J. F. DUSTIN.

ELECTROMECHANICAL STOPPING MECHANISM FOR LOOMS.

APPLICATION FILED JUNE 20, 1910.

988,986. Patented Apr. 11, 1911.

3 SHEETS—SHEET 1.

Fig. 1.

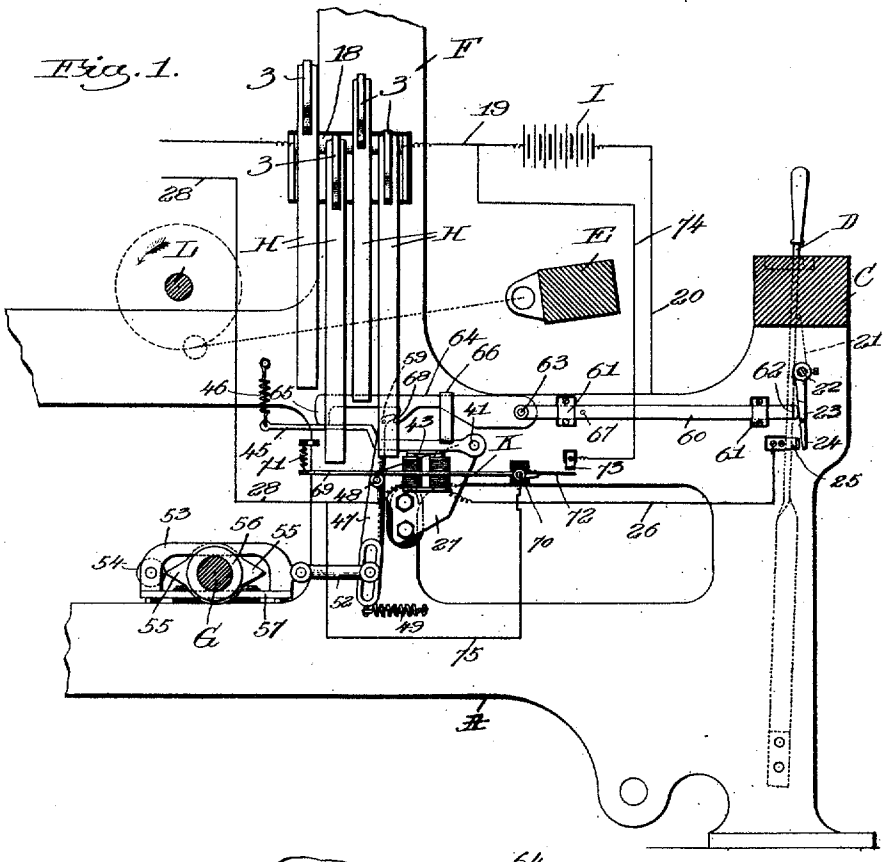

Fig. 2.

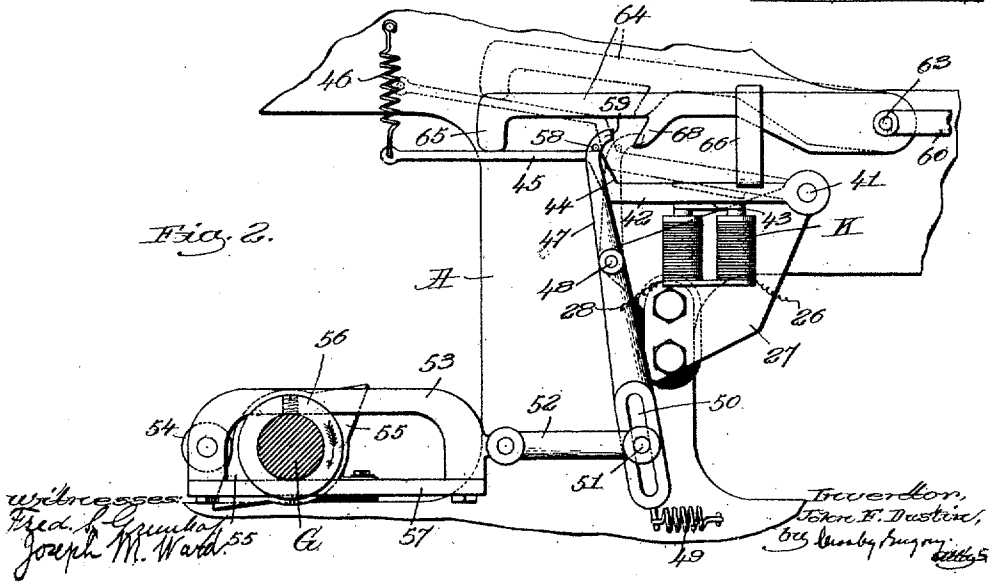

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Fig. 3.

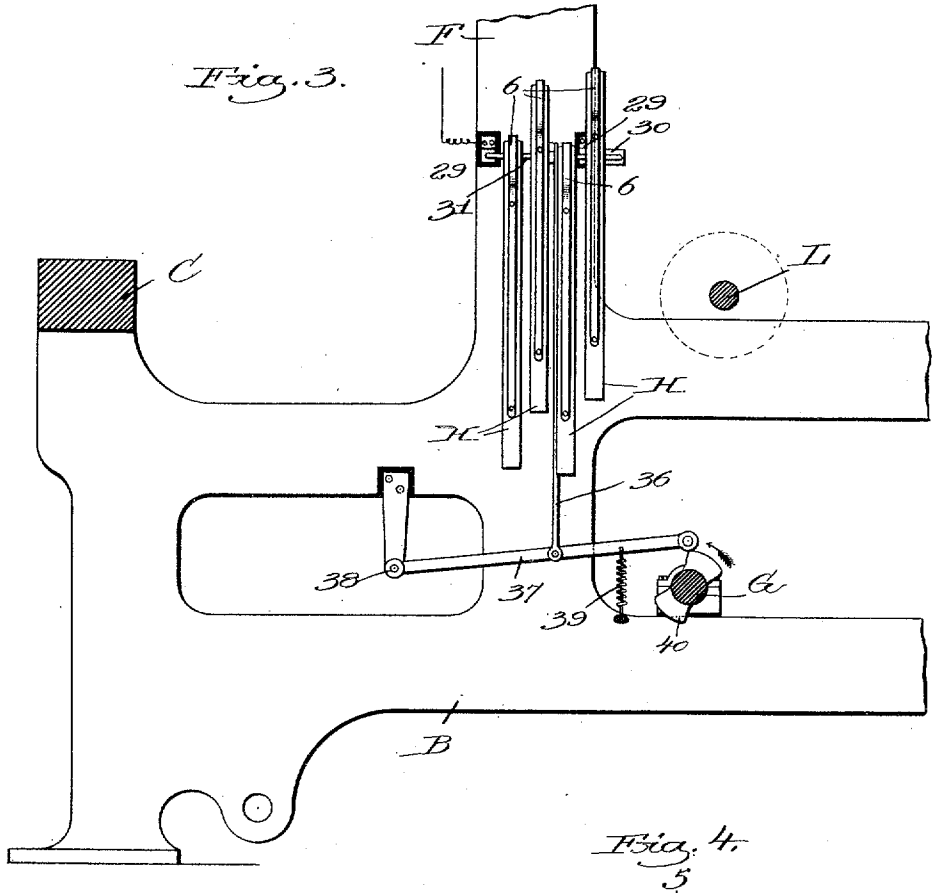


Fig. 4.

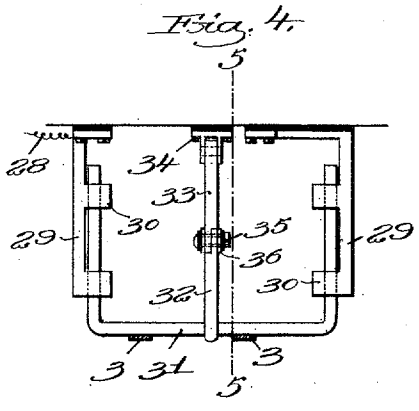
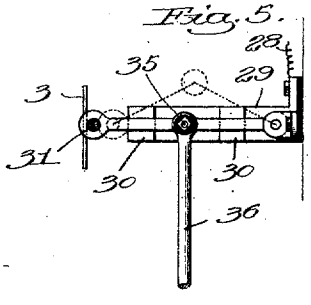


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 6.

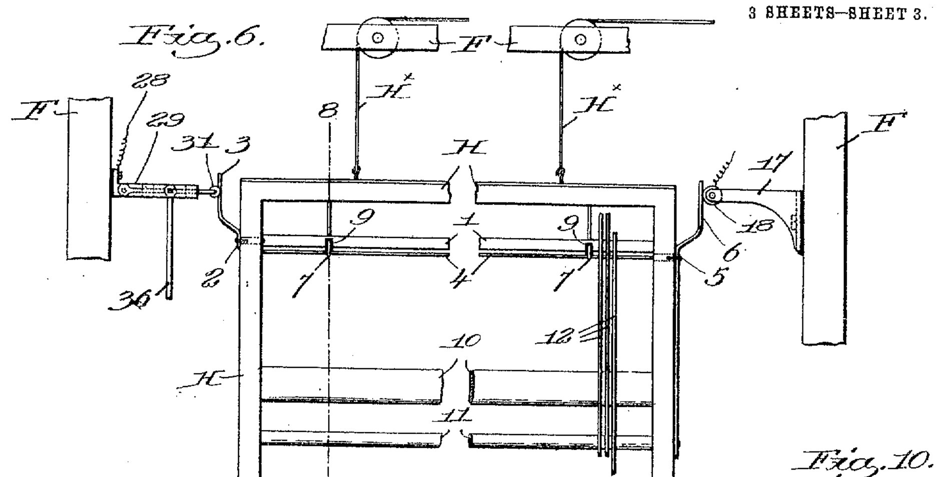


Fig. 10.

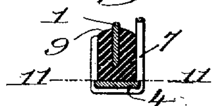


Fig. 11.

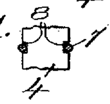


Fig. 8.

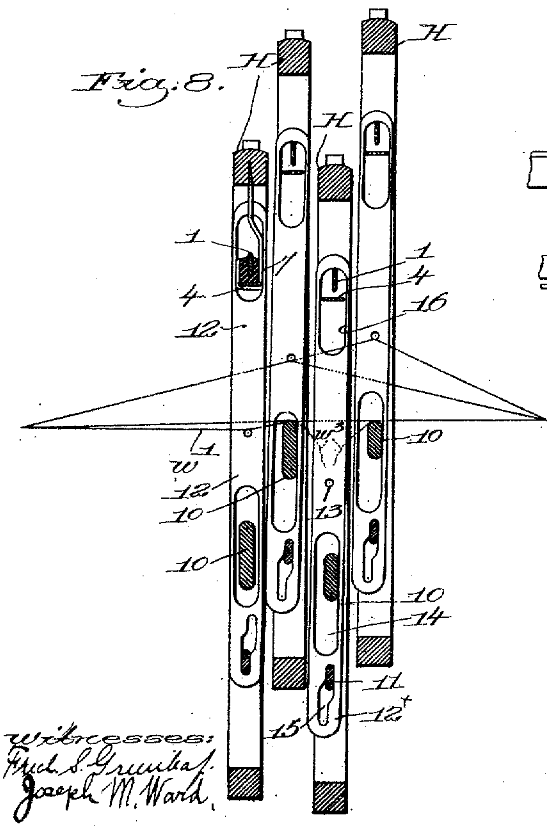


Fig. 7.

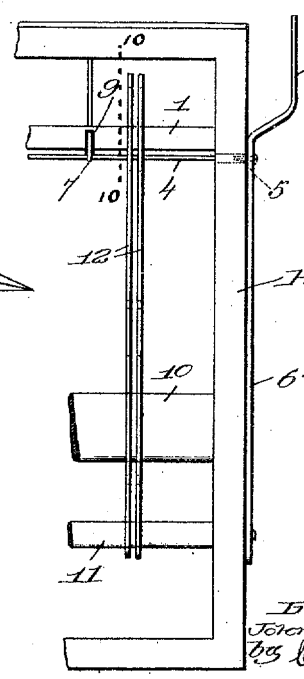
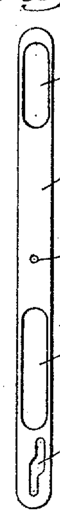


Fig. 9.



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UNITED STATES PATENT OFFICE.

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ELECTROMECHANICAL STOPPING MECHANISM FOR LOOMS.

988,986. Specification of Letters Patent. Patented Apr. 11, 1911.

Application filed June 20, 1910. Serial No. 567,767.

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 Stopping Mechanism 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 a simple and efficient electro-mechanical stop-motion for looms, whereby the loom is stopped automatically upon the occurrence of a warp failure, either due to breakage or running out of a warp thread, and also when an overhead harness-support breaks.

In my present invention each harness is, when down, included in a controlling-circuit, but the latter is not rendered operative thereby unless a heddle is released by failure of its warp-thread, the heddles thereby serving also as stop-motion controlling detectors.

An electro-magnet is included in the controlling-circuit, and the armature of such magnet is positively depressed or moved against the magnet poles at regularly recurring intervals, so that when the magnet is energized it has only to hold the armature attracted long enough to effect the operation of the stop-motion, whereby an electric current of low power can be used.

The various 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 portion of a loom with one embodiment of my invention applied thereto, the harnesses, four in number, being shown in elevation, and illustrating the parts of the stop-motion at the right-hand side of the loom, it being supposed that the stop-motion has just operated to knock off the shipper; Fig. 2 is an enlarged detail in side elevation of the magnet, its armature, and the actuator for the knock-off lever, the actuator, armature and adjuncts being shown in two positions by full and dotted lines, respectively; Fig. 3 is a transverse section through the loom showing the parts of the stop-motion adjacent the left-hand side of the loop; 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 harness when the latter is down; Fig. 5 is a sectional detail thereof on the line 5—5, Fig. 4, looking toward the left; Fig. 6 is a front view, centrally broken out, of one of the harnesses and the means for including the harness-terminals in the controlling-circuit when the harness is down; Fig. 7 is an enlarged detail in front elevation of the right hand side of a harness; Fig. 8 is a transverse section, enlarged, on the line 8—8, Fig. 6, of a four-harness set, with two harnesses up and two down, one of the latter having a broken warp thread; Fig. 9 is a side view of one of the detector-heddles; Fig. 10 is an enlarged sectional detail on the line 10—10, Fig. 7, of one of the harness hooks, showing the insulation of the two harness-terminals from each other; Fig. 11 is a cross-sectional detail on the line 11—11, Fig. 10, to be referred to.

The right and left hand sides of the loom are indicated at A and B, respectively, and the breast-beam C, shipper D, lay E, the arch F, and the cam-shaft G, may be and are all of usual or well known construction and operation.

The mechanism for reciprocating the harnesses forms no part of my invention and is omitted in the drawings with the exception of the overhead flexible supporting connections H^x Fig. 6, by means of which a harness is lifted in well known manner.

Herein each harness comprises a rectangular frame H, preferably made of wood, and a series of thin, flat metallic heddles which serve also as stop-motion controlling detectors, to be referred to, said heddles having each a limited longitudinal movement relative to its frame. A transverse, flat metal bar 1, set on edge, is fixedly attached at its ends to the sides of the harness frame near its top, and at one side of the frame, the left, as herein shown, is in electrical connection by a bolt 2 with an outwardly and upwardly curved flexible contact finger 3 on the side of the frame, the bar 1 constituting one of the harness terminals. A short distance below said terminal is a second harness terminal, conveniently made as a flat metal bar 4 extended across the harness frame and at right angles to the terminal 1, said terminal 4 being electrically connected by a bolt 5 with a curved, upturned and flexible contact finger 6

on the frame II at the right hand side thereof. Harness hooks 7 depending from the top bar of the frame embrace the opposite edges of terminal 4, the latter being notched at 8, Fig. 11, for the purpose, and seats 9 of insulating material are held securely in the hooks, said seats receiving the harness terminal 1 and effectually insulating it from the hooks and from the terminal 4. Below the terminals a transverse bar 10 of wood or other non-metallic material extends across and is fixedly secured to the sides of the frame H, this bar 10 serving as a slack-thread support, as will be explained, and beneath the bar 10 is a thin and flat heddle guide 11, extended across the harness frame. The heddle guide may be of wood or of metal, as desired, and if of metal it can be utilized as a part of the terminal 4 by electrically connecting it with the shank 6 of the contact finger 6, as herein shown.

In Figs. 1, 4 and 8 a four-harness set is shown, but it will be understood that my invention is not restricted to the particular number of harnesses used, and while but one harness is described in detail it suffices for all the harnesses of a set.

Referring to Fig. 6 it will be seen that the contact fingers 3 and 6 are at opposite sides of the harness frame H and at the top thereof, and it will be understood from the foregoing that there is no electrical connection between the harness terminals 1 and 4 save when a heddle is released by failure of its warp thread.

Each heddle 12 has a warp-eye 13, Fig. 9, an elongated and wide slot 14 below it for the reception of the bar 10, a cam-slot 15 for the lowermost bar 11, and near its upper end the heddle has a wide, elongated slot 16 which receives the terminals 1 and 4. As shown in Figs. 8 and 9 the cam-slot 15 is relatively narrow, and its upper and lower ends are offset, the former near the rear upright edge of the heddle and the latter near the front edge of the heddle, so that when a heddle is released and permitted to drop its lower end will be moved forward, as shown by the released heddle in the third harness from the left, Fig. 8. When the warp-threads are intact and the harness frame H rises the upper terminal 1 engages the upper ends of the slots 16 and lifts the series of heddles, bringing their warp-threads into the upper plane of the shed, and as the frame rises with its heddles the latter will electrically connect the terminals 1 and 4, but as the fingers 3 and 6 are not at that time in the controlling-circuit this is unobjectionable. Now, when a harness is depressed the heddles move down with it but if the warp-threads are intact they hold up the heddles as the descent of the frame is completed, as shown by the first harness, Fig. 8, and while the terminal 4 engages the upright edges of the slot 16 it holds such edges away from contact with the terminal 1. Hence at such time there is no electrical connection between the harness terminals, as will be obvious, but if a thread fails its heddle drops and the upper end of the slot 16 engages the upper edge of the terminal 1 and completes the connection between it and terminal 4, as shown in Fig. 8, wherein the thread w^3 of the heddle of the third harness is shown as having broken. The heddle guide 11 at such time throws the lower end of the released heddle forward and insures a good connection between the heddle and the terminal 4, and if the guide 11 is electrically connected with the latter the engagement is made even more absolute and certain. As the terminal 1 is preferably a relatively thin and stiff metal plate, set on edge, its upper edge will always be kept clear of lint or fluff, by the shaking of the harness, and as the heddle slot 16 is so wide relatively to the thickness of the terminal there is no chance for lint to pack or become wedged around the terminal. This arrangement of the harness terminals is very simple and efficient, but one slot being required for the reception of the terminals 1 and 4, and while I prefer to use the lower cam slot 15 and the heddle guide 11 to cooperate therewith, for the purposes set forth, it is not absolutely necessary except that said guide prevents any sticking of the heddles on the down stroke of a harness, and also serves to even the heddles of the series, for on the down stroke the guide 11 engages the lower ends of the slots 15, as shown in the first harness, Fig. 8.

As loom stoppage because of slack threads is unnecessary I provide the cross-bars 10, which are so arranged that those of the lifted harnesses will serve as supports or rests for the warp-threads coöperating with the heddles of a depressed frame, or frames, thereby preventing undue descent of a heddle on a slack thread. That is, referring to Fig. 8, it is supposed that the thread w' of the first harness is slack, but the supporting bars of the second and fourth harnesses, which are up, serve as rests for the thread w' and prevent its coöperating heddle from descending far enough to close the controlling-circuit between the terminals 1 and 4. The bars 10 are made of less depth progressively from front to rear, to accommodate the harness strokes, for it will be understood that the strokes of successive harnesses increase from front to rear to obtain the proper shed opening.

Upon the arch F on the loom side A is mounted a bracket 17 carrying a metallic contact roll 18, which is so positioned that as each harness descends its contact finger 6 will wipe over said roll to thereby close the controlling-circuit at such point and

bring the harness terminal 4 into such circuit. The contact member 18 is connected with the wire 19 of the controlling-circuit, connected with a suitable source of electric-power, such as a battery I, Fig. 1, the bracket 17 being insulated from the loom frame. From the other pole of the battery a wire 20 leads to the metal loom side A, including the loom-frame in the controlling-circuit, the circuit being continued normally through shipper D to the knock-off lever 21 fulcrumed at 22, Fig. 1, the lower arm 24 of said lever having a lateral ear 23, said arm 24 forming one member of a circuit-closer or switch, the other member 25 being mounted on the loom side A, but insulated therefrom. When the shipper is in running position the contacts 24, 25 will be in engagement, closing the circuit at that point the contact 25 being preferably a flat spring, and connected by a wire 26 with the coils of an electro-magnet K suitably mounted on the loom side A by a bracket 27. From the magnet the circuit is continued by wire 28 across the loom to one of a pair of parallel and horizontal bracket arms 29 mounted on and insulated from the arch on the loom side B, said arms having bearings 30, Fig. 4, for the legs of a U-shaped metal terminal 31 movable horizontally toward and from the series of contact fingers 3 on the harnesses H. When said terminal 31 is extended and contacts with the fingers 3 of those harnesses which are down, (the first and third in Fig. 3), the terminals 1 of such harnesses will be included in the controlling-circuit, and so too the terminals 4 of said harnesses will be brought into the circuit through the contact fingers 6 and contact roll 18. Hence at such time a heddle released by failure of its thread will drop onto the terminal 1 and the controlling-circuit will be closed through the heddle and the terminals 1 and 4, energizing the magnet K to effect loom stoppage, as will be described.

A toggle 32, 33 connects the terminal 31 and a fixed pivot on an insulated bracket 34, the joint 35 of the toggle being connected by a depending link 36 with a cam-follower 37 fulcrumed at 38 and held by a suitable spring 39 in operative engagement with a cam 40 on the cam-shaft G, Fig. 3. When the toggle is broken the terminal 31 is retracted, opening the circuit between the said terminal and the finger 3, of each depressed harness, the cam 40 being shaped and timed to effect such opening of the circuit just before the harnesses change the shed, but after shipper release if called for. As the harness terminals 1 are thus thrown out of circuit before the depressed harnesses begin to rise the lifting of the heddles by the terminals 1 has no effect on the controlling-circuit. The terminal 31 is operatively positioned in ample time for engagement with any descending finger 3 in case a dropped or released heddle should call for loom stoppage.

Referring to Fig. 8 the dropped heddle 12^{x} is shown, the controlling-circuit being thereby completed or closed through the terminals 1 and 4 of the third harness, which is down.

The shipper-releasing means is clearly shown in Figs. 1 and 2, wherein the bracket 27 has fulcrumed on it at 41 a rearwardly extended carrier 42 for the armature 43 of the magnet K, the carrier having at its rear end a cam face 44 inclined upward and rearward, with a straight prolongation 45 at the upper end of said cam face, a spring 46 fixed at one end and at its other end connected with the prolongation serving to retract the carrier and its armature. A lever 47, constituting the actuator, is fulcrumed at 48 on bracket 27 and swings in an upright plane, a spring 49 serving to swing rearward the upper end of the actuator, the depending end of the actuator having an adjustable slot and pin connection 50, 51 with a short link 52 pivotally connected with a yoke-like follower 53. The follower embraces the cam-shaft G, as shown, and carries a roll 54 held by the spring 49 in coöperation with a double-throw cam 55 on the cam-shaft, the opposite and tapered high parts of the cam imparting a quick oscillation to the actuator alternating with intervening rest periods. In practice the follower yoke 53 will slide longitudinally on the shaft between the cam 55 and a collar 56 fixed on the shaft, the bottom member 57 of the follower-yoke being made detachable so that it can be readily applied to the shaft.

The upper end of the actuator is provided with a lateral pin 58 which slides over the cam face 44 and depresses the armature carrier 42 when the spring 49 contracts, to depress the armature 43 against the magnet poles, spring 49 being stronger than spring 46, and when the cam 55 acts through the follower 53 to rock the actuator 47 positively the pin 58 swings forward, releasing the carrier so that the spring 46 lifts it and retracts the armature, unless the magnet K be energized.

A longitudinally movable transmitter 60 is slidably supported in bearings 61 on the loom side A, Fig. 1, and has its front end bent laterally at 62 opposite the ear 23 of the knock-off lever, and at its rear end the transmitter has pivoted upon it at 63 a rearwardly extended latch 64 provided with a depending end 65 adapted to normally rest upon the armature-carrier extension 45, the carrier 42 having an upright, forked guide 66 thereon embracing the latch. Referring to Fig. 1 a stop-pin 67 on the transmitter is

provided to limit rearward movement thereof when the shipper is thrown to running position, it being understood that at such time the ear 23 holds the transmitter from any accidental forward movement. As the armature-carrier is oscillated about its fulcrum 41 the latch 64 will rise and fall with it, rocking about the pivot 63, and such rocking of the latch causes a depending toe 68 thereon to alternately rise above and descend into the path of movement of the forwardly curved head or bunter 59 of the actuator 47. When spring 46 retracts the armature 43 the latch is thereby lifted to move the toe 68 out of the path of the bunter 59 on its forward or active stroke, as shown by dotted lines Fig. 2, but when the backward stroke of the actuator acts through pin 58 and cam face 44 to depress the armature against the magnet poles the latch toe 68 will be directly in the path of the bunter, as shown by full lines Fig. 2. If at this instant the magnet K is energized by the closure of the controlling-circuit the armature and its carrier will be held in full line position as the bunter 59 moves forward, and the latter will thereupon engage the toe 68 and will move forward bodily the latch 64 and the transmitter 60, as shown in Fig. 1, the coöperation of the transmitter and knock-off lever thereupon rocking the latter to release the shipper D and effect loom stoppage, in usual manner. This bodily movement of the latch causes its downturned end 65 to slide forward along the carrier extension 45, the latch being guided by the forked or slotted guide 66. Shipper release opens the controlling-circuit by separating the arm 24 of the knock-off lever from the contact 25, as shown in Fig. 1, and such circuit is always open at this point when the loom is at rest, while the circuit is always closed at such point when the shipper is in running position.

It will be observed that the electric current has no function in so far as attraction of the armature 43 is concerned, but it is only strong enough to retain said armature against the magnet poles when even the controlling-circuit is completed or closed.

As the cam-shaft G makes one revolution for each two revolutions of the crank-shaft L the actuator-cam 55 and the circuit-closing cam 40 are made as double-throw cams. The actuator-cam is so constructed and timed that the armature 43 is depressed for substantially three-fourths of the revolution of the crank-shaft, and said armature is released just in time to permit the latch toe 68 to clear the bunter 59 if the warp-threads are intact. If, however, a released heddle has closed the circuit through the coöperating harness terminals as the harness descends the bunter will coöperate with and move the latch and the connected transmitter when the controlling-circuit is completed or closed when the particular harness is down.

Sometimes the harness connections break and one or more of the harnesses of a set will drop, and if the accident is not discovered very promptly by the weaver great damage to the warp is almost certain to result. Herein, by a very simple device, I have provided for stopping the loom automatically when a harness falls, and I utilize a considerable portion of the mechanism heretofore described but without interfering in any way with the operation of such mechanism when a warp-thread fails. To this end I provide a circuit-closer comprising a lever 69, Fig. 1, insulated from the loom side A and fulcrumed thereon at 70 and extended rearward just below the harnesses when they are in their lowermost normal position, the rear end of said lever being upheld by an insulated spring 71, the front end of said lever having a prolonged contact member 72 normally held by the spring 71 out of engagement with a contact member 73 mounted on and insulated from the loom side A. A wire 74 leads from the wire 19 of the controlling-circuit at one side of battery I to the contact member 73, and a second wire 75 connects the contact member 72 with the wire 28 of the controlling-circuit at the left of the electro-magnet K. When contact members 72, 73 engage the auxiliary circuit is closed, and this circuit is traced from battery by wire 74 to contacts 73, 72, thence by wire 75 to wire 28 and magnet K, through main wire 26, contacts 25, 24, knock-off lever 21, shipper D and loom frame to wire 20 and to battery, hence it will be seen that closure of the auxiliary circuit at 72, 73 energizes the magnet K and thereupon the shipper will be released by the coöperation of the latch toe 68 and bunter 59 as previously described. When any harness of a set falls, as will be the case when its actuating connections break, the bottom of the frame H will drop onto and depress the lever 69, rocking it on its fulcrum 70 and thereby lifting the contact member 72 into engagement with the member 73, closing the auxiliary controlling-circuit and effecting loom stoppage, as will be understood. This harness stop-motion thus utilizes a portion of the main controlling-circuit and its adjuncts, and by the arrangement shown the loom is stopped by or through the occurrence of a warp fault or a harness fault. When a dropped harness is lifted and the fault repaired the spring 71 operates automatically to restore the circuit closer or lever 69 to normal position, opening the auxiliary circuit at 72, 73.

Certain features of construction relating to the warp stop-motion herein shown and

described are not claimed broadly herein as they form the subject-matter of claims in United States Patent No. 974,557 granted to me November 1, 1910.

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 harnesses, and means to render operative said circuit whenever a heddle is released by failure of its warp-thread, combined with separate means, including a normally inoperative auxiliary circuit in electrical connection with said controlling-circuit, and a circuit-closer closed only by the falling of a harness thereupon, to thereby render operative the auxiliary circuit and through it render operative the controlling-circuit to effect loom stoppage, said auxiliary circuit remaining inoperative when a released heddle acts to render operative said controlling-circuit.

2. In a warp stop-motion for looms, harness-frames, a series of heddles on each, a controlling-circuit, means to close it through a heddle upon failure of its warp-thread, an electro-magnet included in said circuit, shipper-releasing means, including a transmitting member, a pivotally connected latch having a toe, an armature, a carrier therefor in engagement with the free end of the latch, a spring to cause the carrier to retract the armature and to lift the latch-toe into inoperative position, and an actuator to cooperate with and move the carrier against its spring and thereby bring the armature intermittingly into engagement with the magnet-poles, the latch-toe at such time being operatively positioned, said actuator having a bunter to engage the latch-toe and operate the transmitting member when the energized magnet retains the armature against its poles, closure of the controlling-circuit energizing the magnet.

3. In a warp stop-motion for looms, harness-frames, a series of heddles on each, a controlling-circuit, means to close it through a heddle upon failure of its warp-thread, an electro-magnet included in said circuit, an armature for said magnet, a rocking armature-carrier having a prolongation and an upturned, slotted guide, a spring to retract said carrier and armature, a shipper, releasing means therefor including a transmitting member, and a latch pivoted on said member and resting on the prolongation of the carrier, to rise and fall therewith, said latch entering the slotted guide, a rocking actuator to move the carrier and intermittingly depress the armature against the poles of the magnet, a bunter on said actuator, a toe depending from the latch into the path of the bunter on its active stroke when the magnet is held against the magnet poles, and means to oscillate the actuator, closure of the controlling-circuit energizing the magnet and holding the armature down to retain the latch-toe in the path of the bunter on its active stroke, whereby said latch and transmitter will be moved to effect release of the shipper.

4. In a loom, a controlling-circuit, including an electro-magnet, its armature, a spring-retracted carrier therefor, a shipper, releasing means therefor including a transmitting member and a latch pivotally connected therewith, said latch having a depending end resting on the carrier, to rise and fall therewith, an actuator to coöperate with the carrier and move the armature against the magnet poles, such movement of the carrier positioning the latch to coöperate with the actuator on its active stroke, means to oscillate said actuator, harness-frames, a series of heddles on each, means to close the controlling-circuit and thereby energize the magnet when failure of a warp-thread releases its heddle, a normally inoperative auxiliary circuit including the electromagnet and a portion of the controlling-circuit, and means to render operative said auxiliary circuit to energize the magnet upon the falling of a harness-frame upon a portion of said means, the retention of the armature when the magnet is energized causing the actuator on its active stroke to engage the latch and move it and the transmitting member bodily to effect release of the shipper.

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

JOHN F. DUSTIN.

Witnesses:
JOHN W. STEVENSON, JR.,
G. W. BROOKER.