WEAVING.—No. XXI.

CROSS WEAVING.

Previous to the successful application of Jacquard apparatus to lace machinery, gauze and net weaving was much practised, but at the present time that class of weaving is but rarely used. Still, although it has been almost superseded, there are circumstances which occasionally arise when it is capable of being used to great advantage, and when employed as a ground for figured weaving very beautiful fabrics can be produced, and it may at any time be brought again into use.

There is one purpose, however, where it is of peculiar value, and if it were for that purpose alone it would be of quite sufficient importance to claim attention to it. It frequently happens that cloth of various descriptions is woven in wide pieces and afterwards cut into narrow pieces. Now if no precaution be taken in the weaving the selvages of the piece that has been cut would rove or become unwoven, and it has been frequently a matter of great importance to prevent it from doing so. Brunel (Sir M. I.), so far back as 1802 took out a patent, No. 2663, for weaving narrow fabrics by cutting wide widths, in which he says, "but in all cases adopted to prevent its ravelling out in washing, and of any breadth not exceeding 10 inches." As no drawing accompanies the specification, the description is not very clear, but it does not appear that cross weaving, or gauze, was used as at the present time.

Cross weaving, as its name implies, enables the weaver to twist the warp threads more or less around each other, after the manner of lace, but more limited in extent.

Fig. 197 represents four kinds of gauze. The warp threads of the first are marked *a* and *c*. The threads *a a* will be observed to twist alternately from one side of the threads *c c* to the other, and at each crossing they are held in position by means of the weft threads *w w* which intersect them at the crossings.

In the second example the same process is gone through, but with this difference, every alternate thread twists the reverse way. This, however, is merely a matter of arranging the harness. The third shows the thread *a a* exactly the same as in the first, but in this case instead of its twisting around one thread only it twists round three, as will be seen on referring to the figure.

Now in each of the cases shown the cross thread, or "whip" as it is called, merely twists half round the adjoining thread or threads, and not a whole turn. But in the first example the threads are shown to make a complete turn or twist round each other, and are held in that position by the weft threads *w w* as in the former instances.

The principle upon which the cross or twist depends will be best shown by means of the diagrams, Figs. 198, 199, and 200. The numbers and letters refer to the same parts in each figure.

In Fig. 198 six warp threads only are shown numbered 1 to 6. The threads 1, 3, 5 are passed through mails in the leashes of the headle H, and thence through loops called "doups" fixed to a headle, as shown at D. These doups will be noticed to pass beneath the threads 2, 4, 6.

The warp threads pass forward through the reed R, and thence to the cloth beam, which, however, it is not necessary to show. By this arrangement the threads 1, 3, 5 are passed through two eyes, but the threads 2, 4, 6 are passed through none whatever, and are merely held in position by the lease or cross *e e* and the reed R.

Fig. 198 shows the warp at rest, or in its normal position. Fig. 199 shows the headle H raised, and the weft thread *b* passed through the shed formed by the headle. Fig. 200 shows the headle H lowered to its first position and the doup headle raised.

Now it will be observed in Fig. 200 that the doups have drawn the threads 1, 3, 5 underneath the adjoining threads 2, 4, 6, and consequently effect a half twisting of the threads, as may be seen at *c*. This, therefore, is the simple process of cross weaving, and we have now to follow it through various modifications, but still dependent upon the principle shown.

Figs. 201, 202, and 203 show how the threads are made to twist completely, or a whole turn, round each other. It is effected by carrying the doup not only under the thread 1, but over it, and then to clip the thread 2. In this case beads are shown at *b*, in each of the figures through which the warp and doup threads pass. But beads are not used now, having been dispensed with many years ago. Still,

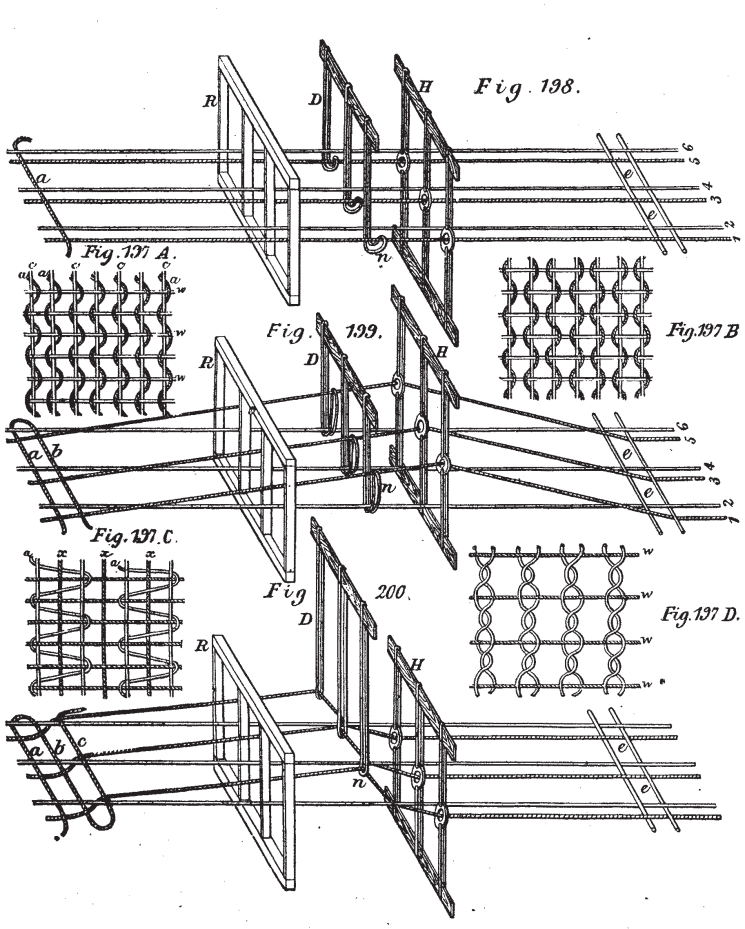
they had certain advantages, and it may be as well not to omit showing them in this instance, although the complete twisting of the thread as shown can be effected just the same without the beads on the doups.

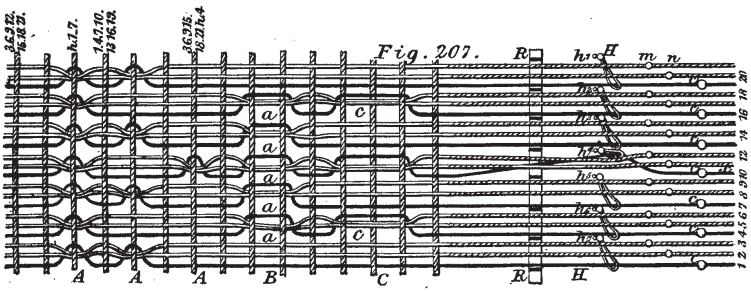
As in the case of the half twisting of the threads last shown the complete twisting is accomplished by first raising the headle S and then the doup headle *d*, and the twisting so effected is held in position by the weft thread shown at *a* a^1 and *c*.

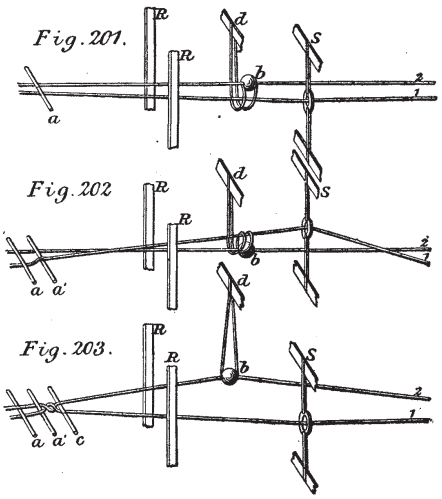
have no strain or tension upon them similar to an ordinary headle, which is provided with a shaft at the bottom as well as the top of the leashes. Certainly when beads were used they gave a slight amount of tension to the doups, but to overcome the difficulty in order to work the loom as fast as this kind of weaving will allow, a plan is adopted of using an additional headle merely for the purpose of supporting and guiding the doup leash, and has nothing to do with the twisting of threads. Let Fig. 204

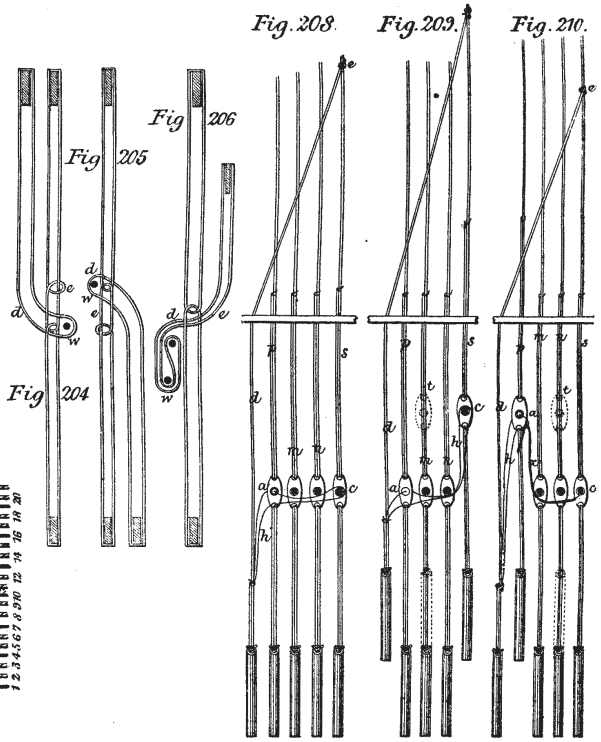
doup, or any assortment of them, or the whole of them, may be brought into use whenever required, otherwise figured gauze could not be produced.

In Fig. 206 the doup leash *e* does not clasp the eye at *a*, as in Figs. 204 and 205, consequently should the warp thread break to which it is connected, the doup would become loose from the standard, and would have to be replaced. This, however, was the plan used before the method of clasping them was adopted.









In this instance both warp threads pass through an eye each, and not as in the former instance. RR represents two of the dents of the reed, and it may be here noticed that all such threads in gauze weaving intended to cross each other must pass through the same opening in the reed, otherwise they could not be twisted. The distance between the dent or teeth of the reed in practice may be one-thirty-fifth or one-fourtieth of an inch only, although we are compelled to show them many times that distance apart. Therefore, when it is remembered that the threads lie so near together, the working of the doup leash will be better understood.

But notwithstanding the apparent simplicity of the operation of gauze weaving, as above represented, there would be found in practice a difficulty in keeping the doups in order, for, as shown, they hang loosely from the headle, shaft, or lath, and

represent an ordinary headle with eye at *e*. Then the doup leash *d* is shown to pass through the eye in such a manner that it cannot be separated from the headle. Now the warp thread *w*, shown in section, is held by the doup against the side of the eye, but the doup cannot draw the thread any further, although the warp thread, when the doup is slackened, may be moved to some distance from the eye. Fig. 205 shows a set of doups attached to the lower shafts of the loom, so that rising and falling sheds may be used as in plain weaving. Fig. 206 represents the doup for effecting a complete twist to the warp threads when attached to a clasp leash. In each instance the doups are arranged upon a shaft, and it follows that the whole of them must work at one time, consequently nothing but plain gauze either in continuous or broken lengths could be woven, but in weaving gauze in connexion with figured work, it is necessary that any single

By describing how this is accomplished in the Jacquard loom, the principle of the action of Figs. 204 to 206 may be easily understood, for gauze work is accomplished in the Jacquard in a peculiarly simple and ingenious manner.

Fig. 207 may represent a plan of a portion of gauze as it would appear in the loom. At A B and C three different kinds of twisting are shown. In the first instance the whip thread is twisted half round the two adjoining threads and only one shoot of the weft is made. At B the whip thread is retained in its position while two shoots of weft are inserted, and at C three shoots are passed through before the whip thread returns to its normal position.

Now to use twistings as at A in connexion with fine silk weaving would be almost impossible, for there would be no room for the threads, consequently spaces such as at B and C are used. It does not follow, also, that the whip thread should pass

under one thread only, but two, four, or six threads may be used, and the whip thread itself may be composed of two threads. But in the figure we have assumed that there is only one whip thread to two warp threads.

Figs. 208, 209, and 210 represent a diagram of a front elevation of the harness shown on plan at H H, Fig. 207 and Fig. 211 represents a side elevation of the same. In all five figures the same numbers and letters refer to the same parts.

Fig. 208 represents two ordinary Jacquard leashes with mails and warp threads, &c., and a is one of a similar kind, but being connected with the doup h, which is the whip thread which is to be twisted round the others by means of the doup h.

The doup is attached to a "dead" leash d as shown, and this dead leash is attached to a whip leash at e. This whip leash is called the "standard," and the whip thread not only passes through the mail or eye in it at c, but through the doup also. See Fig. 211.

The leash p corresponds to the additional headle previously alluded to, to support the doups, and it will be seen in the figures that the doups pass through the mail in a similar manner to that described in Figs. 204 and 205.

Now Fig. 208 shows the three warp threads in their normal position, governed by the leashes m n and s. These leashes can be raised in any order required for plain or figured weaving; but whenever the leash p is raised, it draws with it the whip thread as shown at x Fig. 210.

The mails a and c are employed much closer together than we show them, consequently the effect of the dead leash d is not so apparent. But it will be seen that it effectually holds the doup in position, and by being connected to the standard leash at e whenever the standard is raised, the dead leash is raised also, otherwise the whip thread would be strained by the tension of the doup. See Fig. 209.

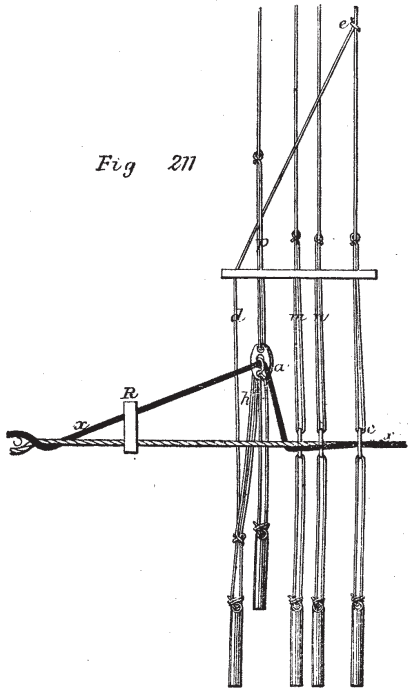
In plan 207 the warp threads are numbered in consecutive order from 1 to 21, every third thread being a whip thread, and is passed first through the mails c c, and thence through the doups h^{1-7}. The doup h^4 is shown drawing with it the whip thread underneath the threads 11 and 12 represented also at Fig. 211, by which means a gauze spot is formed. Now, by referring to the numbers at the margin of the cloth they show the numbers of those warp threads, &c., that have been raised to produce the effect. For instance, at h^{1-7} means that the mails h^{1-7} have been raised to form the twistings or gauze spots shown at that position.

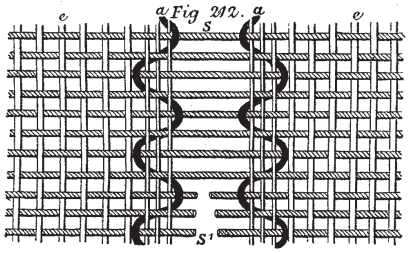
The diagrams will better explain the process than any written description, especially as each motion has been represented in them. It may be mentioned that the reed R R, Fig. 207, shows the set of three threads passing through each space, otherwise, as before observed, they could not be twisted round each other. The whip thread is usually made stronger than the other threads, or used doubled, so as to counteract the strain of the threads round which it is twisted. When four or six threads are used then the strain becomes far greater, and requires considerable judgment in their use.

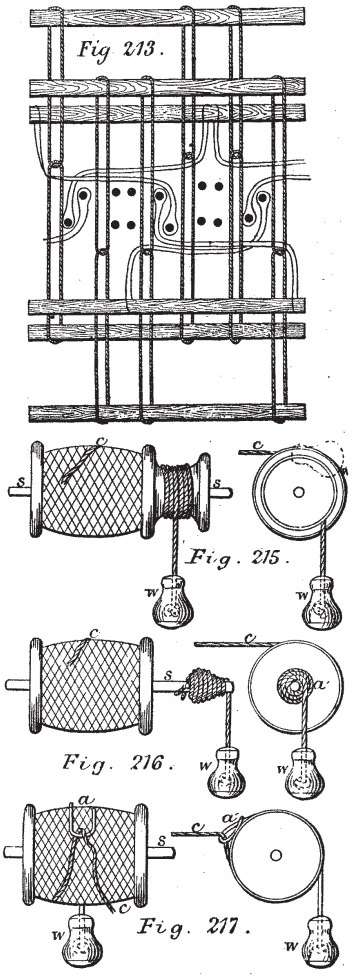
The application of gauze to the formation of selvages may now be readily understood. When the cloth is being woven the place where it is intended to be cut has had no threads passed through the reed, in other words one of the dents, or spaces, has been left empty. On each side of this empty dent gauze threads are used to form the selvages.

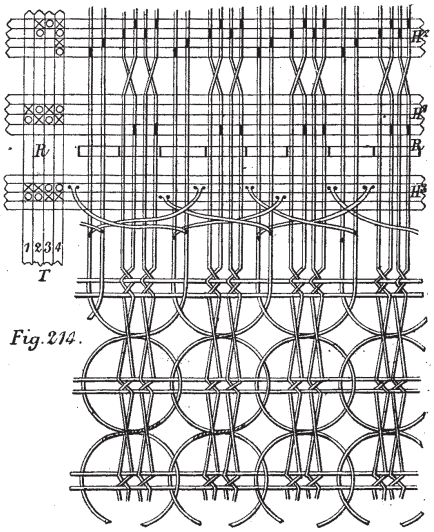
Fig. 212 represents a portion of plain cloth woven showing the gauze selvages with the whip threads a a. At s^1 a portion of the cloth is shown cut, and it may be readily imagined that when the threads are entwined firmly and compactly together, that a very serviceable substitute for a genuine selvage can be made, and by this means narrow strips, such as velvet ribbons and scarves, can be woven at much less expense than where they have to be woven in separate pieces.

Net weaving is an extension of the same kind as gauze weaving, and, therefore, more complicated. In fact the whip thread is made to pass over much wider distances than in gauze weaving, where it is confined to the space of one dent only. To accomplish this effect the whip doups are placed in front of the reed, and not at the back, as in gauze, consequently they form a mass of complicated harness apparently impossible to use. To give an idea of this class of work, which is now perhaps completely superseded by lace-work, Figs. 213 and 214 show an elevation and plan of a fair specimen of network. The reed R R is shown in front of the gauze harness H^1 and H^2, and at the back of the whip threads forming the figure. The tying up of the harness is shown at T, where the connexions between the treadles and headles may be seen represented in the usual manner.









In all classes of gauze weaving it is evident that those threads which are twisted round the others must be used in greater or less lengths according to the amount of twisting. In arranging the loom, therefore, means must be provided accordingly for separate bobbins or small warp beams to be used. This matter was alluded to in the description of the damask loom, Fig. 126, and we shall now show how these small warp bobbins or beams are weighted so as to throw a constant tension upon the threads, and allow of various lengths of thread being used.

There are several ways in which this can be effected, but we shall show three only, viz., Figs. 215, 216, and 217. In each figure a front and an end view is shown.

Fig. 215 shows the plan adopted in the loom Fig. 126, where each bobbin is provided with a groove round which is wound a cord to which a weight w is attached. When the warp thread c is unwound it draws the weight w upwards, until it falls over the top of the pulley and resumes its former position, which is shown at w and w^1. The weight thereby always causes a strain upon the warp thread, and the plan is a very effectual one. The bobbin is supported on the spindle s, which is of wire and is passed through the bobbin.

In Fig. 216 the weight is coiled on the spindle, and instead of being carried over the top of a pulley the cord slips off the end of the spindle, as at a. This plan also causes a constant tension upon the thread c.

The plan, Fig. 217, is more adapted for coarse or stronger threads, such as are used in carpet weaving. In this case the weight is attached to a hook which rests upon the bobbin at a^1, and the warp thread c being passed over it cannot be unwound without a constant friction and back strain to take up the slack after each movement of the harness.

In recapitulation it may be said that gauze weaving merely consists in the employment of additional leashes to the ordinary leashes of the loom, and these leashes, which may be used in any required number, have the power to draw one or more warp threads across the path of one or more of the adjoining threads.