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 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 this 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 end page 34), 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 24 in. to 25 in., but we will assume it, in this instance, to be of the narrower width. The number of warp threads vary considerably, but 600 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 rivaling fine engravings are frequently produced 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:

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 always attempted, and tying up the harness—or "building the monture" (mounting of the loom)—often gives rise to a considerable amount of ingenuity on the part of the designer and weaver for the perforations of the cards must follow in consecutive order the tying-up of the harness, and sometimes this order runs longitudinally—row after row—upon the cards, and sometimes vertically. This, however, in no way affects the principles upon which the warp depends, although it is necessary that it should be stated here before showing the action of it in detail. The harness used in silk weaving is made of fine specially made thread, and soap-stone or French chalk is sometimes used to prevent the friction of the threads from wearing them away, and at the same time to prevent them sticking together, and causing defects in the weaving. Strong thread is used in power looms, and it is usually dressed so as to resemble worsted. This is effected by dressing or soaking it, the principal ingredient being linseed oil, talc, and beeswax, with other things, according to the experience of the harness builder. When so prepared a harness will last for several years, and wear exceedingly smooth.

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. 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 comb- 
board C, where they are also passed through in 
the order required for the warp. The mails are shown 
at a, and the lingoess or weights at b. In Fig. 140 
it will be seen at D D that the lantoes descend in 
consecutive order, from 1 to 40, but the hooks a a 
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 in-
stance 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 comb 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 
rised they will also raise the corresponding warp 
threads, and the figure upon the cloth will be formed 
according. Fig. 148 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 ac-
cordingly the cloth may be woven. The design 
shows the extent of 28 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 rep- 
sent 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 selvage 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" selvage. Only two threads are shown on 
each selvage, 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 leas, &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 stuffs, 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 a a, an end elevation of which is shown at A.
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 de-
sign, 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 A 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 inter-
woven 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 com-
pound harness, in which the extent or power of the 
Jacquard is greatly extended.