Chapter 12

Compound Tabby, Compound Twill And Other Warp-Backed Structures

Han weavers in China used warp-faced compound tabby in their cloth as early as the 2nd century B.C.E. Known as *jin*, the cloth is essentially a warp-faced structure with a series of two or more warp colors. It is woven with one weft, which is invisible if the sett is warp-faced enough. It allows imagery of different warp colors in the sequence, the cloth is reversible, with the image's color positions being interchanged. However, if the series has three or more warp colors (systems), then the face of the cloth will show motifs composed of one warp on top, with the remaining colors working on the back. The warp floats will be contained, so it can be used on both sides, but the back side will be more muted, without distinctions of image.

12-1 Detail from Chinese jin

Compound Tabby

The structure is a four-pick sequence. A rib structure, or "tabby," is the base of the structure. One pick lifts all of the odd repeats of warp colors, and sinks the even groups of warps, and another pick reverses this, sinking the odd warp color group and lifting the even warp color group. These picks are interspersed with picks that lift all of one warp system (i.e., all of one color). The warp color that is lifted will have a float that spans three wefts. With a drawloom, Han weavers used as many as 6 warp systems (i.e., colors in their design) in a fabric, but this was not a common practice.

We created samples of Warp-Faced Compound Tabby on a TC-1 loom using 5/2 cotton in the warp, sett at 30 epi. There was a sequence of four colors, and we choose to mimic the CMYK color system, thus cyan, magenta, yellow, and black were our warp colors.

Design for the Face of the Cloth

When designing compound warp tabby for the jacquard, you can design for the face of the cloth, and then expand the design before putting in the weaves. We had 880 warp ends, which meant with four warp systems, our design had 220 pixels in width (880 ÷ 4 = 220). We used a 3/2 cotton for the weft at 20 picks per inch (ppi derived by weaving a sample of this structure). We could have divided the true ppi by four (the number of wefts in the structural repeat), to have 5 picks as the face ppi, but instead, we divided it by 2, giving us 10 ppi for the face. The reason we could do this was that the structural binding allows for change after two picks, without creating long floats. 10 ppi gave us more detail in the visual design than 5 ppi would have given us.

Our first design was to be 29 inches wide by 10 inches high in the final cloth. We know that the 29 inches became 220 pixels in width for the face, and had to figure out the height, or number of pixels to represent the face weft. In this case, 10 inches multiplied by 10 picks per inch equaled 100 picks, thus 100 pixels in height.

Using Face Pixel Aspect Ratio

To design in the correct Pixel Aspect Ratio for the face of the cloth, we divided the number of face picks by the number of face ends (ppi/epi). In our example, this meant 100 divided by 220, which gave us a Pixel Aspect Ratio of .454 for working on the face design.

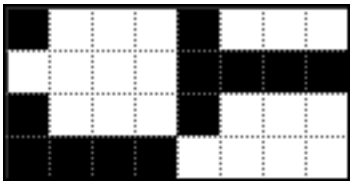
Later, when we expanded the design, before putting in the weaves, the Pixel Aspect Ratio changed. In the final cloth, we had 880 ends (880 pixels in width) and 200 picks (200 pixels in height). The custom Pixel Aspect Ratio for the true cloth was 200 divided by 880, which equaled .227.

Weave Structures/Pattern Presets

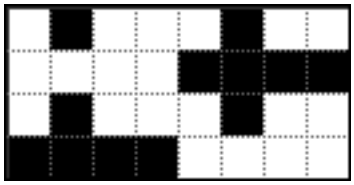
We made fourteen compound tabby warp structures, Pattern Presets numbers CT001–CT014. They use only one weft, so if you want a design to lean towards darker colors, use a dark weft, and if you want the design to appear brighter, use a light weft. If your sett is totally warp-faced, the weft color will not matter, but in our example the sett allowed the weft to show, so the weft color influenced the appearance of the structures.

A description of what is happening in the Pattern Presets is given in the chart on the next page. It is followed by images of the Pattern Presets (Figures 12-2a through 12-2n).

Compound Tabby Structures		
Preset Name	**Warp System(s) on Top**	**Warp System Colors**
CT001	1	cyan
CT002	2	magenta
CT003	3	yellow
CT004	4	black
CT005	1 & 2	cyan & magenta
CT006	1 & 3	cyan & yellow
CT007	1 & 4	cyan & black
CT008	2 & 3	magenta & yellow
CT009	2 & 4	magenta & black
CT010	3 & 4	yellow & black
CT011	1, 2 & 3	cyan, magenta & yellow
CT012	1, 2 & 4	cyan, magenta & black
CT013	1, 3 & 4	cyan, yellow & black
CT014	2, 3 & 4	magenta, yellow & black

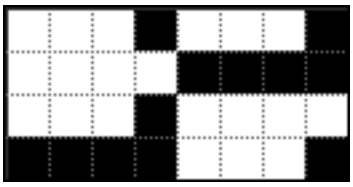


12-2a CT001

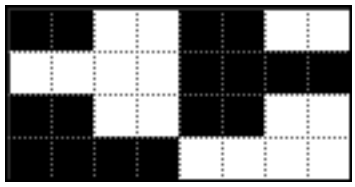


12-2b CT002

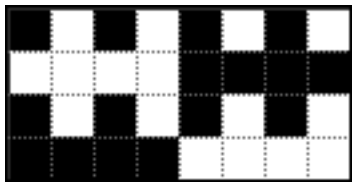
12-2c CT003



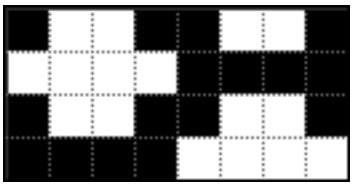
12-2d CT004



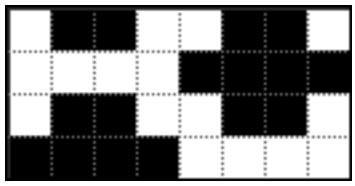
12-2e CT005



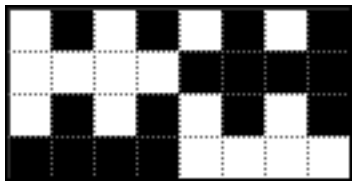
12-2f CT006



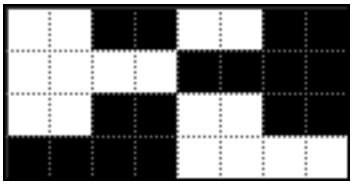
12-2g CT007



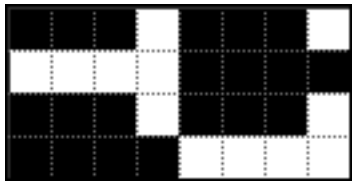
12-2h CT008



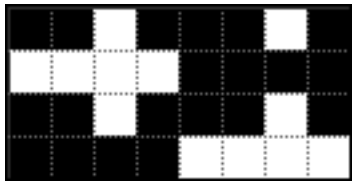
12-2i CT009



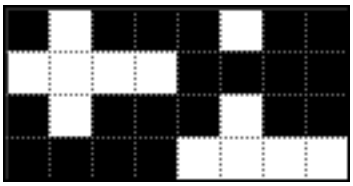
12-2j CT010



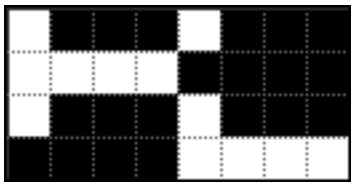
12-2k CT011



12-2l CT012



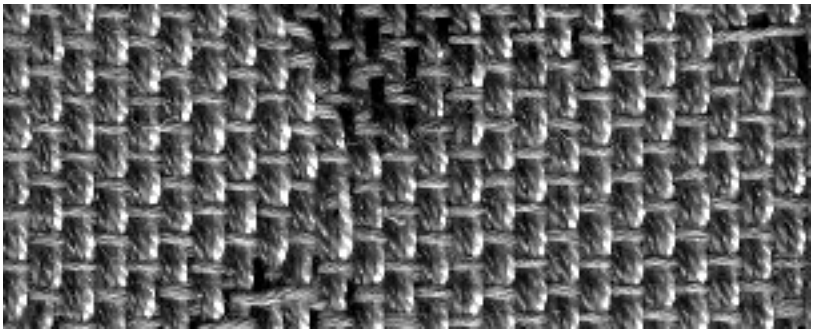
12-2m CT013



12-2n CT014

Note that we have extended the possibility of color by including structures (CT005–CT014) that have two or three warps showing on the face. Because of the underlining rib (tabby) structure, there should not be a problem with long warp floats in the places in the cloth where one structure becomes another. However, you may want to check for and correct long floats in your loom-driver software, if you have this capability.

Here is an example of a detail from a fabric woven using Warp-Faced Compound Tabby.

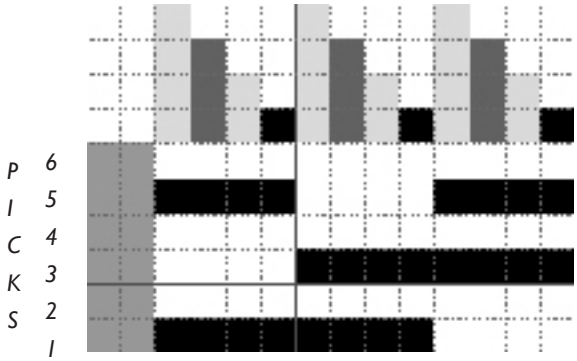


12-3 Compound Tabby

Warp-Faced Compound Twills

Another structure that can be woven on the same warp setup of a sequence of four color warps is called Warp-Faced Compound Twill. Chinese weavers during the Tang Dynasty (618-907 C.E.) made beautiful fabrics using this structure. Some examples of this weave are found in Nara, Japan in the collection of the Shosoin.

The root weave for the warp-faced compound twill is a 2/1 twill. In other words, odd picks will raise groups of threads to create a rib that mimics a 2/1 twill. Twelve ends are needed for a repeat. For the root structure, every odd pick, the following occurs: 8 ends rise and 4 sink, then 4 ends sink and 8 ends rise, and, to complete the root structure, 4 ends rise, 4 ends sink, and 4 ends rise. We are discussing groups of four ends because the rotation of color on our loom is four systems: cyan, magenta, yellow, and black. If your warp had a series of six warp colors, repeated over and over, you would be raising groups of six threads at a time in the root weave; if it had a series of two warp colors, you would be raising two ends at a time in the root weave.



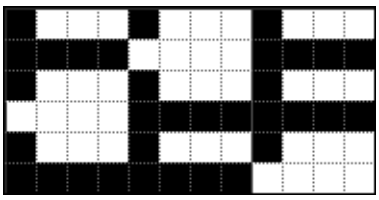
12-4

In between the root weave, on the even picks (pattern picks), you have areas with single warp colors lifting. In our example we have also created weave structures that raise two or three warp colors to the surface on pattern picks. The structures, like the compound tabby structures, use single wefts—which won't show if the sett of the cloth is warp-faced enough. However, if your sett is not that close, as in our example, the weft will show. In this case, the color of the samples will be modified by the color of the weft you use.

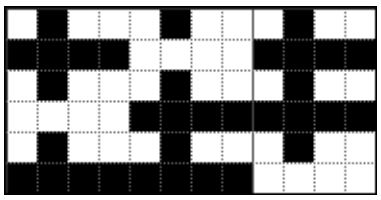
We created fourteen structures, presets CTw001 to CTw014. The following chart explains what warp system(s) will show in each Pattern Preset.

Compound Twill Structures		
Preset Name	**Warp System(s) on Top**	**Warp System Colors**
CTw001	1	cyan
CTw002	2	magenta
CTw003	3	yellow
CTw004	4	black
CTw005	1 & 2	cyan & magenta
CTw006	1 & 3	cyan & yellow
CTw007	1 & 4	cyan & black
CTw008	2 & 3	magenta & yellow
CTw009	2 & 4	magenta & black
CTw010	3 & 4	yellow & black
CTw011	1, 2 & 3	cyan, magenta & yellow
CTw012	1, 2 & 4	cyan, magenta & black
CTw013	1, 3 & 4	cyan, yellow & black
CTw014	2, 3 & 4	magenta, yellow & black

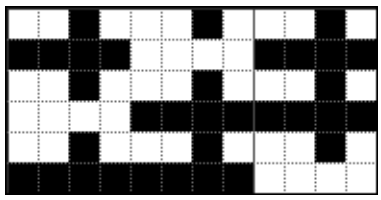
The structures are 12 ends wide and 6 picks high. They look like this:



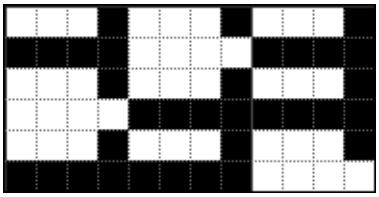
12-5a CTw001



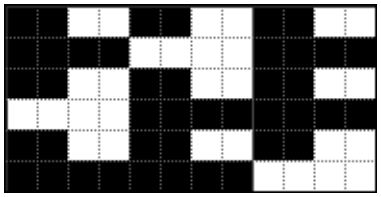
12-5b CTw002



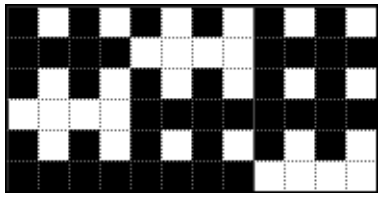
12-5c CTw003



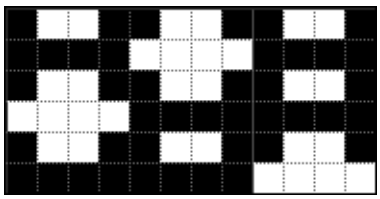
12-5d CTw004



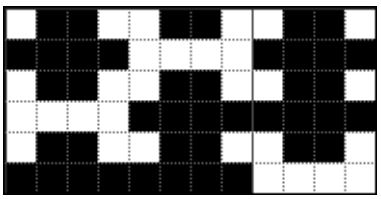
12-5e CTw005



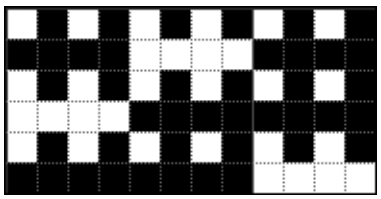
12-5f CTw006



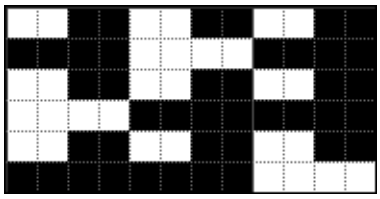
12-5g CTw007



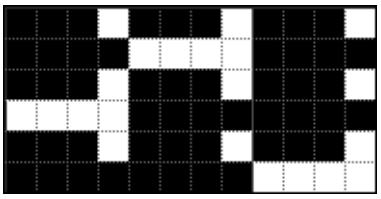
12-5h CTw008



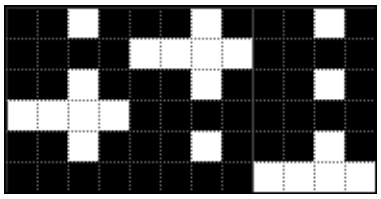
12-5i CTw009



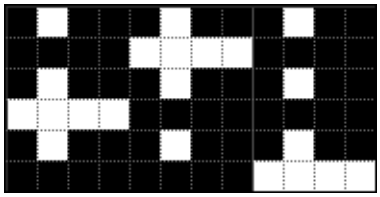
12-5j CTw010



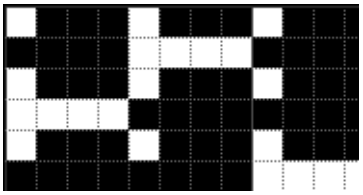
12-5k CTw011



12-5l CTw012

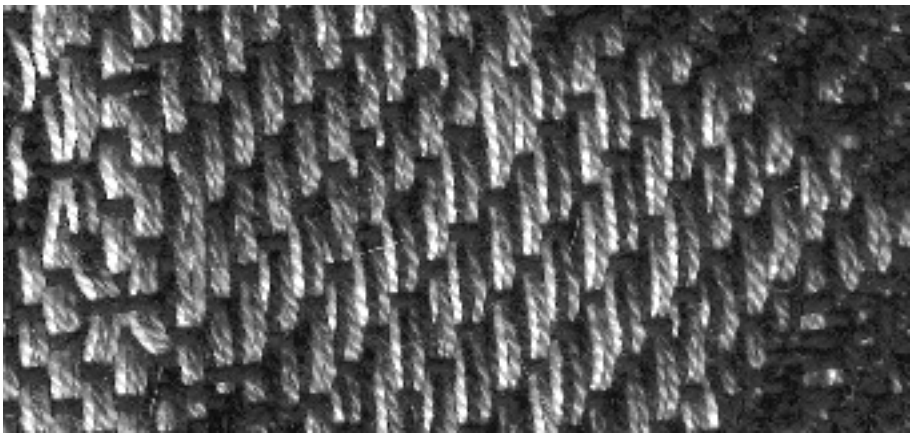


12-5m CTw013



12-5n CTw014

Here is an image of a study in Warp-Faced Compound Twill.



12-6 Compound Twill

Combining Compound Tabby and Compound Twill

In some of our woven examples, we combined both the compound tabby and compound twill structures. There are times where one structure changes into another, and the floats are longer at the boundary. If this is a problem for you, you can run a float check in your loom control program before weaving and modify the long floats. So far we have not found a way to do this in Photoshop.

Other Forms of Warp-Backed Structures

Modifying the Colors in Warp Systems

Warp-backed fabric is faster to weave than weft-backed cloth because you only have one weft to throw. However, winding the warp and setting up the loom is probably going to take more time. You have the possibility of changing the color of a warp system as it moves into the cloth, which makes the cloth appear to have more warp systems than it really has. This mode of designing is called "planting" the warp. It is the same as if you turned the weft shuttle sequence described in Chapter 11, Figure 11-16, 90 degrees and used it for your warp plan.

Here is an example of a warp threading plan for three warp systems, where the first warp (at the top of the image) is a solid color, the second warp is end and end, and the third warp shades from dark to light and back to light. The loom would be threaded one end from the first warp, then one end from the second warp, then one end from the third warp, until every end was used. In the middle you see the first 100 ends of each warp system. The bottom line of the image shows the combined threading plan for the first 300 ends represented above (the total threading would show 900 threads).

each horizontal line represents the warp color plan for three warp systems

the horizontal lines above represent the first 100 ends of each warp system shown at the top

the line above shows the first 300 ends of the combined threading of the three warp systems

12-7

Type of Yarn Affects the Cloth

In a warp-backed structure you see only the warp threads, while a weft-backed structure shows the weft threads. As you know, the type of yarn that works well for warp has to be strong, especially when the sett is close and ends will rub against each other as sheds are created. Weft-backed fabric can use lustrous, lofty yarns, because the weft is not under tension. These yarns probably will not work well for the warp in a warp-backed structure. This element of tension is going to make a warp-backed fabric less pliable, and perhaps less luscious, than a weft-backed cloth.

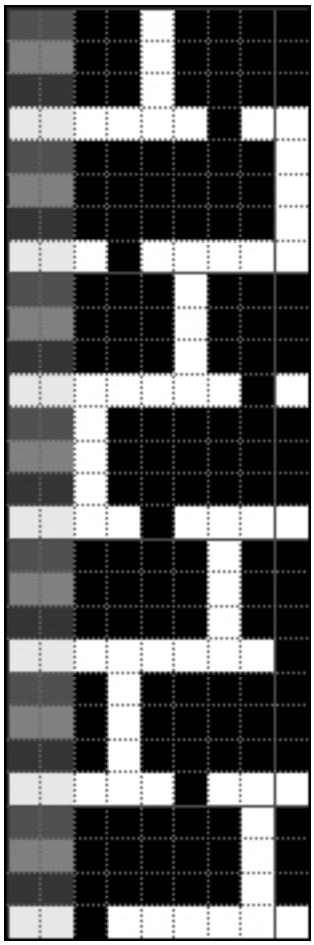
Modifying Weft-backed Structures Into Warp-Backed Structures

You can create structures for a warp-backed cloth by turning the weft-backed structures of our Pattern Presets by 90 degrees. We will show you how to do this by modifying the four weft-system weaves into four warp-system weaves. If you have set up a loom with four warp systems, as we did above, you can use these structures with that warp set-up.

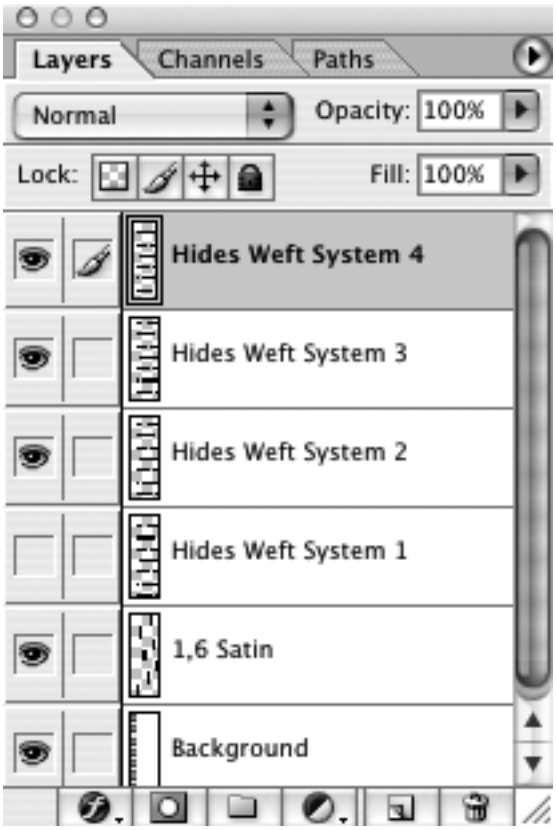
Example of 4 Wefts into 4 Warps

When we made our four weft system structures, we saved a template (***11-11.psd***). We also duplicated and saved it in the Chapter 12 folder as ***12-8.psd***. It is shown in Figure 12-8.

Figure 12-9 shows what the Layers palette looks like for the weft-backed template, when it hides weft systems 2, 3, and 4, as in Figure 12-8.

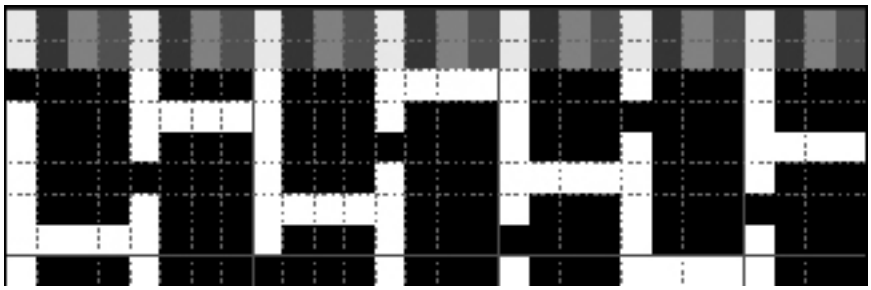


12-8



12-9

Let's turn the structure clockwise. Go to **Image>Rotate Canvas>90 degrees CW** and turn the template so the marks for the weft systems are now on the top, indicating the warp systems. Your template should now look like Figure 12-10, shown on the next page.



12-10

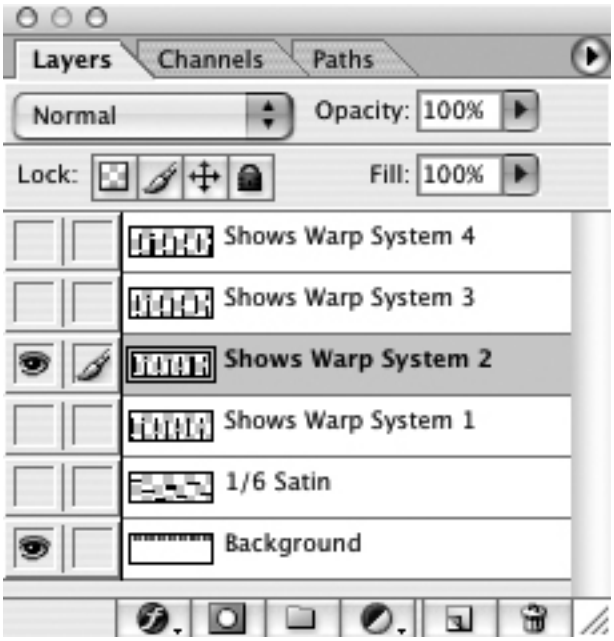
Rename the Layers

The layers are correct, but their names are now misleading. Let's rename them, as we explain them. Turn the visibility of all layers off except for the Background Layer. As you can see, it shows the warp systems in four colors at the top of the file. This is what we want, and the name is correct.

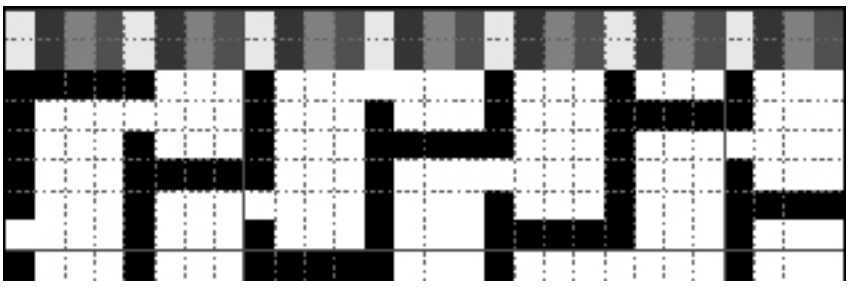
Leave the Background layer visible and turn on the visibility of the *1/6 Satin* layer. The *1/6 Satin* layer stitches all three warp systems at the back of the cloth. Without this layer, the threads on the back of the cloth would just float freely. We can leave this layer alone, and leave the name the same.

Turn the visibility of this layer off and turn on the visibility of the layer named *Hides Weft System 1*. It raises the first warp system as a 6/1 satin. Rename this layer, *Shows Warp System 1*.

Turn off the visibility of that layer, and turn on the visibility of the *Hides Weft System 2* layer. You see the 6/1 satin on the second warp system. Rename this layer, *Shows Warp System 2*. Change the names of the other layers, looking at them first, to *Shows Warp System 3* and *Shows Warp System 4*. Save the template, it is complete, and looks like Figure 12-11 when only the Background layer, the *1/6 Satin* layer, and the *Shows Warp System 1* layer are visible. The Layers palette for Figure 12-11 is shown as Figure 12-12.



12-12



12-11

The structure appears to have few risers, and the image looks like it will show more weft than warp. However, the sett of the cloth should make the lifts of one warp system cover the weft, or have it show only slightly.

Save the Pattern Presets

We can now make up Pattern Presets from the template and save them. Make a Fixed Size Rectangular Marquee of 28 pixels wide by 7 pixels high. Place it over the structural part of the image. Make sure you have only black and white marks selected, and none of the warp system color indicators. We will put a number before our Preset name to indicate the number of warp systems, and then use "wb" to indicate warp-backed (versus the WB of weft-backed). We saved the new Pattern Presets in the master Weave Presets folder under Warp-backed. You can also find them in the Chapter 12 folder of the CD. The 16 Presets made from template ***12-11.psd*** look like this:

12-13a 4wb001

12-13b 4wb002

12-13c 4wb003

12-13d 4wb004

12-13e 4wb005

12-13f 4wb006

12-13g 4wb007

12-13h 4wb008

12-13i 4wb009

12-13j 4wb010

12-13k 4wb011

12-13l 4wb012

12-13m 4wb013

12-13n 4wb014

12-13o 4wb015

12-13p 4wb016

Here is a chart indicating what is happening in each of the Presets saved in the Warp-backed folder on the CD:

Preset Name	Number of Warp Systems	Warp(s) On Top	Face Structure
4wb001	4	1	6/1 satin
4wb002	4	2	6/1 satin
4wb003	4	3	6/1 satin
4wb004	4	4	6/1 satin
4wb005	4	1 & 2	6/1 satin
4wb006	4	2 & 3	6/1 satin
4wb007	4	3 & 4	6/1 satin
4wb008	4	1 & 4	6/1 satin
4wb009	4	1 & 3	6/1 satin
4wb010	4	2 & 4	6/1 satin
4wb011	4	1,2 & 3	6/1 satin
4wb012	4	2, 3 & 4	6/1 satin
4wb013	4	1, 3 & 4	6/1 satin
4wb014	4	1, 2 & 4	6/1 satin
4wb015	4	1, 2, 3 & 4	6/1 satin
4wb016	4	none	1/6 satin

Alternative Method of Making Warp-Backed Structures

You might have realized you could make these Presets in another way. You could Fill files 7 pixels wide x 28 pixels high with the Presets for the 4-weft weft-backed structures, turn them 90 degrees in a clockwise direction, and save them as warp-backed structures. However, if you do this, look carefully at what is happening, and name them appropriately. You might just use this method, make a weave blanket file and weave it. Then you have a visual reference for each of the structures that you saved as Pattern Presets. (If you are a dobby weaver familiar with the process of turning weaves, you most likely use the convention of turning and inverting the structures. Since our examples run through all the possible options, from single warps on top to multiple warps, eventually all the variations are covered. Therefore, we do not have to invert the structures.)

Warp-Backed Cloth and Warp Tapestry

In the following chapter, we discuss another type of compound cloth called warp tapestry. It involves multiple warp systems and multiple weft systems. You can weave warp-backed fabrics on a loom that is set up for warp tapestry cloth, and vice versa. Try them both and see which one you prefer.

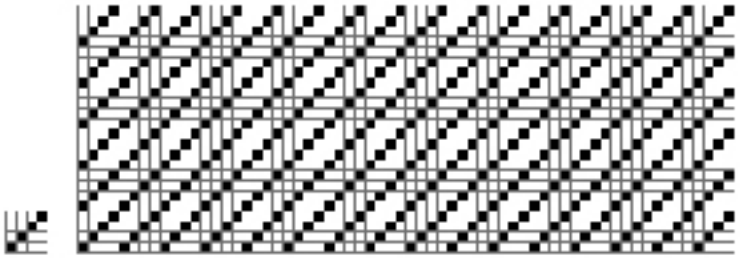
Warp-backed Cloth on a Dobby Loom

You can weave warp-backed fabric on a dobby loom. Compound warp tabby needs four shafts per block for a cloth with 2 warp systems. For every additional warp system, you need an extra two shafts per block. The structures CT001 to CT014 need 8 shafts, threaded on a straight draw, with the warp color following sequentially—system 1, system 2, system 3, and system 4. You can expand a block in width by repeating the threading (i.e., ends threaded on shafts 1–4 repeated as many time as you want, then ends threaded on shafts 5–8 repeated as often as you want—for a 2 warp system compound tabby).

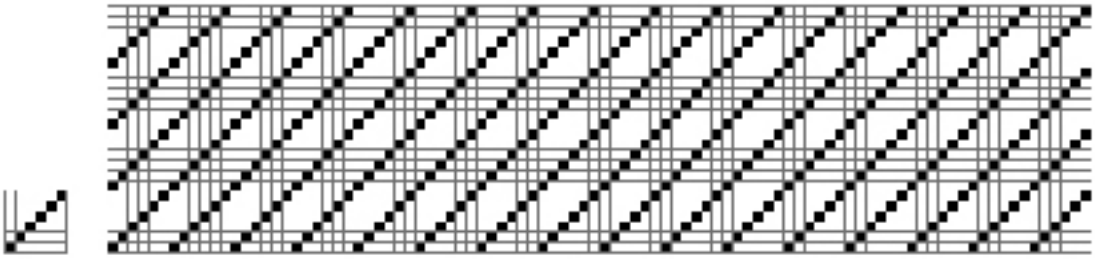
Compound warp twill requires a minimum of 6 shafts per block for a 2 warp system cloth. Add three shafts per block for each new warp system. If your loom has 24 shafts, you can do a four block compound warp twill using two warp systems, or a 2 block design if you want three warp systems (9 shafts per block). A 32-shaft loom will let you do three blocks for a three warp system (using 27 shafts).

Network Drafting

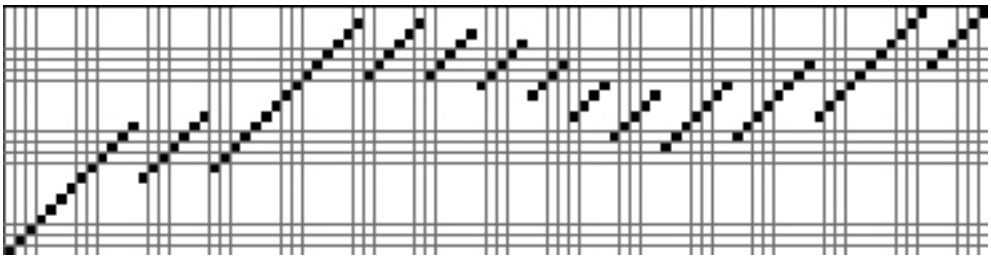
You can also weave these structures on a dobby loom with curved motifs, via network drafting. The threading network for compound warp tabby with two warp systems is based on a 4-end initial (Figure 12-14). The network for compound warp twill with two warp systems is based on a 6-end initial (Figure 12-15). Both these illustrations are found on the next page.



12-14 Network for a 24-shaft loom, based on a 4-end initial

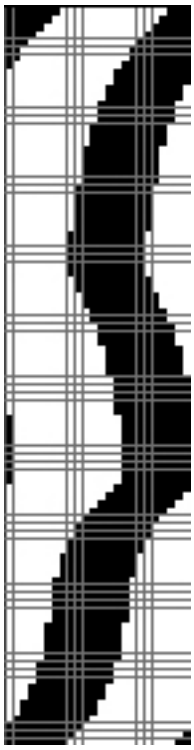


12-15 Network for a 24-shaft loom based on a 6-end initial



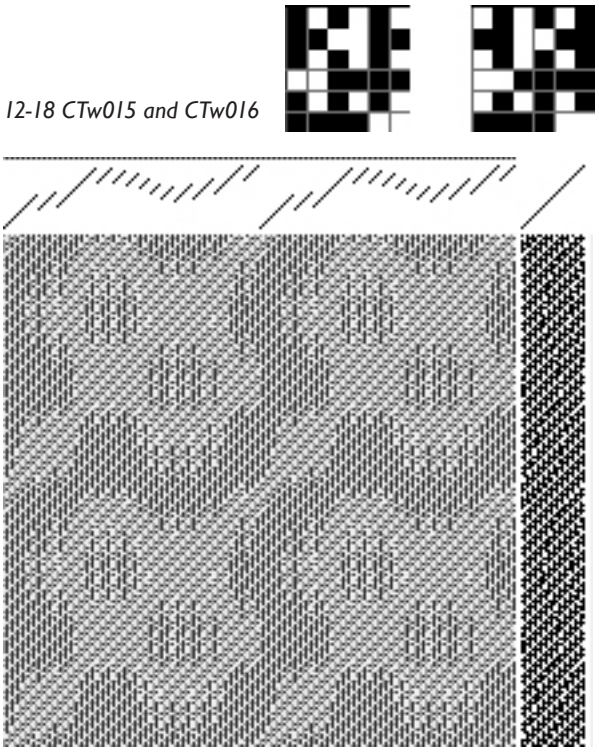
12-16 Threading plotted on the network in Figure 12-15 (network indicates the legal position for each warp thread)

The threading in Figure 12-16 is a networked threading for a 24-shaft loom, plotted on the network from Figure 12-15. The threading has been combined with a liftplan designed with two color areas, black and white (Figure 12-17 on the next page). Each color has been assigned to its own layer, and the layers have been given the Pattern Presets CTw015 and CTw016 (Figure 12-18) as Layer Styles (Figure 12-19). The completed draft with two repeats of threading and lift plan is shown at Figure 12-20. A scan of the woven fabric is at Figure 12-21. You can find these figures on the following page.



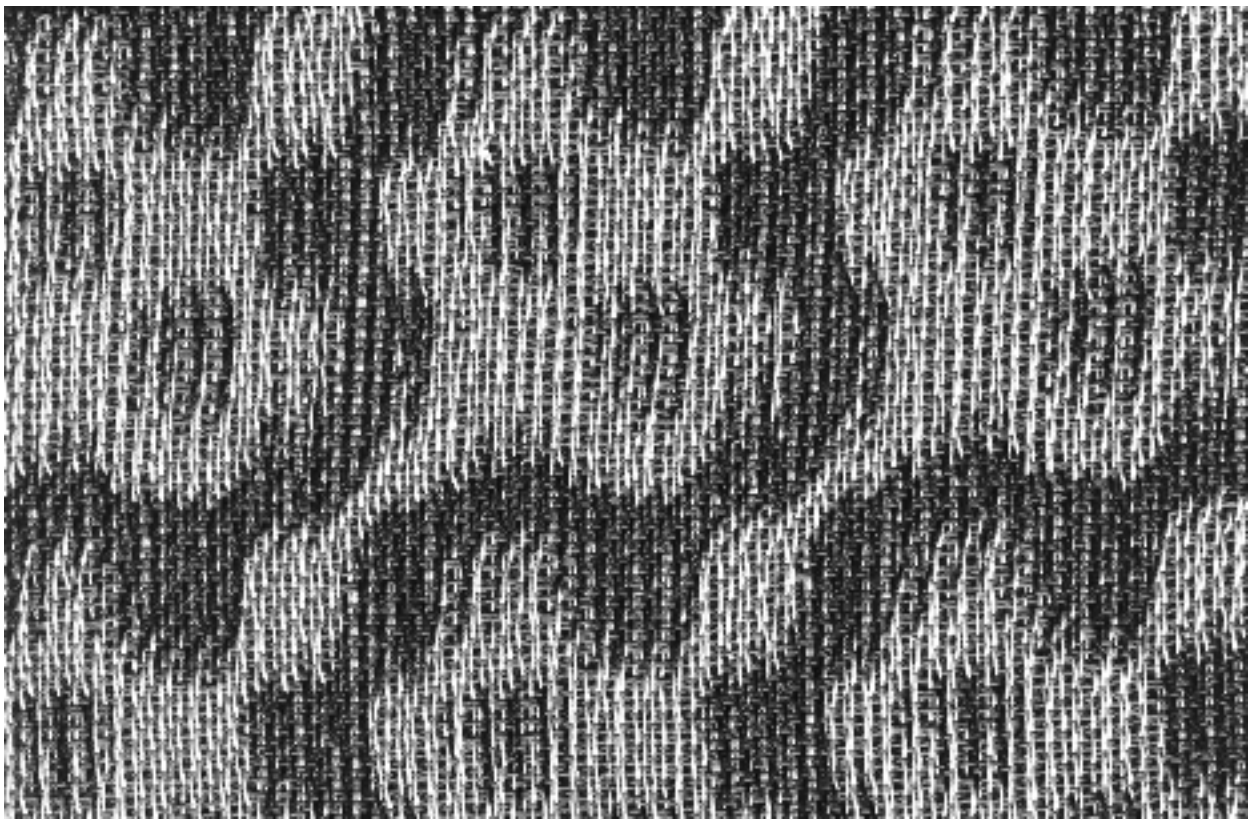
12-17

12-18 CTw015 and CTw016



12-20

12-19



12-21