

## Combination of Weaves for Fabrics Constructed with Two Systems of Warp and One System of Filling.

Weaves for this division of fabrics are obtained by the combination of two (or more) foundation or derivative weaves. They are designed for three purposes.

1st. For using two systems of warp and one system of filling in producing double-faced fabrics, such as ribbons, etc., etc.

2d. For using an extra warp as backing for heavy-weight worsted and woolen fabrics.

3d. For figuring with an extra warp upon the face of a fabric otherwise interlaced with its own filling and warp.

### Two Systems of Warp and One System of Filling for Producing Double-faced Fabrics.

These weaves are largely used in the manufacture of ribbons and similar fabrics used for trimmings, in which one side of the fabric has to be of a totally different color from the other. Such fabrics (mostly of silk) require a great many ends in the warp, as only one-half or two-thirds will form one side of the fabric; the remaining half or one-third forming the other. In addition to the difference in color for each side we can also change the quality of the stock, or the nature of the stock itself; hence we may use a finer quality of stock for one side (the face), and a lower quality of stock for the other (the back); and again we may use silk for one side (the face) and cotton for the other (the back).

In selecting weaves for these fabrics, we generally use the combination of a regular satin weave, warp for face, with its corresponding satin-weave, filling for face. Technically we classify the warp which shows on the upper side of the fabric as the "face-warp," and its mate, or the warp forming the lower side of the fabric, as the "back-warp." As mentioned at the beginning, only one system of filling is used for interlacing both systems of warps.

In combining both warps into one fabric in this way, it is necessary to observe the following Rule: *The raising of the backing warp over the filling must always be done at a place in which two face-threads raise next to it (one on each side of the backing warp as raised).* Diagram Fig. 581 is designed to illustrate this method. Three warp-threads and four picks are represented.

Warp-threads 1 and 3 illustrate the face warp; warp-thread 2 represents the back-warp.

In examining the latter warp-thread, we find its point of interlacing with the filling situated in pick 2.

Face warp-threads 1 and 3 are also raised on pick 2, as required by the rule (given before) for combining both systems of warps. A careful examination of the diagram will show a second point possible for perfectly intersecting the back warp-thread (number 2) into the filling at pick number 3. Picks 1 or 4, if used, would produce imperfectly stitched places, as in the first-mentioned spot face warp-thread 3 is down, and in the latter-mentioned spot face warp-thread 1 is down. To give an illustration of these weaves Figs. 582, 583 and 584 have been designed.

1st warp-thread.	2d warp-thread.	3d warp-thread.	
		■	4th pick.
■		■	3d pick.
■	●	■	2d pick.
■			1st pick.

FIG. 581.

Weave Fig. 582, repeat: 8 warp-threads and 4 picks, has for its foundation the combination of the 4-harness broken-twill, warp up for *face* (■), and the 4-harness broken-twill, filling up for *back* (●). The arrangement of the warp for face and back in this weave and weaves Figs. 583 and 584, is one end face to alternate with one end back.

Weave Fig. 583, repeat: 10 warp-threads and 5 picks, has for its foundation the combination of the 5-harness satin, warp up, for *face* (■), and the 5-harness satin, filling up, for *back* (□).

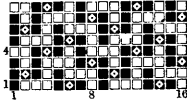


FIG. 582.

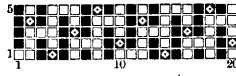


FIG. 583.

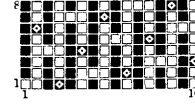


FIG. 584.

Weave Fig. 584, repeat: 16 warp-threads and 8 picks, has for its foundation the combination of the 8-harness satin, warp up for *face* (■), and the 8-harness satin, filling up for *back* (□).

In the same manner as these three examples of weaves are arranged for explaining the present system other combinations of satins or twills can be designed.

#### Using an Extra Warp for Backing for Heavy-weight Worsted and Woolen Fabrics.

These weaves are used to obtain a thickness of the fabric by using a lower stock for the back, as, for example, a wool back for worsted goods.

They may be designed with one of the following arrangements for the warp:

1 end face.	2 ends face.	1 end face.
1 end back.	1 end back.	1 end back.
—	—	2 ends face,
2 ends repeat, or	3 ends repeat, or	1 end back.
		—
		5 ends repeat,

or any other similar arrangement.

In stitching the back warp to the face fabric it is necessary to observe the following points:

1st. The backing-warp has to be raised over the filling, in every instance, between two face-ends, so that the face-threads will afterwards cover the backing ends. Should we have to deal with any face-weave in which only one end-warp raises at the time (satins filling up) we must raise the backing-warp near this one end-face, either to the right or left hand.

2d. We must select for the backing a weave as regular as possible, such as satin-weaves, broken-twills, etc., so that every warp-end gets the same amount of binding and therefore of tension.

3d. If there are more intersections of the face-warp with the filling (in a certain number of picks) than intersections with the back-warp (in the same number of picks as before) we must work each warp from a separate beam. The face-warp, if intersecting oftener than the back-warp (on the same number of picks) requires more material ("takes up more") than the less intersecting back-warp.

Two warp-beams must also be used if the material for the face and back-warp is of a different nature, such as wool and cotton or worsted and wool spun yarn, etc. The number of intersections of face and back-warp in such a case can be equal.

4th. If using the arrangement "one end face-warp to alternate with one end back-warp," never use a heavier size of warp-yarn for the back-warp than you use for the face-yarn. Such a selection will prevent the back-warp from showing upon the face. If using "two ends face to alternate with one end back," a proportionally heavier yarn can be used for the back-warp. Great care must be exercised in selecting the stock for the face-warp and back-warp for fabrics requiring "fulling" during the finishing process. The material in the back-warp, which can be of

a cheaper quality, must have, as nearly as possible, the same tendency for fulling as the "stock" which is used in the face-warp.

In selecting the weave for the back-warp, we should be guided by the required appearance of the face in the fabric. For example, a twill-weave can be used for the interlacing of the back-warp if the face-weave is a prominent twill. If the face-warp is interlaced into a twill of short repeat, as  $2\text{---}_1$  3-harness twill,  $2\text{---}_2$  4-harness twill, etc., etc.; or if the face-warp interlaces on a plain-weave, rib-weave, basket-weave, granite-weave, etc., etc., thus showing small broken-up effects upon the face of the fabric, a satin-weave must be used for the interlacing of the back-warp. In woolen fabrics requiring fulling, the back-warp, by reason of its lesser amount of intersection as compared with the face-warp, is apt to show by impressions the points of intersecting of the back-warp on the

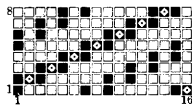


FIG. 585.

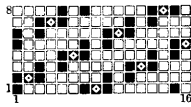


FIG. 586.

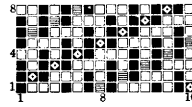


FIG. 587.

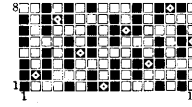


FIG. 588.

face cloth. For this reason a twill-weave, which is used for interlacing the back-warp, might possibly show its lines of impressions running over the face of the fabric, whereas if a satin is used in the present example for interlacing the back-warp, the impressions, if visible on the face of the fabric, will be well distributed and harmonize in every respect with the weave used for the interlacing of the face-warp.

Weave Fig. 585 illustrates what might be called an imperfect combination. The  $2\text{---}_2$  4-harness twill forms the face upon every alternate warp-thread; the  $1\text{---}_7$  8-harness twill, the weave for the back-warp. It will readily be seen that the repeat of the  $1\text{---}_7$  8-harness twill, taken in equal proportions with the  $2\text{---}_2$  twill, will require two repeats of the latter. The interlacing of the back-warp into the face-twill will thus only occur with every other face-twill, and proportionally make every other face-twill appear more prominently.

Weave Fig. 586 illustrates a perfect selection of weaves, the  $2\text{---}_2$  4-harness twill forming the face upon every alternate warp-thread with the 8-harness satin-weave (filling for face) as the weave for the back-warp. A careful examination of this weave will show the method of perfectly combining the back-warp with the face fabric by stitching the former alternately (exchanging) into each twill line of the two repeats of the 4-harness twill, forming one repeat.

Repeat of weaves Figs. 585 and 586 is 16 warp-threads and 8 picks.

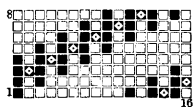


FIG. 589.

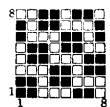


FIG. 590.

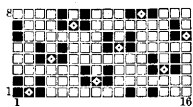


FIG. 591.

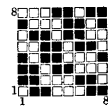


FIG. 592.

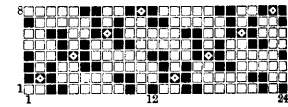


FIG. 593.

Weave Fig. 587 illustrates by taking ■ and □ for raisers, ▣ and ◻ for sinkers, an imperfect selection of weaves, as demonstrated and explained by example Fig. 585.

By exchanging the 8-harness  $1\text{---}_7$  twill (back-weave) in Fig. 587, to the 4-harness twill  $1\text{---}_3$  (■, ▣ and ◻ for raisers, ◻ for sinkers), we produce a perfect combination; the back-warp interlacing with the face fabric regularly in every face twill-line; thus, if producing any impressions, such will be uniformly visible.

Repeat, if using the 8-harness  $1\text{---}_7$  twill of weave for back warp : 16 warp-threads and 8 picks; if using the 4-harness  $1\text{---}_3$  twill for weave of back-warp : 8 warp-threads and 8 picks.

Weave Fig. 588 shows a perfect combination of weaves, the  $3\text{---}_1$  4-harness twill for face-warp and the  $1\text{---}_7$  8-harness satin for back-warp. Repeat: 16 warp-threads and 8 picks.

Weave Fig. 589 shows another perfect combination of weaves. The  $\frac{4}{4}$  8-harness twill is used for the face and the  $\frac{1}{7}$  8-harness twill for the interlacing of the back-warp. Repeat: 16 warp-threads and 8 picks.

Weave Fig. 590 represents a granite-weave. Repeat: 8 warp-threads and 8 picks.

Fig. 591 illustrates the combination of weave Fig. 590 for face-warp with the 8-harness satin for the back-warp, face and back-warp exchanging alternately. Repeat: 16 warp-threads and 8 picks.

Fig. 592 represents a common granite-weave designed for 8 warp-threads and 8 picks in its repeat.

Weave Fig. 593 illustrates the latter applied as a backing warp. Repeat: 12 warp-threads and 8 picks. Arrangement of warp: 2 threads face-warp to alternate with 1 thread back-warp.

The next arrangement for combination of face and back-warp is found in 1 end face, 1 end back, 2 ends face, 1 end back = 5 ends in repeat.

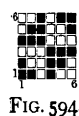


FIG. 594.

Weave Fig. 595 is constructed in this manner, and has for its face-weave Fig. 594 (repeat: 6-harness and 6 picks). Weave Fig. 595 has for its repeat, 10 warp-threads and 6 picks.

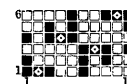


FIG. 595.

**Figuring with an extra Warp upon the Face of a Fabric otherwise interlaced with its Regular Warp and Filling.**

This method of combining two systems of warps with one filling is extensively used in the manufacture of textile fabrics devoted to women's wear. One system of warp and the filling produces the ground structure of the fabric, and then the second system of warp is employed to produce the figure upon this ground structure.

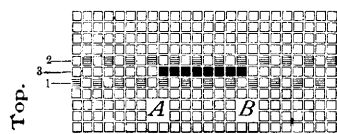


FIG. 596.

Weave to Longitudinal Section. Fig. 597.

As a peculiarity of this second system of warp, we mention that it is only visible on the face of the fabric at certain places (according to the design), while at other times it is made to float on the back or is stitched in certain places not visible on the face.

To give a thorough explanation of the general principles involved in this system, Figs. 596 to 609 are given.

Fig. 596 illustrates a part of a weave. The warp-threads indicated by 1 and 2, shown by ■ type, represent two ground warp-threads interlacing into the filling in "common plain." Warp-thread indicated by 3 and shown by ■ type represents the figuring thread. The latter is 8 picks down, 8 picks up, 8 picks down. *A* indicates the place where the figure warp raises on the face of the fabric, and *B* indicates the place where the former returns for floating on the back.



FIG. 597.

(Section corresponding to Fig. 596.)

Examining the longitudinal section, Fig. 597, we find the same numbers and letters used.

No. 1 warp-thread, ground fabric, is indicated by a dotted line (■ in the weave).

No. 2 warp-thread, ground fabric, is indicated by a fine line (■ in the weave).

No. 3 warp-thread, the figure-thread is indicated by a heavy line (■ in the weave).

Places *A* and *B* in the longitudinal section indicate the respective places marked by corresponding letters in part of a weave Fig. 596.

Fig. 598 illustrates two warp-threads of a four-leaf twill, ground fabric, having in its centre a figure warp-thread, which also is stitched in certain places to the ground fabric, but so that the stitchings are not visible on the face.

Warp-thread No. 1 reads	2 picks up,	}	6 times over,	}	Ground threads.
	2 picks down,				
	—				
Warp-thread No. 2 reads	1 pick down,	}	6 times over,		
	2 picks up,				
	1 pick down,				
	—				
Warp-thread No. 3 reads	1 pick down,				
	1 pick up (binder),				
	4 picks down,				
	7 picks up (figure effect on face),				
	8 picks down,				
	1 pick up (binder),				
	2 picks down.				
	—				

Letter *A* indicates the binding at pick No. 2.  
 Letter *B* indicates the raising to face at pick No. 7.  
 Letter *C* indicates the lowering to back at pick No. 14.  
 Letter *D* indicates the binding at pick No. 22.

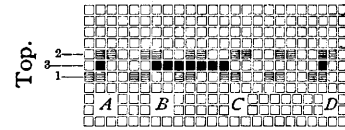


FIG. 598.

Examining the longitudinal section Fig. 599, we find the same numbers and letters used, so as to give a perfectly clear comprehension of the matter.

(Weave to longitudinal section Fig. 599.)

No. 1 warp-thread is indicated by a dotted line, ground fabric (■ in the weave).

No. 2 warp-thread is indicated by a fine line, ground fabric (■ in the weave).

No. 3 warp-thread is indicated by a heavy line, representing the figure-thread (represented by ■ in the weave).

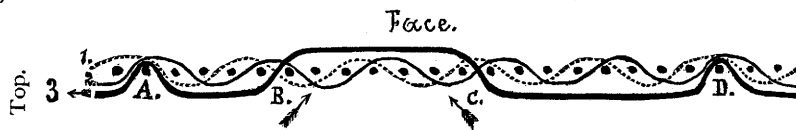


FIG. 599.

(Section corresponding to Fig. 598.)

Places marked *A* and *D* clearly indicate the binding of the figure-warp. By the nature of the operation the same is pulled down below the ground fabric and covered by the two warp-threads nearest to it.

*B* represents the raising of the figure-warp; *C* represents the lowering of the figure-warp.

*Fabrics made with Loose Texture without Binding the Figure.*

If a fabric is constructed with a thin or loose texture, the floating warp-threads are apt to show through on the face, hence the latter threads have to be cut off after the fabric leaves the loom. In this case a second point has to be considered:

If the figure-thread (No. 3) as shown in Figs. 596 and 597, after producing the figure on the face, simply passes to the rear, there will be nothing else to keep the figure-threads upon the ground fabric but the slight pressure of the ground-warp upon the figure-warp, at the place where the latter intersects the former. As this would be insufficient to enable the fabric to resist the

least wear and tear, we must bind the figure-warp close into the ground fabric all around the edges of the design. The best weave to be employed for this purpose is the "plain," which by two or three repeats will give sufficient strength to the figure-warp to allow it to be cut off on the back. (Cut not too close to the place of binding.)

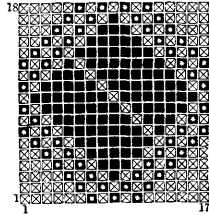


FIG. 600.

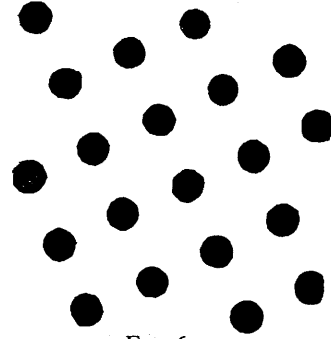


FIG. 601.

Fig. 600 is designed to illustrate this point in general, as well as to illustrate a second point, in which this binding is used for producing a second effect to the main design itself. In the illustration this binding forms a shaded effect around the main design.

This binding may also be used for shading in floral designs, where in some cases the colors have to appear to their full extent. Some cases may require the same color only in a subdued form, while others may require that it shall be scarcely visible.

To get these effects you have to bind your figure-warp into the ground cloth to a sufficient degree and in such order as is required. The weave must be selected according to the required effect, whether heavy twills, fine twills, satin-weaves or cotton-weave, etc.

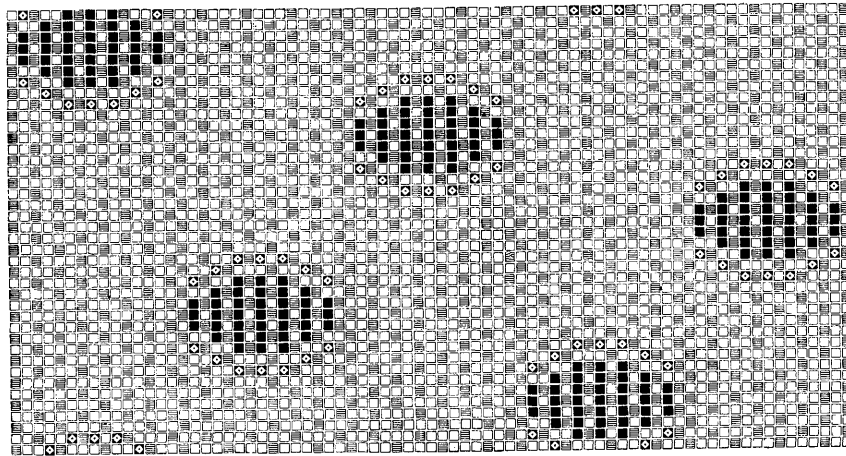


FIG. 602.

Fig. 601 represents a sketch for a design which is practically worked out on the □ designing paper in Fig. 602, to be used on a common harness-loom for a dress-goods fabric, produced on two systems of warp, one system of filling; ground fabric, "plain;" figure as formed by the extra warp—circular spots, distributed after the principle of the five-leaf satin.

The warp is arranged—

$$\begin{array}{r}
 1 \text{ end ground;} \\
 1 \text{ end figure,} \\
 1 \text{ end ground,}
 \end{array}
 \left. \vphantom{\begin{array}{l} 1 \text{ end ground;} \\ 1 \text{ end figure,} \\ 1 \text{ end ground,} \end{array}} \right\} 7 \text{ times over, } 14 \text{ ends.}$$

$$\begin{array}{r}
 \hline
 1 \text{ end} \\
 \hline
 15 \text{ ends in one repeat.}
 \end{array}$$

Fig. 603 illustrates one spot (as used in Fig. 602), shown without the ground-warp, and thus represents the spot effect as visible on the face of the fabric.

In weave Fig. 602 the ◻ type indicates the "raisers" for the ground-warp, the ◼ indicates the effect of the figure-warp as produced upon the before-mentioned ground-structure. The ◻ indicates the additional binding of the figure-warp to the ground-structure.



FIG. 603.

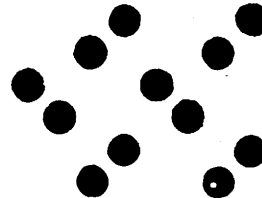


FIG. 604.

As mentioned at the beginning, the plain ground fabric is not always used. Very frequently we have used the "twilled" face. For this reason Figs. 604 and 605 are designed, representing the sketch of the fabric and the weave. The arrangement of the "motive" in the sketch is after the principle of the four-leaf broken-twill. The weave of the ground fabric consists of the four-harness (even-sided) twill  $\frac{2}{2}$ . The ◻ in Fig. 605 represents the ground fabric; the ◼ in Fig. 605 represents

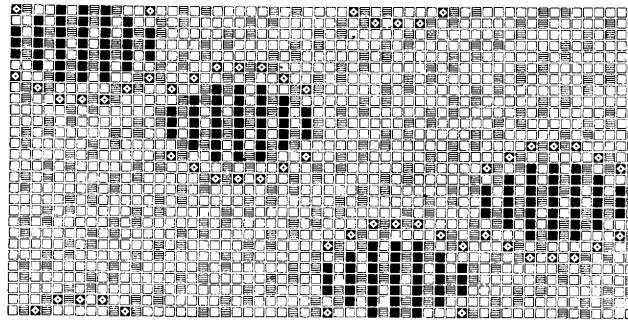


FIG. 605.

the figure produced upon the former; the ◻ indicates the additional binding of the figure-warp to the ground structure.

The warp is dressed—

1 end figure,  
1 end ground,  
—  
2 ends in repeat.

It does not always occur that only one color is used for the figure-warp. Very often differ-

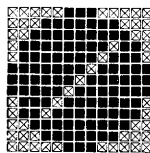


FIG. 606.

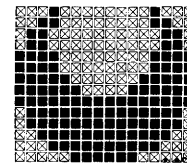


FIG. 608.

ent combinations are employed; but, in whatever shape, form, quality or size, the principle of the construction of the fabric will remain the same as if only one color should be used.

We now pass to fabrics where the floating of the figure-warp is omitted, such as fabrics in which the extra warp is bound to the ground fabric. In constructing fabrics of this character the "plain" weave, which has been used so extensively in weaves previously illustrated for interlacing the ground structure of the fabric, is omitted.

The smallest weave which can be used for the present purpose is the 3-harness  $2\text{---}1$  twill, but generally the 4-harness even-sided twill is used as the smallest repeat of a weave. In this manner Figs. 606 and 607 are constructed, representing a motive and the complete weave for

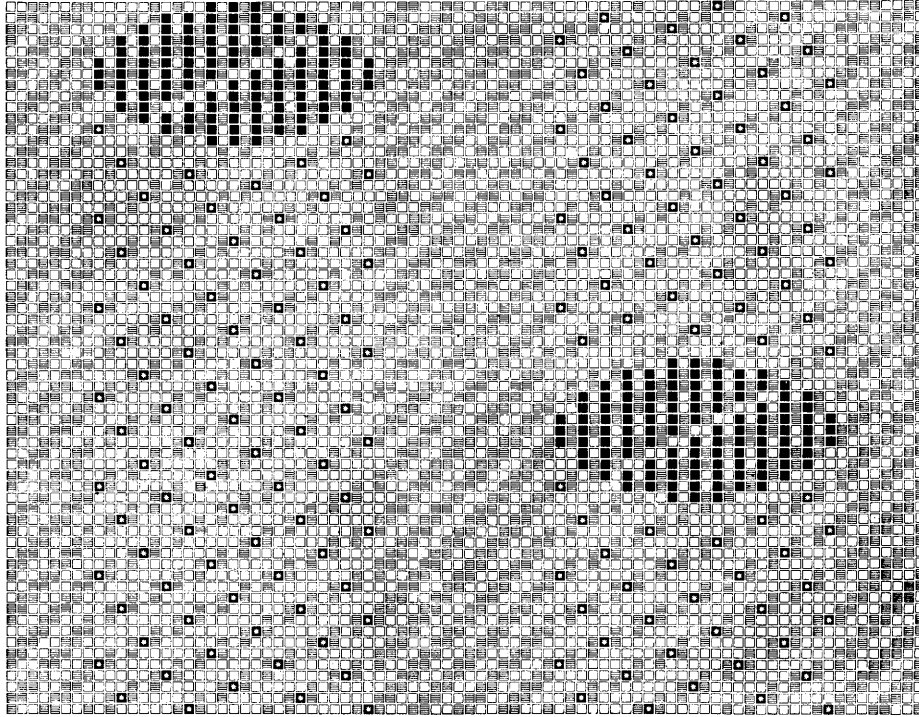


FIG. 607.

a figured dress-goods. The motive, Fig. 606, calls for 13 threads in warp and filling, hence the dressing of the warp for weave Fig. 607 calls for

$$\begin{array}{r} 1 \text{ end ground, } \\ 1 \text{ end figure, } \\ 15 \text{ ends ground,} \end{array} \left. \vphantom{\begin{array}{l} 1 \\ 1 \\ 15 \end{array}} \right\} \begin{array}{l} 13 \text{ times} \\ \text{over,} \end{array} = 26 \text{ ends.}$$

$$\frac{15}{41} \text{ ends in repeat.}$$

The  $\blacksquare$  is for ground warp, the  $\blacksquare$  for figure-warp, and the  $\square$  represents the places for binding the figure-warp to the ground structure. This stitching is done with the regular eight-leaf satin.

Weave 607, calling in its complete extent for 82 ends, can be reduced by cross-draw to 30-harness.

Fig. 608 represents a motive, a crescent, arranged in Fig. 609, for 96 ends repeat. The motive calling for 16 ends for figure, will necessitate the following dressing:

$$\begin{array}{r} 1 \text{ end figure, } \\ 1 \text{ end ground, } \\ 16 \text{ ends ground,} \end{array} \left. \vphantom{\begin{array}{l} 1 \\ 1 \\ 16 \end{array}} \right\} \begin{array}{l} 16 \text{ times} \\ \text{over,} \end{array} = 32 \text{ ends.}$$

$$\frac{16}{48} \text{ ends in repeat.}$$



*Comparison of the Size of the Materials as used for Ground-warp and Figure-warp.*

The first condition required by the figure-warp is to produce a design solid in appearance on the ground fabric. To produce this effect the texture is required to be as close set as possible; and the figure-warp must be made of sufficient thickness, so as to cover the interstices between each other as nearly as possible. The general arrangement for changing ground and figure-warp is the alternate arrangement between both (1 and 1). Again, care must be exercised not to have the ground-warp of a heavier size than is necessary; for the figure-threads have not only to fill the places between the ground-threads, but also to cover them actually; hence the diameter

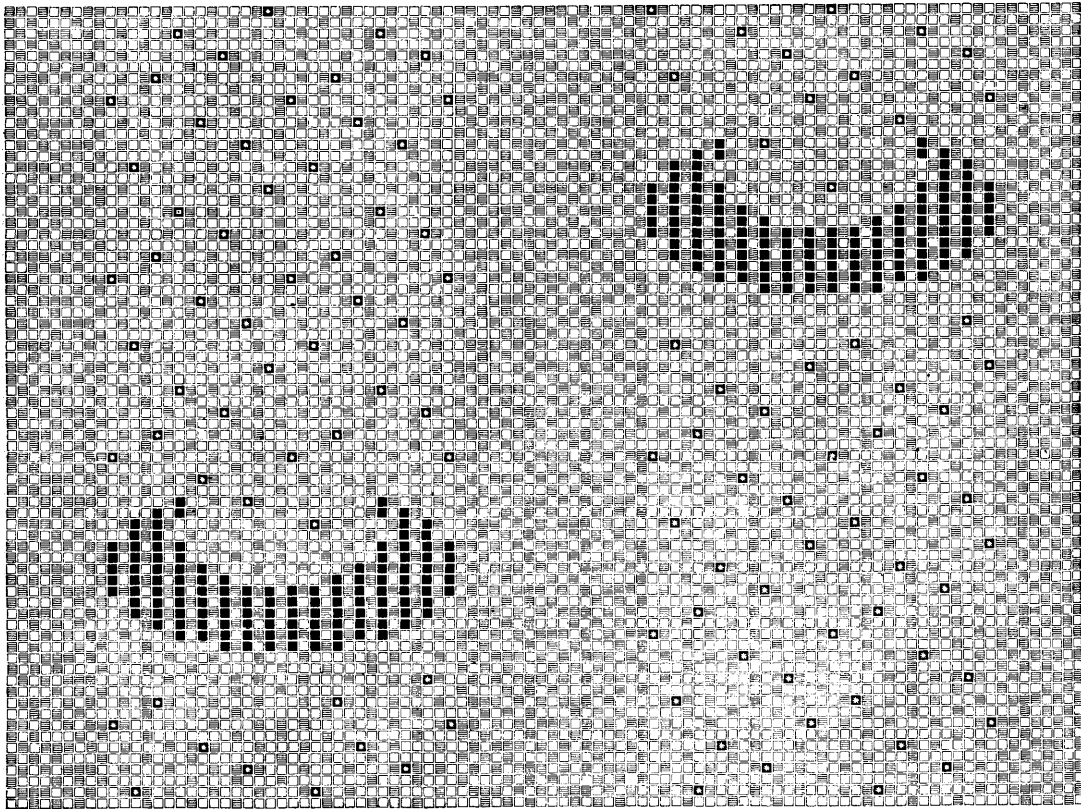


FIG. 609.

of the figure-warp must equal the diameter of the ground-warp, plus the space between each ground-thread.

*Comparison of the Twist in the Materials as used for Ground-warp and Figure-warp.*

As a general rule, the ground-warp is of a harder twist than the figure-warp. The latter is generally only twisted enough to weave well. There are two reasons for this arrangement of the twist. 1. The ground-fabric has to stand the strain in weaving; hence, must be of a harder arrangement in twist. 2. The figure-warp has to cover the design; hence the loose twist will assist in this work.

*Necessity of having Two Beams for Weaving.*

In almost every case in producing the textile fabrics here explained, we are compelled to employ two beams, one beam for the ground-warp, one beam for the figure-warp. The reason for using

two beams is found in the difference of the weave (for the figure-warp is less interlacing than the ground-warp) as well as in the difference of the materials used for ground-warp and figure-warp.

Another system of weaving for producing figures upon the face of a single-cloth fabric is that known as

### Lappet Weaving.

This method of producing figures upon the face of a fabric was very extensively used prior to the introduction of swivel weaving and the invention of the Jacquard loom. The method of operation in this system of weaving is that of passing an independent set of threads through a series of needles set in a frame, situated between the reed and the shuttle-raceway of the lay. This frame is arranged so as to slide horizontally to and fro, regulated by the "pattern-wheel," and the needles are depressed at proper moments to allow the figuring-thread to interweave with the ground-cloth by passing the shuttle and its filling over the figuring-thread. This method of interweaving the figuring-threads is, in looms of older construction, arranged to have the needles

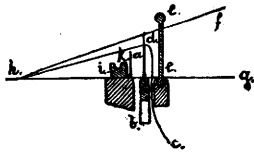


FIG. 610.

which guide the figuring-thread operated on from below, as is illustrated in diagram Fig. 610. The needles *a* (only the first shown) are fixed in the guide-frame *b*. The needles have a thread, *c*, passed through the eye *d* near their point. *e* represents the reed, *f* and *g* the shed formed by the warp of the regular cloth, *h* the woven part of the fabric, and *i* the shuttle.

The method of interlacing is as follows: When frame *b* is raised the needles pass through the warp at the rear of the shuttle *i* and guide-pins *k*, but in front of reed *e*, so that by inserting the filling by means of the shuttle the figuring-thread gets interlaced with the regular cloth structure. Next the frame guiding the needle is lowered and the latter moved to the right or to the left as required by the design to be produced. This horizontal moving of the frame, according to design to be produced, is effected by grooves *l* in a ratchet-wheel *m*, illustrated in Fig. 611. The pin *n*, fastened to the end of the connecting lever *o*, being worked alternately from side to side of the groove, regulates the distance in moving the needles for the figuring effect required.

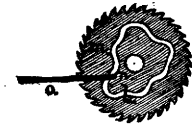


FIG. 611.

This method of operating the frame which guides the needles requires a fresh one for every new design. This ratchet-wheel moves one tooth for each pick, and the number of teeth it contains is regulated by the length of the design.

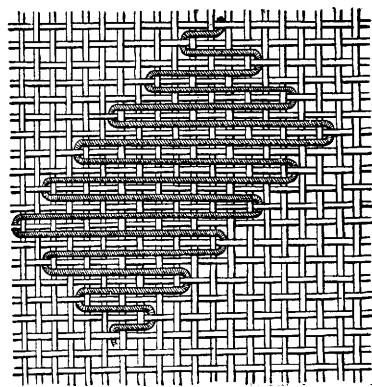


FIG. 612.

Diagram Fig. 612 clearly illustrates (enlarged as to size of threads) the method of interlacing the figuring-threads into the ground structure. The figuring-thread is represented shaded, ground warp and filling outlined.

Fig. 613 is the same effect arranged in 3 repeats in a fabric sample. As previously mentioned, the frame containing the needles for guiding the figuring-



FIG. 613.

warp is placed in some attachment to these looms, situated above the shed formed by the regular warp.

Diagrams Figs. 614, 615, 616, 617, 618, 619 and 620 illustrate a loom and the method of

operation for lappet weaving as extensively used in the manufacture of elastic web fabrics, such as suspender webbing, also ribbons, tapes, and narrow goods generally. It can be arranged, however, for wider "figured" fabrics. This loom is patented by Mr. G. H. Hodges.

Fig. 614 is a side elevation of the lathe and pattern-wheel; certain parts of the lathe being represented as broken off.

Fig. 615 is an end elevation of the lathe, pattern-wheel and ratchet mechanism for operating the pattern-wheel.

Fig. 616 is an elevation of the pattern-wheel detached, showing the side opposite that represented in Fig. 615.

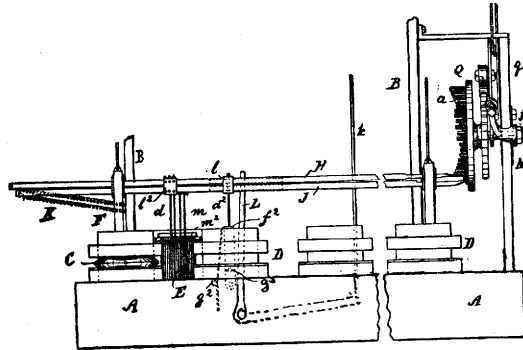


FIG. 614.

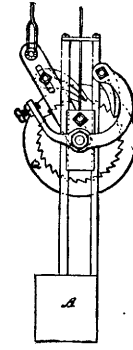


FIG. 615.

Fig. 617 is a sectional view representing the needles elevated.

Fig. 618 is a like view representing the needles depressed.

Fig. 619 is a front elevation, partly broken away, of a lappet loom of the present construction.

Fig. 620 is an end elevation of the loom, the devices for connecting the needle-bars with their actuating levers, and also the mechanism for actuating the pattern-wheel being omitted in order to avoid confusion and to better illustrate the features shown in this figure. Like letters of reference indicate corresponding parts in the different figures of the drawings. *c* represents the figuring-threads; *U*, the woven fabric; *A*, the lathe; *B B*, the pendulous arms by which the same is suspended; *C*, the shuttle; *D*, the shuttle-race; *E*, a section of the reed.

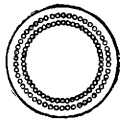


FIG. 616.

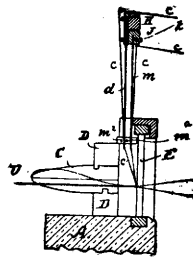


FIG. 617.

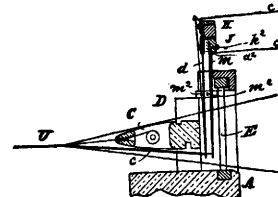


FIG. 618.

The web *U* is ornamented by means of threads *c*, which pass from spools (not shown) mounted on the loom through the guides and thence respectively through the eyes of the needles *d m* and into the web.

Guards *m<sup>2</sup>* are employed to prevent the needles from being sprung or drawn out of proper position by the strain on the threads *c* during the process of intersecting the same in the fabric. These guards consist of rigid wires arranged horizontally in front of the needles near the upper portion of the reed and firmly secured at either end to a fixed portion of the lathe or shuttle race in such a manner that when a needle is bent a trifle

outwardly or toward the front of the lathe by the action of its thread it will strike one of the guards, the vertical movements of the needle not being interfered with thereby. The needles work vertically and pass through the unfilled warp-threads between the path or race of the shuttle, the reed, the pattern-wheel and needles swinging with the lathe. Lateral movements of the needles in one direction or to the left are caused by drawing up the horizontal arm of the lever *L* by means of the rod *k*, thereby bringing the vertical arm of this lever into contact with projections on the pawls causing the latter to engage the teeth and slide the bars or holders *HJ* to the left, the reverse lateral movement of the needles to the right being caused by the action of the springs *K* when the vertical arm of the lever *L* is withdrawn from the projection *i* by depressing the rod *k*. The clamp *l* is returned to its normal position after the vertical arm of the lever *L* is withdrawn by means of the springs *g*<sup>2</sup>, its movement toward the right being arrested by the stop *g*<sup>3</sup>, which determines the oscillation of the socket *f*<sup>2</sup>. When the vertical arm of the lever *L* is withdrawn from the projections on the pawls and strikes the curved arms of the pawls, the pawls are thereby disengaged from the teeth on the bars *HJ*, permitting said bars to be forced

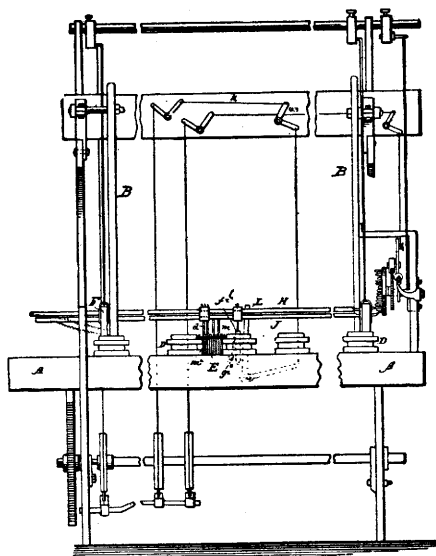


FIG. 619.

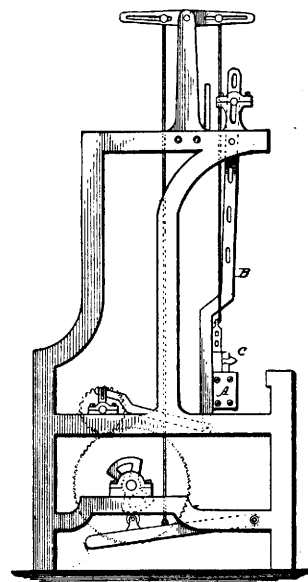


FIG. 620.

by the springs *K* against their respective pins in the wheel *Q*; but as the pins are of unequal lengths one of the bars will travel toward the right a greater distance than the other, thus changing the relative position of the needles *d m* with respect to the web *E*. It will be obvious, however, that when the vertical arm of the lever *L* strikes the projections on the pawls both the pawls will be caused to engage the bars simultaneously and both move in unison to the left.

In order to more clearly understand the method of intersecting the threads *c* in the web *U*, and thereby ornamenting the same, the operation of the principal parts shown during one full revolution of the main driving-wheel of the loom, or one complete traverse of the lathe is described. The lathe being at the front of the loom, the shuttle at the right-hand side of the fabric, and the needles, needle-bars, and pattern-wheel elevated, with the needles threaded, and the bars against their respective pins in the pattern-wheel, if, now, the loom is started up the lathe will be moved or swung back from the breast-beam, and at the first quarter of its traverse the needles, needle-bars and pattern-wheel will be lowered, and the needles carrying their threads will pass through the warp-threads and remain down while the lathe passes through the second and third quarters of its traverse. After the lathe has passed through the first quarter of its

traverse, and while it is making its second and third quarters the shuttle is passed from right to left of the web, completing its passage at about the centre of the third quarter of the traverse of the lathe. The needles begin to rise as the lathe enters upon the fourth quarter of its traverse, their upward movement being completed before the lathe completes its fourth or last quarter. The lathe then continues to advance to the front to beat up the filling, and while completing the fourth or last quarter of its course the lever *L* is actuated through the rod *k*, and the needles carried to the left, after which the pattern-wheel is revolved one notch or step to change the position of its pins with respect to the bars or holders *H J*, after which the lever *L* is withdrawn from the projections of the pawls and striking the arms of the pawls disengages them from the bars *H J*, and permits the springs *K* to move the bars to the right into contact with the pattern-wheel, and thereby change the position of the needles preparatory to repeating the operation. The needles *d* are secured to the needle-bar or holder *H* by a screw-clamp, and the needles *m* in the bar *J* by screws; but any other suitable means may be employed for this purpose. Any desired number of needles and needle-holders may also be employed.

Mr. Hodges in his patent further mentions that "instead of using the rows of pins, annular cam-shaped flanges may be employed on the wheel *Q*, against which the bars *H J* may abut, if desired.

"The movements of the needles may be so timed as to cause them to work 'pick-and-pick,' or pass through the warp-threads at each throw of the shuttle or otherwise, as desired. The pawls and lever *L* afford a convenient means for locking the bars *H J* together, and moving them away from the pattern-wheel conjointly.

"A proper tension and take-up mechanism (not shown) must be used with each of the threads *c*.

"But one shuttle and one reed are shown in the drawings, but it will be understood that several may be employed in the same loom; also, that one or more needles may be employed with each shuttle and reed as desired.

"It is preferable to have the threads carried by the needles of a different color or colors from those composing the warp and filling of the fabric; also, that in commencing the weaving the needle-threads should be drawn some distance through the eyes of the needles, in order that the loose ends of the threads may be caught and secured in the fabric by the filling."

### TRICOT WEAVES.

Under the general name of tricot are classified fabrics presenting rib-effects. The weaves of the tricot fabrics are more or less elastic, according to the uses to which they are to be put. If, for example, the stuffs are to be used for trousering the tricot weaves will be much less likely to bag at the knees than other fabrics. If used for ladies' dress goods, cloakings, etc., they will tend to give the garment a nicer and closer fit to the person of the wearer.

Tricot weaves are graded into tricots forming rib-effects in the direction of the filling and tricots forming rib-effects in the direction of the warp. We will consider the former first.

#### *Tricots with Rib-Effects in the Direction of the Filling*

Are employed largely for stuffs for dress goods, cloakings, overcoatings, suitings, etc. The arrangement of the weave most frequently employed is 2 picks face and 2 picks back; but this may be changed to 1 pick face and 1 pick back, or to 2 picks face and 1 pick back, according to the size of the rib required in the fabric. As a general rule, the heavier the back filling used, the more prominent the rib-effect will be.

Fig. 621 is the 4-harness (filling) tricot weave, 2 picks for face to alternate with 2 picks for back. Repeat: 4-harness, straight draw, 8 picks. This weave has for its foundation the 4-harness broken-twill, 2 picks, warp up, to alternate with 2 picks, filling up.

Fig. 622 is the 3-harness (filling) tricot weave, 2 picks for face to alternate with 2 picks for back. Repeat: 3-harness, straight draw, 12 picks. This weave has for its foundation the 3-harness twill, 2 picks, warp up, to alternate with 2 picks, filling up.

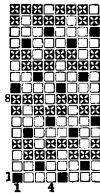


FIG. 621.

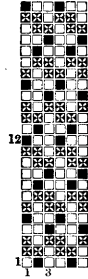


FIG. 622.

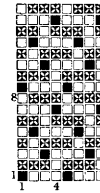


FIG. 623.

Fig. 623 represents the 4-harness (filling) tricot weave, 1 face pick to alternate with a backing pick. 4-harness, straight draw, 8 picks, repeat of pattern. This weave is composed of the 4-harness broken-twill.

Fig. 624, 4-harness (filling) tricot weave, 2 picks face to alternate with 1 pick back. Repeat: 4-harness, straight draw, 12 picks. In designing this weave, observe the following rule: The warp-thread which is lowered in the back pick must be raised in the next following face pick.

*Tricot's Forming Rib-Effects in the Direction of the Warp.*

This division of tricot weaves includes an endless variety of effects in trouserings, suitings, etc., both in wool and worsted goods. A few ends of the regular warp twisted over with organzine silk, or a few fancy-colored threads of worsted wool or sewing silk spread over the fabric (on warp ends showing on the face) will give good effects.

Fig. 625, 8-harness warp, tricot weave. Repeat: 8-harness, straight draw, 4 picks. Harness 1, 3, 5 and 7 are for the face, and hence the harness where the fancy end has to be drawn on.

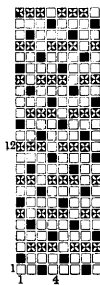


FIG. 624.

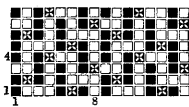


FIG. 625.

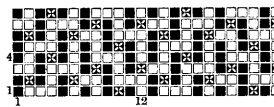


FIG. 626.

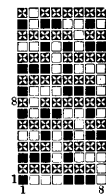


FIG. 627.

Fig. 626, 12-harness warp, tricot weave. Repeat: 12-harness, straight draw, 4 picks. Harness 1, 3, 5, 7, 9 and 11 are for the face, hence for the fancy ends.

Sometimes we have to make these long tricots extra heavy, which may be done by adding an extra backing pick every alternate pick. Fig. 627 is an example. Repeat: 8-harness, straight draw, 8 picks.

In Fig. 628 a specimen of a tricot weave is given which by the proper arrangement of its texture produces a fabric containing a considerable amount of elasticity, in fact, a fabric very closely imitating what is known as "Jersey cloth."

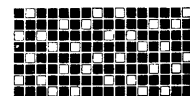


FIG. 628.

As mentioned, it is not upon the weave alone that we must depend for imparting this elasticity to the fabric. The result also follows from use of materials for the yarns

of the proper "counts" and quality and upon their arrangements. The following dressing must be used for the previously given design:

- 2 threads of 2-ply cotton (forming after finishing the body of the fabric).
- 2 threads of single worsted (forming the face of the fabric after finishing).
- 4 threads in pattern.

The fillings to be fine, soft, single worsted (forming the back in the fabric after weaving and finishing).

Both kinds of warp will be visible on the face after weaving, but during the changes the fabric undergoes in finishing the cotton warp will disappear from the face, taking its place in the body of the fabric.

These fabrics must be made very wide in the loom. Thus, in the case of a 54-inch finished fabric, the goods must be woven 92 to 100 inches wide in the loom, according to the texture and quality of the material used. (Fabrics made with weave Fig. 628 require the selvages to be sewed together when they are fulled.)



## Double Cloth:

Under double cloth we comprehend the combining of two single cloths into one fabric. Each one of these two single cloths is constructed with its own system of warp and filling, while the combination of both fabrics is effected by interlacing some of the warp-threads of the one cloth into the other at certain intervals.

The objects for the making of the double cloth are manifold. Among these may be mentioned: To reduce the cost of production for heavy-weight fabrics by using cheaper material for the cloth forming the back; to increase the strength of certain grades of fabrics; to increase the bulk of a fabric; to produce double-faced fabrics; to produce fancy effects by the system of combining or exchanging both single cloths.

As mentioned before, a separate warp and filling is required for each cloth, and so likewise in preparing the design a separate dealing with each is required.

In diagram Fig. 629*a* the section of two single-cloth fabrics is shown.

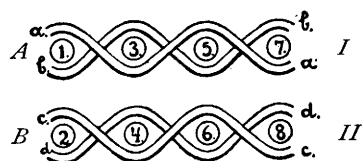


FIG. 629*a*.

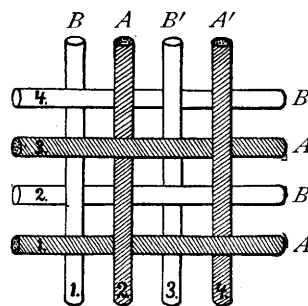


FIG. 629*b*.

In Diagram Fig. 629*b* the plan of two single-cloth fabrics, situated above each other, is shown. Warp-threads 2 and 4 and picks 1 and 3 form one cloth (shown shaded), while warp-threads 1 and 3 and picks 2 and 4 form the other (illustrated in outlined threads).

Examining the section, Fig. 629*a*, and the plan of interlacing, Fig. 629*b*, it is found that each warp-thread interlaces with its own system of filling, and thus each cloth is formed independent of the other. These are, with a few exceptions, such as seamless bags, etc., stitched (or combined) together so as to form one fabric.

The proportion of face warp and face filling to back warp and back filling to be used may be as 1 end face to 1 end back, or 2 ends face to 1 end back, or 2 ends face to 2 ends back, or 3 ends face to 1 end back, etc., etc.

One proportion for the two kinds of warp and a different proportion for the two kinds of filling may also be used, for example:

$$\text{Warp} \begin{cases} 2 \text{ ends face} = \frac{2}{3} \text{ face,} \\ 1 \text{ end back} = \frac{1}{3} \text{ back,} \\ \hline 3 \text{ ends in repeat.} \end{cases}$$

$$\text{Filling} \begin{cases} 1 \text{ pick face} = \frac{1}{2} \text{ face,} \\ 1 \text{ pick back} = \frac{1}{2} \text{ back,} \\ \hline 2 \text{ picks in repeat, etc., etc.} \end{cases}$$

As mentioned before, the stitching has to bind these two single-cloth fabrics together, in fact, to unite the same into *one* fabric. The warp of the bottom fabric may have to bind into the face fabric, or the face warp into the bottom fabric. In both cases the warp of the one has to interweave more or less with the filling of the other.



In fabrics where each side is of a different color, and the color of the face fabric shall not disturb the back, nor the color of the back cloth the face, great care must be exercised in the manner of combining both cloths. For this purpose we must select for binding, points where warp and filling interlace less frequently, as this will reduce the chances of the thread used for interlacing on one cloth showing upon the other.

The binding of both cloths into one fabric also has an influence with regard to the feel (handling) of the fabric, for the oftener we combine (stitch) a certain number of ends of warp and filling the harder and firmer the fabric will feel; again, if not sufficient stitching is used the fabric produced will be loose or spongy.

The amount of binding for both cloths can only be learned through practical experience, yet the rules for binding are the same for wide as well as close-stitched fabrics.

#### RULES FOR DESIGNING THE PRESENT SYSTEM OF DOUBLE CLOTH.

- 1st. *Indicate the back warp and back filling on your squared designing paper.* (At your first few exercises stripe off these threads with a light color so as to readily distinguish one from the others.)
- 2d. *Put the weave for the face cloth upon its own system of threads* (omitting every backing thread as if it were not in the design).
- 3d. *Put the weave for the lower cloth (back cloth) upon its own system of threads.*
- 4th. *Raise all the face warp on every backing pick.*
- 5th. *Combine both single cloths, thus far constructed separately, into one fabric.*

Observe the following rules in combining: The places for combining both fabrics must be distributed as regularly as possible over the entire fabric. Select the amount of binding for the two cloths according to the character of the fabric the weave is designed for.

In combining the two fabrics by raising the back warp over the face filling at certain places, divide the arrangement as equally as possible for each backing thread. If in certain weaves every backing warp-thread cannot be used, arrange the omission of threads uniformly, such as every other or every third thread, etc.

In combining the two fabrics through certain face warp-threads resting in the lower shed of the backing pick, observe the rules given for the back warp.

In using the back warp for binding in the face cloth (as is generally done) the back warp-thread must be arranged to rise at places where the face warp-thread, situated on each side nearest to it, rises at the same time.

It is advisable to have the raising of the back warp into the face fabric arranged to occur immediately before, or right after, the same back warp-threads have been or are to be raised by the weave in the backing cloth.

In using the face warp for binding in the lower cloth, select for points of stitching spots (sinks) in which the warp-thread is down in the two adjacent face picks.

Be careful not to disturb the general effect of the face cloth by arranging perfect points of combinings, but in wrong places. For example: Take the  $\frac{2}{2}$  4-harness twill for face-weave. Suppose one repeat of the back fabric requires two repeats of the face-weave. Requiring a smooth face, and one face twill to show as prominently as the other, the stitching must be arranged alternately for each face twill, because by continuing to use only the one repeat of a twill in rotation, this twill will show more prominently than the other.

To thoroughly understand the foregoing rules for designing double cloth, a study of Figs. 630, 631, 632, 633, 634, 635, 636 and 637 is advised. They represent both weaves for the single cloths and their principle of combining until the weave for the double cloth is perfected. Each rule is illustrated in successive rotation as laid down.

Fig. 630 illustrates the 4-harness (*e*) twill  $\frac{2}{2}$ , designed for 4 repeats, warp and filling ways; hence for 16 warp-threads and 16 picks.

Fig. 631 is the plain weave for 8 warp-threads and 8 picks.

Fig. 632 represents one repeat of the 8-harness satin, filling face.

In giving our rules for designing double cloth rule 1 calls for *the indication of the two single-cloth fabrics*, as each must be treated separately from the other.

Fig. 633, which is designed for illustrating the present rule, explains itself as “two ends for the one single cloth to alternate with one end from the other, warp and filling ways.” This will equal, in the present example, 2 ends face to alternate with one end back.

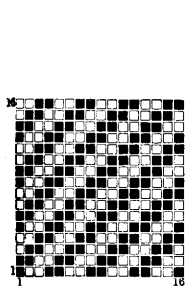


FIG. 630.

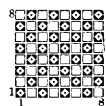


FIG. 631.

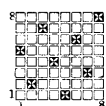


FIG. 632.

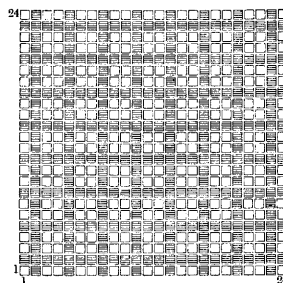


FIG. 633.

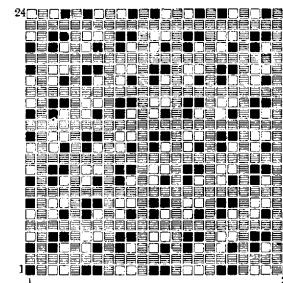


FIG. 634.

Fig. 634 illustrates the application of the second rule as given: “*Put weave for the face cloth upon its own system of threads.*” In this example the 4-harness twill shown in Fig. 630 is applied for face-weave to the plan “2 face 1 back.”

Fig. 635 illustrates the succeeding rule (3d) as applied to example, Fig. 634. “*Put the weave for the lower fabric upon its own systems of threads.*” The weave selected for this example is the one shown in Fig. 631 (common plain). The next rule (4th) calls for *the raising of the face warp on every backing pick*. This is illustrated in Fig. 636. These four rules, as observed thus far and illustrated in Fig. 636, produce two separately constructed fabrics. Two-thirds of the number of warp and filling-threads form the face cloth, and the remaining one-third of warp and filling form the lower cloth. Rule 5 calls for the combining of these separately constructed fabrics, either by using the back warp for interlacing with the face filling or the face warp with the back filling. The first mentioned method is used in the present example.

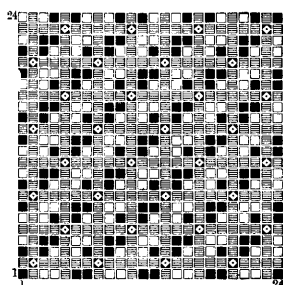


FIG. 635.

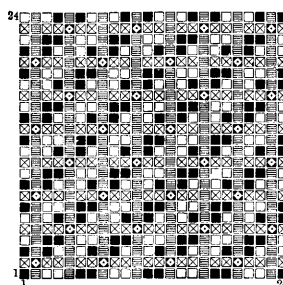


FIG. 636.

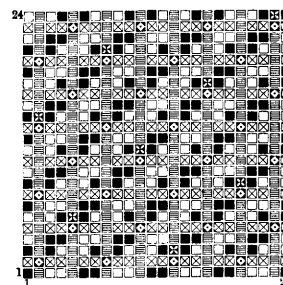


FIG. 637.

Fig. 637. The arrangement for combining (stitching) is after the principle of the 8-harness satin shown in fig. 632.

In designs Figs. 630 to 637 the character of type used for each figure is as follows :

- indicates the weave for face cloth.
- indicates the weave for back cloth.
- ▣ indicates the arrangement for combining both cloths for the double cloth.
- indicates the back warp and filling-threads from face system.
- indicates the raising of the face warp on the backing pick.

The next thing to be studied is the relation of the warp to the filling and the weave. If both cloths (face and back) are equal in every respect (quality of stock, counts of yarn, proportion of warp and filling and its arrangement, and weave used for the face and back-cloth) no difficulties need be experienced in designing the same. But on the other hand, if any of these points, as mentioned, differ in one cloth from the other, great care must be exercised.

We will next proceed to give a few examples of different kinds of double cloth; also complete explanations of them from their foundation to the complete weave.

In the following examples, Fig. 638 to Fig. 688, the different characters of type used give the following indications:

- Raisers.  $\left\{ \begin{array}{l} \blacksquare = \text{the weave for the face-cloth.} \\ \blacksquare = \text{the weave for the back-cloth.} \\ \boxtimes = \text{the stitching of both fabrics, back-warp into face filling.} \\ \boxplus = \text{the raising of face-warp on backing picks, as required for forming the lower cloth.} \end{array} \right.$
- Sinkers:  $\boxtimes = \text{the stitching of both fabrics, face-warp into the back filling.}$

**A. Double-Cloth Weaves having for their Arrangement One End Face to Alternate with One End Back in Warp and Filling.**

This system of double cloth is mostly used in fabrics in which the quality, size and weave of the two cloths (face and back) is nearly, if not entirely equal, as in reversible overcoating, etc.

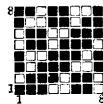


FIG. 638.

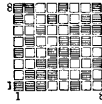


FIG. 639.

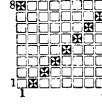


FIG. 640.

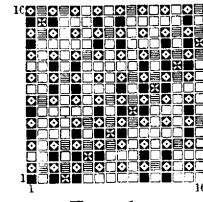


FIG. 641.

Fig. 638 represents the weave for face (8-harness fancy-twill).

Fig. 639 represents the weave for back ( $\frac{3}{2} \frac{1}{2}$  8-harness twill).

Fig. 640 represents the arrangement for combining both cloths through the back-warp, interlacing with the face filling ( $\frac{1}{7}$  8-harness twill).

Fig. 641 is a complete double-cloth weave, constructed out of Figs. 638, 639 and 640. Repeat: 16 warp-threads and 16 picks.



FIG. 642.

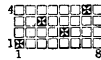


FIG. 643.

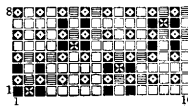


FIG. 644.

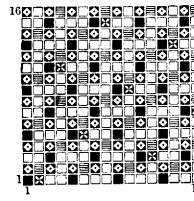


FIG. 645.

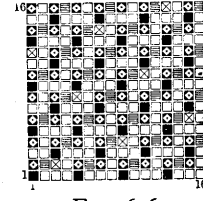


FIG. 646.

Another example illustrating double cloth constructed "one face, one back" in warp and filling, is shown in weave Fig. 644. It contains the common 4-harness basket, illustrated separately in Fig. 642, for its face and back weave.

The method of interlacing observed is the stitching of the back-warp into the face-cloth, as shown by  $\boxtimes$  for raisers in the full design, as well as in the extra plan Fig. 643.

Weave Fig. 645 illustrates the combining of two plain woven cloths into one fabric by binding the back-warp into the face-cloth. It will be seen that the points where the back-cloth interlaces into the face will show on the surface, but as only one thread raises at a time in a plain weave, the required points in Rule 5 (*i. e.* to have for the intersection of the back-warp with the face-cloth, a place where the face warp-threads on each side nearest to the back warp-thread raise at the same time) can never be found, and we must use the weave as mentioned above, or as to whichever side of the fabric is required to be the clearest, we may use the arrangement of the "double plain," as shown in weave Fig. 646. In this the face is arranged to bind the lower fabric as indicated by  $\otimes$  for sinkers. The raising of the back-warp in the face-cloth in weave Fig. 645, as well as the lowering of the face-warp in the lower cloth, as in Fig. 646, are arranged

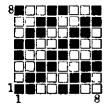


FIG. 647.

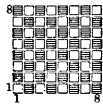


FIG. 648.

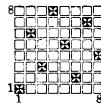


FIG. 649.

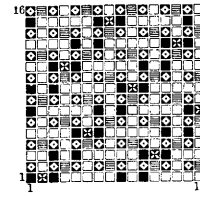


FIG. 650.

after the 8-harness satin (filling face). In the present examples, Figs. 645 and 646, the question may arise as to which method should be preferred?

Taken in the general average of fabrics constructed on this double plain weave, or similar weaves, in which only single threads raise at a time, such as filling-face satins, etc., the preference should be given in favor of the first named weave.

Repeat of designs 645 and 646 is: 16 warp-threads and 16 picks.

Another example of this system of double cloth is shown in Figs. 647 to 650.

Fig. 647 represents the face-weave.

Fig. 648 represents the weave for the lower fabric.

Fig. 649 illustrates the method of binding both cloths into one fabric.

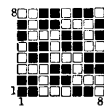


FIG. 651.

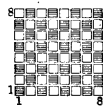


FIG. 652.

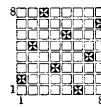


FIG. 653.

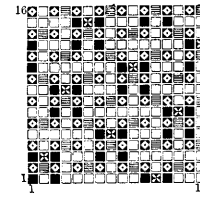


FIG. 654.

Fig. 650 shows the complete design.

Repeat: 16 warp-threads and 16 picks. Face-weave is the  $2\frac{1}{2}$  4-harness twill; back-weave is the plain.

The stitching of the back into the face-cloth is arranged after the 8-harness satin, filling up.

Weaves Figs. 651 to 654 illustrate the combining of an 8-harness "granite-weave" with the plain weave for double cloth, each taken alternately, warp and filling ways.

Fig. 651 illustrates the granite-weave (8-harness) to be used for the face.

Fig. 652 is the plain weave to be used for the back of the double cloth.

Fig. 654 shows the complete double-cloth weave derived by combining both cloths with the 8-harness satin, Fig. 653, using the back-warp for binding into the face-cloth.

**Double Cloth Composed with Different Proportions of Face and Back-threads.**

*B. Warp: 1 end face to alternate with 1 end back.  
Filling: 2 ends face to alternate with 1 end back.*

In this manner weave 655 is constructed. Repeat: 16 warp-threads and 12 picks. Weave

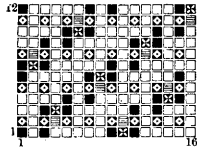


FIG. 655.

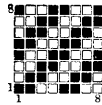


FIG. 656.



FIG. 657.

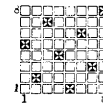


FIG. 658.

for face-cloth is the 4-harness  $2 \frac{2}{2}$  twill, Fig. 656. Weave for the back-cloth is illustrated separately (same kind of type as used in complete weave) in Fig. 657.

The combining of both cloths is effected by the 8-harness satin, Fig. 658.

*C. Warp: 2 ends face to alternate with 1 end back.  
Filling: 1 end face to alternate with 1 end back.*

Designing a double-cloth weave under this proportion is illustrated by weave Fig. 659. Repeat: 6 warp-threads and 8 picks. Weave for face-cloth is the 4-harness  $2 \frac{2}{2}$  twill (Fig. 660).

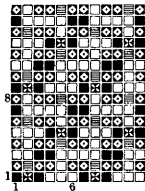


FIG. 659.



FIG. 660.



FIG. 661.



FIG. 662.

The back-cloth is worked on plain, as represented in Fig. 661, and the combining is effected by the back-warp in the face-cloth raising every other back warp-thread on every other face-pick (Fig. 662).

The next arrangement for double cloth is—

*D. Warp and filling: 2 ends face to alternate with 1 end back.*

This proportion for using face-threads to backing-threads in warp and filling has been represented before, in the examples given for illustrating the rules for designing double cloth. At present this system of using face to back-threads is mentioned in its proper place under the heading of "Different Proportions of Face and Back in Double Cloth."

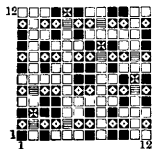


FIG. 663.

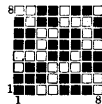


FIG. 664.



FIG. 665.



FIG. 666.

Fig. 663 represents the combination in double cloth of weave Fig. 664 used for the face, and weave Fig. 665 that used for the back. Both cloths are combined into one fabric after the motive of the  $1 \frac{1}{3}$  4-harness twill (Fig. 666). Repeat of weave Fig. 663: 12 warp-threads and 12 picks.

Weave Fig. 667 illustrates the combination of the  $3\text{---}1$  4-harness broken-twill (Fig. 668) for the face-cloth and the  $3\text{---}1$  4-harness common twill for the lower cloth (Fig. 669). Both cloths are combined by motive, Fig. 670 (plain).

Repeat of the double-cloth weave: 12 warp-threads and 12 picks.

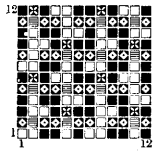


FIG. 667.



FIG. 668.



FIG. 669.



FIG. 670.

This character of the double cloth (2 threads face to alternate with 1 thread back) is that most frequently used in the manufacture of worsted and *woolen* goods. In designing double cloth by this arrangement for 4-harness basket or similar weaves, as also combination weaves of basket and twill effects, etc., always remember that the back-warp must be arranged to work in the centre of the two face warp-threads working alike, as this gives us the only chance for properly binding back to face. For example :

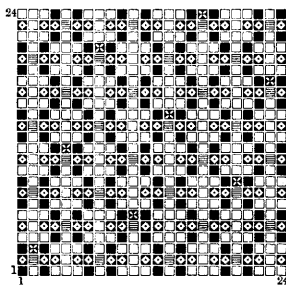


FIG. 671.

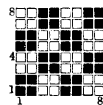


FIG. 672.

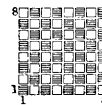


FIG. 673.

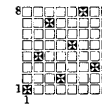


FIG. 674.

Fig. 671 illustrates the weave for a double-cloth fabric, which has for its face the 4-harness basket (arranged as previously mentioned). It has the common plain weave for the backing, and the stitching is done with the 8-harness satin.

Fig. 672, the face weave. Fig. 673, the back weave. Fig. 674, the stitching.

Repeat of weave Fig. 671: 24 warp-threads and 24 picks.

The next arrangement of proportional face and back for warp and filling is :

*E. 2 ends face to alternate with 2 ends back in both systems of threads.*

This method is illustrated in Fig. 675 which is composed of the 8-harness twill  $4\text{---}4$  for face

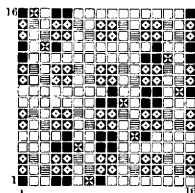


FIG. 675.

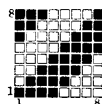


FIG. 676.

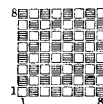


FIG. 677.

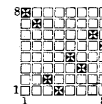


FIG. 678.

and the common plain weave for back-cloth. Both cloths are combined with the weave represented in Fig. 678.

Fig. 676 shows the face-weave. Fig. 677 shows the back. Repeat of the double cloth: 16 warp-threads and 16 picks.

*F. Warp: 2 ends face to exchange with 2 ends back. Filling: 2 picks face to exchange with 1 backing.*

These are used to a great extent in arranging  $63^\circ$  steep twills (diagonals) for double cloth. Figs. 679, 680, 681 and 682, illustrate such a case.

Fig. 680 represents a diagonal on 6-harness and 12 picks repeat, as used for face.

Fig. 681 shows the common plain as used for back.

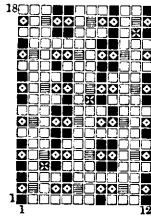


FIG. 679.



FIG. 680.



FIG. 681.



FIG. 682.

Fig. 679 illustrates the complete double-cloth weave, 12 warp-threads and 18 picks repeat. The combining of face and back cloth is shown separately in Fig. 682.

*G. 3 ends face to exchange with 1 end back in warp and the filling.*

These are illustrated in one example by weaves, Figs. 683 to 686.

Fig. 684 represents a 12-harness fancy twill to be used for face-weave.

Fig. 685 shows the common plain to be used for backing weave.

Both cloths are combined into one fabric with the  $\frac{1}{3}$  4-harness twill shown in Fig. 686. Repeat of double-cloth weave, Fig. 683: 16 warp-threads and 16 picks.

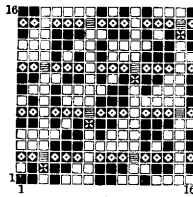


FIG. 683.

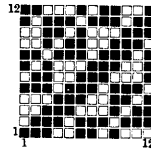


FIG. 684.



FIG. 685.



FIG. 686.

The foregoing 57 weaves have clearly demonstrated that double-cloth weaves may be designed in any combination, from 1 face, 1 back in repeat, to 3 face, 1 back; also that these proportions may be taken independently for warps or for filling in any weave. The binding has mostly been done by the back-warp, yet it has been shown that the face-warp can also be used. In closing this subject on the construction of the double-cloth weaves, a further example is shown in which *both methods of stitching* must be combined in one double-cloth weave.

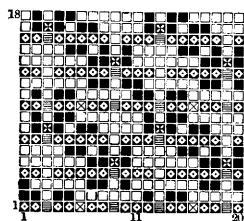


FIG. 687.

Fig. 687 represents such a double-cloth weave.

Repeat: 20 warp-threads and 18 picks. The arrangement of the warp is:

- 3 threads face.
- 1 thread back.
- 5 threads face.
- 1 thread back.
- 10 threads in repeat.

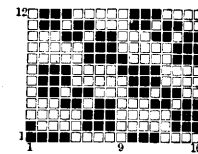


FIG. 688.

The filling intersects 2 picks face, 1 back, = 3 picks in repeat.

On examining the weave we find the centre thread of the 5 face-ends used for interlacing twice in one repeat of the weave in the back. The places of stitching the face-warp into the back are shown by  $\otimes$ .

Weave Fig. 688 represents the single-face cloth, being a granite-weave with fancy spot-effects (by the aid of warp-threads numbers 1 and 9.)

### Double-Cloth Weaving without Stitching Both Cloths.

At the beginning of our lecture on the double cloth, and the purposes for which it is used when the two single cloths are not stitched together so as to form a new fabric, we mentioned the manufacture of seamless bags and fabrics constructed on similar principles. In manufacturing seamless bags a series of panels are formed, each composed of two separate cloths, a series of solid webbings uniting the cloths of the panels, and a series of divisions formed in the solid webbings, each of which are composed of two separate cloths. Diagrams Figs. 689, 690, 691, 692 and 693 are intended to illustrate the method of weaving such seamless bags. (Hardenbrook's patent.)

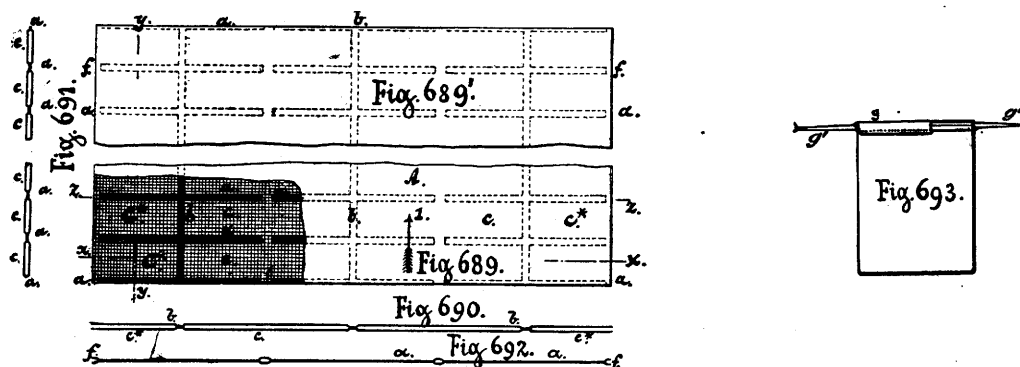
Figs. 689 and 689<sup>1</sup> represent a plan view of the fabric.

Fig. 690 is a transverse section of the same in the plane  $x x$ , Fig. 689.

Fig. 691 is a longitudinal section in the plane  $y y$ , Fig. 689.

Fig. 692 is a longitudinal section in the plane  $z z$ , Fig. 689.

Fig. 693 is a sectional side view of a bag when finished.





A (689) designates a fabric in which the arrow 1 indicates the warp. This fabric consists of a series of panels  $c c^*$ , each composed of two cloths, and of a series of transverse solid webbings,  $a a$ , and longitudinal solid webbings  $b b$ , in which the filling is interwoven with all the warp-threads of the fabric, producing purely single cloth with the latter at places mentioned. The outside edges, as to width of fabric in the loom, may either be temporarily closed with a few threads of plain working selvage, which may be liberated after the fabric has left the loom; or the fabric can be woven without specially uniting the two fabrics in such manner. The commencement and the ending of the weaving of the fabric in the loom is formed in each case by one of the transverse solid webbings  $a$  (single cloth). If the fabric is cut lengthwise through the centre of the longitudinal solid webbings  $b b$ , and through the centre of the divisions, and also transversely through the middle lines of the solid webbings  $a a$ ,  $f f$ , a number of bags are produced, and it will be seen that the bags produced from the side portions,  $c^* c^*$ , of the fabric have selvages at their mouths, while all the others produced from the centre portions,  $c c$ , will have raw edges at their mouths).

The size and the shape of the bags is unlimited and is readily regulated by the changing of divisions (purely single-cloth weaving) or openings (double cloth not stitched).

From the explanations and illustration given it will readily be seen that in cutting up the fabrics represented in the drawings a number of bags are formed, the mouth of each being



composed of two single cloths projecting beyond the solid webbing, so that they can be turned back upon the body of the bag (see Fig. 693) to form the tube *g*, for the reception of the drawing strings *g*<sup>1</sup>, or simply hems to protect the raw edges.

Fig 694 illustrates the double plain weave (two plain woven cloths), without combining or stitching required to produce the openings, while the common rib-weave, Fig. 695  or the common plain weave Fig. 695<sup>2</sup>  is used for forming the divisions in the fabric (purely single cloth.)



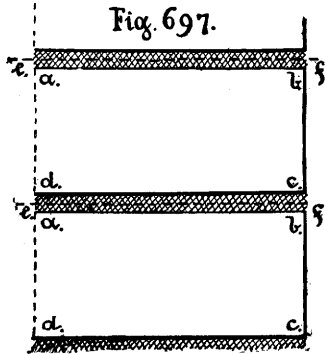
These bags are used mostly for tobacco, salt, flour, etc., or pockets for trouserings, coats, suitings, etc. Frequently seamless bags of a larger description are required to be made, extending in their length over the entire width of the loom. In such case the double plain weave is arranged for two successive picks in each cloth, as shown in  Lower side of bag on loom. Fig. 696. Warp-threads 2 and 4 and picks 3 and 4 forming the lower fabric, and warp-threads 1 and 3 and picks 1 and 2 forming the upper fabric.  S.

FIG. 696.

Only one shuttle being used the filling will form the bottom of the bag at the point where the filling, after leaving one cloth, changes into the other cloth. For example, in the present weave, suppose we commence to insert the shuttle in pick 1 from the right to the left, or in the direction of arrow *S*, below the weave; the shuttle and its filling, after leaving shed 1 of the upper cloth, will return in the *same* cloth on its return (left to right), but will insert itself in the lower cloth on pick 3 by interlacing with the warp and filling of the lower fabric; returning in the same fabric at the opening of shed (pick) 4, ready to change again (combining both single cloth for forming the bottom of the bag) from the lower cloth to the upper (the starting point in the present example).

Before and after weaving the required width of the bag (double plain interlacing on one side of the fabric), the entire number of warp-threads are arranged to interlace on the common rib-weave shown in Fig. 695 (in purely single cloth). Fig. 697 illustrates itself, by the aid of the foregoing explanation, as follows: *a, b, c, d* inside size of bag produced on weave 696. The shaded part between the two bags represents the purely single-cloth fabric interlaced upon the common rib-weave (Fig. 695); *b* to *c* = bottom of the bag, *a* to *d* = opening of the bag. Dotted line *e* to *f* indicates the place for separating the fabric.



In the manufacture of hose and similar textile fabrics the weave given in Fig. 694 (double plain, one end face to alternate with one end back in warp and filling) is used.

**Double Cloth Fabrics in which the Design is Produced by the Stitching Visible upon the Face of the Fabric.**

**WORSTED COATINGS.**

Fabrics of this style are a division of the double-cloth in which the binding of both is arranged so as to form patterns of any required design. This binding of the two fabrics has to be done as firmly as possible all around the outline of the design. The double fabric has to become a single cloth, warp and filling ways, all along the outline of the figure or effect. It has to be bound not only at intervals as in the previously explained stitched double-cloth, but into one compact fabric throughout the entire length of the piece, upon the warp-threads, and across the fabric upon the filling ends which form the outlines of the figure.

Double-cloth fabrics in this arrangement of binding may be made as fanciful as required, but in the manufacture of worsted coatings and similar fabrics they are generally confined to striped and small check figures.

*Textures for these Fabrics and Arrangement for Binding.*

These fabrics are generally constructed on 2 threads face, 1 thread back (binder), and the stitching is done with the back-warp binding over 2 face-picks. For example, take Fig. 698 for the motive of the design and Fig. 699 for the complete weave.

Repeat: 42 warp-threads and 24 picks.

It will be readily understood that the stitching of the back-warp in the face fabric will form impressions on the latter according to the figure employed for the motive of stitching the fabrics. Again, through the places where the double cloth is left unstitched, the fabric will get an em-

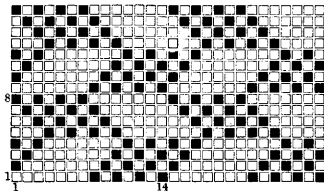


FIG. 698.

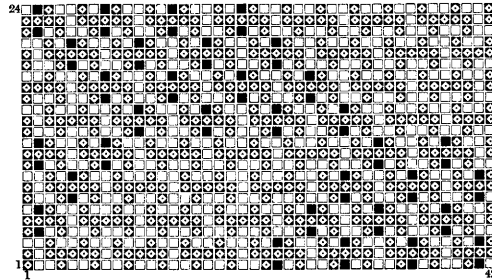


FIG. 699.

bossed effect, similar to that of 2 pieces of cloth embossed with the needle, the binding taking the place of the latter. The cut effect will be more prominent when 2 beams are used, one for the face-warp (ground) and one for the back-warp (binder), and putting more tension on the beam carrying the binder. The  $\frac{2}{2}$  twill for the face, having the backing working on plain weave, may also be used.

Fig. 700. Motive of the effect.

Fig. 701. The complete weave to produce the same, executed on above stated principle  
Repeat: 36 warp-threads and 36 picks.

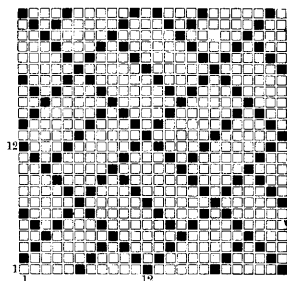


FIG. 700.

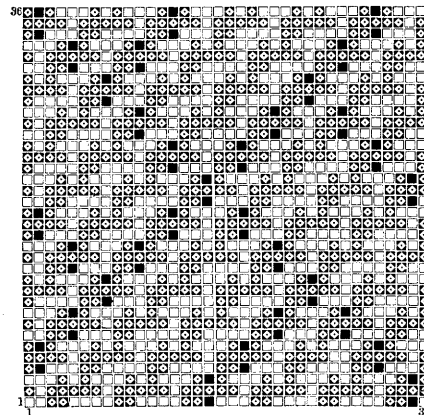


FIG. 701.

In worsted fabrics (also woolen fabrics) forming stripes composed of different weaves, in which it is desired to make the changing from one effect or weave to the other very prominent, by means of a deep or pronounced cut line, use a method similar to the one above explained, *i. e.* "the double-cloth fabric changing into single cloth at the respective last ends of the one weave or effect, and the first ends of the other." The only change observed in the present kind of fabrics, compared with those explained before, is found by combining both fabrics into one through lowering the face-warp into the back filling. In this manner designs Figs. 703 and 705 are constructed.

Fig. 702 represents the motive to weave Fig. 703, and Fig. 704 illustrates the motive for weave Fig. 705.

Fig. 703. Repeat: 18 warp-threads, 6 picks. ◻ for raisers, ◻ and ◼ for sinkers.

Fig. 705. Repeat: 36 warp-threads and 6 picks. ◻ for raisers, ◼ and ◻ for sinkers.

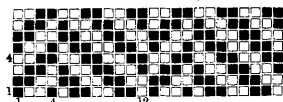


FIG. 702.

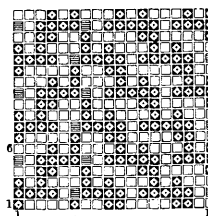


FIG. 703.

### MATELASSES.

These fabrics are chiefly used for ladies jackets or mantle cloth, hence the name "matelasses." The face fabric is mostly silk or fine worsted, the back all cotton, or cotton and woolen. The face and the back are also two separate fabrics, having an extra "wadding" pick between each, which will greatly help to enrich the embossed effect characterizing this line of fabrics. The figure is produced exactly on the same general principle as that explained before. In addition to this

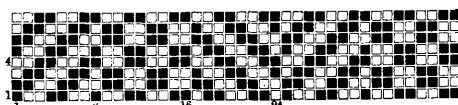


FIG. 704.

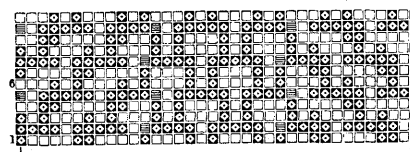


FIG. 705.

binding different weaves for the face effect may be employed by using twills and other weaves in floral and ornamental figures for design. In some of the lighter grades of these fabrics no interior or wadding filling is employed, but simply the two cloths as explained at the beginning of this article. In these fabrics nearly the same effect is obtained for the face appearance, though of course the figures do not stand out as prominently as when wadded, and the fabric is not as stout.

### QUILTS.

#### *Plain Piqué Fabrics.*

Another line of textile fabrics, constructed on the same principle as the coatings and matelasses, is found in quilts, bedspreads, toilet-covers and similar fabrics. These fabrics are generally made in white. In plain piqué fabrics the back-warp forms lines across the fabric. Fig. 706

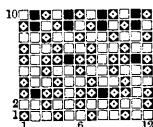


FIG. 706.

shows a draft for such a fabric requiring 4-harness for face-warp, 4-harness for back-warp, = 8-harness.

Repeat: 6 warp threads, 10 picks.

◻ represents the face-warp, ◼ represents the back-warp.

Examination of the design shows:

Picks 1 and 2 interlacing the face-warp on plain weave. Pick 3 is a backing pick, in which the entire face-warp is raised, and also every other one of the back (forming in this manner the first pick of the plain weave for the back). Picks 4 and 5 are a repeat of picks 1 and 2. Pick 6 is a backing pick, in which the entire face-warp is also raised, and also the back warp-ends not raised in pick 3. Picks 7 and 8 are again a repeat of picks 1 and 2. Thus far the weave has

formed two separate fabrics, each one worked on its own system of threads. By picks 9 and 10 these fabrics are united into one cloth by raising the back-warp into both picks and working the face-threads on the plain weave as was done before on picks 1, 2, 4, 5, 7 and 8. This combination of both fabrics gives us the required line across the fabric. If it is desired to produce this fabric for a heavier article, one or two "wadding" picks may be introduced between both fabrics, as in Fig. 707, through pick 5.

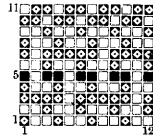


FIG. 707.

- Picks 1 and 2 face.
- " 3 back.
- " 4 face.
- " 5 interior (wadding.)
- " 6 face.
- " 7 back.
- " 8 and 9 face.
- " 10 back.
- " 11 face.

In inferior qualities these fabrics are made by omitting the two backing-picks; hence the binder-warp has to float on the back. The wadding pick taken for these fabrics is of a very heavy size so as to prominently raise the rib effect.

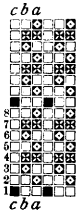


FIG. 708.

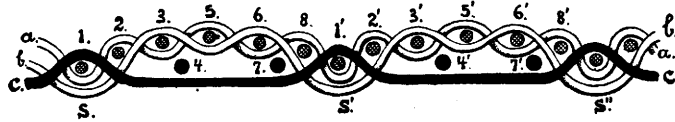


FIG. 709.

Such an example is shown in weave Fig. 708.

Repeat: 2 ends face, 1 end back in warp and 8 picks.

The arrangement of the filling is—

- Pick 1 face, binder.
- " 2 } face, regular.
- " 3 }
- " 4 wadding.
- " 5 } face, the same as picks 2 and 3.
- " 6 }
- " 7 wadding.
- " 8 face, the same as picks 2 or 5.

Diagram Fig. 709 illustrates the section cut of a fabric interlaced with weave, Fig. 708.

*Figured Piqué.*

These fabrics are also executed on the principle of the double cloth. Both cloths are quite plain in their weave, but the face is much finer than the back. White is the color in which they are generally made. A "wadding" pick may be used to give bulk to the cloth, and the embossed effect likewise characterizes these fabrics. The design for the fabric is also formed by binding both cloths together. The thicker the wadding and the larger the figure required to be designed, the more prominent will be the effect. In many of the lighter fabrics no wadding pick is used, but the two cloths are simply stitched together.

Fig. 710 illustrates a weave for these kind of fabrics (without a wadding pick). Fig. 711 is the motive of the stitching for effect in Fig. 710.

A consideration of the face-picks will show in every one of them some of the binder-warp up, according to the figure required.

This will easily explain the stitching of the fabric. As both warps are white, no change in color can be seen but the effect will be produced by the weave, as every binding back-warp thread will pull in the face of the fabric, in any place where it is raised on a face-pick, somewhat similar to the stitching together of two bulky fabrics with a sewing machine. Large designs, such as

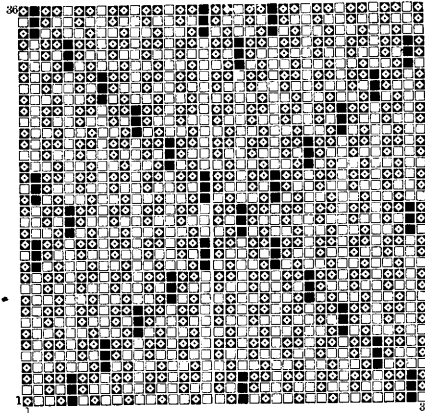


FIG. 710.

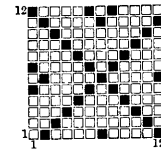


FIG. 711.

flowers, etc., are woven with the Jacquard. As these large figures have a long floating of the binder-warp (back-warp), while not being used for the outline of the figure on the face, the back warp-threads as a consequence float on the back; and as this floating is injurious to the fabric, we must use, in addition to the front-harness for the face-warp, a second set of front-harness for the back-warp (binder), through which the back-warp can be worked on plain.

*Reeding these Fabrics.*

Threads 1, 2 and 3 are drawn in the first dent of the reed; threads 4, 5 and 6 are drawn in the second dent.

**RIB FABRICS.**

Under this division are classified fabrics which, in their method of construction, have high prominent and elevated places exchanging with lower or compressed ones. This method of exchanging is generally arranged to run in the direction of the warp, but can be arranged for a diagonal direction, or even filling ways. The principle of construction of the weaves for these fabrics is nearly related to the common rib-weaves for single cloth.



FIG. 712.

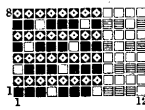


FIG. 713.

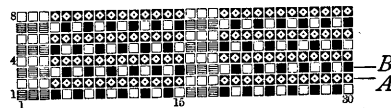


FIG. 714.

Weaves for rib fabrics forming their line (rib) effects in the direction of the warp are generally produced by floating every other pick for 4 to 12 (or more) threads, and then raising these threads so floated for two, three or more warp-threads. The picks situated between them are interlaced either in plain or twill weaves.

For example, Fig. 712. The foundation weave is the common plain weave. Picks 1 and 3 (and picks of uneven number) interlace in the entire repeat (12 warp-threads) on this plain weave, while picks 2 and 4 (and picks of even numbers) technically known as "rib-picks" float below the first 8 warp-threads and over the next (last) 4 warp-threads.

Fig. 713 illustrates a similar arrangement. In this weave the  $3 \text{---} 1$  4-harness twill is used for every pick of uneven number, while the picks of even numbers, the rib-picks, work the same as in the preceding example. Repeat: 12 warp-threads and 8 picks.

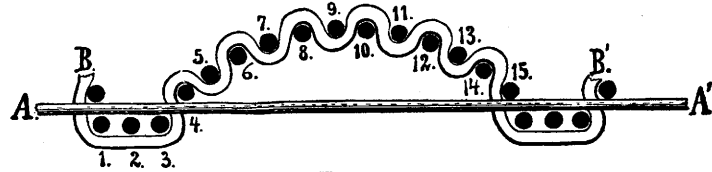


FIG. 715.

Fig. 714 illustrates an example in which every uneven numbered pick interlaces for 12 warp-threads on the common plain weave (floating below 3 warp-threads), while every even numbered pick (rib-pick) floats for 12 warp-threads on the back of the fabric and next forms the face-rib over 3 warp-threads.

Diagram Fig. 715 represents the section cut of a fabric woven with weave Fig. 714. A careful examination of it will show that warp-threads 4 to 15 inclusive must make interlacings with the filling which are not required by warp-threads 1, 2 and 3. To get perfect work and sufficient production it is advisable to have double beams—one beam to contain the first 3 warp-threads, the other the remainder. Repeat: 15 warp-threads and 4 picks.

Another division of rib-weaves is derived by omitting the special rib-pick, using instead of it, every pick to form partways (across the weave) rib-pick and partways regular weave. Every pick in rotation is arranged for "rib-pick" effect (floating on back) when the adjacent picks interlace on common weaving.

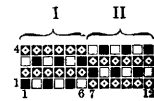


FIG. 716.

This method of alternately exchanging every pick in certain places for "rib-pick" when its preceding and following picks are used for forming the weave (on the face of the fabric), is consumed until the repeat is derived.

Fig. 716 represents such a weave, designed for 12 warp-threads and 4 picks repeat. The float of each pick (for "rib-pick") represents 6 warp-threads as illustrated by a type.

For the remaining 6 warp-threads in the repeat of weave, every pick interlaces with the warp on the regular plain.



FIG. 717.

Diagram Fig. 717 represents the section of weave Fig. 716. This method of using every pick partways as rib-pick (float on back) and partways to interlace with the warp on a weave, and having this arrangement alternated in each adjacent pick will, in addition to the rib-effect produced, prove of great advantage in the manufacture of fancy trouserings, in which every other rib is required to appear in a different color. Using each pick (taken in rotation) with the alternate exchanging of two colors, each alternate pick the same, will (using one color for warp over the entire width of the fabric) produce the above mentioned effect. Such stripe effects will be yet more prominent if the warp in color arrangement is used according to the filling forming the weave.

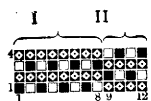


FIG. 718.

Weave Fig. 718 illustrates a rib-weave constructed on the same principle as weave Fig. 716. The distinction between them is the difference in size of ribs forming the new weave. Warp-threads 1 to 8 form the large rib I while the smaller rib II ( $\frac{1}{2}$  the size of I) is formed by warp-threads 9, 10, 11 and 12.

Fig. 719 illustrates a rib-weave in which the 4-harness  $\frac{2}{2}$  twill is used for the face-weave, every pick being used for one-half the repeat in width of weave for floating, thus forming ribs of equal size.

Repeat of weave: 16 warp-threads, 8 picks.

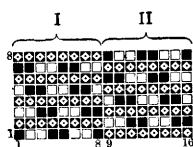


FIG. 719.

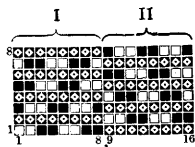


FIG. 720.

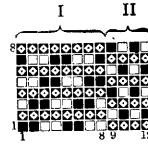


FIG. 721.

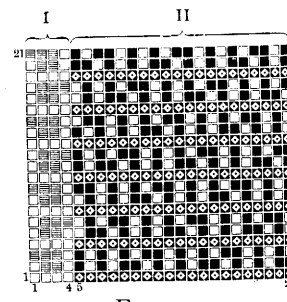


FIG. 722.

The direction for running the twill in both ribs in weave Fig. 719 is the same, but which is differently arranged in weave Fig. 720.

Fig. 720 has a similar repeat and the same weave ( $\frac{2}{2}$  4-harness twill) for face. The difference is in the direction of the twill in the face-weave, which has a different direction arranged for each rib.

Weave Fig. 721 illustrates a further step in figuring rib-weaves. In this figure rib I is interlaced on its face-weave by the  $\frac{2}{2}$  4-harness twill, and rib II with the common plain. Repeat of weave: 12 warp-threads and 8 picks; rib I calls for the first eight warp-threads; rib II requires warp-threads 9, 10, 11 and 12.

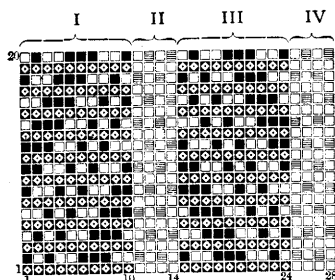


FIG. 723.

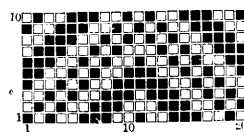


FIG. 724.

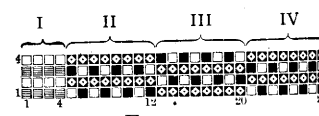


FIG. 725.

Weave Fig. 722 illustrates still another step in the figuring of rib-weaves, observing for the general arrangement 2 face picks, to alternate with one rib-pick. Repeat of weave: 24 warp-threads and 21 picks; rib I is produced by every third pick with the first 4 warp-threads, and rib II by warp-threads 5 to 24, with two successive picks out of three picks in repeat of arrangement, and interlacing as face-weave with the regular 7-harness corkscrew.

Fig. 723. Repeat of weave: 28 warp-threads and 20 picks.

This weave illustrates the application of a pointed twill for face-weave of every other rib, I, III, etc. Every even numbered rib, II, IV, etc., is produced by 4 warp-threads; one pick floating on the face over all four warp-threads (rib-pick in the adjacent ribs) to exchange with one pick interlacing on common plain.

Fig. 724 illustrates the face-weave for Fig. 723, as used for rib I and III. Repeat: 20 warp-threads and 10 picks, and is the pointed twill derived out of the  $\frac{1}{1} \frac{1}{2} \frac{3}{2}$  10-harness, uneven-sided twill.

Weave Fig. 725 illustrates a rib-weave, constructed in four changes. Repeat: 28 warp-threads and 4 picks.

The next sub-division of rib weaves embraces the diagonals. These can be further classified into two divisions. Those designed with an extra rib-pick and consequently an extra face-pick

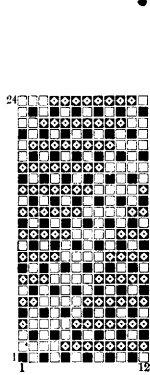


FIG. 726.

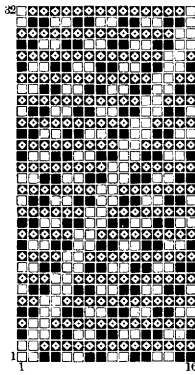


FIG. 727.

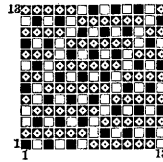


FIG. 728.

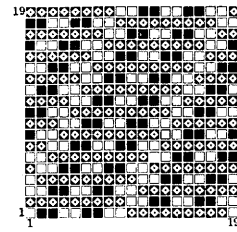


FIG. 729.

(see Figs. 726 and 727), and the diagonal rib-weaves in which every pick is used partways for "rib-pick," and partways for face-pick. In this manner weaves Figs. 728 and 729 are constructed.

Weave Fig. 726 has for its repeat 12 warp-threads and 24 picks. The face-picks interlace in common plain, while the rib-picks float under 8 and above 4 warp-threads.

Weave Fig. 727 requires for its repeat 16 warp-threads and 32 picks. The face-picks have for their weave the  $\frac{2}{2}$  4-harness twill, while the rib-picks in their repeat in 16 warp-threads float under 14 and over 2 threads.

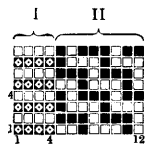


FIG. 730.

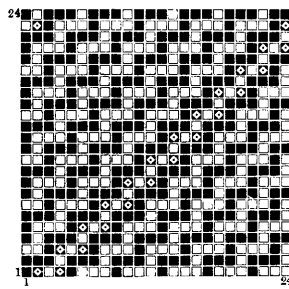


FIG. 731.

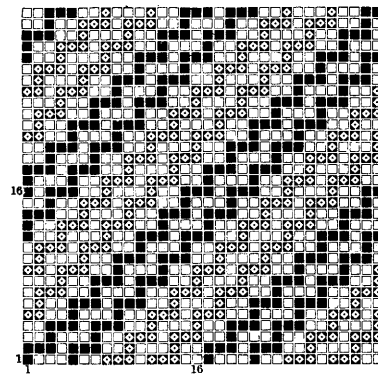


FIG. 732.

Weave Fig. 728, as previously mentioned, is a rib-weave in which every pick is used partways for "rib-pick," and the remaining part forming, by interlacing with the warp, the face-weave. Repeat: 13 warp-threads and 13 picks. Width of rib-float 6 warp-threads, exchanging with 7 warp-threads interlaced on plain weave.

In weave Fig. 729 the same principle, that of using each pick for rib-float and face-pick, is observed. For face-weave a common-twill is used. Repeat: 19 warp-threads and 19 picks. Rib-float is 9 threads, and interlaces in warp for face  $\frac{2}{2} \frac{2}{2} \frac{2}{2} = 10$  threads.



Another method of producing rib-weaves is to combine regular double cloth at certain places with a single cloth. In such cases the fabric when forming double cloth will not be stitched together, as, for example, weave Fig. 730. Warp-threads 1, 2, 3 and 4 form a common plain rib-weave or single cloth, while warp-threads 5 to 12 interlace (without binding) with the filling on the regular "double plain." Repeat of weave: 12 warp-threads and 4 picks.

These rib-effects in double cloth can also be produced entirely by the binding of both single-cloth fabrics. It may be arranged to form ribs in the direction of the warp and effects in a diagonal direction as shown in Fig. 731. Repeat: 24 warp-threads and 24 picks. ■ represents the weave for regular double-plain and ◻ shows the stitching of both fabrics in a diagonal direction for the required rib.

Another step for producing rib-effects in double cloth is taken by exchanging the face-cloth with the back, and the back with the face. This method of exchanging may be arranged to run warp-ways (vertical) or in a diagonal direction. For illustrating this method Fig. 732 has been designed. Repeat: 16 warp-threads and 16 picks.

Fabrics produced by means of weaves designed on the regular double-cloth system, such as weaves Figs. 730, 731 and 732 and other similar weaves, do not have the rib-effect appear so prominent as in the case of the preceding weaves, all of which contain the peculiar pick known as *rib-pick*, *rib-float*, etc., and which *assists*, for the reasons given, to such a great extent in *making the rib-effect prominent*.

### THREE-PLY FABRICS.

It will be readily understood by any one that has carefully studied the structure of two-ply fabrics that by the same method and principles employed in combining two single cloths into one fabric, known as two-ply or double cloth, three such single-cloth fabrics can also be combined into one fabric.

*In the construction of a 3-ply fabric a regular set of warps and filling for each of the three single cloths is required, thus dealing with three systems of warp and three systems of filling in designing.* To impart a more perfect understanding, the construction of a 3-ply fabric from its beginning to the finished weave is shown, and for this purpose three single-cloth fabrics interlaced on the plain weave are selected.

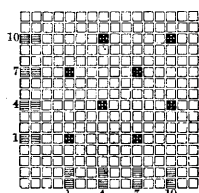


FIG. 733.

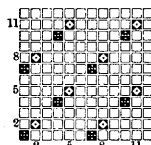


FIG. 734.

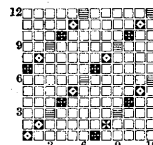


FIG. 735.

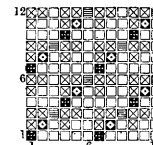


FIG. 736.

Fig. 733 illustrates the first set of the plain weave, or the weave for single cloth number one (■ type). Warp and filling-threads used are numbered on the left side and the bottom of the design, and are indicated by ■ type. "One thread taken and two missed" in each system for the other two single cloths.

Fig. 734 illustrates by ■ on warp-threads 2, 5, 8, 11 and on the corresponding picks, the interlacing of the single cloth number two (plain weave).

In Fig. 735 the interlacing of the third or last single cloth is shown on warp threads 3, 6, 9, 12 and the same numbered picks (■ the type used).

Next, raise for the picks of the lower single cloth (in the 3-ply structure) each warp-thread of the two upper cloths (face and interior cloths); also, raise the warp-threads of the face

cloth on the interior picks. This method of operation is illustrated (successively from Fig. 735) in weave Fig. 736 by ▣ type.

In this is shown:—

- Pick 1, first pick of face cloth.
- “ 2, “ “ interior cloth (face raised).
- “ 3, “ “ back cloth (face and interior raised).
- “ 4, second “ face cloth.
- “ 5, “ “ interior cloth (face raised).
- “ 6, “ “ backed cloth (face and interior raised).

And thus the repeat: 6 warp-threads and 6 picks, allows 2 warp-threads and 2 picks for the structure of each fabric. Weave Fig. 736 thus produces three distinct single cloths resting in the

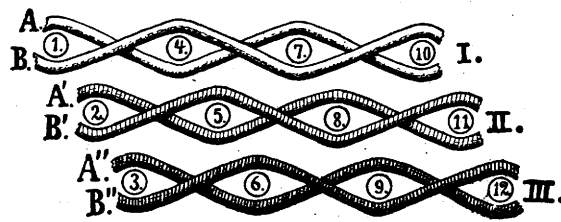


FIG. 737.

loom after being woven one above the other, as shown in the sectional cut in diagram, Fig. 737. The next process is the combining of these three single cloths into one fabric, which is technically known as the “stitching.” To effect this in a proper manner combine the backing-cloth to the interior cloth, and this in turn to its face.

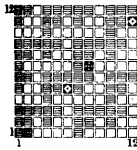


FIG. 738.

In weave Fig. 738 this method of “stitching” is clearly indicated. In this figure the ▣ type illustrates the three single-cloth fabrics, equal to the weave illustrated in Fig. 736 by four different characters of type. In Fig. 738 ▣ illustrates the stitching of the interior cloth to the face-cloth, and the ▣ the stitching of the back-cloth to the interior cloth.

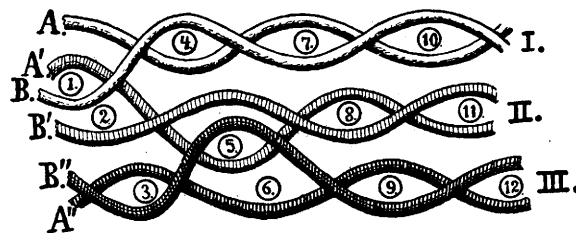


FIG. 739.

Diagram Fig. 739 illustrates the section of a 3-ply fabric interlaced by means of the weave previously shown (Fig. 738).

#### FOUR AND FIVE-PLY FABRICS.

Sometimes it is desired to have produced fabrics constructed out of more than three single cloths.

Weave Fig. 740 clearly illustrates the construction of a 4-ply fabric.

The ▣ type represents the interlacing of the four single cloths.

- on picks 1 and 9 illustrates the stitching of the second cloth to the face (or first) cloth.
- ▣ on picks 2 and 10 represents the stitching of the third cloth to the second.
- ◻ on picks 7 and 15 illustrates the stitching of the back cloth to third cloth, and which completes the stitchings of the four single-cloth fabrics into one, and technically classified as “four-ply.”

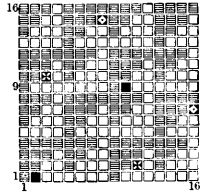


FIG. 740

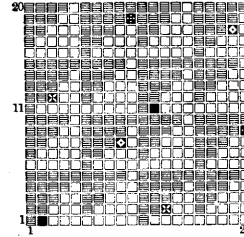


FIG. 741.

Weave Fig. 741 shows the construction of a 5-ply fabric.

- type represents the interlacing of the five single cloths.
- type on picks 1 and 11 illustrates the stitching of cloths 1 and 2.
- ▣ type on picks 2 and 12 illustrates the stitching of cloths 2 and 3.
- ◻ type on picks 8 and 18 illustrates the stitching of cloths 3 and 4.
- type on picks 9 and 19 illustrates the stitching of cloths 4 and 5.

And thus closes the complete stitching of the four single-cloth fabrics into one, technically known as “five-ply.”



## Pile Fabrics.

Textiles classified as "pile" fabrics, form a separate sub-division of woven articles, and are characterized by the soft covering which generally overspreads and conceals, to a great extent, the interlacing of the warp and the filling. In this division of textiles, are to be found some of the grandest and most complicated products of the loom. In every pile fabric one series of threads is employed for producing the ground of the fabric, while a second forms the pile, so that two distinct systems of warp or of filling are always necessary in the manufacture of these fabrics.

Technically, they are divided into pile fabrics in which the pile is produced by an extra filling, and pile fabrics in which the pile is produced by a separate warp in addition to the ground warp. The greatest variety of effects can be produced in the latter sub-division, and fabrics produced on this principle of weaving, find a very extensive use.

### Pile Fabrics Produced by Filling.

#### VELVETEENS, FUSTIANS, CORDUROYS.

These fabrics require for their construction one kind of warp; also, in most fabrics, one kind of filling. If one kind of filling is used the same is consequently employed for the "pile" picks and the "ground" or "foundation" picks of the pattern. If two kinds of filling are used, one kind is employed for the pile and the second kind produces the foundation-cloth. In preparing the design, the arrangement for the ground and pile picks, is either alternately one pick pile, one pick ground, or, two picks pile, one pick ground, or, three picks pile, one pick ground, four picks pile, one pick ground, etc. The arrangement indicated as the second method is the one most generally used. For the ground structure of the fabric, "the plain-weave," or, "the double plain, warp-ways," or, "the 3-harness twill," or, "4-harness even-sided twill," are the ones most frequently used. In any of these cases the filling for the pile is floating over 3, 5, 7 or more warp-threads.

The floats of the pile are afterwards cut open with a knife constructed especially for it. This method of cutting the pile for the fabrics is old, and dates back to the beginning of the fifteenth century.

#### *Cutting the Pile by Hand.*

This procedure is as follows: The fabric is stretched on the cutting table, which has (in most instances) a length of from 55 to 70 inches, and is fastened to it by means of clamps. Next, the cutter takes his knife for cutting the pile, which consists of a long steel bar formed into a very sharp knife at its end, and provided with a guide, consisting of a narrow piece of sheet-iron doubled and forming a groove, fitting on the knife; the part of this piece of sheet-iron extending from the knife, is formed into a needle, of a length which is regulated by the length of the pile to be cut. The cutter inserts the needle into the row of floats which is nearest to the selvage, and pushes the knife (in direction of the warp) through the entire floats in the one direction; the next row of floats is treated in the same manner, and this is continued until all the rows are cut. In the lower grades of these fabrics, only every other row of floats is cut, and consequently the thickness of the pile is reduced in proportion. Again, stripes of cut and uncut pile (regulated as to dimensions in width entirely at will) are produced.

After cutting open the pile over the surface of the table, the clamps are opened and the next length (of 55 up to 70 inches) is fastened. This process is repeated until the entire piece has its pile cut. Every length of the table generally calls, in the lower qualities, for 500 to 600 runs, while the better grades require from 800 to 1200 runs in a single width of those fabrics. This

cutting by hand is naturally a very slow and expensive job. (Flour-paste is often applied to the back of the fabric, so as to make the cutting of the pile easier and safer.)

Of late years, machines have been invented to cut this pile and have proved successful to a certain extent.

After cutting the pile and subsequently mending any imperfections, either produced during the process of weaving or cutting, the fabric is turned over for the dyeing and finishing.

*Designs for Weaving these Fabrics.*

As mentioned already, one warp is used both for interlacing the ground and binding the pile-filling. The ground-weave is generally either  $\blacksquare$  or  $\blacksquare\blacksquare$  or  $\blacksquare\blacksquare$  or  $\blacksquare\blacksquare$  etc., while the pile-filling is floating 3, 5, 7 or more ends.

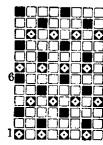


FIG. 742.



FIG. 743.

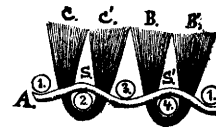


FIG. 744.

Fig. 742 represents a common weave used for these fabrics, and constructed with a texture of 4 warp-threads, 6 picks in one repeat of the pattern.  $\blacksquare$  are the pile-picks,  $\circ$  the ground-picks. Pile, 1 up, 3 down. Ground, "plain," two picks pile to alternate with one pick ground.

Fig. 743 represents the sectional cut of the woven fabric before the pile is cut.

Fig. 744 represents the corresponding section with the pile cut. The letters and numbers in both designs are identical.

Pick A is the ground pick. 1 up, 1 down, to be exchanged in pick 4 (not represented in the drawing) by 1 down, 1 up. Picks B and C are the pile picks, which are duplicated in every repeat of the weave. Arrow S in Fig. 743, represents the place for the cutting of the pile for pick B. S, in Fig. 744, represents the pile as cut. Arrow S<sup>1</sup>, in Fig. 743, marks the place and direction for cutting the pile for pick C. S<sup>1</sup>, in Fig. 744, represents the pile as cut. In Figs. 743 and 744 the ground pick is shown outlined, while Fig. 743 has the one pile pick B marked black, and the other pick C illustrated as shaded. Fig. 744 illustrates both pile picks, and equally represented in black.

This change in Fig. 743 has been made to simplify the construction of the fabric and for the benefit of the novice in designing.

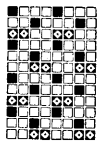


FIG. 745.

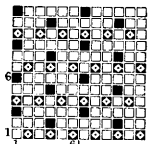


FIG. 746.

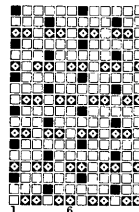


FIG. 747.

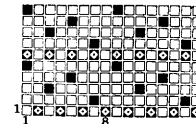


FIG. 748.

Fig. 745.—4 warp-threads, 6 picks in 1 repeat.  $\blacksquare$  equal pile-picks.  $\circ$  equal ground-picks. Pile is produced on 1 up, 3 down. Ground is produced on the common 4-harness rib-weave  $\frac{2}{2}$ .

Fig. 746 represents a weave executed on 6-harness and 6 picks repeat; using for pile-filling ( $\blacksquare$ ) 1 up, and 5 down, while the ground-cloth is formed on the plain ( $\circ$ ).

Fig. 747 is designed for 6-harness, with 9 picks in one repeat;  $\blacksquare$  for pile-filling,  $\circ$  for ground-filling. Pile, 1 up, 5 down. Ground weave, 3-harness twill, warp up.

Fig. 748 represents a draft for a velveteen fabric, having 4 picks of pile-tiling to 1 ground-pick; the pile-filling floating over 7 warp-threads. The ground is interlaced on plain.

A careful examination of this draft will show the possibility of obtaining, by means of the latter, a fabric which will take up the filling easily and yet hold the pile very strongly to the ground-fabric; a point which is of great advantage in producing a firm and perfect fabric; a velvet resisting the wear these fabrics are subjected to so frequently. This draft is designed for a high number of picks to one inch; therefore, if the weight should have to be lowered on account of a considerably less number of picks, this weave must be changed accordingly, so as to bind differently. For example, take picks 7, 8, 9, 10, and move the raisers one thread toward the right hand. If a sufficient number of picks are not in a fabric to warrant the binding of the pile solidly

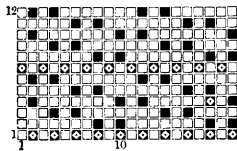


FIG. 749.

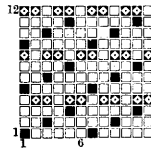


FIG. 750.

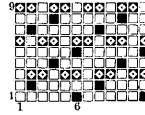


FIG. 751.

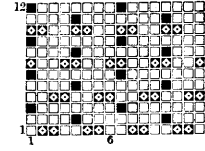


FIG. 752.

to the ground-cloth, by means of binding the former to the latter with one end, two ends up and separated by one thread down, must be used. In this manner weave Fig. 749 is executed, having five plush-picks to each ground-pick. Repeat: 10 warp-threads, and 12 picks. The float of the pile is over 7 threads, and each pile-pick is interlaced to the ground fabric by 1 up, 1 down, 1 up. All the pile-picks interweave under the same warp-threads (use every alternate warp-thread), while one of the two ground-picks intersects over the latter. This arrangement in the design allows the picks to go easy in the fabric and naturally adapts itself for high filling textures.

The proportion of the pile-picks to the ground-picks is always regulated by the required closeness of the pile.

Fig. 750 shows the design for a 3-harness ( $\frac{2}{1}$ ) twill-ground in connection with 3 pile-picks to 1 ground-pick. The design repeats with 6 warp-threads and 12 picks.

Fig. 751 has 2 picks pile, 1 pick ground; the design repeating with 6 warp-threads and 9 picks. Designs Figs. 748, 749, 750 and 751 have pile-picks indicated by ■ and ground-picks indicated by □.

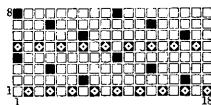


FIG. 753.

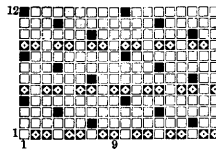


FIG. 754.

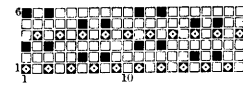


FIG. 755.

Fig. 752 represents the float  $\frac{1}{7}$  for the pile, (■) interlaced in a ground-fabric woven on the 4-harness even-sided twill (□). The arrangement of the pile towards the ground is 2 to 1.

Fig. 753 illustrates the plain ground in connection with the pile-floating,  $\frac{1}{8}$ . 3 picks pile to 1 pick ground; ■ for pile, □ for ground, in design. Repeat of weave: 18 warp-threads, 8 picks.

Fig. 754 shows one of the most frequently used designs on a repeat of 9 warp-threads and 12 picks. 3 pile-picks to 1 ground. ■ for pile, □ for ground. Float of the pile-filling  $\frac{1}{8}$ .

Fig. 755 illustrates the plain ground with the pile  $\frac{1}{1} \frac{1}{7}$ . 2 pile-picks to alternate with 1 ground-pick. Repeat of design: 10 threads in warp and 6 picks. ■ for pile, □ for ground.

Having given a complete idea of the construction of plain-faced fabrics, our attention is next directed to corduroys.

#### CORDUROYS.

These fabrics have stripes running the length of the stuff, but may also have them running in a diagonal direction. Again, they may form figures of any description. If forming the regular cords, they may also be made to vary in widths.

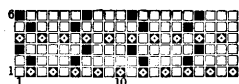


FIG. 756.

Weave Fig. 756. 10-harness and 6 picks repeat of pattern. Ground-fabric is a plain-weave, pile-float,  $\frac{1}{5} \frac{1}{3}$ . 2 pile-picks to 1 ground-pick. ■ for pile, □ for ground.

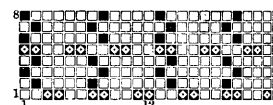


FIG. 757.

Weave Fig. 757. 12-harness and 8 picks repeat of pattern. Ground-fabric, a double plain-weave, warp-ways, pile-float,  $\frac{1}{6} \frac{1}{4}$ . 3 picks pile to 1 pick ground. ■ for pile, □ for ground.

#### CHINCHILLAS—WHITNEYS. (Plain and figured effects.)

These fabrics are produced upon weaves similar to those shown in Figs. 570 to 572. The cutting of the pile filling is done automatically during the finishing process by the "gig," and the pile thus cut is raised by the "whipper." In the construction of these weaves, as well as in arranging the texture, little importance is given to a compact, solid interlacing of warp and filling, especially as the condition of a soft and spongy nature is always required in the finished fabric. In some of these fabrics only two kinds of filling are used, the ground and the pile filling, while others are made with three kinds of filling—the ground, the pile and the interior filling. For fabrics of a plain character (as to face) use weaves such as the 4-harness broken-twill, the 5-harness satin, etc. Filling for face, for the interlacing of the pile or face filling, and the same weave, arranged warp for face, for the ground filling. Such weaves have been previously explained and illustrated in Figs. 570, 571 and 572, page 109.

Regular double-cloth weaves are also used, arranged: 1 end face, 1 end back, 2 ends repeat in warp; 1 pick face, 1 pick back, 1 pick face, 1 pick interior, 4 picks in the repeat. For face-weave the 4-harness broken-twill is generally used (filling up). For back-weave the  $\frac{2}{2}$  or  $\frac{3}{1}$  twill. On the interior pick all the face-warp is raised, leaving the entire back-warp in the lower shed, so that this filling will rest the same as the wadding in the piqué fabric—between the face and back cloth of the fabric. The object of the interior filling is to increase the thickness of the fabric, and to cheapen the cost of manufacture by using a low-grade stock for it, which is neither visible on the face nor the back of the fabric.

As previously mentioned, fabrics of this kind must have a soft spongy nature when finished; so care must be exercised in not weaving them too wide in the loom, as but very little fulling will be required. For the stock for the face or pile filling, select a fine but short staple. After fulling and scouring, or only scouring, the fabric is giggered. The teasels cut the soft pile filling in the centre between the points of interlacing of the latter with the warp, and after running the fabric over the "whipper" before it passes to the dryer, the whipping process (beating) raises each and every single float of filling (fastened by one or more ends of warp to the fabric) and produces a velvet surface. After running the fabric in this condition over the shears, for the purpose of producing an even height of pile, it is put upon the chinchilla machine to have its velvet face rubbed, forming chinchilla rows in the direction of either the warp or the filling, or in a diagonal direction; or forming round knobs known as "Ratinè." The size of the chinchilla effects or the ratinè effect is regulated by the height of the pile, and this by the shearing process. (Two- or three-ply spun face-filling is of more advantage to use than the equivalent size in one-thread compound.)

FANCY OR FIGURED CHINCHILLAS.

These fabrics are produced by arranging the floats of the pile-filling so as to form figures (designs) in the way that the above mentioned pile-filling is fastened to the ground cloth, after having its floats cut.

To illustrate this subject designs Figs. 758, 759, 760, 761, 762, 763, 764, and 765 are given.

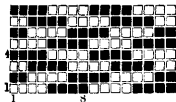


FIG. 758.

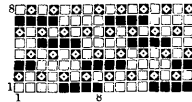


FIG. 759.

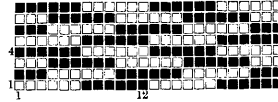


FIG. 760.

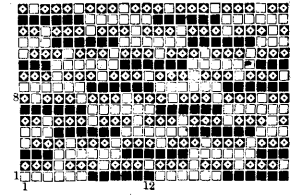


FIG. 761.

Fig. 758 illustrates the face-weave for Fig. 759, the complete weave.

Repeat: 8-harness and 8-picks.

■ are pile-picks, □ are ground-picks.

Fig. 760 illustrates the face-weave for Fig. 761, the complete weave.

Repeat: 12-harness and 8 picks.

■ are pile-picks, □ are ground-picks.

Fig. 762. Repeat: 8 warp-threads and 8 picks.

Fig. 763. Repeat: 12 warp-threads and 36 picks.

Fig. 764. Repeat: 12 warp-threads and 8 picks.

Figs. 762, 763 and 764 are face-weaves for fancy chinchillas, to be arranged either similar to those given in Figs. 758 to 761 or for regular double cloth, using face and back-warp with pile-

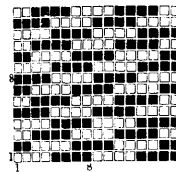


FIG. 762.

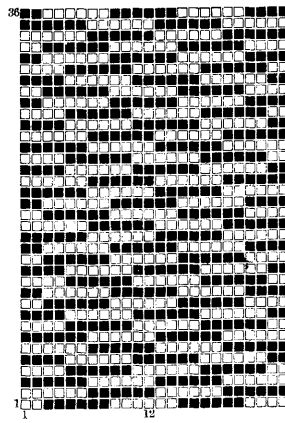


FIG. 763.

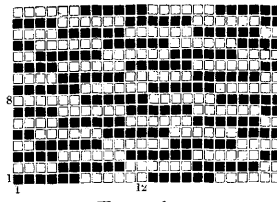


FIG. 764.

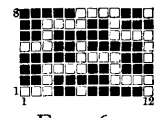


FIG. 765.

filling interior and backing. Fig. 765 illustrates a specimen of the chinchilla weave, specially adapted for producing chinchilla rows lengthways in the fabric.

CHENILLE.

Chenille is a fringed thread and is used either for filling in such fabrics as curtains and rugs, or it is used in its first woven state for ornaments such as trimmings, fringes, etc., for ladies' wear as well as for decorating purposes. (In fringe-weaving the chenille part of the fabric is sometimes produced at the same time that the heading of the fabric is woven. We will later on describe this separate method.)



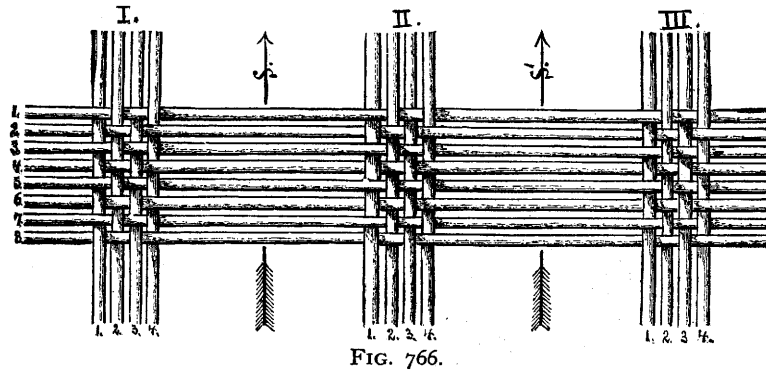
When chenille is used as filling, its fibres extend forward in every direction through the perforations of the fabric, producing a fur-like surface on the goods it is applied to. As a general rule for these fabrics, the chenille forms the main part of the fabric. The remaining part, if warp, or warp and filling, is only used for holding the fabric in its position. There are two methods commonly used in weaving this chenille.

1st. Using 4 warp-threads on common plain weave. 2d. Using 2 or 3 warp-threads on the gauze weave. A short sketch of each method is given.

*Chenille Produced by Using 4 Warp-threads on Plain Weave.*

Procure a set of harness using a plain weave (2, 4, 6 or more shafts). In this draw the warp the same as in regular cloth. By drawing the warp in the reed always put the four warp ends, which have to work together, in one dent, leaving as many dents empty as required, according to the size of the chenille. The filling (which is introduced in the ordinary manner) is bound in plain at the places where the four warp-threads in one dent are situated (see I, II, III in Fig. 766) and floated at the distances where no warp-threads are. After weaving the fabric in this manner it is cut in the direction of the arrows *S* and *S*<sup>1</sup>.

Two methods are employed for cutting chenille. It is done either on the loom during the weaving operation, or after the fabric leaves the loom.



Every set of 4 warp-threads forms one strip of chenille, hence as many sets as are used over the width of the fabric, so many strips are obtained. In figure fabrics where each strip of chenille is required to be of a different arrangement of colors for forming the design, the number of sets used in weaving the chenille indicates the number of fabrics to be set afterwards in the following process. For example: in weaving chenille for dados for turcoman curtains, suppose 140 sets of strips are woven at the weaving of the chenille, and every pick of the dado is to have a different arrangement of colors, the result will give us 70 pairs of curtains to be set. After cutting the chenille into strips they are twisted, every 4 threads of warp being thus formed into one, with the filling-threads extending from it in every direction, and giving it the appearance of a fringed thread. This twisting tends to hold the interwoven filling firmly in the warp-threads, and hence, adds strength to the fabric.

*Chenille Produced by Using 3 Warp-threads.*

The process of manufacture here is the same as in chenille made out of 4 warp-threads on the common plain weave. The only difference consists in employing but 3 warp-threads for the centre of every part of the chenille strips, and interweaving the filling in gauze instead of plain. This process, which certainly will be found more expensive than the first, will in return, give a great deal more strength to the fabric by holding the filling yet more firmly in the warp, and

making the cutting easier and safer. The process of twisting the chenille strips after cutting, as observed in the former fabric, will be the same in this case. (Chenille produced with 2 warp-threads is explained later in a special chapter on Gauze Weaving.)

*Arrangement of Design for Weaving Figured Chenille.*

After the design is finished on the squared paper, it is cut into strips in the direction of the filling, as every line has to be woven separately for the chenille strips. To explain this process, Figs. 767 and 768 are designed.

Fig. 767 illustrates the complete design (border in four colors).

Fig. 768 represents one-half repeat of the design, cut into strips in the direction of the filling.

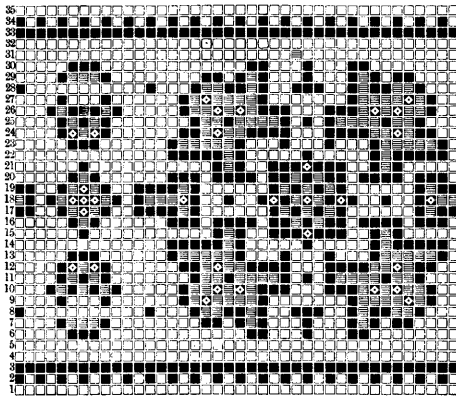


FIG. 767.

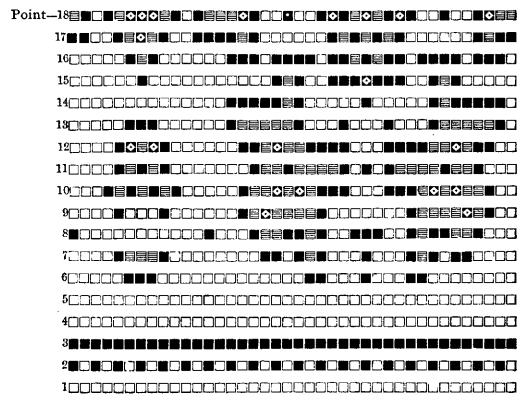


FIG. 768.

In examining Fig. 767 it is found that 35 picks are required for one repeat. The design itself represents a "point figure," picks 1 to 18 and back again. Indicating the colors by type as follows: □ for straw color; ■ for red; ◻ for maroon; ▣ for blue-green, we have :

Strip 1.—All straw color.

" 2.—One pick straw, one pick blue-green, 20 times for one repeat.

" 3.—All blue-green.

" 4 and 5.—All straw color.

" 6.— 5 picks, straw.

3 " blue-green.

13 " straw.

2 " blue-green.

3 " straw.

1 " blue-green.

3 " straw.

2 " blue-green.

8 " straw.

—

Strip 7.—4 picks, straw.

1 " blue-green.

3 " red.

1 " blue-green.

8 " straw.

2 " blue-green.

1 " straw.

7 cont'd.—1 pick, blue-green.

1 " red.

1 " blue-green.

3 " straw.

1 " blue-green.

3 " straw.

1 " blue-green.

1 " red.

1 " blue-green.

1 " straw.

2 " blue-green.

4 " straw.

—

Strip 8.— 1 pick, blue-green.

11 " straw.

1 " blue-green.

3 " straw.

8 cont'd.—1 pick, blue-green.  
 2 " red.  
 2 " blue-green.  
 1 " red.  
 1 " blue-green.  
 2 " straw.  
 3 " blue-green.  
 2 " straw.  
 1 " blue-green.  
 1 " red.  
 2 " blue-green.  
 2 " red.  
 1 " blue-green.  
 3 " straw.

—  
 Strip 9.—4 picks, straw.  
 1 " blue-green.  
 3 " straw.  
 1 " blue-green.  
 6 " straw.  
 1 " blue-green.  
 1 " red.  
 1 " maroon.  
 4 " red.  
 1 " blue-green.  
 7 " straw.  
 1 " blue-green.  
 4 " red.  
 1 " maroon.  
 1 " red.  
 1 " blue-green.  
 2 " straw.

—  
 Strip 10.—3 picks, straw.  
 1 " blue-green.  
 1 " red.  
 1 " blue-green.  
 1 " red.  
 1 " blue-green.  
 1 " red.  
 1 " blue-green.  
 5 " straw.  
 1 " blue-green.  
 2 " red.  
 1 " maroon.  
 1 " red.  
 1 " maroon.  
 1 " red.  
 3 " blue-green.

10 cont'd.—3 picks, straw.  
 3 " blue-green.  
 1 " red.  
 1 " maroon.  
 1 " red.  
 1 " maroon.  
 2 " red.  
 1 " blue-green.  
 2 " straw.

—  
 Strip 11.—4 picks, straw.  
 1 " blue-green.  
 1 " red.  
 1 " blue-green.  
 1 " red.  
 1 " blue-green.  
 7 " straw.  
 1 " blue-green.  
 2 " red.  
 1 " blue-green.  
 4 " red.  
 1 " blue-green.  
 1 " straw.  
 1 " blue-green.  
 1 " straw.  
 1 " blue-green.  
 4 " red.  
 1 " blue-green.  
 2 " red.  
 1 " blue-green.  
 3 " straw.

—  
 Strip 12.—4 picks, straw.  
 1 " blue-green.  
 1 " maroon.  
 1 " red.  
 1 " maroon.  
 1 " blue-green.  
 6 " straw.  
 2 " blue-green.  
 1 " red.  
 1 " maroon.  
 2 " red.  
 4 " blue-green.  
 3 " straw.  
 4 " blue-green.  
 2 " red.  
 1 " maroon.  
 1 " red.

12 cont'd.—2 picks, blue-green.  
2 " straw.

Strip 13.—5 picks, straw.  
3 " blue-green.  
6 " straw.  
1 " blue-green.  
5 " red.  
1 " blue-green.  
3 " straw.  
1 " blue-green.  
3 " straw.  
1 " blue-green.  
3 " straw.  
1 " blue-green.  
5 " red.  
1 " blue-green.  
1 " straw.

Strip 14.—14 picks, straw.  
5 " blue-green.  
1 " red.  
1 " blue-green.  
5 " straw.  
1 " blue-green.  
5 " straw.  
1 " blue-green.  
1 " red.  
5 " blue-green.  
1 " straw.

Strip 15.—6 picks, straw.  
1 " blue-green.  
11 " straw.  
1 " blue-green.  
1 " red.  
1 " blue-green.  
2 " straw.  
3 " blue-green.  
1 " maroon.  
3 " blue-green.  
2 " straw.  
1 " blue-green.  
1 " red.  
1 " blue-green.  
5 " straw.

Strip 16.—5 picks, straw.  
1 " blue-green.  
1 " red.

16 cont'd.—1 pick, blue-green.  
6 " straw.  
3 " blue-green.  
1 " straw.  
4 " blue-green.  
1 " straw.  
2 " blue-green.  
1 " red.  
1 " blue-green.  
1 " red.  
2 " blue-green.  
1 " straw.  
4 " blue-green.  
1 " straw.  
3 " blue-green.  
1 " straw.

Strip 17.—2 picks, blue-green.  
2 " straw.  
1 " blue-green.  
1 " red.  
1 " maroon.  
1 " red.  
1 " blue-green.  
2 " straw.  
4 " blue-green.  
1 " red.  
1 " blue-green.  
6 " straw.  
1 " blue-green.  
1 " red.  
1 " blue-green.  
1 " red.  
1 " blue-green.  
6 " straw.  
1 " blue-green.  
1 " red.  
2 " blue-green.

Strip 18.—1 pick, red.  
1 " blue-green.  
1 " straw.  
1 " blue-green.  
1 " red.  
3 " maroon.  
1 " red.  
1 " blue-green.

18 cont'd.—1 pick, straw.  
 1 “ blue-green.  
 3 “ red.  
 1 “ maroon.  
 1 “ blue-green.  
 2 “ straw.  
 1 “ blue-green.  
 2 “ straw.  
 1 “ blue-green.  
 1 “ maroon.  
 1 “ blue-green.  
 1 “ red.

18 cont'd.—1 pick, maroon.  
 1 “ red  
 1 “ blue-green.  
 1 “ maroon.  
 1 “ blue-green.  
 2 “ straw.  
 1 “ blue-green.  
 2 “ straw.  
 1 “ blue-green.  
 1 “ maroon.  
 2 “ red.  
 —

Pick 19 will equal pick 17. Pick 20 will equal pick 16, and so on until pick 35 is reached, which equals pick 1.

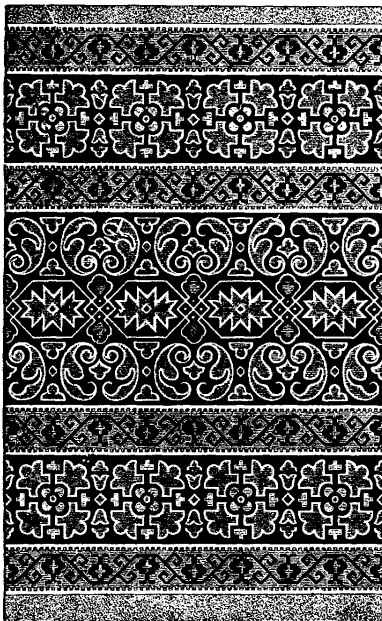


FIG. 769.—Design for Chenille Curtain.  
 (Border.)

automatically in the loom during the process of weaving, and that, the most generally used, which separates the web after it leaves the loom by means of the

Suppose we have 20 picks to 1 inch in the chenille, the repeat of the figure (40 picks) will be 2 inches, or 22 repeats in a curtain 44 inches wide.

According to the width of the loom on which we have to produce the chenille filling and the size of the chenille to be made we find the number of duplicate strips produced the same time.

Suppose we have a loom weaving one yard wide in reed, and want a chenille of  $\frac{1}{4}$  inch diameter (on loom). We ascertain the number of strips of each kind of color-arrangement produced at once, as follows:

$36 \times 4 = 144$  strips chenille of the same color-arrangement, produced at the same time. This equals 72 duplicate strips for 72 pairs of curtains.

If this border should have to be used twice in each curtain (4 strips in the complete pair) we must calculate for 36 pairs of curtains, etc.

Another arrangement for weaving chenille (lower grade) is illustrated and explained in the chapter on cross weaving.

Two methods of separating or cutting the web into the required strips, are in use. That which separates it

### Chenille Cutting Machine.

For illustration of this subject the machine, patented by William McIlwain, has been selected. Fig. 770 is a top or plan view of it. Fig. 771 is a vertical section in line  $xx$ , Fig. 770. (Similar letters of reference indicate corresponding parts in both figures.)

$A$  represents the frame of the machine, on which are mounted rollers  $B C D$ , which feed the chenille fabric into the machine, the rollers  $B D$  receiving motion in the same direction.

$G$  represents a transversely-extending comb, which is secured to the frame of the machine at the end thereof opposite to the roller  $B$ , and  $H$  represents a rotary cutter, whose shaft, mounted

on the frame *A*, receives motion from the pulley *a*. The cutter *H* is formed of a series of circular blades fitted between teeth of the comb *G*, and washers alternating with the blades, the washers serving to adjust the distance between the blades, and in connection with a nut and collar to clamp the blades in position. The comb is vertically adjustable and has above it a pressure bar, *G''*, properly secured to the frame *A*, or a projection thereof, the object being to force the fabric against the comb and hold it firmly and flat during the cutting operation. (Pressure-bar *G''* is

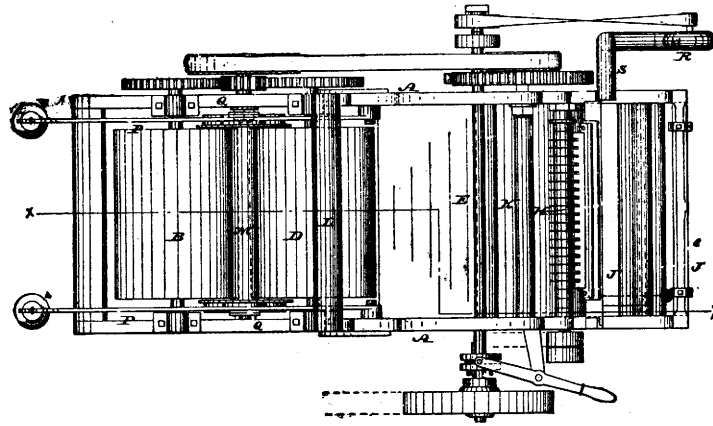


FIG. 770.

removed in Fig. 770.) Mounted on the frame, or the attachments thereof, on opposite sides of the cutter, are tension-regulating rollers *J K*. Secured to the frame, and at the rear end, are transversely extending beams *d e*, around which the fabric to be cut is passed from the roller *D* to the rollers *J*.

*L* represents a roller at the top of the frame *A*, and *M* represents a roller on which the cut chenille is wound. Roller *M* rests on the rollers *B D*, and has its frictional contact with the

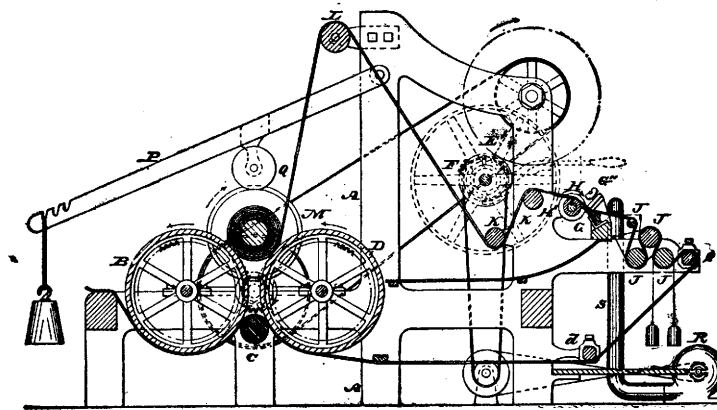


FIG. 771.

roller adjusted by means of weighted levers *P*, which are pivoted to the frame *A*, and carry rollers *Q*, which are in contact with the peripheries of the heads of roller *M*.

Supported on the base of the machine, or on the floor of the apartment, is a fan or blower, *R*, the pipe *S* whereof leads upwardly and transversely, and opens just in advance of the cutter *H*, so as to direct a current of air over the fabric and remove fine particles of the same and dust therefrom. The chenille fabric to be cut into strips is passed under the roller *B* over the roller *C*,

under the roller *D*, under the beam *d*, under and around the beam *e*, under and over the several rollers *J*, and then between the comb *G* and bearing-plate *G'*, where the cutter *H* acts on the fabric, thus severing it into chenille strips, the chenille strips then passing over and under the rollers *K* and over the roller *L* to the roller *M*, on which they are wound. The roller *M* is then removed, and the several lengths of chenille thereon are re-wound or re-rolled on other rollers or spools, and subjected to further operations.

**CHENILLE AS PRODUCED IN THE MANUFACTURE OF FRINGES.**

In fringes and similar upholstery fabrics the chenille is produced through the warp, the filling taking the place of the inside binders. For a practical explanation of this point we refer

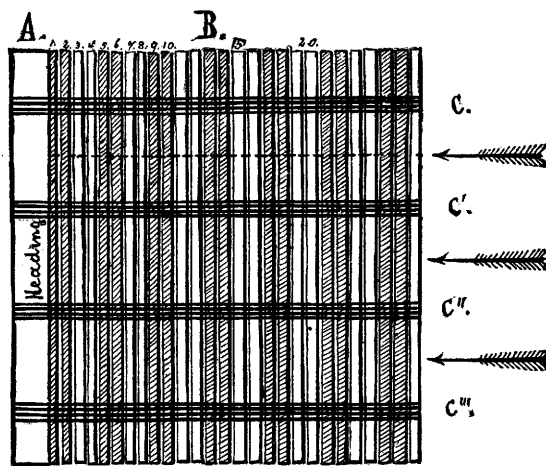


FIG. 772.

to Fig. 772. In this illustration we represent under *A* the heading, under *B* the worsted, wool cotton or silk warp for producing the chenille. *C*, *C'*, *C''*, *C'''*, etc., represent the fine cotton binders interweaving in the heading and chenille part of the fabric (forming the centre of the chenille after cutting). The arrows at the right hand indicate the places where the chenille has to be cut towards the heading as indicated by the dotted line between *C* and *C'*.

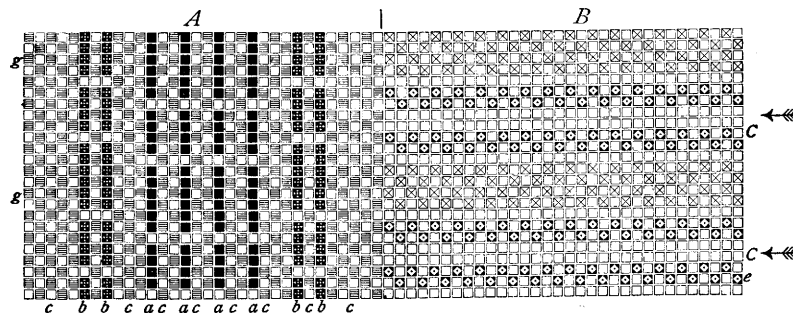


FIG. 773.

Fig. 773 represents the weave for a chenille fringe. *A* is the heading of the fabric and *B* the chenille part. The width of heading in fabric to be  $\frac{3}{4}$  inch; the width of chenille fringe to be from 1 to 3 inches. Three ends of 2-ply loose twisted zephyrs to be used for one end in the

chenille fringe. Two ends of 2-ply 50s cotton used in ground of heading for one end. Two ends of 2-ply zephyr used for one end in figure of heading.

*Specimen Dressing of Heading for Present Example:*

10 ends of 2-ply 50s lt. blue cotton for	5 ends (heddles).
1 " Gold tinsel	" 1 end.
2 " 2-ply 50s lt. blue cotton	" 1 "
1 " Gold tinsel	" 1 "
6 " 2-ply 50s lt. blue cotton	" 3 "
2 " 2-ply lt. blue zephyrs	" 1 "
4 " 2-ply 50s lt. blue cotton	" 1 " } 3 times over = 9
2 " 2-ply lt. blue zephyrs	" 1 "
6 " 2-ply lt. blue cotton	" 3 "
1 " Gold tinsel	" 1 "
2 " 2-ply lt. blue cotton	" 1 "
1 " Gold tinsel	" 1 "
10 " 2-ply lt. blue cotton	" 5 "
—	—
60 ends.	for 32 heddles.

*Dressing for Fringe. (Chenille part.)*

9 ends Zephyrs.	Blue shade No. 1 for 3 heddles.
9 " " " "	" 2 " 3 "
12 " " " "	" 3 " 4 "
12 " " " "	" 4 " 4 "
9 " " " "	" 1 " 3 "
9 " " " "	" 2 " 3 "
12 " " " "	" 3 " 4 "
12 " " " "	" 4 " 4 "
12 " " " Yellow	" 4 "
—	—
96 ends Zephyrs	for 32 heddles.

The □ type in the chenille part of the weave indicates the weave for the cotton cord required to be interwoven for the filling. Hence every filling line in the design containing this type will require 2 separate picks: 1 pick for the heading; ■, ■, and ■ up, □ and □ down; 1 pick for the chenille; □ up, ■, ■, ■ and □ down.

The process of weaving is clearly indicated in the drawing Fig. 774.

In weave, Fig. 773, and fabric sketch, Fig. 774, the letters used for indicating the different systems of threads correspond.

*c* stands for 2 ends of 2-ply 50s light blue cotton (heading).

*b* stands for 1 end of gold tinsel (heading).

*a* stands for 2 ends of 2-ply light blue zephyrs (heading) as used in the different arrangement of colors mentioned before. The arrows in both (weave and sketch) are also on corresponding places.

Fig. 775 represents the finished fabric sample. For the filling for heading, 4 ends of 2-ply light blue worsted are used. For filling for the centre of chenille strip and interweaving in the heading, use 2-ply 60s black cotton.



Weaves Fig. 776 and 777 are two additional specimen designs for chenille fringe.

After the chenille fringe is woven and the heavy cord extracted, the fringe is submitted to a steaming, which process will put the twist into it as required, for a double purpose. *A* for general appearance. *B* for strength, so as to resist a pulling out of threads in the chenille part.

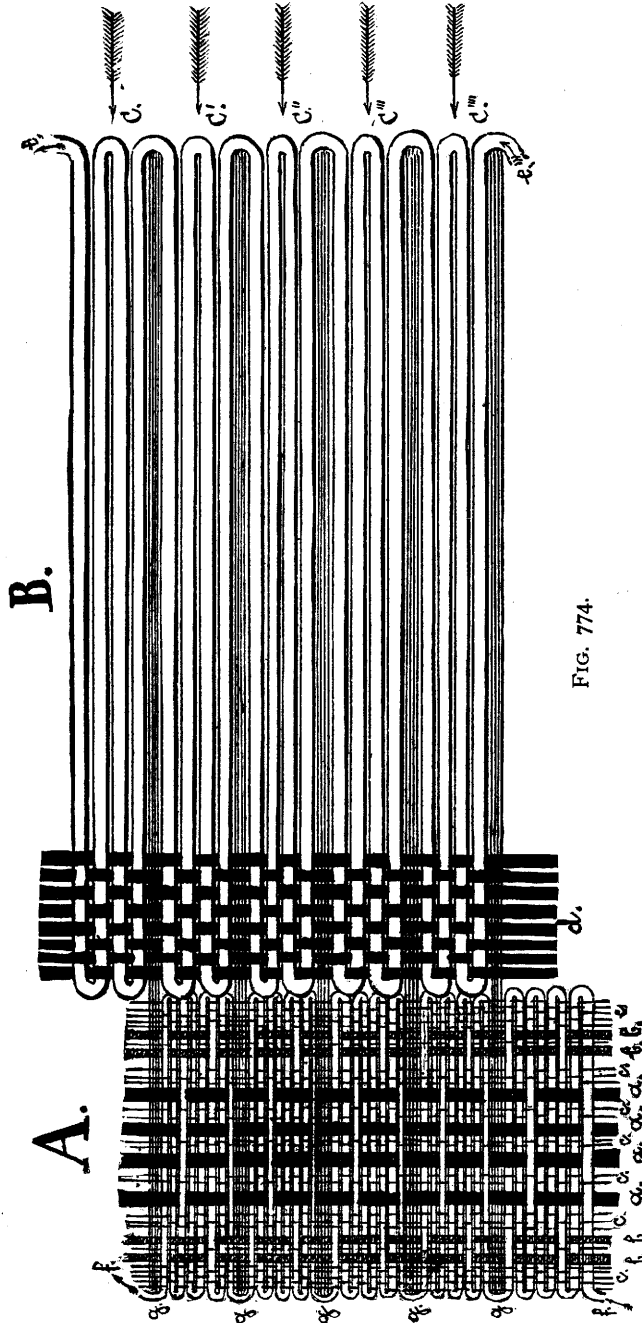


FIG. 774.

Lately this method of producing chenille fringe (in certain fancy effects) has been patented for weaving a double set of fabrics at the same time, thus separately weaving two fillings with two sets of heading warps, at intervals, alternately interweaving the above mentioned fillings with a set of body-warps, and interlacing a temporary filling with these body-warps in alternation with said heading-fillings, and then cutting the body of the fabric so produced between the insertions of heading-fillings and removing the temporary filling.

In diagram Fig. 778 is illustrated such a fabric, having the temporary filling both interlaced and liberated. The body of the fabric is cut and two distinct fringes are produced, each fringe having a series of spaces, and each space of one fringe being slightly wider than the width of two pendants; the spaces and pendants alternating in the fringe.

*A* represents two fringes consisting of the heads *a a* and pendants *b b*. The spaces *c c* between each two pairs being slightly wider than the width of a pair. The fabric of which the fringes are formed consists of a body, *B*, and two heads, *a a*.

In weaving the fringe fabric a cord *d* is thrown into the body at intervals as temporary weft, after the previously explained method of forming "single set" chenille-fringe fabrics. Two shuttles are employed for the heads *a a*, one for each head. The threads *e* from the two shuttles for the heads are

separately woven with the warps *a' a'*, employed for these heads, thus producing two heads, and threads *e* are alternately and at intervals shot past the heads into and across the body, and woven with the warps *d'* thereof, so as to bind the portions of the body, which afterward constitute the axes or cores of the pendants of the fringe, it being noticed that the two

woven heads are alternately connected with the body by such threads  $e$  as are shot into the body at intervals. The cord  $d$  is woven only with the warps  $d$  of the body, and is introduced therein alternately with the filling  $e$ , as shown. When the fabric is finished, the body is cut through between the cords  $d$ , midway between the fillings  $e$ , as usual in making chenille fringe, thus

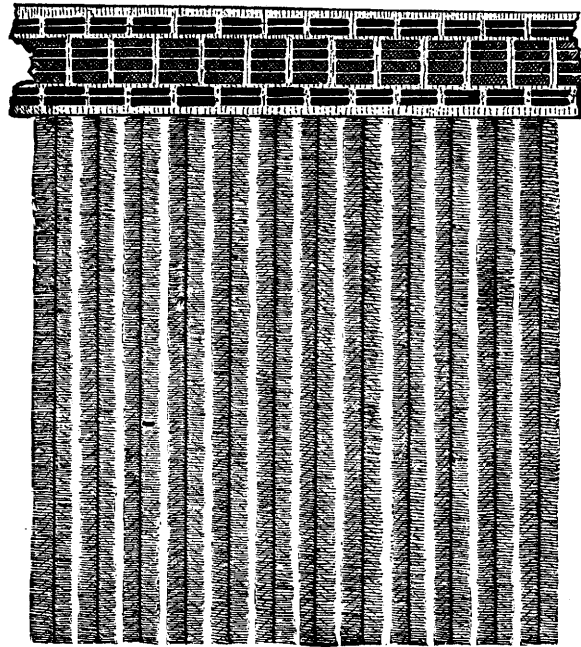


FIG. 775.

severing the pendants, and the temporary filling is removed. It will be seen that by so doing said pendants are separated into two series, one series being connected with one head and the other series with the other head, and the pendants of one series having left among them spaces corresponding with the pendants of the other series. These spaces may be equal

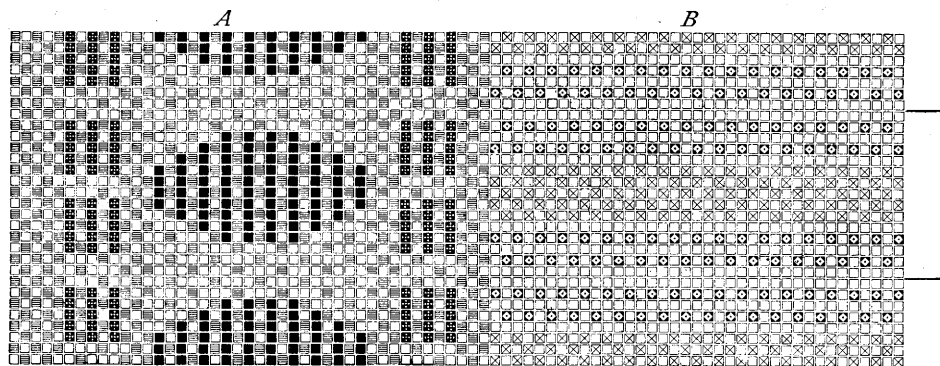


FIG. 776.

to one, two, or more pendants, according as the set of threads  $e$  are thrown across the body from the two heads.

Another method of weaving a double set of chenille fringes at once, and with their pendants attached, is illustrated in Figs. 779 and 780. This method of operation (patented by S. Steinecke) consists in interweaving two separate sets of heading-warps and one series of ordinary body-

warps with a single filling or series of picks, and also a series of temporary picks of another heavier size filling, which is removed in like manner to that of the temporary filling inserted in fabrics previously illustrated.

Fig. 779 represents a plan of the construction of the fabric, showing the pendants in pairs on the opposite headings, some of the fabric being cut so as to form the pendants (as they appear when finished) in pairs on the lower part of the diagram.

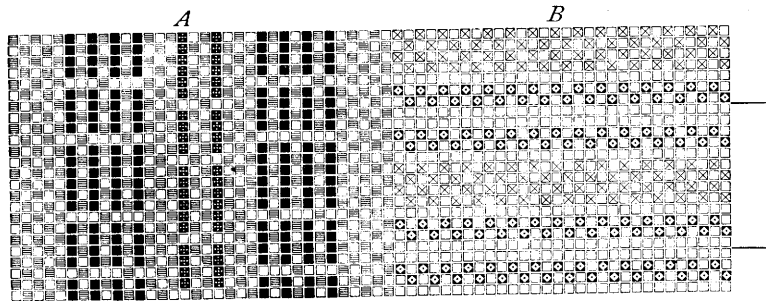


FIG. 777.

Diagram Fig. 780 shows the method of interlacing binder filling which forms the cores of the pendants.

*A A* represent two sets of heading-warps at the sides of the usual body-warps, *B* for forming the pile-threads of the chenille. The warps *A* and *B* are interwoven with the filling *C*, which may consist of a single thread or series of threads, all in the same shuttle.

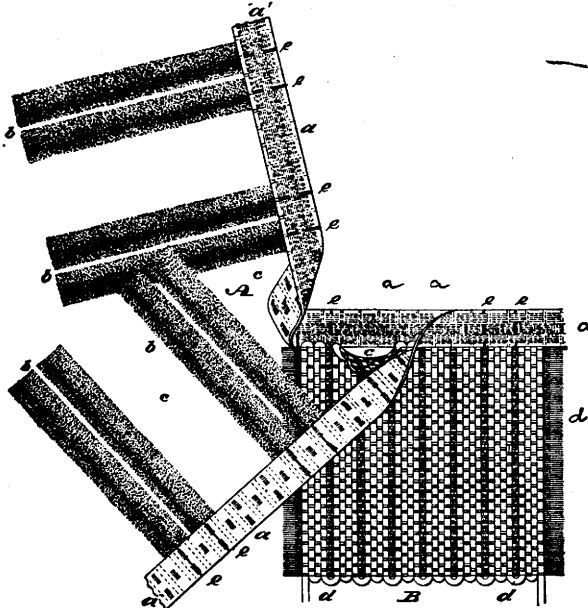


FIG. 778.

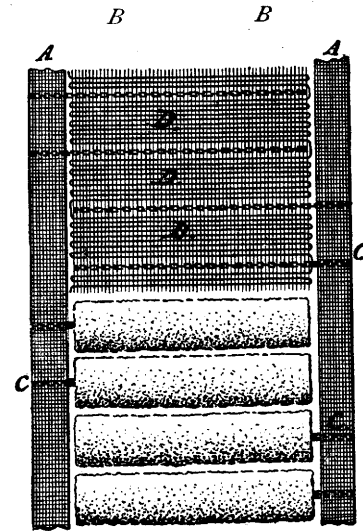


FIG. 779.

The filling is interlaced in the following manner: The filling is interwoven with the left-hand heading-warps *A*, then, with the body-warps *B*, up to the inner edge of the right-hand heading-warp *A* but not with the said right-hand heading-warp *A*; then the intermediate or filling weft, *D*, which is to be removed later on, is interwoven with the body-warps *B*, but not with the headings. After three, four, or more courses of the intermediate weft, *D*, have been formed, the weft-thread *C*

is again interwoven with the body-warps *B* and one of the heading-warps; but in this case the weft *C* is interwoven with the right-hand heading-warp *A*, and with the body-warps up to the inner edge of the left-hand heading-warp *A*, but not with said left-hand heading-warp *A*, and so on alternately, so that, as shown in Fig. 779, the weft-thread *C* is interwoven at regular intervals with the body-warps, and is alternately interwoven with the left and right-hand heading-warps *A*. The warps *B* are then cut parallel with the wefts *C*, midway between them, and the temporary wefts *D* are removed, and thereby two chenille fringes are formed, one on each heading *A*, the pendants being connected alternately with the opposite headings, as shown.

As shown in Fig. 779, the filling can be interwoven in such a manner that in pairs they are alternately connected with the opposite headings, or the first, second and third picks may be interwoven with the right-hand heading, and the next, first, second and third picks to the opposite heading, and so on. In all cases the permanent filling will ordinarily be interwoven with the heading-warps, as shown in Fig. 780, in which case the filling must be severed at the points *a* at both headings. The filling interwoven with the headings, and extending across the warps, form the cores of the chenille pendants.

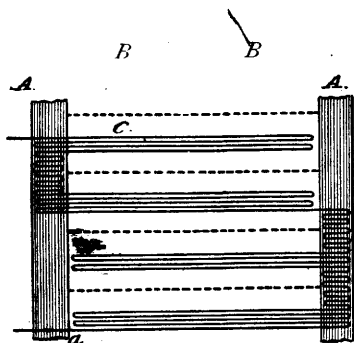


FIG. 780.

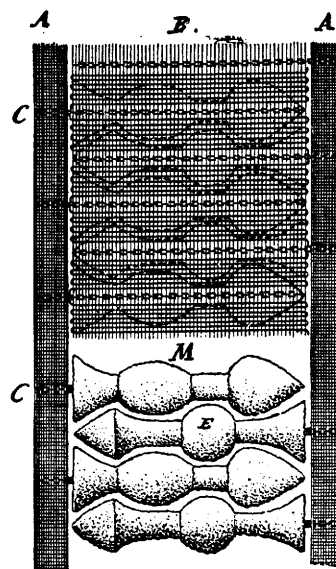


FIG. 781.

In Fig. 781, the previously explained method of weaving a double set of chenille fringes with their pendants attached, is shown as applied to the production of pendants which are shaped so as to have a varying-diameter.

*A A* are the heading-warps; *B*, the body-warps between the two sets of heading-warps.

*C C* filling interwoven with the heading and body warps and forming cores or centres of the pendants *E*. The core *C* of each pendant of the weft is interwoven with one heading warp only, and, as shown in the drawing, the cores of the chenille pendants are interwoven alternately with the opposite headings.

If desired, one, two, or three cores may be interwoven with one heading, and the next one, two, or three cores with the opposite heading, and the cores may be grouped on the opposite headings in any suitable manner.

Temporary filling *M* is interwoven with the body-warps between the picks *C* to form the chenille fabric. Then the body-warps are cut with suitable dies, knives or scissors, between the permanent picks to produce shaped pendants—that is, pendants in which the diameters of the pile-threads vary at different points through their entire length.

### PILE FABRICS IN WHICH THE PILE IS PRODUCED BY A SEPARATE WARP IN ADDITION TO THE GROUND WARP.

As indicated, two kinds of warps are necessary to the production of these fabrics. One warp, the "ground-warp," with the filling, produces the ground or body of the fabric, while a second warp, known as the "pile-warp," produces the face.

In any pile fabric, from the common velvet to the most complicated Astrakan cloth, Brussels, Wilton or tapestry carpet, the method of entwining the ground structure is of a very simple character (either common plain, basket, or a twill of short repeat), while the interlacing of the pile-warp into the ground cloth is of a more complicated nature. In all warp-pile fabrics two methods of producing the pile are essential. Either the pile is left uncut, which is technically known as the "Terry" pile, or the pile is cut, known technically as the "velvet" pile. In addition to these two ground principles for producing the warp-pile, an endless variety of effects and combinations are produced by using various color combinations for each kind, again varying the height of the pile, combining cut and uncut (velvet and Terry effect) pile for forming additional designs in one fabric, etc., etc.

Ground-warp and pile-warp are independent in their operation on the loom, therefore each must be wound on a separate beam, as a different tension and "let-off" is required for each.

In fabrics of a fancy character one beam for the pile-warp will not be sufficient, and the number must be increased for some fabrics to a great extent, in fact in such fabrics as Brussels or Wilton carpets it must be increased to one miniature beam for each individual pile warp-thread.

#### Structure of Warp Pile Fabrics.

Warp-pile fabrics are constructed by raising the pile-warps from the ground cloth over a wire and then interlacing the same into the cloth again. The entire pile-warp may be raised over the wire on a pick, or part of it only. In every case we must be careful to arrange the binding so as to secure the pile proper to the ground cloth. In case we want to raise only a part of the pile-warp at one pick we must, in addition to the binding, arrange the distribution according to the effect required.

#### Terry and Velvet Pile.

In all warp-pile fabrics the same kind of warp yarn may be employed to produce the pile for either the Terry or the velvet effect; but it will be necessary to use different wires if the fabric is to be woven on a power loom. The Terry pile is produced by using a plain wire, as illustrated in Fig. 782, which, when drawn out, leaves the loop intact.



FIG. 783.



FIG. 782.

If "velvet pile" is desired we must use wires of a style similar to that illustrated in Fig. 783, being a wire which has a knife attached to its extreme end. This cuts its way through the pile as the wire is pulled out.

In weaving pile fabrics on a hand loom, frequently one kind of wire is used for producing both Terry and velvet effects of an equal size. This wire is provided with a groove for inserting the knife of the "trevette" when a velvet face is required. Fig. 784 illustrates the section cut of such a wire (see *S*). The knife of the trevette is shown at *A*. *B* represents a warp-thread as cut and secured to the body or ground of the cloth by means of picks 1 and 2, which in the present example represent the two connecting picks to the pick for inserting the wire. If no cutting is required (Terry) the wire is pulled out. Thus it will be seen that the production of velvet or Terry effects in the fabric is effected by cutting, or not cutting, certain pile picks, the change to either effect being entirely at the will of the weaver. The trevette is a frame having a knife fixed

in it for cutting the pile, and is illustrated in Fig. 785 by a front view and in Fig. 786 by a side view. Letters used for indicating the different parts in both designs are used correspondingly.

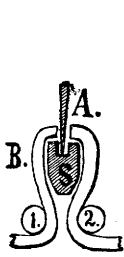


FIG. 784.

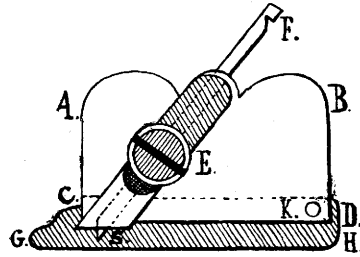


FIG. 785.

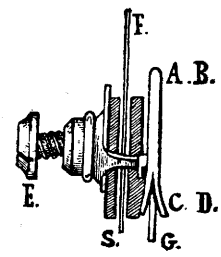


FIG. 786.

The weaver inserts the trevette on the wire to be liberated at the left side of the fabric and runs it quickly over the entire width of the wire.

### Explanations and Illustrations of the Method of Operation in Producing Warp Pile Fabrics.

As previously mentioned, in warp pile fabrics we require two kinds of warp, one for the ground cloth and one for the pile. Each kind of warp is drawn in on its own set of harness, arranging in most every instance the pile warp nearest to the reed.

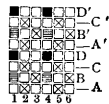


FIG. 787.

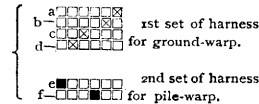


FIG. 788.

In Fig. 787 we illustrate a weave for a pile fabric. Repeat: 3 warp-threads, 4 picks. Arrangement of warp: 2 threads ground (2, 3, 5 and 6), 1 thread pile (1 and 4) = 3 threads in repeat. Filling: 1 ground pick heavy (A), 2 ground picks finer (B and C), 1 pick for inserting wire (D), = 4 picks in repeat.

Fig. 788 represents the drawing-in draft arranged, 4-harness in first set for ground warp and 2-harness in the second set for pile warp. Harness: a, b, c and d for ground; harness: e and f for pile.

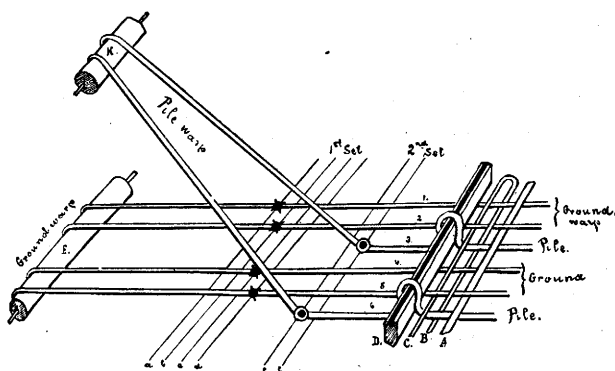


FIG. 789.

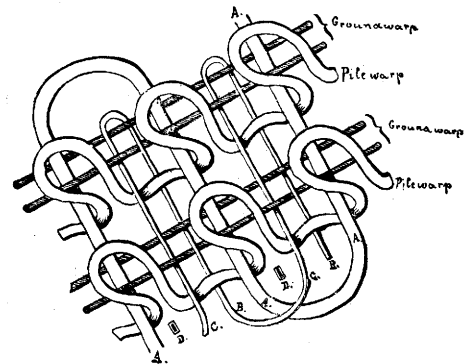


FIG. 790.

Fig. 789 illustrates the method of operation on the loom. Every letter or number used in this diagram corresponds with those used in Figs. 787 and 788, and thus will readily explain itself.

Fig. 790 represents a reproduction in perspective of the fabric as produced with weave Fig. 787. Letters used in this drawing also correspond with those used in Figs. 787, 788 and 789.




In drawing Fig. 789, representing the method of operation for forming pile fabrics, only one wire is shown interwoven. The same will illustrate a principle most frequently observed, *i. e.*, to have the pile warp in the lower shed, both in the pick preceding the wire as well as the one following. This method has a strong tendency to drive the wires into position as well as to keep them there. In some fabrics this method is changed with respect to the pick preceding the wire, but in whatever warp pile fabric to be constructed by means of wires, the pick following the insertion of the wire must have all pile warp-threads, raised as before over the wire, down.

We will now give a short sketch of the method of operation on the hand loom when weaving warp pile fabrics, thus illustrating also a like principle for weaving the same fabrics on the power loom. After the weaver has interlaced the required number of ground picks between the threads of the combined warps, a shed is formed either by raising the entire pile warp-threads in the upper part of the shed and forming the lower part of the shed by means of the ground warp, or by raising only a part of the pile warp in this pick, forming the lower part of the shed by the entire ground warp and also the remaining part of the pile warp. This shed remains formed until the wire has been passed through, extending on each end several inches wider than the selvage threads. Towards this wire so inserted the reed is brought with considerable force, and pushes the wire close towards the previously interwoven ground picks. The shape of these wires is of such a form that, by arranging the latter so that the reed when pressing towards the interlaced part of the fabric comes in contact with the grooved edge, the wire is caused to stand on its lower edge. In this upright position it is maintained by pressing the reed towards the wire until a new shed (ground pick) is formed, in which the filling for the ground cloth is inserted by means of a common shuttle as is done in the ground pick preceding the insertion of the "wire."

By this method of fastening the pile warp over its respective wire to the ground cloth, the latter is also securely fastened to it, and, if an uncut pile effect is desired, requires some effort to liberate it. After inserting the required number of ground picks the process of inserting the wires is repeated, several wires always being retained in the fabric to keep the pile-threads from pulling out of the texture, which would destroy the face. From 6 to 12 wires, according to the material and the method of interlacing the ground cloth, as also the closeness or "height" of texture, are required to remain in the fabric to prevent any possible trouble, as pointed out. The last wire liberated is always the next to be inserted.

We will now proceed to explain and illustrate a few of the most prominent warp pile fabrics.

#### Velvet and Plush Fabrics.

These fabrics are constructed with two kinds of warps. The ground-warp consists either of silk or cotton, and interlaces with the filling on plain , rib , basket , or a 3, 4, 5, 6 harness twill; whereas the pile-warp being of silk, forms the face, through interlacing with the ground-cloth after, or before and after, raising for the wire.

The ground-warp is woven with a tight tension, while the pile-warp is arranged to "take up" easily. The name of the fabric indicates the "cut" character for the pile. As previously mentioned, two beams are necessary, the beam for carrying the ground-warp, and the beam for carrying the pile-warp. The pile-beam must be situated in a higher position (in the rear of the loom) than the beam carrying the ground-warp, so that the pile-threads will run in an oblique direction towards the harness. The proportion of pile and ground-warp as well as the height of texture, and threads per dent, vary for the different qualities.

Arrangements most frequently used are:

2 ends ground to alternate with 1 end pile. or, 2 ends ground to alternate with 2 ends pile.

Or, 2 ends ground, 1 end pile, 1 end ground, 1 end pile, = 5 ends in repeat. Or, 1 ground, 1 pile, 1 ground, 2 pile, = 5 ends in repeat. Or, 1 ground, 2 pile, 2 ground, 2 pile, = 7 ends in repeat. Or, 2 ground, 1 pile, 2 ground, 2 pile = 7 ends in repeat, etc., etc.

The ground-warp and pile-warp are each put on a separate set of harness, generally using 4 successive harnesses for drawing in the ground-warp, and 2 harnesses for the pile-warp.

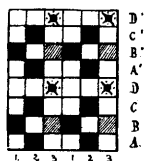


FIG. 791.

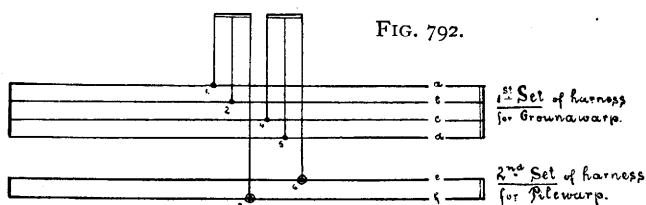


FIG. 792.

For example:

Fig. 791 represents a common velvet weave in which 2 ground warp-threads alternate with 1 end pile-warp. Filling: 3 picks, ground (A. B. C.) to alternate with 1 wire (D).

Fig. 792 illustrates the drawing-in draft with two sets of harness. Harness a, b, c, d for the ground-warp (4), harness e and f for the pile warp (2).

Technically the velvet fabrics are classified as "two-picks velvet," "three-picks velvet," etc., which means that in

the two-picks velvet we use two ground-picks between each insertion of the wire, and in the three-picks velvet three successive ground picks, and so on.

In Fig. 793 we illustrate one of the plainest of the velvet weaves and representing what is technically classified as "the common two-picks velvet" weave.



FIG. 793.

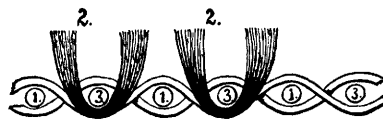


FIG. 794.

Fig. 794 represents the sectional cut of this weave. An examination of this weave will illustrate the following arrangement for each pick:

Pick 1 raises ground warp-thread 1 and the pile.

" 2 " only the pile (wire).

" 3 " " ground warp-thread 2.

Repeat: 3 warp-threads and 3 picks.

Warp: 2 ground-threads to alternate with one pile-thread (this pile can also be a two-fold or a three-fold thread).

Filling: 2 ground-picks to alternate with one pick for inserting wire.



FIG. 795.

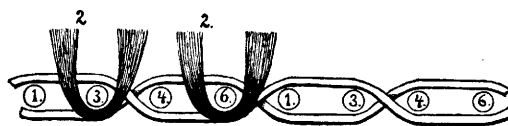



FIG. 796.

In Fig. 795 we illustrate a velvet weave frequently used, which has for the interlacing of the ground cloth the common rib-weave (2 harness and 4 picks 

In this weave we find the ground-picks preceding the pick for inserting the wire, as well as the ground-pick following the latter, call for the raising of the same ground warp-threads (two picks in a shed in the common rib-weave).



Fig. 796 illustrates the section of a fabric interlaced on weave Fig. 795. An examination of each pick will show the following results:

- Pick 1 raises ground warp-thread number 1 and the pile.
- “ 2 “ only the pile (for inserting the wire).
- “ 3 “ only ground warp-thread number 1.
- “ 4 “ ground warp-thread number 2 and the pile.
- “ 5 “ only the pile (for inserting the wire).
- “ 6 “ only the ground warp-thread number 2.

*Repeat:* 3 warp-threads and 6 picks.

*Warp:* 2 ground-threads to alternate with 1 pile-thread (which can also be a two-fold or three-fold thread).

*Filling:* 2 ground-picks to alternate with one pick for inserting wire.

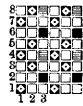


FIG. 797.

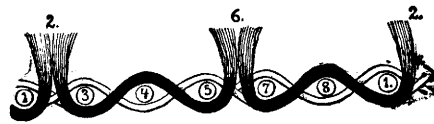


FIG. 798.

In Fig. 797 we illustrate the common “3-picks velvet” weave, which has for its interlacing of the ground-cloth the common plain weave.

*Repeat:* 3 warp-threads and 8 picks.

*Warp:* 2 ground-threads to alternate with 1 pile-thread (which can also be a two-fold or three-fold thread).

*Filling:* 3 ground-picks to alternate with one pick for inserting the wire.

An examination of each successive pick will show the following results:

- Pick 1 raises ground warp-thread No. 1. (Ground-pick 1.)
- “ 2 “ pile-warp for inserting wire.
- “ 3 “ ground warp-thread No. 2. (Ground-pick 2.)
- “ 4 “ ground warp-thread No. 1 and pile-warp. (Ground-pick 3.)
- “ 5 “ ground warp-thread No. 2. (Ground-pick 4.)
- “ 6 “ pile-warp for inserting wire.
- “ 7 “ ground warp-thread No. 1. (Ground-pick 5.)
- “ 8 “ ground warp-thread No. 2 and pile-warp. (Ground-pick 6.)

The section cut of this weave, which is represented in diagram Fig. 798, readily explains the advantages of this weave over the preceding ones, in that it more securely fastens the pile to the ground-cloth, every pile warp-thread being interlaced by  $\frac{1}{1}-\frac{1}{1}$  before it is raised for inserting the wire. Therefore fabrics produced with this weave will be more durable than fabrics interlaced as shown in sections 794 and 796; of course, by using the texture and size of yarn alike in all three examples, the fabric as produced with weave Fig. 797 will be less dense, in appearance of the face, than the others.

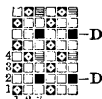


FIG. 799.

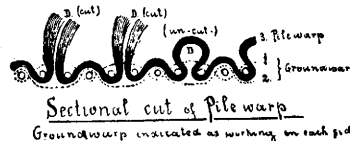


FIG. 800.

In weave Fig. 799 we represent another “3-pick velvet” weave. Diagram Fig. 800 represents the section of a fabric interlaced with weave Fig. 799. Letters for indicating the different threads in weave and section are used correspondingly. Two loops formed by the insertion of the wires are shown as cut, whereas one is represented as uncut.

An examination of the weave will show the following results :

*Repeat* : 3 warp-threads and 4 picks.

*Arrangement of Warp* : 2 ends ground to alternate with 1 end pile.

*Filling* : 3 picks ground to alternate with 1 pick forming the shed for inserting the wire. Picks marked 1, 3, 4, are ground picks. Pick 2 (= *D*) is the pick for inserting the wire. If using a twill weave for interlacing the ground-cloth in a velvet fabric, we generally use not less than 3 successive ground picks to alternate with one pick for the wire. Less ground picks would result in a texture not sufficiently strong to resist the pulling out of the pile by the wear the fabric is put to.

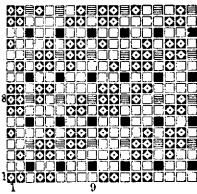


FIG. 801.

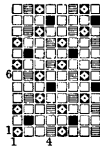


FIG. 802.

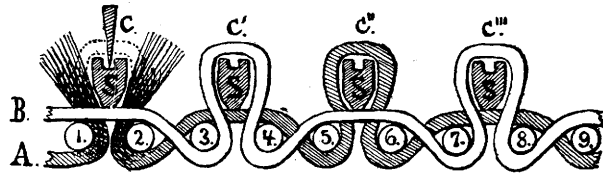


FIG. 803.

In Fig. 801 we illustrate the design for a pile fabric having the  $\frac{4}{2}$  6-harness twill for weave of the ground structure.

*Repeat* : 9 warp-threads and 8 picks.

*Arrangement of warp* : 2 ground threads, 1 pile thread = 3 threads repeat.

*Filling* : 3 ground picks to alternate with 1 pile pick.

The method of interlacing the pile warp to the ground cloth is, in the present example, equal to the one illustrated in Fig. 800.

In place of one pile thread we can also use a two-fold or three-fold thread.

In the manufacture of velvets and plushes, in which no dense pile is required on the face, as also in fabrics in which the material used is rough or too close set, and so liable to “choke” between the raising and lowering of the entire pile warp or *vice versa* the entire ground warp, we raise on every successive pile pick only each alternate pile warp-thread. The proportion of pile warp and ground warp in these fabrics is generally equal; one ground warp-thread to alternate with one thread of pile warp.

In this manner design Fig. 802 is executed.

*Repeat* : 4 warp-threads and 6 picks (4 ground picks, 2 picks for wires).

*Filling* : 2 picks ground to alternate with 1 pick for inserting the wire.

Diagram Fig. 803 represents a sectional view of the method of interlacing both pile warp-threads in the ground cloth in weave Fig. 802. One pile warp-thread, indicated as *A*, is shown shaded and situated behind pile-thread *B*, which is shown in clear outlines. *S* represents the section of a wire as used in hand looms, but which will also demonstrate the section of a wire as used in power looms. *C* represents the section of the knife in the trevette. The first loop is shown as cut, whereas the other three are represented as uncut.

### - FIGURED VELVET.

In these pile fabrics more figuring is possible than in any other kind of textile fabrics. One of the first requisites for figuring these fabrics is the use of different colors for forming designs. Then, again, we can figure successfully by using uncut pile with the regular cut pile, as also by using the common weaving to form figures with the pile weaving. We can also produce new additional designs by means of high and low pile. All these latter methods for forming additional figures will result in the necessity of using a great many beams, and in some fancy figures

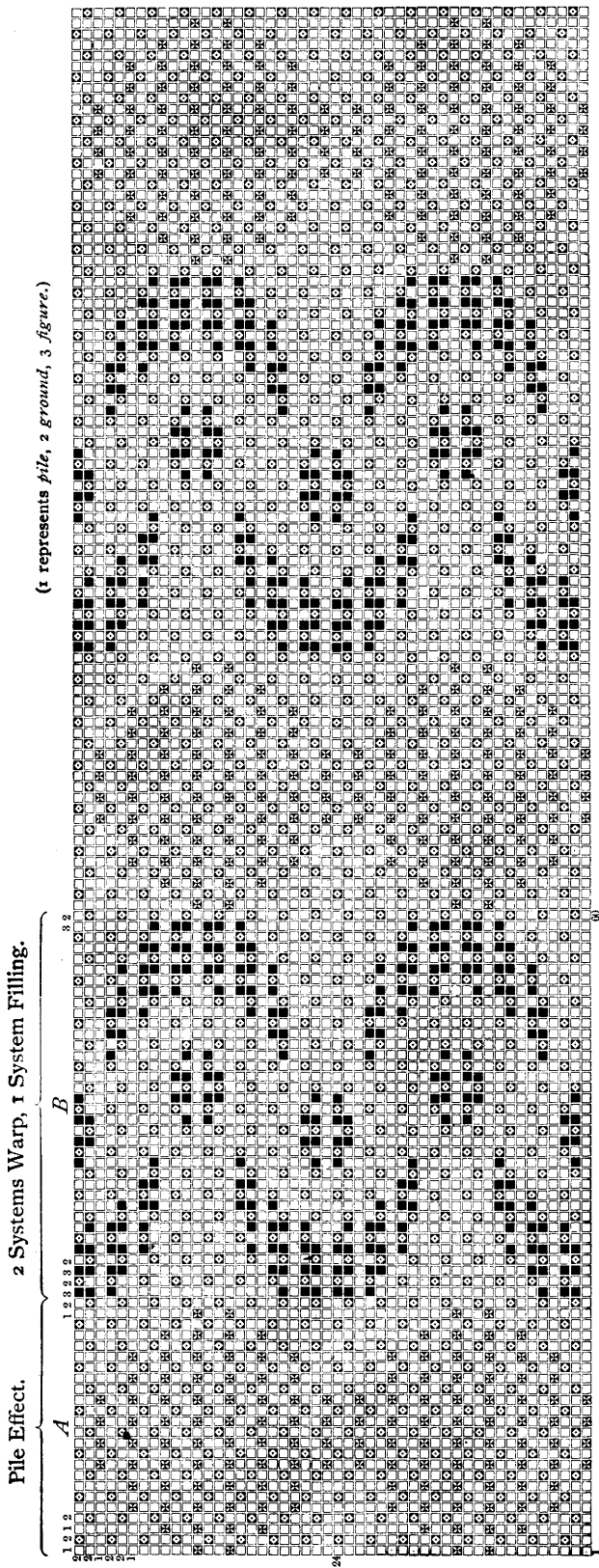


FIG. 804.

produced by harness work as well as all figuring done by means of the Jacquard machine, the number of beams will increase according to figured character of design until a separate small beam "pile-warp spool" for each individual pile warp-thread must be used. In using this arrangement of spools it is advisable to adjust a hack (divider) in rear of the loom, so as to readily find the place of breaking of any thread in the loom during weaving.

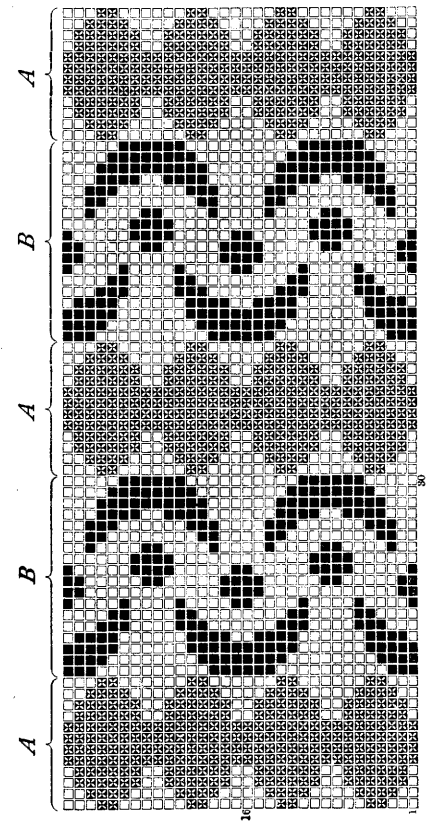


FIG. 804b.

Fig. 804. Combination of figured pile-effects and figure-effects, produced upon two systems of warp and one system of filling.

Arrangement of dressing :

- A, 1 end pile, } 12 times = 24 ends.
  - 1 end ground, }
  - B, 1 end figure, } 18 times = 36 ends.
  - 1 end ground, }
- 
- Repeat 60 ends.

Lowest number of harness possible for drawing in, is 24-harness.

*Filling:* 1 wire (pile), 2 ground.

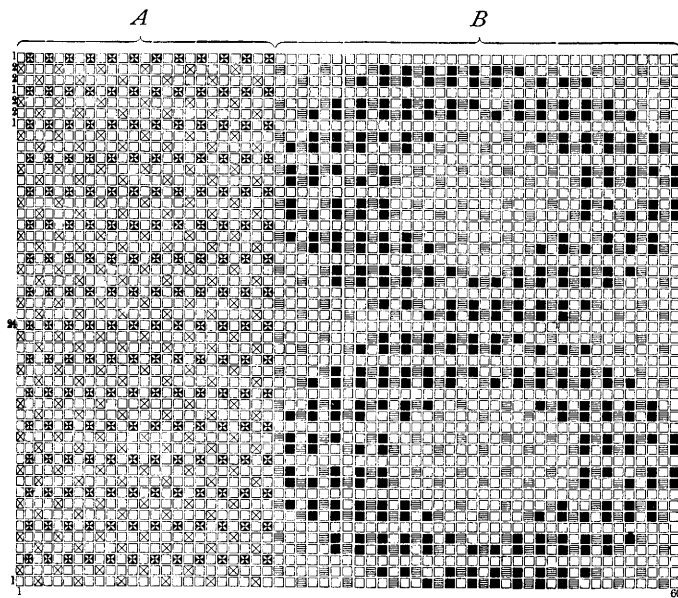
Fig. 804*b*. Motive for weave 804.

■ pile effect. ■ effect produced on ordinary weaving with extra warp.

In both designs (the motive and the weave) three repeats of the pile part and two repeats of the part figured by extra warp (ordinary woven) are illustrated.

Fig. 805. Repeat: 60 warp-threads, 24 picks. Can be reduced, if required, to 21 or 23-harness.

Fig. 805*b*. Motive for preceding weave.



(1 represents pile, 2 ground, filling.)

FIG. 805.

*A. Pile Effect.* Dressing: 1 end pile, 1 end ground, 12 times,  
= 24 ends.

*B. Figure Effect.* Produced upon 2 systems of warp, 1 system  
of filling. Dressing: 1 end figure, 1 end ground, 18 times,  
= 36 ends.

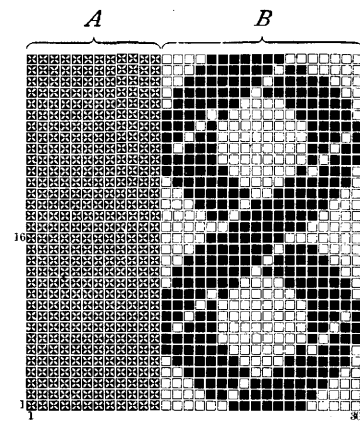


FIG. 805*b*

In both designs (the motive and the weave) only one repeat is shown. ■ for pile-warp. ■ for figure-warp. ■ for ground-warp in pile part of weave. ■ for ground-warp in ordinary weaving part of the design.

### ASTRAKHANS.

These fabrics are also formed by adding an extra pile-warp to a single cloth, otherwise interlaced in plain, basket, rib, or common twill weaves, and are the nearest related (some weaves being exactly the same) to the velvet weaves given in the preceding chapter. We may either cut this pile (plush) or leave the pile uncut (terry); or we may use both methods in the same fabric, producing in this way some of the most beautiful novelties for ladies' cloaking—trimmings, and similar fashionable articles.

#### *Texture of Astrakhan Fabrics.*

The texture of these fabrics requires 2 kinds of warp: *a.* ground-warp, *b.* pile-warp, and one kind of filling (ground). The ground-warp will, by interlacing with the filling, form the

ground or body of the structure, while the pile-warp through being interlaced to this ground structure and raised at certain intervals over wires (as required by the design), forms the face of the fabric.

*Ornamentation of Astrakhan Fabrics.*

Fancy effects upon otherwise plain interlaced Astrakhan fabrics can be produced by various combinations. Among these are found: The use of different colors in the pile-warp; varying

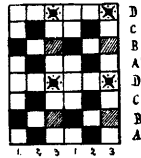


FIG. 806.

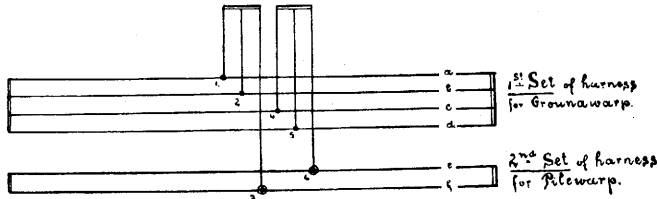


FIG. 807.

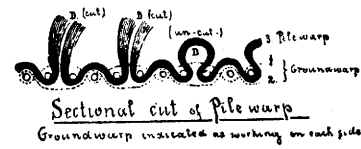


FIG. 808.

the length of the pile; and combining the terry and velvet effects, forming either terry figures upon velvet ground or velvet figures upon terry ground.

*Specimen Weaves for Astrakhans.*

Fig. 806 represents the weave for a plain Astrakhan fabric. Repeat: 3 threads of warp, 4 picks; the entire pile warp (indicated by 3 and 6 in the figure) is raised at once over the wire

FIG. 809.

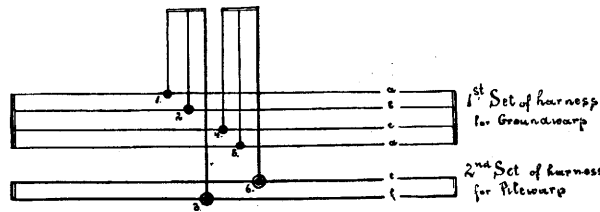
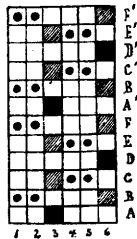


FIG. 810.

as shown in picks *D, D'*. Texture of the warp is 2 ends ground or body-warp (cotton) to alternate with one end pile-warp for the drawing-in on 2 sets of harness.

- 1st set for ground-warp (containing harness *a b c d*).
- 2d set for pile-warp (containing harness *e and f*).

Diagram Fig. 807 represents the drawing-in of the warp on its corresponding two sets of harness (indicated at the right-hand side).

Diagram Fig. 808 illustrates the section of a fabric interlaced on weave Fig. 806. Both ground warp-threads, as working at the right and left, are indicated by dotted lines. The pile-warp indicated in full black is shown in the terry and velvet effect (cut and uncut).

Fig. 809 illustrates another design for Astrakhans. *Warp*: 2 ends ground-warp, 1 end pile-warp, 2 ends ground-warp, 1 end pile-warp (to alternate with the first end pile-warp in weaving).

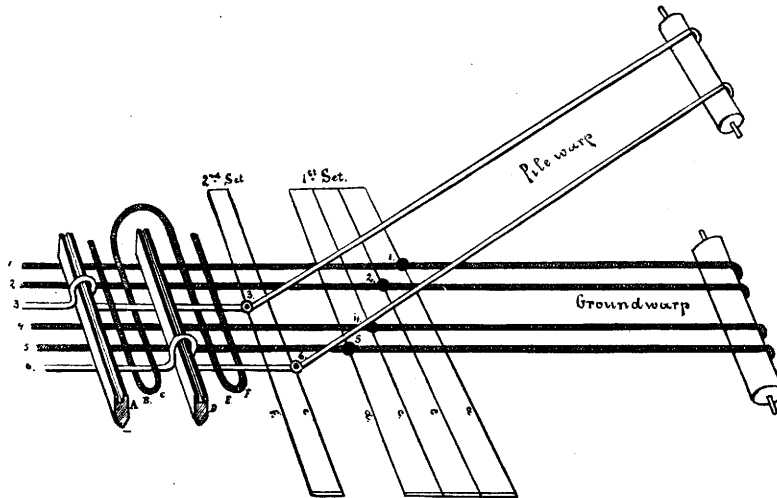


FIG. 811.

Each pile warp-thread is drawn on a separate harness, as shown in Fig. 810. Diagram Fig. 811 illustrates the method of operation in weaving a fabric with the weave just given. 2 picks ground *B, C, E, F*; 1 pick for inserting wire *A, D*. In pick *A* the harness *f* raises warp-thread 3; in pick *D* the harness *e* raises warp-thread 6. The interlacing of the body-cloth is done with the common 4-harness basket-weave having the two warp-threads between the pile warp-threads working the same; also the pick before and the pick after the inserting of the wire.

Fig. 812 illustrates a weave for Astrakhans similar to the one above. The same arrangement for texture, 2 ends ground 1 pile, 2 picks ground 1 wire, and 4 harness common-rib (filling effect)

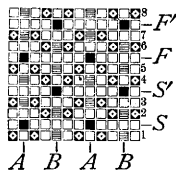


FIG. 812.

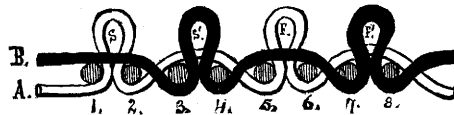


FIG. 813.

for the ground structure is used; but the latter weave is arranged to have the two ground warp-threads, situated in the fabric near each other, work opposite; thus the ground warp-threads working nearest on each side of a pile-thread raise and lower equally. In diagram Fig. 813, a section cut of the two pile-threads, as they interlace in a fabric, is shown. One pile-thread marked *A* is represented in outline (forming loops *S* and *F*), while the other pile-thread is shown in full black (forming loops *S'* and *F'*). The letters and numbers indicating the different warp-threads, picks, and openings of a shed for inserting wires, respectively correspond in weave Fig. 812 and diagram of section Fig. 813.

Weave Fig. 814 has the following arrangement of texture and principles of construction:  
*Warp*: 4 ends ground-warp, 1 end pile-warp, twice over in one repeat of the weave.  
*Filling*: 4 picks for ground, 1 pick for inserting the wire, twice over in one repeat of the weave. Ground-weave: plain. Raising of pile-warp: alternate ends on alternate wires.  
*A* and *B* are pile warp-threads, *C* and *D* the shed for inserting the wires.

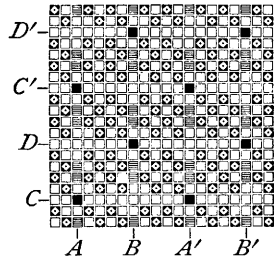


FIG. 814.

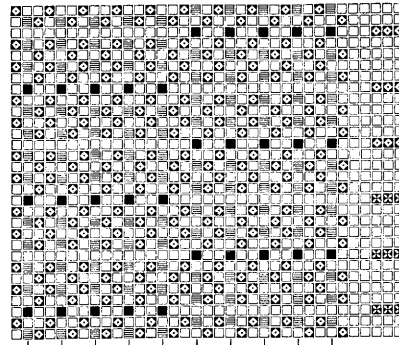


FIG. 815.

Weave Fig. 815 has the following arrangement of texture and principles of construction:  
 2 threads ground-warp, 1 thread pile-warp, 10 times over in repeat of weave.  
*Filling*: 4 picks for ground, 1 pick for inserting wire ("cut"), 3 times over; 4 picks for ground, 1 pick for inserting wire ("uncut"), 3 times over; hence 30 threads warp and 30 picks in one complete repeat.

Weave for body of fabric: plain.  
 ■■■■ on right-hand side of weave for wires "cut."  
 □□□□ on right-hand side of weave for wires "uncut."

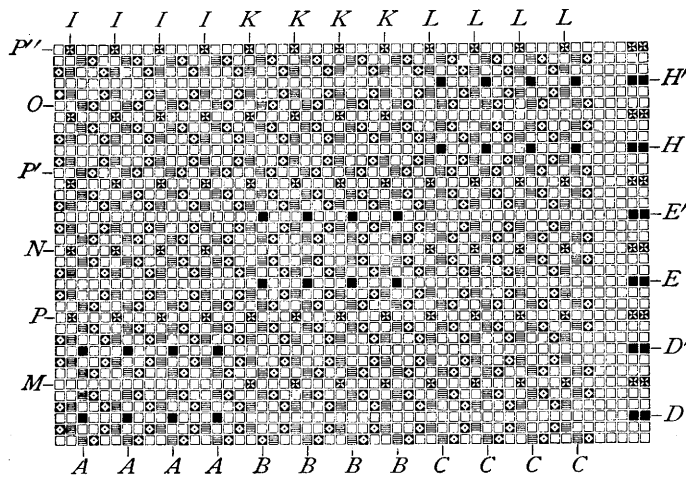


FIG. 816.

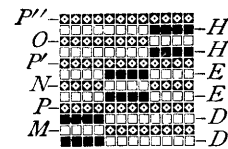


FIG. 817.

Fig. 816 illustrates another fancy weave for Astrakhans, containing the "terry" and "velvet" principles. The arrangement for the warp is: 2 ends ground, 1 end pile-warp (for terry); 1 end pile-warp (for velvet), 12 times over. The warp-threads marked on bottom of the design *A, B, C*, are for the velvet, and the warp-threads marked *I, K, L*, (indicated on top of the design), are for the terry. Picks *D, D', E, E', H, H'*, are to be the "cut" effect, and picks *M, P, N, P', O, P''*,

the "uncut" effect. The weave for the body of the fabric is the common 2-harness rib-weave (two picks in a shed of common plain).

In diagram Fig. 817, the motive for the pile-warp is clearly illustrated (representing the 3-harness twill  $1\text{---}2$ , velvet effect upon a terry ground for motive). It will be easily seen by any one that an endless variety of weaves and effects may be secured by combining *cut* with *uncut*

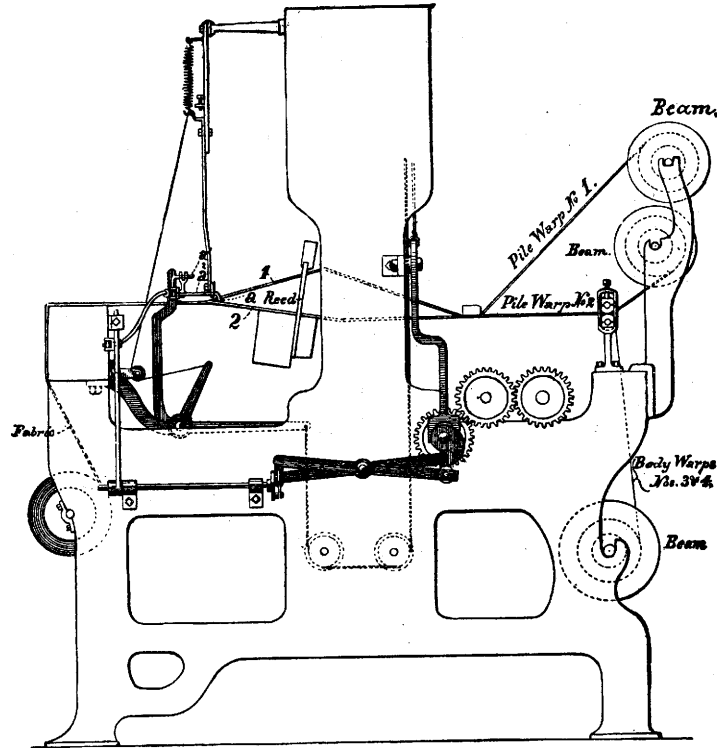


FIG. 818.

pile. And whatever designs may be required, the principles given and illustrated in the preceding examples, will always apply, as they remain unchanged.

In the method of weaving Astrakhan fabrics, as thus far explained, the raising of the pile has been effected with the use of wires, over which the loops of the pile were formed, and which were inserted and withdrawn at intervals. These wires being constructed in a single piece, the

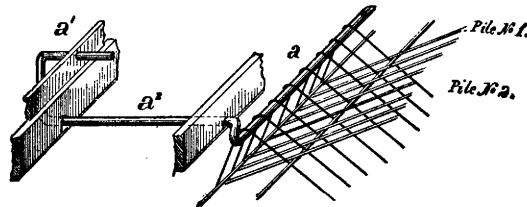


FIG. 819.

width of the fabric which can be made on them is necessarily limited, as a very long wire cannot be withdrawn and inserted with precision automatically by the loom. Also, the means for operating such wires are of a character to prevent rapid weaving; hence it requires a special loom of complicated construction.

In fabrics of a "cut" pile character and in fabrics in which the warp pile is not cut but interwoven very loosely, this process of interlacing and its loom (power or hand) must be used; while



in "terry" pile Astrakhans, which have their pile warp rather solidly interlaced with the body-structure, a device has lately been invented by T. Harrison, which he claims can be applied to almost any power loom, and is not limited to the width of the fabric which it can produce, and which can be arranged so as to form the pile at any desired interval upon the surface of the body fabric. It consists of a movable frame carrying a series of short "wires" upon which the

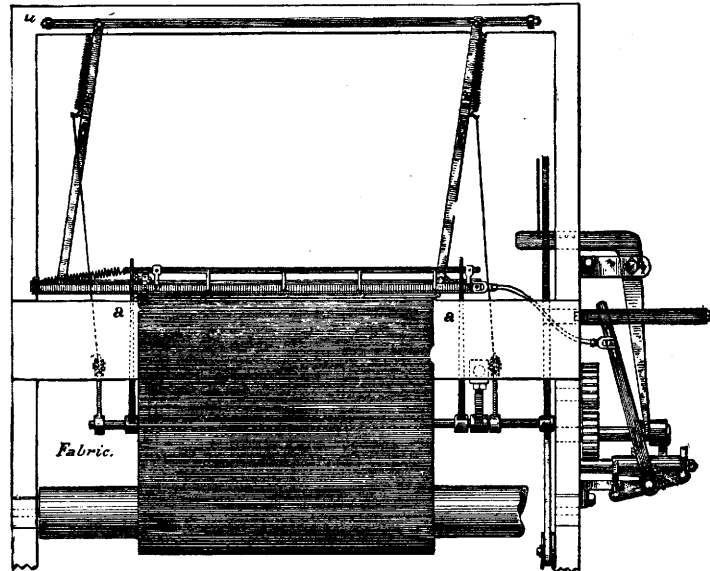


FIG. 820.

pile loops can be formed, each wire being pivoted at right angles to the plane of its longitudinal movement and provided with means for depressing its free end at proper intervals, so as to engage beneath the warps which are to form the pile.

In Fig. 818 an exterior side-view of a loom embodying the arrangement is given. In this, as well as in the following drawings, referring to the present subject, those parts are omitted

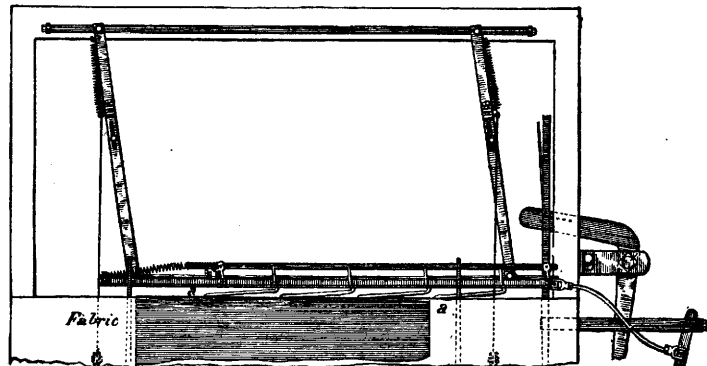


FIG. 821.

which are well understood in their action and whose insertion in the drawings would only tend to confuse the mind, and render a comprehension of the special parts to which the present arrangement relates, less clear.

Fig. 819 is a view in detail of a portion of the sectional wire which forms the basis of the arrangement, showing various parts connected with the portion of the sectional wire, as also a number of warp and filling-threads.

Fig. 820 is a front elevation of the loom with its attachment for raising the pile-warp. In this drawing the working parts are shown in one extreme position, while in Fig. 821 (corresponding to Fig. 820) they are shown in the other extreme.

In diagrams I to X in Fig. 822 are represented the positions which the threads assume at each stage of the formation of the fabric.

Two pile-warps may be used, which are indicated respectively by 1 and 2. The body-warps 3 and 4 of the fabric are brought from a separate beam. To form a row of loops with the pile-warp 1, the operation commences, as shown in Diagram I of Fig. 822—that is to say, the points of the wires *a* are all depressed, and the frame is at the extreme right-hand position shown in

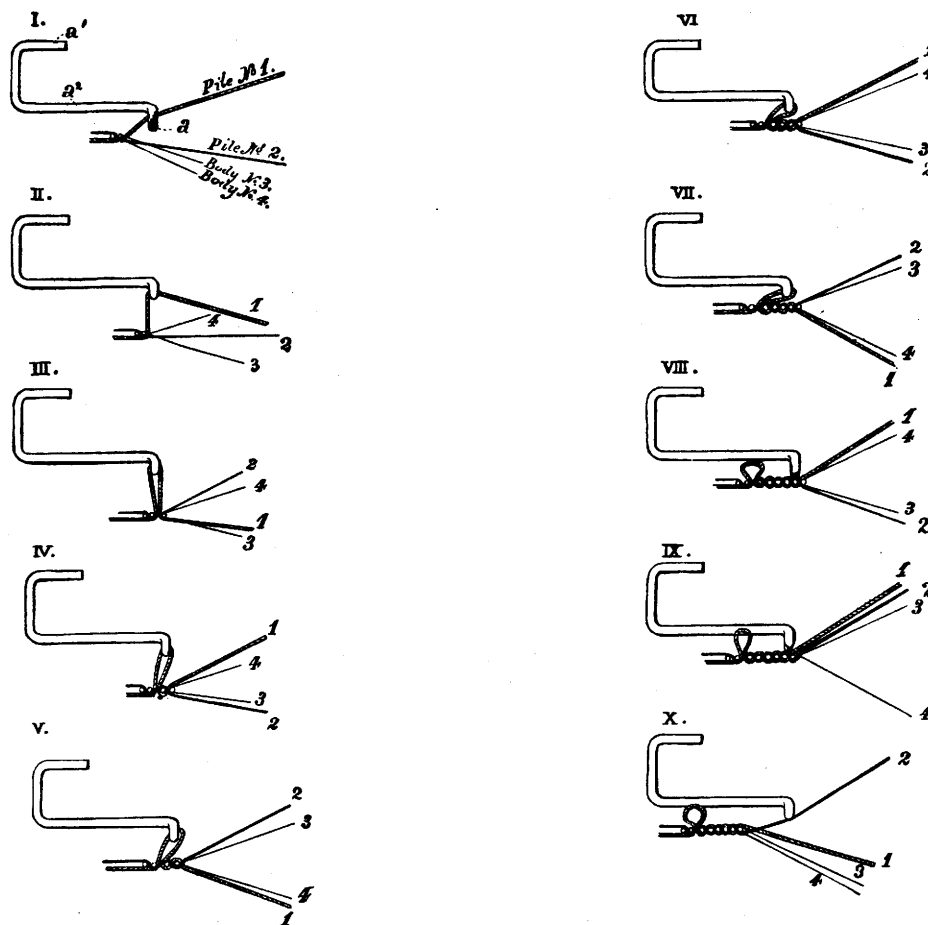


FIG. 822.

Fig. 821. Each wire *a* thereupon enters beneath a number of warp-threads and raises them slightly above the plane of the fabric. A shuttle is then shot through, after which the body-warp 4 rises and the pile-warp 1 descends, as shown in Diagram II of Fig. 822. The pile-warp 2 rises and a pick of the shuttle follows, and the action of the reed throws the filling-thread toward the wire *a*, so as to close the row of pile-loops thereon, as indicated in Diagram III of Fig. 822. The weaving then continues, as indicated from IV to VII inclusive, in Fig. 822, by means of both pile-warps and both body-warps, the shuttle operating in the ordinary manner. During all this period the taking up of the cloth has drawn over the bottom of the pile-loop somewhat to the left in the diagrams, and as soon as a sufficient number of picks have been made to securely lock the pile-loops the frame and the wires *a* are thrown to the right of Fig.

820, or toward the observer from the point of view in the diagrams. This disengages the wires from the loops which they have heretofore supported, and leaves them as shown in diagram VIII in Fig. 822. So long as the wires have been surrounded by the loops and have rested upon the body of the fabric they have been maintained in a horizontal position; but upon their being withdrawn from the loops and upon the rise of the frame bodily, this support ceases and the ends of the wires *a* dip downward by the tension of the spring. This position immediately follows upon their withdrawal, and occurs when the frame is at the extreme right-hand position (shown in Fig. 821), or, in other words, is ready to engage with a fresh set of pile-warps.

Returning now to the Diagram IX, Fig. 820, it will be seen that both the pile-warps are up; but in the Diagram X, Fig. 820, the pile-warp 1 (which has just formed the first series of loops) is down, and with it the body-warps 3 and 4 have descended, leaving only the pile-warp 2 up and ready to be engaged by the wires *a*, whereupon a repetition of the ten positions indicated will occur with the pile-warp 2, and so on throughout the weaving operation, the rows of pile-loops alternating from the warps 1 and 2.

In the method illustrated in the diagrams six picks of filling are represented between the rows of pile-loops; but this number can be varied by varying the frequency of movements of the frame and wires relatively to the picks of the shuttle, and in many cases a much less number of picks will be found sufficient to lock the pile-loops, so as to prevent them from pulling out.

The invention claims further that the frame and its sectional wires can be applied to almost any well-known form of loom without interfering with the general arrangement thereof, and by merely increasing the number of wires *a* the fabric may be produced of as great width as the loom is capable of weaving. In the drawings the number of wires has been arbitrarily reduced and their individual proportions exaggerated, in order to more clearly show their construction; but in practice for making Astrakhans good results are obtained with wires one-eighth of an inch gauge, each about four inches long. Wires of any gauge may, however, be used, according to the fineness of pile which it is desired to produce, the only limit being in the stiffness of the wire, which of course may be relatively increased by diminishing the length of the individual sections.

#### **Machines for Curling Warp-threads for Astrakhans.**

In the manufacture of "Astrakhans" (and similar fabrics) it is necessary to impart a permanent curl or twist to the warp threads which are to form the face of the fabric. The yarn is crimped, the length of the crimp being regulated by the amount of waviness it is desired to give. The crimping is set in the yarn by a steaming process; the yarn is then made into a warp and woven over wires and cut, or the wires are withdrawn without cutting, as explained in the preceding articles on weaving these fabrics. The moment the wire is withdrawn (cut or uncut, as required,) it falls into crimps again, and thus is produced that wavy shagginess which characterizes the surface of these fabrics.

Until lately, the method of producing these wavy yarns was a very slow one, the operation having been performed by hand. At present, however, they are produced quickly and entirely automatically by one operation of the machine.

Figs. 823, 824 and 825 illustrate a machine for performing this work.

The main part of the machine is a solid metal spindle, on which the thread is wound from a bobbin having a rotary motion around the spindle. As soon as the thread begins to wind on the spindle it is forced between two rolls, which are pressing against the direction of the winding of the thread on the spindle, and through their rotation draw the thread from the spindle.

These rolls are heated by a gas jet and transfer their heat to the thread. Through the pressure and the heat the required curling of the thread is fixed.

Fig. 823 represents a side view of the machine. Fig. 824 represents the top view. Fig. 825 represents the mechanism for curling the thread (enlarged from Figs. 823 and 824).

In Figs. 826, 827, 828, 829 and 830, we illustrate another machine (patented by T. Harrison) for preparing these pile warp-threads for Astrakhans or similar fabrics. Fig. 826 represents the front elevation of the machine. Fig. 827 a vertical central section through the coiling device. Fig. 828 illustrates a side elevation of the uncoiling device. Fig. 829 represents the top view of the latter, and Fig. 830 a view of the stop, by means of which a positive motion is imparted to the coiling mechanism.

We will next give a description of the different parts of this machine as mentioned in the invention.

*B* represents the frame of the machine, consisting of two parallel housings, with an inclined upper portion marked *B*<sup>1</sup>.

*A*<sup>3</sup> is the driving shaft, to which the power is imparted by a belt upon the pulley *A*<sup>1</sup>. Upon the driving shaft is mounted a drum, extending entirely across the interior of the machine, and

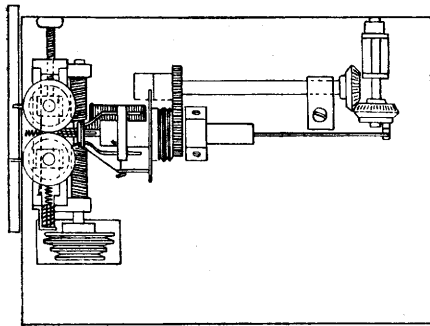


FIG. 824.

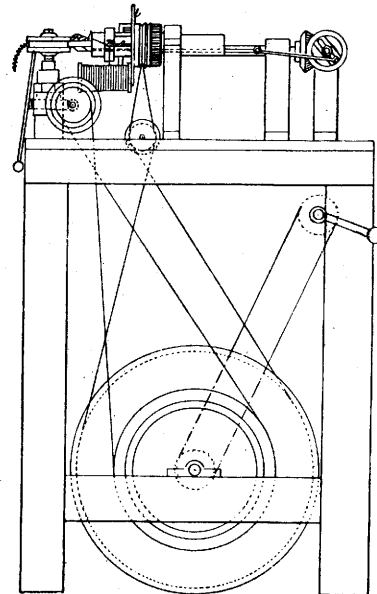


FIG. 823.

which is provided at intervals with grooves to receive a series of small driving cords or belts, which, after being brought into a horizontal plane by passing the inclined part of the belt over idlers, pass around a series of horizontal "whirls," which are journaled upon vertical rings *H* secured in a series of openings formed in the transverse platform *L*<sup>2</sup>. These whirls are formed with a circumferential flange on their upper side, thus providing seats for the "fliers" *G* and *F*. The three fliers marked *G* are coiling devices, the three marked *F* being the uncoiling devices. The coiling fliers each consist of the two uprights, mounted at the bottom upon a ring which fits snugly within the flange of the wheel. At the top the two uprights are connected with a central sleeve which revolves upon a vertical tubular stem, which passes downward through the axis of rotation of the flier and for some distance below, where it is secured in the transverse piece *E*<sup>1</sup>, extending across from side to side of the machine at the front thereof. The spool upon which the warp that is to be coiled is wound in the first instance, fits snugly, but so as to revolve freely upon the outside of the before mentioned stem and rests upon a standard, through whose centre the said stem passes freely.

The last mentioned standard passes freely through the ring *H* and is supported upon a fixed platform *K*. The coiling flier is provided with eyes  $l l^1 L$ , the latter of which is situated at the top of the sleeve  $G^4$ , and is at right angles to the axis of rotation. At the bottom of the coiling fliers are stop-pins  $K^2$  (see Fig. 830) projecting into slots in the flange of the whirls. These stops make the rotation of the coiling-fliers positive.

As before stated, there are in the machine shown in the drawing, Fig. 826, six of the horizontal whirls, three of which drive the coiling-fliers, the other three driving the uncoiling-fliers. These latter resemble the coiling-fliers in shape, having uprights connected by bottom rings, which rest loosely within the flanges of the whirls, but which (unlike the coiling-fliers) are not positively connected therewith, the weight of the flier alone being the means by which it receives

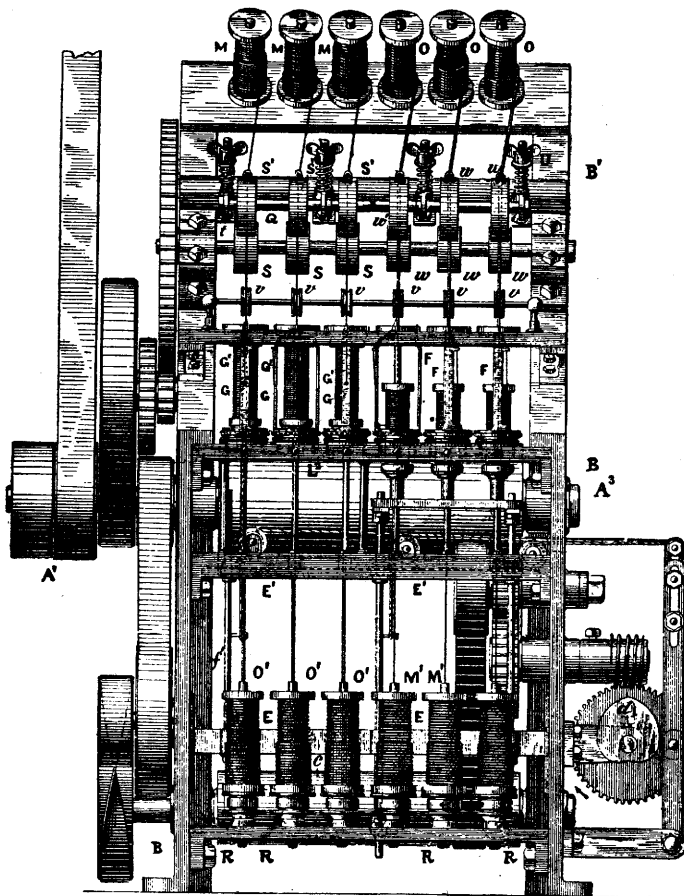


FIG. 826.

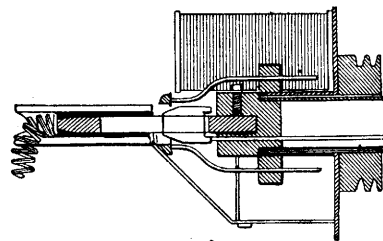


FIG. 825.

its motion from the whirl. The uncoiling-fliers have eyes  $i i^1$  at top and bottom, respectively, the latter being the eye which delivers the thread to the spool or body. They have also at the top a brake mechanism.

A tubular stem extends down through the axis of rotation of each of the uncoiling-fliers, and is held in the cross-bar  $E'$ . These stems receive bearings at the top of the uncoiling-fliers. The spools or bobbins of the uncoiling-fliers fit snugly around the stems and are supported upon standards which also surround said stems, but which are mounted upon a vertically-movable cross-piece arranged to be reciprocated in a vertical direction. The spools or bobbins of the uncoiling-fliers are thus adapted to receive a rising and falling movement within the flier during the rotation of the latter, and in this respect differ from the spools of the coiling-fliers, which are

stationary so far as vertical movement is concerned. The upper ends of the fliers extend into openings in the shelf or platform, provided with rings, and are thus shielded during rotation. The latter shelf is hinged at the rear, so as to be thrown back when the fliers are to be removed.

The brake mechanism of the uncoiling fliers is constructed as follows: Upon the top of each sleeve there is pivoted upon one side a lever, through the centre of which there is a vertical hole coinciding with the opening of the stem. This lever has at its rear end a cam-surface, which, when the lever is in a horizontal position, rests without substantial pressure against the stem. At the front end of the lever is an eye through which the thread, which is being uncoiled, passes,

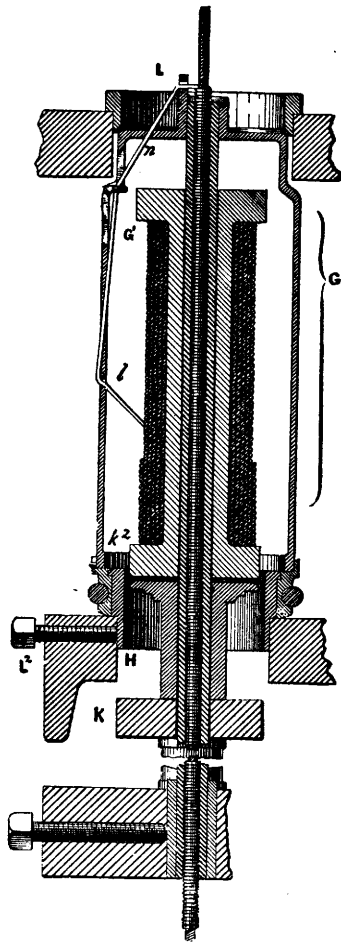


FIG. 827.

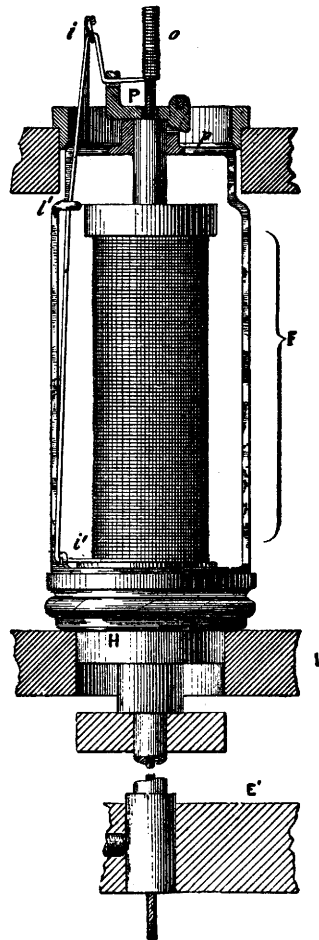


FIG. 828.

and thence rises to the eye *i*, mounted upon the top of the flier. So long as the portion of the thread between the eye and the axis of rotation of the fliers is substantially horizontal the lever will remain in a horizontal position; but if that portion of the thread rises to an angle with the horizontal, then the strain upon the eye will raise the front end of the lever and bring the cam *p* gradually around, so as to press upon the top of the stem. The cam-surface being eccentric, as it turns in the direction of its longest axis, it will raise the flier *F* bodily by bearing upon the top of the stem, and in so raising it will lift the flier clear of the whirl, so that motion will be no longer imparted to the flier. If desired, the lift may be such as to bring the upper part of the flier into frictional contact with the under side of the ring.

At the top of the machine is mounted upon suitable pins the spools or bobbins  $M$ , which contain the cord which is to form the core for winding the Astrakhan warp upon. These bobbins, like the coiling-fliers, are three in number, and the cord from them passes through feeding mechanism, down over pulleys mounted upon a horizontal shaft, and through the central stem of the coiling-fliers.

A belt conveys motion from the driving-shaft  $A^3$  to a pulley, and thence by gears and pinions a very slow rotary motion is imparted to the shaft, which extends entirely across the top of the machine, near the bottom of the incline. Upon this shaft are mounted friction-rollers  $S$ , three in number, over which the cord passes on its way from the spools  $M$ . Upon the cross-piece  $v$  are mounted overhanging arms which support the shaft  $Q$ , on which are mounted friction-rollers bearing down upon the rollers  $S$ . The shaft  $Q$  is provided with a spring pressure device, consisting of a vertical stem having a sliding collar with a hook-shaped projection, which engages with the shaft, and a spring whose tension is adjustable by means of a thumb-nut. By means of this tension device the rollers  $s'$  can be caused to bear upon the rollers  $S$  with any desired degree of pressure. Therefore, although the take-up devices at the bottom pull the cord with some strain, it is fed to them by the positive motion of the rollers  $S$ , and cannot be drawn more rapidly than the rotation of the latter will permit. A similar set of feeding-rollers,  $w w'$ , the latter mounted in similar spring-bearings, are arranged to deliver the cords from the bobbins  $O$  to the three uncoiling-fliers upon the other side of the machine; but the diameter of the positive feed-

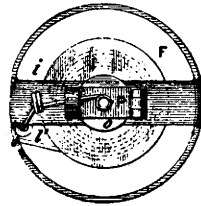


FIG. 829.



FIG. 830.

ing-rollers  $w$  is less than that of the feeding-rollers  $S$ , and with the effect of feeding more slowly to the uncoiling-fliers than to the coiling-fliers.

The take-up bobbins  $O' M'$  for the cords, which pass from the coiling-fliers and uncoiling-fliers respectively, are mounted upon horizontal rotating seats  $R$ , placed at the bottom of the machine and driven by the twist-belts passing around pulleys secured to the seats. The twist-belts are so arranged that they can slip upon their respective pulleys, in case the feed from above requires such slipping.

In order to wind the cords upon the respective bobbins  $O' M'$  evenly, a traveling guide-bar,  $E$ , is provided, which receives a slow vertical reciprocating motion. This traveling bar carries vertical rods, which rise and fall with it, these rods being guided by suitable openings in the cross-bar  $E$ . The rod  $f'$  serves merely as a guide-rod, but the other two rods  $f$ , carry at their tops a cross-piece, which supports the standards of the bobbins  $F$ . Thus if a vertical reciprocation is imparted to the traveling bar  $E$  its motion will cause the bobbin to rise and fall in the same manner.

The traveling bar  $E$  is provided with openings or eyes opposite to the bobbins  $O' M'$ , which openings guide the thread during the rise and fall of the bar, so as to distribute it equally upon the bobbins.

The operation of the machine in coiling and uncoiling the yarn is as follows :

Upon the three bobbins  $M$ , at the top of the machine (see Fig. 826), are coiled cords which are to form the cores for winding the Astrakhan warp upon. These cores are carried down between the feeding rollers  $S S'$ , over three of the rollers  $v$ , and on down through the axes of the

three coiling-fliers; the passage being of course through the tubular shafts. They then are brought down and passed through the three left-hand eyes of the traveling guide-bar *E*, and are secured to the three bobbins *O'*. The Astrakhan warps which are to be coiled are wound in the first instance on the bobbins *G'*, and placed in position within the three coiling-fliers. The ends of the Astrakhan thread, having been brought through the eyes *l' l' L*, are tied fast to the three cores at a point just above the fliers *G*. Assuming now that the proper feeding and take-up movements occur at top and bottom of the machine, respectively, and that the fliers *G* are rapidly rotated, it will be seen that the Astrakhan thread is drawn off from its bobbin and coiled tightly around the core. As the coiling progresses the feeding and take-up movements cause the composite cords to pass down through the tubular shafts, and thence to the bobbins *O'*. The traveling guide-bar *E* causes the composite cords to be evenly wound upon the bobbins *O'*.

When a sufficient quantity has thus been formed, the composite cord—that is to say, the core with the Astrakhan warp wound tightly around it—is removed, steamed, or otherwise treated to render its twist permanent, and is then ready for uncoiling. A portion of the core *m* at the end of the composite cord is left uncovered for a clearer illustration.

The uncoiling operation is as follows: The uncovered end portion of the composite cord (now upon the three bobbins *O* at the top of the machine) is brought down through its feeding-rollers *w w'* over the three right-hand rollers *v*, and thence down through the tubular shafts, through the three right-hand end eyes of the guide-bar *E*, and secured to the three bobbins *M'*. The uncovered portion having been fed down until the commencement of the covered portion or composite cord reaches the top of the uncoiling-fliers. Then carry a loose end of the Astrakhan warp through the eyes of the lever *P* up to the eye *i*, and then down to the eye *i* at the bottom of the uncoiling-flier, when it is taken across to the bobbin and there fastened. The feeding movement at the top and the take-up movement at the bottom being continued and the uncoiling-fliers being rapidly rotated in the proper direction, they will uncoil the warp from the composite cords and wind up the now twisted warp upon the bobbins. These bobbins have the proper rising and falling motion to distribute the warp evenly upon them. The uncoiling movement is necessarily a trifle slower than the coiling movement, hence the composite cords do not require to be fed so fast as do the cores upon the other side of the machine. This difference of speed is produced by smaller diameters of the feeding rollers *w* as compared with the feeding rollers *S*. The uncoiling operation continues and the cores *m* are wound up in a proper manner upon the bobbins at the bottom of the machine so that they can be again transferred to the positions indicated by *M* and the operation repeated. If the uncoiling tends to progress too rapidly, it is checked by the brake mechanism upon the uncoiling-fliers, which are operated by the portion *n'* of the warp assuming an inclined position, instead of substantially a horizontal one, between the eye and the core from which it is unwound. If the uncoiling takes place too rapidly, relatively to the downward feed of the core, the point of the uncoiling will rise higher and higher upon said cord, and will thus produce that inclination of the warp necessary to operate the brake mechanism. The uncoiling of the warp is thus automatically regulated by this brake mechanism and cannot progress with such rapidity as to tangle the warp or to break it.

### TAPESTRY CARPET.

Tapestry-carpet is a warp pile fabric in which the loop formed by the face warp-threads is not cut. The demand for its production is found in the need of a cheaper and more economical imitation of what is known as Brussels carpet. In its general appearance it resembles the latter to a great extent, but in its method of construction differs wholly from it, as may be seen by any one that examines the two methods. In tapestry carpets three different systems of warp-threads are used: *A*, the ground-warp; *B*, the pile-warp or face-warp; *C*, the stoffer or thickening-warp.



The general arrangement for the warp is:

- 1 end ground or binder-warp,
- 1 end double or three-ply thread, of stout linen for strengthening or thickening the body of the carpet, resting in the fabric below the pile-warp and actually forming the main part of the back of the structure.
- 1 end double thread of worsted for face-warp forming the pile, by being interlaced into every third opening of the shed over a wire, as required for the face of these fabrics.
- 1 end ground or binder-warp.

4 ends in repeat of arrangement of warp (= one set); to be reeded into one dent.

The pile or face-warp, before being wound upon the warp-beam, has the pattern printed on it by wrapping the threads around a large cylinder, and coloring them according to the design.

The length of a certain color for each pile-thread, required for each individual loop when woven, is regulated by the size of the needles used.

Fig. 831 illustrates the example of a pile-warp printed as required before weaving. The same illustrates four different colors: black, white, heavy-shaded and light-shaded.

Fig. 832 illustrates the same pile-warp as it appears when interlaced into the fabric; each effect in the warp being reduced to its required size or proportion to the corresponding effect in the design.

Fig. 833 illustrates the sectional cut of the fabric.

*A* and *A'* represent the ground-warp; *B*, the thickening-warp; *C*, the pile-warp; *W*, the wire requiring every third opening of the shed. Picks 1 and 2, requiring the first two openings of the shed in the repeat of three, are the means for interlacing the ground-cloth as well as fastening the pile to this ground structure.

Fig. 834 illustrates the complete draft, or weave for producing a tapestry carpet. Each warp-thread and pick is marked in accordance with previously given explanations.

#### *Different Qualities of Tapestry Carpets.*

The fineness as well as the value of these carpets is regulated by the quality of the material used as also by the height of the pile and number of pile-pick (technically known as number of wires) per inch. Seven to eight wires per inch are about the usual number in the arrangement.

#### *Method for Ascertaining Size of Designing Paper Wanted.*

The designs for tapestry carpets are generally painted on the squared designing paper in about a size equal to the design upon the face of the fabric when woven. Thus the number of small squares to one inch in a horizontal as well as a vertical direction on the designing paper is regulated by the number of loops in the woven fabric, both in the direction of the warp and the filling.

In some cases the number of loops is equal in both directions, while in others it differs to some extent. Designing papers known as 8 x 8 to 1 inch and 8 x 7 to 1 inch are those most frequently used. Tapestry carpets are generally produced 27 inches wide; therefore the design will have to be of equal width. That arrangement for the design may be selected known as the "half-over pattern," or one that has one complete repeat in one width; or a design may be produced which repeats twice (or oftener if small figures are wanted) in one repeat of 27 inches in the fabric.

Lately a method of producing effects in tapestry carpets, classified as "sheeny" or "variegated," has been patented in this country, England and France, but is nothing more than a

method of arranging the design of the carpet so as to make use of more or less solid colored pile-warp yarn, hence requires no printing for this amount of warp. In Fig. 835 such an effect is illustrated; *a* represents the solid colored threads, *b* represents the printed threads. Each

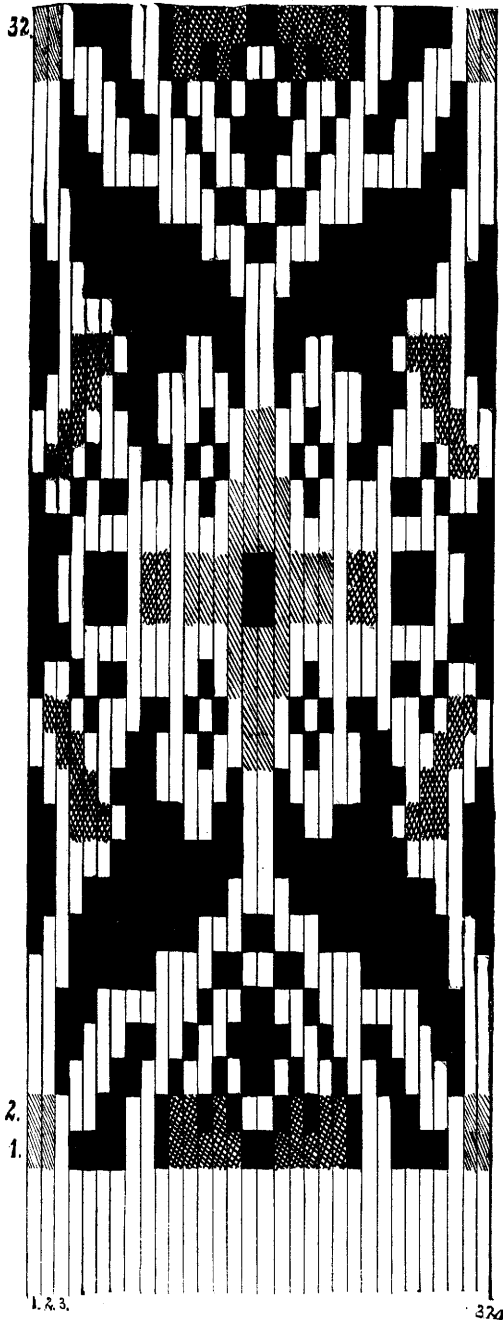


FIG. 831.

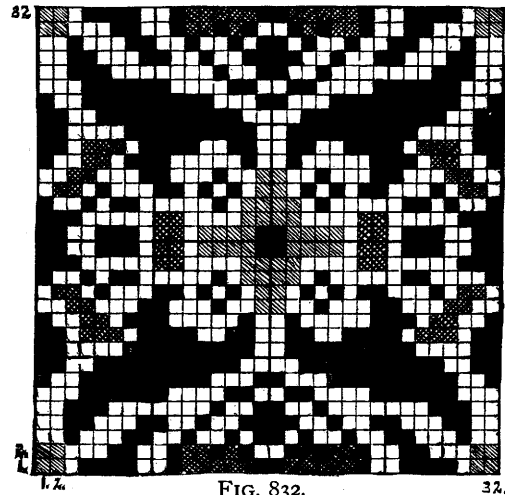


FIG. 832.

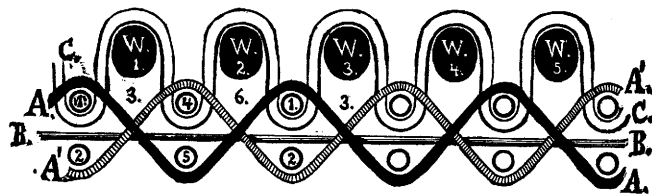


FIG. 833.

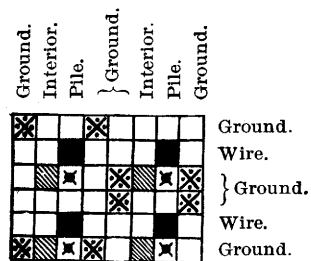


FIG. 834.

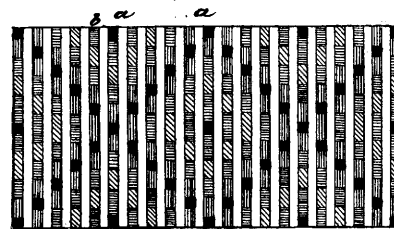


FIG. 835.

kind of pile-warp is operated from a separate beam; so it will be seen that a general range of effects can be produced by simply varying the solid colored threads in each style, leaving the printed warp entirely undisturbed.

### BRUSSELS CARPET.

Brussels carpet is a warp-pile fabric in which figures are produced by raising over the wire different solid colored warp-threads at certain places according to the design. Brussels carpets are of a far superior character, as respects color, quality of material used and the structure, than the tapestry carpets which have been just explained.

In Brussels carpets the colors used are generally "fast," as the yarn is hank-dyed and not colored in the warp as is done with the tapestry carpets.

Brussels carpets are technically classified by "frames," or in other words by the number of different colors called for in a vertical row of squares on the designing paper, as also one row of loops in the direction of the warp in the fabric.

In tapestry carpets one double thread of worsted, printed according to the design, is used for one row of loops (warp-ways) while in Brussels carpets a similar double thread is used for each color as required by one row of squares warp ways in the design. One color only is raised at the time, while the threads then not called for rest in the body and partly on the back of the fabric; therefore the thickness and substance of the fabric is not due to cotton or jute thickening threads, as in the body of the tapestry, but the same pure wool-thread which forms the face will at every place not called for by its color in the design, form part of the "body."


The ground-warp in Brussels carpets is interlaced with the filling on the common four-harness basket-weave (  ) arranged so as to have each two successive picks insert in the same opening of the shed (of the ground-warp) and only separated by the pile warps. One pick passes above, and its mate pick below the pile warp-threads holding the latter firmly secured between; thus, if the raising of the pile warp over its wire for forming the characteristic loop should be omitted, we would produce nothing more than a fabric interlaced on the common four-harness basket-weave having a stout packing or thickening thread in the centre.



FIG. 836.

As mentioned before, Brussels carpets are graded by "frames." There are three-frame, four-frame, five-frame and six frame Brussels carpets.

Under "frame" we classify the number of different colors found in the different rows of squares in a vertical direction on the designing paper; thus a three-frame Brussels carpet has three different colors in one row of loops (warp-ways) in the fabric. Any of these three colors can at any other row of loops (warp-ways) be exchanged to a different color without changing the principle of a "three-frame" carpet.

A "four-frame" Brussels carpet will extend the number of colors for each row of loops to four colors. Thus, a "five-frame" Brussels carpet will show five different colors in one row of loops warp-ways. A "six-frame" Brussels carpet will extend these number of changes to six colors.

Having an individual warp-thread for each color in the formation of the loops will also speak greatly in favor of the Brussels as compared to the tapestry carpets. By means of these separate threads the design will be more clearly defined and its various parts more pronounced, while in tapestry carpets the figure is always more or less indistinct, which arises from the method of operation by which the pattern is produced.

In Brussels carpets the different colors used are variously distributed, one color being used to a greater extent than the other, etc. This method of using every pile warp-thread at will and in a different amount than another, requires us to use instead of ordinary warp yarn beams, bobbins or miniature beams fixed in frames, or a huge creel, stationed behind the loom. The manner in which the different colors are controlled, in other words, in which they are concealed

from or brought into view upon the face of the fabric is of great importance in the manufacture of this article.

*Method of Structure of the Brussels Carpet.*

The pile (loop) is formed the same as in common (uncut) velvet fabrics by the insertion of wires (see Fig. 836) under the pile-threads; but the method of selection is different. In producing a common velvet fabric we raise either the entire warp or one-half, etc., over each wire, while in Brussels carpet we select for each individual loop from a series of duplicate threads (set-frame) each of which has a different color. Another difference between a common velvet fabric and a Brussels carpet is found in the manner of operating the pile-warp during the insertion of ground-picks. In common pile fabrics, as explained in preceding articles, the pile-warps interlace up and down in the body of the fabric, while in Brussels carpet the face or pile-warp rests during the time it is not used for forming loops in a straight line in the body of the fabric.

*Three-frame Brussels Carpet.*

Fig. 837 illustrates part of a design technically known as a "three-frame" Brussels carpet. In the same the different colors for 8 loops, warp and filling-ways (which equals in the present

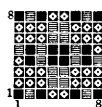


FIG. 837.

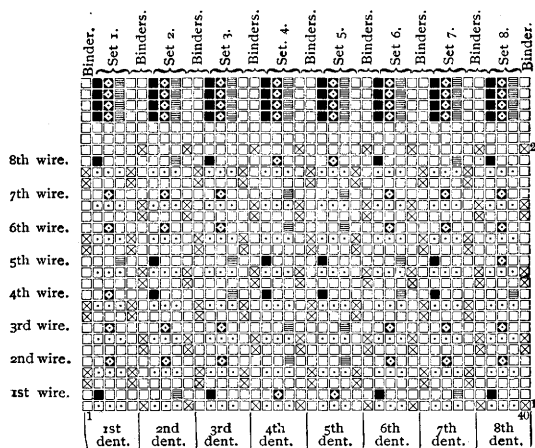


FIG. 838.

example 8 by 8 = 64 loops) are indicated for each color by a separate kind of type. In the same line of the design (looking at the design lengthways), apparently in the same thread, three colors form the pile in succession, which is practically produced by employing three distinct threads, each of which is so controlled that it only appears in the pile when required to produce the design.

In Fig. 838 the ground plan of the method of interlacing is shown. On the top of the plan the arrangement of the warp is indicated.

1 end binder-warp.

3 ends face or pile-warp, each representing a two-fold end of worsted and each of these 3 so indicated pile-threads to be of a different color than the other.

1 end binder-warp.

5 ends in the repeat of arrangement for the warp. Thus  $5 \times 8 = 40$  threads of warp in ground plan, representing the construction of a 3-frame Brussels carpet, similar to the one shown in design Fig. 837.

In plan Fig. 838 every shed for inserting the wire is represented on the left side of the design; and on comparing with the part of the design of the face, Fig. 837, it represents the threads as indicated in the latter raised from each set.

Pick 1 in the design calls for 1 ■, 1 ■, 1 ■, 2 □, 1 ■, 1 ■, 1 ■. Examining wire 1 in the plan we find the selecting of the different colors from each set arranged accordingly.

Thus we select—

From the first	set	■.
“ second	“	■.
“ third	“	■.
“ fourth	“	□.
“ fifth	“	□.
“ sixth	“	■.
“ seventh	“	■.
“ eighth	“	■, etc.

Pick 2 in the design calls for 3 □, 2 ■, 3 □, and the colors of the face-warp for raising over wire number 2 in the plan are selected accordingly.

From the first set of 3	pile warp-threads	we call for	□.
“ second	“	“	□.
“ third	“	“	□.
“ fourth	“	“	■.
“ fifth	“	“	■.
“ sixth	“	“	□.
“ seventh	“	“	□.
“ eighth	“	“	□.

Pick 3 is a repetition of pick number 2.

Pick 4 in the design calls for 1 □, 1 ■, 1 ■, 2 ■, 1 ■, 1 ■, 1 ■, and the colors of the pile-warp raising over wire number 4 in the plan are selected to correspond.

From the first set of 3	pile warp-threads	we call for	□.
“ second	“	“	■.
“ third	“	“	■.
“ fourth	“	“	■.
“ fifth	“	“	■.
“ sixth	“	“	■.
“ seventh	“	“	■.
“ eighth	“	“	■.

Pick 5 in the design calls for 1 ■, 1 ■, 1 ■, 2 ■, 1 ■, 1 ■, 1 □, and the colors of the pile-warp raising over wire number 5 are selected to correspond.

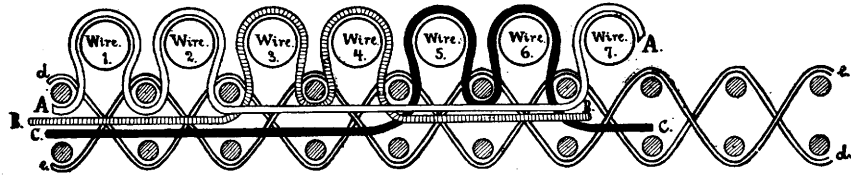
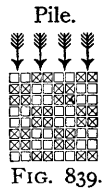
From the first set of 3	pile warp-threads	we call for	■.
“ second	“	“	■.
“ third	“	“	■.
“ fourth	“	“	■.
“ fifth	“	“	■.
“ sixth	“	“	■.
“ seventh	“	“	■.
“ eighth	“	“	■.

Picks 6 and 7 are duplicates of picks numbers 2 and 3.

Pick 8 in the design calls for 1 ■, 1 ■, 1 ■, 2 □, 1 ■, 1 ■, 1 ■, and the pile warp-threads raising over wire number 8, as shown in the plan, are selected to correspond in colors.

From the first set of 3 pile warp-threads we call for ■.  
 " second " " " " " □.  
 " third " " " " " ■.  
 " fourth " " " " " □.  
 " fifth " " " " " □.  
 " sixth " " " " " ■.  
 " seventh " " " " " □.  
 " eighth " " " " " ■.

Any pick that will be called for in any complete design always has its method of interlacing arranged similar to the principle explained in the specimen 8 picks of part of a design given for example.



The two binder warp-threads working between each set of threads in Brussels carpet of any "frame," interlace with the filling as shown in Fig. 839.

The reeding of a 3-frame Brussels carpet is arranged for "1 binder, 3 pile, 1 binder," in each dent; thus splitting by the reed *always* the two binder warp-threads.

Fig. 840 illustrates the section of a 3-frame Brussels carpet. In the same, threads marked *d* and *e* represent the binder-threads. *A, B, C*, represent the 3 different colored pile warp-threads. Wires 1, 2, 3, 4, 5, 6, 7, illustrate the section of the wires as used in the opening of the 3d, 6th, 9th, 12th, 15th, 18th, and 21st opening of the shed. Picks 1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, etc., of the ground structure of the fabric are indicated by shaded circles.

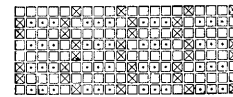
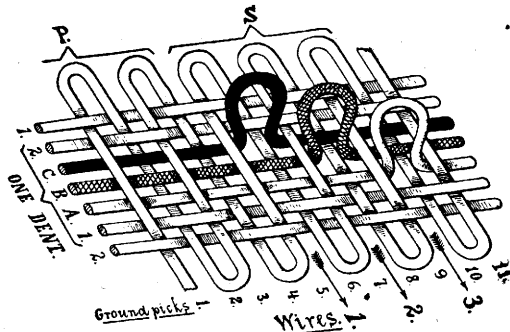
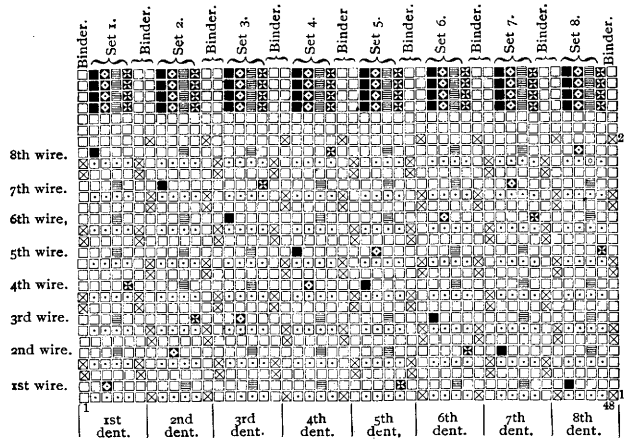


FIG. 841.

FIG. 842.

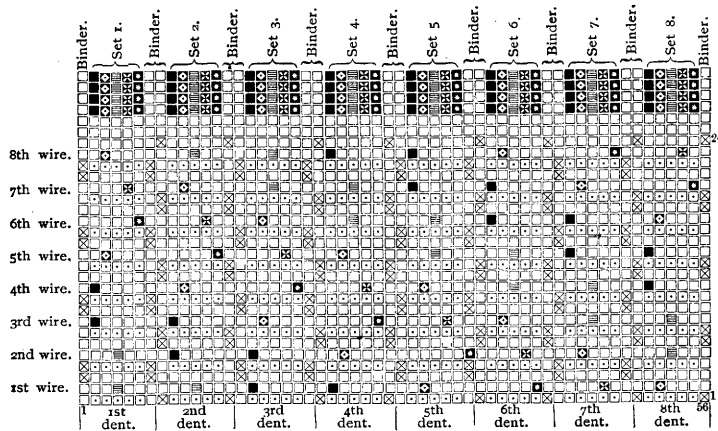
The binder-warp is drawn in two common harness frames which are placed in front of the Jacquard-harness. The face or pile is drawn in the Jacquard-harness, which is tied up for as many sections as there are frames in the carpet, so that in the present example of a 3-frame carpet we must use a 3-section tie-up. (See section on "tie-ups" in my treatise on The Jacquard, etc.) By forming the shed for the insertion of a wire only one pile warp-thread from each set is raised, as is required by the design. If the pile-warp in a carpet, constructed as thus far explained, is cut, the name Brussels is changed to *Wilton*.

Diagram Fig. 841 illustrates the method of interlacing a 3-frame Brussels carpet. This diagram readily explains itself on examination. Warp-threads indicated by *A*, *B*, *C*, are the three different colored pile-threads required (as explained before). Thread *A* is shown blank, thread *B* shaded, and *C* black. The binder or body warp-threads, situated in the fabric on each side of the face-threads, are indicated by 1 and 2. The ground picks and places for inserting the wires are



marked on the bottom of the diagram. *P* on the top of the drawing represents the interlacing of the fabric, omitting the loops, and thus giving, at a glance, the correct principle of interlacing the body.

Fig. 842 illustrates the weave for this part. Shed for "wire" omitted. *S* on the top of the drawing Fig. 841 represents the entire procedure. The wire marked 1 calls for the raising of warp-thread *C* (= black) for forming the face of the fabric. Wire marked 2, the successive wire, calls for the raising of warp-thread *B* (= shaded) for forming the face of the fabric.



Wire marked 3, the next successive wire, calls for the raising of warp-thread *C* (= blank) for forming the face of the fabric.

Warp-threads 2-*C*-*B*-*A*-1 are drawn in one dent of the reed, as indicated on the left-hand side of the drawing.

Fig. 843 illustrates part of a Brussels carpet design classified as a "four-frame."

Fig. 844 furnishes an analysis of the latter. The difference in the construction of a "four-frame," as compared to a "three-frame" carpet, consists in its having four different colored pile warp-threads, instead of only three, as in the latter, so that the figuring possible in both carpets is equal in proportion as 4 is to 3.

Having thoroughly described the method of constructing the "three-frame" carpet, the present "four-frame" design will the more readily explain itself.

Fig. 845 *a* illustrates part of a design for a "five-frame" carpet, which in Fig. 845 *b* is also analyzed.

Brussels and Wilton carpets are made up to and including "six-frames," also "in part of full frames" (after the "three-frame"), as may often be required in order to cheapen the fabric.

### DOUBLE-FACED PILE CARPETS

In which the Pile is Produced by Inserting a Special Heavy Filling-Cord Instead of a Wire.

The construction of these fabrics has for its object the production of a cheap, strong, firm and durable double-faced carpet, wherein the figure at each side of the fabric is derived from

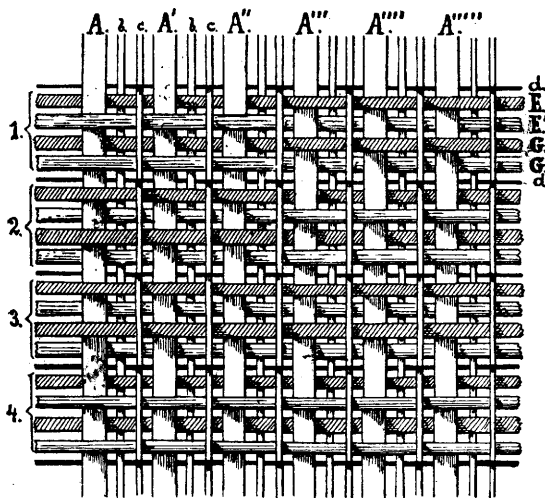


FIG. 847.

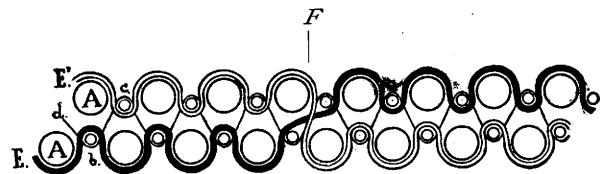


FIG. 846.

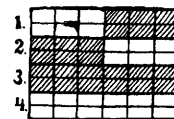


FIG. 848.

face-warps appearing upon one and then upon the other side of the fabric for one or more rib-picks. In addition to the face-warp there is also used a binder-warp, usually having two threads worsted face-warp alternate with one end binder-warp. These face and binder-warp threads are interlaced into one fabric by means of two kinds of filling, the interior (heavy) filling and the binder-filling. The binder-filling at alternate picks passes above all the face-warps and then below all the face-warps. The binder-filling is tied to the upper and then to the lower side of the face-warp by the binder-warp, two picks of binder-filling and two picks of stuffer (interior, heavy or cord) filling being put in in succession. The binder-warp is lifted into the upper half of the shed between the insertion of the first and second picks of stuffer (cord) filling, the binder-warp thus splitting the stuffer or interior filling. The crossing of the warp and filling is such as to enable the two picks of interior or stuffer, when beat up into the shed, to lie nearly one over the other, forming ribs opposite each other at opposite faces of the fabric.

Fig. 846 represents a longitudinal section.

Fig. 847 is a diagram representing the arrangement of the warp and filling as they interlace in the fabric.



Fig. 848 illustrates part of a design (face and back) corresponding to diagram Fig. 847.

The threads shown in Figs. 846 and 847 are separated for a clearer understanding of their working; but in the actual fabric they are beat closely together by the reed and appear somewhat similar to those illustrated in part of a design (effect) Fig. 848.

#### *Method of Operation.*

These carpets are produced on an ordinary two-box Jacquard loom with the addition of front-harness. For the binder-warps an independent harness or set of harness is provided, being operated through a cam on the picker shaft. The sheds for the binder-filling are formed by the binder-warps on the one hand and by all the face or body-warps on the other hand. The face-warps (indicated by letters *E, E', G, G'* in Figs. 846 and 847), which are generally of worsted and of different colors, and dyed or printed according to the colors and patterns it is desired that the carpet shall show, will be operated on by a Jacquard machine of the usual construction, so as to split the face-warps at suitable intervals to form sheds for the introduction of the stuffer or interior filling (indicated by letters *E, A'*, in Figs. 846 and 847) carried by a shuttle. The face warp-threads uppermost or at one side of the fabric remain at that side of the fabric for as many picks as desired, and then are carried to the other side of the fabric.

The binder-warps (indicated by letter *d* in Figs. 846 and 847) are carried by one or two harness frames and are distributed at suitable intervals between the face-warps. They are arranged so as to appear at both sides or face of the fabric between each two picks of interior (or stuffer) filling.

#### *Method of Successive Interlacing of the Warps and Fillings.*

Examining Figs. 846 and 847 from the right to the left, it appears that pick 1 has all the face-warp down and the binder-warp raised, thus forming a shed between all of the face-warp and binder-warp to receive a pick of binder filling.

Pick 2—the second binder-pick—has all the face-warp raised and all the binder-warp lowered.

Pick 3 has one-half of the face-warps raised, which with the binder-warp then down, forms a shed for receiving the first stuffer or interior filling.

Pick 4 has one-half of the face-warp and the binder-warp in the upper part of the shed, and the other half of the face-warp in the lower part. (This pick is not illustrated in Fig. 847, it being opposite to pick 3.)

This operation is repeated until such time as it is desired that the face-warp uppermost in the last shed to receive the stuffer or interior filling shall be made to appear at the opposite side of the fabric. When it is desired to make the warp upon one face of the fabric show for one or more sheds upon the opposite face of the fabric, these face-warp-threads are themselves bodily carried, as indicated at the line *F*, from the upper to the lower part of the shed.

### DOUBLE-PILE FABRICS.

#### Principles of Construction of the Plain "Double Plush."

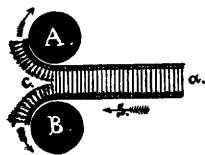


FIG. 849.

The end to be gained in the manufacture of warp pile fabrics of the present division is, the production of two single velvet (or similar) fabrics with one operation of the loom. In the manufacture of double plush the wires so conspicuously referred to in speaking of warp pile fabrics, are omitted. The pile-warp-threads, after interlacing into the "body structure" of one of the single fabrics, pass across to the "body structure" of the other fabric, where in turn they are interlaced before returning to the fabric from which they

started. Constantly exchanging pile-warp-threads from one cloth to the other forms the principle of double-pile weaving, and is illustrated in diagram Fig. 849 by *a*. After combining the pile of a two-ply fabric in the manner previously explained, its pile-warp-threads, running across the centre or interior of the fabric, are cut automatically by means of an attachment on the loom known as the "cutting knife." The variously constructed knives in practical use, as well as the methods of their operation, are treated later on.

*Methods in Use for Interlacing the Pile-warp in Double-plush Fabrics.*

Various methods for exchanging the pile-warp in weaving "double plush," as also the different ways of interlacing (or fastening) these pile warp-threads to the ground-cloth of each fabric, are in practical use. An explanation of a few of these is given, whereby a pretty clear conception

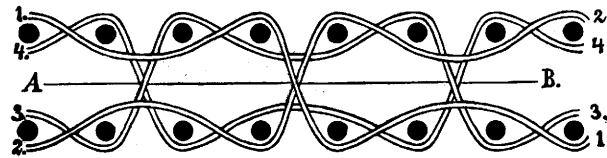


FIG. 850.

may be had of the method of interlacing double plush. Diagram Fig. 850 illustrates the section of a double-plush fabric. In this, four distinct warp-threads are visible, and are indicated by the numbers 1, 2, 3 and 4. These four warp-threads and the sixteen sections of the filling illustrate one repeat of the arrangement of the warp and filling, as well as the method of intersecting both systems, technically known as their weave. Line *A* to *B* in the diagram indicates the direction for cutting the pile-warp.

In diagram Fig. 851, another method for forming double plush is shown. The diagram illustrates the section from a specimen fabric.

In this, two distinct sets of warp-threads (shown by dotted lines) form the body structure for each individual single "plush fabric," while the pile is produced by a separate set of warp-threads which alternately interlace into one and then the other body-structure. The body-warp for the upper fabric is indicated by letters *A* and *B*, and that for the lower by *D* and *E*. Line *F* to *G* shows the course through which the pile is cut to produce the two separate plush fabrics.

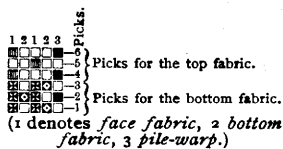


FIG. 851a.



FIG. 851.

An analysis of the section shown in Fig. 851 gives as follows: Picks 1, 2 and 3 for the lower fabric and picks 4, 5 and 6 for the upper fabric.

Fig. 851a is a plan of the method of interlacing, technically known as the "weave." 2 harnesses are required for the body-warp of the upper fabric; 2 harnesses for the body-warp of the lower fabric and 1 harness for carrying the pile-warp; thus 5-harness in repeat. In reeding the warp five threads must be put in one dent.

To produce a well covered full face in the fabric, two kinds of ground or body-warp must be used. One kind for threads working as shown by warp-threads *A* and *E*, or tighter than the other body-warp, or threads working the same as warp-threads *B* and *D*, which operate with less tension; hence two beams are necessary for the body or ground-warp, with one beam for carrying the pile-threads.

The adjusting, or "setting" of the harness is such that when the loom is at rest the set of warp-threads for the upper section of the fabric is in a sufficiently elevated position as compared to those for the lower cloth. The method of operation for the harness is such that for the picks of the upper cloth harnesses are lowered, and for picks for the lower fabrics harnesses are raised. This method of weaving double plush only requires one shuttle, and the weaving is performed the same as ordinary weaving.

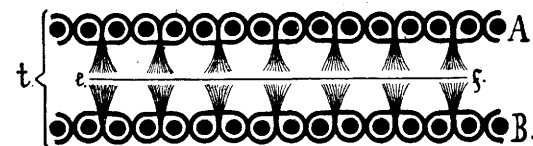
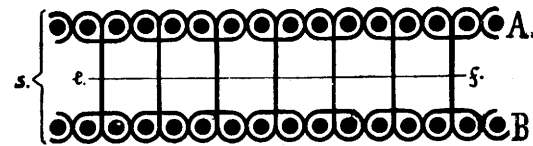
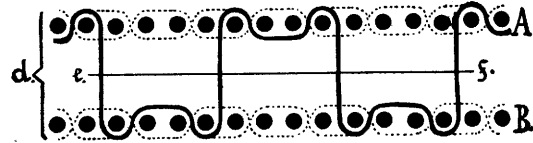
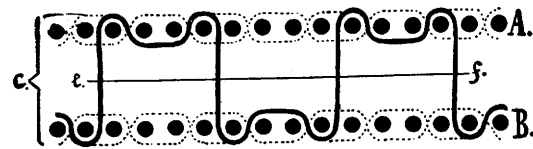
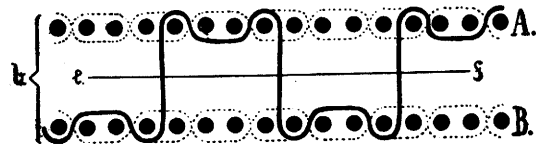
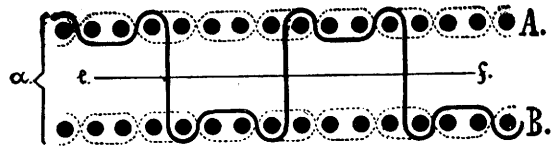
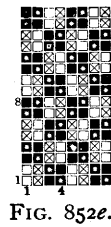
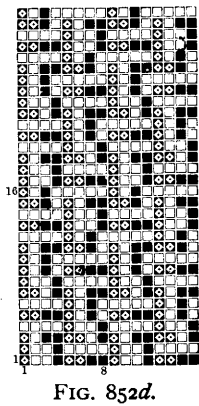
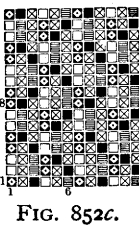
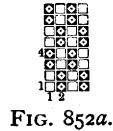
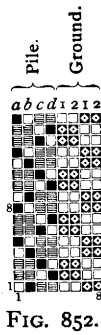


FIG. 852b.

The arranging of three successive picks alternately for each fabric is of no disadvantage to either structure. Each plush fabric will show the same smooth surface after cutting. Diagram Fig. 800, on page 170, in the chapter on the construction of single plush and velvet fabrics represents the section for each separate single cloth of the double plush illustrated in Fig. 851.

Fig. 852 illustrates another plan for weaving double plush. In this instance a double shuttle loom is used (cam-loom principle), using each shuttle for interweaving in the one system of the structure. Consequently two sheds must be formed at one operation of the loom, which is effected by using for the pile-warp "Cams" which are capable of holding the harness frames in three

different positions, "the bottom," "the centre," or "the top" part of the complete double shed. It will be readily understood that "the centre" refers to the upper division of the lower shed, as well as the bottom division of the upper shed.

In Fig. 852 the first 4 harnesses, for future reference indicated by letters *a*, *b*, *c* and *d*, represent the pile. In the same the  $\blacksquare$  type indicates the raising of a harness in the top division of the upper shed or "the top," the  $\blacksquare$  type indicates the placing of the harness for forming "the centre" (being also the temporary "shuttle-race" for the shuttle interlacing the upper ground fabric). This position is also technically known as "dwelling." The  $\square$  type indicates the lowering of the harness for forming "the bottom" of the lower shed in the loom. The rear 4 harnesses indicate the working of the ground warp. Harnesses indicated by 1 form the one body-structure, while the harnesses indicated by 2 form the other body-structure. Each set of the ground-harnesses (1, 1 and 2, 2) is placed by a respectively high or low strapping into its proper position for guiding either the ground or body warp of the upper or lower ground-cloth. The drafting for the present weave is 1 end ground-warp for the top cloth, 1 end ground-warp for the lower cloth, 2 ends pile-warp, thus 4 threads in one repeat.

Fig. 852*a* illustrates the separate weave for interlacing each body-structure, being the common (2-harness, 4 picks) rib-weave, or the common plain two picks in a shed.

In Fig. 852*b*, six respective diagrams are given for illustrating the compound weave Fig. 852. Diagram indicated by *a* represents the section of the corresponding pile warp-thread *a* in the weave; diagram *b* shows the section of pile warp-thread *b* in the weave; diagram *c* illustrates the section of pile warp-thread *c* in the weave, and diagram *d* refers to pile warp-thread *d* in the weave. The ground or body-warp working close by the pile-warp is shown by the dotted lines in each diagram. Letter *A*, in all the diagrams shown under Fig. 852 *b*, indicates the upper fabric and letter *B* the bottom fabric. Horizontal line *e* to *f* indicates the direction for cutting the pile as performed afterwards. In diagram *s* of Fig. 852*b*, the complete interlacing of all the four pile-threads in a fabric is shown. In the same, ground-warps (as previously shown) are omitted so as to give a clearer understanding of the subject. Letters of reference are also selected to correspond with the previously explained diagrams *a*, *b*, *c* and *d*, as well as to diagram *t*, which illustrates the section of the four pile warp-threads when cut (ground-warp again omitted).

In Fig. 852*c*, a separate analysis of one fabric from the double structure is given, showing 4 pile and 2 body warp-threads and 8 picks for its repeat. Warp-threads 1 and 4 for body, warp-threads 2, 3, 5 and 6 for pile.  $\square$  shows the raising of the body-warp,  $\square$  shows the lowering of the body-warp;  $\blacksquare$  shows the raising of the pile-warp;  $\blacksquare$  shows the lowering of the pile-warp for two picks down so as to interlace with the body-structure by means of raising in both adjacent picks;  $\square$  shows the lowering of pile-warp for four picks so as to form the pile by means of interlacing with the mated body-structure (not shown).

Fig. 852*d* shows the complete analysis executed in the regular double-cloth principle, ordinary weaving, one shuttle work; thus only raisers or sinkers and no centre or "dwell," and hence 8 warp-threads and 16 picks. Warp-threads 1, 2, 5 and 6 are for the body-warp and the warp-threads 3, 4, 7 and 8 for the pile-warp.

In Fig. 852*e*, a special plan illustrating the working of the pile-warps, as previously explained, is given.  $\square$  and  $\blacksquare$  show the interlacing in fabric 1 or *A*.  $\square$  and  $\blacksquare$  show the interlacing in fabric 2 or *B*.

#### Methods of Operation in Use for Producing Double-Pile Fabrics and the Different Systems of Cutting the Pile-Threads.

As mentioned at the beginning of the present chapter on double-pile fabrics, both single-cloth fabrics after being woven on the double-cloth system must be separated, or the pile cut in the centre of the float from the one body-structure to the other. Two methods are in practical

use for cutting this pile. First, the pile-warp is cut automatically on the loom on which it is woven, and second, the pile-warp is cut after the fabric has left the loom. The first method is the one most generally adopted, and the illustrations and explanations of some of the processes most frequently used are given.

Diagrams 853, 854, 855, 856, 857 and 858 illustrate C. R. Garratt's invention as to the mechanism for cutting double-pile fabrics.

Fig. 853 illustrates at *M* the section of the double-pile fabric, at *D* the section of the cutting knife, liberating with it both separate pile-cloths as shown at *NN*.

Fig. 854 illustrates a plan-view of part of a loom having the before-mentioned arrangement attached.

Fig. 855 is a front elevation, with the bracket, which supports the operating shaft as well as this shaft and its driving-pulley and bevel-gear, removed.

Fig. 856 is a plan-view of the knife, showing the manner in which the cords are attached.

Fig. 857 is the side-view of a loom (of a different make than the one before) which has the cutting arrangement attached.

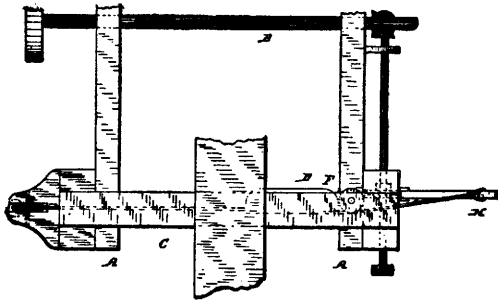


FIG. 854.

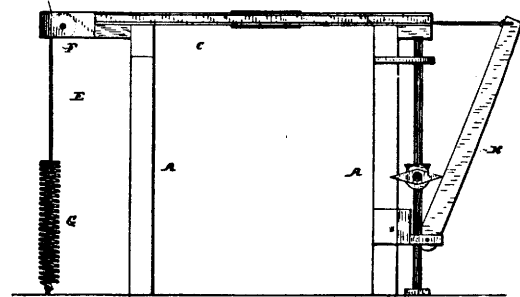


FIG. 855.

The letters used for indicating the different parts in these five diagrams are identical. An examination of the same gives us as follows:

*A* illustrating the framework of a loom.

*B* representing the mainshaft, journaled in the framework, and provided with a driving pulley.

*C* is a cross-piece located at the front of the loom, provided with a groove extending across the loom, in which the knife *D* reciprocates. The main portion of the cutting-edge of this knife is straight, but the ends, or corners, are rounded, so that the knife will cut equally well when moving in either direction, while the straight cutting edge between the rounded corners is adapted for cutting the pile in a smooth and effectual manner through very short reciprocating movements of the knife. At the opposite ends of the knife cords are attached, which pass over pulleys *F*. One of these cords is attached to a spring *G*, which is secured to the floor. The other cord or wire is attached to a lever, which is pivoted in a bracket secured to the framework. This lever can be arranged to vibrate either by means of a cam or crank.



FIG. 856.

In the present illustration the first mentioned arrangement is used. The acting of the cam upon the lever *H* forces the latter outward, and consequently forces the knife to the extreme right of the groove against the power of the spring *G*. The action of the spring as it contracts is to draw the knife to the extreme left of the groove, and at the same time to draw the lever inward.

Fig. 853, as previously alluded to, illustrates at *N* the two separate single pile fabrics. In diagram Fig. 857, the method of "taking up" these fabrics without injuring the pile is shown. After drawing the fabrics over the edges of the "breastbeam" of the loom, they are guided over two "take-up rollers," *X*, opposite each other, which have a roughened surface, and by which the fabrics are held taught and drawn backward from the knife, so that the centres of the uncut pile will be evenly presented for the cutting. After passing the "take-up" rollers *N*, the fabrics fall into the cloth-box *S*.

This method of keeping the fabric loose, and not tightly wound around its "take-up" or cloth beam as in common weaving, preserves the beauty of the pile. The previously explained method of operating the cutting knife may also be changed so as to have it operated on by the lay. This principle is illustrated in diagram Fig. 858. In this, the one cord (formerly connected to a lever) is shown attached to the lathe *O* of the loom. This lathe is operated in any ordinary manner, so that the knife will be reciprocated in its guiding-groove at each throw of the lathe.

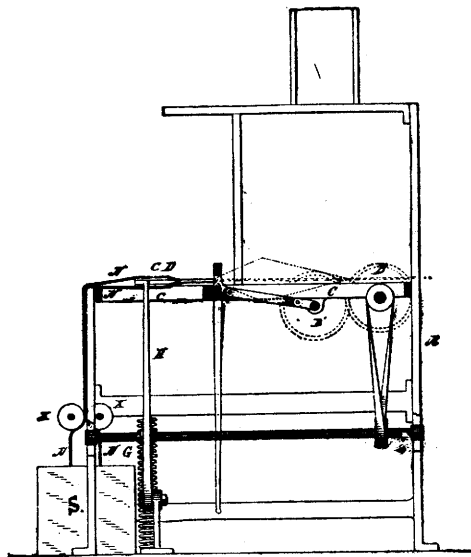


FIG. 857.

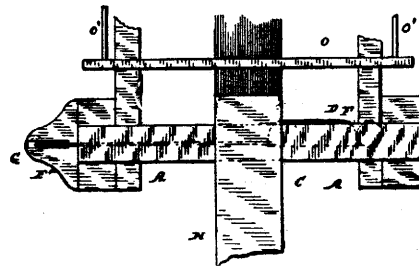


FIG. 858.

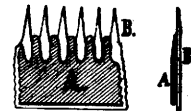


FIG. 859 a. FIG. 859 b.

Another kind of "cutting knife" is shown in Figs. 859*a* and 859*b*. Fig. 859*a* illustrates the plan-view, and Fig. 859*b* the section. In operating this "cutting knife" the long teeth enter between the two pieces of cloth while the lateral movement of the top blade cuts the pile-threads. In the diagram blade *A*, shown shaded, is the movable blade, and is situated upon *B*, the fixed blade which is shown in outline.

Figs. 860, 861, 862, 863 and 864 illustrate a mechanism for severing double-pile fabrics in the loom in which it is woven, as invented by A. Bacon.

Fig. 860 is the side-view of a loom necessary to illustrate the construction and mode of application of the attachment for severing the double-pile fabric produced on the loom.

Fig. 861 is a front-view of the same loom and the cutting device, with the sharpener for the cutting knife removed.

Fig. 862 is a plan-view of the same loom and the cutting device.

Fig. 863 illustrates a perspective view of the cutting device; the sharpening attachment for the knife is illustrated separately, in front, and detached from its supports, so as to give a clearer understanding of the main features of the device.

Fig. 864 is a transverse section (enlarged) on the line 1, 2, in Fig. 862.

The letters indicating the different parts of the cutting device, as well as the loom, are identical. The following description will readily show the manner in which the cutting device is attached to the loom. Also the method of operation of the former, with a general description of its construction.

(This device, as claimed by the inventor, can also be adjusted to any other kind of loom with a few appropriate changes, such as may be required by the style of loom to be adjusted.)

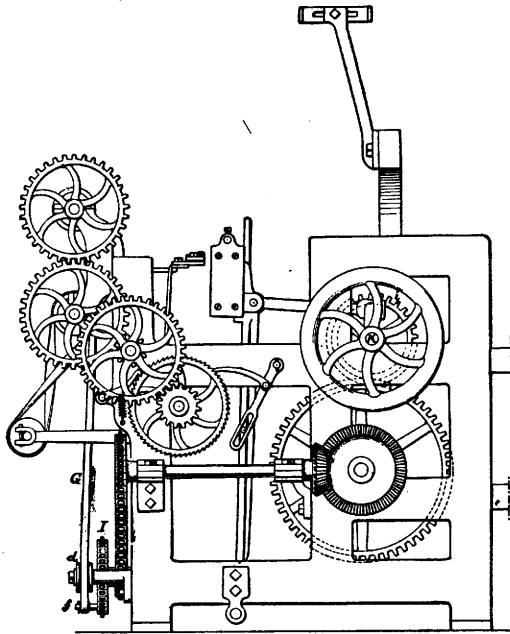


FIG. 860.

Parallel with the breastbeam of the loom (see *A* in drawings) and a short distance in front of it is a bar *B*, which is carried by projecting brackets *X*, and forms a guide for a slide *D*, the latter carrying a stud, on which is free to turn a spur-wheel *a*, to the upper face of which is secured a circular cutter *F*. This spur-wheel engages with a rack *b*, which is secured to the upper face of the guide-bar *B*, so that as the slide *D* is caused to reciprocate transversely in the guide a rapid rotary motion, first in one direction and then in the opposite direction, will be imparted to the cutting-disk *F*. One end of the slide *D* is connected to one end of a belt *G*, which passes around pulleys *d*, supported on the frame of the loom. The opposite end of this belt is

connected to a stud *f*, projecting from one of the links of a chain-belt *H*, adapted to sprocket-wheels *I*, mounted upon studs *g²*, secured to and projecting from the loom-frame. A similar belt *G*, passing

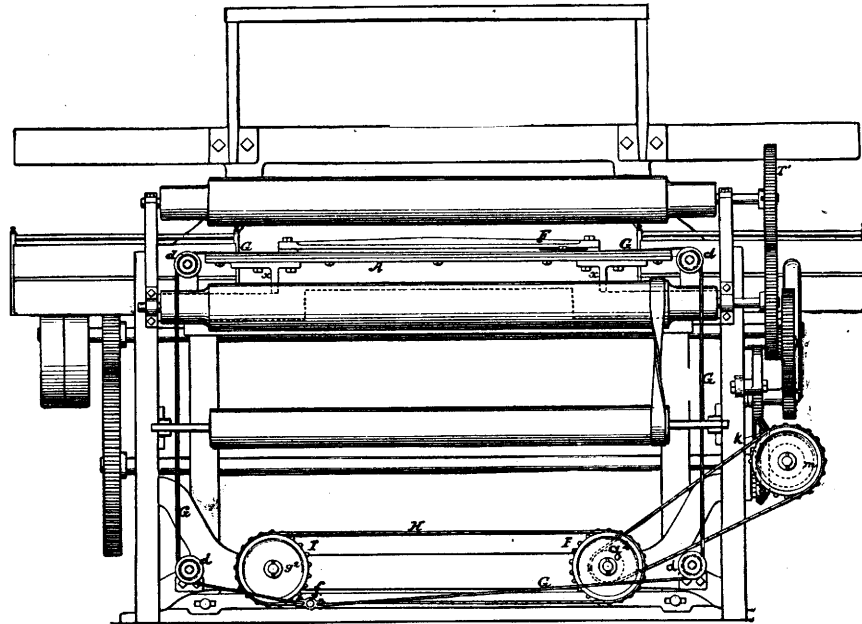


FIG. 861.

around like pulleys *d*, serves to connect the opposite end of the slide *D* to the stud *f*, so that when rotary motion is imparted to the sprocket-wheels *I* the stud *f*, traveling with the belt *H*,

will, through the medium of the belts *G*, impart a transverse reciprocating movement to the slide *D*, and thus cause the cutter *F* to pass to and fro through the web of fabric, so as to cut the pile-threads and separate the compound fabric into two single fabrics, each having a cut-pile surface.

In order to insure uniform cutting of the pile, the movement of the slide and its cutter must be smooth and steady, as any jarring or jerking of the slide or cutter causes irregularity in the

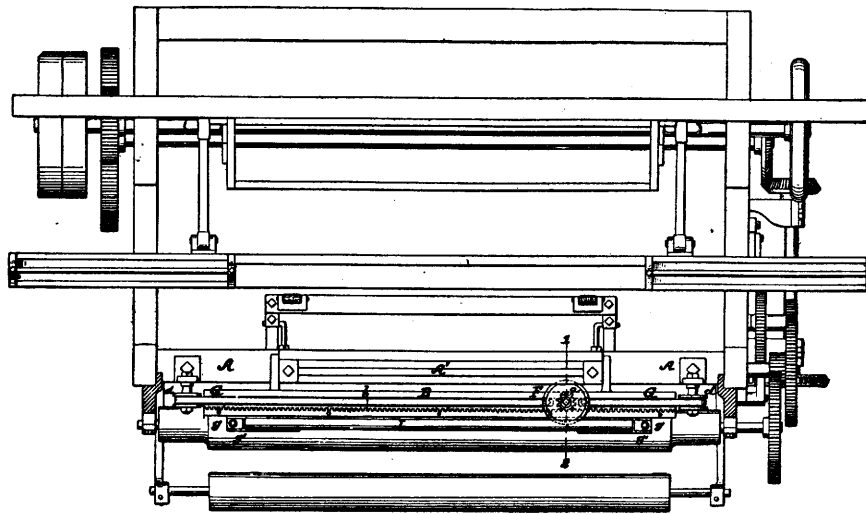


FIG. 862.

cut and unevenness in the length of pile on the fabrics produced. This smooth and steady movement is secured by means of the driving mechanism shown; there is a gradual diminution in the speed of the slide at and near each end of its traverse and a gradual acceleration of speed as it starts on the return movement.

Rolls *J*, between which projects the cutting edge of the knife *F*, are acted upon so as to press the rolls *J* toward each other and into contact with the opposite sides of the knife.

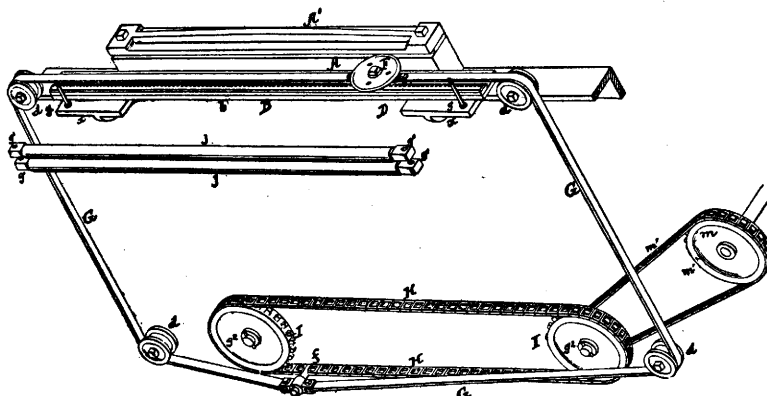


FIG. 863.

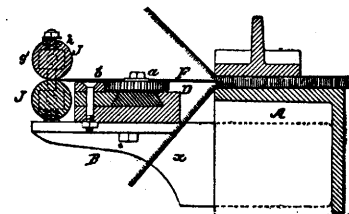


FIG. 864.

The rolls *J* are coated with abrading material, and extend throughout the traverse of the knife, so that the cutting-edge of the latter is at all times under the sharpening influence of the rolls, and a keen edge is thereby maintained. (This cutting device can also be used, applied to a machine for cutting double pile fabrics after the woven cloth has left the loom, instead of being used directly in connection with the loom in which the fabric is woven.)



Drawings Figs. 865, 866, 867, 868, 869, 870, 871, 872 and 873, represent C. Pearson's invention for cutting on the loom double pile velvets and similar pile fabrics during the weaving process.

The invention of the present system for separating the double pile fabric into two separate single pile fabrics, consists in employing two pile-severing knives, which are caused to travel laterally, each a distance only half the width of the fabric, in a transverse guide-plate or race.

The letters of reference in the drawings denote like parts in the several views given.

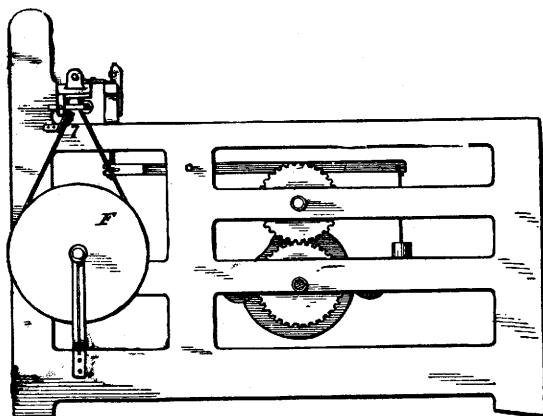


FIG. 865.

Fig. 865 represents a side elevation of part of a loom for weaving double pile fabrics. The drawing also illustrates one of the "knife carriages" with its actuating mechanism, and part of the sharpening mechanism adjacent to it with a part of its actuating mechanism. Fig. 866 is a front view of part of the loom. Fig. 867 illustrates a transverse vertical section of the grooved race-bar; also one of the cutting-knives mounted in its carriage, and one set of the sharpening-rollers with its frame or "housing."

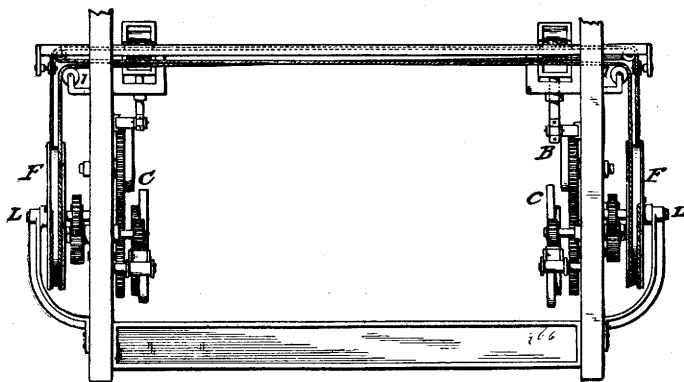


FIG. 866.

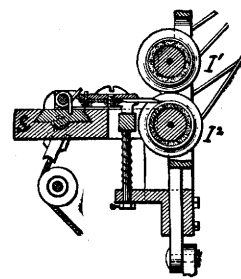


FIG. 867.

Fig. 868 is, partly, a sectional front-view of a pair of the sharpening-rollers mounted in their frame with a portion of the velvet rail or cutting bar.

Fig. 869 is a top-view of the transversely grooved guide-plate or race-bar in which the knife-carriages are reciprocated, and the parallel supporting-bar in which the fabric is cut by the laterally-traveling knives.

Fig. 870 is an enlarged view of the parts at one end of Fig. 869, showing the transversely grooved race-bar, a knife-carriage with its knife, and the stopping mechanism in the race-bar.

Fig. 871 is a cross-section view of the velvet delivery rollers, one of the pile severing knives, and the supporting bars, showing the relative position of these several parts.

Fig. 872 is a transverse section of the inside of that part of the loom shown in Fig. 865 from the outside.

Fig. 873 is a transverse sectional view of the loom, showing the location and arrangement of the crank-shaft and connecting-gear, one of the pulley-wheels, and the sharpening mechanism with its actuating mechanism for one of the knives.

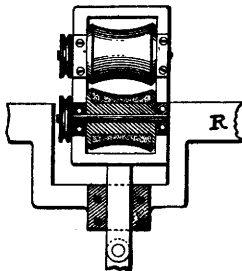


FIG. 868.

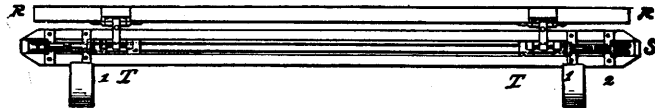


FIG. 869.

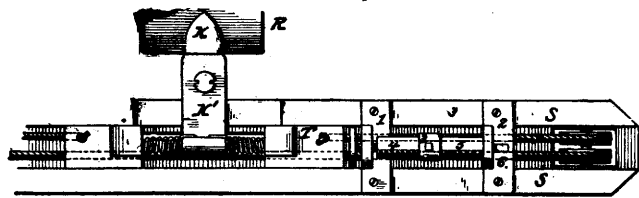


FIG. 870.

The method of operation and principle of construction of the cutting-device is illustrated by drawings Figs. 865 to 873 inclusive.

By means of the double cam *C*, operating the rack-bar and cog-gearing, alternate partial revolutions in each direction are given to the pulley-wheel *F*, to which are secured two cords or bands, the other end of each of which is attached to the "knife-carriage," one cord on one side and one on the other side thereof, so as, by the alternate partial revolutions of the pulley-wheel in

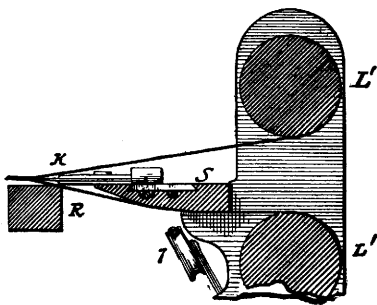


FIG. 871.

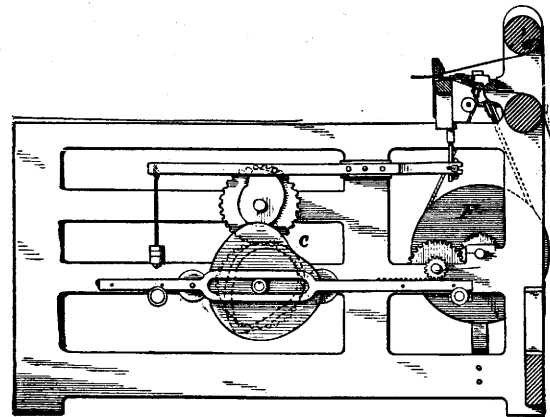


FIG. 872.

opposite directions, to pull the carriage backward and forward transversely along the grooved guide-plate or race of the loom. A similar set of cords and a knife-carriage are provided for each side of the loom, both knife-carriages moving in the same guide-plate alternately, each only about half the distance across, and each alternating in its lateral travel from side to centre of the race-plate.

Transversely across the frame of the loom are arranged two bars or rails, *R* and *S*, their relative positions being as shown in Fig. 869, the former being merely a bar or rail supporting

the double pile fabric while it is being severed in two through the pile by the laterally-moving cutting-knives. Bar *R* is recessed near each of its ends (see Figs. 868 and 869) to admit of the insertion and support therein of the housings for the sharpening-rollers, and so that the upper and lower sharpening-rollers shall come alternately in contact with the upper and lower sides, respectively, of the knife-blade, as shown in Fig. 867.

The bar *S* is a grooved transverse guide-plate recessed at each of its ends, to hold two sets of friction-rollers, over which the knife-actuating cords pass to the corresponding pulley-wheel *F*, and having one wide groove its entire length, serving as a race for the knife-carriages *T T*. At the bottom of this groove are two smaller parallel grooves, extending to the recesses at each end of the plate, and within which the knife-cords are moved. Two cross-bars, 1 and 2, are secured to the bar *S* at each end, supporting a guide-rod, 6, having an enlarged inner end, which serves as a stopper for the knife-carriage, and upon the rod 6 are placed two pieces of india-rubber tubing, 4 and 5, and between them a metal band, 3, which may be slipped along the rod against

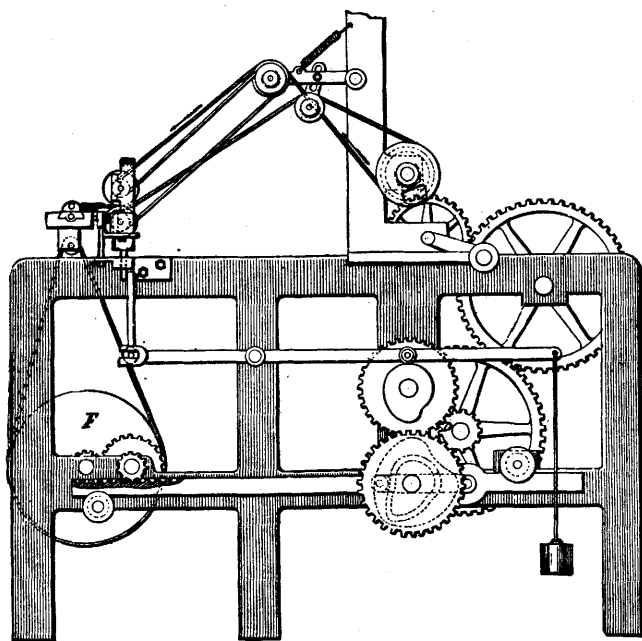


FIG. 873.

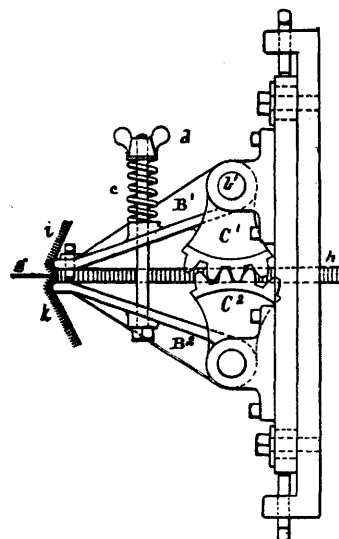


FIG. 874.

the tubing and fastened tight at any point thereon by a set-screw. By this arrangement the rubber tubing acts as an elastic cushion for the stopper-rod and in turn for the knife-carriage. The movable metal band also permits of lateral adjustment of the stopper-rod, thereby producing a variation in the resistance encountered by the knife-carriage. This mechanism is shown in detail in Figs. 869 and 870, the latter showing only one end of the bar *S*, the other end containing similar mechanism for the other knife-carriage.

The knife *K*, to cut the connecting pile latterly between the two backings, is secured in a holder, *K'*, mounted in a carriage, *T*, moving laterally in the large groove of the race-bar *S* backward and forward half the length of the bar, from about its centre to its either end, by means of the pulley and cords before mentioned. The end of the knife-holder *K'* swings upon a cross-bar, passing through it and having its bearings in the carriage *T*. A spring is coiled around this cross-bar on either side, with its ends fastened to the carriage, so that the tendency is to press the knife-blade down upon the supporting-bar *R*, or upon the velvet resting thereon, and cause the knife to travel in its reciprocating motion in a straight line and cut the pile evenly.

Each knife-carriage is provided with two pulley-cords—fastened one at each end thereof, one cord passing from the right-hand carriage over the friction roller at that end of the bar *S* to and partially around the pulley-wheel *F* in one direction, and has its end knotted in the periphery thereof. The other cord, fastened to the other end of the knife-carriage, passes along one of the small grooves in the bar *S* to the other or left-hand end thereof, where it passes over a similar friction-roller and back under the bar *S* to another friction-roller, *7*, and thence to and partially around the pulley-wheel *F*, (in an opposite direction from the other cord) to which it is fastened. A like set of cords are arranged for the other or left-hand knife-carriage. This arrangement causes the knife-carriages to be moved backward and forward in the carriage-race when and as the pulley-wheels wind up either cord successively; the wheels being turned by means of the mechanism operated by the cam *C*.

Upper and lower velvet-rollers *L'L'*, Fig. 871, suitably mounted in the frame of the loom, take up the two pieces of pile fabric cut apart through the connecting pile by the laterally-reciprocating knives *K*, and draw forward the uncut double pile fabric to the traveling knives as it is delivered over and upon the velvet-rail or cutting-bar *R*. These rollers *L'L'* are geared together and actuated by a worm, to which motion is communicated from the picking shaft, or any other suitable actuating mechanism.

#### Machine for Cutting Double Pile Fabrics After Leaving the Loom.

As previously mentioned in the chapter on double pile fabrics, in some instances the separating of both pile cloths is not done in the loom during the process of weaving, but a separate machine is necessary for cutting the fabric afterwards. In using such a cutting device for separating both cloths the former must produce a suitable feeding and tension upon the fabric during the operation so as to divide the pile-threads midway between the two "body-structures" (backs). As the length of pile in any such fabric is not always uniform, it is difficult to maintain the cutting line midway between the webs, and in order to avoid the risk of cutting into the fabrics at places where the weaving is irregular it is necessary to use a longer pile than would otherwise be required, thus consuming more material than is needed for the finished fabric, and also requiring the divided fabric to be "shorn" (afterward) to a greater extent than would otherwise be necessary.

An invention, lately patented by J. A. Campbell of Philadelphia, is designed to obviate these difficulties by making the straining-bars, over which the newly-divided fabrics are drawn, self-adjusting and self-centering, so that, whether the original double pile fabric be thick or thin, the dividing-line shall always be midway between the two fabrics.

Diagram Fig. 874 is a side-view of that portion of a machine which has this improvement attached.

The method of operation is made fully comprehensible by the following explanations given with reference to the letters used in the diagram.

At *h* is shown the double pile fabric passing in between the plates *B' B<sup>2</sup>*, and at *g* is shown a section of the dividing-knife, while at *i* and *k* are shown the divided fabrics passing off.

The operation of the device is as follows: The uncut fabric, being drawn in at *h* by the action of any suitable feeding mechanism, passes between the plates or jaws *B' B<sup>2</sup>*, and is divided by the knife *g*, after which the divided fabrics pass off at *i* and *k*, being drawn taut by suitable winding mechanism. The springs *c c*, being adjusted to a proper tension by the thumb-nuts *d d*, tend to draw the jaws or plates *B' B<sup>2</sup>* together, and so the fabric which is being divided is held firmly between the said jaws *B' B<sup>2</sup>* during the operation of cutting. The divided fabrics *i* and *k*, being drawn taut, tend to draw the jaws *B' B<sup>2</sup>* apart; but this tendency is resisted by the springs *c c*. As the toothed segments *C' C<sup>2</sup>* are firmly fastened to the jaws *B' B<sup>2</sup>*, it follows

that any motion of the jaw  $B'$  will be communicated to the toothed segment  $C'$ , and from thence through the toothed segment  $C^2$  to the jaw  $B^2$ , and so any motion of the jaw  $B'$ , to or from the cutting-line, will be accompanied by a corresponding motion of the jaw  $B^2$ . If, from any irregularity in weaving, the two fabrics of the double pile fabrics are closer together or farther apart at various points than the normal distance, the jaws  $B'B^2$  will press together or be forced apart, but always to an equal extent, and hence the two webs will always be kept at an equal distance from the cutting-line, no matter how irregular their distance from each other may be.

### Weaving Two, Three or more Narrow Widths or Pieces of Double Pile Fabrics at once.

The weaving of two or more narrow widths of double pile fabrics, side by side, in a broad loom, also requires the production of fast selvages for each special narrow width. For this purpose we must form two adjacent selvages with fast edges at any desired part of the width, both of the upper and lower cloths of the double pile fabric, as also selvages in the upper cloth immediately above the selvages in the lower cloth. To form a fast edge to each inner selvage, a warp binding-thread to cross with the outermost warp of the selvage and becoming knit together therewith must be employed. Any desired number of fast inner selvages may be formed in this way in the width, so that the fabric may be divided into widths of any required size by cutting

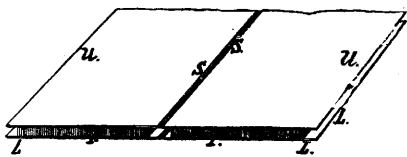


FIG. 875.

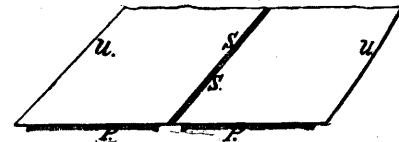


FIG. 876.

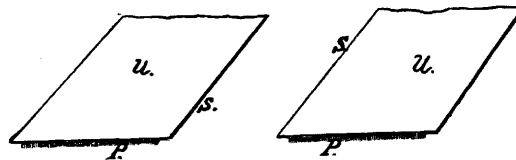


FIG. 877.

both the upper and lower cloths lengthwise between the pairs of fast selvage edges, which have been made in these cloths.

The construction of such "fast" selvages, properly belonging to the division on gauze or cross-weaving, will be explained later on.

Diagram Fig. 875 illustrates a perspective view of a short length of a double pile fabric woven face to face, with fast inner selvages.

Diagram Fig. 876 shows a perspective view of one-half of this fabric when the pile has been severed and the upper cloth separated from the lower cloth.

Diagram Fig. 877 shows two separated pieces, obtained by dividing the fabric shown at diagram 876 longitudinally between the fast selvages which are formed in it. In these diagrams  $U$  is the upper cloth,  $L$  is the lower and  $P$  is the pile.

The two parallel lines  $SS$ , which run lengthwise of each cloth, represent the fast edges of the inner selvages.

### Let-off Mechanism for the Pile Warp for Weaving Double Pile Fabrics.

In double velvet weaving there is one great difficulty to contend with, namely, to keep the two pieces of cloth an equal distance apart. To do this a regular supplying, guiding and delivering of pile-warp is required, otherwise any additional strains would draw the two pieces nearer together, and the pile would be irregular.

Diagrams Figs. 878*a*, 878*b* and 879 illustrate the arrangement for effecting the letting-off, supporting, guiding and delivering of the pile-warp, and represent C. Pearson's Patent.

Fig. 878*a* illustrates a side elevation of that part of a loom containing the necessary mechanism as mentioned.

Fig. 878*b* is a detached view of some of the parts and taken from Fig. 878*a*.

Fig. 879 is a diagram showing the arrangement and position of the several rollers and parts constituting this mechanism.

The letters indicating the different parts in this mechanism are as follows: *A* represents the frame of a loom. *G* and *H* are the beams containing the pile-warp. The latter threads are delivered from these to a guide-roller *R*, secured in the frame of the loom, and thence to a pair of metal rollers, *C C*, turned perfectly true and covered with cloth, plush, or other like rough-surface material, in order to create friction between the surface of the roller and the warp-threads. These rollers are mounted upon shafts having bearings in a bracket bolted to the frame of the loom. They are independently rotated toward each other with unvarying uniformity and precision by means of worm-wheels *d d* on the axes thereof, which engage with two screws, *F F*, one for each

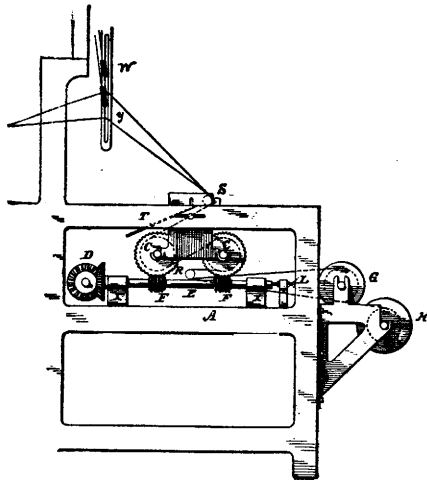


FIG. 878*a*.

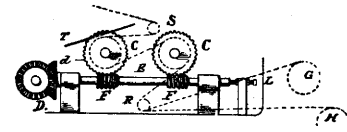


FIG. 878*b*.

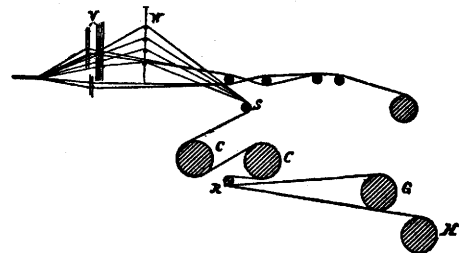


FIG. 879.

roller, one being a left-hand screw and the other a right-hand screw, on a horizontal shaft, *E*, which has its bearings in brackets *X X*, also secured to the side of the frame *A*. One end of this shaft *E* is provided with a beveled gear-wheel, which engages with a similar beveled gear-wheel on the end of the picking-shaft *D*, and is thus continuously driven. The other end of shaft *E* bears against a rod, *L*, in the bracket *X*, provided with jam-nuts, in order thereby to secure desired pressure against the shaft and its actuating-wheel, more especially when actuated by friction as a substitute for the gear-wheels shown. The pile warp-threads are delivered directly from the guide-roller *R* to one of the metal rollers *C*, and under and around the same, and from thence in like manner under and around the other roller, *C*, these rollers rotating toward each other, and from the last-mentioned roller *C* the pile-warp is carried to a second guide-roller, *S*, supported horizontally in the frame *A*, and is from thence taken up by vertical rods *Y*, held up by pull-springs *W*, to support the warp in its passage to the heddles, and to create the necessary tension thereon to hold the same taut.

Carrying the pile warp-threads to a point over the main rollers *C* the loose waste driven off by the operation will drop onto the warp after passing the second roller, *C*, injuring the pile-warp and clogging the mechanism. To prevent this, a shield, *T*, is arranged over the second roller, *C*,

consisting of a flat tin or other suitable plate extending from side to side of the loom and secured to its frame.

Another arrangement for delivering the pile warp in looms for weaving double pile fabrics has been lately invented by Mr. Fred. Pearson. This invention consists of a mechanism for the proper feeding of the pile warp into the harness, and is placed in such a position in the loom as to prevent any fibres or other substances, which may be freed from the warp yarn as it passes over the mechanism (friction rollers), from falling into the latter, and thus injuring the warp-yarn as well as clogging the mechanism. Another advantage Mr. Pearson assigns to his invention is the means provided by which this feeding mechanism can be easily thrown out of action, so as to allow the weaving of the ordinary close-stitched double-cloth required for the weaving of a proper heading at the beginning and ending of each cut. The mechanism is also arranged to permit a quick and correct changing of the amount of pile warp to be delivered, as regulated by the height of pile required for the fabrics woven, by substituting a smaller or larger worm-wheel upon the axle of the main roll.

Diagrams Figs. 880 and 881 illustrate this mechanism.

Fig. 880 is a side elevation of the rear part of a loom or attachment to a common cam-loom, and embodying Mr. Pearson's invention.

Fig. 881 is a sectional elevation, showing the delivering of pile warps (from two beams) and

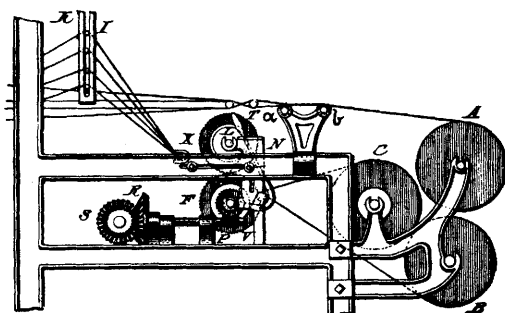


FIG. 880.

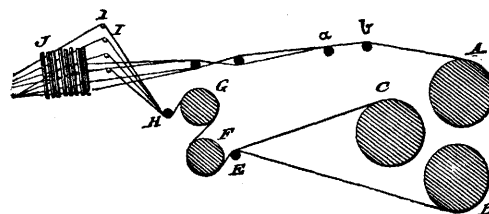


FIG. 881.

the direction of the running off of the ground warps (from one beam). The respective parts with the letters of references given (the same for both Figs.) will in a great measure explain the *modus operandi*.

*A* represents the beam for the ground-warps; *B* and *C*, the beams for the pile warps; *E* and *H*, the guide-rollers; *F* and *G*, the main or friction-rollers, whose axes are mounted in open bearings in an adjustable bracket *N*, attached to and mounted upon the main frame of the loom.

The axis of the lower friction-roller is provided at one end with a worm-wheel which gears into a worm *P* on one end of a horizontal shaft, which is driven by gear wheels *R* and *S*. Upon the opposite ends of the axes of the friction-rolls are mounted gear wheels *VX*, which gear into each other. *J* represents the harness frames.

An examination of Fig. 881, with regard to the direction of running the pile warps and ground warps of the fabric, gives us as follows:

The pile warp-threads, upon the beams *B* and *C*, are, together, carried over the guide roll *E*, under and around the main roll *F*, and around the main roll *G*, under the guide roll *H*, and over the horizontal yielding, or spring-supported rods *I* contained in the vertical guides *K*, and are thence run to the heddles. The ground warp-threads, upon beam *A* are carried over supporting or guide-rollers *a b* to the harness-frames.

At the beginning of the description of this invention we mentioned that a part of the claim was based upon allowing a quick changing from pile weaving to a weaving of regular close-

stitched double-cloth used as headings for the fabrics. This is accomplished by shifting lever *T* to the right (*i. e.*, towards the rear of the loom), thus elevating friction-roller *F* and its worm-wheel, carrying the latter out of contact or gear with the worm *P*, whereby the revolution of the main rollers *F* and *G* will be discontinued and the feeding of pile warp-threads to the heddles will be stopped.

Another method for arranging the beams for pile warps and ground warps in the loom in weaving double plush is that used by Mr. R. H. Patton. In looms of his construction the beam carrying the ground warp is situated in the rear part of the frame, as built in addition to his regular cam loom for operating the harness. The beams carrying the pile warps rest in the upper middle part of said frame. To give a clearer understanding diagram Fig. 882 has been designed. In this *A* indicates the side of the frame previously alluded to, *B* the beam carrying the ground warp, and *C* and *D* the beams for both sets of pile warps. In the present style of arranging the beams for the pile warp and guiding those warps in their run to the delivering

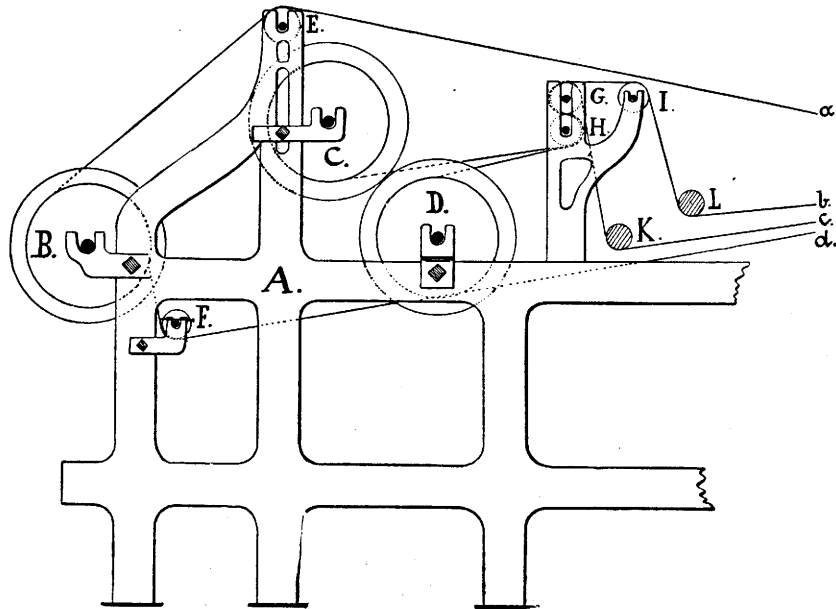


FIG. 882.

rollers *H G*, and from there to the respective harness, one great advantage over that of the previously shown methods will be readily noticed, *i. e.*, that the pile warps are delivered to their respective heddles without crossing the ground system, and consequently any possible chafing is avoided. The ground warp for the upper cloth in the loom passes from the warp beam *B* over stationary guide-roller *E* towards the harness frames; this set of threads being indicated by letter *a*. The other set of ground warps required for the lower cloth passes from beam *B* below guide roll *F* and from there direct to the respective harness frames. This set of ground or body warp has been indicated by the letter *d*. The two sets of pile warp, one from beam *C* and one from beam *D*, are guided from their respective beams into the delivering rollers *G* and *H*. The lower roller (*H*) is covered with a fine sand-paper, while the one above is covered with a plush fabric. After leaving the delivering rollers one set of the pile threads is passed over guide-roll *J* and below guide-roller *L*, and the other set below guide-roller *K*. Each of these two guide-rollers is adjusted to a lever which is on one extreme end connected with the loom frame and on the opposite end has adjusted a spring which is fastened to the floor. These springs will greatly assist in



easing up the "beating home" of the pile warp. The let-off of the pile warp is regulated by sproked gears adjustable to the axis of the delivering roller *H* and gets the motion from the "take-up" by means of a chain belt. The present method of delivering pile warps allows the harness in the front part of the loom to be arranged for an extremely high pile, *i. e.*, the keeping of the two sets of ground warp—ground cloth—as far apart as possible.

The bracket for holding guide-roller *F* can also be applied to the centre standard of the frame.

*Double Pile Fabrics Made with a Proportionally Higher Pile.*

In some double pile fabrics a greater length of pile may be required than the one which can be produced on a common loom. To overcome this difficulty James, Fred. and George Priestley have lately invented an improvement on the lay, suitable to be adopted for any loom. To secure a proportionally higher pile their patent advises the cutting away of a large portion of the solid part of the lay and inserting small steel plates set upon edge. Each plate reaches across the cut-out part of the lay, and the tops of all the steel plates are in a line and carry the shuttle when in operation. The warp-threads of the bottom fabric drop into the spaces between the steel plates and are well out of the way of the shuttle when the top or upper fabric is being woven, and at the same time the pile-threads are kept tight and at full stretch between the two fabrics.

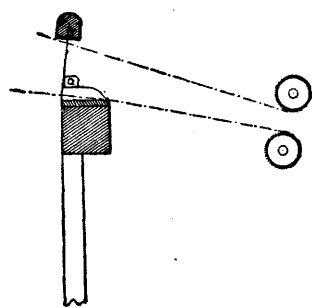


FIG. 883a.

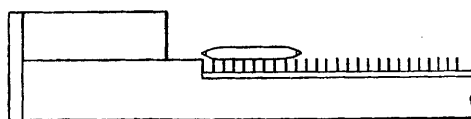


FIG. 883b.



FIG. 883c.

Diagram Fig. 883a illustrates the sectional side-elevation of a portion of the lay of a common loom which is fitted up with such steel plates.

Fig. 883b represents an elevation of the latter, and Fig. 883c illustrates a plan of a portion of the same.

*Figured Double Pile Fabrics.*

Double pile fabrics are also produced by means of the Jacquard machine. Various methods of operation as well as different makes of looms exist for effecting this process.

Diagrams Figs. 884 to 891 illustrate a specimen of such a loom and the method of operation for weaving figured double pile fabrics, which was invented and patented by T. J. Shuttleworth.

The said diagrams illustrate a loom for weaving figured double pile fabrics for operating the pile-threads whereby on the rise of the Jacquard lifter-board any desired pile-thread may be drawn down from the upper warp into the lower fabric or drawn up from the lower warp into the upper fabric, so as to produce two fabrics having a corresponding figure.

In diagrams Figs. 884, 885 and 886 the method of interlacing the two fabrics is clearly demonstrated.

Fig. 887 represents a loom showing sufficient to give one a proper understanding.

Figs. 888 and 889 are diagrams illustrating the operation of the heddles controlling the ground warp-threads.

Figs. 890 and 891 illustrate the operation of the heddles controlling the pile warp-threads. Each of the fabrics has a number of pile-warps (indicated  $x$ ) and two sets of ground backing threads (see  $y$ ), the number of pile-warps depending upon the number of colors in the pattern to be produced.

The operation of weaving the fabric will be understood upon reference to Figs. 884, 885 and 886. In Fig. 884 the threads are represented as they appear after the figuring pile-warps have been drawn from the upper to the lower and the lower to the upper fabric and bound in by picks 1, all of the upper pile-warps being then elevated and the lower pile-warps depressed and the ground or backing warps of each fabric crossed, so as to form upper and lower sheds for the insertion of

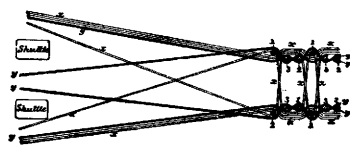


FIG. 884.

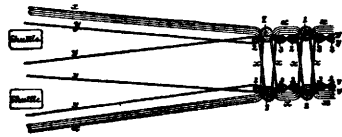


FIG. 885.

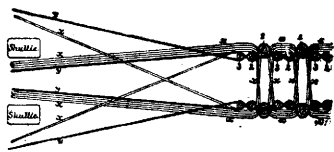


FIG. 886.

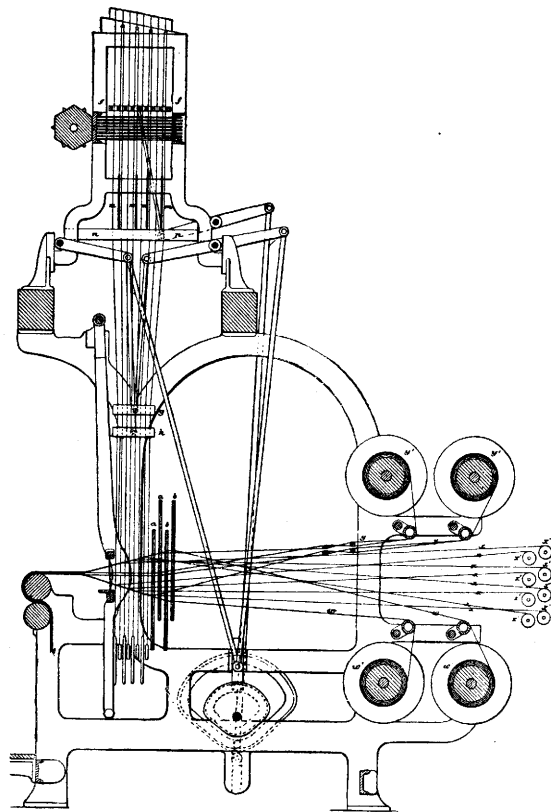
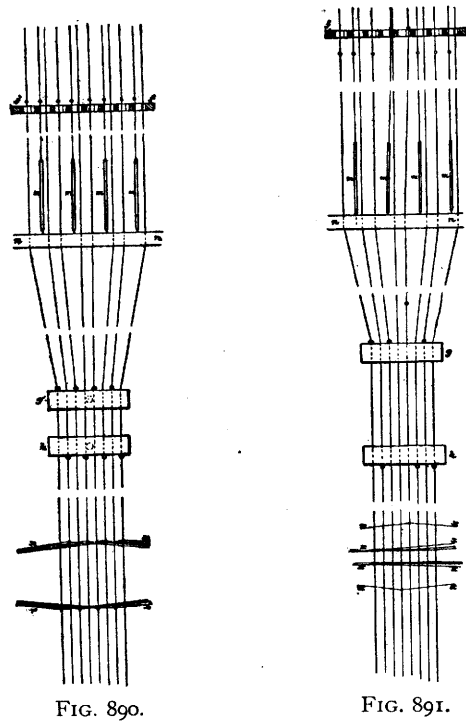
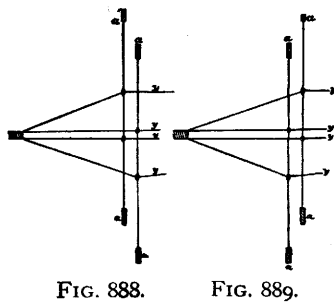


FIG. 887.

the binder picks 2, which are thrown in and beaten up and the ground-warps of each fabric then again crossed, as shown in Fig. 885, to form sheds for the binder picks 3, and after throwing in these picks the ground-warps of each fabric are again crossed to form upper and lower sheds, all of the upper pile-warps except those for the figure being lowered to the level of the bottom of the upper shed, and all of the lower pile-warps except those for the figure being raised to the level of the top of the lower shed, as shown in Fig. 886.

Such of the upper pile-warps as are necessary to form the figure are drawn down into the lower shed; and such of the lower pile-warps as the figure demands are lifted into the upper shed, as shown in Fig. 886, preparatory to throwing in the binder picks which confine said figuring pile-threads on the backs of the fabric; the operations being then repeated. As shown in the drawings, accompanying these explanations, such of the pile-warps as are necessary to form the

figures are drawn across from one fabric to the other on every third pick; but, if desired, only one binder pick may be put in on the face of the fabric between successive tufts of the pile. The mechanism for effecting the movements of the threads which we described, is shown in Fig. 887. The heddles which control the ground warp threads have double eyes, as shown in Figs. 888 and 889. The threads of the upper fabric pass through the upper eyes of the heddles, and the threads of the lower fabric through the lower eyes, these eyes being so related and the lift of the heddles being such as to effect the proper formation of the upper and lower sheds. Each of the pile-warps is controlled by a harness thread connected to one of the needles of the Jacquard, (see Figs. 890 and 891) and passing through the usual notched eye in the lifter board, above the Jacquard needles, each harness-thread having a knot above the lifter-board, so that when the thread is adjusted by the needle to bring this knot over a notch of the board, this knot and that



portion of the thread in which it is formed will be lifted by the board as it rises, there being no lift of those threads the knots of which remain in line with the eyes of the lifter-board.

The movement of the entire body of warps, except those necessary to form the figure, is effected by comber-boards *g* and *h*, Figs. 890 and 891, the upper of which, in the present instance, acts upon knots upon the harness-threads of the pile-warps of the lower fabric, while the lower board acts upon knots upon the harness-threads of the pile-warps of the upper fabric, and these boards are caused to move toward and apart from each other, so that on the rise of the upper board, *g*, all of the pile-warps of the lower fabric, except the figure-warps, will be lifted from the position shown in Figs. 884 and 885 to that shown in Fig. 886, the descent of the lower board, *h*, causing the corresponding pile-warps of the upper fabric to drop to the same extent. The comber-boards remain separated while the binding-shots *i* are being thrown in, after which they are drawn together, so as to restore the warps under their control to the positions shown in Figs. 884 and 885.

Such of the pile-warps as are desired to form the figure are by means of the Jacquard brought

under control of the lifter-board, which has a movement in excess of that imparted to the comber-boards, so that the figuring pile-warps will be carried up or down into the opposite fabric.

The figuring-threads of the lower pile-warp are simply elevated by the action of the lifter-board as the latter rises in the usual manner; but it is necessary to transform this rising movement of the lifter-board into a downward movement of the figuring-threads of the upper pile-warp; hence each of the harness-threads of the upper pile-warps must be passed around a pulley or other bearing so as to double it back upon itself, pass it again through the eye of the lifter-board, and connect it at the lower end to a strip *m*, Figs. 890 and 891, of rubber or other elastic material, secured to the guide-board *n* below the Jacquard apparatus. The lifter-board acts upon a knot on this returned portion of the harness-thread, so that the lift of the board serves to stretch the spring and permit the drop of the weighted portion of the harness-thread which controls the

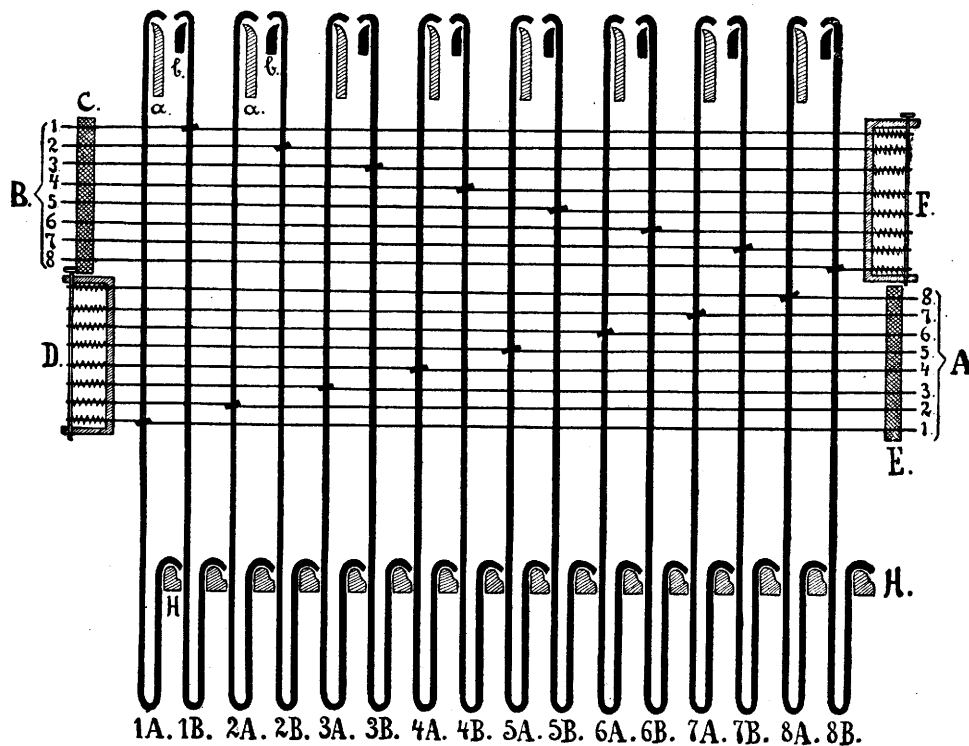


FIG. 892.

warp-thread, this warp-thread being lifted on the descent of the board by reason of the contraction of the spring *m*, which exerts a force considerably in excess of the weight.

The lifter-board of the Jacquard is operated by a cam on a shaft, the cam acting on a slide which is connected by a rod to a lever connected to the lifter-board by a rod.

The comber-boards are operated by another cam on the shaft mentioned before, this cam acting on a slide which is connected by a rod to a lever, and by another rod to an arm; the lever before mentioned being connected by a rod to the upper comber-board, and the arm also previously mentioned is connected by a rod to the lower comber-board, so that the desired movements of both comber-boards towards and from each other are effected.

The principle thus far explained of weaving these double pile fabrics can also be used in connection with a Jacquard apparatus in which griffe-bars are used in place of an eyed and notched lifter-board, and hooks are used instead of knots in the harness.

*Figured Double Plush Produced upon a Jacquard Machine Containing a Stationary and a Raising "Griffe," and also a Lowering (Falling) "Grate" or "Rester."*

Mr. T. Halton has lately applied for a patent for a Jacquard machine for weaving "figured double pile fabrics," which is very simple and effective in its method of construction. This machine resembles to a certain extent a double-lift double-cylinder Jacquard machine used in weaving damasks, dress-goods, etc. This new Jacquard machine has also two sets of griffe-bars (similar to the double-lift double-cylinder), but only one set raises while the other remains

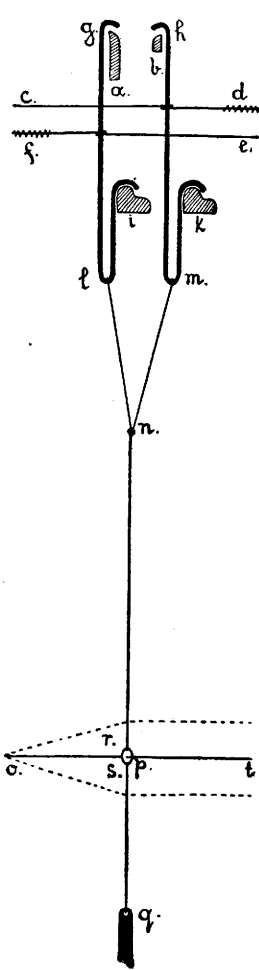


FIG. 893A.

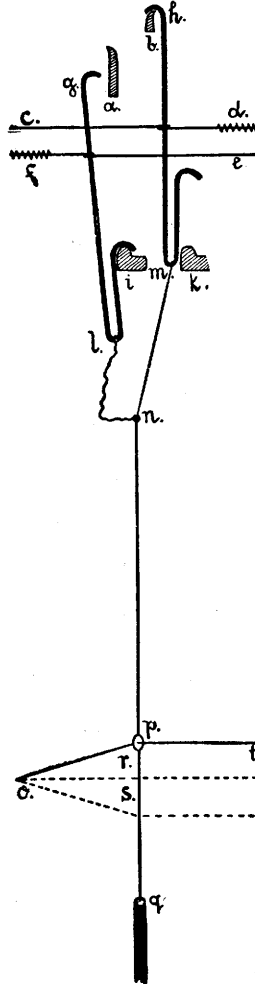


FIG. 893B.

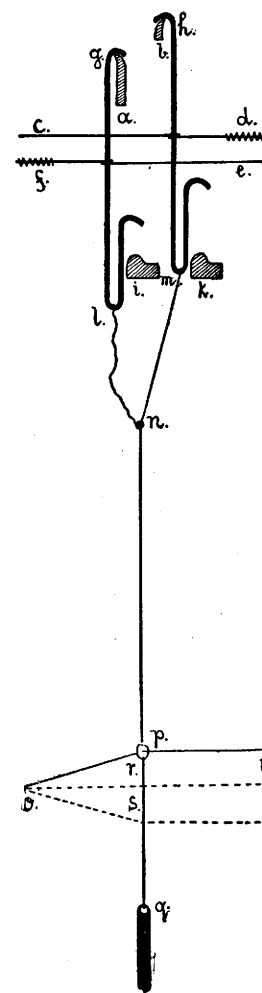


FIG. 893C.

stationary. The "grate" or "rester" for the hooks in the new machine is arranged to lower simultaneously when the previously mentioned griffe raises, and again raises to its starting-point as soon as the griffe lowers to its point of starting. The cylinders of the Jacquard machine for weaving figured double pile fabrics are operated on at the same time, while the cylinders of the Jacquard machine, known as "double-lift double-cylinders," are operated on alternately.

To give a clearer illustration of the construction of the machine, Fig. 892 has been designed. It represents the section of a four-hundred Jacquard machine for weaving figured double pile fabrics.

At the point indicated by *A*, one vertical row of one set of needles is shown (*E* = needle board, *D* = spring box). At *B* one vertical row of the second set of needles is shown (*C* = needle board, *F* = spring box).

*a* represents sections of stationary griffe-bars (shown shaded); *b* represents sections of raising griffe-bars (shown in black); *H* represents sections of the grate or rester (for holding the hooks in the required position and also for guiding the latter in their lowering, if not called for by either one of the griffe-bars).

Hooks 1 *A* and 1 *B* have their neck-cords connected to the same leash. (Also 2 *A* and 2 *B*; 3 *A* and 3 *B*; 4 *A* and 4 *B*, etc.)

Figs. 893 *A*, *B*, *C*, *D* and *E* illustrate the *modus operandi* of the machine and its harness. Two hooks, operating the same warp-threads, are used for illustrating the principle. Letters of reference indicate like parts in each diagram.

*g-l* and *h-m* are the previously mentioned two hooks; *e-f* the needle for operating the hook *g-l*; *c-d* the needle for operating the hook *h-m*; *a* is the stationary griffe-bar; *b* is the raising griffe-bar; *l-n* and *m-n* are the neck-cords; *p* is the heddle eye; *r* and *s* the double shed required; *q* the lingo, and *o* the last woven part of the fabric.

Diagram Fig. 893*A* shows the hooks at rest; or in a position similar to that in Fig. 892 (the complete section of a 400-machine); thus the warps will rest in the loom in the position shown by the full line *o-p-t*, or in the centre.

Diagrams Fig. 893 *B* and *C* illustrate the raising of a warp-thread in the upper section of the top shed (*r*). (See full line *o-p-t*.) In diagram 893*B* this is accomplished by punching a hole in the cards for needle *c*, and none in the other card at the place where needle *e* strikes. Consequently hook *h-m*, not operated on by its needle (hole in card), will be caught by the ascending griffe *b*, and in turn raise the warp-threads by means of the harness

cord in the upper section of the top shed (*r*). (See full line *o-p-t*.) The hook *g-l*, which is thrown backwards by reason of its mate needle *e* having no hole cut in the card, is thus placed out of reach of the stationary griffe-bar and descends with the lowering of the rester *i* until it reaches the base, as shown in the present diagram. This, consequently, will have no effect upon the warp-thread, and nothing else will be produced but the slackening of the corresponding neckcord *l-n*, as represented in the diagram.

In diagram Fig. 893 *C* the same effect (as in Fig. 893 *B*) for the warp-thread (or its raising into the upper section of the top shed) is produced by having two holes cut for both needles (for needle *e*

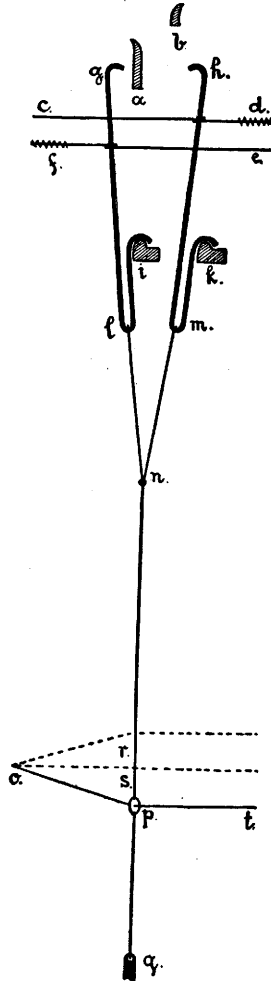


FIG. 893D.

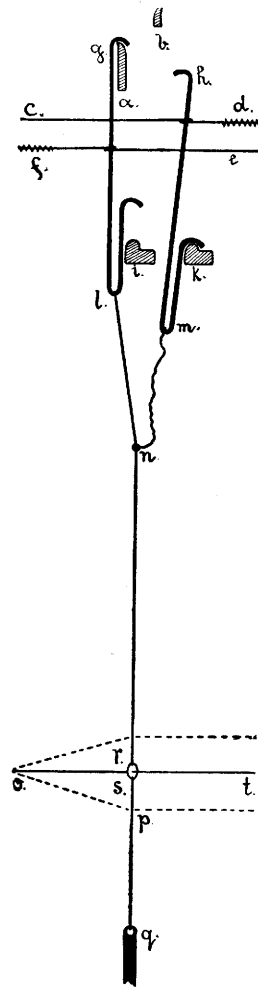


FIG. 893E.