

HAND-LOOM WEAVING; RIBBON LOOMS.

(For Description, see opposite Page.)

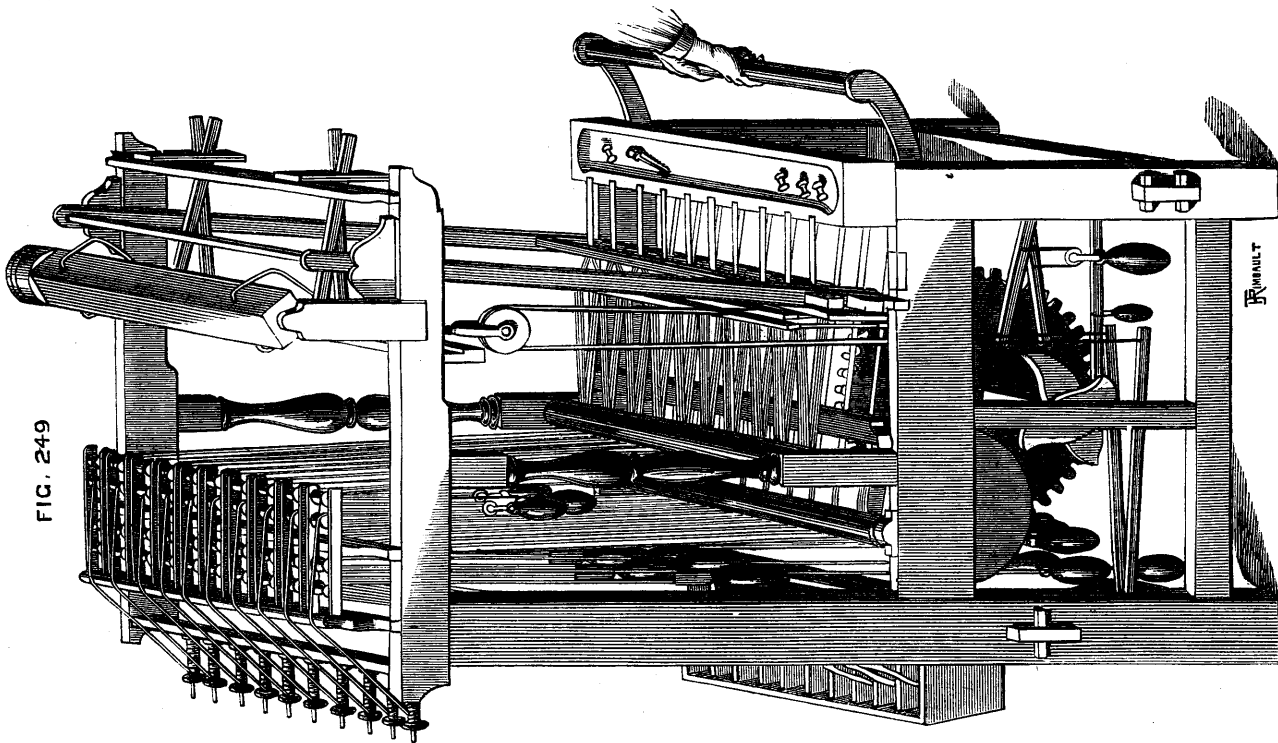


FIG. 249

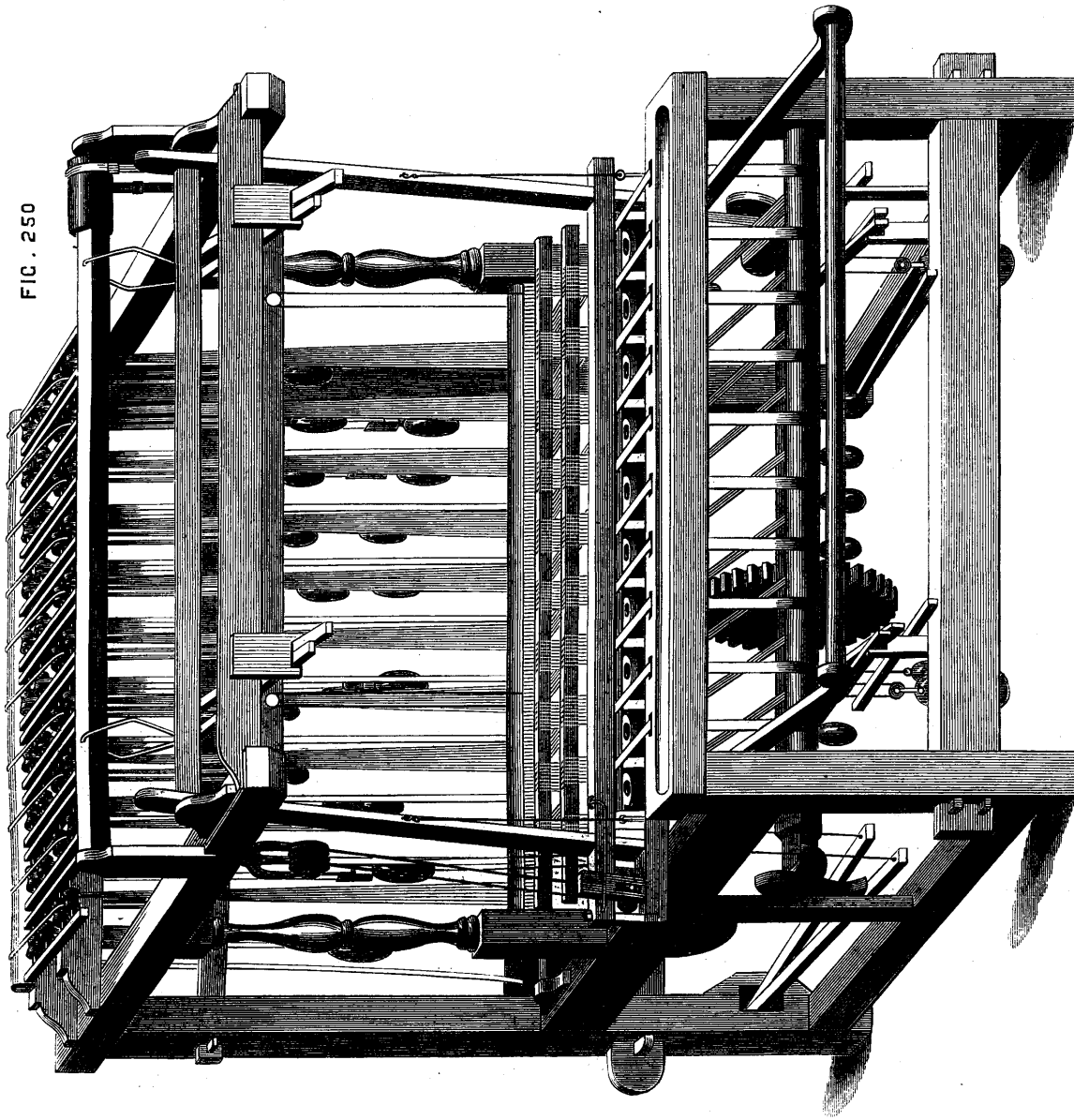


FIG. 250

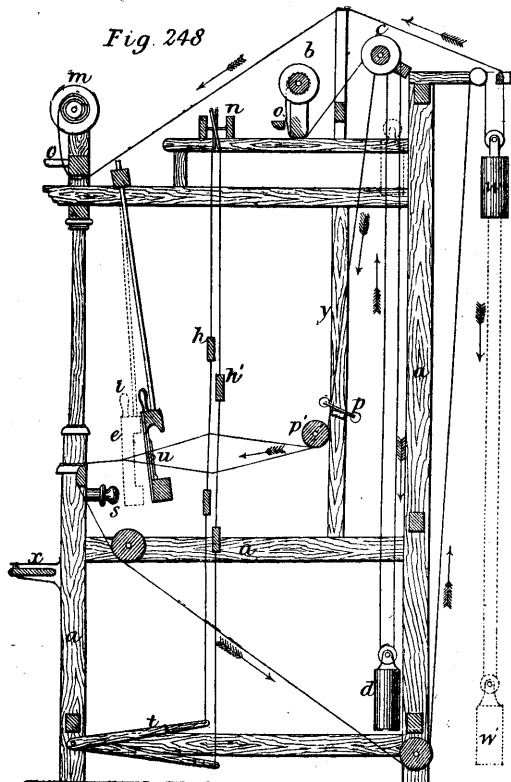
WEAVING.—No. XXIV.

THE RIBBON LOOM.

THE common hand loom for weaving ribbons was formerly known as the Dutch engine loom, and it was also called the swivel loom. Before it was invented ribbons were woven in small looms, and only one ribbon was woven at once. But by means of the swivel loom from 8 to 10 or 30 to 40 ribbons, according to their width, could be woven, consequently it was an invention of great importance, and its introduction caused a considerable amount of trouble as will be presently seen.

More than a century ago, and long before Dr. Cartwright's time, the swivel loom had been made self-acting, for all the principal operations of the loom were made automatic. The shedding of the warp, throwing the shuttle, and beating the weft together were effectually accomplished by means of cranks, tappets, &c., almost in the same manner as used at the present time.

These improvements appear to have been carried



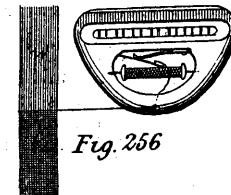
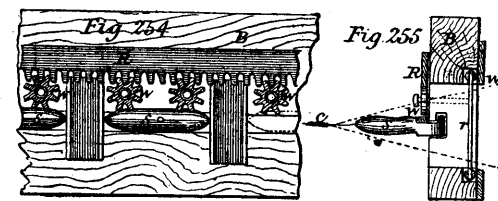
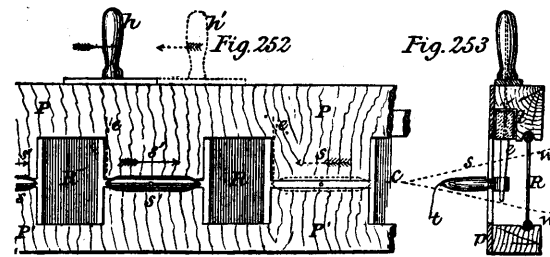
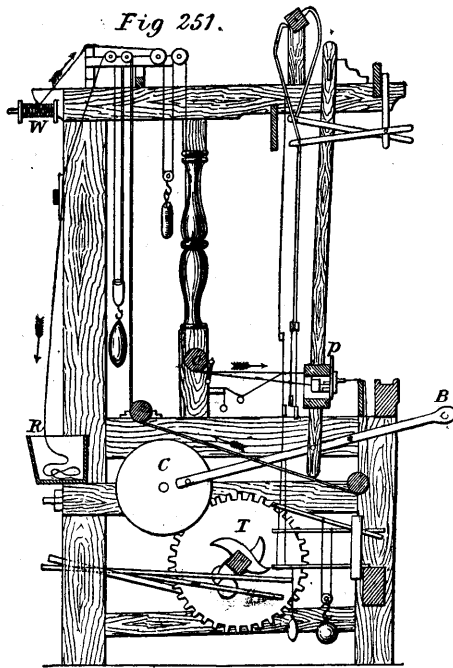
it is probable the ribbon loom had its rise in the Netherlands or Germany, either about the end of the 16th or the beginning of the 17th century, although Mr. Jacobson believes the Swiss invented such looms. The oldest account with which he was acquainted seems to be in favour of Germany and the 16th century."

Lancellotti, in a work published at Venice in 1636, says: "Anthony Moller, of Dantzic, relates that he saw in that city about fifty years before a very ingenious machine, on which from four to six pieces could be wove at the same time; but as the council were afraid that by this invention a great many workmen might be reduced to beggary they suppressed it, and caused the inventor to be privately strangled or drowned. Who this Anthony Moller was I do not know; but that he saw a ribbon loom at Dantzic is beyond all doubt. If the date of the printing of the book be taken as the time in which Lancellotti wrote, there is reason to believe that there was a ribbon loom at Dantzic about 1586;

use for several years to the great injury and even total ruin of many thousands of workmen who were accustomed to weave ribbons on the common loom. This prohibition was renewed in 1639 and again in 1648, as appears in the same work. In 1661 the use of them was extended a little longer and defined with more precision. They were prohibited in Nuremberg in 1664, also in the Spanish Netherlands in the same year.

In the year 1665 there was to be seen at Frankfort-on-the-Maine a loom which of itself wove all kinds of lace, tape, &c., provided the silk or yarn was properly arranged in the usual manner; but if a thread happened to break it was necessary that some one should again join it by means of a knot. The year following some person in that city applied, not only to the council, but even to the emperor, for permission to establish such a loom, but was not able to obtain it.

In 1676 the ribbon loom was prohibited at Cologne, and the same year some disturbance took



out both in France and England, at about the same time. They really formed the first successful application of power to work the loom instead of the usual operations of the weaver. In fact, the history of the swivel loom, and the application of the bar, &c., to it, is the history of the first successful attempts at power-loom weaving, and on that account it deserves more than usual attention.

The "bar" loom, or the "a la bar" as weavers often call it, was introduced in the following manner, according to the evidence of Dr. Bowring before a select committee on the silk trade in 1831-1832. The question asked was, "Whether the bar loom had been introduced subsequently to the Jacquard loom, and if its introduction had met with similar difficulties?" His reply was: "Yes; that it was a Swiss invention, and it was taken into the neighbourhood of St. Etienne by two brothers who were themselves persecuted and abandoned to extreme misery; the last of them died not long ago, in a hospital, in consequence of the obloquy and neglect to which he was subjected. Since then the use of the bar loom has become nearly universal in the immediate neighbourhood of St. Etienne."

According to this evidence the loom was introduced in the early part of the present century, or since the introduction of the Jacquard loom. But both of the great French Encyclopædias, Diderot and D'Alembert's, and the "Encyclopædia Methodique," give detail drawings of the loom thirty years before that time. Therefore Sir John (then Dr. Bowring) must have been misinformed on the subject.

It will be preferable to give the history of the Dutch loom first, and then refer to what is known concerning the improvements made in it. For this purpose Beckmann's account is more than usually clear and interesting, from which it appears "that

but it appears to me that the book was written in 1629, which would bring us to the year 1579."

"The next oldest information," continues Beckmann, "with which I am acquainted is that given by Boxhorn, who says, 'about twenty years ago some persons in this city (Leyden) invented a weaving machine, on which one workman could with ease make more cloth than several others in the same space of time. This gave rise to rioting amongst the weavers, and to such loud complaints that the use of the machine was at length prohibited by the magistrates.' According to this account Leyden was the place of its invention; but in order to determine the time it will be necessary to attend to the following circumstance. Boxhorn's "Institutiones Politicæ" have been often printed. He gave lectures on the subject, and gave verbal illustrations of it to his scholars, one of whom in 1641 carried a fairly written copy of the work to Germany, and gave it to Professor C. F. Frankenstein, who caused them to be printed for the first time at Leipsic in 1658 and again in 1665." In the passage above quoted are to be found the illustrations, Figs. 249, 250, and 251, which are appended. Hence there is reason to conclude that the ribbon loom was known in Holland about 1621.

It is some confirmation of Boxhorn's account that the States General as early as the 11th of August, 1623, if they did not totally prohibit the use of the ribbon loom as commonly asserted, at any rate greatly circumscribed it. The proclamation for that purpose may be found in the Groot Placaet Boeck, a valuable collection published at the Hague, in seven large volumes, between the years 1658 and 1746. Nothing further, however, is found there respecting the history of ribbon looms—which are called "lint-molens"—than that they had been in

place in consequence of its being introduced into England. It is probable that Anderson ("History of Commerce") alludes to this loom when he says, speaking of the above year, "As was also brought from Holland to London the weaver's loom engine, then called the Dutch loom engine." He, however, praises the machine without describing it, nor does he mention that it occasioned any commotion.

In 1681 it was declared by imperial authority that the prohibition of ribbon looms was both useful and necessary. This was followed in 1685 by an Act of the Council of Frankfort. The Council of Hamburg it is said ordered a loom to be publicly burnt, and Charles VI. ordered the prohibition of 1685 to be renewed in 1719, though some mercantile people strongly opposed the measure. In 1720 the Electorate of Saxony issued a general prohibition, but all these coercive means were ineffectual, and the ribbon loom being found useful has become common. Saxony revoked its prohibition in 1765.

The first account of any improvements in the swivel loom is given in the specification of a patent granted to John Kay and John Stell in 1745. It is the same Kay who invented the fly shuttle, and as this patent contains perhaps the first description of tappets, &c., applied to a loom which would be likely to meet with success, it can scarcely be omitted here, although it is unfortunate that no drawings accompany the specification.

The patent is dated 1745, No. 612, for a loom for weaving tapes, and it is in the names of John Kay, of Bury, Lancashire, and John Stell, of Keighley, York. It says:

"The new invention to be added to the Dutch engine or loom now used for working the before-mentioned goods in narrow breadths is by fixing in the lower part of the said engine or loom a rowler

beam, or round piece of timber, that passes through the length of the said engine or loom, and turns round upon its axis at each end, and at a certain distance from one end of the said rowler or beam is fixed a pin made of wood or iron, the said rowler or beam being in part enclosed in a second or other hollow rowler, which moves or slides in a loose position upon the first mentioned rowler or beam, and is at pleasure fixed to the first by means of a notch that receives the aforesaid pin, and is by a tender or handle capable of being moved to and again, or to the right hand and left; which motion, the first rowler or beam being supposed to turn round, sets the said engine or loom to work or stoppeth it at pleasure.

"There are likewise fixed in the sliding beam or hollow rowler at proper distances sundry tappets, which, when the said two rowlers or beams turn round, perform the office of treading the necessary treadles, and moves the battin or lath, and by the help of the other piece of timber or part of the machine fixed upon the aforesaid battin or lath, in the form of the letter T or angle, which plays upon an axis at the centre of the top or head, and by two treadles annexed to the extremity of each uppermost angle, the aforesaid tappets laying hold and treading down the treadles aforesaid, and throws over the shuttles to the right hand and left by means of the lowermost or third angle being annexed to a certain part of the said engine or loom, called a driver, and is further assisted by a balance or weight, and the batten being struck to the piece or web by a weight and spring closeth the shoot and completes the work, and the said engine may go or be worked by hands, water, or any other force."

In 1760 Joseph Stell obtained another patent, No. 753, for "weaving figured and flowered silk ribbons, and other sorts of figured goods made in narrow widths, so as to work a great number at one time." He then proceeds to describe the application of jacks, tumblers, cranks, tappets, and one or two draw-boys to form the figure. There are no drawings to this specification either.

The next account of the swivel loom appears in Diderot and D'Alembert's Encyclopædia, 1762, which contains excellent engravings of the loom, also of the "bar" loom. In 1786 the "Encyclopædia Méthodique" contains additions to the above, and the "bar" loom is represented with the weaver working it (see Fig. 249 page 465.)

Mr. Baines in his "History of the Cotton Manufacture," states that "about the middle of the eighteenth century a swivel loom was invented by M. Vaucanson, and in 1765, a weaving factory, probably filled with those looms, was erected by Mr. Gartside at Manchester, but no advantage was realised, as a man was required to attend to each loom."

Now it is stated in Kay and Stell's patent that the loom may be worked by "hands, water, or any other force," in short a power loom, and as Kay was at that time well known throughout the manufacturing districts of Lancashire and Yorkshire, it may be possible that the looms Mr. Gartside used were of Kay's invention and not Vaucanson's loom. Kay's specification does not mention the application of the "bar," and it was probably intended to be worked by a handle or pulley. On the other hand it is very likely that Vaucanson invented the "bar," which is simply an extension of the two crank arms to which a cross bar was connected, by means of which the weaver turned the crankshaft of the loom, and at the same time he probably invented the wheel and rack motion for the shuttles, the principle of which is still in use.

The bar loom was lately, and perhaps is at the present time, in extensive use, and it can, as before stated, scarcely be considered in any other light than the first successful power or automatic loom.

The frames of the most improved ribbon looms of the present day are still arranged upon the plan of the old Dutch engine or swivel loom. The shuttles are driven, however, by the wheel and rack, and not by the driver as before Vaucanson's time. The more recent improvements in the loom have been the application of the Jacquard machine and the employment of several tiers of shuttles for using various colours of weft. Other minor improvements have been made, but they in no way affect the principle of the loom. The most important of them was perhaps the invention of the double peg slides to draw the shuttles through instead of being jerked through by the driver, as in the old Dutch loom. This peg motion is a cheap and effectual motion, but cannot be applied when several tiers of shuttles are used.

The principle of the peg motion has been shown at Figs. 167 to 176 (*vide* page 219 *ante*), where swivels exactly the same as in the ribbon loom have been applied to the broad loom for the weaving of the spots on the cloth, which is in every way similar in effect to weaving separate ribbons, except that they are woven in with the body of the cloth.

A section of a common swivel loom is represented in Fig. 248, page 465, which probably differs very little from the original invention. A number of ribbons, say from 10 to 30, may be woven at once according to the length of the shuttles used, but loom being shown in section only one ribbon is seen.

The loom is provided with as many reels or small warp beams as there are pieces of ribbons to be woven, also with a similar number of cloth beams upon which the ribbons are wound as they are woven. If this were not the case every piece must be supplied with weft at every throw of the shuttles, and should one of the pieces fail to receive any weft there would be great difficulty in turning back so as to keep all the pieces alike. In weaving plain ribbons the weft may be broken and pieced again at any interval, for the ribbon does not travel unless the weft is supplied. The reed in beating up the weft actually pushes forward the ribbon as it is woven, each beat of the batten pushing the ribbon according to the thickness of the weft, and the tension there is upon the warp and cloth beams.

In the figure let *b* represent one of the warp reels from which the warp for one piece of ribbon passes over the pulley *c* and downwards to the weight *d*, which has a pulley under which the warp passes, and then continues its course over a second pulley at *e*, thence under cylinder or beam at *p*, and through the headles *h*' and *h* and the reed *w*. After it is woven it returns under the loom in the direction of the arrows, and under another weight *w* and is finally wound on the reel *m*.

Now if both the weights *d* and *w* be equal it follows that the blow of the reed will beat the cloth up with a force equal to the friction to be overcome, caused by the silk passing under and over the various pulleys and rails, and as the weight *d* rises the weight *w* falls, carrying with it the ribbon as it is woven. Thus by altering the relative proportion of the weights more or less tension can be put upon the cloth, and the ribbon may be woven with more or less compactness in consequence.

When the weights have arrived at their full extent of motion they are replaced in their former position by slackening out more warp and winding up the woven ribbon. Small wedges or other contrivances are used at *o o* to hold the warp and cloth firmly during the process of weaving.

The weaving is performed by means of headles and treadles in the usual way, but in this loom the weaver can arrange or dress his warp to a certain extent without leaving the front of the loom, for the warp passes through a small reed or comb *p*, and by moving it upwards at *g* the threads can be placed in proper order.

The shuttles, or swivels, are arranged in a batten and slide between two flat plates or "planks." They are "jerked" across the opening and consequently through the shed, from side to side alternately. Each shuttle alternately occupies the place of the adjoining shuttle.

Fig. 252 shows a portion of the batten in front elevation, and Fig. 253 shows a corresponding section. The warp *w* passes through the reed *R* to the cloth *c*. The shuttles *s s* slide in the openings formed by the planks *P P* and *P' P'*, and are thrown across the openings by means of the driver *d*, which is a bar of wood in which pegs *eee* are fixed to strike the shuttles from side to side. The driver is moved by means of the handle *h* which is shown in dotted lines at *h'* at the extent of its motion.

Figs. 254 to 256 show the method of throwing the swivels by means of the rack and wheel motion. This motion seems to have been invented in France about the middle of the last century, as before stated.

The shuttles *s s* have a small rack inserted, and they are geared in the star wheels *w w*. These wheels are worked by the rack *R*, and as this rack works all the wheels by its alternate motion (see Fig. 177), the shuttles are thrown from side to side of the openings through the warp *w*. The advantage of this motion is that the shuttles are forced completely and surely through the shed, and are not liable to stop half way as when driven by the driver used in the Dutch loom.

Fig. 256, page 465, shows a plan of a shuttle as

originally used in the rack and wheel motion, which is still the most important method used at the present time in ribbon looms although modified in certain ways, as we may hereafter show.

The bar loom shown in Figs. 250 and 251 is worked by hand by means of the handle or bar *B*, which is connected to the extensions of the connecting rods working on the crankshaft *C*. This crankshaft works the tappet shaft *T*, which is named from the circumstance that the various tappets or cams for opening the sheds and driving the shuttle are worked by it. In other respects the loom is similar to the Dutch, although the passage of the warp and ribbon is modified to a certain extent, as shown.