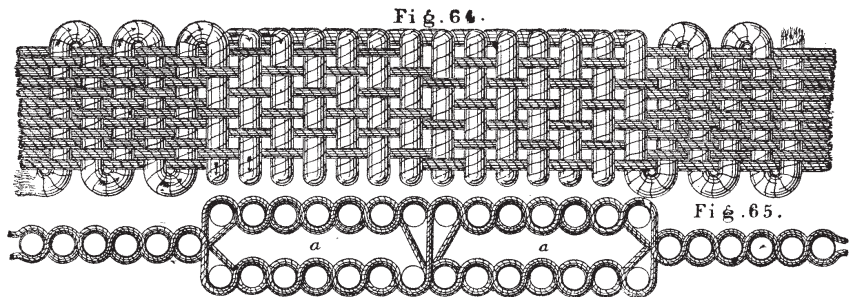
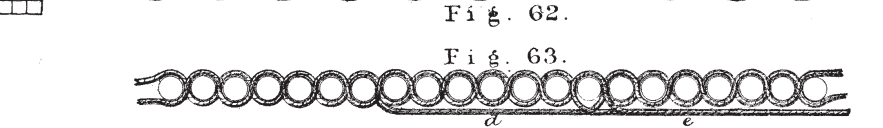
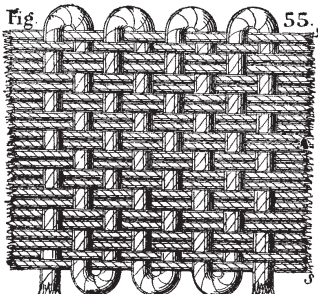
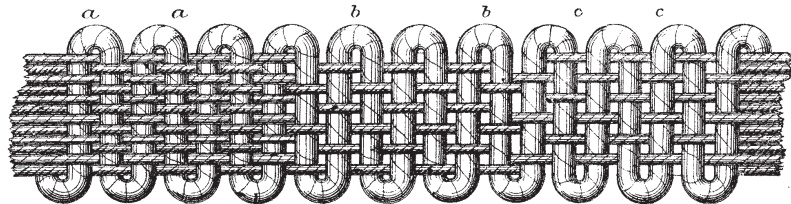
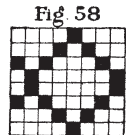
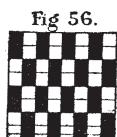
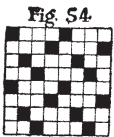
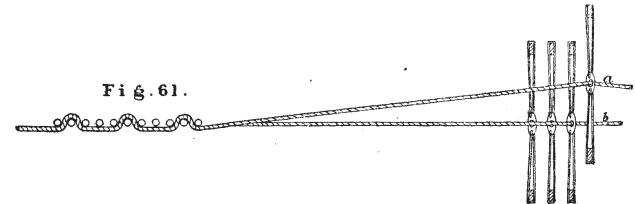
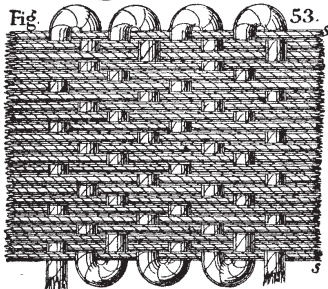
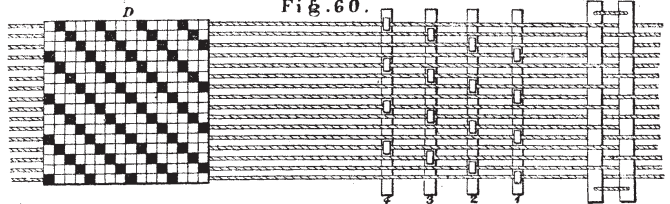
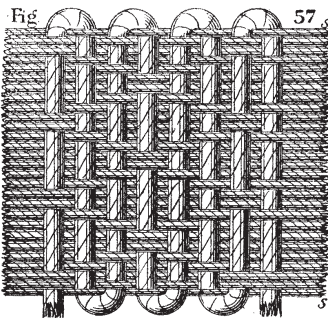
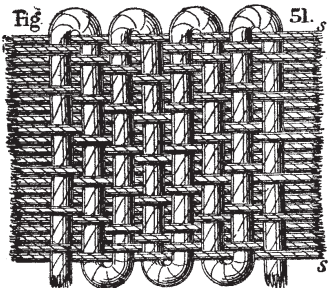
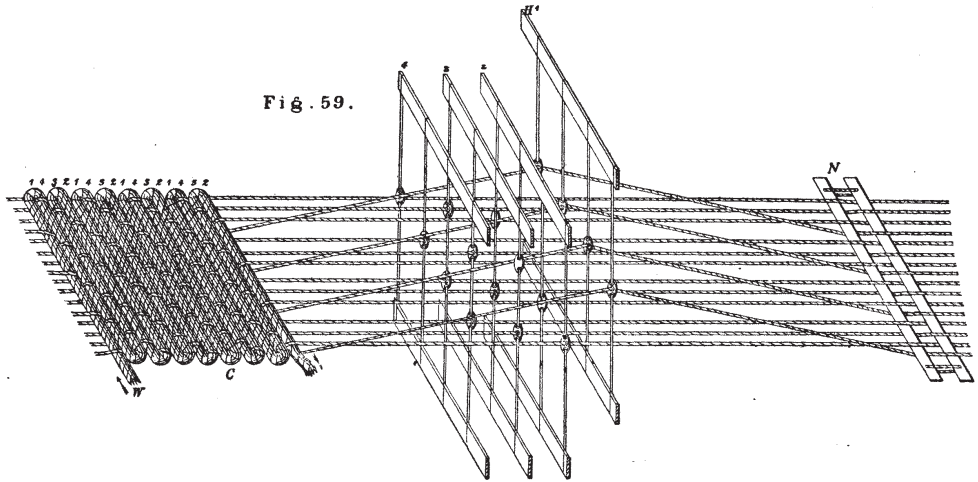
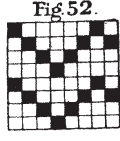
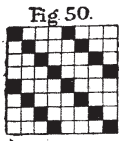
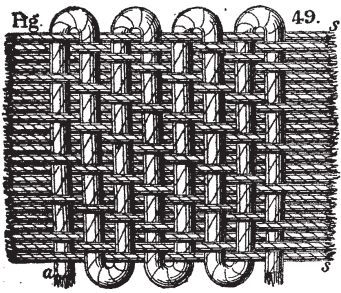

WEAVING.—No. VIII.

ALTHOUGH we have shown the mode of working several shuttles as used in hand-loom weaving, there is still another distinct class of shuttles which we shall hereafter describe. They are for the purpose of weaving small figures like tapestry on the surface of the cloth, and are known as "swivels." Another kind for the same purpose are called "circles," a name derived from the way they are worked.

But the uses and advantages of various kinds of shuttles and weft, will be best seen when the general principles of figured weaving are understood. By their means the manufacturer is not only enabled to produce the most beautiful designs, but he can do so with economy of material, for he can bring to the surface the more costly of the threads and conceal those which are merely intended for giving thickness and firmness to the cloth.

Fig. 49 represents a piece of twill or tweeled cloth, and it may be seen that the threads do not interlace each other alternately, but that they intersect at certain regular intervals. In this case the weft thread w passes under every fourth thread of the warp in such a manner, that after it has passed from side to side of the cloth four times it has intersected all the threads of the warp. These intersections being made in regular and consecutive order give rise to the diagonal appearance which is known as a "twill." In like manner Fig. 51 represents a zig-zag which will be seen to be simply a twill worked backwards and forwards. Fig. 50 represents the mode of showing the twill Fig. 49 on design paper, and Fig. 52 shows in the same way the zig-zag, Fig. 51. In Fig. 53 a satin is represented which is also shown at Fig. 54. It will, in this instance, be observed that the white spaces on the design paper, instead of the black, correspond with the intersections in Fig. 53. This arises from the circumstance that the cloth as shown at Fig. 53 is represented on the contrary side to that shown at Fig. 54, in order to show the smooth appearance peculiar to satin—but far more so in satins—which form so great a contrast to twills and zig-zags. Satin and satins are really broken twills, that is, the intersections, instead of being made in regular order, are broken up so as to avoid as much as

HAND LOOM WEAVING: THE PRODUCTION OF TWILLED FABRICS.



possible all harsh lines. In the satinet shown, it will be observed that three-fourths of the threads constantly appear on the surface of the cloth, but in ordinary satin seven-eighths of the threads appear or float on the surface. Therefore more headles are necessary for weaving satins, as we shall hereafter notice, and it is this circumstance that explains the distinction in the names. Figs. 55 and 56 form another variety of cloth, in which the threads are

used double, and Figs. 57 and 58 a modification of Fig. 51, which is effected by reversing the position of the warp threads in the loom, as will be hereafter described.

In plain weaving it was shown that half of the warp threads were passed through the eyes of one of the headles, and the other half were passed through the eyes of the other headle. Now, instead of dividing them and passing the threads through

two headles only, if they were divided into four parts and each part passed through the eyes of a separate headle in proper order, then not only could the different varieties of cloth represented above be produced, but a great many other changes could be made.

In a similar way three headles may be used, but only to a very limited extent. Four headles are the least, although they are sufficient in number to

show the principles upon which twill satins, &c., depend and the means adopted by the weaver to make them.

By limiting the number of headles and threads, each of them may be distinctly shown and the process of weaving made comparatively clear. In actual work the number of warp threads in each inch in the width of the cloth may range from forty to four or five hundred, or several hundred times more than it would be possible to show in a drawing. By representing a very small number of threads this difficulty may be overcome. Therefore, instead of attempting to show several thousands of warp threads, sixteen will be amply sufficient to illustrate the present part of our subject.

Fig. 41 (see page 461 of our last volume) represents a common hand loom fitted with four leaves of headles in a simple way. There are only sixteen warp threads shown, consequently each of the headles is provided with four eyes or leashes, as each eye and threads attached are called.

The headles are suspended from four levers called tumblers or coupers, which work in the "top castle," as the top framing of the loom is named. To the lower laths or shafts of the headles weights are attached, as shown.

To the four treadles four long levers or marches are attached, and from the ends of these marches cords connect them with the tumblers, as shown. Now as each of the headles is attached or connected indirectly with one of the treadles, it follows, that, by pressing upon any of the treadles the corresponding headle will be raised, and, consequently, the four threads of the warp will be raised also, and thus a shed will be formed for the passage of the shuttle.

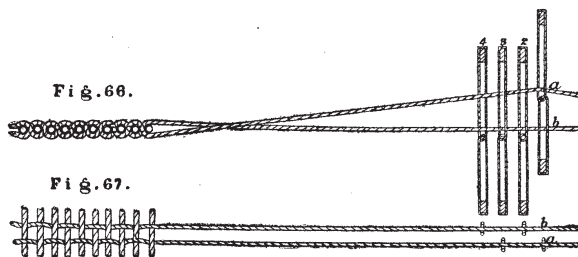
order of arranging the threads in the headles be made, the cloth, as shown at Fig. 57, may be woven.

There is still another system, perhaps the most important in weaving, to be noticed, viz., the method of weaving double cloths. As before stated, it is by this means that the manufacturer cannot only make thicker and heavier cloths, but he is enabled to use the materials to his best advantage. Although we have confined our illustrations to the use of four headles only, the principle upon which it depends can be fairly represented.

Fig. 62 represents a piece of cloth composed of black and white warp threads placed alternately. At *a a* the weft thread is shown to pass under the white and then the black threads alternately. At *b b* all the white threads have disappeared, and the black alone are represented, and if these were sufficiently numerous so as to cover the weft thread well, the surface of the cloth would appear black. At *c c* all the black threads have disappeared and the white threads are thrown upon the surface instead. Thus a black or white surface can be woven at pleasure. Fig. 63 shows a section of the cloth, and it will be seen that when the white threads disappeared at *b b*, Fig. 62, that they lay unconnected with the cloth or floated on the surface, and in the same manner the black threads float at *c* when the white threads are being used. In some kinds of figured weaving these floating threads are cut off as may be noticed in figured shawls, but in such cases the loss cannot be avoided.

Now on comparing Fig. 64 with Fig. 62, the surfaces of both are alike, but on comparing their sections, Figs. 63 and 65, a great difference appears. When either of the white or black threads disappear on one side of the cloth, they are not found

trivances connected with compound harnesses of looms depend, and it has been shown here merely to complete the introductory description of twill and satin weaving.



This will be more clearly seen in Fig. 59, which represents the headles and warp threads on a larger scale, and one of the headles H I is shown raised in the manner mentioned. In the same figure the course of the weft thread W may be traced, and the various warp threads under which it passes may be followed and be seen by which of the headles each intersection of the weft thread has been employed in. Thus the numbers 1, 2, 3, 4 on the weft threads correspond to the number of the headle which has been used when the weft was inserted.

The lease or cross is shown at N, but the reed has been omitted in the diagram, in order to avoid unnecessary complexity. Fig. 60 is a plan of Fig. 59, in which the threads may be more distinctly seen. It will be noticed that D, Fig. 60, represents, as it would be shown on design paper, the cloth as shown at C, Fig. 59. A section of Fig. 59 is shown at Fig. 61.

Now it will be seen that it is by raising the headles singly and in consecutive order that a twill, such as shown in Figs. 49 and 59, may be woven. But on referring to Fig. 51 the order in which the headles have been raised has not been 1, 2, 3, 4, 1, 2, 3, 4, &c., but 1, 2, 3, 4, 3, 2, 1, 2, 3, 4. In this manner a zig-zag may be formed. In Fig. 55 the cloth has been formed by raising two of the headles at once, or by attaching two of the headles to one of the treadles. The satin shown in Fig. 53 may be woven by raising three of the headles at once in the order represented on the cloth. But the same thing can be done by weaving it with the face of the cloth downwards, and this is the usual custom, for by doing so only one of the headles is raised at a time instead of three. Thus not only two-thirds of the amount of friction on the warp threads is avoided, but the labour in raising them is saved also. Fig. 54 represents the cloth, Fig. 53, the reverse side.

In Fig. 57 another variety is shown. Now by observing the zig-zag, Fig. 51, it will be seen that Fig. 57 is merely a zig-zag doubled or reversed. It has been shown that a zig-zag is formed by deviating from the regular or consecutive order of working the headles; if, in a similar way, the consecutive

floating underneath, but are being woven into another cloth, in fact, two separate pieces of cloth connected at the edges, or selvages, are being woven, forming a tube. If a few of the threads were at intervals interwoven from one surface to the other, the two cloths would then be bound together, and form one compact piece, and the spaces *a a*, Fig. 65, would not exist. Again, an entirely different set of weft threads may be inserted so as to fill the spaces *a a* to which the upper and lower surfaces of the cloth could be attached without the threads passing entirely through the cloth to the other side. Three varieties of weft may in this manner be used. The central weft thread is called the wadding, and cannot be observed on either surface of the cloth.

On referring to Figs. 49, 51, 53, and 57, it will be seen that there are two threads at each edge of the cloth which are intersected alternately, as in plain weaving, by the weft thread. Only two threads are shown, although in practice various numbers are used. If these selvage threads were not inserted the edges of the cloth would be very irregular, if the weft followed the course of the ordinary warp threads. This may be understood by referring to Fig. 59.

When four headles are used and only one at a time are raised, it is evident that the selvage threads cannot be raised alternately unless by some special contrivance. One of the various ways by which this is effected is shown in Figs. 66 and 67. It will be seen that each thread is passed through the eyes of leashes, viz., through the first and third or the second and fourth. The leashes shown are clasped, and in them an eye is dispensed with, consequently the warp thread can move freely from the clasp to the top shaft of the headle. By this means, if the threads are arranged as shown in Figs. 66 and 67, they will be raised alternately as in plain weaving, for the thread *a* is not only raised by the headle No. 1, but by No. 3 also. The thread *b* is likewise raised by the headles No. 2 and No. 4.

It is upon this principle that the ingenious con-