No. 681,869.

Patented Sept. 3, 1901.

# E. E. BROWN.

## WITCH LOOM.

(Application filed Nov. 5, 1898.)

(No Model.)

2 Sheets—Sheet 1.

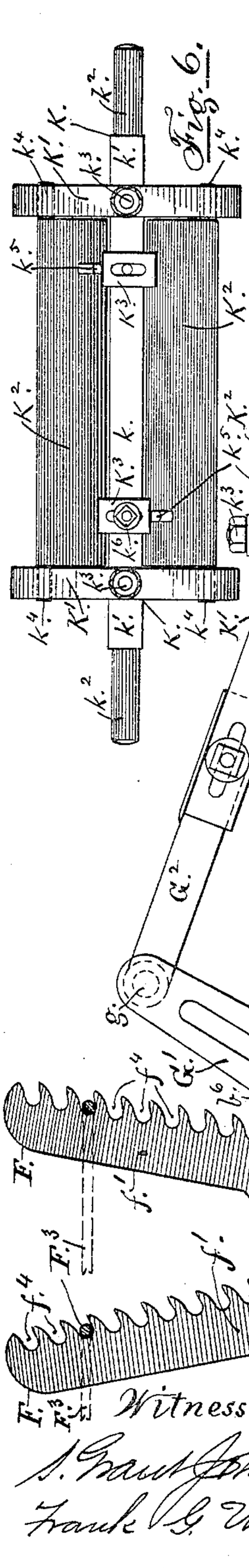

Fig. 6.

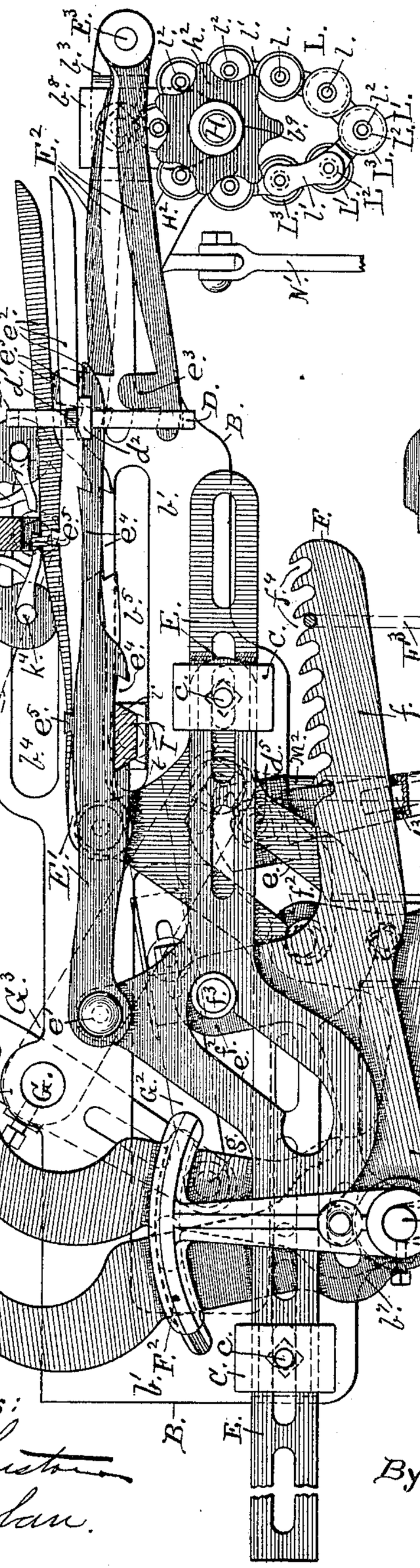

Fig. 1.

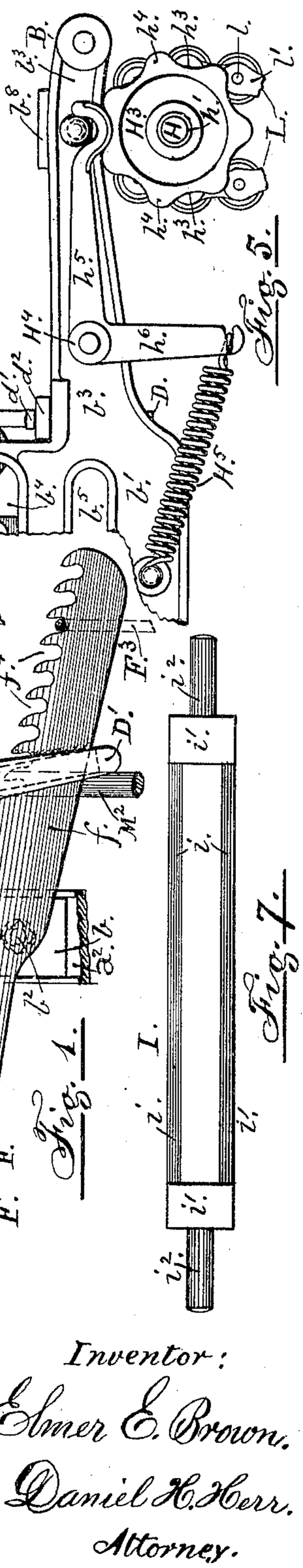

Fig. 5.



Fig. 7.

Witnesses:

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## WITCH LOOM.

(Application filed Nov. 5, 1898.)

(No Model.) 2 Sheets—Sheet 2.

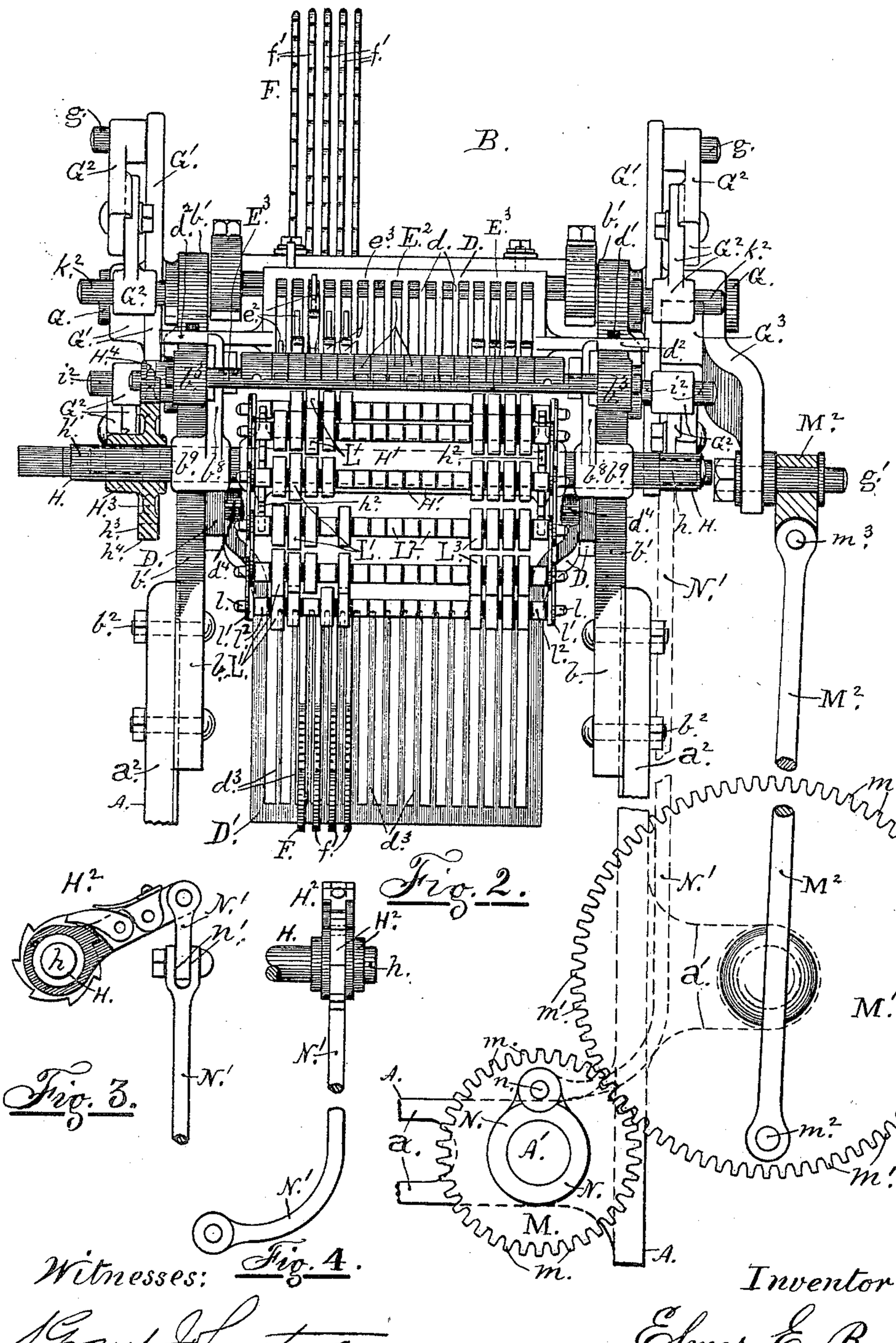


Fig. 2.




Fig. 3.

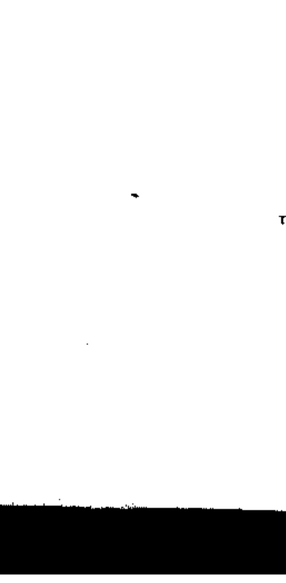


Fig. 4.

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# UNITED STATES PATENT OFFICE.

ELMER E. BROWN, OF MOUNT JOY, PENNSYLVANIA, ASSIGNOR TO HIMSELF AND GEORGE H. BROWN, OF SAME PLACE.

## WITCH-LOOM.

SPECIFICATION forming part of Letters Patent No. 681,869, dated September 3, 1901.

Application filed November 5, 1898. Serial No. 695,618. (No model.)

*To all whom it may concern:*

Be it known that I, ELMER E. BROWN, a citizen of the United States, residing at Mount Joy, in the county of Lancaster and State of Pennsylvania, have invented certain new and useful Improvements in Witch-Looms; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in a loom of that class known to the trade as the "witch-loom," in which the mechanism of the witch or head raises and lowers the frames of the harness, carrying the warp-threads into the required positions to be crossed by the shuttles, carrying the woof-threads by a positive motion, draw or pull, and without the use of springs.

The object of the invention is to provide means whereby the harness-moving mechanism is given a very slow motion while the loom is running at its regular or normal rate of speed, with positive up and down pulls on the harness-frames at practically half the rate of speed of the harness-moving mechanism now known to the trade and adapted to light or heavy work and to any number of harness, yielding, first, less strain on the warp-threads by reason of said slow motion; second, increased production of the loom with the same strain on the warp-threads as under existing harness-moving mechanisms having positive up and down pulls; third, greatly-reduced wear and tear to the working parts, and, fourth, lessened liability to their getting out of order.

The elements of the invention will severally and at large appear in the following description, and they will be separately and collectively set forth in the claims.

The purposes of the invention are attained by the mechanism and devices illustrated in the accompanying drawings, with similar reference characters to designate like parts throughout the several views, in which—

Figure 1 is a side elevation of harness-moving mechanism embodying some of the elements of the invention with the near side of the head-framework removed and the frame of the loom omitted. Fig. 2 is a view from the right of Fig. 1, showing portions of the loom-frame with other elements of the invention in position. Fig. 3 is a detached side view of the chain-moving ratchet and pawl with the upper portion of a jointed connecting-rod in position. Fig. 4 is a view from the left of Fig. 3, showing the ratchet as it appears on the right-hand end of the chain-moving shaft with the lower portion of the connecting-rod detached from its crank-arm. Fig. 5 is a view of the right-hand end of the side removed from Fig. 1 and as it appears viewed from the left in Fig. 2, showing parts thereto attached with the upper portion of the chain in position. Fig. 6 is a top view of the upper knife detached from Figs. 1 and 2; and Fig. 7 is an inverted plan of the lower knife, also detached from Figs. 1 and 2.

It will here be remarked that the elements with which the purposes of the invention are accomplished are, first, the two knives; second, the two gear-wheels; third, the jointed connecting-rods; fourth, the outer end crank-arm, and, fifth, the three-positioned chain, all in combination with certain elements now known to the trade and which will first be described.

In the drawings is shown in dotted and full lines the upper portion of the right-hand end post A of a loom-frame of ordinary or well-known construction, said post having a cross-rail $a$, a rearwardly-projecting side lug $a'$, and two upwardly-projecting side standards $a^2$ $a^2$. The main shaft A', which drives the loom, is journaled in bearings supported by the cross-rail $a$, and a rail similar thereto at the left-hand end of the loom. The construction of the loom being so well known and forming no part of the invention, it was deemed sufficient to illustrate only such parts or portions thereof as serve to support and operate the elements of the invention.

Supported by the end post A is the witch or loom head B, which has the downwardly-projecting arms $b$ of its sides $b'$ secured to the upper ends of the standards $a^2$ by bolts and nuts $b^2$. The sides are provided at their right-hand ends with forwardly-projecting arms $b^3$, rearward thereof and through their

bodies with oblong guide-slots $b^4$ $b^5$, further rearward in their upper edges with journal-bearings $b^6$, and still further rearward in their lower edges with bearing-lugs $b^7$, while near to the outer ends of the arms $b^3$ and against their inner surfaces are adjustably secured by bolts, washers, and nuts the upper ends of the hangers $b^8$, having at their lower ends shaft-bearings $b^9$. The sides are bound together by having placed between them oblong rectangular blocks C, having oblong openings, with upper and lower guide-grooves indicated by dotted lines, through their bodies and secured in place by bolts $c$ passed through the sides and tapped into the ends of the blocks. A grate D, with open spaces between its bars $d$, is placed in position forwardly of the slots $b^4$ $b^5$ and secured in place by the headed screws $d'$, passed through side projecting lugs $d^2$ and tapped into the upper edges of the arms $b^3$ at their rearward ends, while below in the central portion of the head is placed a grate D', with bars $d^3$, free at their upper ends, and said grate is secured in position by nuts and bolts $d^4$, passed through the upper ends of its side bars and the sides $b'$.

Movable back and forth in the guide-grooves of the blocks C are plates or straps E, having widened and sloping centers with triangular upward projections, rounded lower ones, and downwardly and rearwardly inclined cam-slots $e$, with oppositely disposed and rounded ends through said centers. To the upper ends of said upward projections are pivoted by flat-headed rivet-pins $e'$ the rear ends of running strips E', with their forward ends passing through the openings of the grate D, and said strips are cut away underneath, forming narrow fingers $e^2$ to ride on the tops of upwardly-projecting lift-lugs $e^3$ at the forward ends of lift-arms $E^2$, having their forward extremities between the bars of said grate and their rearward ends journaled onto a rod or shaft $E^3$, having its extremities secured into the forward or outer ends of the arms $b^3$. The bodies of said strips E' in their central portions have in their under edges oblong notches or recesses $e^4$, with undercut ends, and on their upper edges dovetailed upward projections or lugs $e^5$, with undercut forward and rearward edges.

In the rearward portion of the head are placed angle-levers F, having arms $f f'$ practically ninety degrees apart and pivoted at the apices of the angles on a shaft or rod F', having its extremities secured into the bearing-lugs $b^7$, said levers rocking freely back and forth thereon, with their arms $f$ forwardly extending and passing through the spaces between the bars of the grate D' and their arms $f'$ upwardly projecting and held laterally in place between T-keepers $F^2$, having their lower ends rigidly secured to the body of said shaft. At prescribed points the upper edges of the arms $f$ are provided with upwardly-projecting lugs $f^2$, carrying side rolls $f^3$ to engage in the cam-slots $e$, causing the angle-levers to rock backwardly and forwardly, according to the backward and forward motion of the straps E, and in the upper and forward edges of these arms in their respective outer end portions are formed notches or hook-recesses $f^4$ to be engaged by links or hooks at the forward and upper ends of the straps or cords $F^3$, indicated by dotted lines, and their other ends secured, respectively, to the upper and lower edges of the harness-frames, (not shown in the drawings,) drawing the harness upwardly and downwardly with a positive pull, according as the straps E have a forward or a backward motion, and without the use of springs to return said harness to normal positions.

In the bearings $b^6$ is journaled a rock-shaft G, with its extremities projecting beyond said bearings. To the projecting ends of the shaft are rigidly secured the centers of rock-arms G', having at their outer ends pivot-pins $g$, having pivoted thereto the forward ends of connecting-rods $G^2$, which have their rearward ends pivoted to the outer or trunnion ends of guide-blocks, forming parts of knives, yet to be described, said blocks moving back and forth in the guide-slots $b^4$ $b^5$, while to one end of the rock-shaft G, as the right-hand end in Fig. 2, is rigidly secured the hub end of a lever or crank arm $G^3$, having at its free end a crank-pin $g'$ to reciprocate thereby said crank-arm, rock said shaft, and move the mechanism of the head.

In the bearings $b^9$ is journaled a shaft H, with its extremities $h$ $h'$ projecting outwardly beyond the bearings, carrying on its body between said bearings a spool H', with sprockets $h^2$ at it sends to support and move a chain, yet to be described, having on its end $h$ a ratchet $H^2$, adapted to intermittently rotate said shaft, and on its end $h'$ a wheel $H^3$, with rounded recesses $h^3$ between rounded projections $h^4$ on its periphery. Onto a stud projecting from the adjacent side of the head and through the juncture of its arms is pivoted an angle-lever $H^4$, having the free end of its arm $h^5$ rounded to ride over said projections $h^4$ and engage in said recesses $h^3$, the former permitting rotation to said wheel $H^3$ and the latter holding it to enable said ratchet-pawl to engage a succeeding tooth, while a coiled spring $H^5$, having one end secured to the free end of its arm $h^6$ and its other end secured to the same side of the head, allows said rotation and compels said holding.

With the exception of the lugs $e^5$, projecting upwardly from the upper edges of the running strips E', no new elements have so far been described, and in place of said lugs said strips at these points were provided with recesses similar to the oblong recesses or notches $e^4$, described and shown as being in their lower edges. The knives adapted to enter said notches heretofore had tapering side edges set in parallel planes to engage

only one end of said notches, either forwardly or backwardly and alternately above and below, requiring complete reciprocation, once up and once down, to the lever-arm $G^3$, rocking the shaft G once backwardly and once forwardly to place the harness in proper positions for the woof-threads to cross, and one of the rock-arms G′ was provided with an intermediate stud on either side of the center thereof, whereby a connecting-rod gave to the ratchet the required motion to move the chain, which was two-positioned only, having only lifts and drops. Now for the purposes of the invention a knife I, having a blade with upwardly and outwardly sloping side edges $i$, end guide-blocks $i'$ flush with the top face of the blade, and trunnions $i^2$ projecting from the outer ends of the blocks, is placed transversely across the body of the head, the blade adapted to enter the notches $e^4$, the edges $i$ to engage against the ends of the notches, the blocks $i'$ movable back and forth in the lower guide-slots $b^5$, and the trunnions $i^2$ pivoted to the rearward ends of the lower connecting-rods $G^2$, whereby said knife is moved back and forth in said slots, giving below the required motion to the running strips E′. To give the required motion above to said running strips E′, is placed transversely across the body of the head a knife K, comprising a rod or bar $k$ passing through the upper guide-slots $b^4$, having guide blocks or portions $k'$ to engage against the upper and lower faces of said slots, and trunnions $k^2$ projecting from the outer ends of said blocks and to which are pivoted the rearward ends of the upper connecting-rods $G^2$, whereby said bar is moved back and forth in said slots. Within and adjacent to the sides of the head and rigidly secured to the top of the bar, as by bolts and nuts $k^3$, are forwardly and rearwardly disposed cross or side pieces K′, with downwardly-projecting rounded ends, the forward one being lower than the rearward one, said ends having practically at their centers pivot-orifices, into which are pivoted the trunnions $k^4$, projecting sidewise from the outer ends of knife-blades $K^2$ and adjacent to their respective forward and rearward side edges, so that their adjacent or inner edges, from their own weight or by gravitation, will have a tendency to drop or swing downwardly, one blade being on each side of the bar $k$. Projecting upwardly from the upper faces and adjacent to the free or dropping edges of the knife-blades are tines or fingers $k^5$, adapted to impinge against the ends of plates $K^3$, having oblong slots therein through which pass studs projecting upwardly from said bar $k$, with nuts $k^6$ on their threaded ends and screwed home thereon, which studs serve to secure said plates so as to be backwardly and forwardly adjustable. These plates regulate the drop of the free edges of the knife-blades, so as to insure the engagement of said edges with the projections $e^5$ of the running strips E′, with which they contact, thus giving to said strips the required backward and forward motion.

It will here be observed that the loom-head here shown is fitted with five sets of angle-levers operating five sets of harness and with five sets of running strips to move them. All are so arranged that the first and fourth, fourth and second, second and fifth, fifth and third, third and first, and so on, will move together, the first being in down or dropped position, the second in a position of rest, and the third in an up or raised position, while the fourth and fifth are in positions of rest awaiting their turns, with their respective arms carrying the lift-lugs in the same positions, and the chain is provided with drop, rest, and lift rolls, so that when it is moved interval by interval by the ratchet secured to its shaft the above motions will obtain and in the order named.

As shown in the drawings, a chain L is mounted on the sprocketed ends of the spool H′. Said chain is composed of the requisite number of links, ten in this instance, comprising rods or shafts $l$, having their extremities pivoted through the ends of link-straps $l'$ and at a distance apart equal to the pitch of the sprocket-teeth, while adjacent to the straps and loosely mounted on the rods are rollers $l^2$, adapted to engage said sprocket-teeth, moving said chain. Between these rollers, also loosely mounted on the rods, but in separate series, are lift, drop, and rest rolls of different diameters, respectively indicated by L′ $L^2$ $L^3$, the first two arranged in pairs in opposite positions in the chain, with three of the last on each side between them, but on succeeding pairs of said rods in the order of rotation. It will here be remarked that the chain may have any width, length of rods $l$, according to the depths of the head, which depth is determined by the number of harness-frames to be moved by the mechanism placed therein, that the rolls L′ $L^2$ $L^3$, being loosely mounted on said rods, are interchangeable thereon, and their arrangement, serial or otherwise, is determined by the style of the weave or the order in which the harness-frames are to be moved, and that the length of said chain, the number of rods or links, is also determined by the number of harness or the style of the weave.

Mounted on the shaft A, adjacent to the outer face of the cross-rail $a$ and rigidly secured to said shaft, is a spur gear-wheel M, having any approved diameter, whose teeth $m$ intermesh with the teeth $m'$ of a gear-wheel M′, journaled onto a stud projecting from the adjacent face of the side lug $a'$, said wheel M′ having twice the diameter and double the number of teeth, whereby two revolutions of the former wheel equal one of the latter. Onto a crank-pin $m^2$, projecting from the outer face of the wheel M′ and at a pre-

scribed radial distance from its center, is pivoted the lower end of a connecting-rod $M^2$, with its upper end pivoted to the crank-pin $g'$ to reciprocate the crank-arm $G^3$ as said wheel revolves, said connecting-rod having a joint $m^3$ near its upper end, allowing the lower end of said rod to conform to the motion of said revolving wheel. It will here be seen that each revolution of the wheel M', by means of said connecting-rod, completely reciprocates the lever-arm $G^3$, once raising and again lowering it.

To the rearward end of the loom-shaft A' is rigidly secured a crank-arm N, having at its free end a crank-pin $n$, onto which is pivoted the lower end of a connecting-rod N', with its upper end pivoted to the outer end of the swinging arm of the ratchet $H^2$ to reciprocate said ratchet, said rod having near its upper end a pivot-joint $n'$ and its lower end inwardly bent, whereby it accommodates itself to the motion of said ratchet and crank arm, giving to the ratchet two reciprocations, while the lever-arm $G^3$ has but one, moving the chain twice to each drop and lift of a harness-frame.

Now the several elements hereinbefore described and occupying the respective positions indicated in the drawings, the following observations will be noted: First, that by means of the crank-arm N, the connecting-rod N', and the ratchet $H^2$ each revolution of the driving-shaft A' moves the chain L to the extent of one link, bringing a different set of rolls L' $L^2$ $L^3$ in position underneath the lift-arms $E^2$; second, that the rolls L' will lift the arms $E^2$ with their lugs $e^3$ and raise the fingers $e^2$ of the strips E' to their highest points, bringing the top projections $e^5$ of said strips into positions to be engaged by the blades of the knife K; third, that the rolls $L^2$ will drop the arms $E^2$ with their lugs $e^3$ and carry the fingers $e^2$ of the strips E' to their lowest points, bringing the under edge notches $e^4$ of said strips into positions to be engaged by the edges of the knife I; fourth, that the rolls $L^3$ will lift the arms $E^2$ with their lugs $e^3$ and raise the fingers $e^2$ of the strips E' to their intermediate points, bringing the top projections $e^5$, as well as the under edge notches $e^4$ of said strips, into positions not to be engaged by the edges of either knife; fifth, that while the strips E' are in the highest positions the blades of the knife K, engaging their top projections $e^5$, said strips will be moved back and forth by said knife; sixth, that while the strips E' are in the lowest positions the blades of the knife I, engaging their under edge notches $e^4$, said strips will be moved forth and back by said knife; seventh, that while the strips E' are in the intermediate positions, the knife-blades engaging neither the top projections $e^5$ nor the under edge notches $e^4$, said strips will not be moved either way, remaining stationary; eighth, that by means of the gear-wheels M M', having intermeshing teeth in the ratio of one to two, and the connecting-rod $M^2$, with the lever-arm $G^3$ and the other connection hereinbefore shown, each revolution of the driving-shaft A' changes the positions of the required angle-levers F, drawing up their down harness-frames and down their up ones, each with a positive pull on their respective straps $F^3$; ninth, that the successive revolutions of the driving-shaft A' will continue these positive pulls upon the harness-straps up on the down ones and down on those which are up; and, tenth, that by reason of these several movements the mechanism of the loom-head performs its functions, raising and lowering the desired harness to the required positions at one-half the rate of speed heretofore required and without the use of returning-springs.

Having now described the invention and ascertained and set forth the manner in which it is performed, what is considered new, and desired to be secured by Letters Patent, is—

1. The combination in a loom-head of the character described and having oscillating angle-levers adapted to raise and lower the warp-harness into positions for the woof by positive pulls on the frames of said harness, plates moving back and forth to oscillate said angle-levers, slide-strips having their rear ends pivoted thereto to move said plates, and means provided to raise and lower and hold in intermediate positions the forward ends of the slide-strips, said slide-strips having dovetail projections on their upper edges and oblong notches with dovetail ends in their lower ones, a two-bladed knife having a transverse bar with blocks moving back and forth in guide-slots through the sides of the head, with cross-pieces secured to the top of said bar toward the ends thereof, and oppositely-disposed wing-blades having the ends of their outer or extreme edges pivoted into the sides of said cross-pieces adjacent to the ends thereof, and their inner or adjacent edges adapted to engage against said upper edge projections, and another two-edged knife having oppositely-disposed and inclined sides with blocks moving back and forth in guide-slots also through the sides of the head, said inclined sides adapted to engage in said lower edge notches, with mechanism provided to simultaneously move said knives in opposite directions, all substantially as described and for the purpose hereinbefore set forth.

2. In a loom-head of the character described, having the angle-levers, F; the bars, E, to oscillate said levers; the slide-strips, E', pivoted to said bars, and having the lower edge notches, $e^4$, and the upper edge dovetail projections, $e^5$, and the two-edged knife, I, to engage in said notches, $e^4$; the wing-bladed knife, K, having the transverse bar, $k$, with the slide-blocks, $k'$, and the pivot-trunnions,

$k^2$; the cross-blocks, K′, secured to the top of said bar, $k$; the wing-blades, $K^2$, with their end pivot-lugs, $k^4$, journaled through said cross-blocks, K′, and the upwardly-projecting tines or fingers, $k^5$, adjacent to the drop edges of the wing-blades; the slotted plates, $K^3$, and the screws, $k^6$, through the slots of said plates, with the tines, $k^5$, contacting therewith; all substantially as described and for the purpose hereinbefore set forth.

In testimony whereof I affix my signature in presence of two witnesses.

ELMER E. BROWN.

Witnesses:

FRED. P. MENTZER,

CHAS. R. KLINE.