## WEAVING.—No. XIX.

### TISSUE WEAVING.

THE general principles upon which the harness or mounting of the loom is constructed for the formation of the figures upon the cloth having been shown in the two last articles, it is now necessary to describe how the same is employed when various colours of weft are to be used for the purpose of making the design to the best advantage, and with the greatest economy of materials to be used. For instance, if the warp and weft consist of materials alike in colour and texture then the figure would show in a manner similar to the appearance of the woven figures upon white linen tablecloths, not very distinct but still quite observable. If the warp be composed of a different material to the weft, then a much greater distinctness is produced, although both warp and weft may be alike in colour. This effect may be noticed in figured stuffs, which are composed of cotton warps and worsted weft. Again, if a different coloured warp and weft be used a far more distinct appearance will be produced, as shown in coloured tablecloths.

A great variety of effect may evidently be made by varying the colours of the warp itself, by arranging it in stripes, &c., as previously alluded to, but the best effect is produced by using various kinds of shuttles as will now be shown, when the advantages to be derived from their use will be apparent.

In Fig. 41 (see ENGINEERING, page 461, vol. xvii.) a loom with drop boxes for using two or more kinds of shuttles was shown for weaving plaids or other goods requiring two or more separate colours. In such cases each shuttle supplied a substantial portion of the thread or weft to form the cloth. Now in distinction to that class of weaving there is a widely different one, viz., where separate shuttles are employed to produce the figure upon the face of the cloth resembling embroidery, and the figure so produced has little or nothing, in its texture, to do in the forming of the substance of the cloth. In fact, so distinct are the threads kept that only just sufficient intersections are made to keep them held together. They float or flush upon the surface of the cloth rather than form a component part of its substance. It is known as tissue weaving, and the richest figured silks are produced by its means.

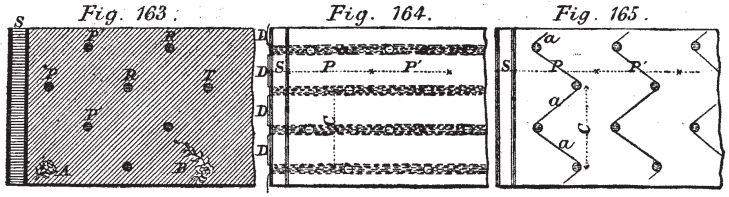
Let Fig. 163 represent a portion of figured silk such as made for scarves as before alluded to. Fig. 164 is the reverse side of the same cloth. It is supposed to have been woven by a Jacquard machine with 400 needles, such as we have already described, and composed of 400 warp threads per inch in width; thus the spaces P and P¹ are 2 in. wide each, for in consequence of the split harness being employed the 400 needle machine governs 800 threads or double the width of cloth, as before described.

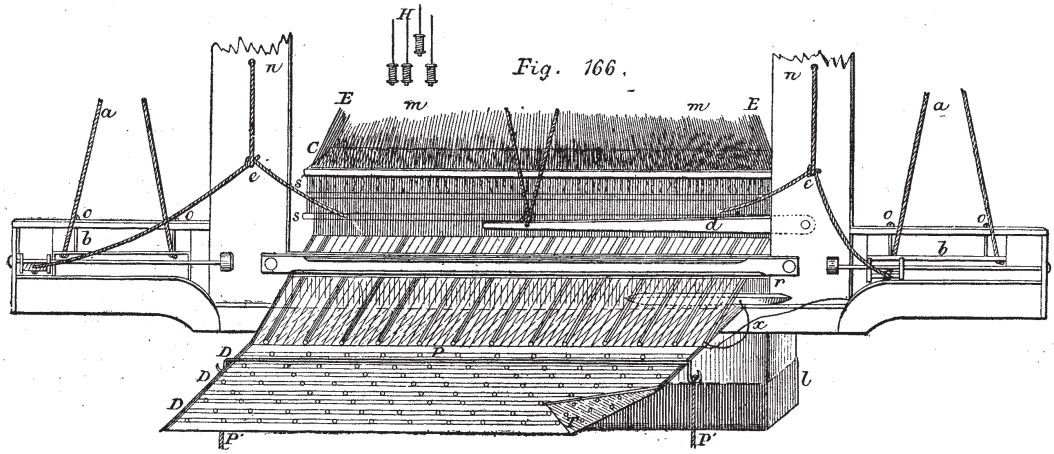
The face of the cloth Fig. 163 shows that the plain portion, or ground, is woven to form a twill, but any other ground, as described in the last article, may be substituted by altering the working of the harness shafts without affecting the figure itself.

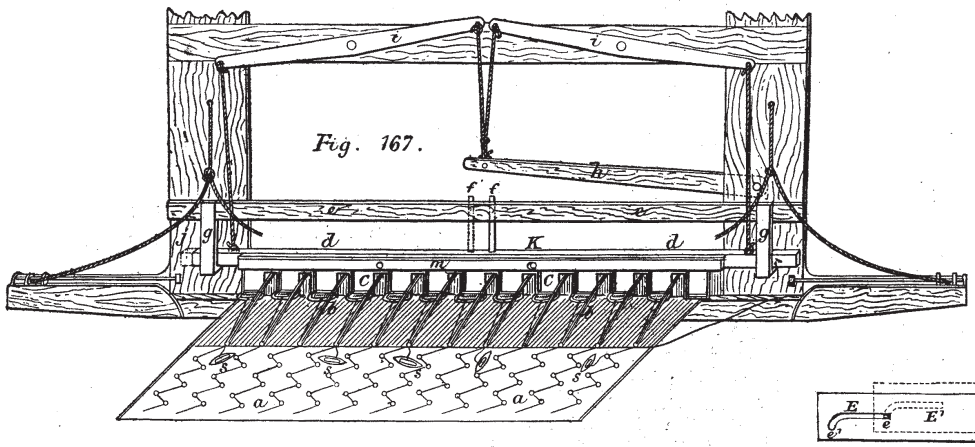
A simple circle or spot is the figure shown to be produced, but it may be designed as a flower as at A, or a running flower as at B. In either case the full width of the figure that could be woven would be equal to 2 in. or the spaces P and P¹, Fig. 164. The space C shows the extent or length of the pattern in this instance, which would take about 200 cards to produce. The threads D D are shown to run across the cloth with a broken appearance, which is to show that they intersect the body of the cloth at certain distances merely to bind them together, otherwise they would float perfectly loose and detached from the cloth in the spaces betwixt the spots. The thread D D is, therefore, the thread that forms the spots, and the shuttle which has inserted it is only used in the line of spots, as shown, and is merely inserted to throw upon the surface a different colour or material to that which forms the ground of the cloth.

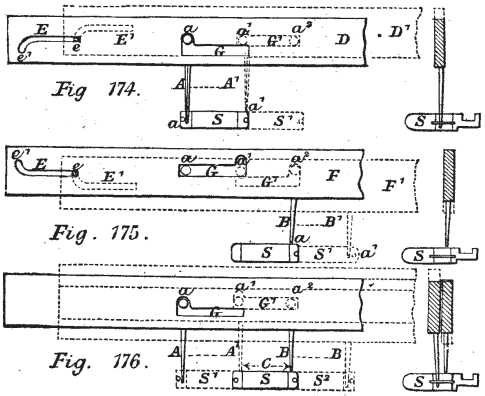
Now upon comparing Fig. 165 with Fig. 164, a marked difference appears. The thread which forms the figure, or spot, in this case, Fig. 165, simply runs from one spot to another, and only the single thread as shown at *a a* travels, and it is merely the length of that one thread that is lost or of no use in the body of the cloth.

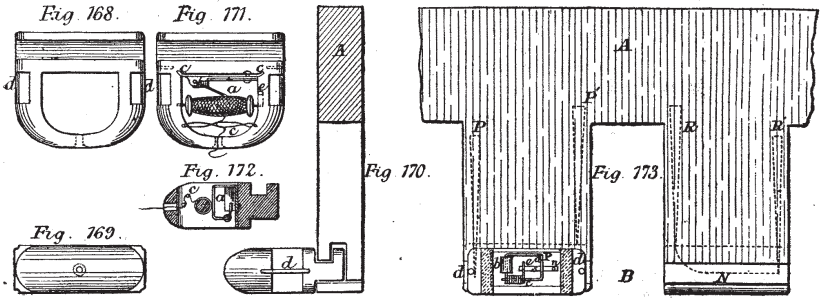
In Fig. 164, on the other hand, the floating threads



at *a a* have really been thrown away, for they are of no practical use. Thus, it will be evident, a considerable saving may be effected by adopting the plan of weaving shown at Fig. 165. It is effected by the use of separate shuttles for each line of spots, and the shuttles are only brought into use where the spots are required.

There are, consequently, two methods that can be used for flushing or throwing the thread to form the tissue figure, namely, by ordinary shuttles thrown across the whole width of the cloth, or small shuttles used at the requisite intervals.

The first of these methods may be distinctly understood by referring to Fig. 166, where the piece of cloth shown at Fig. 163 is represented as it would appear in the loom. The loom is provided with two shuttles, one of which, namely, that which inserts the thread to form the figure, is seen entering the shed at *r*, the ground shuttle being in the other or lower box, but the thread leading from it is seen at *x*.

The face or right side of the cloth is woven downwards, as shown at T, where the corner of the cloth is represented as turned over, and, as before explained, is woven in this manner for the purpose of raising only as few of the lingoes or weights *l* as possible at each shoot, which would otherwise have to be raised in case the cloth was woven with the face upwards. Therefore, where the spots are being formed more threads of the warp are raised, and the thread now inserted by the shuttle, as shown, will be more exposed, and appear distinctly on the underside of the cloth. Between each spot a few threads only are shown raised, and these threads are those, before alluded to, which are required only to bind slightly together the tissue shoot with the back face of the cloth.

In the same figure the lower portion of the Jacquard harness *m m* is shown, and the comber board C through which it passes. The strong cords E E are the cords which raise the shafts *s* of the split harness. One of the shafts $s^1$ is shown raised, and the slackening of the leashes by so raising them is also shown.

The ordinary drop boxes for two shuttles are shown at *b b*, which are raised by the lever *d*, according to the shuttle to be used. At H are shown several small bobbins with a little of the various colours of the weft that may be used, that is, when several kinds are employed. They are called tokens, and are raised by the Jacquard hooks attached so as to remind the weaver which shuttle to use. This plan is, however, only practised occasionally. At $P^1$ an iron bar termed a presser is shown. It is held downwards by means of the cords, shown also in Fig. 143. Temples are not required for this description of work, but a press bar cannot be dispensed with. The great number of 400 threads per inch passing between the reed are liable, when raised, to stick and not to fall back freely to their proper level. The bar has the effect of throwing sufficient strain upon them to prevent them sticking or remaining partially up, and thus allow the shuttle passing above instead of below them.

It is in this manner that rich figured silks are generally woven, and several shuttles may be used, and the figure may cover the whole surface of the cloth. But the use of smaller shuttles for the production of small figures or spots not only gives a better appearance to the figure by throwing it more prominently upon the surface of the cloth, but saves, as before observed, a considerable amount of the silk. Certainly, the amount saved is not altogether gained, for the weaver is paid considerably more wages for weaving with them, but the saving is still sufficient, besides the improvement in the appearance of the cloth, to induce manufacturers to adopt them whenever convenient.

Small shuttles are used in conjunction with the larger ones, and consist of three kinds:

1. Small shuttles, called swivels, fitted in a movable frame.
2. Small shuttles, called circles, fitted in a movable frame.
3. Small shuttles used separately by hand.

Fig. 167 represents an ordinary fly shuttle batten fitted with swivels and engaged in the same kind of work as that shown in Fig. 166.

The swivels are fitted into the frame *d d*, which is simply an addition to the common batten, and can be attached to any loom. It can be raised or lowered by the lever *k*, acting upon the two levers *i i*. Upon the frame *d d* are placed two slides *m*, into which are fixed pegs, and by sliding backwards and forwards these slides, by means of the knob *k*, the swivels are moved to and fro. In this instance the Jacquard having raised the threads to form the spot the swivel frame is lowered, and by moving the knob *k* to the right hand and then to the left, the swivels may be passed underneath the threads the requisite number of shoots until the figure is woven —the ground shuttle being used alternately for the formation of the ground of the cloth in this process as in the former.

On the surface of the cloth several detached small shuttles are shown. Now if it were desired to give better effect to the appearance of a figure, say the flower A, Fig. 163, by introducing only one intersection of a different colour, then it could be done by merely passing them through by hand as may be seen.

The frame *d d* is capable of being moved laterally as shown at *j*, and at *f* and $f^1$. By this means when the lateral alteration of the position of the figure takes place the swivel frame is moved so as to drop the swivels in the places or openings in the warp made for them. When the frame is so moved a spring locks the peg *f* fast until the next removal. No threads between the spot need be raised in this case for binding the tissue thread, as was shown in Fig. 166, for they are not required.

In Fig. 167 twelve swivels, or small shuttles, are shown fitted in the frame *d d* fixed to the front of the batten, which corresponds to the number of spots or figures to be woven in the width of the cloth. Fig. 168 represents a plan of one of the swivels, and Fig. 169 a front view, showing the eye through which the weft passes. In all shuttles the eye is formed of china ware, glass, or metal, and is fixed firmly into the box wood, which is the material generally used for shuttles. At A, Figs. 170 and 173, a portion of the plank or grooved wood, into which the swivels slide, is shown.

In the former figure an end view of the shuttle is seen with the groove and lip upon the plank and swivel. At *d* is a wire staple, seen also on both sides of the swivel in Figs. 168 and 171.

Now, on referring to Fig. 167 it will be evident that the swivel must slide freely under the raised threads, or across the space shown at B, Fig. 173, and it must pass without any obstruction or contact with the warp threads. This is effected in the following manner:

There are two sets of pegs fixed into two slides. One slide by means of the pegs—there being one peg for each swivel in each of the slides—advances or pushes the swivel across the gap or opening in the plank B, into which the warp threads are raised, and immediately it arrives at the opposite side it is caught by the peg in the other slide bar and drawn clearly through the opening. At P Fig. 173, is seen in dotted lines the position of the peg at the commencement of the movement, and at $P^1$ is shown the same peg in its position after it has advanced the swivel, so as to land it on the opposite side N. When it has reached that position the peg R descends behind the staple *d*, and draws the swivel completely across the opening, and of course into the same place as the swivel, which has last occupied that space, but which has been pushed further on. Thus, by the combined movement of pushing and drawing the swivel and raising and lowering the pegs, the operation of throwing the swivel, or shuttle, is not only effectually done, but it cannot stop in its course. If the movement were to be so imperfect as to cause any stoppage of the shuttle during its passage across the opening, it would often give rise to serious damage to the warp, for it would be "trapped," or stick between the threads, and on the next blow of the batten the threads would be cut or broken.

The slides into which the pegs are fixed are moved by means of a peg working into a groove formed into each of the slides. When one slide has been advanced to the appointed distance it is stopped, and thrown out of gear or contact at the same time the other slide has been held stationary, and then thrown into gear or contact.

This will be understood by referring to the diagrams Figs. 174, 175, and 176. Fig. 174 shows the first slide in elevation and section. D shows its position at the commencement of its motion, and $D^1$ in dotted lines, the termination of its motion. The peg *a* is shown working into the groove G, and is in the slot at the commencement of the groove. Now, on moving the peg from *a* to $a^1$ it will carry with it the bar D to that distance, but no further. The bar at this point rises, and the peg being released from the slot continues its course to the end of the groove G, and terminates its motion at $a^2$.

Fig. 175 represents the second bar which is placed behind the bar Fig 174, and it is made with the slots in a reversed position. Both bars are worked by the same peg *a* (seen also at K, Fig. 167), but are shown separately in Figs. 174 and 175, but in Fig. 176 they are shown in connexion. It will be evident that (see Fig. 175) when the peg *a* is moved from *a* to $a^1$, the bar F will remain stationary, for the peg is traversing the groove during that time, but when it arrives at $a^1$ the bar falls and the peg entering the slot carries the bar forward to $a^2$. The pin *a*, therefore, by being moved backwards and forwards causes the two bars to be moved as required for the movement of the shuttles, which is represented in all the Figs. 174 to 176 at S.

In Fig. 174 the peg A is shown to have moved the shuttles to the position $S^1$, and in Fig. 175 the shuttle is carried further on by the peg B to the position shown at $B^1$. The combined action of the pegs is seen in Fig. 176, where the shuttle is represented in the middle of its traverse, or at the point where the peg A has pushed it to, and the peg B commences its motion to draw it the remaining distance.

In Figs. 174 and 175 a peg *e* is shown working into the slot or groove E. There are two grooves in each bar, one at each end, but only one is shown in the diagram to avoid complexity. The groove in the bar F is curved in a reverse manner to the groove in the bar D. The purpose of the peg *e* and the grooves E is that they not only assist in raising and steadying the bars when moved by the peg *a*, but when each bar has traversed its allotted distance the pin *e* prevents the pin *a* from carrying the bar too far. This may be observed by referring to Fig. 174, where in moving the peg *a* to $a^1$ the slot E has advanced to $E^1$, and the peg *e* being stationary has prevented the bar being carried farther through, the slot $e^1$ having arrived at the pin. The slot being curved, of course corresponds with the motion of the traversing pin *a*, and assists in the vertical motions of the two bars.

The details of the swivel are shown in Figs. 171 to 173. Fig. 171 shows a plan of the swivel with the weft bobbin fixed in it, and Fig. 172 represents a section of the same. Both figures are of about two-thirds full size.

The bobbin is fitted upon a wire spindle one end of which is inserted into a hole and the other end into a slot or groove, shown by the dotted lines at *e*. The bobbin spindle is held sufficiently firm in the groove by means of the presser *a* which presses against the bobbin, and not only holds it in position but the friction caused by the pressure prevents the thread from being unwound too easily. Another view of the spring and presser is shown at Fig. 172; a thin brass plate which is firmly fixed into the back of the swivel by means of the ends being inserted into saw cuts, as shown at *c c*, Fig. 171. Upon the plate there is a boss (Fig. 172) through which a hole is drilled for inserting the presser *a*. The presser is formed by turning a spiral tube at one end of a fine wire, and after passing the long end through the boss in the form shown it is inserted into the wire tube to give the presser sufficient rigidity. The other or short end of the wire forms a stud, against which a thin flat spring *s*, which is rivetted at *n* to the brass plate, presses.

These pressers are of various forms, but the one shown, being easily made, can be repaired by the weaver when out of order, and well answers the purpose it is intended for.

At *c* Figs. 171 and 172 the weft thread is shown to pass between a loop made of horsehair, which is fastened to the shuttle through holes bored at the sides as shown.

The purpose for using the horsehair is of some importance, for it not only, by the slight friction it gives upon the weft thread, keeps it in position, but by the weft being properly inserted between the loops by slightly twisting the hair, as shown at *c* in Figs. 171 and 172, it has a tendency to take up or coil the slack of the weft. But this will be better understood when the details of the circles or modification of the swivel is shown, and which will be next described.