

Jan. 20, 1953

R. G. TURNER

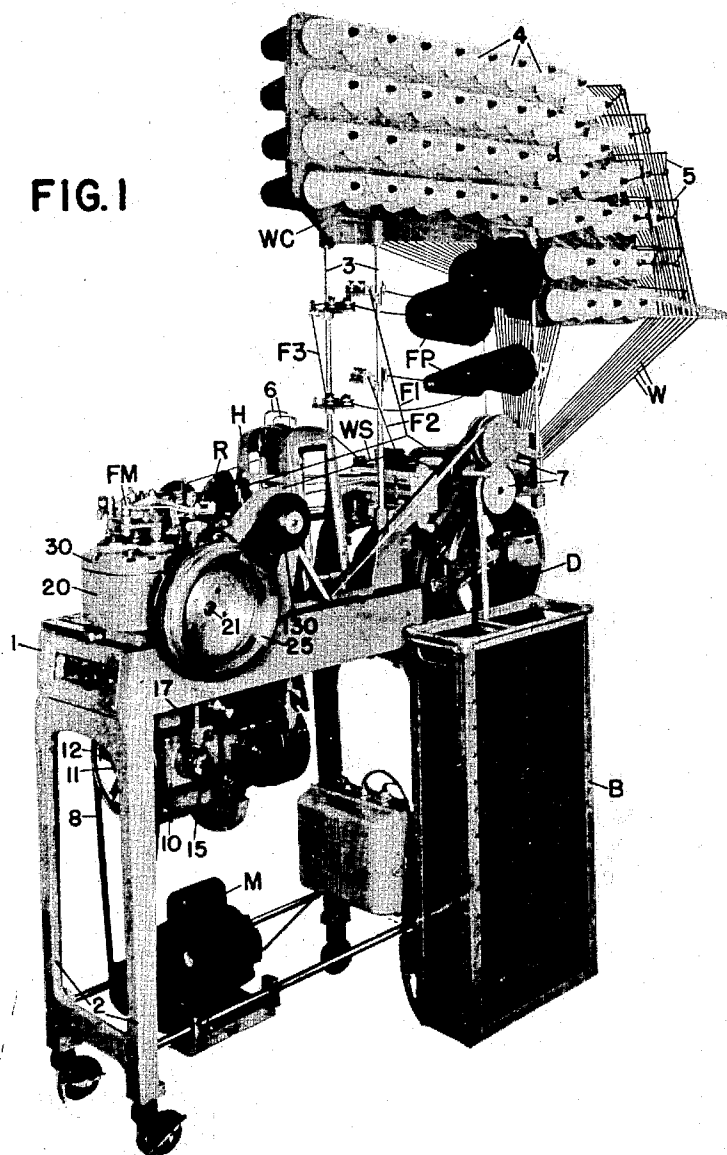
2,625,959

NEEDLE LOOM

Filed May 5, 1950

8 Sheets-Sheet 1

FIG. 1



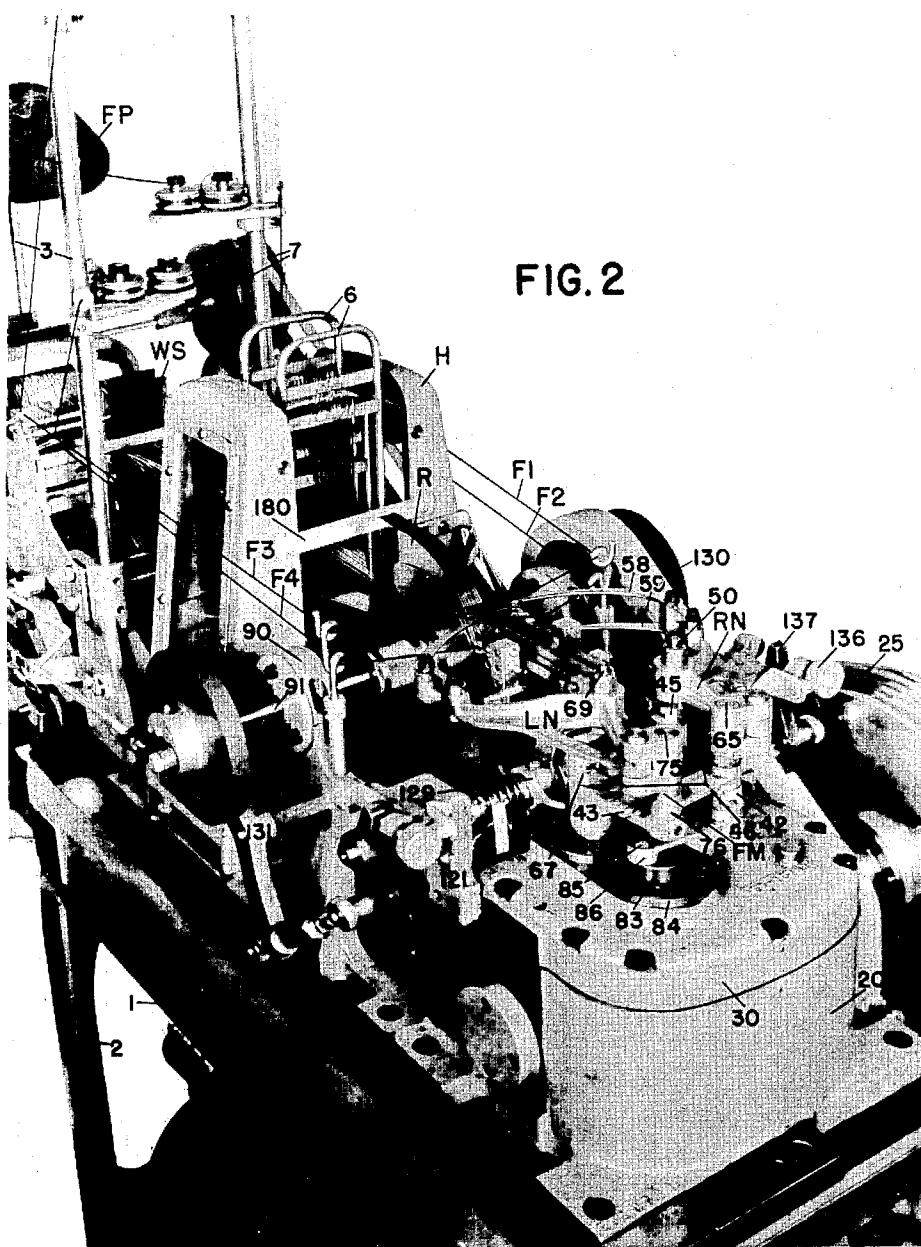
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8 Sheets-Sheet 2



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FIG. 4

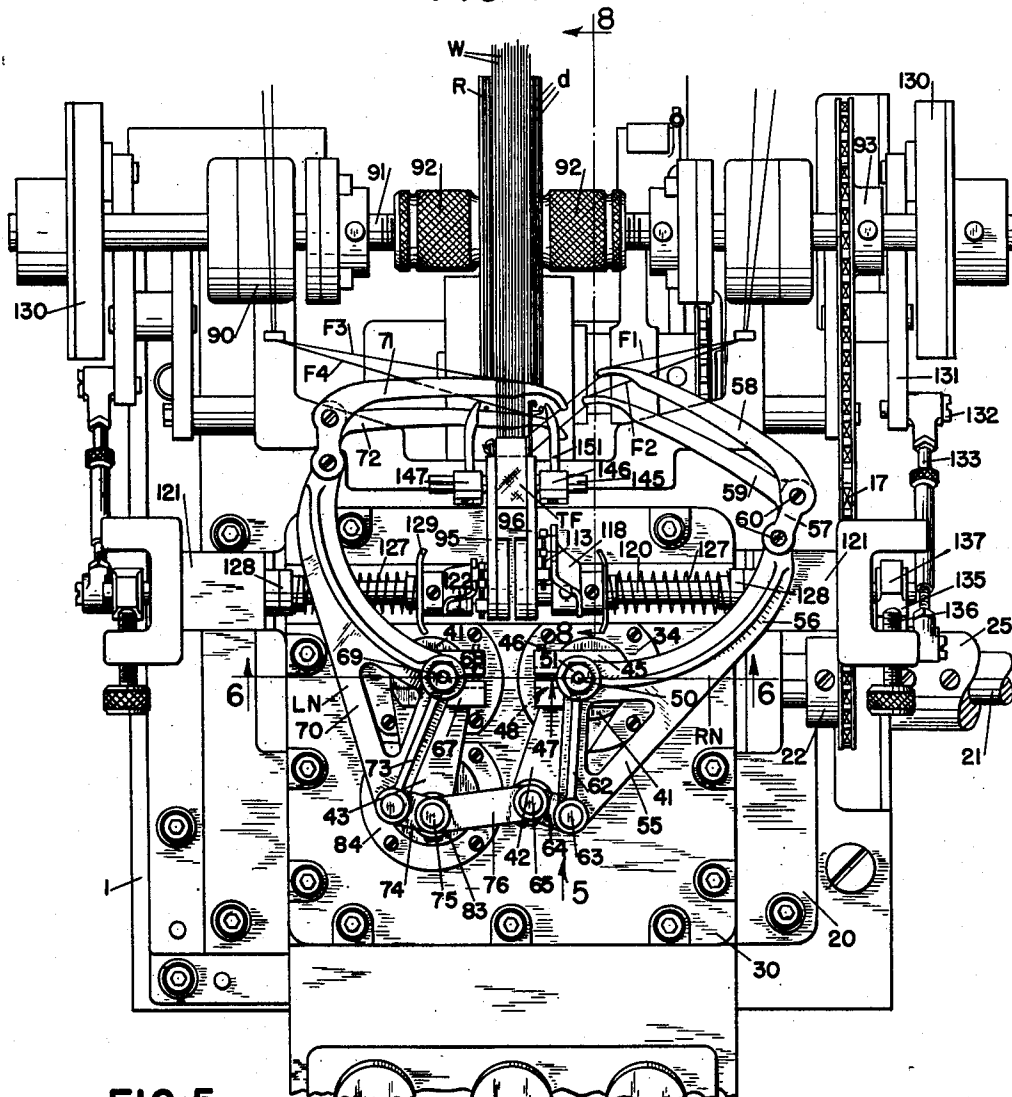
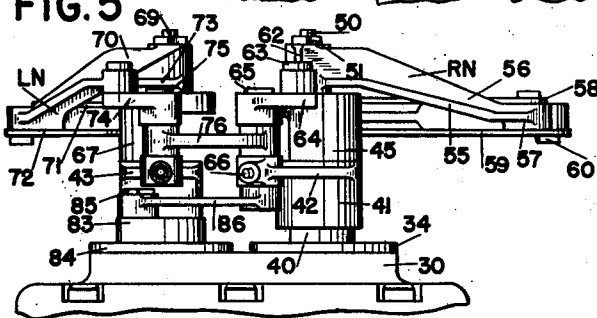


FIG. 5



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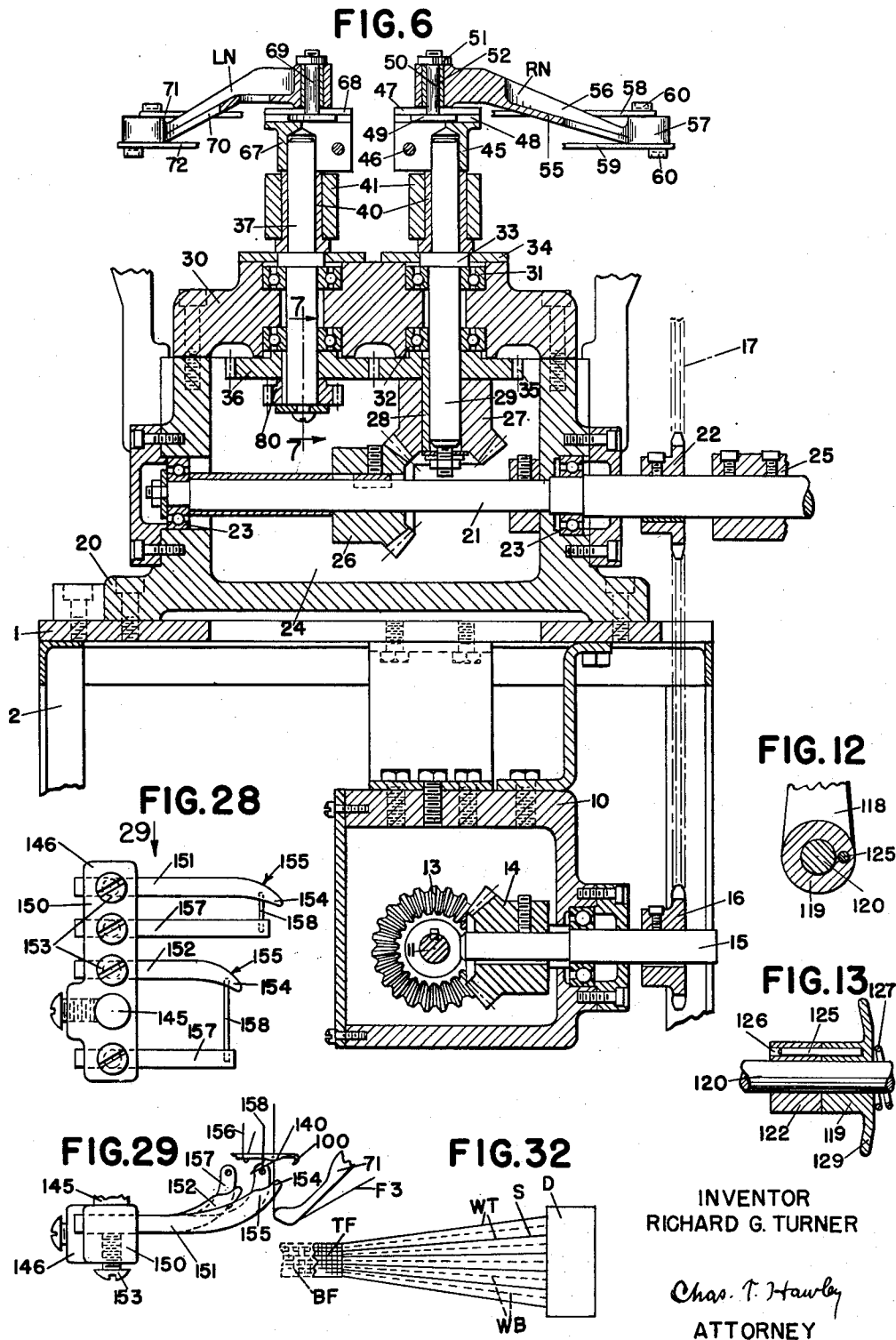
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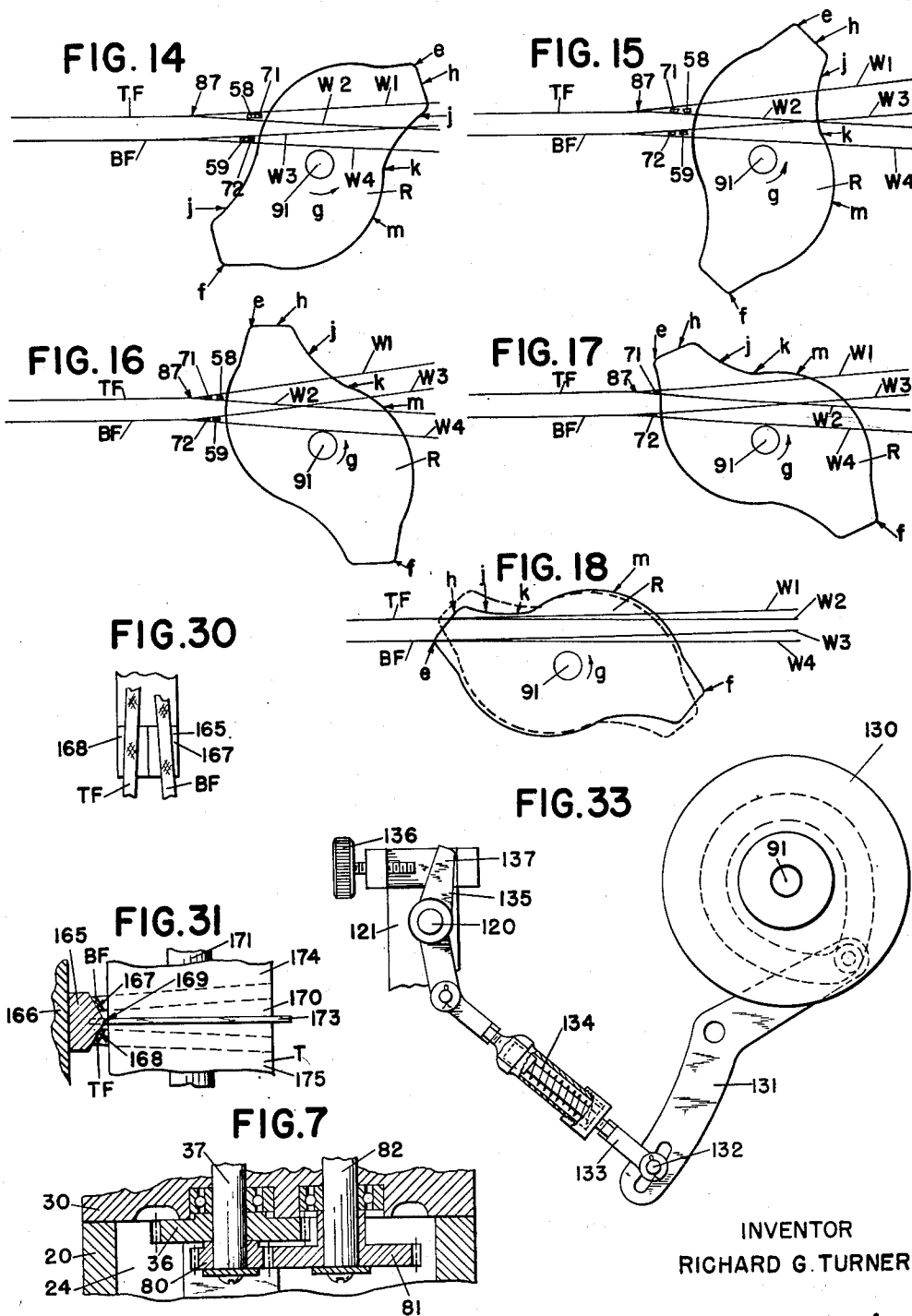
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8 Sheets-Sheet 8

FIG. 19

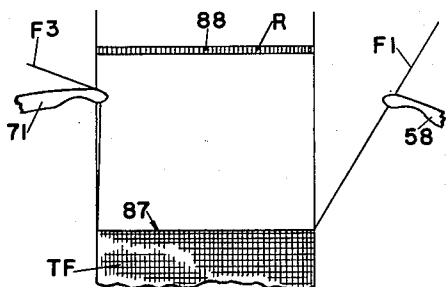


FIG. 20

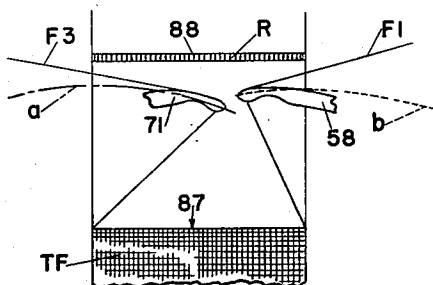


FIG. 21

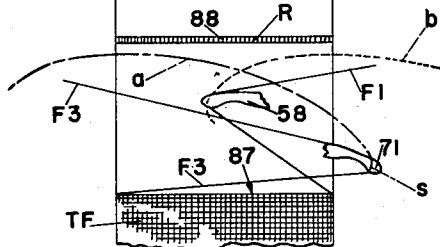


FIG. 22

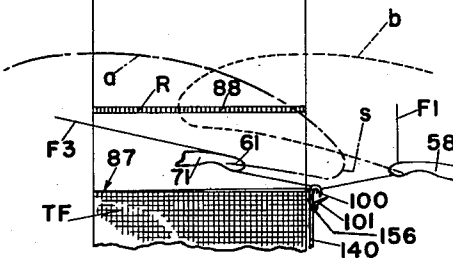


FIG. 23

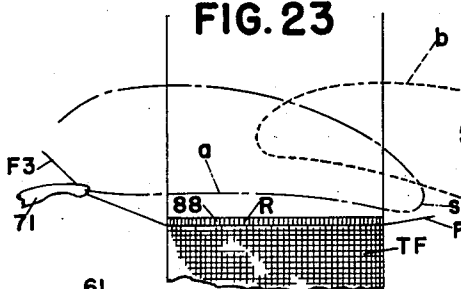


FIG. 24

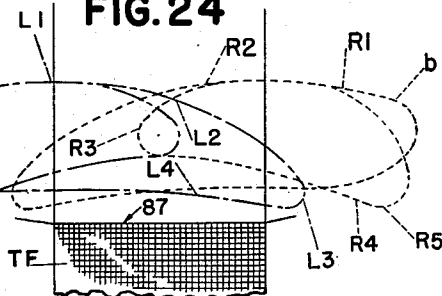
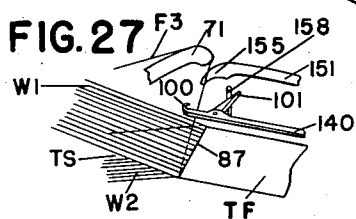


FIG. 25



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UNITED STATES PATENT OFFICE

2,625,959

NEEDLE LOOM

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Mass., a corporation of Massachusetts

Application May 5, 1950, Serial No. 160,166

40 Claims. (Cl. 139—124)

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This invention relates to high speed needle looms for the weaving of narrow ware, such as ribbons, tapes, etc.

In the past it has been customary to weave narrow fabrics on a gang shuttle loom running at comparatively low speeds and producing a single fabric for each shuttle. It is difficult to weave a variety of fabrics on a gang loom due to the fact that most of the mechanisms of the loom must be the same for all the fabrics being woven. It has been proposed heretofore to use small unit looms, but they have in most instances been limited to a single fabric and there has not been sufficient economic gain to justify their general use despite the high speeds at which they run.

It is the general object of the present invention to provide a high speed unit loom for weaving two webs independently of each other by the same group of mechanisms. Included in the mechanisms are weft needles, two for each fabric, which draw their supply of filling or weft from stationary packages.

It is an important object of the invention to drive the weft needles by rotary drivers or actuators directly connected to the needle carrying members to the end that the number of the reciprocating parts may be reduced to a minimum.

It is another object of the invention to drive each needle member by primary and secondary actuators one of which turns a part of the needle member in a horizontal circular path parallel to the plane of the fabric and the other of which serves to shift the center around which the primary actuator moves the needle member.

It is another object of the invention to utilize the primary actuator to move the needle member in a back and forth as well as a lateral direction and turn the primary actuator in such a direction as to cause the needle to enter the warp shed a considerable distance behind the cloth fell and then move forwardly to permit the reed to follow it closely, after which the needle is drawn out of the shed along a path more or less parallel to and spaced a short distance behind the cloth fell. In this way the time of beat-up can follow immediately after emergence of the weft needle from the warp shed.

It has been proposed heretofore to use rotary reeds but in all known instances of such use the reed has either moved completely out of the shed or was so formed that a corner or shoulder of the reed dent has been required to enter a warp shed. In either instance there is no certainty

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that a given dent will always enter between the same warp threads and as a result the fell of the cloth has not been uniform. This condition is aggravated when two or more warp threads are assigned to a reed space.

It is another important object of the present invention to provide a rotary reed the dents of which are so shaped and disposed with respect to the warp shed and the fell of the cloth that some part of the reed dent is always entirely through the warp shed for all angular positions of the reed. By this arrangement the reed is never required to enter a shed but merely changes its position with respect to the shed, always keeping the warp threads in the same reed spaces and thus assuring uniformity of beat-up at the fell.

It is another object of the invention to provide the reed dents with a beat-up point followed by a sharp decline in the dent periphery to permit early entrance of the weft needles into the warp shed. This decline is so located, however, that it never falls below the line of the top warp shed. The dent is also provided with a gradual incline following the decline which permits the part of the reed periphery in the warp shed to advance closely behind the weft needles as they move forwardly toward the cloth fell. As a result of the gradual incline the beat-up can be distributed over a considerable period of the cycle of the loom and after the weft needles leave the shed it is only necessary to move the weft a short distance by the reed to incorporate it into the fabric in the fell.

The reed is so made that it can keep all four sheets of two warp sheds correctly spaced and between the dents for all angular positions of the reed when the loom is weaving two fabrics. It will be understood of course that certain features of the reed will be equally advantageous even though a single web is being woven.

The selvages are formed by knitting needles which reciprocate backwardly and forwardly to catch the weft threads. It is an important object of the present invention to provide driving mechanism for the selvage needles so made that it can be readily moved out of holding position to permit replacement of a worn or broken knitting needle. This feature of the invention includes a spring normally maintaining the needle actuator in driving position but compressible to permit movement of the actuator away from the selvage needles.

It is another object of the invention to provide a loom adjustable for the weaving of webs of different widths. When an adjustment is made

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to accommodate a wider fabric the aforesaid springs compress to accommodate the adjustment.

While certain features of the invention are useful for the weaving of a single web, the loom is adapted more particularly for the weaving of two webs one over the other by two sets of weft laying needles and two sets of selvage forming knitting needles. It is desirable that both webs be as nearly alike as possible and to attain this result it is another object of the invention to supply the warp threads in a sheet from a single warp delivery means wherein the warp threads for both webs or fabrics are distributed uniformly across the width of the warp sheet. After the two fabrics have been woven they are led along a separator which spaces them laterally and directs them to two different take-up areas or zones on a single take-up roll. By the previously mentioned distribution of the warp threads at the delivery means and the feature of directing the two webs to two different take-up areas of the same take-up roll assurance is given that uniformity of the two fabrics with respect to warp tension and weft pick distribution will be attained.

With these and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts hereinafter described and set forth.

In the accompanying drawings, wherein a convenient embodiment of the invention is set forth, Fig. 1 is a perspective view of the complete loom as seen from a point to the right and forward of the loom.

Fig. 2 is a perspective view of the forward part of the loom as seen from the left front looking diagonally rearwardly.

Fig. 3 is a perspective view of the front of the loom as seen from a point at the right and looking diagonally forwardly.

Fig. 4 is a plan view of the forward part of the loom showing the needle mechanisms and reed.

Fig. 5 is a detail front elevation of the weft needle mechanism looking in the direction of arrow 5, Fig. 4.

Fig. 6 is a vertical section on line 6-6, Fig. 4.

Fig. 7 is a detail vertical section on line 7-7, Fig. 6.

Fig. 8 is a vertical section on line 8-8, Fig. 4, parts being omitted and the harnesses being added.

Fig. 9 is an enlarged detail vertical section on line 9-9, Fig. 8, showing the mounting for the selvage needles.

Fig. 10 is an enlarged vertical section on line 10-10, Fig. 8, showing the driving mechanism for the selvage needles.

Fig. 11 is an enlargement of the upper left hand part of Fig. 10.

Fig. 12 is a detail vertical section on line 12-12, Fig. 10.

Fig. 13 is a detail horizontal section on line 13-13, Fig. 10.

Figs. 14 to 18 are diagrammatic side views of a reed dent in different angular positions and showing the warp sheds and fabrics and also the weft needles in Figs. 14 to 17.

Figs. 19 to 24 are diagrammatic plan views showing the weft needles for the top warp shed in different positions.

Fig. 25 is an enlarged plan view of one of the

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weft needles, parts being in section to show the weft eye.

Fig. 26 shows a plan view of one of the selvage knitting needles.

Fig. 27 is a perspective view showing the guide means at one selvage for assisting the selvage needle to catch the corresponding weft thread.

Fig. 28 is an enlarged side elevation of the part of Fig. 8 which carries the weft guides.

Fig. 29 is a plan view in the direction of arrow 29, Fig. 28.

Fig. 30 is a detail rear elevation of the fabric spreader looking in the direction of arrow 30, Fig. 8.

Fig. 31 is a detail horizontal section on line 31-31, Fig. 8.

Fig. 32 is a diagrammatic plan of the warp thread system, and

Fig. 33 is a side elevation, partly in section, of the mechanism at the right side of the loom for reciprocating the corresponding selvage needle actuator.

General description of loom

Referring particularly to Fig. 1, the loom frame includes a table or bed 1 supported on legs 2. Secured to and extending upwardly from the table are four posts 3 which support a warp creel WC on which are mounted yarn cones 4 and warp thread guides 5. The warp threads designated generally at W lead from the creel to a delivery drum D and thence forwardly to a warp stop motion WS. The harness or shedding mechanism H is suitably supported on the table and in the present instance has four harness frames 6 (see Fig. 8). Forward of the shedding mechanism is a rotary reed R and in front of the latter is the weft or filling laying mechanism FM. The take-up mechanism T, hidden by the hand wheel in Fig. 1 but shown in Fig. 3, is under the weft needle mechanism and delivers the woven webs or fabrics to advancing rolls 7 from which the webs fall into a box B partitioned to provide a separate compartment for each web. The conical weft or filling packages FP supply the weft for the four weft needles and are supported on the rear posts 3. The driving motor M is mounted on the bottom of the loom frame and drives a belt 8.

The loom is adapted for weaving two narrow cloth webs or fabrics the upper of which TF is dark in color as shown in Fig. 3, and derives its warps from the warp cones at the back of the creel as seen in Fig. 1. The lower or bottom fabric BF is light in color, Fig. 3, and its warps are drawn from the warp cones on the front of the creel as seen in Fig. 1.

Weft needle mechanism

The mechanism for inserting the weft needles into the warp sheds is shown more particularly in Figs. 4-7, and 19-24.

Suspended from the forward under side of table 1 is a casing 10 supporting a shaft 11 extending horizontally rearwardly from a pulley 12 secured thereto and driven by belt 8. A bevel gear 13 secured to the shaft meshes with a second bevel gear 14 secured to a stub shaft 15 rotatable on the casing and extending horizontally to the right, see Fig. 6. Secured to shaft 15 outside the casing 10 is a sprocket wheel 16 meshing with an endless driving chain 17.

A hollow stand 20 is secured to the top of table 1 at the front end thereof and has journaled therein a cross shaft 21 to which is secured a

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sprocket wheel 22 meshing with chain 17. Shaft 21 turns on bearings 23 which are preferably non-leak so that chamber 24 within housing 20 can hold oil. A hand wheel 25 is secured to shaft 21.

Keyed to shaft 21 is a bevel gear 26 meshing with another bevel gear 27 keyed at 28 to an upright weft needle actuator shaft 29. A cover 30 is secured to casing 20 and has top and bottom bearings 31 and 32, respectively, for shaft 29. A flange 33 on shaft 29 rests on top bearing 31 to support the shaft and oil ring 34 around the flange is secured to the cover. Keyed to shaft 29 above the bevel gear 27 is a timer gear 35 meshing with another timer gear 36 of the same size keyed to another vertical shaft 37 similar to shaft 29.

The upper ends of shafts 29 and 37 are surrounded by bushings 40 resting on rings 34 and shouldered to support the hubs 41 of right and left supporting links or arms 42 and 43, respectively, see Fig. 4, which can rock around but do not turn with their shafts 29 and 37. A head 45 secured at 46 to the top of shaft 29 is formed with a radial slot 47 undercut at 48 to receive the head 49 of a stud 50 extending upwardly from the head and acting as a primary actuator for a right weft needle member RN pivoted to it. Stud 50 is adjustable along slot 47 to be located at different distances from the axis of shaft 29. When the stud is in adjusted position nut 51 is tightened against a bushing 52 around the stud to draw head 49 of the stud 50 up against the part of head 45 which overhangs the undercut. The needle member turns on the bushing 52.

The needle member RN includes a needle carrier 55, which may be a casting of light weight metal, formed with a rear arm 56 having a lug 57 having top and bottom weft needles 58 and 59, respectively, secured thereto as at 60. These needles extend to the left of arm 56, see Fig. 4, and have eyes 61 which receive weft or filling threads F1 and F2 for the top and bottom webs or fabrics, respectively. Needle carrier 55 has a forwardly extending arm 62 pivoted as at 63 to a link 64 pivoted on a vertical stud 65 secured at 66 to arm 42.

A second head 67 secured to the top of shaft 37 has a slot 68 similar to slot 47 which will align with the latter when the heads are as shown in Fig. 4. A left weft needle member LN is pivoted at 69 to head 67 and includes a needle carrier 70 formed like carrier 55 and having top and bottom needles 71 and 72, respectively, receiving weft threads F3 and F4 for the top and bottom fabrics, respectively. Carrier 70 has a forward arm 73 pivoted to link 74 on a pivot stud 75 similar to stud 65 but secured to arm 43. A link 76 joins studs 65 and 75.

Referring to Figs. 6 and 7, the lower end of shaft 37 has keyed thereto a pinion 80 meshing with a gear 81 of twice its diameter secured to the bottom of a short vertical stub shaft 82 journaled in cover 30 and rigid with a disk 83 resting on an oil ring 84 secured to the cover. A crank pin 85 on the disk has pivoted thereto a connector 86 the right end of which, Fig. 5, is pivoted on the lower end of stud 65. Disk 83 turns at one half the rate of the heads 45 and 67.

The studs 50 and 69 are set so that when the radial slots are aligned as in Fig. 4 the studs will have their axes in the plane of the axes of vertical shafts 29 and 37, and each stud will be displaced from its shaft axis the same amount toward the other stud, see Fig. 6. The amount of the displacement will depend upon the width of the

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webs being woven, the wider the webs the greater the displacement. The heads turn at the same rate but in opposite directions, head 45 turning counter-clockwise, Fig. 4.

When the loom is running the intermediate parts of the needle members RN and LN at their primary actuator studs 50 and 69 will turn in horizontal circles about fixed centers. These studs, as primary rotary means, complete two rotations for one rotation of the secondary rotary means or actuator 83. When the latter is in the left hand range of its motion, as shown in Fig. 4, the link 86 will have moved arms 42 and 43 to the left of their center or neutral position and stud 75 as a floating pivot will be to the left and the needles 71 and 72 will be in their extreme right hand position, while needles 58 and 59, because of the fact that their floating pivot 65 is to the left, will be to the right, see Fig. 4. When crank pin 83 is in its right hand range of motion the relation of the two needle members will be reversed. Each needle member has a primary bodily motion in a circle so that the needles have a back and forth as well as sidewise motion. This primary circular motion is modified by a secondary motion derived from the cross wise reciprocation of the floating pivots for the forward ends of the needle members. The combining of these two motions produces an actual motion of the weft needles which is advantageous for high speeds and desirable for laying of the weft near the cloth fell.

From Fig. 8 it will be understood that the warp sheds widen toward the rear. When a wrap shed begins to open its top and bottom planes will be very close together at the cloth fell but will be a little farther apart some distance behind the fell. It is desirable that the weft needles enter the sheds at their wider parts to gain time.

Referring to Figs. 19-24, and considering the top set of needles only, it will be seen that needle 71 enters the shed at the left and a considerable distance behind the fell 87, Fig. 19, and follows a path indicated by dot and dash line *a* forwardly and to the right through the position of Fig. 20 until the eye of the needle 71 is entirely through the shed and has emerged from the right, as in Fig. 21, to a position near the cloth fell. The needle then reverses and moves to the left along a path close to the fell, as shown in Fig. 22, and emerges from the shed near the fell. The forward part of this motion is due largely to movement of stud 69 from a point behind shaft 37 to a position in front of it.

In Fig. 19 that part of the reed immediately behind the needle, indicated at 88, moves forwardly from the position of Fig. 19 and can reach the position shown in Fig. 22 forward of the rear part of path *a* due to the forward motion of the needle caused by rotation of stud 69 forwardly from a rearward position, and due also to the fact that the needle is withdrawn from the shed near the cloth fell.

It will be noted further, and more particularly with wider webs, that needle 58 enters the shed slightly later than does needle 71 which is forward of needle 58 when the latter enters the right side of the shed, but although path *b* of needle 58 passes to the left of needle 71, the two needles do not strike each other.

Figs. 19-23 show the needle paths for a weft laying stroke of but one of the needles, namely, needle 71, when stud 75 is in the left hand range of its motion. When stud 65 is in the right hand range of its lateral motion it will cause needle 58

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to enter the shed first, and the paths of the two needles will be reversed.

Fig. 24 shows the paths traversed by the eyes of needles 58 and 71 for a complete reciprocation of the link 86, the dotted line showing the path of needle 58 and the dot and dash line showing the path of needle 71. Simultaneous positions of the two needles along their paths are indicated by reference characters having the same numbers but differing in the letters, thus positions R1 and L1. In operation the needles move very rapidly but without colliding with each other due to the fact that they are not at the crossing points of their paths at the same time.

Rotary reed mechanism

The rotary beat-up reed R is shown more particularly in Figs. 2, 3, 4, 8 and 14-18. An important feature of the reed is that it extends across the warp sheds for all of its angular positions so that the warp threads never get out of the reed. The warp threads are therefore always correctly spaced and the weft is beaten uniformly across the fell.

Bearing stand 90 secured to the table 1 supports a reed shaft 91 to which is keyed a group of reed dents *d* suitably spaced from each other and held in position by nuts 92 screw threaded on the shaft 91. The latter has secured thereto a sprocket wheel 93 twice the size of sprocket wheel 22 and meshing with the chain 17. The shaft 91 and the reed are rearward of the weft needles already described, and effect two beat-up operations for each rotation thereof.

As shown in Fig. 8 the harness mechanism H separates the warp threads into four planes or sheets, sheets W1 and W2 for the top shed TS and weft needles 58 and 71, and sheets W3 and W4 for the bottom shed BS and needles 59 and 72. Each reed dent has two diametrically opposite beat-up edges, points or areas *e* and *f*, and at the time these points, one at a time, are at the fell of the cloth some of the warp threads may be crossing. In a simple one up and one down weave all the warps will be crossing at beat-up, but in other weaves, such as twills, some of the warp threads will remain unchanged and in raised position at beat-up, and under these conditions some of the threads in top sheet W1 will be up as shown in Fig. 8 at beat-up. The reed dents are so shaped, however, that some part of them will be above the topmost warps at all times.

Referring to Fig. 8, the reed turns in the direction of arrow *g* and the periphery of the dent has a fell clearance edge or area *h* following the beat-up point *e*. Then follows a steep decline *j* leading down to the lowest point *k* of the dent. A gradual incline *m* rises from point *k* and leads to the other beat-up point *f*. The dents are symmetrical about a diameter passing through points *e* and *f*. In Fig. 8 it will be seen that a dot and dash line *n* concentric with the reed axis and passing through low point *k* extends above the top sheet W1.

From this it will be seen that the topmost warp threads are always between reed dents, and this is of course true for all the lower sheets W2-W4. It will be noted in Fig. 8 that the part of the dents above sheet W1 extend continuously above the warp threads of this shed from the point of entrance of the threads at the rear of the reed to the point of their emergence, and no part of the reed dent periphery between the points of warp entrance and emergence is ever below the sheet W1.

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When the point *e* is beating-up, needles are out of the shed and also out of the path of the reed. As the lower end of decline *j* moves under the bottom shed the top and bottom needles can enter their respective sheds slightly forward of line *n*, and over the decline *j*, as shown diagrammatically in Fig. 14. As the reed turns the part of incline *m* in the sheds approaches the fells, but at this same time the needles will be moving forwardly, as already described. As the reed reaches the position shown in Fig. 15 the needles which are laying weft will be fully inserted through their sheds, after which they start their return stroke which continues as the reed assumes the successive positions shown in Figs. 16 and 17. By the time the needles are out of their sheds the reed will be close to the fell in the position shown in Fig. 18.

The reed first beats up at the top fell when in the position shown in dotted lines, Fig. 18, and then immediately thereafter beats up at the bottom fell, see full lines, Fig. 18. The beat-up operation for the two webs are therefore successive, and the reed beats up the weft of the top and bottom sheds one at a time. Because of the fact that both fells are above the level of the reed axis the lower fell will be forward of the top fell, and it is for this reason that the top needles are set rearward of the bottom needles.

Selvage needle mechanism

The selvage mechanism utilizes knitting needles and is shown more particularly in Figs. 3, 4, 8-11, and 33. A knitting needle is provided for each side of each web, each pair of selvage needles being active for the weft laying strokes of the corresponding weft needles on the opposite side of the loom and idle on the next stroke involving the other weft needles.

In order that the loom may be adapted for weaving webs of different widths the pairs of selvage needles have separate mountings which can be spread apart or drawn together, according as the web is to be wide or narrow. The two mountings or stands 95 and 96 shown in Fig. 10 are secured to cover 30 by screws 97 extending through transverse slots 98 in the feet 99 of the stands and tapped into the cover. Since these stands and associated parts are similar a detailed description will be given of but one of them, namely, the right hand stand 96 shown in Figs. 3 and 8, and at the left of Fig. 10.

The selvage needles are all alike and include a rear hook 100, see Fig. 26, a latch 101, a shank 102 and a lateral driving arm 103. The upper part of stand 96 has cut therein top and bottom parallel horizontal slots 105 and 106, respectively, opening to the left, Fig. 9, to receive the top and bottom selvage needles 107 and 108, respectively. The slots are inclined downwardly so that the hook and latch, and also arm 103 are tipped downwardly, as is apparent from Fig. 10. The arms 103 project beyond the stand 96, to the left in Fig. 11, and the two needles 107 and 108 are vertically aligned.

A sliding actuator 110 is guided for back and forth reciprocation by a horizontal slot 111 parallel to and between slots 105 and 106. Slide 110 confines the knitting needles in their slots and has a downwardly opening slot 112 receiving the driving arm of the lower needle 108. A stud 113, screw threaded if desired, is held in back and forth adjusted position in the upper part of actuator 110 by set screw 114, and has a

peripherally grooved head 115 into which extends the driving arm of the top needle 107.

A driving swivel 116 pivoted on the actuator for rocking motion extends into a slot 117 in the upper end of an arm 118 having a hub 119 slidable along a horizontal rock shaft 120 journaled in stand 96 at its inner end and in a bearing 121 at its outer end. A driving collar 122 is keyed to shaft 120 as at 123 and is set screwed at 124.

A driving pin 125 secured to hub 119, see Fig. 13, fits into a hole 126 in driving collar 122 and is the means by which rocking of shaft 120 causes rocking of arm 118 and reciprocation of actuator 110. A compression spring 127 surrounds shaft 120 and is between hub 119 and a collar 128 around shaft 120 and held against motion to the left, Fig. 4, by bearing 121. Spring 127 normally holds pin 125 in driving relation with collar 122, but can be compressed manually by a hand hold 129 rigid with hub 119 to slide arm 118 along shaft 120 away from stand 96. The purpose of this construction is to permit arm 118 to be moved to release the actuator 110 so that the latter can be removed from slot 111 to permit replacement of a broken or worn selvage needle. Furthermore, when stand 96 must be moved to the left, Fig. 10, to accommodate a wider web, the spring will compress to permit such adjustment.

The mechanism for rocking shaft 120 is shown more particularly in Figs. 2, 4 and 33. Secured to the reed shaft 91 is a cam 130, see Fig. 33, which rocks a lever 131 adjustably attached at 132 to a connector 133 adjustable as to length. Connector 133 is extensible by reason of spring 134 and is pivoted to lever 135 secured to shaft 120. A stop screw 136 is positioned to engage the upper arm 137 of lever 135 to limit forward motion of actuator 110. Cam 130 rocks lever 135 positively in a direction to move the actuator 110 rearwardly once for each rotation of the reed and at times when the left hand weft needles are entirely in their sheds on weft laying strokes, as indicated in Fig. 4.

The mechanism for the left hand pair of selvage needles is the same as already described, except that cam 130 moves actuator 139 for top and bottom selvage needles 140 and 141, respectively, when the right hand weft needles are in their sheds on weft laying strokes.

Selvage formation

The means for assisting the selvage needles to catch the weft threads is shown in Figs. 3, 8, and 27-29. A horizontal cross pin 145 held by one or both stands 95 and 96 has secured to the ends thereof thread lifter and latch control mechanisms 146 and 147 for the right and left selvages, respectively. These mechanisms are alike except that they are of opposite hand, and mechanism 146 only will be described in detail.

A block or arm 150 secured to the right end of pin 145 extends upwardly and has top and bottom thread lifting horns 151 and 152, respectively, secured therein for back and forth adjustment by set screws 153. The rear end of each horn is pointed and curved downwardly and toward the adjacent web as 154 and has a lifter surface 155.

The operation of the weft needles and means for moving the selvage needles has already been described, and the operations for forming a selvage will now be described in connection with one weft needle 71 and one selvage needle 140, it being understood that the operation will be the same for all the selvages.

Assuming that weft needle 71 is as shown in Fig. 21, its weft F3 will extend from the left side of the top web TF under needle eye 61 under hook 100 of selvage needle 140, the plane of the hook being inclined downwardly and away from the web. The latch 101 will be in open position. As needle 71 moves along the bend *s* in its path *a* the weft thread F3 will ride up surface 155 of horn 151 and be inclined upwardly forward of hook 100, see Fig. 27. The selvage needle 140 will then move forwardly to catch and hold weft F3 as the weft needle 71 moves toward the position of Fig. 22. A previously formed loop 156 will close the latch as needle 140 continues to move forwardly and weft F3 will be pulled through the loop. A similar operation occurs at the same time with respect to needles 72 and 141.

The selvage needles are moved rearwardly at a rapid rate and when the latch passes behind loop 156 it is likely to snap rearwardly and close hook 100. To prevent this undesirable closure of the hook, resilient means are employed to engage latch and hold it spaced from the hook.

Arm 150 supports a rod 157 under each of the horns to which is secured a vertical resilient latch stop 158, such as a nylon bristle, so placed as to engage latch 101 as the associated selvage needle moves backwardly to weft thread engaging position, thus preventing the latch from closing hook 100, see Fig. 29. The latter will therefore be open to receive the weft thread.

Warp and fabric control

In order that both webs TF and BF may be as nearly alike as possible it is desirable to supply their warp threads under similar conditions and also take up the fabrics at the same rate, even though one web is woven over the other. The warp and fabric controls are shown in Figs. 1, 4, 8, 30-32.

Figs. 1 and 32 show the warp delivery drum D which receives the warp threads W from the creel. The drum, which may be controlled in known manner to effect forward feeding of the warp threads, delivers a sheet S of warp threads distributed across part of its length as shown in Fig. 32. The solid lines WT represent the warps for the top fabric and are distributed substantially uniformly across the width of sheet S. The dotted lines represent the warp threads WB for the bottom fabric which are likewise uniformly distributed across the sheet S. Both sets of warp threads WT and WB are therefore under the same conditions of tension, delivery and distribution and are delivered in a single source or drum.

The stands 95 and 96 have provision for guiding the two webs, horizontal top and bottom cloth board surfaces 160 and 161 for the top and bottom fabrics being between vertical guides 162 and 163, respectively.

The two fabrics lead down from their respective cloth boards, one over the other as shown in Fig. 8, and engage a spreader or separator 165 secured to and extending vertically along the rear wall 166 of casing or housing 20. The separator has two web engaging surfaces 167 and 168 inclined toward each other and forming an angle 169 pointing rearwardly toward the take-up roll 170, of take-up mechanism T, see Fig. 31.

The take-up roll is secured to a cross shaft 171 and may be driven by any appropriate gearing to move its friction surface 172 at a rate determined by the number of double picks to the inch in the fabrics. Extending around roll 170 intermediate its ends is a separator ring 173 which

divides surface 172 into two zones or areas 174 and 175, see Fig. 31, one zone for each web or fabric. Both zones have the same diameter and the rate of take-up is therefore the same for both webs. From the take-up roll the two webs may be led around a pressure roll 176 and thence to the box B, as suggested in Fig. 1.

It will thus be seen that the warps for both webs are evenly distributed in a single sheet and lead to two webs one over the other, and that separator 165 then separates the webs laterally and directs them to different areas or zones of the take-up roll. This arrangement insures uniformity of warp tension and pick spacing in both webs.

Summary

The loom described hereinbefore produces simultaneously and at a high rate of speed two similar fabrics or webs made of textile yarns and suited to a variety of uses, such as tapes for slide fasteners, ribbons, etc. While two fabrics can be woven, certain features are of use for the weaving of a single fabric.

The weft needle mechanism utilizes constantly turning primary rotary actuators and a secondary rotary actuator, and these two actuators combine to produce lateral shifting of the needles simultaneously with a forward motion of the weft laying needle, and also effect withdrawal of the needles from the sheds along paths close to the cloth fell. The stroke of the weft needles can be varied by changing the location of the studs 50 and 69 with respect to their actuating shafts. Depending upon the location of these studs the loom may weave a narrow web as shown in Figs. 2, 3 and 4, or a wider web as shown in Figs. 19-24. When wider webs are woven the back and forth throw of the weft needles will be increased, and an adjustment of connectors 133 may be necessary to place the selvage needles correctly with respect to the weft needles. While the paths of the weft needle eyes for a given web overlap in the warp shed, the needles travel along their paths in such manner as not to strike each other, but both needles move forwardly while in the shed to permit forward motion of the reed.

The rotary reed dents have their peripheries so shaped that all of the warp threads are correctly spaced and confined between adjacent dents for all angular positions of the reed around its axis. Despite this feature the dents have a sharp decline δ which enables the needles to enter their sheds very shortly after beat-up. The reed turns at a constant speed and the dents have no points or shoulders to approach and force their way into a sheet of warp threads. If desired, a cross bar 180, see Fig. 2, may be used if desired to limit upward motion of the top warps, but the bar is not essential.

The selvage needles can be readily replaced when worn or broken by compression of springs 127, and the latter also yield when the stands 95 and 96 are separated to accommodate a wide web. When the hand hold 129 is depressed to disengage driving pin 125 from hole 126 arm 118 can be turned slightly to move the pin out of register with the hole, thereby holding the arm spaced from the associated stand 95 or 96 to permit removal of the actuator 110.

Uniformity of the two webs is insured by the uniform distribution of the two groups of warp threads for the webs as shown in Fig. 32, and the lateral separation of the two webs so they can be directed to different areas of the take-up roll.

Having thus described the invention it will be seen that changes and modifications of the foregoing specific disclosure may be made without departing from the spirit and scope of the invention.

What is claimed as new is:

1. In a needle loom, a weft needle member having a weft eye, continuously turning primary rotary means moving part of the needle member in a circle, link means pivoted at one end thereof to another part of the needle member, a pivotal mounting for the other end of the link means, and continuously turning secondary rotary means effecting a reciprocation of the pivotal mounting once for every two rotations of the primary rotary means.

2. In a needle loom, a weft needle member having a weft eye, rotary means continuously moving part of the needle member in a circle, link means pivoted at one end thereof to another part of the needle member, a pivotal mounting for the other end of the link means, a second rotary means continuously turning at half the speed of the first rotary means operatively connected to and reciprocating said pivotal mounting once for every two rotations of the first rotary means.

3. In a needle loom, a weft needle member, constantly turning primary rotary means moving part of the needle member intermediate the ends thereof in a circle, a weft needle having an eye secured to one end of the needle member, secondary rotary means turning constantly at half the speed of the primary means, and means operatively connecting the secondary means to the other end of the needle member to reciprocate said other end once for every two rotations of the primary means.

4. In a needle loom, a needle member having a weft needle at one end thereof, constantly turning primary rotary means constantly moving part of the needle in a circle, a link pivoted to the other end of the needle member, a pivot for the link having two ranges of motion, and means locating said pivot in one of said ranges for one rotation of said primary means and locating said pivot in the other of said ranges for the next rotation of said primary means.

5. In a needle loom having warp threads leading to the fell of the cloth, a weft needle member having a weft eye, primary rotating means causing a part of the needle to turn continuously in a circle the plane of which is substantially parallel to the cloth, floating pivot means for another part of the needle movable from one range of movement to another range of movement, and secondary rotating means turning at half the speed of the primary means operatively connected to the floating pivot means locating the latter in one of said ranges for one rotation of the primary means causing the latter to move the weft eye along a path relatively far from said fell of the cloth, and said secondary means locating said floating pivot means in the other of said ranges for the next rotation of the primary means causing the latter to move the weft eye along a path relatively near the fell of the cloth.

6. In a needle loom, a weft needle member having a weft eye at the rear end thereof, a primary continuously rotating actuator turning part of the needle member in a circle, said part of the member moving rearwardly during a half rotation of the primary actuator and moving forwardly during the next half rotation of the actuator, and means operatively connected to a part

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of said member spaced from said actuator moving said other part of the member in one direction for the first half of said rotation of the actuator and in the opposite direction for the second half rotation of said actuator.

7. In a needle loom having a warp shed, a weft needle member having a weft eye at the rear end thereof, a continuously turning primary actuator moving a part of said member between the ends thereof in a circle the plane of which is parallel to the cloth being woven, said actuator for one half of a rotation thereof moving the member bodily rearwardly and for the next half rotation thereafter moving the member bodily forwardly, link means connected to the other end of said member, and secondary actuator means rotating at half the speed of the primary actuator operatively connected to said link means, said primary actuator on the second half of the said rotation thereof moving the eye forwardly while said primary and secondary actuators cooperate to move the eye entirely through the warp shed.

8. In a needle loom having a warp shed leading rearwardly from the cloth, a weft needle member having an eye at the rear end thereof to lay weft in the warp shed, a continuously turning primary actuator moving a part of said needle member in a circle and moving said part backwardly and then forwardly and also laterally away from and then toward the cloth, and a continuously rotating secondary actuator turning once for every two rotations of the primary actuator effecting movement of another part of the needle member in one direction for one rotation of the primary actuator and moving said other part of the control member in the opposite direction for the next rotation of the primary actuator.

9. In a needle loom having a warp shed leading to the cloth, a weft needle member on each side of the cloth having an eye to enter the warp shed, two continuously rotating primary actuators, one for each needle member, said primary actuators turning at the same rate, each primary actuator moving a part of the corresponding needle member in a circle the plane of which is substantially parallel to the cloth, said primary actuators each moving the associated needle member bodily rearwardly at the same time during a half rotation thereof and then forwardly during the next half rotation thereof, continuously turning secondary actuator means turning at half the speed of the primary actuators, and means operated by the secondary actuator moving corresponding parts of said needle members in one direction for one rotation of the primary actuators and in the opposite direction for the next rotation of said primary actuator.

10. In a needle loom having a warp shed leading forwardly to the cloth, a weft needle member on each side of the cloth, a continuously rotating primary actuator for each member, each actuator moving a part of the associated needle member in a circle, said actuators turning at the same speed and rotating in opposite directions and moving the needle members bodily backwardly and forwardly together and also moving said members bodily toward each other for one half of a rotation of the actuators and then bodily away from each other for the next half rotation of the actuators, a secondary actuator turning at half of the speed of the primary actuators, said needle members having corresponding parts spaced from the associated primary actuator, and

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means operatively connecting the secondary actuator to said corresponding parts of the needle members moving said corresponding parts in one direction for one rotation of the primary actuators and moving said corresponding parts in the opposite direction for the next rotation of the primary actuators.

11. In a needle loom, two weft needle members each having a weft eye, one needle member on one side of the warp threads and cloth and the other needle member on the other side, a primary rotary means for each needle member continuously turning a part of the latter in a circle, both primary means turning at the same speed, a floating pivot means for each needle member connected to a part of the latter spaced from the associated primary means, link means joining the floating pivot means, the link means being movable back and forth from one range of movement to another range of movement, and secondary rotary means turning continuously at half the speed of the primary means operatively connected to said link means locating the latter in one range for one rotation of each of said primary means and locating said link means in the other range for the next rotation of said primary means.

12. In a needle loom having warp threads leading to the fell of the cloth, two needle members each having a weft eye, one needle member on one side of the warp threads and cloth and the other needle member on the other side, primary rotary means causing a part of one needle member to move in a circle, a second primary rotary means causing a part of the second needle member to move in a circle, both rotary means turning at the same speed, a floating pivot means connected to said one needle member at a point spaced a given distance from the first primary means, a second floating pivot means connected to said second needle member at a point spaced said given distance from said second primary means, connecting means causing the first and second floating pivot means to move bodily in unison, the first pivot means being in one range of movement therefor while the second pivot means is in one range of movement therefor and the first pivot means being in another range of movement therefor while the second pivot means is in another range of movement therefor, and secondary rotary means turning at half the speed of either primary means locating the pivot means in the said one ranges for one rotation of each primary means and locating each pivot means in the said other ranges for the next rotation of each primary means.

13. In a loom having a warp shed leading rearwardly from the cloth fell, a continuously turning rotary reed shaft rearward of and below the warp shed, weft beat-up reed dents secured to and rotating with the shaft, a weft needle entering one side of the shed at a given point between the reed and fell and leaving said side of the shed at a point nearer the fell than said given point, each reed dent having an inclined edge the part of which in the shed moves progressively toward the fell as the needle moves forwardly, each dent having a beat-up edge which reaches the fell after the needle leaves the shed, and each reed dent having some part thereof above the warp shed for all angular positions thereof.

14. In a loom having warp sheds leading rearwardly from the cloth fell, weft beat-up reed

dents rotating about an axis below the shed and rearward of the fell, each reed dent having a periphery formed with a beat-up edge and a decline leading to the point in said periphery nearest said axis, and a weft needle which enters and leaves the warp shed forward of said axis and moves transversely of the warp threads while in the shed, the radial distance of said point from said axis being greater than the distance from said axis to the highest warp thread in said shed to the end that the reed resists lateral motion of the warp threads by the needle when the latter is in the shed and moving transversely of the warp threads.

15. In a loom having a warp shed leading rearwardly from the cloth fell, a reed having weft beat-up dents rotating about an axis below the shed and rearward of the fell, each reed dent having a periphery leading from a low edge up an incline to a high beat-up point, and a weft needle forward of said axis entering the warp shed over said low edges of the dents while said inclines are rearward of the needle, the needle moving forwardly in the shed as the reed due to rotation thereof causes the part of the incline rearward of the needle to move toward the fell, said low edge when over the axis projecting above the topmost warp threads in the warp shed.

16. In a loom having a warp shed leading rearwardly from the cloth fell, weft beat-up reed dents having warp thread spaces therebetween rotating about an axis rearward of the fell and below the warp shed, each reed dent having a periphery formed with a low edge and a high beat-up point, and means to lay weft in the warp shed forward of the dents, the warp threads entering said spaces between the reed dents from the rear of the latter and extending forwardly in said spaces between the dents for all angular positions of the reed dents, said low edges when over the axis projecting above the topmost warp threads in the warp shed.

17. In a loom having warp threads to form a warp shed leading rearwardly from the cloth fell, weft beat-up reed dents having warp thread spaces therebetween rotating about an axis rearward of the fell and below the warp shed, and means effective to lay weft in the warp shed forward of the dents, the warp threads of the warp shed extending through the spaces between the dents and some part of the reed dents extending above the parts of the warp threads over said axis for all angular positions of the reed dents about said axis.

18. In a loom having two warp sheds leading rearwardly from each of two fabrics arranged one over the other, reed dents rotating about an axis rearward of the fabrics and below both warp sheds, and means effective to lay weft in each warp shed forward of the dents, said dents having peripheries which always extend above the warp threads of both warp sheds.

19. In a loom having a warp shed leading rearwardly from the cloth fell, weft beat-up reed dents having warp thread spaces therebetween rotating about an axis rearward of the fell and below the warp shed, and means effective to lay weft in the warp shed forward of the dents, said dents having peripheries some part of which for all angular positions of the dents about said axis extends continuously above the shed from the point of entrance to the point of emergence of the warp threads relative to said warp thread spaces.

20. In a loom having a warp shed leading rear-

wardly from the cloth, a weft beat-up reed having dents rotating about an axis below the warp shed and rearward of the cloth, each reed dent having a periphery formed with two beat-up points between which is located a low edge, and a weft needle entering the warp shed over the low edges after one of said beat-up points has left the cloth and moving forwardly in the shed as the other beat-up point moves toward the cloth, said low edge when over said axis extending above the highest warp threads in said warp shed.

21. In a loom operating with a weft laying needle to move into a warp shed leading rearwardly from the cloth, a stationary stand located at one side of the cloth having a horizontal slot therein opening in a direction away from the cloth and extending in the direction of the warp thread, a selvedge needle slidable in said slot, an actuator for said needle reciprocable on said stand and removable therefrom by motion in a direction away from the stand and normally confining the selvedge needle in said slot, a rock shaft transverse of the warp threads, an actuator arm slidable on and rocking with the shaft, and a spring around said shaft normally holding said arm in operative relation with respect to the actuator and acting through the arm to hold the actuator in normal position relative to the selvedge needle, said arm being movable away from the actuator against the action of said spring by sliding movement on said shaft, whereupon said actuator is movable away from said stand for the purpose of removing the selvedge needle from said slot.

22. In a loom operating with a weft laying needle to move into a warp shed leading rearwardly from the cloth, a stand guiding the cloth, a horizontal slot in the stand on a side thereof opposite to the cloth extending in the direction of the length of the warp threads and opening in a direction away from the cloth, an actuator slidable on said stand in a direction parallel to said slot, a selvedge knitting needle confined in said slot by said actuator, the latter being removable from the stand by movement in a direction away from the selvedge needle, a rock shaft, an actuator arm slidable on and rocking with said shaft, and a spring on the shaft yieldingly holding said arm in operative relation with respect to the actuator and operative to urge the actuator toward the selvedge needle, and said spring being compressible by motion of the actuator arm away from the stand to release the actuator for removal from said stand to effect replacement of the selvedge needle in said slot.

23. In a loom for weaving two fabrics one over the other and having two weft laying needles, one needle for each fabric, a stand at one side of said fabrics, two selvedge needles each having a driving arm slidable back and forth in said stand, one selvedge needle for each fabric, a single actuator for said selvedge needles slidable back and forth on the stand, said actuator having fixed driving relation with respect to the driving arm of one of said selvedge needles, and operating means on said actuator for the driving arm of the other selvedge needle adjustable on the actuator in the direction of the length of the selvedge needles.

24. In a loom having a weft needle to move into a warp shed extending rearwardly from the cloth, a stand on the loom at one side of the

cloth adjustable laterally of the cloth, means holding said stand on the loom in adjusted position, a rock shaft, a bearing in the stand for the rock shaft, said stand sliding along the shaft when the lateral position thereof is adjusted, a selvage needle slidable on the stand, and an actuator operatively related to the needle and rocking with the shaft and slidable along the latter to be operatively related to the selvage needle for all laterally adjusted positions of the stand.

25. In a loom having a weft needle to move into a warp shed extending rearwardly from the cloth, a stand, means holding the stand in laterally adjusted position with respect to the cloth, a rock shaft, a bearing in said stand for the rock shaft, said stand sliding along the shaft when the lateral position thereof is adjusted, a selvage needle slidable on the stand, actuator mechanism for the needle including an arm slidable along and rocking with the shaft, and a spring surrounding said shaft engaging said arm urging the latter toward the stand for all lateral adjusted positions of the latter.

26. A loom as set forth in claim 25 wherein said spring is compressed when the stand is moved to accommodate a wider fabric and is subject to further compression when the arm slides along the shaft away from said stand.

27. In a loom having a weft needle to move into a warp shed extending rearwardly from the cloth, a stand adjustable laterally of the loom to accommodate fabrics of different widths, means holding the stand fixed in the adjusted positions thereof, a cloth board extending from one side of the stand under the cloth, a selvage needle slidably mounted on the opposite side of the stand, and means located at said opposite side of the stand reciprocating the selvage needle when said stand is in any of the laterally adjusted positions thereof, said cloth board maintaining the cloth in fixed position with respect to the selvage needle.

28. In a loom having a weft needle to move into a warp shed extending rearwardly from the cloth, a stand at one side of the cloth having a selvage needle groove in the side thereof opposite the cloth opening in a direction away from the cloth, a guide groove on said opposite side of the stand parallel to the needle groove, a selvage needle in the selvage needle groove, an actuator reciprocable on the stand in the direction of the length of the selvage needle and having a part thereof entering said guide groove, said actuator being removable from the stand by movement in a direction away from the cloth and having a part thereof normally confining the selvage needle in the selvage needle slot, and actuator means normally operatively related to the actuator to effect reciprocation of the selvage needle, but movable from the actuator to be disengaged therefrom in a direction away from the cloth to permit removal of the actuator from the guide groove for the purpose of removing the selvage needle.

29. In a loom having a weft needle which moves in a plane to insert weft in a warp shed extending rearwardly from the cloth, a stand at one side of the cloth having a selvage needle groove therein extending longitudinally in the direction of the warp threads and inclined transversely downwardly relative to said plane and opening in a direction away from the cloth, a selvage needle slidable in said groove and having a weft thread engaging hook inclined downwardly in the direction of inclination of said

slot, and means reciprocating said selvage needle on the stand.

30. In a loom having a weft needle to move into a warp shed extending rearwardly from the cloth, a stand secured to the loom at one side of the cloth, a rock shaft extending from said stand transversely of the cloth, a driving collar secured to said shaft adjacent to said stand and rocking with said shaft, an actuator arm slidable on the shaft in a direction away from said stand and collar, driving connections between the collar and arm, a spring on said shaft normally maintaining said collar and arm operatively connected by said driving connections to cause the arm to rock with the shaft, a selvage needle slidable on the stand, and means operatively connecting the arm and selvage needle to effect reciprocation of the latter as the shaft rocks, said arm slidable along said shaft against the action of said spring to a position out of driving relation with said collar.

31. The method of weaving two fabrics in the same loom consisting in the following steps: delivering a single supply of warp threads, dividing the warp supply into two groups, weaving each group into a fabric separate from the other fabric, moving the fabrics one over the other forwardly from the point of weaving, separating the fabrics laterally with respect to each other, and taking up each fabric at the same rate around a common center.

32. The method of weaving two fabrics in a loom, said method consisting in the following steps: delivering a single sheet of warp threads toward the weaving point, incorporating certain of the warp threads distributed substantially uniformly across the width of the sheet into one fabric, incorporating the remaining warp threads uniformly distributed across the width of the sheet into another fabric above the first fabric, leading said fabrics one over the other away from the point of weaving, separating the fabrics laterally, and taking up said fabrics at the same rate around a common center.

33. In a loom for weaving two separate fabrics, means delivering a single sheet of warp threads, weaving instrumentalities incorporating the warp threads into two fabrics one over the other, a single take-up roll, and spreader means separating the fabrics laterally and directing said fabrics to different parts of the take-up roll.

34. In a loom for weaving two separate fabrics, single means delivering a sheet of warp threads horizontally, a single horizontal take-up roll, weaving instrumentalities incorporating the warp threads into two fabrics one over the other, and separator means spacing the fabrics laterally and directing said fabrics to different parts of the take-up roll.

35. In a loom for weaving two separate fabrics, means delivering a single sheet of warp threads, a group of said warp threads being distributed uniformly across the width of the sheet, means incorporating said group into a fabric, the remaining group of warp threads also being distributed uniformly across the width of the sheet, means incorporating the second group into another fabric over the first fabric, a single take-up roll, and separator means spacing the fabrics laterally and directing said fabrics to different parts of the take-up roll.

36. In a loom for weaving two separate fabrics, means delivering warp threads horizontally in a single sheet, instrumentalities weaving certain of the warp threads into a fabric, other weaving in-

instrumentalities weaving the remaining warp threads into a second fabric vertically aligned with the first fabric, a separator spacing said fabrics laterally, and a single take-up roll drawing the fabrics from said separator and on which the fabrics are horizontally spaced.

37. In a loom for weaving two separate fabrics, means delivering warp threads disposed horizontally in a single sheet, weaving instrumentalities incorporating certain warp threads in the sheet distributed substantially uniformly across said sheet into a fabric, other weaving instrumentalities incorporating other of the warp threads in the sheet uniformly distributed across said sheet into a second fabric vertically aligned with the first fabric, a single take-up roll, and separator means between the weaving instrumentalities and the take-up roll separating said fabrics horizontally and directing said fabrics to horizontally spaced areas of the take-up roll.

38. In a loom for weaving two separate fabrics, means delivering a single sheet of warp threads from a single source, weaving instrumentalities incorporating said warp threads into two vertically aligned fabrics, a single take-up roll having two horizontally spaced take-up zones, and separator means spacing the fabrics laterally and directing said fabrics to said zones, one fabric to each zone.

39. The loom set forth in claim 38 wherein the take-up roll is provided with means extending from the periphery thereof separating said zones.

40. The loom set forth in claim 38 wherein the separator means has two surfaces inclined toward each other, one surface and one fabric corresponding to one zone and the other surface for the other fabric corresponding to the other zone.

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