



APPENDIX 1999

CONTENTS

	pg.
Knot nomenclature	<i>i</i>
Names and Terms used in the Braiding World	<i>iii</i>
Nested Cylindrical Braids — Hunter's Bend	<i>v</i>
Nested Cylindrical Braids — The Kirsten Knots ...	<i>viii</i>
Nested Cylindrical Braids — The Knot of Brian Walsh	<i>x</i>
Our Questions and Readers Answers	<i>xv</i>
Errata — <i>The Braider</i>	<i>xv</i>
Subscribers to <i>The Braider</i>	<i>xviii</i>

A quarterly publication
for
the braiding artisan

Resale of this publication or copies thereof
is strictly prohibited

Copyright ©1999 by :

{ 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.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photo-copying, recording, or otherwise, without prior written permission.

This publication is available to braiding artisans only.

Copies may be obtained from :

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

Knot nomenclature

In *The Braider*, Issues No. 18, pp. 403–404, and No. 20, pp. 446–464, we have already met some of the confusing trends regarding the naming of knots. To complicate matters even further, we see far too often incorrect referencing, or worse still, no referencing at all. A typical case, for example, involves the **Hunter's Bend**, also known as a **Rigger's Bend**.

We mentioned already in Issue No. 20, pg. 464, a naming error associated with the **Zeppelin Bend** by either Geoffrey Budworth (*The Knot Book*, pg. 129) or Brion Toss (*The Rigger's Apprentice*, pg. 47), as well as the error in *The Australian Whipmaker*, No. 44, pg. 838, where the **Edwards' Knot** was called the **Hunter's Knot**. In *The Australian Whipmaker*, No. 47, pp. 892–893, a follow-up article adds a further number of undesirables to the saga of the **Hunter's Bend** and the **Zeppelin Bend**.

Unfortunately, this follow-up article does not give any references, not only as to the name **Rosendahl** (as opposed to **Rosenthal**), but even more seriously also not to its contained remark: "...I have seen this knot published as a **Zeppelin Bend** and **Hunter's Bend**" (referring to the fourth row of its drawings (depicting the **Zeppelin Bend**), the central drawing of which depicts the everted-lateral uppermost left diagram in Fig. 382 of *The Braider*, Issue No. 20, pg. 461). There is however a very essential and distinct difference between the **Zeppelin Bend** and the **Hunter's Bend**, namely, for braiding material which is symmetric with respect to shape, colour and pattern/texture, the **Zeppelin Bend** and its complementary form are identical whereas the **Hunter's Bend** and its complementary form are **not** identical.

The knot depicted in the article's second row of drawings is, contrary to the statement made, **not** [identical to] the **Hunter's Bend** as illustrated in Ashley (#1425A), but is instead the complementary form of it (note that in Ashley's lowermost drawing the crossing of the black lines must be opposite to that depicted).

At least some of the confusion concerning the **Hunter's Bend** and the **Zeppelin Bend** may have been caused by Geoffrey Budworth in his booklet *The Knot Book* (ISBN 0-7160-0704-5). Although the **Hunter's Bend** in this booklet (pg. 128, Fig. 85(A)) is the same as in Ashley, but with the correct crossing between the thin black lines in Fig. 85(B) as opposed to Ashley, the story on pg. 129 under *poor man's pride* wrongly states: "*It's* [the **Hunter's Bend**] *really the Rosendahl Bend (otherwise known as the Zeppelin Knot)*". His **Poor Man's Pride** in Fig. 87 on pg. 131 is in fact the **Zeppelin Bend**.

Notwithstanding that the **Hunter's Bend** in Ashley (#1425A) and its complementary form (the **complementary Hunter's Bend**) are in fact two different bends (they are not identical!!!), in some publications (*The Century Guide to Knots* (ISBN 0 7126 0089 2) by Mario Bigon and Guido Regazzoni, pg. 131, and *Identifying Knots* (ISBN 1-85348-900-X) by Peter Owen, pg. 55) the complementary **Hunter's Bend** is called the **Hunter's Bend**.

Although there is a great deal of confusion concerning the **Zeppelin Bend** and the **Hunter's Bend**, or even incorrectly tied **Hunter's bends** (the **Edwards' Knot** for example), the **Hunter's Bend** is certainly stronger than the **Zeppelin Bend** due to its more gentle string curvature, and since the construction of the **Hunter's Bend** is for many easier to remember, it is likely that the remarks by Alf Reimers, in *The Australian Whipmaker*

1997 No. 46, pg. 873, correctly do refer to the Hunter's Bend. He states there the following: "When I was about ten years of age my father showed me how to tie this knot [the Hunter's Bend]. That was seventy-three years ago [1924]. This was called the No. 8 knot. I guess because it was a beautiful way to join No. 8 gauge wire and was probably used by my forebears and others in the pioneering days of the last century. I have used this knot while fencing all my life." Furthermore, the Hunter's Bend and its (everted) complementary form were most likely known and used in ancient times due to their easy to remember construction algorithms.

For the Hunter's Bend we start with the **overhand** knot, hence with the Standing End (S_1) towards the left; the first crossing its Working End (W_1) makes is an **over**-crossing. The second string, with its Standing End (S_2) towards the right makes then with its Working End (W_2) the crossing-movements $2o - 2u - 2o - 2u - o$ (see Fig. 1).

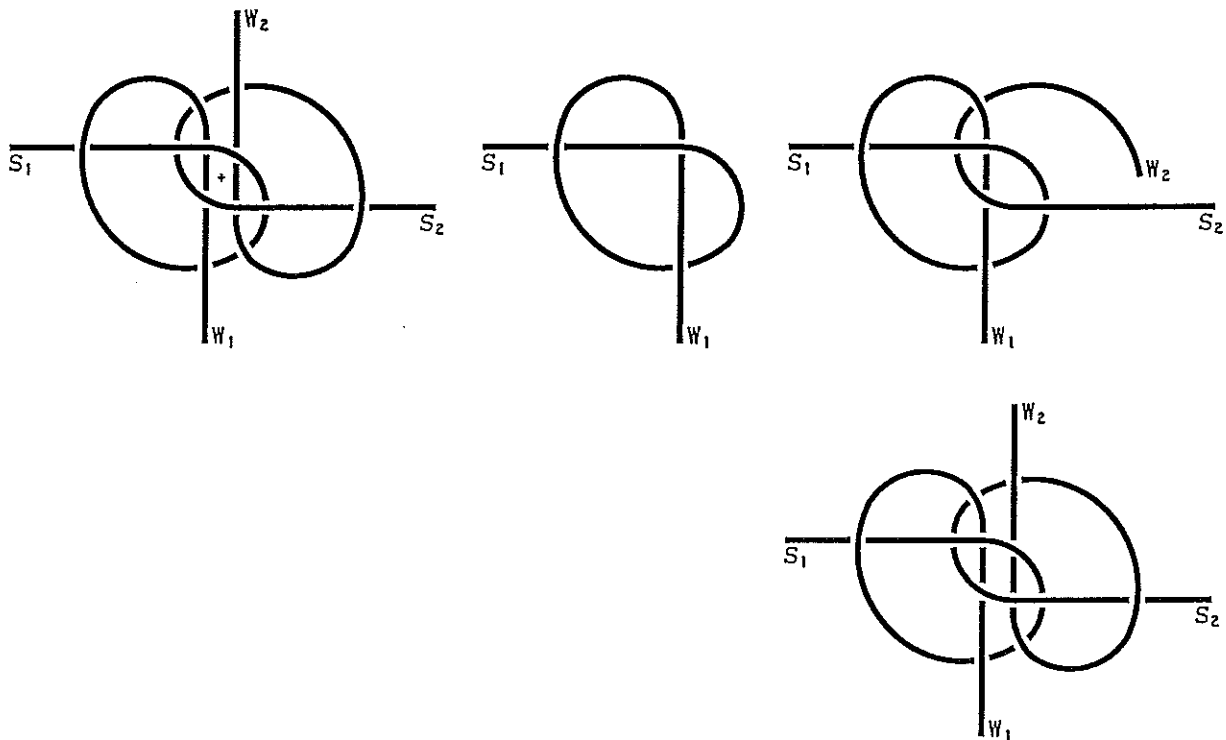


Fig. 1 — The Hunter's Bend and its construction algorithm.

For the (everted) complementary Hunter's Bend we start with the **underhand** knot, hence with the Standing End (S_1) towards the left; the first crossing its Working End (W_1) makes is an **under**-crossing. The second string, with its Standing End (S_2) towards the right makes then with its Working End (W_2) the crossing-movements $2u - 2o - 2u - 2o - u$ (see Fig. 2).

Not only are these tying algorithms very easy to remember (which is very essential for a useful bend), but they contain another very interesting property. Let the second string make the inverse sequence of the above crossing-movements, hence when we start with the **overhand** knot, the second string makes the crossing-movements $o - 2u - 2o - 2u - 2o$, and when we start with the **underhand** knot, the second string makes the crossing-movements $u - 2o - 2u - 2o - 2u$. The resulting knots are then respectively the (everted) Ashley's bend or Footrope knot and the complementary Ashley's bend or Footrope knot. Thus with the easy to remember algorithm-form for the Hunter's bend, we know at the same time the algorithm-form for the Ashley's bend

or Footrope knot. Furthermore, here (and only here; see Appendix 1997, pp. *viii-x*) it is where the name **Ashley's bend** comes in handy: the first letter in Ashley is the first letter of the alphabet and the algorithm-form for Ashley's bend begins with *1o* or *1u* and the rest of the alternating crossing-movements are in sets of two; the algorithm-form for Hunter's bend begins with *2o* or *2u* and the rest of the alternating crossing-movements are as far as possible in sets of two.

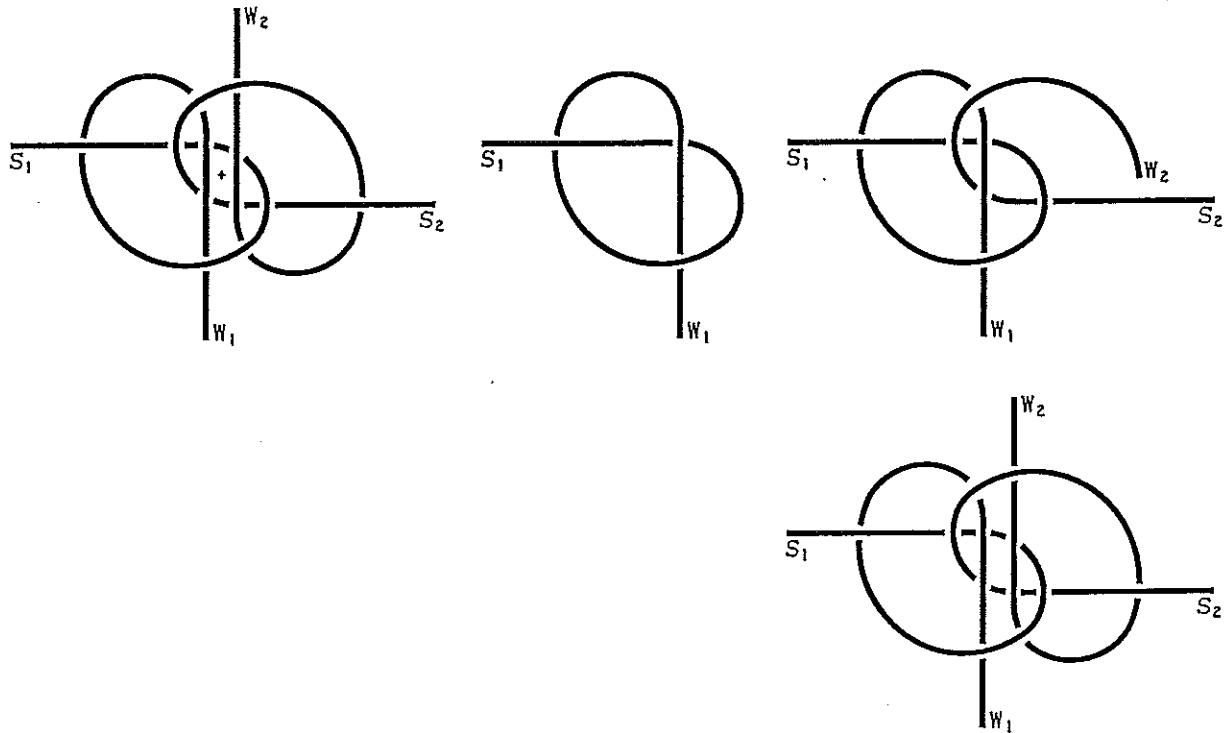


Fig. 2 — The (everted) complementary Hunter's Bend and its construction algorithm.

These tying algorithms may not necessarily be the quickest, but they avoid erroneous tying procedures and are certainly the easiest to remember. That's what counts in practice!!!

Not only was the Hunter's bend rediscovered by Hunter, but from the above it appears logic that also Ashley's bend as such was a rediscovery; logically and hence obviously we may assume that both were known as bends in the distant past.

Names and Terms used in the Braiding World

The average braider doesn't realise that in a knot or braid it is the string-run which is of prime importance and **not** the coding. The coding is independent of the string-run, although we might not be able to superimpose **any** overall coding **pattern** on **any** string-run. Hence the coding is only of minor value, hence of secondary importance only. Sure, in some knots the coding is of more importance than in other knots, but it is in the first place the string-run and **not** the coding which 'classifies' a braid. It should therefore be appreciated that there isn't a knot-name or part of a knot-name that has a 'good definitive meaning', and what is more, there never will be such a thing. Most terms used in the knot-naming game are relative indicators only, nothing more and nothing less. Take for example the term 'Casa' in the name "Casa Knot":

Tom Hall specifies the ‘Casa’ Knot as an **over-under coded Regular Knot**. A Regular Knot being a **single string Cylindrical Braid with two parallel circumferential bight-boundaries between which the string-run zigzags**. He couples the term ‘Casa’ to a **Regular Knot** made from a **single string** which then has an **over-under coding**.

We, on the other hand, did not use such a seemingly more precise and hence much more restrictive coupling procedure, but instead coupled the term ‘Casa’ to an **over-under coding** instead, hence to the **coding-form** of Tom’s ‘Casa’ Knot. Consequently we could couple the term ‘Casa’ to an **over-under coded Regular Cylindrical Braid** (referred to as an **over-under coded Regular Knot** if it requires **one essential string** ($\text{g.c.d.}(p, b) = 1$), and referred to as a **Semi-Regular Knot** if it requires **more than one essential string** ($\text{g.c.d.}(p, b) > 1$)). In fact, we could couple the term ‘Casa’ to any braidform as long as it had an **over-under coding**.

The seemingly more precise coupling way of Tom Hall is of course, as already mentioned, much more restrictive than ours, and the question arises if such a seemingly more precise way of coupling the term ‘Casa’ by Tom Hall is of sufficient value to offset its more restrictive nature. The answer, as we shall see, is certainly **no**.

We used the term ‘seemingly’ above not for nothing, because the term ‘Casa’ as used by Tom compared to its use by us offers nothing of specific practical value since it still does **not define** the knot used any closer[†] other than its in practical sense rather irrelevant nature of **having to be constructed with a single string**. In fact, Tom’s definition is not only in practical sense but even in theoretical sense a rather irrelevant one since an emphasis is placed on the compulsory **single string** property. Hence if, for example, a 7-parts/4-bights over-under coded Regular Knot is made with a single string, then according to Tom’s definition the knot is a ‘Casa’ Knot, but if it is made with say four strings then it is **not** a ‘Casa’ Knot. **Note, however, that in either case the knot is still a Regular Knot since it requires only one essential string**; apart from its bight-boundary and string-run conditions, the only important parameter for being a Regular Knot is that the $\text{g.c.d.}(p, b)$ is equal to 1 (there is no compulsion to make it from a single string!!!).

In Tom Hall’s definition of a ‘Casa’ Knot we used the term **over-under coded**, but Tom uses the term **one-pass** instead. This brings us to the much used, but in general meaningless term **pass**.

The term **pass** is being used for two different knot ‘parameters’.

We find the term **pass** being used for a section of the string-run from **somewhere around one bight to somewhere around the next consecutive bight along the string-run**. Since ‘somewhere’ can be anywhere, a **pass** is undefined and consequently is totally useless as a parameter. It is really astounding how much it is being used by ‘braiders’ and obviously their accompanying further description has, with a bit of luck, to make it clear what was meant. A **half-cycle** on the other hand has been clearly defined as a section of string-run from **one bight to the next consecutive bight** along the string-run, consequently it is very useful as a parameter.

We find the term **pass** also being used for some overall general coding arrangement. Apart from the term **one-pass** (meaning **over-under coding**), the term **n-pass**, where

[†] The reader is hereby referred to *The Braider*, Issue No. 21, pp. 471-482, to be published in February 2000.

n is a natural number greater than 1, can only be understood by people familiar with some commonly used braiders jargon accompanying the term. In other words, it is **not** unambiguously defined. If we would unambiguously define an n -pass weaving-pattern as an n over- n under coding along the string-run, then, for example, a 2-pass Standard Herringbone Knot doesn't exist, nor does a 2-pass Standard Herringbone Pineapple Knot exist, but a 2-pass Gaucho Knot and a 2-pass Headhunter's Knot do exist. One might ask: *can we give the term n -pass a definition so that it always clearly, hence unambiguously, defines any so-called n -pass weaving-pattern?* The answer is no, we cannot; we can only use the term as a rough indicator.

We use many of such rough indicator terms in the world of braiding. Unfortunately some braiders get a hang-up about one or more of such indicator terms and want to see them as the best thing after sliced bread; they often belong to the old-time pattern-braiders who are rusted solid in their braiding tracks.

A lot of nonsense and claptrap has, and still is, being written about braiding: academic nitwits love to see the hypothetical topological knot theory as being relevant to actual knotting and braiding and hence write volumes of claptrap as far as real knots and braids are concerned, the braiders which are solidly anchored in their tracks write volumes with claptrap too. Some of those still love to use enlargement methods during their actual braiding.[†]

Sure, nice artistic knot and braid drawings look terrific and often mysterious. It often appears that the more mysterious such drawings look, the better. The trouble is that even the very best drawings, or photographs for that matter, even with their associated construction procedures, cannot readily transmit to the reader a clear encompassing picture of the knot or braid. Only the grid-diagram of the knot or braid can do this, and hence it is of the utmost importance to depict also their grid-diagram. Some braiders have started to do this now, but unfortunately most of them don't understand (or don't want to understand in order to be different) why we depict grid-diagrams in the way we do. They should again thoroughly read and try to fully comprehend the reason for that what has been written in *The Braider*, Issue No. 2, pg. 32 line 32 from the top.

Nested Cylindrical Braids — Hunter's Bend

Refer to *The Braider*, Issue No. 19, August 1999 pp. 415 - 422; Issue No. 20, November 1999 pp. 457 - 458, and Fig. 3 below on pg. vi.

The string-run of Hunter's Bend may be derived from the string-run of the Nested Cylindrical Braid $(0/2/3)\{1/112\}6$. The general string-run at the left and right bight-edges is as depicted in Fig. 4. Consequently, the value of $A_l = 1$ and the value of $A_r = 3$, while $K_l = 1$ and $K_r = 2$.

The string-run of $(0/2/3)\{1/112\}6$ with the ranking-numbers as subscripts attached to the bight-boundary numbers is thus: $(0/2/3)\{1_1/1_1 1_2 2_3\}6$.

[†] Enlargement methods are now only of theoretical importance and not any longer in the actual production of braidwork; algorithm diagrams offer a much simpler and direct way in the actual production of braidwork.

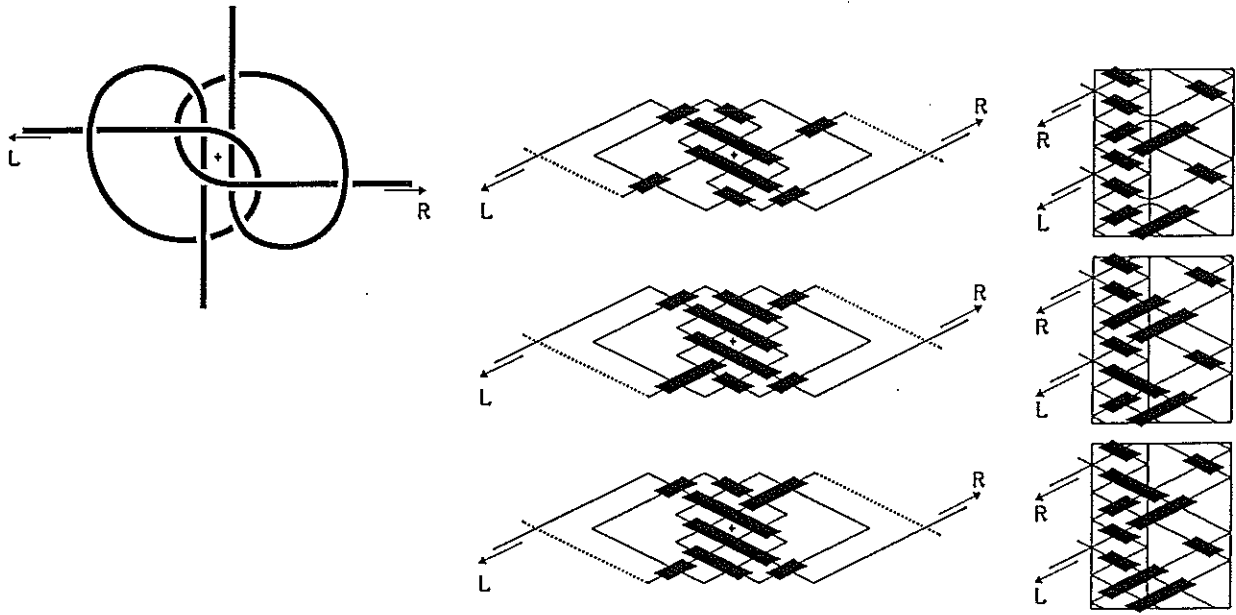


Fig. 3 — Hunter's Bend and its associated Nested Cylindrical Braids.

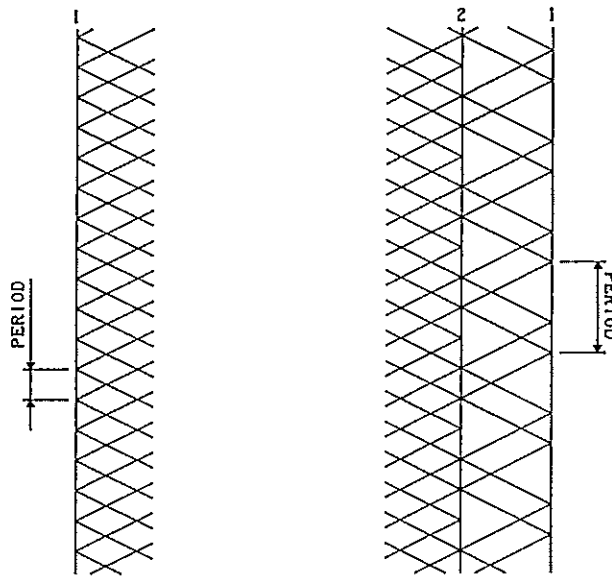


Fig. 4 — The string-run at the left and the right bight-edge.

For this string-run $((0/2/3)\{1_1/1_1 1_2 2_3\}6)$ we thus obtain:

$$A_l = 1; A_r = 3; d = \text{g.c.d.}(A_l, A_r) = \text{g.c.d.}(1, 3) = 1.$$

$$A^{**} = \frac{A_l \cdot A_r}{d} = \frac{1 \cdot 3}{1} = 3.$$

$$B_l^* = \text{number of periods at left bight-edge} = 6.$$

$$B_r^* = \text{number of periods at right bight-edge} = 2.$$

$$B_{total} = A_l B_l^* = A_r B_r^* = A^{**} B^{**} = 3 \cdot 2 = 6.$$

$$B^{**} = \frac{B_{total}}{A^{**}} = 2.$$

$$\mathcal{K}_l = 1; \mathcal{K}_r = 2.$$

Hence:

$$\begin{aligned} \Delta_{l_i} = 0 \quad \text{for } l_i = 1. & & \Delta_{r_i} = 3 \quad \text{for } r_i = 1. \\ & & \Delta_{r_i} = 0 \quad \text{for } r_i = 2. \end{aligned}$$

Each lower-left to upper-right half-cycle type in a Nested Cylindrical Braid occurs only once in all the first-return string-runs of such a braid. The lower-left to upper-right half-cycle types can be read from the Nested Cylindrical Braid specification $(0/2/3)\{1_1/1_1 1_2 2_3\}$:

$$\begin{aligned} 1_1 &\longrightarrow 1_1 \\ 1_1 &\longrightarrow 1_2 \\ 1_1 &\longrightarrow 2_3 \end{aligned}$$

Any one of these listed types may be taken as the first lower-left to upper-right half-cycle in the 1st first-return string-run, but normally we take the first listed one. Every lower-left to upper-right half-cycle encountered in this 1st first-return string-run gets deleted from the type-list.

Any one of the remaining types in the type-list may be taken as the first lower-left to upper-right half-cycle in the 2nd first-return string-run, and again every lower-left to upper-right half-cycle encountered in this 2nd first-return string-run gets deleted from the remaining type-list.

This process is carried on till all the lower-left to upper-right half-cycle types have been deleted from the type-list.

For the first-return string-runs we thus obtain:

$1_1 \swarrow$	1_2	$l_{1j_l} = 1_1 \longrightarrow 1_1 = r_{1j_r}$	$\rightarrow j'_l = 1 + 0 + 2 + 3 _1 = 1$	\rightarrow	$l_{2j'_l} = 1_1.$
$1_1 \swarrow$	1_2	$l_{2j'_l} = 1_1 \longleftarrow 1_1 = r_{1j_r}$	$\rightarrow j'_r = 1 + 3 + 2 + 0 _3 = 3$	\rightarrow	$r_{2j'_r} = 2_3.$
$1_1 \swarrow$	2_3	$l_{2j_l} = 1_1 \longrightarrow 2_3 = r_{2j_r}$	$\rightarrow j'_l = 1 + 0 + 2 + 0 _1 = 1$	\rightarrow	$l_{3j'_l} = 1_1.$
$1_1 \swarrow$	2_3	$l_{3j'_l} = 1_1 \longleftarrow 2_3 = r_{2j_r}$	$\rightarrow j'_r = 3 + 0 + 2 + 0 _3 = 2$	\rightarrow	$r_{3j'_r} = 1_2.$
$1_1 \swarrow$	1_1	$l_{3j_l} = 1_1 \longrightarrow 1_2 = r_{3j_r}$	$\rightarrow j'_l = 1 + 0 + 2 + 3 _1 = 1$	\rightarrow	$l_{4j'_l} = 1_1.$
$1_1 \swarrow$	1_1	$l_{4j'_l} = 1_1 \longleftarrow 1_2 = r_{3j_r}$	$\rightarrow j'_r = 2 + 3 + 2 + 0 _3 = 1$	\rightarrow	$r_{4j'_r} = 1_1.$

$$P_c = \frac{\alpha \cdot x + \sum_{A^{**}} (\Delta_{l_i} + \Delta_{r_i})}{A^{**}} = \frac{3 \cdot 2 + (0+0+0) + (3+0+3)}{3} = 4.$$

$$\text{g.c.d.}(P_c, B^{**}) = \text{g.c.d.}(4, 2) = 2.$$

Hence:

$$P_{total} = \sum P_{component} = 4.$$

$$\left. \begin{array}{l} \text{number of} \\ \text{components} \end{array} \right\} = \text{number of first-return string-runs} = 1.$$

$$\left. \begin{array}{l} \text{total number of} \\ \text{essential strings} \end{array} \right\} = \sum \text{sub-components} = 2.$$

Nested Cylindrical Braids — The Kirsten Knots

Refer for the calculation procedures to *The Braider*, Issue No.19, August 1999, pp.415-422.

In the Dutch bimonthly knotting publication *Het Knoopeknauwertje*, Issue No.5, April 1997 pp.16-17, we find the description of a small braided knot called *The Kirsten Knot* which can be used for covering a small spherical object. It was, however, only a small example of the **Kirsten Knots** designed by Frans Masurel. As usual, the grid-diagram of the knot discussed has not been shown in the above mentioned publication and consequently could not be analysed with the result that its true nature remained hidden (we have depicted its grid-diagram in Fig.6).

The string-run of the Kirsten Knots is characterized by the left-hand and right-hand periods depicted in Fig.5. Consequently, the value of A_l and the value of A_r are both 6 for these knots, while \mathcal{K}_l and \mathcal{K}_r are both equal to 3.

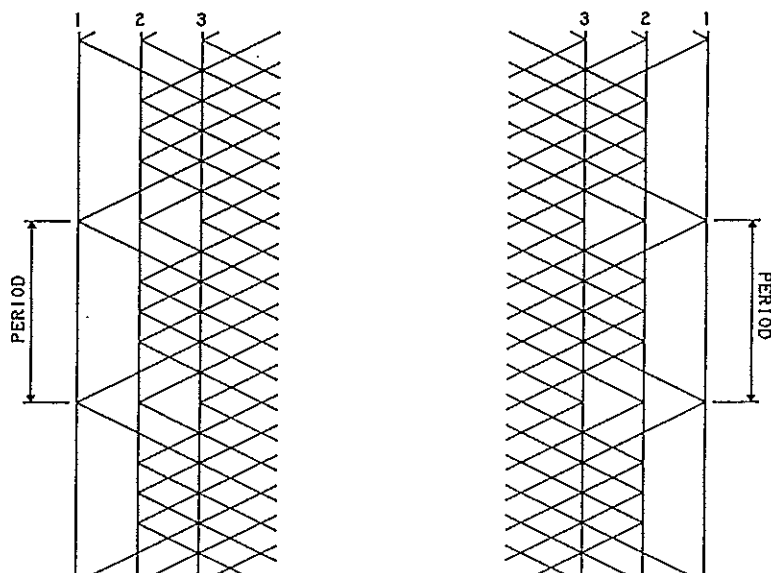


Fig.5 — The string-run at the left and the right bight-edge of the Kirsten Knots.

The string-run specification of *The Kirsten Knot* is : $(22/3/22)\{122232/222123\}6$, or with the ranking-numbers as subscripts attached to the bight-boundary numbers :

$$(22/3/22)\{1_1 2_4 2_5 2_6 3_3 2_2 / 2_1 2_2 2_3 1_4 2_5 3_6\}6.$$

For the string-run in Fig.6 we obtain :

$$\begin{aligned} A_l &= 6 ; A_r = 6 ; d = \text{g.c.d.}(A_l, A_r) = \text{g.c.d.}(6, 6) = 6. \\ A^{**} &= \frac{A_l \cdot A_r}{d} = \frac{6 \cdot 6}{6} = 6. \\ B_l^* &= \text{number of periods at left bight-edge} = 1. \\ B_r^* &= \text{number of periods at right bight-edge} = 1. \\ B_{total} &= A_l B_l^* = A_r B_r^* = A^{**} B^{**} = 6 \cdot 1 = 6. \\ B^{**} &= \frac{B_{total}}{A^{**}} = 1. \\ \mathcal{K}_l &= 3 ; \mathcal{K}_r = 3. \end{aligned}$$

Hence :

$$\begin{aligned} \Delta_{l_i} &= 4 & \text{for } l_i &= 1. & \Delta_{r_i} &= 4 & \text{for } r_i &= 1. \\ \Delta_{l_i} &= 2 & \text{for } l_i &= 2. & \Delta_{r_i} &= 2 & \text{for } r_i &= 2. \\ \Delta_{l_i} &= 0 & \text{for } l_i &= 3. & \Delta_{r_i} &= 0 & \text{for } r_i &= 3. \end{aligned}$$

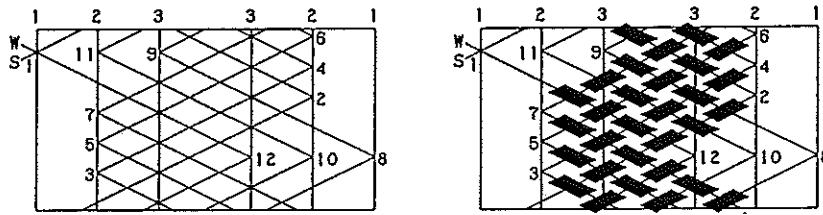


Fig. 6 — The Kirsten Knot.

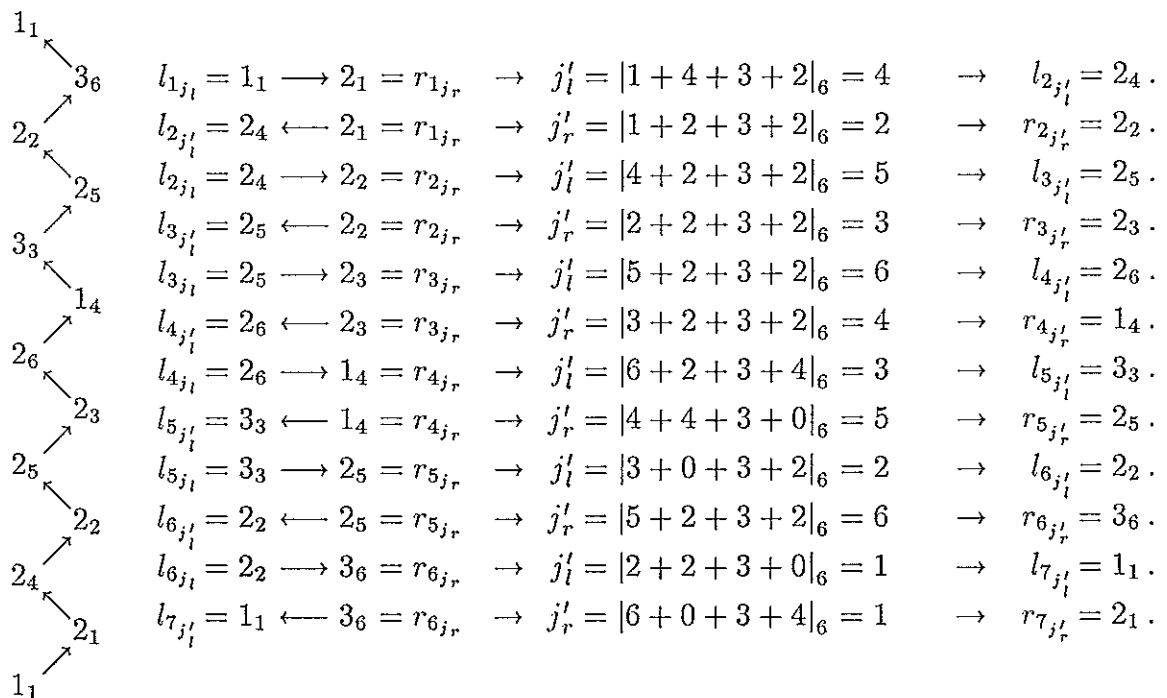
Each lower-left to upper-right half-cycle type in a Nested Cylindrical Braid occurs only once in all the first-return string-runs of such a braid. The lower-left to upper-right half-cycle types can be read from the Nested Cylindrical Braid specification $(22/3/22)\{1_1 2_4 2_5 2_6 3_3 2_2/2_1 2_2 2_3 1_4 2_5 3_6\}6$:

$$\begin{aligned} 1_1 &\longrightarrow 2_1 & 2_6 &\longrightarrow 1_4 \\ 2_4 &\longrightarrow 2_2 & 3_3 &\longrightarrow 2_5 \\ 2_5 &\longrightarrow 2_3 & 2_2 &\longrightarrow 3_6 \end{aligned}$$

Any one of these listed types may be taken as the first lower-left to upper-right half-cycle in the 1st first-return string-run, but normally we take the first listed one. Every lower-left to upper-right half-cycle encountered in this 1st first-return string-run gets deleted from the type-list.

Any one of the remaining types in the type-list may be taken as the first lower-left to upper-right half-cycle in the 2nd first-return string-run, and again every lower-left to upper-right half-cycle encountered in this 2nd first-return string-run gets deleted from the remaining type-list. This process is carried on till all the lower-left to upper-right half-cycle types have been deleted from the type-list.

For the first-return string-runs we thus obtain :



$$P_c = \frac{\alpha \cdot x + \sum (\Delta_{l_i} + \Delta_{r_i})}{A^{**}} = \frac{6 \cdot 3 + (4+2+2+2+0+2) + (2+2+2+4+2+0)}{6} = 7.$$

$$\text{g.c.d.}(P_c, B^{**}) = \text{g.c.d.}(7, 1) = 1.$$

Hence :

$$P_{total} = \sum P_{component} = 7.$$

$$\left. \begin{array}{l} \text{number of} \\ \text{components} \end{array} \right\} = \text{number of first-return string-runs} = 1.$$

$$\left. \begin{array}{l} \text{total number of} \\ \text{essential strings} \end{array} \right\} = \sum \text{sub-components} = 1.$$

Note that as long as $B_l^* = B_r^* \neq$ a multiple of 7, the knot has only one essential string.

From the string-run of the Kirsten Knots at the bight-edges (see Fig. 5) it follows that :

- (i.) the number of parts between the left bight-boundaries 1 and 3 is equal to 2,
 - (ii.) the number of parts between the right bight-boundaries 1 and 3 is equal to 2,
- hence the total number of parts of Kirsten Knots is equal to $2 + 2 + x = 4 + x$.

In *Het Knoopeknauwertje* attention was drawn to the fact that the braiding of its Kirsten Knot begins with braiding a $p/b = 5/4$ over-under coded Regular Knot by braiding the first eight half-cycles. However, since no proper grid-diagram was used, it was, for example, not realised that there were more Kirsten Knots with $B = 6$ which require one essential string only and go through an over-under coded four bight Regular Knot stage. Such Kirsten Knots form the following two sets :

1. The Kirsten Knots with specification $(22/1+6n/22)\{1_1 2_4 2_5 2_6 3_3 2_2 / 3_1 2_2 2_3 2_4 1_5 2_6\}6$ go through the $p/b = (3 + 4n)/4$ over-under coded Regular Knot stage, where n is a whole number.
2. The Kirsten Knots with specification $(22/3+6n/22)\{1_1 2_4 2_5 2_6 3_3 2_2 / 2_1 2_2 2_3 1_4 2_5 3_6\}6$ go through the $p/b = (5 + 4n)/4$ over-under coded Regular Knot stage, where n is a whole number.

Nested Cylindrical Braids — The Knot of Brian Walsh

Refer for the calculation procedures to *The Braider*, Issue No.19, August 1999, pp. 415-422.

In the English knotting publication of the IGKT (International Guild of Knot Tyers) *Knotting Matters*, Issue No. 55, March 1997 pp. 30-31, we find the description of a small braided knot under the heading **The Impossible Knot (a 5 lead x 5 bight Turk's Head?)**. The heading is followed by: *From Brian Walsh, Ipswich, England. Found by Geoffrey Budworth in some archives sent to him by Frank Harris.* Then, in Issue No. 57, September 1997 pg. 43, Jesse Coleman, Alabama, U.S.A., shows the planar construction form of this knot with the comment that it is not a Turk's Head. Next, in

the Dutch knotting publication *Het Knoopeknauwertje*, Issue No. 12, pp. 22 - 25, Pieter van de Griend shows the construction of this knot as in *Knotting Matters*, Issue No. 55, and its planar construction form as in *Knotting Matters*, Issue No. 57. He compares this knot, for the purpose of covering a sphere, with the *Kirsten Knot* as described in *Het Knoopeknauwertje*, Issue No. 5, pp. 16 - 17.

Again as usual, the grid-diagram of the knot by Brian Walsh has not been shown in any of the above referred to publications and consequently its true nature was not discovered (a weird contraption of its supposed grid-diagram is depicted in *Het Knoopeknauwertje*, Issue No. 12, on pg. 24).

The upper left-hand diagram in Fig. 7 represents the construction layout of the knot in KM No. 55, and the lowermost diagram in Fig. 7 is the planar construction form as depicted in KM No. 57.

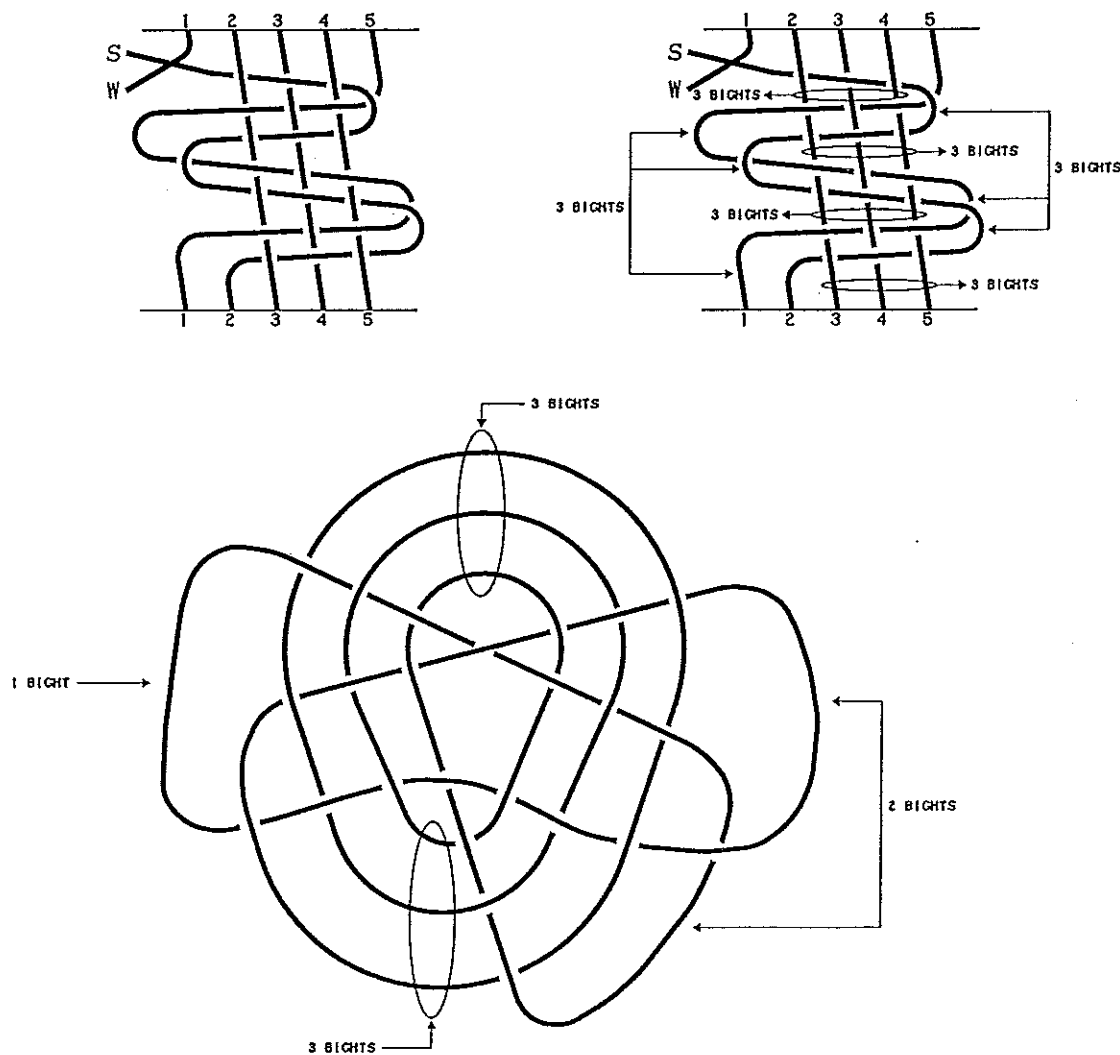


Fig. 7 — The knot by Brian Walsh.

It is interesting to note that none of the above mentioned knot tyers saw that the construction diagrams clearly indicate that the knot by Brian Walsh has **nine** bights instead of five. The formation of the nine left-hand bights and the nine right-hand bights is shown in the upper right-hand construction layout of the knot in Fig. 7. The formation of the nine bights on one of the two bight-edges is also shown in its lower planar construction layout in Fig. 7.

The string-run diagram and grid-diagram of the knot by Brian Walsh in accordance with its construction procedure as described in KM No. 55, hence as indicated by the upper left-hand construction layout in Fig. 7, is depicted in Fig. 8.

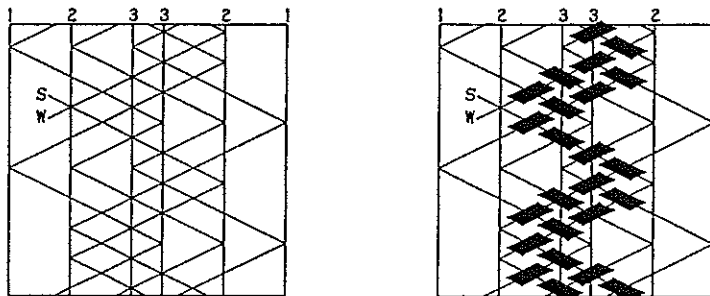


Fig. 8 — String-run and grid-diagram of the knot by Brian Walsh.

The string-run of the knot by Brian Walsh is characterized by the left-hand and right-hand periods depicted in Fig. 9. Consequently, the value of A_l and the value of A_r are both 9 for this knot, while \mathcal{K}_l and \mathcal{K}_r are both equal to 3.

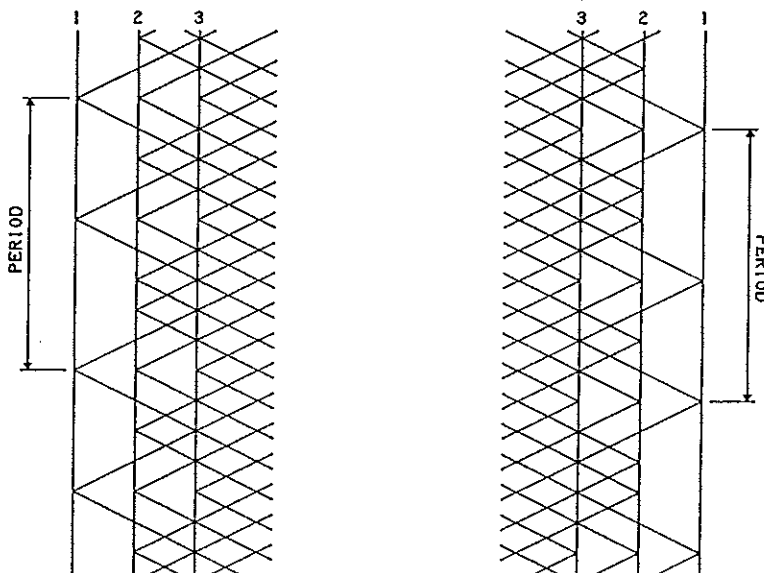


Fig. 9 — The string-run of the knot by Brian Walsh at the left and the right bight-edge.

We can thus depict the string-run and grid-diagram of the knot by Brian Walsh as shown in Fig. 10.

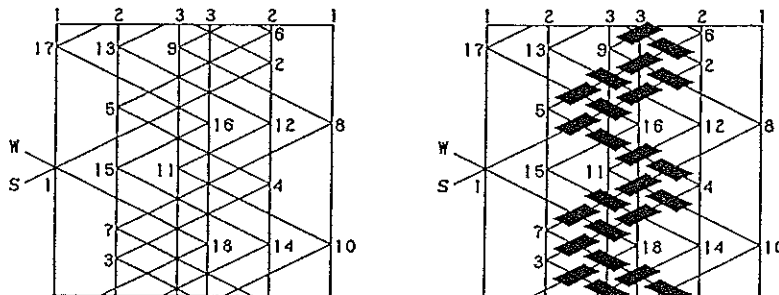


Fig. 10 — String-run and grid-diagram of the knot by Brian Walsh.

The string-run specification of this knot is : $(22/1/22)\{123212232/221232123\}9$,
 or with the ranking-numbers as subscripts attached to the bight-boundary numbers:
 $(22/1/22)\{1_1 2_4 3_7 2_6 1_5 2_8 2_9 3_3 2_2 / 2_1 2_2 1_3 2_4 3_5 2_6 1_7 2_8 3_9\}9$.

For the string-run in Fig. 10 we obtain:

$$\begin{aligned}
 A_l &= 9; \quad A_r = 9; \quad d = \text{g.c.d.}(A_l, A_r) = \text{g.c.d.}(9, 9) = 9. \\
 A^{**} &= \frac{A_l \cdot A_r}{d} = \frac{9 \cdot 9}{9} = 9. \\
 B_l^* &= \text{number of periods at left bight-edge} = 1. \\
 B_r^* &= \text{number of periods at right bight-edge} = 1. \\
 B_{total} &= A_l B_l^* = A_r B_r^* = A^{**} B^{**} = 9 \cdot 1 = 9. \\
 B^{**} &= \frac{B_{total}}{A^{**}} = 1. \\
 \mathcal{K}_l &= 3; \quad \mathcal{K}_r = 3.
 \end{aligned}$$

Hence:

$$\begin{aligned}
 \Delta_{l_i} &= 4 \quad \text{for } l_i = 1. & \Delta_{r_i} &= 4 \quad \text{for } r_i = 1. \\
 \Delta_{l_i} &= 2 \quad \text{for } l_i = 2. & \Delta_{r_i} &= 2 \quad \text{for } r_i = 2. \\
 \Delta_{l_i} &= 0 \quad \text{for } l_i = 3. & \Delta_{r_i} &= 0 \quad \text{for } r_i = 3.
 \end{aligned}$$

Each lower-left to upper-right half-cycle type in a Nested Cylindrical Braid occurs only once in all the first-return string-runs of such a braid. The lower-left to upper-right half-cycle types can be read from the Nested Cylindrical Braid specification $(22/1/22)\{1_1 2_4 3_7 2_6 1_5 2_8 2_9 3_3 2_2 / 2_1 2_2 1_3 2_4 3_5 2_6 1_7 2_8 3_9\}9$:

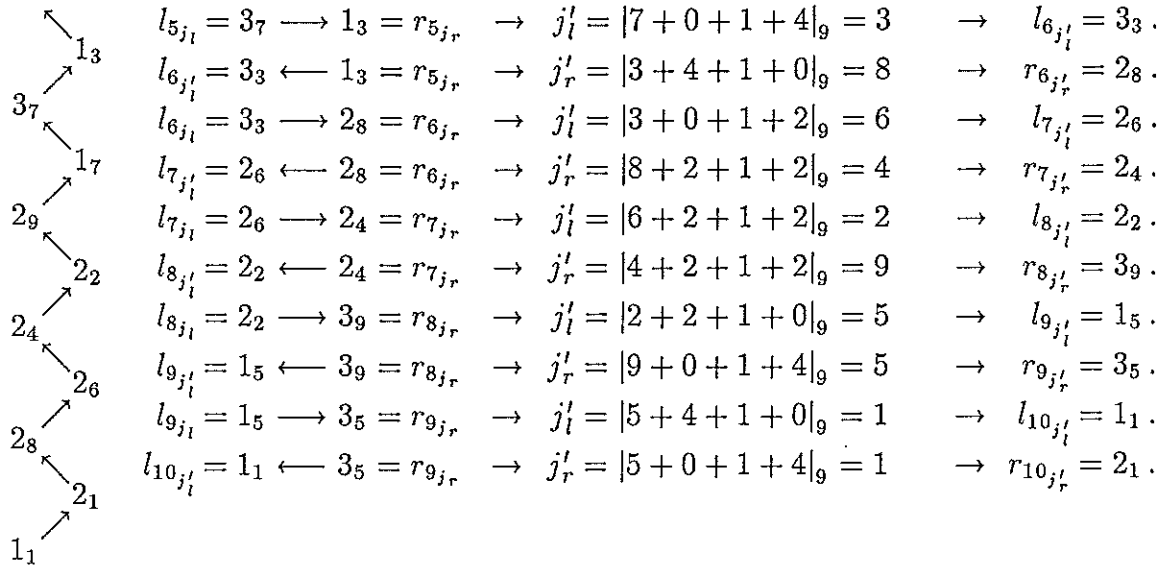
$$\begin{array}{lll}
 1_1 \longrightarrow 2_1 & 2_6 \longrightarrow 2_4 & 2_9 \longrightarrow 1_7 \\
 2_4 \longrightarrow 2_2 & 1_5 \longrightarrow 3_5 & 3_3 \longrightarrow 2_8 \\
 3_7 \longrightarrow 1_3 & 2_8 \longrightarrow 2_6 & 2_2 \longrightarrow 3_9
 \end{array}$$

Any one of these listed types may be taken as the first lower-left to upper-right half-cycle in the 1st first-return string-run, but normally we take the first listed one. Every lower-left to upper-right half-cycle encountered in this 1st first-return string-run gets deleted from the type-list.

Any one of the remaining types in the type-list may be taken as the first lower-left to upper-right half-cycle in the 2nd first-return string-run, and again every lower-left to upper-right half-cycle encountered in this 2nd first-return string-run gets deleted from the remaining type-list. This process is carried on till all the lower-left to upper-right half-cycle types have been deleted from the type-list.

For the first-return string-runs we thus obtain:

$1_1 \longleftarrow 3_5$	$l_{1j_l} = 1_1 \longrightarrow 2_1 = r_{1j_r} \rightarrow j'_l = 1 + 4 + 1 + 2 _9 = 8 \rightarrow l_{2j'_l} = 2_8.$
$1_5 \longleftarrow 3_9$	$l_{2j'_l} = 2_8 \longleftarrow 2_1 = r_{1j_r} \rightarrow j'_r = 1 + 2 + 1 + 2 _9 = 6 \rightarrow r_{2j'_r} = 2_6.$
$2_2 \longleftarrow 2_4$	$l_{2j_i} = 2_8 \longrightarrow 2_6 = r_{2j_r} \rightarrow j'_l = 8 + 2 + 1 + 2 _9 = 4 \rightarrow l_{3j'_l} = 2_4.$
$2_6 \longleftarrow 2_8$	$l_{3j'_l} = 2_4 \longleftarrow 2_6 = r_{2j_r} \rightarrow j'_r = 6 + 2 + 1 + 2 _9 = 2 \rightarrow r_{3j'_r} = 2_2.$
$3_3 \longleftarrow 2_8$	$l_{3j_i} = 2_4 \longrightarrow 2_2 = r_{3j_r} \rightarrow j'_l = 4 + 2 + 1 + 2 _9 = 9 \rightarrow l_{4j'_l} = 2_9.$
$3_3 \longleftarrow 2_8$	$l_{4j'_l} = 2_9 \longleftarrow 2_2 = r_{3j_r} \rightarrow j'_r = 2 + 2 + 1 + 2 _9 = 7 \rightarrow r_{4j'_r} = 1_7.$
$3_3 \longleftarrow 2_8$	$l_{4j_i} = 2_9 \longrightarrow 1_7 = r_{4j_r} \rightarrow j'_l = 9 + 2 + 1 + 4 _9 = 7 \rightarrow l_{5j'_l} = 3_7.$
$3_3 \longleftarrow 2_8$	$l_{5j'_l} = 3_7 \longleftarrow 1_7 = r_{4j_r} \rightarrow j'_r = 7 + 4 + 1 + 0 _9 = 3 \rightarrow r_{5j'_r} = 1_3.$



$$P_c = \frac{\alpha \cdot x + \sum_{A^{**}} (\Delta l_i + \Delta r_i)}{9} = \frac{9 \cdot 1 + (4+2+2+2+0+0+2+2+4) + (2+2+2+4+4+2+2+0+0)}{9} = 5.$$

g.c.d. (P_c, B^{**}) = g.c.d. (5, 1) = 1.

Hence :

$$P_{total} = \sum P_{component} = 5.$$

$$\left. \begin{array}{l} \text{number of} \\ \text{components} \end{array} \right\} = \text{number of first-return string-runs} = 1.$$

$$\left. \begin{array}{l} \text{total number of} \\ \text{essential strings} \end{array} \right\} = \sum \text{sub-components} = 1.$$

Note that as long as $B_l^* = B_r^* \neq$ a multiple of 5, the knot has only one essential string.

As with the Kirsten Knot we can generalise the Brian Walsh Knot. From the string-run of the Brian Walsh Knots at the bight-edges (see Fig. 9) it follows that :

- (i.) the number of parts between the left bight-boundaries 1 and 3 is equal to 2,
 - (ii.) the number of parts between the right bight-boundaries 1 and 3 is equal to 2,
- hence the total number of parts of Brian Walsh Knots is equal to $2 + 2 + x = 4 + x$.

Apparently none of the above mentioned knot tyers (Brian Walsh, Frank Harris, Geoffrey Budworth, Jesse Coleman and Pieter van de Griend) nor any of those associated with the compilation of *Knotting Matters* realised that the construction of the Brian Walsh Knot with $x = 1$ could begin with braiding a $p/b = 3/5$ over-under coded Regular Knot by braiding the first ten half-cycles of the Brian Walsh Knot $(22/1/22)\{1_1 2_4 3_7 2_6 1_5 2_8 2_9 3_3 2_2 / 2_1 2_2 1_3 2_4 3_5 2_6 1_7 2_8 3_9\} 9$. Furthermore it was apparently also not realised that there were more Brian Walsh Knots with $B = 9$ which require one essential string only and go through an over-under coded five bight Regular Knot stage. Such Brian Walsh Knots form the following two sets :

1. The Brian Walsh Knots with specification :

$$(22/9n/22)\{1_1 2_4 3_7 2_6 1_5 2_8 2_9 3_3 2_2 / 3_1 2_2 1_3 2_4 3_5 2_6 2_7 1_8 2_9\} 9$$

go through the $p/b = (2 + 5n)/5$ over-under coded Regular Knot stage, where n is a whole number.

2. The Brian Walsh Knots with specification:

$$(22/1 + 9n/22)\{1_1 2_4 3_7 2_6 1_5 2_8 2_9 3_3 2_2 / 2_1 2_2 1_3 2_4 3_5 2_6 1_7 2_8 3_9\}9$$

go through the $p/b = (3 + 5n)/5$ over-under coded Regular Knot stage, where n is a whole number.

Many braiders seem to have a hang-up about braids which cover a sphere. Hence it is no wonder that some are going to compare for such purpose the $x = 1$ Brian Walsh Knot with the $x = 3$ Kirsten Knot. It is of course a rather stupid act to do so, not only since the x -values are not the same, but the Brian Walsh Knots and the Kirsten Knots are **cylindrical braids** with more or less dome shaped ends of which only a few can be used to cover to some extent a sphere.

Our Questions and Readers Answers.

Is Mike Hickey (Tom Hall) really the only reader who tries to solve our questions??? He seems to be the only one who discovered that the string-run specification $(22/5/22)\{123/312\}12$ under (1) of the question on pg.422 is impossible. He thought that there was a typing error in the specification, however, this specification was purposely given to see if there was anyone who takes the effort trying to answer the questions presented, since we never did receive a solution to any of our questions. Hence congratulations to Mike Hickey who is the very first one to send us a solution to a question!!! The purpose of the questions is to enable the reader to test his/her understanding of the material presented.

ERRATA—*The Braider*

The updated errata list below lists the typing errors which were noted in at least some copies of the following Issues of *The Braider*.

No. 1

pg. 3, line 9 — **it is**

pg. 3, line 10 — **unnecessarily**

pg. 3, line 17 — in order **to** present

pg. 12, line 5 under “An Introduction to Flat Braids” — Four pages are devoted to

pg. 16, line 9 under “Reviews” — **instructor**

No. 2

pg. 21, line 2 — delete **that**

pg. 28, line 6 — However, a one colour

pg. 38, line 18 under “Reviews” — **they** are first class

No. 3

pg. 42, line 2 — Naturally, **queries** not directly

No. 4

pg. 76, line 5 — **phenomenon**

pg. 81, line 16 — **phenomenon**

No. 5

pg. 87, line 3 from bottom of page — **exclude**

pg. 106, line 11 — **locality**

No. 6

pg. 129, line 15 — 2-colour

No. 7

No. 8

pg. 158, line 3 — Hence **the** number of bights

pg. 161, line 12 — In Fig. 144 are depicted the **parts-raising** processes

No. 9

No. 10

pg. 213, line 2 — **choose**

No. 11

pg. 232, line 17 — **in general**

pg. 245, line 8 — **in general**

No. 12

pg. 257, line 6 — or $B = \{(2m + 2)(\alpha + 1) - 1\}N - (\alpha + 1)$ bights

pg. 257, line 7 — Those with $B = \{(2m + 2)(\alpha + 1) - 1\}N - (\alpha + 1)$ bights

pg. 257, line 9 — $b = \{(2m + 2)\alpha - 1\}N - \alpha$ bights. Those with

$B = \{(2m + 2)(\alpha + 1) - 1\}N + (\alpha + 1)$ bights

pg. 257, line 10 & 11 — with $p = \{(2m + 2)\alpha - 1\}$ parts and $b = \{(2m + 2)\alpha - 1\}N + \alpha$ bights

pg. 257, line 7 from bottom — delete **thinspace**

No. 13

pg. 276, line 7 — **in general**

No. 14

pg. 308, line 3 — **in general**

No. 15

pg. 338, line 1 — **independent**

No. 16

- pg. 347, line 3 — $P = 2m(\alpha + 1) + 1$
 pg. 353, line 16 — **screw**
 pg. 356, line 3 — **two**
 pg. 359, line 5 under Fig. 310 — **boundary**
 pg. 361, line 3 from bottom — **Headhunter's-coded**
 pg. 366, line 30 — **braided**

No. 17

- pg. 369, line 12 — **mathematical**
 pg. 372, lines 8, 9, 10, 13 — **positive**
 pg. 383, line 13 — **Figs. 326–328**
 pg. 387, line 2 below Fig. 332 — **in general**
 pg. 387, line 13 below Fig. 332 — **cases**

No. 18

- pg. 393, the right-hand brace } immediately before the second equal sign is missing in the three lines above the upper line, and the right-hand brace } immediately before the third equal sign is missing in the first line below the upper line.
 pg. 395, line 4 — **additionally**
 pg. 396, bottom line — **in general**
 pg. 397, line 4 from bottom — **in general**
 pg. 412, Fig. 345 immediately below the sixth diagram — change $o - u - o - u$ to $u - o - u - o$.
 pg. 413, Fig. 346 leftmost diagram in second row of diagrams: the two non coded crossing points should have been provided with an under coding each for the braiding direction indicated.

No. 19

- pg. 419, lines 2 & 3 from bottom — **in general**
 pg. 421, line 2 — $(12/19/113)\{1_1 1_2 2_4 3_3 / 1_1 1_2 3_3 1_4 4_5 2_6\} 2_4$
 pg. 430, lines 3 & 5 — **in general**

No. 20

- pg. 446, line 14 — A few **simple** examples
 pg. 446, line 3 from bottom — **in general**
 pg. 447, Footnote — **These** are the
 pg. 450, last line — delete **thinspace**
 pg. 464, line 20 — **Brion Toss**

No. 21

- pg. 465, line 16 — **in general**

No. 22

- pg. 493, second line under “Question on pg. 479” — **appliqué**

No. 23

pg. 516, line 3 — **categorisation**
 pg. 523, line 14 — Fig. 445

No. 24

pg. 537, line 2 — **arises**
 pg. 537, line 14 — **actual**
 pg. 545, line 1 — read as: greater than or equal to 2 and less than *p*

Subscribers to *The Braider*

The up to date full address list in alphabetical order of all those who receive *The Braider* is as follows:

J.E. Barcus
 507 North Matlock St.
 Mesa, Arizona 85203-7223
 U.S.A.

J. Leach
 14 Barley Mow Lane
 St. Albans
 Hertfordshire AL4 ORP
 England.

W.J. Budd
 779 Cessna Ct.
 Spring Creek, NV 89815
 U.S.A.

F.J.M. Masurel
 Ganzenzijde 4
 2317 XG Leiden
 The Netherlands.

E.G. Glasby
 214 Wood Street West
 Warwick 4370
 Queensland
 Australia

E. Pass #22242
 P.O. Box 24406
 Santa Rita Unit
 10012 South Wilmot Rd.
 Tucson, AZ. 85734-4406.
 U.S.A.

M. Hickey (T. Hall)
 HC 67 Box 27
 Lonetree
 Wyoming 82936
 U.S.A.

A.G. Schaaake
 21 Sundown Cresc.
 Hamilton
 New Zealand.

J.C. Hoefnagel
 Willy Martensstraat 23
 3314 XV Dordrecht
 The Netherlands.

D. Van Tassel
 Box 335
 Craig, CO. 81626-0335
 U.S.A.

R. Huffman
 P.O.Box 217
 Amesville, Ohio 45711
 U.S.A.
