No. 813,307. PATENTED FEB. 20, 1906.

F. E. KIP & F. M. ARMSTRONG.

WARP STOP MOTION FOR LOOMS.

APPLICATION FILED MAR. 3, 1905.

3 SHEETS—SHEET 1.

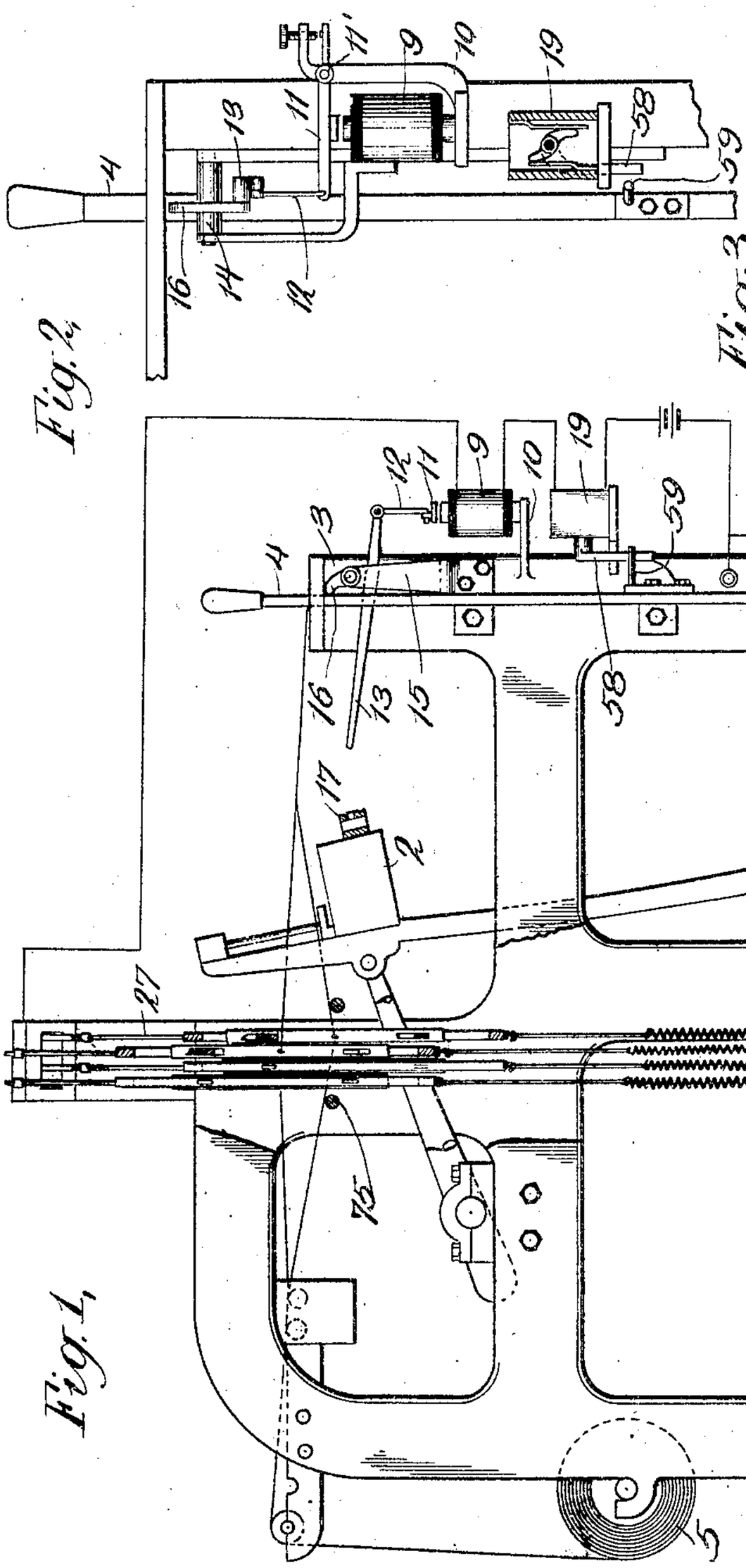

Fig. 1.

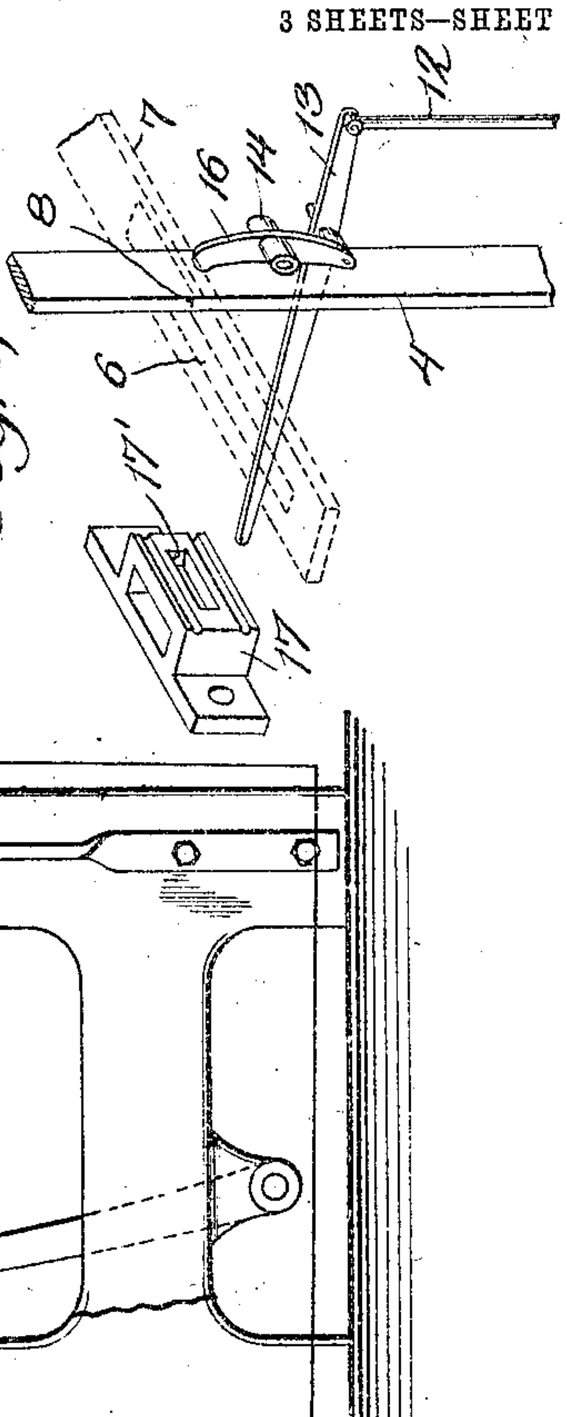

Fig. 3.

Fig. 2.

WITNESSES:

Grace L. Heasley.

Alexander S. Rodgman

INVENTORS

Frederic E. Kip

Frederick M. Armstrong

BY

Charles A. Jones

Their ATTORNEY

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3 SHEETS—SHEET 2.

Fig. 11,

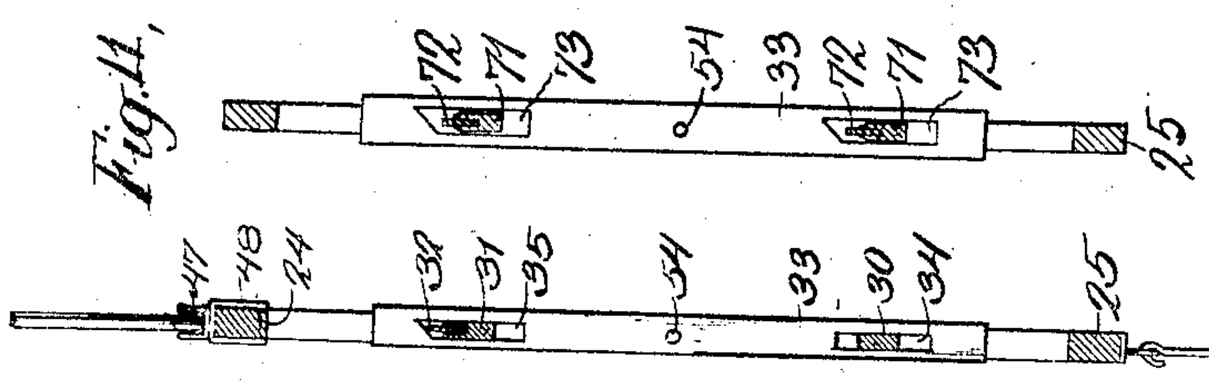

Fig. 3,

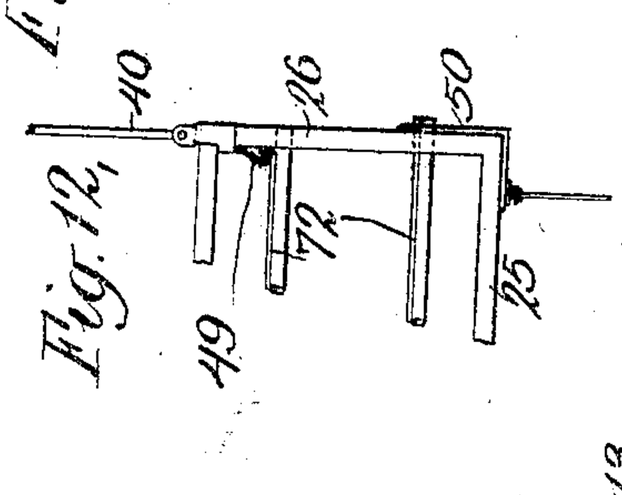

Fig. 4,

WITNESSES:

Grace L. Healey.

Alexander S. Hamilton

INVENTORS

Frederic E. Kip.

Frederick M. Armstrong

BY

Charles S. Jones

their ATTORNEY

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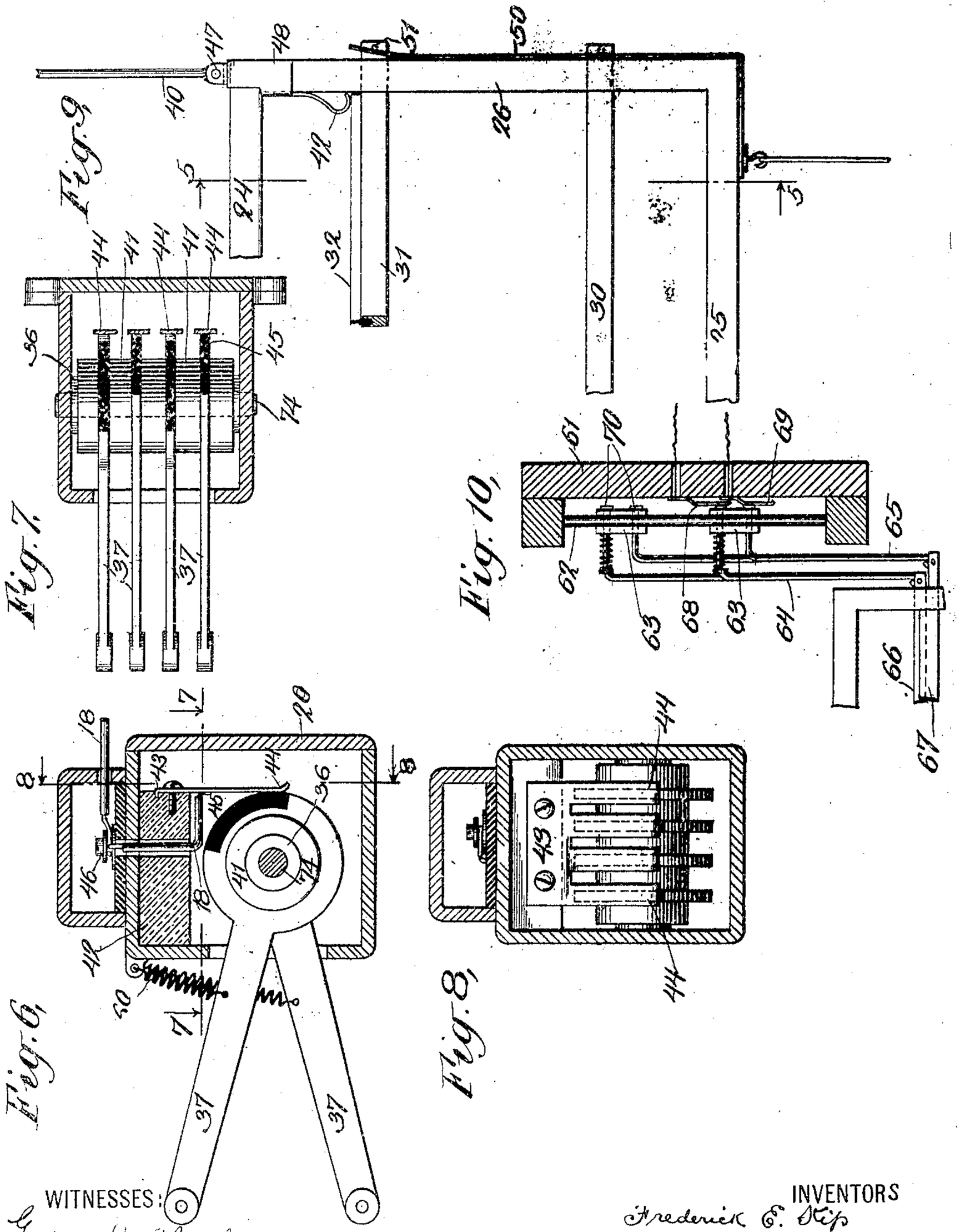
3 SHEETS—SHEET 3.



WITNESSES:
Grace L. Hearst
Alexander S. Rodman

INVENTORS
Frederick E. Kip
Frederick M. Armstrong
BY
Charles D. Jones
Their ATTORNEY

UNITED STATES PATENT OFFICE.

FREDERIC E. KIP, OF MONTCLAIR, NEW JERSEY, AND FREDERICK M. ARMSTRONG, OF PAWTUCKET, RHODE ISLAND, ASSIGNORS TO KIP-ARMSTRONG COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

WARP STOP-MOTION FOR LOOMS.

No. 813,307. Specification of Letters Patent. Patented Feb. 20, 1906.

Application filed March 3, 1905. Serial No. 248,261.

To all whom it may concern:

Be it known that we, FREDERIC E. KIP, a resident of Montclair, New Jersey, and FREDERICK M. ARMSTRONG, a resident of Pawtucket, Rhode Island, citizens of the United States, have invented certain new and useful Improvements in Warp Stop-Motions for Looms, of which the following is a specification.

The present invention relates to a warp stop-motion for looms contained in the harness and in which the formation of the shed is not only controlled by the heddles, but the latter also act to close an electric circuit upon the breakage or undue slackness of a warp-thread to set in operation the loom-stopping mechanism.

To that end the invention embodies, among other features, an electric circuit which is controlled in such manner as to be alternately opened and closed at two points by the heddle-frames as the latter are moved in the formation of a shed, one such point being within each harness-frame and the other without, the operation being so timed during the normal running of the loom that when the circuit is closed at one point it is broken at the other. The heddle or harness frames comprise as one of the lifting-bars for the heddles a compound electrode or terminal, with one member of which the heddles are in constant contact, and complete electrical engagement is made when the harness-frames are in an elevated position and also when a warp-thread breaks or becomes unduly slack, although in the former instance the loom is prevented from knocking off by the breaking of the circuit at the point outside of the frames.

The invention embraces other features herein described, and specifically pointed out in the claims, all of which will be understood by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of a loom, showing the application of the invention thereto, the loom-frame being broken away at parts. Fig. 2 is a front elevation of a portion of the left-hand end of the breast-beam. Fig. 3 is a perspective detail view. Fig. 4 is a diagrammatic view showing a portion of two of the harness-frames and the electrical circuit. Fig. 5 is a vertical sectional view of a heddle-frame on the plane of the line 5 5 of Fig. 9. Fig. 6 is a vertical sectional view through the compound switch. Fig. 7 is a horizontal section on the plane of the line 7 7 of Fig. 6. Fig. 8 is a vertical sectional view on the plane of the line 8 8 of Fig. 6. Fig. 9 is a front view of a portion of one of the harness-frames on an enlarged scale. Fig. 10 is a vertical sectional view of a modification, and Figs. 11 and 12 illustrate a further modification.

Similar reference-numerals indicate similar parts in the several views.

Referring to the drawings, the frame 1, lay 2, breast-beam 3, shipper-lever 4, and warp-beam 5 may be and are of the usual construction and arrangement in looms. The shipper-lever, as shown, occupies a slot 6 in a bracket 7, forming an extension of the breast-beam, and engages when the loom is running a shoulder 8. When freed from this shoulder, a spring (not shown) shifts the shipper-lever to stop the loom.

In order to set the shipper-lever free, an electromagnet 9 is mounted below the breast-beam on a bracket 10, secured by suitable means to the loom-frame, and its armature-lever 11, fulcrumed at 11′ on said bracket, is connected by a link or wire rod 12 to one end of a dagger 13. Pivotally supported by pins or studs 14 in a bracket 15, secured to the loom-frame, is a knock-off lever 16, attached at its lower end to the dagger 13 (see Fig. 3) and at its upper end adapted to engage the shipper-lever 4. The dagger 13 is normally in such position that upon the beat up of the lay it will enter an opening 17′ in the bunter 17, mounted on the lay, or some other vibrating or moving part of the loom; but when the magnet 9 is energized through the means hereinafter described the dagger is moved into such position as to be impinged upon by the face of said bunter, thereby moving the knock-off lever and freeing the shipper-lever and stopping the loom, as will be readily understood. In this case I have shown a form of bunter described in the patent of Allan A. Johnson, No. 778,132, dated December 20, 1904, as such bunter prevents the operative from interfering with the effectiveness of the knock-off mechanism, although any other suitable form of bunter could be used.

To set in motion the loom-stopping mech-

anism when a warp-thread breaks or becomes unduly slack, a controlling-circuit 18 is employed, which circuit includes a cut-out switch 19, the coils of the magnet 9, a compound switch 20, the latter outside of the harness-frames, but controlled thereby, and a compound terminal 21 within and forming a part of the harness-frames. The circuit is normally closed through the switch 19, and normally opened and closed alternately through the switch 20 and compound terminal 21—that is, during the normal operation of the loom when the current-circuit is closed through the compound terminal 21 by a heddle in electrical engagement therewith it is opened by the switch 20 for that particular heddle-frame, and, vice versa, when closed at the switch 20 the current-circuit will be opened at the compound terminal 21. The means by which the controlling-circuit is utilized when a warp-thread breaks or becomes unduly slack to stop the loom will now be described.

The heddle or harness frames, of which there may be any desired number, are composed of top and bottom bars 24 and 25, respectively, connected at or near their ends by side bars 26. They may be supported in any well-known and usual manner—as, for instance, by suitable straps connecting the upper bars 24 with actuating-levers, springs 28, secured to the lower bars 25 and to a fixed metallic plate 29, serving to pull the heddle-frames to their lowermost positions after having been raised by the straps and their actuating-levers. Rigidly secured to the side bars of each frame is a cross-bar 30, and above the same, near the upper part of the frame, is the compound terminal 21, also rigidly secured to the side bars 26. Said compound terminal is of well-known construction and comprises an electrical conductive body member 31, into one edge of which is set an electrical conductive strip or blade 23, properly insulated from the body member. The heddles or drop-wires 33 may be of any form adapting them to the desired purpose. As shown, they are made of thin metallic strips having a thread-aperture 54 and slots 34 and 35, through which slots the bar 30 and compound terminal 21, respectively, are passed and by which the heddles are hung or supported in the harness-frames on said bars and terminals. The thickness of the body members 31 of the compound terminals and the bars 30 are substantially equal to the width of the slots 35 and 34, so as to maintain the heddles in proper vertical position and in side contact with said members and bars, and the length of said slots is such as to permit of a slight vertical movement of the heddles independently of the movement of the frames. The upper wall of slot 35 is preferably inclined to insure good electrical engagement with the blade 32 of the compound terminal.

When the loom is running normally, the heddle-frames will act as usual loom-harnesses for the formation of the shed. When the harness-frame rises, the tendency of a warp-thread is to draw its heddle downward and into electrical engagement with the compound terminal. When the harness has dropped so far as to depress the threads which it controls below their normal level, then each of the threads which is intact or unbroken raises its heddle and supports it out of operative engagement with the compound terminal. If, however, one of the threads is broken, then its heddle will fall into electrical engagement with the compound terminal, and when the frame containing the broken thread reaches its lowermost position the circuit will be closed not only through the compound terminal, but also through the switch 20, and the current is thus free to flow through its completed circuit. If the circuit is not cut out at switch 20 at all times except when the frames are at their lowermost positions, then the loom would be stopped not only when the frames are at their highest points, but also when sufficiently raised to permit the heddles to hang loosely. In other words, when the loom is running normally and the circuit is closed through the compound terminal by the upward movement of the harness it must be broken at the switch 20. Each harness-frame with its heddles must, therefore, be an electrical unit, each containing in itself the electrical stopping elements and each provided with controlling devices to admit the electric current to these elements at the proper time and withhold it from them at all other times.

Referring more particularly to Figs. 6, 7, and 8, we have shown one form of switch cooperating with the harness-frames to secure the alternate opening and closing of the circuit when the circuit is respectively alternately closed and opened through the compound terminal. This switch 20 is constructed and connected to the harness-frames as follows: Within a suitable casing is a bearing 74, surrounded by an insulating-bushing 36. Upon said bushing are fulcrumed levers 37, of conducting material, as brass or steel, similar in construction and one for each harness-frame and each insulated from the others by fiber or other insulating washers 41. Supported within the casing is a block 42 of insulating material, to which is secured a metallic brush 43, having teeth or fingers 44 corresponding in number to the levers 37 and so mounted that one tooth presses against each lever. The brush 43 is sufficiently elastic to insure good electrical engagement between the teeth 44 and the levers 37. In the periphery of each lever 37 is set a strip 45 of insulating material, so that at certain times when the levers 37 are oscillated said strip will be brought beneath the contact-

tooth 44 to break or interrupt the circuit. The circuit-wire 18 is led into the switch-box 20 and connected to a suitable binding-post 46 and thence connected to the brush 43, as shown in Fig. 6. In order to connect the switch 20 both electrically and mechanically with the harness-frames, each lever 37 is pivoted at its outer end upon a pin 38, held in a suitable clip 39, secured to the upper end of a rod 40, said rod at its lower end being connected with the harness-frame by a spring-clip 47, which so pinches the rod 40 as to insure good electrical engagement at that point, or by any other suitable means. The spring-clip 47 is secured to a plate 48 on the harness-frame, and said plate has integral therewith or attached to it a spring-tongue 49 in contact with the blade 32 of the compound terminal. As shown in Fig. 9, the body member 31 of the compound terminal projects through the side bar 26 and alongside of or through an opening in a metal plate 50, secured to the harness-frame. The upper end of the plate 50 is sprung away from the frame normally when not connected with the compound terminal. To effect the connection, the plate 50 is sprung toward the frame and a pin 51 inserted into a hole in the member 31, the engagement of said plate and pin effecting a good electrical contact. The springs 28 are connected, through suitable means, to the metallic plate 50, and the circuit-wire 18, leading from one pole of the battery, is connected, through a binding-post, to the plate 29, to which the other end of the springs are connected.

The operation of the mechanism above described will be readily understood, and for the sake of clearness we will refer to only two harness-frames, assuming that at each pick of the loom the said two frames (shown in Fig. 4) are moved alternately, causing the threads carried thereby to be alternately moved into the upper and lower planes of a shed. As the heddle-frame 23 is lowered in the usual manner to move the warp-threads 53 to form the lower plane of a shed the tension of such warp-threads, if unbroken, will hold the heddles through which they pass out of contact with the blade 32 of the compound terminal, thus opening or breaking the circuit at that point. At the same time, however, the lever 37, secured to the frame 23, will be oscillated, so that the insulating-strip 45 of that particular lever will wipe from under the corresponding tooth 44 of the comb 43, thereby establishing electrical contact between said comb and the lever 37, as shown in the first lever at the top in Fig. 7, and closing the circuit for the frame 23 at that point. The reverse situation at such time is present in the harness-frame 22. In that frame, shown at its uppermost position, the tension of the warp-threads 52 holds the heddles in electrical engagement with the compound terminal 21, thereby closing the circuit at that point, while the lever 37, secured to the frame 22, is oscillated to bring its insulating-strip 45 beneath the corresponding tooth 44, thereby breaking the circuit at that point, as shown in Fig. 6, and the second lever from the top in Fig. 7. Thus it will be seen that the controlling-circuit has two points at which during the normal operation of the loom it is alternately broken and closed—one within the harness-frame and the other outside thereof—and that for a given harness-frame when the circuit is broken at one point it will be closed at the other. The parts described are so constructed and timed for normal operation of the loom that a given lever 37 does not make electrical engagement with its corresponding tooth 44 of the comb 43 until after the heddles of the harness-frame to which it is connected have been raised by the tension of the warp-threads out of contact with the plate 32 of the compound terminal. In other words, when the loom is running normally the circuit for a given frame should never be closed at the same time through the switch 20 and the compound terminal. As the frame begins to rise no movement will be imparted to the heddles, owing to the slight vertical play allowed them; but as the upward movement of the frame continues the compound terminal 21 will engage the upper walls of slots 35 in the heddles 33, and the latter will be raised with the frame to the limit of its upward movement, the tension of the thread acting to hold the heddles in electrical engagement with the compound terminal, as above described. When the frames begin to descend, such tension of the warp-threads will be maintained until at or about the time they reach their normal level, from which point to the lowermost position of the frame the tension of the warp-threads will tend to raise the heddles, so as to break the electrical contact at the compound terminal. The lower slot 34 is made longer than the upper slot 35 to insure good electrical contact between the compound terminal and a fallen heddle. Assume now that a warp-thread breaks when the frame 23 is at its lowermost position, its heddle falls and contacts with the blade 32 of the compound terminal. The circuit, when the frame containing the broken thread is at that position, is then closed through both the compound terminal and its corresponding tooth 44 of the comb 43 and may be readily traced from battery 55, cut-out switch 19, electromagnet 9, comb 43, tooth 44, and lever 37, corresponding to frame 23, rod 40, plate 48, tongue 49, blade 32, heddle 33, bar 31, plate 50, spring 28, plate 29 to battery. When the electromagnet 9 is thus energized, its armature-lever 11 is attracted and moves the dagger 13 into position to be impinged upon by the bunter 17 to thereby

stop the loom. If a thread should break when the frame is in its uppermost position, its heddle being already in contact with the blade 32, so as to close the circuit at that point, will remain in that position during the downward movement of the frame; but the stopping mechanism will not be thrown into action until the frame is moved to its lowermost position to bring the lever 37 of that frame into electrical engagement with its corresponding tooth 44 of the comb 43. Likewise if a thread should break when a frame is at an intermediate position the circuit will be immediately closed through the fallen heddle, and the compound terminal and the loom will be knocked off when the frame reaches its lowermost position, so as thereby to close the circuit through the switch 20.

When a loom is operated at high speed, the duration of the electric current through the circuit above described is so short as to amount to little more than an impulse, being just sufficient to move the magnet-armature and its connected dagger, but not sufficient to hold them in position to engage the dagger with the bunter and to stop the loom. We have therefore shown as a part of the present invention means to insure the maintenance of the dagger in position after it has once been set by the movement of the armature of the electromagnet 9 until it has engaged the bunter and until after the shipper-lever has been released and operated the cut-out switch 19, as hereinafter described. For that purpose the armature-lever 11 is included in a shunt-circuit 18', having a terminal 57 adapted to contact with said lever when the controlling-circuit 18 is closed and the electromagnet energized to stop the loom, as shown in Fig. 4. When the magnet-armature is drawn down, the shunt-circuit is thrown in, which insures that the armature shall remain down independently of any action of the switch 20. The magnet having been energized remains so until the loom is stopped, when by the armature resuming its normal position the shunt is thrown out of circuit.

In order to save the batteries, it is desirable that the circuit should be broken after the current has done the work required of it in moving and maintaining the dagger 13 in position to be impinged upon by the bunter 17. To effect this, we include any ordinary form of switch 19 (shown in section in Fig. 2) in the controlling-circuit 18, said circuit being normally closed through said switch. As here shown, the switch 19 is supported upon a bracket secured to the loom-frame and is provided with a lever 58 in contact with and adapted to be moved by a projecting arm 59 on the shipper-lever, said arm being connected so as to move said lever in both directions. When the controlling-circuit 18 is closed by a fallen heddle, the shipper-lever is released, as above described, and as said lever is moved the switch-lever 58 is moved so as to break the circuit at the switch 19. When the loom is again set in motion by moving the shipper-lever 4 into engagement with the shoulder 8, the lever 58 will be moved to close the circuit at switch 19.

In Fig. 6 we have shown springs 60 fastened to the levers 37 and to the switch-box 30 to assist the movement of said levers in either one direction or the other.

In Fig. 10 we have shown a modified form of switch which has been made the subject-matter of an application filed of even date herewith in the names of Frederic E. Kip and Ernest Greenwood, Serial No. 248,252. In this modification a block 61 is secured at any convenient point on the loom-frame, and preferably above the harness-frames, and vertically supported therein are guide-rods 62. Between these rods are mounted slide-blocks 63, through which are passed the bent upper arms of rods 64 and 65, said rods being connected, respectively, to the blade 66 and the body member 67 of the compound terminal. On the ends of said rods which project through the slide-blocks 63 are secured suitable shoes 70, adapted to contact with two spring-plates 68 and 69, to which the terminals of the controlling-circuit are connected. Said spring-plates are so positioned that the shoes 70 on the rods 64 and 65 will make electrical engagement therewith when the harness-frame is at or about its lowermost position, so that when in such position if a warp-thread should have been broken and its heddle thereby released, so as to close the circuit through the compound terminal, then the controlling-circuit will be closed at both points and the magnet 9 energized, as above described, to effect the stoppage of the loom. This modification is more particularly described in said companion application; but as it operates upon the same principle as the switch illustrated in Figs. 6, 7, and 8 the intention is to claim the invention generically in the present application.

An important feature of the present invention is that the closing of the circuit at a point within the harness-frames is effected by a gravity-drop. This very much simplifies both the construction and the mode of operation in that it dispenses with springs and clamping devices and the like which have heretofore been suggested as elements of a warp stop-motion. Furthermore, it permits of the use of a narrow vertically-arranged terminal heddle which occupies but little space and by which fluff and lint, which is liable to collect on the compound terminal, is prevented by reason of the circuit-closing heddle being above the warp.

While we have shown the switch 20 directly connected with the harness-frames, it is obvious that said switch may be operated through a connection with some other part

that moves in synchronism with the harness-frames, or it would be feasible to connect the shaft 74 with some other rotating member of the loom that is positively connected with the harness motion and in such manner that an arm or finger secured to the said shaft 74 would make contact with the comb 43 whenever the harness-frame is at its lowermost position.

In the construction shown in Figs. 4 and 5 the bar 30 of the harness-frame serves merely as a guide, the slot 34 is longer than slot 35, and the circuit is closed at the frame through the compound terminal. Figs. 11 and 12 show a modified construction in which we employ two guide-bars 71, made of wood or other insulating material, into which are set blades 72. of conductive material, and the slots 73 are made the same length. As shown in Fig. 12, the spring-tongue 49 contacts with the upper blade 72 and that the lower blade 72 is extended through the side bar 26 of the harness-frame to make electrical engagement with the metallic plate 50. When a warp-thread breaks or becomes unduly slack, the fallen heddle will rest upon both blades 72, and all the other parts remaining the same as described in connection with Fig. 4 the circuit can be traced from battery 55, switch 19, electromagnet 9, switch 20, rod 40, tongue 49, upper blade 72, heddle 33, lower blade 72, plate 50, to battery. During the normal running of the loom the heddles will be raised by the engagement therewith of both blades 72 instead of, as in Figs. 4 and 5, by the compound terminal only; but when the circuit is thus closed at the frame it will be broken at the switch 20 in the same manner as heretofore described.

In practice it may be found desirable to use adjacent to the loom-harness two rods 75 to prevent too great sag of the warp-threads due to the weight of the heddles. These rods are placed immediately below the plane of the lower shed, so that in the normal running of the loom a uniform plane will be maintained and the usual amount of sag of the warp-threads prevented from closing the circuit, and thus knocking off the loom.

Believing ourselves to be the first to provide a warp stop-motion comprising a heddle-bar included in the controlling-circuit and heddles having slots through which said bar is passed, the heddles performing the usual functions of a heddle and additionally serving as gravity drop devices to close the controlling-circuit to set in operation the stopping mechanism, we desire to claim the same broadly and without limitation to the specific details shown. By "heddle-bar" we mean a bar included in the controlling-circuit and passing through a series of drops. This bar may be a compound terminal or it may be a single terminal, the other being below or above it.

What we claim, and desire to secure by Letters Patent, is—

1. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a series of heddles suspended therein, a switch included in said circuit and located outside of said frame, and means to close the circuit at said switch when the frame is at or near its lowermost position.

2. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a series of heddles suspended therein, a switch included in said circuit and located outside of said frame, and means to break the circuit at said switch when the frame is at or near its uppermost position.

3. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a series of heddles suspended therein, a switch included in said circuit and located outside of said frame, and means to alternately close and break the circuit at said switch as the frame is at or near its lowermost and uppermost positions respectively.

4. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a plurality of harness-frames each having a series of heddles suspended therein, a switch included in said circuit and electrically connected to each of the harness-frames, and means to alternately close and break the circuit at said switch for each frame as it is at or near its lowermost and uppermost positions respectively.

5. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a series of heddles suspended therein, a switch included in said circuit and located outside of said frame, and means to operate said switch in synchronism with the movement of said frame so as to alternately close and break the circuit at said switch when the frame is at or near its lowermost and uppermost positions respectively.

6. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a series of heddles suspended therein, a switch included in said circuit and located outside of said frame, a connection between said frame and said switch whereby the latter is controlled to alternately close and break the circuit when the frame is at or near its lowermost and uppermost positions respectively.

7. A warp stop-motion for looms comprising a controlling-circuit for setting in operation the stopping mechanism, a harness-

frame having a heddle-supporting bar secured therein said bar being included in said circuit, and means comprising a gravity drop device for closing the circuit through said bar when a warp-thread breaks or becomes unduly slack.

8. A warp stop-motion for looms comprising a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a heddle-supporting bar secured therein above the warp said bar being included in said circuit, and means comprising a gravity drop device for closing the circuit through said bar when a warp-thread breaks or becomes unduly slack.

9. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame carrying a fixed contact-bar said bar being included in said circuit, a series of heddles suspended on said bar, said circuit being closed through said bar by the falling of a heddle when a warp-thread breaks or becomes unduly slack to set in operation the stopping mechanism.

10. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame carrying a fixed contact-bar, said bar comprising two members insulated from each other the terminals of said circuit being electrically connected respectively to said members, a series of heddles suspended on said bar, said circuit being adapted to be closed through said bar when a warp-thread breaks or becomes unduly slack to set in operation the stopping mechanism.

11. A warp stop-motion for looms comprising a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a heddle-supporting bar included in said circuit, heddles having slots through which said bar is passed, said circuit being closed through said bar by the falling of a heddle when a warp-thread breaks or becomes unduly slack to set in operation the stopping mechanism.

12. A warp stop-motion for looms comprising a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a heddle-supporting bar included in said circuit, heddles having slots through which said bar is passed, the point of suspension of said heddles being above the warp, said circuit being closed through said bar by the falling of a heddle when a warp-thread breaks or becomes unduly slack to set in operation the stopping mechanism.

13. A warp stop-motion for looms comprising a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a series of heddles therein, a supporting-bar for said heddles secured to the frame and included in said circuit, the tension of the warp-threads on the heddles during the normal operation of the loom alternately closing and breaking the circuit through said supporting-bar when the harness-frame is at or near its uppermost and lowermost positions respectively, said circuit also being closed through said bar by the falling of a heddle when a warp-thread breaks or becomes unduly slack to set in operation the stopping mechanism.

14. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame to which the terminals of said circuit are electrically connected, a bar electrically connected to said frame and carried thereby, and metallic heddles suspended in said frame and adapted when fallen to contact with said bar to close the circuit.

15. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a series of heddles suspended therein, said harness-frame being included in said circuit and means operative during the normal running of the loom to close said circuit at a point outside of said frame when said frame is at or near its lowermost position and at the same time to break the circuit through one of the heddle-supporting bars.

16. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a series of heddles suspended therein, said harness-frame being included in said circuit and means operative during the normal running of the loom to break said circuit at a point outside of said frame when said frame is at or near its uppermost position and at the same time to close the circuit through one of the heddle-supporting bars.

17. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame having a series of heddles suspended therein, said frame being included in said circuit, a switch also included in said circuit and located outside of said frame and means operative during the normal running of the loom to close the circuit at said switch when it is broken at a point within the harness-frame.

18. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame carrying a fixed contact-bar, a series of heddles suspended on said bar, said heddles being controlled by the tension of the warp-threads during the normal running of the loom to close and break the circuit through said bar when the frame is at or near its uppermost and lowermost positions respectively, and means to close and break said circuit at a point outside of the frame at the

time when it is broken and closed at said bar respectively.

19. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a harness-frame carrying a fixed contact-bar said bar being included in said circuit, a series of heddles suspended on said bar and controlled by the tension of the warp-threads to break and close the circuit when the frame is at or near its lower and upper most positions respectively, a switch located outside of said frame, and means to operate said switch in synchronism with said frame so that during the normal running of the loom the said circuit will be closed at the switch when it is broken at said terminal and broken at the switch when closed at said terminal.

20. A warp stop-motion for looms comprising a controlling-circuit for setting in operation the stopping mechanism, said circuit having two points at which it is alternately broken and closed during the normal running of the loom, one such point being within the harness-frame and the other outside thereof, and means to close the circuit at said outside point only when the frame is at or near its lowermost position.

21. A warp stop-motion for looms comprising a controlling-circuit for setting in operation the stopping mechanism, a harness-frame carrying a fixed contact-bar, said bar comprising a body member and a blade insulated from said member and projecting above the same, a series of heddles suspended on said bar, said circuit being adapted to be closed through said bar when a warp-thread breaks or becomes unduly slack to set in operation the stopping mechanism.

22. A warp stop-motion for looms comprising a controlling-circuit for setting in operation the stopping mechanism, a harness-frame carrying a fixed contact-bar, said bar comprising a body member and a blade insulated from said member, a series of heddles supported on said bar, a switch located outside of said frame and means to actuate the same to establish an electrical connection between the switch and said blade when the said frame is at or near its lowermost position, whereby said circuit will be completed by a fallen heddle contacting with said blade when the frame reaches said position.

23. A warp stop-motion for looms comprising a controlling-circuit for setting in operation the stopping mechanism, a harness-frame carrying a fixed contact-bar, said bar comprising a body member and a blade insulated from said member, a series of metallic heddles suspended on said bar, a switch to which one terminal of said circuit is connected located outside of said frame, an electrical connection between said switch and said blade, a plate on said frame of conductive material to which the other terminal of said circuit and said body member are connected, the said parts being so arranged that the circuit will be closed through said switch and said bar at the same time only when the frame is at or near its lowermost position.

24. A warp stop-motion for looms comprising a controlling-circuit for setting in operation the loom-stopping mechanism, a plurality of harness-frames, a switch having a plurality of levers included in said circuit and each harness-frame having connected thereto a corresponding switch-lever and each lever having a contact and a non-conducting face, and contact-fingers to which one terminal of said circuit is connected, the parts being so arranged that the circuit will be closed through said switch for a given frame only when said frame is at or near its lowermost position.

25. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, means for closing said circuit when a warp-thread breaks or becomes unduly slack, an electromagnet included in said circuit, a dagger connected to the armature of said magnet and means to hold said armature in its attracted position until after the loom has been knocked off.

26. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, means for closing said circuit when a warp-thread breaks or becomes unduly slack, an electromagnet included in said circuit, a dagger connected to the armature of said magnet, and a shunt-circuit adapted to be closed by said armature to maintain the coils of the electromagnet energized until after the loom has been knocked off.

27. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, a shipper-lever, an electromagnet and a contact-switch included in said circuit, a dagger connected to the armature of said magnet, means to hold said armature in its attracted position until after the shipper-lever has been released, and means on the shipper-lever to operate said cut-out switch to break the circuit after said lever has been released.

In testimony whereof we have hereunto signed our names in the presence of two subscribing witnesses.

FREDERIC E. KIP.
FREDERICK M. ARMSTRONG.

Witnesses to the signature of Frederic E. Kip:

ARTHUR OAKLEY,
ALFRED HOLROYD.

Witnesses to the signature of Frederick M. Armstrong:

STANLEY N. CHASE,
FREDERIC W. ENTWISTLE.