This invention relates to the manufacture of fabrics with bias weft, that is to say fabrics in which the weft threads are oblique relatively to the warp threads. For the manufacture of such fabrics, the object of the invention is to provide a process which mainly consists in beating the weft threads or picks passed obliquely in the warp threads, by means of a reed having oblique teeth and receiving both a movement of translation parallel to the weft threads and a movement of translation in a perpendicular direction, the resultant of both movements being parallel to the warp threads.

Such as defined in its principle, the process is conveniently carried out on ordinary weaving looms, by utilizing most of their elements and parts, with the adjunction of simple devices.

In its application to usual weaving looms, the process is characterized by the fact that the obliquity of the warp threads is determined from a fixed transverse reed holding the heads of the harness vertical, the reed having oblique teeth being controlled from the lay of the loom through the medium of movement transforming mechanisms.

Concerning the means to carry out the process according to the invention, the latter is particularly characterized by the following points:

(a) The oblique reed is fitted on the lay in such a manner that it can be subjected, relatively to the latter, to displacements transverse to the loom and kinematically associated with the displacements of the lay in order that the teeth of said reed should move parallel to the oblique threads of the warp.

(b) In an arrangement according to Paragraph (a), the ends of the reed are connected by cables or chains to pulleys or pinions journalled on the lay and angularly moved by the action of cables or chains attached to fixed points of the loom.

(c) In an arrangement according to Paragraph (a), the reed having oblique teeth is subjected to the action ofcams.

(d) The temples provided in the known manner on weaving looms, comprise pin wheels, the rolling plane of which is set in the direction of the oblique warp threads.

(e) The woven sheet or fabric is straightened by passing on an oblique breast beam, so that it can wind in the direction of the warp threads on the ordinary take up roller of the loom.

The accompanying diagrammatic drawings illustrate, by way of example only, forms of construction of means for carrying the invention into practice on an ordinary weaving loom.

Fig. 1 is a diagrammatic side view of an improved weaving loom according to the invention.

Fig. 1a is a fragmentary plan view of the means for directing the reed 4 at an angle of 45°.

Fig. 2 is a plan view.

Figs. 3 and 4 are diagrammatic side views showing modifications of arrangements for straightening out the woven sheet or fabric before it is wound on the take up roller.

Fig. 5 is a front view of the weaving loom, showing the straightening out and winding of the woven sheet or fabric.

Figs. 6, 7, and 8 are diagrammatic views of mechanisms for controlling the oblique reed.

Figs. 9 and 10 illustrate a form of construction of special temples according to the invention.

Fig. 11 is a side view of a weaving loom which is transformed for carrying the invention into practice.

On the weaving loom, the warp threads 1, set in the known manner, are guided in a fixed reed 2, in the proportion of one thread between two teeth. This reed is adapted to hold the usual heads 3 of the harness vertical and parallel; these heads act in the known manner for alternately crossing the warp layers between the passage of two consecutive picks or shots.

When issuing from the fixed reed 2, the warp threads 1 are inclined according to the angle of the bias to be obtained and enter between the oblique teeth of a movable reed 4. The obliquity of the teeth corresponds to that of the warp threads relatively to the weft threads or picks which are passed parallel to the frames of reeds 2 and 3.

This reed 4 is fitted on the lay 5 so as to participate in the displacements of the latter for beating up the picks, but, in order that the oblique teeth should move along the warp threads, the reed 4 is subjected at the same time to a transverse displacement. Use can be made for that purpose of any suitable mechanisms. In the example of Fig. 1a, the frame of the reed 4 is transversely guided on the lay is attached at each of its ends to an inextensible bond 6 secured, after passing around a pulley 7, to a fixed point 8 of the loom. The bond 8 can be constituted by a cable or a chain; in the latter case, the pulleys 7 are replaced by pinions. By means of this arrangement, the reed 4, when it moves on the lay, is subjected at the same time to a transverse displacement of the same amplitude. The teeth of reed 4 thus follow paths inclined to
the extent of 45 degrees relatively to the longitudinal axis of the weaving loom.

In Fig. 1a the band or cable 6 is shown on one side only, the other side being exactly similar.

Fig. 2, 113,492 the extent of 45 degrees relatively to the longitudinal axis of the weaving loom. In Fig. 1a the band or cable 6 is shown on one side only, the other side being exactly similar. For weaving at a different inclination than 45 degrees, it suffices (see Fig. 2) to journal two pairs of pulleys or pinions 7 and 7* on the lay, the two pulleys 7 and 7* of one pair being rigid so as to turn as a single unit. The pulleys 7 and 7* are connected by a pinion or chain 6* (as indicated in Fig. 2) passes over the pulleys 7 and 7* and is connected at its ends to the two fixed points 3 of the loom. The connection of one point of the periphery of each pulley 7 with the corresponding end of the reed 4 is shown by the cables 6. If R is the diameter of the pulleys 7 and r the diameter of the pulleys 7 when the lay 4 is displaced the distance L parallel to the longitudinal axis of the loom, the reed 4 is displaced transversely

\[ L = \frac{r}{R} \]

and the angle \( \alpha \) of the bias is given by the equation

\[ \tan \alpha = \frac{r}{R} \]

By suitably determining the respective diameters of pulleys 7 and 7*, a movement can be imparted to the teeth of the reed the path of which forms any desired angle with the longitudinal axis of the loom. The pulleys 7—7* can be constituted by a single pulley provided with two grooves having different diameters.

The suitable movement of reed 4 relatively to the lay can also be effected as shown in Figs. 6 and 7. Fig. 6 shows the reed 4 in partial front view. The frame of the reed is provided with a finger 9 extending into an oblong opening 10 formed in a bell crank lever 11 pivoted at a fixed point 12 of the lay and provided with a roller 13 moving on an incline or cam 14 secured to the loom. When the reed moves with the lay, the roller 13, by rolling on the fixed incline 14, imparts to the reed a movement of translation in the plane of the lay. With a suitably chosen profile of the incline, this movement of translation combines with the movement of the lay for imparting to the teeth of the reed movements parallel to the oblique warp threads.

In the example of Fig. 8, a finger 9* of the frame of reed 4 extends in a cam-grooved shaft 15 jour- nalled in suitable bearing portions of the lay and provided with a pinion moving on a fixed rack of the loom, or with a pinion or pulley on which winds a chain or a cable attached to a fixed point of the lay.

The simple forms of construction which have just been described for imparting to reed 4 a suitable movement on the lay are given only by way of examples. The invention also includes in its scope all kinematic devices to obtain the effects just set forth.

Behind the reed 4, the woven sheet is subjected, as for straight weaving, to the action of temples 17 of special construction and an example of which is illustrated in Figs. 9 and 10, which respectively show a left-hand temple and a right-hand temple, the latter being shown in axial section. Each temple comprises pin wheels 18, the rolling planes of which are set parallel to the oblique warp threads. These pin wheels are loosely mounted as one and the same unit on shafts 19 at right angles to the direction of the oblique warp threads. These shafts are, for instance, provided on one and the same unit secured, by any suitable means, on a support 21 fitted on the loom as for known temples. Through the stay members can pass, for instance, a rod 22, with a key 23 secured at 24 on support 21.

The woven sheet or fabric 25 passes on longitudinal stretching bars 26 between which is arranged an inclined bar 27 acting as breast beam, as shown in particular in Fig. 5, in such a manner that it is placed in the direction of the weft threads, when the woven sheet or fabric slides on said bar 27. When leaving the special breast beam 27, the woven sheet is straightened out, that is to say its warp threads are arranged parallel to the longitudinal axis of the loom; it can thus normally wind on the take up roller 26 as a fabric woven in the ordinary manner, and wind on said bar 27. The latter can serve for supporting the bar 27, as shown in Fig. 5.

The inclined breast beam or bar 27 peculiar to the invention, can be arranged either above, or below the plane containing the upper face of the usual breast beam 29. In Fig. 1, it is shown above, and in Fig. 3 below this plane. Its inclination is preferably adjustable by any suitable means.

The invention is applicable to all types of looms, automatic or not, provided with a fixed reed or with a movable reed for any width. It allows of manufacturing, with a weft inclined to the right or to the left, and according to any angle, all kinds of weaves in fabrics of simple or multiple thickness, all pitches of warp or weft threads, with all desired numbers of yarns.

Fig. 11 shows a usual weaving loom transformed for carrying the invention into practice.

For supporting the reed 2, in front of the heads, two brackets or supports are secured by means of bolts 24 on the upper cross member 25 of the loom. For the ordinary reed of the lay is substituted a reed 4, having oblique teeth and the frame of which can slide in the lay. This frame is attached to chains 26 provided with screw-threaded adjusting rods 27 passing through right angled members 28 secured one on the side standard of the loom frame and the other on a table 30 or a member constituting an extension of the same. Each chain passes around a grooved pulley 1 jou-nalled in a bearing 29 secured to the frame of the lay. The latter is supported by arms 30 and is actuated by connecting rods 31 by known means provided on the loom. The woven fabric held at its edges by the temples of Fig. 9 passes under a bar 33, then over the oblique breast beam 34, under a bar 35, over table 36 and winds on said bar 37 provided in the known manner on the weaving loom. For supporting the bars 32 and 35 and the breast beam 34, brackets 38 and 39 are provided and are secured by bolts on table 38.

In this example, the two simple pulleys 7 ensure weaving of the bias at 45 degrees.

What I claim as my invention and desire to secure by Letters Patent is:

1. In a weaving loom of the type comprising a warp roller for the warp threads, a take-up roller for the woven sheet and a breast beam for holding weft threads and arranged parallel to the said warp roller, a frame for holding weft threads, and heads for crossing the warp threads, in combination: a fixed reed arranged perpendicularly to the warp threads in front of the heads, a reed 73
slidably mounted in the lay, means adapted for normally engaging the warp threads on the take-up roller by giving them an oblique direction relatively to the axis of the loom from the fixed reed and means adapted for controlling the movement of the reed sliding in the lay so that the teeth of the said reed follow the direction of the oblique warp threads.

2. In a weaving loom of the type comprising a warp roller for the warp threads, a take-up roller for the woven sheet and arranged parallel to the said warp roller, a lay for holding weft threads and arranged parallel to the said rollers, and healds for crossing the warp threads, in combination, a fixed reed arranged perpendicularly to the warp threads in front of the healds, a reed slidably mounted in the lay, an oblique breast beam for guiding warp threads arranged obliquely to the longitudinal axis of the loom from the fixed reed and means adapted for controlling the movement of the reed sliding in the lay so that the teeth of the said reed follow the direction of the oblique warp threads.

3. In a weaving loom of the type comprising a warp roller for the warp threads, a take-up roller for the woven sheet and arranged parallel to the said warp roller, a lay for holding weft threads and arranged parallel to the said rollers and healds for crossing the warp threads, in combination, a fixed reed arranged perpendicularly to the warp threads in front of the healds, a reed slidably mounted in the lay, means adapted for normally engaging the warp threads on the take-up roller by giving them an oblique direction relatively to the axis of the loom from the fixed reed, rotating members journaled on the lay and bonds passing over the said rotating members and connected on the one hand to the sliding reed and on the other hand to fixed points of the frame of the loom so that the teeth of the said sliding reed follow the direction of the oblique warp threads.

4. In a weaving loom of the type comprising a warp roller for the warp threads, a take-up roller for the woven sheet and arranged parallel to the said warp roller, a lay for holding the weft threads and arranged parallel to the said rollers and healds for crossing the warp threads, in combination, a fixed reed arranged perpendicularly to the warp threads in front of the healds, a reed slidably mounted in the lay, an oblique breast beam in front of the take-up roller, horizontal tension bars in front of and behind the said oblique breast beam for guiding warp threads arranged obliquely to the longitudinal axis of the loom, from the fixed reed, rotating members journaled on the lay and bonds passing over the said rotating members and connected on the one hand to the sliding reed and on the other hand to fixed points of the frame of the loom so that the teeth of the said sliding reed follow the direction of the oblique warp threads.

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