weave!

An anthology of weave structures and techniques
created by the Weave Structure Study Group of the
Cambridgeshire Guild of Weavers, Spinners and Dyers

Sagaman

This book is dedicated to the memory of
Jenny Schurr

The Cambridge Weave Structure Study Group
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Awards for All and
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Foreword

I am delighted to write the foreword for this book which is the visual end of a labour of love and joy by all that have worked on it. It is also the kind of project the Association of Guilds of Weavers, Spinners and Dyers wants to encourage and that the Cambridgeshire Guild can be proud of. The book has not only brought together members to work alongside each other, but has encouraged the exchange of ideas that will enhance the knowledge of all who use the book. It is also a visual feast, which will stimulate and encourage weavers to extend their own design talents. I would particularly draw attention to the idea of juxtaposing fabrics with rugs, braids, edgings and trims which gives the book an individual style and distinction.

It goes without saying, the putting together of such a book needs not only hard work, but also talent and organisation skills. It is no surprise therefore to discover that the members involved in the production of this book successfully applied and succeeded in getting lottery money to cover most of the production costs. An undertaking such as this can only succeed if those committed to it have the energy and enthusiasm to see the project through. Not only has this been accomplished, but achieved with style and imagination.

John Allen FRCA, President – Association of Guilds of Weavers, Spinners and Dyers

Cambridge Weave Structure Study Group

We set up the study group in 1998 with the aim of researching a range of weave structures that would not only stretch our technical understanding and creativity on the loom, but also provide an inspirational and technical reference for our fellow Guild members. We meet around once every three months, having chosen a particular structure or technique we wish to explore, and in between the meetings each of us produces samples of our own design. The only rule is that the research must lead to a piece of weaving that has a defined function, whether that is a scarf, a rug, an upholstery or curtaining fabric, a coat or dress fabric, or even a trimming.

We found that our tri-monthly meetings became a fascinating and rewarding educational experience. We learned a lot from each other as we discussed our samples, throwing in "what if..." and "why don't you..." and "Oh, is that how you do it..." and we shared ideas about colour, yarns, texture and the development of the design. Sometimes, we would go home and weave up a final sample with this positive criticism in mind, altering minute details such as sett or warp or weft threads, to achieve a better fabric.

We decided to publish our work for three reasons:

- ✧ To promote the concept of study groups and encourage other guilds to set them up too. A study group can be just whatever you want it to be—it is up to the members to share ideas and define their own aims and objectives. In the Cambridgeshire Guild we now have study groups on weaving, dyeing and spinning.
- ✧ To share our technical and design adventures with a wider public, including other guilds within the Association of Guilds of Weavers, Spinners and Dyers, as well as weave departments within art schools and universities.
- ✧ To encourage weavers to play on the loom and sample new structures, textures and colours, and to enjoy the whole process as much as we do. We hope that you will use the technical and visual information in these samples as starting points for your own work.

Anna Crutchley Mary Dainty Reidun Dow Suzi Gough
Verena Martinez Ann Ruel Doreen Sanders

Designing on the Loom

It is convenient to copy a threading from a book, but it is really far more creative to produce your own design and so be more adventurous with your weaving.

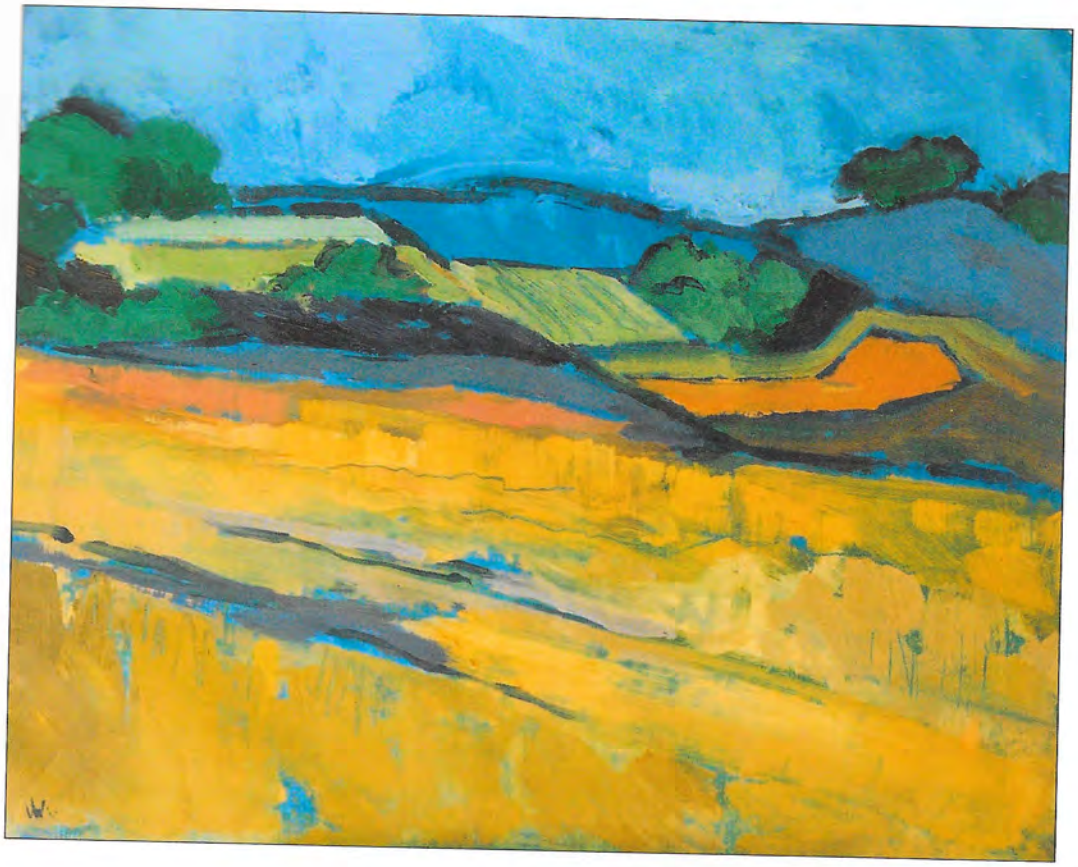
The first step is to plan an interesting warp and this can be done by choosing a threading that interests you, and then deciding what the fabric will be used for. For instance, an upholstery fabric needs to be very firm with a close sett and a hard beat, whereas a scarf or stole will need to have more drape and therefore a loose sett and beat. The choice of yarn will also play a big part in this, so the design of the final fabric will be a successful combination of threading, yarn, sett and beat. One needs to be aware of this when studying the threadings in this book as they all produce many different fabrics.

When starting on a project it is well worth putting on a small sample warp 4–5 inches (10–13 cms) wide to study the threading and see if it will easily break into several colour divisions or groups. An alternative to this is to wind a warp in a random colour sequence which will break down any hard pattern repeat and give a lovely overall impression. Remember that strong contrasts of colour will give a very strong warp stripe throughout the cloth, which may not always be wanted.

Having threaded up and tied on your warp, now is the time to experiment. By all means try the suggested lifting plan in different colour wefts, but then break away. Few people are aware that there are 14 different sheds on a four-shaft loom which are achieved by lifting: 1,3; 2,4; 1,2; 2,3; 3,4; 1,4; 1; 2; 3; 4; 2,3,4; 1,3,4; 1,2,4; 1,2,3. Start by putting a fairly thick weft through each of these picks so that you are aware of what is happening with the warp threads. If, for instance, you have a thick weft thread that you would like to show more of, put this through a shed that has only one shaft lifted and this will show it off to its full potential. Similarly, if you want more warp to show, use the sheds with three shafts lifted at a time. Carry on experimenting in this way until you have built up an interesting and unique pattern. The one pitfall is to watch that one shaft is not left out for more than four or five picks or you will end up with a patchwork of floats on the underside.

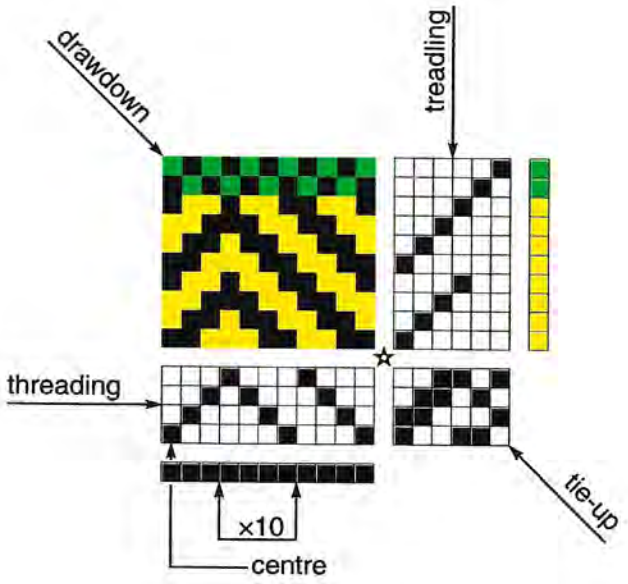
Colour Matching and the Use of Colour

So many people seem to be afraid of colour and think that they have to have an in-depth knowledge of colour theory. But one of the easiest ways of planning a colour scheme to weave with is to collect postcards and magazine cuttings that you feel happy with. Then, make a collection of yarns in the shades that show themselves in your picture. Take a small piece of white card, wrap the yarns around it starting from the top of the picture and working down. If you are not happy with the end result, try changing the proportions of those same colours until you achieve a combination that works well. If you do not have all the shades of yarn you need, try working with small strips of coloured paper that you have cut out from magazines instead. When you have completed your winding, it is often interesting to add a completely contrasting colour to your scheme. If you include it in a small amount, this can make things zing! You then have a colour scheme from which to plan your warp and weft.



Reading the Drafts

The drafts in this book are comprised of four elements – threading, tie-up, treadling, and drawdown – arranged as shown below. Read the drafts from the point where the threading, treadling and tie-up intersect. That point is marked with a star on the sample draft below.



Threading

Read the threading section beginning at the star and moving to the left. Each horizontal row in the threading section represents a shaft on the loom: The bottom row represents shaft 1, the one closest to you as you sit at the loom. Vertical columns represents warp ends. Each black square in the threading section indicates that a warp end should be threaded on the shaft represented by the row the square occupies. Working from the star in the example above, first thread a heddle on shaft 1, then a heddle on shaft 2, a heddle on shaft 3, and a heddle on shaft 4. This sequence is then repeated 10 additional times as indicated by the brackets and the notation "×10." Only the right half of the threading is shown above. From the "centre" indication, the threading order should be "mirrored"—following the thread on shaft 1 at the centre of the example draft, threads should be entered on shaft 2 and shaft 3 before repeating the sequence (4,3,2,1) 10 times and ending with 4,3,2,1 at the left selvedge.

The row below the threading section indicates the warp colour order. In the example draft, all of the warp ends are black.

If denting is an important aspect of the threading, it is indicated by encircling those warp ends which should be entered together in a dent (see the draft for crammed and spaced warps). Empty dents are indicated by blank columns in the threading section. For block weaves, brackets are used to indicate the warp ends comprising each block.

Tie-up

The tie-up section indicates how the treadles and the shafts are connected. Each column represents a treadle (similar to the treadling section) and each row represents a shaft (similar to the threading section). A black square in any column indicates that the treadle represented by that column should be tied-up to the shaft represented by the row the black square occupies. For example, black squares in rows one and two of the left column in the example draft show that treadle one should raise shafts one and two.

To lower shafts for a countermarch or counterbalance loom, tie up the blank squares.

Treadling

Read the treadling section beginning at the star and moving up. Each horizontal row in the treadling represents a pick, so the treadling is read from the bottom up to mimic the weaving process and so that the drawdown accurately reflects the cloth as you see it while weaving.

Each vertical column in the treadling section represents a treadle, with the farthest left column representing treadle 1. Each black square in the treadling section indicates that the treadle represented by the column the square occupies should be depressed and a pick inserted. In the above example, treadle 1 is depressed and a pick inserted, followed by treadle 2 and a pick, treadle 3 and a pick, treadle 4 and a pick, and so on. Only one repeat of the treadling (10 picks) is shown, so this unit is repeated consistently throughout the length of the woven cloth.

The column to the right of the treadling section indicates the weft colour order. In the example draft, 8 yellow picks are followed by 2 green picks repeatedly.

Some of the drafts in this book have the notation "use plain weave" alongside the treadling section. Where this notation is present, it indicates that a plain weave pick should follow each of the pattern picks indicated in the treadling section. The weaving sequence is then pattern pick, plain weave pick, pattern pick, opposite plain weave pick.

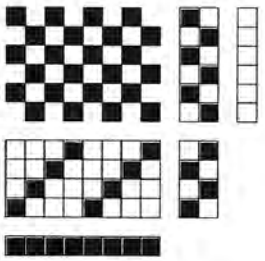
For block weaves, brackets are used to indicate the picks comprising each block.

Drawdown

The drawdown shows the weave produced using the given threading, tie-up, and treadling. The drawdowns in this book are all warp drawdowns, so black squares (or warp-coloured squares if there is more than one colour in the warp) represent raised warp threads The drawdown can be determined by examining each pick in sequence. First determine the shafts raised for that pick and then, to the left of the treadling mark for that pick, fill in squares above the warp ends corresponding to the raised shafts. In the example above, the first pick is placed when treadle one is raised. Treadle one raises shafts one and two, so all threads on shafts one and two are black in the drawdown row for that pick.

Plain Weave

Plain weave, or tabby, is the simplest weave structure and the only one that can be woven on two shafts. Warp and weft threads continuously interlace in an over-under sequence, so that each warp travels over or under only one weft and visa versa. Plain weave produces a firm, stable, strong, and reversible fabric without floats.



Yarns

Warp: Assorted cotton and linen yarns, blue

Weft: Same as warp

Warp and Weft Spacing

Warp: 24 epi average, sleyed 2 per dent in a 12 dent reed

Weft: 24 ppi average

Notes

Random warp. Weft well beaten with jute gimp thread at random intervals.

2

3

Plain weave is the most basic weave structure and yet it is used to produce an enormous variety of fabrics, some of which are quite complex. The yarn size, material, structure, twist and colour can all be varied as can the relative distribution of warp ends and weft picks. Plain weave fabrics can be balanced with the warp and weft equally spaced and of the same size, or they can be warp-predominant to warp-faced, or weft-predominant to weft-faced. Tapestry is weft-faced plain weave with discontinuous wefts, hopsack is plain weave with warp ends and weft picks doubled or tripled, and hand-manipulated openwork techniques, such as mock leno are worked on a plain weave ground.

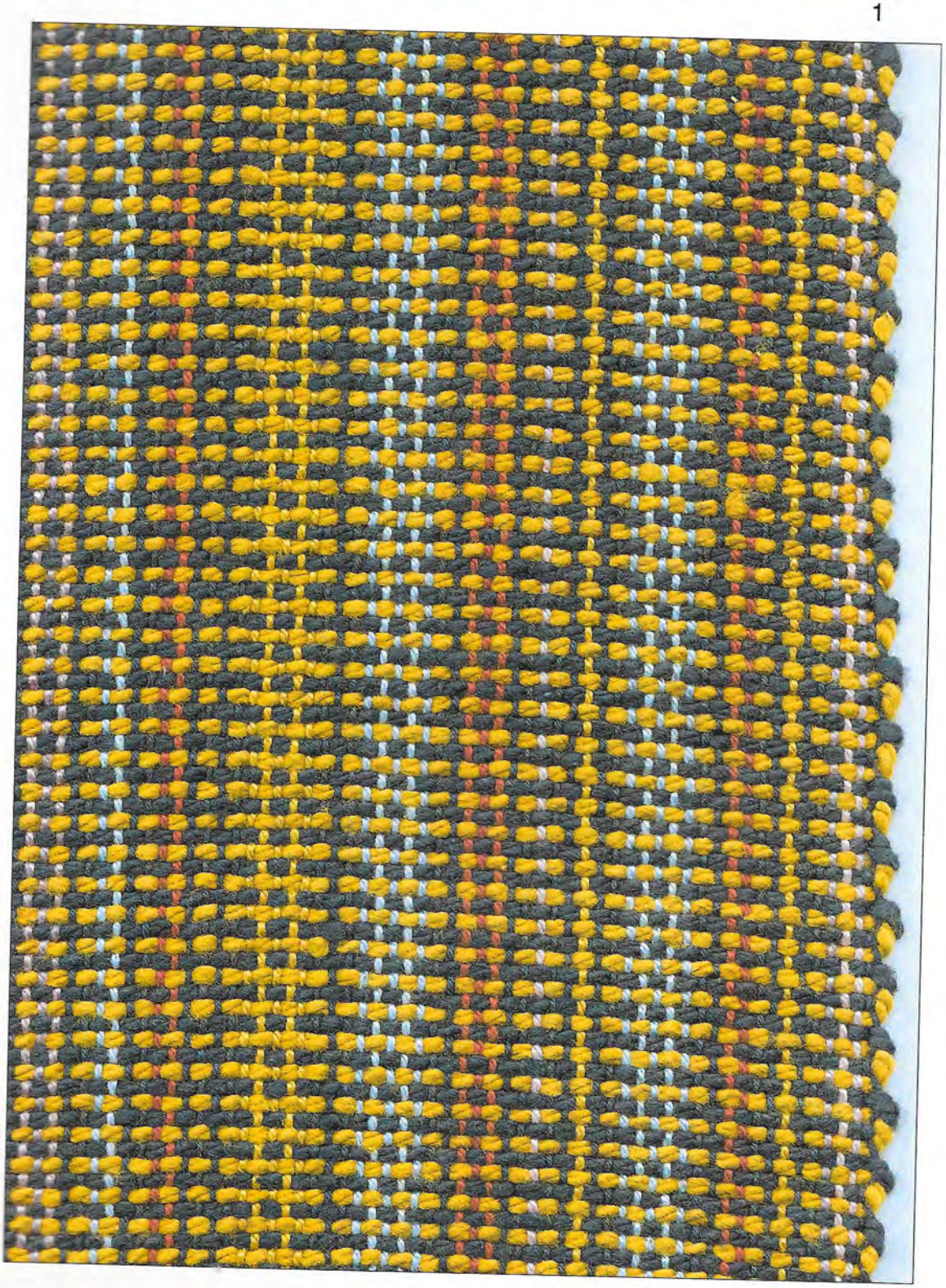
Sample 1, opposite, has a random, striped warp with alternating light and dark wefts of much heavier cotton, and is a weft-predominant plain weave fabric.

Sample 2, above left, is an example of colour-and-weave effect where the dark/light colour sequence in both the warp and the weft creates a visual pattern quite different from the plain weave structure of the fabric.

Sample 3, left, uses plain weave as a ground for inlay—supplementary weft threads are "laid in" along with the ground weft to produce pattern.

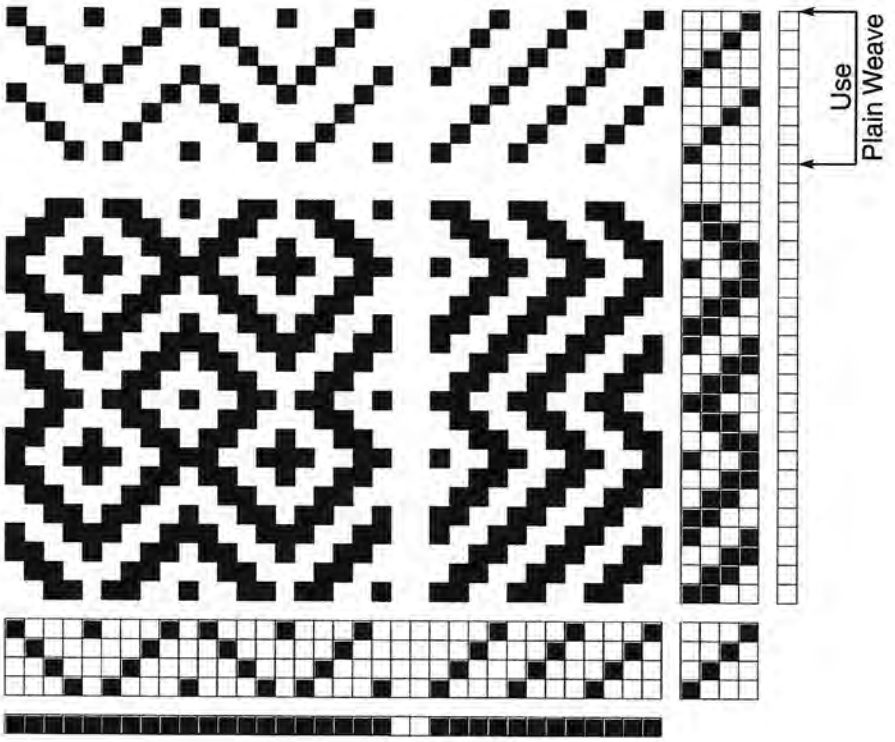
These examples are but a few of the plain weave possibilities. What about weaving stripes, plaids, seersucker (where groups of warp threads are heavily tensioned while other groups are lightly tensioned), or even using plain weave as the foundation for a supplementary warp?

1



Twill

The word twill describes a very large group of weaves characterized by diagonally-aligned floats. Usually, twills are described using ratios such as 2/2 or 1/3 to indicate the number of warp threads each weft will repeatedly go under and then over. Simple twills, such as the balanced 2/2 twill or the warp-faced 3/1 twill, have constant-length floats in both the warp and the weft, although the length of the warp and the weft floats is not necessarily the same. With complex twills, such as a 3/2/1/2 twill, both the length of the floats and the direction of the diagonals can vary.



Yarns

Warp: 2/8 Shetland wool, purple

Weft: 2/8 Shetland wool, natural

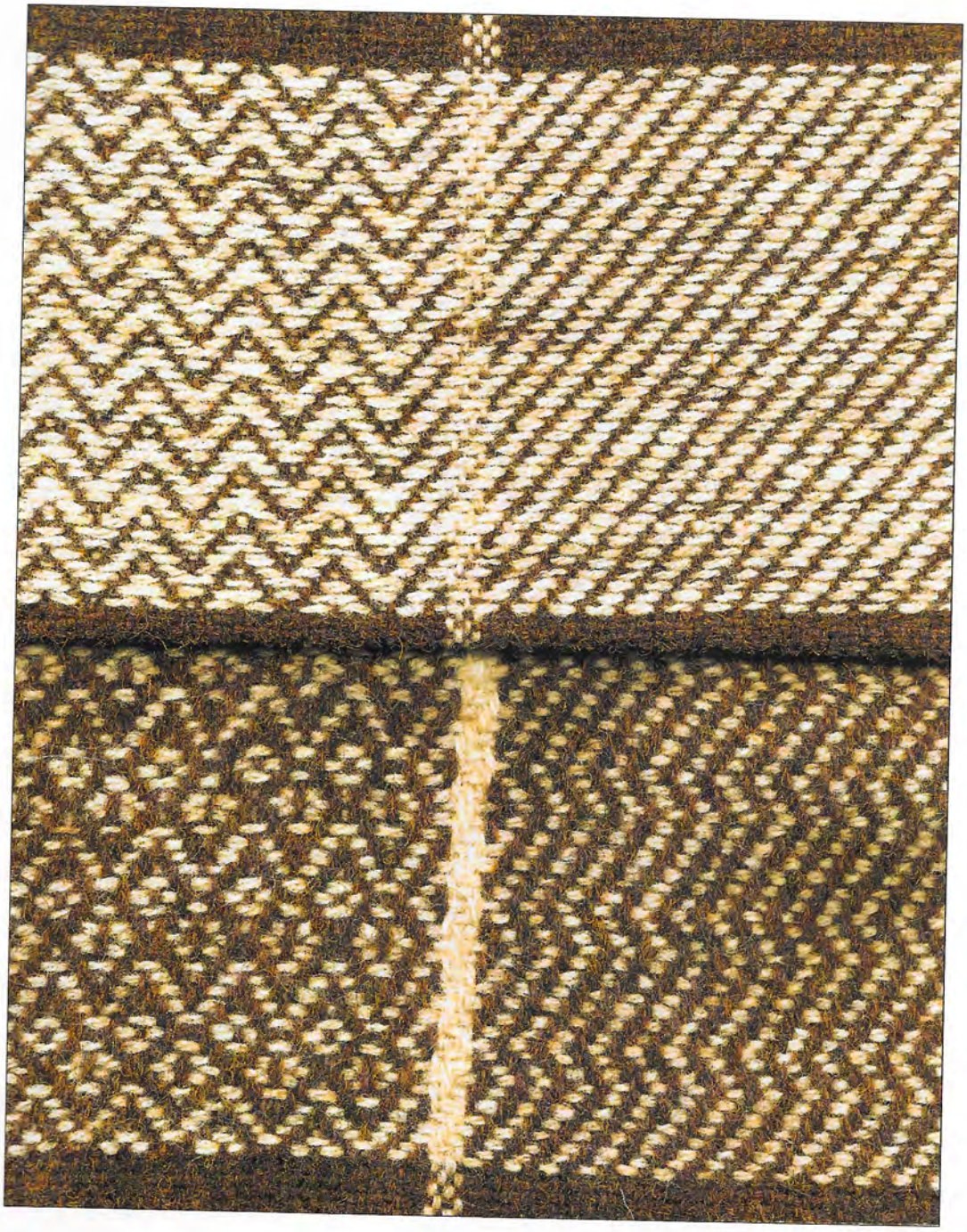
Warp and Weft Spacing

Warp: 16 epi, sleyed 2 per dent in an 8 dent reed

Weft: 16 ppi average

Notes

The *Sample opposite* consists of two twill threadings. On the right is a simple straight twill, threaded 4,3,2,1 repeatedly, and on the left is a complex broken point twill. A broken point twill has one or more shafts omitted from a straight twill that periodically reverses direction. In this case, shafts 2 and 3 are omitted just before the twill threading reverses direction. This sample was woven on a table loom, so the draft shows a direct tie up with one or more shafts lifted for each pick in the treadling. In the upper half of the sample, a thin plain weave weft alternates with the twill weft. The plain weave threads could be omitted, however, since they are not required structurally.



1

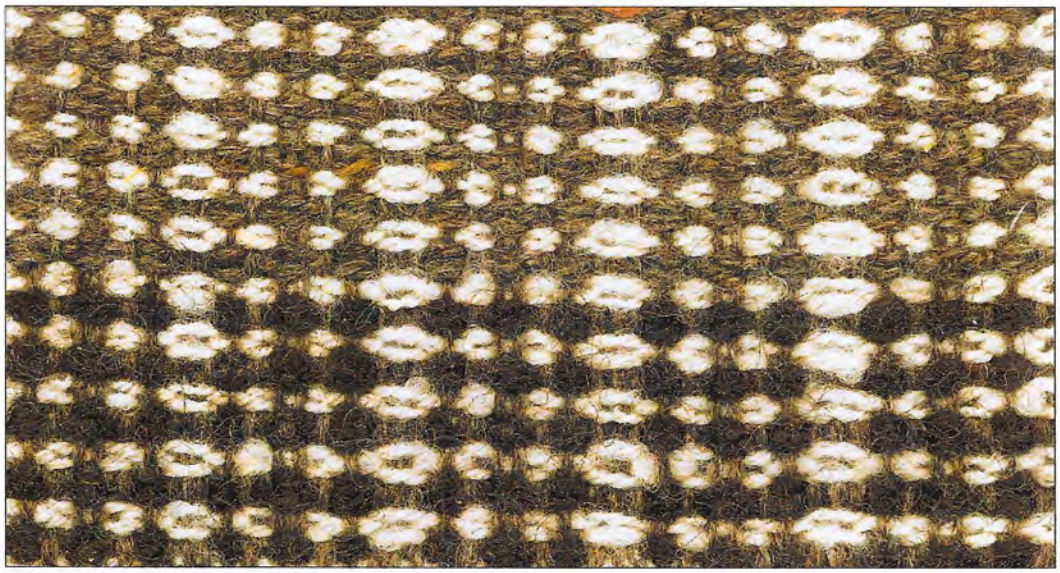
Innumerable twills can be woven on four shafts and even more can be woven on eight shafts. Straight twills, point twills, broken twills, intermittent twills, undulating twills, corkscrew twills, plaited twills, interlocking twills, double-faced twills, and progressing twills are but a few of the options. With each of these threadings, the tie-up and treadling sequences can also be varied. For example, with a four-shaft loom, shafts can be lifted individually, in pairs, or lifted three at a time. Unique twills can be designed simply by choosing a four-shaft twill threading and combining some of the above lifts into treadling sequences that weave pleasing patterns. Given that warp and weft colours add yet another design element, it is not hard to imagine a lifetime spent weaving nothing but twills.

The variety in ***Samples 1, 2 and 3,*** shown here, clearly illustrates the wide scope of twill threadings.

Sample 1, left, is threaded and treadled as a simple 2/2 twill. It is weft-faced, however, so the diagonal lines typical of twills are only readily apparent in the sections where two blue wefts alternate with a single orange weft.

In ***Sample 2*** the diagonal twill lines are not apparent either, since the weft colour sequence instead focuses attention on the lozenge shapes. This sample is another treadling variation from the warp on the previous page.

Finally, in ***Sample 3,*** wide undulating twill stripes are separated by narrow stripes of straight twill. This undulating twill is a straight twill threading that has been modified by repeating each shaft twice to flatten the twill lines.



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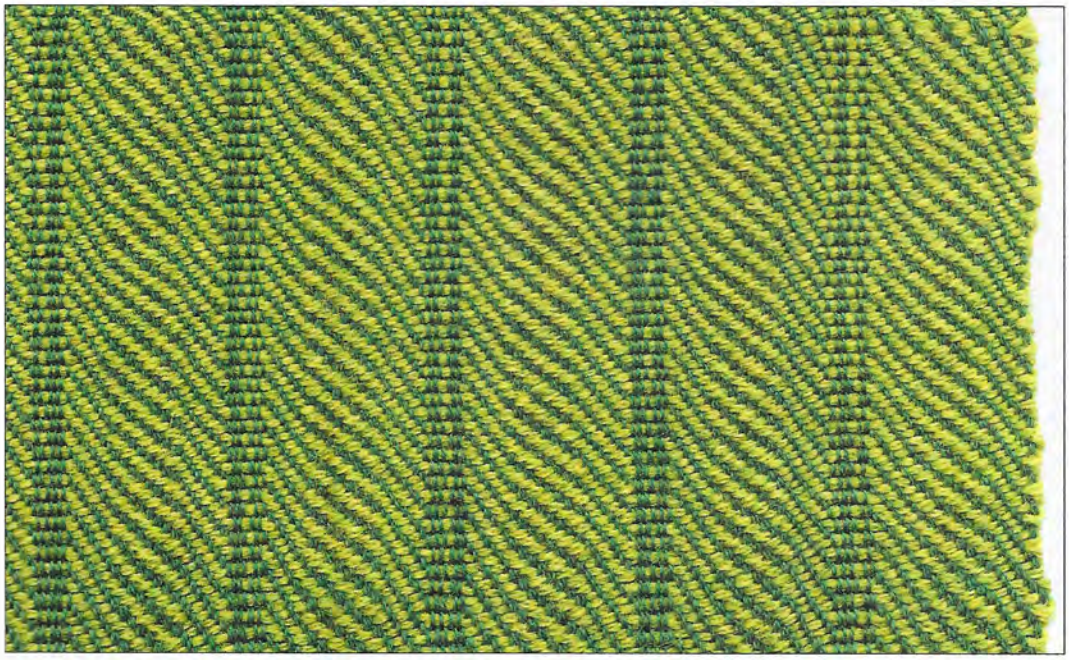
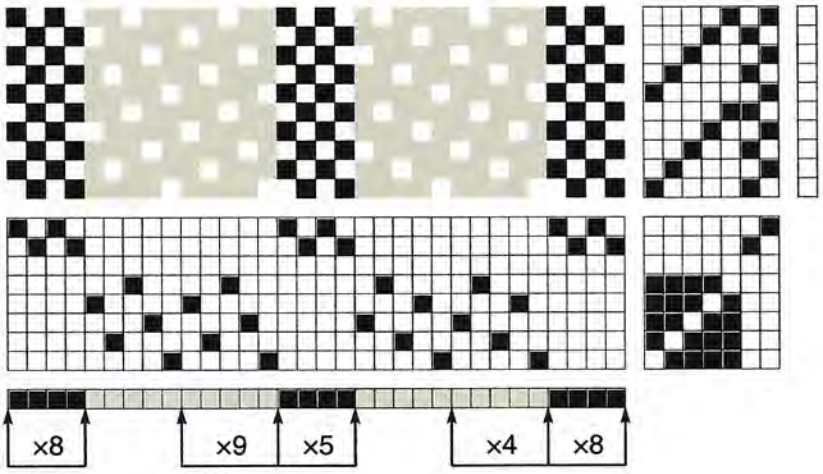


3

Satin and Sateen

Satin and sateen are simple float weaves, characterized by long floats and dispersed stitching points (points where the warp or weft are bound). Satin is a warp-faced weave with each warp end floating over all but one pick per repeat. Sateen is sometimes called a weft satin, as it is a weft-faced weave with each pick floating over all but one warp end per repeat. The reverse of a satin fabric is sateen and the reverse of a sateen fabric is satin.

There are two types of satin structures, regular and irregular. In regular satins, the interval between the stitching points does not vary as it does with irregular satins. Satins are generally woven with a straight draw threading and treadling, so it is the tie-up that determines the distribution of stitching points. Often, satins are woven sateen side up to reduce the number of shafts lifted.



Yarns

Warp: Rayon, lustrous gold

Weft: 60/2 Shantung silk, light brown

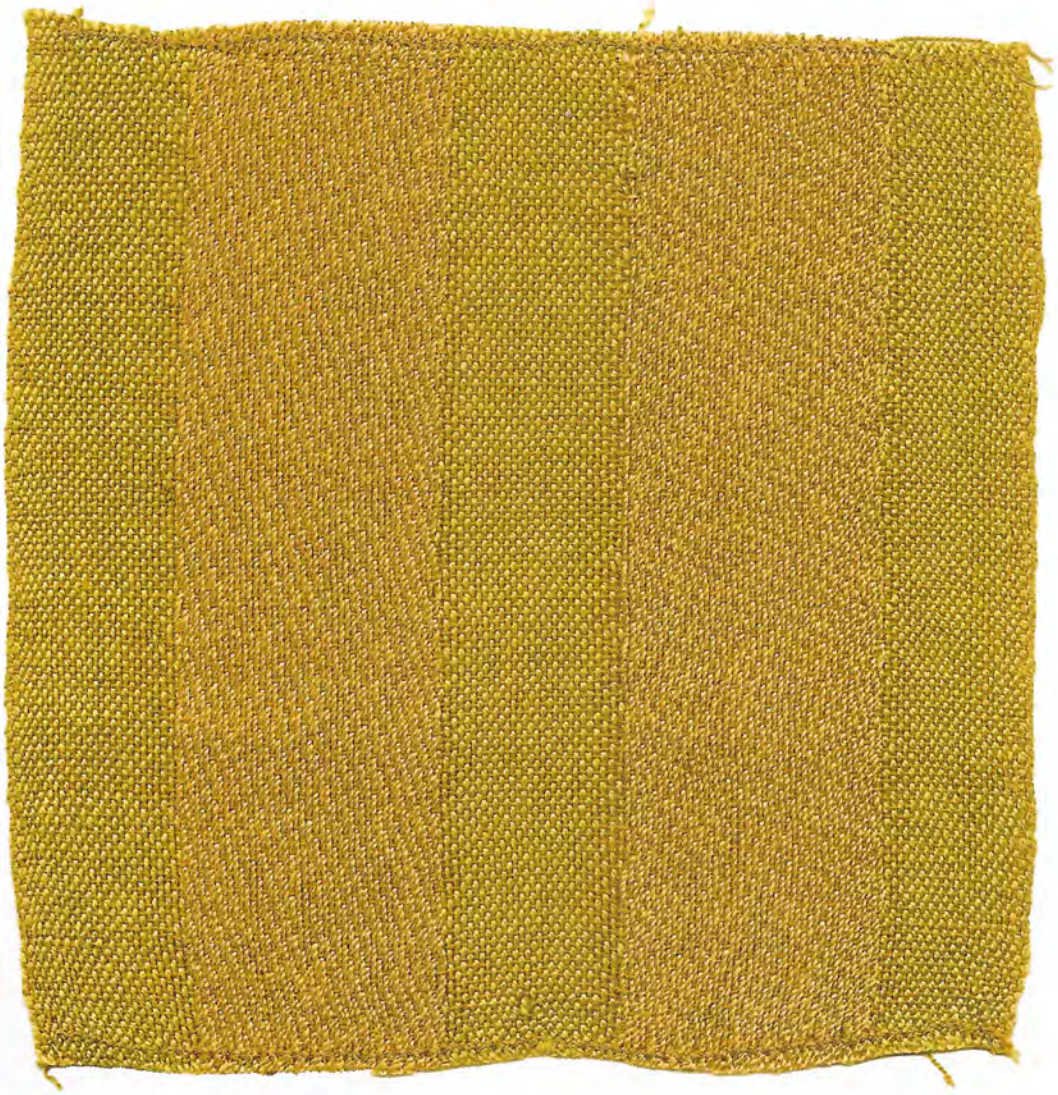
Warp and Weft Spacing

Warp: 30 epi, sleyed 3 per dent in a 10 dent reed

Weft: 28 ppi

Notes

The ***Sample opposite*** consists of two regular 5-shaft satin stripes separated by plain weave. The left satin stripe has a stitching interval of two, while the right satin stripe has a stitching interval of three. Note that two treadles are lifted for each pick, one to weave the satin stripes and one to weave the plain weave stripes.



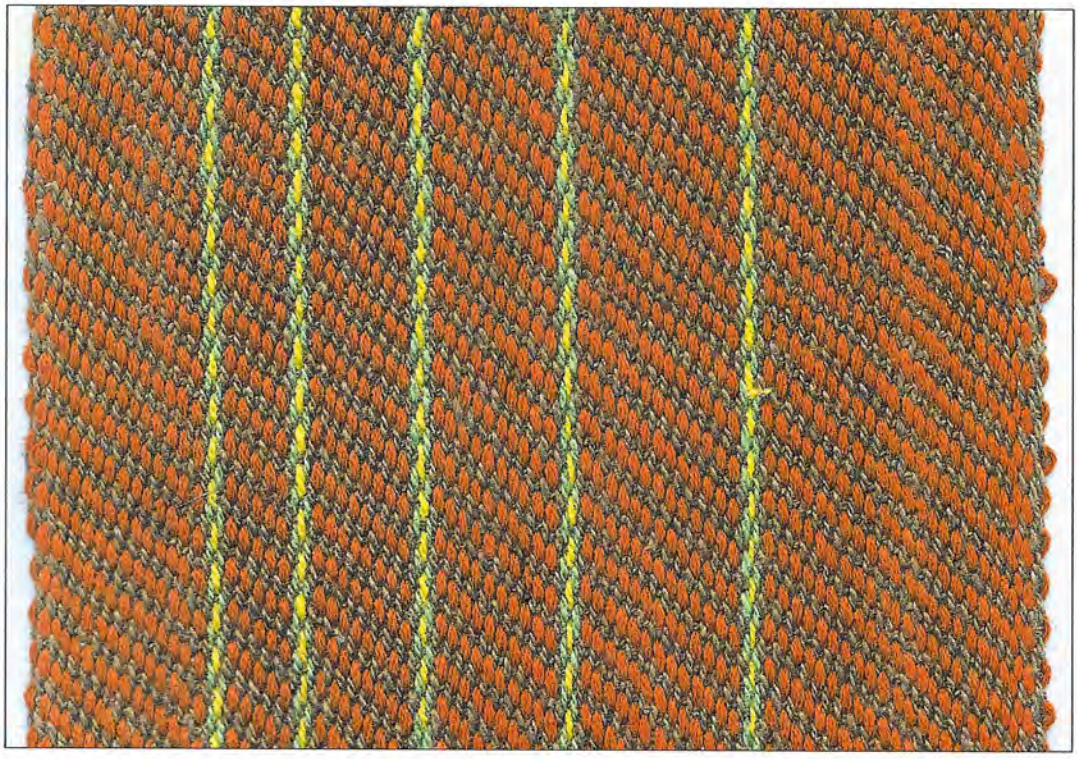
The ideal satin or sateen is a stable fabric with long floats that are not obviously arranged in diagonal lines. Fabric stability is primarily a function of sett, which must be closer than that normally used for twills to compensate for the long floats and relatively low number of stitching points. The type of interval chosen, regular or irregular, affects the arrangement of stitching points. Diagonal lines will be less apparent if an irregular satin or sateen is used, but the resultant fabric will be slightly more textured than if it was woven as a regular satin or sateen. A minimum of five shafts is required to weave a regular satin; a minimum of six shafts is required to weave an irregular satin.

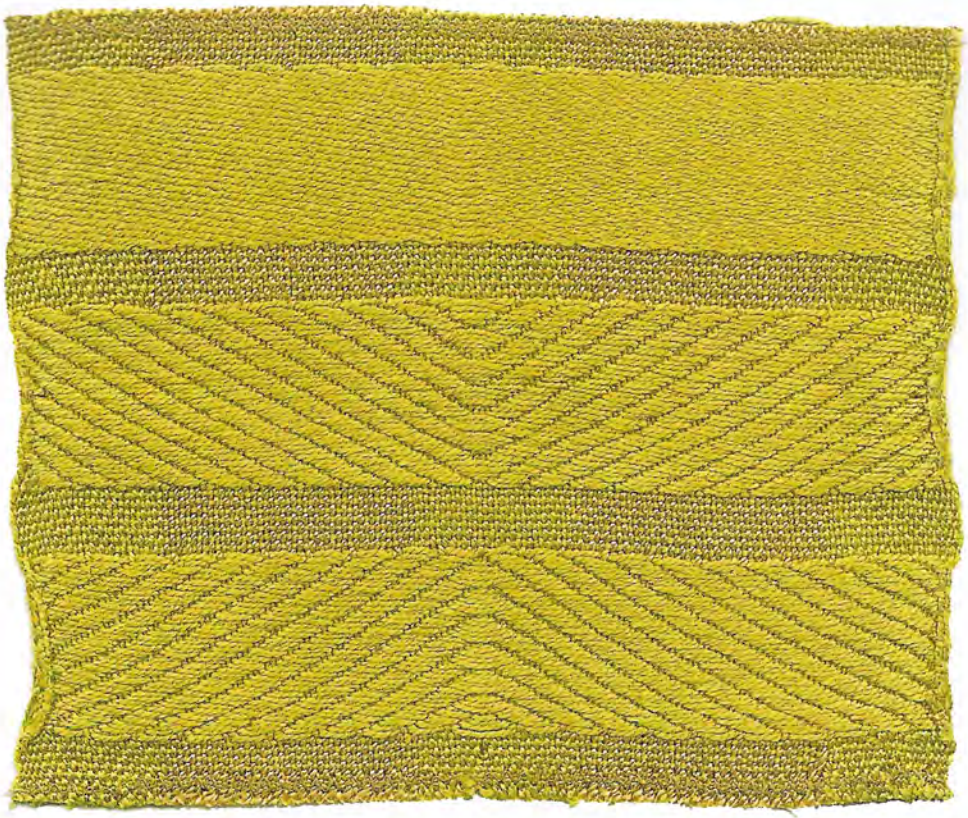
Satin and sateen often produce fabrics that are smooth, silky and lustrous.

Sample 1, opposite, is a typical example. It is an 8-shaft irregular sateen, woven with a direct tie-up and several treadling sequences (only the top one is a true sateen). In comparison, Samples 2 and 3 are much less silky and lustrous.

Sample 2, below, is an 8-shaft regular satin, while ***Sample 3,*** opposite, is a textured fabric woven with alternative tie-ups and various wefts. It is the mixture of mercerised cotton and cottolin threads in these two samples that reduces the lustre and increases the firmness of the woven fabric. In addition, the use of alternate brown and red warp threads in the wider stripes emphasizes the diagonal alignment of floats in Sample 2 and adds visual interest in Sample 3.

2





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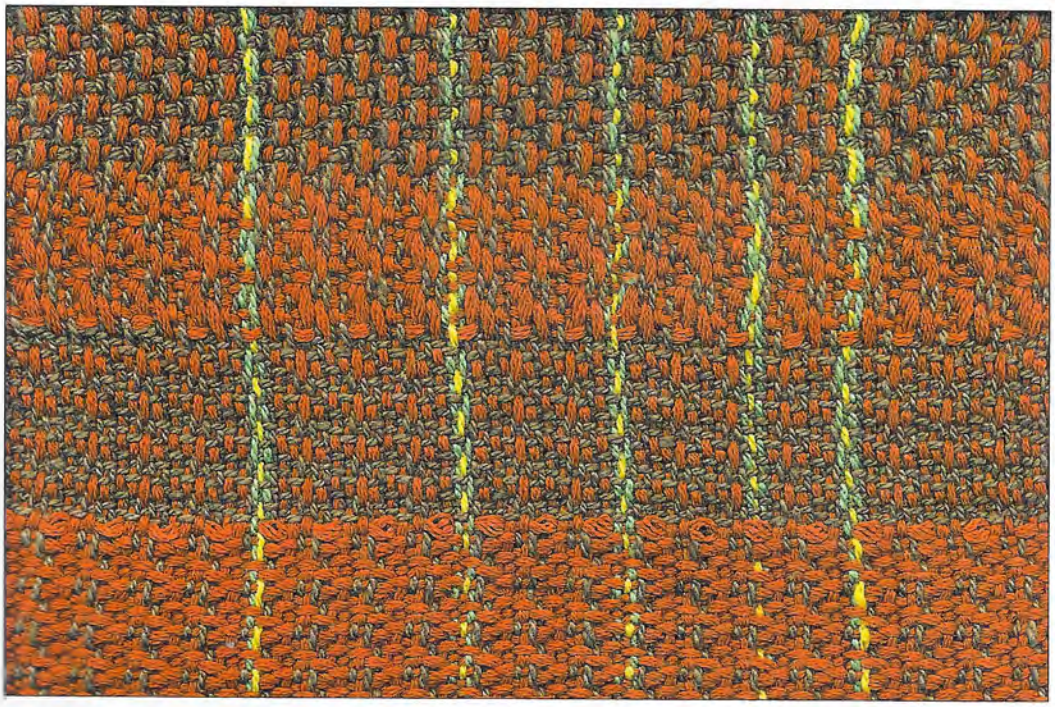
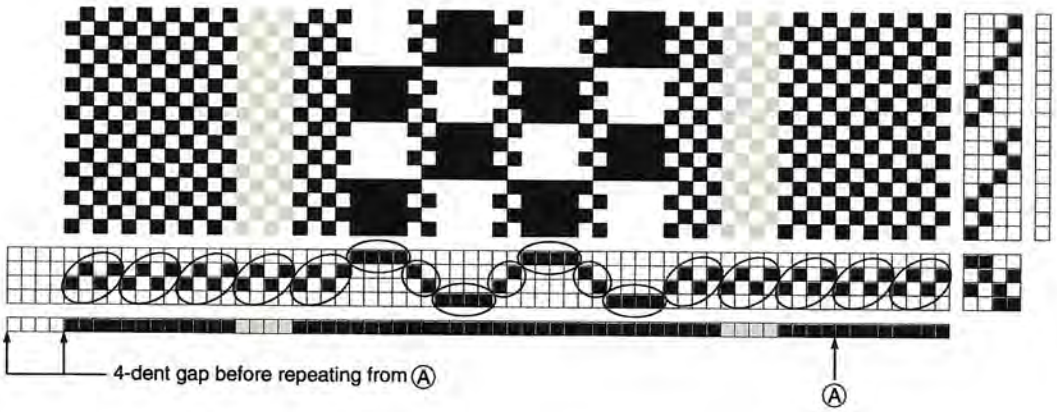


3

Crammed and Spaced Warps

The reed is employed as a design tool for crammed and spaced warps, since warp ends are bunched or spaced in the reed after being individually threaded through the heddles. The result is a variety of setts across the width of the fabric that vary the appearance of the weave and/or modify the texture and colour of the fabric.



Yarns

Warp: 2/20 mercerized cotton, white; linen and cotton slub yarn, red

Weft: Linen and cotton slub yarn, beige

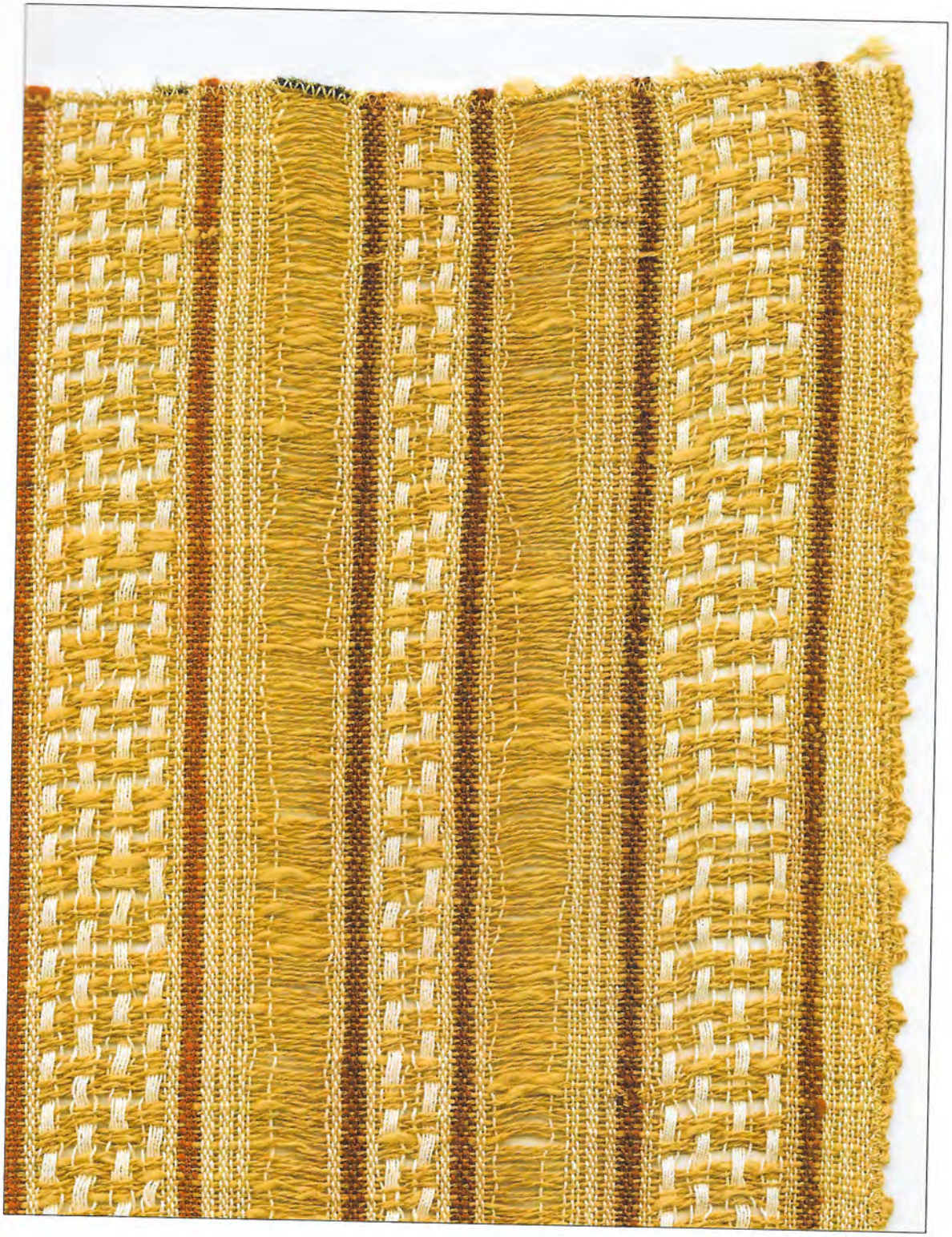
Warp and Weft Spacing

Warp: 24 epi average, sleyed as indicated on draft in an 8 dent reed

Weft: 26 ppi average

Notes

The ***sample opposite*** has several interesting design points. Four thin threads act as one thick thread in the wide-sett stripes, reed groupings are apparent in the crammed white stripes, and the white edge threads have migrated into the unwarped areas creating an unusual effect.



Sample 1, opposite, is a simple fringe consisting of two crammed warp sections separated by an equally wide stripe containing no warp. This produces a fairly stiff fabric that is suitable for trimming a wide-variety of objects.

Sample 2 also incorporates crammed stripes, but they are narrow compared with the spaced stripes, and so add stability to a very drapeable scarf fabric.

Interesting colour effects can also be created with crammed and spaced warps, since sett affects colour perception. In both ***Samples 1 and 2,*** the colour in the crammed stripes is more intense than it would have been had the stripes been sett wider.

Yarn texture is also an important element in crammed and spaced warps. Anything but a smooth yarn in the crammed areas will lead to warps clinging to one another and therefore poor sheds. In contrast, yarns with texture can be used to advantage in spaced sections to prevent slippage of the widely-space warp threads. ***Sample 2*** illustrates this well—a slightly fuzzy, thicker wool is used to contain the edges of the crammed silk and cotton stripes.

Sample 3 illustrates a crammed inlay weft on a crammed and spaced warp. In this fabric, the warp provides background interest while the crammed weft stripes become the focal points. Where wefts are continuous across a fabric, variations in beat could be used to produce a crammed and spaced weft.

Another crammed and spaced warp variation would be to sley the reed in a continuum of setts from oversett to undersett to produce undulating lines in twill or plain weave fabric. Alternatively, slippage could be encouraged in widely sett sections and used as an additional design element.

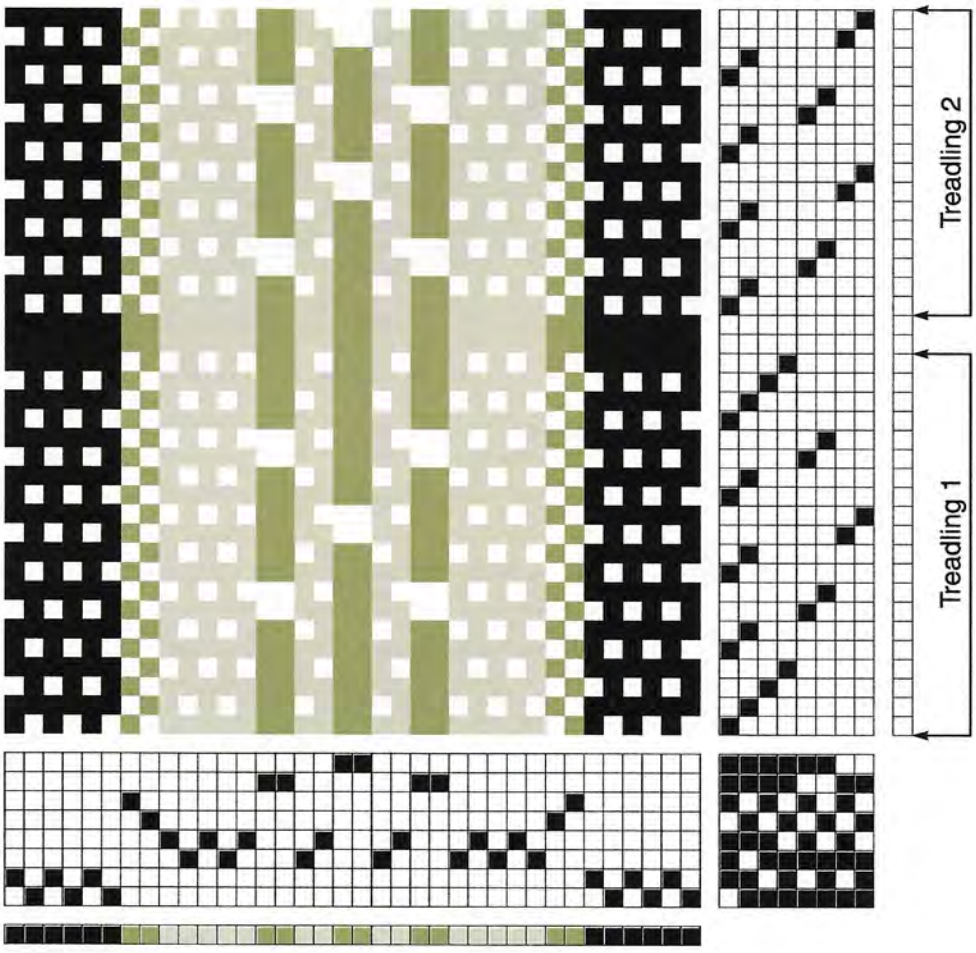
1

2

3

Bedford Cord

Bedford cord is a pattern weave that produces a fabric with raised cords parallel to the warp. There are three different groups of warp threads in the simplest Bedford cord—the tie-down or "cutting" threads between the cords, and two sets of warp threads to produce the cords because the cords are woven alternately. When finished, the floats stretching the full width of the cord backs shrink more than the tightly interlaced cord faces and an arch or cord is formed.



Yarns

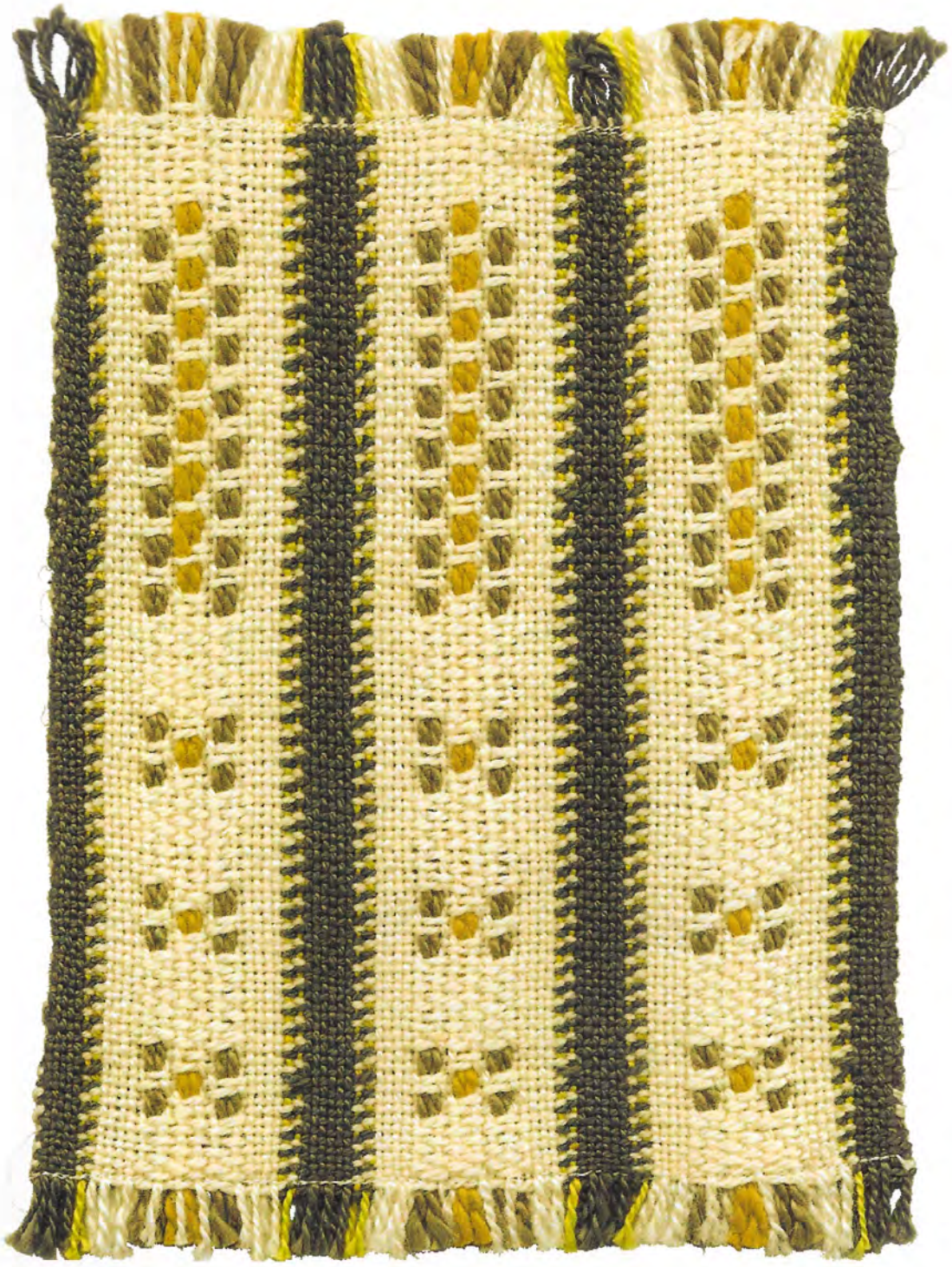
Warp: 2/6 cotton, white and grey; 2/6 mercerised cotton, yellow and sage green; and 2/3 mercerised cotton, gold

Weft: 2/6 mercerised cotton, white and 2/6 cotton, grey

Warp and Weft Spacing

Warp: 24 epi, sleyed 3 per dent in an 8 dent reed

Weft: 32 ppi average



Notes

The ***Sample above*** shows the decorative use of wadding or padding threads, which are non-structural warp ends threaded separately on shafts 7 and 8. These threads float between the face and back of the fabric, only interlacing with the cord face when they are brought to the surface. Padding threads can also be used to accent cord ridges and/or to make the fabric firmer.

Sample 1, opposite, shows an effective use of warp colours. Warp stripe colours are alternated to define the cords, and dark red tie-down ends are used to emphasize the furrows between the cords and give the illusion that the cords are more pronounced. The cords are further defined by the use of padding.

Sample 2 is woven on the same warp but incorporates the dark red colour in the weft. It is woven pick and pick with the green from one set of cords to produce a lovely chequerboard effect.

In ***Sample 3,*** the warp colours have been varied for the cords as well but, in this case, the colours are more random and the result is an interesting irregular stripe pattern. Sample 3 also illustrates varying cord widths and the difference between padded cords (five cords on the left side of the sample) versus unpadded cords. Various weft colours were also used in this sample: Yellow and black alternate pick and pick for the defined stripe at the top of the sample, while the pure grey and white stripes at the bottom of the sample produce relatively muted horizontal stripes.

There are many other ways to vary Bedford cord, including (but not limited to):

- ✧ Add colour and weave designs to plain weave cords.
- ✧ Change the cord structure to twill, broken twill, herringbone, or satin.
- ✧ Alternate stripes of Bedford cord with stripes of plain weave.
- ✧ Start and stop stuffed cords.
- ✧ Vary the position of the tie-down ends in the threading draft so that cords can be divided into two and recombined.
- ✧ Turn the cords horizontally and weave piqué.
- ✧ Alternate Bedford cord and piqué.

Some of the above ideas can be used to modify the usually heavy and non-draping quality of Bedford cord fabrics and could, therefore, expand the uses for the fabric. Traditionally, Bedford cord fabrics have been used primarily for upholstery and outerwear.

1

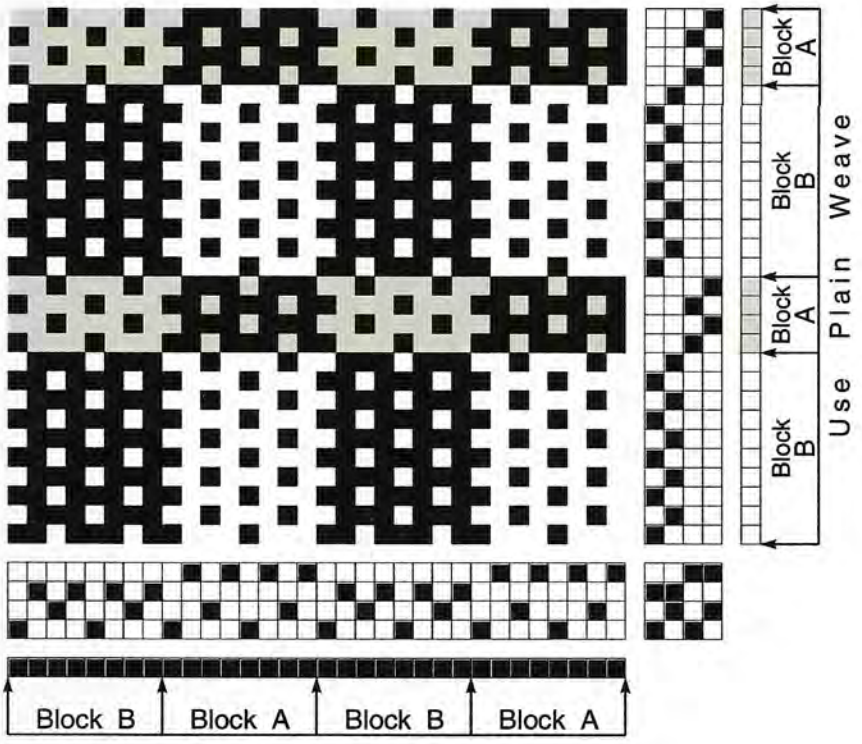
2

3

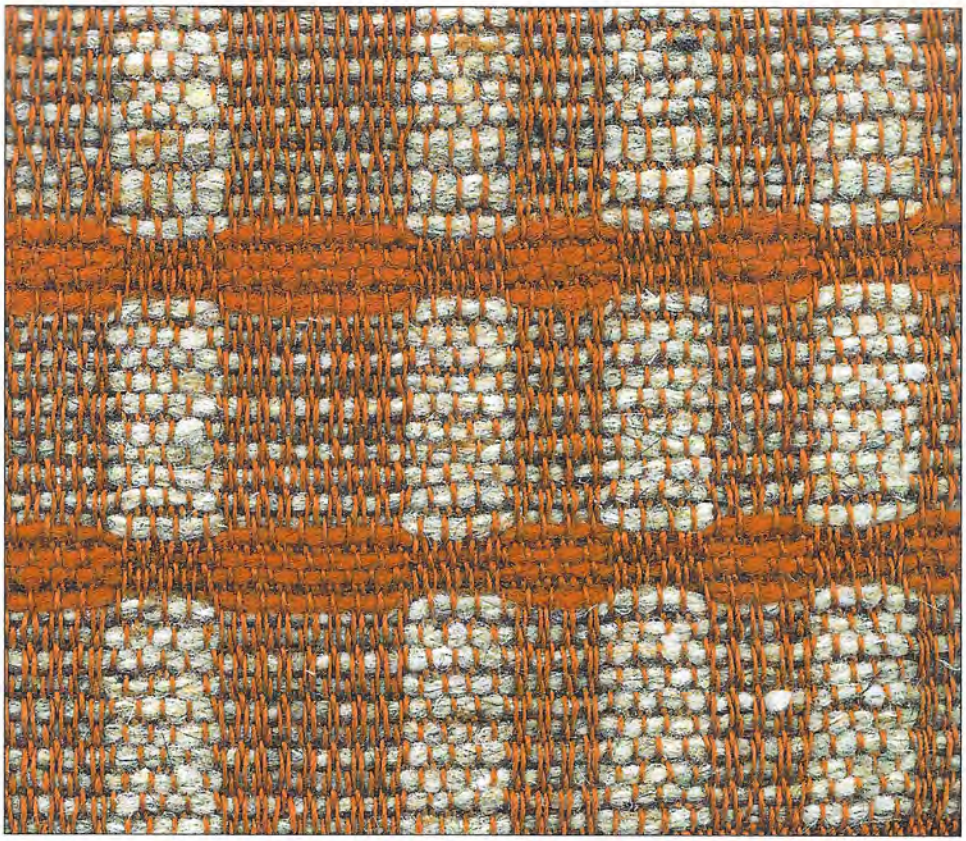
Block Weave

Block weaves are so called because the use of two or more different threading and/or treadling units, or blocks, produces rectangles of different woven designs. The woven rectangles or blocks will appear darker if corresponding threading and treadling blocks are combined (for example threading Block A and treadling Block A) and lighter if different threading and treadling blocks are combined (threading Block A and treadling Block B). A two-block design allows vertical stripes and chequerboard designs to be woven, while three or more blocks can be arranged and combined to produce a vast number of different designs.

The block design and the weave structure are independent of one another. The block design defines the overall woven pattern, while the weave structure defines the interlacement that comprises the individual pattern elements. The same block design can be woven using many different weave structures and can, therefore, produce textiles of quite different appearance and quality. Structures commonly used for block weave include plain weave, twill, satin, double weave, honeycomb, lace weaves, and overshot.



Block Weave – Sample 1



1

Yarns

Warp: linen, red

Weft: 2/8 wool rug yarn, beige and 18-count wool, red

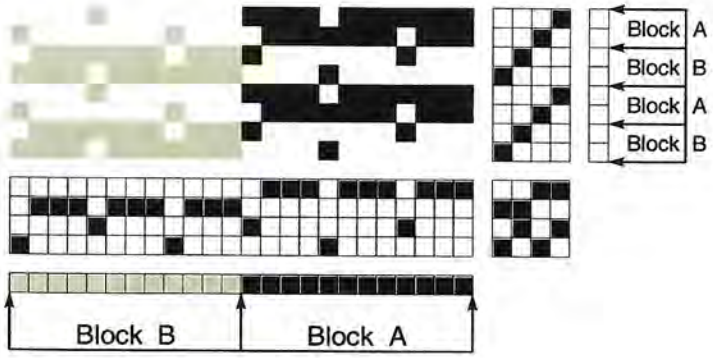
Warp and Weft Spacing

Warp: 30 epi, sleyed 4,4,4,3 in an 8 dent reed

Weft: 19 ppi, average

Notes

Sample 1, above, is a two-block design with Summer and Winter threading blocks (Block A is threaded 1323, Block B is threaded 1424). Note the weft distortion occurring naturally where the treadling blocks change. Using different coloured wefts for the different treadling blocks highlights this. The linen warp yarn was used for the plain weave weft.



Block Weave – Sample 2

Yarns

Warp: 30-count cotton, red, green, black, and two shades of pink

Weft: same as warp

Warp and Weft Spacing

Warp: 80 epi, sleyed 1 ground end and 3 pattern ends per dent in a 20 dent reed

Weft: 8 ppi, average

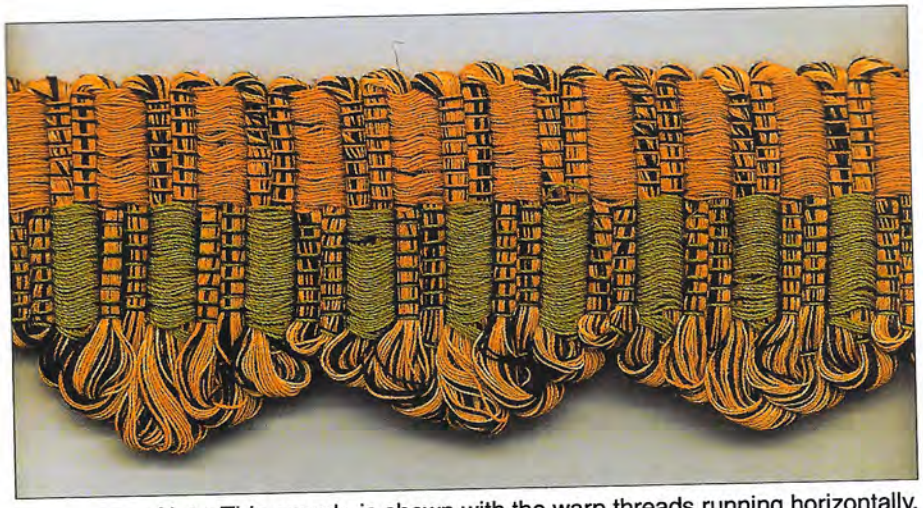
Notes

Sample 2. opposite, is another two-block design utilizing Summer and Winter threading blocks (modified so that three ends on shaft 3 or 4 alternate with 1 end on shaft 1 or 2). It is quite different from Sample 1, on the previous page, both visually and in quality. Two threads were used for each warp end; 30 threads were used for each weft pick. Three additional shafts were used to produce the fan edging, which was woven over wires.

Sample 3, opposite, looks quite complex, but is simply a third variation of a two-block design using Summer and Winter threading blocks. The visual complexity results from varying the warp and weft colour, thickness and material, and from varying the width (threading) and length (treadling) of the blocks. Once threaded, however, the block widths are constant, as can be seen by the vertical boundaries occurring at each threading block change. Treadling changes are then used to vary the length of the blocks.

Two types of weave structures are used in block weaves. The first type produces contrasting areas of pattern and background and results in a reversible fabric. Summer and Winter, satin and sateen, 1/3 and 3/1 twills, and double weave all fall into this category. The second type of block weave structures is where pattern ends or picks float over a ground fabric. Overshot and other structures of this type can produce long floats if used in designs featuring large blocks. Therefore both the desired block sizes, and the final fabric requirements, affect the choice of weave structure used to interpret a block weave design.

The number of blocks available for design depends both on the weave structure chosen and the number of shafts on the loom to be used—a two-block satin design requires ten shafts, while a four-block plain weave design requires just eight shafts. More blocks mean more design flexibility, since the blocks can do more than alternate. Figures, curvilinear designs, and complex patterns are all possible with multiple blocks. Non-traditional techniques such as shaft switching can also be utilized to further increase design options.



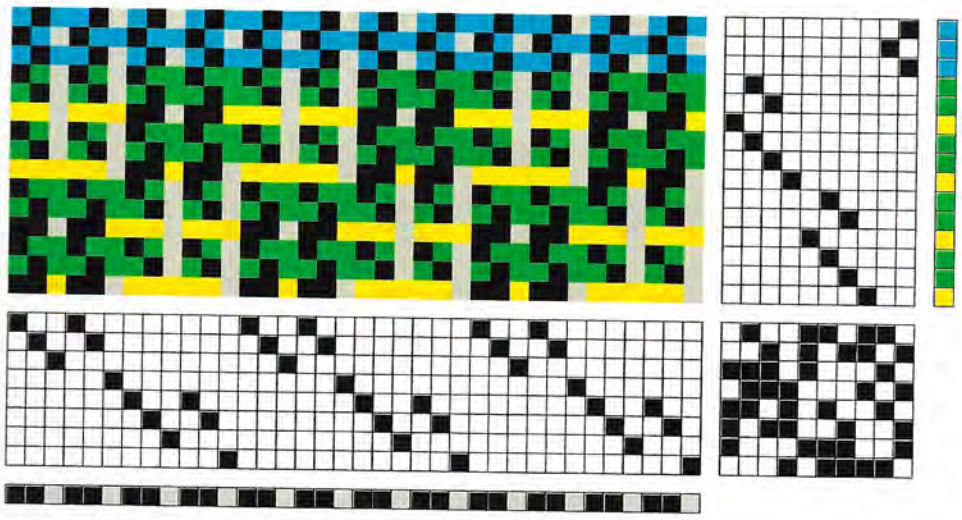
2

Note: This sample is shown with the warp threads running horizontally.

3

Double Weave

Double weave techniques allow two layers of fabric to be woven simultaneously. Similarly, multiple layer techniques allow three or more layers to be woven. The number of shafts available and the weave structure of each layer govern the number of layers possible. For example, with an 8-shaft loom, you could weave two layers of 2/2 twill or four layers of plain weave, or one layer of 2/2 twill and two layers of plain weave. Each layer has its own warp and weft and can be woven independently or interconnected in various ways with the other layer or layers. It is the number of shuttles used and the order in which the layers are woven that determines if and how the layers are joined. Double-width fabric, quilted fabric, and vertical and horizontal tubes are just a few of the double weave possibilities.



Yarns

Warp: linen and rayon, mixed naturals; mercerised cotton, mixed whites and 13lb-test fishing line

Weft: same as warp

Warp and Weft Spacing

Warp: 16 epi for yarn and 8 epi for fishing line, sleyed 3 per dent in an 8-dent reed

Weft: varies

Notes

The ***Sample opposite*** incorporates two blocks of plain weave in each layer, and was designed to highlight a collection of handmade paper. The fishing line was difficult to work with, but it provides a nearly invisible front for the pockets containing the paper. This effect is further enhanced by the wide set used for the fishing line layer. The pockets were stuffed during weaving and then sealed off by weaving the two layers as one.

Samples 1 and 2, opposite, are good examples of unusual double weave applications and the variations possible on a single warp.

Sample 1 is comprised of a continuous vertical tube flanked by narrow horizontal tubes. This ribbon has similar top and bottom faces in different colourways. It can be used flat, or it can be ruffled by inserting a cord through the centre tube (see the illustration on the back cover).

Sample 2 is a series of horizontal tubes where only the bottom layer is woven. For this ribbon, the top warp floats and is only tied down at the end of each tube when the top and bottom layers are exchanged. The two sides of this ribbon are quite different—the face is bright and shiny, while the back is quite muted.

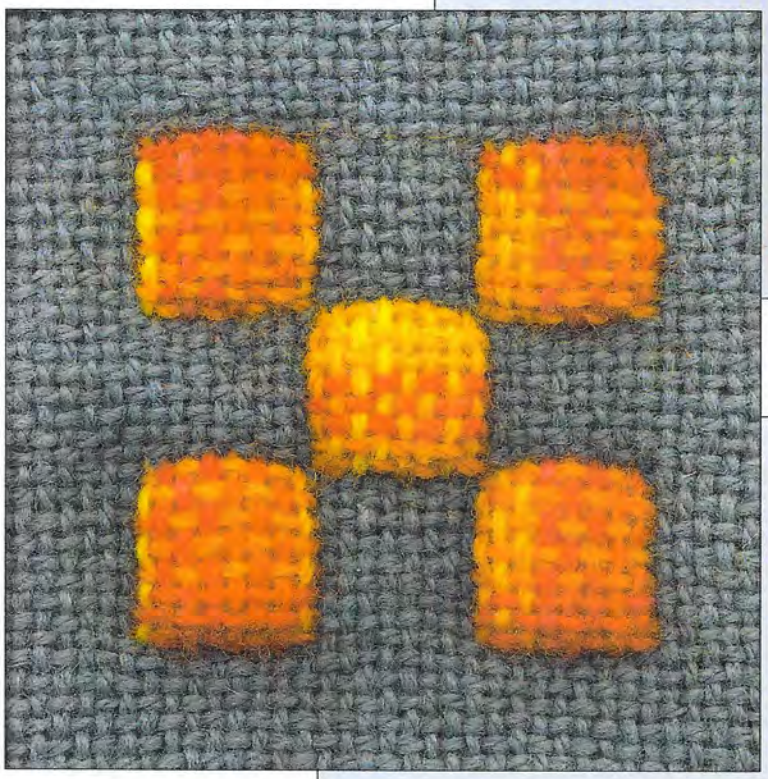
Many other loom-controlled double weave effects are possible. Quilted fabrics can be produced if warp ends or weft picks from the back layer periodically catch either an end or a pick from the top layer (self-stitched double cloth), or if a third warp alternately catches picks from the top and bottom layers (centre-stitch double cloth), or if the top and bottom layers periodically interchange (interchanging double cloth). Folds, flaps, loops, fringes, and pleats can all be created if the warp tension can be controlled independently for each layer. Layers can also be separated and recombined and tubes can be formed, either next to each other or inside one another. Varying the layer colours and weave structures adds further design elements.

But what if you only have a 4-shaft loom? Using double weave in concert with pick-up techniques allows nearly unlimited design flexibility while minimizing shaft requirements.

Sample 3, opposite, is a good example of what is possible. It was woven on a 4-shaft loom using pick-up to interchange the layers and form a simple block design. It would require 12 shafts to weave this sample without pick-up—two shafts for each of the three plain-weave blocks on the top layer and two shafts for each of the three plain-weave blocks on the bottom layer.

Multiple vertical tubes can also be woven on 4 shafts if small sections of warp are individually woven in tubular fashion. Similarly, one or more selvages or openings can be created at any point on either layer by modifying the shuttle entrance and exit locations. Hand-manipulated techniques such as mock leno and soumak can be used on either layer. Or, a portion of a layer could remain unwoven to feature the other layer, to be cut later for a fringe, or to be a design element in its own right. Additionally, differential shrinkage could be used as a design element if different fibres were used for each layer.

1



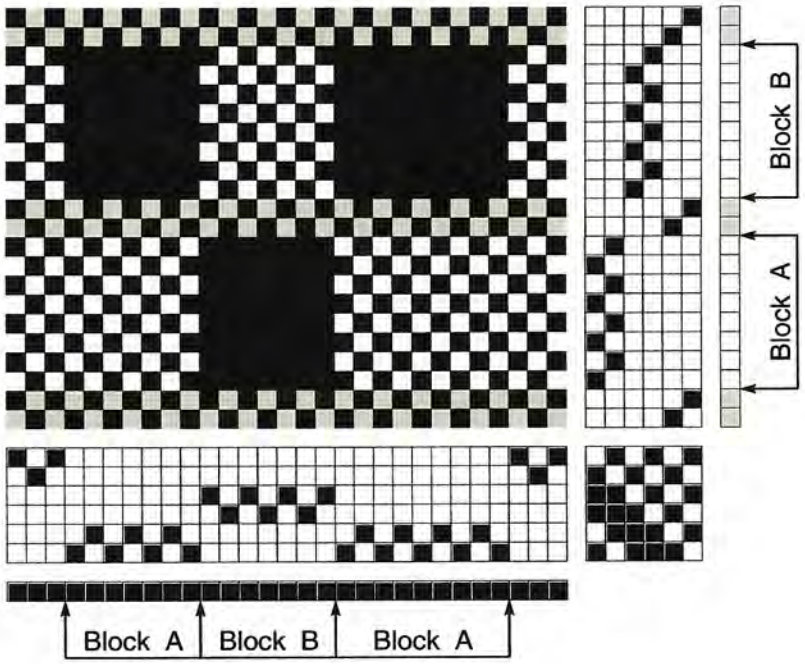
3

2

Honeycomb

Honeycomb is so called because the fabrics typically produced with this threading have a cellular structure that resembles a bee's honeycomb. It is a block weave, where blocks alternate between being woven and unwoven. The blocks, or cells, are then outlined with plain weave picks inserted between treadling blocks. These outline picks undulate, curving down in areas of unwoven blocks and up in areas of woven blocks, and serve to visually isolate the cells as well as to stabilize the fabric. Because the outline picks are deflected, honeycomb is a distorted-weft technique.

Each plain-weave honeycomb block requires two shafts: With eight-shafts, four blocks can be woven in any order and in any combination providing that the floats on the back of the fabric do not become excessive. The cells will appear once the fabric is off the loom and will become defined with finishing.



Yarns

Warp: wool, various thicknesses, off-white, blue-grey, blue-black, blue, brown, light blue, light brown (plied for warp)

Cell Weft: wool, light brown

Outline Weft: wool, blue-black

Warp and Weft Spacing

Warp: 8 epi, sleyed 1 per dent in an 8 dent reed

Weft: 9 ppi average

Notes

The ***Sample above*** is a two-block honeycomb where the blocks vary in width but are always comprised of an odd number of threads (to maintain the odd-even plain weave alternation). This could be woven on a four-shaft loom without the plain weave selvedge ends threaded on shafts 5 and 6. The random warp stripes, which were inspired by a flint wall, de-emphasize the cell structure and add complexity to the fabric.

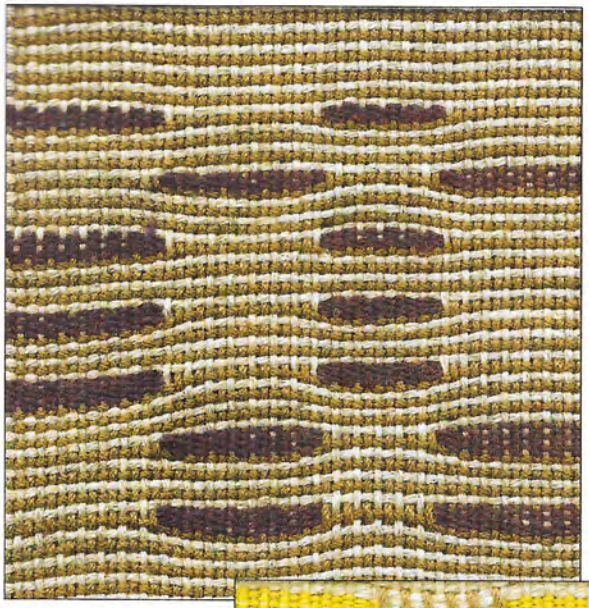
The ***Samples opposite*** are all two-block honeycomb woven on a four-shaft loom.

Samples 1 and 2 are from the same warp and illustrate well how changes in the thickness of the outlining picks affects the appearance of the cells: The thicker the outlining weft, the deeper or more three-dimensional, the cells appear.

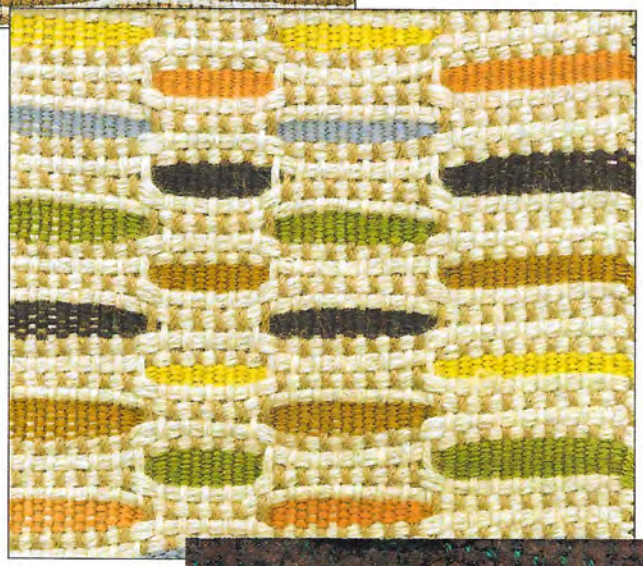
Sample 3 utilizes dark cotton chenille for the outlining weft. The deep colour of the chenille and the contrast in texture and lustre between the outlining weft and the cell weft combine to give the cells a jewel-like quality.

With more than four shafts, other honeycomb variations are possible. The cells can be woven in a structure other than plain weave, honeycomb can be combined with plain weave in a striped design, or two-faced honeycomb can be woven. One type of two-faced honeycomb is woven so that the cells are a single cloth, while the face and back have separate outline wefts. The two outline weft layers conceal the weft skips between cells. The second type of two-faced honeycomb is essentially a double cloth. There are no weft skips with this technique, since the cell wefts weave alternate cells on alternate faces.

Although honeycomb is the best-known distorted weft technique, it is not the only one. A supplementary weft can be distorted on the surface of a fabric if it is held and deflected by long warp floats, and piqué can be used to produce waved or patterned horizontal ribs. Or, variable denting can be used to produce loosely interlaced sections which allow the weft to sag.



1



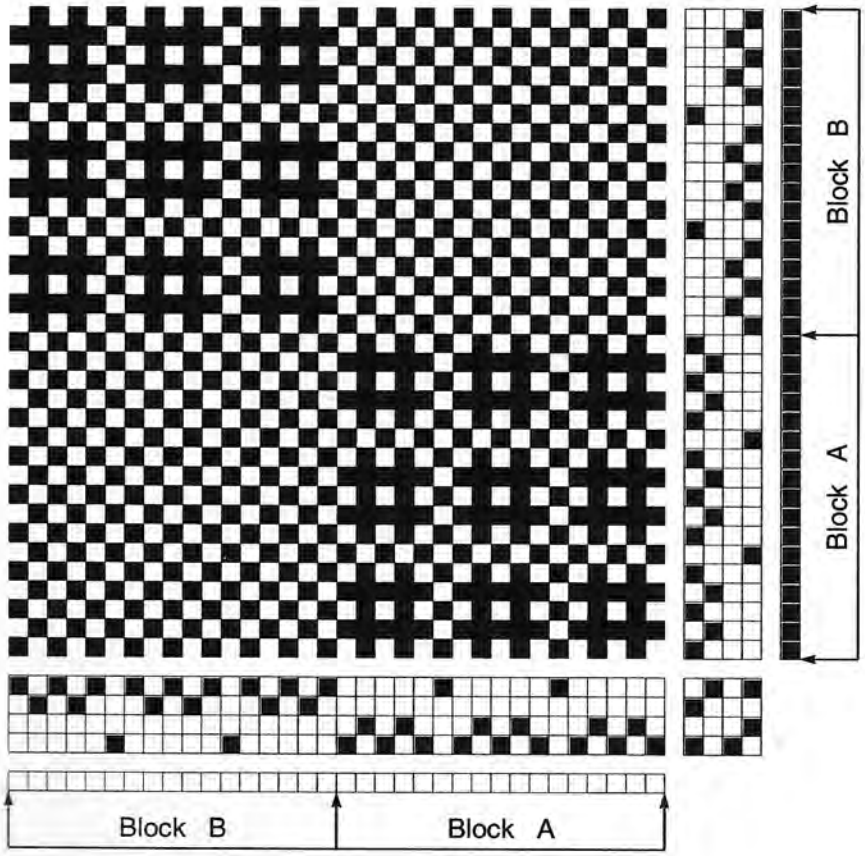
2

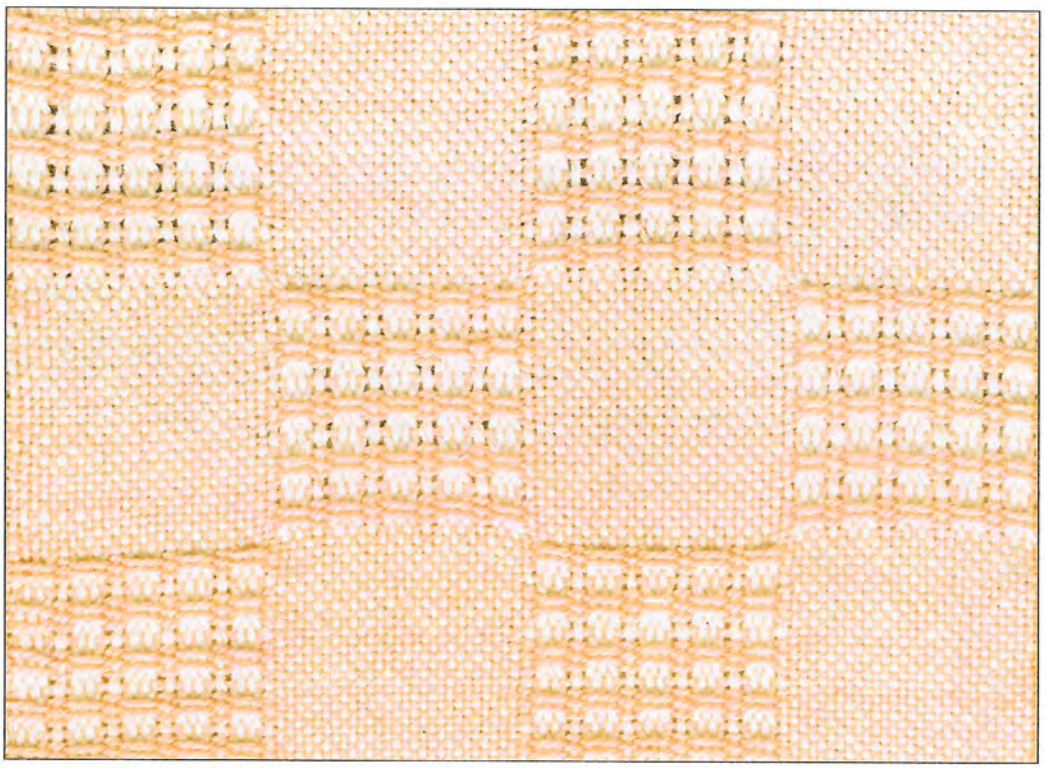
3

Swedish Lace

Swedish lace is a loom-controlled lace weave. The basic structure is plain weave, with pattern shafts added to create warp floats and dropped to create weft floats. It is normally woven on four shafts, with Block A threaded 12121 and Block B threaded 43434. The tie-down threads, on shafts 1 and 4, weave a plain weave background fabric, while the pattern threads, on shafts 2 and 3, combine with the opposing plain weave threads (4 and 1, respectively), to float on the surface in pattern areas and weave plain weave in background areas. If blocks are repeated (say, AAABB), then a tie-down thread on shaft 4 must be added between each A-group and a tie-down thread on shaft 1 must be added between each B-group. It is not necessary to add a tie-down thread between A- and B-groups.

Each block can be woven as warp lace (where warp threads float), weft lace (where weft threads float), or plain weave, but both blocks cannot weave the same type of lace at the same time. If both blocks are weaving lace, the blocks are "turned" so that one block weaves warp lace while the other weaves weft lace. Traditionally, though, one block weaves lace while the other weaves plain weave. The blocks then switch roles or both weave plain weave.





Yarns

Warp: 4 ply cotton, white

Weft: thinner mercerised cotton, pink

Warp and Weft Spacing

Warp: 20 epi, sleyed 2 per dent in a 10 dent reed

Weft: 20 ppi average

Notes

This is a traditional example of Swedish lace with Blocks A and B alternating between weaving plain weave and weft lace.

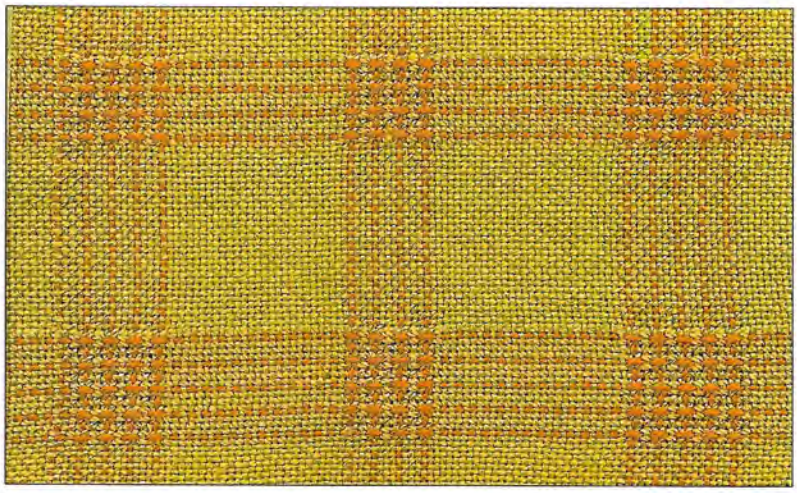
There are few design constraints with Swedish lace, since the blocks can be combined at will and repeated as often as desired. This is true both for threading and for treadling. You can also easily extend the Swedish lace threading to more than four shafts.

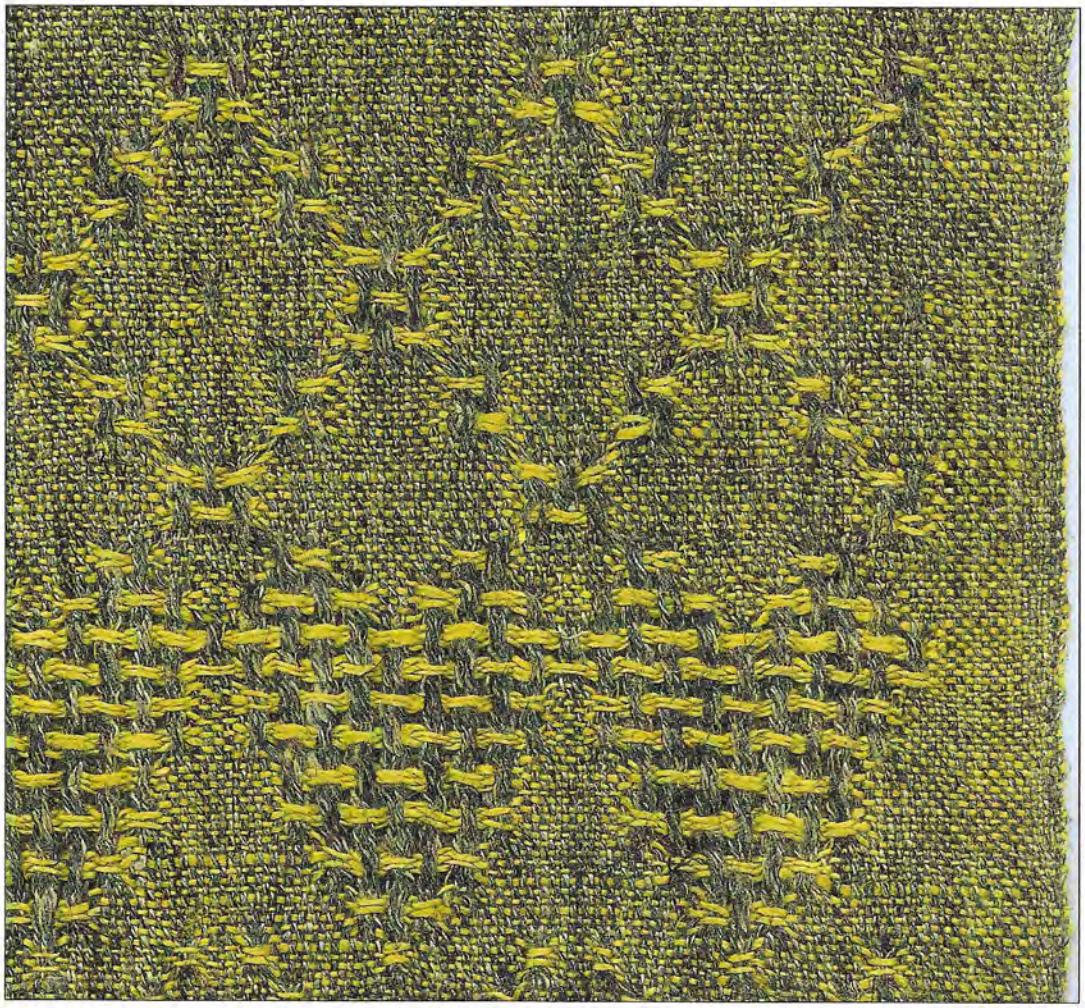
Sample 1, opposite, is an eight-shaft Swedish lace in which six blocks have been coaxed by utilizing shafts 1 and 2 for tie-down threads and shafts 3 through 6 for pattern threads. The six blocks have been arranged in point twill order in the threading, then various blocks were combined while treadling to produce diamond and heart motifs. Note that alternate blocks in the motifs are turned. This is a feature which could be used to outline parts of a design or to turn entire figures.

Sample 2, below, combines stripes of Swedish lace with stripes of plain weave. A three-end Swedish lace block is used in this sample, with a red thread accentuating the centre of each block. Red weft threads are also used, producing a plaid with weft lace where the lace threading and treadling blocks intersect.

Other interesting effects can be created by varying warp and weft colours. Turning blocks can be emphasized by using contrasting warp and weft threads and minimized by using a single colour for warp and weft. Or, for a different effect, warp and/or weft colours can be alternated pick and pick.

2

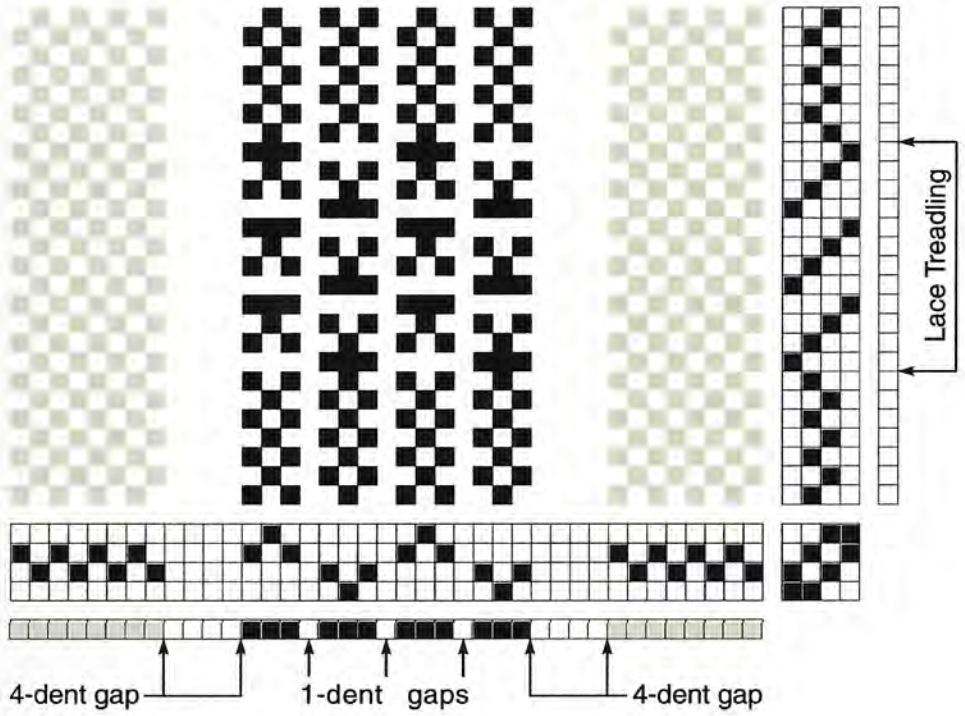




1

Two Different Threadings

Using two different threadings in one fabric is another versatile design option. The quality of the fabric, the texture, and/or the visual impact can all be modified by the use of more than one structure. Plain weave with twill, basket weave with twill, and lace weaves with plain weave are common structure combinations.



Yarns

Warp: 2/24 wool, 2 shades of green

Weft: same as warp

Warp and Weft Spacing

Warp: 32 epi, sleyed 1 per dent in an 32 dent reed

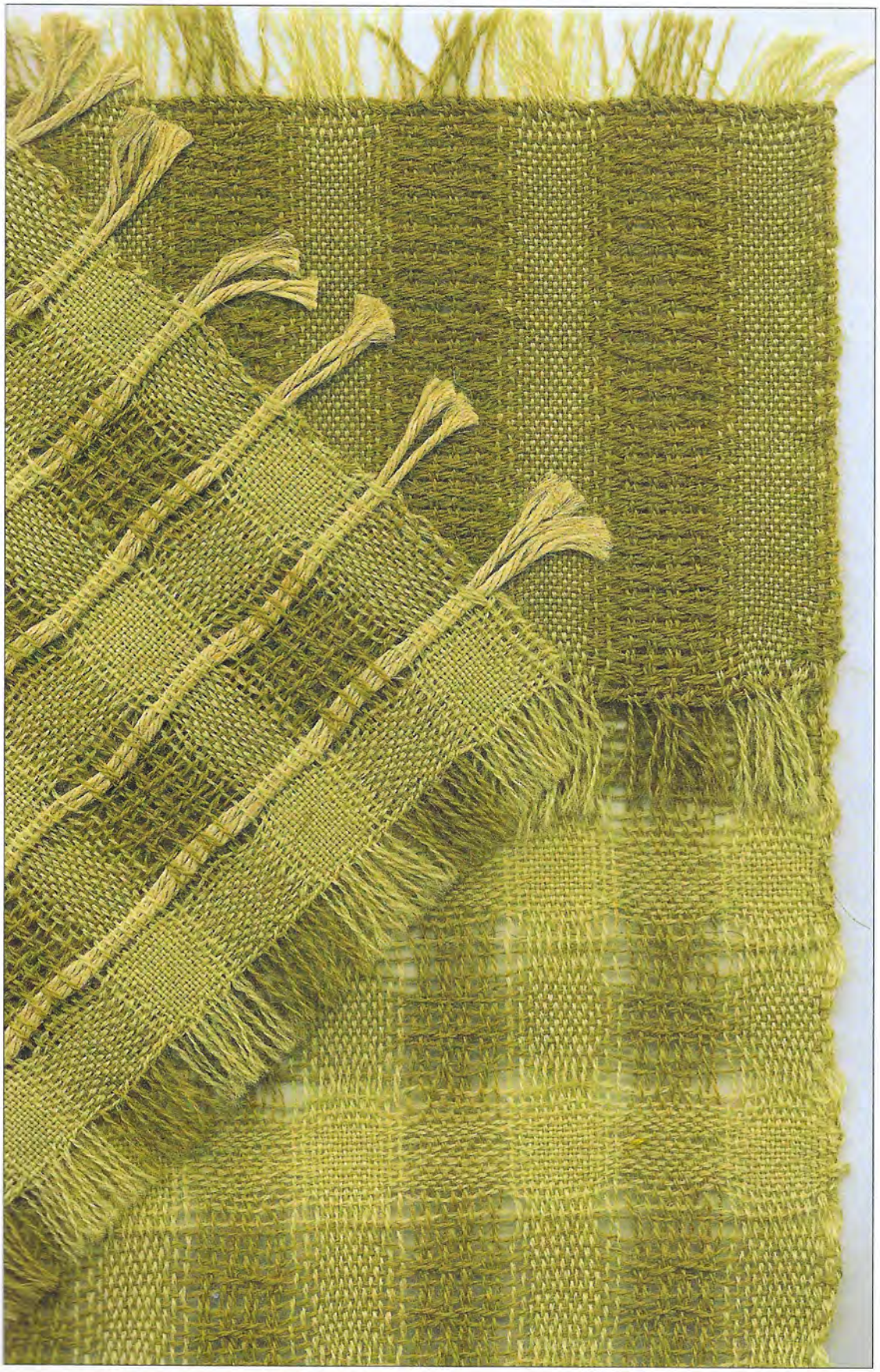
Weft: ppi varies

Notes

The ***three samples opposite*** are all from the same warp, which was threaded with plain weave (on shafts 2 and 3, in this case) and 3-thread Huck lace. (Huck lace is Swedish lace without the tie-down thread between threading blocks that allows a particular block to be repeated. In Huck lace, the 3,4,3 threading block must alternate with the 2,1,2 threading block.) Open dents are used to further emphasize the Huck lace threaded sections.

Samples 1 and 2 are identical, except that Sample 2 incorporates two heavy weft threads in the plain weave sheds at the beginning and end of the lace treadling sections.

Sample 3 is treadled lace throughout and produces lace and plain weave stripes. Note that the lace treadling used here is not the typical 3-thread Huck lace treadling (plain weave, pattern block A, plain weave, opposing plain weave, pattern block B, opposing plain weave), which would produce a chequerboard of warp-float and weft-float huck spots in the lace threaded areas.



3

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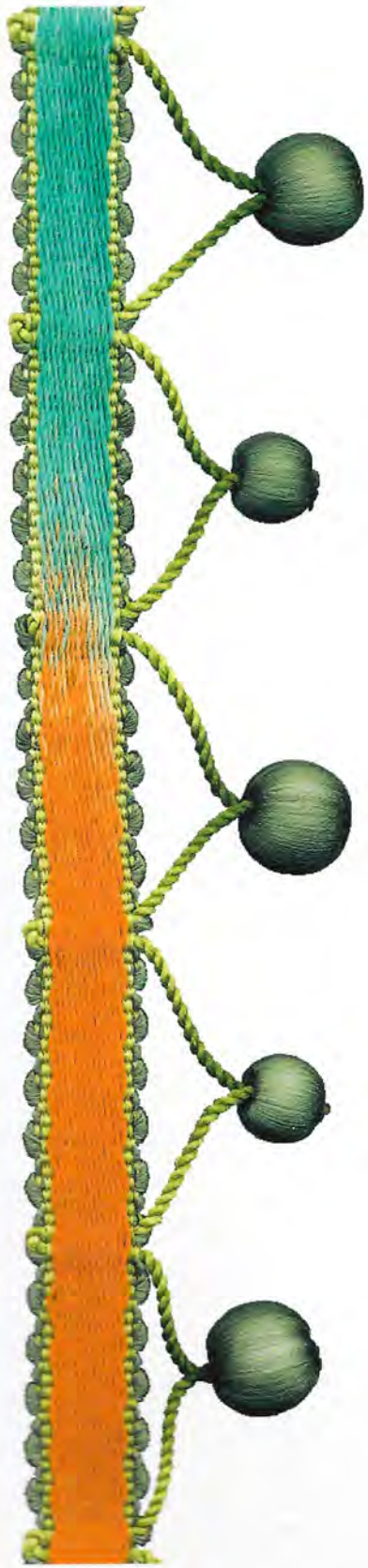
2



Sample 1, opposite page, illustrates two different treadling sequences on a warp where the central section is threaded differently from the flanking sections. The two different threadings increase the textural interest in the sample, while the variable warp and weft colours add to its visual complexity. There is also a slight difference in handle of the fabric across its width—it drapes better in the centre. This is one aspect of fabrics with two threadings that could be exploited for a particular project.

Sample 2, adjacent, shows a functional application of two threadings. The centre of the trim is a 3/1 (warp-faced) twill, while plain weave is used to stabilize the selvages. The narrow plain weave stripes visually lift the warp-faced section, making the space-dyed yarns more prominent.

Other ideas for utilizing two different threadings include (but are not limited to):

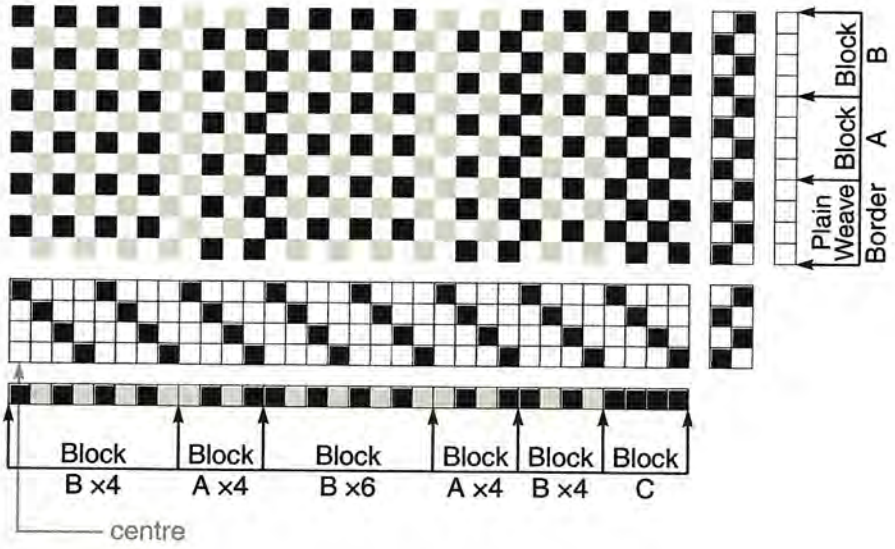
- ✧ Twill or lace "windows" in plain weave.
- ✧ Varying fibres to emphasize the different structures.
- ✧ Using colour to mask or emphasize structural differences.
- ✧ Planning threading combinations for structural reasons, perhaps using stripes of a more flexible weave to form corners or bends for a shopping bag or box pillow cushion.
- ✧ Blending two four-shaft drafts into one composite 8-shaft threading which can be woven as either of the original components.

1

Warp Faced Weaves

A fabric is warp-faced when the warp threads are so dense that they completely cover the weft. The colour and texture of the warp threads therefore dominate the fabric surface, with the weft showing only at the selvages. Plain weave, twill, and satin are the most common structures used to weave warp-faced fabrics.

Warp take-up is high with this technique, since the warp threads travel a sinuous path over and under the weft threads, while the weft threads travel straight across the fabric. Because the warp moulds itself to the profile of the weft, the resultant fabric is comprised of horizontal ribs. The prominence of these ribs is a function of weft thickness.



Yarns

Warp: fine mercerised cotton, green and white

Weft: 8-strand cotton, white and fine mercerised cotton, white

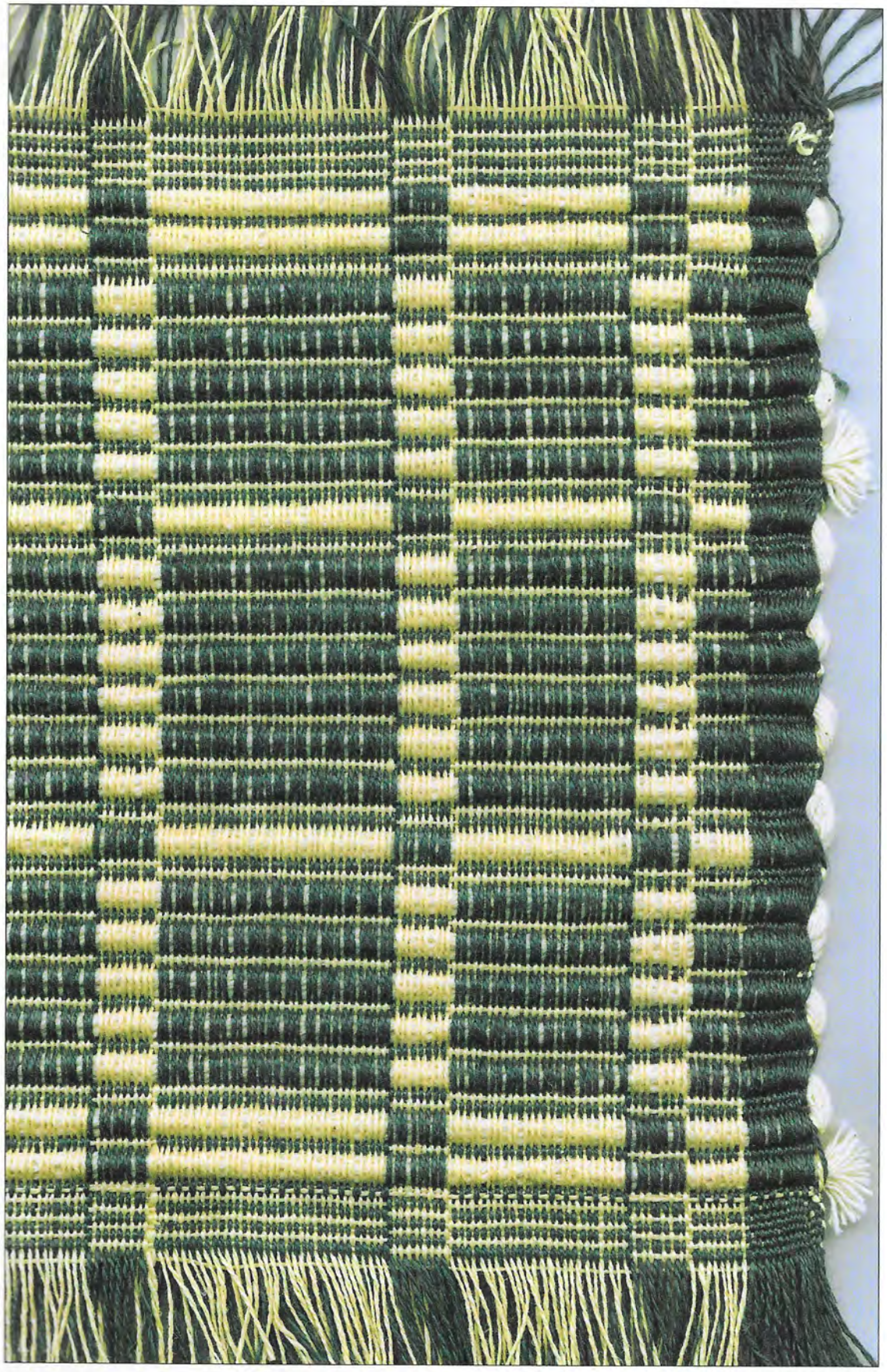
Warp and Weft Spacing

Warp: 40 epi, sleyed 5 per dent in an 8 dent reed

Weft: 6½ ppi average

Notes

The ***Sample opposite*** is a warp rep or rep fabric. The structure is plain weave, the warp is comprised of closely set thin threads alternating between dark and light colours, and the weft is alternating picks of thick and thin yarns. The different weft thicknesses accentuate both the horizontal ridges inherent in warp-faced weaves and the three different blocks of warp colours in this sample. (The warp threads in Block C are all dark green and, therefore, produce a solid vertical stripe at the sample edges.) Note that the warp does not completely cover the weft in this sample, indicating that the sett should have been a bit closer.

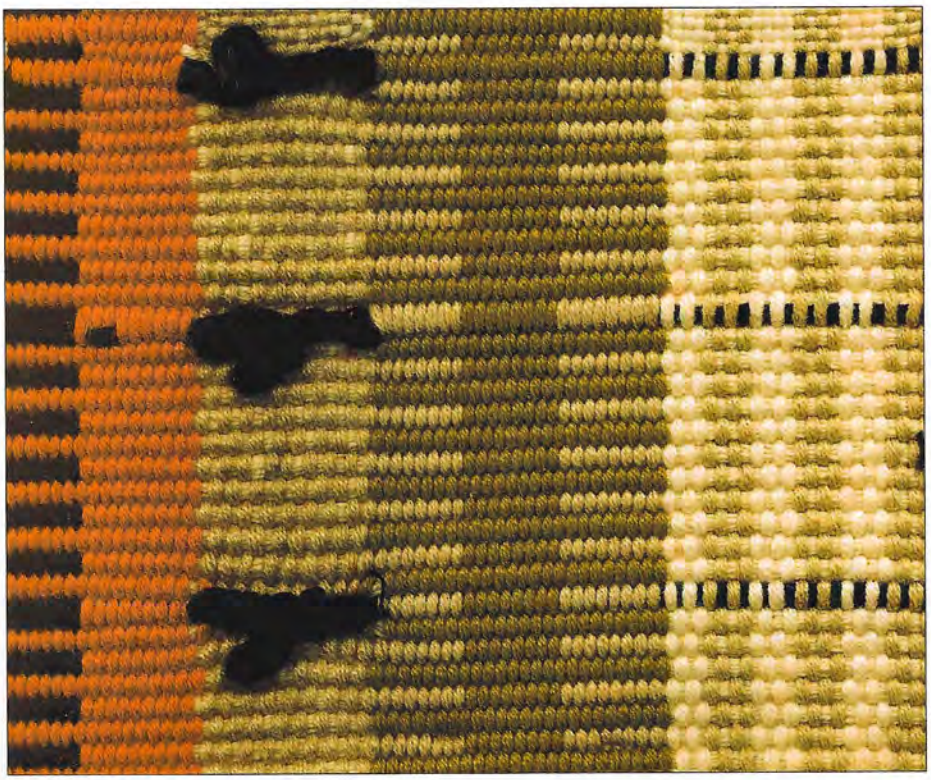


Sample 1, opposite, is woven in a 1/3 twill. The colours of the warp stripes in this sample are undiluted and pure, a combination of the close sett and the warp-faced twill structure.

I*Sample 2*, below, has warp-faced stripes, which alternate with stripes at a normal or balanced sett. In addition, two warp colours alternate in portions of the warp-faced stripes, increasing the complexity of the woven fabric. Periodic use of a thick, contrasting and over-twisted weft adds another interesting element. Note that two warp beams were used to weave this fabric because the warp-faced sections have considerably more take -up than the balanced sections.

The high density of warp threads causes warp-faced fabrics to be relatively stiff, with little drape, and they are generally used for flat items such as rugs, place mats, and wall hangings. Warp-faced fabric will bend parallel to the weft, however, and this feature can be exploited if these fabrics are used for straps or roller blinds or for items, such as shopping bags, that require right-angle bends.

2

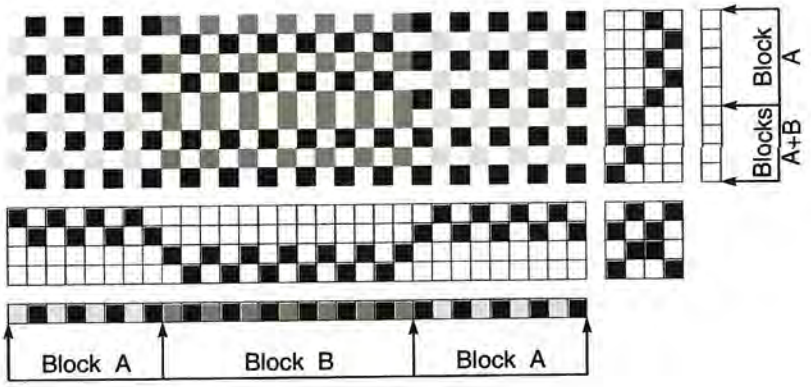


1

Warp Faced Rugs

With warp-faced rugs, the primary design element is the warp itself. The warp ends are densely sett and are visible the length of the rug (on one side or the other) since they completely cover the weft. Dense setts make warp-faced rugs more time-consuming to warp and more difficult to weave than weft-faced rugs. However, sticky sheds can be minimized by using smooth warp yarns, by spreading the warp ends over all the available shafts, and by using a sturdy loom. A sturdy loom is also necessary to withstand the hard beating required to pack down the weft enough to make the rug strong and functional. Since thick weft yarns are generally used, there are few picks per inch and warp-faced rugs weave quickly.

Plain weave, four-shaft twills, and block weaves are commonly used for warp-faced rugs. With block weaves, each block is normally comprised of two warp colours alternating end on end. The rug is then woven with alternate thick and thin wefts, so that the ends raised when the thick weft is inserted show clearly on the face of the rug, while those raised when the thin pick is inserted hardly show at all. Painted warps and ikat-dyed warps can be used with any warp-faced structure to further expand design options.



Yarns

Warp: 2-ply rug wool used three-fold, dark grey, slate, purple, mauve

Thin Weft: 2-ply rug wool, light and dark pink

Thick Weft: 2-ply rug wool used six-fold, light and dark pink

Warp and Weft Spacing

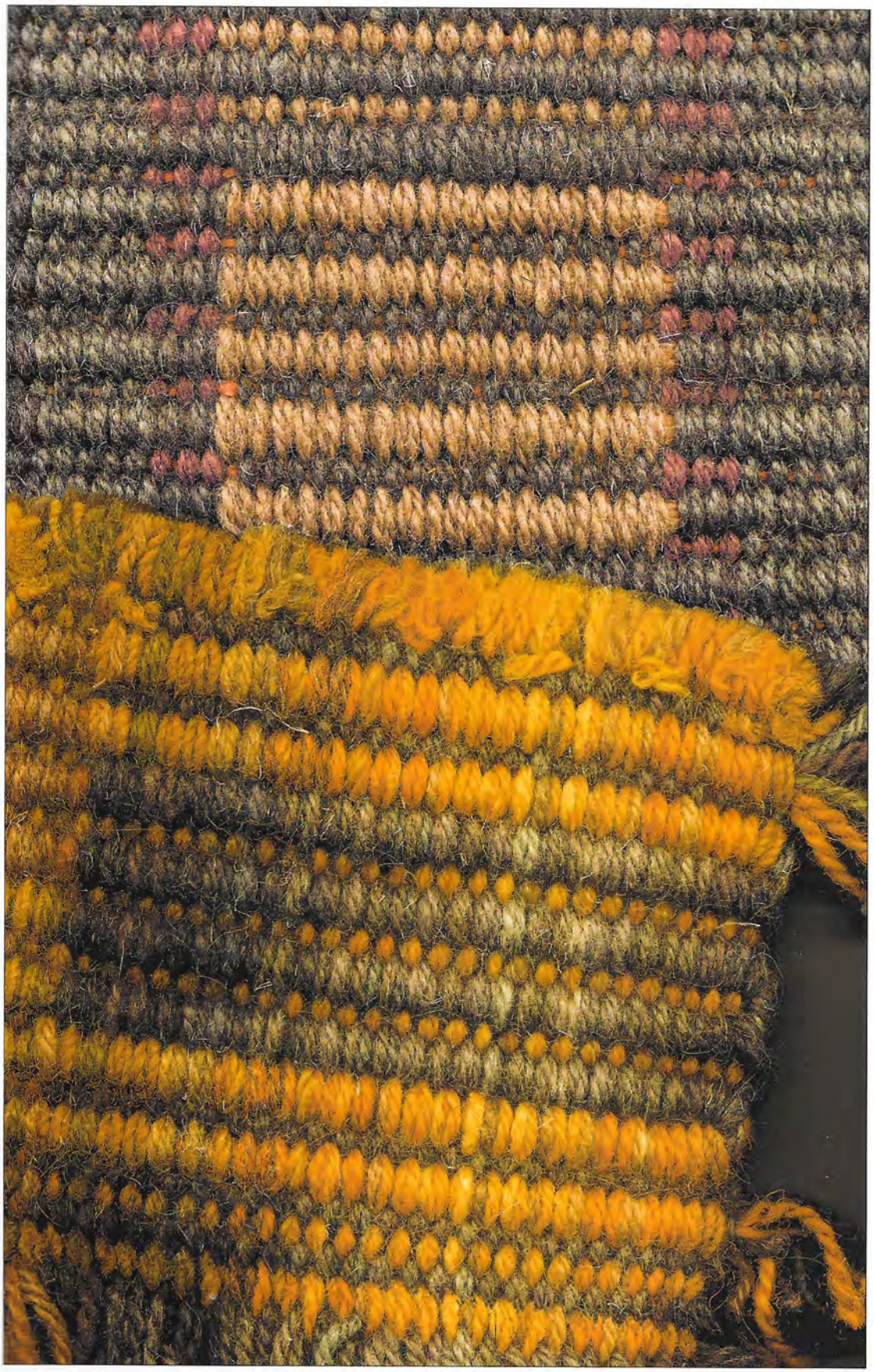
Warp: 12 three-fold epi, sleyed 1,2 in an 8 dent reed

Weft: 4 ppi

Notes

Both ***Samples 1 and 2,*** opposite, utilize a 2-block plain weave structure, therefore only the draft for sample 1 is shown. The draft shows warp ends, but does not indicate that each of the three strands comprising each warp are threaded in individual heddles.

When weaving, wefts must be pulled tightly at the edges and linked around each other to ensure that the warp ends are tied in. Binding the fringe in ½ inch bundles is a good method for finishing warp-faced rugs.



1

2

Weft Faced Rugs – Introduction

Weft-faced rugs can be woven using many different threadings and weave techniques. The simplest threading is plain weave, which provides design options ranging from horizontal stripes, if the weft is continuous across the warp, to unlimited colour and pattern options, if tapestry techniques are used. Twill threadings are also widely used for weft-faced rugs. Krokbragd is a pointed three-shaft draft usually incorporating two or three differently coloured wefts to produce small-scale patterns. Four-shaft twills for rugs are often straight or point-twill threadings and can be woven with different weft colour sequences and treadlings to provide a wide range of design options. Interesting colour and weave effects, and shadow weave, can be produced using six-shaft twills, and with eight-shaft twills the design options include innumerable small-scale patterns, as well as an expanded pallet of block designs. Pick-up and pile techniques are also used for weft-faced rugs.

Regardless of the threading or technique used to weave a weft-faced rug, the warp must be widely sett and the weft must be a compressible material to allow full coverage of the warp yarns. Other tips for ensuring complete warp coverage include:

- ✧ Ensuring that the warp yarns are highly tensioned.
- ✧ Bubbling or arcing each weft pick to compensate for the high take-up as the weft yarns travel over and under the warp yarns.
- ✧ Using a warp yarn with some texture to help stabilize the weft yarns.
- ✧ Ensuring that the warp yarn, weft yarn, and sett all work together to produce a rug of the desired thickness and firmness.
- ✧ Using a hard, consistent beat.
- ✧ Weaving on a sturdy loom.

A separate consideration is limiting structure choices to those that produce floats less than 3 threads or ½ inch long, otherwise the floats are prone to snagging, which will reduce the life of the rug.

Weft-faced rugs are not quick to weave as there are generally many picks per inch all of which have to be firmly beaten into place. However, the number of threadings and techniques available make them quite versatile and endlessly interesting to design. An added bonus is that weft-faced rugs are usually the same on both sides and are therefore reversible.

Weft Faced Rugs – Twill Threading

Two examples of weft-faced rugs woven with twill threadings are shown on this and the following two pages.

Sample 1, below, is woven on a 4-shaft broken twill threading (1,2,4,1,3,4,2,3), with a 2/2 twill tie-up and straight treadling (there is no draft for this sample). The pattern results from the varying colour sequences used for the four picks compressed into each row of weft.

1

Sample 2, opposite, is a straight 4-shaft twill threading with a 2/2 twill tie-up as shown in the ajacent draft. Changes in treadling and weft colour order are used to produce the three quite different effects illustrated in the sample.

Note the difference in weight between *Sample 1*, on the previous page, and *Sample 2*, opposite. The straight twill rug (sample 2) is sett twice as close as the broken twill rug and uses single strands of 2-ply rug wool for weft versus three strands of 2-ply rug wool in the broken twill rug. Both rugs are good examples of suitable combinations of warp yarn, weft yarn, and sett.

Yarns

Warp: 2-ply rug wool, grey

Weft: 2-ply rug wool, brown and grey

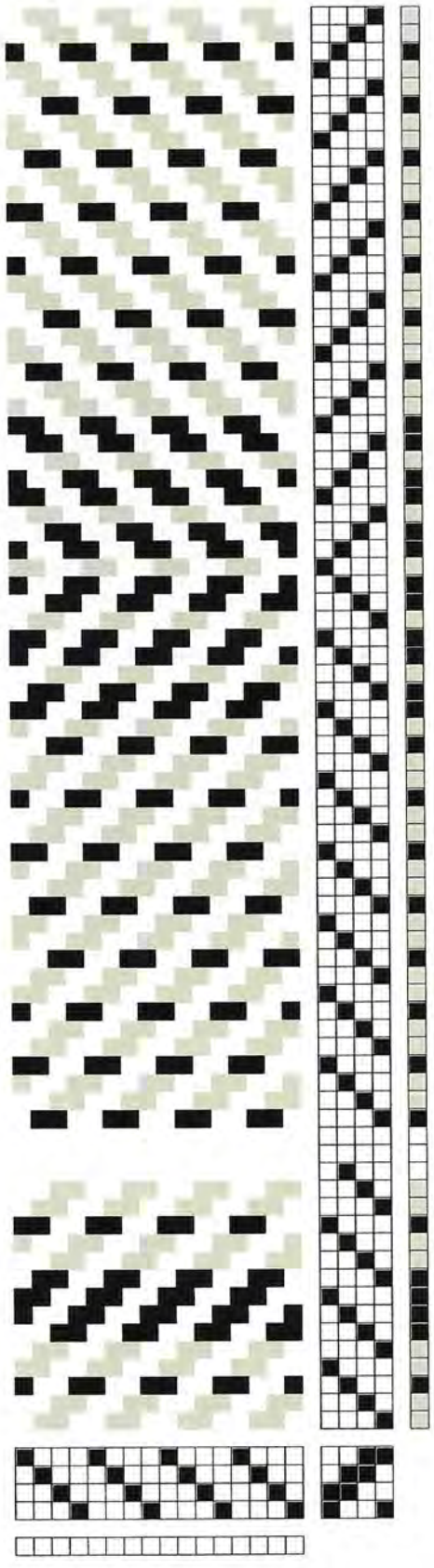
Warp and Weft Spacing

Warp: 8 epi, sleyed 1 per dent in an 8 dent reed

Weft: 20 ppi

Notes

Many other diagonals, chevrons, diamonds, triangles, and zigzags are possible by modifying the treadling, the tie-up, or both. In addition, interesting designs can be produced by using only three of the four treadles in the 2/2 twill treadling sequence. Note that the draft shows uncompressed picks and so does not give a good visual picture of the woven rug.



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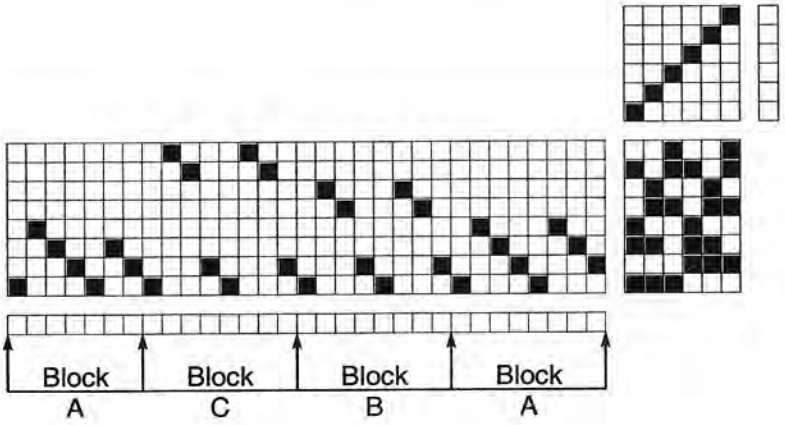
Weft Faced Rugs – Block Threading

Block weaves are used to produce larger-scale patterns and to define weft colour boundaries. Usually, two colours are used to produce pattern on a background of a different colour, and the back of the rug will have the opposite colourway.

A common block weave for rugs is Peter Collingwood's 3-end block weave which produces two blocks (1,2,3 and 1,2,4) on four shafts. Summer and Winter is another common block threading which also allows for two blocks (1,3,2,3 and 1,4,2,4) on four shafts. Both of these block weaves can be expanded, with each additional shaft adding one block.

The number of threading repeats determines the width of each block, and once threaded, the width of each block remains constant. That is, unless shaft switching is employed. Shaft switching breaks down vertical block boundaries by allowing individual pattern threads to be moved from one shaft or block to another. Methods for accomplishing shaft switching vary from permanent loom modifications to simply threading each end between two heddles and tying it to the appropriate heddle.



Yarns

Warp: 8/5 linen, natural

Weft: three strands of 2-ply rug yarn, 80% wool and 20% nylon, green, grey, and yellow

Warp and Weft Spacing

Warp: 4 epi, sleyed 1 every other dent in an 8 dent reed

Weft: 20 ppi

Notes

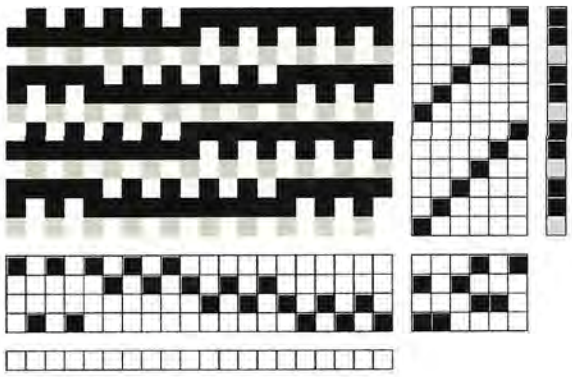
The *sample opposite* is an example of three-colour block weave. Various weft colour sequences are used in the bottom half of the sample to change the colour appearing in each block. The top half of the sample illustrates shaft switching—two threads from one block have been moved to an adjacent block. Note that the draft does not include the drawdown. The drawdown would be unrepresentative since the weft compression occurring during weaving cannot be effectively replicated.

Sample shown at 80% full size

Weft Faced Rugs – Corduroy

Corduroy is a weft pile technique where each pile pick alternately weaves and floats for a set interval. The floats are later cut to produce the pile, which is held securely by the woven intervals. The structure is further stabilized by a plain weave ground pick after every two pile picks. Single corduroy characteristically produces widely spaced columns of pile tufts. Double corduroy produces a thicker pile, since the threading allows the pile floats to be staggered rather than arranged in columns.

Corduroy design options include varying weft colour sequences to produce vertical stripes or two-colour tufts, weft inlay, varying the pile length, and/or choosing to leave some of the pile floats uncut. In addition, double-faced corduroy, twill corduroy, and half corduroy (which is a combination of pile and flat weave) can be woven. Corduroy can also be combined with other pile techniques.



Yarns

Warp: 12/6 cotton, seine twine, unbleached

Ground Weft: ½ cotton, white

Pile Weft: ½ cotton used six-fold, light green and dark green

Warp and Weft Spacing

Warp: 8 epi, sleyed 1,1,0 in a 12 dent reed

Weft: 12 ppi

Notes

The ***sample opposite*** is four-shaft double corduroy with various weft colour sequences. From the bottom, single-colour pile is followed by a section of two-colour tufts produced with light and dark green pile floats arranged in twill order. The weft colour order was then varied twice more to produce wide and narrow vertical stripes.