J. F. DUSTIN.

ELECTROMECHANICAL WARP STOP MOTION FOR LOOMS.

APPLICATION FILED APR. 22, 1910.

974,557.

Patented Nov. 1, 1910.

3 SHEETS—SHEET 1.

Fig. 1.

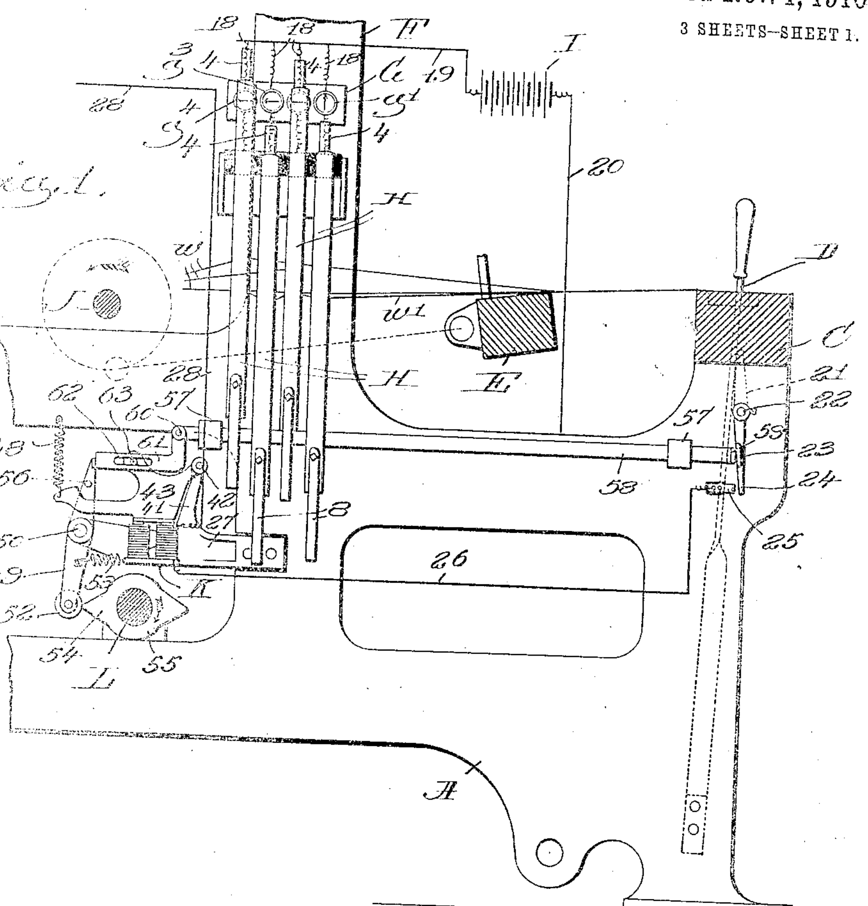


Fig. 2.

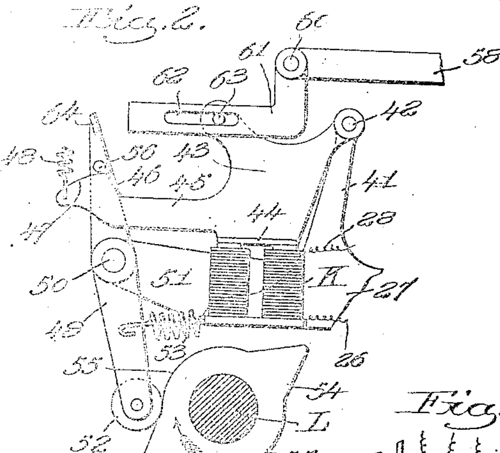


Fig. 2a.

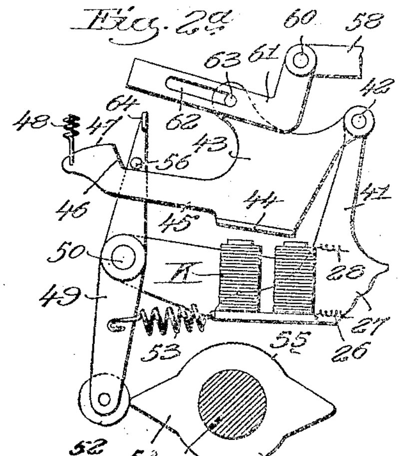
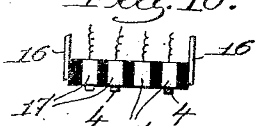


Fig. 10.



Witnesses:

Fred S. Grunleaf.

Joseph M. Ward.

Inventor.

John F. Dustin,

by Crosby Gregory, Attys.

J. F. DUSTIN.

ELECTROMECHANICAL WARP STOP MOTION FOR LOOMS.

APPLICATION FILED APR. 22, 1910.

974,557. Patented Nov. 1, 1910.

3 SHEETS—SHEET 2.

Fig. 3.

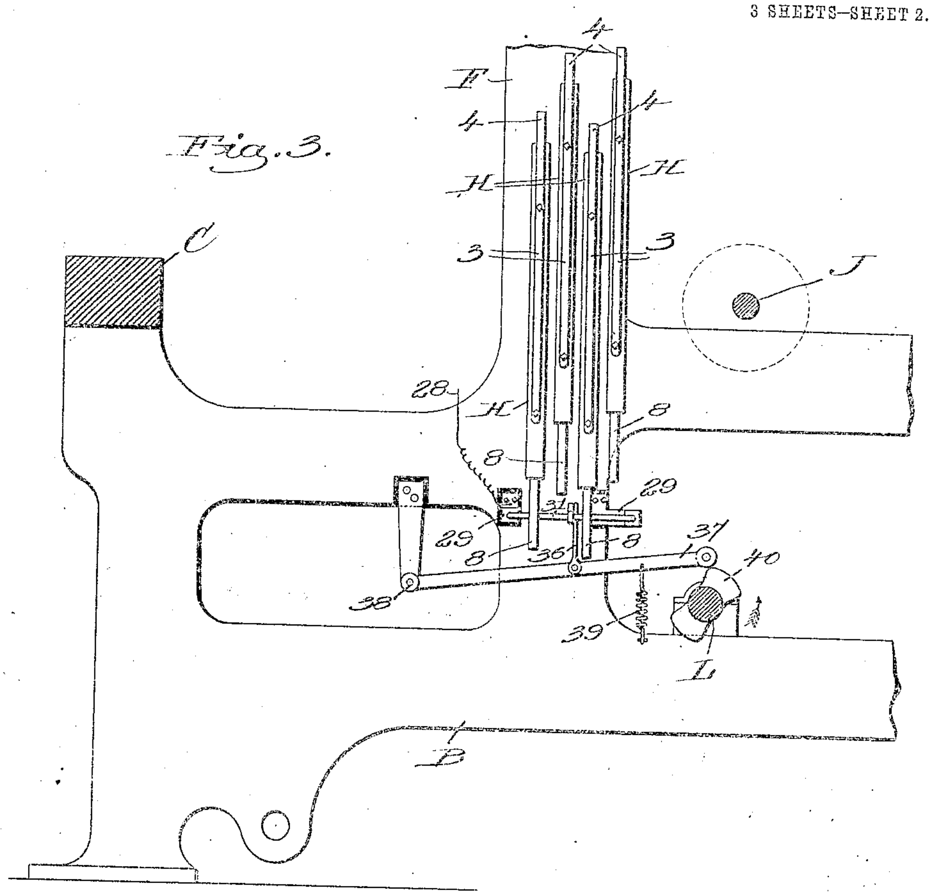


Fig. 5.

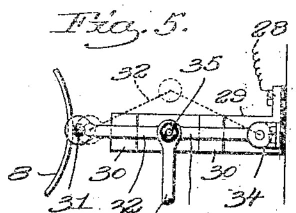
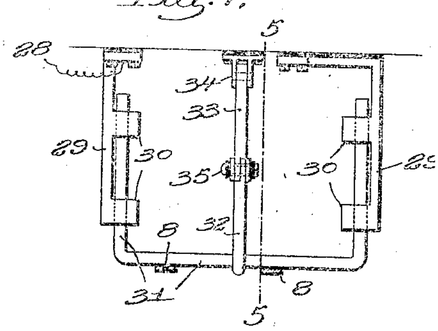


Fig. 4.



Witnesses:
Fred. S. Grumleaf.
Joseph M. Ward.

Inventor.
John F. Dustin,
by Emery, Booth, Janney & Varney.
Attys.

J. F. DUSTIN.

ELECTROMECHANICAL WARP STOP MOTION FOR LOOMS.

APPLICATION FILED APR. 22, 1910.

974,557. Patented Nov. 1, 1910.

3 SHEETS—SHEET 3.

Fig. 6.

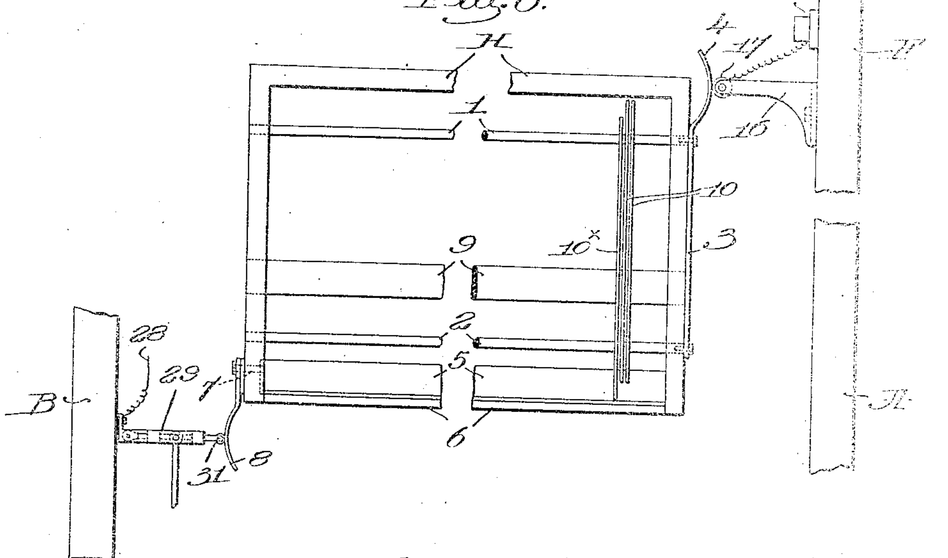


Fig. 8.

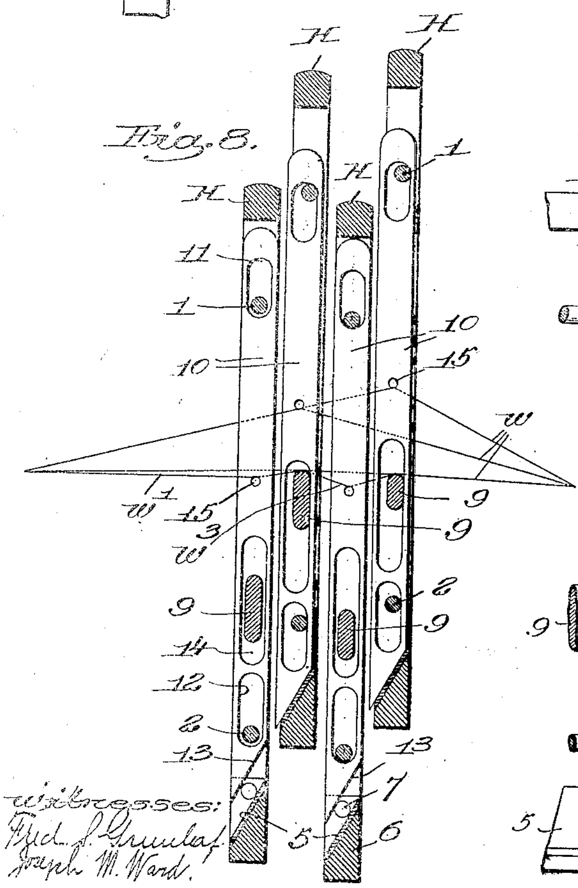


Fig. 7.

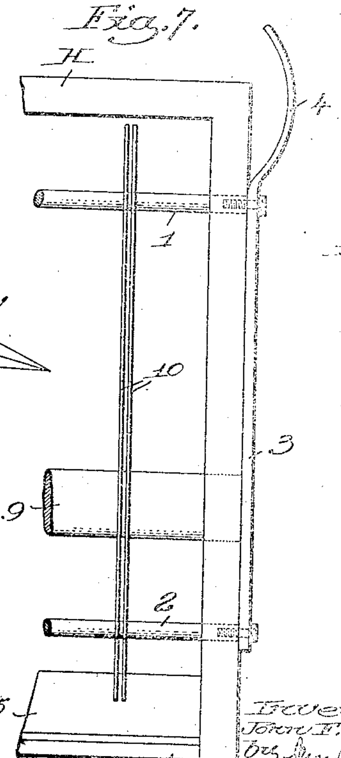
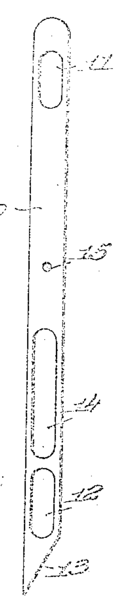


Fig. 9.



Witnesses:
Fred. S. Greenleaf.
Joseph M. Ward.

Inventor:
John F. Dustin,
by Dunby Gregory
Attys.

UNITED STATES PATENT OFFICE.

JOHN F. DUSTIN, OF FULTON, NEW YORK, ASSIGNOR OF ONE-HALF TO JOHN W. STEVENSON, OF FULTON, NEW YORK.

ELECTROMECHANICAL WARP STOP-MOTION FOR LOOMS.

974,557. Specification of Letters Patent. Patented Nov. 1, 1910.

Application filed April 22, 1910. Serial No. 556,955.

To all whom it may concern:

Be it known that I, JOHN F. DUSTIN, a citizen of the United States, and resident of Fulton, county of Oswego, State of New York, have invented an Improvement in Electromechanical Warp Stop-Motions for Looms, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention has for its object the production of an electro-mechanical warp stop-motion for looms embodying various novel features of construction, operation and arrangement, as will appear in details hereinafter, the harnesses comprising heddles which also serve as stop-motion controlling detectors to effect the operation of the stop-motion when a warp-thread breaks.

I have so arranged the mechanism that any number of harnesses may be employed, and in connection therewith an annunciator is provided to indicate the particular harness containing the detector-heddle which has brought about the operation of the stop-motion. I have also arranged the harnesses in such a manner that those which are up will take care of a slack thread of a harness which is down, thus obviating unnecessary loom stoppage from slack threads, as ordinarily a slack thread will be taken up in the operation of the loom.

The controlling-circuit is rendered operative to cause loom stoppage by or through a released detector-heddle in a harness when the latter is down, and I have improved various details of construction in the harness and the circuit-changing devices to effect better and more rapid response when required.

The armature of the magnet included in the controlling-circuit is positively depressed at regularly recurring intervals so that when a detector is released to render operative the controlling-circuit the energized magnet is only required to hold the armature down long enough to effect the operation of the stop-motion, thus enabling me to operate with a much smaller current than is necessary when the magnet is required to attract its armature.

These and other novel features of my invention will be fully described in the subjoined specification and particularly pointed out in the following claims.

Figure 1 is a transverse sectional view of a sufficient portion of a loom, showing the harnesses and the parts of the stop-motion embodying my invention which are located adjacent or upon the right-hand side of the loom frame, the parts being shown in the position assumed just after the shipper has been knocked off; Fig. 2 is an enlarged detail in side elevation of the magnet and its armature, and the actuator for the knock-off lever, the armature being shown as moved against the poles of the magnet by said actuator; Fig. 2^a is a similar view but showing the actuator in another position, with the armature retracted; Fig. 3 is a transverse section through the loom showing the parts of my invention on or adjacent the left hand side of the loom; Fig. 4 is an enlarged detail in plan of the means for establishing connection between the controlling-circuit and one of the circuit-terminals on each of the harnesses when the latter are depressed; Fig. 5 is a sectional view of said means on the line 5—5, Fig. 4, looking toward the left; Fig. 6 is a front elevation, centrally broken out, of one of the harnesses, and the means at opposite sides of the loom for putting the harness terminals in circuit when a harness is down; Fig. 7 is an enlarged detail in front elevation of one side of a harness; Fig. 8 is a transverse sectional view on a large scale of a four-harness set, with two harnesses up and two down; Fig. 9 is a side view of one of the detector-heddles; Fig. 10 is an enlarged detail of the contact member adjacent the annunciator, shown in Fig. 1.

For convenience in illustration and description the right-hand side of the loom frame is indicated by A, and the left-hand side by B, and the breast-beam C, shipper D, and lay E, Fig. 1, may be and are all of usual or well known construction, a portion of the arch F of the loom frame being shown in Figs. 1, 3 and 6, the means for reciprocating the harnesses being altogether omitted as it can be of any desired construction and forms no part of my invention. Herein each harness frame H is shown as rectangular and in the present case made of wood, and provided with transverse metal rods 1, 2 near its top and bottom and connected at the right-hand side of the frame by a metal plate 3, Figs. 6 and 7 having its upper end outwardly curved to form a contact finger 4, said rods 1 and 2 constituting a terminal, and a second terminal is formed by a frontwardly and downwardly inclined metal plate 5 attached to the beveled upper face of the bottom bar 6 of the frame. Said terminal 5 is in electrical connection by bolt 7 with an out-curved contact finger 8 at the left-hand side of the frame and depending below it, as shown in Fig. 6, said fingers being omitted in Fig. 8, a four-harness set being shown in Figs. 1 and 8, although any desired number of harnesses may be used.

Between the terminal rods 1 and 2 a transverse bar 9 of wood or other non-metallic material extends across the frame, for a purpose to be described, and the heddles, which also serve as controlling detectors, are preferably made of relatively thin sheet metal, each heddle 10 having a beveled lower edge 13, and upper and lower slots 11, 12 for the reception of the terminal rods 1 and 2 respectively, an intermediate and longer slot 14 receiving the bar 9.

The warp-threads w are drawn through eyes 15 in the heddles, as herein shown. When the warp-threads are intact the heddles are lifted by the upper terminal rods 1 and by engagement of their beveled ends 13 with the plate 5 as the frame H rises from its lowest position, the several slots in the heddles permitting longitudinal movement thereof relatively to the frame.

When a harness is fully depressed, as are the first and third, Figs. 1, 3 and 8, there is quite a space between the bottoms of the heddles and the terminal 5, so long as the warp-threads are intact, and hence there is no electrical connection between the contact fingers 4 and 8, but if a thread is broken its heddle drops onto terminal 5 and the connection is then complete through the heddle from the terminals 1, 2 to terminal 5.

The inclined terminal tends to shed dust or lint, so that its surface is always clean and in proper condition to make a good contact with a dropped heddle, and by the engagement of said terminal with the beveled end 13 of the heddle the latter is pushed forward, (see Fig. 8, the second and fourth harnesses) bringing the rear edges of slots 11 and 12 against the pair of terminals 1 and 2, to get a perfect contact.

By making a two-part terminal it is impossible for the dropped heddle to fail of proper contact with one or the other of the parts 1 and 2, as will be manifest.

While the heddles complete the connection between the transverse terminals 1, 2 and 5 when a frame is lifted the terminals are not then in the controlling-circuit, for the fingers 4 and 8 are inoperative, as will be explained, and as a frame H rises from its lowest position said fingers will break the controlling-circuit before the terminal plate 5 and terminal 1 pick up the heddles.

As the stroke of successive harnesses from front to rear increases, in order to obtain the proper shed formation, the several non-metallic bars 9 are made of progressively less depth to permit such harness movement, see Fig. 8.

It is unnecessary to stop the loom because of a slack thread, and the bars 9 are so arranged that those of the lifted harnesses will serve as rests for the warp-threads coöperating with heddles of the depressed frame, or frames, so that the heddle on the slack thread will not at such time effect loom stoppage.

Referring to Fig. 8, it is supposed that threads w' and w^3, coöperating with heddles in the first and third harnesses are slack, and it will be seen that were it not for the supporting bars 9 of the second and fourth harness, then up, the slack threads would allow their heddles to drop on the terminals 5 and close the circuit to effect loom stoppage. Said bars 9, then, serve when their harnesses are up as warp rests for slack threads of harnesses which are down, and while it is common in loom structures to have fixed warp rests extended from side to side of the loom I am not aware that warp rests have ever been used prior to my invention so arranged that lifted harnesses take care of slack threads of harnesses which are depressed.

Upon the arch F at the right-hand side of the loom I mount a bifurcated bracket 16 between the branches of which is held a series of contact disks 17, see Fig. 10, insulated from each other and arranged to be wiped over by the fingers 4 of the depressed harnesses to close the circuit at such point whenever one of said fingers engages its corresponding disk 17.

Each disk is electrically connected with one of the drops g', g^2, g^3, g^4, of an annunciator indicated at G, Figs. 1 and 6, the short wires 18 leading from the drops to the wire 19 of the main or controlling-circuit, connected with a suitable source of electricity, as a battery I, Fig. 1. From the other pole of the battery I wire 20 leads to the metal loom side A, including the frame in the controlling-circuit, the connection being continued through shipper D to the knock-off lever 21 fulcrumed at 22, Fig. 1, and having a lateral ear 23, and herein I have shown the lower arm 24 of said lever as forming one member of a circuit-closer, the other member 25 being mounted on the loom side A, but insulated therefrom.

When the shipper D is in running position the contact members 24, 25 will be in contact, said member 25 being made as a flat spring to insure a perfect contact, and by a wire 26 it is connected with the coils of an electro-magnet K, herein shown as mounted on a bracket 27 on the loom side A.

Before describing the parts adjacent the magnet I will trace the circuit therefrom by wire 28 across the loom to a bracket mounted on the loom side B but insulated therefrom, said bracket being shown in Figs. 3, 4 and 5 and comprising two horizontally extended, parallel arms 29 29 each provided with bearings 30 to receive the legs of a substantially U-shaped metal terminal 31, movable horizontally toward and from the paths of movement of the depending contact fingers 8 on the harness frames. When said terminal 31 is extended, Figs. 3, 4 and 5, the fingers 8 of those harnesses which are depressed will contact therewith and thereby the terminals 5 of such harnesses will be included in the controlling-circuit, as will be apparent, and if at such time a heddle 10 drops by breakage of its warp-thread such circuit will be closed through the heddle and terminals 1, 2, and the magnet K will be energized to bring about stoppage of the loom. A toggle 32, 33, Figs. 4 and 5, is pivotally connected at its ends with the terminal 31 and a fixed bracket 34, the joint 35 of the toggle having depending from it a link 36 attached to a cam-follower, shown as an arm 37, Fig. 3, having a fixed fulcrum 38 and held by a spring 39 in engagement with a cam 40 on the cam-shaft L of the loom. The full line position of said follower in Fig. 3 causes the link 36 to break the toggle, see dotted lines Fig. 5, to thereby retract the terminal 31 and open the circuit by moving it away from the fingers of any depressed harnesses, the cam 40 being so shaped and timed to effect such retraction just before the harnesses change the shed, but after shipper release if the latter is called for. Inasmuch as the terminals 5 of depressed harnesses are thus thrown out of circuit before such harnesses begin to rise it will be manifest that the lifting or picking up of the heddles by such terminals can not have any effect on the controlling-circuit.

The cam 40 permits the follower 37 to descend and operatively position the terminal 31 (by straightening the toggle) in ample time for contact with any descending contact finger 8 should a dropped heddle call for the operation of the stop-motion.

In Fig. 6 a dropped heddle is shown at 10^{x}, and it contacts with the terminals 1, 2, and 5 at the time said terminals are in circuit through the fingers 4 and 8 and their respective contacting terminals 17 and 31.

Having described the controlling-circuit and traced the path of the electric current therethrough when loom stoppage is called for I will now explain the means by which the shipper is released when required, having reference to Figs. 1, 2 and 2^{a}. Bracket 27 has an upturned extension 41 on which is pivoted at 42 a metal plate 43 constituting an armature and having a flat portion 44 to coöperate with the poles of the magnet K, Fig. 2, the armature plate being prolonged rearwardly at 45 and having cam faces 46, 47 thereon, a spring 48 serving to retract said armature into the position shown in Fig. 2^{a}. An actuator, shown as a lever 49, is fulcrumed at 50 on a second extension 51 of bracket 27, the lower end of said actuator carrying a roll 52 held by a spring 53 in engagement with a double-throw cam 54 on the cam-shaft L, the tapered high parts of said cam imparting a quick rocking motion to the actuator alternating with rest periods due to the dwell portions 55 on the cam. When the actuator is positively rocked by said cam, as in Fig. 2^{a}, a pin 56 thereon is retracted from the cam faces 46, 47 and the spring 48 swings armature 43 up and away from the magnet K unless the latter is energized, but as cam 54 revolves the stronger spring 53 rocks the actuator and causes pin 56 to first traverse the face 46 and thereby depress the armature upon the magnet poles, overcoming the pull of spring 48, and the pin 56 then travels up onto the cam face 47 and holds said armature against the magnet poles while the roll 52 engages the dwell 55 of the operating cam, as in Fig. 2.

Bearings 57 on the loom side A, Fig. 1, sustain a longitudinally movable transmitter 58 having its front end bent laterally at 59 opposite the ear 23 on the arm 24 of the knock-off lever, the rear end of the transmitter being pivoted at 60 to an elbow lever 61. The longer arm of said lever has a longitudinal slot 62 which receives loosely a stud 63 laterally extended from the upper part of the armature 43, as clearly shown in Figs. 2 and 2^{a}.

When the armature is retracted by its spring 48, as in Fig. 2^{a}, the stud 63 acts to swing the rear end of the elbow lever 61 up and out of the path of movement of a lateral ear 64 on the actuator 49, and the transmitter 58 is pushed back to its normal position by the knock-off lever when the shipper is in running position. This position of the transmitter is shown in Figs. 2 and 2^{a}, and it will be seen by reference to Fig. 2 that when the actuator 49 is operating to hold armature 43 down on the magnet poles the rear end of the elbow lever 61 is located directly in the path of the ear or bunter 64 on said actuator. Now if the magnet is energized it will hold the armature down as the ear or bunter 64 swings forward, and thereupon it will engage and move forward bodily the lever 61, and the transmitter 58, as shown in Fig. 1, so that the bent end 59 of the transmitter engages the ear 23 and rocks the knock-off lever, releasing the shipper D and effecting loom stoppage in usual manner. As the lever 61 is thus moved forward it slides with relation to the armature, owing to the pin and slot connection 63, 62, and as shown in Fig. 1 the release of the shipper opens the controlling-circuit by separating the arm 24 of the knock-off lever and the contact 25. Thus no matter what may be the condition of the rest of the controlling-circuit it is always open at 24, 25 when the loom is at rest, and it is always closed at such points when the shipper is on or in running position, so that when the loom is stopped there is no waste of current.

By effecting a positive movement of the armature into engagement with the poles of the magnet K the latter has no function to perform other than to retain the armature in operative position when the controlling-circuit is closed, so that a much weaker current can be used than would be possible were the magnet required to attract as well as hold the armature.

The cam-shaft L makes one revolution for each two revolutions of the crank-shaft, as is usual, hence I provide a double-throw operating cam for the actuator 49, and the cam 40 at the opposite side of the loom has a double-throw for the same reasons.

The cam 54 is so constructed and timed that it causes the armature to be depressed against the magnet poles for substantially three-fourths of the revolution of the crank-shaft, and releases it just in time to let the end of elbow lever 61 clear the bunter 64 on the actuator when there is no broken warp-thread, but if a dropped heddle has closed the circuit in its frame as the latter descends the bunter will engage and move said lever 61 and the transmitter as the controlling-circuit is completely closed when the particular harness-frame is down. It is also to be noted that the terminal 31 is retracted from engagement with a contact finger 8 just before the harness starts to rise, thereby opening the circuit at that point, the cam 40 acting to operatively position the terminal 31 during one-half the revolution of the crank-shaft J of the loom.

The fingers 4 and 8 on the harness-frames are made resilient or spring-like, in order to secure an effective contact with the corresponding terminals or contact members 17 and 31.

It will be manifest that the release of the shipper is positively effected through the coöperation of the actuator 49, elbow lever 61 and transmitter 58, and the knock-off lever 21, 24, the actuator at such time being swung by the action of the cam 54.

While I prefer to use the inclined terminal plate 5 on the harness-frame to coöperate with the correspondingly beveled end of a dropped heddle, because of the ease with which lint or dust is shaken off such terminal by the movement of the harness, and also because it acts to throw a dropped heddle forward against the double terminal 1, 2, it will be obvious that the operation of the stop-motion as a whole will not be interfered with should said lower terminal 5 be set flat on the harness-frame, and the lower end of the heddles be made flat instead of beveled.

It is to be understood that while the non-metallic bars 9 serve ordinarily as warp-rests for slack threads when a harness is down they do not interfere with the operation of the heddles should their warp-threads break, for the slots 14 through which the bars 9 pass are made long enough to permit the proper descent of a heddle to close the circuit in the harness-frame when a thread breaks.

Various changes or modifications in details of construction and arrangement may be made by those skilled in the art without departing from the spirit and scope of my invention as set forth in the claims annexed hereto.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. A warp stop-motion for looms comprising a controlling-circuit for setting in operation the stopping mechanism, a series of vertically-reciprocating harness-frames, terminals carried by each frame, means to include said terminals in the controlling-circuit when a frame is in its lowest position, said means including a member moved automatically and independently of the frame as the latter begins to rise, to throw the terminals out of the circuit, and a series of metallic heddles in each harness-frame and normally maintained inoperative by their warp-threads when the frame is down, breakage of a warp-thread releasing its heddle and causing closure of the controlling-circuit through the terminals on the frame while said terminals are in circuits.

2. A warp stop-motion for looms comprising a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a series of metallic heddles, terminals carried by the frame and adapted to be electrically connected by a heddle when released by failure of its warp-thread, resilient contact fingers on the outside of the frame and connected with said terminals, coöperating contact members in the controlling-circuit and arranged to be engaged by the said terminal contact-fingers when the harness-frame is at or near its lowest position, and means movable independently of the frame to open the circuit by or through one of said contact members as the frame begins to rise.

3. A warp stop-motion for looms com-

prising a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a series of metallic heddles, terminals carried by the frame and adapted to be electrically connected by a heddle when released by failure of its warp-thread, contact fingers on the outside of the frame and connected with said terminals, a fixed contact member in the controlling-circuit, and a movable contact member also in said circuit, said contact members engaging the fingers when the harness-frame is at or near its lowest position, and positive means to retract the movable contact member from the coöperating finger as the rise of the harness-frame begins.

4. In a warp stop-motion for looms, a harness-frame, an upper, transverse terminal thereon having an external contact finger, a series of metallic heddles longitudinally slotted to receive said terminal, a lower transverse terminal on the frame, extended beneath the lower ends of the heddles and having an external contact finger, a controlling-circuit for setting in operation the stopping mechanism, means for including said terminals in such circuit when the harness-frame is at or near its lower position, a dropped heddle at such time completing the circuit through the upper and lower terminals on the frame, and means to open the circuit at the contact finger of one of the terminals as the frame begins to rise.

5. In a warp stop-motion for looms, a controlling-circuit for setting in operation the stopping mechanism, a plurality of reciprocating harness-frames each having a series of metallic, longitudinally slotted heddles, means to complete the controlling-circuit through a dropped heddle when its harness-frame is at or near its lowest position, and a non-metallic cross-bar on each frame extended through the slots in the heddles thereof and located below the sheet of warp, the cross-bars on harness-frames which are raised serving as warp-rests for a slack thread coöperating with a heddle in a frame which is down, to sustain the heddle and prevent completion of the controlling-circuit thereby.

6. In a warp stop-motion for looms, a controlling-circuit for setting in operation the stopping mechanism, a plurality of reciprocating harness-frames each having a series of metallic heddles normally maintained inactive by intact warp-threads, means operative when a frame is at a predetermined point in its stroke to close the controlling-circuit through a heddle of such frame if released by failure of its warp-thread, and means on the several harness-frames whereby those beyond the predetermined point in their stroke prevent closure of the controlling-circuit by a heddle on a slack thread when such heddle is in a frame at the circuit-closing point.

7. In a warp stop-motion for looms, a controlling-circuit for setting in operation the stopping mechanism, a plurality of reciprocating harness-frames each having a series of metallic heddles normally maintained inactive by intact warp-threads, means operative when a frame is down to close the controlling-circuit through a heddle of such frame if released by failure of its warp-thread, and means on the harness-frames whereby the frames which are up prevent a heddle in a frame which is down from closing the controlling-circuit if the thread of such heddle is slack.

8. In a warp stop-motion for looms, a controlling-circuit for setting in operation the stopping mechanism, a plurality of reciprocating harness-frames each having a series of metallic heddles normally maintained inactive by intact warp-threads, means operative when a frame is down to close the controlling-circuit through a heddle of such frame if released by failure of its warp-thread, and a warp-rest carried by each frame, the warp-rests on the frames which are up sustaining a slack thread coöperating with a heddle of a frame which is down, to thereby prevent closure of the controlling-circuit by the heddle on such slack thread.

9. In a warp stop-motion for looms, harness-frames, a series of heddles on each, a controlling-circuit, means to close it by or through release of a heddle due to failure of its warp-thread, an electro-magnet included in said circuit, shipper-releasing means, including a transmitting member, an armature, means to intermittingly and positively move it into contact with the poles of said magnet, said means including a bunter, and an engaging member for said bunter, mounted on the transmitter and moved into and out of the path of the bunter by movement of the armature toward and away from the magnet, said magnet when energized by closure of the controlling-circuit retaining the armature in abnormal position.

10. In a warp stop-motion for looms, harness-frames, a series of heddles on each, a controlling-circuit, means to close it by or through release of a heddle due to failure of its warp-thread, an electro-magnet included in said circuit, a spring-retracted armature, means to positively move said armature against the magnet poles at regularly recurring intervals, a shipper, and releasing means therefor rendered operative when the magnet is energized to retain the armature in engagement therewith.

11. In a warp-stop-motion for looms, harness-frames, a series of heddles on each, a controlling-circuit, means to close it by or

through release of a heddle due to failure of its warp-thread, an electro-magnet included in said circuit, an armature therefor, positively acting means to move the armature against the magnet poles when a harness-frame is down, a shipper, releasing means therefor, including a member controlled as to its position by the armature, and a positively moved bunter to coöperate with said member when the magnet is energized and retains the armature in engagement therewith.

12. In a warp stop-motion for looms, harness-frames, a series of heddles on each, a controlling-circuit, means operative only when a harness-frame is at or near its lowest position to close said circuit by or through a heddle released by failure of its warp-thread, an electro-magnet included in said circuit, a spring-retracted armature therefor, positively acting means to move the armature against the magnet poles whenever a harness-frame is down, said means including a bunter, a shipper, and releasing means therefor including a member operatively connected with the armature and positioned thereby in the path of the bunter when the magnet is energized and retains its armature in engagement therewith.

13. In a warp stop-motion for looms, harness-frames, a series of heddles on each, a controlling-circuit, means to close it by or through release of a heddle due to failure of its warp-thread, an electro-magnet included in said circuit, an armature therefor, positively acting means to move the armature against the magnet poles when a harness-frame is down, a shipper, releasing means therefor, including a member controlled as to its position by the armature, and a positively moved bunter to coöperate with said member when the magnet is energized and retains the armature in engagement therewith, combined with means to open the circuit automatically when the shipper is released.

14. In a warp stop-motion for looms, a controlling-circuit, an electro-magnet included therein, a pivoted armature, a retracting spring therefor, a rocking actuator coöperating with said armature to depress the armature against the magnet poles at regularly recurring intervals, a bunter on the actuator, a shipper, releasing means therefor, including a transmitter, and a member pivoted thereon, and an operating connection between said member and the armature, to move said member into the bunter path when the armature is depressed against the magnet poles, retraction of the armature moving said member out of the path of the bunter, combined with means to close the controlling-circuit upon breakage of a warp-thread and when the armature is depressed.

15. In a warp stop-motion for looms, a controlling-circuit to set in operation the stopping mechanism, a series of harness-frames each having a series of heddles, means to close the circuit by or through breakage of a warp-thread when a harness-frame is in a predetermined position, devices on the harness-frames to prevent closure of said circuit by or through a slack thread, and positively operated means exterior to the harness-frames to open the controlling-circuit thereat as each harness-frame begins to move away from its predetermined position.

16. In a warp stop-motion for looms, a controlling-circuit to set in operation the stopping mechanism, a series of harness-frames each having a series of metallic heddles, separated terminals on each frame, electrically connected by a heddle released by failure of its warp-thread, contact fingers outside the frame and connected with the terminals thereof, a fixed contact to engage one of said fingers when a frame is at or near its lowest position, to include the connected terminal in the circuit, a movable contact to engage the other finger of a frame when such position of the frame is reached, to thereby include the other terminal in the circuit, and means to reciprocate said movable contact and retract it from its coöperating finger when the frame begins to rise, whereby the controlling-circuit is opened positively between said movable contact and the adjacent finger on the harness-frame.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

JOHN F. DUSTIN.

Witnesses:
JOHN CLARK,
THOS. SULLIVAN.