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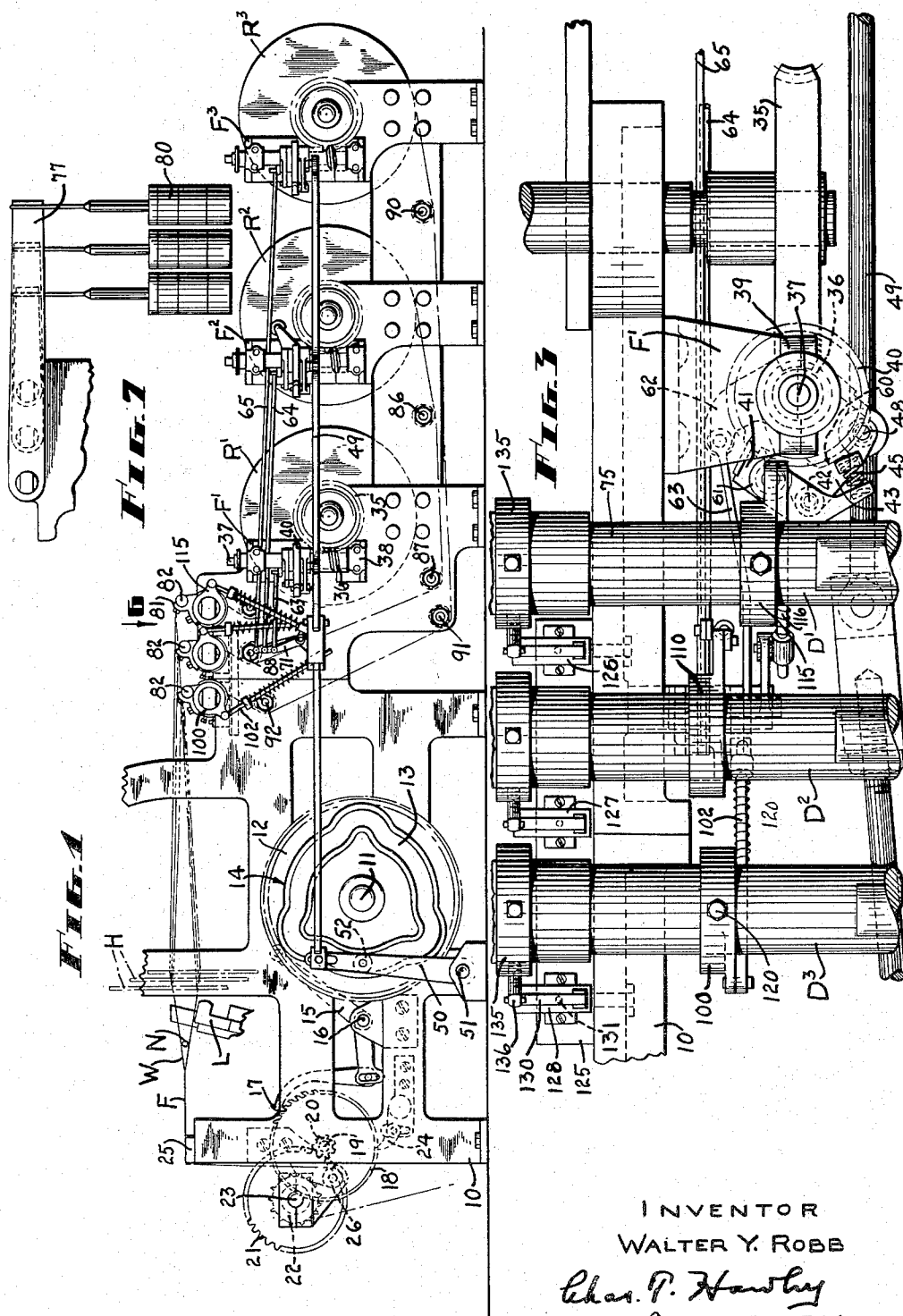
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2,363,996

LET-OFF MECHANISM FOR LOOMS

Filed April 12, 1943

3 Sheets-Sheet 1



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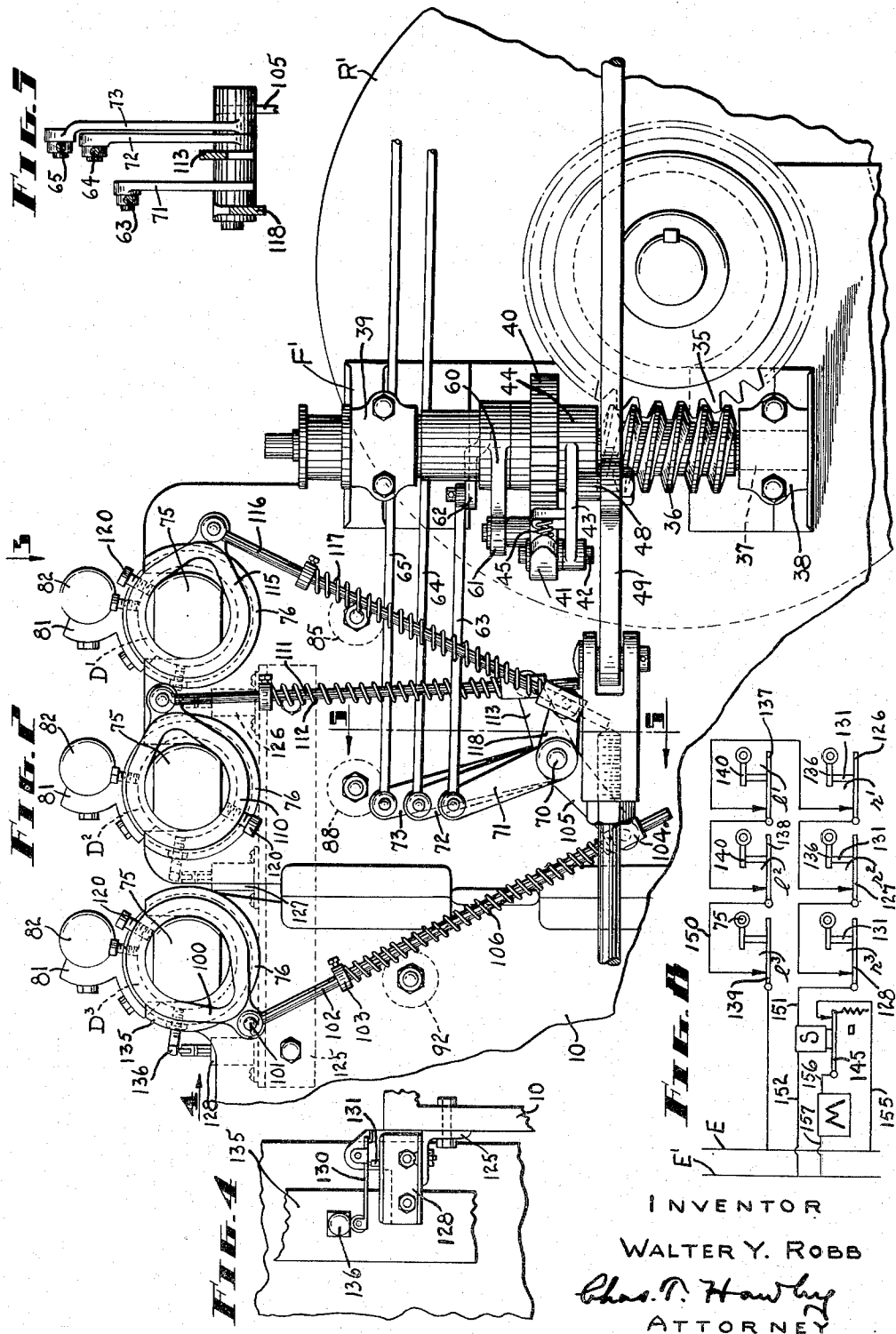
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3 Sheets-Sheet 2



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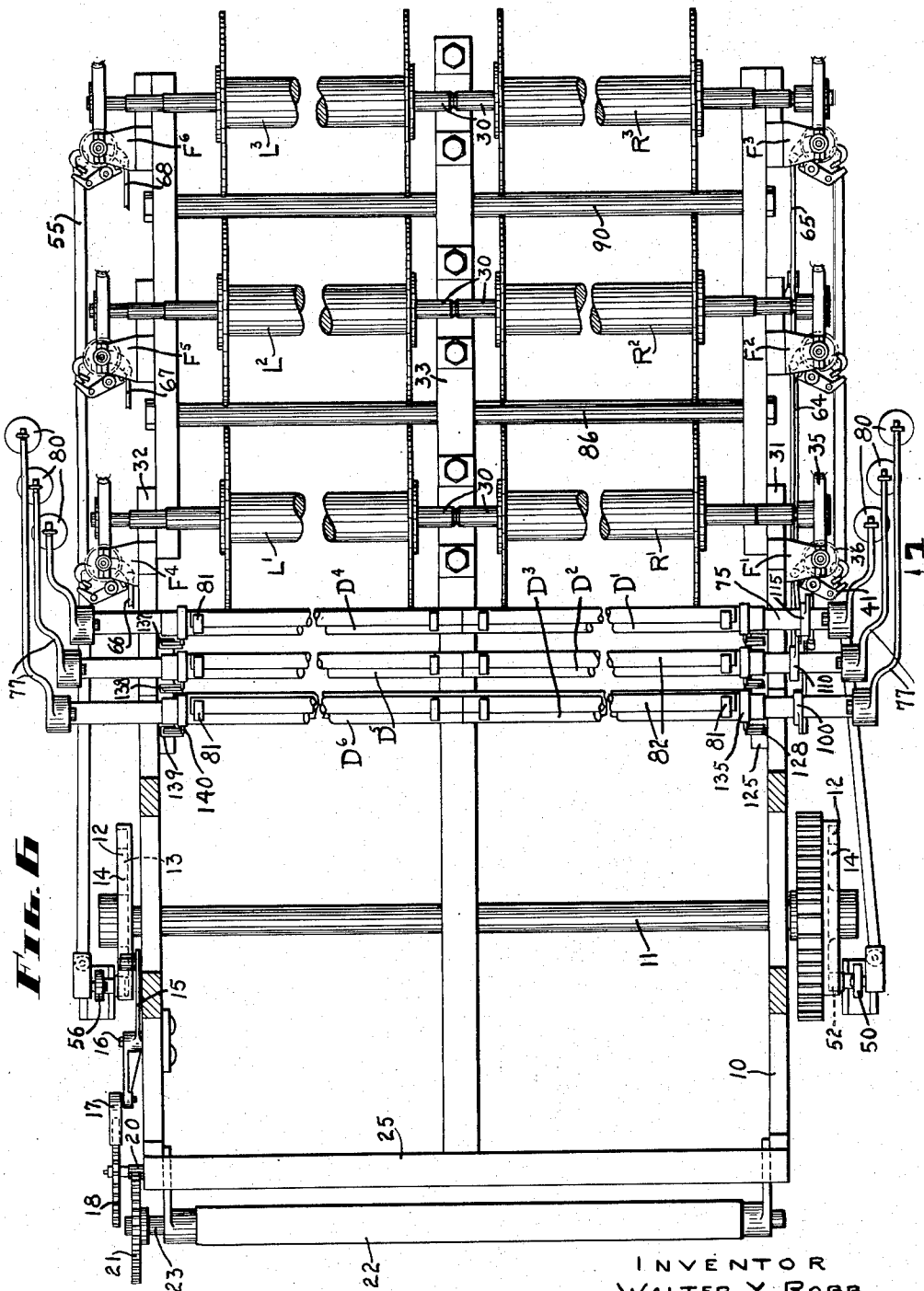
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2,363,996

LETOFF MECHANISM FOR LOOMS

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Application April 12, 1943, Serial No. 482,683

9 Claims. (Cl. 139—352)

This invention relates to let-off mechanisms for looms more particularly of the type used for weaving Axminster fabrics and it is the general object of the invention to provide means for stopping the loom when the warp tension becomes too high.

In wide Axminster looms the ground warp is wound on several beams and is led forwardly through the harnesses to the cloth. When the fabric being woven is heavy and requires a large number of threads the warp is wound on two or more beams all of which turn to feed their respective sheets of warps. When looms of this type are of considerable width such as 20/4, it is difficult to use beams to supply warp for the full width of the fabric and I overcome this difficulty by aligning two or more warp beams to supply a group of sheets of warp threads. Each beam has its own let-off mechanism which operates independently of other similar mechanisms and because of this fact there is a possibility that one of the beams may fail to let off as much warp as the other beam which is aligned with it.

The warp threads of each sheet pass over a whip roll the position of which is determined in part by the warp tension and it is a more important object of my present invention to provide means for stopping the loom if the warp tension in any sheet increases sufficiently to move the corresponding whip roll to an abnormal position.

It is another object of my present invention to provide each of the warp systems with a loom controlling electric switch in position to be operated by the associated whip roll when the latter moves to abnormal position for the purpose of effecting loom stoppage before the warp tension becomes high enough to cause thread breakage or distortion of the fabric.

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

In the accompanying drawings, wherein a convenient embodiment of my invention is set forth,

Fig. 1 is a side elevation of part of an Axminster loom having my invention applied thereto,

Fig. 2 is an enlargement of part of Fig. 1 showing the whip rolls and the let-off mechanism for one beam,

Fig. 3 is a plan view of Fig. 2 looking in the direction of arrow 3,

Fig. 4 is a detailed front elevation in the direction of arrow 4, Fig. 2 showing the electric switch and its operating mechanism on an enlarged scale,

Fig. 5 is a detail vertical section on line 5—5 of Fig. 2,

Fig. 6 is a plan view of the loom looking in the direction of arrow 6, Fig. 1,

Fig. 7 is a detail side elevation looking in the direction of arrow 7, Fig. 6 showing the weights for the whip rolls, and

Fig. 8 is a diagrammatic view of the electric circuit and loom shipper control mechanism used with my invention.

Referring particularly to Figs. 1 and 6, I have shown the lower part of an Axminster loom frame 10 and a shaft 11 appropriately driven by a motor M indicated in Fig. 8 which causes the shaft to have a rotation every third pick or beat of the loom for the weaving of so-called three-shot Axminster. Mounted on each end of shaft 11 is a cam 12 having a groove 13 and a face 14. The cam at the left end of the loom drives a lever 15 pivoted as at 16 to the loom frame and provided with a feed pawl 17 which cooperates with a ratchet wheel 18 mounted on a stud 19 carried by the loom frame. The ratchet wheel is fast with a pinion 20 which meshes with a gear 21 secured to the take-up roll 22 mounted as at 23 for rotation in the front part of the loom. A hold pawl 24 prevents retrograde movement of the ratchet wheel on the idle or non-working stroke of the pawl 17.

As will be understood from Fig. 1 a complete rotation of shaft 11 will cause three rockings of lever 15 in a counterclockwise direction to advance the take-up roll 22 by three successive steps, one step for each beat of the loom. The lay L has a forward motion for each beat and the weft needle N is inserted through the warp shed once for each beat.

The fabric F extends forwardly from its fell and over the cloth board 25 down to and around a guide roll 26 and then up to the take-up roll, from which point it goes to a wind-up cloth roll not shown. The fabric is composed of shots of filling laid by the needle N and warp threads designated generally at W in Fig. 1 which form the sheds for the needle. These warp threads extend through harness mechanism H and then rearwardly to the warp beams.

The loom set forth herein is used more particularly for the weaving of heavy fabrics requiring a large number of warp threads and the latter are derived from warp beams located at the back part of the loom as shown in Fig. 6, and considering the left hand part of the loom as viewed in Fig. 6 as its front, I show three pairs of aligned beams, the right hand beams being designated R1, R2 and R3, respectively, while their corresponding

left hand beams are indicated at L1, L2 and L3. The beams are thus arranged in pairs, each right hand beam aligning with its corresponding left beam.

The beams may be appropriately mounted for rotation on shafts 30 and bearings forming part of the loom frame. The outside bearings for the right and left hand sides are indicated at 31 and 32, respectively, while an intermediate bearing frame 33 accommodates the inner ends of the shafts 30. The beams are preferably all of the same size and will be wound with the same kind of warp and for all practical purposes are identical with each other. Each beam is rotatable independently of all the other beams and the rate of its rotation is independent of the rate of rotation of the remaining beams.

Each beam has its own let-off mechanism which in the present instance is positive and includes means for turning the beam gradually during loom operation so that its warp will be unwound. As shown in Fig. 6 the let-off mechanism which effects feeding of the warp for beams R1, R2 and R3 are designated generally at F1, F2 and F3, respectively, and in similar manner, the let-off mechanisms for the left hand beams L1, L2 and L3 are designated generally at F4, F5 and F6, respectively. Since these let-off mechanisms are substantially the same only one of them will be described.

The shaft of each warp beam has secured there-to a worm wheel 35 which meshes with a worm 36 secured to a vertical shaft 37 the lower end of which turns in and is supported by a bearing 38 fastened to the adjacent part of the loom frame. A second bearing 39 also fastened to the loom frame affords support and bearing for the upper part of the shaft 37, as shown in Figs. 2 and 3.

Secured to each shaft 37 is a ratchet wheel 40 actuated by a pawl 41 pivoted at 42 on an arm 43 having a bearing 44 which is loose on the shaft 37 and free to rock back and forth thereon. A spring 45 carried by the arm 43 tends to turn the pawl into operative position with respect to the ratchet wheel 40 but permits the pawl to be moved to non-driving position relatively to the ratchet.

The pawls of the several let-offs are operated in unison by means of jointed rods, those pawls at the right of the loom have their arms 43 pivotally connected as at 48 to a rod 49 which extends forwardly to an upright lever 50 pivoted as at 51 about a fixed axis. Lever 50 carries a roll 52 located in the groove 13 of the right hand cam 12 which causes forward movement of lever 50, or movement to the left as viewed in Fig. 1, three times for each complete rotation of the shaft 11. It will thus be seen that the pawls for the let-offs F1, F2 and F3 all have feeding strokes in unison and these strokes occur each beat of the loom.

The let-offs F4, F5 and F6 at the left side of the loom are operated by mechanism similar to that already described and including a rod 55 similar to rod 49 extending forwardly to a lever 56 similar to lever 50. The left hand let-offs are therefore also operated in unison and preferably though not necessarily synchronous with the right hand let-offs.

Provision is made for interrupting the feeding of each of the ratchet wheels 40 by its ratchet for one or more beats of the loom to prevent turning of the associated warp beam should the corresponding sheet of warp be too slack. Accord-

ingly, each shaft 37 has loosely mounted thereon a shield 60 for engagement with a roll 61 on the corresponding pawl 41 and the shield has an arm 62 connected to an operating rod, see Fig. 3. Each let-off has its own shield operating rod, the let-offs F1, F2 and F3 having rods 63, 64 and 65, respectively, while the let-offs F4, F5 and F6 have similar rods 66, 67 and 68, respectively. Since the control mechanism for the shields are the same on both sides of the loom I will describe only the mechanism at the right and shown in Fig. 2.

A fixed stud 70 affords support for three levers 71, 72 and 73 which are connected, respectively, to the rods 63, 64 and 65. These levers are the means by which the corresponding shields are moved either to idle or shielding position. Thus, if lever 71 is rocked to the left as viewed in Fig. 2 its rod 63 acting through arm 62 will move the shield 60 of let-off F1 to the position shown in Fig. 3 and permit the associated pawl to feed its ratchet wheel 40. If, on the other hand, lever 71 is moved to the right as viewed in Fig. 2 the rod 63 will be moved rearwardly to cause rocking of the shield 60 in a clockwise direction as viewed in Fig. 3 into engagement with corresponding roll 61 to rock the associated pawl 41 around its axis and thereby move the pawl to inoperative position with respect to the ratchet wheel 40. So long as the shield 60 is in shielding position due to rearward movement of lever 71 the corresponding pawl will have idle strokes and the associated worm 36 will remain at rest. When the shield is in idle or non-shielding position as shown in Fig. 3, however, each operating movement of the pawl will advance the ratchet wheel 40 and give the worm 36 a partial turn for the purpose of rotating the corresponding warp beam through its worm wheel 35. While the detailed operation of the shield and pawl have been given with respect to the front let-off on the right hand side of the loom, yet it is to be understood that each of the let-offs will operate in the same manner, levers 72 and 73 controlling the shields of let-offs F2 and F3, while the let-offs F4, F5 and F6 at the left hand side of the loom have their shields similarly controlled by rods 66, 67 and 68.

Each warp beam has its own whip roll and in the drawings I show three whip rolls D1, D2 and D3 for the beams R1, R2 and R3, and whip rolls D4, D5 and D6 for the beams L1, L2 and L3, respectively. These whip rolls are substantially the same and each includes a relatively heavy shaft 75 rotatable in bearings 76 on the loom frame. The outer end of each shaft 75 has secured thereto a weight lever 77 which supports and is urged downwardly by a variable weight 80, as suggested in Fig. 7.

Each shaft 75 is provided with several small brackets 81 which are shaped as shown in Fig. 2 and have fastened thereto a warp engaging rod 82. The latter are above the axes of their corresponding shafts 75 and can swing backwardly or forwardly, depending upon the tension of the corresponding sheet of warp. As shown in Fig. 1 the warp sheets from the front pair of aligned beams R1 and L1 pass in front of a stationary guide rod 85 and thence upwardly to the rear of the back pair of rods 82 and then forwardly to the harnesses H. In similar manner the warp sheets from the middle beams R2 and L2 extend around guide rods 86, 87 and 88 fixed to the loom frame and then to the middle pair of rods 82, while the sheets of warp from the back pair of beams R3 and L3 pass around guides 90, 91 and 92 to the front whip rods 82. There are thus six

separate sheets extending forwardly from the whip rolls to the harnesses and these sheets can either be led through their corresponding harnesses or drawn through the latter in any desired manner.

In order that the position of each rod 82 may determine the position of the corresponding shield I use the mechanism shown in Figs. 1 and 2. The front right hand shaft 75 has secured thereto a collar 100 which is pivotally connected at 101 to the upper end of a rod 102 having secured thereto an adjustable collar 103. The lower end of rod 102 slides through a swivel 104 pivotally mounted on arm 105 of lever 73. A compression spring 106 extends between the collar 103 and swivel 104 and exerts a downward force on arm 105 tending to move the lever 73 forwardly, or in such direction as to move the rod 65 toward the front of the loom and therefore keep the corresponding shield in idle or non-shielding position. In similar manner the middle right hand rod 75 is provided with the collar 110 connected to a rod 111 surrounded by a spring 112 which exerts a downward force on arm 113 of lever 72, and the rear right hand shaft 75 carries a collar 115 connected to a rod 116 surrounded by a spring 117 which exerts a downward force on arm 118 of lever 71. The forces exerted by the several springs can be adjusted by the collars on the associated rods, and the position of the collars 100, 110 and 115 can be adjusted on the associated shafts 75 by means of set screws 120. Similar mechanism at the left side of the loom is provided for the shafts 75 corresponding to beams L1, L2 and L3.

The stopping mechanism for the loom includes an electric switch and a controller therefor on each whip roll. The right hand side of the loom frame is provided with a small stand 125 on which are mounted three electric switches 126, 127 and 128, corresponding to beams R1, R2 and R3. Each switch has an arm 130 to operate a plunger 131 forming part of the switch. These switches are so placed on the support 125 that their arms can be operated conveniently by their respective whip rolls and each of the latter is provided with a collar 135 angularly adjustable on the associated shaft 75 and having a projecting switch actuating arm 136. Each arm 136 is capable of operating its corresponding arm 130 for operation of the associated switch when the whip rolls rocks toward the left as viewed in Fig. 2 to an abnormal position. Similar switches 137, 138 and 139 are provided for the whip rolls of beams L1, L2 and L3 at the left hand side of the loom to be operated by arms 140 on the associated whip rolls.

In operation, the warp beams will all have adequate supplies of warp wound thereon and then placed in the loom as suggested in Fig. 6. The sheet of warp from each of the beams will be laid around the guides already described and over the appropriate bars 82 and thence forwardly to the weaving instrumentalities. The weights 80 normally act to hold the bars 82 rearwardly so that the arms 136 on the shafts 75 will all be either spaced from their associated switch operating arms 130, or at least will be in such position as not to effect opening of the latter switches. With each beat of the loom the rods 49 and 55 will be moved forwardly to give all of the pawls 41 a working stroke, but under normal conditions the levers 71, 72 and 73 will be turned to the left as viewed in Fig. 2 to place the shields 60 in idle position and the pawls will be active to turn their respective beams. Continued operation of

the loom under these conditions causes backward movement of the rods 82 and rearward movement of the shield controlling rods 63-68. Eventually the shields 60 engage their rolls 61 and the pawls are temporarily disabled and stop feeding of the warp. The rods 82 then move forwardly incident to consumption of warp and the shields start to move toward non-shielding position. This alternate stopping and starting of the turning mechanism for the warp beams go on so long as all parts of the several let-off mechanisms function properly, but if one or another of the feeding mechanisms should fail to operate the corresponding beam will remain at rest and its sheet of warp tightened sufficiently to move the associated whip roll bar 82 forwardly to an abnormal position.

Fig. 8 shows diagrammatically the circuit and loom motor control used with my invention. Wires E and E' represent the power lines, M the loom driving motor appropriately connected to shaft 11, and S the solenoid which when energized maintains the main loom switch 145 closed. The six switch units in Fig. 8 controlled by the whip rolls are designated at r^1 , r^2 and r^3 , and l^1 , l^2 and l^3 , and correspond to the beams R1, R2 and R3, and L1, L2 and L3, respectively.

When the loom operates as described the conditions shown in Fig. 8 will continue, and electric current will flow in the following circuit: wire E, switch 139 of the front left whip roll, wire 150 to the next switch in unit l^2 , and then in succession through the switches 137, 126, 127, 128 of units l^1 , r^1 , r^2 and r^3 , respectively, to solenoid S via wire 151, and thence by wire 152 to power wire E1. This circuit is kept closed so long as all the switches 126 are closed and results in energization of solenoid S to keep switch 145 closed. Current therefore flows from wire E, over wire 155 to closed switch 145, thence by wire 156 to motor M and then back by wire 157 to the opposite side E' of the power source.

If any one of the warp sheets should become too tight and move its whip roll rod 82 to abnormal forward position, the associated arm 136 will depress its switch arm 130 and plunger 131 to open the corresponding switch 126, whereupon the first traced circuit will be opened and solenoid S will be deenergized. The resultant opening of switch 145 will cause stoppage of the motor and the loom will come to rest. The weaver can then advance the ratchet wheel 40 of the tight warp sheet sufficiently to pay off enough warp to permit the associated rod 82 to move rearwardly to its normal range of movement and effect closure of its switch. Normal warp conditions will then have been established and weaving can be resumed, since switch 145 will by this time be closed.

From the foregoing it will be seen that I have provided an electrically operating control for the loom which acts to stop the loom until a warp sheet becomes too tight. It will further be seen that I have provided a loom having a plurality of warp beams each associated with an electric switch and wherein the switches are all connected electrically to means for controlling the loom motor in such a way that if any switch is open the loom will be stopped. Also, I have provided a series circuit including a normally closed switch for each warp beam when its sheet of warp is under normal tension, abnormal tension in any sheet being effected to open the corresponding switch and thereby break the circuit so that the loom will be stopped.

Having thus described my invention it will be

seen that changes and modifications may be made therein by those skilled in the art without departing from the spirit and scope of the invention and I do not wish to be limited to the details herein disclosed, but what I claim is:

1. In a loom having a driving electric motor and a motor switch which when closed causes the motor to run and when open causes the motor to stop, a sheet of warp subject to change from normal to excessive tension, an auxiliary electric switch controlled by said sheet of warp normally closed when warp tension is normal and opened by excessive tension of the warp, and electric circuit means controlling the motor switch and controlled by said auxiliary switch and effective when the auxiliary switch is closed to maintain said motor switch closed and effective when said auxiliary switch is open to effect opening of said motor switch.

2. In a loom having a driving motor and an electric motor switch therefor which when closed causes the motor to operate and when open effects stoppage of the motor, a warp beam supplying a sheet of warp, a whip roll over which the sheet of warp passes, said whip roll being moved from normal to abnormal position by the warp sheet when the tension of the latter becomes excessive, normally closed electric circuit means effective only when closed to keep said motor switch closed, said switch opening when the circuit means is opened, and means operated by the whip roll when the latter moves to abnormal position to open said circuit means to effect opening of the motor switch for the purpose of stopping the motor.

3. In a loom having a driving motor and a master electric switch therefor and an electro-magnetic controller which when energized maintains said master switch closed to cause running of the motor but when deenergized effects opening of the master switch to stop the motor, a warp beam having a sheet of warp, a whip roll over which the sheet of warp passes, means tending to maintain the whip roll in normal operating position, the sheet of warp when under excessive tension moving the whip roll to abnormal position against the action of said means, a normally closed auxiliary electric switch, an electric circuit including said auxiliary switch and said electro-magnetic controller and normally effective to maintain the latter energized to hold the master switch closed, and means moving with the whip roll when the latter moves to abnormal position to open the auxiliary switch and effect deenergization of said controller for the purpose of causing opening of the master switch to stop the loom.

4. In a loom having a warp beam supplying a sheet of warp and having a driving motor, a master switch for the motor, a solenoid for said switch operative when energized to maintain said switch closed to effect running of the motor, means to move the switch to open position when the solenoid is deenergized, a whip roll for the sheet of warp moving from normal to abnormal position when the sheet of warp is under excessive tension, and an auxiliary switch normally closed when the whip roll is in normal position, an electric circuit including said solenoid and auxiliary switch to maintain said solenoid energized to keep the master switch closed when the auxiliary switch is closed, and means moved by the whip roll when the latter moves to abnormal position to open the auxiliary switch and thereby

break said circuit to effect deenergization of the solenoid and cause opening of the master switch to stop the motor.

5. In a loom having a plurality of warp beams each supplying a sheet of warp, the loom having an electric driving motor and a motor switch operated by an electro-magnetic controller effecting opening and closing of the motor switch, a normally closed auxiliary electric switch for each warp beam, an electric circuit including said auxiliary switches and controller in series and normally closed and causing the controller to maintain the motor switch closed to effect running of the motor, said controller effecting opening of the motor switch when said circuit is broken, a whip roll for each warp beam movable from normal to abnormal position, and means on each whip roll operative when the latter moves to abnormal position to open the associated auxiliary switch and break said circuit.

6. In a loom having a driving electric motor and a master electric switch which when closed causes the motor to run and when open causes the motor to stop, a plurality of warp beams each having a sheet of warp leading to the fabric being woven, each sheet of warp subject to change from normal to excessive tension, a normally closed auxiliary switch for each sheet of warp, an electro-magnetic controller for the master switch, a series electric circuit including the controller and all the auxiliary switches and effective only when closed to cause said controller to keep the master switch closed, and means operative when the tension of any sheet of warp becomes excessive to open the corresponding auxiliary switch and thereby break said series circuit.

7. In a loom having a plurality of warp beams and a driving motor, a master switch for the motor, an electro-magnetic controller for the master switch, a whip roll for each warp beam movable from normal to abnormal position, an auxiliary switch for each whip roll, an operator on each whip roll for the corresponding auxiliary switch, and means constituting an electric circuit including said auxiliary switches and electro-magnetic controller normally effective to cause said controller to keep the master switch closed when all the whip rolls are in normal position, operation of any auxiliary switch by the operator of the corresponding whip roll effecting a change in said electric circuit means and altering the condition of the electro-magnetic controller for the purpose of opening said master switch.

8. In a loom having a driving electric motor and a motor switch which when closed causes the motor to run and when open causes the motor to stop, a warp beam from which extends a sheet of warp subject to change from normal to excessive tension, an auxiliary electric switch for said sheet of warp capable of being either in open or closed position, an electromagnetic controller for the motor switch, and means constituting an electric circuit including said auxiliary switch and said electromagnetic controller normally effective when said auxiliary switch is in one of the positions thereof to cause the electromagnetic controller to keep the motor switch closed when the sheet of warp is under normal tension, occurrence of excessive tension in said sheet of warp causing the auxiliary switch to move to the other position thereof and effecting a change in said electric circuit means and altering the condition of the electromagnetic con-

troller for the purpose of effecting opening said motor switch.

9. In a loom having a driving motor and a motor switch which when closed causes the motor to run and when open causes the motor to stop, a sheet of warp subject to change from normal to excessive tension, an electromagnetic controller for the motor switch, an auxiliary switch controlled by the sheet of warp, and means constituting an electric circuit including said electromagnetic controller and said auxiliary switch

normally effective to cause said electromagnetic controller to keep the motor switch closed when the tension of the sheet of warp is under normal tension, operation of the auxiliary switch incident to a change in the warp sheet from normal to excessive tension effecting a change in said circuit means and altering the condition of the electromagnetic controller for the purpose of effecting opening said motor switch.

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