No. 681,165. Patented Aug. 20, 1901.

W. H. BAKER & F. E. KIP.

WEFT CONTROLLING AND REPLENISHING MECHANISM FOR LOOMS.

(Application filed May 15, 1901.)

(No Model.) 6 Sheets—Sheet 1.

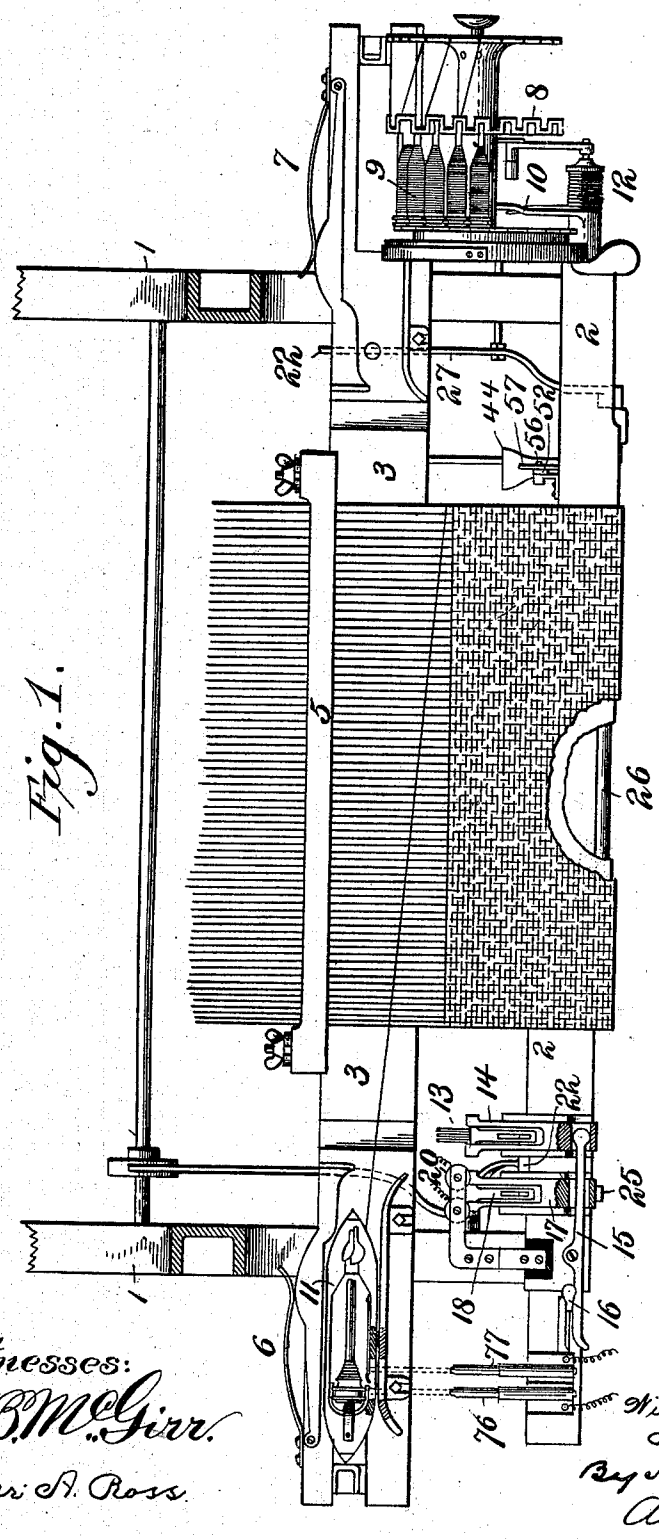


Fig. 1.

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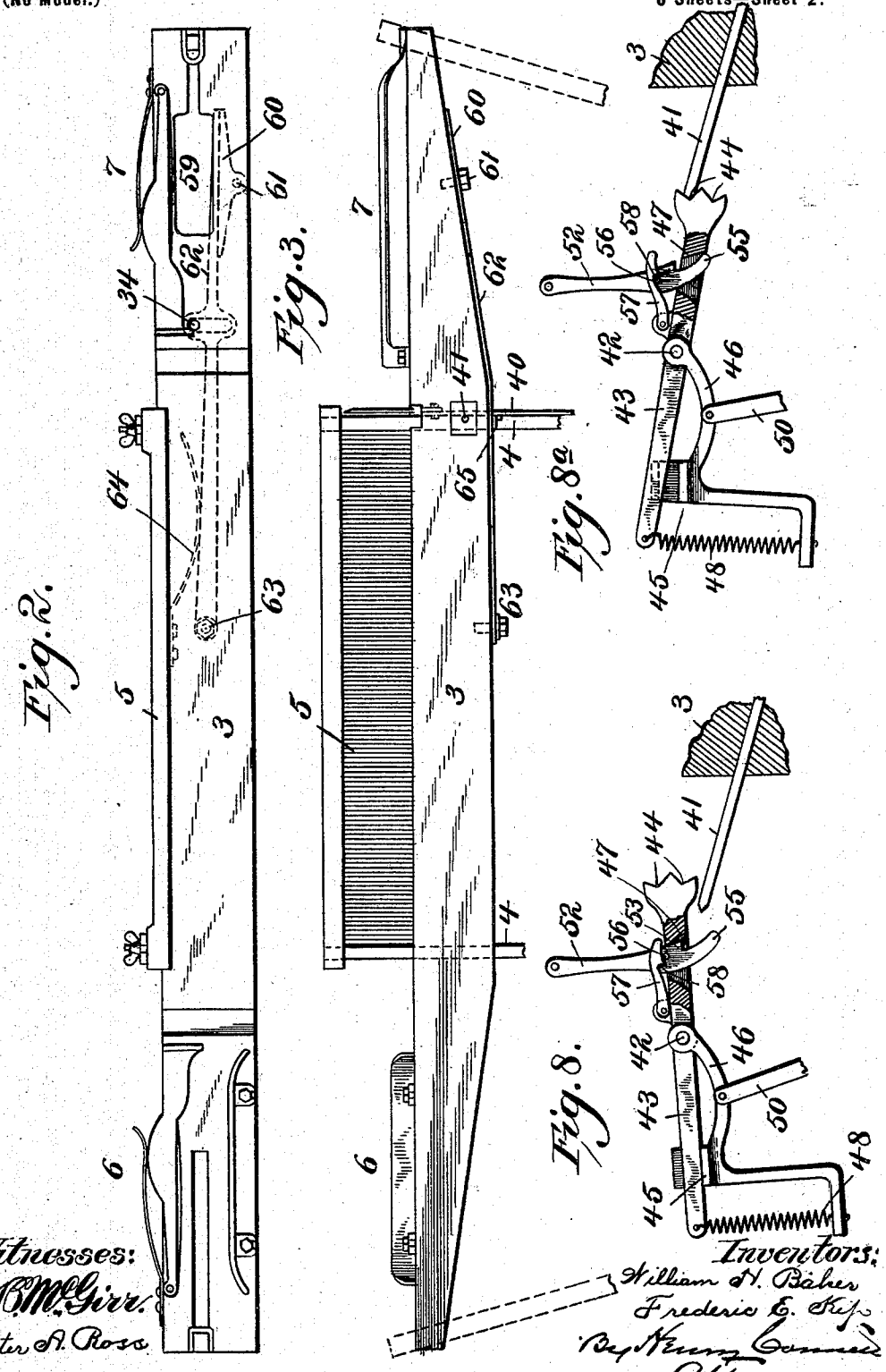
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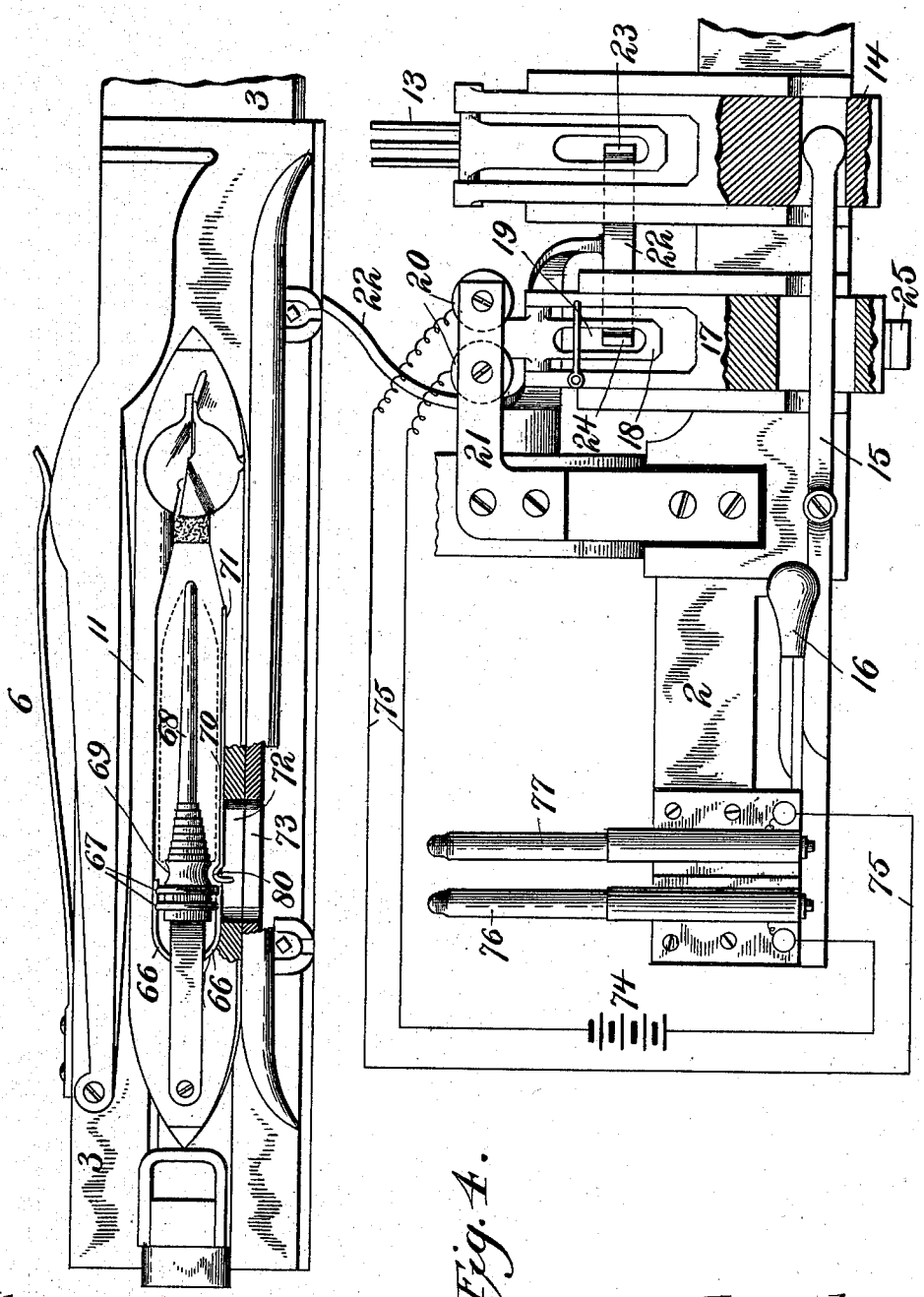


Fig. 4.

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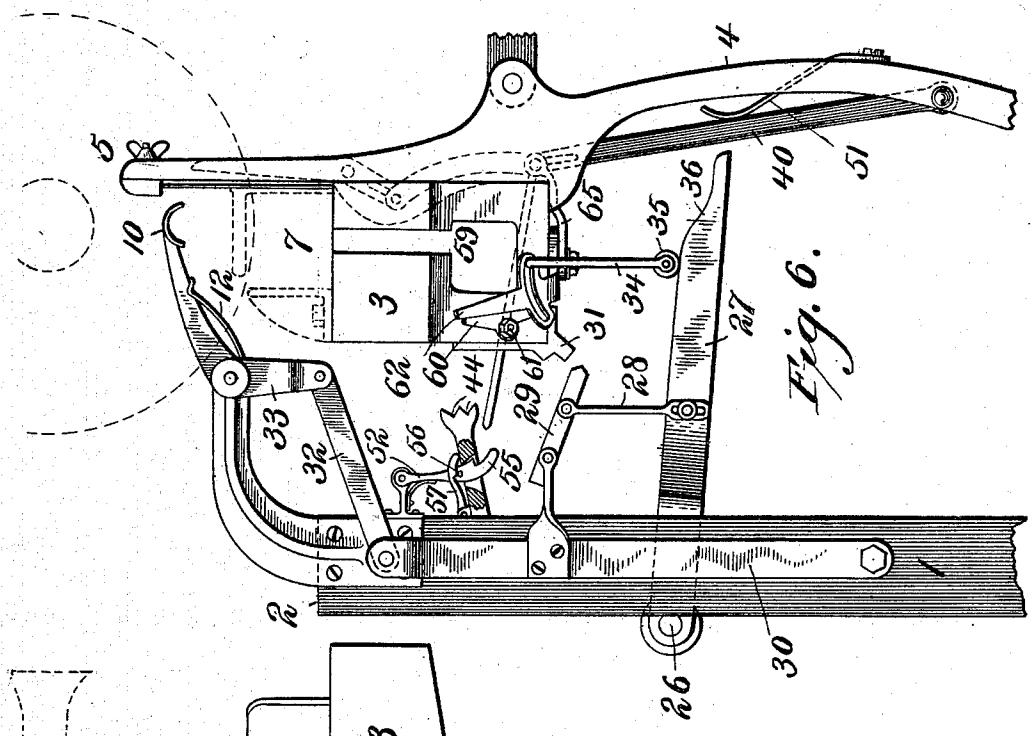


Fig. 6.

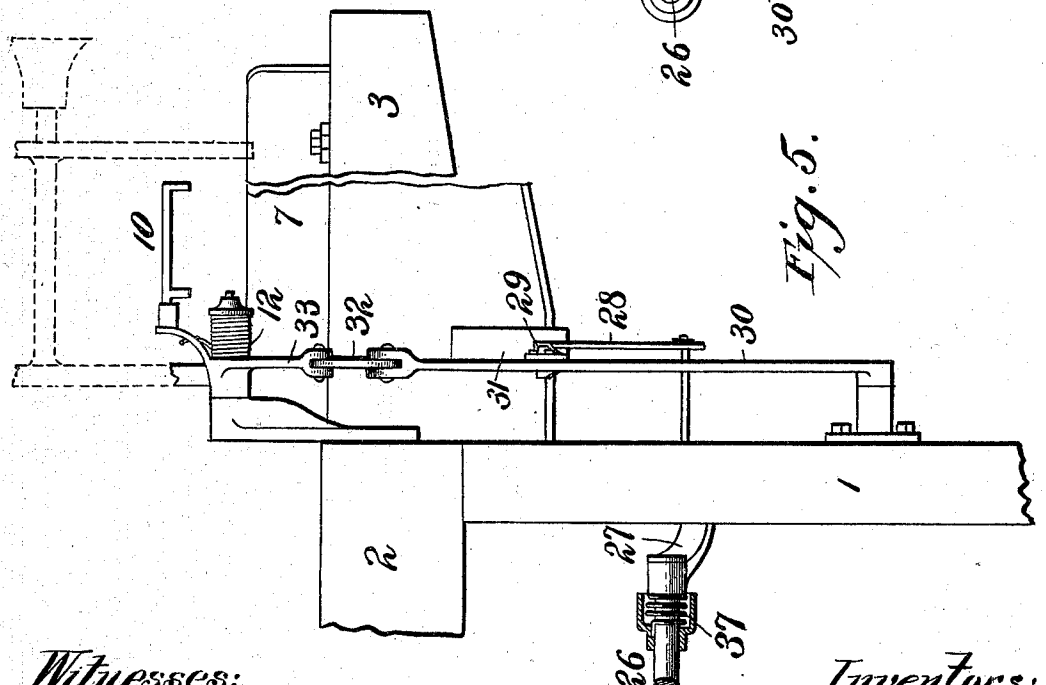


Fig. 5.

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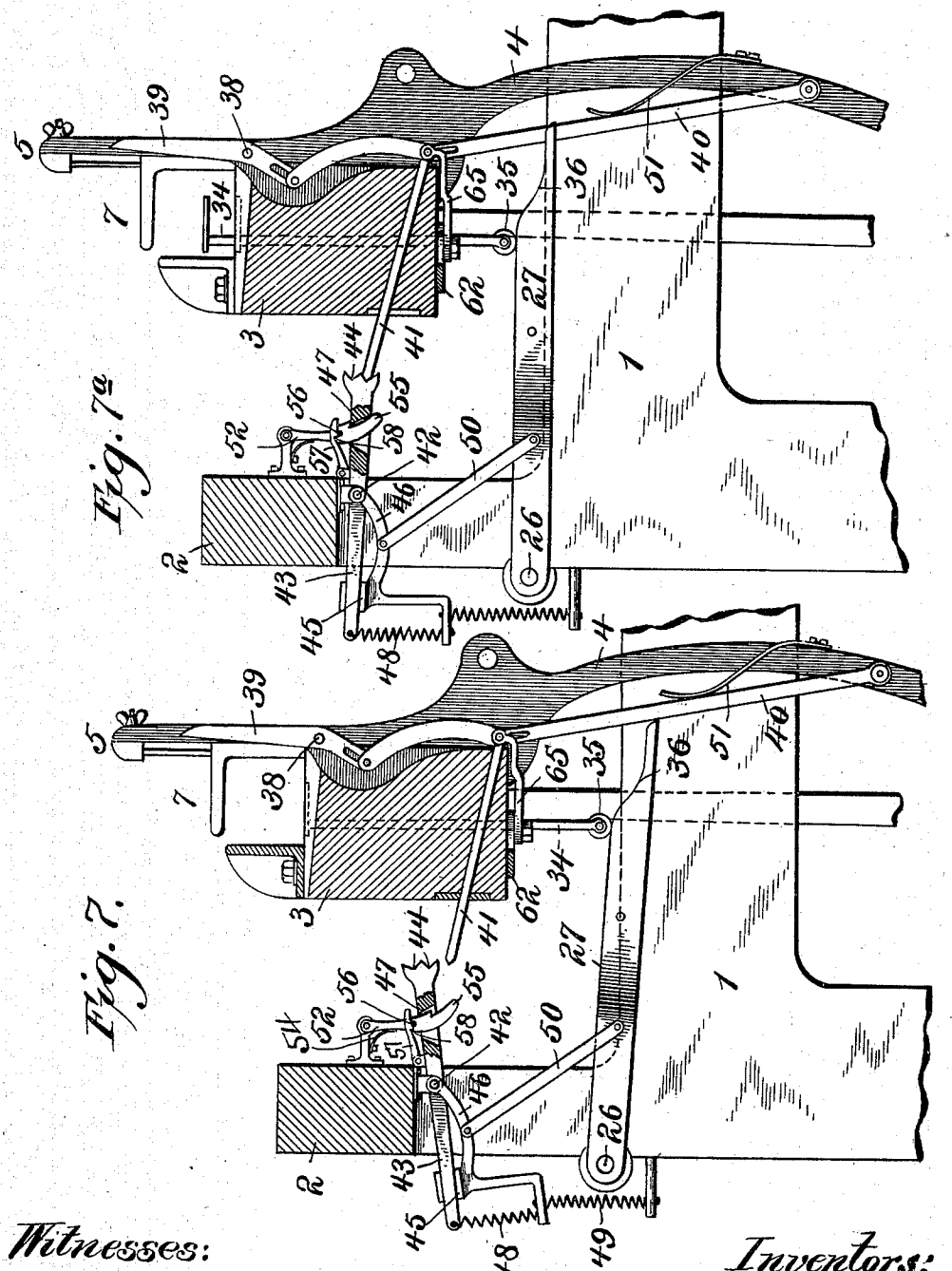
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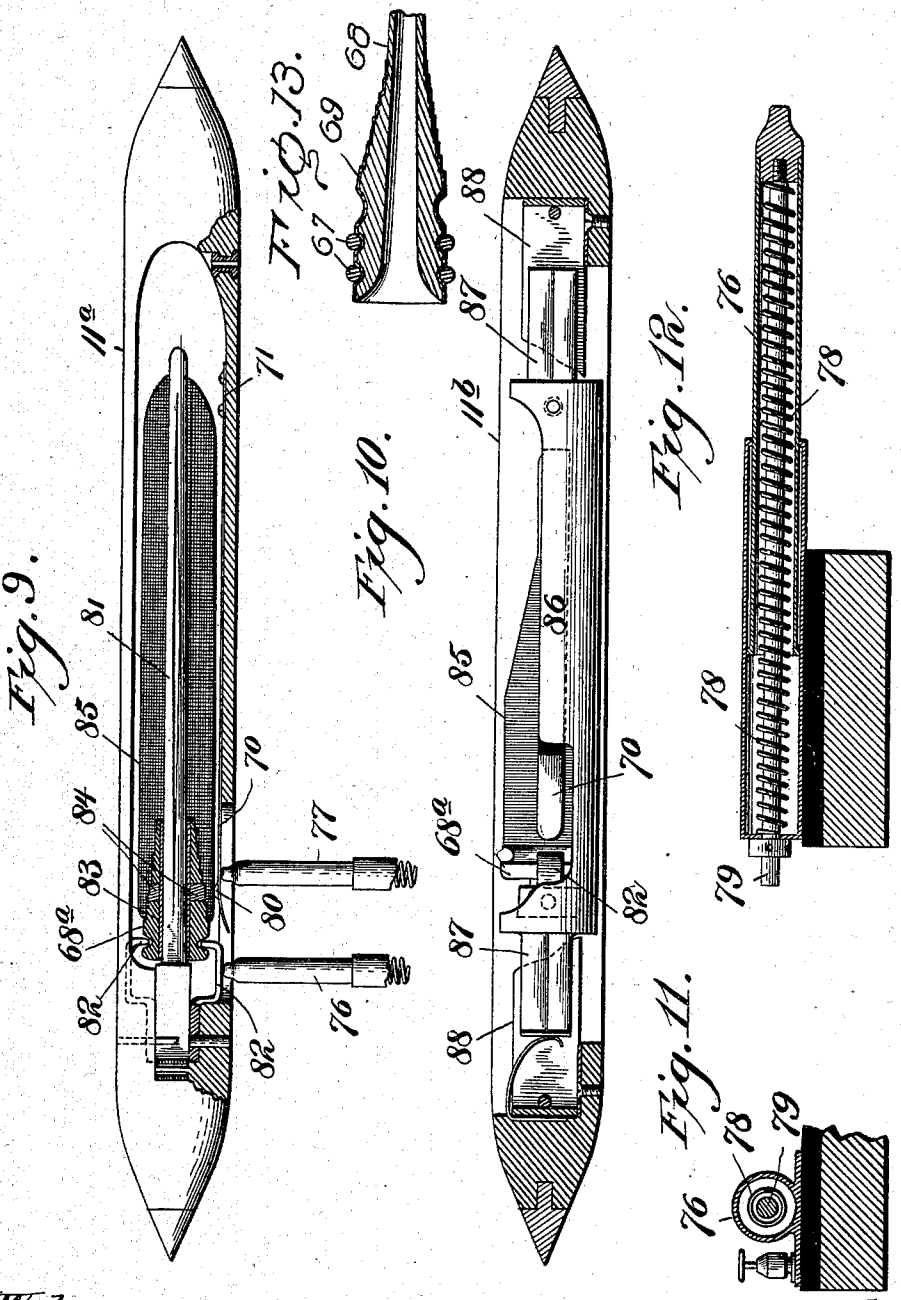
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WEFT CONTROLLING AND REPLENISHING MECHANISM FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 681,165, dated August 20, 1901.

Application filed May 15, 1901. Serial No. 60,274. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM H. BAKER, residing at Central Falls, Providence county, Rhode Island, and FREDERIC E. KIP, residing at Montclair, Essex county, New Jersey, citizens of the United States, have invented certain new and useful Improvements in Weft Controlling and Replenishing Mechanism for Looms, of which the following is a specification.

This invention relates to electromechanical means for controlling the weft or filling of looms, and is applicable to weft-replenishing mechanisms, to which it is herein shown as applied.

The invention also includes means for cutting or parting the weft-thread and weft end at proper times and means for holding the weft-thread coming from the discarded bobbin or weft-holder, so as to prevent it from being drawn into the shed by the shuttle on its next pick.

In the accompanying drawings, which serve to illustrate an embodiment of the invention, Figure 1 is a plan of the front part of a loom provided with our improvements, the view being broken away in parts to illustrate the construction. Fig. 2 is a plan view, and Fig. 3 a front elevation, of the lay and its appurtenances on the same scale as Fig. 1. Fig. 4 is a plan view, on a larger scale, of the parts seen at the left in Fig. 1. Fig. 5 is a front view, and Fig. 6 a side view, of that part of the loom where the magazine is situated, illustrating the mechanism for driving the bobbin from the magazine down into the shuttle. Figs. 7 and 7^a are similar sectional views illustrating the construction and operation of the weft-parting mechanism; and Figs. 8 and 8^a are similar detail views of the dagger devices which operate the knife or blade, representing the parts in different positions. Fig. 9 is a plan view of a shuttle, partly broken away, with the weft-holder in section, showing the adaptation of the invention to a shuttle-changing mechanism. Fig. 10 is a longitudinal section of a shuttle, illustrating the adaptation of the invention to a shuttle carrying a weft-case. Figs. 11 and 12 are detail views illustrating the two-pole-feeler terminals of the controlling-circuit; Fig. 12 is a cross-section, and Fig. a longitudinal section, of the terminal. Fig. 13 is an sectional view of the enlarged end of a bobbin, showing the metal thimble thereon in section.

Before proceeding to minutely describe the present invention it may be well to state that the loom, as herein shown, is provided with a suitable magazine to supply weft-holders to the active shuttle, as required, and that for convenience of illustration we have shown an intermittently-rotative magazine mounted on the loom-frame in a position to be directly over the shuttle-box at one side of the loom when the lay beats up and a driver for driving the bobbin down from the magazine into the shuttle, these features, the magazine and driver, being like those shown in the United States patent of Chace, No. 633,976, of September 26, 1899, and others.

The controlling means is electromechanical and employs a two-pole feeler, making contact through an interposed spring carried by the shuttle on the bobbin when the weft thereon is substantially exhausted, thus closing the circuit through an operating electromagnet, whereby the dagger is set for operating the driver of the replenishing mechanism at the next beating-up movement of the lay. When the weft-holder is driven out of the shuttle by the incoming weft-holder from the magazine, a gripper holds the strand of yarn still connecting the discharged and substantially exhausted bobbin with the shuttle and prevents this strand of yarn from being carried by the next pick into the warp-shed along with the yarn from the full weft-holder in the shuttle, thereby producing a fault in the goods; and the weft parter or cutter serves to sever both the weft-thread from the discharged weft-holder and the weft end from the freshly-supplied weft-holder.

The invention will now be described in detail.

1 is the loom-frame, and 2 the breast-beam, forming a substantial part thereof.

3 is the lay.

4 is one of the lay-swords.

5 is the reed on the lay.

6 and 7 are the two shuttle-boxes on the lay, the former at the left, wherein the two-

pole feeler plays, and the latter at the right, where the magazine is situated.

At the right-hand side of the loom, as herein shown, is situated the magazine 8, supported rotatively in brackets in a known way on the loom-frame and carrying bobbins or weft-holders 9. As this magazine and its appurtenances are well known in looms it will suffice here to say that the bobbins 9 rest at their ends in suitable bearings in the respective heads or ends of the magazine and are brought one by one by suitable and known mechanism into position over the shuttle-box 7, from which bearings they are driven by a driver 10 down into the running shuttle 11 in the box at intervals as the weft or filling in the shuttle becomes substantially exhausted. The driver is held normally in its elevated position by a spring 12 and is actuated to drive out the bobbin by means that will be explained more in detail and with especial reference to Figs. 4, 5, 6, 7, and 7ª.

13 is the ordinary weft-fork, and 14 its slide.

15 is the ordinary knock-off lever, and 16 the shipper-lever. These are common on many looms.

17 is a slide mounted on the breast-beam and carrying an armature-lever 18, in one arm of which is a slot 19. An electromagnet 20 is carried by a bracket 21 and has its poles located directly over the armature on the lever 18.

The weft-hammer 22 has two branches 23 and 24. The former actuates the slide 14 of the weft-fork, and the latter at proper times actuates the slide 17—that is to say, normally the armature falls away from the poles of the magnet 20, and thus elevates the slotted arm of the lever 18 above the vibrating branch 24 of the weft-hammer; but when said magnet is excited the slotted arm of the lever 18 is depressed, the branch 24 of the vibrating weft-hammer engages the slot 19, and the slide 17 is moved. In moving the end of said slide impinges on an upright arm 25 on a rock-shaft 26, which extends across the front of the loom and rocks said shaft. This shaft carries on its end, at the right-hand side of the loom, an arm 27, which is coupled by a link 28 to a dagger 29, pivotally hung on an upright arm 30, pivoted at its lower end 31 on the loom-frame. The rocking of the shaft 26 by the slide 17 under normal conditions elevates the arm 27, and this brings the dagger 29 up to such a position that when the lay beats up the end of the dagger is impinged upon by a dagger-bracket 31 on the lay, thus causing the dagger to swing the arm 30 forcibly. This arm 30 is coupled at its upper end by a link 32 to an arm 33, fixed on or to the driver 10, and thus the forcible and sudden movement of the arm 30 actuates the driver and causes it to descend and drive a weft-holder from the magazine down into the shuttle in the box below, the incoming weft-holder knocking out the substantially-exhausted holder from the shuttle. It may happen for some reason that the shuttle when picked from the opposite side will not properly enter the box 7—that is, will fall short of entering far enough to properly receive a weft-holder from the magazine when one is to be supplied. In such a case it is important to provide means for preventing the driver from being operated, and this means, which is in the nature of a precautionary device, will now be described.

Playing upright and loosely through an aperture in the lay at the proper point is a rod 34, which carries or may carry a roller 35 on its pendent lower end. Normally this rod drops until its head or upper end is flush with the raceway, Fig. 7, its lower end being in the same vertical plane with the arm 27, which has an inclined cam-surface 36 on its prolonged free end. As the lay swings to and fro normally the roller 35 swings over the depressed arm 27, Fig. 7, without touching it; but if said arm be elevated by the rocking of the shaft 26 the rod 34 will be driven upward. This may occur, of course, when the shuttle to be supplied with weft is properly "home" in the shuttle-box 7. If, however, the shuttle is not home, but over the upper end of rod 34, the latter cannot rise, and consequently the arm 27 cannot rise. Therefore the dagger 29 will not be elevated, and no bobbin will be driven out of the magazine by the driver. In order to permit the shaft 26 to rock without actuating the arm 27 when the latter is held down by the rod 34, the said arm has a stiff spring connection to the shaft 26, as seen in Fig. 5, the coupling-spring 37 being amply strong enough to lift the arm 27, the dagger 29, and the coupling-link 28. Normally the spring 37 is not under tension, and by its resistance to change by torsion it holds the arm 27 steady in its normal position with respect to the shaft 26.

The lay is provided with a weft parter or cutter which when the weft is replenished acts at two successive picks of the loom, or, more exactly, at two successive beats of the lay. The first action of the cutter is to sever the thread or yarn of the discarded weft-holder at or near the selvage, and the second action is to sever the weft end from the weft-holder just supplied to the running shuttle. This weft-parting mechanism will now be described with especial reference to Figs. 7, 7ª, 8, and 8ª.

Mounted pivotally on the lay at 38 is a knife or blade 39, which stands normally upright at the end of the reed and cuts down across the raceway into a slot in the lay. The heel of this blade below the pivot 38 has a slotted connection to the upper end of an operating-lever 40, fulcrumed at its lower end on the lay-sword. Mounted to play in an inclined bearing through the lay is a yielding or sliding dagger 41, the rear end of which has a slotted connection to the lever 40. When this dagger is driven rearward the effect is to drive

the blade 39 down forcibly and quickly, and it may be noted here also that when the dagger is driven back its front end descends a little owing to the inclination of its bearing. Fulcrumed on the under side of the breast-beam at 42 is a device 43, which we call a "dagger-lever," and which is provided at its rear end, where it is designed to impinge upon the yielding dagger 41, with two notches 44, one above the other. The front arm of this lever extends over a stirrup 45 on a stirrup-arm 46, hung on the same pivot with the dagger-lever. Springs 49 and 48 tend, respectively, to hold down the arm 46 and the lever 43, as clearly shown. A link 50 couples the stirrup-arm with the arm 27. Now it will be noted that when the arm 27 is elevated to put the dagger 29 in position for operating the driver on the next beat up of the lay the link 50 will elevate the arm 46, and with it the front end of the dagger-lever 43, thus depressing the front end of said lever to an extent to put its lower notch 44 in the path of the dagger 41, and when the lay beats up the effect will be to operate the blade 39 to cut off the weft thread or yarn connecting the discarded bobbin with the selvage; but the dagger 41 moves back in operating the blade, and in moving back, owing to its engagement with the lowermost notch in the end of the dagger-lever, it depresses this notched end of said lever, turning the latter about its fulcrum and raising its front arm above the stirrup 45. Now when the lay next recedes the dagger 41 of course withdraws and a suitable spring 51 returns the blade 39 to its normal upright position, and consequently means must be provided for holding the lever 43 depressed, so that on the next beat up of the lay the blade may be again operated. This detaining device is best seen in Figs. 7 to 8ª, and it consists of a pendent latch-detent 52, hung from the breast-beam above and provided with a shoulder 53 and a spring 54. This latch-detent depends through a slot in the lever 43, which slot has an inclined front end 47, upon which the curved end 55 of the latch may bear like a cam. In the side of the latch-detent is a stud or pin 56, and with this pin may engage at proper times a gravity-dog 57, mounted on the lever 43 and having a shoulder 58 to engage the pin 56. Normally the parts occupy the positions seen in Figs. 7 and 8. When the notched end of lever 43 is depressed through the elevation of the arm 27 and the stirrup-arm 46, the lower notch 44 is brought into the path of the sliding dagger 41, and on the next beat up of the lay this dagger is impinged upon and driven back, thus operating the blade 39 to sever the weft-thread from the discarded bobbin or weft-holder. As the inclined dagger 41 moves back it depresses the lever 43 (the spring 48 yielding) until the upper notch 44 therein is brought into the path of the dagger 41. Fig. 8ª shows the position of the parts when the dagger is in engagement with the upper notch 44. The depression of the lever 43 causes the shoulder 53 on the latch-detent 52 to take over the lever 43 and hold it depressed as the lay recedes, and when the lay next beats up the dagger 41 engages the upper notch 44 of the lever 43 and is driven back, thus causing the blade 39 to descend and sever the weft end from the fresh weft-holder supplied to the shuttle. The backward movement of the inclined dagger 41 in operating the blade depresses the lever 43 still farther, and the inclined front end 47 of the slot in the lever 43, acting on the hooked extremity 55 of the latch 52, presses the latter back until the shoulder 58 on the dog 57 engages the stud 56 on the latch and holds the latter back out of engagement. This is the position seen in Fig. 8ª. When the lay next recedes, the lever 43 flies up quickly under the influence of its spring 48 and trips the dog 57, thus allowing the parts to assume again their normal position.

The shuttle employed in this class of replenishing mechanisms is usually "self-threading," and when the bobbin is knocked down and out of it the thread from the bobbin still remains engaged in the eye of the shuttle, and the weft end from the incoming shuttle also passes into this eye. From this it frequently results that although the thread from the outgoing bobbin is cut or parted from the selvage of the goods in the loom, this thread is liable to be held by the shuttle and carried back into the warp-shed, thereby producing a fault in the fabric. To avoid the possibility of this occurring, a gripper is provided to seize and hold the thread from the discarded bobbin long enough to draw it from the eye of the shuttle when the latter is next picked. This gripper device, which is illustrated in Figs. 2, 3, 6, 7, and 7ª, will now be described.

On the under side of the lay, adjacent to the aperture (59 in Fig. 2) through which the bobbin falls from the shuttle, is a gripper-jaw 60, preferably pivoted at 61, so that it will adjust itself to the operative jaw 62 of the gripper, which is pivoted at 63. The jaw 62 is backed by a suitable spring 64, which keeps it pressed up elastically to the jaw 60 normally. The jaw 62 is coupled by a link 65 to the lever 40, which operates the blade 39, so that when the dagger 41 is first pressed back in severing the thread from the discarded bobbin the jaw 62 will be pressed back to the opposite side of the aperture 59, so that the discarded bobbin passes out and down between the jaws 60 and 62, and as the lay recedes the spring 64 will close the jaw 62 on the bobbin-thread and clamp it up to the jaw 60. Thus this thread will be held fast until the next pick of the shuttle frees the waste thread from the latter. One side of the shuttle-box 7 is omitted from Fig. 2, so as to better disclose in dotted lines the positions of the gripper-jaws.

The manner of closing the controlling electric circuit and the means employed in effect-

ing such closure will now be described, with especial reference to Figs. 1, 4, 11, and 12.

Referring first to Fig. 4, which shows the shuttle 11 and the bobbin or weft-holder therein, 66 designates the metal jaws in the shuttle, which grip metal rings 67 on the bobbin 68 in a known way. These rings embrace a metal sleeve or thimble 69 on the bobbin, which thimble may extend down over the tapered and stepped portion of the bobbin. This thimble is seen in section in Fig. 13. In the shuttle, at its side, is mounted a contact-spring 70, secured to the shuttle at 71 and its free end extending over or part way across an aperture or way 72 in the side of the shuttle. When the shuttle is in place in the box, this aperture 72 registers with a suitable opening or way 73 in the adjacent side of the box. The filling on the bobbin is indicated by dotted lines in Fig. 4.

Referring now to Figs. 4, 11, and 12 more especially, the contact devices or two-pole feelers will be described.

74 is a generator, and 75 represents the conductors, of an electric circuit which includes the magnet 20 and said generator. The terminals 76 and 77 of this circuit are mounted on and insulated from the loom-frame. These terminals are or may be alike, and one of them is illustrated in Figs. 11 and 12. To make the terminal yielding, it is formed, by preference, telescopic, of two tubes, one within the other, the distending means being a spring 78 and spring-rod 79, situated inside the tubular parts. These terminals are placed, as seen in Fig. 4, so that when the lay beats up the terminal 76 will impinge upon a jaw 66 (or some other metal part) and the terminal 77 upon the spring 70, pressing the latter in against the filling on the weft-holder. The apertures 72 and 73 in the shuttle and box open a way to one of the jaws 66, so that the terminal 76 may impinge thereon. Now so long as there is a predetermined quantity of filling in the running shuttle the operating-circuit will not be closed; but when the filling has been exhausted in the weaving down to a predetermined extent the circuit will be closed and the replenishing mechanism set for operation at the next beat up of the lay.

It may be explained here that in the construction of the contact devices seen in Fig. 4 the contact-spring 70 in the shuttle has or may have a slight contact protuberance 80 to touch the contact-thimble 69 when the filling is sufficiently exhausted, and this protuberance may be varied as to the extent of its inward projection to suit the varying conditions of the case. With some yarns and with some fabrics the mass of waste filling to be left on the bobbin will vary considerably. With other yarns no protuberance on the spring will be required, and we wish it understood that the condition of the spring can be varied in thickness, length, and shape to best suit the particular class of yarn being woven. What we have called a "protuberance" on the contact-spring or circuit-closer 70 may be, as shown in Fig. 4, a part of said spring bent or set out of line laterally with that part of said circuit-closer which bears on the weft in the shuttle.

One of the principal objections to the commercial use on looms of weft-replenishing mechanisms having feeler devices which denote the condition of the filling previous to its being entirely exhausted has been that no exhaustion-indicating feeler device has been produced with scope sufficient to permit it to be used equally well on wide and narrow looms or with fine, medium, or coarse weft and still leave in each of these varying conditions a minimum amount of weft or filling on the weft-holder. We have in our present device provided an exhaustion-indicating device which has the necessary scope and which by modifying the shape of the contact portion of the interposed circuit-closer may be used on any width of loom and with any count of yarn and still leave the minimum quantity of weft to prevent an imperfection in the fabric. We therefore consider this feature of our invention important and novel and desire to claim it broadly.

Our two-pole feeler or exhaust-indicator may be employed in connection with a weft-replenishing mechanism wherein the shuttle is changed—such, for example, as in our Letters Patent No. 636,704, of November 7, 1899; No. 637,195, of November 14, 1899, and Nos. 637,695 and 637,753, of November 21, 1899.

Fig. 9 shows a shuttle 11^a fitted up with our contact devices, the bobbin or weft-holder being mounted on a spindle therein. In this figure, which shows the weft-holder in section, 81 is the metal spindle in the shuttle, and this spindle is in electrical connection at its hinged end with the metal jaws or plate 82 in the shuttle. The spindle and the jaws 82 are common in shuttles. On the spindle is slipped a weft-carrier 68^a, which is a butt-cop, as shown in Fig. 9. In this cop is a metal tube 83 in contact with the spindle on the one hand and with the metal contact piece or stud 84 in the cop on the other hand. This stud 84 is normally covered with the weft or filling 85 on the weft-holder. Obviously the stud 84 is always connected electrically with the jaws 82 through the spindle. Within the shuttle, as in the case before described, is mounted the contact-spring 70, adapted to be impinged upon by the terminal 77, while the terminal 76 impinges upon one of the jaws 82 or some other metal part. The spring 70 in this case has its protuberance 80 adapted to impinge upon the stud 84 when the latter is uncovered by the filling.

Our two-pole feeler and contact devices may also be employed in a weft-replenishing mechanism where the weft-holder is mounted in a weft-case, and the latter, with its exhausted weft-holder, is driven out of the running shuttle in the manner previously explained with respect to a bobbin. Our Patents No.

633,944, of September 26, 1899, and Nos. 655,645 and 655,647, of August 7, 1900, will serve as showing examples of this class of weft-replenishing mechanisms. The adaptation of our invention to a weft-case is illustrated in Fig. 10, which shows the shuttle 11^b in longitudinal section. In this construction 86 is a weft-case having end pieces or journals 87, whereby it is mounted in jaws 88 in the shuttle. The weft-holder 68^a is mounted in the weft-case precisely as the weft-holder of Fig. 9 is mounted in the shuttle, and no special description will be required. It need only be said that the contact-spring 70 is mounted on the inner face of the weft-case and properly insulated therefrom, as both will usually be of metal. The weft-case will also be apertured or cut down at the side, so as to admit the terminals 76 and 77. It will be noted that the movable spring or intermediate circuit-closing part 70 is limited in its movements by the weft or filling in the running shuttle and positioned and controlled by the quantity of such weft or filling; also, that it insures the proper closure of the circuit so long as the shuttle is in the box at a point where the terminal feeler 77 may impinge upon some part of said circuit-closing spring. Being the first, as we believe, to employ such an intermediate circuit-closer on a weft-carrier in connection with a two-pole feeler to close the controlling-circuit of exhaustion-indicating devices in a loom, we claim the same broadly. The United States Patent of Chace, No. 633,976, of September 26, 1899, as well as our pending application, Serial No. 64,246, filed June 12, 1901, show like electromechanical exhaustion-indicating devices for controlling an automatic weft-replenishing mechanism and controlling mechanism for stopping the loom when the weft requires replenishing, and it will be obvious that our electromechanical exhaustion-indicating devices have the same extent orscope of application.

By "exhaustion," "absence," "substantial absence," or "denudation" as referring to the weft or filling in the shuttle we mean such degree thereof as will permit the circuit-changing means to operate while there is still sufficient filling in the shuttle to prevent an imperfection in the cloth being woven. By "bobbin" or "weft-holder" we mean any form of known weft-holder upon which weft or filling is placed for the purpose of feeding it to the web of the cloth.

Having thus described our invention, we claim—

1. In a loom, the shuttle having an aperture or way, a metal part or plate, and a movable circuit-closer, a weft-holder having a metallic part normally in electrical connection with said metal part or plate on the shuttle, and an electromechanical weft-replenishing mechanism, in combination with the controlling-circuit of said mechanism having a two-pole electromechanical feeler the terminals of which impinge respectively on said metal part or plate and said movable circuit-closer, substantially as set forth.

2. A loom having an electrically-controlled weft-replenishing mechanism; a two-pole feeler constituting the terminals of the controlling-circuit of said mechanism, and a shuttle or weft-carrier having a movable circuit-closer in the path of one of said terminals and mounted on the shuttle, said circuit-closer being limited in its movement and positioned by the filling in the weft-carrier.

3. In a loom, an electrically-controlled weft-replenishing mechanism, a two-pole feeler constituting yielding terminals of the controlling-circuit of said mechanism, a shuttle-box having an aperture or way, a shuttle having an aperture or way, a movable, spring circuit-closer carried by the shuttle for one of said terminals to impinge upon, and a metal part for the other terminal to impinge upon, and a weft-holder in said shuttle having a contact-piece normally in electrical connection with the said metal part on the shuttle and protected from contact with said movable circuit-closer by the filling on said holder.

4. In a loom, the shuttle having an aperture or way in its side, a metal part 66 and a movable spring circuit-closer 70 having a protuberance 80, and the weft-holder having a metal thimble or part 69, in combination with an electrically-controlled weft-replenishing mechanism, and the two-poled feeler constituting terminals of the circuit controlling said mechanism.

5. A loom having a weft-replenishing mechanism and means situated under the lay for automatically holding the thread from the discarded weft-holder until after the next succeeding pick, substantially as and for the purpose specified.

6. A loom having a weft-replenishing mechanism and means under the lay for automatically seizing and holding the thread from the discarded weft-holder until after the next succeeding pick, said means comprising a gripper the jaws of which are opened through the operation of said replenishing mechanism, and which are closed automatically by a spring, substantially as set forth.

7. A loom having a weft-replenishing mechanism, means for severing the thread connecting the selvage with the discarded weft-holder, and means for seizing and holding said severed thread until after the next pick of the loom.

8. A loom having a weft-replenishing mechanism, and means for severing the weft-thread of the outgoing weft-holder and the weft end from the incoming holder, at successive picks of the loom, said severing mechanism comprising a pivoted blade on the lay, an inclined, sliding dagger on the lay which actuates said blade, a dagger-lever which impinges on said sliding dagger, and means

for shifting said dagger-lever into and out of operative position.

9. In a loom, the combination with the lay, the blade 39 mounted pivotally thereon, the spring which holds said blade in its normal erect position, the operating-lever of said blade, and the inclined sliding dagger coupled to said lever, of the stirrup-lever 46, its stirrup and spring, the dagger-lever 43, supported on said stirrup and two notches 44 in its end, the spring of said dagger-lever, means for elevating said stirrup-lever in order to depress the notched end of the dagger-lever, and a detent device for holding said dagger-lever when depressed, substantially as set forth.

10. In a loom, the combination with the rock-shaft 26 and cam-arm 27 thereon, both forming a part of a weft-replenishing mechanism, of the lay, and rod 34, slidably mounted in the lay over the arm 27, and adapted to be lifted by said arm, so situated as to be under the shuttle at the replenishing side of the loom if the shuttle shall not be fairly in place in its box.

11. In a loom, the combination with an electrically-controlled weft-replenishing mechanism, and a feeler which forms one of the terminals of the controlling-circuit, of a shuttle having an aperture or way for the entry of said feeler, and an intermediate spring circuit-closer adapted to be impinged upon by said feeler and to close the controlling-circuit in the shuttle when the weft is sufficiently exhausted, said circuit-closer having its contact portion set out of line laterally with that face of the circuit-closer which bears on the weft in the shuttle.

12. In a loom, the combination with an electrically-controlled weft-replenishing mechanism, and a yielding feeler which forms one of the terminals of the controlling-circuit, of a shuttle having an aperture or way for the entry of said feeler, an elongated movable circuit-closer in the path of said feeler and between it and the weft in the shuttle, whereby said weft serves to hold the circuit open normally but permits it to be closed by substantial exhaustion, and coöperating circuit-closing means in the shuttle.

13. In a loom, the combination with a weft-replenishing mechanism, of the controlling electric circuit thereof provided with telescopically-constructed terminals, and a shuttle containing circuit-closing means adapted to close the circuit through said terminals when the weft of the shuttle is substantially exhausted.

14. In a loom, an electromechanically-actuated weft-replenishing mechanism, the terminals of the circuit of which are yieldingly and telescopically constructed, in combination with a shuttle carrying two metal contacts adapted to be impinged upon, respectively, by said yielding terminals at the vibratory movement of the lay, one of said contacts being movable and held, normally, out of contact with the other by the weft in the shuttle.

15. In a loom, the combination with an electric circuit containing a magnet, a two-pole feeler constituting the terminals of the circuit thereof, and a shuttle having a movable circuit-closer mounted on the shuttle and in the path of one of said terminals, said circuit-closer being limited in its movement by the filling in the shuttle.

16. In a loom, the combination with an electric circuit containing a magnet, a two-pole feeler constituting yielding terminals of the controlling-circuit thereof, a shuttle-box having an aperture or way, a shuttle having an aperture or way, a movable spring circuit-closer carried by the shuttle for one of said terminals to impinge upon, and a metal part for the other terminals to impinge upon.

17. In a loom, the combination with an electric circuit including a generator and magnet, of a shuttle provided with a weft-holder having circuit-closing means, and provided also with a yieldingly-sustained conductor or circuit-closing piece, means exterior of said shuttle adapted in the operation of the loom to press against said circuit-closing piece, said circuit-closing piece having its free end directed toward the butt-end of the weft-holder, said circuit being held inoperative by the presence and made operative by the substantial absence of the weft or filling in the shuttle.

18. In a loom, an electrically-controlled weft-replenishing mechanism, a shuttle having a weft-holder to contain weft and provided with circuit-changing means, said shuttle also having a yieldingly-sustained conductor or circuit-closing piece, means exterior of said shuttle adapted in the operation of the loom to press against said circuit-closing piece, said circuit-closing piece having its free end directed toward the butt-end of the weft-holder, said circuit being held inoperative by the presence and made operative by the substantial absence of the weft or filling in the shuttle.

19. In a loom, the combination with a weft-replenishing mechanism, an electric circuit including a generator and electromagnet, a terminal of said circuit constituting a feeler, of a shuttle, having an aperture in its side for the entry of said feeler, and a yieldingly-sustained conductor or circuit-closing piece which extends lengthwise of the shuttle across said aperture, the free end of said circuit-closer being directed toward that end of the shuttle where the holding devices for the bobbin or filling-holder are situated.

20. In a loom, the combination with an electric circuit and a two-pole feeler constituting yielding terminals of said circuit, a shuttle-box having an aperture, a shuttle having an aperture, a movable, spring circuit-closer carried by the shuttle for one of said terminals to impinge upon, and a metal part for the other terminal to impinge upon, and a weft-

holder in said shuttle having a contact-piece normally in electric connection with the said metal part on the shuttle, and protected from contact with said movable circuit-closer by the filling in the shuttle.

21. In a loom, the combination with an electric circuit and a feeler which forms one of the terminals of the controlling-circuit, of a shuttle having an aperture or way for the entry of said feeler, and an intermediate spring circuit-closer adapted to be impinged upon by said feeler and to close the controlling-circuit in the shuttle when the weft is sufficiently exhausted, said circuit-closer having its contact portion set out of line laterally with that face of the circuit-closer which bears on the weft in the shuttle.

22. In a loom, the combination with an electric circuit and a feeler which forms one of the terminals of the controlling-circuit, of a shuttle having an aperture or way for the entry of said feeler, an elongated movable circuit-closer in the path of said feeler and between it and the weft in the shuttle, whereby said weft serves to hold the circuit open normally but permits it to be closed by substantial exhaustion, and coöperating circuit-closing means in the shuttle.

23. In a loom, the combination with an electric circuit including a magnet and generator, the terminals of said circuit being telescopically and yieldingly sustained, and a shuttle containing circuit-closing means adapted to close the circuit through said terminals when the weft of the shuttle is substantially exhausted.

24. In a loom, the combination with an electric circuit, including a generator and electromagnet, a terminal of said circuit constituting a feeler, of a shuttle provided with a yieldingly-sustained conductor or circuit-closing piece to be impinged upon by the said feeler in the operation of the loom, said circuit-closer having its free end, where the contact is made, directed toward that end of the shuttle where the bobbin-holding devices are mounted.

25. In a loom, the combination with an electric circuit, including a generator and electromagnet, a terminal of said circuit constituting a feeler, of a shuttle having an aperture in its side for the entry of said feeler and a yieldingly-sustained conductor or circuit-closing piece which extends lengthwise of the shuttle across said aperture, the free end of said circuit-closer being directed toward that end of the shuttle where the holding devices for the bobbin or filling-holder are situated.

26. In a loom, the combination with an electric circuit, including a generator and electromagnet, a terminal of said circuit constituting a feeler, of a shuttle provided with a yieldingly-sustained conductor or circuit-closing piece to be impinged upon by the said feeler in the operation of the loom, said circuit-closer having its free end, where the contact is made, directed toward the butt of the weft-holder in the shuttle, and the said weft-holder provided with a contact-piece.

In witness whereof we have hereunto signed our names, this 14th day of May, 1901, in the presence of two subscribing witnesses.

WILLIAM H. BAKER.
FREDERIC E. KIP.

Witnesses:
HENRY CONNETT,
PETER A. ROSS.