April 13, 1954 R. G. TURNER 2,675,028

WEFT BEAT-UP FOR FLY SHUTTLE LOOMS

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FIG. 1

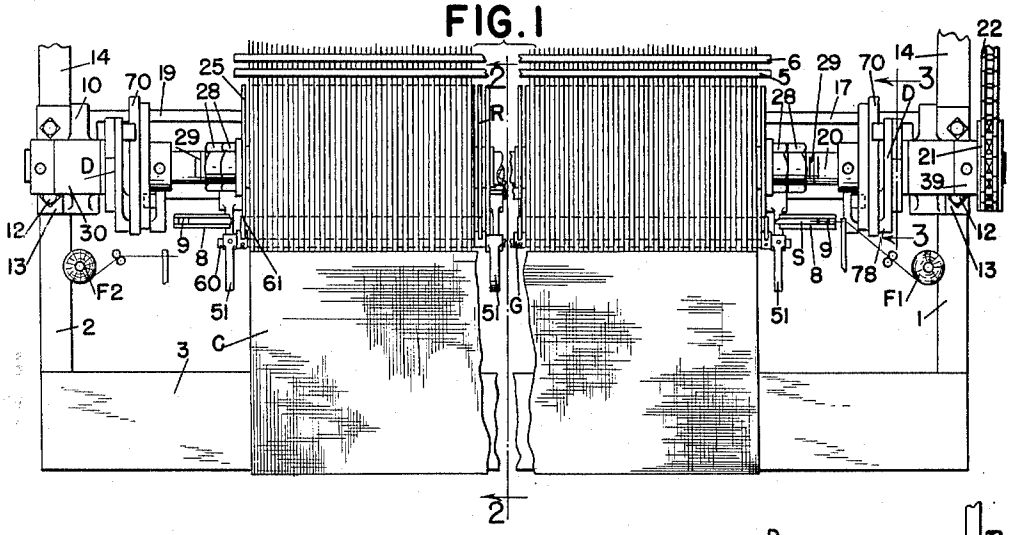
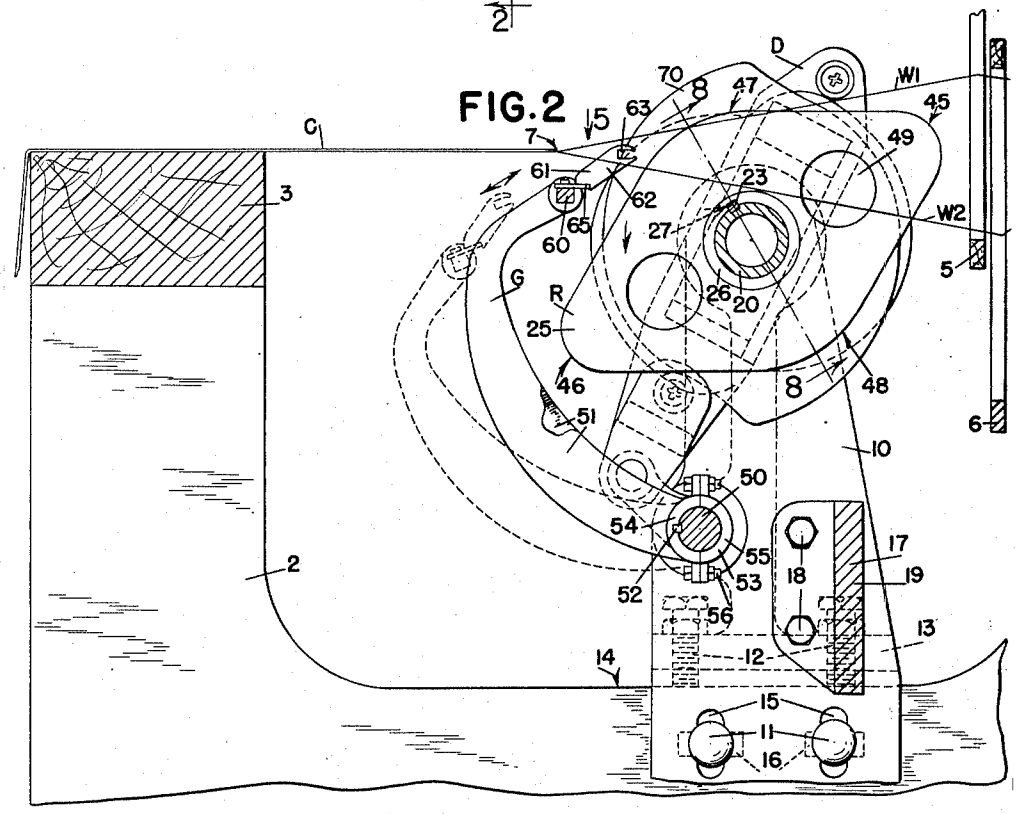


FIG. 2



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WEFT BEAT-UP FOR FLY SHUTTLE LOOMS

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FIG.3

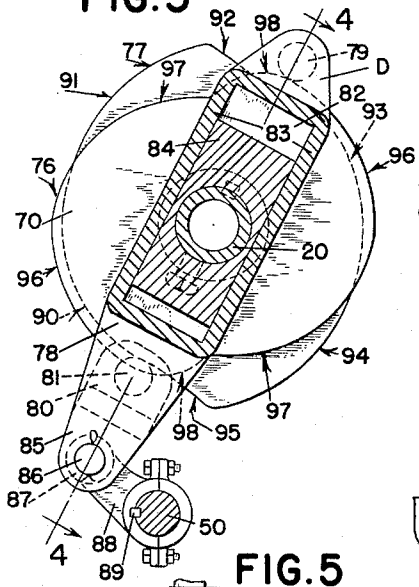


FIG.4

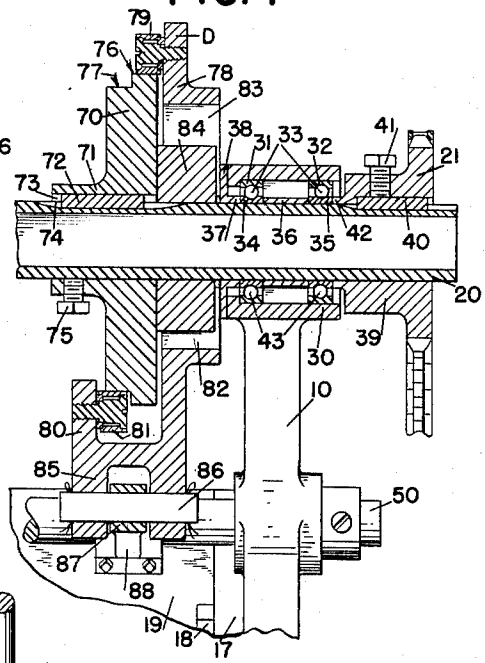


FIG.5

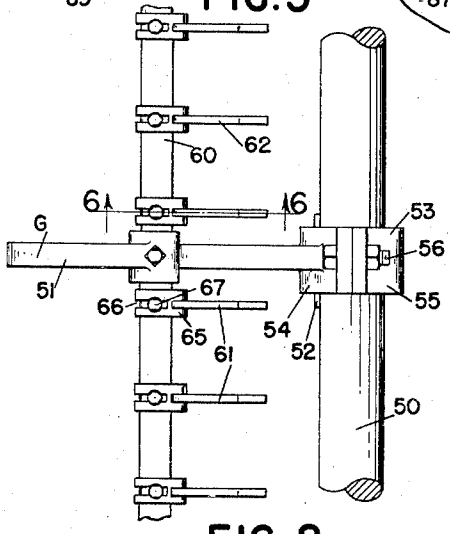


FIG.6

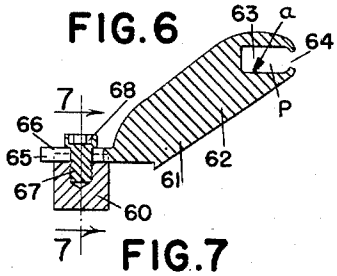


FIG.7

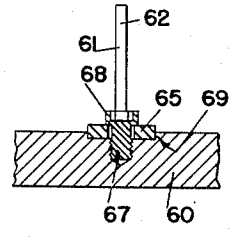
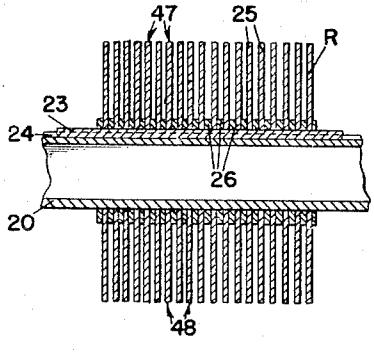


FIG.8



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UNITED STATES PATENT OFFICE

2,675,028

WEFT BEAT-UP FOR FLY SHUTTLE LOOMS

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Application September 18, 1951, Serial No. 247,129

16 Claims. (Cl. 139—191)

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This invention relates to improvements in weft laying and beat-up mechanisms for fly shuttle looms and it is the general object of the invention to provide rotating reed and shuttle guide means movable into and out of shuttle guiding position in timed relation with the beat-up operation of the reed as the latter rotates.

In certain types of high speed looms the reciprocation of the lay causes objectionable vibration due principally to the need for a dwell motion of the lay to permit time for passage of the shuttle. Looms of this general type generally include a reed and some form of guide for the shuttle which rock back and forth. In such looms a small fraction only of a second is available for the beating up operation and the previously mentioned objectionable vibration grows out of the rapidity of motion of the reciprocating reed and lay.

It is an important object of the present invention to separate the reed from the shuttle guide means and rotate the reed at a preferably though not necessarily uniform speed and manipulate the guide means so that it moves into and out of the warp shed between successive beating up operations of the rotary reed. In this way a large part of the weight heretofore mounted on the lay is placed on a fixed axis and the reed dents can be made so that they are in balance around the reed axis and therefore produce little or no vibration.

It is a further object of the invention to provide beat-up means including a rotary reed the dents of which have on opposite sides thereof relatively high beat-up areas located angularly between low non-beat-up areas and control the guide means so that it moves into and out of the warp shed when the low area parts of the reed dents are facing the fell of the cloth. By this arrangement time is provided for the flight of the shuttle between successive beating up operations of the reed, the low non-beat-up parts of the reed dents leaving ample room in the warp shed for the flight of the shuttle.

It is another object of the invention to mount the shuttle guide means for rocking motion about an axis parallel to the axis of the rotary reed and connect the reed and the guide means so that these two parts move in unison but in such relation that the guide means are always out of the path of the rotating reed dents but are capable of dwelling in the warp shed a sufficiently long time to permit the shuttle to complete a flight. The guide means are preferably made so that they will have a shuttle supporting surface extending entirely under the path of the shuttle and have all parts thereof above the bottom warp shed so that the thread which is drawn across the loom by the shuttle will be kept out of frictional contact with the bottom warp.

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It is a still further object of the invention to have the reed dents of such size that the warp threads are always guided by the dents, the latter always having some part thereof extending above the top warp shed.

It is another object of the invention to interconnect the rotary reed and shuttle guide means by mechanism including preferably conjugate cams secured to a shaft forming part of the rotary reed and operating connections which rock the shuttle guide means.

It is a still further object of the invention to provide a shuttle guiding and weft beat-up unit which can be readily supported on a loom frame.

In order that the invention may be clearly understood reference is made to the accompanying drawings which illustrate by way of example the embodiments of the invention and in which:

Fig. 1 is a plan view of part of the loom showing the invention applied thereto,

Fig. 2 is an enlarged vertical section on line 2—2, Fig. 1,

Fig. 3 is an enlarged vertical section on line 3—3, Fig. 1, showing the conjugate cams and the connector between them and the rocker shaft for the shuttle guide means,

Fig. 4 is a vertical section on line 4—4, Fig. 3,

Fig. 5 is a plan view showing part of the mechanism and looking in the direction of arrow 5, Fig. 2,

Fig. 6 is an enlarged vertical detailed section on line 6—6, Fig. 5, showing one of the shuttle guide plates,

Fig. 7 is a vertical section on line 7—7, Fig. 6, and

Fig. 8 is a vertical section on line 8—8, Fig. 2.

Referring particularly to Figs. 1 and 2, the loom frame includes right and left loomsides 1 and 2 which may be joined across their upper ends by a breast beam 3 over which the cloth C extends toward a take-up mechanism which may be of any desired type but not shown herein. The loom is provided with harness frames 5 and 6 which are operated in usual manner to produce top and bottom warp sheds W1 and W2. These warp sheds come together at the fell 7 of the cloth in usual manner. While only two harness frames have been shown it is to be understood that more harness frames can be used if desired in conformity with usual loom design practice.

The loom set forth herein may for instance be of the general type shown in my prior Patent No. 1,441,611 which operates with one or more outside supplies of weft and a dummy shuttle to which the weft is attached to be drawn into the warp shed by the shuttle. As shown for instance in Fig. 1 two filling thread supplies F1 and F2 are provided at the right and left sides of the loom and a shuttle S of the spoolless type may be provided for introducing weft from the spools into the warp shed. The present invention does not relate particularly to the manner of fastening the weft threads to the shuttle or the manner in which the latter is picked and the showing set forth in Fig. 1 is for illustrative purposes only. It will be sufficient for the present description to state that the weft is connected to the shuttle and that the latter is propelled or projected from guides 8 by the equivalent of a picker stick represented at 9.

In carrying the present invention into effect provision is made for a rotary weft beat-up reed designated generally at R and shuttle guide means designated generally at G. Each of the loomsides 1 and 2 has secured thereto a bearing member 10 fixed thereto as by bolts 11 and adjusted as to vertical position by screws 12 tapped into a lateral foot 13 and bearing against a top surface 14 of the adjacent loomside. The bolts 11 pass through vertical slots 15 in the lower part of bearing 10 and also through horizontal slots 16 in the loomside so that each of the bearing members 10 can be adjusted both vertically and in a back and forth direction, that is, to the right or left as viewed in Fig. 2. The bearings 10 are jointed to each other by a cross beam 17 each end of which is secured as at 18 to the corresponding bearing. The bearings and beam form a rigid frame designated generally at 19 forming the support for the rotary reed and shuttle guide structures.

A preferably tubular reed shaft 20 extends across the loom below the bottom shed W2 and is mounted for rotation about a fixed axis in the bearing members 10. The shaft has a sprocket wheel 21 secured thereto meshing with a chain 22 which can be driven by any convenient means (not shown), the wheel 21 and chain constituting mechanism for rotating shaft 20. The shaft is provided with an elongated key 23, see Fig. 8, fitting into a key slot 24 extending along the shaft. Mounted on the shaft 20 are the reed dents 25 which are separated from each other by spacer rings 26. Each reed dent has a transverse key slot 27 receiving the key 23 so that all of the dents are fixed as to their angular position on the shaft and turn with it. Nuts 28 on screw threads 29 on shaft 20 locate the reed dents in the desired position along the length of shaft 20.

The details of the bearings for the shaft 20 are shown in Fig. 4 which shows the bearing at one end of the shaft, but it is to be understood that the opposite bearing 10 will be similarly constructed. As shown in Fig. 4 the bearing 10 has a hollow head 30 within which are located the outer shells or rings 31 and 32 of two ball bearings 33. The inner rings or shells 34 and 35 preferably have a tight fit with the shaft 20 and are separated by a sleeve 36. An end member 37 shown at the left of shell 34 in Fig. 4 is provided with the flange 38 extending generally in a plane perpendicular to the axis of the shaft 20. A hub 39 of sprocket wheel 21 is keyed as at 40 to shaft 20 and is held in position lengthwise along the shaft by set screw 41. The hub 39 has a reduced extension 42 which engages the right side of the shell 35 as shown in Fig. 4. Balls 43 between the inner and outer shells provide for free turning of shaft 20 relative to the bearing member 10.

The reed dents 25, shown more particularly in Fig. 2, are made of flat sheet metal plates and are provided with two high beat-up points or areas 45 and 46 which are aligned lengthwise of shaft 20 and successively turn to beat-up position. The dents also have two low non-beat-up areas 47 and 48 also aligned lengthwise of shaft 20 intermediate the beat-up areas. The minimum radius of the reed dent is greater than the distance between the axis of shaft 20 and the top warp shed W1 so that some parts of both the top and bottom sheds are always located between the reed dents. While this is a desirable construction in order to maintain correct alignment of the warp threads with the reed it may not be essential in certain forms which the invention may take. For the sake of lightness the reed dents are provided with perforations 49. The peripheral edge of each dent and also preferably the perimeters of the holes 49 are smooth so that they will not abrade the warp threads.

For each rotation of shaft 20 there will be two beat-up operations. As contemplated herein the shaft will turn counter-clockwise as viewed in Fig. 2 so that high beat-up area or point 45 will be presented to the fell 7 of the cloth after the reed is turned counter-clockwise from the position shown in Fig. 2, and then one beat later the high point or area 46 will be presented to the fell of the cloth. Between these beat-up operations the low areas 47 and 48 will face the fell of the cloth and be spaced an appreciable distance behind it. The high and low areas alternately face the cloth fell 7.

The shuttle guide means G includes in its construction a cross rocker shaft 50 journaled in the bearings 10 and having arms 51 keyed thereto as at 52. As shown herein the hubs 53 of the arms 51 are split, part 54 of the hub being integral with the arm and part 55 being formed as a cap held to the arm by bolts 56.

Secured to the upper ends of the lever 51 is a cross bar 60 rockable about the axis of shaft 50. Bar 60 has secured thereto a plurality of shuttle guides 61 which may be made as shown in Figs. 5, 6 and 7. Each guide has a vertical relatively thin plate 62 the upper rear end of which is provided with a shuttle guide opening or aperture 63 opening rearwardly as at 64 to provide for egress of weft from the guide openings 63. The forward end of each plate 62 is provided with a foot 65 which is slotted as at 66 to receive a securing screw 67 tapped into the bar 61. The head 68 of each screw clamps the corresponding foot 65 against the top of the bar 62 to hold the guide in fixed adjusted back and forth position on the bar. The bar is provided with a slot 69 for each foot 65, the slots 69 being transverse of the bar and serving to position the shuttle guides so that their flat plates 62 are in vertical planes substantially perpendicular to the bar 61. The openings 63 of the several guide plates are aligned across the loom and provide a shuttle pathway P parallel to the reed shaft 20. As shown in Fig. 6 the shuttle guide or plate 62 is made with a surface *a* on the under side of the slot or opening 63 and as will be apparent from Fig. 2, this part *a* which serves as a support

means for the shuttle extends entirely under the path of the shuttle and is located above the bottom warp shed. In this way the thread which is drawn behind the shuttle is kept out of frictional engagement with the bottom warp shed. As shown herein the previously mentioned shuttle guide means G comprises the rocker shaft 50, the arms 51, the bar 60, and the shuttle guides 61, but the invention is not limited to this particular assembly of parts to form the guide means.

In order that the shuttle guide means may be oscillated or reciprocated each side of the loom is provided with a guide means operating mechanism designated generally at D. These mechanisms are alike and one of them is described in detail herein.

Referring particularly to Figs. 3 and 4, the shaft 20 has mounted thereon a cam member 70 the hub 71 of which is secured to the shaft 20 in fixed angular position by a key 72 fitting into a slot 73 in the hub and also into a slot 74 in the shaft. A set screw 75 holds the cam member in adjusted lengthwise position along the shaft 20 and the key 72 causes the cam member to rotate with the reed shaft 20.

In the present instance the cam member is provided with two cam surfaces 76 and 77 which in effect provide conjugate cams for the operation of a yoke or slide connector 78. This connector has a roller 79 rotatably mounted thereon for engagement with the surface 76 and as shown at the lower part of Fig. 4 has an upstanding finger 80 on which is mounted for rotation a second roller 81 for engagement with the cam surface 77. The rollers engage their respective cams on opposite sides of reed shaft 20. The connector is formed with a slot 82 the sides 83 of which engage a guide block 84 freely oscillatable on shaft 20 and confined betwen the previously described flange 38 and the cam member 70. The flange 38 and the cam member also hold the slide connector 78 in operating position along the shaft 20.

The lower end of the connector 78 is forked as at 85 and mounts a pin 86 which passes through a bearing 87 on an arm 88 keyed as at 89 to the shaft 50. When the connector 78 moves transversely of shaft 20 by sliding along the block 84 the arm 88 and shaft 50 will be rocked.

The contours of the two cam surfaces 76 and 77 are shown more particularly in Fig. 3. Referring first to surface 77 and roll 81, the parts are shown in Fig. 3 in the position they occupy when the shuttle guide means is in the warp shed forward of the reed. Roll 81 is against a dwell surface 90 and as the cam rotates counter-clockwise the dwell will continue in engagement with roll 81 to hold the guide plates stationary long enough to permit the shuttle to complete its flight. Then as beat-up area 45 approaches the fell 7 incline 91 engages roll 81 and lowers it from the position shown in Fig. 3, thereby moving the shuttle guides forwardly toward their normal position shown in forward dotted line position, Fig. 2, to clear the advancing high area 45 of the reed. Incline 91 continues to move the shuttle guide forwardly until after beat-up and until the part of the reed behind the beat-up area 45 is below the fell 7, whereupon a relatively steep decline 92 engages roll 81 to effect a rapid movement of the shuttle guide into the warp shed to the full line position shown in Fig. 2. Upon completion of movement of the shuttle guides into the warp shed another dwell 93 similar to dwell 90 will engage roll 81 and the guides will be ready for another flight of the shuttle. The remainder of surface 77 includes an incline 94 and a decline 95 similar, respectively, to parts 91 and 92 of surface 77.

The surface 76 has dwells 96 corresponding to dwells 90 and 93, has declines 97 corresponding to inclines 91 and 94, and has inclines 98 corresponding to declines 92 and 95, so that the two cam surfaces cooperate in timed relation with the reed to positively move the guide plates 61 into the warp shed in shuttle guiding position as soon as one high point of the cam has completed a beat-up operation, then hold the guides stationary long enough to permit a complete flight of the shuttle, and thereafter move the guides out of the shed to provide clearance for the other high beat-up area of the reed. While the shuttle is in flight through the shed and along its pathway as defined by the slots 63 the thread trailing from the shuttle will be supported by the edge or area *a* above the bottom warp shed. During operation the reed rotates about a fixed axis and the shuttle guide means, which is independent of the reed, is rocked back and forth around another axis spaced from but parallel to the axis of the reed.

From the foregoing it will be seen that the invention sets forth simple means by which the relatively heavy reed is rotated about a fixed axis and sets up little or no vibration in the loom and the relatively light shuttle guide means moves into and out of the shed in timed relation with the rotation of the reed to permit flight of the shuttle when a low non-beat-up area of the reed faces the fell of the cloth, or is between the top and bottom warp sheds W1 and W2. The driving mechanism for the shuttle guide means includes cam means secured to the reed shaft and operatively connected, as by the connector 78, to the rocker shaft 50 on which the shuttle guide means is mounted. The cams have been shown herein as of the conjugate type to give positive movements to the shuttle guide means and produce a dwell motion which will hold the pathway P stationary in the warp shed to guide the shuttle while it makes a flight between successive beat-up operations. The reed dents are preferably though not necessarily of sufficient size so that both the top and bottom warp sheds always pass between reed dents to preserve alignment of the warp threads with the reed. The invention also sets forth a unit which can be attached readily to the frame of the loom, this unit comprising essentially the frame 19, the reed structure R, the guide means G, and the mechanism D for oscillating the guide means. Furthermore, it will be seen that the part *a* of the shuttle guide 62 on which the shuttle is supported extends uninterruptedly laterally of the path of the shuttle with all parts thereof above the warp shed to hold the weft out of engagement with the bottom warp shed.

Having now particularly described and ascertained the nature of the invention and in what manner the same is to be performed, what is claimed is:

1. In a loom operating with a shuttle, a rotary weft beat-up reed turning about an axis during loom operation and when turning having successive weft beat-up operations, reciprocating shuttle guides independent of the reed moving into the warp shed forward of the reed and then moving out of the warp shed between successive beat-up operations of the reed, and means to

project the shuttle through the guides while the latter are in the shed.

2. In a loom operating with a shuttle, a shaft extending across the loom, a weft beat-up reed fixed to and rotating with the shaft, mechanism to rotate the shaft and cause the reed to have successive beat-up operations, shuttle guides independent of the reed normally out of the warp shed but mounted for movement into the warp shed, means acting in timed relation with said mechanism to move the guides into the warp shed forward of the shaft between successive beat-up operations of the reed, and means to propel the shuttle through said guides when the latter are in the warp shed.

3. In a loom operating with a weft laying shuttle, a set of reed dents having a low non-beat-up area and a high beat-up area mounted for rotation about an axis, mechanism to rotate said dents about said axis so that the low and high areas thereof alternately face the fell of the cloth, a set of aligned shuttle guides providing a shuttle pathway therethrough and located normally out of the warp shed but mounted for movement into the warp shed, means coordinated with the mechanism effective to move said guides into the warp shed when said low areas of the dents face the fell of the cloth and remove the guides from the warp shed before the high areas of the dents face the fell, and means to propel the shuttle through said guides when the latter are in the warp shed to lay weft in the warp shed, the mechanism thereafter causing the high areas of the dents to beat up the weft laid by the shuttle while said guides are out of the warp shed.

4. In a loom operating with a weft laying shuttle, a set of reed dents having low non-beat-up areas and high beat-up areas mounted for rotation about an axis, mechanism to rotate said dents about said axis so that the low and high areas thereof are alternately in the part of the warp shed between said axis and the fell of the cloth, a set of shuttle guides defining a shuttle pathway parallel to said axis and mounted for movement into and out of the warp shed, means to locate the guides in said part of the warp shed with said shuttle pathway in the warp shed when the low areas of the reed are in said part of the warp shed and locate the guides outside of the warp shed when the high areas of the reed are in said part of the warp shed, and means to project the shuttle through the guides along said pathway to lay weft in the warp shed when the guides are in the warp shed, the mechanism thereafter causing the high areas of the reed to enter the warp shed to beat up the weft while said guides are located outside the warp shed.

5. In a loom in which a shuttle passes through a warp shed to lay weft, a shaft extending across the loom and rotating during loom operation, a rotary reed mounted on the shaft having dents provided with beat-up areas which during rotation of the shaft are alternately in and out of the part of the warp shed forward of said shaft, shuttle guide means defining a pathway for said shuttle mounted for movement into and out of said part of the warp shed, and means effective to locate the guide means in the warp shed when said beat-up areas are out of said part of the warp shed for a passage of the shuttle through said pathway and thereafter effective to locate said guide means out of the warp shed while said beat-up areas are in said part of the warp shed to beat up the weft laid by the shuttle.

6. In a loom operating with a shuttle, a reed shaft rotating during loom operation, reed dents secured to the shaft having high beat-up points aligned longitudinally of the shaft and having low non-beat-up points also aligned longitudinally of the shaft, a rocker shaft, shuttle guide means mounted on and moving with the rocker shaft, cam means secured to and rotating with the reed shaft, and operative connections between the cam and the rocker shaft effective to rock the latter to move the shuttle guide means into the warp shed when the low points of said reed dents face the fell of the cloth and move said guide means out of the warp shed preparatory to movement of the high points of the reed to the fell of the cloth to beat in the weft laid by the shuttle.

7. The structure set forth in claim 6 wherein the cam is of the conjugate type having two surfaces and the connections include a yoke having rollers, one for each of the cam faces, located on opposite sides of the axis of the reed shaft.

8. The structure set forth in claim 7 wherein a guide block is mounted for free oscillation on the reed shaft and cooperates with the yoke to hold said rollers in position to engage their respective cam surfaces at opposite sides of the axis of the reed shaft.

9. In a shuttle guiding and weft beat-up unit for a loom, a support frame, a reed shaft rotatably mounted on the frame and having secured thereto reed dents having a high beat-up area and a low non-beat-up area, a rocker shaft mounted for rocking movement on the support frame, shuttle guide means secured to the rocker shaft, and operative connections between the reed shaft and the rocker shaft effective when the reed shaft rotates to move said guide means toward the low areas of the reed dents and thereafter move said guide means away from the high areas of the reed dents.

10. The unit set forth in claim 9 wherein the connections comprise a conjugate cam secured to the reed shaft and having two cam faces and a yoke connector having rollers engaging said surfaces and operatively connected to the rocker shaft.

11. The unit set forth in claim 9 wherein said connections include a cam on the reed shaft and means moved by the cam operatively connected to the rocker shaft.

12. The unit set forth in claim 11 wherein the cam has inclined surfaces effective to move the shuttle guides relative to the reed shaft and having also dwell surfaces to hold the shuttle guide means in stationary position during part of a rotation of the reed shaft.

13. The unit set forth in claim 11 wherein the support frame comprises end bearing members for the reed shaft and rocker shaft and a cross bar rigidly connected to the bearing members.

14. In a loom operating with a shuttle, a rotary weft beat-up reed turning about an axis during loom operation and when turning having weft beat-up operations, shuttle guides independent of the reed moving into the warp shed forward of the reed and then moving out of the warp shed prior to a beat-up operation of the reed, and means to project the shuttle through the guides while the latter are in the warp shed.

15. In a loom operating with a supply of weft exterior to the loom, a reed occupying beat-up and non-beat-up positions during operation of the loom, a shuttle capable of attachment to the weft having a flight through the warp shed for-

ward of the reed when the latter is in non-beat-up position and drawing weft from the supply into the warp shed forward of the reed, shuttle guides movable independently of the reed having aligned openings therein defining a pathway through which the shuttle and thread attached thereto pass, said guides having the parts thereof under said openings therein extending across said pathway to provide supports on which the shuttle travels, and means moving the shuttle guides into the warp shed when the reed is in non-beat-up position with said parts thereof which are under said openings located above the bottom warp shed to support the weft drawn by the shuttle above and out of contact with the bottom warp shed.

16. In a loom operating with a weft supply exterior to the loom, a reed occupying beat-up and non-beat-up positions as the loom operates, a shuttle which on a flight through the warp shed forward of the reed when the latter is in non-beat-up position is attached to and draws weft from said supply into the warp shed, guide means defining a pathway for the shuttle movable independently of the reed into the warp shed when the reed is in non-beat-up position and having support means for the shuttle and the thread extending laterally of and entirely across the bottom of said pathway, and means to move said guide means into the shed when the reed is in non-beat-up position and locate said support means above the bottom warp shed to support the thread above and out of engagement with the bottom warp shed when said thread is being drawn into the shed by the shuttle.

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