Double Weave with an 8 Shaft Loom

Introduction to 8 Shaft Double Weave

Perhaps the biggest change for a handweaver occurs when the decision is made to "move up", to weave with more than a 4 shaft loom. Arbitrarily our discussion deals with what can be done in double weave with an 8 shaft loom. It is much easier conceptually to move to 12 or 16 shafts or more than it is to move from 4 shafts to 8.

For this workshop the major impact occurs in the threading changes that can be made but the challenge in determining the tieups is still there and of course we will come to that in due course. In the program up to this point you have been able to weave designs that are somewhat limited. This is the result of the fact that the weft threads weave from selvage to selvage in the layers of double weave. Now you will be able to have weft threads move from the top layer to the bottom layer and back again within a weft shot. Let's begin with a short discussion of units and blocks which make thinking about multishaft weaving a great deal simpler.

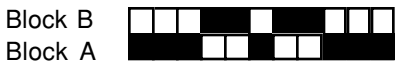
A. Units and Blocks in Double Weave

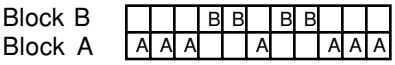
There are different ways of talking about units and blocks, Here is mine.

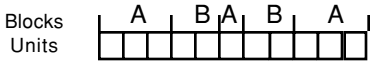
A warp unit in weaving is the smallest number of warp threads that will produce the desired weave structure. For double weave the warp unit is four warp threads in straight draw configuration. The usual convention is to call the warp unit threaded on shafts 1-4 unit A, the warp unit threaded on shafts 5-8 unit B, and so on. (Later you may learn that warp units can be threaded on other shafts, for example 3-6 but let's not worry about that now.)

Warp weaving blocks are made of one or more warp units and are referred to as block A, B and so on.

A profile draft is a shorthand system that is very helpful in planning designs. The discussion so far in this workshop has highlighted thread by thread drafts but a more efficient way is based on using warp units and blocks. For now we want to keep things simple and say that 8 shaft double weave offers two weaving units and hence two weaving blocks. You may encounter different ways of writing profile drafts so let's look at several of them. They mean the same thing. The warp threading has 3 units on shafts 1-4, 2 units on shafts 5-8, 1 unit on shafts 1-4, 2 units on shafts 5-8 and ends with 3 units on shafts 1-4. Choose the one that you feel comfortable with.

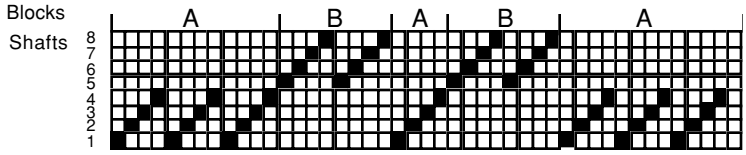






Since each block of double weave requires 4 shafts, there is only one design block for a 4 shaft loom, two design blocks for an 8 shaft loom and so on.

The complete threading of the profile draft looks like this.



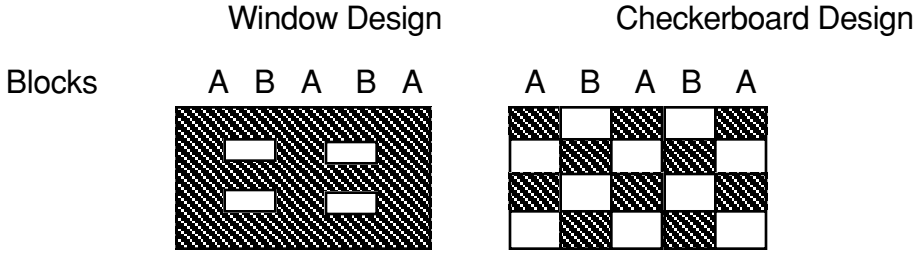
Here is the secret of weaving with 8 shafts where you have the two weaving blocks A and B.

> You can choose to make block B
> weave in the same or different manner from block A.

The tieup controls what happens. You will be able to make both the warp and weft threads move from one layer to the other and back again. Time to look at the two principal designs for double weave with an 8 shaft loom.

B. 8 Shaft Double Weave Designs

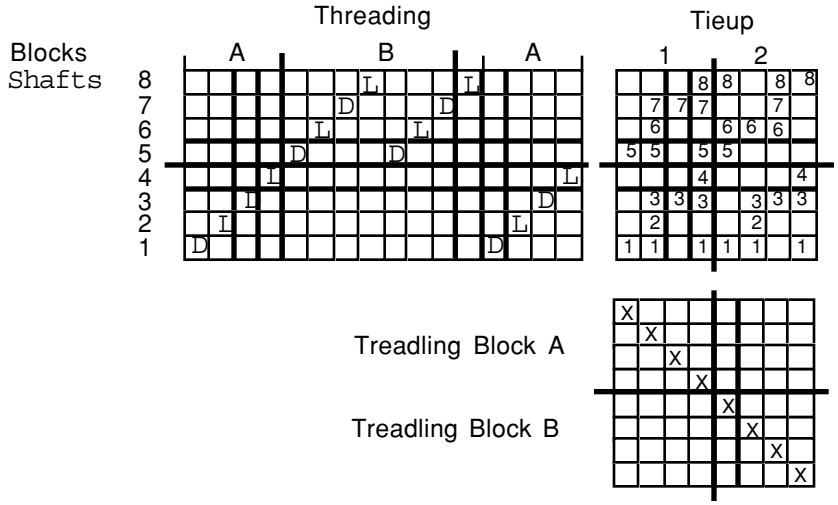
Almost all of the 8 shaft designs can be classified as “windows” or as “checkerboards” or as “multilayer weaving”. Which of these you weave is determined first in the threading and then by the tieups and treadling order. Here are examples of the first two designs in profile form.



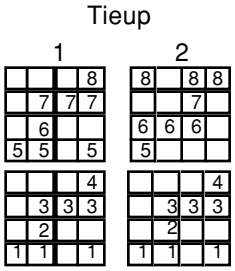
The proportions of the blocks can be anything the weaver wants. They can be varying widths and heights and of course color changes can be introduced in the warps and wefts. Enough possibilities to keep a double weaver happy for quite some time. Let’s discuss each design in some detail and then you can choose which pattern to try in the exercises that follow.

1. The Window Design

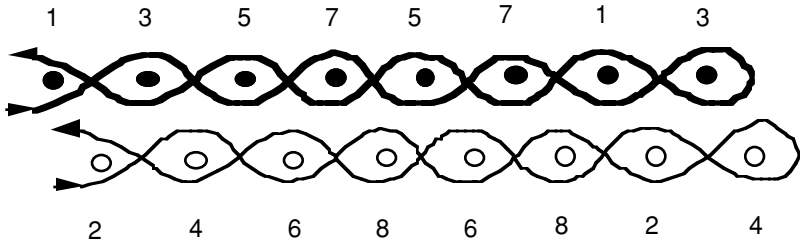
The fact that 8 shafts are required for this double weave design must be reflected in each of the components: threading, tieup, and treadling order. Here is a diagram with each of these components shown in detail.



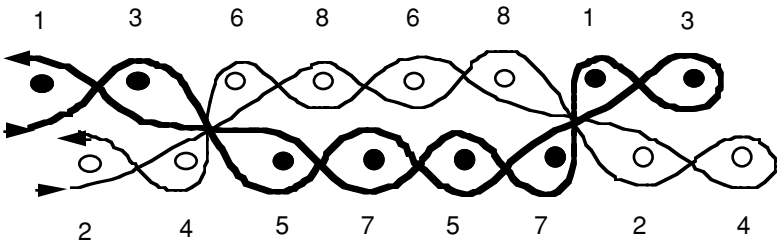
The threading and the treadling order do not need much comment beyond saying that the blocks can be threaded as the weaver desires to create wide or narrow windows, and treadled as the weaver desires to create tall or short windows. The tieup is where the action is. The tieup diagram has been expanded to make it easier to look at the four grids that make up the tieup.



Look at the two grids on the left. They have identical form which means that the threads on shafts 1-4 and on shafts 5-8 are going to weave in the same manner. The form of each tieup is that of basic double weave tieup 1 which weaves dark warp and weft in the top layer and light warp and weft in the bottom layer. An 8 shaft loom is weaving as though it were a 4 shaft loom. The weave structure looks like this.



There is nothing new for you here except for some shaft numbers. A dark cloth layer on top and a light cloth layer on the bottom. Let's look at the two tieup grids on the right. The form for shafts 1-4 remains the same while the form for shafts 5-8 changes. The two sets of shafts weave in a different manner. Block A has the tieup form to weave a dark cloth on top and a light cloth on the bottom while the tieup form for block B reverses this, a light cloth on top and a dark cloth on the bottom. In block B both the warp and the weft have moved from the top layer to the bottom layer, a trick not possible with only a 4 shaft loom. The weave structure controlled by tieup 2 on the right looks like this.

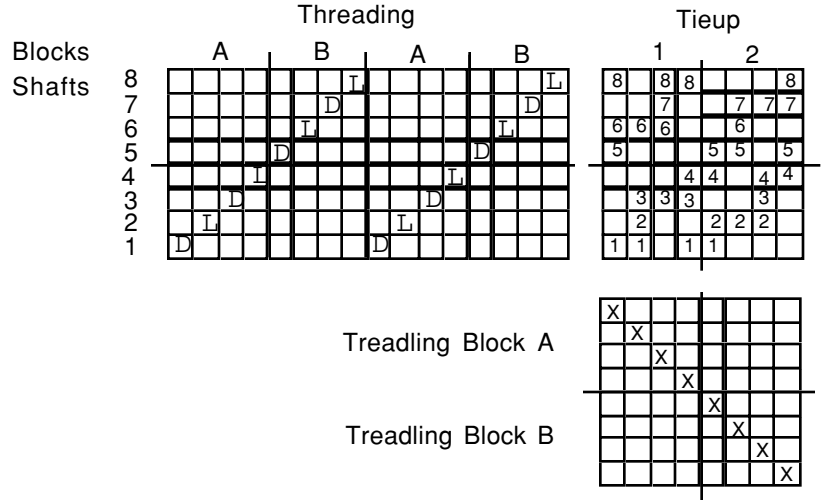


Notice how the layers have changed position in the center of this diagram. The light cloth layer is on top creating the “window”. Another thing has happened. The central section has now been sealed off creating a tube in the warp direction that can be made as long as you want it to be. It can be be stuffed with insulating material or with a rod or dowel to support the weaving.

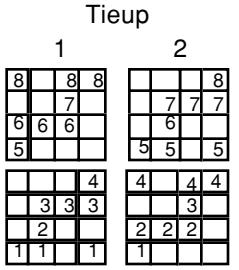
You can close off the window by weaving another section with treadling order A. That is all you need to create the window design in double weave.

Do you remember how I kept saying in the discussion of 4 shaft double weave that I wanted you to keep the color order for the weft to stay the same, always DLDL? Now I can tell you why with the window design as the example. When tieup 1 on the previous page is used to weave the background, the weft color is DLDL for both blocks A and B. When the window portion of the design is woven using tieup 2, the tieup and therefore the weft color order for block A stays the same. And, another therefore, the weft color order must stay the same, DLDL, for block B. Why? The same weft threads are weaving both blocks. The design change is controlled by the new tieup form for block B, not by changing the weft color order.

2. The Checkerboard Design



The threading has changed to give alternating blocks A and B. The tieup has also changed. An expanded view makes it easier to see what has happened.



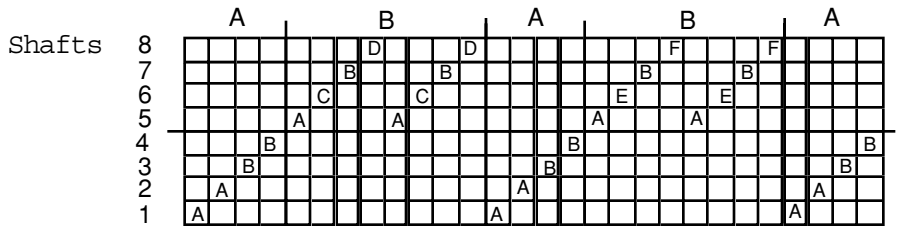
Tieup 1 has shafts 1-4 weaving a dark cloth layer on top and a light cloth layer on the bottom. and at the same time shafts 5-8 weave a light cloth layer on top and a dark cloth layer on the bottom. Tieup 2 reverses this so that shafts 1-4 weave a light cloth layer on top and a dark cloth layer on the bottom and shafts 5-8 weaves a dark cloth layer on the top and a light cloth layer on the bottm. The checkerboard pattern develops as the treadling order A switches to treadling pattern B and then back again.

The 8 shaft double weave designs I call windows or checkerboard are brought about by combining the two basic tieups for double weave in different ways. Very straightforward once you go through the requirements for the two designs. But now it is time for more weaving exercises. These are not as specific as the exercises given for 4 shaft double weave. The starting point is a new warp for 8 shafts. The treadling is the one to weave two cloth layers with two shuttles. The primary emphasis in these exercises will be changing weft colors. Remember the weft color order stays the same throughout as DLDL (with the D's and the L's standing for different colors).

C. Exercises in 8 Shaft Double Weave

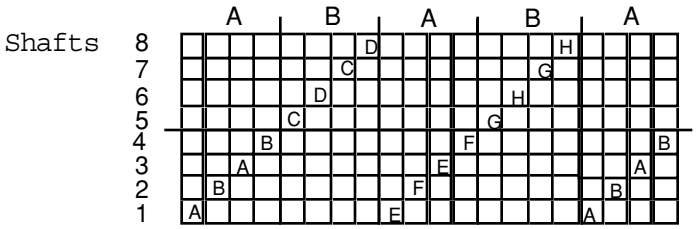
The first thing to do is prepare a new warp. Choose either the window or the checkerboard design and wind a warp about 3 yards long and 5-6" in width. Here are two suggested threadings with color indicated by the letters A,B,C.....

Window Threading



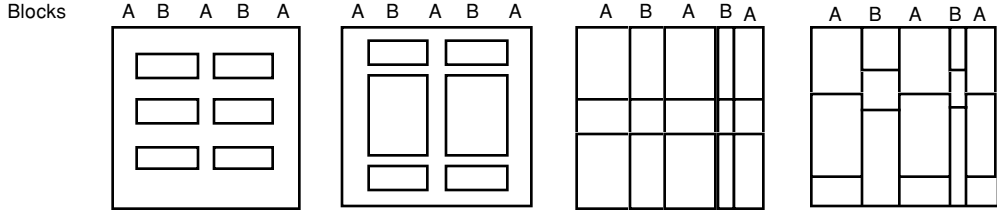
Plan to have at least two different windows in your design. Colors A and B always appear in each threading unit so that an outline of the window is possible. My personal preference is to make the background darker than the windows which then appear to be brighter than the background. I would also suggest that all six colors should be from no more than 2 or 3 neighboring color families.

Checkerboard Threading



I find it is much more challenging to design a checkerboard because each section is adjacent to other colored sections on four sides while the windows are surrounded by the same background color. Five units have been chosen for the checkerboard to balance the design. I would suggest that the six colors be of approximately the same value and come from no more than 2 or 3 neighboring color families. Each threading unit has two colors which means that there are three warp color combination that you can choose, for example AA, AB, or BB. And don't forget that you can use any of the six warp tieups to produce even more color variations in the windows or checkerboard designs. Look back at pages 10 and 11 in 4 shaft double weave to refresh your memory about the tieup possibilities. Later you may want to try a checkerboard warp with four colors in each threading unit.

In the exercises with 8 shaft double weave, you should explore both design and color possibilities. At first stay with the same colors that you have in the warp. Then see what happens when you use opposite colors. The design can be varied in a number of ways. Two possibilities show how the proportions or the placement of the two blocks can be changed for either the window or checkerboard designs.



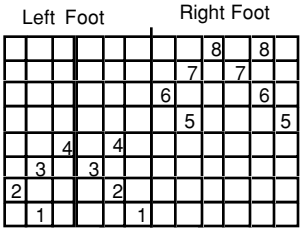
Introduce a new weft color in the middle of a treadling block. A plaid design results. And don't forget to look at the back of your weaving to see what the design is like. This is particularly true for the window design where you may see a plaid on the reverse of the fabric. Plenty of possibilities.

E. More helpful hints.

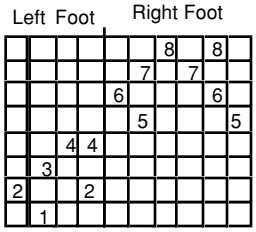
1. A skeleton tieup is very helpful for 8 shaft double weave. Unless you are fortunate to have 12 treadles on your 8 shaft floor loom, not even the skeleton tieup can give all the combinations that are needed. Here are two skeleton tieups, the first for floor looms with 12 treadles and the second for floor looms with 10 treadles. You have to retie your treadles on your 10 treadle loom to get the remaining combinations.

I find that it is very convenient to use your left foot to treadle shafts 1-4 and your right foot to treadle shafts 5-8. At times you have to press two treadles with one foot. I also suggest you rig the treadles to give all the combinations for shafts 5-8 because that is usually where you want to make the most color changes, at least with the window design.

12 Treadle Skeleton Tieup

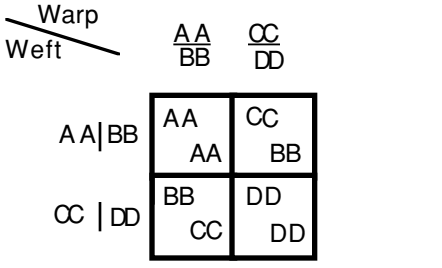


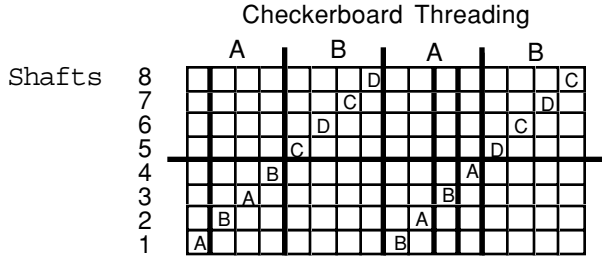
10 Treadle Skeleton Tieup



I chose to keep the four tabby treadle combinations for the 10 treadle skeleton tieup but you might choose a different group of 10 treadles from the 12.

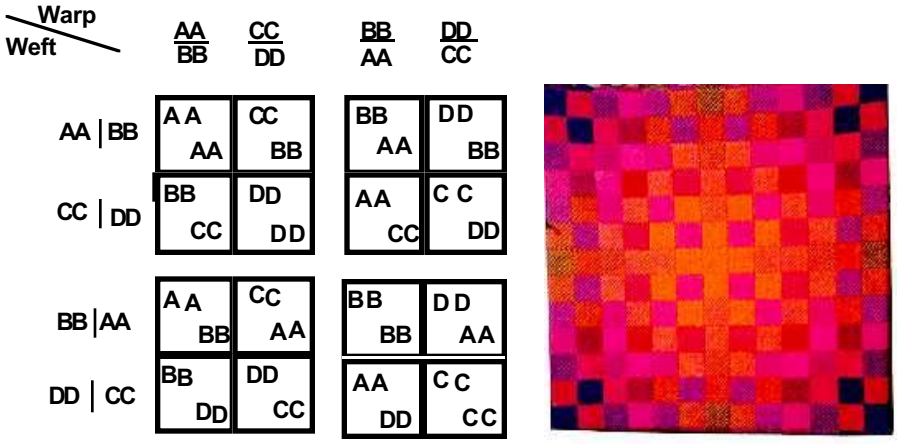
2. In planning designs I often plot colors with the warp colors in the upper left corner and the weft colors in the lower right corner. The warp suggested for the checkerboard design serves to illustrate what I mean. Warp AA/BB means the threading for that warp unit was ABAB. In the first vertical column, warps AA weave in the top layer in the first square. The two layers are interchanged so that warps BB weave in the top layer as shown in the second square. Weft AA/BB means that the weft color order is ABAB. In the first horizontal row, wefts AA weave in the top layer and in the second square wefts BB weave in the top layer and so on across the warp.





The warp combinations alternate in the vertical direction because the warp layers are

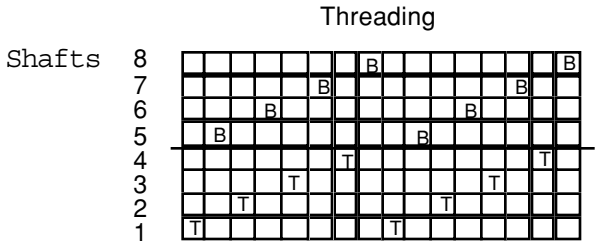
interchanged. At the same time the weft combinations alternate in the horizontal direction because the threading blocks alternate between blocks A and B. (In the weaving the 4 x 4 grids join one another. They have been separated for clarity.)



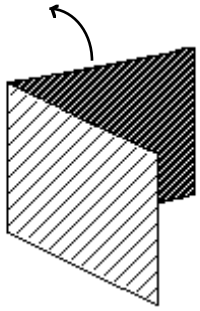
The squares along the diagonal from upper left to lower right are solid colors and the other squares are 50-50 mixes of two colors. Reflection around the diagonal give the same color mixes with the warp and weft colors exchanged. The color possibilities are endless!

3. Twill Weave Structure in Double Weave

It takes four shafts to weave twills in a one layer weave. Therefore an 8 shaft loom is required if you want to weave two cloth layers with twill structure. This became important when I was weaving ruanas on a small loom. Since I wanted to take advantage of the fact that twills drape better than plain weave, I needed to have an 8 shaft loom in order to weave a double width fabric. There are several ways to thread the loom but this one, a divided draft, is easiest to see. The warp threads for the top layer are threaded on shafts 1234 and the warp threads for the bottom layer are threaded on shafts 5678.



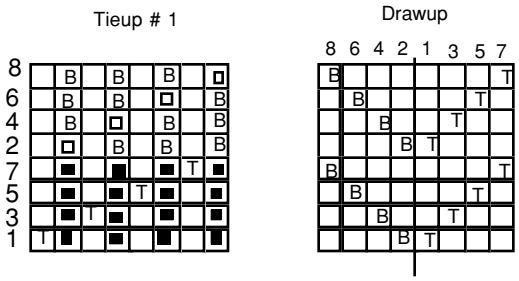
The challenge is to make the twill patterns match at the woven selvage. I wanted the tieup to weave the top layer in 1/3 twill structure and the bottom layer 3/1 twill weave structure. Imagine that you can see through both the top and the bottom layers from above while weaving. It would look like this.



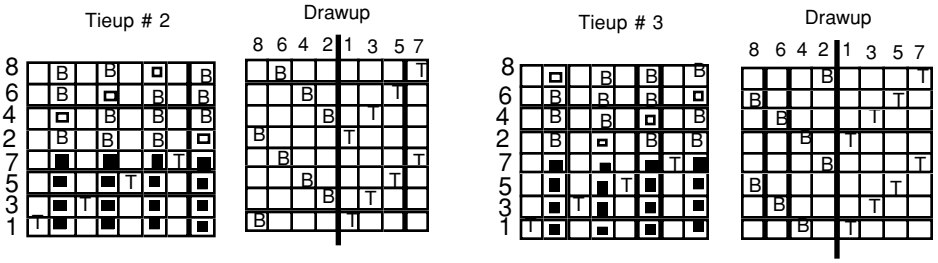
Therefore when the doublewidth fabric is opened out, the bottom layer swings up to the left showing its back side in 1/3 twill. Here is the tieup. A drawup of the fabric, rather than the usual drawdown, is shown in the next diagram. Two things should be pointed out.

While you are weaving both twill lines slant up to the right. When the double width cloth is opened up, the twill lines slant in opposite directions. The black circles indicate the top warp being raised out of the way and the small open circles indicate the warp threads on the bottom layer that are not raised during the weaving.

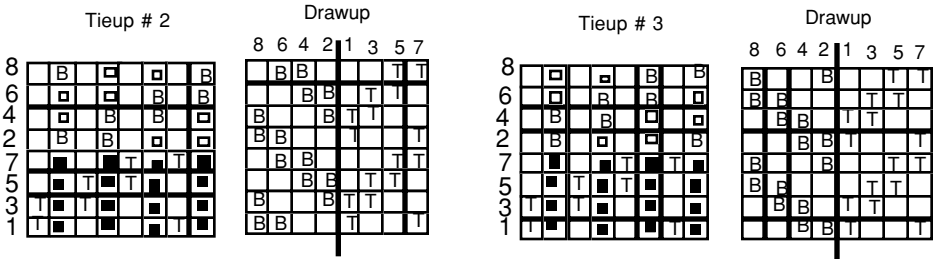
When the double width cloth is opened out, you are looking at the top side of the fabric woven on shafts 1-4 but at the underside of the fabric woven on shafts 5-8. This means that those warp threads represented by the open squares appear as though they had been raised while the warp threads represented by the B's act as though they had not been raised. A little confusing so look at the next diagram and reread what I have just written. The dark line between the numbers 1 and 2 in the drawup indicates the fold line at the woven selvage.



Not quite done. There are two threads that weave together at the woven selvage. There are two ways to correct this. Slide the tieups for the bottom layer to the left (tieup # 2) or to the right (tieup # 3). Then the diagrams look like these. Choose one or the other tieup.

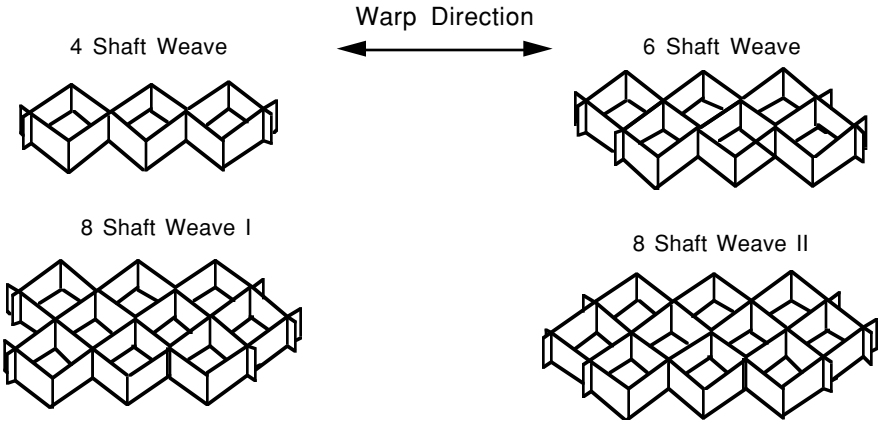


It will be easier now to develop the tieup for weaving 2/2 twill in each layer of the double width cloth. The threading is the same. Here are the two tieups and drawups.



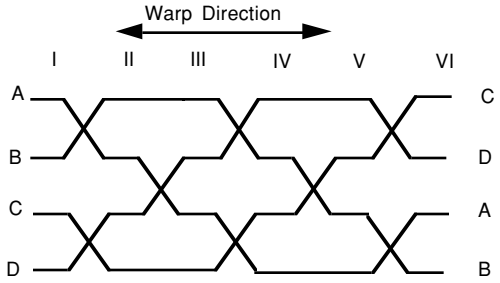
4. Multilayer Weaving

The last basic design for 8 shaft double weave takes us into a different style of weaving, weaving four separate cloth layers at the same time. The layers can be interchanged in a variety of ways to create three dimensional weavings. Here are some perspective drawings for 4, 6 and 8 shaft multilayer weaving.



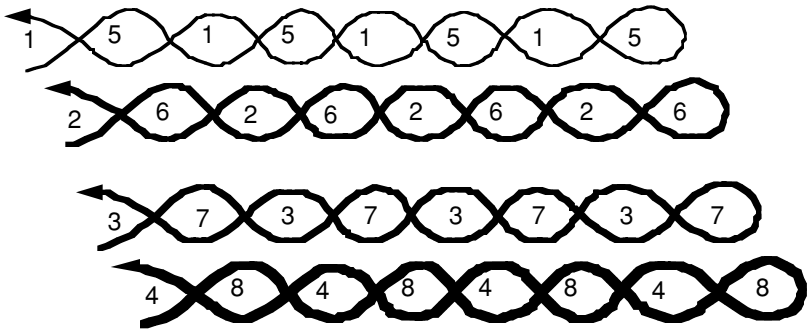
The next diagram looks at the weaving from the side followed by a "book keeping" system to keep track of the position of each layer. The Roman numerals indicate sections of the weaving. There is no need to use a second warp beam because the tension for all of the layers stays the same.

Analysis of Four Layer Weave

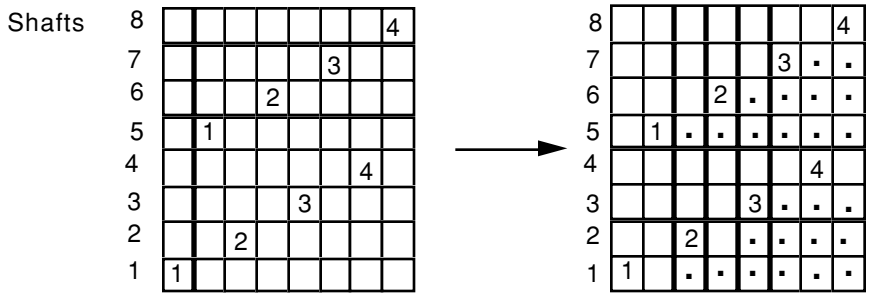


I	II	III	IV	V	VI
A	B	B	D	D	C
B	A	D	B	C	D
C	D	A	C	B	A
D	C	C	A	A	B

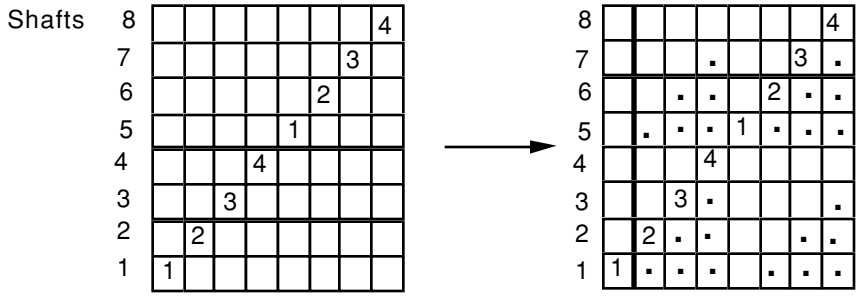
Four color threading on 8 shafts would be ABCDABCD in straight draw and the weave structures lead to the tieups. Notice that the four layers in this example would have the warp color pairs AA, BB, CC, and DD. Also notice that color A is on shafts 1 and 5, color B on shafts 2 and 6 and so on, spacing threads as evenly as possible.



Tieup 1



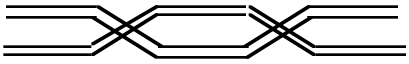
Tieup 2

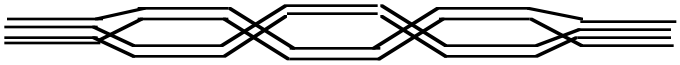


Four shuttles are required for weaving four separate cloth layers. The sett must be four times what it would be for weaving one layer of weaving. There is a bit of a logistical problem balancing four shuttles as you weave so that the various wefts do not get tangled. My solution is to lay the four shuttles in order on my right on the loom bench. I use tieup 1 to weave two shots over and back with shuttle 1 and lay it down on the bench, pick up shuttle 2 and weave two more shots over and back and lay that shuttle down in its proper position, and so on through the four shuttles. Tieup 2 shows how to weave one pick with shuttle 1, the next pick with shuttle 2 and so on. This now means the four shuttles are on the left where I have no room on the bench where the shuttles can be placed (I use an AVL compu-dobby with a built in bench). That is why I came up with tieup 1. Technically that means the layers advance two weft threads at a time rather than one thread at a time which is preferred. However the difference in appearance is not appreciable.

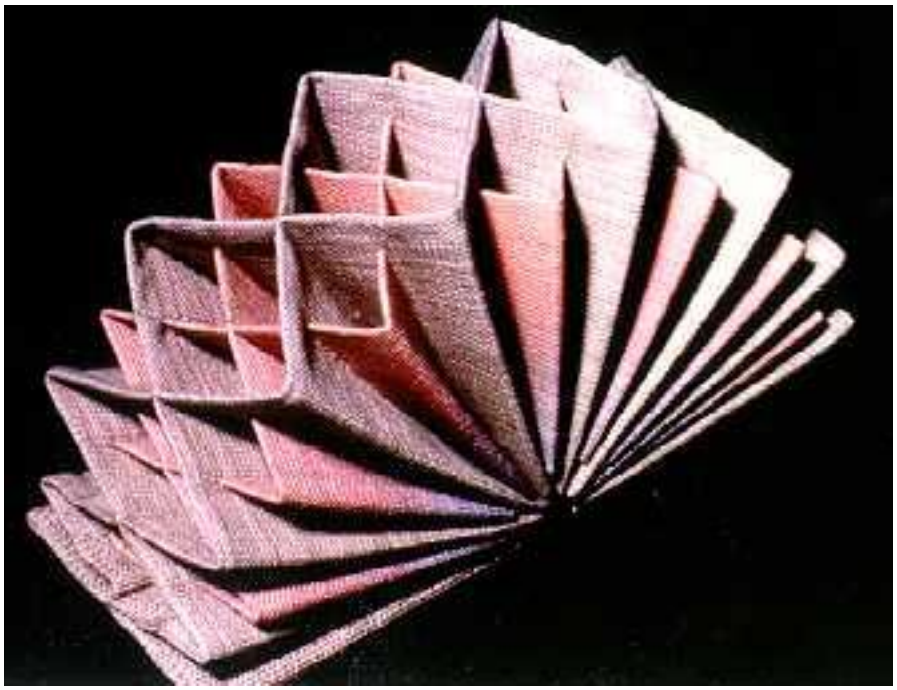
Another way to weave four layers is in the form of two double width layers. ThisPP permits me to insert a stiffener between the two layers and then hand sew the open selvage. I have used buckrum, aluminum metal, mylar film and wood as the stiffener to support three dimensional weavings. I also used the trick of weaving one double width layer inside another double width layer, bringing the hidden layer out into the open when I wanted it to be seen. Here are two diagrams for 8 shaft weaving which show what I have just

described.



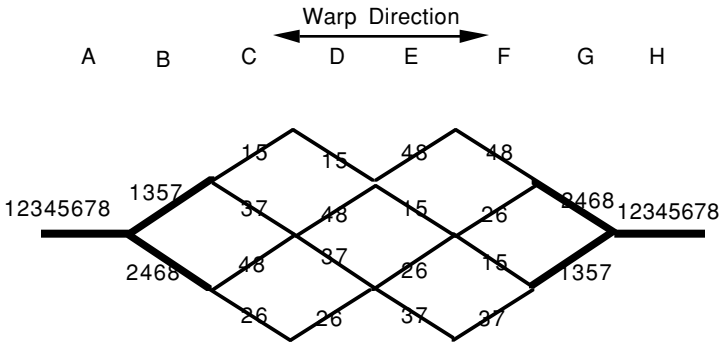


As a final example of multlayer weaves, an analysis of one of Kay Sekimachi's beautiful weavings in monofilament nylon is shown on the next page. Schematically, all warp threads are woven in one layer, then divided into two layers and again into four layers. The four layers are interchanged several times before rejoining to weave two layers and finally back into a single layer. The threading is straight draw on 8 shafts and the numbers indicate the shafts that are combined in weaving the layers. The threads are spaced evenly wherever possible. The book keeping system helps to keep things in order.



Fan -- 1987

Analysis of Kay Sekimachi's 8 Shaft Monofilament Hanging



Plain Weave in All Layers

1357 vs 2468	15 vs 37	1 vs 5 3 vs 7	1 vs 5 4 vs 8	4 vs 8 1 vs 5	4 vs 8 2 vs 6	26 vs 48	1357 vs 2468
	26 vs 48	4 vs 8 2 vs 6	3 vs 7 2 vs 6	2 vs 6 3 vs 7	1 vs 5 3 vs 7	15 vs 37	

Tieups for Each Section