In the production of chenille yarns such as are used for example in making carpets the strong ground threads are used as the warp while the threads which later form the chenille pile are used as the weft. As is well-known at the points where the warp thread crosses the ground threads they must be knotted in order to bind together the warp and the weft. For this purpose so-called leno threads are used, two being generally used for each knot. These threads are guided so that they cross one another at the crossing point that is the thread lying to the left at its next weave is led to the right and the thread lying to the right at its next crossing is led to the left hand side.

To attain this result it has been proposed to pass each group of leno threads through a perforated rail each leno thread being passed through one hole in the rail. The two bars are longitudinally movable relatively to one another on a common head frame. When the rails are moved longitudinally relatively to one another the previously right hand threads are moved to the left and vice versa, with respect to the warp thread in question. The warp threads themselves are passed through the needles of the known reed hook and led over a guide roller beneath the leno threads. The needles on each depression of the head frame pass between the two leno threads associated with their warp thread and thereby position these threads.

Difficulty arises from the fact that the two leno threads must actually be held clear of one another before they come into engagement with the corresponding needle in order that the actually desired result will be obtained. Moreover when the needles are properly passed between the two threads the latter must remain in proper position so that when the shuttle passes through the shed the correct arrangement of the threads is maintained.

In previously known apparatus the heald frame has an exactly vertical reciprocating movement but the mechanism which engages the two leno threads swings around a common pivot. Consequently on the vertical movement of the heald frame the rails are given an undesirable additional longitudinal displacement by the movement of the mechanism engaging there with which, experience shows alters the correct position of the two threads in relation to one another and of the main warp threads between them so that the needles cannot pass with certainty through the two threads. The two leno threads with the warp threads between them pass through the reed so that each three associated threads are passed between two adjacent reed blades. On movement of the lay disarrangement of the threads lying in the correct position is still possible and is in fact liable to occur so that the weft on passing through the shed may strike leno threads incorrectly disposed and a proper knot cannot be formed.

In accordance with the present invention the means for shifting the longitudinally movable perforated rails in the heald frame engage horizontally movable guide members in which the ends of the rails are vertically guided and for the reed is arranged a separating device which consists of a number of slotted balls or the like corresponding to the number of warp threads in such manner that a warp thread passes through each ball opposite a needle, the free end of the ball passing between the two associated leno threads on downward movement of the heald frame but before the leno threads engage the reed.

As the result all the threads will be properly disposed with respect to one another until the weft is beaten up on the already finished fabric and faulty goods will not be produced. Moreover as the three threads are each properly guided the leno threads on beating up the reed on the finished fabric are pulled quite tightly so that the desired crossing is effected in its most satisfactory form. As the result the great advantage is obtained that after the fabric is cut midway between each pair of separate warp threads the weft ends formed at both sides of the warp threads are drawn together in consequence of the tension on the leno threads i. e. are erected to produce the chenille yarn without the need for raising them artificially by special means as was hitherto necessary.

Preferably there is used an operating rod moved by the loom operating mechanism which engages an upright pivot arranged in a fixed frame so as to turn this pivot, levers mounted on this pivot having connecting rods controlling guides movable horizontally in the frame in the vertical slots of each of which end of a perforated rail slides. The slotted balls are inclined rearwardly and upwardly from the reed between each pair of reed bars.

The invention is illustrated in the accompanying drawing in which similar reference characters designate corresponding parts. Fig. 1 shows a chenille cloth as it is woven on the loom in accordance with my invention. Fig. 2 shows a sectional view seen in the direction of the arrows.
along line 2—2 of Fig. 2a. Fig. 2a is a side elevation of a sample of chenille cloth woven on my machine. Fig. 3 is a sectional view seen in the direction of the arrows along line 3—3 of Fig. 2a. Fig. 3 is a side elevation of a sample of chenille cloth woven on my machine in which only single weft threads are employed. Fig. 4 shows a portion of the reed bars together with the warp and leno threads. Fig. 5 shows the relative position of the ball shaped separators with respect to the reed bars. Fig. 6 shows the apparatus in front elevation. Fig. 7 is a plan view, the means for actuating the operating rods for the perforated rails being omitted. Figs. 8 and 9 show the loom in side elevation in two operative positions of the heald frame. Figs. 10 and 11 illustrate in enlarged detail the rail operating mechanism shown respectively in Figs. 6 and 7 and are viewed from the same positions as they are.

Referring to Fig. 1, the warp threads a are arranged at a suitable distance from one another in the loom. In the example shown in Fig. 1, each pair of warp threads are assumed to be combined together to form a group. Of course, there may be more than two warp threads combined to a group. Likewise, for each warp thread group a single warp thread may be substituted. The weft threads b cross the warp threads at right angles, all the weft threads generally lying beneath the warp threads. Where they cross at x the warp threads must be tied to the weft threads. This binding operation is effected by so-called leno threads, two leno threads being generally used for each crossing point. These threads form the knot as shown in Fig. 1. They lie first beneath the weft threads, but are raised in forming the shed over the warp threads and at the same time are displaced from right to left over the warp threads. This is repeated alternately so as to produce crosswise knotting of the weft threads. In the form shown in Fig. 1 two weft threads are always tied together. The product indicated in Fig. 2 in vertical longitudinal section is produced.

When the fabric is completed it is cut between two warp threads along the dot and dash lines y shown in Fig. 1. The resulting products which are obtained, each contain longitudinally extending warp threads from which the knotted ends of the weft threads project to the left and to the right and the ends are folded together in chenille fashion as indicated in Figs. 2 and 2a. If only one weft thread is tied then the form shown in Figs. 3 and 3a is provided. Obviously also more than three threads can be knotted by means of leno threads.

The separate leno threads are now passed through holes provided in the rails 1 and 2, the one group of leno threads being passed through the holes in the rail 1 and the other group through the holes in the rail 2. The rails are longitudinally movable in the heald frame 3. If the two rails are displaced longitudinally in relation to one another then the leno threads of the one group are moved to the right and the other to the left, and vice versa as the result of wrist motion at the pivoting point on the respective rail. Assuming that the correct amount of movement has been selected.

The warp a is drawn through a needle 4 between each pair of leno threads and led behind the needle downwards over a guide roller 5. All the needles are combined on the tabular rail 6 to form a reed.

Before commencement of the operation the heald frame 3 is in the raised position shown in Fig. 8. The perforated rails are then displaced relatively to one another. Then the frame 3 is moved downwards into the position shown in Fig. 9 and the needles pass between the two associated leno threads and a shed is formed between the warp a and the leno threads c. The weft b is now passed by means of the usual shuttle Sch, by raising the frame the shed is again closed and by swinging the lay 7 the weft is brought against the completed fabric G by means of the usual beater 8 the reed bars of which make the strokes.

In order that each needle will find the two associated leno threads e in front of it in the correct position and pass between them the following arrangement is provided.

The shaft 9 is driven by the actuating mechanism of the loom. On this shaft mounted in the loom frame 10 are mounted two cam discs the one cam disc being formed with a peripheral cam groove 11 indicated in dotted lines in the drawing. This cam groove is tracked by a roller 12 carried by a bracket mounted on a rock lever 14. This rock lever is pivoted on a pivot 15, twice on each revolution of the shaft 9. Wires 16, 17 extending from the ends of the rock lever are connected to the chains 18 and 19 which are guided over the sprockets 20 and 21 and are secured to the cross members 22 and 23 of the frame 3. In this manner the frame 3 is moved up and down, a guide, not shown, ensuring vertical movement.

The second cam disc mounted on the shaft 9 is formed with a peripheral cam 24 shown in dot and dash lines. This cam is tracked by a roller 25 mounted on the end of an actuating rod 26. This rod is provided with a lever rocking about the fixed pivot 27 and is rigidly connected with a bracket 28 formed with a slot 29 through which extends a bolt 30 adjustable in the slot which bolt is mounted on the end of the actuating rod 31. The rod 31 is connected to a lever 32 which is mounted on a vertical axle 33. The vertical axle 33 is rotatable in a U-shaped ball 54 which is secured to the loom frame as at 55 in suitable manner.

The U-shaped ball 34 on its arms 54 is provided interiorly at opposite points with grooves 30 and 41 between respective pairs of which slides 31 and 32 are guided and spaced. Each slide is provided with a vertical longitudinal slot 42. In the respective slots, slides 43 and 44 are guided. Attached to slide 43 by means of a bolt 44 to slide 44 is the rail 2. The axle 35 has fixedly mounted thereon and spaced from each other, two identically shaped and positioned double armed lever arms designated at 32° and 37°, lever 32° being integrally formed with lever 33. Lever 32° at 32° has pivotally connected thereto a link 35 which is pivotally connected to slide 39 at 39°. Lever 32° at 32° has pivotally connected thereto a link 36 which is pivotally connected to slide 38 and 39°. Similar links 35 and 36 connected the corresponding ends of lever 37 to another set of pivotally pivoting joints on the respective rail. Thus as rod 31 alternately rotates lever 32 in opposite direction, the respective slides 38 and 39 through levers 32° and 37° and links 35 and 36, are given motion in opposite directions relative to each other to effect the requisite crossing of the leno threads which are threaded through the holes in rails 1 and 2.

As a result of this arrangement on raising and
lowering the heald frame the rails 1 and 2 remain absolutely unaltered in the position given to them by the actuating rod 31 so that the needles pass with safety between the leno threads positively retained in their correct position on downward movement of the heald frame into the position shown in Fig. 9.

While now in earlier known arrangements the warp a with the two associated leno threads c as shown in Fig. 4, were guided between two reed bars 8 of the reed so that in the shed formation, lay movement and so on, the three threads were liable to be twisted, in the present invention the following arrangement is provided.

On the reed are half-shielded separators 45 provided with longitudinal slots closed at their upper sides through which the warp a passes.

Opposite each needle 4 is a separator 8 i.e., as shown in Fig. 6 a separator 45 is arranged between each pair of reed bars 8. The separators 45 on corresponding warp threads or threads c are drawn, are so positioned relative to the reed bars 8 that the warp threads are kept in the center of the space between pairs of reed bars.

It is understood of course that the openings in the separators 45 are opposite those in the needles 4. As a result a clear separation of the three threads extending between two reed bars is obtained so that these ends cannot be twisted together in forming the shed and in operation of the lay. The separators are slightly curved rearwardly and upwardly of the reed and are of sufficient length that their ends project upwardly beyond the needles. These ends first pass between the two leno threads and position them before the needle engages with the leno threads.

As now the threads are always properly arranged the reed may be quite sharply struck and the crossed twist threads tensioned to such an extent that after cutting the fabric (see the dot and dash lines in Fig. 1) the tightly drawn threads themselves lift the weft ends so that the chenille cloth is formed without auxiliary means.

I claim:

1. Apparatus for producing leno fabric in particular for the production of chenille cloth, comprising in combination with the loom operating mechanism, a vertically movable heald frame, rails for the leno threads movable longitudinally through said heald frame, means for shifting said rails comprising horizontally movable slides and guides movably therein, the ends of said rails being vertically slidable in said guides, needles for warp threads and means for separating the leno and warp threads during formation of the shed comprising a member opposite each needle, so arranged that at the descent of said heald frame the free end of each of said members enters between corresponding two leno threads before engagement of the latter with the corresponding needle.

2. Apparatus for the production of leno fabric, for the production of chenille cloth, comprising in combination with the loom operating mechanism, a vertically movable heald frame, rails for the leno threads movable longitudinally through said heald frame, means for shifting said rails comprising horizontally movable slides and guides movably therein, the ends of said rails being vertically slidable in said guides, needles for warp threads, means for separating the leno and warp threads during the formation of the shed comprising a member opposite each needle so arranged that at the descent of said heald frame the end of each of said members enters between two corresponding leno threads before the latter are engaged by the needle, actuating means operated from said loom operating mechanism and including a fixed frame, an upright pivot carried by said frame and operatively connected to said last named means and means operated from said pivot and controlling the horizontally movable slides.

3. Apparatus for producing leno fabric, particularly chenille cloth comprising in combination with a loom having a vertically movable heald frame, horizontally mounted longitudinally slidable perforated rails for leno threads, means for moving said rails longitudinally, needles for warp threads, a shuttle for weft threads adapted to move transversely to the leno and warp threads and a beater having reed bars for bringing the lay against the completed fabric of means for retaining said longitudinally slidable rails while said heald frame is moved vertically in its longitudinal position during forming of the shed and means for keeping the warp and leno threads in proper relationship with each other during formation of said shed, said means including a slotted member opposite each needle adapted to enter between two corresponding leno threads before their engagement with the corresponding needle.

4. In a device as per claim 3, in which said means for retaining said longitudinally slidable rails while said heald frame is moved, in their longitudinal position during formation of said shed comprises a ball having vertically mounted horizontally movable slides, each of the latter having a vertical slot and members slidable mounted in said slots and attached to the ends of the respective rails.

5. In a device as per claim 3, in which said means for keeping the warp and leno threads in proper relationship with each other during formation of the shed comprise separators mounted between pairs of reeds through which the warp threads are adapted to pass, said separators curving rearwardly and upwardly of the reeds and so admeasured that their ends project upwardly beyond the needles.

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