(No Model.)

3 Sheets—Sheet 1.

R. B. GOODYEAR.

HEDDLE MOTION FOR LOOMS.

No. 559,278.

Patented Apr. 28, 1896.

Fig. 1.

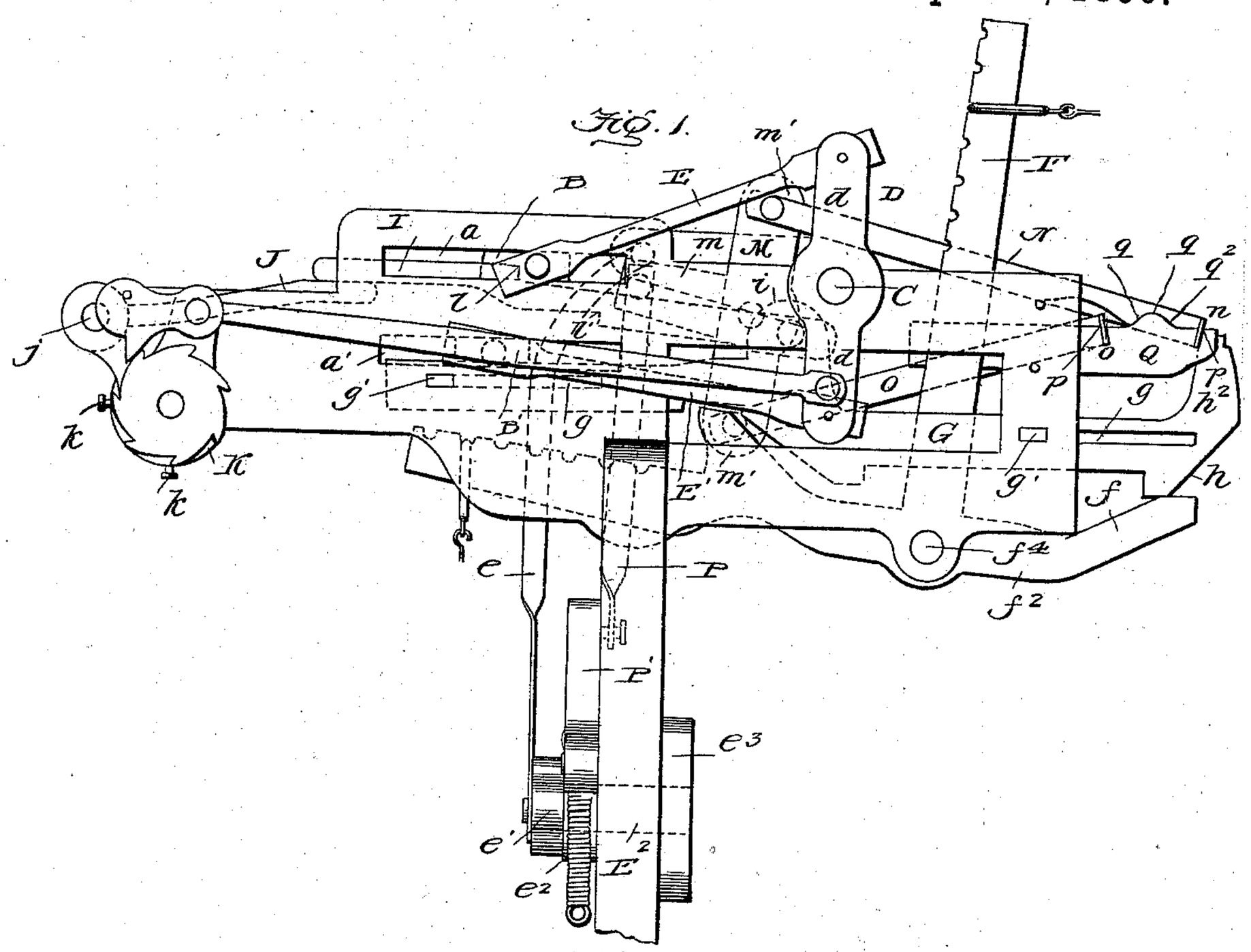
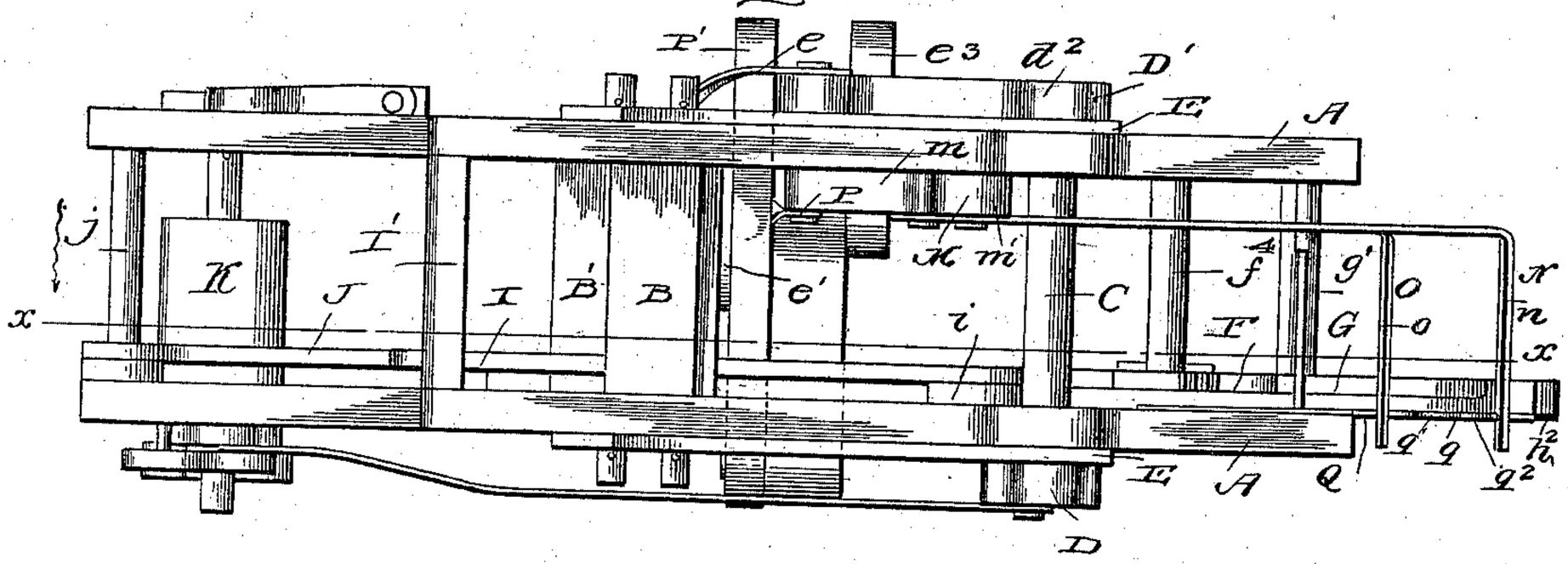


Fig. 3.



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(No Model.) 3 Sheets—Sheet 2.

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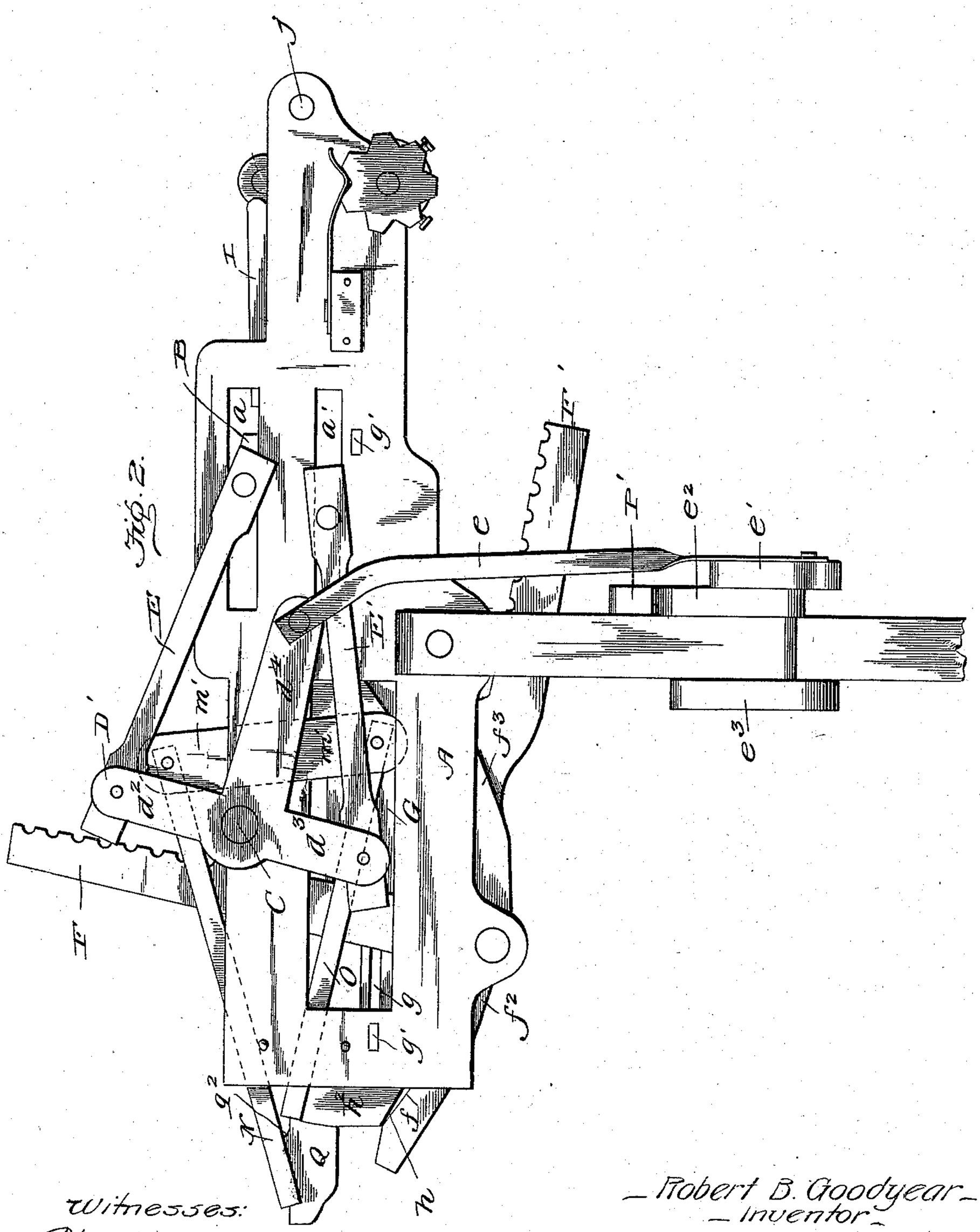

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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Fig. 4.

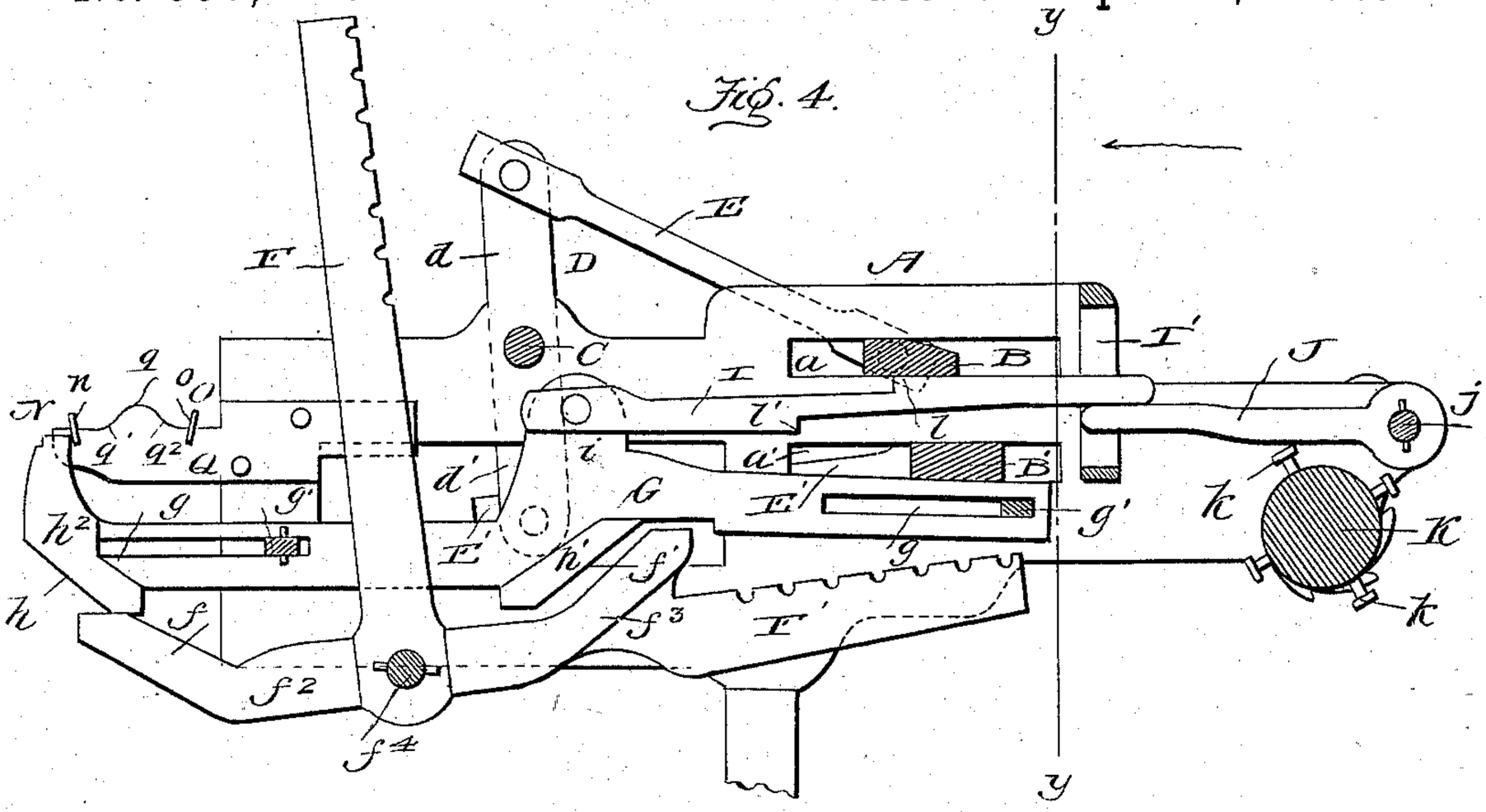
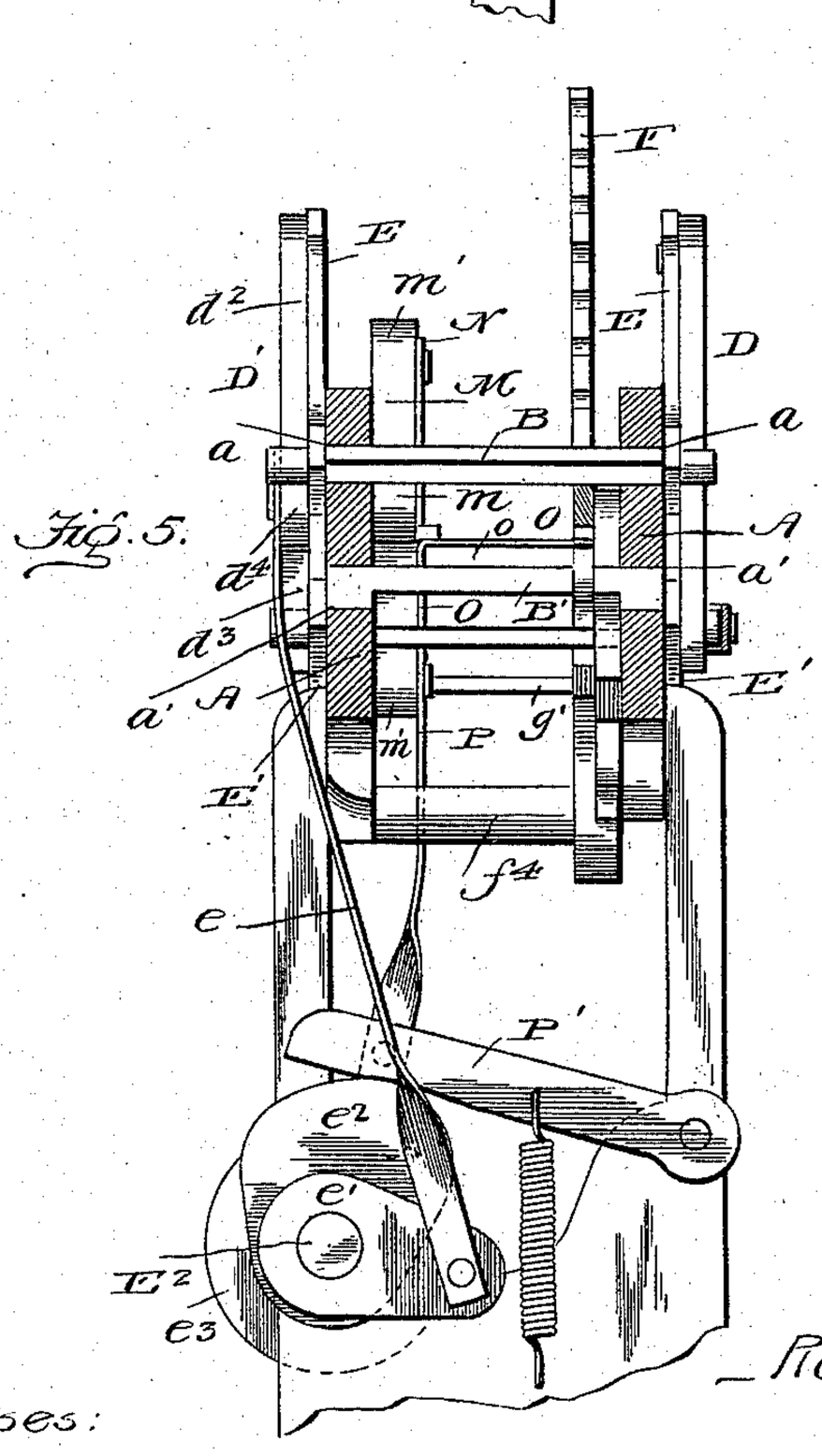


Fig. 5.



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UNITED STATES PATENT OFFICE.

ROBERT B. GOODYEAR, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO JACOB HOFFMAN, OF SAME PLACE.

HEDDLE-MOTION FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 559,278, dated April 28, 1896.

Application filed January 16, 1896. Serial No. 575,709. (No model.)

To all whom it may concern:

Be it known that I, ROBERT B. GOODYEAR, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Heddle-Motions for 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.

My present invention relates to improvements in mechanism for giving to the heddles of a loom the necessary rising and falling motions; and the objects that I have in view are, first, to provide an efficient heddle-actuating mechanism which shall comprise a small number of parts, simple in construction, and arranged in a compact manner to expose the parts to as little friction as possible, and, secondly, to an automatic locking contrivance which will temporarily arrest the heddle-levers during the intervals of rest of said heddle-levers and of the heddles between the rising and falling motions of the latter.

With these ends in view the first part of my invention consists in the combination of a rocking two-armed heddle-lever adapted to be connected by suitable cords or the like with the top and bottom of a heddle-frame and said lever provided with cam-shaped inclines on opposite sides of its fulcrum, a cam-formed slide mounted for reciprocation in horizontal paths and so arranged with relation to the cam-shaped inclines of the two-armed heddle-lever that its cams will ride thereon during the reciprocal or endwise play of said slide, a double-notched jack connected to said cam-formed slide and adapted to be raised or lowered by a pivoted finger actuated at suitable intervals of time by pins or projections on the pattern-cylinder, slidable impelling-bars guided to play back and forth above and below the double-notched jack attached to the cam-formed slide and adapted to engage alternately with said double-notched jack, according as it is raised or lowered by the finger controlled by the pattern-cylinder, a cam, and positive connections between said cam and the slidable impelling-bars to move the latter in opposite directions simultaneously.

The invention further consists in an auxiliary motion mechanism, arranged to be actuated by a cam and to be thrown into the path of the cam-formed slide for a short interval at the termination of each endwise movement of said slide and to be automatically moved out of the path of said cam-formed slide before its endwise movement begins, in order to prevent the slide and the heddle-levers from moving during the intervals of the rising and falling movements of the heddles; and the invention further consists in the novel combination of devices and in the construction and arrangement of parts, which will be hereinafter fully described and claimed.

To enable others to understand my invention I have illustrated the same in the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is an elevation looking at one side of a heddle-controlling mechanism embodying my improvements. Fig. 2 is a view looking at the opposite side of the mechanism, with the heddle-lever in the reverse position from that shown by Fig. 1. Fig. 3 is a plan view. Fig. 4 is a longitudinal sectional view on the plane indicated by the dotted line *x x* of Fig. 3; and Fig. 5 is a vertical sectional view on the plane indicated by the dotted line *y y* of Fig. 4.

Like letters of reference denote corresponding parts in all the figures of the drawings.

In the drawings I have shown so much of a loom-frame as is necessary to an understanding of my mechanism for actuating the heddles of an ordinary loom, and the letters A A designate the parallel sides of a portion of the frame of the machine. In these sides A A are the horizontal slots *a a'*, of which slots those designated by the letters *a' a'* are below the other slots *a a*. In the upper slots *a* in the two side pieces is fitted a slidable primary impelling-bar B, which extends transversely across and between the sides A A, while in the lower slots *a' a'* is fitted a similar slidable primary impelling-bar B', these two bars being actuated to move in opposite directions simultaneously.

C is a transverse rock-shaft which is journaled in suitable bearings on the sides A A, and to the ends of this shaft are secured th

levers D D′. The lever D is secured centrally to the rock-shaft C to have two arms d d', while the lever D′ is formed with three arms d^2 d^3 d^4. The arm d of the lever D and the arm d^2 of the lever D′ are connected by the pitmen E E to the ends of the upper slidable bar B, and the arm d' of lever D and arm d^3 of lever D′ are likewise connected by the pitmen E′ E′ with the ends of the lower slidable primary impelling-bar B′. As the rock-shaft is turned to throw the arms d d^2 in one direction and the arms d' d^3 in the reverse direction, the pitmen E E and E′ E′ move the two bars B B′ in reverse directions simultaneously, said bars being guided by the slots a a' to move in horizontal paths one below the other. The arm d^4 of the lever D′ projects from the middle of said lever and at right angles to the arms d^2 d^3 thereof, and to the free end of said arm d^4 is pivoted the upper end of an upright link e, the lower end of which link e is pivotally attached to one part e' of the double cam e' e^2. This double cam e' e^2 is carried by a rotary shaft E², which is suitably journaled on the loom-frame and is equipped with a driving-pulley e^3, or other mechanical appliance, whereby it may be driven from a suitable part or shaft of the loom in a manner well understood by those skilled in the art to which the invention relates.

F F′ is the double heddle-lever, which is made rigid or integral with the cam-shaped inclines f f'. In the embodiment of this part of my invention, which is illustrated more clearly by Fig. 4 of the drawings, the lever F is made integral with two arms f^2 f^3, which stand at right angles to the lever F, and which arms f^2 f^3 are shaped or otherwise wrought to produce on their upper faces or edges the cam-shaped inclines f f'. The lever F′ projects outwardly from and beyond the cam f', so that the arm f^3 forms a part of the lever F′, and these two levers F F′ are serrated or notched, as shown, to adapt the cords or other connections for the heddles (not shown) to be readily and easily attached to the said levers F F′. This double heddle-lever is fulcrumed on a stationary arbor or bolt f^4, which is fixed in the sides A A of the loom-frame.

G is the cam-formed slide (see Fig. 4) which acts on the cam-shaped inclines f f' and serves to rock the double heddle-lever F F′ to give to the heddles the rising and falling motion and produce the shedding for the passage of the shuttle. This cam-formed slide is mounted to play above and in contact with the inclines f f' of the double heddle-lever, and said slide is preferably provided with the horizontal longitudinal slots g, through which pass the angular guide and supporting bars g' g', suitably fastened to the sides A A of the frame. At an intermediate point of the length of said slide is formed one of the inclines or cams h', which acts upon the incline f' of the double heddle-lever when the slide is moved in one direction, and at one end of said slide is produced a head h^2, the end face of which is formed to produce the incline or cam h, which is adapted to act upon the incline f of the double heddle-lever when the said slide is moved in the opposite direction. The head h^2 of the cam-formed slide extends a suitable distance above the length of the slide proper, and said head is made angular in form to better adapt the auxiliary motion to engage with the same.

To a lug i, which rises from the cam-formed slide at an intermediate point of its length, is pivotally attached one end of the horizontal jack I. This jack I lies above the cam-formed slide and it passes through the slotted guide I′. Said jack I is movable horizontally with the slide G in its endwise movements; but it is capable of a limited vertical play under the influence of a finger J, which is pivoted at one end on an arbor j and has its free end fitted beneath the free end of the jack I, so that the latter rests upon the finger J, which serves to raise the jack I when the said finger is acted on by one of the pins or projections k on the pattern-cylinder K. On its upper side this pivoted jack I is shaped to provide the shoulder l, against which is adapted to take or bear the upper slidable primary impelling-bar B′; but on the lower side of the jack I is formed a shoulder l' for the primary impelling-bar B to bear against. When the part e' of the double cam actuates the levers D D′ to move the primary impelling-bars B B′ in the directions indicated by the arrows in Fig. 4, the pattern-cylinder lifts the finger J, which in turn raises the jack I so its shoulder l is in the path of the primary impelling-bar B. This bar B impels the jack I, and with it the slide G, in one direction until the pattern-cylinder releases the finger J, which permits the finger and the jack I to drop or fall by gravity, and during this endwise movement of the slide in one direction the cam or incline h' thereof rides against the incline f' of the double heddle-lever, so as to turn the double lever on its fulcrum, and thereby shift or change the positions of the loom-heddles. As the finger releases the pivoted jack I at the end of the stroke or movement of the slide G in one direction, the jack I drops down far enough for the shoulder l to clear the path of the jack B; but the shoulder l' of said bar I lies in the path of the other primary impelling-bar B′, to be engaged thereby on the next revolution of the double cam. When the primary impelling-bar B′ is engaged with the shoulder l' of the pivoted jack, said primary impelling-bar and the slide G are impelled in the reverse direction and returned to their first positions, and during this return movement of the slide the incline h rides against the incline f to rock the double heddle-lever F F′ and return said heddle-lever and the heddle to their first positions.

It will be observed that when the cam or incline h rides against the incline f and has

moved the heddle-lever to shift the heddle the cam *h* rests against a flat surface on the incline *f*, as shown by Fig. 4, and thereby locks the heddle-lever to prevent it from turning out of position. The same is true with reference to the cam *h'* when the slide is moved in the opposite direction to cause the cam *h'* to ride against the incline *f'* and shift the heddle-lever and heddle—that is, the cam *h'* rests on a flat surface of the incline *f'* to positively lock the heddle-lever in its reversed position. It will thus be seen that the heddle-lever is locked in position during the intervals between the back-and-forth play of the cam-formed slide G, which has cams *h h'* to ride against the inclines *f f'* of the heddle-lever to actuate and lock the lever F F'.

In order to increase the speed of the loom and the motion of the heddle to be much easier upon the yarn, I have so arranged and proportioned the stroke of the reciprocating bars B B', the cam, and the intermediate connections between the bars and the cam in such a manner that the bars B B' do not act to give the slide G its full movement or stroke; but this full movement or stroke is effected by the provision of an auxiliary motion which I have devised and arranged to act in conjunction with the slide G, and which auxiliary motion also serves to lock the slide between the intervals of its back-and-forth play. By organizing the auxiliary motion to complete the movement given to the slide G by the reciprocating bars B B', I am able to withdraw the primary impelling-bars B B' from the jack I before the slide completes its movement in either direction, and thus the primary impelling-bars B can begin their return movement before the slide G completes its stroke, thus enabling the speed of the loom to be increased, and the motion of the heddle is made easier on the yarn.

My auxiliary mechanism to assist the primary impelling-bars B B' in completing the stroke of the slide G and to restrain the double heddle-lever and the heddles from movement accidentally during the intervals between the rising and falling movements of said heddles is an auxiliary contrivance arranged for service automatically to impel the slide to its full limit and to interpose a barrier to the movement of the slide G at the completion of each stroke and to withdraw said barrier just prior to the commencement of the endwise stroke. The preferred construction by which these results are attained comprises a three-armed lever M, two carrying-rods N O, a link P, and a cam-guide Q.

The three-armed lever M of the auxiliary contrivance is placed between the two side frames A A, so as to be out of the way, and it is fulcrumed at the point or hub where the three arms are joined together by a suitable bolt or arbor. To the horizontal arm *m* of said lever is connected the upper end of the link P, which has its lower end pivotally attached to a spring-controlled actuating-lever P'. The free end of said lever P' is normally pressed down upon the part e^2 of the double cam e' e^2, so that said spring-lever has peripheral contact with said cam, and the vibrations of this cam-controlled lever are communicated through the link P to the actuating-lever M. To the vertical arms *m'* of said lever M are pivotally attached the carrying-rods N O, which lie one below the other and which are adapted to be moved by said lever M in opposite directions simultaneously. The carrying-rods have angular bends *n o* at their free ends, which bends are arranged to lie and ride upon the cam-guide Q, which serves to determine the positions of the carrying-rods relative to the head h^2 of the cam-formed slide.

As shown, the cam-guide is a metallic plate, fastened to the opposite side A from the other side to which the lever M is fulcrumed, and said plate is arranged to lie close alongside of the head h^2 of said cam-formed slide G. The upper end of this cam-guide has a raised cam-surface, the top *q* of which is horizontal, but the opposite edges q' q^2 are reversely inclined. (See Figs. 1 and 4.) In order to keep the carrying-rods N O in proper position and prevent them from being displaced, notches *p* are cut in the angular ends *n o* to enable said ends to receive the edge of the plate forming the cam-guide; but this is optional, because other means may be resorted to for holding the free ends of the carrying-rods in place on the cam-guide.

With the slide G in the position shown by Figs. 1 and 4 the lever M is substantially vertical and the rods N O are separated, so that the end *n* of one rod is on one side of the cam projection of the guide Q and the end *o* of the rod O is on the opposite side of the cam projection, with the end *n* in the path of and in contact with the head h^2 of the slide G to carry the slide G to the full limit of its stroke and also lock the slide in place. As the cam e^2 makes a quarter of a revolution the lever P' moves the link P to throw the lever M to a position where the rods N O are drawn toward each other, and as the ends *n o* ride upon the inclines q' q^2 in approaching each other said ends of the rods N O are raised out of the path of the head h^2 of said slide. The slide G is now impelled in one direction by the bar B engaging with the notched jack I, and when the slide has traveled far enough for the head h^2 to pass below the end *o* of the rod O the cam e^2 actuates the connections P' P to move the lever M to a position where the rods N O are drawn apart, so that the end *o* of the rod O can travel in the path of head h^2 and can take position behind said head h^2 of the slide G at the end of its stroke or movement in one direction. Just prior to the return movement of the slide G the rods N O are moved toward each other by the action of the cam e^2 on the connections P' P M, so that the ends *n o* are raised by the cam projection of the cam-guide out of the path of the head h^2.

After the slide G has moved far enough on its return movement in the direction toward its initial position for the head h^2 thereof to pass beyond the raised end n of rod N the cam e^2 actuates to draw apart the rods N O and cause the end n of rod N to travel in the path of the head h^2 and to take position behind the head h^2 of the cam-slide as it completes its stroke or movement in the reverse direction, and to assume the initial position shown by Figs 1 and 4. The differential movement in the cam-formed slide G and in the locking-rods N O is effected by striking the cams e' e^2 from different centers and giving the tread of cam e^2 the proper contour and thereby impart to the spring-lever P' a rising-and-falling motion during each revolution of the double cam.

In the drawings I have shown the slidable primary impelling-bars B B', the cam e', and the means for actuating the primary impelling-bars B B' as constructed and arranged to give to the primary impelling-bars B B' a stroke or movement of less length than the stroke of the slide G, while to complete the movement of the slide G in either direction I have arranged the cam e^2, the levers P' M, and the rods N O in a manner to cause the rods N O to engage with the head h^2 of the slide G and impel it in either direction the full limit of its movement.

It is evident that by the described construction of the slide G operating in connection with the two cams on the heddle-lever and the described means for actuating the slide G, consisting of the jack-bar, the slidable impelling-bars, the levers linked to the slidable impelling-bars, and the cam, the slide may be given its full stroke or movement; but I prefer to use the auxiliary mechanism in connection with the slide to complete the movement thereof, because the combination of mechanisms enables me to run the loom at faster speed and to make the motion of the heddle easier on the yarn than in devices which do not use the auxiliary motion.

The operation of my mechanism, as shown in the accompanying drawings, may be described, briefly, as follows: With the parts in the positions shown in Figs. 1 and 4 the cam e^2 first draws the rods N O toward each other to enable them to be raised by the projection of the cam-guide Q above the path of the head h^2 of the cam-slide G, the pattern-cylinder lifts the finger J to raise the jack I so its shoulder l is in the path of the primary impelling-bar B, and the cam e' moves the levers D D' and the bar B so as to impel the jack I and the slide G in the direction indicated by the arrows in Fig. 4. When the slide G has been impelled to a point where the head h^2 moves beyond the end of the rod O, the cam e^2 moves the levers P' M to separate the ends n o of the rods N O and allow the ends to descend into the path of the head h^2, so that the end o will take position behind the head h^2 of said slide. Before the cam e' completes its revolution it withdraws the bar B from engagement with the primary impelling-jack I and the end o of rod O engages with the head h^2, so as to complete the movement of the slide G in the direction indicated, this movement of the slide being completed by the time the cam e' has made a full revolution, at which time the pattern-cylinder releases the finger J, so that the finger and jack I will drop or fall by gravity. As the cam-slide G is moved in the manner described its incline h' rides against the incline f', and this pressure turns the double heddle-lever to move the heddle-frames in a well-known manner. As the slide G completes its stroke the head h^2 is engaged by the rod O to prevent the slide and heddle-lever from being moved accidentally. As the cams e' e^2 continue to rotate the cam e^2 operates the lever M to again move the rods N O and cause the ends n o to approach and ride upon the inclines q' q' of the guide Q, thus lifting the rods out of the path of the head h' of said slide G, and the cam e' now moves the levers D D' in a manner to draw the primary impelling-bar B' into engagement with the shoulder l' on the lower side of the jack I, which, it will be remembered, was lowered on the completion of the first stroke or movement of the slide G. This primary impelling-bar B' now impels the slide G in the reverse direction until the head h^2 thereof passes the end n of the bar N, at which time the cam e^2 moves the lever M to separate the ends n o of the rods and cause the end n to take position behind the head h^2. The cam e' now retracts the bar B and the cam e^2 impels the rod N to force its end n against the head h^2 and to cause the rod N to impel the slide G to the full limit of its stroke or until the slide again assumes the position shown by Fig. 4. As the slide G is impelled in the direction referred to its incline h rides against the incline f to rock the double lever F F' and cause it to again move the heddles.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of a heddle-lever, a cam-formed slide to actuate said heddle-lever, cam-actuated mechanism to impel the slide positively in either direction for a distance less than the full limit of movement of the slide, and an auxiliary cam-actuated mechanism to complete the full limit of motion of the slide in either direction, substantially as described.

2. The combination with a heddle-lever, and a slide for actuating the same, of mechanism to give the slide part movement, and auxiliary mechanism for completing the movement of the slide, as and for the purposes described.

3. The combination with a heddle-lever, of a reciprocating slide guided to ride on said lever as it moves back and forth and to turn

the lever on its fulcrum, mechanism for positively giving to said slide movement in either direction for a distance less than the full length of stroke of said slide, and an auxiliary and positive locking mechanism to engage with said slide before it completes its movement in either direction and to impel the slide to complete its full stroke, as and for the purposes described.

4. The combination with a heddle-lever, and a cam-formed slide for rocking the same, means for actuating the cam-formed slide, of oppositely-movable rods interposed at intervals in the path of said slide, a cam-guide to determine the position of said rods relative to said slide, and mechanism to impel the rods, substantially as and for the purposes described.

5. The combination with a heddle-lever a reciprocating slide for rocking the same, and means for actuating said slide, of a cam-guide, a rocking lever, rods pivotally attached to said rocking lever and riding upon the guide, a controlling-cam and means actuated by said controlling-cam and operatively connected with said rocking lever, substantially as and for the purposes described.

6. The combination with a heddle-lever, and a cam-formed slide, of a pattern-controlled jack movable with said cam-formed slide, slidable impelling-bars and a lever to actuate the same, the movable cam-guided rods and a lever for reciprocating the same, a double cam, and connections between said double cam and the two levers which actuate the slidable impelling-bars and the cam-controlled rods, for the purposes described, substantially as described.

7. The combination of a double heddle-lever provided with the arms f^2, f^3 and with the reversely-inclined cam-surfaces f, f', the cam-formed slide G provided with the reversely-inclined cam-surfaces h, h', and guided to move in a horizontal path whereby its cam-surfaces alternately ride upon the cam-surfaces on the double heddle-lever, a pattern-controlled jack movable with said cam-formed slide, the slidable impelling-bars B, B′ guided to travel in paths on opposite sides of the jack, the three-armed lever having two of its arms linked to said slidable impelling-bars, a cam, and a link connecting said cam with a third arm of said three-armed lever, substantially as described.

8. The combination with a heddle-lever having the cams or inclines, a cam-formed slide guided to ride upon said cams or inclines of the lever, the slidable impelling-bars B, B′, levers linked to said impelling-bars, a notched jack pivoted to the slide and playing therewith between the impelling-bars, a pattern-controlled finger operatively connected with the notched pivoted jack, a fixed cam-guide alongside of the slide, reciprocating bars arranged to ride upon the cam-guide, a lever to which said bars are connected, and a duplex cam having independent connections with the levers which control the bars B, B′ and the lever which actuates the reciprocating bars, substantially as described.

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

ROBERT B. GOODYEAR.

Witnesses:
ALFRED J. WILKINSON,
CLARENCE L. CLEGG.