Aug. 4, 1953 E. C. NICHOLS 2,647,541

LENO WEAVING

Filed Feb. 17, 1951 2 Sheets-Sheet 1

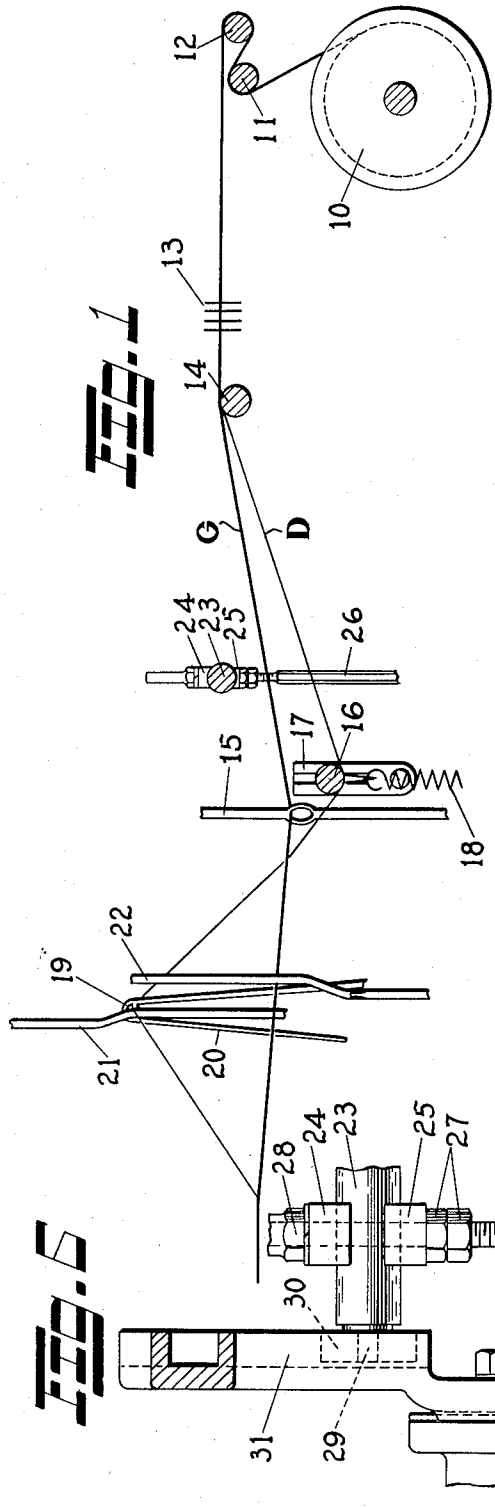

Fig. 1

Fig. 3

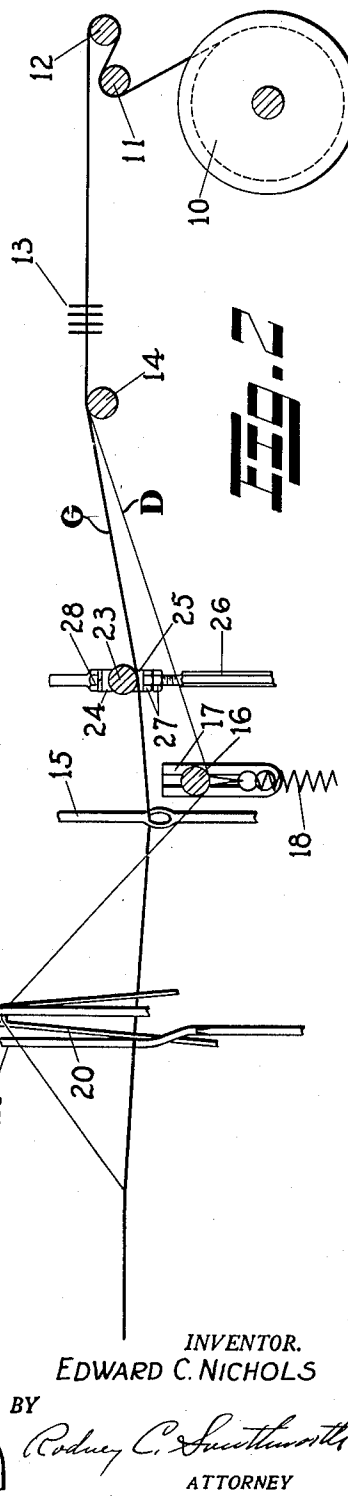

Fig. 2

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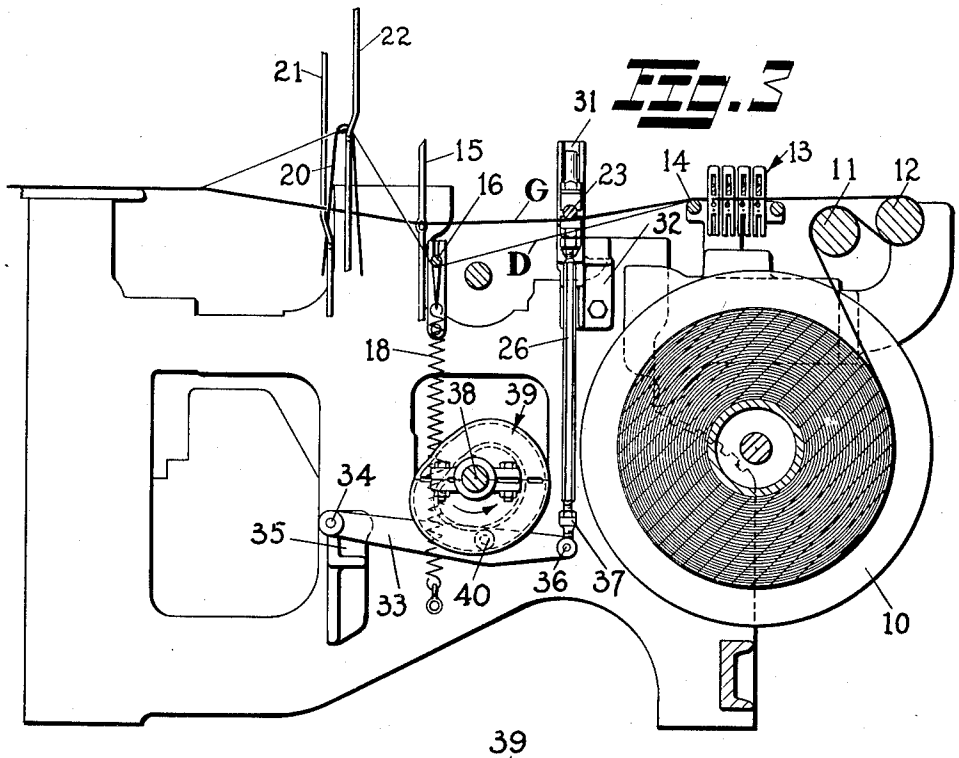

Fig. 3

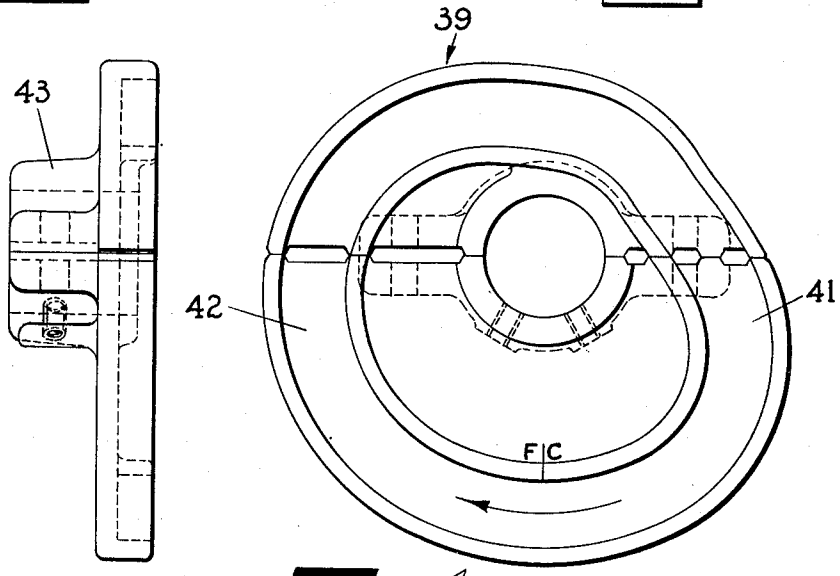

Fig. 5

Fig. 4

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Patented Aug. 4, 1953

2,647,541

UNITED STATES PATENT OFFICE

2,647,541

LENO WEAVING

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Application February 17, 1951, Serial No. 211,466

8 Claims. (Cl. 139—50)

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This invention pertains to improvements in looms such as those employed for weaving leno fabric, and more specifically, to a novel method and mechanism employed in such looms and which contribute toward the weaving of more uniform leno material.

It is a general object of the invention to devise a novel method and appropriate mechanism for carrying said method into effect which will obviate certain difficulties heretofore attendant upon the weaving of leno material and make it possible to produce more uniform weaves and to control the quality of the resulting product within precise limits.

It is a more specific object of the invention to devise a method and mechanism for functioning upon the ground threads of the leno warp so as to assure equalization of tension therein at all picks regardless of whether or not the pick is one inserted while the ground and doup threads of the warp are crossed, or while they are in position to form a so-called "open shed."

In weaving various leno fabrics, for example, the well known marquisette materials, considerable difficulty has always been experienced in that the spacing of the picks of filling has varied thereby giving rise to a definite and observable lack of uniformity. Fabric woven according to previous practices has frequently been characterized by groups of picks lying more closely adjacent than others, the usual effect produced being characterized by pairs of picks spaced a definite distance, each pair apparently being spaced from the adjacent pair by a distance appreciably greater than the distance between the picks of each particular pair. Thus a pattern is set up characterized by spaced pairs of picks whereas the intent normally would have been to space each of the picks equally from that adjacent thereby producing fabric of relatively great uniformity.

While it is true that these effects may extend over the entire width of the fabric, it may be that the obvious faults therein are limited to a portion only of the fabric width, at least, insofar as any particular area is concerned. Thus the defects may appear as "ridges" extending only part way across, or alternatively as "cracks" similarly confined to a part of the fabric width of a particular area of a small number of picks.

One other common fault observable in these fabrics is known as "reediness." This may extend entirely or partially across the width of the fabric and is frequently identified with an unpleasant and rough feel of the goods rather than one of smoothness and uniformity.

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The causes of these defects have always been in dispute, and it is probable that their causes have never been fully determined, it being a fact that corrective influences applied have generally, if they cured one fault, given rise to or at least, enhanced others. However, the general basis of approach here involved is one providing as nearly as practicable, identical conditions of warp, both ground and doup, for each pick. It has been discovered by applicant that the doup threads, although they may appear to suffer the greatest change between open and crossed shed picks, really may be allowed to take care of themselves as governed by the standard leno mechanism, but that the ground warp is really affected by the crossing or not crossing of the doup threads, and must be very precisely controlled. As a result of using applicant's method and mechanism, it has for the first time become possible to weave uniform leno fabric wherein the relative amounts of both types of warp thread entering into each pick are properly regulated to compensate for the differences between shed conditions as the same are crossed or open.

The proper spacing of the picks relatively to the distance between adjacent warp threads should make it possible to weave a fabric in which the general open work structure is comprised of squares, or at least, of rectangles each of which is similar to the others. As a result of difficulties experienced heretofore, that desired result has not always been forthcoming and when the picks are not equally spaced, the general effect produced in the leno material is that of a fabric made up of a more or less open type of meshwork in which the spaces or rectangles between warp threads and adjacent picks have varied in size and also in general configuration. Obviously, such lack of uniformity is not desired and it has been common knowledge in this art that fabric which departs too far from the desired standard has not been saleable as first quality material, or, perhaps, not saleable at all.

Various devices have been devised and employed for alleviating these difficulties above mentioned, all of which insofar as applicant is aware, having been applied to or have functioned upon the doup threads, that is, those threads comprising a part of the entire warp structure and which are alternately crossed in accordance with some pattern with the ground threads so as to tie in the filling and to form the general open structure or arrangement desired. However, it is generally known that all of these devices functioning upon the doup threads have been only

partially successful, if at all, and the general problem of lack of uniformity in weaving leno material has still prevailed.

According to the invention hereinafter described in greater detail, it has been found that control of the ground threads is better adapted to remedying the difficulties in weaving leno material, and that the control of the ground threads must be rather definitely governed to occur only at the so-called "open shed picks," that is, on those picks inserted at a time when the doup threads lie parallel to the accompanying ground threads rather than being crossed therewith.

Control of the ground threads as will hereinafter be described in greater detail may be provided for by any one of several different types of mechanism, but, generally speaking, is of a nature to impart to these threads an additional amount of tension over that to which they would have been subjected in the event the said additional mechanism and the present method were not employed, such additional tension being applied only at the said picks during which the shed is open. When the doup threads are crossed with the ground threads, the effect thereof appears to be one in which the ground threads are shortened or additionally tensioned, although the doup threads themselves being controlled through resilient mechanism as is well known, do not suffer any particular variation in tension although they may be moved throughout such a pathway that they would tend to be elongated or additionally tensioned during "crossed shed picks" as compared to the opposite or open shed picks.

At this point it seems appropriate to point out that in the following specification and claims the terms "open shed," "open shed picks," "crossed shed" and "crossed shed picks" have their normal meaning considered from the point of view and the nomenclature of leno weaving.

One specific mechanism for carrying out the method has been illustrated herein and comprises a bar which is cam controlled and which is adapted to engage against the ground threads between spaced supports therefor and to deflect those threads throughout a sufficient angular extent so as to impart the desired amount of tension thereby to equalize the tension on open shed picks to bring the conditions at that time into conformity with the general conditions prevailing during crossed shed picks.

In the accompanying figures of drawing similar parts have been indicated by like reference numerals and in these figures:

Fig. 1 is a diagrammatic view showing the general arrangement of the shedding and other mechanism functioning upon the ground and doup threads during the weaving of a so-called crossed shed pick.

Fig. 2 is a corresponding view showing the positions assumed by the parts during weaving at open shed, and also illustrating the action of the novel mechanism with which the present case is concerned.

Fig. 3 is a section through a typical loom illustrating the manner in which the novel mechanism for carrying out the method is applied thereto and showing the details thereof.

Figs. 4 and 5 are a plan and elevational view, respectively, of a cam which functions to impart to the ground thread controlling means the necessary movement.

Fig. 6 is a detail view showing part of the ground thread controlling means as the same is supported and guided at its ends.

Now referring to Figs. 1 and 2, just enough of the harness mechanism and other controlling means for the warp thread has been shown diagrammatically to illustrate the principles of the invention. The warp threads which are divided into ground and doup threads, these being terms which are well understood by those skilled in the art, are distinguished by a heavy line characterizing the ground threads and a relatively fine line employed for the doup threads. These threads are preferably drawn from a warp beam 10 over a drag roll 11 and about a whip roll 12 from whence they are threaded through the usual warp stop motion indicated by numeral 13 and then are carried forwardly to the weaving point being threaded over and through various mechanisms which will be described in due course. In some instances, the warp and doup threads may be drawn from separate warp beams, that being more or less immaterial to the invention herein described and claimed. After passing through the warp stop motion, all of the warp threads are passed over a supporting element which herein takes the form of a fixed bar or roller 14, although it is to be understood that in certain instances this element may not be essential if the warp stop motion is suitably constructed to perform the same function.

The ground threads G and the doup threads D are divided into separate groups after passing over the supporting means 14, or the like, and the first group passes onwardly to be threaded through the heddles 15 of a jumper harness, the function of which is understood by all those who are conversant with leno weaving. These ground threads then pass onwardly to the fell or beat-up point at which the fabric is formed, the latter thereafter being taken up as it is passed over take-up mechanism and wound onto a take-up roll (not shown).

The doup threads are preferably carried in a more inclined direction to pass underneath a so-called jazz bar 16 which is restrained within a guide means 17, one at either side of the loom, and which is resiliently drawn downwardly or in a direction to impart tension to the threads by a spring or springs 18.

After passing underneath the jazz bar 16, the doup threads are then threaded through their respective doup heddles. Each thread D is threaded through the eyelet 19 at the upper end of a doup needle 20, each of these needles being controlled by front and rear standards 21 and 22, these standards being a part of harness frames such as are usually employed for the purpose and which are controlled by suitable harness cams, dobbies, or other means adapted for the purpose.

While it is possible to weave leno fabrics with no more mechanism than is shown herein, most leno weaves are sufficiently complicated and the number of ends sufficiently great to require the use of more harnesses. It is to be understood that the jumper harnesses 15 and that the harnesses which control the standards 21 and 22 may be multiplied in any manner required to control the weaving of the leno material as may be necessary. For purposes of simplicity of illustration, the invention will be described and illustrated in the simplest possible manner.

It is to be understood that in the weaving of leno material the standards 21 and 22 are located at opposite sides of the ground thread to which they apply or with which they function and they may shift the needle 20 to either side of that ground thread and raise it as illustrated to carry

the cooperating doup thread upwardly as shown to form a shed for passage of a shuttle. Raising of the front standard **21** as in Fig. 1 results in a crossed shed, while the raising of the rear standard, Fig. 2, controls the threads so as to form a so-called open shed. The threading of the warp may be varied so that what has just been said above would be reversed, but the standard procedure is that herein illustrated and described.

As the standards **21** and **22** are alternately raised and lowered, the jumper harness **15** is also raised to a predetermined point so as to elevate the ground threads which are normally in lowermost position to a point where the needle **20** may pass beneath the ground threads thereby to facilitate and assure the reversal of position of the doup threads at alternate or other pattern controlled picks.

As the doup harnesses are alternately raised and lowered thereby controlling the needles **20**, there would tend to be considerable variation in the tension of the doup threads. The jazz bar **16** is adapted to take care of this. The resilient control of the jazz bar keeps a more or less constant tension on the doup threads, especially as the same are moved to extreme positions to form the shed and, while often attempted, further control of the doup threads is not practical. However, the condition existing at open shed and crossed shed positions is noticeably different. In actual practice, the crossed shed gives rise to a condition in which some strain or taking up of the ground threads is brought about due to the tension imposed thereon by the laterally deflected doup threads, Fig. 1. During open shed picks, however, the tension in the ground threads is unaffected by the adjacent doup threads so that the difference in the relative tensions of the threads varies considerably at open shed picks as compared to crossed shed picks. According to the method and by the mechanism hereinafter described in detail, the ground threads are additionally controlled during open shed picks so that they have imparted to them a deflecting movement and thus a slight additional amount of tension over that which would otherwise prevail. The condition of these ground threads relatively to the condition of the doup threads is caused to conform substantially to that prevailing during the crossed shed picks. Thus uniformity of weaving conditions is substantially realized and it has been found that by employment of the present invention, each pick is beaten into a shed in which the same relative tension in ground and doup threads assures uniform appearance and structure in the fabric.

Again referring to Figs. 1 and 2, the control of the ground threads is accomplished through a tension bar **23** which is disposed above the mass of ground threads and which may be moved upwardly and downwardly by means hereinafter described. This bar is clamped between blocks **24** and **25**, Fig. 6, at the upper end of a rod **26** which is threaded to provide a certain amount of adjustment upwardly or downwardly for the tension bar **23**. The nuts **27** below the bar and a top nut **28** provide the adjustment and for fixing the part in completely assembled relationship, the nut **28** having an upwardly extended hollow portion within which the threaded rod extends, this said portion being for the purpose of protecting the warp from the threaded end of the rod.

Each end of the bar **23** is turned down to provide a reduced end **29** which fits within a slot **30** cut or otherwise formed within an upwardly extending bracket **31** which is fixed to a pad or other appropriate attaching element at the loomside extension **32**.

The bar **23** is moved upwardly to clear the ground threads G on crossed shed picks while it is moved downwardly as illustrated in Fig. 2 to engage the ground threads and to deflect them a sufficient amount to impart the necessary additional tension over and above that which would normally prevail at that time. The ground threads are supported by the rod **14** and by the jumper harness so that downward movement of bar **23** onto the threads, and then for a definite extent beyond that point, tensions the threads to a desired degree. It has been found in actual practice that a movement of about three-quarters of an inch after contact between the ground threads and bar **23** is made will serve quite satisfactorily for weaving marquisettes, while other factors are kept at what would otherwise be considered normal. Of course, it is to be understood that for different materials and patterns, and under varying conditions, the amount of deflection of the threads and therefore the added tension may be differently controlled; this however is a matter for the weaver or loomfixer and by adjustment of the parts at the loom after other elements have been properly set, the correct degree of control and thus the most perfect fabric will be made possible.

Now referring to Fig. 3, one particular embodiment which the invention may take has been shown as applied to a more or less conventional loom. In this view the showing of all details of the loom has been considerably simplified and the section taken at a point adjacent the center thereof illustrates the warp on the warp beam **10** and the manner in which the warp is drawn off over the various elements previously described and through the conventional warp stop motion to pass over a supporting roll **14** which may or may not be a separate element from supporting means at the warp stop motion itself. The primary purpose in employing a supporting member at this point is that of sustaining the warp threads at a particular level and resisting the downward forces applied by the novel ground thread tensioning means operable at spaced or non-adjacent picks.

The particular phase in the cycle illustrated in this Fig. 3 corresponds to that of Fig. 2, that is, the parts are illustrated in the position which they occupy as the ground and doup threads form an open shed. The tension bar **23** is shown bearing on the ground threads and is moved downwardly as the rods **26**, one at each end of the bar, are moved downwardly by the arms **33** to which they are attached. These arms are pivoted at **34** to the brackets **35** attached to the loomsides and extend rearwardly of the loom having the said rods **26** connected at their relatively free ends by pivot means **36** passing through connecting clevises, or by other satisfactory pivotal attaching means.

The cam shaft **38** of usual form and performing its other intended functions also has clamped thereon or otherwise fixed thereto a cam generally indicated by numeral **39** and preferably having closed cam race within which operates a roller or other type cam follower **40** pivoted to the arm **33** at a point more or less centrally thereof. The cam pathway is so defined as to draw the tension bar **23** downwardly at and for a particular

period of time as is required to apply the additional tensioning forces to the ground threads during the insertion of an open shed pick and at all other times, maintains the bar **23** in an elevated position such that no contact is made with the ground or other threads.

Now referring to Figs. 4 and 5, cam **39** has been illustrated as it appears from the face or side thereof in which the groove is cut. It is to be noted that the cam here is reversed from that illustrated in Fig. 3 for the purpose of avoiding a dotted line showing. The cam rotates in the direction of the arrows and, of course, it is to be borne in mind that the cam shaft makes one revolution for every two picks so that each degree of travel of the cam **39** represents a corresponding movement of the crank shaft amounting to two degrees. The front center position of the cam is illustrated at the bottom and a dwell or rest of approximately fifty degrees provides for applying the additional tension to the ground threads for about fifty degrees of crank shaft travel before front center or the extreme beat-up point, and about fifty degrees of crank shaft travel after that point. These limits have been found to be sufficient for the purpose of assuring that the proper tension relationship exists between the ground threads and the doup threads at each beat-up of the lay thereby to assure that each pick is inserted under similar conditions no matter whether the shed at that particular time is crossed or open.

The remainder of the cam following the fifty degree, more or less, rest or dwell provides for elevating the tension bar **23**, then for retaining it in elevated position for forty degrees, more or less, that elevated position being terminated about fifteen degrees or so before back center position. Thereafter the cam provides for lowering the bar **23** into contact with the ground threads and for drawing it downwardly as may be required for tensioning the threads as above described. It is to be understood that the jumper harnesses **15** raise the ground threads once for each pick, and that the raising of the bar **23** and then the drawing down thereof as provided by the portions **41** and **42** of the cam are so controlled as to maintain the bar **23** out of contact with the ground threads even though they are elevated during corresponding upward movements of the jumper harness.

It is to be understood that the layout of the cam as herein shown and described merely represents one particular modification thereof which has been found to function quite satisfactorily. The extent of the angular movements and dwell periods provided may be changed within limits as required for adapting the same to each individual installation, it being understood that in the weaving of different types of leno material, as the number of harnesses varies, and according to other variable factors, such changes may well be found to be necessary or at least desirable.

The cam is of split type thereby to faciliate its application to a crank shaft already installed in a loom. However, the cam may be of unitary construction although its adjustment and removal are preferably of a type as herein shown. The hub **43** has drilled and tapped holes within which suitable set screws are threaded thereby to clamp the cams in adjusted position on the cam shaft. Instead of the closed cam race which functions positively in each direction, a simple cam and spring return may be utilized.

It is to be understood that the preferred embodiment of the invention comprises a construction in which the cam **39**, lever **33**, rod **26**, etc., are all duplicated at each side of the loom thereby to provide an even and precisely controlled movement for the bar **23**. It is conceivable that under certain circumstances control might be derived from similar mechanism at one side only, the bar thereby moving upwardly and downwardly in parallelism to the ground threads and it being maintained in such relationship by suitable guide means, or other appropriate devices. Instead of functioning from below, control might be applied from above.

Accordingly, it is believed that the invention in a novel method and mechanism for carrying out that method as herein above described is unique and particularly effective in controlling the weaving of leno materials such as marquisette, etc., and in maintaining uniformity of that material in a manner heretofore not found practicable. It is to be understood that the ground threads are preferably controlled at or about at the point herein shown, that is, between a support such as support **14** and the jazz bar **16**. In certain looms adapted for leno weaving the warp stop motion, jazz bar, jumper harnesses and other parts may be differently located so that it may be more practicable to separate the ground and doup threads at a different locality and therefore it may be found more convenient to apply the added tension as by a tension bar **23** located and operable at such different and more convenient position.

While one embodiment of the invention has been disclosed, it is to be understood that the inventive concept may be carried out in a number of ways. The invention is, therefore, not to be limited to the precise details described, but is intended to embrace all variations and modifications thereof falling within the spirit of the invention and the scope of the claims.

I claim:

1. In a method of weaving leno fabric which includes the step of inserting filling within warp sheds formed by manipulation of ground and doup threads the latter of which are, according to a predetermined pattern, crossed over the ground threads to form a crossed shed at some picks as distinguished from an open shed prevailing when the two groups of threads are not crossed, the step of applying an additional tensioning force to the ground threads only during a part of the cycle when an open shed pick is being woven thereby to facilitate the weaving of more uniform leno material.

2. In a method of weaving leno fabric which includes the step of inserting filling within warp sheds formed by manipulation of ground and doup threads the later of which are, according to a predetermined pattern, crossed over the ground threads to form a crossed shed at some picks as distinguished from an open shed prevailing when the two groups of threads are not crossed, the step of applying a deflecting pressure against said ground threads only during open shed picks only as distinguished from crossed shed picks, thereby to establish a similar condition of tension in the ground threads for open shed picks as compared to the tension therein during crossed shed picks.

3. A method of equalizing the relative tension conditions in the ground and doup threads of a warp employed in leno weaving to establish relatively uniform conditions at both open shed

picks and crossed shed picks which comprises the step of applying to the group of ground threads only at open shed picks only a thread deflecting tensioning force sufficient to induce in those ground threads a total effective tension substantially the equivalent of that prevailing therein when said ground threads are affected by the doup threads crossed therewith at crossed shed picks.

4. A method of equalizing the relative tension conditions in the ground and doup threads of a warp employed in leno weaving to establish relatively uniform conditions at both open shed picks and crossed shed picks which comprises the step of applying to the group of ground threads only during open shed picks only and for a period of time preceding and after the beating in of that pick, an added tensioning force sufficient to induce in those ground threads a total effective tension substantially the relative equivalent of that prevailing therein at crossed shed picks when said ground threads are affected by the doup threads which are crossed therewith.

5. In a loom for weaving leno fabrics and having shedding and supporting means for two groups of warp threads, one group comprising ground threads and the other group doup threads, that improvement for assuring uniformity of the leno weave from pick to pick which comprises a tension bar guided and positioned for movement toward and from the ground threads and for engaging and imparting a deflecting movement to said ground threads only, and means functioning in timed relationship to the operable parts of said loom for moving said tension bar to deflect the said ground threads at open shed picks thereby to induce in the ground threads at those picks a tension the relative equivalent to that existing therein during crossed shed picks.

6. In a loom for weaving leno fabrics and having shedding and supporting means for two groups of warp threads, one group comprising ground threads and the other group doup threads, that improvement for assuring uniformity of the leno weave from pick to pick which comprises a tension bar guided and positioned for movement toward and from the ground threads and for engaging and imparting a deflecting movement thereto, and cam means and interconnecting linkage therefrom to said bar for moving it to deflect the said ground threads at open shed picks thereby to induce in the ground threads at those picks a tension the relative equivalent to that existing therein during crossed shed picks.

7. In a loom for weaving leno fabrics and having shedding and supporting means for two groups of warp threads, one group comprising ground threads and the other group doup threads, that improvement for assuring uniformity of the leno weave from pick to pick which comprises a tension bar and guide means for the bar effective at the ends thereof, a cam shaft rotatable in timed relationship to the operable parts of said loom, cams thereon and levers pivoted adjacent said cams and followers carried by said arms and affected by said cams, and links connecting said arms with the bar to impart movement from the cams to the bar, the effective contour of said cams being such as to impart to the bar a ground thread tensioning deflection at the beat-up phase of each open shed pick and to retain said bar in a relatively inactive position during the similar phase of crossed shed picks.

8. In a loom for weaving fabrics and having shedding and supporting means for two groups of warp threads, one group comprising ground threads and the other group doup threads, that improvement for assuring uniformity of the leno weave from pick to pick which comprises a tension bar guided and positioned for movement toward and from the ground threads and for engaging and imparting to that group of threads only a deflecting movement, and actuating means connected to sad bar and to operating parts of the loom for moving the bar to deflect the said ground threads at open shed picks thereby to induce in the ground threads at those picks a tension the relative equivalent of that existing therein during cross shed picks.

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