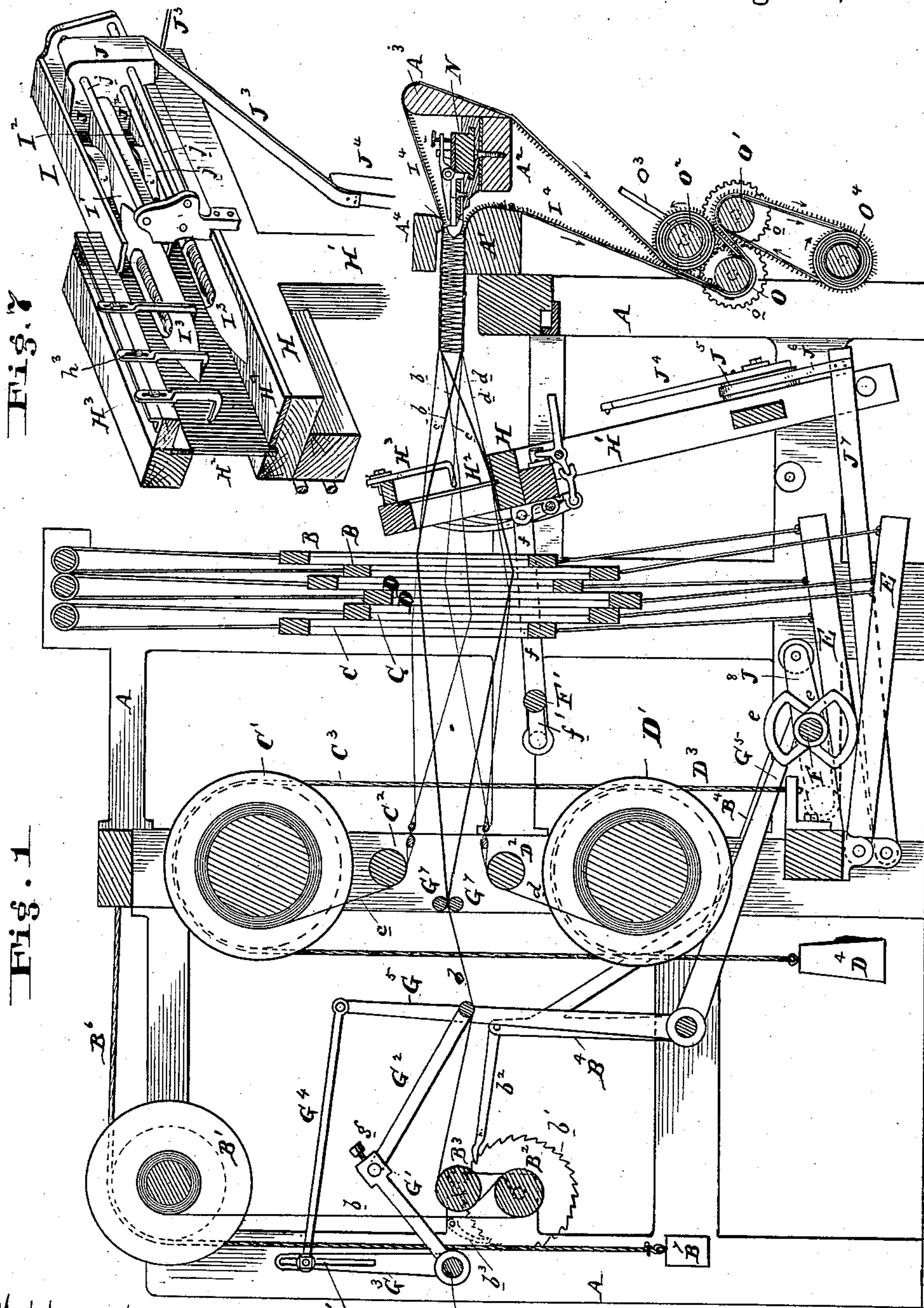


4 Sheets—Sheet 1.

No. 324,394.

Patented Aug. 18, 1885.



# Fig. 1

# THIS

Attest

*L. J. M. at the*

Fig. 3

Inventors

Robert Mair and  
H. H. Royal  
By their atty -

*John Franklin*

(No Model.)

4 Sheets—Sheet 2.

R. MAIR & W. H. ROYAL.  
LOOM FOR WEAVING DOUBLE PILE FABRICS.

No. 324,394.

Patented Aug. 18, 1885.

Fig. 12

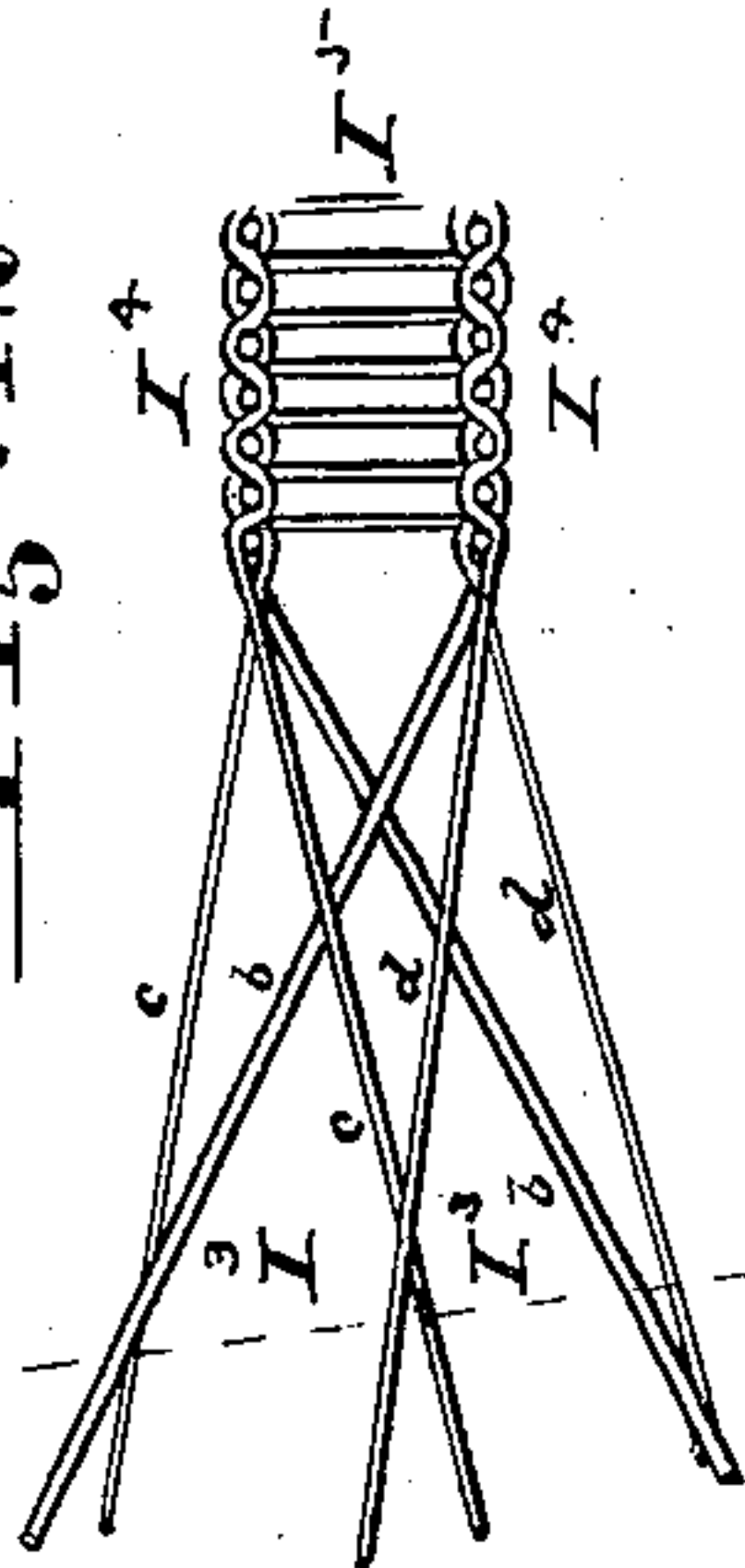
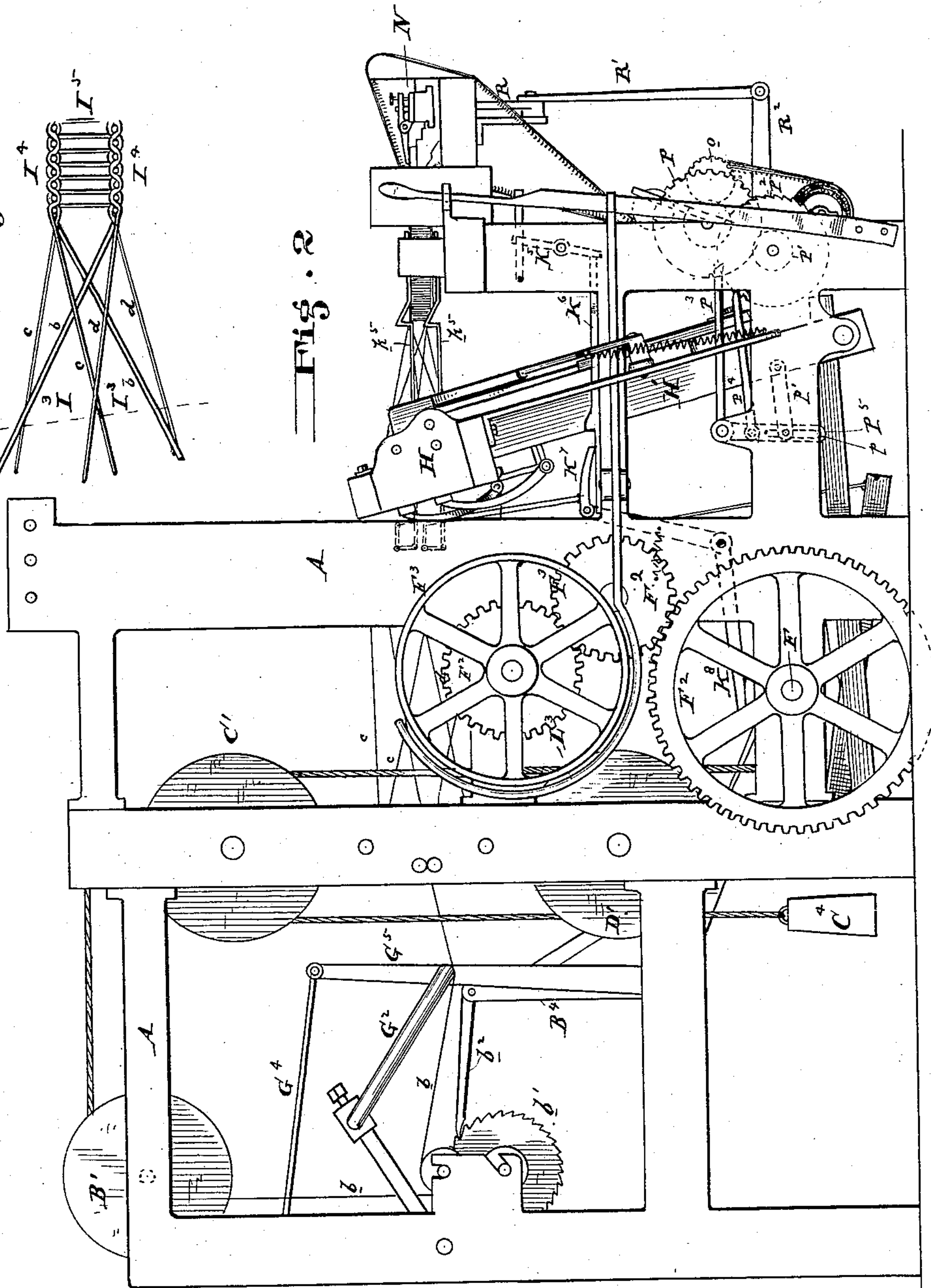
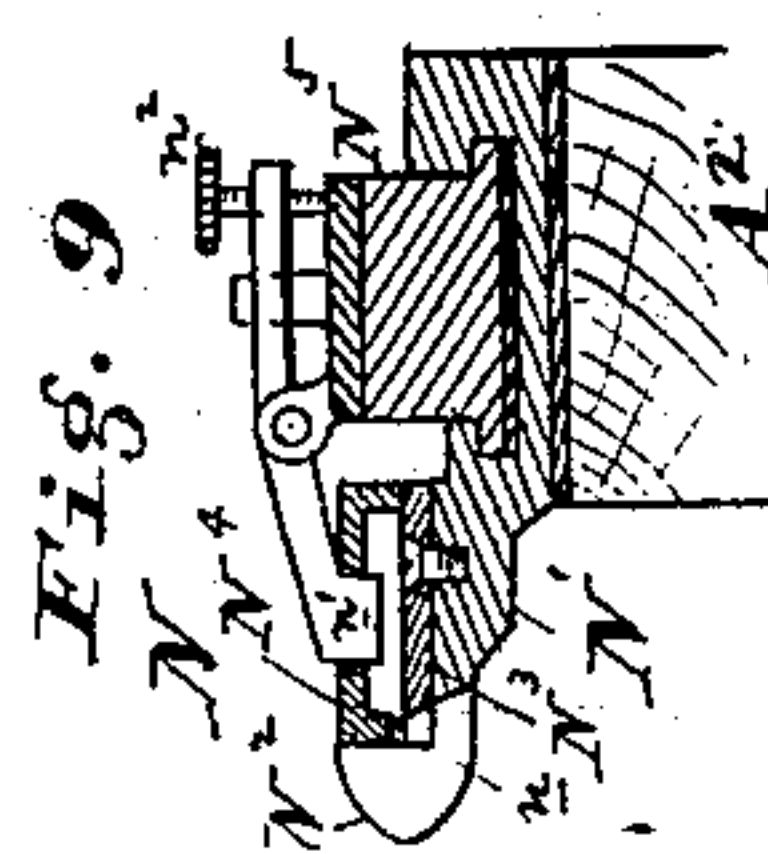


Fig. 2



Attest  
L. J. Mair  
[Signature]



Inventors  
Robert Mair and Wm. H. Royal  
By their atty -  
[Signature]



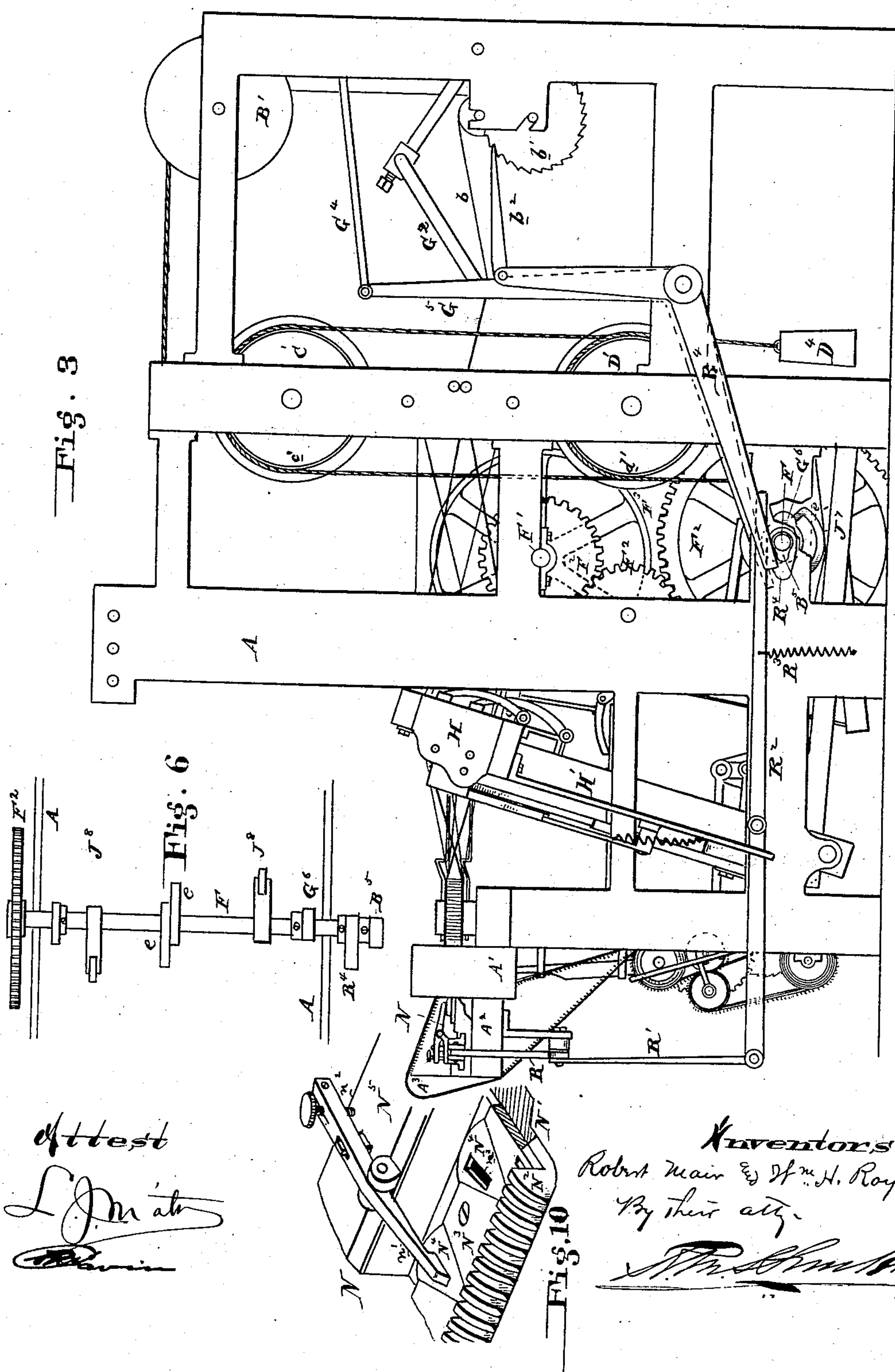
(No Model.)

4 Sheets—Sheet 3.

R. MAIR & W. H. ROYAL.  
LOOM FOR WEAVING DOUBLE PILE FABRICS.

No. 324,394.

Patented Aug. 18, 1885.



(No Model.)

4 Sheets—Sheet 4.

R. MAIR & W. H. ROYAL.  
LOOM FOR WEAVING DOUBLE PILE FABRICS.

No. 324,394.

Patented Aug. 18, 1885.

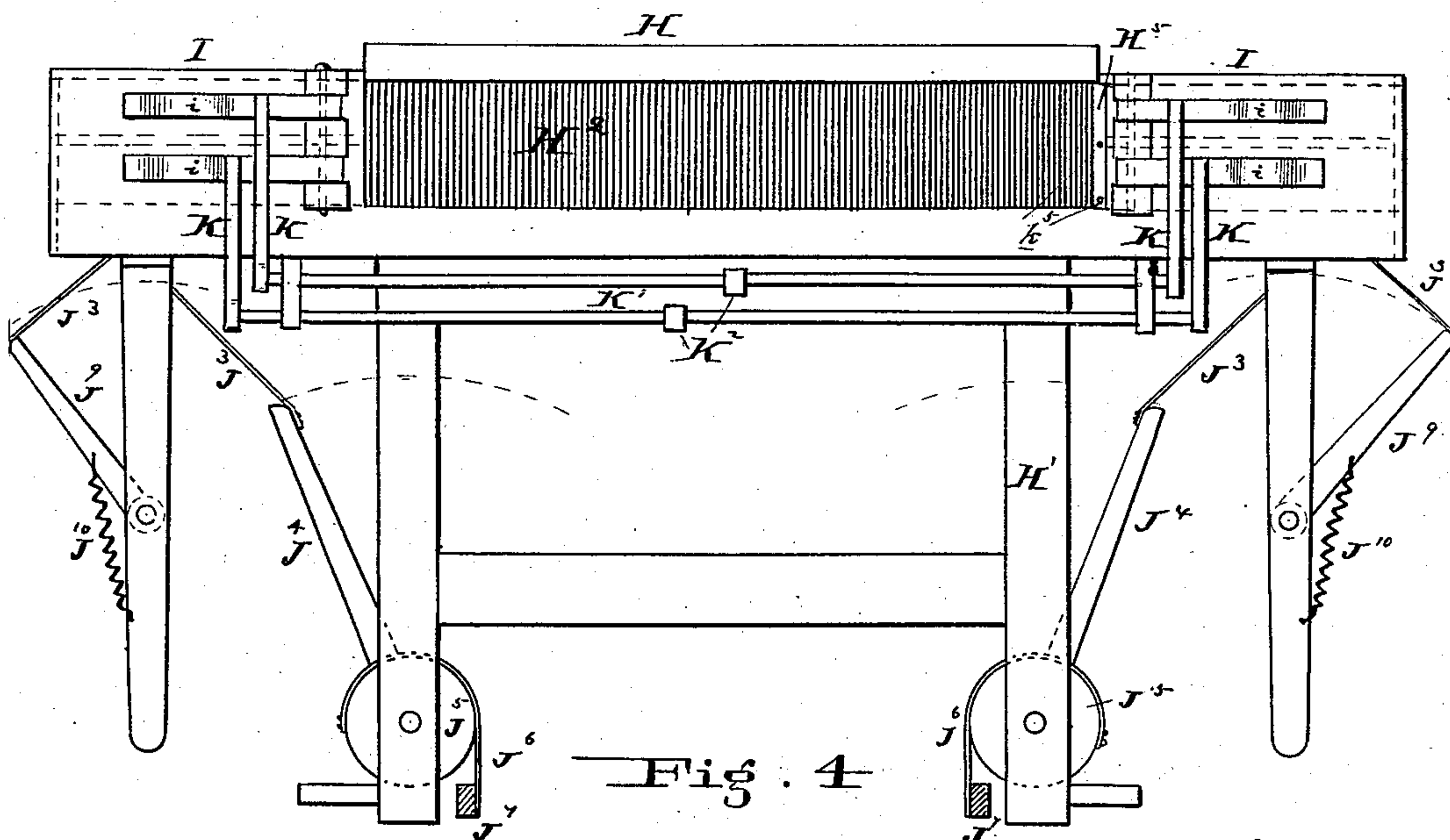


Fig. 4

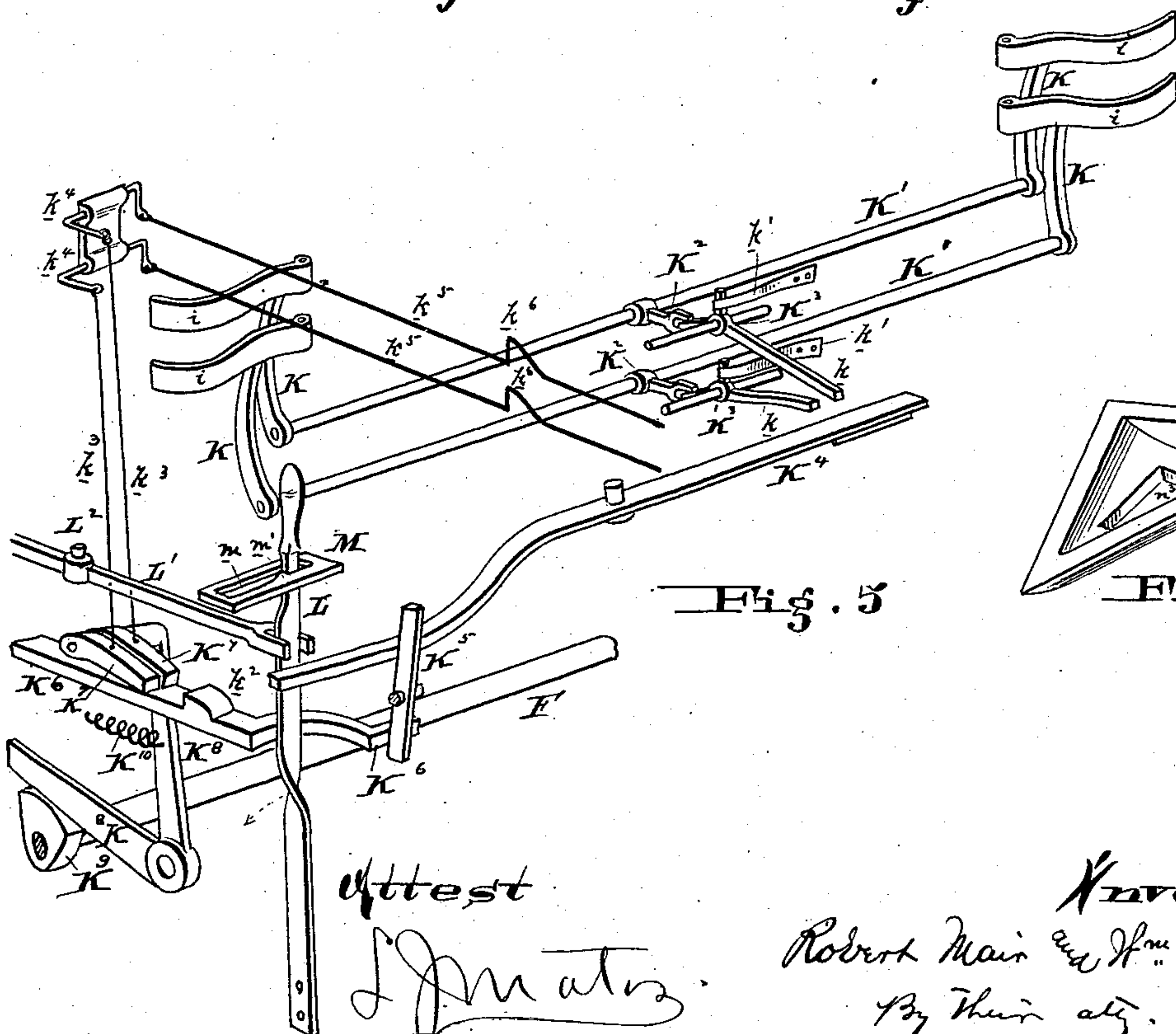


Fig. 5

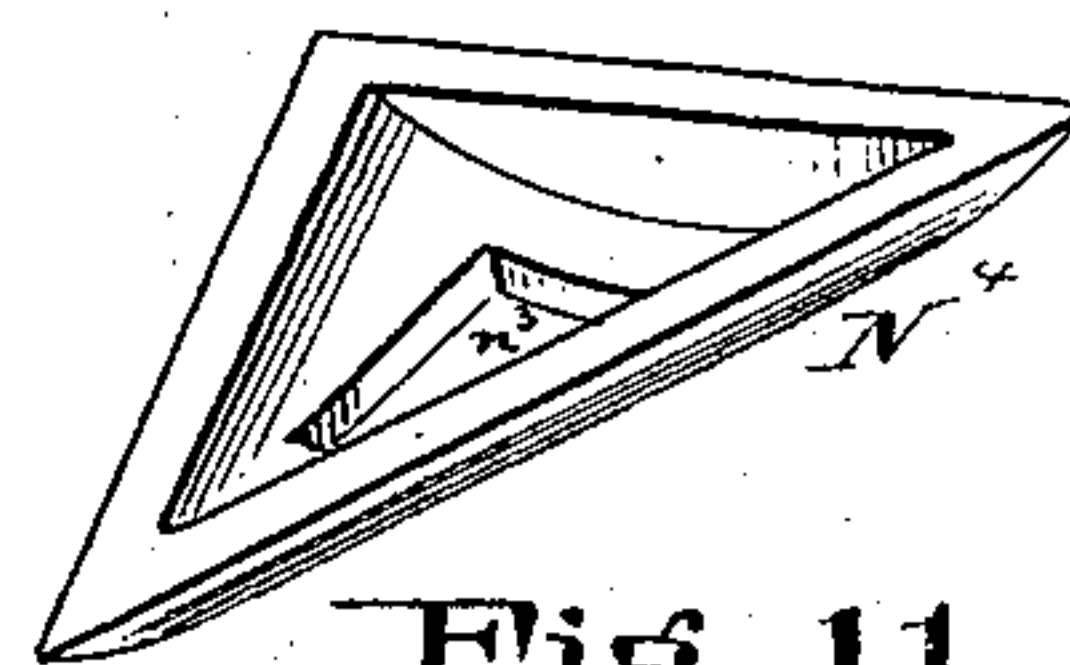


Fig. 11

Attest  
J. M. Atz.  
Baron

Inventors  
Robert Mair and W. H. Royal  
By Their atty.  
J. M. Atz.



# UNITED STATES PATENT OFFICE.

ROBERT MAIR AND WILLIAM H. ROYAL, OF PHILADELPHIA, PENNSYLVANIA.

## LOOM FOR WEAVING DOUBLE-PILE FABRICS.

SPECIFICATION forming part of Letters Patent No. 324,394, dated August 18, 1885.

Application filed December 14, 1882. (No model.)

*To all whom it may concern:*

Be it known that we, ROBERT MAIR and WILLIAM H. ROYAL, both of the city and county of Philadelphia, and State of Pennsylvania, have invented an Improvement in Looms for Weaving Double-Pile Fabrics, of which the following is a specification.

Our invention has reference to looms for weaving double-pile fabrics; and it consists in certain improvements set forth in the following specification, shown in the accompanying drawings, which form part thereof, and pointed out in the claims.

The object of our invention is to provide an improved loom for weaving and severing a double-pile fabric, such fabric being composed of two ground or foundation webs united by intersecting threads, which, when cut to separate the webs, form pile on each of the latter.

In the drawings, Figure 1 is a sectional elevation of our improved loom. Figs. 2 and 3 are side elevations of same. Fig. 4 is a rear elevation of the lathe and mechanism carried thereby. Fig. 5 is a perspective skeleton view of the devices to stop the loom if the working of the same is deranged from breakage of the filling or weft yarns or from the shuttles failing to enter their boxes. Fig. 6 is a plan view of the cam-shaft. Fig. 7 is a perspective view of part of the lathe, and shows the double set of shuttles, &c. Fig. 8 is a perspective view of one of the fingers forming the upper shuttle-race. Fig. 9 is a cross-section of the cutting mechanism. Fig. 10 is a perspective view of part of the cutting mechanism. Fig. 11 is an inverted perspective view of one of the cutters or knives, and Fig. 12 is a diagram showing the method of weaving.

A is the frame of the loom. B are the heddles for operating the silk or worsted pile-warp. C are the heddles for the warp of the ground or foundation web of the upper fabric I<sup>1</sup>, and D are the heddles for the warp of the ground or foundation web of the lower fabric I<sup>2</sup>.

The upper and lower warps, *c* and *d*, are respectively wound upon cylinders C' and D', which are kept from unwinding too freely by ropes C<sup>3</sup> D<sup>3</sup>, which pass over flanges *c'* and *d'* upon said cylinders, and are secured to weights

C<sup>4</sup> D<sup>4</sup>. These warps *c* *d*, respectively, pass around rollers C<sup>2</sup> D<sup>2</sup>, and then to their respective heddles. The pile *b* is wound upon the beam or cylinder B', which is kept from rotating too freely by rope B<sup>6</sup> and weight B<sup>7</sup>, and is passed down under feed-roll B<sup>2</sup>, then over roller B<sup>3</sup>, and then between the guide-rods G<sup>7</sup> to the heddles B B.

The heddles are operated in sets of three, each by two levers, E E, that are alternately depressed by cams *e* on shaft F, which derives its motion by gear-wheels F<sup>2</sup> from the shaft F', carrying band-wheels F<sup>3</sup>, or other equivalent devices.

The heddles B, for raising and depressing the pile-warp *b*, are moved a greater vertical distance than the heddles for the warps *c* and *d*, so that the pile-warp controlled by each of the heddles B is alternately shifted from the range of the warp *c* to that of the warp *d* and interwoven in each of the ground-webs or foundation fabrics.

The threads of each warp are divided between the two heddles of the appropriate pair, B B, C C, or D D, and the set of heddles connected with each treadle or lever E includes one heddle of each pair. To move the heddles B B a greater distance than the other heddles, they are connected with the treadles E farther from the fulcrum thereof than the others.

The feed-roller B<sup>2</sup> is provided with a ratchet-wheel, *b'*, which is kept from turning backward by a pawl, *b*<sup>3</sup>, and is intermittently rotated forward by a pawl, *b*<sup>2</sup>, pivoted to the bell-crank, B<sup>4</sup>, which is actuated by cam B<sup>5</sup> on shaft F.

G<sup>2</sup> is a whip-roll adjustably secured to arms G' by screw *g*, the said arms being secured to the rock-shaft G, having an arm, G<sup>3</sup>, provided with a slot, *g'*, which arm is actuated by rod G<sup>4</sup>, bell-crank G<sup>5</sup>, and cam G<sup>6</sup> on shaft F. By pivoting the rod G<sup>4</sup> higher or lower in the slot *g'* the throw of the whip-roll G<sup>2</sup> may be varied and made to control the length of the pile by taking up more or less of the pile-warp, and thereby drawing the two ground fabrics more or less closely together.

H is the lathe, and H' its swords. H<sup>2</sup> is the reed. H<sup>4</sup> is the lower shuttle-race; and above which an upper shuttle-race is formed by means of the fingers H<sup>3</sup>. The fingers H<sup>3</sup>



are L-shaped, and are made thin, as shown in Figs. 7 and 8, so as to pass between the warps, and the point  $h$  of each finger is directed toward the reed, but does not touch it.

5 These fingers are provided with slots  $h'$  at the upper end, through which screws or bolts  $h^3$  pass and secure them to the lay-cap. By means of these slots the fingers may be adjusted on the lathe to raise or lower the upper

10 race. The lathe is vibrated by rods  $f$  and cranks  $f'$  on the shaft  $F'$ . Each end of the lathe is provided with the rigid shuttle-boxes  $I$ , having two shelves,  $I^1 I^2$ , upon which the two shuttles  $I^3$  rest at the end of each of their

15 reciprocations. Each picker-block  $J$  has two arms  $J^1 J^2$ , which project into the shuttle-boxes and are arranged above each shelf and in line with the shuttles. The said picker-block is guided on three-rods,  $j$ , and is moved by strap

20  $J^3$ , arm  $J^4$ , pulley  $J^5$ , strap  $J^6$ , lever  $J^7$ , and cam-arm  $J^8$  on shaft  $F$  in one direction to throw the shuttle, and is returned to the outer end of the boxes by the strap  $J^3$ , arm  $J^9$ , and spring  $J^{10}$ .

25  $i i$  are pivoted arms or shuttle-binders, which project into the shuttle-boxes in line with the two shuttles, and are adapted to be pushed out by the entrance of the shuttles into the shuttle-boxes. When both of the

30 shuttles, or either of them, after being thrown from the shuttle-boxes  $I$  at one end of the lathe, fail to enter the boxes  $I$  at the opposite end, one or both of the shuttle-binders  $i$  are pressed into the boxes by the springs which

35 rock the rods  $K'$  and their arms  $K$ . This permits the elevation of one or both of the fingers  $k k$ , which, in the forward movement of the lathe, are permitted to strike the lever  $K^4$  and throw the spring-lever  $L$  out of the

40 notch  $m'$  in the slot  $m$  in plate  $M$  and allow the said lever  $L$  to move the lever  $L'$ , which is pivoted at  $L^2$ , laterally to shift the driving-belt and stop the loom. When both of the shuttles  $I^3$  enter the boxes  $I$  upon either side

45 of the loom, the shuttle-binders  $i i$  are forced out, rocking the rods  $K'$  by the action of the said binders against arms  $K$ , and causing the arms  $K^2$  to rock the pieces  $K^3$ , carrying the daggers  $k k$ , and depress said daggers  $k k$  so

50 that in the forward movement of the lathe they may not strike the lever  $K^4$ . Upon the shuttles being thrown out of the boxes the springs  $k'$  return the various parts to their proper normal position, so that if the said

55 shuttles or one of them should not enter the opposite shuttle-boxes the loom would be brought to rest.

This mechanism is similar to that in general use, with the exception that it is duplicated.

60  $K^6$  is a plate provided with a lug,  $k^2$ , and adapted when forced forward to rock the lever  $K^5$ , which will thereby be caused to operate the lever  $K^4$  and release the spring-lever  $L$ , so as to stop the working of the loom. Two loose

65 pawls,  $K^7 K^7$ , are reciprocated above this plate by a bell-crank,  $K^8$ , which is operated by a cam,  $K^9$ , on shaft  $F$ . In the normal working

of the loom the said pawls are lifted above the lug  $k^2$  at each forward movement of the lathe by wires  $k^3 k^3$  and bell-cranks  $k^4 k^4$ , which are 70 connected with the rods  $k^5 k^5$ , having projections  $k^6 k^6$ , against which the filling-yarns are drawn by the motion of the lathe, as in ordinary looms. If the filling-yarns should break or the shuttles become empty, then either one 75 or both of said rods  $k^5$  will not be moved, and consequently the pawl or pawls  $K^7 K^7$  connected therewith will remain lowered. When the pawls  $K^7 K^7$  are next moved forward, they will engage with lug  $k^2$  on the plate  $K^6$  and 80 move said plate forward so as to stop the loom. This west-stop mechanism is similar to that in general use, except that it is made double to indicate the condition of both the upper and 85 lower west-yarns.

The rods  $k^5$  work through a slot,  $H^5$ , in the lathe.

$K^{10}$  is a spring which returns the bell-crank  $K^8$  to its normal position.

The double woven fabric passes between the 90 upper frame,  $A^4$ , and lower frame,  $A'$ , and the pile is divided in the middle by the cutting mechanism  $N$ , which separates the double fabric into two pieces of plush or velvet,  $I^4 I^4$ , the lower of which passes over frame  $A'$ , and 95 the upper of which passes over frame  $A^3$  above the cutter, then down, joining the lower piece, whence they both pass around roller  $O$ . Then the upper piece passes up over roller  $O^2$ , upon which it is wound, the said roller  $O^2$  being 100 allowed to recede from roller  $O$  by guide-bearing  $O^3$ , and being rotated by the friction of the lower piece  $I^4$  of moving fabric. The lower piece of plush passes over roller  $O'$ , which is driven from roller  $O$  by gear-wheels 105  $o$ , and then passes down around roller  $O^4$ , then up around roller  $O'$  again, and finally around the roller  $O^4$ . By these devices the upper and lower pieces of plush are wound automatically upon the rollers  $O^2$  and  $O^4$ . 110

The roller  $O$  is provided with a spur-wheel,  $P$ , which meshes with a small pinion,  $P'$ , secured to ratchet-wheel  $P^2$ , which is intermittently rotated by pawl  $P^4$ , actuated by lever 115  $P^5$ , having slot  $p$  and rod  $p'$ , the said rod connecting the slotted lever  $P^5$  with the vibrating lathe-sword  $H'$ . The slot in lever  $P^5$  allows of adjustment to vary the throw of the said lever  $P^5$ , and consequently its pawl  $P^4$ . The pawl  $P^3$  prevents the ratchet-wheel  $P^2$  120 from turning backward.

The cutting mechanism  $N$  is formed as follows: The frame  $A^2$  supports the bed-plate  $N'$ , which is provided with the guide-points  $N^2$ , which form a comb and are adapted to enter 125 between the pile-threads and separate the ground fabrics so that the pile will be severed by the cutters at an equal distance from each of said backs or fabrics, thus insuring the pile of the plush or velvet being of an even depth 130 throughout. The bed-plate  $N'$  supports the additional comb-plate  $N^3$ , which serves as the stationary part of the cutting devices.

$N^5$  is a reciprocating block which carries a



series of levers,  $n'$ , the forward ends of which are elevated by screws  $n^2$  to cause their rear ends to engage in the slots  $n^3$  of the cutters  $N^4$ , the said cutters being arranged about two inches apart across the entire width of the loom and adapted to reciprocate over the comb-plate  $N^3$ . The block  $N^5$  is reciprocated by bell-crank  $R$ , rod  $R'$ , lever  $R^2$ , spring  $R^3$ , and cam  $R^4$  on shaft  $F$ . If desired, any suitable gearing and cranks may be used to reciprocate this cutter-block.

In weaving the double-pile fabric the ground-warps and wefts and pile-warp are interwoven, as shown in Fig. 12, the foundation fabrics being formed as ordinary plain backs by means of the ground-warps  $c$  and  $d$ , which are separately interwoven with the wefts of the two shuttles. After each flight of the shuttles the heddles  $B$  cause the two portions of the pile-warp to change or cross, carrying the same from one ground-warp to the other, causing the pile-threads which were interwoven with the upper ground fabric to descend to the lower ground fabric and become interwoven therewith, and vice versa, and uniting the two foundation fabrics by the pile-warp  $b$ , which, when cut by the cutting mechanism  $N$ , forms the pile of the plush or velvet. When the heddles  $B$  are changed, the whip-roll  $G^2$  is raised and the wheel  $B^2$  turned, and after the shuttles have passed through the two sheds  $I^3$  of warp and the reed  $H^2$  has pressed the wefts or fillings home the whip-roll  $G^2$  takes up the excess of the warp  $b$  and keeps the backs of the fabrics  $I^4$  smooth and free from loops. After the shuttles have passed through the warps, and as the lay advances toward the breast-beam, the upper filling is pressed by the warps backward off the free ends of the fingers  $H^3$  and down to that part of the reed  $H^2$  below the upper race-fingers  $H^3$ , so that the said fingers shall not interfere with the operation of beating up the filling.

If the filling-yarn was not pressed down from within the upper shuttle-race the fabric would be destroyed, as it is necessary that all the filling-threads or yarns shall be pressed home by the reed  $H^2$ , as in the ordinary process of weaving.

If during the operation of the machine either of the shuttles fail to enter the shuttle-boxes after being thrown, or the weft-thread should break either in the upper or lower or both sheds, then upon the lathe moving forward either one or both rods  $k^5$  will remain stationary, and one or both the pawls  $K^7$  will remain down. Now, as the shaft  $F$  rotates the cam  $K^9$  rocks the bell-crank  $K^8$ , which action throws forward the pawls  $K^7$ , and as either one or both are down the lug  $k^2$  on slide-bar  $k^6$  will be struck and said bar moved forward. This in turn oscillates lever  $K^5$ , the upper end of which presses in one end of the pivoted bar or lever  $K^4$ , and this bar presses the spring, stopping and starting-lever  $L$  out of the catch  $m'$ , allowing it to spring back and move the belt-shifting lever  $L'$ , moving the driving-belt from

the driving-pulley to the loose pulley, thus stopping the machine.

In addition to the foregoing, of either shuttle fails to enter its shuttle-box, then one of the levers  $k$  will remain in the position shown in Figs. 1 and 5, as the rod  $K'$  will not be rocked owing to the fact that the arm  $i$  will not be forced out by the entrance of the shuttle within its box. Hence upon the forward movement of the lathe the end of the lever  $k$  strikes the free end of lever  $K^4$ , oscillating it, and, as before explained, causes shifting of the belt to stop the loom. From this it is seen that if either one or both of the weft-threads should break or become slack, or one or both of the shuttles fail to enter their boxes, the machine must be automatically stopped.

As hereinbefore specified, these devices are similar to those in common use, with the exception that they are duplicated to attain the requirements of a loom of this character.

The loom, as shown, changes its sheds upon every passage of the shuttles; but, if desired, a double passage of shuttles may take place, as is usual in many kinds of weaving.

We do not claim the combination of a lathe provided with a lower shuttle-race, an upper skeleton shuttle-race, and shuttle-boxes having two shelves with two shuttles, and picker-blocks having two striking parts or arms.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. Three sets of heddles, means for operating said heddles to divide the ground-warps into two sheds, one for each shuttle-race, and divide the plush-warps into one shed, which shall take in both shuttle-races, and three warp-beams, in combination with a lathe having two shuttle-races, cutting mechanism to divide the double-woven fabric, a whip-roll for the middle warp, means for operating the whip-roll and varying its movements, cloth-receiving rollers, and means for operating the lathe and cloth-receiving rollers, substantially as and for the purpose specified.

2. Three sets of heddles, means for operating said heddles, and three warp-beams, in combination with a feed device for the middle warp, a whip-roll for the middle warp, adjustably hinged to its supporting-axle, means for operating said whip-roll and varying its movements, a lathe having two shuttle-races, cutting mechanism adapted to divide the double-woven fabric, cloth-receiving rollers, and means for operating the lathe and cloth-receiving rollers, substantially as and for the purpose specified.

3. Three warp-beams and three sets of heddles, in combination with a lathe having two shuttle-races, two shuttles, mechanism to actuate said shuttles, heddles, and lathe, a whip-roll for the middle warp, a rock-shaft having arms  $G'$ , to which said whip-roll is attached, and an arm,  $G^3$ , a rod or link,  $G^4$ , a bell-crank, and a cam to actuate said bell-crank, and mechanism to stop the action of the loom



should either the upper or both shuttles fail to enter their boxes, substantially as set forth.

4. Three warp-beams and three sets of heddles, in combination with a lathe having two shuttle-races, two shuttles, mechanism to actuate said shuttles, lathe, and heddles, a whip-roll for the middle warp, a rock-shaft having arms  $G'$ , to which said whip-roll is attached, and an arm,  $G^3$ , a rod or link,  $G^4$ , a bell-crank, and a cam to actuate said bell-crank, and mechanism to stop the action of the loom should the yarns of either the upper or lower shuttles break, substantially as and for the purpose specified.

5. A lathe having two shuttle-races, and a shuttle-box at each end having two shelves, in combination with a picker-block having two arms to project into said box above each shelf, a guide for said block consisting of three stationary rods, means to reciprocate the picker-block, and two shuttles, substantially as and for the purpose specified.

6. The combination of heddles B, C, and D, means to actuate said heddles, warp beams or cylinders  $C' D'$ , means to retard the rotation of said beams, a pile-warp beam or cylinder,  $B'$ , a feed-roll for said pile-warp, means to intermittently rotate said roll, rods  $G^7$ , whip-roll  $G^2$ , a rock-shaft having arms  $G'$ , to which said whip-roll is attached, and an arm,  $G^3$ , a rod or link,  $G^4$ , a bell-crank, and a cam to actuate said bell-crank, a lathe having two shuttle-races, cutting mechanism to divide the cloth, cloth-receiving rollers, and means to operate the lathe and cloth-receiving rollers, substantially as and for the purpose specified.

7. The combination of heddles B, C, and D, means to actuate said heddles, rollers  $C^2 D^2$ , warp beams or cylinders  $C' D'$ , means to retard said beams in their revolution, pile-warp beam or cylinder  $B'$ , means to feed said pile-warp, rods  $G^7$ , whip-roll consisting of rod  $G^2$ , arms  $G'$ , and shaft  $G$ , and means to actuate the same, with a lathe having two shuttle-races, mechanism to stop the action of the loom should either or both the shuttles fail to enter their boxes, mechanism to stop the action of the looms should either or both of the filling-yarns become broken, cloth-receiving rollers, and means for operating the lathe and cloth-receiving rollers, substantially as set forth.

8. Mechanism to weave a double fabric, in combination with cutting mechanism N, frame  $A' A^2 A^3 A^4$ , rollers  $O O' O^2 O^4$ , gears  $o$ , means for operating roller O, and guides  $O^3$ , substantially as and for the purpose specified.

9. Mechanism to weave double fabric such as set forth and shown, in combination with plate  $N'$ , mechanism having guide-teeth to insure cutting in the right place, cutters  $N^4$ , levers  $n'$ , slide-bar  $N^5$ , and means to reciprocate said bar, substantially as and for the purpose specified.

In testimony of which invention we hereunto set our hands.

ROBERT MAIR.

WILLIAM H. ROYAL.

Witnesses:

R. M. HUNTER,  
R. S. CHILD.