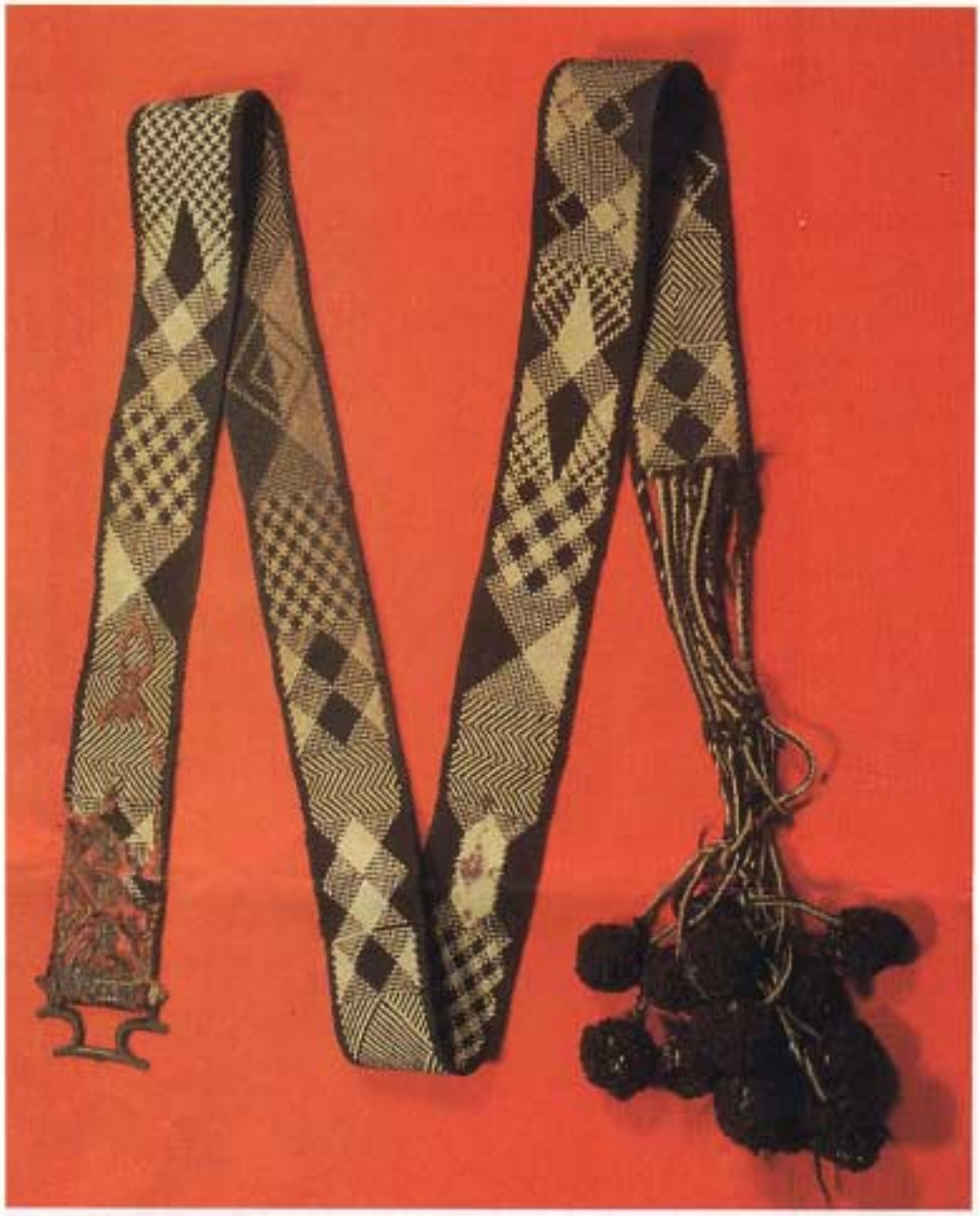


Try ply-split braiding with a simple braid (right) in 'plain oblique twining.' (Look for future articles in other ply-split braiding techniques.)

'Plain oblique twining' is the structure used to make this camel girth from Rajasthan, India (above left). Three- dimensional objects can also be made with ply-split braiding, such as the bottle (left), which incorporates several slits into the basic plain oblique twining structure.

PLY-SPLIT BRAIDING

BY PETER COLLINGWOOD

"Every fabric has a way of interworking the elements used to create a coherent whole, i.e., converting the linear into the planar. In weaving it is interlacing; in knitting it is interlooping. In ply splitting, elements are interworked by the plies of one yarn being opened sufficiently to pull another completely through it — a very simple operation."

If a set of parallel elements, like a warp, is split at right angles by another element, like a weft, it is 'ply-split darning,' a structure found worldwide which can bear a superficial resemblance to simple tablet weaving; see *1a*.

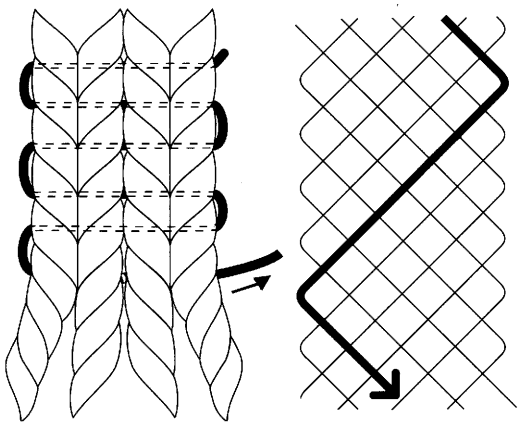
PLY-SPLIT BRAIDING

But in ply-split braiding, the elements move as in all braids. That is, they move on oblique courses, first lying on one diagonal, say the 'S,' then meeting a selvedge, switching to the other 'Z' diagonal, meeting the opposite selvedge, and switching back to the 'S' diagonal, and so on; see the heavy line in *1b*. At each point where an element on one course meets an element on the opposite course, one splits the other and passes through it. So at each such point, there are only two possibilities; either the right-hand element can split the left-hand (*2a*), or the left-hand can split the right-hand (*2b*). From the correct placing of these two options stem the three main structural types of ply-split braiding and a surprising range of design possibilities.

The technique is found almost exclusively in northwest India and neighboring areas, where it is used for bags, camel girths, and other decorative animal trappings. Ply-splitting, from the spinning of the yarns to the final item is entirely a male activity.

It is odd that the first two written descriptions of ply-splitting both date from 1972, Virginia Harvey's *Split-Ply Twining* (based on analysis of just one type of girth collected by visitors to India) and the late Judith Stein's thesis *Camel Belts of Western India* (later expanded with co-researcher Betsy Quick into *Ply Split Camel Girths of West India,* Fowler Museum, UCLA).

1a. *Ply-split darning* ***1b.*** *Ply-split braiding*



2a. *Right-hand yarn splits left-hand yarn*

2b. *Left-hand yarn splits right-hand yarn*

Preparing cords for ply-splitting

The elements used for ply-splitting, the 'cords,' need special properties not usually found in purchased yarn, so ply-splitting always begins with making your own cords. Traditionally the cords consist of four 2/ply yarns (S-plied) plied together in the Z direction. Cords of any ply can be used, but 4-ply cord is described in this article. The basic yarn must have a natural springiness or elasticity; so wool is ideal in the absence of goat hair, the material most found in India.

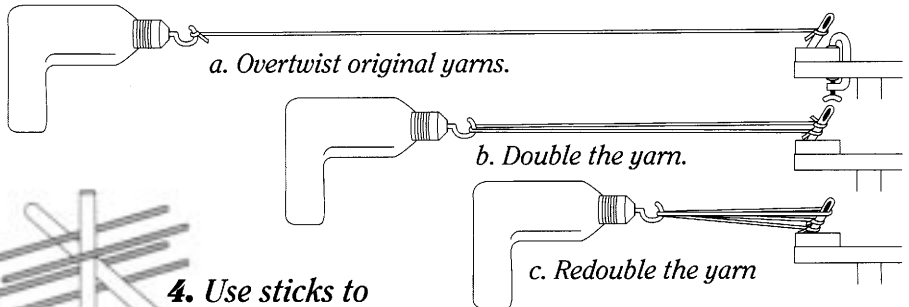
To make the cords, use a power drill (preferably cordless or with a very long cord) with a hook (bent wire, cuphook) fixed in the chuck. A small block of wood with a nail or very large needle knocked in at an angle is the only other item needed; it is clamped to a table; see *3a*.

Using a 2-ply rug wool, make a loop at each end of a strand of yarn, putting one loop on the nail and the other on the drill's hook as far away as space permits, as in *3a*. Switch on the tool so it increases the twist already in this stretched length of yarn; this is usually in the 'S' direction. As this overtwist is inserted, the yarn shortens and you have to move forward. Stop when a short length, slackened, twists back on itself or snarls.

You now have to fold this into four to make the cord. Assuming your arms are not long enough for you to reach the nail, get a helper to take the loop off the hook, catching the yarn itself around the hook, and then carry the loop to the far end and slip it on the nail. As this is done, you are forced to advance half the distance down your rope walk and there is now a doubled yarn between you and the nail, as in *3b*. Again the helper returns, takes the loop from the hook catching the doubled yarn around the hook, and carries this loop and puts it on the nail (or needle). Again you are forced to advance, and now there are four lengths between your hook and the nail, as in *3c*.

Next put the drill in reverse so these four lengths can be plied in the opposite direction to make the final cord. Whereas the overtwisting can be done at speed, the plying needs a more controlled speed. To ensure the four plies lie perfectly in place, the helper inserts two sticks (or even fingers) between them, as in *4*, about 6" from the hook. As the cord forms between the hook and sticks, the latter are moved towards the nail and then pulled out. The amount of twist is not critical here: if too much, the cord untwists when released; if too little, it twists up by itself.

3. *Use a power drill to ply the cords*



4. *Use sticks to control four plies*

Securing the cord

The two ends of the cord must now be secured to prevent unplying. A cotton tie is put through the loops on the hook. If a length of cotton is threaded through the needle eye and then the yarns pulled off the needle, this cotton will go through all these and can be tied to secure them. Alternatively, Scotch tape can be wrapped tightly near each end and the extreme ends cut off; see the ends of the cords in the sample on p. 46. If a long cord has been made, it can be subdivided into shorter lengths by wrapping with tape at regular intervals and cutting mid-wrapping. Lengths of cord 4'-5' long are suitable for a beginning sample, such as on p. 46.

Consistency of twist

The twist in the cord should be such that if a section is forcibly unplied, it springs back to its original state. Too little twist will make a loose fabric; too much a harsh, stiff one. Remember that once the cord is made the degree of its twist cannot be altered, as it is a function of the original overtwist. To ensure consistency, mark on the floor where you stand at the start and finish at the first stage. Personally I often use a hand-operated drill so I can accurately count the revolutions of the hook, but I find these gadgets are confined to museums in America!

An ingenious twister with four hooks is made by Bradshaw Machinery, PO Box 102, Deer Isle, Maine, 04627. This can be worked by one person; it first overtwists the four yarns simultaneously, then very efficiently plies them into a perfect cord. Long cords can thus be speedily made by a solo worker.

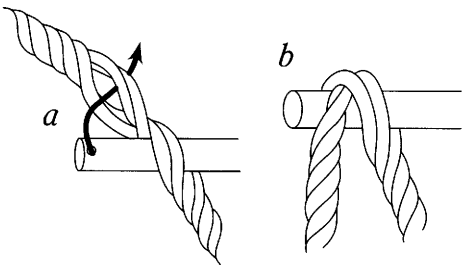
If forced to make a cord solo, and without the above gadget, the maximum possible length will be about half your arm span; but there are dodges for getting round this limitation, such as placing the tool on the floor and acting as your own helper.

For a first sample, such as on p. 46, make six cords in a dark color, D, and six in a light color, L.

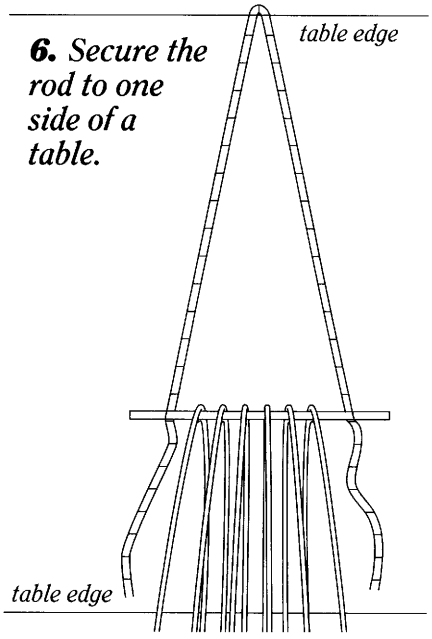
Starting a Braid

The above cords have to be fixed to a starting rod, which can be a stiff wire, a narrow dowel, even a pencil; I use lingoes from a Jacquard loom. Push the rod through the cord under two of the plies at the cord's midpoint, then immediately under the other two plies, so that the cord is now fastened to the rod, as in *5a-b*; see sample p. 46. There are several other ways of fixing to the rod, even a way of starting without a rod, but this one is easy. Each cord provides two free-hanging ends about 2' long. Fix the six dark cords on the right, giving 12 dark hanging ends; and six light cords on the left, giving 12 light hanging ends, 24 ends in all to work with (as shown in *8a*).

***5.** Inserting the rod*



***6.** Secure the rod to one side of a table.*

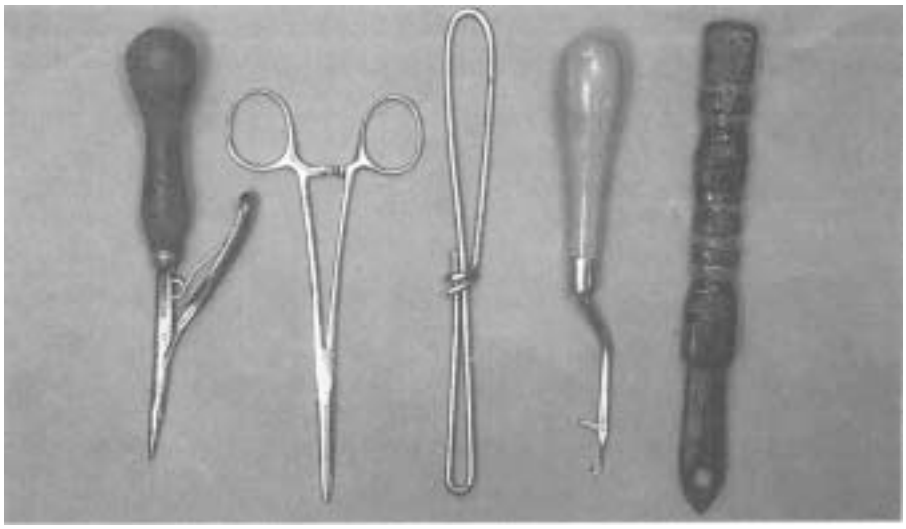


Indian ply splitters work on the move holding everything in their hands, but I find it much easier to work at a table with the starting rod held in a horizontal position. Poke its two ends through appropriate holes in a length of Texsolv (see *6*) which is fastened at its midpoint at the far side of the table. Lacking Texsolv, a doubled pair of cords with periodic knots serves well. The work is then held conveniently and can be turned over easily which is done repeatedly in ply splitting.

With the cords made and assembled on the rod, all that is now needed is some implement to make easy the splitting of one cord and the pulling through of another. Traditionally a self-made wooden needle is used as at the left *Photo a*. Other gadgets (shown at the right in *Photo a*) which work well are a latchet hook mounted in a handle (as sold for hooking rugs), a loop made of bent wire, a fine-pointed hemostat, and my favorite, a tool used in prodding rags through burlap in mat making, sometimes found in junk shops. For simplicity the implement will here be called a needle.

In weaving there are several basic structures, such as plain weave, twill, satin, etc.; similarly in ply splitting there are three main structures: 'plain oblique twining,' 'single course oblique twining,' and 'two-layered oblique interlacing.' This article describes plain oblique twining (POT). The camel girth from Rajasthan, shown on p. 46, is made entirely in this structure.

Photo a. Tools for ply-split braiding



Plain Oblique Twining

This structure is produced by the constant repetition of two rows, a short row (*8b*) and a long row (*8c*).

Short row

By rolling the left finger and thumb, unply cord 2 close under the starting rod. The four plies now run parallel and untwisted between these fingers and the rod; see *7a*. Push the needle, held in the right hand, through the exposed plies, going under two and over the other two; *7b*. This movement, upwards and to the left splits cord 2 centrally. Now put cord 3 into the needle's eye (*7c*) and draw the needle back, downward to the right, dragging cord 3 through the center of cord 2; see *7d*. Pull on both cords to tighten, giving cord 2 a twist to make sure it re-plies completely.

This is the basic maneuver, which occurs with little exception in all ply-split braiding. It can be called a rightward splitting, and this one can be written in abbreviated form as 3>2, i.e., cord 3 passes through 2. Repeat the movement exactly with cords 4 and 5; unplying 4 and pulling 5 through its center and so on. Continue all across to the left until cord 23 has been pulled through cord 22. The row can be written as 3>2, 5>4, 7>6, etc., ending with 23>22. Tighten this and subsequent rows by taking the split cords in one hand and the splitting cords in the other, then firmly pull these two groups apart.

Notice that cords 1 and 24 have been omitted in this row, making it a short row with only 11 splittings; see *8b*. At each splitting, it is the split cord which shows: dark or light rectangles in *8b* mark the sections of split cords (dark or light) that show on the surface when the cords are tightened. Compare the top row of the braid in *Photo b* with the rectangles in *8b*.

Long row

In *8c*, a long row follows the short row in *8b*. Notice three things: 1) cords 1 and 24 omitted in the first row are now included, making this a long row with 12 splittings. So the total number of splittings in a repeat of a short and long row is 11 + 12 = 23, one fewer than the number of cords being used, a basic law of braiding; 2) that the cords split in the last row become splitters in this row and vice versa (this is part of the basic structure of plain oblique twining); and 3) for the latter to happen, the splittings must all be leftward.

To produce such leftward splittings, there are two options. The hands can change roles, the right unplying a cord and the left holding the needle, so the splitting is leftward. Or, as is almost always done, the whole piece is turned over so that the splittings immediately become the familiar rightward type and the hands can work as usual. This constant turning over between rows is characteristic of all ply-splitting techniques, and the two hands become very adept at their appointed tasks. Though the turnings play havoc with the numbering system, it is only used in the learning stages.

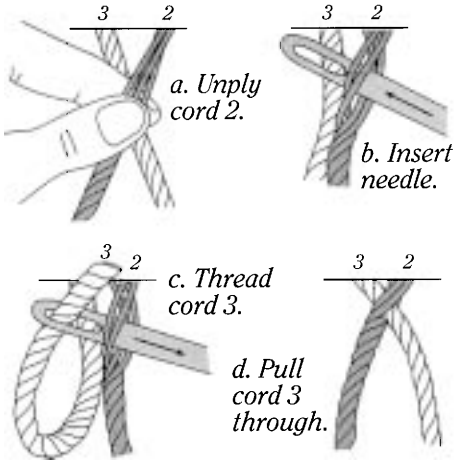
So with the piece turned over, again working right to left, split cord 24 (which is now on the extreme right) and pull 22 (the adjacent cord) through it. Then split 23 and pull 20 through and so on, ending by splitting 3 and pulling 1 through. As before, this can be abbreviated to 22>24, 20>23, and so on until 1>3. Turn the piece back over.

Short and long rows alternate

The next row, a short row, is exactly like the first row except in one particular, which is always found in the usual, closely worked type of POT: every relevant cord must be split in such a way that a ¼ twist is left between this and its previous splitting. The left hand unplies the cord until the plies can be seen running straight back to the last splitting (in the previous short row) and then lets it twist back a ¼ turn; then the right hand pushes the needle through. From now on this is done with every splitting. Make the next long row exactly like the previous long row, leaving the vital ¼ twist in each split cord between splittings.

Keep repeating the short and long rows above. The braid will quickly assume its own natural width, a function of the number and thickness of cords used, so the selvedges present no problem and will stay straight if the work is consistent.

7. Beginning a short row



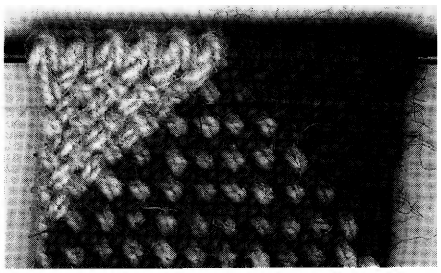
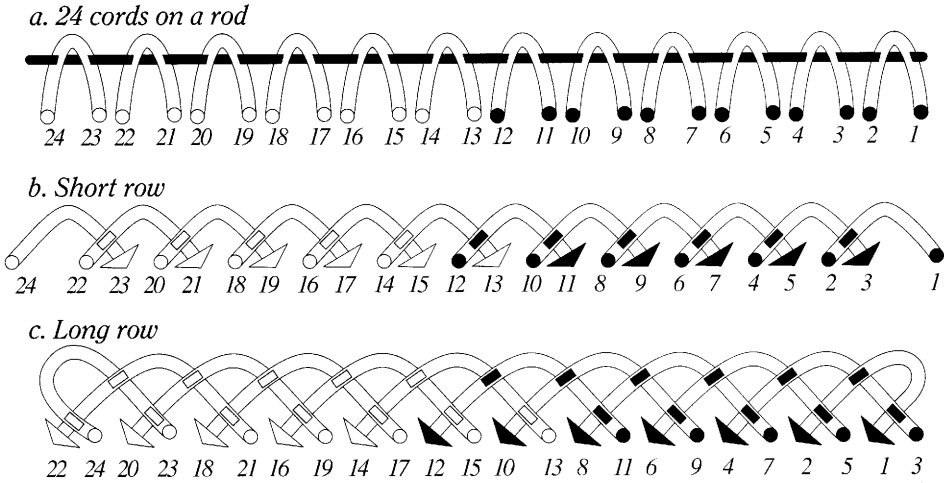


Photo b. The first 12 rows of the sample: six short rows alternate with six long rows. The yarn that is split shows on the surface; the splitter does not show. Compare the first two rows with 8b and 8c.

8. Working a short row and a long row



Characteristics of plain oblique twining

If the eyes trace a single cord through the braid, the cord appears in one row (where it is split) but is completely hidden in the next (where it is the splitter); see the slightly opened out view in *9* and the fabric in *Photo b*, p. 49. This alternation, looking like the interlacement of plain weave, is the origin of the name 'plain oblique twining.' Because of the ¼ twist maintained between successive splittings, the two plies of a single cord which are visible are constantly changing, though this does not appear obvious to the eye.

At the center of the growing braid, progressively more and more of the splittings are dark with light. This continues until at the dashed line in *10 all* splittings are of this type. Thereafter the number of dark/light splittings decreases, then increases, to produce the simple design shown in *10* and in the top third of the sample, p. 46.

The design consists of a succession of central diamonds with D/L splittings, giving a small checked pattern, flanked by triangles of all D and all L splittings. This, or some similar design resulting from a different color arrangement at the start, can continue unaltered for the rest of the braid. But luckily a very simple maneuver, called a 'twined linking,' can alter the cord's color sequence in any desired way and so influence the pattern produced.

Twined Linking

Examine the two cords, *a* and *b* in *11*. After a normal rightward splitting of cord *a* by cord *b*, *b* is immediately split by *a*, again a rightward splitting. So *b* now lies on the oblique (Z) course formerly taken by *a*, and *a* now lies on the oblique (S) course formerly taken by *b*. In other words, the twined linking makes these two cords swap courses. This obviously has nothing but a slight textural effect unless *a* and *b* are of different colors as shown. Twined linkings are therefore always introduced where there is a dark/light crossing of cords.

Changing the design with twined linking

To practice twined linking with the sample on p. 46, stop work at the center of a diamond as at the dashed line in *10*, or at a similar level, e.g., a third of the way down the sample, where there is a long row consisting entirely of D/L crossings. If now the six left-hand (or right-hand) splittings are made into twined linkings, the pattern immediately becomes that seen in middle third of the sample because the color sequence has been changed from 12D, 12L into 6D, 6L. If at any further point where all crossings are D with L, the 3rd and 4th, and 9th and 10th splittings are made into twined linkings, the pattern again changes, because the color sequence is now 2D, 2L; see bottom third of sample.

Twined linkings obviously take up a little more space than the normal splittings in the same row but if pulled tightly they cause no distortion.

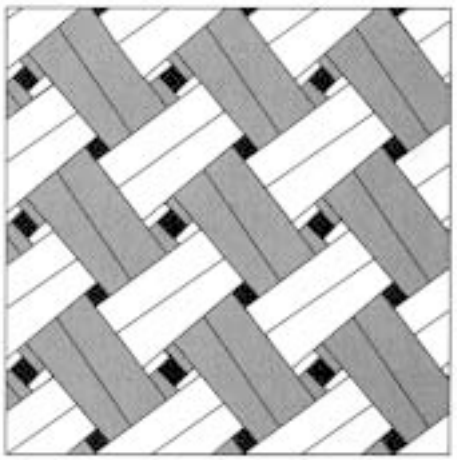
In fact any color sequence using an equal number of D and L cords can be produced by this means. It is a subtle and ingenious means exploited with apparent ease by Indian ply splitters. The ultimate division of the two colors is when they alternate, cord by cord, on both S and Z courses, resulting in thin 'hairlines' (analogous to color-and-weave effects in weaving). Occasional interruptions in this strict alternation produces designs with the hairlines running on both diagonals. The diamond in *Photo c* results from twine linking every other D/L splitting, just at one point, after which the design appears automatically.

Twined linkings can also be used if borders of a solid (or third color) are wanted, between which the patterned center is contained. The twined linkings are then repeatedly used, stacked one above the other, occurring in every other row. They can also be used anywhere in the body of a design; see the solid-color centers and borders in *Photo d*.

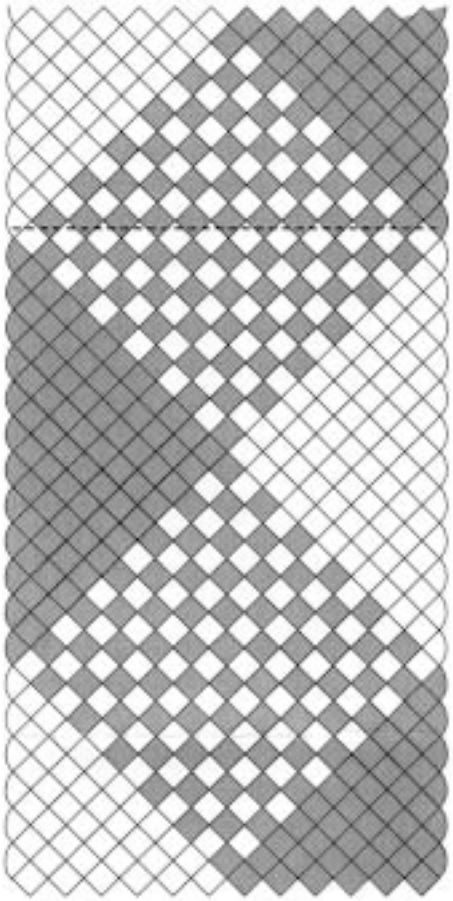
Slits

Instead of, say, two twined linkings one above the other, a slit in the fabric can be produced, giving the same result but with a cleaner color boundary; see the edges of the central design in *Photo e*. When working a slit, you are really making two unconnected ply-split braids, side by side, each with its own long and short rows and two selvedges. A long slit tends to gape; bridging slits with occasional twined linkings overcomes this.

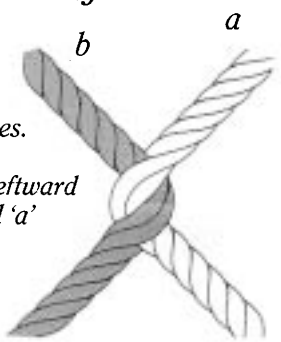
***9.** Plain oblique twining (POT)*



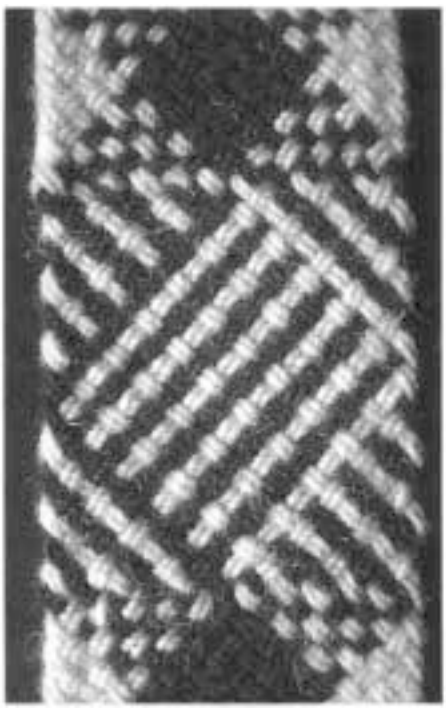
***10.** Pattern made with POT*



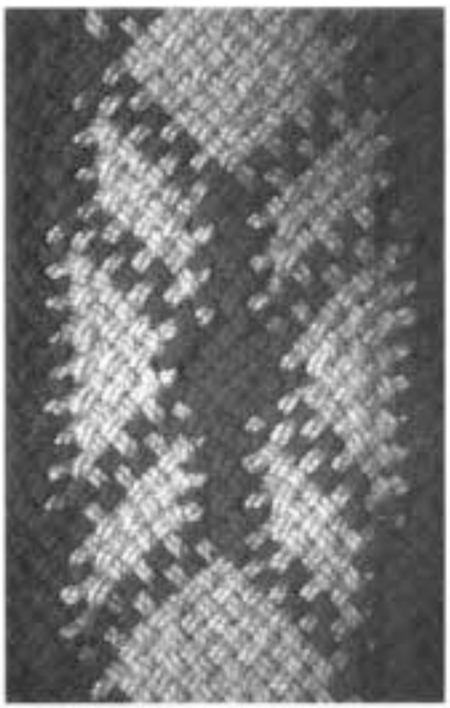
***11.** Twined linking*



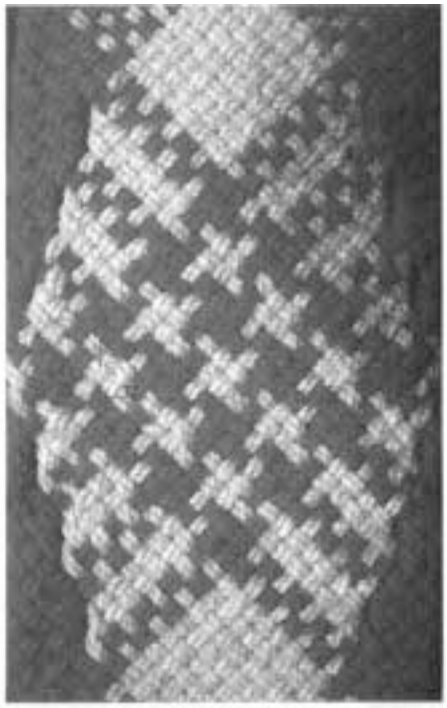
With twined linking, a pair of cords changes courses. Here, cord 'b' changes to a leftward direction; cord 'a' changes to a rightward direction.



c. Hairline pattern resulting from one transverse set of twined linkings



d. Repeated twined linkings, giving vertical color boundaries



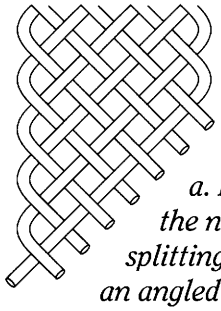
e. Slits giving vertical color boundaries

3-D Effects

POT can easily be worked cylindrically. If, in a short row, the braid is curved, bringing the two normally unused outermost cords together, and one splits the other, a cylinder is begun. For the next row, the piece cannot be turned over, however, as the back is now the inside of the cylinder. So turn it upside down and your hands can work as usual, the left unplying the relevant cord and the right pushing the needle downward through it to pick up the next in line. When you are working cylindrically, every row includes all the cords; there are no long and short rows. Also, you can begin a row anywhere on the circumference. POT is such a firm structure that a cylindrical form can stand by itself; see the bottle, p. 46, made from handmade Indian 2/ply cord.

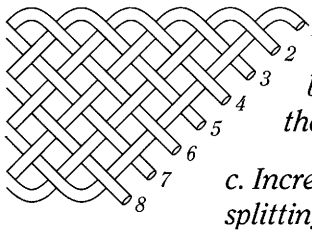
Other possibilities

There are many other possibilities which include: 1) making an openwork fabric by leaving more than a ¼ twist between a cord's successive splittings; 2) splitting cords eccentrically, not centrally; 3) using 2-ply cords, especially if some are S- and some Z-plied; 4) adding cords, either at the selvedges or mid-braid to increase width; and 5) turning the long axis of a braid through a right angle.



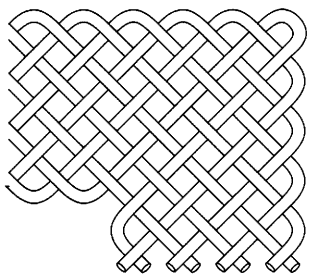
***12.** Making a braid with right angles*

a. Decrease the number of splittings to make an angled fell.



b. Rotate the braid 90°.

c. Increase the splittings.



To do possibility #5, first decrease the number of splittings in an ordered way so the braid acquires an angled fell, as in *12a*. Turn it over and through a right angle so it is now as in *12b*. Starting at the top, increase the splittings in an ordered way, i.e., 2>1, turn; 1>3, turn; 3>2, 4>1,turn; 1>5, 2>4, turn; and so on. Eventually all the cords are engaged and the braid continues normally, as in 12c, its long axis having swung neatly through a right angle without any interruption to the POT structure.

One thing ply splitting will *not* give you is a fine fabric, simply because there is a lower limit in yarn size below which the splitting becomes impossible.

Future articles will describe the other two structures and how they can be combined: 'single course oblique twining' and 'two-layered oblique interlacing.' ✂

Peter Collingwood is giving two seminars (July 18-20, 1996) and a 3-day workshop (July 14-17, 1996) on ply-split braiding at Convergence, in Portland, Oregon.