No. 813,309. PATENTED FEB. 20, 1906.

F. E. KIP & E. C. SMITH.

WARP STOP MOTION FOR LOOMS.

APPLICATION FILED OCT. 27, 1905.

3 SHEETS—SHEET 1.

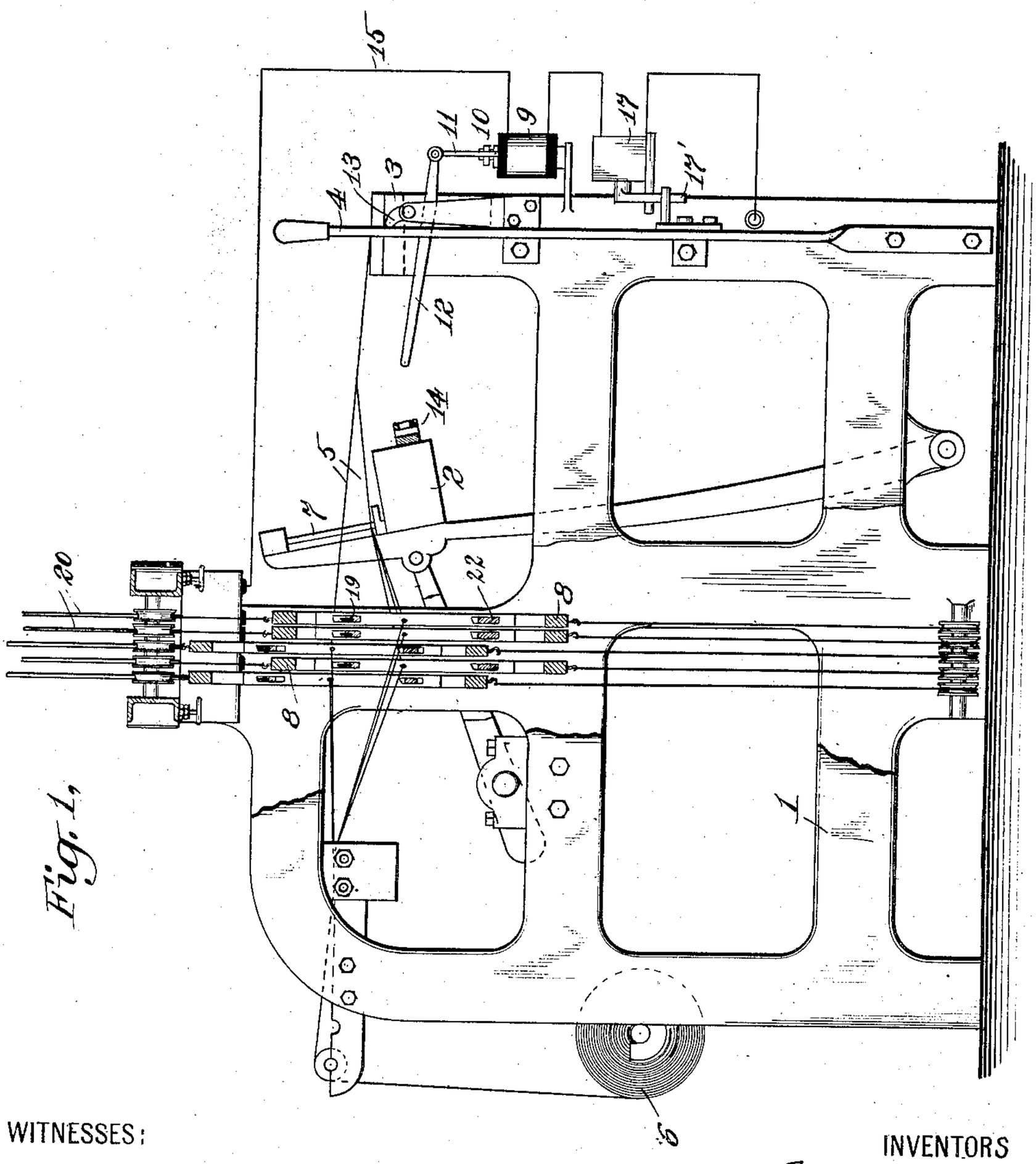

Fig. 1.

WITNESSES:

A. S. Williams.

Mary S. Avery.

INVENTORS

Frederic E. Kip

Edwin C. Smith

BY

Charles B. Jones

Their ATTORNEY

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3 SHEETS—SHEET 2.

Fig. 2,

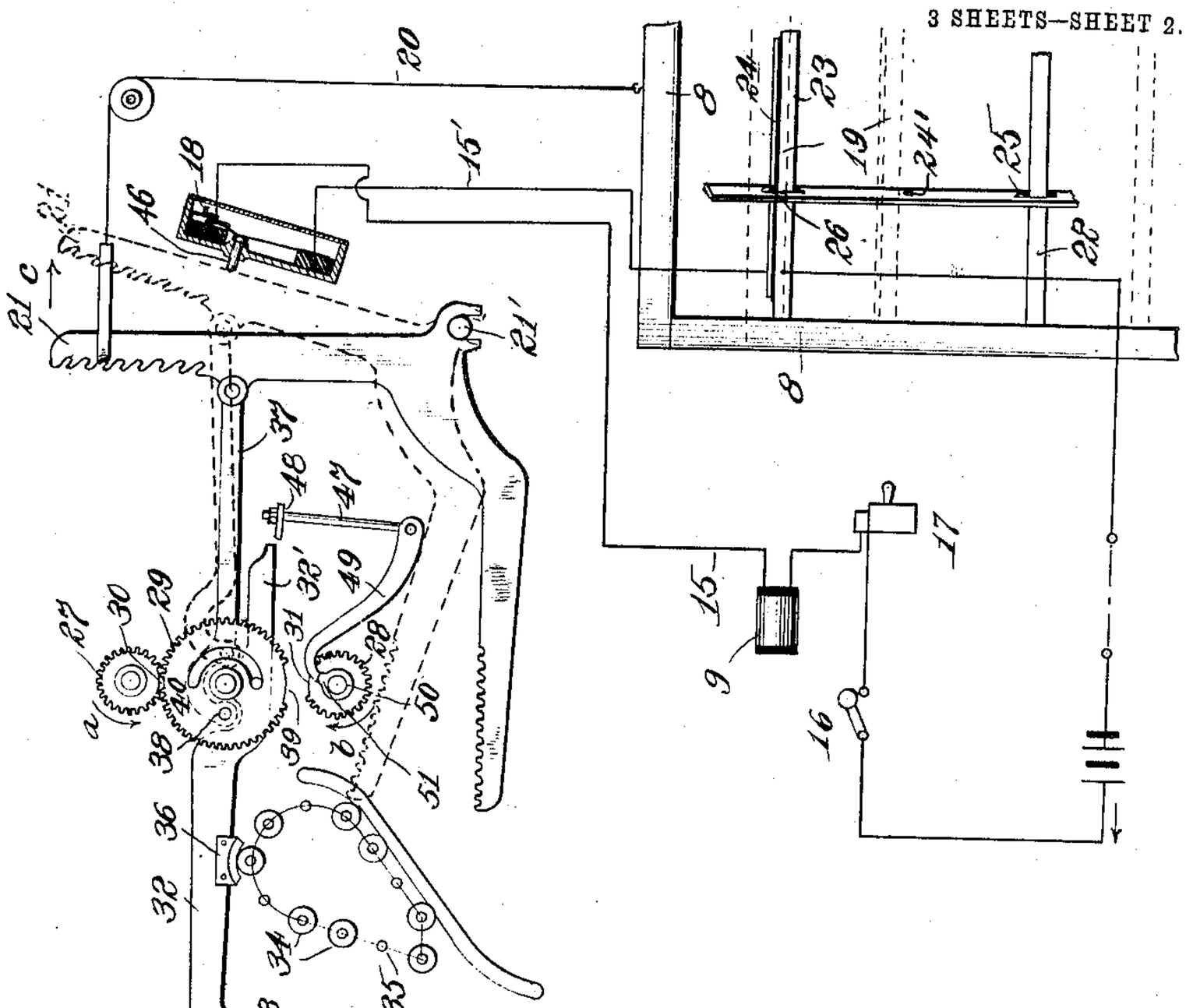

Fig. 3,

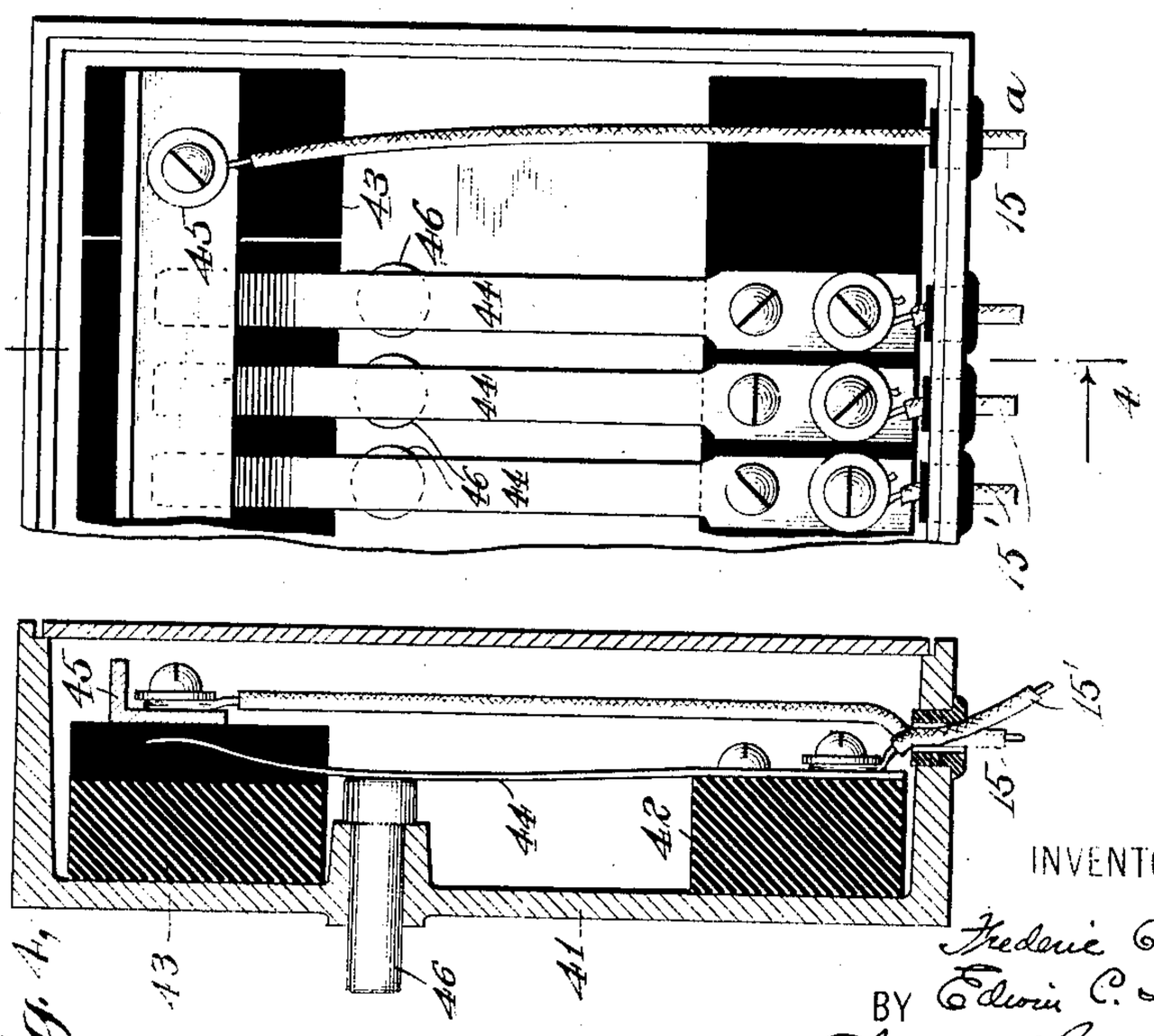

Fig. 4,

WITNESSES:

A. S. Williams.

Mary S. Avery

INVENTORS

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Edwin C. Smith

BY Charles A. Jones.

Their ATTORNEY

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3 SHEETS—SHEET 3.

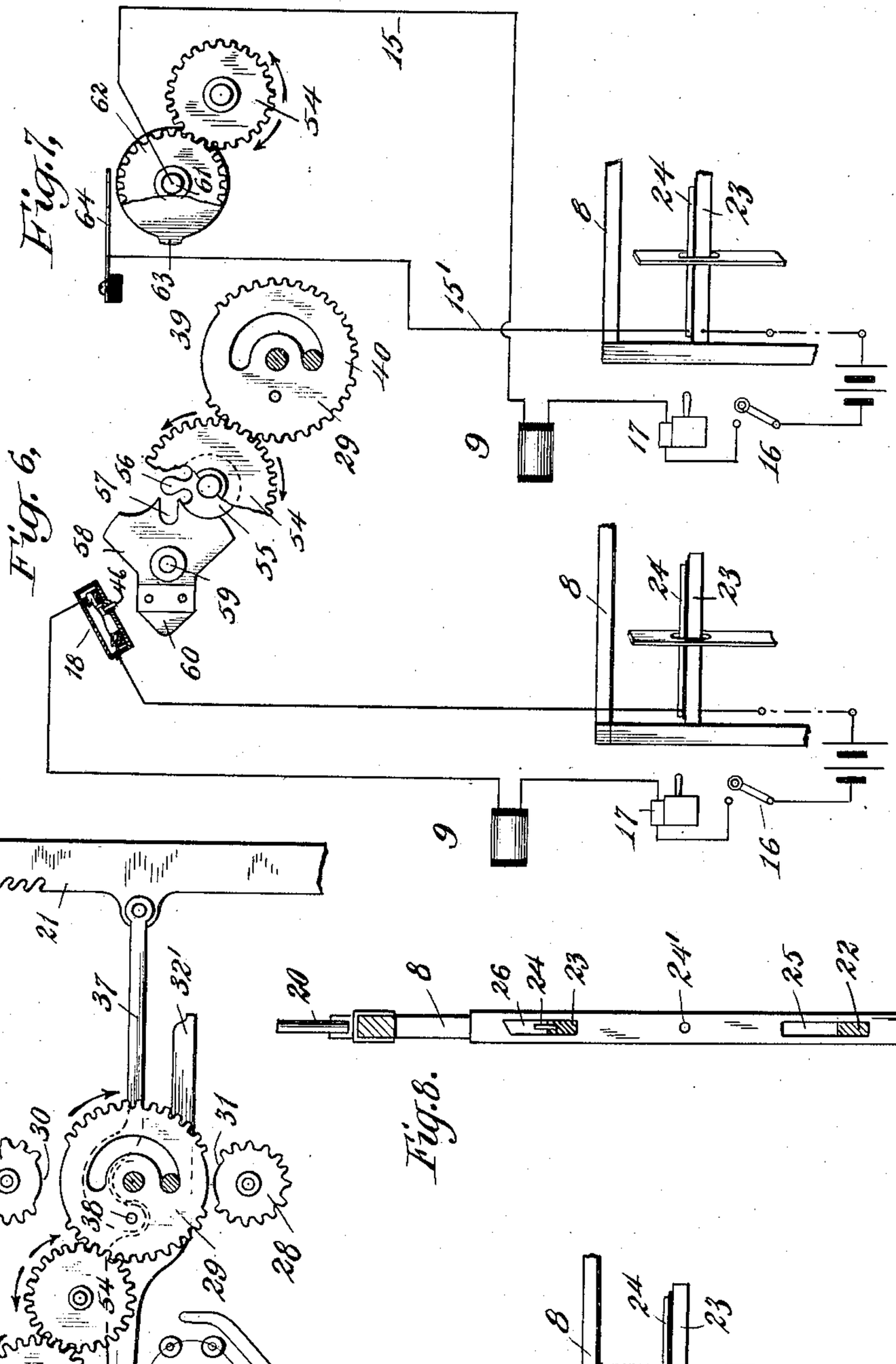

Fig. 1.

Fig. 6.

Fig. 8.

Fig. 5.

UNITED STATES PATENT OFFICE.

FREDERIC E. KIP, OF MONTCLAIR, NEW JERSEY, AND EDWIN C. SMITH, OF CENTRAL FALLS, RHODE ISLAND, ASSIGNORS TO KIP-ARMSTRONG COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

WARP STOP-MOTION FOR LOOMS.

No. 813,309. Specification of Letters Patent. Patented Feb. 20, 1906.

Application filed October 27, 1905. Serial No. 284,692.

To all whom it may concern:

Be it known that we, FREDERIC E. KIP, a resident of Montclair, county of Essex, State of New Jersey and EDWIN C. SMITH, a resident of Central Falls, State of 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 of the type described in the application for Letters Patent of Frederic E. Kip and Frederick M. Armstrong, Serial No. 248,251, filed March 3, 1905, in which the heddles perform their usual functions in the formation of the shed and additionally serve as gravity-drop devices to close a controlling-circuit to set in operation the stopping mechanism. The invention illustrated in that application comprises an electric circuit which is alternately opened and closed at two points during the normal running of the loom, one of said points being within the harness-frame and controlled by the tension of the warp-threads, and the other a switch outside the harness-frame and actuated in synchronism with said frame, the parts being so related that when the circuit is closed within the frame it will be opened at the point outside thereof, and vice versa, the circuit being closed at both points when a warp-thread breaks or becomes unduly slack, to thereby set in operation the stopping mechanism. In the specific embodiment of the invention the switch-levers were shown as mechanically connected to the harness-frames in such manner as to derive their movements from said frames. In the embodiment of the present invention the switch is not so connected, but is actuated directly by the pattern-forming mechanism. For the purpose of illustration and as a preferred use of the invention we have illustrated the same in connection with a dobby or head-motion loom. In the application of our invention to this type of loom the switch is so placed as to be directly under the control of the jacks or some other element of the harness-actuating mechanism.

The invention 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 detail view showing one of the jacks with its actuating mechanism and the relation of the switch thereto, the circuit being shown diagrammatically. Fig. 3 is a face view of the multiple-contact switch. Fig. 4 is a vertical section on the plane of the line 4 4 of Fig. 3. Figs. 5, 6, and 7 are detail views showing a part of the pattern-forming mechanism, illustrating various modifications in the manner of applying the invention; and Fig. 8 is a vertical sectional view of the harness-frame.

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

Referring to the drawings, the numeral 1 designates the frame of the loom; 2, the lay; 3, the breast-beam; 4, the shipper-lever; 5, the warps; 6, the warp-beam; 7, the reed, and 8 the harness-frame. These parts are of the usual construction and arrangement in looms. The shipper-lever 4, as usual, occupies a slot in a bracket forming an extension of the breast-beam and engages a shoulder when the loom is running. When freed from this shoulder, a spring shifts said lever to stop the loom, all as will be readily understood.

In order to set the shipper-lever free, an electromagnet 9 is mounted below the breast-beam, on a bracket secured by suitable means to the loom-frame, and its armature-lever 10, which is fulcrumed on said bracket, is connected by a link or wire rod 11 to one end of a dagger 12. Pivotally supported by pins or studs in a bracket secured to the loom-frame is a knock-off lever 13, attached at its lower end to the dagger 12 and its upper end adapted to engage the shipper-lever 4. The dagger 12 is normally in such position that upon the beat up of the lay it will enter an opening in a bunter 14, mounted on the lay or some other vibrating or moving part of the loom. When the magnet 9 is energized, the dagger is moved into such position as to be impinged upon by the face of said bunter, thereby moving the knock-off lever to effect the release of the shipper-lever. In the drawings we 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. Any

other suitable form of bunter, however, may be used.

In order to energize the magnet 9 when a warp-thread breaks or becomes unduly slack, a controlling-circuit 15 is employed, said circuit including the main loom-switch 16, a cut-out switch 17, the coils of magnet 9, a switch 18, the latter outside of the harness-frames and controlled directly by the harness-actuating mechanism, and compound terminals 19 within the harness-frames. The circuit when the loom is running is closed through the switches 16 and 17 and normally opened and closed alternately through the switch 18 and compound terminals 19. During the normal operation of the loom when the circuit is closed through a given compound terminal—that is, when the frame is at or near its uppermost position—the circuit will be broken at the switch 18 for that particular frame, and, vice versa, when closed at the switch 18 the circuit will be opened at the corresponding compound terminal 19—that is, when a frame is at or near its lowermost position.

The harness-frames, of which there may be any desired number, may be of the usual construction and supported in any well-known and usual manner. In Fig. 1 five frames are shown; but for convenience of illustration we have shown in the remaining figures but a single frame, it being understood that the frames are similar in constructions in all respects. As shown in the drawings, they are connected by straps 20 to jacks 21 of the pattern-forming mechanism. Rigidly secured to the side bars of each frame is a cross-bar 22, and above said bar, near the upper part of the frame, is a compound terminal 19, also rigidly secured to the side bars. Said compound terminal is of well-known construction and comprises an electrically-conductive body member 23, into the upper edge of which is set a blade 24, also of conductive material properly insulated from the body member. The heddles may be of any form adapting them to the desired purpose. As shown in Fig. 8 they are made of thin metallic strips having a thread-aperture 24′ and slots 25 and 26, through which slots the bar 22 and compound terminal 19, respectively, are passed. The thickness of the body members 23 of the compound terminals and the bars 22 are substantially equal to the width of the slots 25 and 26, so as to sustain 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 26 is preferably inclined to insure good electrical engagement with the blade 24 of the compound terminal. The lower slot 25 should be of such length and so disposed that there is greater possibility of movement of the cross-bar within said slot to insure the contact of the compound-terminal blade 24 with the heddle.

When the loom is running normally, the heddles will act as usual for the formation of the shed. When a harness-frame rises, the tension of the warp-threads draws the heddles downward and into electrical engagement with the compound terminal. When the harness-frames are lowered so far as to depress the threads which each controls below their normal level, then the threads which are intact or unbroken raise their heddles and support them out of electrical engagement with the compound terminal. If, however, one of the warp-threads is broken, then its heddles will fall into electrical engagement with the compound terminal, and when the frame containing the broken thread is at or near its lowermost position the circuit will be closed not only through the compound terminal of that frame, but also through the switch 18—that is, during the normal running of the loom when the circuit is closed through the compound terminal of a given frame by the upward movement of the frame it must be broken at its corresponding point at the switch 18, and, conversely, when broken through the compound terminal the circuit must be closed at the corresponding point in the switch 18.

For the purpose of actuating the switch 18 we have shown it so disposed as to be controlled by the pattern-forming or harness-actuating mechanism of a dobby-loom, and as this type is well known a brief description of the parts essential to the carrying out of our invention will be sufficient.

Referring more particularly to Fig. 2, we have shown one adaptation of the invention in which the switch is actuated directly by the movement of the jacks. In this figure we have shown one of the jacks 21 in connection with its harness-frame, all of the jacks being so mounted as to rock on the rod 21′. The mechanism for effecting the movements of the jacks, and consequently the corresponding frames, comprises two oppositely-rotating toothed rolls 27 and 28, (or "cylinders," as they are generally termed,) adapted at the proper time to impart a half-rotation to a gear 29, there being one such gear for each jack 21, and the toothed rolls 27 and 28 being of such length as to serve for all the gears 29. The toothed rolls 27 and 28 are connected by a train of gears to the main driving-shaft of the loom, the train being so proportioned as to properly time said rolls. The teeth on the rolls 27 and 28 do not extend continuously about the peripheries thereof, there being gaps or mutilated portions 30 and 31, respectively, as indicated in Fig. 2. These mutilated portions of the rolls are so related that both are inward toward the gear 29 or outward away from it at the same time.

Gear 29 is mounted on one end of a lever 32, the outer end of said lever being supported on a bar 33 in such manner as to permit said lever to swing upwardly or downwardly for the purpose of bringing the gear 29 into engagement either with the roll 27 or the roll 28. The desired shifting of the lever 32 is effected by the chain of rolls 34, which are driven preferably by intermittent gearing of the well-known "Geneva stop" type. As will be understood, there is not an individual chain for each harness-frame or for each jack, but one chain for all, the roll-spindles being of such length as to receive a number of rolls. The rolls 34 are disposed according to the desired shed formation, spacing-sleeves being inserted on the spindles where rolls are omitted—as, for instance, at 35. Fig. 2 shows twelve spindles on the chain, eight with rolls thereon and four without rolls, adapted to actuate one of the jacks 21. The chain is so moved that when the mutilated portion of either roll 27 or 28 is toward the gear 29 then there is beneath the bearing 36 on the lever 32 either a roll 34 or an empty spindle. When the former occurs, the lever 32 will be raised, so as to move gear 29 into engagement with roll 27, which is continuously rotated in the direction of the arrow *a*. Should there be no roll, as at 35, then as soon as its empty spindle comes under the bearing 36 the lever 32 will drop, if it has been raised by a roll next preceding, or will not be raised, but permitted to remain down, thus causing the gear 29 to engage the toothed roll 28, which is continuously rotated in the direction of the arrow *b* or opposite to the direction of rotation of the roll 27. These rotary movements of the gear 29 are communicated to the corresponding jack 21 through a link 37, connected at one end to said jack and at the other to a crank-pin 38 on the gear 29.

The gear 29 is mutilated at 39, and a tooth is also omitted at the point 40. The ratio of the number of teeth in the rolls 27 and 28 and in the gear 30 and the relation of the teeth to the mutilated portions of their peripheries are such that engagement of the gear 29 with either the roll 27 or 28 causes only a half-rotation of the gear 29. In the position shown in Fig. 2 the gear 29 has just been raised into position to mesh with the roll 27, the corresponding harness-frame 8, connected to the jack 21, being at its uppermost position. The gear 29 will then be rotated in a right-handed direction through substantially one hundred and eighty degrees or until the mutilated portion 39 thereof is brought diametrically opposite to the position indicated in said figure. The crank-pin 38 will therefore be thrown through one hundred and eighty degrees, shifting the link 37 and the jack 21 in the direction of the arrow *c* to the positions indicated in dotted lines, thus lowering the corresponding harness-frame 8. When the gear 29 is in mesh with the roll 28, then the latter will be rotated through substantially one hundred and eighty degrees in a left-handed direction, so as to shift the link 37 and its connected jack 21 to the position shown in full lines, thus raising the corresponding harness-frame to its uppermost position. Should there be successive rolls 34 on the pattern-chain, then the frame will be held in the position to which it was moved by the first one of the rolls 34—that is, its uppermost position. Similarly, should there be successive vacant spaces on the chain the frame will be held in its lowermost position. When a roll alternates with a vacant space, then the gear 29 will be alternately moved into mesh with the rolls 27 and 28, or, in other words, alternately lowered and raised.

In order that the switch 18 may act in synchronism with the movements of the frames, we have illustrated several simple, effective, and preferred arrangements whereby we utilize the movements of parts of the harness-actuating mechanism for directly actuating or controlling said switch. Thus in Fig. 2 the switch 18 is so disposed as to lie in the path of the jacks 21, so as to close the circuit at said switch when the corresponding harness-frame is lowered, it being remembered that at that time during the normal running of the loom the circuit is broken at the compound terminal 19 by reason of the tension of the warp-threads raising the heddles out of contact with the blade 24 of said terminal. A convenient form of switch that may be used in this connection is shown in detail in Figs. 3 and 4. It comprises a suitable casing 41, to which is secured two blocks 42 and 43 of insulating material. To the block 42 are secured spring contact-arms 44, one for each of the jacks 21, and to the block 43 is secured a contact-strip 45. The block 43 may be one piece extending from one end to the other of the casing, but cut away at the top to provide a clearance for the spring-contacts 44, or there may be two individual supports, one at each end of the casing, between which the strip 45 extends. The strip 45 is shown flanged or angular for stiffness, as it is quite long in some cases. The main circuit-wire enters the casing through an insulated bushing and is connected to the strip 45 by means of a binding-post, and the separate harness circuit-wires 15′ are connected by individual binding-posts to their respective spring contact-arms 44, the circuit being grounded in the loom-frame at any convenient point. Slidably mounted in bearings in the casing 41 are pins 46, preferably of non-conductive material, said pins at their inner ends bearing against the spring-contacts 44 and their outer ends projecting outside of the casing in position to be acted upon when the jacks 21 are moved to lower

the harness-frames, as indicated in Fig. 2. As the jacks on a dobby are from three-eighths to one-half inch apart, a multiple plunger-switch of the character described is efficient for the purpose, not liable to derangement, and, moreover, is extremely simple and inexpensive to manufacture.

The operation of the mechanism above described and the relation of the switch 18 to the movements of the harness-frames will be readily understood. As a given harness-frame 8 is lowered to move the warp-threads to form the lower plane of the shed the tension of said warp-threads if unbroken will hold the heddles through which they pass out of contact with the blade 24 of the compound terminal, thus opening or breaking the circuit at that point. At the same time, however, the corresponding jack 21 will contact with the projecting end of a pin 46, so as to force its spring-contact arm 44 against the strip 45, thus closing the circuit for that particular frame at the switch 18. The reverse condition obtains when the harness-frame is at or near its uppermost position. At that time the tension of the warp-threads will hold the heddles in contact with the blade 24 of the compound terminal, thus closing the circuit at that point, the circuit being broken through the corresponding spring-contact 44 as soon as the pressure of its jack 21 releases the pin 46, said pin being then projected outwardly, as indicated in Fig. 4, by the spring-arm 44. These operations occur during the normal running of the loom for each of the harness-frames, and, as will be readily understood, all frames which are at or near their lowermost positions having the circuit closed at the switch 18 and open at the compound terminal and all frames which are at or near their uppermost positions having the circuit broken at the switch 18 and closed at the compound terminal. The parts described are so constructed and timed for the normal operation of the loom that a given jack 21 does not contact with the corresponding pin 46 to close the circuit for that frame at the switch 18 until after the heddles of the harness-frame to which that jack is connected have been raised by the tension of the warp-threads out of contact with the blade 24 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 18 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; but as the upward movement of the frame continues the compound terminal 19 will engage the upper walls of slots 26 in the heddles and the latter will be raised with the frame to the limit of its upward movement, the tension of the threads 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 threads will tend to raise the heddles, so as to break the electrical contact at the compound terminal.

Should a warp-thread break when a given frame 8 is at its lowermost position, then its heddle will fall and will contact with the blade 24 of the compound terminal. The circuit when the frame containing the broken thread is at that position is then closed both through the compound terminal and its corresponding spring-contact arm 44 and may be readily traced from battery through coils of electromagnet 9, strip 45, spring-contact 44, blade 24, through the heddle to the body member 23 of the compound terminal to ground. When the electromagnet 9 is thus energized, the dagger 12 will be moved into position to be impinged upon by the bunter 14 to effect the stoppage of the loom, as already described.

Should a thread break when a given frame is at or near its uppermost position, its heddle being already in contact with blade 24, so as to close the circuit at the compound terminal, will remain in that position during the downward movement of the frame; but the stopping mechanism will not be thrown in operation until the corresponding jack 21 is moved into such position as to impinge against the pin 46 to force the spring-arm 44 into contact with the strip 45, when the circuit will be closed at both points. Similarly, if a thread should break when a frame is at an intermediate position the circuit will be immediately closed at the compound terminal and the loom will be knocked off when the frame is at or near its lowermost position.

Although we have shown in Fig. 2 a construction in which the pins 46 are impinged upon by the jacks, we do not desire to be limited to that precise detail of construction, as it is perfectly obvious that a form of switch may be employed in which the switch-levers may be connected directly to the jacks, so as to be positively moved in both directions—as, for example, a type of switch shown in the said application of Kip and Armstrong, referred to at the beginning of this specification.

To lock the lever 32 in its up or down position, there is provided what is termed a "vibrator" 47, at the upper end of which is a lock-plate 48. Connected with the vibrator is an arm 49, the toe of which bears on the hub 50 of the shaft of the roll 28. On this hub is a cam projection 51, which is circumferentially in line with the mutilated portion of the roll 28. When, therefore, the rolls 27 and 28 are in position to be engaged by the gear 29, the cam projection 51 has raised the

toe of arm 49 and withdrawn the lock-plate 48 from the extremity 32′ of lever 32. As soon as the proper meshing of the gear 29 with the roll 27 or 28 is secured then the cam projection 51 has wiped from under the toe of arm 49, thus permitting the lock-plate 48 to pass either above or below the extremity 32′ of lever 32, as the case may be, to hold said lever in position. The vibrator 47 is actuated by a spring (not shown) to hold it in engagement with lever 32.

In the preceding description the switch 18 is under the control of the jacks. It is, however, within our invention to place said switch under the immediate control of any other part of the pattern-forming mechanism. Thus in Fig. 5 is shown an adaptation of the invention which comprises a gear 52, carrying a projection 53 of non-conductive material which is adapted to engage a corresponding pin 46 of the switch 18 and to force said pin against its spring-contact arm 44 to close the circuit at said switch for a given frame at the proper time. In order to rotate the gear 52, an idler-gear 54 is mounted between the former and gear 29, these gears being so proportioned that as gear 29 makes its half-rotation, as before described, the gear 52 will make less than a complete rotation. As shown in Fig. 5, the projection 53 is so placed that it requires a rotation through two hundred and seventy degrees substantially in order to actuate its corresponding pin 46.

Fig. 6 illustrates a somewhat similar arrangement, except that the gear 52 is replaced by a Geneva stop-motion, a species of intermittent gearing. This comprises a single-toothed wheel 55, fixed to the idler-gear 54, the tooth 56 being adapted to engage a recess 57 in a sector 58, rotatably mounted on a shaft 59. The sector 58 is provided with a nose 60, which engages a pin 46 of the switch 18 to close the circuit, the parts being so timed that the idler-gear 54 will make approximately one-half rotation to each half-rotation of the gear 29 to effect the desired contact between the nose 60 and the pin 46.

Fig. 7 illustrates still another arrangement that may be employed in which the main circuit-wire 15 is connected to a stationary shaft 61, upon which is mounted a gear 62, said gear having a projection 63 of conductive material. The harness circuit-wire 15′ in this instance is connected directly to an arm 64, supported in an insulated bearing, said arm extending over the gear 62, so that the projection 63 will contact therewith when said gear is rotated by the gear 29 through the intermediate idler 54. The idler-gear 54 in this arrangement must be of non-conductive material, preferably fiber, and the shaft 61 will require insulation.

In the adaptation of the invention illustrated in Fig. 5 it is to be understood that each gear 29 will have a corresponding gear 52 with an intermediate idler 54, in Fig. 6 a corresponding Geneva stop, and in Fig. 7 a corresponding gear 62, and that in all of these forms the parts are so timed as to break the circuit at the switch when it is closed at the harness-frame—that is, when the corresponding frame is at or near its uppermost position—and to close the circuit at the switch when it is broken at the harness-frame—that is, when the corresponding frame is at or near its lowermost position. The manner in which the stopping mechanism is set in operation is therefore precisely the same as before described in connection with the arrangement illustrated in Fig. 2. The controlling-circuit also includes a cut-out switch 17, the circuit being closed through this switch during the normal running of the loom. When the circuit is closed to set in operation the stopping mechanism, as before described, the shipper-lever is released, and as such lever is shifted the switch-lever 17′ is moved, so as to break the circuit through the switch 17 immediately after the loom has been stopped. When the loom is again set in motion, the break in the circuit at the switch 17 will be closed.

By the term "dobby" or "head-motion" loom we mean any style or type of loom wherein the heddle-frames are operated by a pattern-forming mechanism, such mechanism being known by various names, such as "dobbies," "head-motions," "gem-heads," "engines," &c.

Being the first, as we believe, to provide an electrical warp-stop having a switch which is actuated directly by the pattern-forming mechanism, we desire to claim the same broadly without reference to the specific means for accomplishing the desired result.

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, pattern-forming mechanism, and means actuated directly by said pattern-forming mechanism for controlling the opening and closing of said switch.

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, pattern-forming mechanism, and means actuated directly by said pattern-forming mechanism to alternately close and break the circuit at said switch when the frame is at or near its lowermost and uppermost positions respectively.

3. In a warp stop-motion for looms the combination of a controlling-circuit for set-

ting in operation the stopping mechanism, a plurality of harness-frames each having a series of heddles therein, circuit-wires leading to each of said frames, a switch included in said circuit comprising contacts corresponding to the harness-frames, pattern-forming mechanism, and means actuated directly by said pattern-forming mechanism for closing the circuit through those contacts of which the corresponding frames are at or near their lowermost positions, and breaking the circuit through those contacts of which the corresponding frames are at or near their uppermost positions.

4. 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 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 thereat when the frame is at or near its lowermost and uppermost positions respectively, a switch included in said circuit, and pattern-forming mechanism for directly controlling said switch so that during the normal running of the loom the circuit will be closed at the switch when it is broken at said terminal and broken at the switch when closed at said terminal.

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 heddle-supporting bar included in said circuit, said circuit being closed through said bar by a fallen heddle when a warp-thread breaks or becomes unduly slack, a switch also included in said circuit, and pattern-forming mechanism for directly controlling said switch so as to close the circuit at said switch when the frame is at or near its lowermost position.

6. 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, a switch included in said circuit and having contacts corresponding to the harness-frames, pattern-forming mechanism, and means actuated directly by said pattern-forming mechanism for closing the circuit of a given frame when said frame is at or near its lowermost position, and for breaking the circuit when the frame is at or near its uppermost position.

7. In a loom the combination with the pattern-forming mechanism, of mechanism for stopping the loom, a controlling-circuit for said stopping mechanism, a switch included in said circuit, said pattern-forming mechanism comprising a gear-wheel and means for imparting thereto a half-rotation to lower or raise the corresponding harness-frame, and means actuated by said gear to control the closing and opening of said switch.

8. In a loom the combination with the pattern-forming mechanism, of mechanism for stopping the loom, a controlling-circuit for said stopping mechanism, a switch included in said circuit, said pattern-forming mechanism comprising a gear-wheel and means for imparting thereto a half-rotation to lower or raise the corresponding harness-frame, a jack connected to said gear, said switch being so disposed as to be controlled by the movements of said jack so as to close and break the circuit at said switch when the corresponding harness-frame is at or near its lowermost and uppermost positions respectively.

9. In a warp stop-motion for looms the combination of a controlling-circuit for setting in operation the stopping mechanism, harness-frames each having a series of heddles suspended therein, a switch included in said circuit, jacks to which said frames are connected, means for actuating said jacks to lower and raise the frames in the formation of the shed, said switch being so disposed as to be controlled by said jacks to close and break the circuit at said switch when the corresponding frames are at their lowermost and uppermost positions respectively.

10. 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 frame having a series of heddles suspended therein, a switch included in said circuit and having contacts corresponding to the harness-frames pattern-forming mechanism comprising gear-wheels and means for rotating the same, and means actuated by said gears to control the closing and opening of the corresponding switch-contacts.—

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

FREDERIC E. KIP.
EDWIN C. SMITH.

Witnesses as to signature of Frederic E. Kip:

OLIN A. FOSTER,
A. S. WILLIAMS.

Witnesses as to signature of Edwin C. Smith:

WILBER T. REYNOLDS,
MARGARET CHAMBERLAIN.