

Sept. 6, 1960

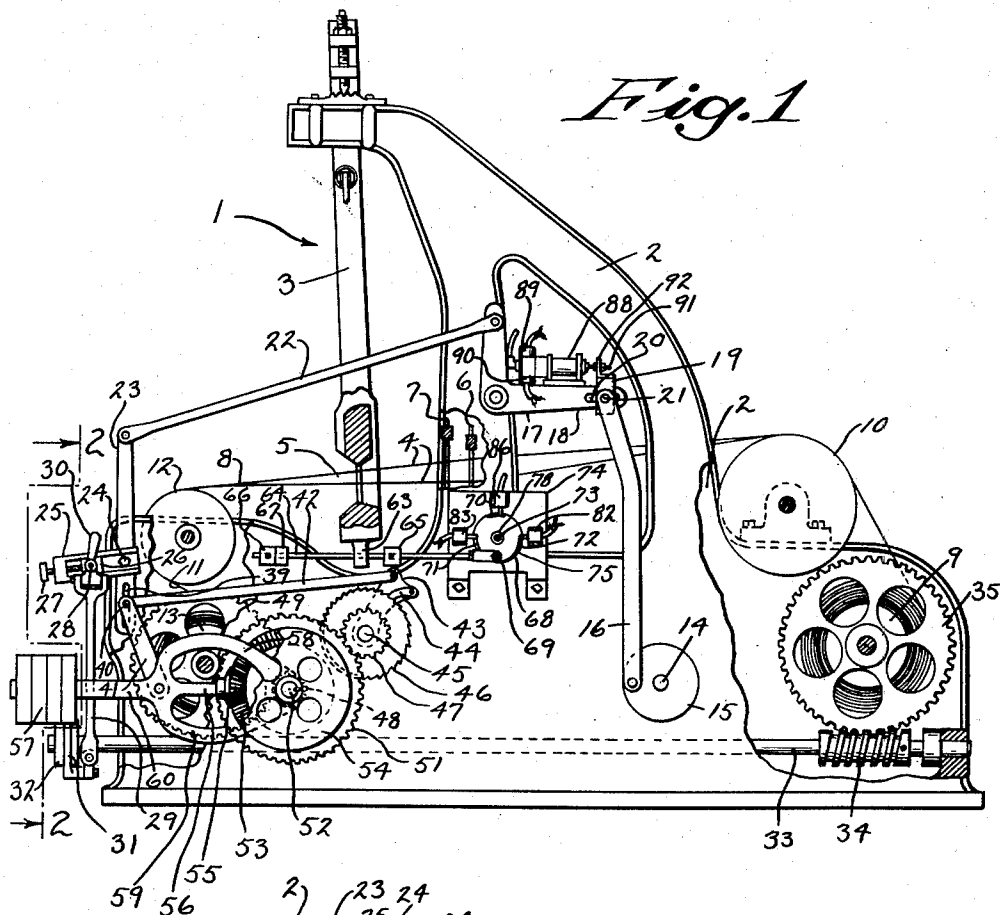
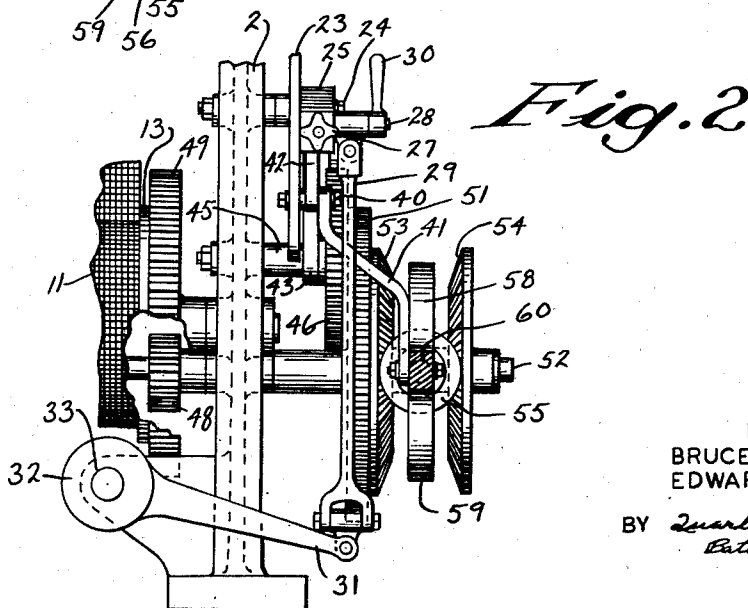
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2,951,508

BEAT LINE CONTROL FOR LOOMS

Filed Aug. 21, 1958

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

Fig. 3

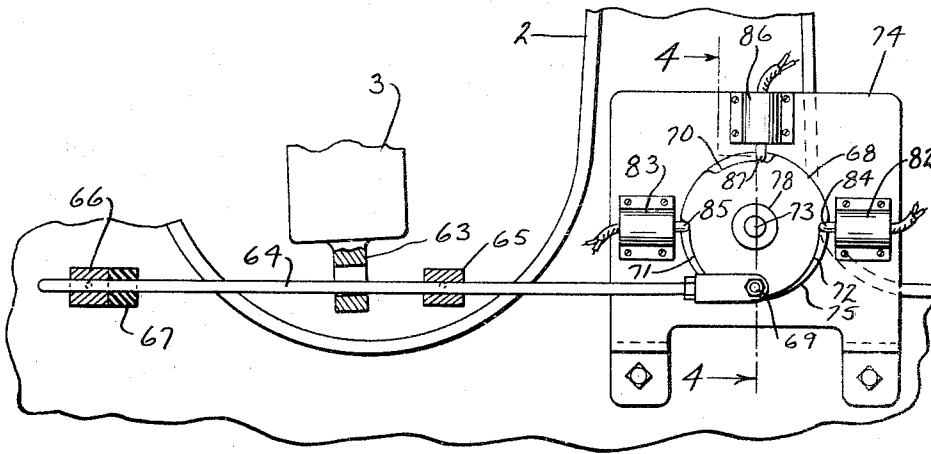
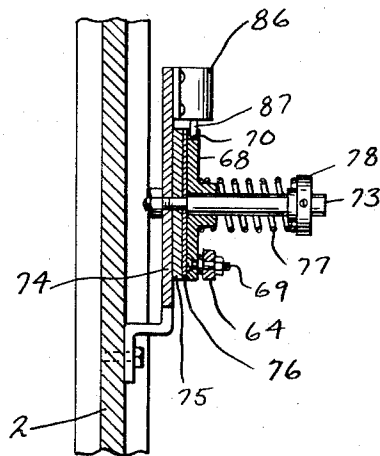


Fig. 4



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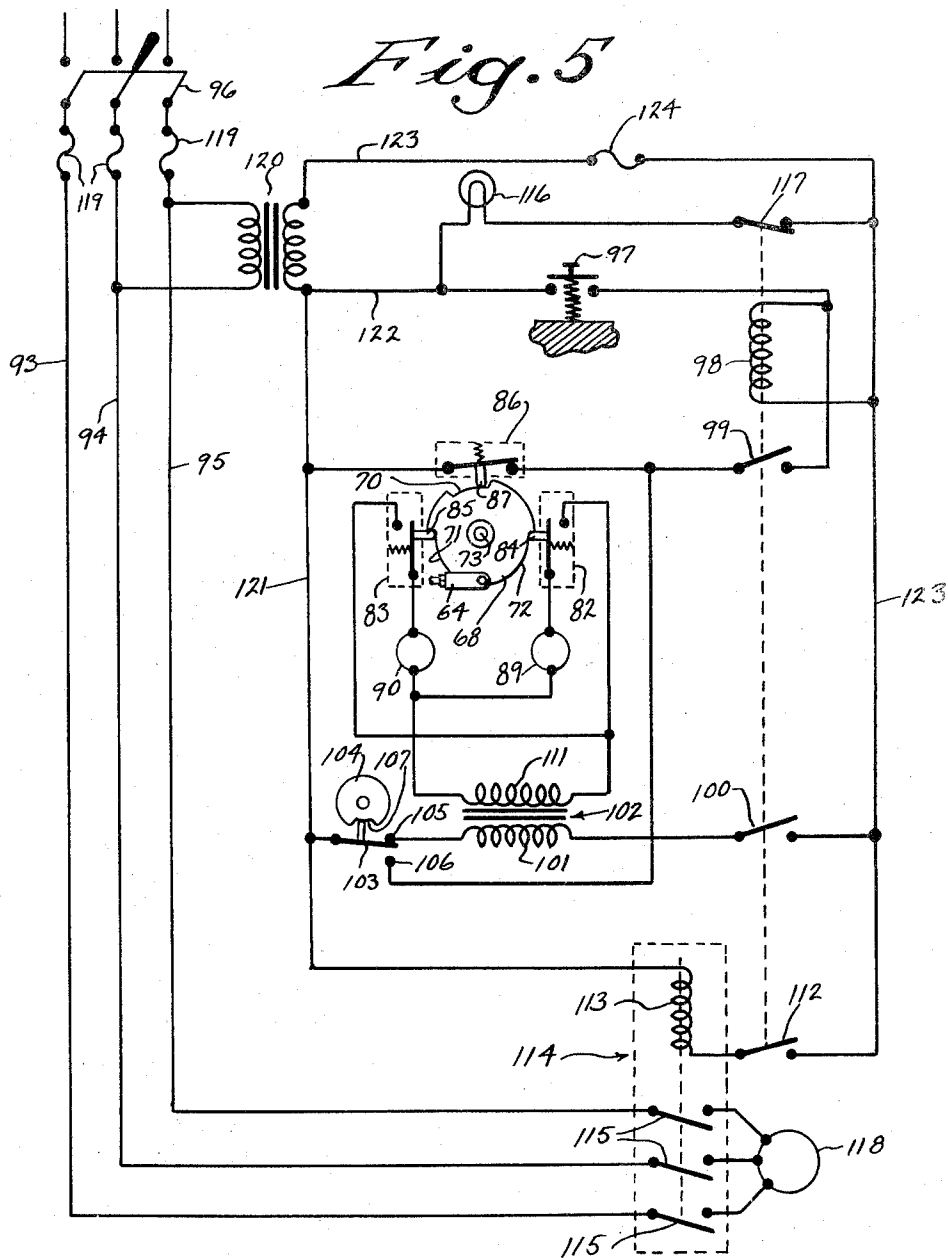
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4 Sheets-Sheet 3



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BEAT LINE CONTROL FOR LOOMS

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4 Sheets-Sheet 4

Fig. 6

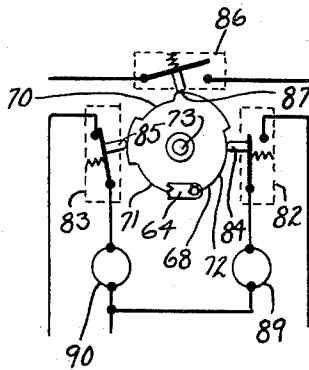


Fig. 7

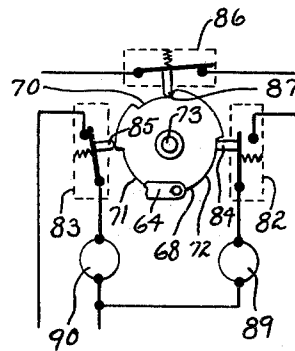


Fig. 8

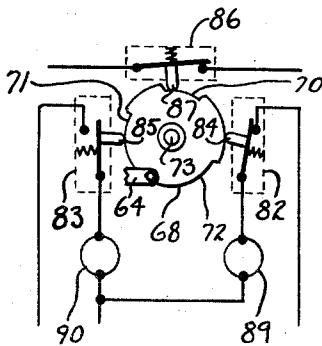
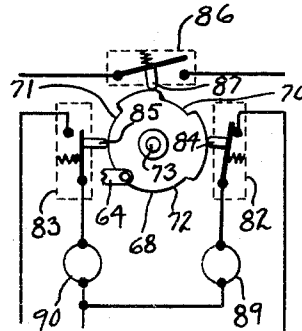


Fig. 9



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2,951,508

BEAT LINE CONTROL FOR LOOMS

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Filed Aug. 21, 1958, Ser. No. 756,508

19 Claims. (Cl. 139—105)

This invention relates to looms for weaving and more particularly resides in an apparatus for controlling the position of the beat line during the weaving operation which comprises a warp thread advancing mechanism which has an element that may be controlled to vary the rate of advance of the warp threads, a member for detecting the position of the beat line, and a control circuit responsive to said detecting member which controls said element, whereby the element is responsive to beat line position.

In weaving fine mesh wire cloth, such as Fourdrinier wires, it is imperative that the beat line be held within a predetermined range of positions at all times. A lay will transmit varying impact forces when it is stopped at different points along its path of travel, and hence if the beat line is permitted to shift the force imparted to the cloth will vary. Spacing between weft threads will accordingly vary and uneven cloth will result. Hence, in order to achieve uniformity in the woven cloth the lay must strike the beat line at approximately the same point in its travel during each beat. In the past, it has been usual for the loom operator to shut down the machine and carefully measure the position of the beat line at frequent intervals. Both the shutdown time of the machine and the operator's labor consumed in carrying out this measurement were costly factors in the weaving operation. The present invention, on the other hand, provides a means for automatically positioning the beat line within preselected limits by increasing or decreasing the rate of advance of the threads. When the beat line shifts in the direction of the cloth roll, in which condition the work is said to be too low, the apparatus of the invention operates to decrease the rate of advance of the threads, and when the beat line shifts toward the warp roll such that the work is too high the rate of advance is increased. In addition, the present invention contemplates the provision of means for stopping the loom operation in the event that the beat line should shift in either direction beyond certain predetermined points. While various tolerances may be suitable depending on the weaving operation, the present invention has been employed to automatically hold the beat line within a range of a thirty-second of an inch, which has been found to be a satisfactory range in the manufacture of most Fourdrinier wires. At the same time it will operate to stop the loom if through unexpected loom failure or operator error the beat line should shift outside of the preselected range, for example, a range of one-eighth of an inch.

It is an object of this invention to provide a control over the position of the beat line wherein the beat line is automatically positioned as the weaving process is carried out.

It is another object of this invention to control the position of the beat line by an apparatus which may be adapted for use on conventional looms.

It is another object of this invention to provide an apparatus for controlling the position of beat lines wherein the rate of movement of the warp threads is regulated,

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It is another object of this invention to provide an automatic beat line positioning apparatus in which the tension on the warp threads remains substantially constant during periods of adjustment of the beat line.

It is another object of this invention to provide an apparatus for controlling the position of the beat line which will operate to automatically shut down the loom when the position of the beat line is shifted outside of certain preselected limits.

It is another object of this invention to provide a beat line positioning apparatus in which the inspection for the position of the beat line is made at the same time during each cycle of lay operation.

These and other objects and advantages of this invention will appear from the description to follow. In the description, reference is made to the accompanying drawings, which form a part hereof, and in which there is shown by way of illustration and not of limitation a specific form in which this invention may be embodied.

In the drawings:

Fig. 1 is a side view in elevation with parts broken away and in section of a loom in which the invention has been embodied,

Fig. 2 is a view in section of a portion of the loom letoff and takeup mechanism as viewed in the plane designated by line 2—2 indicated in Fig. 1,

Fig. 3 is an enlarged view of a portion of the apparatus shown in Fig. 1 including a beat line position control switch mechanism,

Fig. 4 is a view in section of a portion of the switch mechanism taken in the plane designated by line 4—4 indicated in Fig. 3,

Fig. 5 is a wiring diagram of a control circuit forming a part of the invention,

Figs. 6, 7, 8 and 9 are diagrammatic views showing various positions of a pivoted cam and its associated switches which form a part of the circuit in Fig. 5.

Referring now to the drawings, there is shown in Fig. 1 a loom 1 having side frames 2 supporting a pivotally suspended lay 3 which is adapted for reciprocating movement in a path of travel substantially parallel with the forwardly extending warp threads 4. The warp threads 4 are spread to form a shed 5 by means of heddles 6 and 7 which are vertically movable with respect to one another, such that during its forward beat, the lay 3 will carry weft threads, not shown, transversely disposed in the shed 5 into meshing relationship with the warp threads 4 at a beat line 8.

A supply of warp threads 4 is wound on a warp roll 9, and the threads 4 extend upwardly and forwardly over a guide roll 10 and thence through heddles 6 and 7 to the beat line 8. From the beat line 8 formed cloth 11 passes over a breast beam 12 to a takeup or cloth roll 13.

The letoff of the warp roll 9 and the takeup of the cloth roll 13 is accomplished in the following manner. A drive shaft 14, which is geared to rotate through one complete revolution during each cycle of the lay 3, is fitted at one end with a flange 15. A connecting member 16 is pivotally secured to the flange 15 at a point eccentric of its axis of rotation, whereby rotation of shaft 14 will impart to the connecting member 16 a vertical reciprocating motion. The other end of the member 16 is pivotally connected to an arm 17 of a bell crank 18. The connection between the arm 17 and the member 16 consists of a bifurcated guide block 19 straddling the arm 17, a radially extended slot 20 in the arm 17 in alignment with the block 19, and a pivot pin 21 extended through the connecting member 16, the bifurcated guide block 19 and the slot 20. A rod 22 is secured at one end to the end of the bell crank 18 opposite that joined with the member 16, and extends forwardly to a pivot connection with the upper end of a vertically extending lever 23,

which lever 23 in turn is pivotally mounted on a horizontal pivot pin 24. Integral with the lever 23 and extending forward from the pivot pin 24 is a guide arm 25 that mounts a movable guide block 26 which is adjusted by means of a hand screw 27 rotatably secured to the guide block 26 and in threaded engagement with a forward portion of the adjustable guide arm 25. Depending from an outwardly projecting pivot pin 28 secured to the guide block 26 is a linking member 29 which is fitted with single universal joint assemblies at either end, and which is pivotally attached to the pivot pin 28 by means of a hand nut 30. At its lower end, the linking member 29 is pivotally connected to an operating lever arm 31 of an override clutch 32 supported by a rearwardly extending letoff shaft 33. The override clutch 32 is adapted to permit rotation of shaft 33 in one direction only as the lever arm 31 is reciprocally moved about the shaft 33. The construction and mode of operation of the clutch 32 is well understood in the art. A worm gear 34 is fixed to the rear end of the shaft 33 and is in mesh with a sprocket gear 35 that is concentrically mounted with and secured to the warp roll 9. Thus, it may be observed that the letoff of the warp roll 9 is accomplished through a direct drive mechanism whereby power is transmitted from the main drive shaft 14 through the mechanical linkage heretofore described to the warp roll 9.

The takeup mechanism, which is arranged to rotate the cloth roll 13 at a rate consistent with the rate of letoff of the warp roll 9, is illustrated in Figs. 1 and 2. A portion of the lever 23 extending below the pivot pin 24 is fitted with an extended slot 39 in which there is inserted a floating pivot pin 40 that pivotally joins an end of a bar 41 and an end of a rod 42. Rod 42 is pivotally connected at its other end to a pawl carrier 43 which carries a pivotally mounted pawl 44. The pawl carrier 43 is rotatably supported by shaft 45 together with a ratchet gear 46, which gear 46 is engageable by the pawl 44 when the carrier 43 is rotated in a counterclockwise direction, as viewed in Fig. 1. A pinion gear 47 is concentrically mounted to the ratchet gear 46. Arranged in engagement with the pinion gear 47 is a spur gear 51 which is rotatably supported on a shaft 52 extending between the side frames 2. Secured to and concentric with the spur gear 51 is a first bevel gear 53, and in opposed face-to-face relationship with bevel gear 53 is a second bevel gear 54 which is keyed to the shaft 52. Also secured to the shaft 52 at the inner side of the side frame 2, as illustrated in Fig. 2, is a pinion 48 which is engaged with a cloth roll sprocket 49 concentrically mounted with the cloth roll 13. In engagement with both the first bevel gear 53 and the second bevel gear 54 is a bevel pinion 55 supported at the end of a short shaft 56 which comprises an extension of a weight supporting shaft 60 adapted to carry suitable weights 57 attached thereon. A pair of curved support arms 58 and 59 extend outwardly and forwardly from the junction of shafts 56 and 60 and intersect at a pivot connection with shaft 52 on the opposite side of the bevel pinion 55. The free end of bar 41 is also pivotally connected at the junction of shafts 56 and 60. The operation of the mechanism will be discussed hereinafter.

A depending lug 63 is carried at the underside of the lay 3, as shown in Figs. 1 and 3. A small diameter rod 64 projects through a substantially larger aperture in the lug 63, and carries a pair of stops 65 and 66 secured to the rod 64, one on each side of the lug 63. The stops 65, 66 are positioned so as to be struck by the lug 63 as the lay 3 is reciprocally moved during its cycle. To absorb the impact of the lug 63 striking the forward stop 66, a rubber bumper 67 is secured to the rod 64 adjacent to the stop 66. At its rearward end the rod 64 is pivotally connected to a suitably formed cam plate 68 by means of a projecting bolt and nut assembly 69. The cam plate 68 is preferably formed of a wear resistant metal or plastic and is substantially circular in shape with suitably positioned peripheral recesses 70, 71 and 72. It is pivotally

supported at its center on a stationary pin 73 which is secured to a mounting plate 74 supported by a side frame 2 of the loom 1 as shown in Figs. 3 and 4. Secured to the mounting plate 74, and concentric with the cam plate 68, is a circular base plate 75 having a thin sheet of brake lining material 76, such as cork, disposed on its outward surface in contact with the flat rear face of the cam plate 68. A coil spring 77, which encircles the pin 73 to the front of the cam plate 68, is utilized to hold the cam plate 68 in contact with the brake material 76. The outer end of the spring 77 bears against a seating collar 78 secured to the stationary pin 73, and the inner end of the spring 77 bears directly against the cam plate 68.

A pair of normally open switches 82 and 83 are secured to the mounting plate 74 and are positioned on diametrically opposed sides of the cam plate 68, such that the associated contact operators or switch followers 84 and 85 are in contacting engagement with the camming surfaces of cam plate 68. A normally closed switch 86 is also secured to the mounting plate 74 and is positioned at the upperside of the cam 68 such that its associated switch follower 87 is also in contact with a camming surface of cam 68. As shown in Fig. 3, the switch follower 84 of the switch 82 will be moved as the cam recess 72 is moved into and from alignment with the line of movement of the follower 84. Similarly, switch 83 is responsive to the position of the cam recess 71 and switch 86 is responsive to the position of the cam recess 70.

For purposes of adjustably moving the bifurcated guide block 19 and its associated pivot pin 21 within the extended slot 20 there is employed an air actuated cylinder 88, shown in Fig. 1. The cylinder 88 is mounted upon and carried by the bell crank arm 17, and the operation of the cylinder 88 is controlled by electrical solenoids 89 and 90 which are electrically connected to the switches 82 and 83, as shown in the wiring diagram of Fig. 5. The piston rod 91 of the cylinder 88 is attached to a projecting ear 92 which is secured to the upperside of the bifurcated guide block 19, such that extension and retraction of the rod 91 lengthens and shortens the effective working length of the bell crank arm 17.

Referring specifically now to the circuit diagram of Fig. 5, there is illustrated a set of 3 phase power lines 93, 94 and 95 which are to be connected to supply power through a manually operated switch 96 and a set of fuses 119. A control transformer 120 is connected between lines 94 and 95, and the low voltage secondary of transformer 120 feeds voltage distribution leads 121, 122 and 123, the latter lead 123 having a fuse 124 inserted therein. A reset push button 97 is connected between line 122 and one side of a relay coil 98, which coil 98 is connected at its other side to line 123. Associated with the relay coil 98 is a set of normally open contacts 99 which are connected between the side of the relay coil 98 joined to reset button 97 and one side of the normally closed switch 86 illustrated in diagrammatic form in Figs. 5 through 9. The opposite side of switch 86 is joined to the lead 121. Another set of normally open relay contacts 100 operated by relay coil 98 is connected between line 123 and one side of a transformer primary winding 101 which forms a part of a transformer 102. The other side of the primary winding 101 is connected to contact 105 of a cam operated switch 103, and hence through the switch 103 to the line 121. A cam 104 is adapted to move the blade of the switch 103 between the contact 105 and a second contact point 106 in timed relation with loom and lay operation. In those looms wherein a series of cams are rotated in synchronism with loom operation to govern and control such operation, the cam 104 may be driven together with such cams. The mode of driving such cams is well understood in the art. A suitably positioned notch 107 in the periphery of the cam 104 causes the blade of the switch 103 to close on contact point 105 once during each cycle of lay movement, for the purpose of inspecting

the position of the beat line 8, in a manner to be described hereinafter. Contact point 106 is joined to the connection between switch 86 and relay contacts 99.

One end of a secondary winding 111 forming a part of the transformer 102 is joined to one side of both of the normally open switches 82 and 83, shown in diagrammatic form in Figs. 5 through 9, while the other end of the secondary winding 111 is joined to a parallel connection of one side of each of the low voltage solenoids 89 and 90, also shown in diagrammatic form in Fig. 5. The opposite side of each solenoid 89, 90 is, in turn, separately connected to a terminal of an associated switch 82, 83.

Also connected between the leads 121 and 123 is a series circuit consisting of normally open relay contacts 112 responsive to relay coil 98, and a switch coil 113 which forms a part of a motor control relay 114. Coil 113 operates normally open switch contacts 115 associated therewith which are interposed between the power lines 93, 94 and 95 and a loom motor 118. The loom motor 118 is adapted to supply the mechanical power for the operation of the loom through drive means, which includes the shaft 14, hereinbefore described, and other means well known in the art and not forming a part of this invention. A final branch in the control circuit consists of an operator signal light 116 connected between leads 122 and 123 in series with normally closed relay contacts 117 which are operated by the relay coil 98.

In Figs. 1 and 3 the lay 3 is illustrated in a position midway between the extent of its travel in either direction. It may be observed that as the lay 3 moves to its rearward or retracted position, the lug 63 will contact stop 65 and carry the rod 64 rearwardly. Rearward motion of the rod 64 rotates the cam 68 in a counterclockwise direction to a so-called reset position, as shown in Fig. 6. In this reset position the cam recess 71 is displaced from under the switch follower 85 and hence the switch 83 will be moved to a closed position. At this time the switch 82 will also be in the normally open position, and the normally closed switch 86 will be moved to an open position. Subsequently, as the lay 3 is moved forward toward the beat line the lug 63 is urged against the bumper 67 causing the rod 64 to move forwardly and rotating the cam 68 in a clockwise direction. Depending on the position of the beat line, which determines the extent of the forward travel of the lay 3, and hence the final position of the cam plate 68, five different switch position combinations for switches 82, 83 and 86 may result at the time of the beat of the lay 3.

(1) The cam 68 may not be rotated a sufficient distance clockwise to move the switches out of their respective positions at reset, such that switch 82 will remain in normally open position, switch 83 will remain in a closed position and switch 86 will remain in open position, as shown in Fig. 6.

(2) The cam plate 68 may be rotated clockwise to the position shown in Fig. 7 such that switch 82 will remain in its normally open position, switch 83 will remain in a closed position, but switch 86 will be moved to its normally closed position when the follower 87 is aligned with peripheral recess 70.

(3) The cam plate 68 may be rotated clockwise a sufficient distance to move the switches into the positions in which they are shown in Figs. 1, 3 and 5, wherein the cam recesses 71 and 72 permit the switches 82 and 83 to be in normally open position and cam recess 70 permits the switch 86 to be in normally closed position.

(4) The cam plate 68 may be rotated from reset position a sufficient distance clockwise, as illustrated in Fig. 8, to move switch 82 into a closed position, to move switch 83 to its normally open position and to move switch 86 to its normally closed position.

(5) The cam 68 may be rotated a maximum distance clockwise, as shown in Fig. 9, such that switch 82 will be moved to a closed position, switch 83 would be moved

to its normally open position, and switch 86 will be moved to an open position.

In Fig. 5 it may be seen that when the manually operated switch 96 is moved to closed position power lines 93, 94 and 95 will be energized. The signal light 116 will now glow, which is an indication to the operator that the beat line control circuit is de-energized. To energize this circuit, reset push button 97 is depressed causing the energization of relay coil 98, which in turn closes the associated relay contacts 99, 100 and 112 and opens normally closed relay contacts 117. When the reset button 97 is released, continued energization of relay coil 98 will be dependent on the self-holding contacts 99 together with either the switch contacts 86 or the switch 103 when it is closed on contact 106. When the cam 68 is moved to reset position, as hereinbefore described, switch contacts 86 will be in open position, during which time switch 103 must be closed on contact point 106 in order to maintain the energization of the relay coil 98. Thus it may be seen that cam 104 must be suitably synchronized with the lay operation so that switch 103 closes on contact point 105 for a brief period only during the time interval following the beat of the lay 3 and before the lay 3 moves to its rearward position to reset the cam 68.

As the cam 104 is rotated as hereinbefore described, there will be a brief period of time during each cycle when the switch 103 is closed on contact point 105 at which time inspection of the position of the beat line is accomplished. Such an inspection is performed as follows: With switch contacts 103 closed on point 105 and with contacts 100 held in a closed position by the associated relay coil 98, the primary winding 101 is energized thereby inducing a voltage in the secondary winding 111. This induced voltage will cause an energization of either solenoid 89 or 90 when its associated switch 82 or 83 is in closed position as dictated by the position of the cam 86 at the time of the inspection. Solenoids 89 or 90, are adapted to control the operation of the cylinder 88 as hereinafter described. If, during this inspection period, cam 68 would be in a position allowing the normally closed contacts 86 to be open as shown in Figs. 6 and 9, then the relay coil 98 would be de-energized and the contacts 99, 100 and 112 would be moved into open position. Simultaneously the normally closed contacts 117 would be moved to closed position to illuminate the signal light 116.

When the contacts 112 are moved to closed position, the motor control relay coil 113 is energized causing its associated switch contacts 115 to move into closed position whereby the loom motor 118 may be supplied through power lines 93, 94 and 95 for normal operation. However, when the coil 98 is de-energized contacts 112 are moved into open position whereby relay coil 113 will be de-energized. This causes the contacts 115 to be opened to disconnect the power supplying the motor 118.

When the solenoid 89 is energized by virtue of the switch 82 being in closed position as shown in Fig. 8, it operates to actuate the cylinder 88 to extend the piston rod 91 thus lengthening the adjustable arm 17 of the bell crank 18. In this extended position, the amount of translational motion imparted to the rod 22 and hence to the upper end of lever 23 is reduced. Correspondingly, the amount of translational motion imparted to the linking member 29 and hence through the lever arm 31 to the override clutch 32 is reduced. This operates to decrease the amount of rotation imparted to the shaft 33 during each cycle and consequently decreases the amount of letoff of the warp roll 9. On the other hand, the solenoid 90 is energized when its associated switch 83 is moved into closed position as shown in Fig. 7. The piston 91 of the cylinder 88 is then moved to a retracted position which effectively shortens the length of the adjust-

able arm 17 of the bell crank 18. Thus, the amount of translational motion imparted through the bell crank 18 to the rod 22 is increased and by means of the previously described linkage mechanism the amount of let-off of the warp roll 9 is increased.

The switch 82 will be moved into closed position as described when the lug 63 contacts the bumper 67 and rotates the cam 68 clockwise to the position shown in Fig. 8. Similarly, when the lay 3 does not move sufficiently far forward, the switch 83 will be in closed position as shown in Fig. 7. As is indicated hereinbefore, when the cam 68 is in either of the positions illustrated in Figs. 6 and 9 one or the other of the switches 82 or 83 is in closed position to cause an apparent energization of either of the solenoids 89 and 90. However, when the cam 68 is positioned as therein illustrated, the switch 86 is in open position resulting in a complete de-energization of the circuit and loom motor 118 as previously discussed.

A suitable mechanism is employed as previously described for automatically rotating the cloth roll 13 a necessary amount each cycle to retain a substantially constant tension in the warp wires 4. As the upper portion of the lever 23 reciprocally pivots about the pivot pin 24 the lower end of the lever 23 is caused to move in a similar fashion. Such movement causes the rod 42 to move reciprocally whereby the pawl carrier 43 supporting the pawl 44 is pivoted about the shaft 45. As the pawl 44 engages the teeth of the ratchet gear 46 the ratchet gear 46 is moved in a counterclockwise direction. Simultaneously, the pinion gear 47 is moved in a counterclockwise direction which causes the meshing spur gear 51 to move in a clockwise direction as well as the attached first bevel gear 53. When the first bevel gear 53 moves clockwise the bevel pinion 55 is rotated causing the second bevel gear 54 which is keyed to shaft 52 to move in a counterclockwise direction. The rotation of the second bevel gear 54 and its associated shaft 52 causes the pinion 48 to drive the cloth roll sprocket 49 to take up the cloth 11 on the cloth roll 13. It may be seen that as the weight 57 tends to move downwardly, the length of the arm between the pivot pin 40 and the pivot pin 24 is increased, causing the rod 42 to reciprocate through a greater distance. Hence, the amount that the ratchet gear 46 moves is increased resulting in a corresponding increase in the amount of takeup of the cloth roll 11. Now when the amount of takeup of the cloth roll 11 exceeds the amount of letoff of the warp roll 9, the tension in the warp threads 4 is increased resulting in an automatic upward shift of the weight 57.

The apparatus of this invention provides for the automatic positioning of the beat line during the weaving operation, and at the same time provides a means for disabling the loom operation in the event that the beat line shifts out of a desired range of positions. It may be seen that the length and position of the peripheral recess 70 controls the distance through which the beat line may shift before the loom is shut down. Similarly, it may be observed that the positions as well as length of the peripheral recesses 71 and 72 are critical to a determination of the amount that the beat line is allowed to shift before a positional correction by the means heretofore described is effectuated. Consequently, it is contemplated that various alterations may be made in the positions of the peripheral recesses 70, 71 and 72, and the cam 68 may be embodied in various sizes and shapes without departing from the spirit of the invention.

The cylinder 88 is preferably of the double acting type and is arranged so that after the piston rod 91 has been moved to either an extended or a retracted position, the rod 91 will retain that position until either solenoid 89 or 90 is actuated to move the rod 91 in the opposite direction.

We claim:

1. In a beat line positioning apparatus for a loom having a mechanism for advancing warp threads toward and past a beat line the combination comprising: actuating means including control switch means; a beat line position indicator adapted to engage threads at the beat line and to operate said actuating means whereby said switch means is responsive to beat line position; an operating member in said warp thread advancing mechanism that is of variable operating length; and electrically operated regulating means responsive to said switch means of said actuating means, said regulating means being joined to said operating member to vary the length of said member in response to operation of said actuating means.

2. In a beat line positioning apparatus for a loom having a mechanism for advancing warp threads toward and past a beat line the combination comprising: switch means having two sets of contacts; switch actuating means adapted to engage threads at the beat line and operate said two sets of contacts, whereby one set is made operative if the beat line is too high and the other set is made operative if the beat line is too low; a timing switch connected to said switch means and opened and closed in time with said actuating means; an operating member in said warp thread advancing mechanism having a movable portion thereon which acts as one end of the operating length thereof; electro-magnetic means associated with said operating member and cooperatively related with said movable portion to set the operating length; and circuit connections electrically joining the timing switch and switch means with the electromagnetic means whereby the timing switch places the switch means in active circuit with the electromagnetic means to shorten the operating length of the operating member if one set of switch means contacts is operative and to lengthen the operating length if the other set of switch contacts is operative.

3. In a beat line positioning apparatus for a loom having a lay movable between a beat position and a retracted position, and warp thread advancing means including a mechanical linkage adapted to advance warp threads toward and past the beat line position the combination comprising: an extensible operating member connected in said linkage; electrically operable means for varying the length of said operating member; a movable switch operator; means movable in response to the lay into a position indicative of beat line position and cooperatively joined with said switch operator to move the operator into a position corresponding to the beat line position; electrical switch means operable by said switch operator; and electrical circuit connections joining said electrically operable means and said switch means, whereby the length of said operating member is determined by beat line position.

4. In a beat line position apparatus for a loom having warp thread advancing means including a mechanical linkage adapted to advance warp threads past the beat line, and a lay movable between a beat position and a retracted position, the combination comprising: a movable cam; a cam operator cooperatively joining said lay and said cam to move the cam into a position corresponding to the beat position of the lay; electrical switch means operable by said cam; a member forming an element in said linkage of adjustable operating length adapted to control the advance of the warp threads through adjustment of the length; and electrically responsive adjustment means operably connected to said switch means and arranged to move said adjustable member.

5. In a beat line positioning apparatus for a loom having a warp thread advancing means including a mechanical linkage adapted to advance warp threads past the beat line, and a lay movable between a beat position and a retracted position, the combination comprising: a

movable cam; a cam operator cooperatively joining said lay and said cam to alternately move the cam into positions corresponding to the beat position and retracted position of the lay; electrical switch means operable by said cam; a variable length operating arm connected in said linkage; a cylinder having an extendable and retractable piston forming a part of said arm to vary the operating length thereof; actuating solenoids associated with said cylinder; and electrical circuit connections joining said solenoids and said switch means.

6. In a beat line positioning apparatus for a loom having warp thread advancing means including a mechanical linkage adapted to advance warp threads, the combination comprising: a member movable between a position at the beat line and a position retracted therefrom; a movable cam; a cam operator cooperatively joining said member and said cam to move the cam into a position corresponding to the beat position of the member; switch means operable by said cam; an extensible member in said linkage adapted to vary the advance of the warp threads by change in the length thereof; and a solenoid electrically connected to said switch means cooperatively related with said extensible member to vary the length of the member when said solenoid is energized through said switches.

7. In a beat line positioning apparatus for a loom having a mechanical linkage adapted to advance warp threads, and a lay movable between a beat position and a retracted position, the combination comprising: a lug with an aperture therethrough carried by said lay; a pivotally mounted switch operating cam; a rod projecting through the aperture of said lug and being pivotally connected to said cam at a point eccentric of the mounting pivot of said cam; stops attached to said rod at either side of said lug; a variable length operating arm in said linkage, a portion of said arm having mounted thereon electrically responsive means for varying the length of said arm; electrical switches operable by said cam; and electrical connections joining said switches and said electrically responsive means for operation of said means through said switches.

8. In a beat line positioning apparatus for a loom having a warp thread roll and a cloth roll, warp thread advancing means including a mechanical linkage adapted to advance warp threads from the warp roll to the cloth roll, and having a lay movable between a beat position and a retracted position, the combination comprising: a pivotally mounted switch operating cam; a connection between said cam and said lay to pivot the cam into a position corresponding to the beat position of the lay; a pivotally mounted crank having a pair of arms operably connected in said advancing means, one of said arms having a radially movable connection point to provide an adjustable effective operating length; a pair of switches to be operated by said cam when the cam is pivoted into a position corresponding to the beat position of the lay; and solenoid means in circuit with said switches for moving said connection point.

9. In a beat line positioning apparatus for a loom having a warp roll and a cloth roll, warp thread advancing means including a mechanical linkage and a pawl and a ratchet gear wherein the number of teeth engageable by said pawl is governed by the linkage and controls the advance of warp threads from the warp roll to the cloth roll, and a lay movable between a beat position and a retracted position, the combination comprising: a switch operator; a connection between the lay and switch operator adapted to move the switch operator into a position corresponding to that of the lay when in beat position; an arm of adjustable length in said linkage; electrical switch means operable by said switch operator; electrically responsive means arranged to adjust the length of said arm; and electrical connections joining said switch means and said electrically responsive means.

10. In a beat line positioning apparatus for a loom having a warp roll and a cloth roll, a warp thread advancing means including a mechanical linkage adapted to transmit reciprocal motion to a pawl and a ratchet gear having teeth engageable by said pawl to advance warp threads from the warp roll to the cloth roll, and a lay movable between a beat position and a retracted position, the combination comprising: a movable cam member; a cam operator cooperatively joining said lay and said cam to move the cam into a position corresponding to the beat position of the lay; an adjustable member in said linkage adapted to limit the number of teeth engaged by said pawl during each reciprocation; electrical switching operable by said cam; electrically responsive means being arranged to adjust said member; and electrical connections joining said switching and said electrically responsive means.

11. In a beat line positioning apparatus for a loom having a warp roll and a cloth roll, a warp thread advancing means including a mechanical linkage adapted to advance warp threads from the warp roll to the cloth roll, a rotatable drive shaft having a crank, a lay movable between a beat position and a retracted position; the combination comprising: a lug with an aperture therethrough carried by said lay; a pivotally mounted switch operating cam; a rod projecting through the aperture of said lug and being pivotally connected to said cam; stops attached to said rod at either side of said lug; switches including contacts and contact operators in engagement with said cam; a pivotally mounted member having a pair of angularly disposed arms extending from the pivotal mounting, one of said arms being pivotally connected to said linkage; a radially movable pivot connection on the other of said arms; a member cooperatively joining said pivot connection and the crank of said drive shaft; and electrically responsive means for moving said pivot connection; and electrical connections joining said switches and said electrically responsive means.

12. In a beat line positioning apparatus for a loom having a warp roll and a cloth roll, a warp thread advancing means including a mechanical linkage adapted to advance warp threads from the warp roll to the cloth roll, a rotatable drive shaft having a crank, a lay movable between a beat position and a retracted position; the combination comprising: a lug with an aperture therethrough carried by said lay; a pivotally mounted switch operating cam; a rod projecting through the aperture of said lug and being pivotally connected to said cam; stops attached to said rod at either side of said lug; switch means including contacts and contact operators in engagement with said cam; a pivotally mounted bell crank having a pair of angularly disposed arms extending from the pivotal mounting, one of said arms being pivotally connected to said linkage; a radially movable pivot connection on the other of said arms; a member cooperatively joining said pivot connection and the crank of said drive shaft; an actuating cylinder having an alternately retractable and expandable piston rod operably connected to move said pivot connection; a solenoid arranged to control the actuation of said cylinder; and electrical connections joining said solenoid and said switch means.

13. In a beat line positioning apparatus for a loom having a warp thread advancing linkage and a lay movable between a beat position and a retracted position the combination comprising: a movable cam; a cam operator joining said lay and said cam to move the cam into a position corresponding to the beat position of the lay; switch means operable by said cam; a timing switch open and closed in timed relation to the lay; a member in said linkage of adjustable operating length; a connection mounted on and movable along said member for adjusting the operating length thereof; electrically responsive means on said member joined to said connection adapted to move the connection along the member; and electrical connections joining said switch means, said timing switch,

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and said electrically responsive means whereby said timing switch places the switch means in operative circuit relation with the electrically responsive means upon the cam being placed in position corresponding to beat position.

14. In a beat line positioning apparatus for a loom the combination comprising: a switch operator having a pair of switch actuating surfaces; a pair of switches each moved between open and closed position in response to the position of an actuating surface of said switch operator; a member movable toward and from a position at the beat line of the loom; a connection between said member and said switch operator adapted to place the switch operator in a position corresponding to beat line position, whereby the actuating surfaces of the switch operator actuate one of said switches if the beat line position is advanced below a preselected point and actuate the second of said switches if the beat line position is above a preselected point; a timing switch opened and closed in a sequence related to movement of said member; a mechanism for advancing warp threads through the loom including a member of adjustable length; electrically responsive means associated with the member adapted to adjust the length thereof; and circuit connections cooperatively joining the electrically responsive means with the pair of switches and the switches with the timing switch, whereby the timing switch places the pair of switches in active circuit relation with the electrically responsive means after the switches have been actuated by the switch operator.

15. In a beat line positioning apparatus for a loom having a warp thread advancing mechanism and a lay movable between a beat position and a retracted position the combination comprising: an extensible member in said warp thread advancing mechanism adapted to vary the rate of advancement of the warp threads when the operating length thereof is varied; electrically responsive adjustment means on the extensible member adapted to alter the operating length of said member; a switch operator cooperatively joined with said lay to move the operator into a position corresponding to the beat position of the lay; switch means having contacts operable by said switch operator; a source of electrical energy; a timing switch opened and closed in timed relation to the lay and placed in closed position when said switch operator is in a position corresponding to the beat position of the lay; and electrical connections joining said switch means contacts, said timing switch, said source, and said adjustment means whereby said adjustment means may be energized by said source through said switch means when the timing switch is closed.

16. In a beat line control apparatus for a loom having a warp thread advancing mechanism, a loom power supply, and a lay movable between a beat position and a retracted position, the combination comprising: an extensible member in said warp thread advancing mechanism adapted to vary the rate of advancement of the warp threads when the operating length thereof is varied; electrically actuated adjustment means associated with the extensible member adapted to vary the operating length of said member; a switch operator cooperatively joined with the lay to move the operator into a range of positions including a zone of permissible positions corresponding to permissible positions of the beat line and zones of positions to each side of the permissible positions corresponding to undesirable positions of the beat line; first switch means having contacts operable by said switch operator when said operator is moved into the zone of

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permissible positions; electrical circuit connections joining said contacts and said adjustment means whereby said adjustment means may be actuated when said first switch contacts are operated; second switch means having contacts operable by said switch operator when said operator is moved into a zone of positions corresponding to undesirable positions of the beat line; electrically actuated interrupting means interposed between said power supply and said loom; and electrical circuit connections joining said interrupting means and said second switch means contacts to actuate said interrupting means when said contacts are operated.

17. In a beat line positioning apparatus for a loom having a mechanism for advancing warp threads toward and past a beat line, the combination comprising: an operating member of variable operating length in said warp thread advancing mechanism wherein the length of said member is determinative of the rate of advancement of said threads; solenoid means associated with said operating member for varying the length of said member; switch actuating means operably connected to said solenoid to control the same; and a beat line position indicator adapted to engage threads at the beat line and to operate said switch actuating means according to the position of the beat line.

18. In a warp thread advancing apparatus for a loom the combination comprising: a warp thread advancing mechanism including an operating member of extensible length; a plunger cooperatively joined to said operating member to vary the length thereof; electrical solenoid means adapted to move said plunger; detecting means adapted to measure the position of threads on the loom; control switch contacts responsive to said detecting means; and a control circuit between said switch contacts and said solenoid means to operate the solenoid means to move the plunger and set the length of said operating member.

19. In a warp thread advancing apparatus for a loom the combination comprising: a warp thread advancing mechanism including a member of variable operating stroking having at least two stroke positions, the first stroke position adapted to cause the warp threads to advance at a reduced rate and the second stroke position adapted to cause the warp threads to advance at an increased rate; an operator for said member for setting the same at a desired stroke position; a detector adapted to periodically detect the position of threads in the loom; control means cooperatively joined with said detector and set in position upon a detection by the detector, which position is indicative of thread position in the loom and is preserved after detection is made; a timer which establishes periodic test intervals; and connections between said control means and said operator that are rendered operative by said timer during a test interval, whereby said control means and operator place said member in the first stroke position when the detected threads are forward of a selected point and place said member in the second stroke position when the detected threads are rearward of a selected point.

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