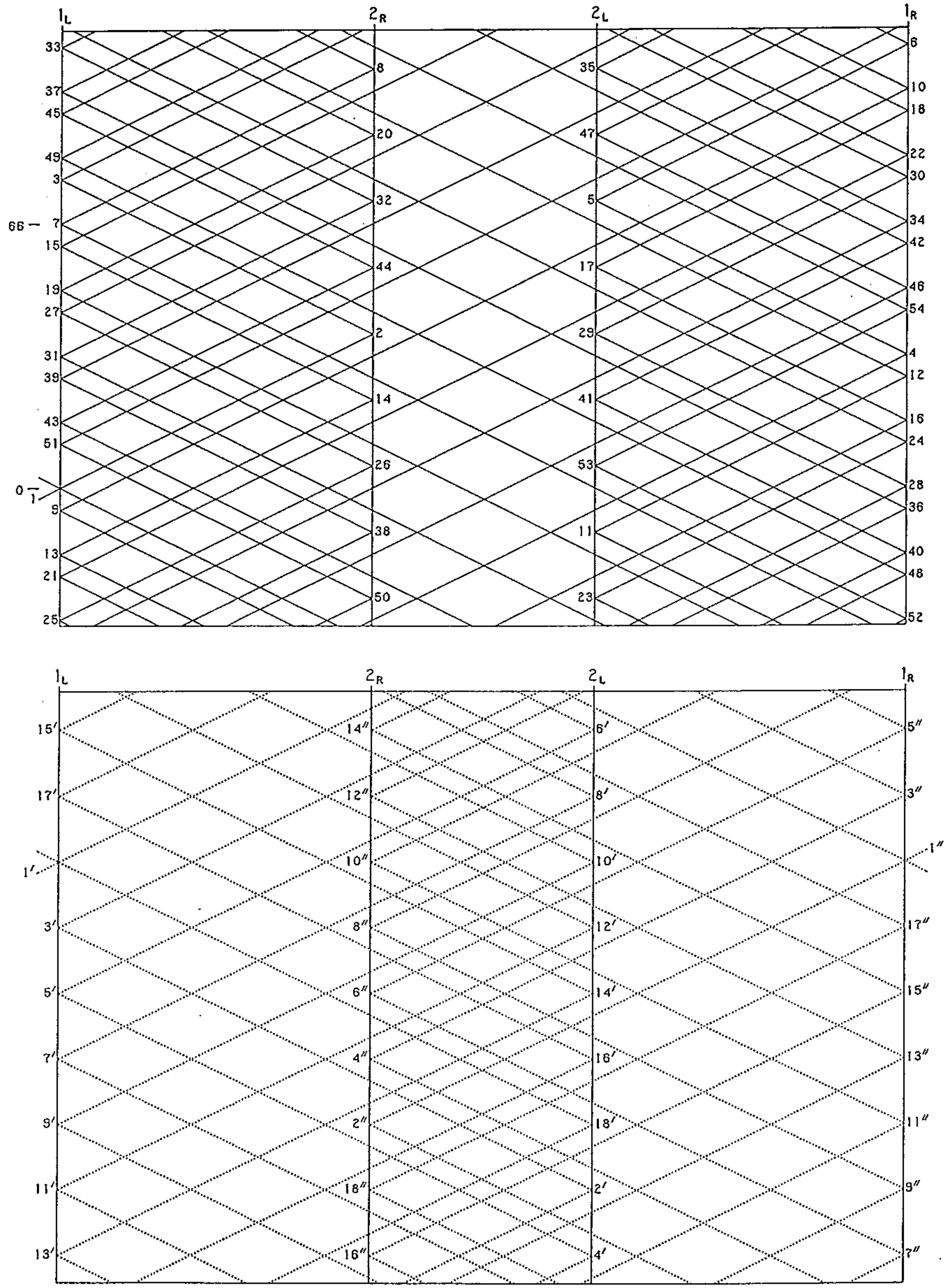

Fig. 997 — The string-runs of the foundation braid and the two interbraided Regular Knots.

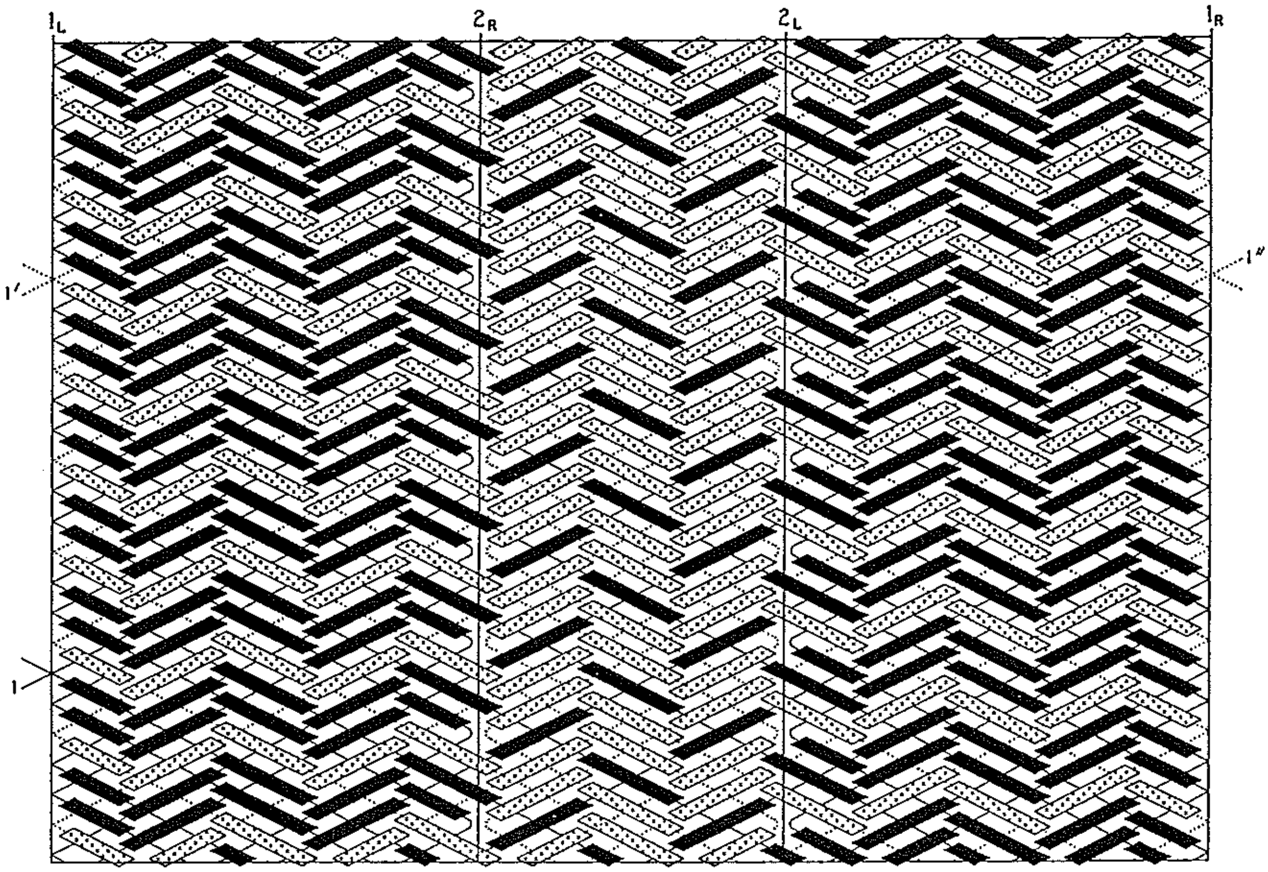

Fig. 998 — A coding superimposed on the string-run.

The braiding algorithms for the foundation knot can be read from the tables in Figs. 999 & 1000. In these tables, half-cycle n intersects the half-cycles which end at the beginning of the half-cycles $\leq n$ listed on their right. These tables give us the following half-cycle braiding algorithms:

1. $1_L \longrightarrow 2_R$: Free run.
2. $2_R \longrightarrow 1_L$: Free run.
3. $1_L \longrightarrow 1_R$: Free run.
4. $1_R \longrightarrow 2_L$: Free run.
5. $2_L \longrightarrow 1_R$: Free run.
6. $1_R \longrightarrow 1_L$: $2o$.
7. $1_L \longrightarrow 2_R$: u.
8. $2_R \longrightarrow 1_L$: o.
9. $1_L \longrightarrow 1_R$: $2u$.
10. $1_R \longrightarrow 2_L$: o.
11. $2_L \longrightarrow 1_R$: u.
12. $1_R \longrightarrow 1_L$: $3o - u$.
13. $1_L \longrightarrow 2_R$: u.
14. $2_R \longrightarrow 1_L$: $o - u$.
15. $1_L \longrightarrow 1_R$: $u - o - 2u - o$.
16. $1_R \longrightarrow 2_L$: $o - u$.
17. $2_L \longrightarrow 1_R$: $u - o$.
18. $1_R \longrightarrow 1_L$: $o - u - o - u - o - 2u$.

HALF-CYCLE								
1	51	43	39	31	27	19	15	7
7	3	49	45	37	33	25	21	13
13	9	X	51	43	39	31	27	19
19	15	7	3	49	45	37	33	25
25	21	13	9	X	51	43	39	31
31	27	19	15	7	3	49	45	37
37	33	25	21	13	9	X	51	43
43	39	31	27	19	15	7	3	49
49	45	37	33	25	21	13	9	X
	U	O	O	U	U	O	O	U

HALF-CYCLE								
5	X	47	43	35	31	23	19	11
11	7	53	49	41	37	29	25	17
17	13	5	X	47	43	35	31	23
23	19	11	7	53	49	41	37	29
29	25	17	13	5	X	47	43	35
35	31	23	19	11	7	53	49	41
41	37	29	25	17	13	5	X	47
47	43	35	31	23	19	11	7	53
53	49	41	37	29	25	17	13	5
	U	O	O	U	U	O	O	U

HALF-CYCLE																					
3	49	45	37	33	25	21	13	9	X	43	31	19	7	53	49	41	37	29	25	17	13
9	X	51	43	39	31	27	19	15	7	49	37	25	13	5	X	47	43	35	31	23	19
15	7	3	49	45	37	33	25	21	13	X	43	31	19	11	7	53	49	41	37	29	25
21	13	9	X	51	43	39	31	27	19	7	49	37	25	17	13	5	X	47	43	35	31
27	19	15	7	3	49	45	37	33	25	13	X	43	31	23	19	11	7	53	49	41	37
33	25	21	13	9	X	51	43	39	31	19	7	49	37	29	25	17	13	5	X	47	43
39	31	27	19	15	7	3	49	45	37	25	13	X	43	35	31	23	19	11	7	53	49
45	37	33	25	21	13	9	X	51	43	31	19	7	49	41	37	29	25	17	13	5	X
51	43	39	31	27	19	15	7	3	49	37	25	13	X	47	43	35	31	23	19	11	7
	U	O	O	U	U	O	O	U	U	O	U	O	U	U	O	O	U	U	O	O	U

Fig. 999 — Tables for the odd-numbered half-cycles.

19. $1_L \longrightarrow 2_R$: $u - 2o$.
20. $2_R \longrightarrow 1_L$: $o - 2u$.
21. $1_L \longrightarrow 1_R$: $u - o - u - o - u - 2o$.
22. $1_R \longrightarrow 2_L$: $o - 2u$.
23. $2_L \longrightarrow 1_R$: $u - 2o$.
24. $1_R \longrightarrow 1_L$: $o - 2u - o - u - o - 2u - o$.
25. $1_L \longrightarrow 2_R$: $u - 2o$.
26. $2_R \longrightarrow 1_L$: $o - 2u - o$.
27. $1_L \longrightarrow 1_R$: $u - 2o - 2u - o - u - 2o - u$.
28. $1_R \longrightarrow 2_L$: $o - 2u - o$.
29. $2_L \longrightarrow 1_R$: $u - 2o - u$.
30. $1_R \longrightarrow 1_L$: $o - 2u - 2o - u - 2o - 2u - 2o$.
31. $1_L \longrightarrow 2_R$: $u - 2o - 2u$.
32. $2_R \longrightarrow 1_L$: $o - 2u - 2o$.
33. $1_L \longrightarrow 1_R$: $u - 2o - 2u - o - 2u - 2o - 2u$.
34. $1_R \longrightarrow 2_L$: $o - 2u - 2o$.
35. $2_L \longrightarrow 1_R$: $u - 2o - 2u$.
36. $1_R \longrightarrow 1_L$: $o - 2u - 3o - u - 2o - 2u - 2o - u$.
37. $1_L \longrightarrow 2_R$: $u - 2o - 2u$.
38. $2_R \longrightarrow 1_L$: $o - 2u - 2o - u$.
39. $1_L \longrightarrow 1_R$: $u - 2o - 2u - o - u - o - 2u - 2o - 2u - o$.
40. $1_R \longrightarrow 2_L$: $o - 2u - 2o - u$.

HALF-CYCLE								
2	52	44	40	32	26	20	16	8
8	4	50	46	38	34	26	22	14
14	10	2	52	44	40	32	28	20
20	16	8	4	50	46	38	34	26
26	22	14	10	2	52	44	40	32
32	28	20	16	8	4	50	46	38
38	34	26	22	14	10	2	52	44
44	40	32	28	20	16	8	4	50
50	46	38	34	26	22	14	10	2
	O	U	U	O	O	U	U	O

HALF-CYCLE								
4	54	46	42	34	30	22	18	10
10	6	52	48	40	36	28	24	16
16	12	4	54	46	42	34	30	22
22	18	10	6	52	48	40	36	28
28	24	16	12	4	54	46	42	34
34	30	22	18	10	6	52	48	40
40	36	28	24	16	12	4	54	46
46	42	34	30	22	18	10	6	52
52	48	40	36	28	24	16	12	4
	O	U	U	O	O	U	U	O

HALF-CYCLE																					
6	52	48	40	36	28	24	16	12	4	46	34	22	10	2	52	44	40	32	28	20	16
12	4	54	46	42	34	30	22	18	10	52	40	28	16	8	4	50	46	38	34	26	22
18	10	6	52	48	40	36	28	24	16	4	46	34	22	14	10	2	52	44	40	32	28
24	16	12	4	54	46	42	34	30	22	10	52	40	28	20	16	8	4	50	46	38	34
30	22	18	10	6	52	48	40	36	28	16	4	46	34	26	22	14	10	2	52	44	40
36	28	24	16	12	4	54	46	42	34	22	10	52	40	32	28	20	16	8	4	50	46
42	34	30	22	18	10	6	52	48	40	28	16	4	46	38	34	26	22	14	10	2	52
48	40	36	28	24	16	12	4	54	46	34	22	10	52	44	40	32	28	20	16	8	4
54	46	42	34	30	22	18	10	6	52	40	28	16	4	50	46	38	34	26	22	14	10
	O	U	U	O	O	U	U	O	O	U	O	U	O	O	U	U	O	O	U	U	O

Fig. 1000 — Tables for the even-numbered half-cycles.

41. $2_L \longrightarrow 1_R$: $u - 2o - 2u - o$.
42. $1_R \longrightarrow 1_L$: $o - 2u - 2o - u - o - u - o - u - o - 2u - 2o - 2u$.
43. $1_L \longrightarrow 2_R$: $u - 2o - 2u - 2o$.
44. $2_R \longrightarrow 1_L$: $o - 2u - 2o - 2u$.
45. $1_L \longrightarrow 1_R$: $u - 2o - 2u - o - u - o - u - o - u - 2o - 2u - 2o$.
46. $1_R \longrightarrow 2_L$: $o - 2u - 2o - 2u$.
47. $2_L \longrightarrow 1_R$: $u - 2o - 2u - 2o$.
48. $1_R \longrightarrow 1_L$: $o - 2u - 2o - 2u - o - u - o - u - o - 2u - 2o - 2u - o$.
49. $1_L \longrightarrow 2_R$: $u - 2o - 2u - 2o$.
50. $2_R \longrightarrow 1_L$: $o - 2u - 2o - 2u - o$.
51. $1_L \longrightarrow 1_R$: $u - 2o - 2u - 2o - 2u - o - u - o - u - 2o - 2u - 2o - u$.
52. $1_R \longrightarrow 2_L$: $o - 2u - 2o - 2u - o$.
53. $2_L \longrightarrow 1_R$: $u - 2o - 2u - 2o - u$.
54. $1_R \longrightarrow 1_L$: $o - 2u - 2o - 2u - 2o - u - o - u - 2o - 2u - 2o - 2u - o$.

Euclid's algorithm, the path formula, the path in the RKT for the interbraided Regular Knots and their algorithm diagrams are shown in Fig. 1001. For the interbraided Regular Knot between the bight-boundaries 1_L and 2_L we read the following half-cycle braiding algorithms from its algorithm diagram:

$1'$. : $2u - 2o - 2u - 2o - 2u - o - u - o$.
$2'$. $(i = 0)$: $u - o - u - 2o - 2u - 2o - 2u - 2o$.
$3'$. $(i = 0)$: $2u - 2o - 2u - 2o - 2u - o - u - o$.

4′.	$(i \leq 1)$	:	$2u - o - u - 2o - 2u - 2o - 2u - 2o.$
5′.	$(i \leq 1)$	:	$2u - 3o - 2u - 2o - 2u - o - u - o.$
6′.	$(i \leq 2)$	:	$2u - 2o - u - 2o - 2u - 2o - 2u - 2o.$
7′.	$(i \leq 2)$	:	$2u - 3o - 3u - 2o - 2u - o - u - o.$
8′.	$(i \leq 3)$	:	$2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o.$
9′.	$(i \leq 3)$	:	$2u - 3o - 3u - 3o - 2u - o - u - o.$
10′.	$(i \leq 4)$	:	$2u - 2o - 2u - 3o - 2u - 2o - 2u - 2o.$
11′.	$(i \leq 4)$	:	$2u - 3o - 3u - 3o - 3u - o - u - o.$
12′.	$(i \leq 5)$	:	$2u - 2o - 2u - 3o - 3u - 2o - 2u - 2o.$
13′.	$(i \leq 5)$	:	$2u - 3o - 3u - 3o - 3u - 2o - u - o.$
14′.	$(i \leq 6)$	:	$2u - 2o - 2u - 3o - 3u - 3o - 2u - 2o.$
15′.	$(i \leq 6)$	:	$2u - 3o - 3u - 3o - 3u - 2o - 2u - o.$
16′.	$(i \leq 7)$	:	$2u - 2o - 2u - 3o - 3u - 3o - 3u - 2o.$
17′.	$(i \leq 7)$	:	$2u - 3o - 3u - 3o - 3u - 2o - 2u - 2o.$
18′.	$(i \leq 8)$	:	$2u - 2o - 2u - 3o - 3u - 3o - 3u - 2o.$

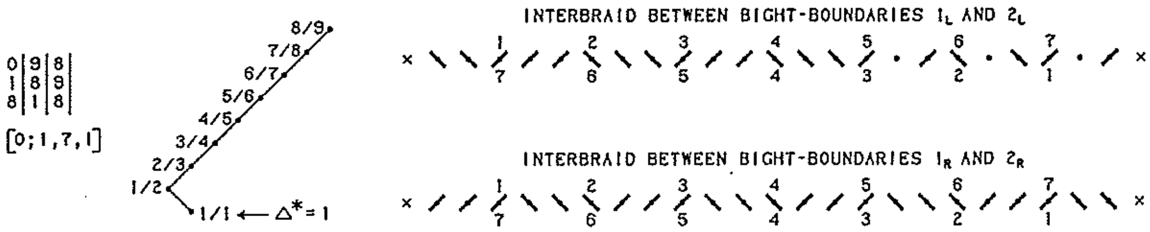

Fig. 1001 — Euclid's algorithm, path formula, path in RKT and algorithm diagrams for interbraided Regular Knots.

For the interbraided Regular Knot between the bight-boundaries 1_R and 2_R we read the following half-cycle braiding algorithms from its algorithm diagram:

1″.		:	$2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o.$
2″.	$(i = 0)$	:	$2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o.$
3″.	$(i = 0)$	:	$2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o.$
4″.	$(i \leq 1)$	:	$3u - 2o - 2u - 2o - 2u - 2o - 2u - 2o.$
5″.	$(i \leq 1)$	:	$2u - 3o - 2u - 2o - 2u - 2o - 2u - 2o.$
6″.	$(i \leq 2)$	:	$3u - 3o - 2u - 2o - 2u - 2o - 2u - 2o.$
7″.	$(i \leq 2)$	:	$2u - 3o - 3u - 2o - 2u - 2o - 2u - 2o.$
8″.	$(i \leq 3)$	:	$3u - 3o - 3u - 2o - 2u - 2o - 2u - 2o.$
9″.	$(i \leq 3)$	:	$2u - 3o - 3u - 3o - 2u - 2o - 2u - 2o.$
10″.	$(i \leq 4)$	:	$3u - 3o - 3u - 3o - 2u - 2o - 2u - 2o.$
11″.	$(i \leq 4)$	:	$2u - 3o - 3u - 3o - 3u - 2o - 2u - 2o.$
12″.	$(i \leq 5)$	:	$3u - 3o - 3u - 3o - 3u - 2o - 2u - 2o.$
13″.	$(i \leq 5)$	:	$2u - 3o - 3u - 3o - 3u - 3o - 2u - 2o.$
14″.	$(i \leq 6)$	:	$3u - 3o - 3u - 3o - 3u - 3o - 2u - 2o.$
15″.	$(i \leq 6)$	:	$2u - 3o - 3u - 3o - 3u - 3o - 3u - 2o.$
16″.	$(i \leq 7)$	:	$3u - 3o - 3u - 3o - 3u - 3o - 3u - 2o.$
17″.	$(i \leq 7)$	:	$2u - 3o - 3u - 3o - 3u - 3o - 3u - 3o.$
18″.	$(i \leq 8)$	:	$3u - 3o - 3u - 3o - 3u - 3o - 3u - 2o.$

If one wants to interbraid the Regular Knot between the bight-boundaries 1_R and 2_R first, then their braiding half-cycles are the ones above for half-cycles 1′-18′, while the braiding half-cycles for the Regular Knot between the bight-boundaries 1_L and 2_L are then the ones above for half-cycles 1″-18″.

The Alamar Knot

In braidwork associated with *Western Horse Tack* we often encounter the name *Alamar Knot.* This knot is there not only used as a basis for decorative braids[†], but also in a halter as a non-slip knot at the left-hand and right-hand junctions between nose piece, cheek piece and curb piece.[‡]

Fig. 1002 shows the configuration of the basic Alamar Knot.

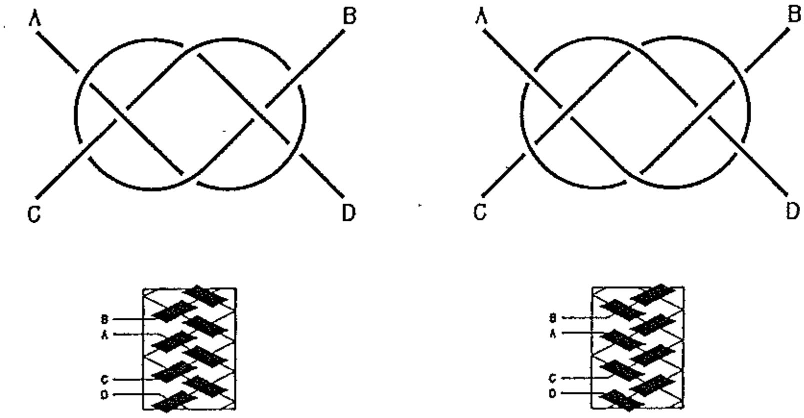

Fig. 1002 — The basic configuration of the Alamar Knot.

When the working ends are the diagonally opposite ends, it is known as the Carrick Bend or Full Carrick Bend. It is then also known as the Split Knot to the knitwear manufacturer, the Warp Knot to the sailor, and the Cowboy Knot to the cowhand.[††]

When all four ends are employed it is called the Josephine Knot.[‡‡]

When the ends *A* and *B* are connected, hence with the ends *C* and *D* free, or when the ends *C* and *D* are connected, hence with the ends *A* and *B* free, it is called the Pretzel Knot, the Austrian Knot, or the Sailor's Breastplate when the connected ends form a large enough loop to place over a person's neck.

When end *A* is connected with end *B* and end *C* with end *D*, it is the Trefoil Knot or the Three-part Four-bight under-over coded Regular Knot.

[†] See for example the *Encyclopedia of Rawhide and Leather Braiding* by Bruce Grant: pg. 286.

[‡] See *Western Tack Tips* by Tom Hall: pp. 40 and 41. It should be noted here that the so-called Hibbert Halter on pg. 40 in Tom Hall's *Western Tack Tips* is not the real Hibbert Halter under the U.S. Patent 4,106,266 of August 15, 1978.

[††] See *The Century Guide to Knots* by Mario Bigon and Guido Regazzoni, pg. 136.

[‡‡] Contrary to Clifford W. Ashley, Charles Warner in his book *A Fresh Approach to Knotting and Ropework*, pg. 181, fig. 482, calls the configuration in which both working ends are on the same side of the knot, the Josephine Knot.