

All designs for weaving, except those of the very simplest description, have to be worked out on ruled paper, and it is possible, after a practical acquaintance with the principles of the craft has been obtained, to arrange *all* the details of the most complicated webs in this manner. Fig. 68 will show the manner in which the paper is ruled. In the first place, the paper is always set out in exact squares ruled in thick lines, and these squares are subdivided both vertically and laterally. To the left of the line AA the partial ruling consisting of vertical lines only is shown, and the spaces between these represent the threads of the warp, in some cases single and in others in groups of equal numbers. To the right of the line AA the squares are divided laterally as well as vertically. These lateral divisions are for the purpose of enabling the designer to indicate the weft wherever it is intended to show as it crosses a thread of the warp. The proportional thickness of the weft in relation to the warp is indicated by the size of the spaces in the lateral divisions. For instance, to the right of the line AA the lowest squares, B, are divided into four spaces, both vertically and laterally; this indicates that the weft is of the same thickness as the warp thread, or group of threads, indicated by the vertical spaces. If the weft be thicker than the warp, as would usually be the case if single threads of the latter were intended, the lateral spaces must be larger in order to keep the right proportion in the woven design. In the case of the weft being one-third thicker than the warp the squares would have to be divided 4×3 , as in the middle squares, C, instead of 4×4 . If this were not so the design, when woven,

The Use
of Ruled
Paper for
Designing

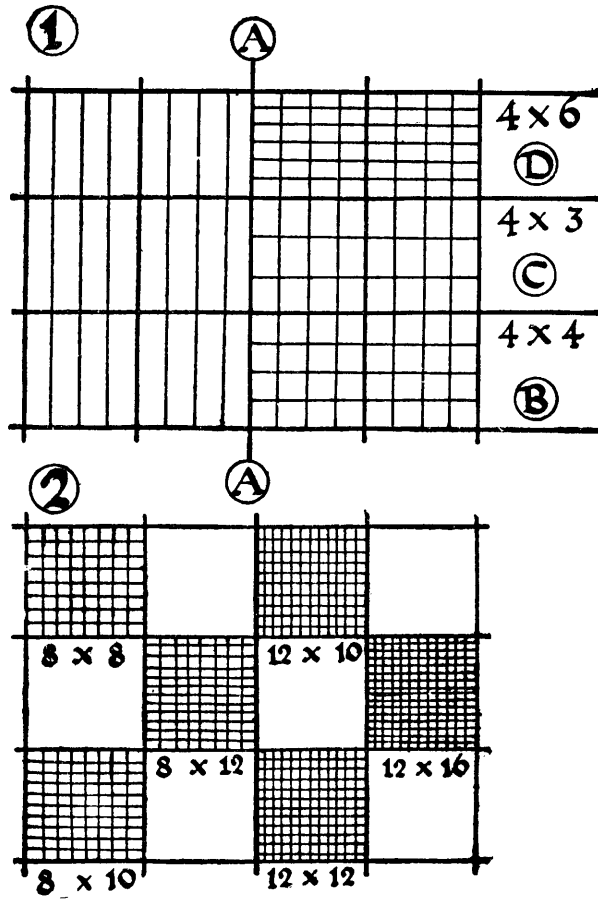
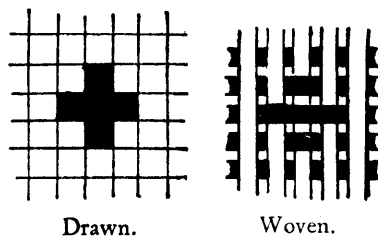


FIG. 68.—Ruled Papers.

would be one-quarter longer in proportion to its width than the drawing as set out on the large squares. The general shape and proportion of the design, therefore, is sketched, in the first place, on the thick-lined, large squares, and the edges of the shapes, the details of ties, &c., are worked out correctly by means of the subdivisions. No. 2 shows some of the most usual ruled papers in use, but papers of all kinds of sub-

division may be obtained. Unless otherwise specified, in the illustrations throughout this book each vertical space, as well as each lateral one, may be understood to represent only one thread respectively either of warp or weft.



Drawn.

Woven.

FIG. 69.

The filling in of a single space, in a ruled-paper drawing, indicates that in that particular spot the weft crosses the warp and covers it up (see fig. 69).

Fig. 70 shows the method by which the designer indicates to the weaver the way of entering the warp in the harness. The vertical lines represent the warp threads, and the horizontal lines the headles of the harness. The headles are numbered 1, 2, 3, and 4, beginning, as is generally the case, at the back. A tick or dot on the cross-line indicates the headle through which the thread is to be entered.

A HARNESS OF ANY NUMBER OF HEADLES MAY ALWAYS BE UNDERSTOOD TO BE ENTERED IN THE

General
Method of
entering and
expressing it
on Paper

General Method of entering and expressing it on Paper

Cloth mostly woven Face Downwards

REGULAR ORDER SHOWN IN THE SKETCH, FROM BACK TO FRONT. IF ANY OTHER ENTERING IS INTENDED SPECIAL INSTRUCTIONS ARE GIVEN FOR IT.

In order that the weft may cross the warp as shown in fig. 69, the cloth being made, as is

usual, face downwards, it is of course necessary that the headle in which the warp threads covered by the black cross are entered must be raised, so that the shuttle carrying the weft may pass beneath them. It has already been explained that the headles are raised by means of treadles, which the weaver controls

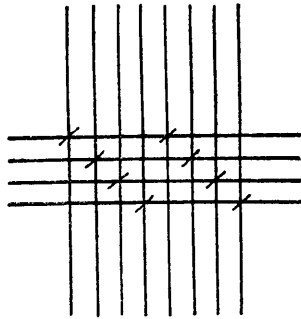


FIG. 70.—Sketch of entering in Harness of Four Headles.

with his feet, and the simplest way of connecting the headles and treadles for this purpose is shown by fig. 42. There are, however, various ways of doing this, which will be described later on, under the head of *Shedding Motions*, but they are all alike in one particular, which is, that they all provide for the lifting of the headles as indicated on the ruled-paper drawing. This being so, the drawing out of the design is not affected by the particular kind of shedding motion with which the loom, on which the web is to be made, is fitted up.

Designs on Ruled Paper not affected by Shedding Motions

Tying up the Loom

Tying up the headles and treadles is a matter for the weaver to arrange according to the sequence of rising indicated by the design of the pattern on

ruled paper, and much ingenuity has often to be exercised in doing this in the most convenient manner for weaving. If, as he were working, the weaver had to think of the pattern, however simple, and the necessary succession of treadles to form it, the weaving would be slow and not automatic. He therefore has to arrange a plan for the *tie-up*, which will allow of his treadling in the order to which he is accustomed, and will, at the same time, cause the headles to rise in such a succession and combination as will work out the pattern correctly.

Tying up
the Loom

The usual order in which a set of treadles is worked is from the outside right and left to the centre. For instance, with eight treadles, the outside right one is no. 1 and the outside left no. 2. Next to no. 1 is no. 3, and next to no. 2 is no. 4. No. 5 is on the right by no. 3, and no. 6 on the left by no. 4. No. 7 is the last trodden by the right foot, and no. 8 the last taken by the left. Some weavers prefer to begin with the left foot and others prefer to work right across, in which cases they make out their plan or draught to suit themselves; but this does not alter the method of tying up.

The Plan
of Tie-up

Fig. 71 shows two plans of tie-up, together with the effect produced by them when woven. They also illustrate the simple method generally used by weavers to indicate the tie-up on paper. Both figures represent a set of eight headles, each harness being entered in the usual straightforward manner. This is shown by the ticks to the right of the diagrams above B. The vertical lines C, C are the treadles, numbered according to the above-mentioned sequence of treading from the right and left to the centre. The tie-up of the treadles

Examples of
Tie-up

Examples of Tie-up to the headles is indicated by the crosses, on the several lines, at places where they intersect. In diagram 1, where only two treadles are necessary to produce the effect designed at A, each treadle is tied up to four headles, no. 1 to headles 1, 3, 5, and 7, and no. 2 to headles 2, 4, 6, and 8, so that treadle 1

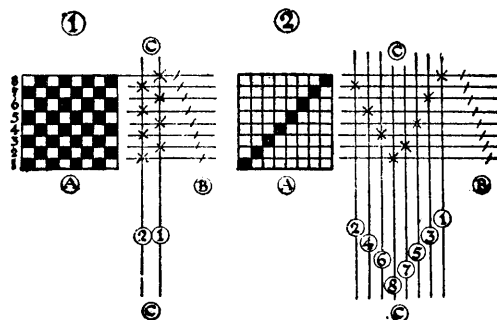


FIG. 71.—Plans of Tie-up.

will raise headles 1, 3, 5, and 7 and produce the effect of the lowest and other similar lines in the design A. The second treadle will in like manner raise the headles for the four alternate lines of the sketch, nos. 2, 4, 6, and 8. Diagram 2 has the same headles and entering as diagram 1, but instead of only two, there are eight treadles, C, C, one headle being tied separately to each treadle. The result of this tie-up, when the treadles are used in the order in which they are numbered, is shown in the sketch above A.

An amazing amount of ingenuity has been exercised by weavers in arranging for the lifting of

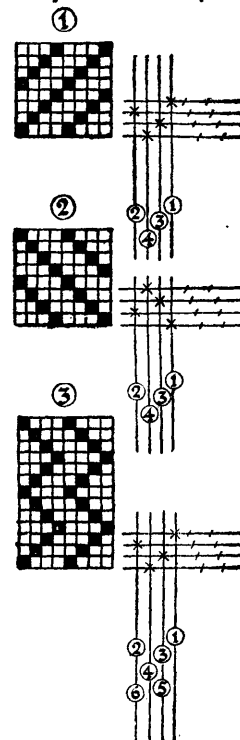
large numbers and complicated systems of headles, and pattern-weaving was formerly done to quite an astonishing extent in this manner.

The use of simple automatic contrivances has, however, quite superseded the use of an inconvenient number of treadles. But for small patterns, grounds, satins, twills, &c., there can be no doubt, that the direct tie-up of the treadles to the headles is better and more certain in action than any other contrivance whatever.

The principles of the use of ruled paper, the entering of the warp in the harness, and the connection of the treadles to the headles being understood, it will now be interesting to exemplify and examine a few of the patterns that can be woven on a loom with a single harness of only four headles, and an equal number of treadles. Fig. 72 gives examples of the simplest possible designs. The treadles for these are tied up singly to each of the four headles.

At no. 1 a right-hand *twill* is given, with the plan of entering it and also the tie-up of the treadles. The numerals in the circles on the treadle lines show

Examples of Tie-up



Pattern-capacity of a Loom with Four Headles and Four Treadles

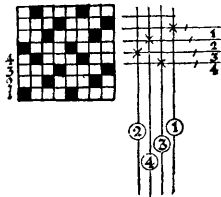
Simple Twills

FIG. 72.—Examples of Simple Twill Patterns.

Simple
Twill

the order in which the treadles are to be worked. At no. 2 the tie-up is seen to be reversed, which throws the twill in the opposite direction, making it a left-hand one. At no. 3 a combination of both the above is shown, the result being a zigzag. This is made by extending the treading as indicated

The Broken
Twill



may be used with either the tie-up of no. 1 or no. 2 indifferently.

The next ground pattern to claim attention is sometimes called a *broken twill*. It is made, like the ordinary twill, on four headles and

FIG. 73.—Broken Twill treadles, but the tie-up is rather different; fig. 73 is a draught of it. It will be seen that the direct diagonal line of the twill is broken by missing headle 2, and making it rise between the fourth and the first headles. The result of this arrangement is that if a rich close warp is being used the weft will scarcely show at all, the tie being distributed so evenly over the ground that no ribs or lines are visible. This is a most ingenious invention, and shows the principle on which the various satins are formed. It is said to be of Chinese origin, which is most probable, as it is particularly adapted for displaying the rich, glossy quality of silken thread, which the Chinese were certainly the first people to use for weaving. Before passing on, it should be noted particularly that IF COUNTED IN EITHER DIRECTION THE SAME NUMBER OF THREADS WILL BE FOUND BETWEEN ALL THE TIES OF THE BROKEN TWILL.

The Origin
and Character
of
Satin Ties

THIS IS THE SPECIAL CHARACTERISTIC OF ALL THE SATINS. FURTHER REFERENCE TO THIS WILL PRESENTLY BE MADE.

Several more extended designs may be made on the same principle as the twill, with four headles and treadles only, if the entering of the warp be specially arranged for them. A sample group of these designs is given in fig. 74, and many others can be devised, both by alteration of the entering, tie-up, or order of working the treadles. The entering necessary for the designs illustrated, repeats once in every twenty-four threads of the warp. It will be seen that three courses of four threads are entered from back to front, then one thread by itself on the back headle, followed by three courses of four threads, from front to back, the fourth thread in the last course beginning the next repeat. If the treadles are tied up and trodden as for ordinary twill a large lateral zigzag will be woven (fig. 1); by working the treadles in the order shown by the numerals in the lower part of the diagram no. 2 will be made; and on taking the treadles in the following order, 1, 2, 3, 4, 13, 14, 15, 16, no. 3 will result.

With the same entering and tie-up plain cloth may be made at will, so that lateral spaces or panels of any of these small designs may be woven by way of ornament at intervals in the plain material. Very pretty effects may be arranged for, especially if the bands are shot with gay-coloured wefts. In order to make the plain cloth in alternation with the ornamental bands, it is only necessary to depress the first and third treadles together with the right foot, for one shoot, and the second and

The Origin
and Character of
Satin Ties

Extension of
the Four-
headle Twill

Extension of
the Four-
headle Twill

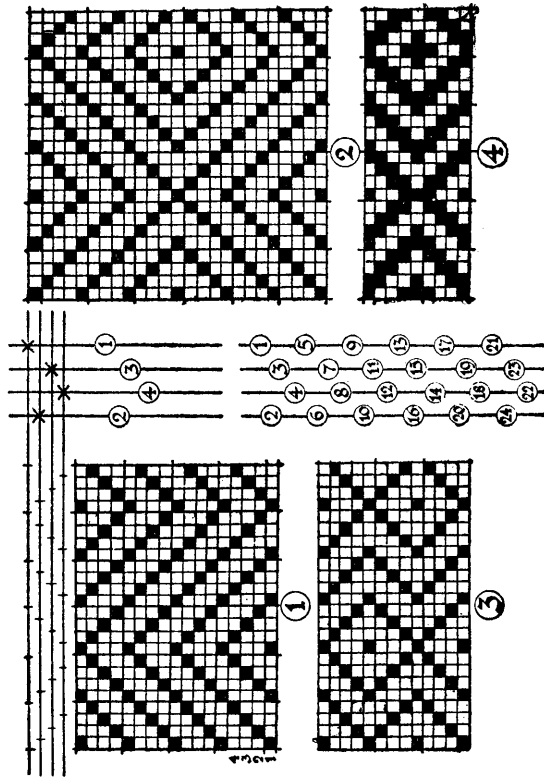


FIG. 74 — Extended Twill Patterns

fourth treadles together with the left foot for the next. Extension of the Four-headle Twill

In order to produce the design shown at no. 4, fig. 74, the same entering and treading are required as for no. 3, but the tie-up must be different (see fig. 75). In this case two headles must be tied up to each separate treadle, in the following order: Headles 1 and 2 to treadle 1; headles 2 and 3 to treadle 2. Treadle 3 has headles 3 and 4 tied to it, and treadle 4 must be tied up to headles 4 and 1. The effect of this tie-up may be seen in the diagram, and requires no further explanation.

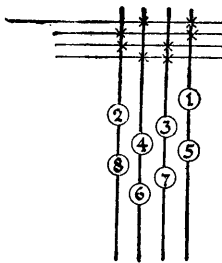


FIG. 75—Tie-up for fig. 74, no. 4

It will have been gathered from the last illustration that more than one headle may be tied up to each treadle. This being so, a much greater variety of patterns is possible than would be the case if only single tie-ups were practicable. The tie-up may really be of any number of headles to one treadle, only short by one of the number that would raise the whole of the warp. If four headles are used, one, two, or three

of them may be tied to any one treadle, it not being necessary that an equal number be tied to each treadle, as is the case in fig. 75. Fig. 76 is

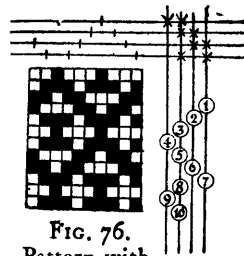


FIG. 76. Pattern with unequal Tie-up.

Extension of an illustration of a pattern and tie-up in which one, the Four-headle Twill two, and three headles severally are connected with single treadles, as will be seen by the plan.

The curious diagonal design fig. 77 requires six treadles tied up to four headles, as shown in the

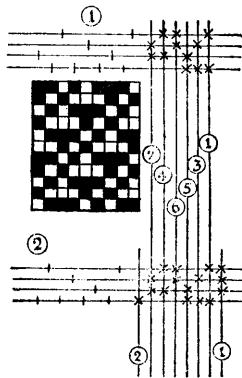


FIG. 77.

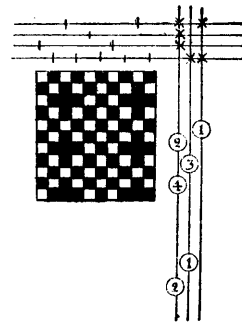


FIG. 78.

plan. The entering in this case is remarkable, as half the warp is raised by means of the fourth headle and the other half is distributed equally over the other three. Plain ground cannot be woven with this tie-up of six treadles, but two extra ones, one on each side of the six, will render it possible. These tabby treadles must be tied up as shown in the plan no. 2.

With the same entering as that of the last design, and a tie-up to three treadles, the pattern fig. 78 can be made, and by the use of treadles 2 and 3 plain tabby ground can also be woven in alternation with broad bands of ornament.

Fig. 79 gives the plan of one of the most elaborate designs workable by this simple method of weaving. It requires the use of a harness of ten headles and a set of ten treadles to produce it. The entering is

Extension of
the Four-
headle Twill

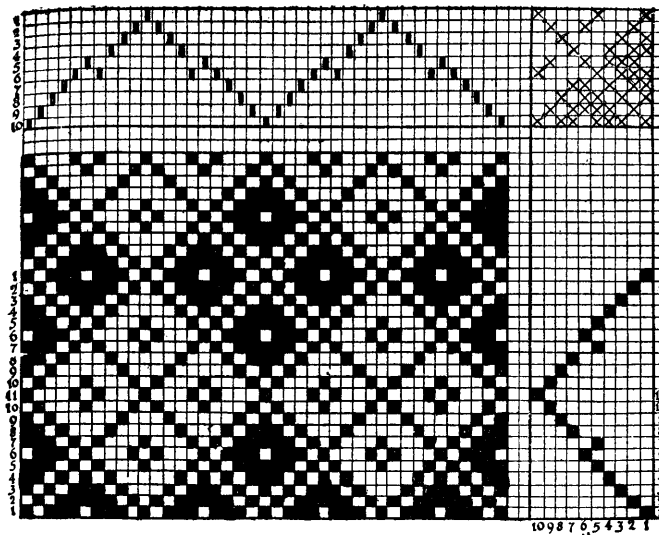


FIG. 79.—Elaborate Design for Simple Weaving.

on twenty threads of the warp, and the tie-up is rather complicated, as will be seen by the plan.

It will have been noticed that this design and plan, (fig. 79) are worked out entirely on ruled paper. This is a convenient method of setting out complicated weavings, as the order in which the treadles follow can be marked in the line of the design they each govern. A careful study of the

Setting out
Complete
Plans on
Ruled Paper

Setting out drawing and a comparison of the numerals will
Complete elucidate the relation of the various parts one to
Plans on another. The final arrangement of the position
Ruled Paper of the treadles for working is always left to the
weaver, and is, indeed, quite immaterial, so long as it
causes the headles to rise in the order set down in
the design. In setting out such a drawing, the
entering must be indicated first, and then the design
filled in below it on the same number of squares as
one repeat of the entering contains. The number
in this case is twenty. The scope of this design is
also further limited, by the nature of the entering,
to a figure having its centre line on the eleventh
thread, and both its halves alike except that they
are reversed and point in different directions. In
weaving this is technically called a *point* design.
The length of the design is not limited, as its
breadth is, by the entering of the harness; this
is decided to some extent by the number of
treadles employed. Any treadle, however, may be
made to rise and repeat the same lateral line of the
design any number of times, and the whole number
of treadles, or any portion of them, may be worked
backward and forward or in any sequence necessary
to form the pattern.

After the design and entering are set out, the
design must be dissected, in order to find how many
different lateral lines there are in it, as the several
headles forming each different line have to be tied
up to a treadle. In fig. 79, for example, there are
ten different lines, which necessitates the use of ten
treadles. By repetition, however, their scope is ex-
tended to twenty lines. Many designs will allow
of even a great deal more repetition than this.

Designs of the kind exemplified by figs. 71 to 80 are particularly adapted for weaving on small looms such as may conveniently be used in the home. They are very suitable for linen and cotton fabrics intended for domestic use, such as table linen, bed furniture, and simple garments of the kind for which linen and cotton materials are required. These simple woven patterns are for the most part only effective when the yarns from which they are made are not very fine. They should generally be not more than forty to a reed space of one inch, and not less than thirty. The best effects also are to be obtained if good, even, hand-spun yarns are used, especially in the weft.

Setting out
Complete
Plans on
Ruled Paper

It will be remembered that good cloth requires the weft to be thicker than the warp (see p. 5), and it will be at the same time observed that in order to weave most of the patterns illustrated, in the same proportion as the drawings, the warp and weft should occupy equal spaces. This difficulty is to be obviated by using a warp made of fine threads half the size of the weft. If these fine threads are warped and entered double, the condition of the proportion of the warp to the weft can be kept, and as the two warp threads will only count as one, the proportions of the design will also be maintained.

The Use of
Double
Threads in
the Warp

When designing these small patterns for simple weaving, care must be taken to break up the spaces by intersection of the warp and weft as much as possible. Not more than five threads either way should ever be left to cross each other without interlacing, or the cloth will be found to be too weak for good wear. Even five loose threads must not occur too frequently

Frequent
Intersection
of Warp
and Weft
necessary

Frequent
Intersection
of Warp
and Weft
necessary

in the design. If broad spaces of ornament are desired in this kind of weaving, some means must be used to strengthen the cloth without interfering with the effect of the ornament. This can be done, and a similar effect obtained to that of brocading, except that the ornaments, instead of being in

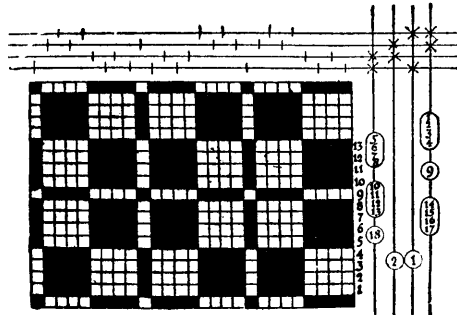


FIG. 80.—Pattern with Tabby Ground

Pattern-
weaving
with Tabby
Ground

detached spots, will be repeated in a close geometric pattern all over the cloth. Fig. 80 is a type of the design suitable for weaving in this way, and will clearly exemplify the weaving together of the ornamentation and the ground cloth. This design requires only four headles, entered in the order shown above the sketch, and four treadles, two of which are used for the tabby groundwork and two for the pattern. On the two outside treadles the pattern is tied up, and on the two inside ones the tabby ground is tied. An extra shuttle and richer weft must be used for the *design* part of the weaving, and it is better for this purpose to use several fine threads together as a weft, than one

coarse one, as they will lie flatter and cover the ground better. Ordinary plain cloth is woven by using only the centre pair of treadles, but as soon as it is determined to introduce the design one of the outside treadles must be brought into use after any one of the tabby shoots, and the pattern weft introduced in the shed made by it. The next shoot of tabby ground must then be made, and after it the same pattern treadle again depressed and another pattern shoot thrown. These alternate shoots of ground and pattern must be repeated until the first row of squares is complete, in which there will be found four shoots of ground and four of pattern. When this point has been reached, the opposite pattern treadle will have to be used, in the same alternation with the ground ones, for the same number of shoots, thus making the second row of squares. After this the first pattern treadle must be depressed for one shoot only, in order to make the thin strip dividing the squares. After four more shoots in the shed, made by the second pattern treadle, the first one is returned to, and after four more shoots and a single one, the first repeat of the design will be found to be complete. It will be readily understood that the squares of this pattern may be made of any size desired, by extending the entering in the harness and the number of sheds made by the pattern treadles. At the same time this will not weaken the cloth, as the same tabby ground will run throughout, whatever size the squares may be. Whilst weaving this kind of design it will be found necessary to beat the weft together with more force, or with a double blow, in order to keep the ground as close as the plain

Pattern-
weaving
with Tabby
Ground

Pattern-
weaving
with Tabby
Ground

parts of the web, if there are to be any such. If properly beaten together the pattern woven by this method should appear quite solid, and entirely hide the tabby ground which is beneath it.

The great importance of the satin ties in the development of weaving, especially of fine silk, renders it necessary that the next chapter should be set apart for their exclusive consideration. But at the same time it must be noted here, that many useful and beautiful satin and partly satin webs may be designed for weaving on small domestic looms in which either linen, cotton, woollen or spun-silk yarns can be used.

CHAPTER XII

THE SATINS AND DOUBLE CLOTH

Construction and Utility of the Satin Tie—
Meaning of the Term *Satin*—Peculiar Quality of
the Satin Tie—Various Satins and the Number of
Headles required for weaving them—Reasons for
weaving Webs Face Downwards—Exceptions—The
Selvages of Satin and other Webs—Separate Selvages
and their Fitting up—When Separate Selvages are
necessary—Contrast of Colours in Satin Webs and
its Limits—Double Cloth, its Advantages—Pre-
paring and entering the Warp for Double Cloth—
Weaving Double Cloth.

THE construction of the broken-twill has already been explained (p. 168, fig. 73) and its importance as an example of the principles of satin-weaving commented on. Its reputed Chinese origin was also mentioned. It is remarkable that, apart from Eastern influence, there seem to be no traces of this tie in ancient weaving, although there are a few examples of the ordinary twill. The earliest known specimens of weaving in which the use of satin ties is a feature belong to the fourth or fifth centuries of the Christian era, and even of that date the fragments that remain are very few in number.

The satin tie for plain webs is not much used, except in the case of warps of fine silk, the richness

The Con-
struction and
Utility of
the Satin
Tie

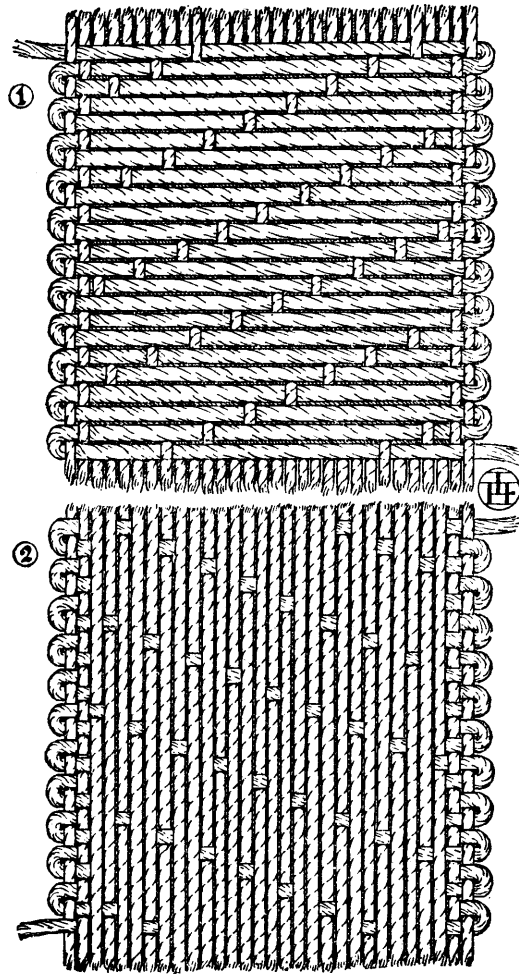
The Construction and Utility of the Satin Tie of which it is peculiarly fitted to display. But it is in the weaving of the extensive and elaborate pattern webs known as damasks that its chief utility consists, and that not only for the weaving of silk, but for the weaving also of linen, cotton, and woollen ornamental fabrics.

Meaning of the Term "Satin" The name satin is generally misunderstood. It is usually taken to signify some kind of silk material. This is no doubt owing to the fact that this tie is for the most part restricted to silk in the case of plain materials. The term, however, has no reference to the yarn employed in the web, but only to the manner of weaving it.

There are various kinds of satin in use, all being based on the same principle. They are distinguished according to the number of headles required in the harness used for weaving them. The broken twill, which we have seen requires a harness of four headles, is not always called a satin, but is often designated a satinette.

Valuable Quality of the Satin Tie Peculiar value is given to the satin tie because of its throwing a very large proportion of the warp to the face of the material woven, so that if the warp consists of fine rich silk and the weft of common silk, linen, cotton, or wool, the rich silk, in the case of a very rich satin of, say, sixteen headles, will almost entirely cover up the poorer weft. The latter will in its turn show almost entirely at the back of the cloth. Fig. 81 represents the front and back of such a satin-woven material, very much enlarged.* In the actual cloth

* The square of sixteen-headle satin represented would repeat from nine to twelve hundred times in a square inch.



Valuable
Quality of
the Satin
Tie

FIG. 81.—Satin Cloth (much enlarged).

Valuable Quality of the Satin Tie represented the sixteen threads between the ties would probably not occupy a space of more than the thirtieth part of an inch. At no. 2 the face of the cloth is shown, and it will be seen that fifteen threads of warp intervene between each intersection of the weft laterally, and also that the warp threads each float over fifteen shoots of weft between the ties vertically. In the actual stuff when loose and out of the loom these infrequent ties would scarcely be seen at all, and the glossy surface of the silken warp would appear to be unbroken. At no. 1 the back of the stuff is shown. Here the weft only for the most part shows, held together at regular though infrequent intervals by the intersection of the fine warp.

Various Satins Satins may be made on harnesses of almost any number of headles from five to twenty-four. The satin most generally used is that made on eight headles, and is called *eight-headle*, *eight-lam*, or *eight-shaft* satin. In some respects this is the best of all satins, as in it the ties are most evenly distributed, and the twill from which it, in common with all satins, is derived is less in evidence. (See no. 3, fig. 82.)

Five-headle satin is more used for linen damasks and other coarser woven ornamental fabrics than for silk. A great many of the mediæval silk damasks were, however, made with this tie, which gives the dry and more subdued effect often to be seen in them. (See no. 1.)

In fig. 82 are given ruled-paper drawings of all the satins. Many of them, however, are not in general use, as nine, seven, eleven and other odd numbers of headles would be inconvenient in a

harness, as plain tabby cloth could not be made on it. Five-headle satin (no. 1) is generally made

Various Satins

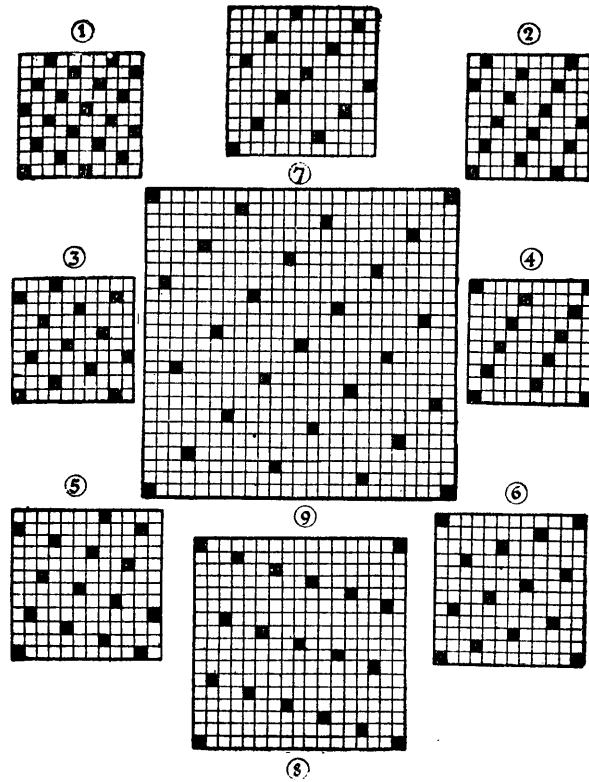


FIG. 82.—Satin Ties.

on a harness of ten headles, for the above reason, and tied up so that two of the headles rise at each

Various Satins tread. Such a harness can also, of course, be used for the ten-headle satin (no. 5). Nos. 2, 4, and 11 would only be used as ties on portions of a design woven on a different principle, as if made on a harness they could only be worked with an awkward number of headles, although the eleven-headle satin is perhaps the most well-distributed of them all, not excepting the eight-headle one. Nos. 7, 8, and 9 are only used for the very richest and finest silks, or as ties in portions of designs in fancy-silk weaving, which will be treated of later on.

Reasons for weaving Webs Face Downward Returning to the representation of sixteen-headle satin, fig. 81. It will be noticed that the back of the cloth, no. 1, corresponds more closely with the sketch of the same satin in fig. 82 than no. 2 (the front of the cloth) does. The reason of this resemblance is that the black squares of the sketch represent the lifted threads of the warp. It has already been stated that most weaving is done with the face of the cloth downwards. This is particularly the case with satin webs. Obviously the lifting of one headle out of many instead of the lifting of all but one, makes the work lighter for the weaver. The raising of one thread instead of many causes also much less friction and wear, not only in the warp itself, but in the harness and general fittings of the loom. There are several other minor advantages, so that, taking all into consideration, the inconvenience to the weaver caused by not seeing the front of the web as the work proceeds, is more than compensated for. Moreover, the difficulty of weaving webs face downwards is not so great in most cases as would at first appear, for if the back is right and the loom in all its parts is seen to be

working properly the weaver need have little doubt that the surface of the material will be satisfactory. Although weaving is usually thus done face downwards, it is not absolutely necessary that it should be. In the case of some complicated fancy webs, where two or three thicknesses of cloth are woven together, and it would be impossible to judge from the back if the surface were weaving properly or no, it may be possible and advantageous to so arrange that the fabric may be made face upwards. This is effected by tying up in accordance with the white spaces of the ruled-paper design, instead of the black ones.

Exceptions
to weaving
Webs Face
Downward

When a piece of cloth is being inspected by an expert one of the first points to be examined is the edge of the web, generally called the *selvage*. It may be pretty confidently expected that if the edges are straight and even, and at the same time neither tighter nor looser than the body of the stuff, the cloth will prove to be well woven throughout. A good selvage is the finishing grace in a woven fabric, and none but good weavers can keep perfect the edges of their work.

The
Selvages of
Satin and
other Webs

In tabby or plain weaving, when the warp and weft are properly proportioned, there is not much difficulty in keeping a perfect edge, and it is only necessary to fortify the warp by making a few of the edge threads double ; but in the case of the looser satin, or the various kinds of fancy webs where two or three different warps and wefts are used, an arrangement of the selvage warps to work independently of the main warp becomes necessary, and often requires a good deal of ingenuity on the part of the weaver to devise. Another reference to

The
Necessity for
Selvages

The Necessity for Selvages

fig. 81 will be sufficient for the purpose of explaining the necessity and working of the selvages on the edges of satin webs. Although there are only two threads shown in the drawing, it is quite clear that they make a straight tabby edge and prevent the weft being drawn back, by the returning shuttle, as far as the first tie of the satin. This might be any distance from the edge up to the space of sixteen threads of warp. Without these tabby-woven threads the edges would be extremely uneven, however carefully the weaving might be done. The defective edge can be avoided if a few strong threads are so arranged that a narrow strip of tabby weaving may be made along each side of the web. There are various ways of arranging for the separate tabby shedding of the selvages, but the simplest way is to provide two extra pairs of headle shafts at the back of the harness, at the ends of which the selvage leashes are fixed, so that the extra threads passing through them, by the sides of the main warp, may be entered close to it in the rather wider dents usually provided for them in the reed. These selvage headles are each tied up to half the treadles in such a way that they will be raised alternately as one of the right or left half of the treadles is depressed. In the case of satins and other loosely tied webs it is found necessary to warp the selvages and weave them off small rolls, separately fitted up and weighted, as shown in fig. 83. This separation from the main warp is necessary, because the more frequent intersection of the warp and weft, in tabby weaving, causes the warp to be used up more quickly than is the case with the less frequently intersected threads of the satin ground. If the

Fitting up Separate Selvages

Why separately warped Selvages are required

Why
separately
warped
Selvages are
required

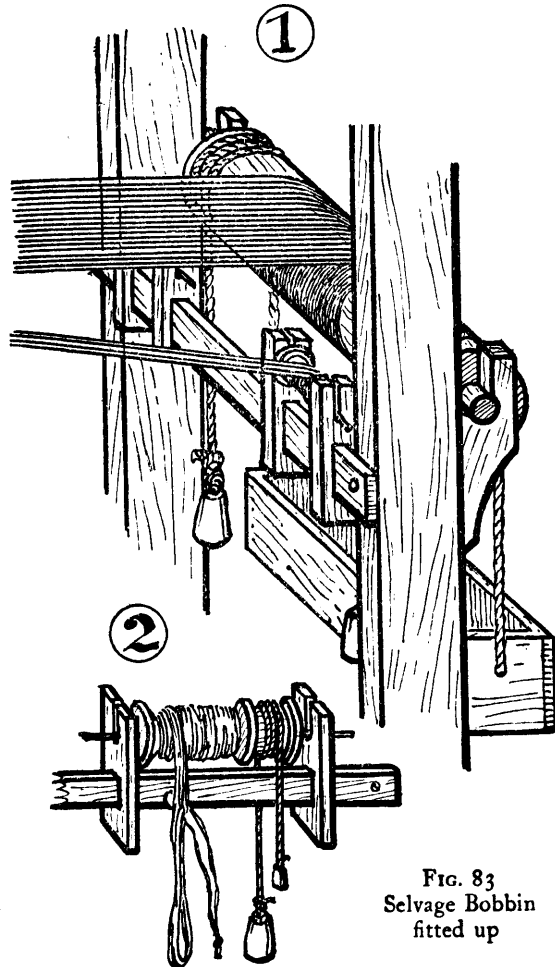


FIG. 83
Selvage Bobbin
fitted up

No. 1 shows the position of the bobbin in the loom.
No. 2 : Details of the bobbin, with warp and method
of weighting.

Why separately Warped Selvages are required tabby selvages, therefore, came off the same roller as the satin warp, as soon as about half a yard of stuff had been woven, the edges would get so strained that the work could not go on. They would then break out altogether and spoil the web.

Contrast of Colour on the Back and Front of Satin Webs It will be readily understood from the foregoing description of satin-weaving, that the back and front of a web may be made different in colour, to a very large extent, providing the warp and weft used are distinct in that respect. The colour of the warp will predominate in the front, and that of the weft at the back in similar proportion. In five-headle satin, for instance, the warp colour on the face of the cloth will be in the proportion of four parts to one part of weft, and at the back the proportions will be reversed. With richer satins the difference will be greater, but however great it may be the colour of the weft will always tinge that of the warp in the front, and at the back the weft colour will be modified by the ties of the warp in the same manner. In satin-weaving, therefore, the colours of back and front can never be quite distinct.

Double-cloth Weaving There is another system of weaving, however, by means of which two separate webs, of perfectly distinct colours, joined at the edges may be woven at the same time, from the same warp, in the same loom. A great deal of pattern-weaving has been done by taking advantage of this possibility.

It will now be best to describe the method of weaving this double cloth, but its utilisation for pattern-weaving must be left for consideration in a future chapter.

Double tabby cloth of separate colours can be woven on a loom with a harness of four headles,

but the warp must be specially arranged for the purpose. If it be decided to make one cloth black and the other white, the warp must be made throughout with alternate threads of those two colours. The warp of black and white threads being entered in the usual way, if the first thread be black the whole of the first headle will be found to contain all black threads, the first, fifth, ninth, &c.; the second headle will carry all white threads, the second, sixth, tenth, &c. The third headle will be all black, with threads 3, 7, 11, &c.; and the fourth headle will take the rest of the white threads, 4, 8, 12, &c. In other words, all the odd threads, which are black, will be found in headles 1 and 3, and all the even ones, which are white, in headles 2 and 4.

With such a warp separate selvages would be fitted up to work in the same way as for satin, so as to bind the double cloth together at the edges.

When all is ready, in a loom so arranged, weaving must begin by raising half the black threads by means of headle 1, and throwing the shuttle carrying the weft through the shed so formed. The next shed is to be made by raising headle 3, which raises the second, half of the black threads for the second throw of the shuttle. This completes two shoots of

Entering
of Double-
cloth Warp
in Harness

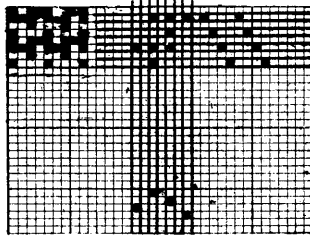


FIG. 84.

Weaving
the Double
Cloth

**Weaving
the Double
Cloth** the black face of the double cloth. For the next shed, headles 1 and 3 must rise and lift all the black threads, and headle 2 must rise with them to lift half the white threads. The third shoot of weft having been made, the fourth headle will have to rise, as well as the first and third again, and the fourth shoot of weft will complete the second shoot of the white face of the double cloth. This order of shedding must be repeated, and when a few shoots have been made, it will be found, that, two distinct webs united at the edges have been woven. In order to make the colours distinct two shuttles must be used, one for the black and one for the white face of the cloth, and when this is done the double cloth will be found to be perfectly black on one side and perfectly white on the other. Fig. 84 gives the sketch on ruled paper with the plan and tie-up for double cloth.

CHAPTER XIII

SHEDDING MOTIONS

The Simplest Shedding Motion—Two Typical Shedding Motions—Differences between the Two Kinds of Shedding Motions—Choice of Shedding Motion left to Weaver—Suitable Design for Shedding Motion No. 2.

THE name *shedding motion* is given to any contrivance by means of which the opening or shed is made in the warp, in front of the reed, for the passing through of the weft. The shedding motion shown on the old English loom, fig. 42, consists of two treadles and two pulleys connected with the headles of the harness by cords. A similar motion, having precisely the same effect, in which two short pieces of bamboo take the place of the pulleys, is shown in the Indian loom, fig. 41. Needless to say, these are the simplest forms of shedding motion possible, but it now becomes necessary to describe the rather more complicated arrangements by means of which headles may be lifted for the grounds and small figures exemplified in the preceding chapters.

Only two distinct shedding motions need to be described and their differences pointed out, as all others are for the most part modifications of them,

The
Simplest
Shedding
Motion

Two Typical
Shedding
Motions

Two Typical and will present no difficulties to the student if their
 Shedding principles are perfectly understood. Figs. 85 and
 Motions 85A represent these two typical motions.

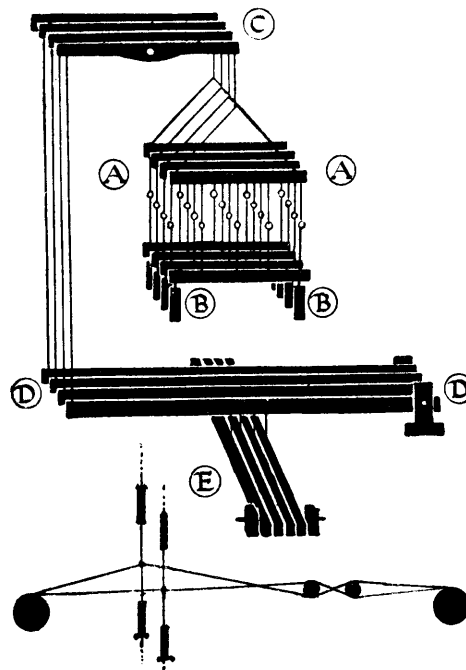


FIG. 85.—Shedding Motion.

In order to keep the diagrams of these shedding motions as distinct and simple as possible, the harness to which they are attached is only represented as

one of four headles. This is all that is necessary Two Typical
 for the purpose of illustration, but any number of Shedding
 headles up to twenty, or even more, might be Motions

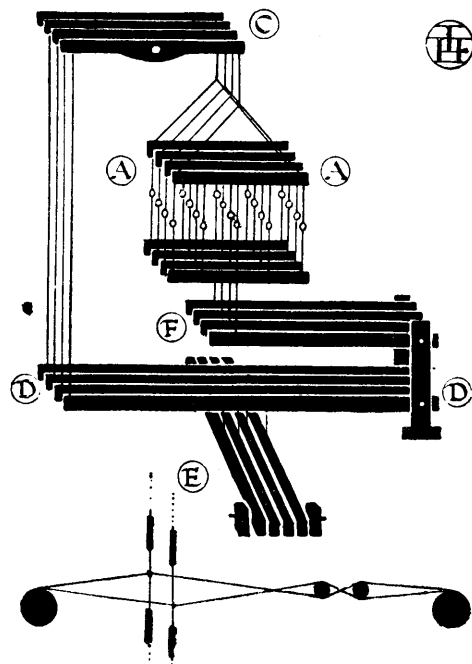


FIG. 85A.—Shedding Motion.

governed in the same way, providing that the
 number of levers and treadles was increased in the
 same proportion. In the diagrams, also, only the

Two Typical headles and the shedding motion are shown; all the
Shedding supporting parts of the loom, which would only
Motions complicate the drawing and render it less clear,
are omitted. The position of the harness in the
loom is, of course, the same as in fig. 42, with its
harness of two headles.

In fig. 85 it will be seen that the headles, A, A, have long lead weights, B, B, on their lower shafts, instead of their being tied directly to the treadles as in fig. 42. If any of the four headles, therefore, be raised, as soon as it is released, the weights on its lower shaft will bring it down again to its normal position. Strong wire spiral springs are sometimes, for some purposes, preferred to lead weights, but these have the same effect as regards the mechanism of the shedding motion.* At letter C four short, strong laths are shown, having a hole somewhere near their centres, through which an iron rod is passed. The ends of the rod are fixed in a long, wooden frame, which rests on the top of the loom in the position occupied by the centre cross-piece, from which the harness is suspended, in the old English loom, fig. 42.

From one end of each of these laths, just above the centre of the headles, a double cord descends, and, being divided, in the manner shown in the drawing, is attached to both ends of the top shaft of headles. This attachment is made by the use of the adjustable slip-knot, described in Note 2 to Chapter VII., p. 106, in order that the height of the headles in the loom may be adjusted to a nicety. At the opposite ends of the levers C

* The effect of the dead weight is to close the shed rather more quickly than the spiral spring, and therefore it is generally preferred.

long cords are firmly fixed. These descend, and are tied, by the same kind of slip-knot, to the ends of four long laths, D, which, reaching right across the loom at the height of about a foot from the ground, have their other ends hinged to a strong support, which is fastened to the ground, or to the framework of the loom itself. It will now be seen that the four treadles, E, placed under the weaver's feet, as he sits in the loom, only need to be tied up to the long cross-levers to enable him by pressure of his foot to pull down at will one end of any of the levers C. This will raise the other end, from which a headle is suspended, and open the shed. By this means the headles can be raised in any order or combination necessary for the formation of the pattern.

Two Typical
Shedding
Motions

In fig. 85A the arrangements for raising the headles are the same, but the weights on the bottom shaft are dispensed with. In place of the weights, four levers, long enough to reach from the side of the loom to beyond the centre of the harness are fixed, between the long levers and the bottom laths of the headles, and tied to each of the latter (see letter F, fig. 85A). If, with the motion arranged as at fig. 85A, the first treadle be pressed down, the first headle will rise, and the first lever F will rise with it. The second, third, and fourth headles, having no weights to keep them down except the light weight of the levers themselves, will neither be held firmly down nor raised. To rectify this, levers 2, 3, and 4 must be tied firmly by cords to the first treadle. The result of this additional tie will be, that, when treadle 1 is again depressed headle 1 will rise as before, but headles 2, 3, and 4 will be drawn down at the

Two Typical Shedding Motions same time. This cording has to be carried all through ; thus, the second treadle must be connected with the levers 1, 3, and 4, the third treadle with levers 1, 2, and 4, and the fourth treadle with levers 1, 2, and 3. When all these connections are made the raising of any one of the four headles will cause the remaining three to sink. If when this motion is used two headles are required to rise at one time, the treadle must be connected with two long levers in order to raise them, and the remaining two levers must be tied to the same treadle. By this means two headles will rise and two sink. In short, no matter how many headles the harness may consist of, each must be connected with all the treadles either by means of the long levers which raise the headles or by the short ones which sink them.

Difference in the Two Kinds of Shedding Motions The section of the sheds below figs. 85 and 85A will show the important difference between the two shedding motions. Fig. 85 is called a *rising shed*, because, while the bulk of the warp is stationary, the required threads rise from it. Fig. 85A is called a *rising and sinking shed*, because when certain threads are raised all the others sink down at the same time.

Each of these shedding motions has its advantage, according to the kind of weaving it is used for. When only a few threads require lifting, as in the case of satins, a rising shed is preferable, but when about half the threads of the warp are raised, a rising and sinking shed may be advantageous, although there is always more friction when the latter is used.

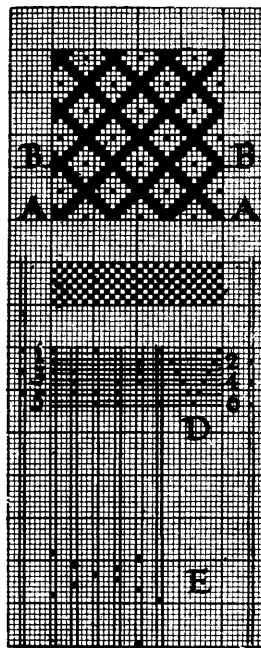
There are various other shedding motions in use,
196

but they are all based on one or other of these two principles, and the above may be taken as types of all.

Also, by connecting the treadles to only certain of the remainder of the headles instead of all, another variety of shed may be made. This connection will be described later on, as it is required in a particularly important class of pattern-weaving.

The sample patterns already given can be woven with either of the above shedding motions, and the use of one of them would not affect the design on ruled paper or the indicated tie-up of the treadles. The rising of the headles would be the same in both, but in the second motion after the tie-up for raising the headles had been made, the headles corresponding to the vacant spaces in the tie-up plan would have to be connected by means of the short levers to the several treadles. The kind of shedding motion most suitable for any particular design is a point for the weaver to settle to his own satisfaction.

Difference in the Two Kinds of Shedding Motions



Choice of Shedding Motion left to Weaver

FIG. 86.

A Design
suitable for
Shedding
Motion 2

Fig. 86 is an example of a small design suitable for weaving with the shedding motion no. 2—that is, with a rising and sinking shed—as the ground and figure are exactly equal in weight.

Between A and B, in the design, one repeat of the pattern is shown drawn out on the ruled paper. At first sight it would appear to require ten headles and ten treadles to make one repeat of the design. But on analysing it, it will be found possible to weave it on six headles, governed by six treadles provided the entering of the warp in the harness be done as indicated in the sketch above letter D. The real design is only a quarter of one repeat, but it is turned over or “pointed” both laterally and vertically. Instead, therefore, of containing ten different lines of squares, the design has only six, four lines being repeated twice in it. The lateral turnover is effected by the entering of the harness, the vertical one by reversing the order of treadling. The tie-up for this design with no. 2 shedding motion must first be made, as shown in the sketch, to the long levers, or *long marches*, as they are more correctly called. When this is done it will be found that there are three connections to each treadle, and three headles will still remain unconnected with each of them. These unconnected headles must, by means of the short levers, be connected with the treadles, as indicated by the unmarked crossings. The effect of this second tie-up has already been fully explained in the description of the second shedding motion, fig. 85A, p. 193.

CHAPTER XIV

DOUBLE-HARNESS PATTERN-WEAVING

Diaper-weaving — Example — Patterns in Double Cloth—Indian Example—Use of the Figure Harness —Use of the Tabby Harness—Importance of the Two-harness Method of Weaving—The Weaving of Small Damask Patterns with Two Harnesses —Details of Weaving Figured Damask—Analysis of the Effect of the Two Harnesses—Shed-making for Damask Patterns—All Modern Weaving of Pattern based on Two-harness Principles—Weaving from Two Separate Warps—Velvet-weaving and its Methods—Arrangement of the Loom for Velvet-weaving—Actual Process of Velvet-weaving —Principal Tool for Velvet-weaving—Terry Velvet—Superiority of Hand-loom Velvet —Small Designs in Velvet—Tobine Weaving.

THE name diaper is now usually understood to signify any small design which is repeated geometrically over the surface which it decorates. The term diaper-weaving, however, does not really refer so much to the kind of pattern woven as to the method of weaving it. This ingenious method, although invented in Asia, was as early as the eleventh century practised in England, especially for weaving the silken groundwork of the embroideries for which the ladies

Diaper-
weaving

Diaper-weaving of England were famous at that time. A great deal of quite large pattern weaving was formerly done in this way, but on account of its being, except for simple designs, difficult to set up as well as to manage, it was superseded by less complicated contrivances.

When Useful For small patterns, however, especially in linen and cotton materials, it may still be used with advantage. It must therefore now be described.

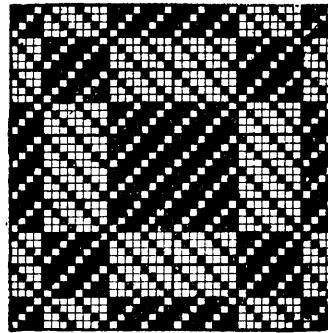
Diaper-weaving : Method In diaper-weaving, the harness is divided into sets of equal numbers of headles. There may be any workable number of sets, and these may contain any equal number of headles. The treadles also are divided into sets, but each set of treadles acts on more than one set of headles, so that, whichever set of treadles is used the whole of the warp is acted upon, and no gaps remain in the weaving.

Harness and Entering Fig. 87 is a simple design which will serve well to explain the method. Here the harness is divided into two sets having four headles in each (nos. 1 and 2). There are also two sets of treadles, each set consisting of four. The entering shown to the right of the plan corresponds with the proportions of the square and oblong forms of which the design is composed. For instance, if the design be compared with the plan of entering, it will be found that the warp is entered in the spaces where dark predominates. The second division of the harness and the bottom line of the design agree, while the first division of the harness and the fifth line of the design agree also. Before proceeding it may be remarked that the size and proportion of the squares and oblongs laterally is determined by the entering. In the present case four courses are entered in no. 2 harness and two in no. 1, which makes the oblong

twice as wide as the square.

The plan of tie-up for the headles, shows the second harness connected with the four treadles of the first set. The connection is made in the order necessary to form the twill tie on the portion of warp entered in the second harness. To the same treadles the first harness is tied up to make the reverse twill. The second set of treadles is tied up with the reverse twill in front and the figure tie at the back. The effect of this arrangement is that if weaving be done, using

①
②



Plan of Tie-up for Diaper-weaving

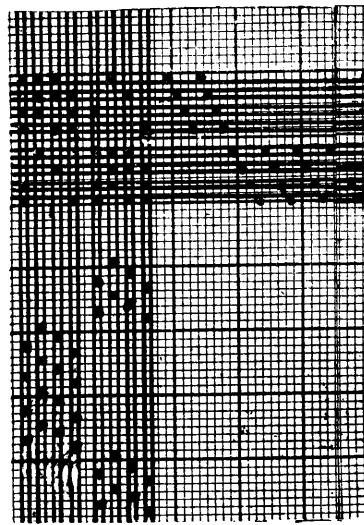


FIG. 87.—Example of Diaper-weaving.

Plan of Tie-up for Diaper-weaving

Extended Diaper-weaving

Pattern-weaving with Two Harnesses

the first set of treadles only, a broad and narrow stripe of light and dark reversed twills will be made ; on the contrary, if the second set of treadles only are used the broad stripe will be dark and the narrow one light (see top and bottom of fig. 87A).

By the alternate use, then, of the set of treadles 1 and 2 the changes from light to dark spaces, required for the pattern, can readily be made.

By adding to the number of sets of headles and extending the entering through them, with or without adding to the number of the treadles, a great variety of intricate designs can be arranged for ; and, indeed, this used to be done, but since the same effects have been found to be attainable by less intricate means, the more elaborate forms of diaper-weaving have been discontinued, and the ingenious contrivances for working large numbers of sets of headles, are only interesting from an antiquarian point of view.

A great advance was made in the weaving of pattern when the idea occurred of passing the warp threads through two or more sets of headles,

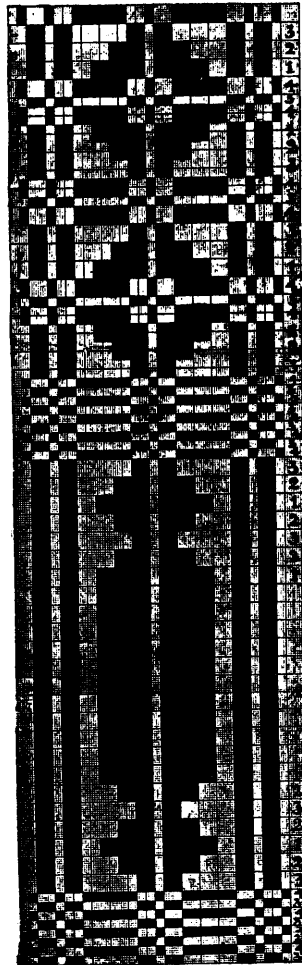
each set having its own separate function to perform, such as making the ground, forming the pattern, or binding a portion of the design separately, as is sometimes necessary.

A good example of the action of two separate harnesses working together, is afforded by the Indian



FIG. 87A
Variations of
Fig. 87

double-cloth pattern, fig. 88. The making of plain double cloth and the advantages such cloth possesses have been fully described at the end of Chapter XII., p. 188. That description should be referred to at this point. It may be noted in addition, that, while cloth is being woven from one half of the warp for one or two shoots, as the case may be, the other half-warp is either lifted out of the way or left below, but that **THEY NEVER REVERSE THEIR RELATIVE POSITIONS.** Now in double-cloth *pattern-weaving* while the tabby cloth of one colour is being made the warp of the other colour is lifted in some places and remains below in others, according to the design, but whether above or below it does not interfere with the tabby



Pattern-weaving with Two Harnesses

FIG. 88.—Indian Double Cloth.

Pattern-weaving with Two Harnesses

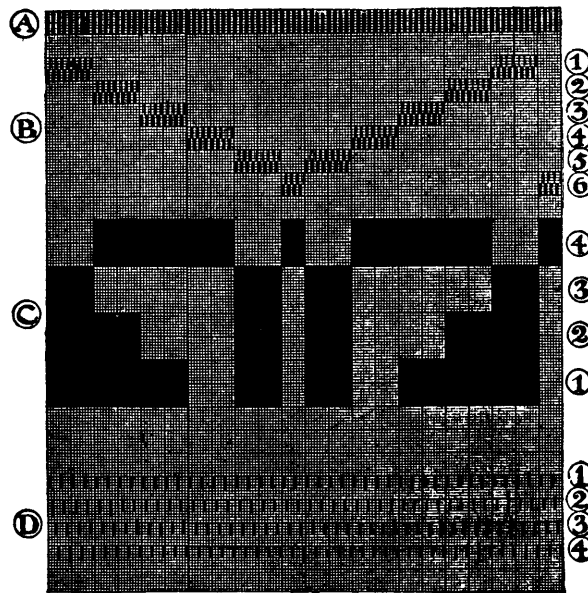


FIG. 89.—Plan of Indian Design.

outline or the shapes of the design, where the threads will be found to cross or intersect one another.

Fig. 89 is a portion of the working plan of the Indian design fig. 88. The warp, which has alternate threads of black and white, is shown at A, at the top of the diagram.

In front of the loom, as near to the reed as it can conveniently hang, the tabby or ground harness must be placed. This consists of four headles having long eyes on the leashes as described at p. 156, fig. 66. The warp must be entered in the harness in regular order from back to front, beginning with a black thread (fig. 89D). When the entering is finished all the black threads should be found on headles 1 and 3, and all the white ones on headles 2 and 4. Although thus mentioned first, as appeared necessary, the ground harness would not be fitted up or entered until the figure harness, which will presently be described, was in its appointed place with the warp ready entered in it.

In order to find the requirements for the figure harness the design fig. 88 must be dissected. The result of this dissection is shown at C, fig. 89. The design consists of only four different groupings of a few squares of eight black and eight white threads, arranged in lines and repeated in different sequence. These lines are numbered 1, 2, 3, and 4 in the design, fig. 88. It will also be seen that laterally there are five squares and two half-squares. The first figures indicate that four treadles will be required for the black portion of the design, and four more for the white portion. The second figures show that twelve headles will be wanted, six for lifting the white threads and six for the black. These twelve headles are shown at letter B in the diagram, and their construction and entering is as follows :

Unlike any of the enterings shown up to the present, this harness is entered in groups instead of single threads, the groups consisting of eight threads,

Mounting
the Loom
for Double
cloth
Indian
Design

The
Ground
Harness

Dissection
of the
Design

Construc-
tion of the
Figure
Harness

Construction of the Figure Harness except in the cases of the first black and first white headle, which are entered in groups of four. It will be at once seen that if any one of the headles be lifted, all the black, or, all the white threads in two squares of the design, will be raised; also that by raising two, three, four, or five, or even six headles together various groups of squares can be formed; in the last case—that is, with six headles—solid black or solid white will be lifted.

Spaced Harnesses If this harness were made specially for this pattern the leashes would only be hung on the shafts of the headles in the places required for the groups of threads. This is called spacing the harness. By thus spacing the leashes, not only is time and thread saved in making the harness, but the inconvenience of having unnecessary empty leashes hanging about is avoided. This spacing of harnesses will often be referred to as we proceed in the subject of pattern-weaving.

The Work of the Tabby Harness in Double-cloth Pattern-weaving It will be remembered that in making plain double cloth with a tabby harness of four headles one half of the warp was raised by two of the headles, while the plain weaving was being done by the other two. In the case of double-cloth pattern-weaving this lifting out of the way is effected by means of the figure harness, and the tabby harness is only used for making the black and white plain cloth in regular alternation.

The Work of the Figure Harness The province of the figure harness is to form the design *in large* without regard to the binding or weaving it together. If only the figure harness were used, the design would be formed, but the threads of both warp and weft would only interlace

where the black takes the place of the white or the white that of the black.

By using two harnesses, one for the formation of the design and the other for the details of the weaving, the scope of pattern-weaving is immensely extended, and IT WAS BY THE DEVELOPMENT OF THIS TWO-HARNESS METHOD THAT THE MOST SPLENDID RESULTS OF THE WEAVER'S ART WERE ACHIEVED.

The plan, tie-up and treadling of the Indian design are given in fig. 90. An examination of these will show that only some portions of the black warp are raised above the surface at the one time, and the same thing occurs in regard to the white warp. Those portions remaining below, however, do not get woven into the tabby, because they are of the opposite colour to that which is at the moment being made. For example, when the black threads are some, right up, and some, down, the white cloth, is being woven by two headles of the tabby harness and in like manner when some white threads are held up by the figure harness, and some left down, the black plain cloth is being woven and cannot interfere with them.

It will be sufficient, in order to make the working quite clear, to analyse one line of the design as a key to the whole. In the first line, beginning at the left hand, three squares together are shown black, one white, one black, half a white, one black, one white, three black together, and half a white. In order to form this series of squares headles 1, 2, 3, and 5, entered with black thread, must be lifted. While these are held up the second headle of the front harness is raised, and one shoot

The Work
of the
Figure
Harness

Importance
of the Two-
harness
Method of
Weaving

The Plan
and Tie-up
of Indian
Design

Analysis of
the Working
of the
Design

Analysis of
the Working
of the
Design

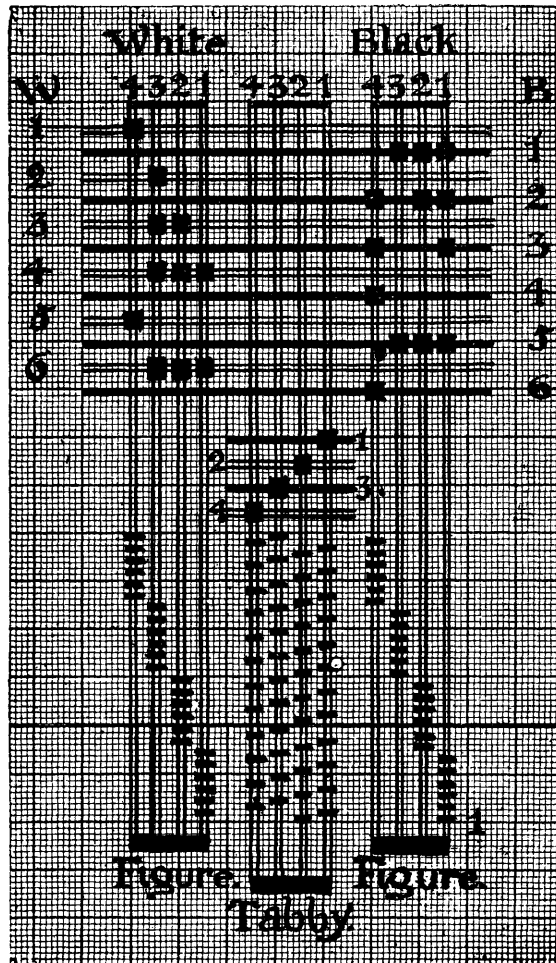


FIG. 90.—Plan of Tie-up.

of white weft thrown in. This shoot being pressed close, the white figure headles 4 and 6 must be raised, and together with them the first tabby headle. This being black must be shot with black weft. The same black headles must again rise, but this time the fourth headle of the front harness must be raised with them, for the second shoot of white tabby. The same white figure headles again rise, and the third tabby headle makes an opening for the black weft. After this order of proceeding has been repeated six or eight times, according to the size of the wefting, one line of squares will be woven. The upper and under surfaces of the cloth will be found to be exactly the same in design, but the colours will be reversed.

The first line of the pattern being complete, the second line will proceed as indicated in the plan, which need not be further described.

As will be gathered from the above, two shuttles must be used if the effect of clear black and white is desired. If only one shuttle were used, the form of the design would be quite correct, but the colour of the weft would tinge the black and the white and modify them.

The treadles are shown in the plan and tie-up, arranged in three groups for the sake of clearness, but the weaver would no doubt rearrange them to suit his own convenience. He would probably mix the white and black treadles up so as to bring the first white next to the first black, in order to work them with his toe and heel. This rearrangement, however, will not affect the order of rising in the least if the tie-up be made correctly in accordance with it.

Analysis of
the Working
of the
Design

Two
Shuttles
necessary
for Solid
Effect of
Black and
White

Weaving of
Small
Damask
Patterns

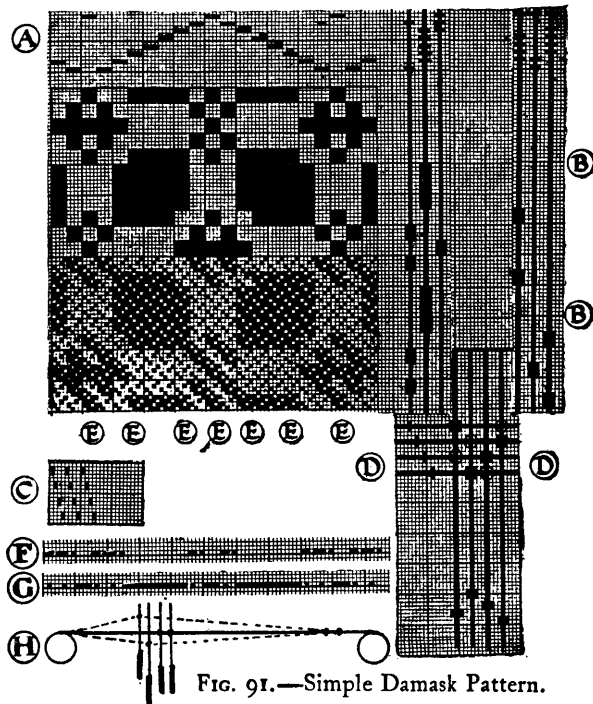
Another method of small-pattern weaving with two harnesses, by which what are known as damask effects are produced, is perhaps more generally useful than that for the weaving of double-cloth patterns. The material woven is also lighter and more perfect in texture. It owes its effect to the fact, already pointed out, that on one surface of a satin or twill web, the warp threads are for the most part exposed, and on the other surface the weft threads predominate (see Satin, p. 184). The result of this peculiarity is, that, if the weaving be arranged in such a manner as to bring both warp satin and weft satin, as the two surfaces may be called, together, side by side, in certain shapes, on the front of the material, the design so worked out will be quite distinct. This will be so, even if the warp and weft are of precisely the same size, colour, and material. This most subtle and charming of all effects of woven design results from the threads of warp and weft running, as they needs must, in contrary directions; so that the light strikes and reflects differently on the different parts of the pattern, according as the vertical warp or lateral weft threads, most preponderate.

Details of
Weaving
Pattern
Damask

Fig. 91 is an example of a simple design which may be woven in the damask manner—that is, by means of two harnesses, one for raising the figure, or design, and the other for making the ground. The ground harness must be fitted up with leashes having long eyes, the same as in double-cloth pattern-weaving. The entering of the figure harness is shown above the design. The harness must have eight headles and four threads must be entered in each leash. This is indicated, in the sketch of the entering, by the filling in of four small squares to each

entry (A, fig. 91). The entering of both harnesses would probably be done at once, the hook being passed through the eye of the leash of the ground

Details of Weaving Pattern Damask



harness first, and then through the eye of the figure harness. If entered singly, the cross must be preserved by drawing the threads over and under a rod, alternately. Only six treadles are required for

Details of
weaving
Pattern
Damask

working the figure harness to form the whole design, although it consists of sixteen lines in the one repeat. This is possible because one line is used six times over, one four times, and three lines twice in the one repeat. The sequence in which the treadles are to be depressed for weaving the pattern is indicated by the black oblongs, placed on the treadle lines at B, and level with the spaces with which they agree. If it were woven with this harness alone, the white warp and black weft would only intersect at the places where the black shapes join the white ones, as shown in the upper half of the drawing. The white spaces would simply consist of long loops of warp threads, and the black spaces of loops of weft. In the lower half of the drawing a broken twill tie is represented binding the loose loops of warp and weft together. In the case of damasks the threads of the weft satin (see black spaces in drawing) are tied down by the warp threads crossing them at regular intervals (see white spots on black figure), and the threads of the warp satin (white spaces in design) are bound by the occasional crossing of the black weft (see black binders on white ground). This effect is the same both on the back and the front of the material, except that the white spaces of one side will be the black spaces of the reverse. It must now be carefully explained how this ingenious result is obtained. After passing through the figure harness, in groups of four, the warp threads have to be entered singly in the long-eyed ground harness. As the tie, in this case is a broken, four-headle twill (p. 168), this harness must consist of four headles. The ordinary entering of the warp in the ground harness, is shown below the design at C. This

harness will require four treadles, and these would be placed in a group between the six treadles of the figure harness. They are so shown in the plan, D, D. The twill tie-up and order of treading are also there given. In this case the usual order of working the treadles for the twill ground may be departed from, because the weaver will only have one foot to spare for the ground, as the other foot will be occupied in treading and holding down the figure treadles. We have already noted the effect of weaving with the figure harness only. If in like manner we now use the ground harness by itself, the web will be a plain satin. The front, or under surface, will be like the white spaces in the design, warp satin with black weft ties. The back or upper surface will be just the reverse, being black weft satin with white warp ties.

Details of
weaving
Pattern
Damask

Having now a clear idea of the effect of the two harnesses when used separately, and all being ready, let us suppose that the weaver places his left foot on the first treadle of the ground harness. This will raise the first of every four threads of the whole warp. If now, still holding the ground harness treadle down, the first figure harness treadle be depressed with the right foot, groups of threads will be seen to rise, similar to the black spaces E, E, E of the first line of the design, but more correctly shown at the line F, which represents the back or upper side of the web, whilst G gives the reverse or under side. The line G should correspond with the drawing, but it will be seen that it does not quite do so. The white ties are missing from the black spaces, although the black ties are to be seen on the white ground. At F, on the

The Effect
of the Two
Harnesses
when used
together

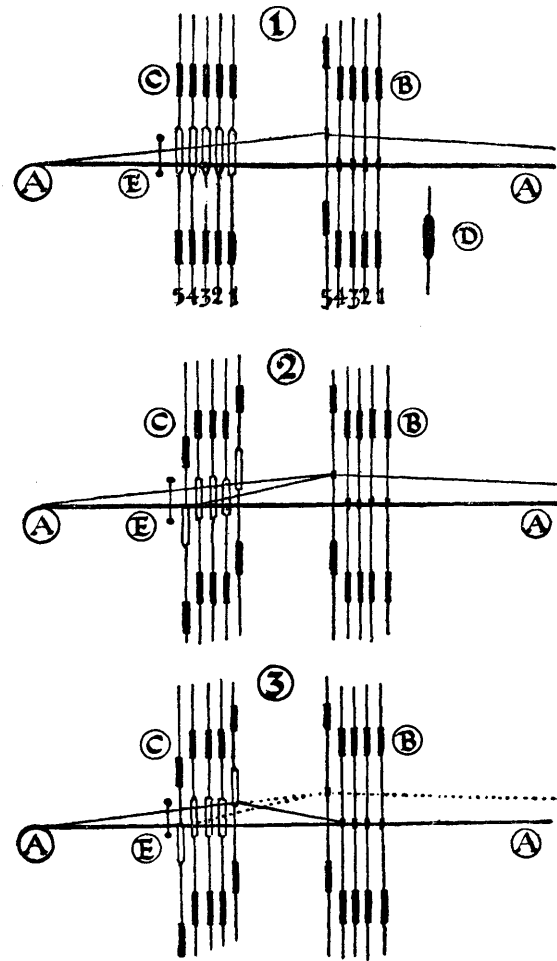
The Effect
of the Two
Harnesses
when used
together

Rising and
Sinking
Shed with
Stationary
Bottom
necessary
for Ground
Harness

Contrary
Action of
the Two
Harnesses
further
explained

contrary, the white ties are in their places on the black portions, but there are no ties on the white spaces. In order to rectify this omission and complete the damask fit-up of the loom, the ground harness must be furnished with the shedding motion similar to 85A, so as to cause the missing binder threads to sink, and be held down at the same time as the others rise. The counter-marches, or short levers, to which the lower shafts of the treadles are tied must be exactly the same as at fig. 85A. The connection with the treadles, however, must in this case be somewhat different, as what we now require is to sink and hold down, only one thread out of the three stationary ones left, when one is raised as we have seen it. The shed now wanted is represented at H, fig. 91, where the dotted lines show the rising and sinking threads and the thick line the stationary bottom. We must therefore tie up treadle 1, to the short lever connected with the lower shaft of the first headle. The second treadle must be connected with the fourth headle, the third treadle with the second headle, and the fourth treadle with the third headle. This second tie-up for the sinking headles may be shown on the tie-up plan by circles, to distinguish it from the first or rising tie-up, indicated by crosses. The new arrangement being complete, if another trial be made it will be found that the sinking threads will make the required ties both for the warp and weft satins.

In order to make this contrary action of the two harnesses quite clear fig. 92 is perhaps necessary. It is a most important point, and must be perfectly understood, for, simple as it may appear to be, on it the whole system of damask-weaving depends.



Contrary
Action of
the Two
Harnesses
further
explained

FIG. 92.—Various Two-harness Sheds.

Further
Description
of Shed-
making for
Damask
Patterns

In no. 1 of this figure the warp, represented by the thick horizontal line AA, is seen to pass through a figure harness (B) of five headles having short-eyed leashes. The entering in this harness may be of any reasonable number of threads; for this instance let it be four; and if it be deemed desirable to keep the threads separate, although this is not essential, the figure harness leash eyes may consist of mails having four holes, as shown in the enlargement at D. Beneath letter C the ground harness is shown, also consisting of five headles, but these have long-eyed leashes. Between this harness and letter A on the left, a shed, E, is shown opened by the rising of the fifth headle of the figure harness. The rising of this headle has lifted four threads together; these are represented by the line drawn from the eye of the raised headle to the letters A, A. Although each of these five threads may pass through the eye of one of the five ground harness headles C, the latter will not be affected by them because of their long eyes. This allows for the formation of the design without ties, as described at p. 212. At no. 2 the same line of warp, AA, and the same harnesses, B and C, are depicted. In this case, however, the shed is much more complicated. The fifth headle of the figure harness is still up, but its line of four threads is divided. The thread passing from it through the fifth headle of the ground harness is not allowed to rise, as it is held down by the sinking of the headle. The effect on the front of the web of this contrary action is similar to that shown at G, fig. 91. At F, in the same figure is the back of the web as it would appear to the weaver, providing the warp were white and the

weft black. Although one of the lifted threads passes through the first headle of the ground harness, it is not affected by its rising, as it is already up, so that it does not have any influence on the portion of the design raised by the figure harness headle. No. 3 will explain the action of the first headle (shown raised) of the ground harness on the parts of the warp not raised for the figure. Here the holding down of headle 5 will have no effect, as all the threads of the figure harness are down as well, but the first headle being up, will tie the figure at the back and at the front as at E, E, fig. 91. The dotted lines between the two harnesses are not really essential in no. 3, but are merely put in to make easier the comparison between nos. 2 and 3.

Further
Description
of Shed-
making for
Damask
Patterns

The great scope given to pattern-weaving by means of the above ingenious invention will now be realised. It will also be understood, from the foregoing examples, that all the most astonishing developments, to be seen in the more or less modern ornamental textile fabrics, are based on this principle whether they be woven by hand or by power, on the draw-loom of the seventeenth and eighteenth centuries, or by means of the Jacquard machine and appliances of the nineteenth century.

All Modern
Pattern-
weaving
based on
Two-
harness
Principles

It has already been shown that the tabby selvage of a satin web will use up a greater length of warp than the body of the material, and that this is due to the fact that in tabby weaving there are more intersections of the warp and weft than there are in satin-weaving. The same thing occurs sometimes in a pattern web. A large space or stripe of satin, running longitudinally in the web, would, on account of this difficulty, require special consideration.

Weaving
from Two
Separate
Warps

Weaving
from Two
Separate
Warps

For example, let us examine fig. 93. Here we have a stripe of satin in a tabby ground. This pattern would be woven on eight headles, entered

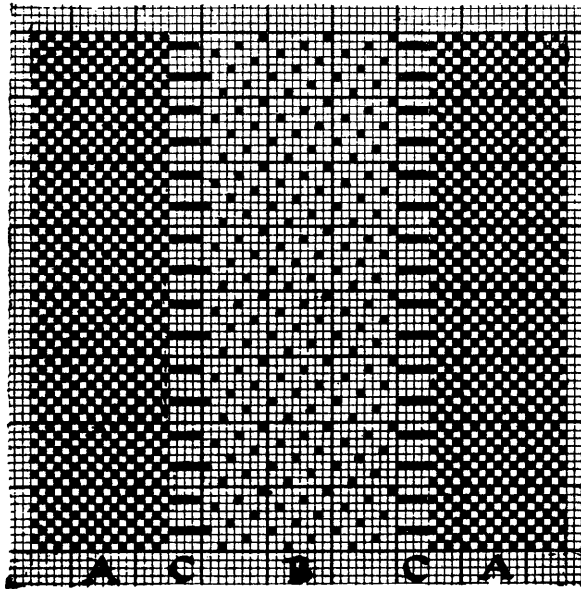


FIG. 93.—Stripe of Satin and Tabby Ground.

and tied up to eight treadles. If only one warp were used for this web, it would soon be found, that the tabby woven portion of the warp would begin to get tighter than the satin stripe, and ere long the difference would be so great that the weaving could not proceed. This inconvenience can be obviated by the use of a separate roller for the warp of the satin

stripe. This second roller would be fixed either above or below the one for the tabby ground. It would also be weighted separately from it. By this means the take-up of the two warps would be rendered quite independent one of the other. In making the two warps, the whole number of threads in the collection of satin stripes would be counted and warped together, and the same would be done for the tabby ground. In turning on to the rollers, the satin stripes would have to be set out and wound on in their proper places on the one; and on the other, corresponding spaces left vacant for them. This being done, the two warps could be entered in the harness and reed as one. Very often in fancy weaving, especially when there is brocading, a separate binder is required, and it is generally necessary to have the warp for it wound on to a separate roller. This will be explained later on in the book, when the subject of *brocatelle* and other *tissue* webs, as they are called, is dealt with.

Weaving
from Two
Separate
Warps

Plain velvet-weaving requires the use of two warps on separate rollers, while figured velvet needs for its production the use of many warps for the pile, sometimes to the extent of needing a separate warp roller or bobbin for each group of threads in the repeat of a design, and there are sometimes as many as four, or even eight hundred, of these tiny warps arranged in a figured-velvet loom.

For plain velvet-weaving, the two warps required are, one for the groundwork, which may be an ordinary tabby, twill, or satin, and one for the pile. The difference in the take-up of these two warps is astonishing, the pile warp having to be made at least six times the length of that for the ground. In order to

Velvet-
weaving

Velvet-weaving

make one yard of velvet, the ground will take up about one and one-sixteenth of a yard of warp, but for the pile, not less than seven yards will be required. The reason of this enormous take-up of the pile warp, in velvet, is owing to the method of weaving peculiar to this sumptuous material. Velvet-weaving also requires the use of two harnesses, and the two warps are each entered in the harnesses

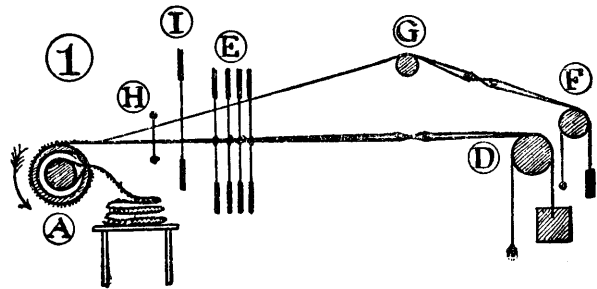


FIG. 94.—Section of Velvet Loom.

independently. Fig. 94 will assist in the explanation of the arrangement.

The Velvet Breast Roller

In fig. 94 A is the breast roller, a section of which, so enlarged as to show its details of construction, is given on the next page (fig. 94A). This construction of the roller is necessary because the cut pile surface of the velvet cannot be wound and pressed on the roller without injury, as other materials may be. The roller is hollow, and generally much larger in circumference than ordinary breast rollers. It has a wide, hinged lid, running its entire length, so shaped on the outside as not to interfere with its cylindrical

form when the lid is closed (fig. 94A, D). The edge of the lid is cut away and carefully rounded in the centre, so as to leave, when it is shut, a narrow opening wide enough for the velvet to pass in and out again, without crushing the pile together. Inside the roller, which must be perfectly smooth, a second roller, B, is fitted in such a manner,

The Velvet
Breast Roller

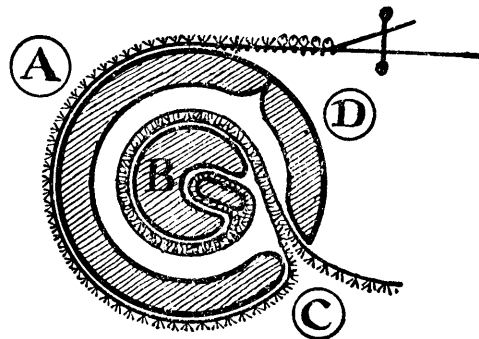


FIG. 94A.—Breast Roller of Velvet Loom.

that the velvet, after entering at the narrow opening C, fig. 94A, may pass round it and out again in the same opening. The inner roller has a wide and deep groove in it, and is covered with some material to which the velvet clings, so that very little pressure by a lath in the groove, is sufficient to prevent its slipping. This, together with the slightly rounded edge of the narrow opening, holds the velvet tight enough to allow for the strain of weaving.*

* When the inner roll is covered with the velvet it is prevented from turning by pins or buttons at the ends.

The Velvet Breast Roller As soon as enough velvet has been made to allow of passing it round the inner roller, the lid is opened, and after the end of the velvet is in the right position it is closed, fastened down, and the weaving proceeds. When the narrow opening in the roller, C, nearly reaches the under surface of the velvet, the work is loosed, the roller moved round, the lid

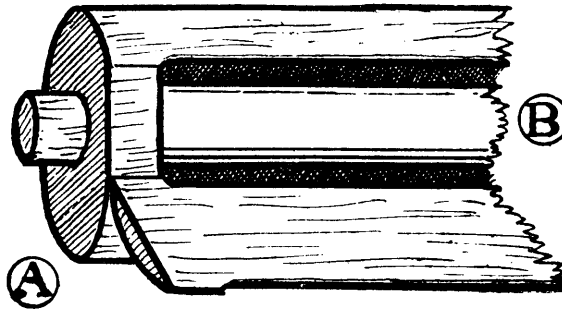


FIG. 94B.—Velvet Roller with Lid Open.

opened, and the velvet, being separated from the small roller, is drawn round it and carried under the loom, to be hung on a rack, or gently laid in loose folds on a low shelf placed conveniently to receive it (see fig. 94). The greatest care has to be taken to keep the material straight and true while it is being thus moved along. As the roller is about ten or twelve inches in circumference, it will be seen that about one yard can be made between every shift. One yard of fine velvet is about a day's work for a good weaver, so that this operation of moving the

web does not hinder the weaving to any great extent.

Referring again to fig. 94, D is the roller for the ground warp. This warp is indicated by the strong line passing from D to A. E are the headles of the ground harness; four are shown here, but the harness may consist of any number of headles required to make the ground tabby, twill, or satin, as the case may be. F is the roller for pile or *pole* warp, as it is often called. This is usually placed above the ground roller, and is very lightly weighted. Sometimes the roller itself is fixed very high in the loom, but more generally a second small roller, G, is fitted high up, at about the centre of the loom, and over this the warp passes as in the diagram. This arrangement is made in order to keep the two warps as separate as possible, and is placed by the weaver himself so as to suit his own peculiar method of work. The line drawn from the roller F over G through the headle I and the reed H to join the ground warp, near the roller A, is the pile warp. Only one headle, I, is shown, and it may be that only one is necessary, as for plain velvet, with one pile warp, the pile threads all rise or sink together. If, however, the pile is too rich to be all entered in one headle, two or more may be required. The pile harness is hung as near to the reed as the working of the batten will allow.

As regards the warps themselves, the ground warp is by far the richer, the number of threads in it being usually three or four times as great as that of the pile. All the other fittings of the loom for weaving velvet are the same as those for the ordinary hand-woven materials.

The Velvet
Breast Roller

The Warps
for Velvet-
weaving

The Ground
Warp

The Pile
Warp

Proportion
of the
Warps

Velvet-
Weaving :
the Actual
Process

The special fittings of the loom for velvet-weaving being now all described, the actual process claims our consideration. Everything being, so far, in order, the weaver would begin by making a few inches of the ground, raising and depressing the pile harness, in regular order, as may be indicated in the plan. The pile thus woven in, has little visible effect on the ground, especially if the latter be a rich satin. It will only give a slight, lateral, ribbed appearance to the material, and thicken the ground to a certain extent. When all is working properly the pile is raised by itself, and its raising forms a shed in front of the reed. Into this the weaver, instead of weft, inserts a finely made, smooth, flat brass wire, called a *velvet rod*. This rod has a fine groove cut in one edge, which, when the rod is placed in the shed, should be on top. It is held by the weaver until the next shoot of ground is made with the pile down ; this will fix it in position. Two or three ground shoots are then made, the pile rising and falling between them as may be arranged by the designer ; this binds the pile to the ground more or less securely. After these few shoots of ground, the pile is again raised by itself and another rod inserted, being followed up in the same manner. When five or six rods are thus woven in, the most delicate operation of velvet-weaving begins, viz., the cutting of the pile. This is effected by the weaver, with a tool called a *trevette*, in which a fine, sharp, peculiar-shaped blade is most accurately fitted. The necessary perfection and accuracy of this tool, according to some authorities, gave rise to the proverb "As right as a trevette," and the suggestion seems quite reasonable. A drawing of this implement is given at fig. 95.

It is taken from a trevette of the simplest construction, and is therefore of the kind which in skilful hands is capable of the nicest adjustment. The trevette is made in two parts, the upper part, which carries the knife, shown open at no. 1, being hinged to one end of the lower part, and grooved at its bottom edge so as to fit quite firmly on to one side of it

Description
of the
Trevette

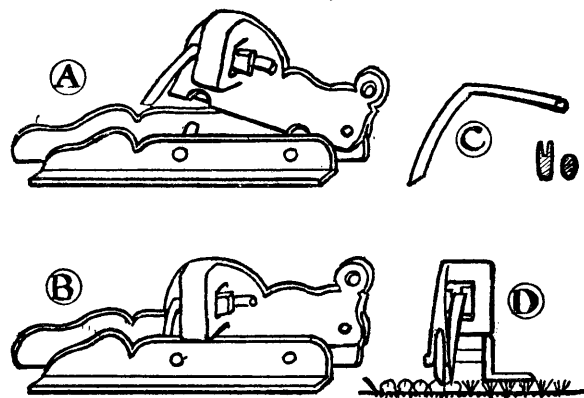


FIG. 95.—Trevette.

when the instrument is closed for use, as at letter B and at letter D, where the end view is given. The knife, C, is shown at A fixed in the strong staple, by small hardwood or metal wedges, and it is in the adjusting of the knife with these, and keeping it sharp, that a great deal of the art of velvet-weaving consists. It is for the purpose of adjusting and sharpening the knife that the two parts of the trevette are hinged together. When closed, ready for work, the knife is so placed that its sharp end is very near to the

Description of the Trevette inner edge or the straight steel side or the lower part of the tool. This may be seen in the end view, D. The brass front of the lower part, letter B, is for the purpose of steadying the instrument when in use.

Velvet-weaving (continued) We must now return to the loom, where we left the first rod ready to be cut out of the pile. The weaver, taking in his right hand the trevette, rests it on the left-hand side of the web in such a position, that, the sharp edge of the knife fits into the groove of the *first* rod woven into it. Making sure that it is rightly placed, by a firm, steady, rapid movement, he draws the trevette right across the web to the other side, and, if the knife be sharp and has been kept in place, the rod will spring out and the line of pile will stand up, like a row of delicate little, silk brushes in its place. Having cut out the first rod successfully, the pile shed is again opened and the cut-out rod inserted, ground is woven as before and the second rod cut out, and so on in regular succession. As may be imagined, great care has to be exercised in cutting out the rods, as an unfortunate slip may result in cutting out more or less of the ground warp, which is most disastrous. If properly cut, the velvet made by hand should require but very little finishing when out of the loom, beyond what the weaver himself can do.

Terry Velvet Terry velvet is simply velvet woven in the above manner, but uncut in the pile. Smooth, grooveless wires are used in this case, and when half a dozen have been woven in, instead of being cut out the rod is drawn out from the same end at which it was inserted.

Velvets, woven and cut by hand in this ancient
226

manner and made of good silk throughout are unequalled, both for texture and durability, by any imitations that can be produced by modern means. A comparison of the many specimens of ancient velvets, with the most perfect and ingenious productions of the power-loom, will verify this statement. Power-loom imitations smoothly shaved and highly finished present a hard, inartistic, shining surface when thus compared with the rich, glowing and slightly varied texture of hand-loom woven velvets, either of mediæval or modern times.

The
Superiority
of Hand-
loom Velvet

With regard to small-pattern weaving in velvet, a great deal might be done by quite simple means, such as varying the colour of the pile warp, or spacing it out so as only to come up in spots or lines, vertical or lateral. The use of terry and cut pile in the same pattern is also quite easy to produce. Many of the ordinary small designs, too, could be made in velvet quite readily if the pile were entered in a harness which would lift it in the separate portions required, and the warp were distributed over the requisite number of warp rolls. The necessary arrangements for small velvet patterns will, however, be better understood when the description of figured-velvet weaving, which will be found in Part III. of this book, has been read.

Small
Designs in
Velvet

The edges of stripes in striped materials such as that shown at fig. 93, p. 218, and taborettes, as well as the grounds of rich brocades, are often decorated with little squares, oblongs, or lines, composed of warp threads floating over two or more shoots of ground weft and dipping below it at regular intervals. These form bright edges and embellishments, and often have a very pleasing effect. This simple kind of

“Tobine”
Embellish-
ments

“Tobine” ornamentation is called *tobine*, and requires a separate warp spaced out and entered in one headle, in the same manner as a velvet pile warp. Fig. 96 is a ruled-paper drawing of a taborette stripe, and will

Embellish-
ments

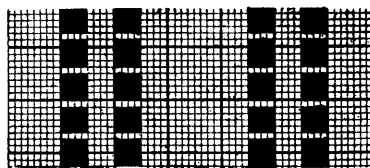


FIG. 96.—Tobine Stripes.

sufficiently explain the method of introducing the tobine edges. Plate IX is a good example of the use of tobine stripes, which, being graduated in colours, form the sole but very effective ornamentation of a seventeenth-century silk.

CHAPTER XV
AUTOMATIC MACHINES FOR SHEDDING
MOTIONS

Automatic Shedding Motions and their Use—
Disadvantages of the Jacquard Machine for Home
Weaving—Comparison of it with Simpler Machines
—The Jack-in-the-box—Its Inventor—Character
of Old Hand-loom Weavers—Tie-up and Working
of the Jack-in-the-box—The Drawboy Machine,
its Details and Use—Examples of Pattern-weaving
with Drawboy.

It now becomes necessary to describe two ingenious automatic contrivances, by means of which the inconvenience of managing a large number or treadles, required for lifting the headles in the formation of some patterns, may be obviated to a great extent. At the present time the ingenious invention, the Jacquard, and the various machines made on the same principle, have taken the place of all other automatic machines for pattern-weaving. But the Jacquard machine, although admirable in its capacity and adaptability, has certain disadvantages for hand-looms, especially if these be in a private house, a small workshop or a studio. Not the least of these disadvantages is that the Jacquard machine requires the constant attention of a skilled

Automatic
Contriv-
ances for
Shedding
Motions

The
Jacquard
Machine

Advantages of Simpler Machines
 machinist to keep it in working order. It also requires to be continually in use. For the weaving of simple designs, therefore, on an isolated hand-loom, the less delicate and complicated machines, invented by weavers themselves for the purpose of simplifying the shedding of the loom, are preferable. They have the advantage, too, that the weaver himself can repair and keep them in order, as, like the loom, they are chiefly made of wood and string. They are also less heavy and noisy in working than the Jacquard machine, and, being placed by the side of the loom instead of at the top, no extraordinary height is required in the place where they are set up. For rapid commercial work in a factory, where a great number of looms are set up and in constant use, the Jacquard machines are, of course, superior and offer many advantages, but it can be readily understood that different qualities are desirable in a machine for home weaving.

Jacquard Machine most suitable for Factories

The two machines we have to examine are the *Jack-in-the-box*, or Jennings shedding motion, and the *Drawboy* machine, which latter was intended for drawing the cords of the draw-loom, but was found to be equally useful for drawing up any number or combination of headles required for small-pattern weaving.

Jack-in-the-box, when invented, and by whom

The Jack-in-the-box was chiefly used for making rich satins and very small figures. For this purpose many hand-loom weavers prefer it to a small Jacquard machine, it being so perfectly reliable in its action.

Ingenious old Weavers

It was invented about 1840 by a working silk-weaver of Bethnal Green named Theodore Jennings; and it is interesting to notice, by the way, how many of the valuable inventions of weaving appliances in

the old days were made by the actual workers, who not only understood the working of the loom when all was prepared for weaving, but could build harnesses, contrive alterations of design and methods of working, tie up new patterns, and do all the necessary preparation of the loom, themselves. This required for its accomplishment much judgment and skill, and we find that many of the old hand-loom weavers possessed these qualities to a very great extent. Some of them, indeed, were quite famous in their day, not only for weaving, but in various branches of science. Mathematical, entomological, botanical, and other clubs were common amongst them, and several were corresponding members of the learned scientific societies of the eighteenth and early nineteenth centuries.

Ingenious
Old Weavers

In Chapter XIII., where the typical shedding motions are described, it was pointed out, that as many treadles were required as there were headles or groups of headles to be raised in succession to form any particular pattern. In an eight-headle satin, for instance, the eight headles required eight treadles to raise them in the following order : 1, 4, 7, 2, 5, 8, 3, 6. The Jack-in-the-box provides the means for raising any number of headles in any sequence by the use alternately of two treadles only.

Jack-in-
the-box :
its Utility

Fig. 97 is a general view of the shedding motion of the loom, with this simple machine in its relative position to the treadles and headles. Fig. 98 gives the details and construction of the various parts. Fig. 98, no. 1, AA, is a strong oblong wooden box, without back or front, set on end and perforated at the top end with two rows of holes,

Description
of the Jack-
in-the-box

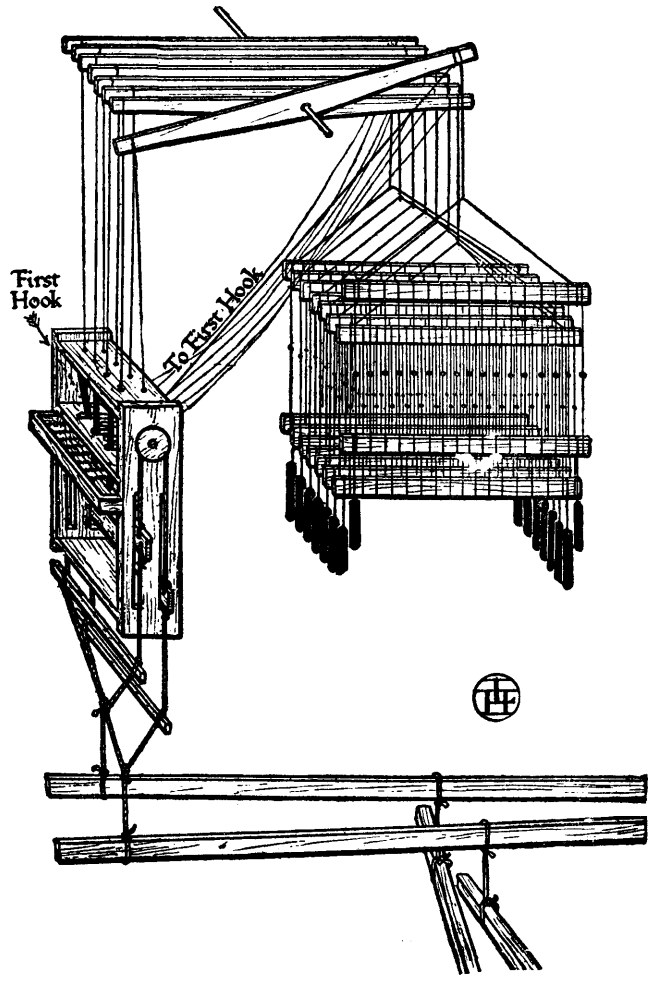


FIG. 97.—The Jack-in-the-box.

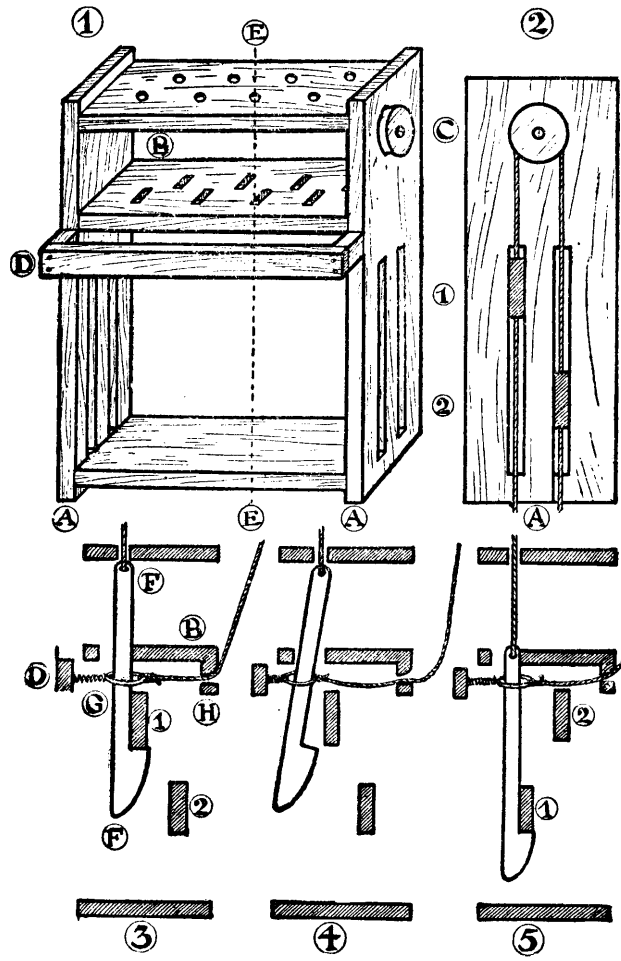


FIG. 98.—Details of the Jack-in-the-box.

Description of the Jack-in-the-box four holes in each row. Inside it has a shelf, B, placed across it, at about one-third of the distance from the top to the bottom ends. This shelf has transverse slots cut in it, to correspond with the eight holes with which the top is pierced. These transverse slots are cut in such a position, that one of the top holes is over the centre of each slot. The box has also two long slots cut in each of its sides, and above these pulleys are fixed. One of these is shown in the drawing and marked C. Just below the shelf, in front, a bar, D, is fixed from side to side, and this bar is made to stand an inch or two in front of the box, by means of two short arms which project from its sides.

No. 2 shows an elevation of one side of the box. Both sides being exactly alike, the description of one will suffice. Here we have again the two long slots and the pulley C. In addition to these, the elevation shows the sections of two, long bars, numbered 1 and 2, which are fitted to the slots and are long enough to reach from side to side of the box, and, after passing through the slots, to project not less than three inches beyond them. To the top of one bar a strong cord is tied, carried over the pulley C, and then fixed to the other bar. The cord is of such a length, that when one bar is near the top of its slot, the other bar will be at the bottom of the other slot. Two other cords are fastened to the bottom edges of the two bars, and connect them with the two treadles of the loom in a manner which will presently be explained. It will now be perceived that when one bar is pulled down, the other must rise and reverse the position shown in the drawing. Also, that, by working the two treadles, with which

they are connected, this action of the bars can be repeated in alternation.

Description
of the Jack-
in-the-box

Nos. 3, 4, and 5 represent a section of the box no. 1, taken at the place indicated by the dotted line EE. The parts which will be recognised severally are: (1) the bottom board of the box; (2) the top board pierced with holes, one of which appears in the section; (3) the shelf, with one of the transverse slots shown; (4) the front bar attached to the sides of the box; and (5) the two sliding bars. In this figure three new and important features are shown: (1) The large hook FF, made of hard wood and suspended from a cord passing through the hole in the top board. The hook itself hangs through the corresponding transverse slot in the shelf, and when held in the position shown, is caught by the bottom edge of the sliding bar 1, which is represented up. A metal ring, placed just below the slot, is connected with the front bar D by a strong piece of elastic, or wire spring, G. The ring encircles the hook F, and would pull the hook towards the bar D were it not held, in its present position, by the tight cord tied to it, which passes through the perforated narrow board H. This board is fixed to the back edge of the shelf B. The position of the hook set free by the slackening of the cord is shown in No. 4.

In order to complete the machine it must be fitted up with eight hooks, springs, rings, and cords. A greater number of hooks can be used, and the capacity of the machine much enlarged, but the details of the construction would remain the same in any case.

Turning back to fig. 97, where the Jack-in-the-

Description of the Jack-in-the-box box is shown fitted in the loom, the eight headles suspended from the eight levers, will be recognised as similar to those seen in the illustration of the shedding motions in Chapter XIII. The cords, however, which in those passed down from the ends of the levers and were fastened to the ends of the long marches, are now seen to pass into the box and terminate in the hooks hanging there. In this case only two long marches and two treadles are needed, instead of as many of each as there are headles in the harness. The long marches are connected with the two rising and falling bars, whose ends project from the side slots in the box.

The machine itself is now complete, and, if the treadles of the loom are worked alternately the result will be, that, the two sliding bars will rise and fall regularly, but nothing else will happen, as the hooks at present are all held back by the rings and springs as at No. 4, fig. 98.

Tie-up of the Jack-in-the-box The tie-up to the headles, in accordance with the design, must next be effected. From the ends of the levers, just above the headless, even loose cords and one tight one are seen to pass into the back of the box, and it is by means of these cords that the tie-up is made. As the tie-up has to be made with very great nicety, all the strings must have adjustable loops, as well as the cords by which the hooks are suspended.

Although any tie-up can be arranged for, it will be best, for the purpose of illustration, to take the simplest one possible, which is that for an eight-headle twill. For the formation of this, the headles will have to rise in regular succession from back to

front. The cord from the first or back lever, therefore, must be tied to the ring of the second hook, which is the *first* in the back row of hooks. The second lever cord must be tied to the third ring, the third lever to the fourth ring, and so on till the last lever is reached. This cord must cross over and be tied to the first ring in the box. Now if the cords are all of the proper length—which can only be ascertained by experiment—the result of drawing down any one of the hooks will be that the lever to which it is suspended will be drawn down with it, and its other end, to which the headle is suspended, will be raised, raising the headle with it. The lever rising will also tighten the cord which is connected with the ring of the next hook to be drawn down and pull it forward, so that it catches on the sliding bar, which is at present up. When this bar is drawn down by the treadle, it carries the hook down with it; this raises the headle and draws forward the next hook, and so they all follow, in succession, till the last is reached, which, being connected with the first ring, draws it forward, and the same course is repeated again and again. All that is now required to start the motion, is, for any one of the hooks to be placed under the sliding bar and drawn down by one of the treadles; all the others will then follow in proper order if the tie-up be correct. The tie-up always has to be arranged so that each succeeding hook is in the opposite row, in order that it may be drawn down by the alternating bar. This can always be provided for by altering the tie-up of the hooks to the levers above the box, if it cannot be done without.

Tie-up of
the Jack-in
the-box

Working
the Jack-
in-the-box

The action of this little machine, especially when

Working
the Jack-
in-the-box

used for the weaving of light webs, such as twills and satins, is most neat, cheerful, quiet, and altogether admirable.

The
Drawboy
Machine

The *Draw-boy machine* is of much greater capacity than the Jack-in-the-box, and more adapted for heavy and complicated work. Any number of headles or cords, singly or in groups, up to as many as four hundred or more, can be managed by its means, and only two treadles are required to keep it in motion. It was originally intended for use with the draw-loom, in place of the boy employed by the weaver to draw the cords necessary for the successive lines of the design, as will be explained later on. It was, however, soon adopted for the purpose of drawing the complicated systems and sets of headles for pattern-weaving, which had till then been drawn by a large number of treadles, brought in and out of action by various levers and cords. It is said that "when introduced in Spitalfields the weavers hoped to reap great advantage from them; for instance, they would save the draw-boy's wages. But they began to find that they had adopted a mistaken notion. They found that if they had not to pay the draw-boy they had to pay the manufacturers for the use of the machine, and, moreover, the work itself was heavier." The complaint that the work was harder would refer only to the draw-loom, as the simple management of two treadles must be much easier and lighter than that of twenty.

Fig. 99 is a representation of a drawboy machine. It is shown attached to a set of cords, A. These cords may, in their turn, be connected with any system or sets of headles. Twenty cords are shown,

but there might be any number attached, the number of headles only being limited by the space in the loom where they could hang and be efficient

The Drawboy Machine

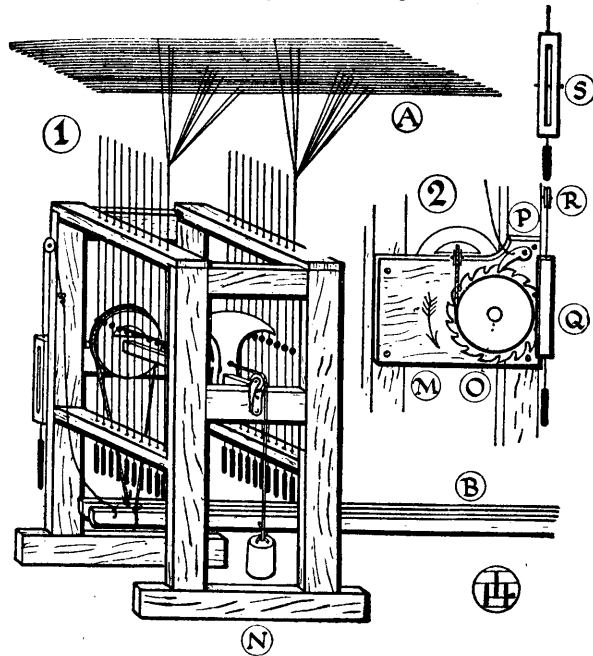


FIG. 99.—The Drawboy Machine.

for opening the shed. The machine is worked by the long marches of the loom, B, which, in their turn, are governed by the two treadles.

Fig. 100 gives all the parts of the machine in

Details
of the
Drawboy
Machine

detail. No. 1 is the framework, which consists of four strong wooden uprights, about two feet six inches long, D, D, D, D. These are set firmly in

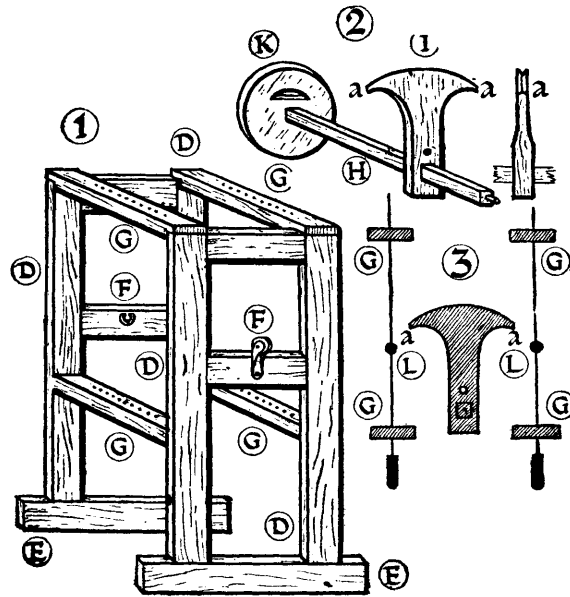


FIG. 100.—Details of the Drawboy Machine.

pairs on two cross-pieces, E, E, which are screwed to the ground at the side of the loom near the front and about two feet apart. Each pair of uprights is joined together at the top by a strong cross-piece, and there are also cross-pieces, F, F, just above the centre. In these centre cross-pieces, on the insides,

there are sockets, made to hold the end pins of a rocking shaft, which when placed in them reaches from one end of the frame to the other. On the centre of the outside of the cross-piece F, at the end shown in the drawing, a pulley may be seen raised a little above its top edge. The two pairs of uprights are joined together by four side cross-pieces; G, G, G, G. Two of these are fixed at the top and two at the sides a little lower than the end centre cross-pieces F, F. The cross-pieces G are made of hard wood, and have a number of holes (in this case ten in each) accurately and smoothly drilled in them, not more than an inch apart. The row of holes must begin and end about six inches from the four uprights.

Details
of the
Drawboy
Machine

At H, no. 2, a rocking shaft is shown, which fits into the sockets on the inside of the cross-pieces F, F. The shaft is made of hard wood, and must be exactly the same size, and perfectly square from one end to the other, so that the pecker, I, when fitted on it, may be made to slide easily backward and forward along its whole length. At one end of the rocking shaft a large, strong, deep-grooved pulley, K, is firmly fixed. Through the pulley a segmental hole is cut, just above the centre, where the shaft joins it.

The
Rocking
Shaft

The pecker, I, no. 2, shown in position on the shaft and in side elevation on the right, is also generally made of hard wood, although sometimes partly of metal. The points a, a, and the top edge, have a deep but narrow groove cut in them, just large enough to allow a fair-sized cord to slip in them. The pecker has also a hole pierced through it, just above the shaft, as well as the square hole through

The Pecker

The Pecker which the shaft itself passes. When the rocking shaft is in its place (see fig. 99) the pulley K is near the end of the shaft towards the back of the loom. In the groove of this pulley a strong cord is placed, its ends being tied separately to each of the two long marches of the loom, B, which are made long enough to enter the frame beneath the end of the shaft where the pulley K is fixed.

The Cords No. 3, fig. 100, shows a section of the machine, with the pecker, also in section, in position. G, G, G, G are the perforated side cross-pieces; the pecker is seen mounted on the rocking shaft; L, L are two, of twenty cords, having weights at their ends which are seen, in fig. 99, to hang in the holes of the side cross-pieces, a row of ten being on each side of the machine. Near the points of the pecker, a, a, a hard knot, or bead, is so placed, that, when the rocking shaft is set in motion by the long marches being pulled down alternately, the pecker will rock from side to side, and, catching the cords in the groove at its points just above the beads, will pull the cords downwards, first on one side, and then on the other. It will now be seen that if the pecker be caused to slide along the bar, rocking as it goes, its movement being properly regulated, as it comes opposite to each pair of cords, they will be pulled down as described, and that by the time the pecker has passed the twenty cords, they will all have been pulled down in regular succession. If then the side cords of the drawboy machine are tied up to a set of twenty headles, the latter may be caused to rise in any grouping and sequence desired.

In order to complete the description of the draw-

boy machine, it only remains to explain the means by which the pecker is caused to travel along the rocking shaft. No. 2, fig. 99, represents the back end of the machine where the pecker motion is placed.

The Pecker
Motion

M is a strong board firmly screwed to the uprights. Above the board, between the uprights, a part of the pulley of the rocking shaft, with its segmental hole, may be seen. Opposite the centre of the hole, and projecting a little from the board, to the top edge of which it is fixed, a small metal pulley matches the pulley at the other end of the machine above letter F, fig. 100. Over the pulley F in fig. 99 a cord with a weight, N, attached to it is seen to pass, through the pecker, and along the shaft to the segmental hole in the large pulley, where it disappears. Turning to no. 2, the same cord, coming through the hole in the rocking shaft pulley and passing over the small pulley on the edge of the board, is seen to be attached to another large pulley, which is riveted to a ratchet wheel. The combined ratchet wheel and pulley turn loose on their axle, which is a stud strongly bolted to the board M. Now, if the ratchet wheel be turned in the direction of the arrow, the cord will be wound on to the large pulley and drawn through the hole, drawing with it the pecker along the rocking shaft, past each pair of cords, until it reaches a stop, fixed on the shaft near the rocking shaft pulley. Also, if the distance between the beaded cords, be made equal to the teeth of the ratchet wheel, the pecker as it travels along the shaft will stop between each pair of drawing cords, and, as it rocks, pull them down first on one side, and then on the other. When the

The Pecker
Motion pecker has drawn all the cords, if the ratchet-pulley be released, the weight N, fig. 99, will bring the pecker back to its original position in the machine.

The ratchet wheel itself is governed by means of two catches, P and Q. The catch P, is to prevent the ratchet wheel turning back before the pecker has finished its course. The other catch, Q, is to move it gradually, one tooth at a time. The catch P has a thin cord attached to it, which may easily be guided by pulleys to the front of the loom and enable the weaver to release the ratchet at the completion of one repeat of the pattern. This, of course, coincides with the pecker's arrival at the stop on the rocking shaft. The catch Q, which moves the ratchet, is connected with one of the marches by the cord which passes over the pulley R, and its length is so regulated as to raise the catch just enough to move the ratchet one tooth at a time, or as may be desired. The mechanism of the catch Q, is shown above no. 2. It is simply a piece of hard wood having a long slot, into which the ratchet wheel partially enters. It is so hung that the pin S, will be, when the catch is at rest, just underneath one of the teeth, and as the catch is raised by the cord attached to the march, it will move the wheel, which, when moved, is prevented from returning, as the catch Q falls, by the second catch, P.

Utility
of the
Drawboy
Machine Any of the designs previously given could be woven with two treadles if the drawboy machine were used. Fig. 101 is, however, an example of the kind of design for which it is specially adapted, and the way of tying it up to the cords is shown

above the machine (fig. 99).* This design might be woven in various ways, but it will only be necessary to give two of the most useful workings as specimens.

(1) The warp might be fine cotton or linen, entered in the back or figure harness in the order shown above the design, two threads being entered together in each headle eye for each square of the drawing. If in the reed there were forty threads to an inch, the woven design would be about twice the size of the drawing. The kind of weaving suggested in this case would have the same effect as that described at p. 176, fig. 80, being a tabby ground with a floating figure woven by alternate shoots with two shuttles. In addition to the figure harness, a ground harness having long eyes must be used. It would be advisable to make it of eight headles, as such a harness would be most generally useful, and it could just as well be used with only two treadles as a harness of smaller capacity.

The warp would be entered in the front harness singly, in regular order, and the eight headles would be tied up to the two treadles in the usual way (see fig. 71, no. 1, p. 166).

The length of the design would be regulated by the number of times the depression of each treadle was repeated. Probably two treads for each line of the design would be sufficient, but this depends

* The tie-up of two lines of the design to two draw-cords of the drawboy only are shown (fig. 99, p. 239). There would, of course, be a much greater space between the top of the draw-cords and the headle cords than it is possible to show in the limited space at disposal.

Utility
of the
Drawboy
Machine

Examples
of the Use
of the
Drawboy
Machine

Examples
of the Use
of the
Drawboy
Machine

entirely on the size of the warp and weft used in the weaving. Either a fine coloured, tussah silk or

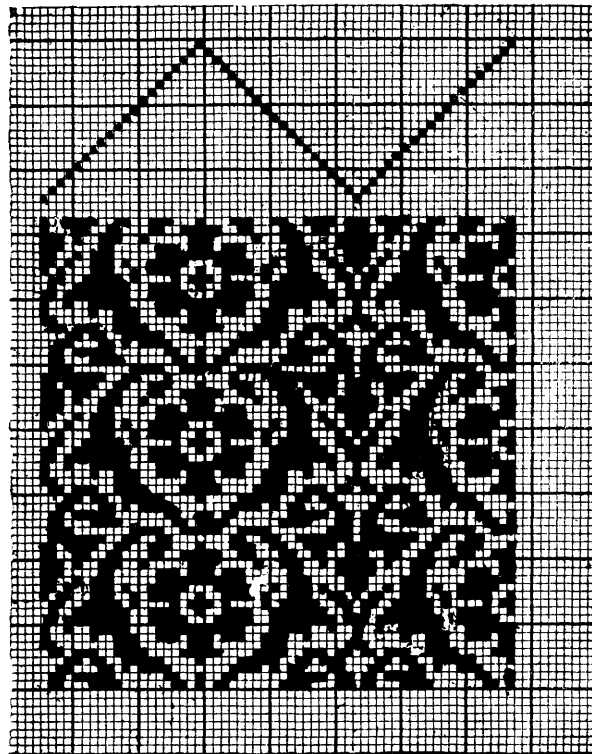


FIG 101.—Design for Floating Figure on Tabby Ground.

fine wool, would be a very suitable weft for the pattern shoot of this material.

(2) This would be a very suitable design for a fine silk damask, the arrangements for which would be as follows. The headles would have to have eyes or mails of glass, with separate holes for eight or ten threads to be entered in. (See fig. 92, letter D). These eight or ten threads are represented in the drawing by one small square of the ruled paper. The headles, too, would of course be spaced, so that leashes were only placed on the shafts where required (see top of fig. 101). In addition to the twenty pattern headles, a front or ground harness of eight headles with long eyes will be required, in which the fine silk threads must all be separately entered. The number of leashes to the inch must agree exactly with the spacing of the figure harness. It is not necessary that the number of threads lifted by each mail of the figure harness should agree with the number of headles in the ground harness, but only that the whole number of threads must be entered evenly and come out to the same total width in both. The satin made on eight headles may either be eight-headle satin or four-headle broken twill. In the latter case it would only require four treadles for the ground harness, but in order to make a fine, rich-looking damask, eight-headle satin, requiring eight treadles, must be used. The method of tying the treadles up for the satin has already been explained in the chapter devoted to their consideration, and that of damask-weaving in connection with fig. 91, p. 211.

In damask-weaving it is not necessary to drop the pattern headles between each shoot of the ground weft. The two treadles of the drawboy machine can therefore have a hook near them screwed in the

Examples
of the Use
of the
Drawboy
Machine

Examples of the Use of the Drawboy Machine floor, which will allow of their being conveniently held down, while the necessary number of ground treadles are worked over. In this pattern each line of the design would require about six shoots of weft between the change of figure treadles. In damask-weaving the length of a design can be perfectly regulated by the number of times each line of the ruled paper is worked over. It is necessary to add that in the case of damask-weaving the drawboy machine only acts on the figure harness, the ground harness having to be governed by treadles in the usual manner.

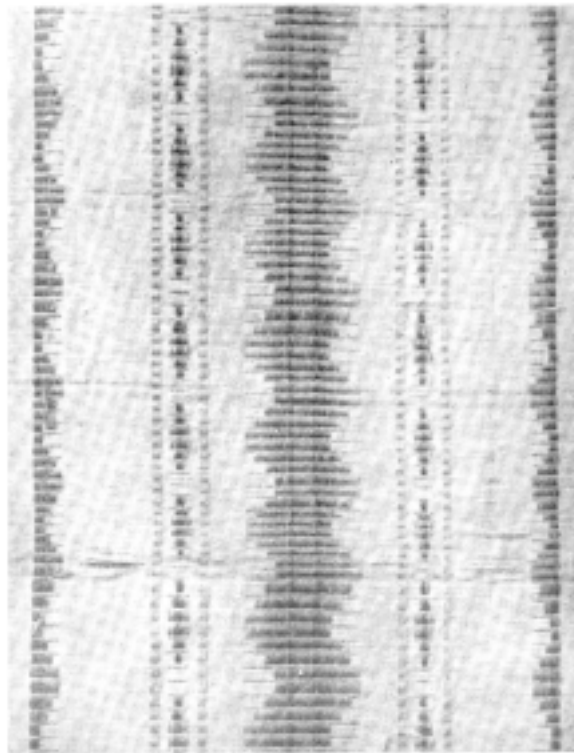


Plate IX.—Piece of Eighteenth-century Silk-weaving,
illustrating *Tobine Stripes*.

See page 228.

Victoria and Albert Museum, South Kensington.



Plate X.—Fragment of Seventeenth-century French Brocade,
a most perfect specimen of the Weaver's art.

See page 316.

Author's Collection.

PART III
COMPLEX PATTERN-WEAVING

PART III
COMPLEX PATTERN-WEAVING

CHAPTER XVI

THE DRAW-LOOM AND THREAD
MONTURE

Ancient Origin of the Draw-loom—Its Importance in Weaving—Description of Draw-loom—Building the Monture—The Two Kinds of Repeating Patterns—The Comber-board—The Pulley-box—The Tail Cords—The Simple and Guide Cords—The Term *Cords* in reference to Design—Rigidity of Lateral Repeats on a Loom—Freedom of Vertical Repeats—The Drawboy—The Drawboy's Fork—The Most Perfect Loom—The Thread Monture—Various Uses of the Thread Monture—Examples of Silk-weaving on Thread Monture.

THE number of headles it is possible to hang effectively in a loom must necessarily be limited, because of the space they occupy, no matter how closely they may be crowded together and how thin their shafts may be made. This limitation renders it impossible to weave any large design with a figure harness composed of headles. The small

Ancient
Origin of
the Draw-
loom

Ancient
Origin of
the Draw-
loom

capacity of the headle harness led, no doubt, to the invention of the *draw-loom*, in which, in place of the headles, a narrow perforated board is fixed across the loom, in the holes of which, separate leashes are hung. They are so arranged, that a design which occupies the whole width of the loom for one lateral repeat, takes up no more space than a harness of eight or ten headles, on which number only the very smallest patterns can be woven, as we have already seen.

Importance
of the
Draw-loom
in Weaving

It is impossible to fix the date of this ancient invention. The earliest specimens of, what are without doubt, draw-loom webs, are of about the sixth century, and are of Asiatic origin. But when, or wherever it may have first been made, THERE CAN BE NO DOUBT THAT THIS INVENTION IS THE MOST IMPORTANT IN THE WHOLE HISTORY OF TEXTILE DEVELOPMENT. All the finest pattern-weaving of the Eastern, as well as the Western world, ancient and modern, has been done on the draw-loom principle, and even the invention of the Jacquard machine, which is often supposed to have superseded it, did not alter the essential principle of draw-loom weaving in the least. Jacquard's invention only rendered the tedious process of tying up the design on the cords of the loom itself unnecessary. Jacquard substituted for the tie-up, an endless band of cards, on which the pattern to be woven was punched line by line. The design for the tie-up of the cords of the draw-loom was worked out, or draughted, on paper, ruled out in squares, in exactly the same way as is requisite for the punching of the cards used in the Jacquard machine. In some of the early accounts of its introduction into this country, Jacquard's invention is called the "new draw-loom engine."

The essential part of the draw-loom is the perforated *comber-board*, in and about which the *monture*, as the draw-loom harness is called, is built. Description of the Draw-loom

Fig. 103, is a representation of a draw-loom

monture very much simplified for the sake of clearness. A headle harness is drawn below it for comparison. A is a harness of six headles, entered, in the way before described, as necessary for a design having equal sides pointing different ways, and which requires eleven threads of warp for one lateral repeat. B is the comber-board of a draw-loom, perforated with eleven holes in a single row. C is the bottom board of a box pierced with six holes, through which the cords D are seen to pass. These answer to the cords from which we have hitherto seen the headles suspended. We need not trouble at present about the means of

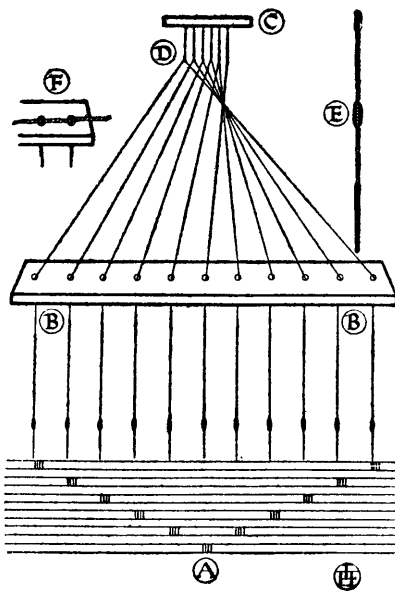


FIG. 103.—Diagram of Monture and Harness, Point Repeat.

Description of the Draw-loom governing them, whether by treadles, drawboy, or Jacquard machine. All that concerns us now are the details of the monture below the board C.

Hanging in each of the eleven holes of the comber-board a separately weighted leash may be seen. The weight itself consists of a thin strip of lead wire, having a hole at one end, by which a loop of harness thread about six inches long is attached to it. These strips of lead are called lingoës, and vary in weight from an ounce upwards, according to the kind of material to be woven in the loom when completed. As in some cases there are as many as three or four thousand of these lingoës in a monture, the accumulated weight is considerable when a large proportion are drawn up, especially as the weight is nearly doubled by the friction at various points of the monture. At the other end of the thread loop, to which the lingo is attached, a glass eye or mail is tied, having at least three holes in it, through the centre one of which the future warp will be entered. The holes at the ends of the mail are used, one for attaching it to the loop of the lingo, as we have just seen, and the other for tying it to another loop about nine inches long. When this has been done the leash is complete as shown at E.

Building a Monture When preparations are being made to build a monture all the loops of one size are, of course, made together of exactly the same length. They are then tied up in bundles ready for slipping on to the mails and lingoës, as required.

In building a monture the top loops of the leashes are hooked up through the holes in the comber-board, and a cord temporarily threaded

through them in order to keep them suspended while the upper cords are being attached. This is shown, still in place, in the separate diagram F.

Referring now to the plan of entering the harness shown at A, the first, and the eleventh leashes, are found on the first headle. Accordingly the corresponding leashes in the comber-board, must be joined by threads passing from them to the end of the first cord at D, in the bottom board of the box C. The second and tenth leashes are on the second headle ; the corresponding ones to these in the comber-board must be joined in the same manner to the second cord D. The third and ninth, fourth and eighth, and the fifth and seventh leashes, must be connected in like manner to the cords D, while the sixth, the only remaining leash, is to be connected singly with cord 6, which corresponds with the sixth headle, on which only one leash is found to two on each of the other headles.

It is now obvious that if any of the cords D are pulled upwards, singly or in combination, it will have the same effect on the warp, entered in the mails, as the similar raising of any one or more of the harness headles. Thus we have in a single row in the comber-board, equal facility for selecting and raising particular threads of warp with that afforded by the six rows of headle-mounted leashes. But this example, owing to the necessary simplicity of the drawing, is very inadequate to show the enormous advantage obtained, for suppose the row of holes in the comber-board extended to eleven hundred (quite a moderate number) instead of only eleven, the effect would be the same as if the harness consisted of six hundred headles, which is, of course, an impossible

Building a
Monture

The Point
Repeat

Monture
Capacity

The
Comber
Repeat

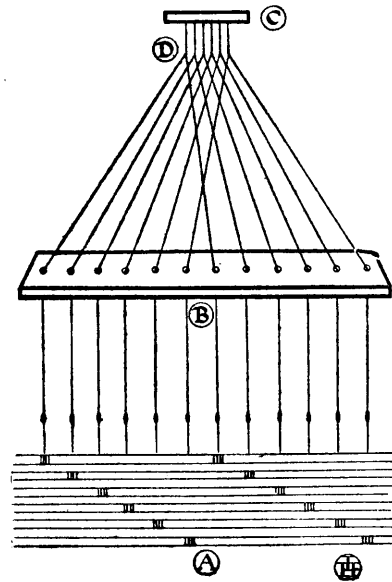


FIG. 104.

number. A linen table-cloth was woven at Dunfermline, about sixty years ago, which required a comber-board with four thousand two hundred leashes, each

under separate control, so that one, or any combination of them, could be raised as indicated on the draught.

Fig. 103 shows the comber-board arranged for the *point* repeat, the valuable qualities of which, to the designer, will have to be dealt with later on. Fig. 104 is the same in all respects as the previous one, except that it

is what is now called a comber* repeat. It has the same effect as the ordinary straightforward entering of the harness, indicated at the bottom of the diagram. Two exact repeats, or combers, on six threads, are shown in the harness, and these require twelve holes in the board, instead of the

* Originally *camber*.

eleven required for the turnover point repeat. Any design for this arrangement would have to be made so as to repeat on every six threads of the warp. For comber repeats, the necking of the monture is tied up differently. The first and seventh leashes are connected to the first cord D. The second and eighth, the third and ninth, the fourth and tenth, the fifth and eleventh, and the sixth and twelfth are all likewise joined to the top cords in regular order. This difference between the point and comber repeats of woven designs must always be borne in mind, as they will now very frequently be referred to.

The
Comber
Repeat

Fig. 105 represents a draw-loom complete enough for the purpose of explanation. In this drawing the comber-board is pierced with three rows of holes. It will also be observed that it is not simply a single board, but is composed of several slips of thin, hard wood. This is a great convenience when a very large number of holes is required, as the perforated slips can be spaced out slightly, and thus enable the builder to regulate the number of holes to every inch of the entire width, which must be done with great accuracy.

Building
the Comber-
board

The comber-board in the illustration is made up of eight slips, each containing nine holes. The board is therefore pierced with seventy-two holes in all.

These seventy-two holes are divided into four repeats of eighteen holes each. It is usual in England to hang the first leash in the first row, at the back left-hand side, as indicated in the drawing. To prevent confusion, only the first six leashes which begin the repeats and the last one in each repeat are shown, these being all connected in the diagram by dotted lines. The first leash of each

Building
the Comber-
board

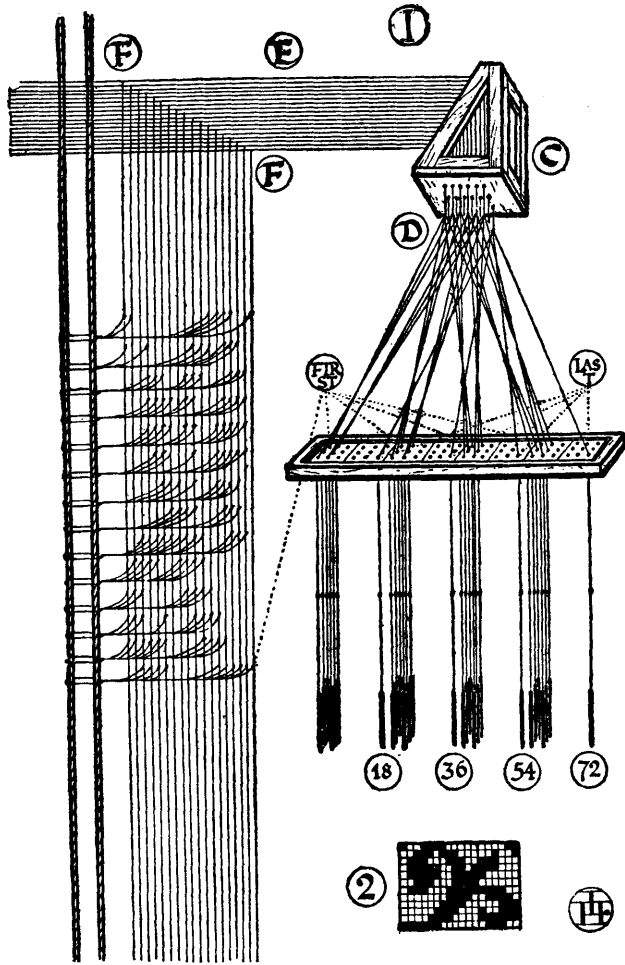


FIG. 105 —Mechanism of the Draw-loom.

repeat is attached by the necking cords to the first pulley cord D, which is seen to enter the pulley-box, C. Six pulley cords only are shown, but it is evident that there must be eighteen of them, as eighteen sets of four necking cords each have to be tied to them. The attachment of the six sets of necking cords is shown, and from these the principle of the whole arrangement will be readily understood. It must be noted that the height of the pulley-box, above the comber-board, must be much greater than could be shown in the drawing without making all the parts inconveniently small. It may vary from four to six feet. As much height as possible is necessary here in order to avoid friction in the working.

Building
the Comber-
board

The *pulley-box* itself (C) now claims attention. The bottom board of the box, looking upwards, shows the eighteen holes through which the pulley cords pass. Inside the box an arrangement of the eighteen pulleys is fitted up. They are so placed as to be immediately over the holes in the bottom board. The box has to be very strongly framed together, and to be very firmly fixed in its place on the top of the loom. The comber-board also has to be very firmly fixed close to the ground harness in the exact position required for the proper opening of the shed. In gating the loom all these details of position require a great deal of consideration and experiment.

The Pulley-
box

The pulley cords D, after passing over their several pulleys, are carried to the nearest wall or beam, and tied there in regular order, being accurately adjusted as to length, in a horizontal line, as shown at E, fig. 105. These cords, between the pulleys

The Tail
Cords

- The Tail Cords and the wall, are called the *tail cords* of the loom. When a drawboy machine is used the design is tied up on them, and they are simply pulled down in the requisite order to form the pattern. The pulling down of a tail cord pulls up the corresponding necking cords, and raises the several leashes depending from their ends. By this means the necessary shed is opened.
- The Simple and Guiding Cords When a real drawboy, not a machine, is employed, another set of cords, equal in number to those of the tail, is required. These are called the *simple*, and on it the design is tied up. In the illustration the simple is shown joining the tail cords at F, F, and from that point its cords are carried vertically to the ground. In front of the simple two very strong cords called *guides* are stretched vertically, between the ground and the roof of the workshop. The groups of ties to the simple cords, making each separate line of the design, are gathered together and passed round these strong guiding cords in succession as they are formed. By this means they are kept in regular order and free from entanglement. In the drawing the small design no. 2 is shown tied up on the simple, and its formation will be readily traced out.
- Capacity of an Ordinary Silk Monture The above description of the draw-loom, although complete as to its mechanism, must not be taken as a sample of its capacity. It is only intended to show the construction and purpose of the various parts of the machine, as well as their relation to each other. In a very ordinary silk-loom the space occupied by the design no. 2 would not be more than three-quarters of an inch, so that there would be in the narrowest loom, say twenty-one inches

wide, twenty-eight repeats to be allowed for in the comber-board. The latter would have to be pierced with five hundred and four holes, and require to be furnished with the same number of leashes. Twenty-eight leashes would have to be attached to each of the pulley cords, and by their means the pattern would be exactly repeated across the whole width of the web. WITH THE SAME COMBER-BOARD AND THE SAME NUMBER OF LEASHES ANY KIND OF REPEAT THAT CAN BE DESIGNED ON FIVE HUNDRED AND FOUR LINES OF RULED PAPER COULD BE ARRANGED FOR. The most ordinary repeat is, perhaps, two combers or one repeat point. Either of these would require two hundred and fifty-two cords in the simple for working out the design on, and, of course, the same number of tail and pulley cords. In this case each pulley cord would only have two leashes attached by the necking to it. The technical method of describing the number of lines in the width of a design is, to say that it is draughted on, two hundred and fifty-two cords, or four hundred cords, as the case may be; the cords referred to being those of the simple. The same term is used now in connection with the Jacquard machine, but it would be more correct to say, draughted for so many needles or hooks, as these have taken the place of the *simple*, in modern weaving.

It may be well here to call attention to the fact, that, in all weaving, but particularly in drawloom, and Jacquard weaving, the *width* and number of repeats in a loom is most rigid, and cannot be altered without rebuilding the whole monture. The designer and draughtsman must know exactly the number of cords and the kind of

Capacity of
an Ordinary
Silk
Monture

The Term
Cords
used in
describing
Width of
Design

Rigidity of
Lateral
Repeats in
a Loom

Elasticity of Vertical Repeats in a Design repeat the loom has, which he is designing for. This is not the case with regard to the *length* of the design; here the artist is at perfect liberty. The only objection to a very long, vertical repeat is, that the tie-up for the draw-loom, or the endless band of cords for the Jacquard machine, has to be more extensive. No alteration is required in the loom, whatever length the design may be, nor is the weaver's work affected by it to any appreciable extent.

The Draw-boy The work of the *drawboy*, as the weaver's assistant was called, must now be described. He had to pull forward, by means of the loops on the guide cords in front of the simple, each set of cords, in regular order, as they were required to form the successive lines of the design. He not only had to pull them forward, but downward, in order to raise the leashes; and not only this, but to hold them down while the weaver worked over three, four, or more shoots of the ground, as explained in the chapter on damask-weaving. We have seen that the lingoes often weigh an ounce each, and also that in a not over-rich silk-loom, such as that described at p. 261, twenty-eight leashes had to be raised by each cord of the simple.

The Draw-boy's Fork When several of these cords were drawn together, and the frictional resistance added to the actual weight of the lead, it is obvious that the boy must need some mechanical assistance in drawing the cords down, and holding them as long as required. The heaviest line in no. 2, fig 105, is the sixth, in which twelve cords have to be drawn together. The lingoes for these would weigh three hundred and thirty-two ounces, or twenty-four pounds, so that, taking into consideration the frictional as well as the dead weight

on this line, the cords have to raise thirty-six pounds at least, and the boy has not only to lift that weight, but, as just explained, hold it for about one-third of a minute while the ground is woven. For

The Draw-boy's Fork

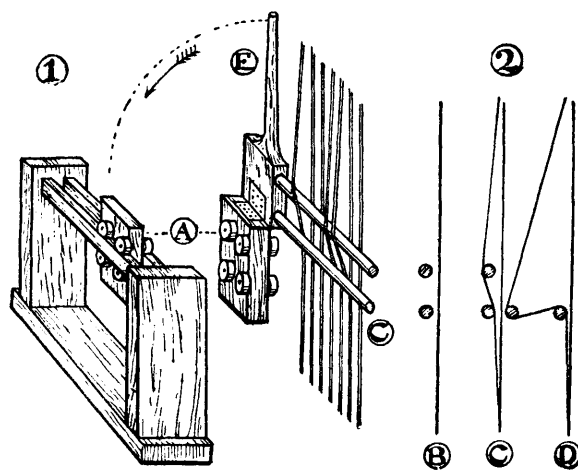


FIG. 106.—Draw-loom Fork.

his assistance in this arduous work the boy is furnished with a fork and lever (fig. 106).

This drawing shows a solid stand, no. 1, having two broad uprights. This is fixed by the side of the simple, but a little in advance of it. At the top the uprights are joined together by two parallel bars. A, is a block of hard wood which fits between the two bars, and is kept in position by four small wheels, or runners, being fixed on both sides of the block, two above and two below, as shown in the drawing.

The Draw-boy's Fork These runners allow the block to move freely along from end to end of the bars. The fork and lever, shown separately at A, E, are hinged to the top of the sliding block in such a manner that they can be easily moved from a vertical to a horizontal position, and will remain in either.

When about to be used, the block is moved back until the points of the fork are by the back edge of the simple, and in the upright position as shown in section at B, no. 2. The boy, by means of the loops, next draws forward the simple cords necessary for the formation of one line of the design. He carefully inserts the upper prong of the fork in the opening made, gradually drawing it forward as he does so. When this has been done the position is represented by C, no. 2. Grasping the end of the lever, the boy now draws it down and holds it in a horizontal position, the result being that the required cords are drawn down as shown at D.

The Most Perfect Loom The most perfect pattern loom possible, is one in which the leashes are entered with one thread of warp only, and every leash is under separate control by means of the tie-up. On such a loom every imaginable form of design and variety of tie can be woven without the use of any other mechanism whatever. The extensive tie-up in the case of the drawloom, and the unmanageable quantity of machinery required if Jacquard machines were used, would, in the case of silk at any rate, render this unpractical. Silks warps, of twenty-one inches wide, sometimes contain, as we have seen, as many as eight thousand threads, which would involve the building of a simple with eight thousand cords, or the use of twenty Jacquard machines, with four hundred needles

Large Designs Unpractical in Silk with Thread Monture

and hooks in each.* As regards the comber-board and the loom itself, there would be no difficulty; in fact, the weaving on such a monture would be as simple as any pattern-weaving could possibly be.

If linen, cotton, or wool warps are used, such an arrangement for a fine bold design is quite practical. A design draughted on eight hundred and forty lines in the width of the ruled paper gives forty threads to an inch in the reed. This is sufficient for a massive pattern, where great refinement of detail is not required. Weaving with a thread monture gives the designer liberty to use any variety of texture, form, and detail that he can get in on the eight hundred and forty threads at his disposal. He may make the ground of tabby, twill, or satin, and he may ornament parts of the figure with tabbies of double, treble, or any number of threads, and fill the different spaces of it with any of the various twills or satins he may wish. **IN FACT, HIS ONLY LIMITATION IS THE NUMBER OF THE SQUARES INTO WHICH HIS SPACE IS DIVIDED.**

It will be seen that the preparation of the draught, particularly for this kind of weaving, is a most important work, as on it the whole of the success of the finished web depends—that is, with regard to its ornamental shapes and texture. It also requires a thorough knowledge of the effect that weaving has in modifying or exaggerating edges, angles, and outlines generally.

Fig. 107 is a portion of one of the finest of the traditional Italian damask designs. Various versions of it are to be found amongst sixteenth- and

* This might be possible if electricity were applied to the draw-loom.

Large
Designs
Unpractical
in Silk with
Thread
Monture
Practical for
Cotton,
Linen, or
Wool
A Large
Design on
Thread
Monture

Preparation
of the
Draught
needs
Technical
Knowledge

Example
of Italian
Design

Example
of Italian
Design



FIG. 107.—Italian Damask. Point Design.

seventeenth-century weavings. Some of the earliest wall-papers in imitation of silk damask were copied from it. There is some such paper remaining in the mansion of Christchurch Park, Ipswich, copied from one of the finest versions of it, the length of its longitudinal repeat being about nine feet.

This design will also illustrate the great advantage gained by using the point repeat. All the effect in scale of a design drawn on eight hundred and forty cords, is by its use obtained on a simple of four hundred and twenty cords. This was no doubt the reason for the frequent adoption of this plan of design in the early work. It will be observed that nearly all the old designs of greater width than ten or twelve inches are constructed in this way. We must notice in passing that in the Sicilian and early Italian designs (fig. 108), which are so admirable, narrowness of repeat is a chief characteristic of their construction, and there can be no doubt that the reason for this peculiarity is the desire for economy in tying up the design on the loom.



Example
of Italian
Design

FIG. 108.—Sicilian Damask.
Point Design.

Modern Treatment of Traditional Italian Design

In this case, then (fig. 107), the simple would need four hundred and twenty cords, and the monture would have to be built in *point* as in fig. 103. The first, and the eight hundred and thirty-ninth leashes, would be drawn by the first cord, answering to the first, and the eleventh, in that diagram.* All the other cords would also draw the leashes from opposite sides until the centre cord 420 was arrived at. This, like the centre cord of the diagram (fig. 103), would only support one leash.

Effect of Point Repeat on Tabbies, Satins, and Twills in a Thread Monture

If the centre cord only has one leash attached to it, a tabby ground will not be affected by it. This is one reason for building the monture on eight hundred and thirty-nine cords instead of the even number. All the other ties, satins, twills, &c., will be thrown in opposite directions by the point repeat. This will make little difference in the general effect, and will only require a little extra care at the centre line of the design, where the change of direction in the ties is most obvious.

Damask Effect on Thread Monture

The damask effect depending on reversed satins can quite easily be woven on a thread monture. Fig. 109 shows a small portion of the design draughted for this effect. For the coarse texture at present under consideration a five-headle satin, shown in the sketch, is the most suitable one. A linen or cotton warp, not too fine in size, shot with wool of a contrasting colour, would bring the design out well. This kind of web used to be largely used for furniture and curtains, and was called *union damask*. It was very useful and artistic, as

Union Damask

* One hole in the comber-board would remain empty, as the centre cord only requires one leash instead of two.

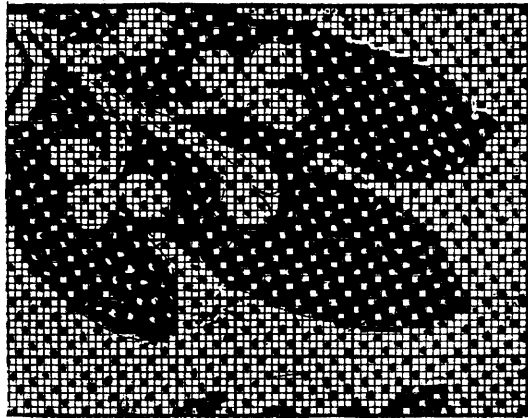


FIG. 109.—Union Damask.

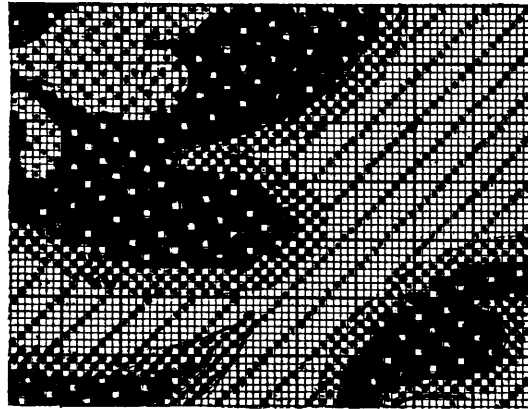


FIG. 110.—Draft showing
various Ties.

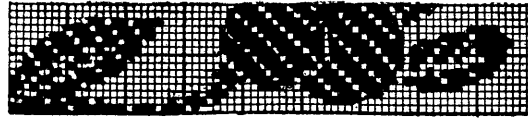


FIG. 111.
Figure Draught.

Union Damask well as durable, if the colours were well chosen and the yarns good and well dyed.

Perhaps a still better effect would be gained by making the ground tabby and the figure a looser satin or a four-headle twill and shooting a coarse-spun or tussah silk into the warp instead of wool. Of course, endless suggestions might be made in this connection, but it is in such details as this that the designer and craftsman must exercise his taste and invention.

Another Treatment by Various Ties Fig. 110 is a draught of a portion of the same design in which a different treatment is adopted. The field or background of the design is a twill, while the figure is shaped and brought out by means of a tabby outline and the use of different ties for its various parts.

The Effect of a Tabby Ground If a tabby shoot of weft, similiar to the warp, were made between each opening of the figure shed, and an extra shuttle carrying a different weft used for the figure, the strength and solidity of the cloth woven would be much enhanced. This separate treatment of the design would also make it stand out from the ground in a bolder and much clearer manner both as to form and colour. The easiest way to do this would be to fit up a harness with long-eyed leashes in front of the monture and enter the warp in it as well as in the leashes of the monture. This would enable the weaver to work the tabby ground independently of the drawboy, by means of two treadles. The draught of this effect would not need the tie on the ground to be indicated, but would be drawn as in fig. 111.*

Front Harness preferable for Tabby Ground

* If a Jacquard machine to govern the thread monture is being used, the tabby can be made by inserting an extra card between each of the figure cards, and the extra harness would not be necessary. The

If the thread monture be used for silk-weaving without any additional harness or other appliance for making the groundwork, very perfect webs, full of variety and detail, can be made. The designs certainly must be very limited as to size, but that is practically their only limitation. They may be as fine as the finest engraving, for any lines and spots down to the three-hundredth part of an inch may be woven with the greatest ease and certainty. Such delicate little designs as fig. 112—which is reproduced the exact size of the original—are examples of thread-monture weaving. The example illustrated was made in Spitalfields about the end of the eighteenth century, most probably on a draw-loom with a draw-boy machine. A few weavers are left in Bethnal Green who still make this kind of silk, which is mostly used for ties and scarves. The Jacquard machine is, of course, now used for lifting the threads, but the monture itself is exactly the same as in the old times. This Spitalfields sample is woven about two hundred and eighty threads to an inch. The design repeats fourteen times in twenty-one inches, and is drawn for four hundred cords. The comber-board would have to be pierced with five thousand eight hundred and eighty holes, and the same number of leashes and lingoos would, of course, be required to fill it up. The repeat of this design is comber. Although the figures are turned over to extend them, they do not turn over on the same lines; they are work, however, would be much heavier, and the number of cards necessary would be doubled. The front harness would probably be used even in this case, especially as it would allow of the ground being changed at will.

Silk-weaving
on Thread
Monture

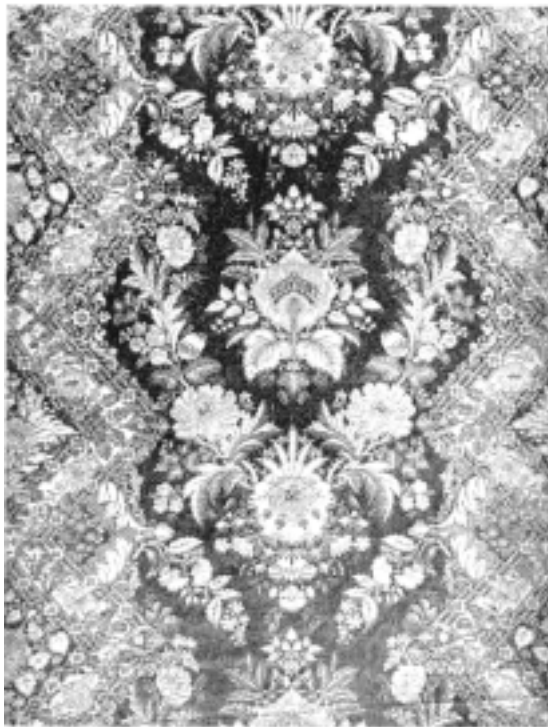


Plate XI.—Example of French Silk-weaving, time of
Louis XIII. Size of design, 30" × 21".

See page 274.

Victoria and Albert Museum, South Kensington.

Silk-weaving
on Thread
Monture



FIG. 112.—Spitalfields Silk. Size of Original.

therefore what designers now call *drop turnover* repeats. This is of no advantage in regard to the Silk-weaving
on Thread
Monture

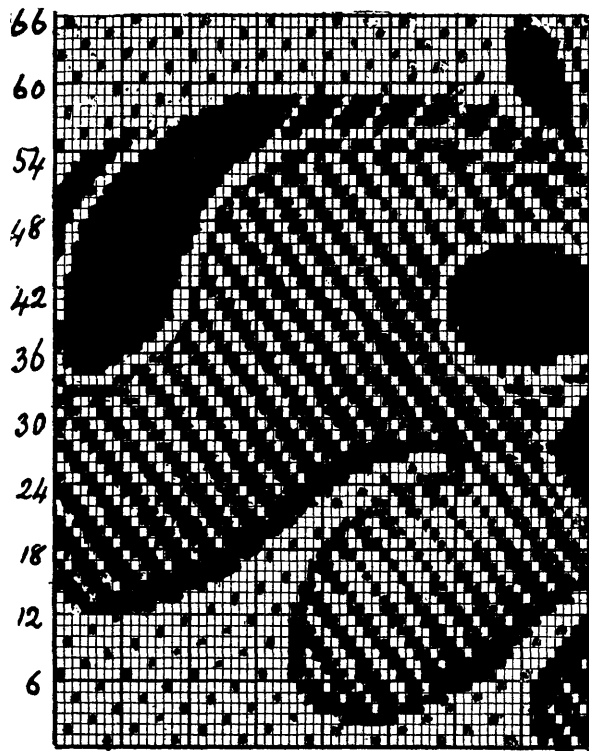


FIG. 113.—Part of Draught for Fig. 111.

weaving, but is an easy way of getting balance in a design, and is often resorted to.

Weaving
Large
Damask
Patterns

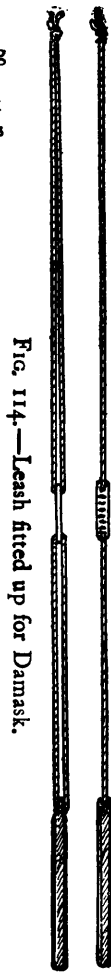


Fig. 114.—Leash fitted up for Damask.

Fig. 114 is taken from a portion of a ruled-paper draught for fig. 112. It represents the twenty-fifth part of a square inch of the finished silk, and shows the amount of detail required in such designs, as well as the freedom with which the textures may be varied in designing for this most perfect loom.

The manner of weaving damask webs with two harnesses has already been fully explained in Chapter XIV., but it is necessary just to describe the making of damask on the monture of a draw-loom, which takes the place of the figure harness. Such large designs as the traditional Italian pattern given in fig. 107 or the beautiful Louis XIII. damask of plate XI cannot be made on a thread monture, and, indeed, would lose a great deal of their beauty if they were. The fine sharp edges which result from the lifting of every thread would make such large designs hard and uninteresting. A great deal of the charm of woven ornament results from the mystery given to the edges of the forms by the more or less evident steps of their outline.

Both the large designs referred to are made on from four hundred to four hundred and fifty cords of the simple, acting on ten and a half inches of the warp, and as they are point designs, one repeat fills the whole twenty-one inches of the width of warp, and requires eight hundred or eight hundred and fifty holes in the comber-board. If

the count of silk in the warp were four thousand eight hundred threads, each mail in the monture would have to lift six threads at least. In order to do this the mails of the leashes must be perforated with six holes in addition to the two required for the construction of the leash. Fig. 114 shows a leash fitted up with its lingo, and a mail having the required number of holes. It will therefore be seen that **THE RICHNESS OF THE SILK IN DAMASK-WEAVING DOES NOT DEPEND ON THE SCALE OF THE DESIGN, BUT ON THE NUMBER OF THREADS LIFTED BY THE LEASHES.** After passing through the mails the threads of warp are entered separately in the long eyes of the front or ground harness, which is worked by treadles, and the process of weaving is the same in all respects as that described in Chapter XIV.

Weaving
Large
Damask
Patterns

CHAPTER XVII

THE SHAFT MONTURE

Invention of the Split or Shaft Harness—The Comber-board for Shaft Harness—Building a Shaft Harness—Description of Various Parts of the Harness—The Shaft Harness in Use—Note on regulating the Length of Designs—Draughting Designs—Examples of Shaft-harness Weaving.

Important
Addition to
the Thread
Monture

A VERY important improvement was made in the monture about the middle of the last century by Mr. James Gough, a weaver of Bethnal Green. By means of this invention separate grounds, satins, twills, and tabbies can be made without a separate front harness, the use of which was explained in the last chapter. At the same time the design can be worked out in a larger repeat on groups of two, four, or more threads, while the ties are made with single threads. This facilitates the weaving of fine silk in large designs, and gives freer opportunity, when a separate binder is provided, for making the large and important class of webs known as *tissues*, of which the *brocatelle* is a member.

Invention
of the Split
or Shaft
Harness

The invention was not made until after the Jacquard machine had come into general use, and was therefore never used on the original draw-loom. It would, however, have been a very useful addition

to it, and have made the wonderful tissues of the seventeenth and eighteenth centuries much less laborious to weave.

Invention
of the Split
or Shaft
Harness

This invention is called the *split* or *shaft* harness. One name is as good as the other, but each by itself only describes the invention in part, for the leashes are split, and they are also suspended on shafts.

The comber-board for this description of harness requires the same number of holes as the thread monture, but each cord of the simple raises several leashes together for the formation of the design, just as the glass mails lift several threads together in the damask monture.

The Comber
board for
the Shaft
Harness

Let us take such a warp of silk as the sample of Spitalfields weaving examined in the last chapter, and see what can be done with it on a shaft monture. The count was five thousand five hundred and eighty threads, one thread being entered in every leash. We will at once decide that each square of the ruled paper, on which the design is to be draughted, shall represent four threads. This gives us one thousand three hundred and ninety-five groups of four, in the whole width, which shall be twenty-one inches. Three comber repeats, of seven inches each, would be a convenient size for a design; we decide, then, on this, and divide one thousand three hundred and ninety-five by three. This gives us four hundred and sixty-five cords on which to form the design. The ruled paper must also have four hundred and sixty-five squares, counted laterally, for the draught.

$$\begin{array}{r} 5580 \div 4 = \\ 1395 \div 3 = \\ 465 \end{array}$$

The number of rows of holes in the comber-board must next be decided, and if the most usual satin, viz., eight-headle satin, is intended to be used there must

**Building
a Shaft
Harness**

be eight, sixteen, or twenty-four rows. Twenty-four rows would no doubt be decided on, two hundred and thirty-three being in twelve rows, and two hundred

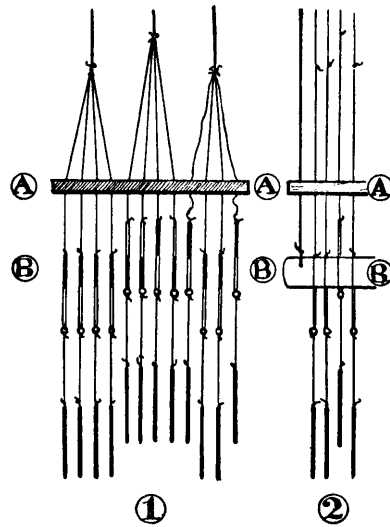


FIG. 115.—Section of Split Harness.

no. 1, is the section of a comber-board having twelve rows of leashes suspended through its holes. The lower parts of the leashes have lingoes and mails, and are made in the usual manner. But between the mails and the comber-board the leash is much longer than usual in the ordinary monture, and part of this length is occupied by a long loop, which begins at, or a little above, the mail and reaches

* For description of comber-board and illustration see p. 308.

about half-way between it and the comber-board. The upper part of the leash to which the loop is attached is made of stouter cord. This passes through the comber-board and is gathered together with another, or it may be, several other leashes, and knotted to a necking cord, which in its turn is attached to the cord coming from the pulley-box above the loom. The twelve leashes of the illustration are shown joined in fours to three of the necking cords of the monture. No. 2, B, B, shows the end of one of a set of twelve shafts of stout hoop-iron, made perfectly smooth, and enamelled. The shafts are a little longer than the comber-board, and are passed through the loops as shown at B, no. 1, in section, one shaft passing through all the loops of the leashes in each row. The shafts are hung from strong cords, which pass through an extra row of holes drilled in the frame of the comber-board, which is made wide at the ends for that purpose. The shafts are hung at such a height that the leashes just hang on them when the loom is at rest. This is the state of the four leashes on the left. If one of the cords of the simple, on which the tie-up of the design is made, be drawn, it will draw up with it the four leashes with which it is connected, but the shafts will remain stationary. If then the shafts were raised they would have no effect, as their particular loops are already drawn up. This position will be made clear by the centre group of leashes in the illustration, which has been raised by the figure cord. The third shaft in the group is seen to be raised, but has no effect on the leash. In the third group of leashes on the right the result of raising two of the shafts, while the figure cord is left down,

Building
a Shaft
Harness

Description of the Shaft Harness is shown. The shafts have raised the two leashes, with which they are connected, but the other two members of the group are unaffected. It will now be seen that any ground or figure can be made with single threads by means of the twelve shafts independently of the figure harness. Also that any pattern made by the figure harness raising the four threads in groups may be made without affecting the shafts, so that in spaces where the figure is not raised the shafts can be filling in a background of satin or twill, as may be arranged.

The Shaft Harness in Use Fig. 116 will make the whole arrangement perfectly clear. The large sketch is a portion of a ruled-paper draught, and represents the face of a figured silk made on a shaft harness. The warp is fine white silk, of which the drawing shows one hundred and sixty threads. The weft is black silk, for the sake of contrast. The twelve shafts shown in section at fig. 115, each carrying a twelfth part of the warp, have to make a ground of twelve-shaft satin. This is indicated by the fine black dots powdered over the background of the draught. One shaft has to be lifted for each shoot, and each shaft must rise in the necessary order to form the satin. The mechanical method of raising the shafts will be described presently.

The effect of the figure harness is seen in the bold black squares of the design. These consist of weft, which crosses in front of the lifted white threads. The shaft satin has no binding effect on the figure, for the reason already explained; accordingly it follows that the smallest intersection of warp and weft in the pattern must be four threads wide. Such intersections are shown working a tabby

edge to the square in the centre of the flower. If all the odd- and even-numbered cords of the simple

The Shaft
Harness
in Use

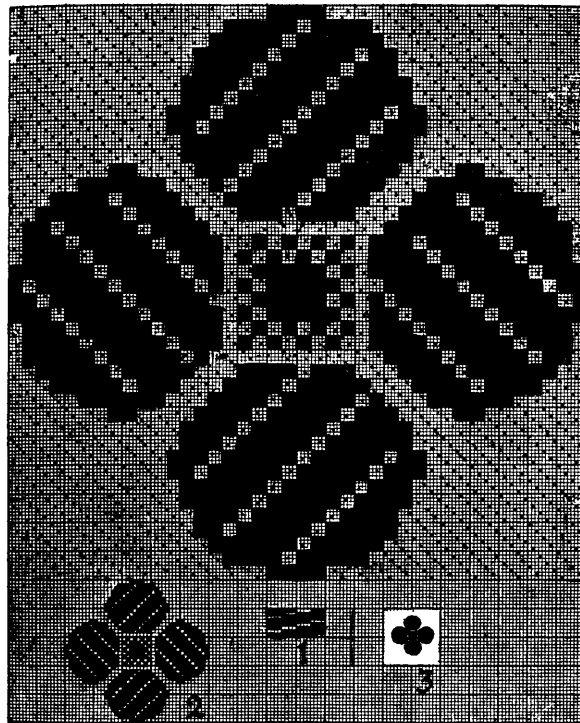


FIG. 116.—Draught for Shaft Harness.

were drawn alternately, this tabby effect, with a single-thread tie occasionally appearing in the

The Shaft Harness in Use white portion only, would cover the face of the cloth. It will now be apparent that any ties on the figure, must be drawn on the design ; and that these when woven will be four threads wide. These quadruple ties are seen on the petals of the flower, arranged in diagonal lines. Much care is necessary in designing these ties, in order to prevent undue length in the floating loops of weft. The draught being made on ruled paper with squares divided equally 8×8 , the ties in this case are square and need more than one shoot of weft to build them up. If the designer had wished, he might have made them only one shoot high instead of four, as shown in no. 1 below the flower. This would, however, involve the drawing of the figure cords every shoot, and make the tie-up four times as long as at present. If a Jacquard machine were used, the number of cards required would also be increased fourfold.

Note on regulating the Length of Designs It is perhaps necessary to pause and specially note here that in order to bring any design to the required length, the cords of the simple have to be held down over two or more shoots, according to the size of the weft and the nature of the pattern. The draughtsman makes his design on the number of lines he deems necessary for the effect he wishes to obtain, but the number of shoots to each line required to bring the woven pattern to the same proportion as the draught, has to be settled by experiment, when the web is ready for starting. Some designs, especially for damasks, need each separate line to be repeated as many as eight times. In the draw-loom the figure harness is left up while the requisite number of shoots of ground are made, but with a Jacquard machine

the shed is closed every shoot, and opened again by keeping the same card on the cylinder of the machine, until the requisite repetition has been completed.

Draughting
Designs

Returning to fig. 116, no. 2 shows the manner in which the design would be worked out on the ruled paper. The ground would be left plain, being woven independently by the shafts. The pattern for the tie-up would have to be drawn with all its ties and subordinate effects, such as little diaper patterns and different-sized tabby fillings. Any shapes and details that can be got in on the available four hundred and sixty-five squares are weavable. In making the draught, care must be taken to avoid long loose floats of weft. The design may be of any length desired, but it must be remembered, that, great length of design needs a long tie-up on the draw-loom, or an expensive and unwieldy set of cards for the Jacquard machine.

No. 3 of the illustration shows the proportional size of the flower in comparison with the draught, and its general effect when woven in fine silk.

Plate XII is a copy of an eighteenth-century French silk. It was photographed from the woven silk reproduction, and is the same size as the original. The illustration only shows a part of the design, which is seven inches wide and repeats four times in a web of twenty-eight inches. The count of the warp is about the same as that of the Spitalfields example, fig. 112, p. 272. The groundwork is eight-shaft satin, woven on a split harness, and the lace-like pattern is formed by raising the threads two together instead of four as in fig. 115. The

Draughting Designs draughting is on eight hundred cords instead of the four hundred and fifty. This increase of size in the draught is rendered necessary by the fewer number of leashes raised by each cord of the simple. In all other respects the draughting and weaving of this silk are the same as described in connection with fig. 115.

CHAPTER XVIII

BROCATELLE AND TISSUE WEAVING

The Technique of Brocatelle Webs—Weaving Brocatelles—Draughting for Tissue weaving—Two Methods of mounting Binders—Old Spitalfields Tissue—Broché Tissues—General Utility of Shaft Harness—Shaft Harness for Coarse Materials—Tissues of Wool, Linen, and Cotton on Shaft Harness—Examples of Modern Wool Tissues—Old Method of Tissue weaving without Split Shaft Harness.

BROCATELLES and other webs, which weavers call by the general name of *tissues*, cannot be made on the shaft monture, described in the last chapter, without some arrangement being added in order to work a separately warped binder. The reason for separate warping generally, was given in Chapter XIV. But it will be necessary to examine a sample of these webs and ascertain the reason why a separate binder is specially required for brocatelle and tissue weaving ; and afterwards the fitting which has to be added to the loom, for this kind of weaving, can be explained.

The chief characteristic of a brocatelle web is the raised satin figure, which gives such a rich appearance to the fabric (see plate XIII). In a

The
Technique
of Brocatelle-
weaving

The
Technique
of Brocatelle
Webs

Damask
and
Brocatelle
Effects
compared

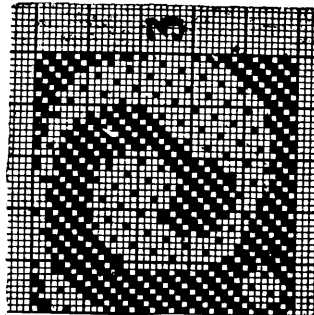
damask web the background of the figure is a satin, made by the long floating threads of the silk warp, while the figure itself is the reverse satin, in which the weft chiefly shows. In the brocatelle, on the contrary, the warp floats rather loosely in the figure, and a special weft entirely covers it up in other places. The second weft is tightly bound down by a separate binder, and forms the background to the design.

Fig. 117, no. 1, shows a portion of a brocatelle as it would be draughted by the designer. The weaver, in tying up the design on the simple cords, in this case, would not tie up the figure, shown in white, as he would for a damask web, but would tie up the ground, represented by the black portion of the draught. In like manner, on cards for a Jacquard machine the instruction to the card-puncher would be, "Cut the ground, not the figure." No. 2 shows the effect as far as it could be woven on the shaft harness as described in the last chapter. Plain satin has been woven all over by the shafts, the warp being white and the weft, as is usual in brocatelles, an undyed linen.* The satin ties, shown on the figure are of linen, but the ground having been raised by means of the simple cords, a black silk weft has been shot across the spaces so lifted. These ground spaces are thus only covered by unbound loops of the second weft, and the separate binder is required to tie them down securely in their places. In brocatelle weaving the characteristic raised effect of the satin figure is obtained by

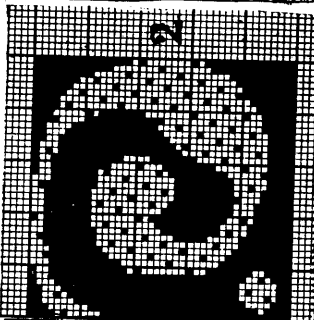
* The first or satin shoot of a brocatelle only binds the satin, and does not show on the face of the cloth. Linen gives solidity of texture, and on that account is usually employed.

lightly weighting the roller of the main satin warp and heavily weighting the binder roller, and the effect is further enhanced by the harshness of the linen back.

No. 3 shows the ground weft bound down by a four-headle twill, and it is in order to enable this to be done that an addition of some kind has to be made to the monture. This may be arranged for in two ways, as follows: (1) The number of shafts may be increased by four, the extra ones being fitted up in front of those used for the satin ties of the main warp. This will make twenty shafts in all. On these shafts, four extra rows of leashes are hung by their long loops. These leashes have no top member



Damask and Brocatelle Effects compared



Plan of making a Separate Binder

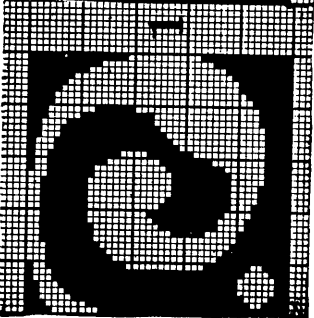


FIG. 117.—Illustration of Draughting.

Plan of making a Separate Binder passing through the comber-board, as the others have, but are complete when hung upon the shafts. The warp for the binder is brought through the main body of leashes, one between every four, and entered in regular order in the binder. This completes the arrangement, and the brocatelle effect of no. 3, fig. 117, is obtained by the following procedure.

Weaving the Brocatelle The first shoot of flax thread is made with the binder all lifted, and one shaft of the main warp lifted as well. The second shoot of weft (black silk in this case) is made with one shaft of the binder down and the ground of the design raised by the drawing of the cords of the simple. When this has been done the effect of one line of no. 3, fig. 117, will have been woven. The next and following shoots proceed in their proper order, first the flax and then the silk, in regular succession. A set of four additional treadles and levers will be required to lift the binder shafts, or if an automatic machine such as a drawboy or a Jack-in-the-box are used to lift the grounds, the necessary additions will have to be made for them.

Care required in draughting for Tissue-weaving In draughting for brocatelles, and other tissues, it is necessary to be more careful in selecting the ruled paper, in regard to its proportion ; as the length of the design of a brocatelle cannot so easily be regulated in the loom as can that of a damask. It is true the same *simple* cords can be drawn twice or thrice over, but as there are two wefts to be shot in, the space occupied by one line of the design is much greater than is the case in fine damask. The draught has to be made on paper ruled 8 x 12, or 8 x 10, and the final regulation of the length of the woven pattern must be made by the

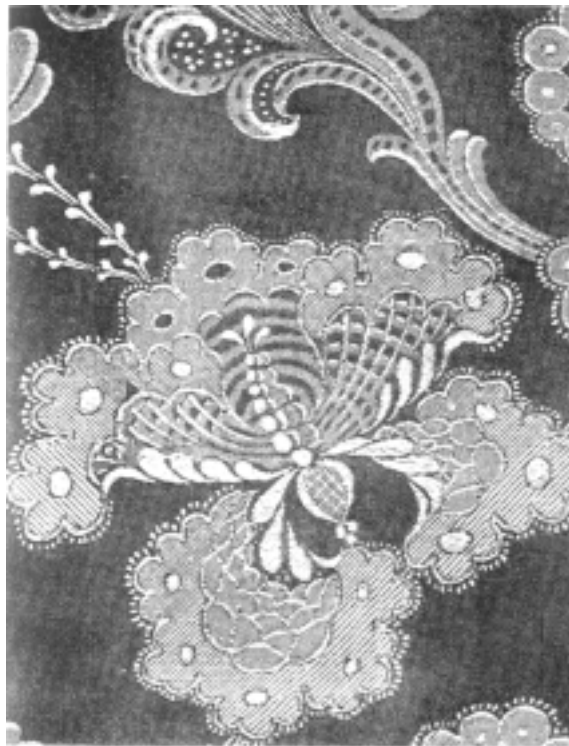


Plate XII.—Copy, by the Author, of Eighteenth-century Fine French Silk.
A portion of the design only is shown. The part photographed
is the full size of the original.

See page 283.



Plate XIII.—Copy, by the Author, of Sixteenth-century Italian Brocatelle. A portion of the design only is shown, about half the actual size of the original.
See page 285.

alteration of the size of the wefting used, as well as by the closeness with which the weft itself is beaten together. In the case of some tissues in many colours, where several shoots of weft go to make up each line, the ruled paper has to have fewer lines in the height than the width. It may be necessary, therefore, to use paper ruled 8×6 or 8×4 . Anyway, all these points must be carefully calculated before the draught is commenced.

Care required in draughting for Tissue weaving

2. Another arrangement of the binder, required for weaving brocatelles, is to mount an ordinary harness, of the proper count, in front of the shaft monture in the same position as for damask-weaving, and to enter the second or binding warp in it. The warp, however, unlike that of the damask harness, is not entered in the mails of the monture leashes, but passes between them. It is also not necessary that the binder leashes should have long eyes. This kind of binder harness is sometimes preferred to the shaft harness, but the latter takes up less space and is in the position to receive another improvement, which will be noticed presently. As far as the brocatelle and some other tissues, which now claim our attention are concerned, one of the above plans of fitting up the binder harness is as good as the other. For a temporary work perhaps the binder could be more easily added in the second method.

Alternative Plan of arranging Binder Harness

The weaving of a great variety of fabrics is possible, with the draw-loom at the stage of development to which we have traced it. A volume, or perhaps many volumes, might be filled with descriptions and dissections of such webs, but a very few

An Old Spitalfields Tissue analysed

An Old typical specimens must suffice for the present hand-
Spitalfields book.

Tissue First we must examine two very different ex-
analysed amples of tissue weaving, which might, however,
have been woven on the same loom, with the same
count of warps and precisely the same fitting up.

Plate xiv is taken from a fine piece of tissue-
weaving made in Spitalfields probably at the be-
ginning of the nineteenth century. The colours are
green and gold. The ground is green satin, both
rich in colour and in texture. The design is in
green, lighter than the ground, and gold, and repeats
point once in the width. Both the green and gold
portions of the figure are tied by the same twill
binder. The warp of the satin ground was not
lightly weighted, as in brocatelle weaving, but is
peculiarly flat, which would suggest that it was more
heavily weighted than is usual even for a damask.
The binder warp of the figure, on the contrary, is
rather lightly weighted. This tissue has no linen
shoot, but is all pure silk throughout, the weft
of the ground satin being fine and rather harder
than usual. The green and the gold weft used
in the figure are both, rich, lightly twisted silk,
known by the name of *tram*, as distinguished
from *organzine*, which is the harder-twisted silk
always used for warps. Three shuttles are required
for weaving this web, one for the ground satin,
which is the first shoot. The ground satin, as we
saw was the case in the brocatelle, is made on the
main warp, with the figure cords at rest and the
binder all lifted out of the way. At the second
shoot, the green part of the figure is lifted, and one
shaft of the binder left down while the other shafts



Plate XIV.—Spitalfields Tissue in Green and Gold Silk.
Date about 1900.

See page 290.

Author's Collection.

This is shown as an example of skilful weaving, not of fine design.

are all raised. The shed for the second shoot being thus made, the shuttle carrying green weft is sent across, and passes behind the satin ground until it comes to the lifted figure. Here it goes in front of the satin and all the binder warp threads, except those entered in the one left down. These remain in front of the weft to tie it. When the shed has closed on the second shoot the gold figure cords are

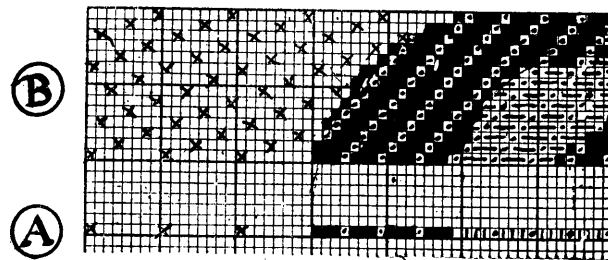


FIG. 118 —Spitalfields Tissue.

drawn, the same binder shaft left down, and the shed being open the third shoot is made, the weft now being gold-coloured silk. This shoot also passes behind the satin ground, and behind the green figure as well, until it reaches the opening made by the raised ground warp and all the binder threads except the first. Here it shows on the face of the cloth, and when the shuttle is drawn out and the shed closed one line of the ground and figure will be completed, and is represented on ruled paper in fig. 118, letter A. In this draught the white squares stand for the main warp threads of green silk, the dots for the green binder warp threads, the crosses for the first shoot of green ground

An Old
Spitalfields
Tissue
analysed

weft, the black squares for the green figure shoot, and the lined squares for the third shoot, the gold weft.

The draughting of the separate colours on the ruled paper must always be done very carefully, as a separate tie-up has to be made for each. If, for instance, two shuttles have to be used in forming one line of the figure, as in the above case, there have to be two rows of loops in the tie-up on the simple, in order that the cords may be drawn in proper succession. If as many as seven shuttles had to be used for one line of the figure, the same number of rows of loops would have to be tied up for it.

A Broché
Tissue

The next example, fig. 119, is of quite a different character. In this design, a part of which only is shown, a great variety of colours are used, which have on the face of the material almost the effect of brocading in many coloured silks. Four shoots have to be made in each line of the weaving, one for the plain ground, and three for the figure, and they are all thrown right across the web in the ordinary manner. A glance at the back of the material would show that the colours are all arranged in lateral stripes of different widths, and also that the colour effect is obtained by changing the weft used for the figure, at certain intervals, as arranged for on the draught by the designer. In many designs of this class great ingenuity is displayed by the artist in distributing the coloured ornament in such a way, that, the lateral stripes of the weft are altogether lost sight of. This at first was no doubt the aim of the designer, who wished to obtain the effect of brocaded ornaments in a quicker way. But although this deception is quite possible, after all, some of the most successful of such designs show the method of working quite



A Broché
Tissue



FIG. 119.—Rococo Tissue. Broché Weaving.

A Broché
Tissue

frankly. It will be seen that the chief difference between this example and that of the tissue previously given is a matter of design. The working out is very similar, except that the ground is a tabby with a thick weft, such as used to be called a *lute-string*, or *lustring*, as it is often spelt on old designs. The three figure wefts are all thrown into the same shed of the binder, which opens, in different parts of the web, according to the drawing of the simple cords at three successive shoots. In order to show clearly the method of changing the colours of the weft, the sketch is ruled laterally from letter A to G. At A the architectural feature is coloured yellow and shaded with dark brown; in the yellow there are small touches of dark green, represented by the solid black. The foliage above the vase is mostly dark green, and the yellow shuttle is changed for one having light green weft in it, so that in the space marked B, only light and dark green show. In the space C the light and dark green are continued and the dark brown weft is changed to red (represented by dots). The light green at D is changed to purple (cross-hatching), and at E the dark green changes to yellow, so that in this space red, purple, and yellow occupy the three shuttles. At F the red changes to orange, in the pines, where it is heightened by touches of yellow, and in the space G with dark green, which takes the place of the purple shuttle.

Small
Broché
Tissue

Fig. 120 is an example of a small design, quite ordinary in form, which, when woven in the above manner, in lateral stripes of rose-colour, green, and dull gold on a dark blue satin ground, has a most excellent effect. This is woven with only two



Small
Broché
Tissue

FIG. 120.—Modern Broché Tissue. Designed and arranged for weaving by the Author.

Small shuttles, one for the ground satin, and the other with changing wefts for the figure.

Broché It is not only for the weaving of fine silk that the Tissue shaft monture is useful, but it is equally so for linen, General cotton or woollen pattern webs, of either large or Utility of small design, such as are used for hangings, furni- the Shaft ture, and other purposes. If properly planned, an Harness astonishing variety of weft effect patterns can be designed, which do not require alterations to the loom itself. This is, indeed, the chief advantage of designs in which the weft is most conspicuous. It is obvious that where the warp is only used as a ground or binder to the ornament, alterations are easier to make. Different designs can be woven on the same length of warp, and altogether more freedom is given to the artist in arranging his design. Take, for instance, the simple matter of stripes. If a stripe or stripes of colour are made in the warp, they have to remain in the same position from beginning to end of the web. But, weft stripes, of any size, colour, or distance apart, can be thrown in at will. It is therefore a great advantage to have a loom built particularly with a view to weft effect designs, especially in a studio or small workshop.

Description As an example of a most useful build of shaft mon- of a Most ture for the weaving of these coarser materials, the Useful Shaft following may be interesting. The comber-board Harness for is the first thing to consider. We will suppose Coarser that the width of the web to be woven is twenty- Materials four inches. It might be forty-eight inches,* in

* In the case of the warp being forty-eight inches wide a fly-shuttle would have to be used, and when two

which case the figures of the specification would simply have to be doubled. The space of the pierced part of the comber-board must be at least twenty-four inches, and in view of the material to be used, fine linen or cotton, it must be pierced with sixteen hundred holes, arranged in eight rows. The eight rows of leashes suspended in these holes will require eight shafts, and the leashes themselves must have much heavier lingoos than we saw to be necessary for fine silk. The number of cords in the pulley-box, or hooks in the Jacquard machine, should be four hundred, and four leashes should be raised together by the drawing of each cord for the figure. One comber repeat will fill the whole width of twenty-four inches, so THAT ANY DESIGN DRAUGHTED ON FOUR HUNDRED SQUARES, IN THE WIDTH OF RULED PAPER, CAN BE WOVEN ON THE LOOM.

Shaft
Harness
for Coarse
Materials

The binder, in which there must be eight hundred threads of the same size as those of the main warp, may either be mounted on eight extra shafts in front of the figure shafts, or be distributed in an eight-headle harness. It should be on eight headles in order that tabby, twill, or satin binders may be made at will. The entering of the binder threads, is only in the binder leashes; they must pass between each two of the main warp, but not be entered in its mails. The raising of the binder harness may be either by means of the treadles and levers, or by the Jack-in-the-box, unless a Jacquard or more shuttles were required drop-boxes must be added. Most of the old draw-loom weaving was done with hand-shuttles, the fly not being invented till the middle of the eighteenth century, and the drop-box much later.

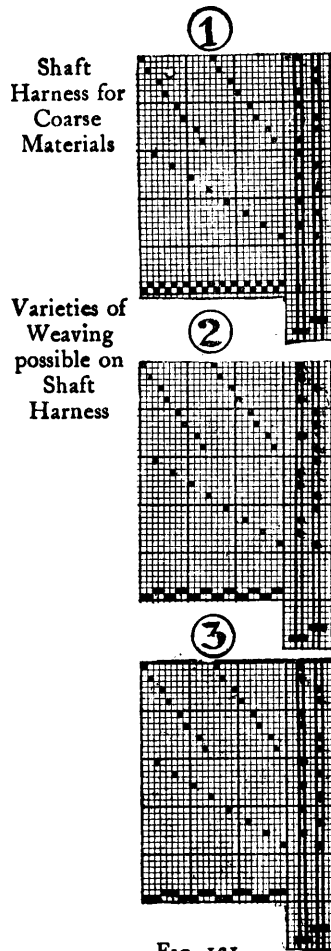


FIG. 121
Tie-ups for Tabby.

machine is used, in which case all the lifting, both of figure and binder, is done by it.

The reed, for the loom thus fitted up, would require eight hundred dents, and each dent to have two threads from the main warp, and one from the binder entered in it.

Some examples of the kind of weaving to be done with the above loom may now be given. In the first place, tabby cloth, quite plain and even, made by lifting single threads alternately, can be woven, all the threads of both warps being used. This would require all the shafts to be tied up to the treadles as shown at fig. 121, no. 1. No. 2 gives the sketch plan of the entering and tie-up of a tabby of two threads. No. 3 shows the plan and tie-up for three-thread tabby. Tabby of four threads could not be made unless there were sixteen shafts in the figure harness, and above that number of threads would make too coarse a tabby to be of any service.

Double or treble cloth could be made either with single, double, or treble threads, and with or without pattern. Also double cloth,

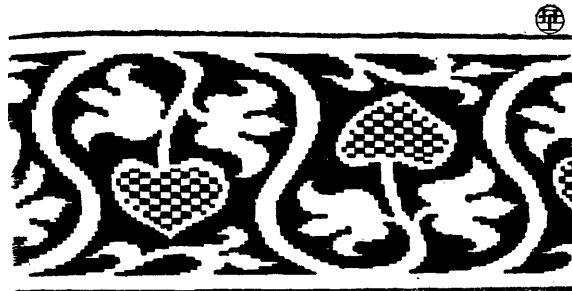


FIG. 122.—Curtain Border.

one portion having double threads and the other portion having single threads, could be woven, and double cloth of two different textures, one tabby and the other satin, could be devised.

Figs. 122 and 122A will show the great utility of being able to weave a perfect plain cloth, with a border introduced at regular intervals. The illustrations are from such a web. It was made for a heavy curtain to fill an archway, and both surfaces were alike. The border being double cloth, it was possible to make the front and back exactly alike, even as to the position of the colours, which in single weaving must always be reversed. The letters of a motto or a monogram might in this way be woven so as to be read rightly on both sides.

We must now examine three samples of woollen hangings recently made on a loom constructed according to the plan just specified.



FIG. 122A.—Curtain Edging.

Varieties of Weaving possible on Shaft Harness

Woollen Hangings woven on Shaft Harness

Woollen Hangings woven on Shaft Harness

Plate xv was woven for a church hanging in scarlet, blue, and green wool on a ground of fine cream-coloured, mercerised cotton. The ground is a treble-thread tabby, but shows very little on the face of the web—only, in fact, in the bold outlines of the conventional lily and the large leaf forms which compose the trellis of the design. The lily is in scarlet wool, and is only tied down by a satin, which is made on the simple cords of the figure harness. This loose tie allows it to stand well above the general surface of the cloth. The green vase and foliage, and the dark blue background, are tied by a four-headle, single-thread twill, made by the binder harness.

It is often found more convenient to weave this kind of material face upwards as the present example was made.

Examples of Wool Tissues

The order of the weaving was: (1) A tabby shoot of coarse mercerised cotton in a shed made by the tie-up of no. 3, fig. 121. (2) For this shoot all the cords of the figure harness are raised except the background of the design. For the binder the first and fifth binder shafts are raised. Into the shed thus formed the dark blue weft is shot. (3) All cords raised in the figure, except, the foliage and a portion of the trellis leafage. The third shuttle carries a light green weft, and the same binders are raised as for the blue shoot. The spaces between the scarlet lilies (about two-thirds of the design) are woven with three shuttles, but when the lily is reached a fourth shuttle must be added. In this part of the design all the figure cords are raised except those forming the lily itself. Here all the binder headles are left down, as the binding of this part of the

design is by four threads of the figure harness, in the same manner as shown in fig. 116.

The next example, plate xvi, is a portion of a very heavy wool and spun-silk hanging. In this web the binder does not show on the surface, except in the treble-thread tabby ground, as the few ties required on the figure are made by lifting one of the group of four threads raised by the cords of the simple, and are arranged for by the designer on the draught. The binder harness is, however, useful, as it ties in the wool at the back and keeps it flat; it also helps to force out the figure and make it stand well up from the ground. It will be observed that the two colours of the figure are so interwoven that there are very few long floats of weft which require being tied down. Whenever a float of more than seven squares of the ruled paper is made a binder is raised for the tie. Three wefts, carried by three shuttles, are used in this tissue, and four shoots are necessary to complete one line of the draught.

The warp consists of three thousand two hundred threads of spun silk, warped double. Their being warped double, makes the necessary number of threads (1600) for entering in the figure harness, and the binder must also have double threads like the cane warp. The spun silk for both warps is white.

The weft for the tabby ground is coarse, strong-spun silk, four or five ends being twisted together. This is also white. The weft for the figure is soft wool spun rather finely, several ends (six or eight) being also lightly twisted together. One shoot of the figure is green and the other a very dark indigo blue. One repeat of the bold design

Examples
of Wool
Tissues

fills out the whole width of the twenty-four-inch web.

The order in which the wefts are shot is: (1) The white silk in a tabby shed made by the shafts only, of both harnesses; (2) the same weft in the alternate tabby shed; (3) the figure harness alone being used, the green wool is shot into the shed first raised by the simple cords, and is followed (4) by the dark blue in the next figure shed. This completes one line of the design as draughted. This web is also woven face upwards, and the tie-up has to be so made, that, the cords lift first the ground and the blue part of the figure, and secondly the ground and the part of the figure coloured green.

Fig. 123 is particularly interesting, as it shows the great extent to which the changing of the weft in lateral stripes may be carried, with advantage. It is difficult in black and white to indicate the variety of colours used in this pattern, which is arranged to weave with one ground and two figure shuttles only; but the changing colours are indicated to some extent by dots, lines, and cross-hatchings. Fifteen changes of colour are made in one vertical repeat, and the effect of lateral striping is entirely hidden. The weft changes are shown in the two vertical stripes at the side of the illustration.

The ground in this case is a tabby of double threads only, and is of fine linen. The tabby is made by both harnesses working together, as draughted at no. 2, fig. 121. As in the last example, there is no binder on the figure except in the few places where the length of the floating loops renders it necessary. Where thus required



Plate XV.—Wool Hanging, designed, draughted, and arranged for weaving by the Author for St. Christopher's Church, Haslemere. The colours are scarlet, blue, green, and white.

See page 300.



Examples
of Wool
Tissues

FIG. 123.

Examples of Wool Tissues they are made by drawing one cord of the simple.

This pattern is woven face downwards, which makes it very light, both as to the tie-up and the drawing of the simple cords, but it needs the binder harness all raised while the figure is being woven.

The first shoot is one of tabby with white linen weft. The second is fine black or very dark green wool, two or three ends being wound together. This colour runs nearly all through the design, there being only three small spaces where it is changed, once to yellow, at A, and twice to green, at B, B. The third shoot begins with blue at C, and changes at D to green, at E to purple, at F to a different blue, at G to another green, at H to rose-pink, at I to green, at K to brown, at L to blue-purple, at M to green, and finishes the repeat at N with scarlet.

The Split Harness not Indispensable for Tissue weaving

It must be understood that all these examples of tissue weaving could be made on the loom as fitted up for damask weaving—that is, with a long-eyed harness in front of the figure harness, if to the latter were added another set of headles to work the separate warp of the binder. In fact, this was the kind of mounting on which the old brocatelles and tissues were made. The split harness is, however, a great improvement, and has many advantages, not the least of which is its occupying so little space in the loom.

The Compound Harness

There is another kind of harness for silk damask weaving which was also invented by a working weaver of Bethnal Green; this is called the compound harness. It is most ingenious, and has been extremely useful in connection with the Jacquard



Plate XVI.—Portion of Hanging of woven wool and coarse silk.
Designed, draughted, and arranged for weaving by the Author.
See page 301.

machine, for use with which it was invented, but as it is not suitable for use with the draw-loom it is not necessary to describe it here.

The
Compound
Harness

The next group of samples for examination require for their weaving a still further development of the monture, which must be explained in the next chapter.

CHAPTER XIX

THE COMPOUND MONTURE

Advantages of dividing the Monture—Description of the Compound Monture—Examples of Compound Monture Weaving—Old English Brocade—Eighteenth-century Striped Brocade—French Late Seventeenth Century Brocade.

Advantages
of the
Divided
Monture

THE scope of tissue-weaving may be immensely increased by building the monture in two or more divisions, to be governed by separate sets of simple cords, and acting on separate warps, all combining to make one web. This compound build of monture was often used by the tissue weavers of the sixteenth, seventeenth, and eighteenth centuries, and enabled them to produce an almost unlimited variety of webs. It is also even more largely used in modern pattern-weaving by power, which to a very great extent consists of warp effects. Warp effects, in power-looms where very long lengths of the same patterned material must be woven at the highest possible speed, are the most economical, as when once the loom is set up, no matter how complicated the pattern may be, the actual loom-tending is very simple. In the draw-loom sometimes, montures with as many as four divisions seem to have been used, but generally two divisions

were deemed sufficient. The weavers of the best periods for the most part used weft rather than warp effects in their webs.* The advantages of weft effects have already been dwelt upon in the previous chapter.

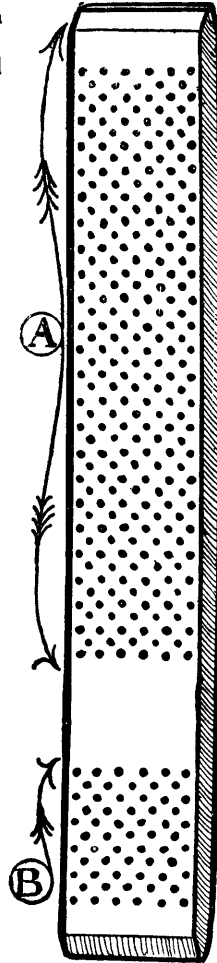
Advantages
of the
Divided
Monture

For the demonstration of the utility of the compound monture let us make an addition to the split shaft harness for silk-weaving described in Chapter XVII., p. 278. The comber-board is there described as pierced with twenty-four rows of holes, two hundred and thirty-three being in each row. These are lifted in fours by the simple cords, which number four hundred and six, in order to make three comber repeats in twenty-one inches. The leashes, in the twenty-four rows, are also separately suspended on twenty-four shafts. This is the figure harness complete. In Chapter XVIII., p. 287, four extra shafts were added for a separate binder, on which four rows more, of similar leashes were hung, but were not connected as those of the figure harness were with the comber-board. This completed the monture for making brocatelles and broché tissues. On the loom so arranged, brocading in detached spaces could not be done, as the binder warp would be in the way whether it were lifted or not. If left down it would hide or mar the brocaded ornament, while if it were raised it would

Description
of the
Compound
Monture

* There is a design for silk brocade in the print room of the Victoria and Albert Museum, South Kensington, which has a note at the back to the effect that four simples were required for its production. As it is only a sketch design, not a draught on ruled paper, it is impossible to say how the divisions were made or why they were required.

Description
of the
Compound
Monture



make the manipulation of the brocading shuttle very tiresome. In fact, a weaver of to-day would despairingly say it was impossible. For making true brocaded tissues, then, some addition to the shaft harness and binder is needed, and this need is met by arranging the figure harness as a compound monture.

Fig. 124 represents a pierced hardwood comber-board slip one inch wide and ten inches long. Twenty-one of such slips would be required to fill the frame of our comber-board. The twenty-four rows of holes in division A are already occupied by the leashes of the figure harness as described. For the compound monture the comber-board would have to be extended above the binder shafts as shown in division B, where six more rows of holes are seen to be pierced; and below these new holes the six shafts of the binder harness are already suspended by their long loops. These leashes must now all be connected with the comber-board in the same manner as directed for those of the figure.

FIG. 124
A Comber-board Slip
308

harness (see p. 278, fig. 115). At the top of the loom the pulley-box must be doubled in capacity, or a second box having the same number of pulleys placed in front of it. Tail and simple cords must also be added to complete this addition. Sometimes the second simple was arranged on the opposite side of the loom, but more often the simples were placed side by side, so as to be worked together when required. All such details of the construction were, of course, subject to individual requirement and convenience.* All these additions being made, it only remains to join the leashes of the front harness, in regular order, to the cords of the front pulley-box, care being taken to connect them in the same repeats as the main figure harness. As the binder warp equals only one-fourth of the figure harness, it follows that the leashes of the former must be joined up singly instead of in fours.†

Description
of the
Compound
Monture

The additions being complete, the compound shaft harness will enable the weaver (1) to raise the binder threads all together or in separate rows by the shafts as freely as before, and also to use the main figure harness simple by itself, also as before ; so that any web that has already been made can be

* It is only possible in such a book as the present to show the general principles on which these complicated machines were made. In practice they were subject to innumerable modifications.

† This is not an arbitrary arrangement. The harnesses in both divisions may be exactly alike. In fact, any combination may be planned on the same principle and have special advantages.

Description of the Compound Monture repeated. (2) To raise any single thread of the binder or a combination of them, at any place, to make ties for a brocaded figure. (3) To utilise the binder warp in order to make small designs, diapers, checkers, spots, or what not, as a background to the main design.* (4) To lift any portion of the binder out of the way of any other weaving that may be going on. (5) To weave damask-like figures in the background of the brocade, as was so often done with fine effect in the French and Italian webs.

Examples of Compound Monture Weaving It is difficult to select a few examples of tissues woven on compound montures out of the great number available, any one of which might be chosen on account of some special point of interest in its technique. The space, however, now at our disposal precludes the extended examination which this part of the subject deserves. Three examples must suffice; these have been chosen as diverse as possible, and will give some idea of the capacity of the drawloom in its highest state of development. Ample opportunity for further study of tissue-weaving is afforded by the fine collection of drawloom woven fabrics in the Victoria and Albert Museum, which is particularly rich in seventeenth- and eighteenth-century examples, French, Italian, and English. There is also in the print room of the same museum a wonderful and most instructive collection of designs for this class of weaving, dating from the beginning of the eighteenth century. The value of these drawings is much enhanced by

* This kind of background effect is particularly characteristic of English eighteenth-century weaving.

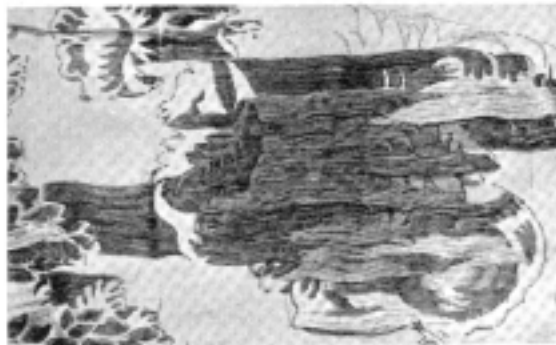


Plate XVII.—Brocade, probably Old English. The lower portion of the photograph shows the method of brocading with small shuttles at the back.

See page 311.

Author's Collection.

the designers' and weavers' notes which are written on their margins.

The first example for present examination is a pure brocade, probably old English (plate xvii). The cream-coloured ground is a rich plain tabby, very finely and closely woven, there being eighty shoots of weft to an inch. Two shoots of weft are laid between each line of the brocading, and there are two shoots of brocading to each line of the draught on ruled paper. The quaint floral and landscape design occupies the whole twenty-one inches of the width of the web, and is draughted for six hundred cords. The most convenient ruled paper for this size of design, would be divided into twelve lateral spaces in each of the fifty large squares on to which the design had been first sketched, and as each line is repeated, as we have seen, in the weaving, the proportional number of vertical spaces would be eight. This would therefore be said to be drawn on 12 x 8 ruled paper. The colours are so arranged, that, although there are a great variety of them, as they are brocaded in, there is no necessity for more than four tie-ups for each line of the design on the simple, or for four cards if the lifting were done by a Jacquard machine. For the latter, however, each card would have to be duplicated, as when more than one card is used for each line the second and third, or whatever number are required, must follow in unbroken sequence. The Jacquard machine cannot be turned back to the first card of the line without great trouble; accordingly a second sequence identical with the first has to be laced in the endless band of cards. This repetition, however, could be done quite easily on

Examples of
Compound
Monture
Weaving
Old English
Brocade

Old English the draw-loom providing the cords were drawn
Brocade by a human drawboy.*

The tie-up for this design would be very simple, as only a few cords here and there would have to be drawn at each line.

All the colours would have to be painted in on the draught quite distinctly, in order that the tie-up might be *read in* correctly by the weaver, and also that it should be a clear guide to him in the brocading. Two draughts would have to be made, one painted in, exactly as the design is to appear when woven, only without the binders; the other having all the shapes exactly copied, but without colour, and the binder ties indicated. In the colour draught, the colours to rise in each tie-up would have to be indicated by letters or numerals, 1, 2, 3, or 4. The colour draught would be for the back or main division of the monture, and the binder draught, for the front division. The effect on the loom of this arrangement, when the tie-up was made, would be that the back division of the simple would draw up the figure in large on the main warp without any ties (see effect of shaft harness, p. 287, fig. 117, no. 1). Now if the cords of the front harness be drawn simultaneously with those of the back, all the threads of the second warp will be lifted from the figure, except those required for binders. As there

* With regard to two or more colours being tied up in one line for brocading, it should be pointed out, that, as each colour is put in with a small shuttle separately, it follows, that if sufficient space is left between the parts lifted, any reasonable number of colours can be brocaded in one line. With a skilful weaver a very little space between the colours is sufficient.

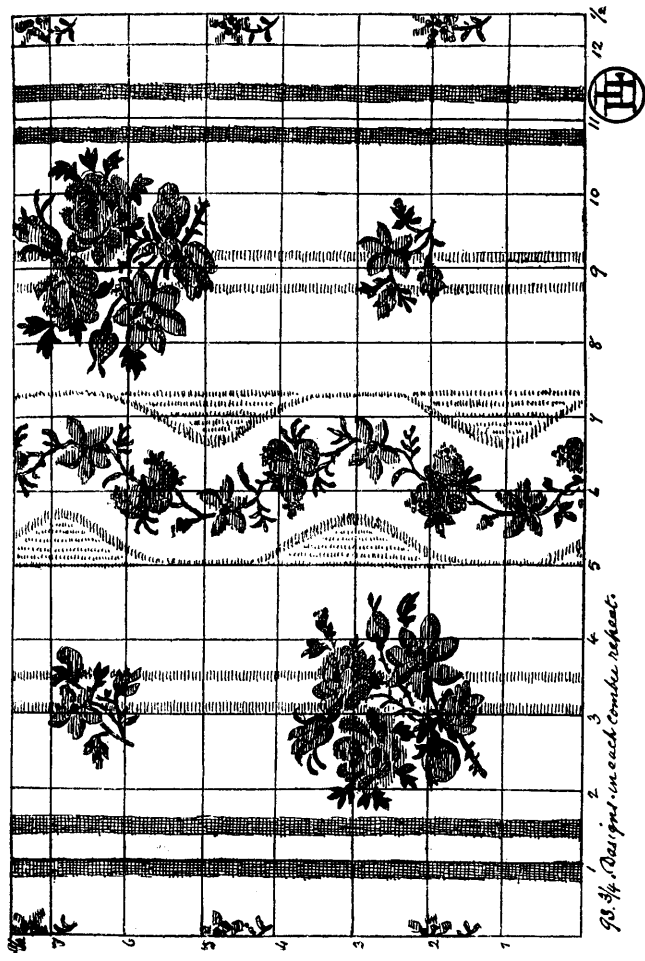


FIG. 125.—French Brocaded Silk Tissue, Eighteenth Century.

Old English Brocade are six shafts for the binder warp, the twill tie may be either a three- or six-shaft twill. The one used in the example (plate xvii) is on six shafts.

The weaving would proceed as follows: Shoots 1 and 2 will be a tabby of the ground and binder together. The brocading shed will next be made by drawing the first tie-up of both the simples together. The brocading wefts in the first shed being laid in the places indicated in the draught, the second tie-ups will open the second brocading shed; this also being laid, the third tie-ups will open the final shed, for the first line of the design. The third and fourth tabby shoots follow next in order, and the same sheds are to be repeated for the brocading. When the two lines of brocading are thus woven, with two tabby shoots between them, one line of the design, as draughted, will have been woven. The weaving of brocades requires great care and skill, especially when, as in this example, several colours are put in at one drawing of the simple. The weaver has to follow the coloured draught very attentively until he has learned the position and entry of the different colours. Needless to say, brocading must be done face downwards, and the small brocading shuttles are left standing on the back of the web in exact order, like a fleet of little boats, and pass through the shed in regular succession. The lower portion of plate xvii shows the back of the old English brocaded silk, and will greatly assist in the explanation.

The dainty and characteristic eighteenth-century brocaded and striped silk of French weaving (fig. 125) could be woven on two differently



Plate XVIII.—Figured Velvet. The ornament is composed of cut and terry pile. This specimen is beautifully designed and perfectly woven.
See page 321. Victoria and Albert Museum, South Kensington.

mounted looms: (1) On a loom arranged for damask-weaving, with two separate harnesses in front, one to work tabby and the other to weave a satin, with two spaced warps on separate rollers, and with the harnesses also spaced, and *both* entered in the monture. (2) On a divided shaft harness, with one simple and with the warps spaced and arranged on two rollers. If made in the latter way the weaving would be much simpler, and there would be a great deal less strain on the silk, which is always an advantage. The design must first be briefly described, and then the method of preparing the monture for it. The design is shown squared out in preparation for the draughting. The broad stripes on which the large bouquets are placed are of rich satin of a pale blue colour. The narrower stripes, one of which, in the centre, has a wavy ribbon with a garland of small flowers adorning it, and the other, the half of which is seen at each edge of the drawing, are both white tabby-woven silk. The two narrow stripes near each edge are of the same satin as the wide one, and only differ from it in their colour, which is pink, with white edges. These are arranged in the warping. The fine stripes on which the large bouquets are placed are floating white silk weft, as are also the edges of the wavy ribbon and the fine stripes of various lengths which are placed at its side. The bouquets, sprays, and garland are all brocaded in exquisitely delicate tints of pink, creamy yellow, and green. It is not necessary to give a specification of the monture for reproducing this example, but only to indicate broadly the method of its building. The comber-board would be in two divisions, and as there

Eighteenth-
century
French
Striped
Brocade

Eighteenth-century French Striped Brocade would be an equal number of shafts for both divisions the same number of rows of holes would require piercing in the board. In the back division holes would only be pierced in the spaces required for the satin stripes, and in the front division holes would be made for the tabby stripe spaces. In this web there would be no binders for the brocading, as the smallness of the spaces brocaded renders them unnecessary. The cords from both divisions of the shaft harness could be brought into one simple, as the figures are all raised simultaneously. The first tie-up of the simple would be of the fine stripes in the centre of the broad satin one, and the fine vertical lines and edges of the wavy ribbon. The second, third, and fourth tie-ups would be for the three sheds of the brocading.

The order of the sheds, for the shoots of white silk, in weaving would be as follows : (1) The tabby and satin groundwork on shafts alone of both warps together ; (2) the first tie-up on the simple cords would be drawn and the second shoot of tabby and satin groundworks lifted. When these shoots had been made, the first tie-up of the brocading figure would be lifted by the simple cords and the brocading done ; then the second and third tie-ups and their brocading, in succession. This would finish one line of the design. At the fourth pair of ground shoots with the white weft, the one round of ties of the eight-shaft satin would be complete, and the fifth pair would begin with the first tabby and first satin shafts again together.

The third and last example to be examined is the fine late seventeenth century French brocade which is reproduced in colours as the frontispiece

of this Part of the book. It is a superb piece of weaving, and a fine specimen of appropriate and economical design. The fragment from which the photograph is taken is only fifteen inches high and ten and a half inches wide, yet this gives nearly two repeats of a fairly bold design. The figure is turned over in repeating vertically, so that the real design is barely eight inches, and yet on looking at a whole piece of the brocade we should have "no wearisome sense of repetition," which is a quality in design that William Morris commended so highly when describing the early Sicilian webs.* Then again the design is so perfectly adapted to the method of its production that no artist who was unacquainted with the technique of weaving could invent a pattern so suitable for working out in the loom.

French Late
Seventeenth
Century
Brocaded
Tissue

The ground of the web is a lilac silk tabby, very rich and warped with double threads. The graceful ornament, consisting of a twisted ribbon and conventional flowers and foliage, is all brocaded in, by means of a multitude of small shuttles. The silks used for the wefts are of exquisitely delicate-coloured dyes, and are varied in a most artistic way in the repeats. The dark green and red wefts are fine chenille threads, which give a velvet-like texture to the portion of the work where they are used. A part of the floral ornament is brocaded with a curiously twisted silk thread, which gives a metallic

* A fine description of the early Sicilian damasks may be found in a lecture on textile fabrics by the late William Morris. The report of the lecture is in the Art Library, South Kensington.

French Late appearance wherever it is used.* The intricate
Seventeenth brocading is not tied down with a binder, but is left
Century loose or floating, the designer having so arranged the
Brocaded draught that none of the loops are inconveniently
Tissue long.

It was not only on account of its exceeding beauty that this example was chosen for this particular illustration, but on account of the peculiarity of the embellishment of the background of the figure. This background pattern, is put in by means of the second or front division of the monture working on the second warp, which is used for this purpose instead of as a binder. This ornament is woven in the tobine manner described at the end of Chapter XIV. As will be gathered from that description, tobine effects are generally confined to narrow stripes, vertical or lateral, as small squares and oblongs, but here we have a kind of key pattern and spaces between it of plain tabby, and it does not interfere with the brocading, although it is in a line with it. All this shows that some means has been devised for raising and depressing the tobine warp at any place required by the design and between any one of the tabby shoots. In order to effect this, the front division of the monture is fitted up with ordinary leashes without shafts. The extra warp, of the same colour as the main one, is about one-fourth of its richness, and the simple cords draw from four to six leashes with every cord. The shapes of the brocading figure have to be tied up on

* The French weavers were very ingenious in twisting threads of silk and metal, and many beautiful effects in their webs are due to this special weaving.

the front simple and drawn simultaneously with those of the back. The tobine pattern on the ground is worked in by the tie-up of the front simple while the ground itself is being woven. This tie-up of the front division of the harness would all have to be worked out on a separate draught from that of the brocading.*

French Late
Seventeenth
Century
Brocaded
Tissue

* These tobine effects for groundwork patterns became very common and characteristic of English Spitalfields weaving in the eighteenth century. In French work they occur chiefly in stripes.

CHAPTER XX

FIGURED-VELVET WEAVING

Pile and Terry Figured Velvet—The Draught—
The Monture—The Preparation of the Loom—
The Bobbin Frame—Italian and Spanish Velvets.

Figured-
velvet
Weaving

THE weaving of plain velvet has been fully described in Chapter XIV. It will therefore require but few words to explain the method of making figured velvet, which, as far as the actual weaving goes, is done in precisely the same manner. In one respect the weaving of figured velvet is not so difficult as when the pile is plain, as small defects in the cutting out of the rods are not so apparent.

The design for figured velvet is draughted in exactly the same way as designs for damask weaving. Each square of the ruled paper represents a group of from four to eight threads of the pile. When both cut, and terry, velvet are in one design they are treated as two colours, and require two successive tie-ups on the simple.

The leashes of the monture for velvet weaving are more heavily weighted than for damask or tissue weaving. They are also mounted on shafts as in the tissue shaft harness. When both terry and cut pile are being woven the grooved rod is first placed in its shed, and the terry one next to it, before the

intervening shoots of ground are made. This is the only difference in the weaving process. The shafts raise and depress the pile altogether between the shoots, and the cords of the simple raise the pile as required for the design. Plate XVIII is taken from a very fine example of cut and terry figured velvet in the collection at the Victoria and Albert Museum.

Figured-
velvet
Weaving

Although the actual weaving is so similar there is a great difference in the preparation of the loom for figured velvet. Each separate group of threads, lifted for the design by the cords of the simple, has to have a small warp of its own, individually weighted with a tiny piece of lead wire. Eight hundred or a thousand of these, mounted in a frame at the back of the loom, is no uncommon number. It will be remembered that the take-up of the pile warp is so great that the warp has to be at least six times the length of the ground warp. It will therefore be readily seen, that parts of the design, where more or less pile is raised would take up different lengths of warp. Some of the bobbins are found to run out sooner than others, and when they do so they are immediately replaced and the new threads of silk joined to the original ones. In this way the pile warp is kept even, whatever the nature of the design may be.

The Pile-
bobbin
Frame

Figured-velvet weaving seems to have reached its highest perfection in Italy and Spain during the sixteenth century. The webs then produced have never been surpassed, or even equalled, although if good silk, of fine colour were used, in a properly set up hand-loom, there is no reason why velvet, the most sumptuous of all textiles, should not be made as well as ever.

Sixteenth-
century
Velvet

CONCLUDING NOTE

Concluding Note It may be surprising, and perhaps somewhat disappointing, to some readers to find that this description of the methods of weaving and weaving appliances, comes to an end at this point. We have traced the history and development of the craft, from its earliest beginning, up to the time when the Jacquard machine was introduced and began to supersede the traditional draw-loom for pattern-weaving. This ending, although perhaps somewhat abrupt, is not unintentional, for it was just at that time that weaving, to a great extent, ceased to be an artistic craft. It was then that the loom ceased to be a tool, more or less complicated, which the weaver himself could keep in order and cunningly adjust, alter, and adapt to any particular work he might have in hand.

With the exception of the fly-shuttle, chiefly useful for weaving wide webs, the Jack-in-the-box, and the split or shaft harness, descriptions of which have been given, no real improvement has been made in weaving or weaving appliances since the middle of the eighteenth century.

As regards the Jacquard machine, the chief advantage (?) it offers is the facility with which designs can be changed in the loom, the endless

band of cards taking the place of the weaver's tie-up. This facility for change only resulted in the multiplication of patterns; patterns, for the most part inferior to the traditional ones already in use. The Jacquard machine is also responsible, to a great extent, for the separation of the art of designing from the craft of weaving.

Concluding
Note

The speed of weaving has been by means of the power-loom, of course, vastly increased, but although this is in some respects a commercial advantage, the quality of the weaving is far below that of the earlier times, and the ruthless, rigidly perfect mechanism of the machine loom has had a disastrous effect on the weaver as a craftsman.

There can be no question that the best weaving was done before these innovations of the engineer and mechanic were made. It would therefore seem, that the right road to improvement in weaving, as in all the crafts, can only be found by those who are willing to return to the traditional methods and simpler ideals of the earlier masters of craftsmanship.

GLOSSARY *

Batten, the frame of a reed.
Beam, a roller.
Beaming, winding on a warp.
Beaming drum, the essential part of beaming machine.
Beaming posts, supports for a beam.
Binder, the tie for floating weft.
Binder harness, headles for lifting binders.
Bobbin, a reel.
Bobbin-carrier, a reel-holder for warping.
Bobbin frame, part of a warping mill.
Box batten, batten with fly-shuttle boxes.
Breast roll, front beam of a loom.
Brocade, a brocaded web ; originally, silk wefted with gold or silver thread.
Brocading, weaving detached ornaments in a web.
Brocatelle, tissue with satin ties in figure.
Broché, web to imitate brocading.

Cane, a new warp.
Cane roll or roller, the back roller of a loom.
Cane sticks, sticks for fastening the warp in beam.

Glossary

* This glossary does not pretend to comprise all the technical terms used in weaving. These are of infinite variety, and often have totally different meanings in districts separated but a very short distance one from another.

Glossary

Carding, preparing fibre for spinning.
Cards or *cardings*, fibre prepared for spinning.
Cloth beam, the breast roller.
Comber-board, a board perforated to hold the leashes of a monture.
Comber repeat, repetition of a design which does not turn over.
Comber slip, a portion of the comber-board.
Compound harness, two or more harnesses working together.
Compound monture, monture with two or more sets of leashes.
Cords, the simple on which the pattern is tied up in a draw-loom.
Counter-march, a short lower lever in a loom.
Couper, the top levers of a loom.
Cross, the crossing threads of a warp.
Cross, porrey, the cross retained while weaving.
Cross, portee, the cross at the finishing end of a warp.
Cross sticks, smooth rods for preserving the cross.

Damask, a system of weaving introduced from Damascus.
Dent, one space in a reed.
Design, a pattern ; one square of ruled paper.
Diaper, a system of weaving small patterns.
Distaff, appliance used in spinning.
Doubling, winding two or more threads together.
Draught, drawing on ruled paper.
Drawboy, a boy employed to draw the cords of a simple.
Drawboy's fork, implement for drawing the cords in a draw-loom.
Drawboy machine, machine for drawboy's work.

Entering, threading warp in leashes or reed.
Entering hook, thin hook for drawing thread through mails.
Eye, centre loop of a leash.

- Fancy web*, see *Tissue*.
Figured velvet, velvet with pattern.
Figure harness, the monture or pattern headles.
Float, a loop of weft passing over two or more threads.
Fly-shuttle, a shuttle driven by a picking stick.
Friction brake, appliance for regulating weight.
- Gatherer*, a part of the heck-block.
Gating, adjusting a loom.
Ground, the plain part of a web.
Ground harness, headles which form the ground of a web.
Guiding cords, supports for the pattern loops on the simple.
- Hand-shuttle*, a shuttle for throwing by hand.
Hand-stick, a short stick on which warps are wound.
Harness, a collection of headles.
Headle or *heddle*, a collection of leashes.
Headle frame, a frame for knitting headles upon.
Headle gauge, a tool for making leashes.
- Inlaying*, see *Brocading*.
- Jack-in-the-box*, invention which reduces the number of treadles required in a loom.
Jacquard machine, a machine perfected by M. Jacquard to supersede the drawboy in pattern-weaving.
- Lam*, see *Headle*.
Leaf, see *Headle*.
Lease, see *Cross*.
Leashes, loops of a headle.
Lingo, the weight of a leash.
Long march, the long levers below a loom.

Glossary *Loom*, any arrangement for supporting a warp and keeping it in order for weaving.

Mail, the glass or metal eye of a leash.

Monture, the mounting of a loom for pattern-weaving.

Necking cords, cords joining pulley cords and leashes in a monture.

Pecker, part of the drawboy machine.

Pickers, tweezers.

Picking-stick, the handle of the fly-shuttle motion.

Pile, the cut portion of a velvet.

Plan and tie-up, a sketch showing entry of harness and tie-up of treadles.

Plug, a tube on which weft is wound for the fly-shuttle.

Point repeat, a design repeating in opposite directions.

Pole, the pile warp of velvet.

Porrey, the warp between headles and cross-rods.

Portee, a collection of threads warped together.

Pulley, a grooved wheel.

Pulley-box, the upper part of a draw-loom.

Pulley cords, cords in a pulley-box.

Quill, a tube on which weft is wound for a hand-shuttle.

Race, the beading on the race-block of hand-batten.

Race-block, the lower part of a batten.

Race-board, that on which the shuttle runs.

Raddle, implement for evenly spreading warp.

Ratchet and wheel, a toothed wheel and catch.

Reed, a comb-like implement for keeping warps even and beating weft together.

Reed hook, hook for entering reed.

Retting, steeping flax in water.

Reverse satin, a satin with weft predominating.

Rising shed, a shed in which part of the warp rises, the rest being stationary.

Rocking shaft, part of the drawboy machine.

Ruled paper, paper for draughting.

Satin, a web with infrequent intersections.

Satinette, a short tied satin.

Selvage, the edge of a web.

Selvage bobbin, reel for mounting separate selvages in a loom.

Shaft, a flat lath.

Shed, the opening in the warp for the shuttle.

Shed-stick, a flat stick for opening the warp.

Shedding motion, a contrivance for opening the warp.

Shoot or shute, weft ; also throwing the shuttle.

Short march, see *Counter-march*.

Shuttle, a tool for carrying weft.

Shuttle-box, part of a fly-shuttle batten.

Simple, the pattern cords of a draw-loom.

Sinking shed, shed made by drawing threads down.

Skein, a loosely wound length of thread.

Skutching, cleaning retted flax.

Slot, an elongated perforation.

Spacing, arranging threads or leashes in groups.

Spinning, twisting fibre to make thread.

Spinster, a female spinner.

Tabby or *taffeta*, plain weaving.

Tail cords, the upper cords of a draw-loom.

Take-up, the gradual winding of cloth on to breast roller.

Tapestry, tabby weaving, in mosaic, with loose weft.

Tartan, a web striped in warp and weft.

Temple, implement for keeping out the edges of a web.

Terry velvet, see *Velvet*.

Glossary *Thread monture*, a monture with single threads in the mails.
Tie, a binder on loose weft.
Tie up, connecting parts of a loom together for forming patterns automatically.
Tissue, a web having one or more binder warps.
Tobine, ornaments formed by one or more headles rising and sinking together.
Trevette, a knife for cutting velvet pile.
Tumbler, a top lever of a loom.
Turning on, beaming.
Twill, a web with a diagonal tie.

Union damask, damask woven of linen and wool.

Vateau, implement for spreading the warp on cane roller.
Velvet, cut, a woven fabric with cut pile.
Velvet, figured, see *Figured velvet*.
Velvet knife, see *Trevette*.
Velvet rod, a grooved rod for the pile.
Velvet, terry, velvet with uncut pile.

Warp, longitudinal threads of a web.
Warping, preparing a warp.
Warping board, for making small warps.
Warping mill, for warping large warps.
Web, a piece of finished weaving.
Weft, the crossing thread of a warp.
Whorl, a spindle weight.
Woof, weft.

Yarn, thread of any kind.

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ADDENDA

NOTE TO P.99.—At end of 10th line it should be Addenda added that—The batten requires to be very exactly made, and the reed especially must be carefully fitted in such a manner that the swords of the batten and the front of the reed are quite flush.

NOTE TO P.105.—After the word “batten” in the 5th line, the method of fixing the warp to the front roller should have been described thus.—The front roller must now be rested on its brackets at exactly the same height as the back roller, and a thin iron rod, having been passed through loops at the ends of two weighted cords and attached by cords or tapes to another rod placed in the groove of the roller, must be fixed in the manner shown in fig. 47A.

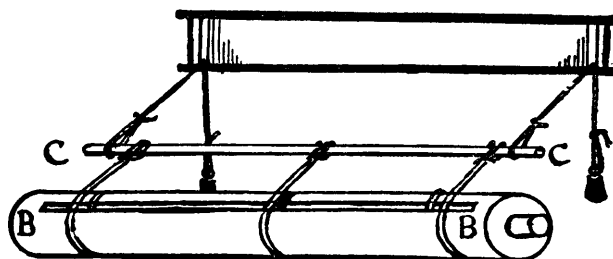


FIG. 47A.

Addenda

The bunches of threads must now be tied to the iron rod as evenly as possible, but in order to do this the back roller must be fixed temporarily so that it cannot turn as the threads are pulled and firmly tied. When the warp is quite evenly tied to the rod the back roller can be released, a little weight put in the weight-box to give some tension to the warp, and the front roller being turned the rod CC can take the place of rod BB, and the warp will be fixed to the cloth roller ready for weaving. An examination of fig. 47B will explain the method of fixing the rod C in the groove of the roller.— A being the warp and C and B the respective rods.

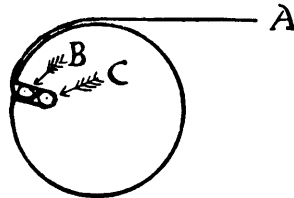


FIG. 47B.

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