July 5, 1949. C. R. KRONOFF ET AL 2,475,505

ELECTRIC PROTECTOR MECHANISM FOR LOOMS

Filed March 19, 1947 2 Sheets-Sheet 1

FIG.5

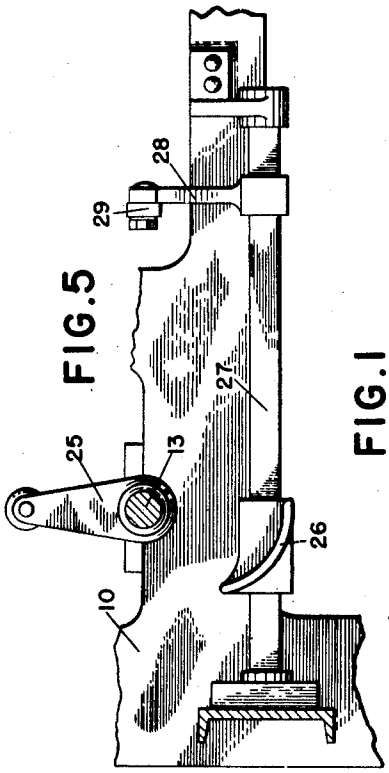
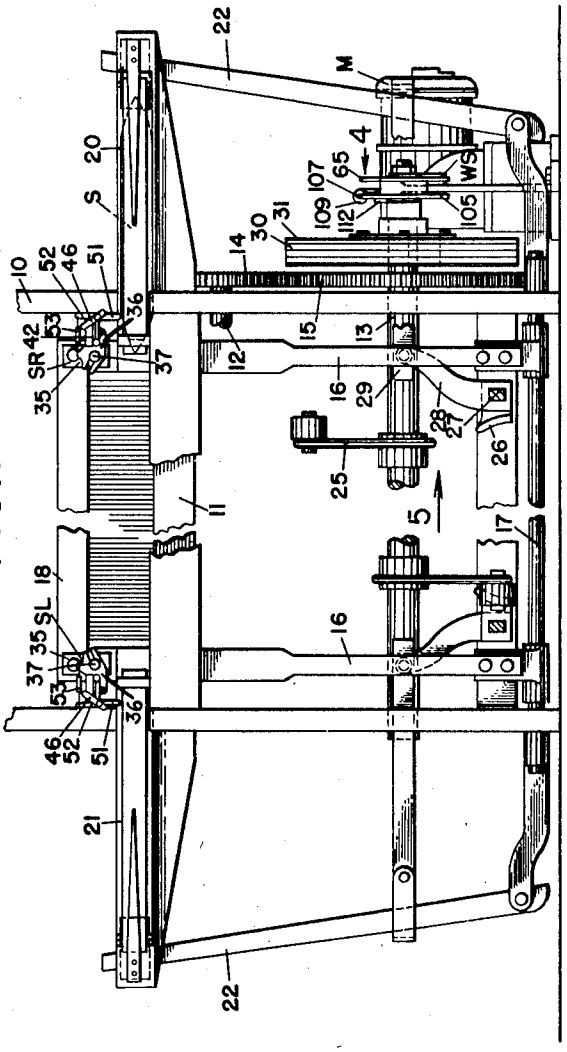


FIG.1



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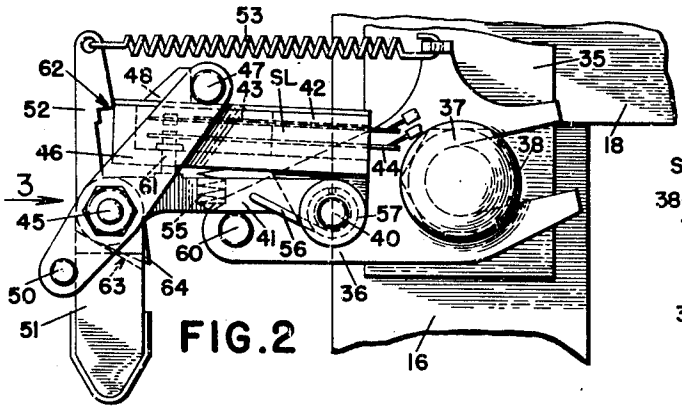


FIG.2

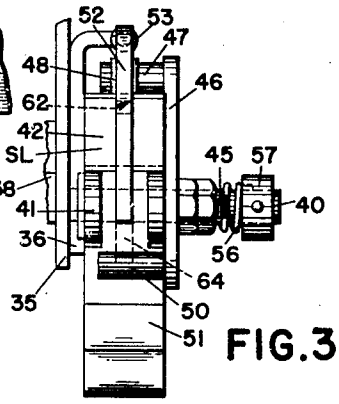


FIG.3

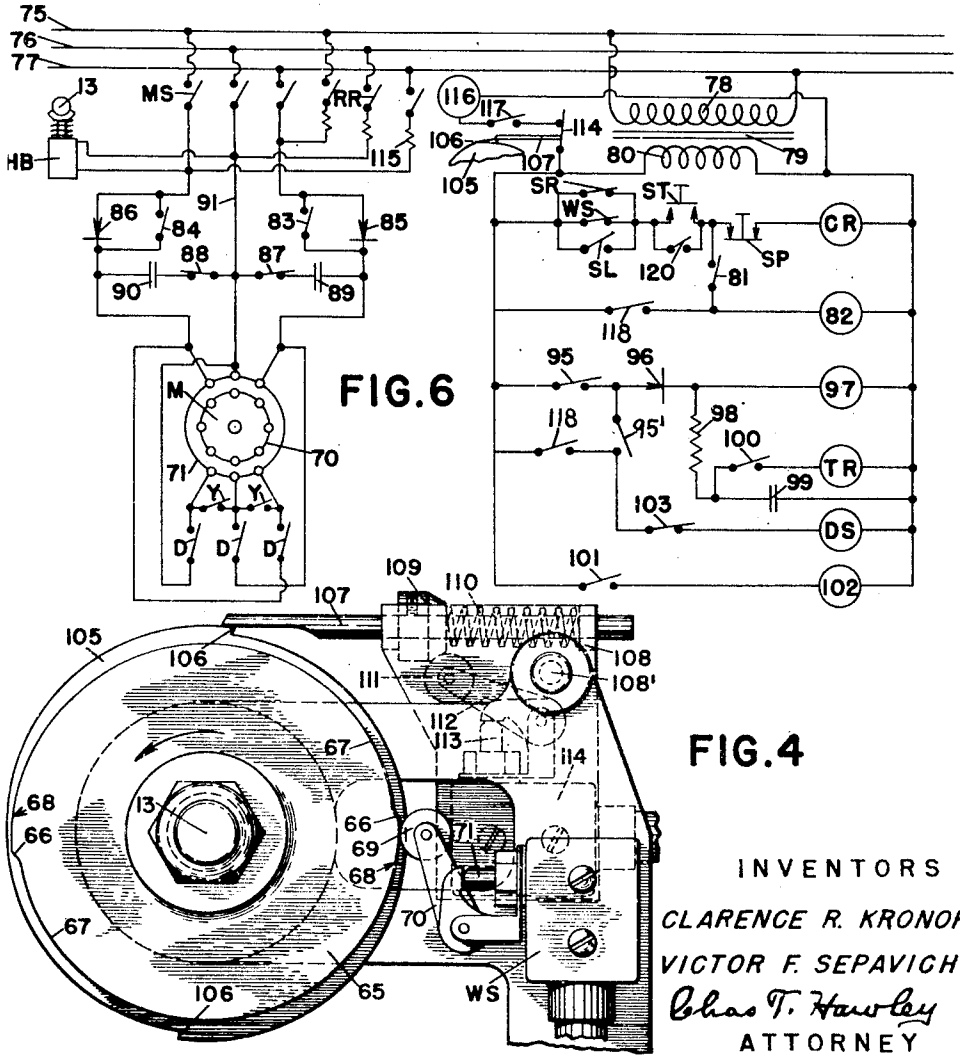


FIG.6

FIG.4

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ELECTRIC PROTECTOR MECHANISM FOR LOOMS

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11 Claims. (Cl. 139—341)

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This invention relates to improvements in electric protecting means for looms and it is the general object of the invention to control the loom motor by two switch means one of which is closed and opened by the shuttle and the other of which is closed independently of the shuttle during regularly recurring intervals.

In the operation of a loom it occasionally happens that the picking mechanism will operate with reduced power, or may break, in which event the shuttle fails to box in proper time. This condition requires immediate stopping of the loom to prevent a warp smash. Various devices have been proposed heretofore to accomplish this general result, but many of them apply a stopping force while the motor is still running and connected to the loom, with the result that the stopping mechanism must not only overcome the momentum of the lay but also the driving power of the motor. It is an important object of our present invention to provide electric controls which stop the motor promptly in the event the shuttle fails to box on time.

The lay of a loom ordinarily reciprocates backwardly and forwardly and at the beginning of a normal flight interval the shuttle is picked at so-called top center when the lay is moving rearwardly and is boxed at the end of the interval when the lay is at or slightly forward of its bottom center position and is moving forwardly. If the shuttle fails to box properly at the end of the flight interval it is necessary to effect immediate stoppage of the lay. It is an important object of the present invention to relate the aforesaid two switch means in such manner that one of them will maintain the motor circuit closed during the normal flight interval and then act to open the motor circuit. If the shuttle is on time it will be able to close the other switch means before the end of the flight interval and thus keep the motor circuit closed. If, however, the shuttle is tardy it will not close its switch means until after the flight interval and the resultant interruption in continuity of the motor control circuit will cause motor and loom stoppage.

Under certain conditions it is desirable to reverse the loom under power in order to remove the shuttle from the warp shed, particularly if the lay is heavy. It is another object of the invention to provide reversing means for the motor controlled in such manner as to limit the amount of reverse motion which is possible. This second feature of the invention may be utilized to stop reverse motion of the loom when the sheds are wide open to permit easy removal of the trapped

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shuttle. It is also desirable to stop reverse motion before the picking arm can move backwardly far enough to damage the picking cam.

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

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

Fig. 1 is a front elevation of a loom equipped with the invention.

Fig. 2 is an enlarged front elevation of one of the shuttle controlled switches showing the latter in the open position to which it is moved when the shuttle is moved out of the adjacent shuttle box,

Fig. 3 is an end view looking in the direction of arrow 3, Fig. 2,

Fig. 4 is an enlarged side elevation looking in the direction of arrow 4, Fig. 1,

Fig. 5 is a detailed side elevation of one of the picking mechanisms looking in the direction of arrow 5, Fig. 1,

Fig. 6 is a diagrammatic view of electric circuits of a type which can be employed with the invention to effect sudden stoppage of the motor in the event the loom protects.

Referring particularly to Fig. 1, the loom frame 10 is provided with a lay 11 which is rocked backwardly and forwardly in known manner. Top and bottom shafts 12 and 13 are connected by gears 14 and 15 of such size as to cause the bottom shaft to rotate once every other pick of the loom. The top shaft completes a rotation every pick of the loom and supplies the power by which the lay is reciprocated. The lay is mounted on lay swords 16 carried by a rocker shaft 17, and a hand rail 18 connects the tops of the lay swords.

The lay is provided with shuttle boxes 20 and 21 located respectively at the right and left ends of the lay. Picker sticks 22 operate in alternation to propel the shuttle S back and forth across the lay from one box to the other. One of the picking mechanisms is shown in Fig. 5 and includes an arm 25 on bottom shaft 13 for operation of a cam 26 on a picking shaft 27 extending backwardly and forwardly in the loom. During normal running of the loom picking arm 25 first engages the low side of cam 26 and then progresses therealong to the high side, thereby depressing the cam and rocking shaft 27 in a counter-clockwise direction as viewed in Fig. 1. The picker shaft has a picking arm 28 connected to a sweep stick 29 to give the picker stick a picking stroke when shaft 27 rocks. After arm 25 passes the

cam 26 the latter returns to its normal position with the high side thereof near the arm.

If shuttle S is to be picked to the left as viewed in Fig. 1 the picker mechanism already described will move the picker stick to the left when the lay reaches top center, or approximately its mid-position when moving rearwardly. The picked shuttle then travels across the lay toward box 21 as the lay continues to move backwardly and also during a part of the ensuing forward movement of the lay. Ordinarily the shuttle will complete its travel in the normal flight period or interval and will enter box 21 on time. If for any reason the shuttle should fail to reach box 21 on time part of it at least will be in the warp shed and cause a warp smash unless forward motion of the lay is stopped.

The loom is operated by a motor M which may be connected to the bottom shaft 13 by means of belts 30 wrapped around a pulley 31 secured to shaft 13. We do not contemplate use of the customary clutch and shipper mechanism, but rely upon a permanent connection between the motor and the loom for operation of the latter whenever the motor is running. If the motor is stopped abruptly it will act through the belts 30 and gears 15 and 14 to stop the lay.

Of the two previously mentioned control switch means one is operated by the shuttle and the other by the loom. The shuttle control switch means includes two switches designated generally at SR and SL in Fig. 1 for the right and left hand sides of the loom. Each switch is adjacent its corresponding shuttle box and has a part which is moved by the shuttle as the latter enters and leaves the shuttle box. Both of these switches are the same except that they are of opposite hands, and a description will be given of but one of them, namely, the switch SL adjacent to box 21.

The left end of handrail 18, see Fig. 2, has secured thereto a plate 35 to which a support 36 is secured in adjustable angular position by stud 37 which has a lock nut 38 to hold its adjustment. A stud 40 extends forwardly from support 36 and has pivotally mounted thereon a carrier arm 41 and a switch casing 42. The latter has upper and lower spring contacts 43 and 44 which in effect constitute a switch which is closed when contacts 43 and 44 engage each other.

Arm 41 is provided with a stud 45 on which is pivoted an operating lever 46 having at its upper end a finger 47 extending over the casing 42 and to the right of an abutment or stop 48 on the casing. The lower end of lever 46 is provided with a second finger or pin 50 which extends along the left side of a shuttle engaging operating arm 51 pivoted on stud 45. A lock arm 52 also pivoted on stud 45 extends upwardly and is normally drawn to the right as viewed in Fig. 2 by a tension spring 53 extending between the support 36 and the upper end of lock arm 52.

A compression spring 55 between carrier arm 41 and switch casing 42 tends normally to separate these parts, and a torsion spring 56 around stud 40 has one end in engagement with arm 41 and the other end held by an adjustable collar 57 on stud 40. Spring 56 normally tends to hold arm 41 down against a stop 60 on the left end of stationary support 36.

In Fig. 2 the parts are shown in the position they assume when the shuttle is in flight toward box 21, casing 42 being up due to action of spring 55 and the spring contacts 43 and 44 being out of engagement with each other to maintain switch

SL open. The resilience of contact 44 keeps a small plunger 61 in down position against arm 41 as shown in Fig. 2.

As the shuttle enters the box its upper advancing end will engage arm 51 and move the latter to the left, thereby moving pin 50 in such a direction as to turn lever 46 clockwise and lower stud 47 the effect of which is to swing casing 42 downwardly around stud 40. Plunger 61 is prevented from moving downwardly by its engagement with arm 41 and the contacts 43 and 44 consequently engage each other to close switch SL.

Lock arm 52 is provided with a detent 62 which is moved over the left end of casing 42 by spring 53 when the casing is depressed by stud 47. The casing is therefore locked in down position and switch SL remains closed so long as the shuttle is in box 21.

When the shuttle is picked out of box 21 it engages and moves arm 51 to the right as viewed in Fig. 2, thereby causing a lifting surface 63 thereon to engage the lower end 64 of lock arm 52 and rock the latter in a counter-clockwise direction as viewed in Fig. 2 to move detent 62 to the left away from holding position relatively to casing 42. The latter thereupon rises under action of spring 55 and the contacts 43 and 44 separate to open switch SL.

Switch SR at the right side of the loom is similar to switch SL except that it is reversed and is closed by right hand movement of the shuttle into box 20 and is opened by left hand movement of the shuttle out of box 20.

From the matter thus far described it will be understood that whenever the shuttle enters one or the other of the boxes 20 or 21 the adjacent switch will be closed, but when the shuttle is picked out of the box the switch will be opened. It is apparent that while the shuttle is in flight both switches SR and SL will be open and closure of one or the other of them will depend upon arrival of the shuttle at the corresponding shuttle box, or at least upon arrival at given points along the lay near the shuttle boxes.

The second of the aforesaid motor controlling switch means is shown in Fig. 4 and operates in time with the loom independently of the shuttle. This control includes a disk cam 65 secured to the bottom shaft 13 and completing a rotation in the direction of the arrow every second pick of the loom. One half of the disk therefore corresponds to one pick of the loom. The disk has two inclines 66 each rising from a low dwell 67 to a higher area 68 which gradually declines to a dwell. Engaging this disk is a roll 69 rotatable on an arm 70 pivoted on a switch WS. The latter is closed by a plunger 71 whenever roll 69 engages a dwell 67, but is open when an incline 66 engages the roll and moves it away from shaft 13. As the cam continues to turn the roll 69 returns gradually to the other dwell 67.

Switch WS is thus seen to be controlled by the loom and will be closed during the aforesaid normal flight interval, or from a time shortly prior to picking of the shuttle out of either box until the time has arrived in the loom cycle when the shuttle should be boxed at the opposite side, or at least have reached a given point along the lay near the box. Switch WS is then opened, but if the shuttle is on time switch SR or SL will be closed before switch WS opens. If, on the other hand, the shuttle is tardy, switch WS will open before one or the other of the switches SR—SL closes, and there will be a period during which all three of these switches are open. This is the

condition which as described hereinafter will bring about sudden stoppage of motor M. When the shuttle is running properly there will be no time during which all three switches are open, and motor M will continue to run, control of it being taken over by a shuttle switch before switch WS relinquishes its control. It will be understood that each complete rotation of disk 65 provides the aforesaid controls of switch WS for two successive picks of the loom.

The condition under which all three of the switches SR, SL and WS are open simultaneously can be utilized to control any one of several circuit means for stopping the motor M. The circuits shown in Fig. 6 are illustrative of electric means which can accomplish this result, but we do not wish to be limited to such circuits, nor do we claim the details of this circuit means. The right hand part of Fig. 6 shows the manual or low voltage controls for the motor, while the left hand part illustrates the power connections which are controlled by the right hand circuits.

The motor M may be of the three phase alternating current type having a squirrel cage rotor 70 and a stator 71 the leads of which are brought out as indicated at the lower left hand part of Fig. 6 to permit the motor to be started first with a delta connection of its stator windings to give high starting torque, and then change to Y connections for continued running. The delta switches are designated at D and the Y connections by switches Y. This mode of converting from delta to Y operation is desired when the motor is connected directly to the loom without the use of a clutch, as herein contemplated.

The three alternating current power lines 75, 76 and 77 may be relatively high voltage such as is customary in the operation of textile motors, and two of these wires excite the primary 78 of a transformer 79 the secondary 80 of which supplies reduced voltage, such as 110 volts, for the control circuits. The loom is provided with a start switch ST and a stop switch SP, and the previously described switches SR and SL and WS are connected in parallel.

When the loom is at rest and it is desired to start weaving, the shuttle will be in one or the other of the boxes 20 or 21, and the lay will in all likelihood be in such position that switch WS will be closed. In Fig. 6 it is assumed that switches WS and SR are closed and switch SL open with the shuttle at the right side of the loom. Stop switch SP will be closed under these conditions so that depression of the start switch ST will cause current to flow from the secondary 80 through a control relay CR. When this relay is energized it effects closure of switch 81 the result of which is to energize a relay 82 which closes the switches 83 and 84 to shortcircuit half wave rectifiers 85 and 86, respectively, and simultaneously open switches 87 and 88 to disconnect the negative side of condensers 89 and 90 from wire 91 leading from the master motor switch MS to stator 71.

As soon as control relay CR is energized it also closes switches 95 and 95' which connect one side of secondary 80 with a control relay DS for closure of the D switches corresponding to the delta connection of the motor. Closure of switch 95 also connects secondary 80 to a single wave rectifier 96 connected directly to the master switch relay 97 to close the motor master switch MS. The motor therefore starts with a delta connection and with the rectifiers 85 and 86 short-

circuited by switches 83 and 84, respectively, and with switches 87 and 88 open.

Connected also to the rectifier 96 is a resistance 98 leading to parallel circuits one of which includes a condenser 99 and the other of which includes a switch 100 closed by relay 97 and a transfer relay TR which has a relatively high resistance. Condenser 99 is normally discharged and requires an appreciable time to become fully charged during which it prevents operation of relay TR. When condenser 99 is fully charged, however, it no longer drains the current which flows through the resistance 98 and relay TR will close switch 101 to operate relay 102 to close switches Y and open switch 103 to release relay DS to open switches D.

As previously mentioned, it is essential that the lay be stopped suddenly if the shuttle should fail to box properly, and this result is accomplished by causing direct current to flow through the stator of the motor when protection is to be effected. The direct current is supplied by the rectifiers 85 and 86 and the condenser 89 and 90 smooth out the pulsations of unidirectional current from the rectifiers to give a continuous strong non-rotary magnetic field in the motor.

In order to enable the rectifiers 85 and 86 to operate it is necessary to open switches 83 and 84 and close switches 87 and 88. This is accomplished either by pushing the stop button SP, or by having all three switches SR, WS and SL open at the same time to break the circuit on the control relay CR. Whenever this latter condition arises relay CR is deenergized and switches 81 and 95 open. Opening of switch 81 acts by release of relay 82 to open switches 83 and 84 and close switches 87 and 88, thereby enabling the rectifiers 85 and 86 to deliver unidirectional current to the motor. This direct current flows for a short time only and brings the motor to a sudden stop in about the same time that opening of switch 95 and its release of relay 97 causes opening of the master switch MS. The motor is therefore stopped promptly and disconnected from the power lines 75—77. By reason of the direct connection between the motor and the lay the latter is stopped abruptly to prevent the lay from moving the shuttle forwardly to cause a warp smash.

In the lighter types of loom it may be desirable to provide the loom with a light holding brake HB which can be overpowered by the weaver when turning the usual hand wheel in reverse direction. This brake is off when switch MS is closed, but is on when that switch opens. When the invention is applied to heavier looms, such as those used in the manufacture of carpets, it is desirable to be able to reverse the loom under power, but it will be understood that the amount of reversal should be limited to prevent picking arm 25 when moving reversely from striking the high side of cam 26. It will also be apparent that it will be sufficient so far as withdrawal of the shuttle from the shed is concerned if reverse motion is stopped automatically when the warp sheds are wide open.

This second feature of our invention is illustrated in Figs. 4 and 6. A second disk 105 is mounted on bottom shaft 13 and has two notches 106 for cooperation with a plunger 107 slidably mounted in a stand 108 on pivot 108' supported from the floor. Secured to the plunger is a conical collar 109 held to the left as viewed in Fig. 4 by a compression spring 110. The collar 109 is normally in the position shown in Fig. 4 and per-

mits roll 111 on arm 112 and spring plunger 113 to be in high position to keep switch 114 in the closed position.

When the loom is running normally notches 106 slip under plunger 107 and the latter remains in normal position to permit continued closure of switch 114. If, however, the motor is reversed, as will be described hereinafter, disk 105 turns in the direction opposite to that indicated by the arrow in Fig. 4 and one or the other of the notches 106 moves plunger 107 to the right, thereby causing conical collar 109 to depress arm 112 and act through plunger 113 to open switch 114.

Referring to Fig. 6, the leads from master switch MS are connected in reverse order and through resistances 115 to a reverse switch RR. A control reverse relay 116 for switch RR is connected to the secondary 80 by a circuit which includes switch 114 and a normally open manually closable switch 117.

After the loom has been stopped as already described, and assuming that the invention is applied to the type of loom on which power reversal is desirable, switch 117 will be depressed and relay 116 will be energized to close switches RR and 118, thereby effecting reverse motion of the motor to swing the lay backwardly from the fell of the cloth to permit extraction of the trapped shuttle. If switch 117 should by oversight be depressed too long one of the notches 106 will eventually push plunger 107 to open switch 114 the result of which deenergizes reverse relay 116. The reverse switch RR thereupon opens to prevent further backward movement of the motor, and switches 118 release relays DS and 82.

Start button ST is bridged by a switch 120. When relay CR is energized by closure of the start switch it closes switch 120 and the latter remains closed so long as the relay is energized. If the relay is deenergized by opening of the stop switch, or simultaneous opening of switches SL, SR and WS, switch 120 will open. It is for this reason that relay CR will not be reenergized upon closure of loom operated switch WS when the weaver turns the loom back to take the trapped shuttle out of the warp shed. Switch 120 has no control over the reversing circuit and the fact that it is open will not interfere with reversal of the loom under power.

If the lug strap of either picker stick should loosen and fall, thus increasing the leverage on the stick, the shuttle will be picked with a force stronger than usual and is likely to rebound after being boxed. In that event the adjacent shuttle switch SL or SR will be opened during the normal period of opening of the loom switch WS, and the loom will be stopped.

From the foregoing it will be seen that we have provided electric protecting means for looms operated in such manner as to exercise two separate controls over the motor controlling circuits. One of these controls is derived from switches SR and SL and is under control of the shuttle, while the other control is derived from disk 65 and is under control of the loom. When the periods of closure of these controls overlap, a condition existing when the shuttle is operating properly, there is no interruption in the control circuits for the motor and the latter continues to run to operate the loom pick after pick. If, on the other hand, the shuttle should be tardy, switch WS is open before closure of switch SR or SL, and the motor control circuits are interrupted to effect instant loom and motor stoppage. The switches at the shuttle boxes are made

in such manner that they are closed upon entry of the shuttle into the box and opened when the shuttle is picked out of the box, and these two switches will normally be open while the shuttle is in flight. Furthermore, we provide for reversal of the motor under such control as will allow a limited amount only of reversal. Disk 105 can be so set with respect to the loom that when either notch 106 pushes plunger 107 switch 114 will open with the lay on approximate back center, or with the sheds wide open. This control also occurs before the picking mechanism by reversal can cause damage by engagement of arm 25 with the high side of cam 26.

Having thus described our 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 we do not wish to be limited to the details herein disclosed, but what we claim is:

1. In electric protecting means for a loom operating with a shuttle, an electric motor driving the loom, a switch closed during a shuttle flight interval but open at the end of the interval, a second switch closed by the shuttle prior to the end of said interval if the shuttle is on time and remaining closed independently of the shuttle but open simultaneously with the first switch if the shuttle is late, and electric circuit means controlled by said switches effective to cause continued running of the motor so long as one or the other of said switches is closed but effective to cause motor stoppage if said switches are both open simultaneously.

2. In electric protecting means for a loom operating with a shuttle, an electric motor driving the loom, a switch closed each pick of the loom for an interval ending with the end of the normal time required for flight of the shuttle but open after said interval, a second switch closed prior to the end of said interval if the shuttle is on time and remaining closed independently of the shuttle but open simultaneously with the first switch if the shuttle is late, and electric control circuit means for the motor controlled by said switches effective to cause continued running of the motor so long as one of said switches is closed before the other switch opens but effective to stop the motor if both switches are open simultaneously.

3. In electric protecting means for a loom operating with a shuttle, an electric motor driving the loom, a switch closed each pick of the loom for an interval ending with the end of the normal time required for flight of the shuttle but open after said interval, a second switch closed prior to the end of said interval if the shuttle is on time and remaining closed independently of the shuttle but open simultaneously with the first switch if the shuttle is late, and electric control circuit means for the motor including said switches effective to cause continued running of the motor if the second switch is closed prior to the end of said interval but effective to stop the motor if said second switch is open at the end of said interval.

4. In electric protecting means for a loom having a shuttle moving along a lay, a motor running to operate the loom, electric circuit means controlling the motor effective when remaining closed to cause running of the motor but effective if opened to stop the motor, a part independent of the shuttle moved regularly by the loom during loom operation, a switch for said circuit means closed by said part for a given

interval only of the loom cycle, and a second switch remaining open after said interval if the shuttle fails to reach a given point along the lay before the end of said interval, but being closed by the shuttle if the latter reaches said point before the end of said interval and remaining closed independently of the shuttle, each switch when closed closing said circuit means, and said switches when open simultaneously opening said circuit means.

5. In electric protecting means for a loom having a shuttle in flight along a lay toward a shuttle box, a motor running to operate the loom, normally closed electric control circuit means which when remaining closed causes continued operation of the motor but effective if opened to stop the motor, a switch closed during a given portion only of the loom cycle to close said circuit means, a second switch mounted on the lay independently of but adjacent to said shuttle box open at the beginning of the flight of the shuttle but closed by the shuttle when the latter reaches a given point in the travel thereof along the lay toward the shuttle box, said second switch if closed prior to the end of said portion of the loom cycle maintaining the circuit means closed to effect continued running of the motor, said second switch if remaining open after the end of said portion of the loom cycle opening said circuit means to stop the motor.

6. In electric protecting means for a loom operating with a shuttle, an electric motor driving the loom, two switch means, electric circuit means including said switch means causing continued running of the motor so long as one or the other of said switch means is closed but causing stopping of the motor if both switch means are open simultaneously, and means operated by the loom causing one of said switch means to be closed during a given flight interval in the loom cycle and to be open at the end of said interval, the second switch means being normally open during shuttle flight but being closed by the shuttle prior to the end of said interval if the shuttle is on time and remaining closed independently of the shuttle, said second switch means being open simultaneously with the first switch means if the shuttle is late and fails to close the second switch means prior to the end of said interval.

7. In electric protecting mechanism for a loom having a shuttle box and a shuttle in flight during part of one pick of the loom cycle and in said box during the remainder of said pick and then picked out of the box on the next pick of the loom, an electric motor driving the loom, an electric switch closed at regularly recurring intervals during loom operation when the shuttle is in flight, a switch adjacent to but independent of said shuttle box open when the shuttle is in flight and closed when the shuttle is in said box, and electric control circuit means for the motor including said switches effective when remaining closed to cause continued running of the motor but effective if interrupted to stop the motor, the shuttle when running normally closing the second named switch before the first named switch opens at the end of the interval of said one pick and opening the second switch after the beginning of the interval of the next pick to effect continued closure of said control circuit means, the second switch unless closed from a time prior to the end of the first interval until after the beginning of the second interval causing an interruption of said circuit means to effect stoppage of the motor.

8. In electric protection means for a loom having a lay and operating with a shuttle having alternating periods of flight and rest in a shuttle box, an electric motor driving the loom, electric control circuit means for the motor which when remaining closed effects continued running of the motor but if interrupted causes stoppage of the motor, and two switch means controlling said circuit means, the first of said switch means being loom operated and closed periodically during intervals corresponding to flight of the shuttle and the other switch means being mounted on the lay independently of the shuttle box and closed by the shuttle and remaining closed during periods of rest of the shuttle, the shuttle when running normally closing the second switch means before opening of the first switch means on any given pick of the loom and the first switch closing prior to opening of the second switch means incident to picking of the shuttle on the next pick of the loom to effect continued closure of said circuit means, said first and second switch means when opened simultaneously effecting interruption of said circuit means.

9. In electric protection means for a loom having a lay with the shuttle box at each end thereof and a shuttle picked back and forth from one shuttle box to the other shuttle box and having periods of flight alternating with periods of rest in one or the other of said shuttle boxes, an electric motor driving the loom, electric control circuit means for the motor which when remaining closed effects continued running of the motor to drive the loom but which when interrupted causes stoppage of the motor and the loom, a loom controlled switch closed during an interval of each pick of the loom corresponding to normal flight of the shuttle and open during normal periods of rest of the shuttle, and a shuttle switch mounted on the lay independently of the shuttle box and adjacent each shuttle box, each shuttle switch being open during flight of the shuttle and the shuttle switch adjacent to the shuttle box toward which the shuttle is moving being closed prior to the end of said interval if the shuttle is on time but remaining open after the end of said interval if the shuttle is late, said loom and shuttle switches when having overlapping periods of closure effecting continued closure of said circuit means but effective when open simultaneously to interrupt said circuit means, each interval ending after closure of a shuttle switch by the shuttle if the latter is on time and starting prior to the next flight of the shuttle.

10. In electric protecting mechanism for a loom having a lay provided with a shuttle box and a shuttle, the shuttle having an interval of flight during each pick and then entering the box, a loom controlled switch closing during an interval corresponding to flight of the shuttle and opening at the end of the interval, a shuttle operated switch mounted on the lay independently of the shuttle box and closed by the shuttle as the latter enters the shuttle box but opened by the shuttle if the latter rebounds from the shuttle box, said loom operated switch and said shuttle operated switches having overlapping periods of closure when the shuttle is running normally and enters the shuttle box on time but being simultaneously open if the shuttle is running abnormally and is late, an electric motor driving the loom, and electric control circuit means for the motor remaining closed to effect continued running of the motor when the periods of closure of the loom operated switch and the shuttle op-

erated switches overlap but effective to stop the motor if said loom controlled and shuttle controlled switches are opened simultaneously due either to late closure of the shuttle controlled switch or opening of the latter by rebounding of the shuttle while the loom controlled switch is open.

11. In electric protecting mechanism for a loom having a shuttle box toward which a shuttle is moving, an electric motor driving the loom, an electric control circuit for the motor which when remaining closed effects continued running of the motor but which when opened effects motor stoppage, a loom controlled switch closed to close the circuit during a given interval of the loom cycle and then open for the remainder of the cycle, a shuttle controlled switch mounted independently of the shuttle box closed to close the circuit means by the shuttle when the latter enters the shuttle box and opened by the shuttle when the latter leaves the shuttle box, the shuttle when entering the shuttle box on time closing the shuttle operated switch before opening of the loom operated switch to effect continued closure of said circuit means, and the loom operated switch then closing before the shuttle leaves the shuttle box to effect further continued closure of said circuit means, said shuttle operated switch if being open at any time during which the loom operated switch is open effecting opening of said circuit to stop the motor.

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