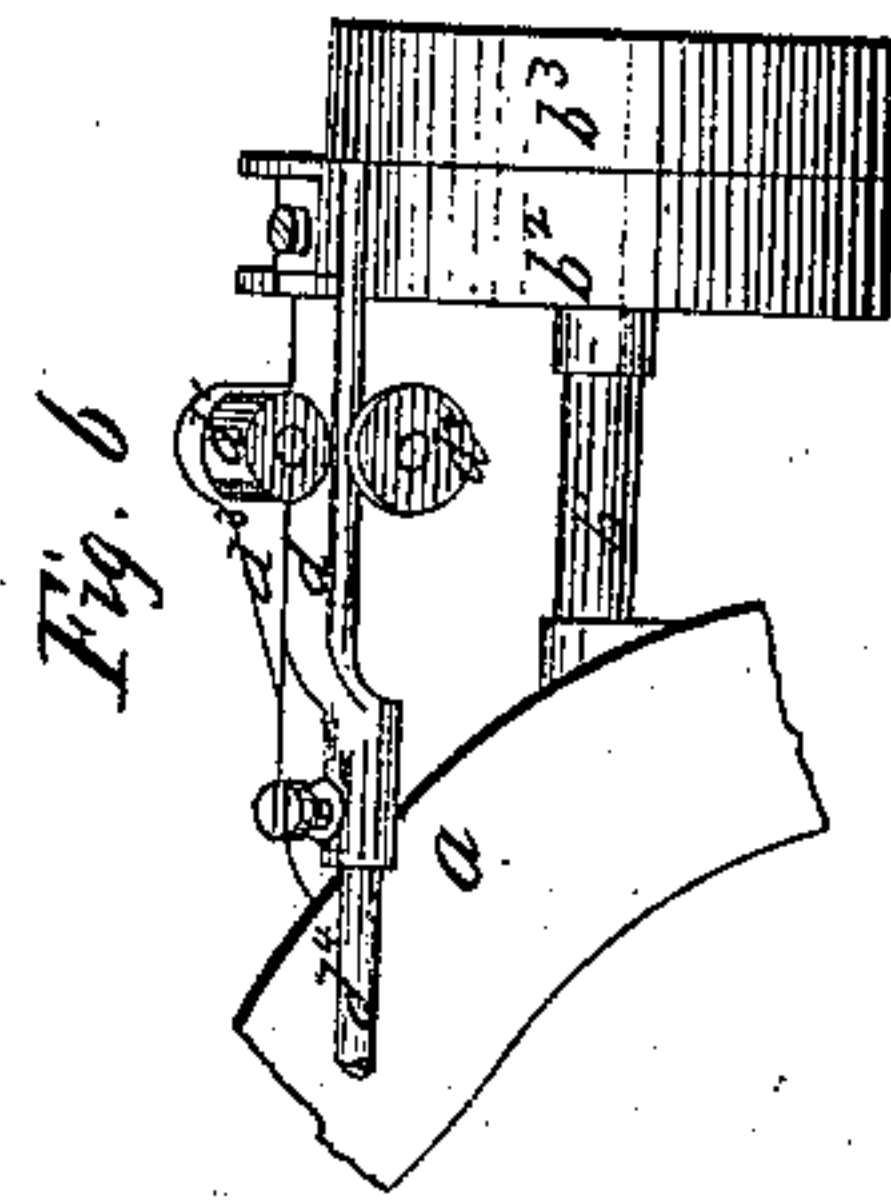
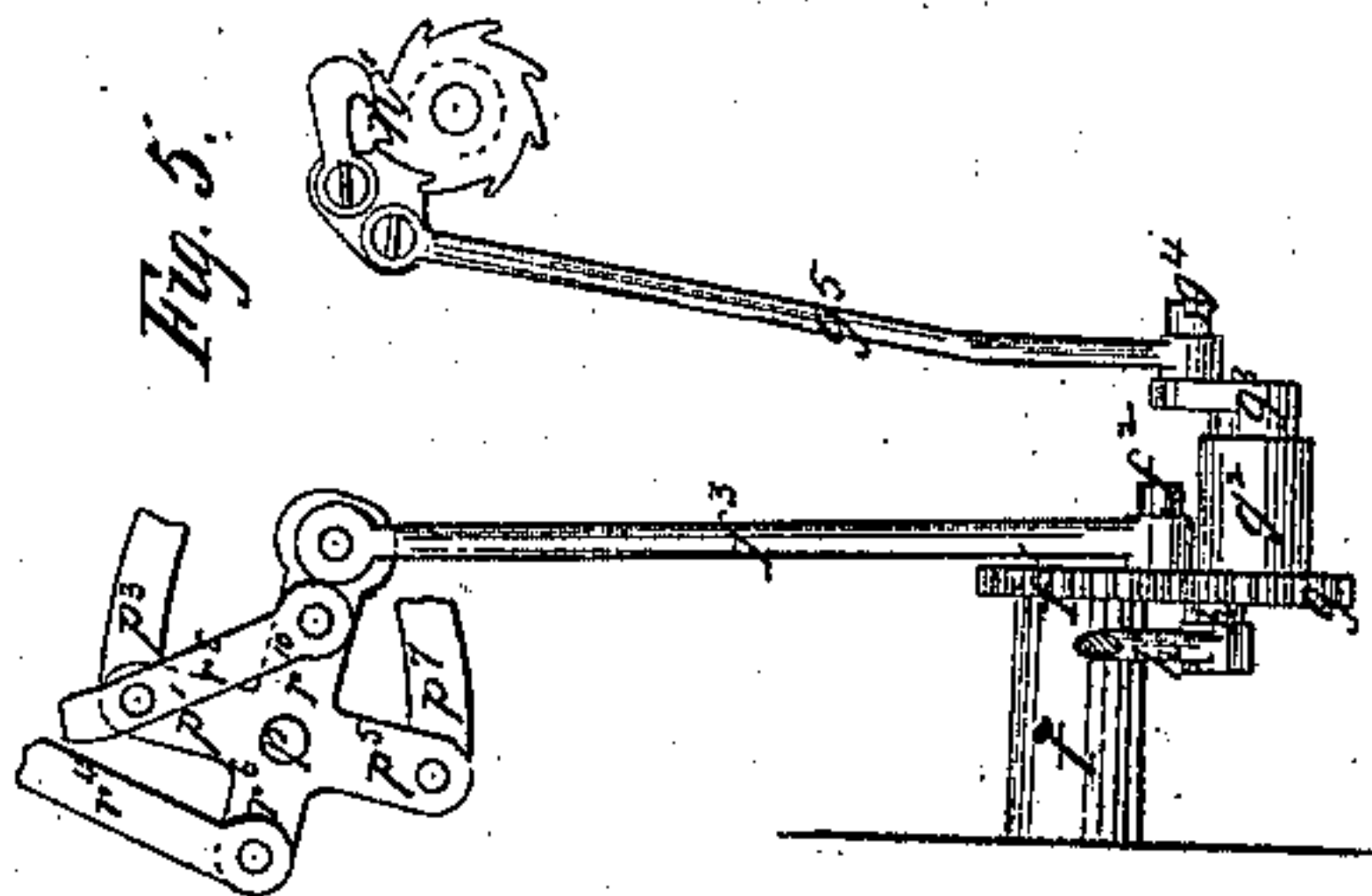
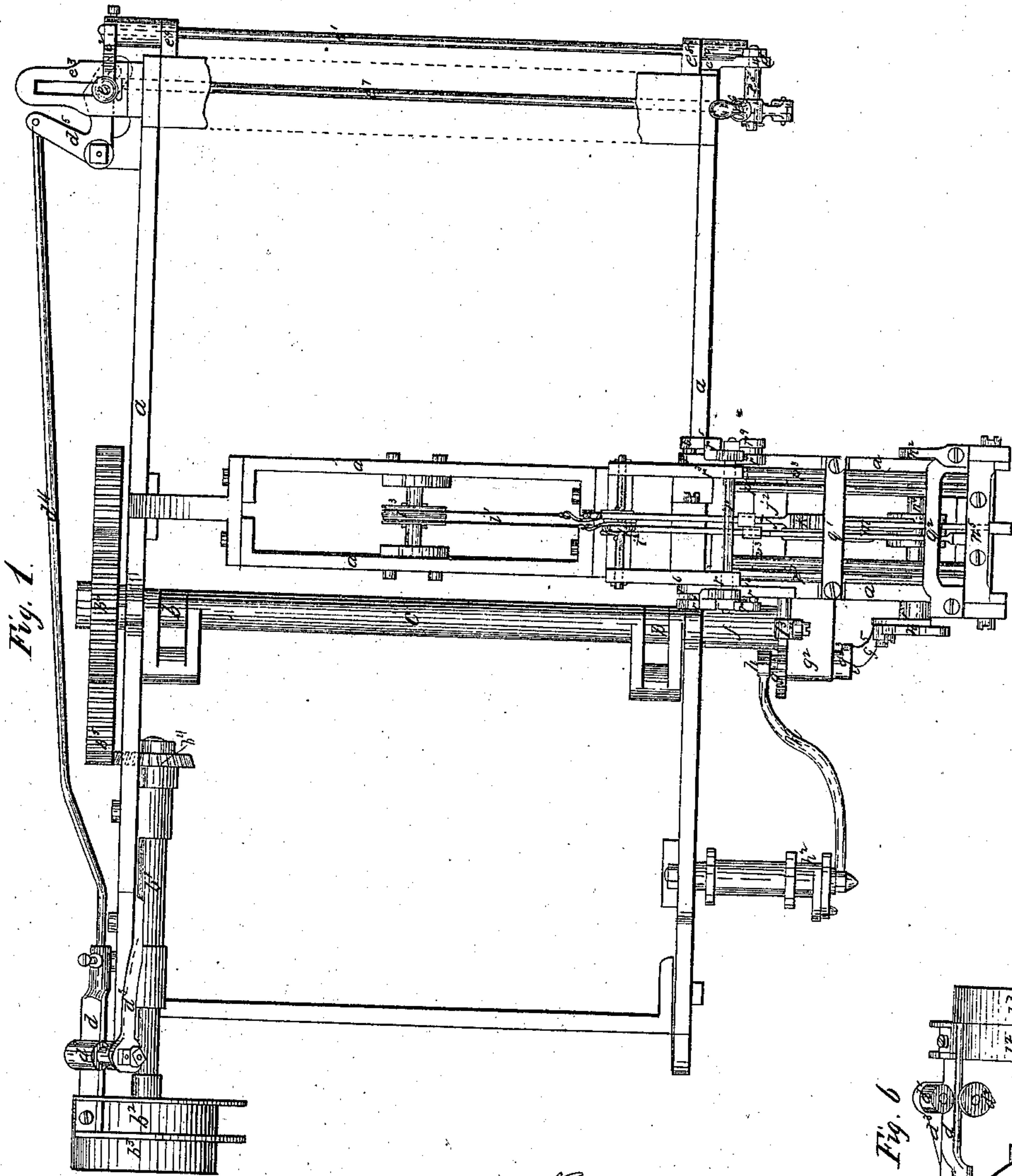


*J. C. Duckworth.*  
*Power Loom.*

Sheet 1-2 Sheets.

*N<sup>o</sup> 90,085.*

*Patented May 18, 1869.*



Witnesses,  
Emmrod  
Richard Roberts

*Inventor.*

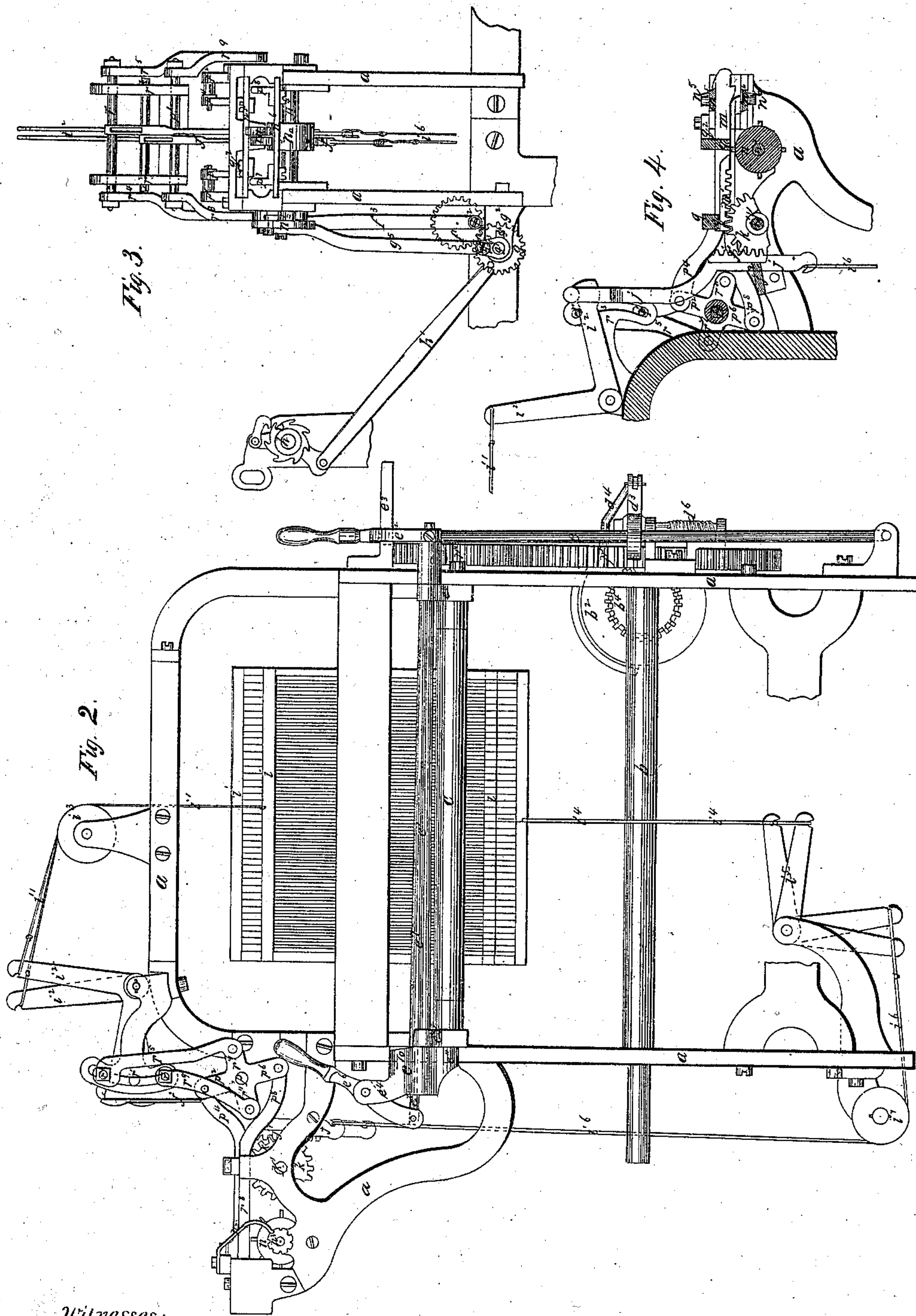
J. C. Duckworth

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*Sheet 2-2 Sheets.*

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*Patented May 18, 1869.*



*Witnesses:*  
*Emmwood*  
*Richard Roberts*

*Inventor:*  
*J. C. Duckworth*



# United States Patent Office.

JOHN C. DUCKWORTH, OF PITTSFIELD, MASSACHUSETTS, ASSIGNOR TO DUCKWORTH AND SONS, OF THE SAME PLACE.

*Letters Patent No. 90,085, dated May 18, 1869.*

## IMPROVEMENT IN POWER-LOOM.

The Schedule referred to in these Letters Patent and making part of the same.

### *To all whom it may concern:*

Be it known that I, JOHN C. DUCKWORTH, of Pittsfield, in the county of Berkshire, and State of Massachusetts, have invented certain new and useful Improvements in Fancy-Looms; and I do hereby declare that the following is a full and correct description thereof, reference being had to the accompanying drawings, and to the letters of reference thereon.

The first part of my invention relates to the mechanism of a fancy-loom, whereby the required leaves of heddles are selected and operated to form and shift the shed. In fancy-loom, this is generally accomplished by means of a series of jacks, selected by a pattern-mechanism, and directly combined with levers connected with the heddles in a suitable manner, the jacks being moved to operate the heddles by means of reciprocating knives, commonly called lifters and depressers.

Various modes have been devised of combining the jacks, lifters, and depressers, and pattern-mechanism, with the leaves of heddles of a fancy loom, which are too numerous to describe in detail, and are only referred to in this place for the purpose of showing that a combination of such devices, broadly, is well known.

For many reasons well known to practical loom-builders, it has been considered best to arrange the jacks horizontally at the side of the loom, projecting therefrom outwards in line with the leaves of heddles, which they operate, and also to place them above the main frame of the loom, with the pattern-mechanism below them, so that the pattern-chain is convenient of access and unobstructed by the other parts of the loom. In looms so constructed heretofore, the jacks have been hinged or jointed to upright levers, placed at the side of the loom, one for each leaf of heddles, and moved toward and from the side of the loom, to operate the leaves of heddles with which they are connected.

This form of construction is simple, and has many advantages, but is subject to the objection of jarring the loom and the room in which the loom is situated, by reason of the violence of the motion of so great a number of side levers as are required for the operations of the loom, besides the liability of breakage of the levers.

The object of this part of my invention is to obtain the advantages of the arrangement of the jacks horizontally at the side of the loom, and projecting outward from the same, as above mentioned, without the disadvantage of the jarring action of the side levers; and

It consists in combining the jacks so placed and arranged with a series of upright sliding bars, placed at the side of the loom, one for each leaf of heddles, in line with the same, and which move up and down to operate the leaves of heddles with which they are connected, through bell-crank levers, and suitable cords

above and below, the combination between the horizontal jacks and the upright sliding rods being effected by means of a series of cogged wheels, or segments, one for each jack, which gear into rack-teeth upon the jacks and upon the upright sliding rods.

My invention further consists in moving the eveners to close the shed in the arc of a circle described by the movement of the part of the arms of the levers upon which they operate to close the shed, for the purpose of preventing the wearing or sawing off of the eveners by friction upon the levers.

The next part of my invention consists in a simple combination and arrangement of mechanism, whereby motion from the crank-shaft of the loom is imparted to the lifters and depressers for moving the jacks that operate the heddles, to the pattern-mechanism which selects said jacks, and to the pattern-mechanism which selects the shuttles.

In fancy-loom having shifting-shuttle boxes selected by a pattern-mechanism, the pattern-chain for selecting the shuttles must be moved at every revolution of the crank-shaft which drives the lay, as must also the pattern-mechanism which selects the jacks, and the lifters and depressers which move the jacks, to form and shift the shed, and their movement must be so timed, with respect to each other, that each shall perform its function at the proper time in the operation of the loom.

The object of this part of my invention is to provide a simple and direct mode of imparting the required motion susceptible of ready adjustment.

To this end, I extend the crank-shaft that drives the lay a short distance beyond the side frame of the loom, outside thereof, and place upon it a cog-wheel, upon the side of which is a crank-pin, which drives the link that communicates motion to the lifters and depressers.

The cog-wheel upon the crank-shaft gears into another cog-wheel of the same size upon a short crank-shaft, parallel with the first, and supported in a bracket-bearing outside of the side frame, which carries two cranks; one of them, fixed in the side of the cog-wheel, drives the link that operates the ratchet of the pattern-chain which selects the shuttles, and the other crank, placed upon the opposite end of the short crank-shaft, is made adjustable by a set-screw, and drives the link that operates the ratchet of the pattern-chain which selects the heddle-jacks.

The arrangement and combination of the short crank-shaft, with its two cranks and gear-wheel, and the projecting end of the crank-shaft which drives the lay and its crank and gear-wheel, being such that the relative adjustment between the lifters and depressers which operate the heddle-jacks, and the pattern-chain which selects the shuttles, is obtained by shifting the point of engagement of the gear-wheels with each other, and



this adjustment having been properly made, the relative adjustment of the motion of the pattern-chain which selects the heddle-jacks is effected by moving the crank, which drives it around upon the short shaft to its proper place for giving the required motion at the proper time, and securing it in place by the set-screw.

By thus bringing the ends of the three links which operate, respectively, the three mechanisms above mentioned, close together near the end of the crank-shaft, and connecting them with the three cranks, I am enabled to simplify greatly the gearing of this part of the loom, and at the same time readily and accurately adjust and determine the time of the motions.

The next part of my invention relates to the belt-shipper.

In the use of looms, especially broad looms, it is frequently necessary to start or stop the loom when the operator is at the side of the loom farthest from the belt-shipper, and therefore a second lever has been pivoted to the opposite side of the loom to operate the shipping-lever, by means of a sliding rod, carrying and operating a cam and hook. This part of my invention, therefore, is limited to the combination of the second lever with the shipping-lever, when the second lever is connected directly with the shipping-lever, by means of a link, and is pivoted upon the arm of a rock-shaft, which extends across the front of the loom, and has upon its other end an arm, which acts upon the shipping-lever to release it.

In order more particularly to describe my invention, I will refer to the accompanying drawings, which illustrate my improvements.

Figure 1 is a plan view of a loom-frame with my improvements;

Figure 2, a front elevation of the same;

Figure 3, a side elevation of a portion of the loom, showing the harness-motion;

Figure 4, a detached section, showing the harness-motion;

Figure 5, a detached view of the arrangement of cranks and gear-wheels with the end of the crank-shaft of the loom, for giving motion to the lifters and depressers, and pattern-mechanism connected with the heddle-jacks, and the pattern-mechanism for selecting the shuttles; and

Figure 6, a detached view of a portion of the belt-shipper, with its roller-guides.

Letter *a* represents the frame of the loom.

*b*, the main shaft.

*b*<sup>1</sup>, the driving-shaft, carrying the tight and loose pulleys *b*<sup>2</sup> *b*<sup>3</sup>, and connected with the main shaft by a bevelled pinion, *b*<sup>4</sup>, gearing into a crown-gear at the side of the gear-wheel *b*<sup>5</sup>, fast to the main shaft *b*, which also gears into the cog-wheel *b*<sup>6</sup>, fast to the crank-shaft *c*, which drives the lay of the loom, (not represented in the drawings, which are only intended to represent the improvements herein described, and parts immediately connected with them.)

The forks of the belt-shipper are attached to a sliding bar, *d*, supported and guided by and between two anti-friction rollers *d*<sup>1</sup> *d*<sup>2</sup>, the latter having flanges upon it to hold the slide-rod in place.

These rollers turn upon pins projecting from a bracket, or hanger, *d*<sup>3</sup>, bolted to the rear of the side frame of the loom, the sliding bar *d* being connected by a rod, *d*<sup>4</sup>, to the usual bell-crank lever *d*<sup>5</sup>, provided with a spring, *d*<sup>6</sup>, and operated by the shipping-lever *e*.

In front of, and extending across the loom, is a rock-shaft, *e*<sup>1</sup>, to one end of which is fixed an arm, *e*<sup>2</sup>, which, when moved against the shipping-lever, releases it from the catch in the slotted guide *e*<sup>3</sup>; and at the other end of the rock-shaft is fixed an arm, *e*<sup>4</sup>, that carries a fulcrum-pin, *e*<sup>5</sup>, of the second shipping-lever, *e*<sup>6</sup>, connected directly with the main shipping-lever by a connecting-rod, *e*<sup>7</sup>.

When the operator desires to release the belt-shipper by the action of the second lever, he takes hold of the handle, and moves it toward the rear of the loom, thereby moving the rock-shaft and the releasing-arm upon the other end thereof, which latter pushes the shipping-lever backward, and releases it from the notch by which it is held, so that the spring is free to actuate the belt-shipper to throw off the belt and stop the loom.

To start the loom by means of the second lever, it is simply necessary to move the handle toward that of the main shipping-lever, until the latter comes opposite the notch which holds it, and then to move the handle of the second lever slightly toward the front of the loom, to remove the releasing-arm of the rock-shaft from contact with the shipping-lever.

The rock-shaft *e*<sup>1</sup> rocks in bearings *e*<sup>8</sup> *e*<sup>9</sup>, but has a limited motion, the arm *e*<sup>4</sup> having projections or stops *e*<sup>10</sup> *e*<sup>11</sup> above and below the rock-shaft, which alternately bear upon the loom-frame as the shaft is rocked one way or the other.

The crank-shaft *c*, which drives the lay, projects outside the loom-frame on the opposite side of the loom from the gearing by which it is driven, and to it is fitted and secured a sleeve, or hub, *f*, of a cog-wheel, *f*<sup>1</sup>, from the side of which projects a crank-pin, *f*<sup>2</sup>, which drives the link, or pitman *f*<sup>3</sup>, that operates the lifters and depressers, and in this loom the eveners also.

The cog-wheel *f*<sup>1</sup>, upon the projecting end of the crank-shaft, gears into another cog-wheel, *g*, having the same number of teeth, and fast to a horizontal rotating spindle, or short shaft, *g*<sup>1</sup>, which rotates in a bearing, *g*<sup>2</sup>, projecting from the bracket-frame which supports the harness-motion, and carries upon its outer end a crank, *g*<sup>3</sup>, and crank-pin *g*<sup>4</sup>, which drives the link, or pitman *g*<sup>5</sup>, that operates the pattern-mechanism of the harness-motion.

A crank-pin, *h*, projecting from the side of the cog-wheel *g*, drives the link, or pitman *h*<sup>1</sup>, which operates the pattern-mechanism *h*<sup>2</sup> for selecting the shuttles, which may be, as usual in looms, a pattern chain, or pattern-barrel, and is not necessary to be further described herein.

The crank *g*<sup>3</sup> is fixed in place to move the pattern-mechanism for selecting the heddle-jacks at the required time, by a pinching-screw, *g*<sup>6</sup>; therefore, in order to set the three links to move at the proper time to operate their respective mechanism, it is only necessary to match the teeth of the two cog-wheels at a point which determines the correct position of the two links driven by the crank-pins attached to them, and then to place the crank *g*<sup>3</sup> in its proper angular position upon the short shaft or spindle, to determine the proper time of movement of the link which it drives, and secure it by the set-screw.

It will be seen that this arrangement of the cranks and pitmen avoids the ordinary complicated arrangement of gearing and connections usually employed for the purpose.

In fancy-loom, the number of leaves of heddles used varies in accordance with the pattern, but only two are shown in the drawings, the operation of one being the same as the operation of the rest.

In my improved harness-motion, the heddles *i* are connected by cords to a double series of bell-crank levers, one above and the other below, one of each series for each leaf of heddles, the cords *i*<sup>1</sup> passing up to the bell-crank levers *i*<sup>2</sup>, over pulleys *i*<sup>3</sup>, directly over the heddles, and the cords *i*<sup>4</sup>, passing downward directly to the lower series of bell-crank levers *i*<sup>5</sup>, beneath the heddles.

The lower series of bell-crank levers have each connecting-cords *i*<sup>6</sup>, which run to the pulleys *i*<sup>7</sup>, at the side of the loom-frame, outside thereof, and from thence



upward to the lower ends of the upright sliding bars  $j$ , to which they are hooked.

The upper ends of the upright sliding bars  $j$  are connected with the horizontal arms of the upper series of bell-crank levers, so that whenever these upright sliding bars are moved up and down, the leaves of heddles with which they are respectively connected are also moved, there being one for each leaf of heddles.

Each of the upright sliding bars has a rack of cog-teeth,  $j^1$ , upon it, which gears into a segment cog-wheel,  $k$ , there being one of these segment cog-wheels for each sliding bar arranged in front of the sliding bars, upon a fixed shaft,  $k'$ , common to them all, and upon which they each turn freely, irrespective of each other.

Guides  $j^2$  are placed behind the racks of the sliding bars, to keep them in place and in gear with the teeth of the segment-wheels.

The horizontal hooked jacks  $m$  are also provided with rack-teeth  $m^1$  upon their lower edges, which gear into the teeth of the segment-wheels  $k$ , so that when a jack is moved horizontally it moves the upright sliding bar vertically, through the segment-wheel, the sliding bars being shaped as shown in the drawings, to permit the jacks to move backward over those parts which carry the rack-teeth.

Directly beneath the horizontal hooked jacks is placed the pattern-barrel  $n$ , which may be armed with pins, as shown in the drawings, or may carry the ordinary pattern-chain used in fancy-loom, and is moved at the proper time by a pawl and ratchet,  $n^1$ , actuated by the link, or pitman  $g^5$ , driven by the crank  $g^3$ , and held at rest by the friction-spring  $n^2$  acting upon the notched wheel  $n^3$ , fast to the shaft  $n^4$ , which carries the pattern-mechanism.

The horizontal hooked jacks, when selected by the pattern-mechanism, are moved either toward or from the loom, as required, by two reciprocating knives,  $n^5$   $n^6$ , one placed above and the other below the jacks, in channelled guides in the frame, and reciprocated by means of the rock-shaft  $p$ , the upper knife being connected to two arms,  $p^1$   $p^2$ , of the rock-shaft, by two links,  $p^3$   $p^4$ , and the lower knife to two arms,  $p^5$   $p^6$ , of the rock-shaft, by two links,  $p^7$   $p^8$ .

The upper knife is free to lift, in order to prevent breakage, in case of interference of the jacks.

The hooked jacks are held in place by guides  $q$ , projecting downwards from two framing-pieces  $q^1$   $q^2$ , which extend over the jacks, and are secured to the frame.

The eveners, which in this loom close the shed and bring all the parts of the harness-motion into proper position for forming and opening the new shed, are two horizontal rods,  $r$   $r^1$ , one above and the other below the horizontal arms of the upper series of bell-crank levers connected with the heddles.

They are guided so as to move in the same curve of motion as the parts of the arms of the bell-crank levers upon which they act move, by means of slotted guides  $r^2$   $r^3$  of the required curvature, through which

they project, and are moved up and down by links, connected with two horizontal arms, fast to each end of the rock-shaft  $p$ , the upper evener-rod  $r$  being connected by the two links  $r^4$   $r^5$  to the arms  $r^6$   $r^7$ , and the lower evener-rod  $r^1$  by the links  $r^8$   $r^9$  to the arms  $r^{10}$   $r^{11}$ .

The rock-shaft  $p$ , which thus moves the reciprocating knives, sometimes called lifters and depressers, and in this loom the eveners, is rocked by the link, or pitman  $f^3$ , driven by the crank  $f^2$ , upon the projecting end of the crank-shaft of the loom.

The evener-rods may be made to move in the same curve of motion as that of the parts of the arms of the levers upon which they act, without the use of the curved slotted guides, by attaching, to each end of the evener-rods, arms pivoted upon the same centre of motion as the fulcrum of the levers.

The drawings show this harness-motion adapted to narrow looms, with single cords connecting with the heddles over pulleys placed centrally above them, but in broad looms the usual double connections of cords or straps running over two sets of pulleys above the heddles are of course to be used.

The extent of motion of the different heddles of a fancy-loom varies with their location, and may be regulated by making the arms of the bell-crank levers with which the cords connect, of different lengths, or by placing a number of notches in the arms, into which the connecting-cords may be hooked, as required.

I claim—

1. In combination with the jacks, arranged horizontally at the side of the loom, and projecting outward therefrom, the segment-wheels and upright sliding bars, connected with the leaves of heddles, substantially as described.

2. The evener-rods, in combination with the arms of the levers upon which they operate to close the shed, when the eveners are moved in the curve described by the movement of that part of the arms of the levers with which the eveners are in contact, substantially as and for the purposes described.

3. The arrangement and combination of the short crank-shaft with its two cranks and gear-wheel, with the gear-wheel and crank carried by the projecting end of the crank-shaft which drives the lay, whereby motion from the crank-shaft is imparted to the links which drive the lifter and depresser, and pattern-mechanism of the harness-motion, and the pattern-mechanism for selecting the shuttles, substantially as described.

4. In combination with the main shipping-lever, the rock-shaft, with its releasing-arm, the second lever, and connecting-rod, substantially as described, whereby the loom may be stopped or started from either side, as set forth.

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