

WEAVING.—No. XVII.

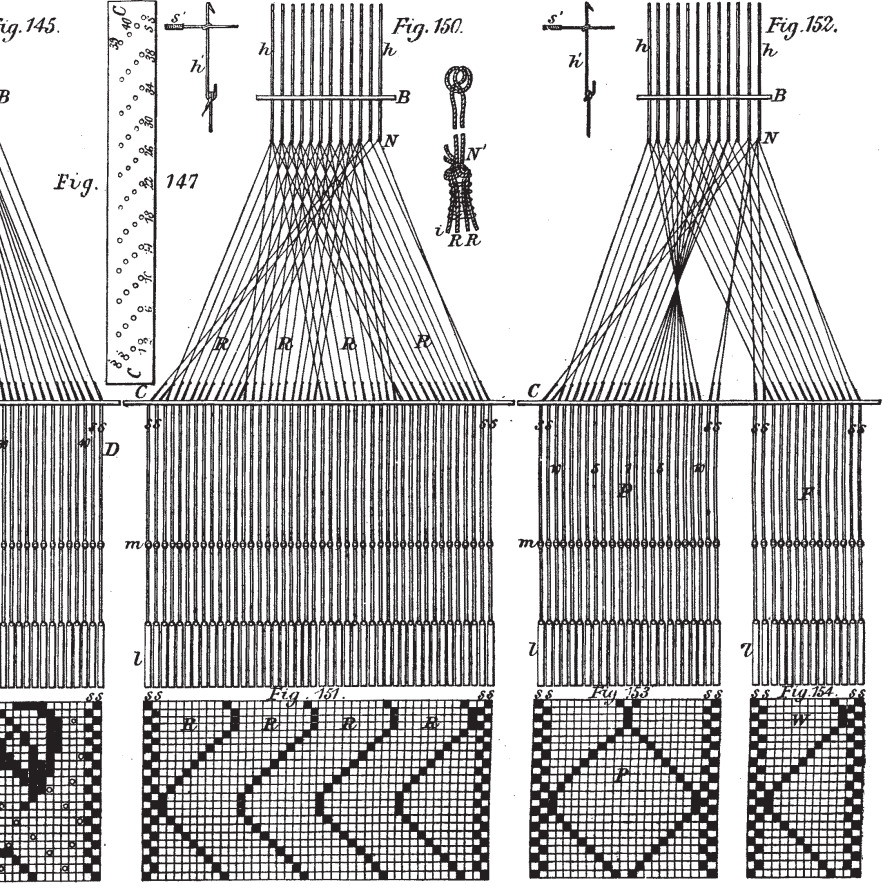
THE JACQUARD APPARATUS.

IN articles XV. and XVI. we have shown that the Jacquard machine is simply a frame containing a number of wire hooks, and these hooks can be raised in any required number or order corresponding to the warp threads to be raised for the passage of the shuttle and the formation of the patterns to be woven. For instance, when the selected hooks are raised, they also raise the warp threads to which they are connected, and after the shuttle has been thrown through the shed made thereby, the hooks are

24 in. to 36 in., but we will assume it, in this instance, to be of the narrower width. The number of warp threads vary considerably, but 400 threads per inch in width is a common number, and that would amount to a total number of 9600 threads—exclusive of the selvage—in the narrow width of 24 in.

If each of these threads was provided with a separate hook it would of course take 9600 hooks—a number quite unknown in practice. But whenever a loom is supplied with a separate hook for each warp thread it is the most perfect, and is capable of producing every form of design. In France, portraits rivalling fine engravings are frequently pro-

duced by such machines, and the well-known Coventry book-marks are woven in a similar manner. The loom is therefore comparatively perfect when each thread has a separate hook. But as this could scarcely be carried out in practice various means are adopted to make the loom as effectual as possible with the smallest number of hooks. The various ways of doing this may be divided as follows:



lowered to their former or normal position, and a fresh selection is made for the next throw of the shuttle. Thus the operation consists of two movements, viz., raising and then lowering the hooks. Now, if the machine be made so that one set, or selection, of threads are being raised at the same time that the last used selection were falling, then double the speed, as well as other advantages would be derived, and the apparatus would be more adapted for power-loom purposes. It is the attainment of that object that has given rise to far greater complication in the construction of the apparatus than in the common form already described, as will be hereafter shown.

Before the paper duty was taken off the cost of cards was far more severely felt than at the present time, and many attempts were made to substitute other materials and contrivances to avoid the expense. Bands of thin paper were tried, and several other methods, which we shall hereafter allude to, but at the present time, owing to the reduction of cost, it does not appear likely that any contrivance will supplant the ordinary cards, and these are used both in single and double-action machines with perfect success.

We purpose now to show the action of the common form of the machine, and the different ways it is applied, when the purpose of the various modifications above alluded to will be easily understood.

Fig. 143 (see ante page 24), as before mentioned, shows the common hand loom mounted with a 400-needle Jacquard, such as is generally used for the production of the rich figured silk used for gentlemen's scarves. The cloth is woven in widths from

1. A repetition of the same figure.
 2. A repetition, by reversing the figure, as in weaving the two opposite borders of the cloth.
 3. The use of compound harness as already described in Fig. 112 (see page 337 of our last volume).
 4. A modification of the compound harness called the "split harness."
 5. Various combinations of the above systems.

Now it will be evident that the most perfect loom—so far as its capability of weaving elaborate figures is concerned—is the most simple, for it merely consists in having a separate hook for every thread of the warp, and no complication exists such as is found in the systems above alluded to. But such looms are only adapted for special use, as above stated. Therefore the usual application of the Jacquard machine to the loom is by one or more of the systems mentioned, which we shall now endeavour to show in as simple a form as possible. We shall, therefore, only represent one row or line of hooks in each case, so as to avoid the complication that a representation of eight or twelve rows would give rise to. We shall, also, show the hooks in the most direct position to connect them with the warp threads. For instance, on referring to Fig. 143 it

will be seen that the Jacquard is placed with the cards hanging over the side of the loom, but in power looms the cards usually hang over the warp. These positions require a different method of connecting the leashes or cords from the hooks to the warp threads in order to bring them in consecutive order, and to make the arrangement as direct and free as possible. There are many ways of tying-up the harness to effect this, and different names are given to them, such as the "London tie-up" and the "Norwich tie," alluding to the places where they originated or were mostly in use. But whatever method may be adopted the most direct plan is

Fig. 144 represents an end elevation of a Jacquard machine and harness, and Fig. 145 is a front elevation of the same. It contains 40 hooks, and each hook is connected to one thread only of the warp, excepting the two hooks which are used for forming the selvages S S.

They rest upon the bottom board of the Jacquard B, which is the only portion of the machine necessary to be shown, and the leashes which are attached

to the hooks pass through the board to the comber-board C, where they are also passed through in the order required for the warp. The mails are shown at *m*, and the lingoos or weights at *l*. In Fig. 145 it will be seen at D D that the leashes descend in consecutive order, from 1 to 40, but the hooks *h h* being arranged in four rows, require some means to connect them in the most direct manner to suit the consecutive order arranged in the warp. In this instance the hooks are numbered, as shown, Fig. 146, which is a plan of the board B, upon which the hooks rest, and Fig. 147 is a plan of the comber C, through which the cords pass. Now, by comparing the figure 144 to 147, in which all the letters and figures refer to the same parts, the connexion of the hooks with the mails to govern the warp may be traced.

It follows, therefore, that if any of the hooks are raised they will also raise the corresponding warp threads, and the figure upon the cloth will be formed according. Fig. 149 shows a design or piece of cloth that could be woven by the harness—the black squares may represent the warp, and the white squares the weft—and by raising the hooks accordingly the cloth may be woven. The design shows the extent of 23 cards, and 13 warp threads are raised, as shown, exclusive of the selvages.

On the design will be noticed the small circles on the squares. These are merely placed instead of shading the squares, in order to show that these intersections are the necessary intersections called the "ground" to give firmness or bond to the cloth, and they are shown so as not to interfere with the rest of the figure. In this instance the intersections represent an ordinary eight-leaf satin ground, and the cards would require to be perforated for each of the intersections. A twill or satin ground of any other kind may be substituted, but fresh cards would have to be made or "cut." In compound harnesses the ground is formed by self acting means, as we shall presently show.

The selvaige cords are attached to the hooks S S, and these hooks are raised alternately, as may be observed at S S, Fig. 149, and form a plain or "tabby" selvaige. Only two threads are shown on each selvaige, but it will be apparent that any number may be used by simply attaching in proper order more leashes to the two hooks S S.

Fig. 148 shows on a larger scale one method of attachment of the mail to the leash, &c.

It will now be evident that when many thousands of warp threads are used that other means must be used than to provide a separate hook to each thread. In weaving figured stuff cloths, which have from 60 to 70 threads, and in many other fabrics, the harness of a number of threads is attached to each hook, and in this way the pattern is repeated six or eight times across the surface of the cloth. Fig. 150 shows a harness of this kind, in which ten hooks are used, and where the pattern is repeated four times. R R R R, and Fig. 151 shows its effect upon the cloth, for whatever figure is formed upon the cards it would be repeated four times on the cloth.

In this instance we have only shown one row of hooks *h h*, an end elevation of which is shown at *h'*. The leashes R R are attached to the neck cords as shown enlarged at N', where it will be seen that the leashes R R are stitched together in a flat form, to allow of their being raised without obstruction from the adjoining necks. The selvages are formed in a similar manner as in Fig. 145.

Fig. 152 shows what is known as a point harness, and consists in twisting or reversing the leashes in such a manner that any design consisting of two similar parts, such as a diamond or square figure of a shawl, may be woven by merely cutting half of the design or one border upon the cards. This will be understood by reference to Fig. 153 at P, which shows the effect the point harness would have upon the design, shown at Fig. 151. In this arrangement it will be noticed that all the hooks have two cords each, except that which governs the centre or point leash, which is a single leash to which the others converge.

At F Fig. 152 it is shown that the same hooks may be attached to a separate warp or piece of cloth, and it is in this mode of separation that ribbons, &c., are woven, or where narrow figured stripes are interwoven with plain weaving. Thus the effect from one set of hooks, Fig. 152, is shown at Figs. 153 and 154.

In the next article we intend showing the compound harness, in which the extent or power of the Jacquard is greatly extended.