United States Patent [19]

Sparling

[11] **3,717,182**

[45] **Feb. 20, 1973**

[54] RAPIER LOOM

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[22] Filed: **May 18, 1970**

[21] Appl. No.: **38,137**

[52] **U.S. Cl.** ..... **139/127 R,** 139/188

[51] **Int. Cl.** **D03d 47/18**

[58] **Field of Search** 139/188, 190, 122–127

[56] **References Cited**

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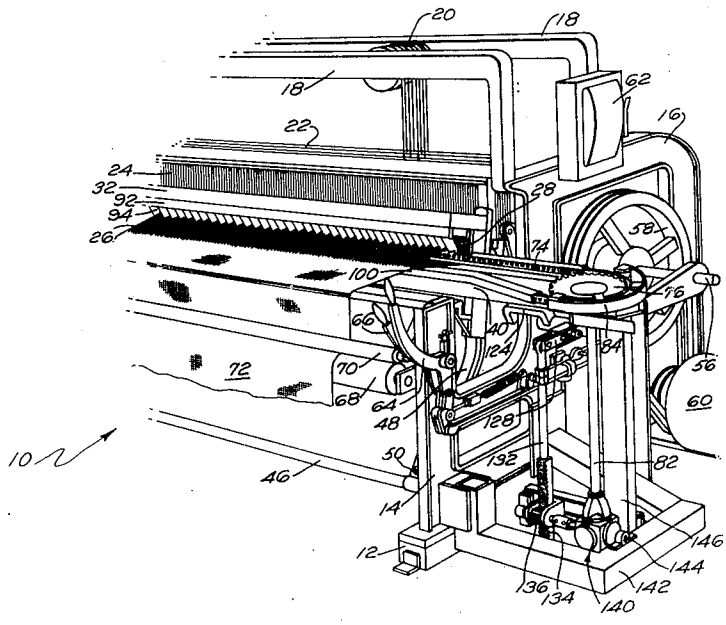
[57] **ABSTRACT**

A rapier, or shuttleless, loom comprising a flexible rapier or tape, there being means for supporting, feeding and retracting the tape on its edge, there being additional guide means associated with the lay of the loom for maintaining the tape in juxtaposition to the front side of the reed as the tape is fed into and retracted from the shed. The means for feeding and retracting the tape is directly responsive to and is controlled by the means which rock the lay, whereupon the feed and retraction of the tape are in a predetermined time sequence to the rocking motion of the lay.

14 Claims, 10 Drawing Figures



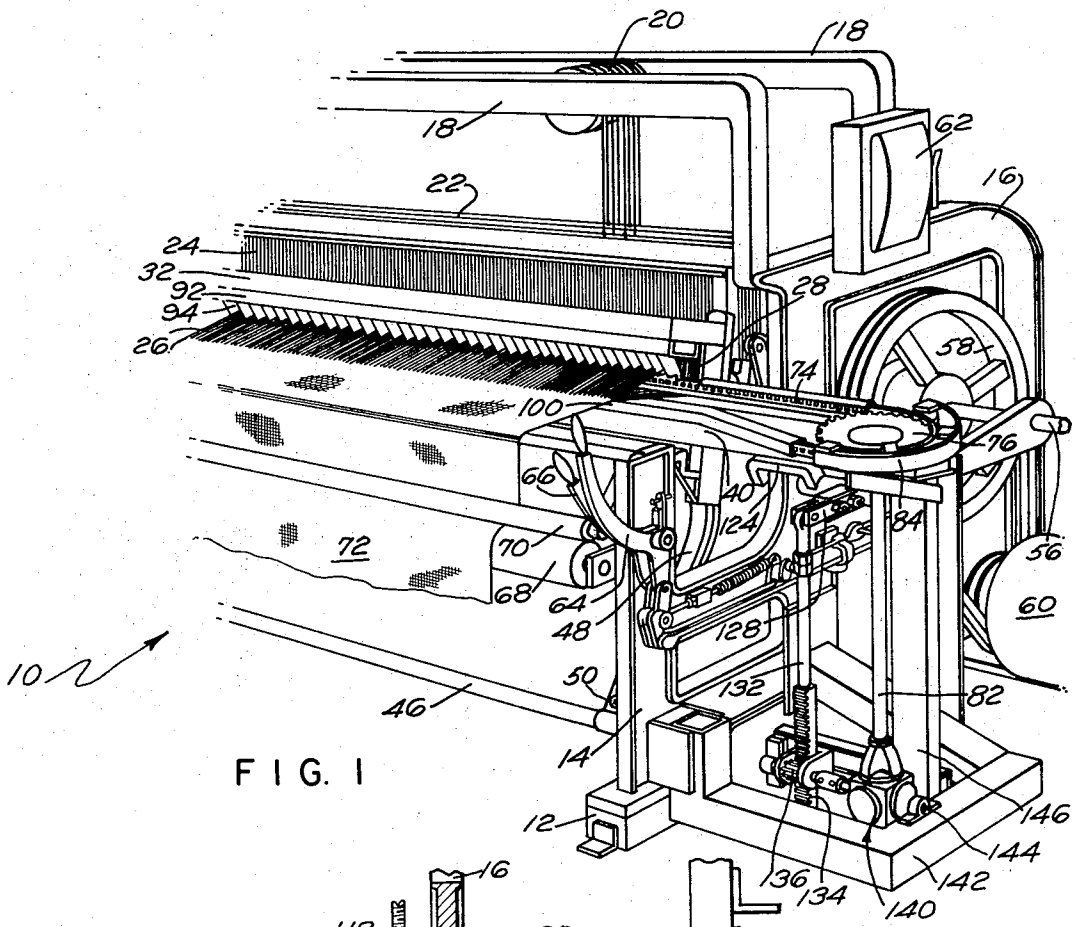


FIG. 1

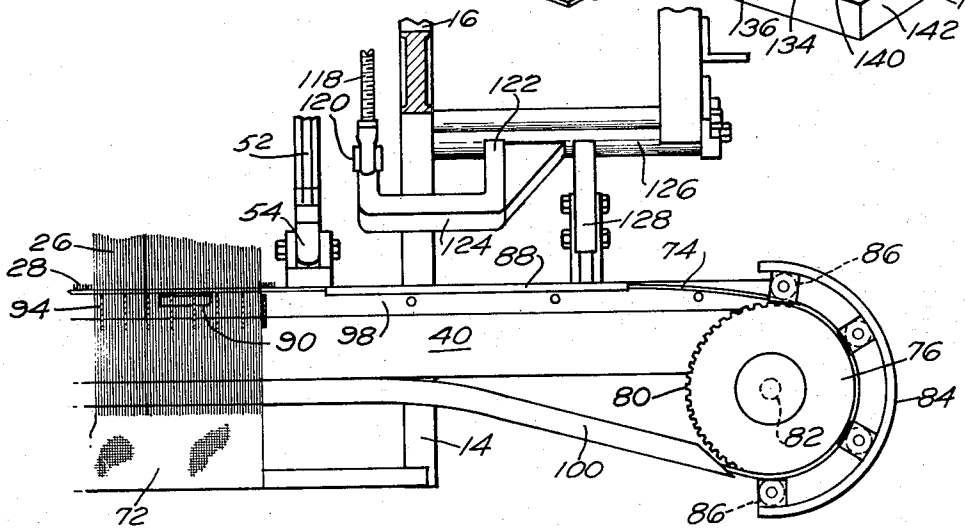


FIG. 2

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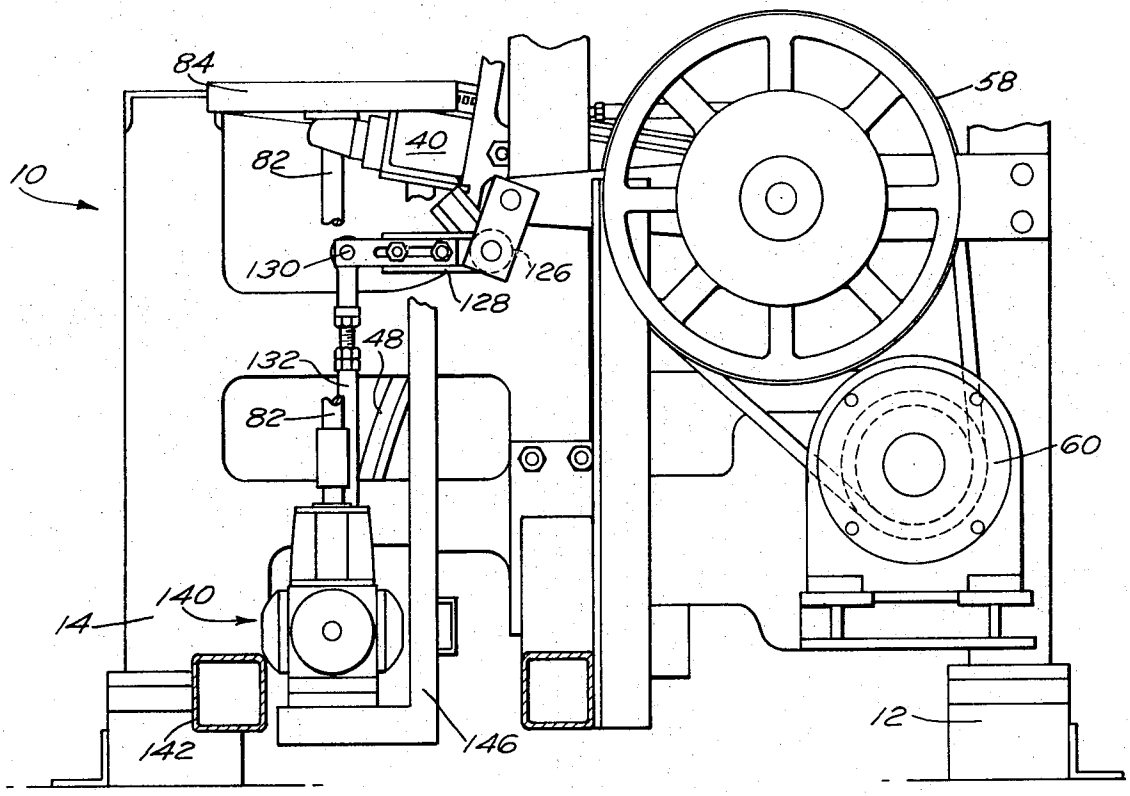

FIG. 3

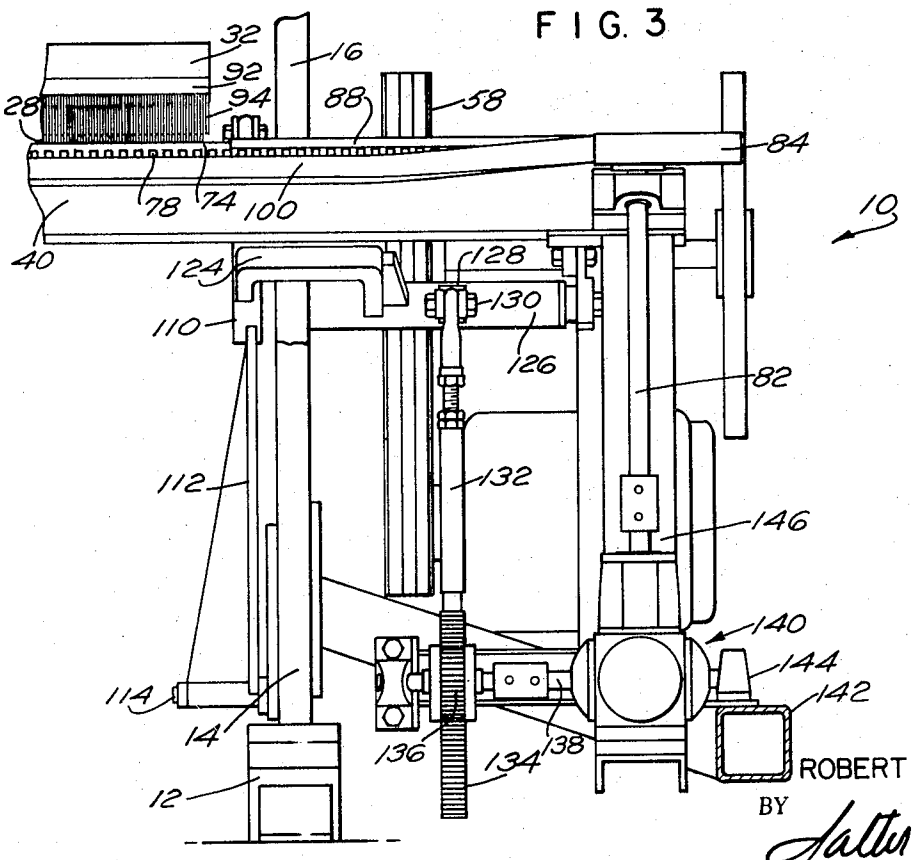

FIG. 4

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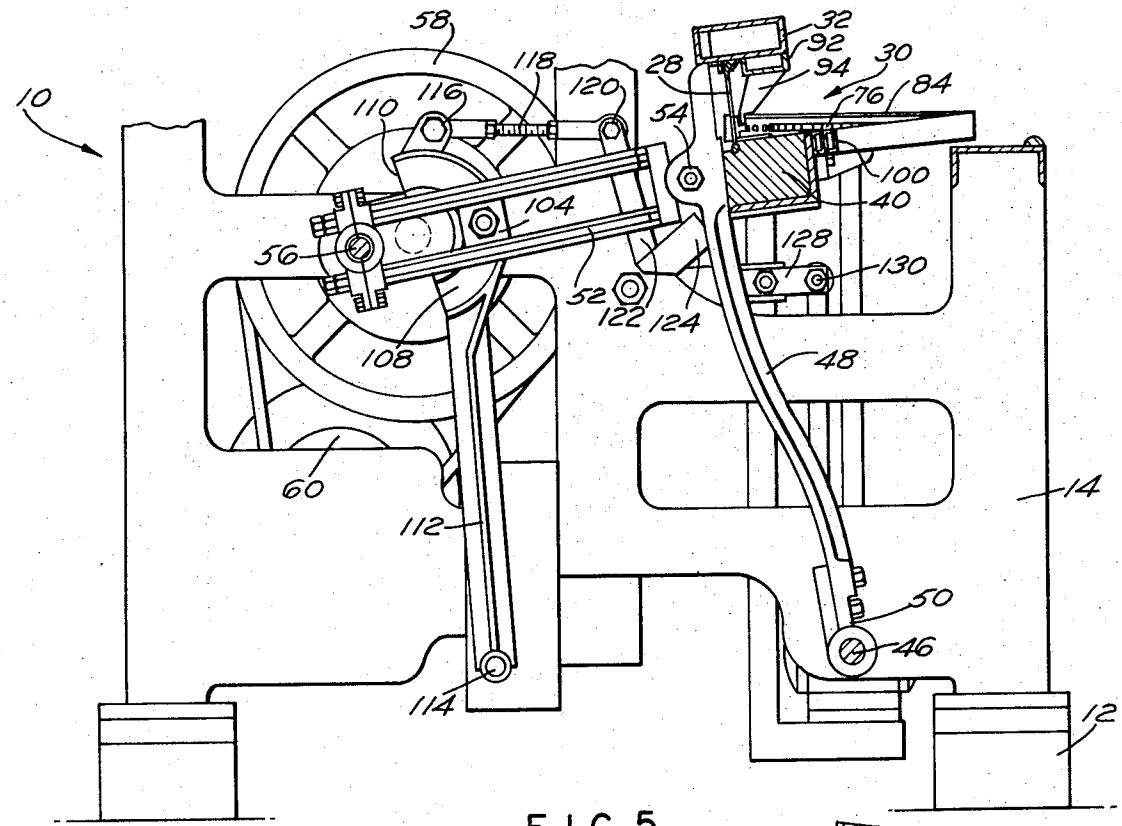

FIG. 5

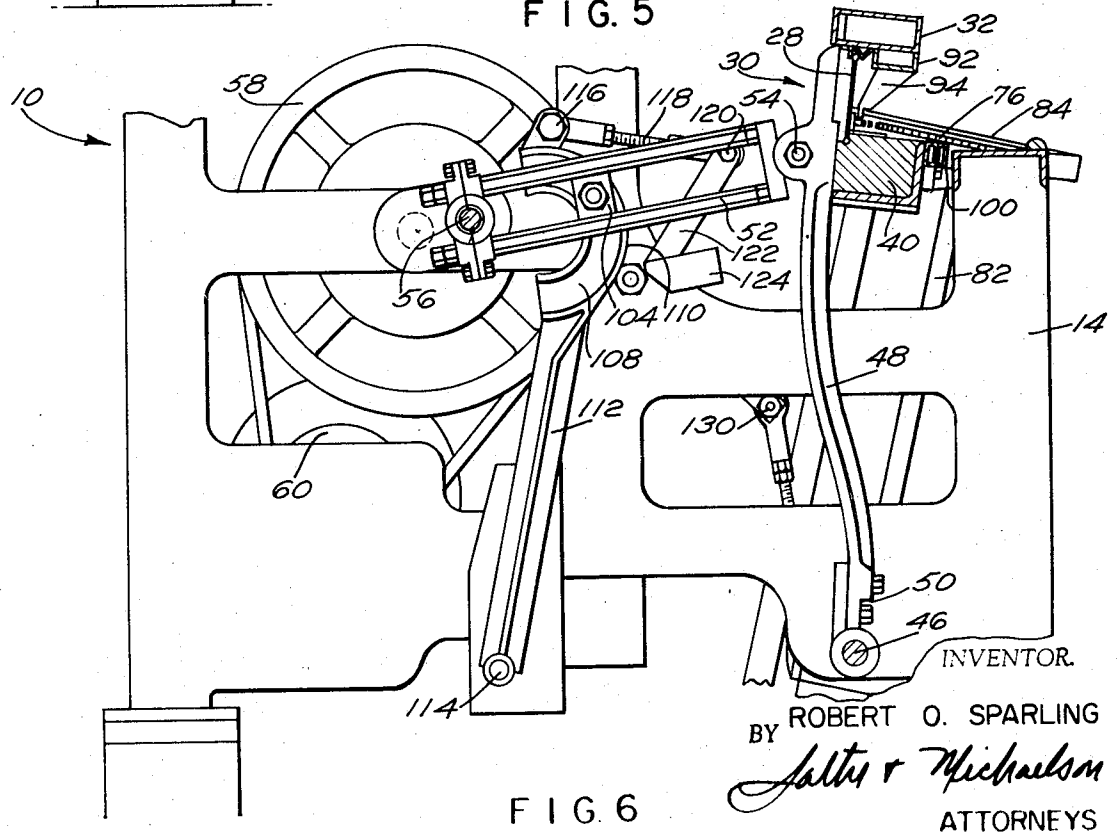

FIG. 6

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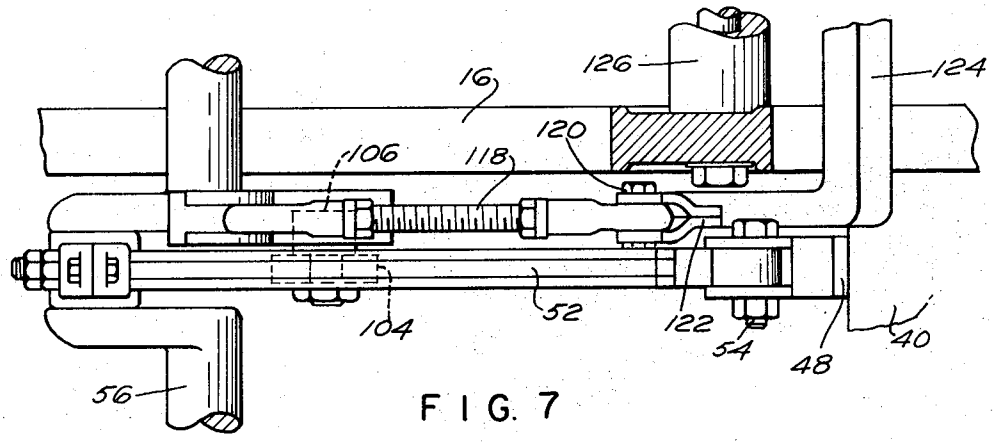

FIG. 7

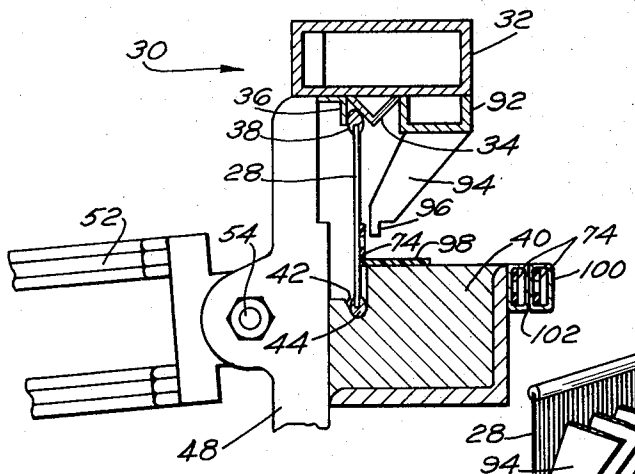

FIG. 8

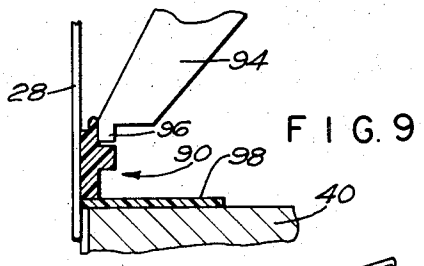

FIG. 9

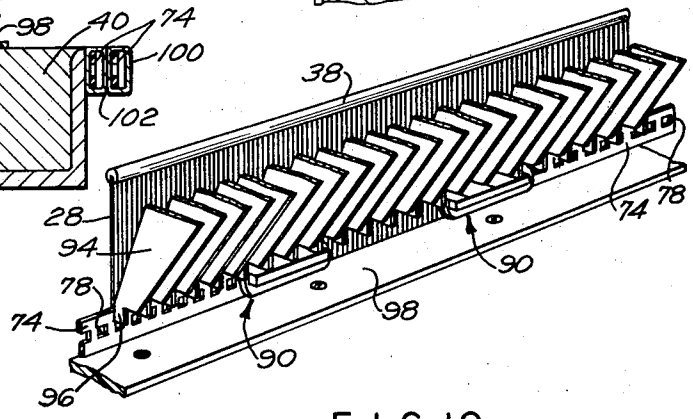

FIG. 10

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RAPIER LOOM

BACKGROUND OF THE INVENTION

The advantages of a shuttleless loom have long been recognized in the textile art. Furthermore, shuttleless looms employing flexible rapiers or tapes in place of the conventional fly shuttle for carrying the weft thread across the warp shed are well known in the art, as illustrated, for example, by Budzyna et al., U. S. Pat. No. 2,604,123, dated July 22, 1952. In the Budzyna patent, means are provided for feeding a pair of flexible tapes from opposite sides of the shed to substantially the center point thereof, and then retracting said tapes. The inner ends of the tapes are provided with carrier members whereby one of the tapes carries the weft thread to the center of the shed as the tapes are fed inwardly, and then the the thread is automatically transferred to the carrier of the other tape whereupon when the tapes retract, the weft thread is carried across the remaining half of the shed to complete the pick. It has been found that this type of shuttleless loom not only operates faster than the conventional fly shuttle loom; but since the tremendous inertia forces present in the conventional fly shuttle loom are avoided, rapier looms of this type are more durable in use and have a longer life.

In prior art rapier looms of this type, as disclosed in the Budzyna patent, for example, it is customary to mount the flexible tapes so that they are flat, or, expressed differently, in horizontal disposition as they move through the warp shed. Although shuttleless looms utilizing horizontally disposed flexible tapes have proven to be generally satisfactory in operation, it has now been found that certain pronounced advantages exist where the flexible tapes are vertically disposed, or, expressed differently, ride on their edges as they move across the shed.

A further problem that exists in shuttleless looms of the type disclosed in the above-mentioned Budzyna patent is to be sure that the feed and retraction of the flexible tapes are in proper timed sequence and relation to the rocking movement of the lay. More specifically, it is desirable and even essential that the flexible tapes feed and retract with maximum rapidity while the rocking motion of the lay is in its dwell. And, conversely, the flexible tapes should be in the dwell period of their cycle after retraction from the shed and while the lay is moving forwardly and rearwardly.

A further problem with shuttleless looms of the type disclosed in the Budzyna patent is that the lay must stop while the tape is inserted into and retracted from the shed.

SUMMARY OF THE INVENTION

It has been found that by providing a shuttleless loom of the type shown in Budzyna U.S. Pat. No. 2,604,123, but wherein the flexible tapes that carry the weft thread across the shed are vertically disposed, i.e., ride on the edges, numerous advantages are achieved. First of all, where the tapes are vertically disposed, the feed wheels that drive and retract the tapes will assume a horizontal disposition with a vertical operating shaft. This arrangement has been found to promote maximum compactness of the overall loom, since the tapes, when retracted, may extend across the front of he loom, as will hereinafter be described in more detail. Furthermore, by mounting the tapes so that they ride on their edges, minimal friction is encountered during feed and retraction of the tapes, and the vertically disposed tapes may be conveniently supported on one side by the reed. Specially designed fingers are carried by the reed cap and extend downwardly therefrom to a point spaced from the reed and slightly below the upper edge of the tapes; whereupon the tapes, as they move across the shed, are supported between the reed and the aforesaid fingers. It has been found that by vertically positioning the tapes against the reed, less chance of skipping threads exists than where the tapes lie flat. Also, with the tapes vertically disposed, there is more clearance between the warp threads and the tape, thus minimizing wear on the warp threads which might possibly take place where the tape is lying flat and where the edge of the tape remote from the reed might in some cases be engaged by he warp threads.

It is therefore a primary object of my invention to provide a shuttleless loom wherein the weft threads are carried across the warp shed by means of vertically disposed flexible tapes which move on their edges, said tapes being supported on one side by the reed and on their other side by specially designed guide fingers.

Another object of my invention is the provision of specially designed means for feeding and retracting the flexible tapes through the warp shed, which means operate in response to and are directly controlled by the conventional means in the loom for rocking the lay, whereby the desired time sequence and relationship between movement of the lay and feeding and retraction of the flexible tapes are achieved.

Another object of this invention is the provision of a shuttleless loom, the novel features of which are so constructed as to be readily associated with a conventional fly shuttle loom in order to convert the latter to a shuttleless loom.

DESCRIPTION OF THE DRAWINGS

In the drawings which illustrate the best mode presently contemplated for carrying out the present invention:

FIG. 1 is a fragmentary front perspective view showing one half of a loom embodying the present invention;

FIG. 2 is a fragmentary top plan view, partly in section, showing one of the rapier drive and guide means;

FIG. 3 is a fragmentary side elevational view showing the loom and rapier drive;

FIG. 4 is a fragmentary front elevational view showing the loom and rapier drive;

FIG. 5 is a fragmentary side elevational view of the drive means shown in FIG. 3, looking from the opposite direction, and with the lay in its rearward position;

FIG. 6 is a view similar to FIG. 5 with the lay in its forward position;

FIG. 7 is a fragmentary top plan view of part of the drive means shown in FIGS. 5 and 6;

FIG. 8 is a fragmentary section, on an enlarged scale, of the lay assembly, including the rapier mounting and guide means;

FIG. 9 is a fragmentary section, on an enlarged scale, taken through one of the transfer blocks attached to the end of one of the rapiers; and

FIG. 10 is a fragmentary perspective view showing the rapiers and their transfer blocks, and the rapier support and guide means.

DESCRIPTION OF THE INVENTION

Referring now to the drawings, and more particularly to FIG. 1, there is shown a loom 10, or, more specifically, the right-hand half of the loom, it being understood that the construction shown in FIG. 1 is duplicated at the left end of the loom, which has therefore not been illustrated. The loom 10 is in many respects of conventional structure and operation. Expressed differently, the loom 10 is in many respects similarly constructed to a conventional fly shuttle loom, and, in fact, one of the advantages of the present invention is the fact that a conventional fly shuttle loom may be converted to a shuttleless loom by modifying it to include the novel features of the present invention, hereinafter to be described in detail.

The loom 10 is supported by fixed frame portions 12, 14 and 16, there being the usual cross braces (not shown) for imparting structural rigidity to the frame members. The frame portion 16 supports laterally extending arch members 18 which in turn rotatably support a plurality of sheaves 20, which in turn control the raising and lowering of the plurality of harnesses 22 and their associated heddles 24, all in a well-known manner. The warp threads 26, are fed from any suitable source of supply (not shown) and pass through the reed 28 of the lay assembly shown generally at 30, see FIG. 8, and form the shed for receiving the weft thread, all of this being conventional in the textile art. The lay assembly 30 comprises a laterally extending reed cap 32 which has a V-shaped bar 34 extending longitudinally along its undersurface, said V bar 34 cooperating with angle 36, also secured to the undersurface of reed cap 32 and extending longitudinally therealong, to wedgingly receive the enlarged upper end 38 of reed 28. The lay assembly 30 further comprises a race member 40 having a cutout 42 for receiving the enlarged lower end 44 of reed 28. Thus it will be seen that the reed 28 is securely mounted in the lay assembly, and it will be understood that the lay is rockable or reciprocal about rocker shaft 46 by means of lay sword 48 pivoted to shaft 46 as at 50. It will be understood that lay sword 48 is rigidly secured to lay assembly 30 by any suitable means and that the lay sword and the lay assembly are rocked or reciprocated about shaft 46 by means of a connecting rod 52 which is pivotally attached to the lay sword as at 54. Connecting rod 52 is driven by crank shaft 56 which in turn is driven by drive pulley 58 driven by motor 60. It will therefore be seen that when the loom 10 is operated, as by suitable operating switches (not shown) provided at control panel 62, the motor 60, by means of pulley 58, drives crank shaft 56, the rotation of which, through connecting rod 52, imparts rocking motion to the lay sword 48 about its rocker shaft 46, thus rocking the lay assembly 30, all in a manner well known in the art. Conventional clutch means, not shown in detail, are provided, and a shifter handle 64 is operable to engage and disengage the clutch means. Likewise, suitable brake means, not shown, may be controlled by brake handle 66. Conventional take-up rolls 68, 70 are provided for receiving the woven cloth 72.

The loom 10, as described heretofore, is conventional in all respects. The means for feeding the weft thread across the warp shed forms one of the important features of the present invention and will now be described. Since one of the basic concepts of this invention is the provision of a novel and improved shuttleless loom, it will be obvious that a fly shuttle is not used for feeding the weft thread. Rather, a pair of flexible tapes or rapiers 74 are employed for this purpose, it being understood that each tape 74 is identical in construction, as is the mounting means therefor, and hence only one of said tapes and mounting means will be described. The tape 74 is of any suitable flexible construction, preferably plastic, and cooperates with sprocket wheel 76 for effecting the feed and retraction of the tape through the warp shed. Specifically, as will be seen most clearly in FIGS. 1 and 10, the tape 74 is provided with openings 78 which cooperate with the teeth 80 to effect driving engagement between the tape and the sprocket wheel. It is important to note that the wheel 76 is horizontally disposed and is oscillated by means of a vertical shaft 82, the drive for which will hereinafter be described. An arcuate plate 84 carries pressure rollers 86 which serve to maintain the tape 74 is engagement with wheel 76, as will be seen most clearly in FIG. 2. It will be noted that the tape 74 is vertically disposed, or, expressed differently, rides on its edge, and the tape extends around sprocket wheel 76 for approximately 180° of the circumference of the latter and then passes under a guide lip 88 and then into the shed formed by the warp threads 26. At its innermost end, the tape 74 is secured to a transfer block 90; and, as will be seen most clearly in FIGS. 1, 2 and 10, the tape 74 as it enters the warp shed, is vertically disposed in juxtaposition to the reed 28, whereby the reed 28 actually acts as a support for one side of the tape 74. The reed cap 32 is provided with a channel 92 that extends longitudinally along the undersurface of the reed cap, as will be seen most clearly in FIGS. 1 and 8; and secured to and depending from the bottom of channel 92 are a plurality of guide fingers 94. The fingers 94 are generally angularly disposed with respect to reed 28 but have a lower portion 96 that is spaced from and substantially parallel to reed 28 and that depends slightly below the upper edge of tape 74, whereby the tape is actually sandwiched between reed 28 and portion 96 of fingers 94 and hence is maintained in the desired vertical disposition. It is important to note that portion 96 is spaced from reed 28 sufficiently so as to permit the upper portion of block 90 to slide therebetween, as shown in FIGS. 9 and 10. Also, the fact that portions 96 of fingers 94 terminate above the race 40 provides sufficient area for the weft thread to be beat-up when the lay rocks forwardly. Expressed differently, although the lower edges of fingers 94 extend into the warp shed when the lay is in its normal position, as the lay is rocked forwardly, the lower edges of the fingers move toward the divergent front corner of the shed and clear the upper warp sheet so as not to interfere with the beat-up of the weft.

In order to reduce wear and friction, race 40 is provided with a race plate 98, preferably of plastic construction, on which the lower edge of tape 74 and block 90 slide. It will be seen that as the sprocket wheels 76 on opposite sides of the loom 10 are simultaneously

oscillated, the tapes 74 will be fed inwardly until they meet at substantially the center point of the warp shed. One of the transfer blocks 90 will carry with it a weft thread; and, when the two blocks meet at the center of the warp shed, the weft thread will be transferred to the other block 90; whereupon, when the wheels 76 reverse direction and the tapes are retracted from the warp shed, the weft thread will be carried across the remaining half of the warp shed to complete the pick. The specific construction of the transfer block 90 forms no part of the present invention, and it will be understood that any suitable transfer means, such as those disclosed in the aforesaid Budzyna patent, for example, may be utilized. When the tapes 74 are retracted out of the warp shed, the free outer ends of the tapes are fed into guide means 100 secured to the front of race 40 and extending thereacross. Since the tapes, when fully retracted, may overlap each other in the guide channel 100, a vertical partition 102 is provided fro maintaining the two tapes separate from each other.

It has been found that by feeding the flexible tapes 74 in vertical disposition so that they ride on their edges and so that they are supported against the reed, minimal possibilities exist of undesirable contact between the tapes and the warp threads. Expressed differently, this arrangement results in maximum clearance between the tapes and the yarn, so that wear on the yarn is kept at a minimum. Also, the possibility of skipping threads is minimized by this arrangement. In addition, no close tolerances need be maintained when the tape is supported on its edge, as above described. Lastly, by supporting the tapes on their edges, the drive wheels 76 may be horizontally disposed, thus making it a simple matter for the retracted tapes to extend toward each other and even overlap, while at the same time utilizing a minimum of space. It has been found that this arrangement results in a far more compact overall loom than where the tapes are horizontally disposed, thus requiring drive wheels which are in a vertical plane, which in turn raises a problem as to where to receive the retracted tape.

Since it is imperative that the tapes 74 be fed and retracted in a predetermined timed relationship to the rocking of the lay assembly 32, novel drive means for the tape 74 have been developed and form an important part of the present invention. Specifically, the drive means for the tapes 74 is directly responsive to and is controlled by the means which impart rocking motion to the lay assembly. More specifically, the connecting rod 52 which imparts oscillating movement to lay sword 48 in the manner hereinbefore described has secured thereto a cam follower 104 which comprises a roller 106, see FIG. 7, that is received within the arcuate track 108 of cam member 110. As will be seen most clearly in FIGS. 5 and 6, the cam member 110 has a depending arm 112 fixedly secured thereto which is pivotally mounted at its lower extremity to the fixed frame of the loom 10, as at 114. Pivotally secured to the cam 110, as at 116, is an adjustable link arm 118 which in turn is pivotally connected, as at 120, to bell crank 122, the lower end of which has a laterally extending portion 124 that is fixedly connected to roller 126. The roller 126 in turn carries an adjustable rocker arm 128, the forwardmost end of which is pivotally attached, as at 130, to a vertically extending rod 132 provided with a rack segment 134 at its lower extremity. Rack 134 in turn drivingly engages pinion 136 whereupon reciprocal movement of rack 134 imparts oscillating movement to pinion 136 and shaft 138, which, through gear box 140, imparts the desired oscillation to the drive shaft 82 on which sprocket wheel 76 is mounted.

It will thus be seen that as crank shaft 56 rotates to impart the desired rocking motion to the lay assembly, as hereinbefore described, the engagement of roller 106 in the arcuate track of cam 110 will cause the cam 110 to oscillate about its pivot point 114. However, the oscillation of cam 110 about pivot point 114 will not result in the same movement as is imparted to lay sword 48 since the up-and-down movement of roller 106 in cam track 108 will cause oscillating movement of cam 110 in a particular predetermined relationship to the rocking motion of lay sword 48. As the cam 110 oscillates, similar oscillation will be imparted to the roller 126 by means of link arm 118 and bell crank 122. As the roller 126 oscillates, the arm 128 fixedly carried thereby will impart vertical reciprocal movement to shaft 132 and rack 134, which in turn, through pinion 136 and gear box 140, will result in the desired oscillatory rotation of shaft 82 and drive wheel 76 carried thereby. By adjusting the length of link arm 118, the extent of oscillatory movement imparted to roller 126 may be varied, thus in turn varying the feed stroke of drive wheel 76. Also, it is important to note that gear box 140, shaft 82, and drive wheel 76 rock as a unit with the lay assembly, it being specifically noted that the gear box is pivotally mounted on the fixed frame 142 as at 144, see FIG. 1, and the gear box is structurally connected to the lay assembly by means of frame member 146, see FIG. 3.

It will thus be seen that the main crank shaft 56 actually drives the tape feed means; and, more specifically, a controlled relationship exists between the rocking motion of the lay assembly and the feed and retraction of the flexible tapes due to the cam action which exists between follower 104 and its roller 106 carried by connecting rod 52 and the cam member 110 which in turn initiates the tape drive.

What is claimed is:

1. In a rapier loom having a lay and means for imparting rocking movement to said lay, a pair of flexible rapier tapes, means for simultaneously feeding said tapes from opposite sides of the loom to substantially the center point of the lay and then retracting them, transfer means carried by the inner ends of said tapes whereby one of said transfer means carries a weft thread from one side of the loom to the center thereof and then transfers the weft thread to the other transfer means so that as the tapes retract, the weft thread is carried across the remaining half of the loom to complete the pick, and means supporting said tapes on their edges during their movement across the lay, said feeding means comprising a drive wheel at each side of the loom making driving engagement with one of said tapes, said wheels each being horizontally disposed and each having a vertical shaft fixed thereto, and means for oscillating said shafts to feed and retract said tapes, said oscillating means being controlled by said rocking means, whereby movement of said tapes is in predetermined timed sequence to rocking of the lay, said

rocking means comprising a crank shaft and connecting rod, said oscillating means comprising an arcuate cam having a fixed arm extending therefrom and mounted for pivotal movement about a pivot point spaced from said cam, and a follower fixed to said connecting rod and slidably engaging said cam, whereby as said crank shaft rotates, oscillating motion is simultaneously imparted to said connecting rod and to said cam and arm, the movement of said follower along said cam causing said arm to oscillate in a predetermined relation to oscillation of said connecting rod.

2. In the rapier loom of claim 1, a second arm secured to and extending from said cam for oscillation therewith, linkage means interconnecting the free end of said second arm and said vertical shafts, whereby oscillation of said second arm results in oscillatory rotation of said vertical shafts.

3. In the rapier loom of claim 2, means for adjusting the extent of oscillatory rotation of said vertical shafts, said adjusting means comprising means for varying the length of said second arm.

4. In a rapier loom having a lay comprising a reed depending from a transversely extending reed cap and means for imparting rocking movement to said lay to beat-up the weft, a flexible rapier tape having weft thread gripper means at its inner end, means for feeding said tape in and out with respect to the lay to carry a weft thread thereacross, guide means including an arcuate portion adjacent the end of the lay for guiding the tape through a portion of its in-and-out movement, and means supporting said tape on its edge during its movement across the lay, said means comprising a plurality of guide fingers extending downwardly from said reed cap in forwardly spaced relation to said reed to a point slightly below the top edge of said tape whereby said tape is maintained on edge between said fingers and said reed.

5. In the rapier loom of claim 4, said feeding means being directly responsive to and controlled by said rocking means.

6. In a rapier loom having a lay comprising a reed depending from a transversely extending reed cap and means for imparting rocking movement to said lay to beat-up the weft, a flexible rapier tape having weft thread gripper means at its inner end, means for feeding said tape in and out with respect to the lay to carry a weft thread thereacross, and means supporting said tape on its edge during its movement across the lay, said means comprising a plurality of guide fingers extending downwardly from said reed cap in forwardly spaced relation to said reed to a point slightly below the top edge of said tape whereby said tape is maintained on edge between said fingers and said reed, said feeding means comprising a drive wheel at one side of the loom making driving engagement with said tape, said wheel being horizontally disposed and having a vertical shaft fixed thereto, and means for oscillating said shaft to feed said tape in and out, said oscillating means being controlled by said rocking means, whereby movement of said tape is in a predetermined timed sequence to rocking of the lay.

7. In the rapier loom of claim 6, said rocking means comprising a crank shaft and connecting rod, said oscillating means comprising an arcuate cam having a fixed arm extending therefrom and mounted for pivotal movement about a pivot point spaced from said cam, and a follower fixed to said connecting rod and slidably engaging said cam, whereby as said crank shaft rotates, oscillating motion is simultaneously imparted to said connecting rod and to said cam and arm, the movement of said follower along said cam causing said arm to oscillate in a predetermined relation to oscillation of said connecting rod.

8. In the rapier loom of claim 7, a second arm secured to and extending from said cam for oscillation therewith, linkage means interconnecting the free end of said second arm and said vertical shaft, whereby oscillation of said second arm results in oscillatory rotation of said vertical shaft.

9. In the rapier loom of claim 8, means for adjusting the extent of oscillatory rotation of said vertical shaft, said adjusting means comprising means for varying the length of said second arm.

10. In a rapier loom having a lay and means for imparting rocking movement to said lay, a pair of flexible rapier tapes, means for simultaneously feeding said tapes from opposite sides of the loom to substantially the center point of the lay and then retracting them, transfer means carried by the inner ends of said tapes whereby one of said transfer means carries a weft thread from one side of the loom to the center thereof and then transfers the weft thread to the other transfer means so that as the tapes retract, the weft thread is carried across the remaining half of the loom to complete the pick, and means supporting said tapes on their edges during their movement across the lay, said feeding means comprising a drive wheel at each side of the loom making driving engagement with one of said tapes, said wheels each being horizontally disposed and each having a vertical shaft fixed thereto, and means for oscillating said shafts to feed and retract said tapes, each of said tapes engaging its respective drive wheel for approximately one half of the circumference thereof, the free ends of said tapes extending toward each other and overlapping when the tapes are in retracted position, channel means extending between said wheels for receiving the retracted tapes, and a vertical partition in said channel means for keeping said retracted tapes separated from each other.

11. In a rapier loom having a lay and means for imparting rocking movement to said lay, a flexible rapier tape having weft thread gripper means at its inner end, means for feeding said tape in and out with respect to the lay to carry a weft thread thereacross, said feeding means being directly responsive to and controlled by said rocking means, said feeding means comprising a drive wheel making driving engagement with said tape, said wheel having a drive shaft fixed thereto, and means for oscillating said shaft to feed said tape in and out, said rocking means comprising a crank shaft and connecting rod, said oscillating means comprising an arcuate cam having a fixed arm extending therefrom and mounted for pivotal movement about a pivot point spaced from said cam, and a follower fixed to said connecting rod and slidably engaging said cam, whereby as said crank shaft rotates, oscillating motion is simultaneously imparted to said connecting rod and to said cam and arm, the movement of said follower along said cam causing said arm to oscillate in a predetermined relation to oscillation of said connecting rod.

12. In the rapier loom of claim 11, a second arm secured to and extending from said cam for oscillation therewith, linkage means interconnecting the free end of said second arm and said shaft, whereby oscillation of said second arm results in oscillatory rotation of said shaft.

13. In the rapier loom of claim 12, means for adjusting the extent of oscillatory rotation of said shaft, said adjusting means comprising means for varying the length of said second arm.

14. In the rapier loom of claim 1, said guide fingers each having a lower portion in guiding engagement with said tape, said lower portion being substantially parallel to said reed, and an upper portion that inclines away from said reed.

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