(No Model.) 7 Sheets—Sheet 1.

S. T. & W. S. THOMAS.

W. S. THOMAS, Administrator of S. T. THOMAS, Deceased.

LOOM.

No. 435,549. Patented Sept. 2, 1890.

Fig. 1.

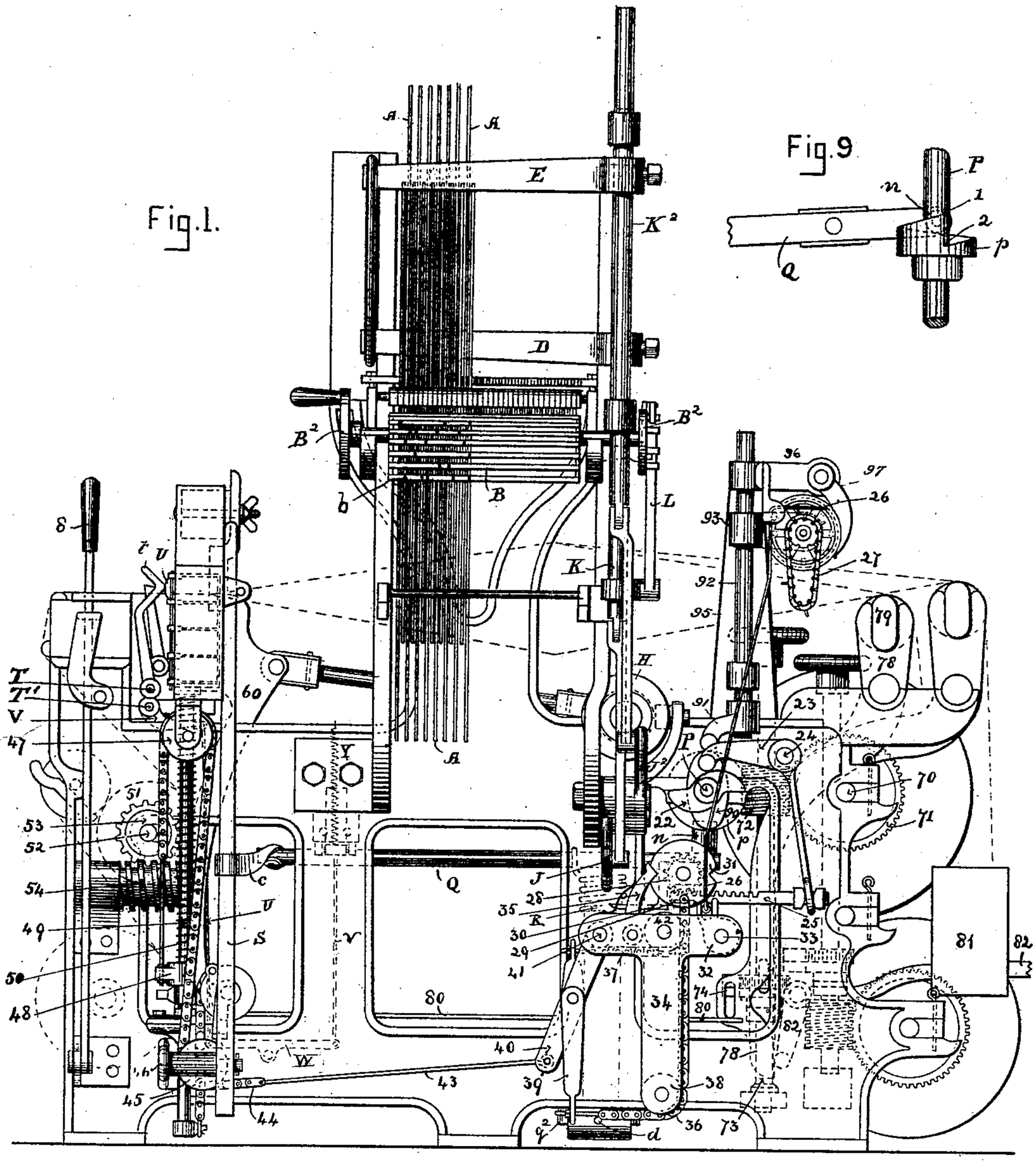

Fig. 9.

Witnesses.
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W. O. Ricker

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Winfield S. Thomas
by E. Planta
Attorney.

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LOOM.

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Fig. 2.

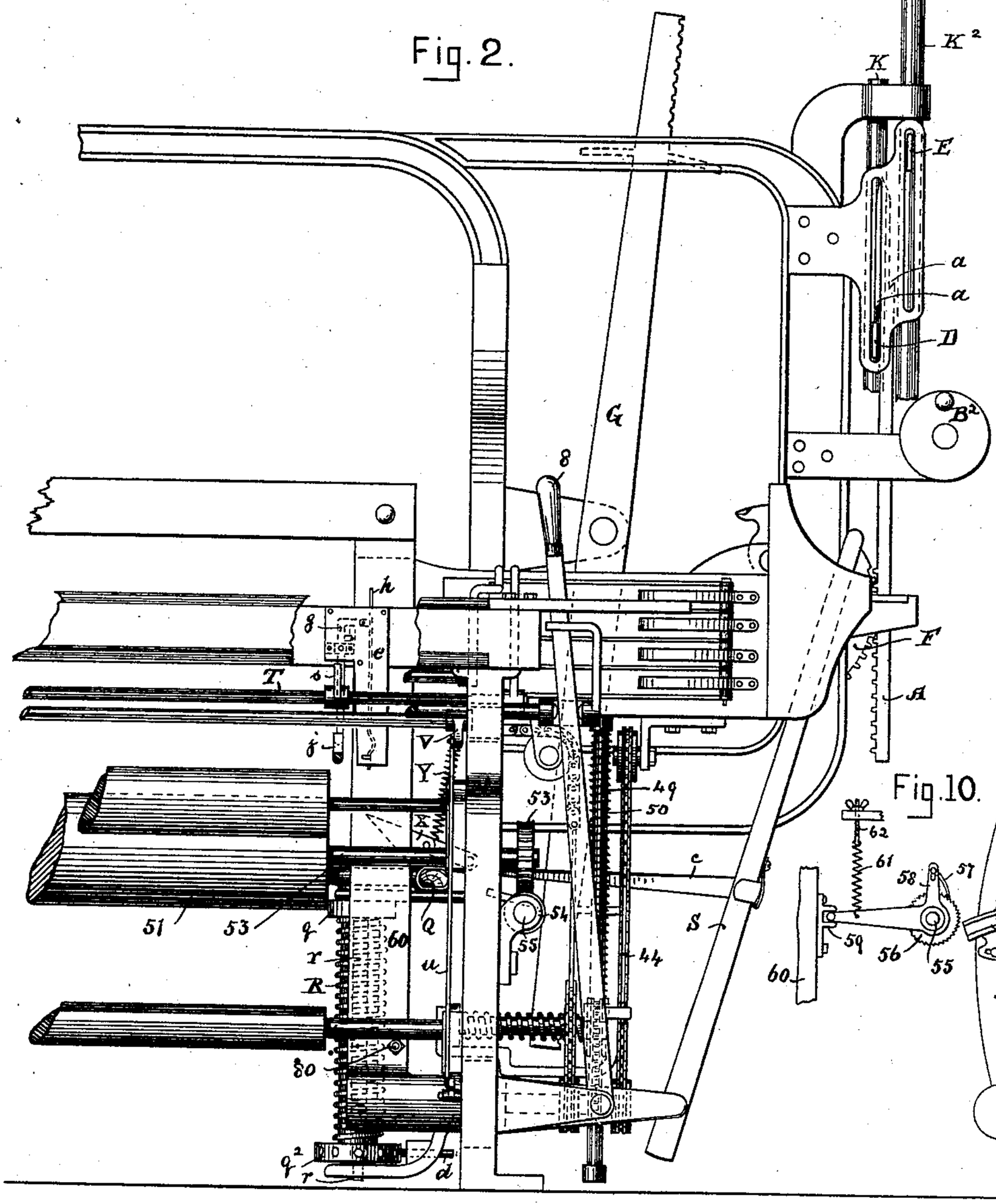

Fig. 10.

Witnesses.
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(No Model.)

7 Sheets—Sheet 3.

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LOOM.

No. 435,549. Patented Sept. 2, 1890.

Fig. 8.

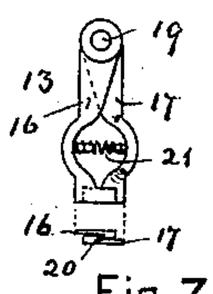


Fig. 7.

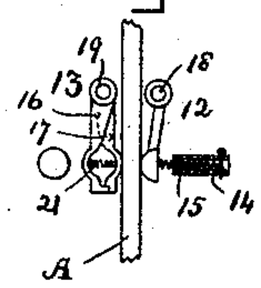


Fig. 3.

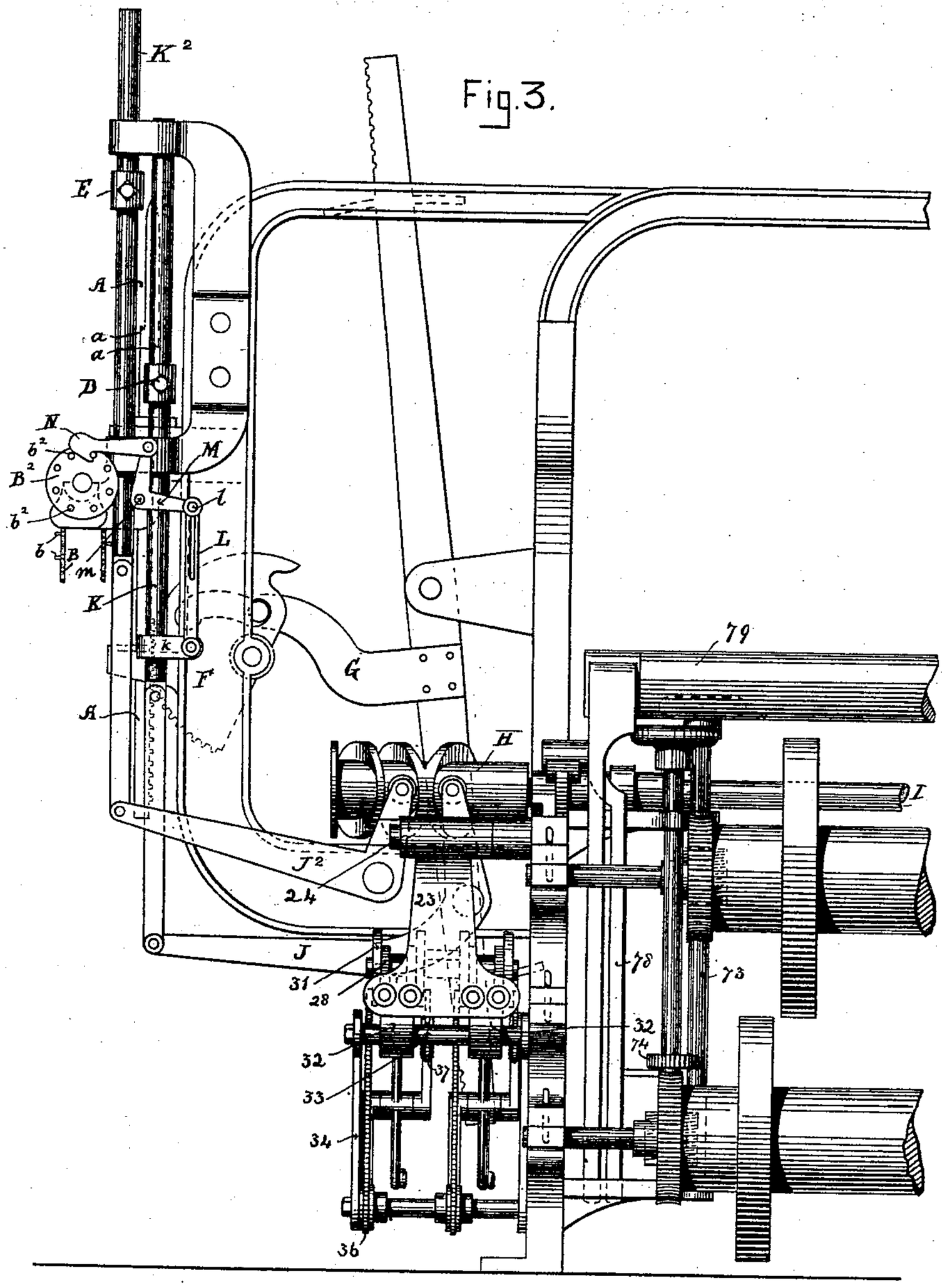


Fig. 11.

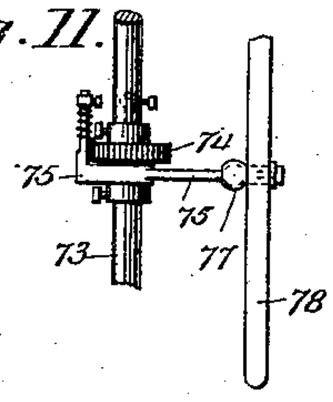
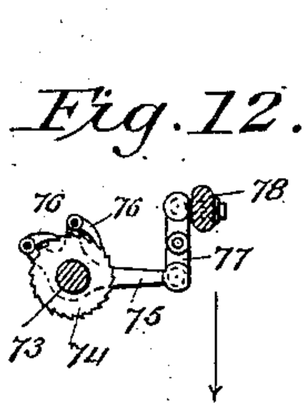


Fig. 12.



Witnesses.
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(No Model.) 7 Sheets—Sheet 4.

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LOOM.

No. 435,549. Patented Sept. 2, 1890.

Fig. 4.

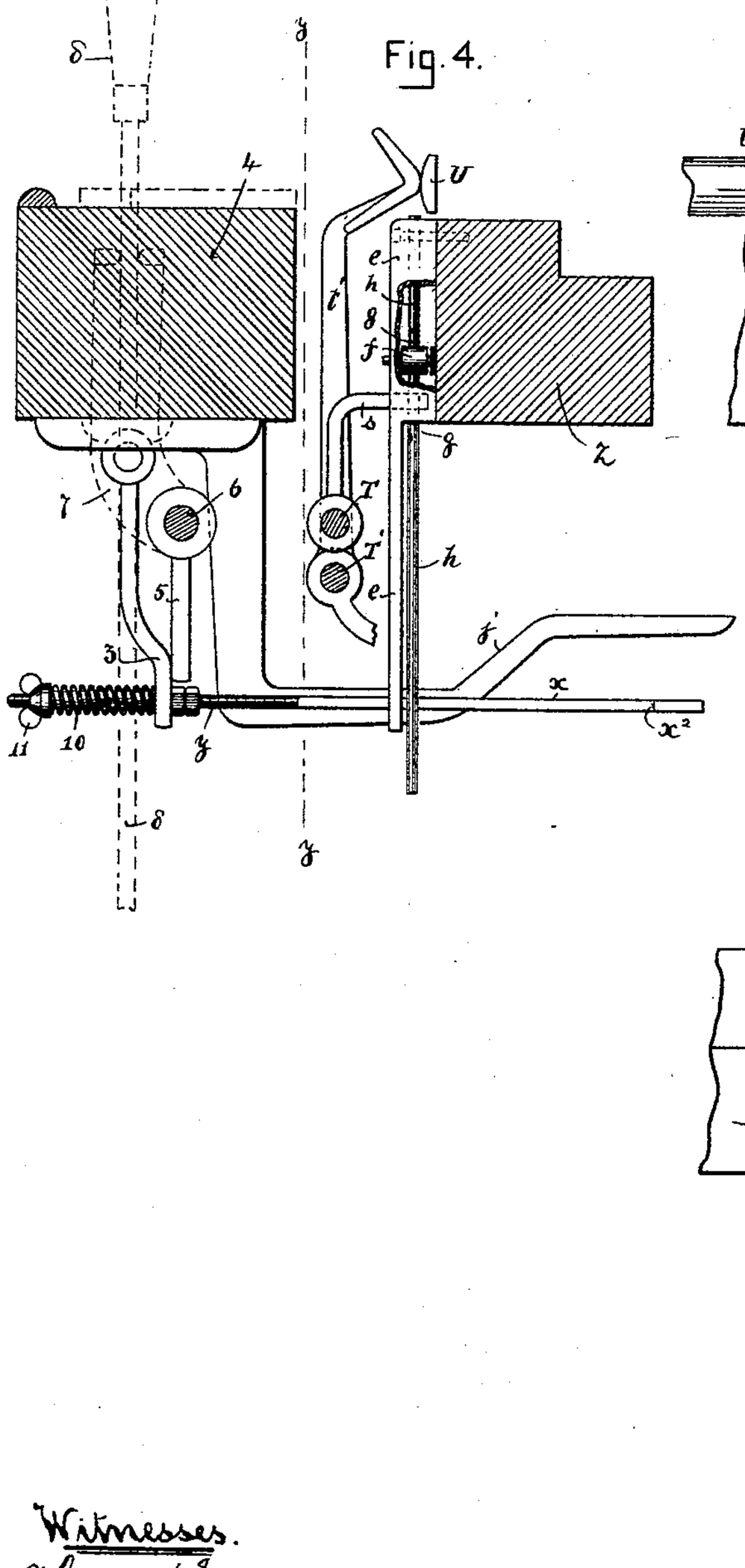


Fig. 5.

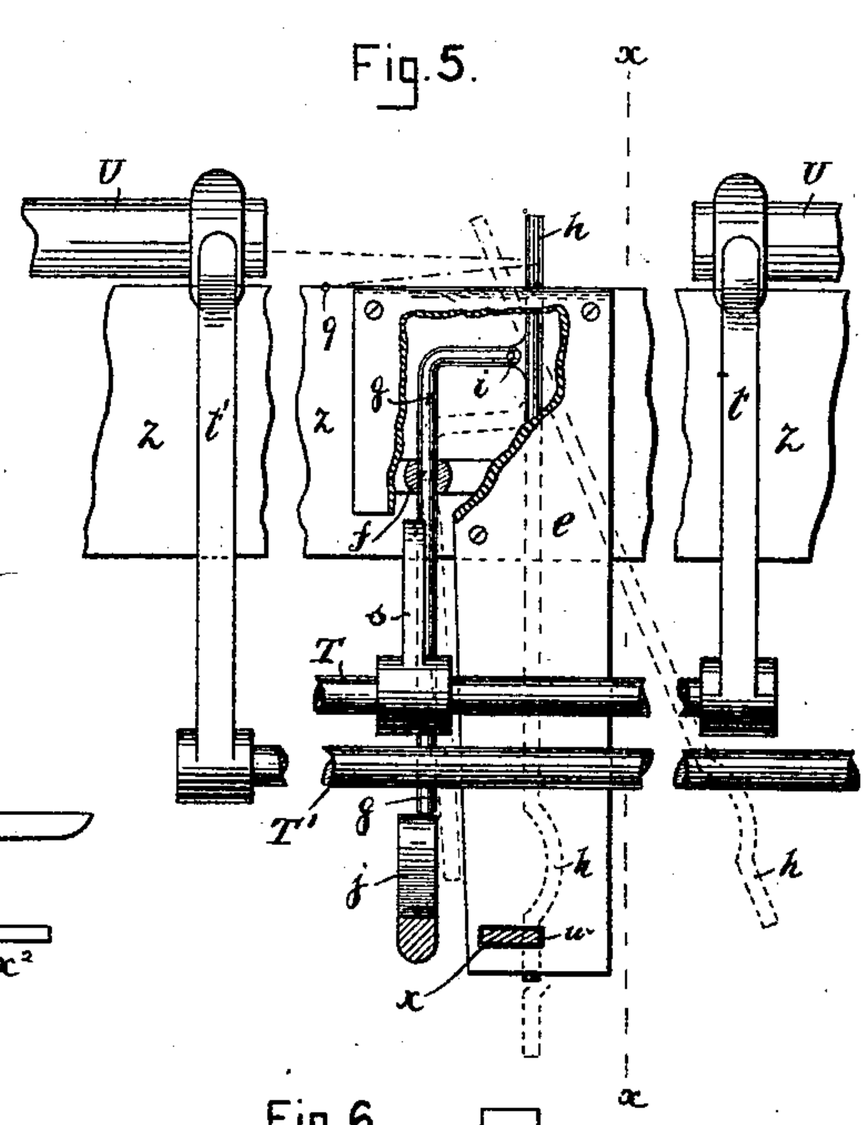
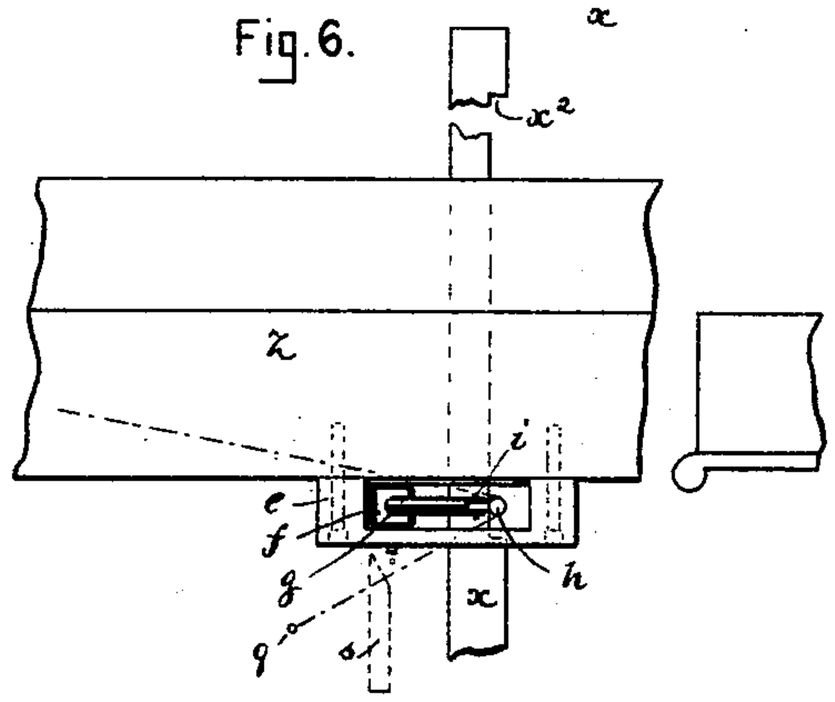


Fig. 6.



Witnesses.
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LOOM.

No. 435,549. Patented Sept. 2, 1890.

Fig. 13.

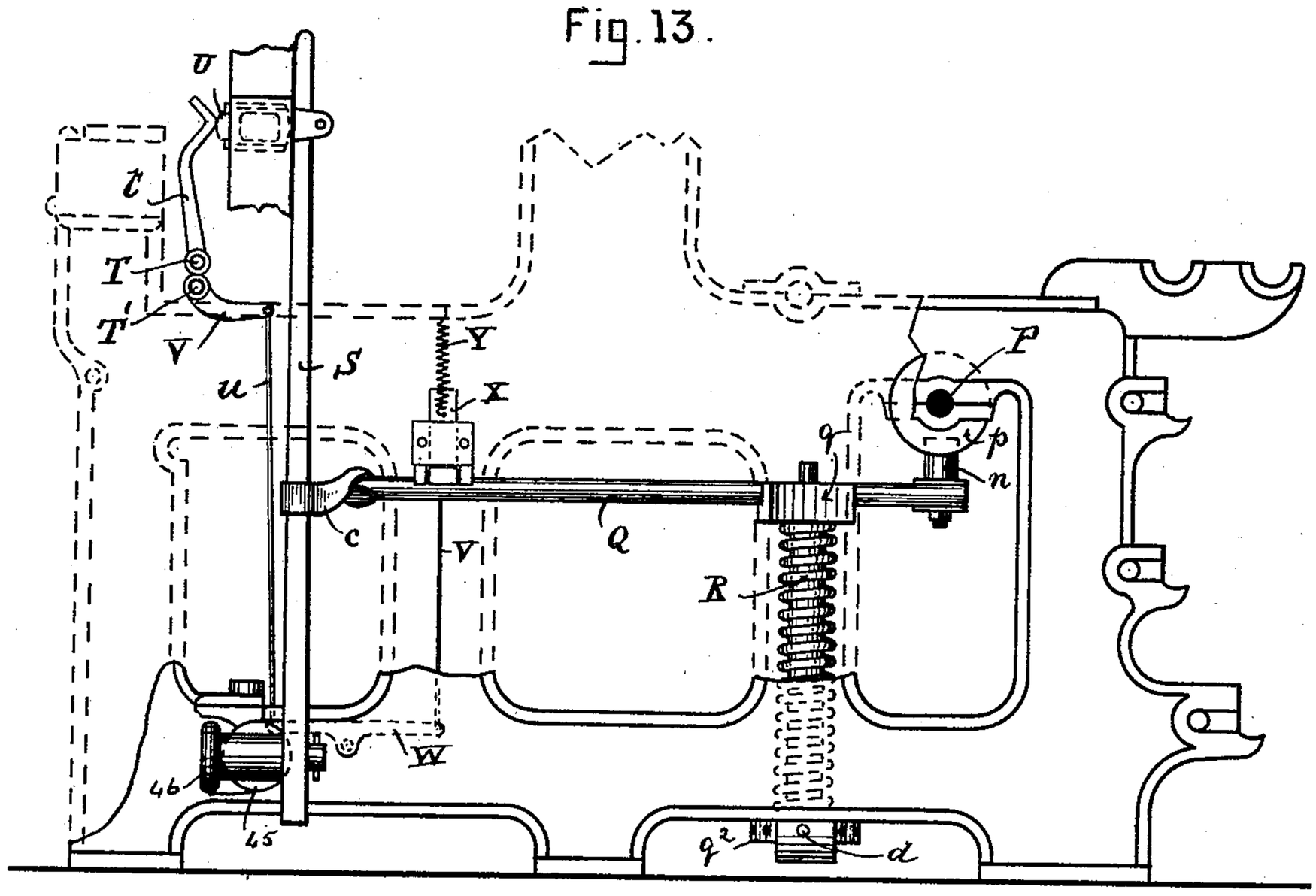
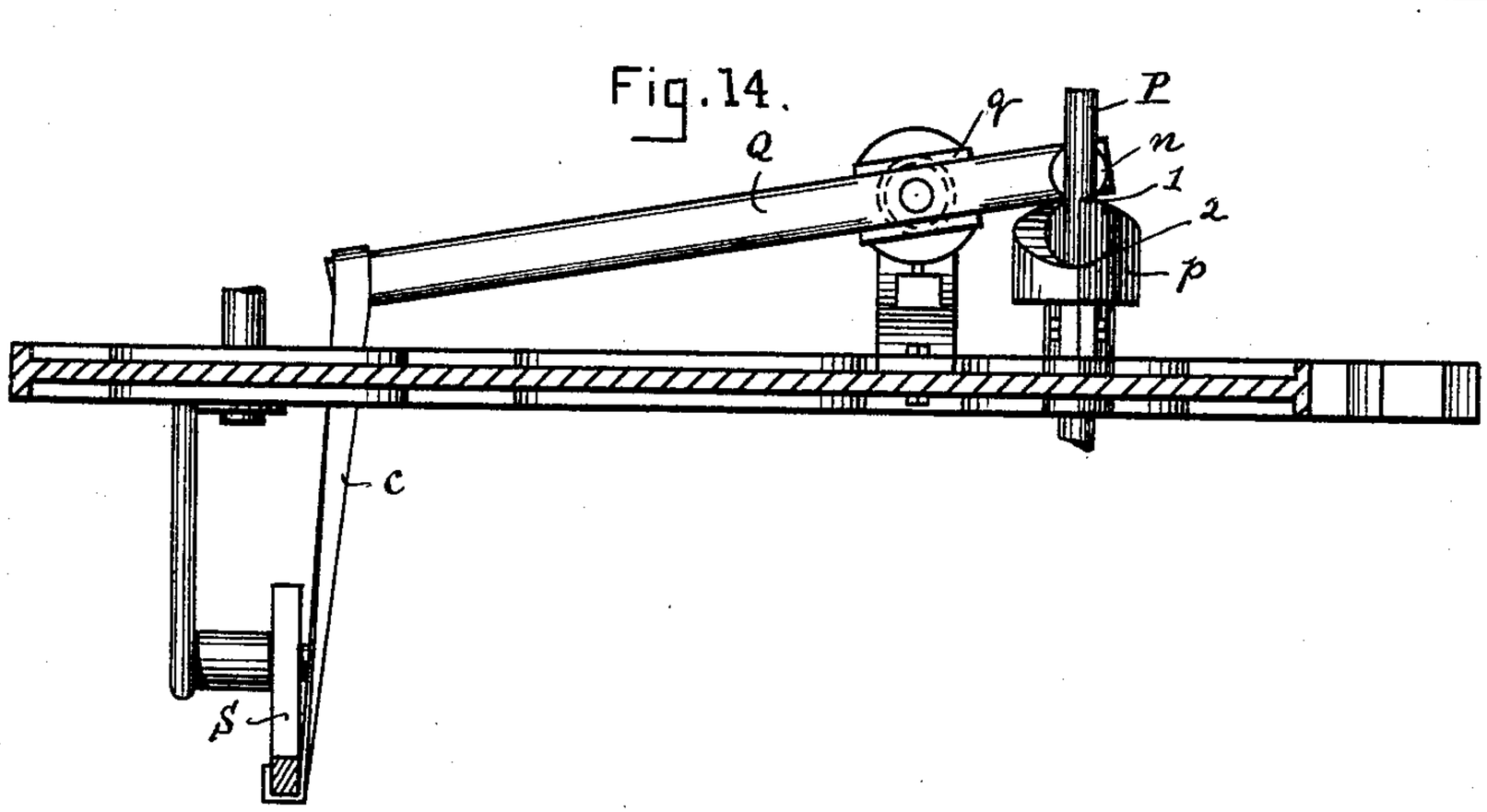


Fig. 14.



Witnesses.
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LOOM.

No. 435,549. Patented Sept. 2, 1890.

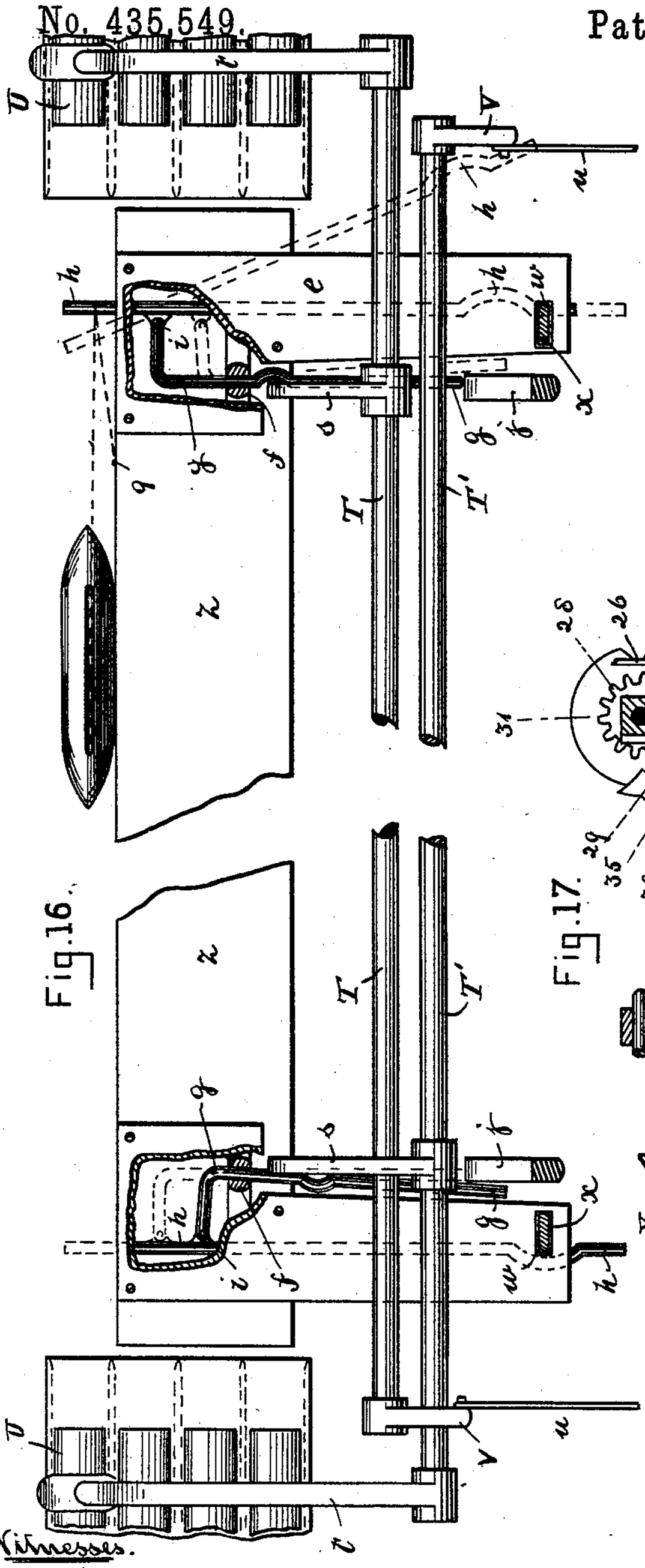

Fig. 16.

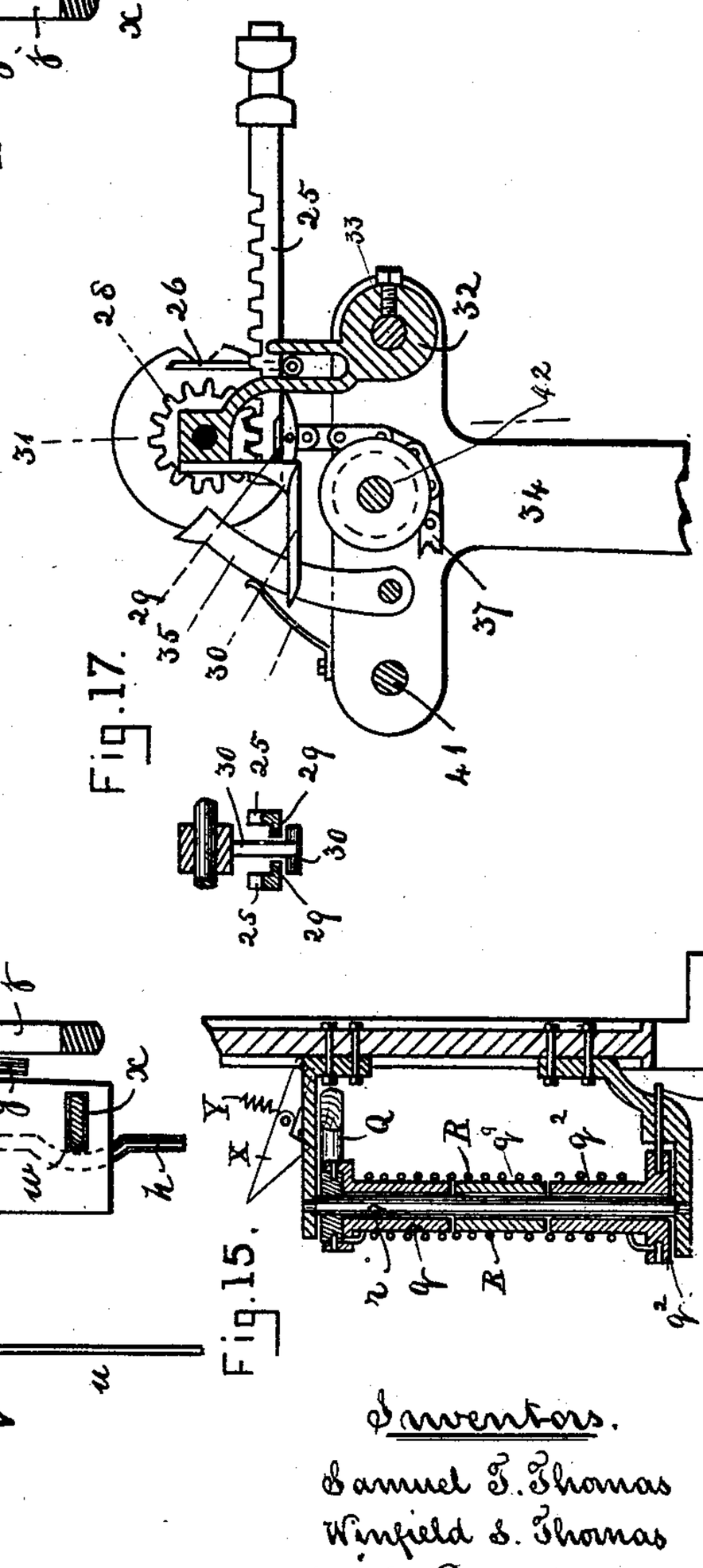

Fig. 17.

Fig. 15.

Witnesses.

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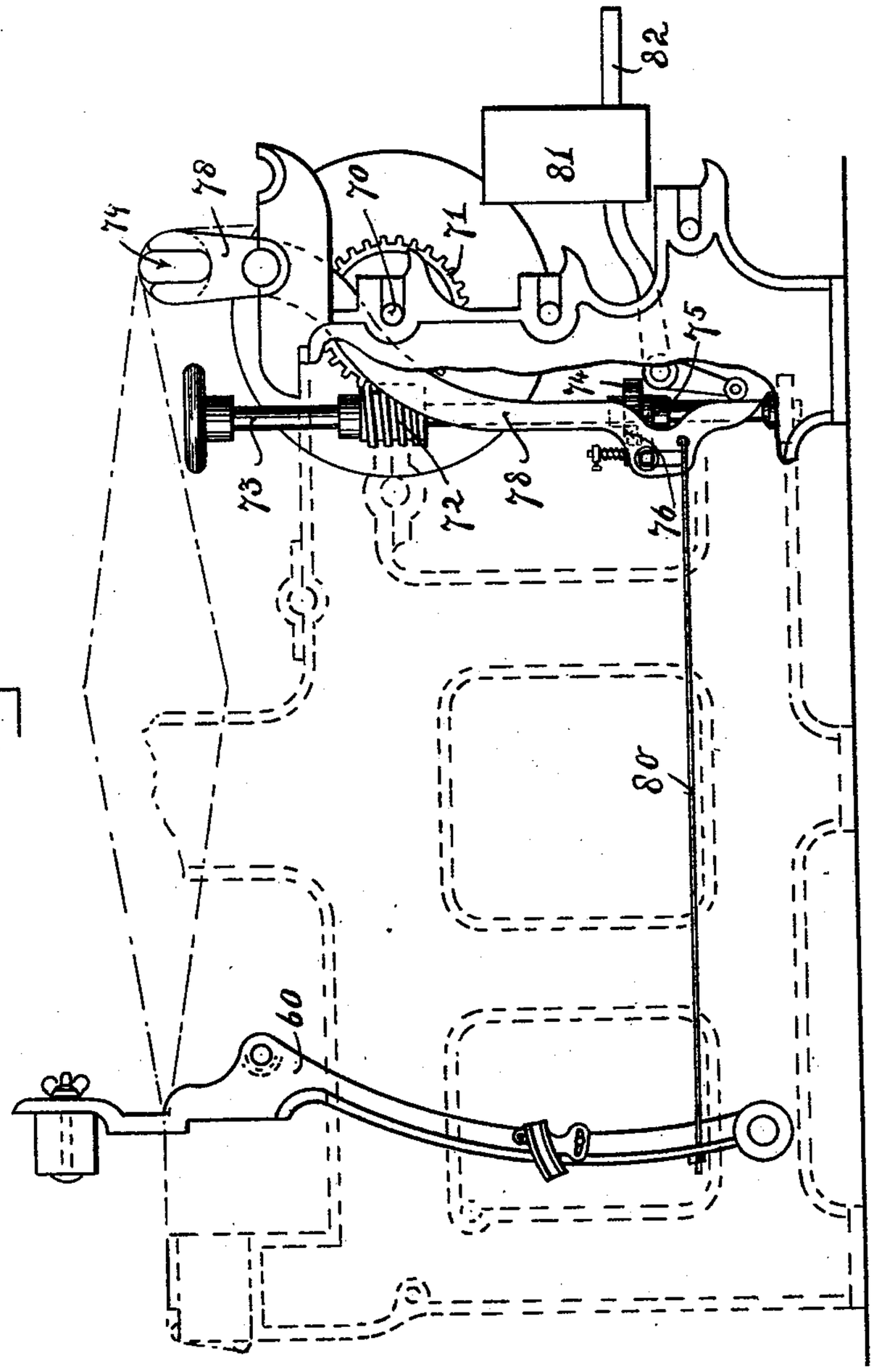
LOOM.

No. 435,549. Patented Sept. 2, 1890.

Fig. 18.



Witnesses.
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T. O'Connell

Inventors
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Winfield S. Thomas
by E. Blanta
attorney

UNITED STATES PATENT OFFICE.

SAMUEL T. THOMAS AND WINFIELD S. THOMAS, OF BOSTON, MASSACHUSETTS; WINFIELD S. THOMAS ADMINISTRATOR OF SAID SAMUEL T. THOMAS, DECEASED.

LOOM.

SPECIFICATION forming part of Letters Patent No. 435,549, dated September 2, 1890.

Application filed October 10, 1887. Serial No. 251,911. (No model.)

To all whom it may concern:

Be it known that we, SAMUEL T. THOMAS and WINFIELD S. THOMAS, citizens of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Looms, of which the following is a specification.

This invention relates, first, to improved drop-weights or tumblers, in combination with the pattern-chain, racks, geared sector-cams, and harness-lever of a positive open-shed-harness motion; secondly, to improved mechanism to prevent a shuttle being thrown unless there is an empty box opposite to receive it; thirdly, to an improved drop-shuttle-box motion, whereby any box in the series can be brought into the required position without fail; fourthly, to an improved filling-stop motion; fifthly, to an improved let-off motion.

Referring to the accompanying drawings, Figure 1 represents a side view of a loom embodying our invention. Fig. 2 is a front view of the right-hand end of the loom, showing our improvements. Fig. 3 is a back view of the same end of the loom. Figs. 4, 5, and 6 show the stop-motion, Fig. 4 being a section taken on line $x\,x$ of Fig. 5; Fig. 5, a section taken on line $y\,y$ of Fig. 4, and Fig. 6 is a plan of Fig. 5. Figs. 7 to 18 are detail views of various parts.

The drop-weights or tumblers 12 and 13 (see Figs. 7 and 8) are of two kinds, hung on rods 18 19 at the front and back of the upright racks or jacks A, and bearing against them, one of each kind to a rack. Those at the back 12 are hung on the rod 18 and have their weighted end half-disk shape, (see Fig. 7,) the circular part being pressed against the rack by a spiral spring 14 on the back side of each. The springs 14 are supported in a series of holes in a plate 15, the holes being the proper distance apart opposite the back of each tumbler 12. The tumblers at the front are hung so that their weighted ends on one side bear against the fronts of the racks A and the other against the pattern-chains B. Each of these tumblers 13 (see Figs. 7 and 8) consists of two parts 16 17, hung at their upper ends on the rod 19, and the parts that come in contact with the pattern-chain and rack are formed of a bow shape with catches 20 at the bottom to prevent them being forced apart by the spring 21, held on studs in the bows. The tumblers 12 at the back keep the racks pressed forward all the time by the action of the spiral springs 14, unless pressed back by the presence of screws or pins b in the pattern-chain bearing against the front drop-weights. This action of the screws b in the pattern-chain against the front drop-weights 13 moves the racks A, whose upper ends have notches a on the front and back, into the path of the lifting-bar D, which engages the notches a in the racks and carries them up. If there is no screw in the pattern-chain, the action of the spiral springs 14 presses the racks A forward into the path of the depressing-bar E, which engages the notches in the racks A and carries them down. The lower ends of the racks A are toothed to the gear with the sector-cams F, which operate the harness-levers G. The pattern-chain cylinder B^2 is driven from a scroll-cam H on the end of the crank-shaft I, through bell-crank lever J, the long arm of which is connected to the lifting-rod K, to which a collar k is secured. Pivoted to the collar k is a slotted bar L, that is connected to a bell-crank lever M by means of a pin l passing through the slot in the bar L. The bell-crank M is fulcrumed to a stud at m, and its upper end is pivoted to a pawl N, that engages with the pins b^2 on the pattern-chain cylinder B^2.

The operation of these parts is as follows: As the crank-shaft I rotates, the scroll-cam H imparts an up-and-down motion to the lifting-rod K through bell-crank J. The slot in the bar L allows the rod K to rise without moving the bell-crank M, until the bottom of the slot comes into contact with the pin l, when the bell-crank M is thrown up and the pawl N pushed forward to take hold of another of the pins b^2. As the shaft I continues to rotate, the lifting-rod K is drawn down and the pawl N moves the pattern-cylinder B^2 one-eighth of a revolution. Both the lifting and depressing bars D and E are moved by the scroll-cam H on the end of the crank-shaft I, through the two angled levers J J^2, connected to the upright shafts K K^2, the lifting-bar D being

secured to upright shaft K and the depressing-bar being secured to the upright shaft K^2.

The shuttle or picking motion is obtained as follows: On the lower or cam shaft P, at a proper distance from the inside of the loom-frame, is keyed a side cam *p*, on which runs the roll *n* of the shuttle arm or lever Q, which is rigidly fastened to the upper end of a sleeve *q*, turning loose on an upright shaft *r*. (See Figs. 13, 14, and 15.) At the lower end of this shaft *r* is another sleeve q^2, with a flange on its lower end, in the circumference of which holes are drilled at equal distances apart, as shown, and between these two sleeves q q^2 is an intermediate sleeve q^9, these three sleeves being all loose on the upright shaft *r*, whose upper and lower ends are supported in stands fixed to the loom girt or frame. Around these three sleeves is coiled a powerful steel spring R, one end of which is fixed to the lower sleeve q^2 and the other to the shuttle-arm Q, on one end of which is the arm-roll *n*, bearing against the side cam *p*, (see Figs. 1, 9, 13, and 14,) while the other end is connected by a suitable strap *c* or connector to the picker-stick S. The lower sleeve q^2 is prevented from turning by a projecting pin *d* passing through the lower stand and into one of the holes in the flange of the lower sleeve, and the tension on the spring R can be regulated by changing this pin *d* from hole to hole, according to the power required to throw the shuttle. The cam *p* (see Fig. 9) is an incline, which starts at 2 and rises to its highest point 1, and then drops to its lowest point 2, as shown. This cam makes one pick for every revolution of the shaft P; but if desired to make two picks, then the cam would have to be made double.

As the side cam *p* on the lower shaft P turns around, the roll *n* on the shuttle-arm Q moves up the inclined plane on the cam *p*, thereby winding up the spring R until the roll *n* drops square off, which relieves the spring R and its force is imparted through the shuttle-arm Q and connector *c* to the picker-stick S, which throws the shuttle. The force of the spring R to throw the shuttle does not depend upon the speed of the loom, for the velocity of the shuttle would be the same whether the loom runs eighty picks per minute or only forty. In fact, the loom may be run until the speed is almost nothing, but the shuttle will still be thrown with a uniform velocity.

To prevent the shuttle being thrown, if there is a full box opposite, we use two rods T T′ (see Figs. 1 and 4) running along the front of the lay. On one end of each of the rods is a finger *t t′* rigidly fastened thereto and bearing against the shuttle-binder or swell U U. At the opposite end of each of the rods T T′ from the fingers *t t′* an arm V is fixed, which is connected by a chain or cord *u* with one end of a lever W fulcrumed at or about its center to the frame and connected at its other end by another chain or cord *v* to a latch-lever X, the notched end of which hangs directly over the front end of the shuttle-arm Q, and this end of the notched lever is kept up out of the path of the shuttle-arm by a coiled spring Y, which also keeps the fingers *t* pressed against the shuttle-binder U. As long as the shuttle-box is empty, the notched lever X on the opposite side of the loom is kept out of the path of the shuttle-arm Q, but if there is a shuttle in the box it throws out the shuttle-binder U, which moves out the finger *t* and through its connections drops the end of the notched lever X over the shuttle-arm Q at the opposite side of the loom and prevents its moving; consequently the shuttle on the latter side will not be thrown, and the loom will be stopped in the following manner: On the front of lathe Z is secured a metal casing *e*, the front of which extends down some distance below the bottom of the lathe Z. In the casing *e* is pivoted a small block *f*, through which slides a rod *g*, the upper end of which is bent at right angles, and to which is pivoted the needle *h*, the point *i* acting as a fulcrum for the needle to swing upon. The lower end of the bar *g* rides up upon the face of an inclined plane *j* when a shuttle is in its box. When the box is empty, the binder U, and consequently the finger *t*, moves inward and causes the arm *s* on shaft T to move inward and push the rod *g* out of the path of the incline plane *j*, the end of the lever *s* being beveled off, as shown in Fig. 6. In the lower end of the plate *e* is formed a slot *w*, through which slides a flat metal plate *x*, provided at its inner end with a hook x^2 and at its outer end with a screw-threaded rod *y*, which passes through an arm 3 fulcrumed in a stand on the under side of the breast-beam 4. The arm 3 bears against an arm 5, secured to the rod 6, upon which is also secured the shipper-disengaging arm 7, the upper end of which is forked, through which fork the shipper-handle 8 passes. When the box which should be empty has a shuttle in it, the binder U is forced out by the shuttle and consequently the finger *t* is pressed outward and causes the lever *s* on shaft T to move outward away from rod *g*, which then stands perpendicular and in the path of the inclined plane *j*, up which the end of the rod *g* passes as the lathe is moved back carrying with it the needle *h*, so that its straight end will be in the path of the hook x^2 in the plate *x*, and comes into contact with the same as the lathe moves back, which causes the plate *x* to draw upon the arm 3, which coming into contact with lever 5 on rod 6 causes the shipper-arm 7 on said rod 6 to move the shipper-handle 8 out of its notch, thereby causing the loom to stop.

In some cases, if desired, the arm 5 may be extended down and provided with a slot for the rod *y* to pass through, in which case the arm 3 would be dispensed with. The operation of this stop-motion is as follows: When the shuttle is in the box ready to be thrown, the binder U, the finger *t*, and lever *s* are all out, which allows the end of the rod *g* to be

raised by riding up the incline *j* in the backward movement of the lathe Z. As the rod *g* is raised, the needle *h* is also carried up until in the position shown in Fig. 5. As the shuttle leaves the box, the filling forms a loop round the needle *h*, as shown in Figs. 5 and 6, (9 representing the selvage-point,) and tilts the needle, as shown in dotted lines, so as to be out of the path of the hook x^2 on the end of plate *x*. If the filling breaks or the shuttle is empty the needle *h* would not be tilted, but remain perpendicular, and as the lathe moves back the needle will come into contact with the hook x^2 and draw upon the bar *x*, which draws arm 3 against arm 5 and moves the arm 7 and shipper-handle 8 and stops the loom. When the shuttle-box is empty, the binder U, finger *t*, and lever *s* are thrown in and the lever *s* moves the rod *g* to one side, so that it will not come in contact with the incline plane *j*. Consequently the rod *g* and needle *h* remain down, the lower end of the needle being formed with a bow which comes opposite the bar *x* when the needle is down, so that the hook x^2 will not come into contact with the needle and will not stop the loom.

On the end *y* of the bar *x* is provided a spring 10, the tension of which is regulated by a thumb-screw 11. The object of this spring is to prevent any undue strain upon the arm 3 and shipper-handle 8.

The shuttle-box motion may be described as follows: On the end of the lower or cam shaft P, outside the loom-frame, a cam 22 is attached, which moves a bell-crank lever 23, fulcrumed on a stud 24 to a stand on the loom-frame. Through the lower end of this lever 23 pass four horizontal racks 25, the outer ends of which are raised or lowered by means of wires 26, according as the wires are operated by the screws on the pattern-chain 27, so that when a wire 26 is raised by one of said screws the corresponding rack 25 will be thrown into gear with a pinion 28; but when the wires 26 are not raised the rack 25 will slide under and not engage with the pinion 28. The wires 26 of pattern-chain 27 are operated in the following manner: A cam 90 is mounted upon shaft P, which cam bears against an arm 91, connected to a shaft 92, and imparts an up-and-down motion thereto. Near the upper end of the shaft 92 is connected an arm 93, provided with a stud upon which is mounted the pattern-chain cylinder 94. The shaft 92 works in bearings on a standard 95, the upper end of which is provided with an arm 96, to the outer end of which is pivoted a pawl 97, provided at its end with a hook which engages with pins on the pattern-chain cylinder, so that the cylinder is rotated so as to bring up one bar of the pattern-chain 27 every time the shaft 92 moves down, which is at every pick of the loom. On the side of the rack 25 at its forward end is a small projection 29 (see Fig. 17) which, when the rack is raised and pushed forward, slides upon a guide 30 until the projection 29 passes the end of said guide, when the end of the rack falls down and it is drawn back out of contact with the pinion 28. Each of the pinions 28 is secured to a face-plate 31. There are four of these pinions and face-plates, and they are supported in pairs on a stud carried by a stand 32, keyed onto shaft 33, mounted in a T-shaped frame 34 on the side of the loom-frame. Each of the face-plates 31 is provided with two notches to receive the end of the catch-pawl 35 that holds the face-plate in position at each half-revolution, the rack 25 being provided with just half the number of teeth that there are in the pinion 28, so that each time the pinion is operated by the rack it will make just one-half a revolution. To each of the face-plates 31 is secured one end of a chain 36 or 37. The chain 36 passes down and under a sheave 38 to a proportional lever 39, to the lower end of which the end of the chain is attached. The lever 39 is fulcrumed at the center of a lever 40, hung on a shaft 41 in the T-frame 34. The chain 37 passes under a sheave 42, and its end is secured to the upper end of the proportional lever 39. The lower end of the proportional lever 39 is just twice the length of the upper end, so that if the same amount of travel is imparted to the upper end it will cause the lever 40 to move just twice the distance that the same movement would do if imparted to the lower end of the lever. To the lower end of the lever 40 is connected a rod 43, the other end of which is connected to a chain 44, that passes round a sheave 45, attached to the picker-stick stand 46, then passes up and over a sheave 47, attached to the under side of the shuttle-box frame, and then down, and is connected to a loose collar 48 on the shuttle-box rod 49, around which is placed the spiral spring 50 in the usual manner. It will be seen that as the cam 22 revolves it will operate the bell-crank lever 23 and impart motion to the racks 25, which, when in gear with the pinions 28, will impart a half-revolution to the pinion and face-plates 31, so that when the face-plate that connects with the lower end of the proportional lever 39 is operated it will give one box; but when the face-plate that is connected to the upper end of the proportional lever 39 is operated it will give two boxes, and if both plates are operated simultaneously they will give three boxes.

To operate the boxes at one end of the loom it takes two racks, two pinions and face-plates, and two chains—one connected to the upper and the other connected to the lower end of the proportional lever—and the same arrangement is required to operate the boxes at the other end, the chain 44 in this case passing to the other end of the loom underneath the lathe.

For the take-up we use a take-up roll 51, whose circumference is turned to an exact whole number of inches, and on one end of the take-up-roll shaft 52 a worm-gear 53 is

fixed with just as many teeth as there are inches in the circumference of the roll, so that each tooth of the gear and also each inch of the circumference of the roll represents an inch of the woven fabric. Running in the worm-gear 53 is a single worm 54 on a short shaft 55, turning in a stand fixed to the loom-frame, and at one end of this short shaft 55 is placed the take-up ratchet 56 with just as many teeth in its circumference as there are picks to the inch in the fabric to be woven. One revolution of the ratchet moves the worm-gear 53 one tooth, which takes up one inch of the woven goods. The ratchet 56 (see Fig. 10) is moved one tooth at each movement of the lay by a pawl 57, attached to one end of a lever 58, swinging on the hub of the ratchet 56, the other end being raised at every forward movement of the lay by an inclined plane or groove 59, attached to the sword 60. This forms a positive take-up, and the number of teeth in the take-up ratchet 56, which ratchet can be readily changed, must be the same as the number of picks per inch required in the woven fabric. To convert this same mechanism into a negative take-up—that is, a take-up where the number of picks per inch varies to accommodate the inequalities of the filling—the inclined plane 59 is moved up on the sword 60, so as to bear on the top of the lever 58 that operates the pawl, and at the end of this lever 58 a spiral spring 61 is attached, the other end of the spring 61 being hooked to a threaded rod 62, passing through a stand on the loom-frame with a thumb-nut on the rod to adjust the tension of the spring. The weight of the goods woven is governed by the tension of the spring.

The let-off is as follows: On the yarn-beam shaft 70 a worm-gear 71 is attached, running in which is a worm 72, on an upright shaft 73, supported in stands bolted to the loom-frame. On this upright shaft 73 a ratchet-wheel 74 (see Figs. 11 and 12) is attached, on whose hub is a loose pawl-plate 75, on which swing two or more pawls 76, as may be required. This pawl-plate 75 is connected by an arm 77 to a perpendicular lever 78, whose upper end is fulcrumed in a stand on the loom-frame, and to the other end of which lever 78 the whip-roll 79 is rigidly fastened. At a proper distance on this lever 78 one end of a rod 80 is attached, the other end passing loosely through a hole in the lay-sword 60, with a nut on the end to regulate the distance between the sword 60 and the whip-roll lever 78. Every forward movement of the sword 60 moves the rod 80 forward to a definite point, thereby also moving the lower end of the whip-roll lever 78 forward to a definite point, and the arm 77, being connected at one end to the whip-roll lever 78 and at its other end to the pawl-plate 75, the latter is caused to partially rotate at every forward movement of the sword, and by means of the pawls 76 cause a partial rotary motion to be imparted to the ratchet 74, secured to the upright shaft 73, carrying the worm 72, that gears with the worm-wheel 71 on the yarn-beam shaft 70, which movement lets off the yarn. The backward movement of the sword relieves the rod 80 and whip-roll lever 78, so that the tension of the warp on the whip-roll 79 will draw it forward, thus drawing the lower end of the whip-roll lever backward. Thereby through arm 77 and pawl-plate 75 the pawls are drawn back one or more teeth, according to the tension of the warp. The requisite tension that is wanted on the yarn is governed by an adjustable weight 81 on a bell-crank lever 82, fulcrumed to a stand on the frame, one end of the lever bearing against the lower end of the whip-roll lever 78. The length of the rod 80, attached to the whip-roll lever 78 and passing through the sword 60, is so adjusted that when the lay strikes it holds the whip-roll rigid. This mechanism may be applied separately to two yarn-beams on the same loom and the tension of each governed independently, as shown in Fig. 1.

What we claim as our invention is—

1. In a loom, a drop-weight made in two parts that are kept extended by a spring and provided at their lower ends with notches to prevent their being forced apart, in combination with a pattern-chain, racks, lifting and depressing bars, geared sector-cams, and harness-levers, substantially as shown and described.

2. In a loom, a drop-weight consisting of two parts 16 17, the parts that come in contact with the pattern-chain and rack being bow-shaped and their lower ends provided with catches 20, in combination with a spring 21, held on studs in the bows, substantially as and for the purposes set forth.

3. In a loom, the pawl N, bell-crank lever M, slotted bar L, and collar *k*, in combination with the lifting-rod K, bell-crank lever J, scroll-cam H, and the pattern-chain cylinder B^2, substantially as set forth.

4. The shuttle stop-motion herein described, consisting of the rod T, carrying finger *t*, arm V, chain or cord *u*, lever W, chain or cord *v* and spring Y, latch-lever X, and shuttle-boxes, in combination with the swell U, shuttle-actuating arm Q, and cam *p*, substantially as set forth.

5. The rod T, carrying finger *t*, arm V, chain or cord *u*, lever W, chain or cord *v*, latch-lever X, and spring Y, in combination with needle *h*, rod *g*, block *f*, inclined plane *j*, arm *s*, plate *x*, provided with notch x^2, arm 3, arm 5, rod 6, arm 7, shipper-handle 8, swell U, shuttle-arm Q, cam *p*, and shuttle-boxes, substantially as and for the purposes set forth.

6. The rod T, carrying finger *t*, in combination with the swells U, lever *s*, needle *h*, rod *g*, block *f*, inclined plane *j*, plate *x*, provided with notch x^2, arm 3, arm 5, rod 6, arm 7, shipper-handle 8, and shuttle-boxes, substantially as and for the purposes set forth.

7. The shuttle-box motion herein described,

consisting of cam 22, shaft P, bell-crank lever 23, racks 25, pinions 28, face-plates 31, chains 36 and 37, proportional lever 39, lever 40, connected to the shuttle-box rod, and the shuttle-box rod 49, in combination with rods 26 and pattern-chain 27, substantially as shown and described.

8. The cam 22, lever 23, and racks 25, provided with projections 29, in combination with the pinions 28, guide 30, rods 26, and the pattern-chain, substantially as shown and described.

9. The let-off motion herein described, consisting of whip-roll 79, whip-roll lever 78, worm-gear 71, shaft 73, worm 72, ratchet-wheel 74, pawl-plate 75, pawls 76, and an arm 77, in combination with the weighted bell-crank lever 82, rod 80, and lay-sword 60, whereby the motion to the whip-roll is imparted directly from the sword, substantially as set forth.

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

SAMUEL T. THOMAS.
WINFIELD S. THOMAS.

Witnesses:
L. W. HOWES,
E. PLANTA.