No. 666,898.

Patented Jan. 29, 1901.

J. S. GRAHAM.

PLANING MACHINE.

(Application filed May 18, 1896.)

(No Model.)

10 Sheets—Sheet 1.

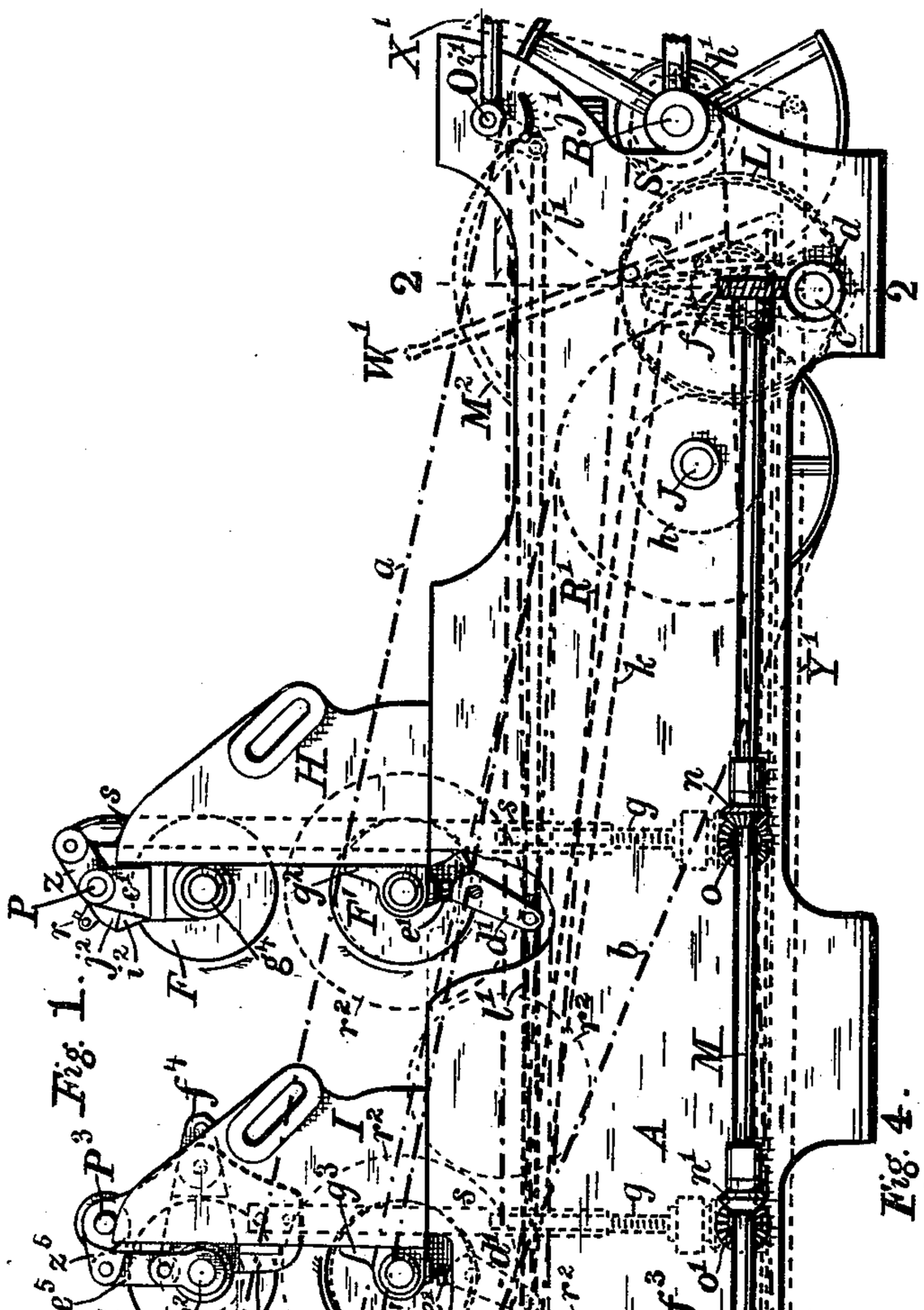


Fig. 1.

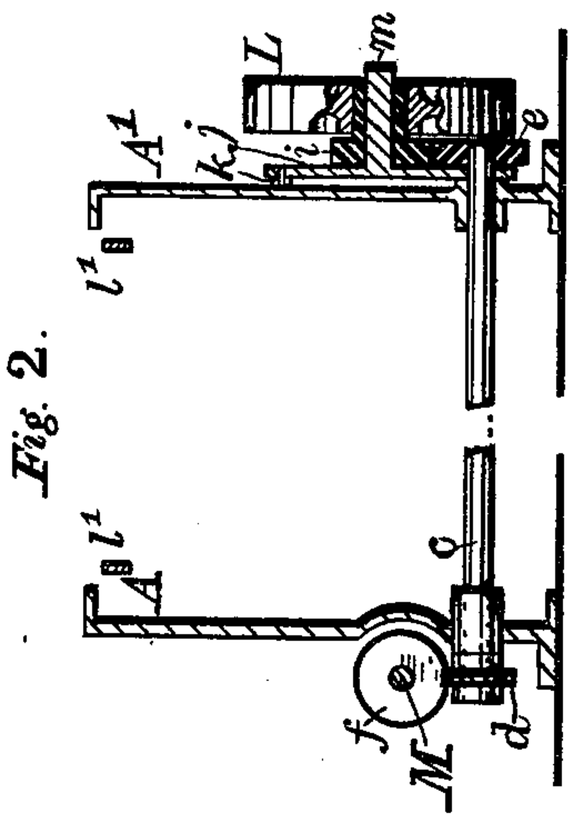
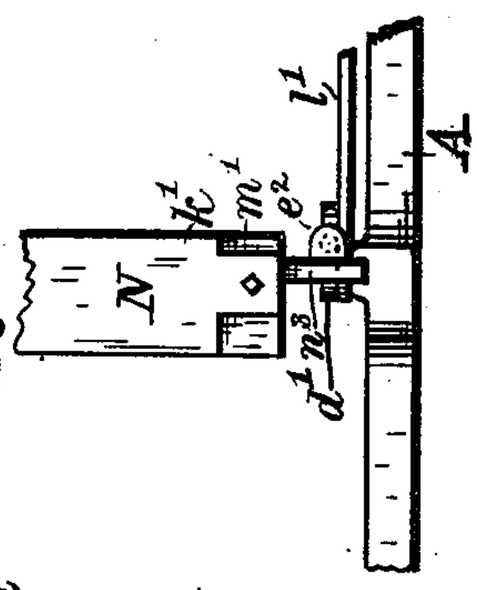


Fig. 2.



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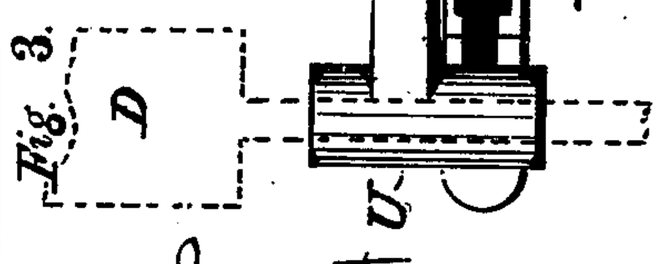

Fig. 3.

Witnesses:
G. S. Dey.
C. F. Cranmell

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No. 666,898. Patented Jan. 29, 1901.

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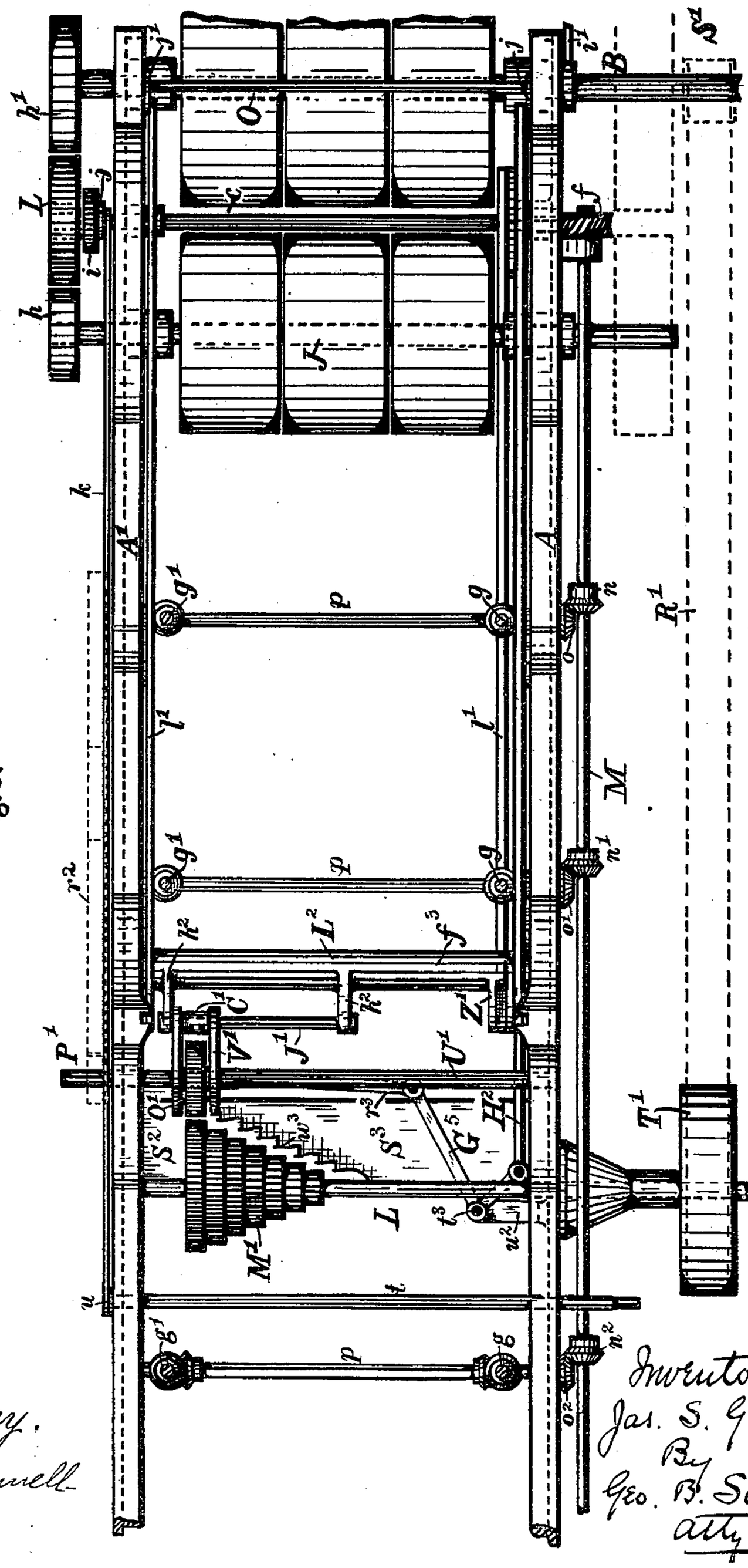
PLANING MACHINE.

(Application filed May 18, 1896.)

(No Model.) 10 Sheets—Sheet 2.

Fig. 5.



Witnesses:
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No. 666,898. Patented Jan. 29, 1901.

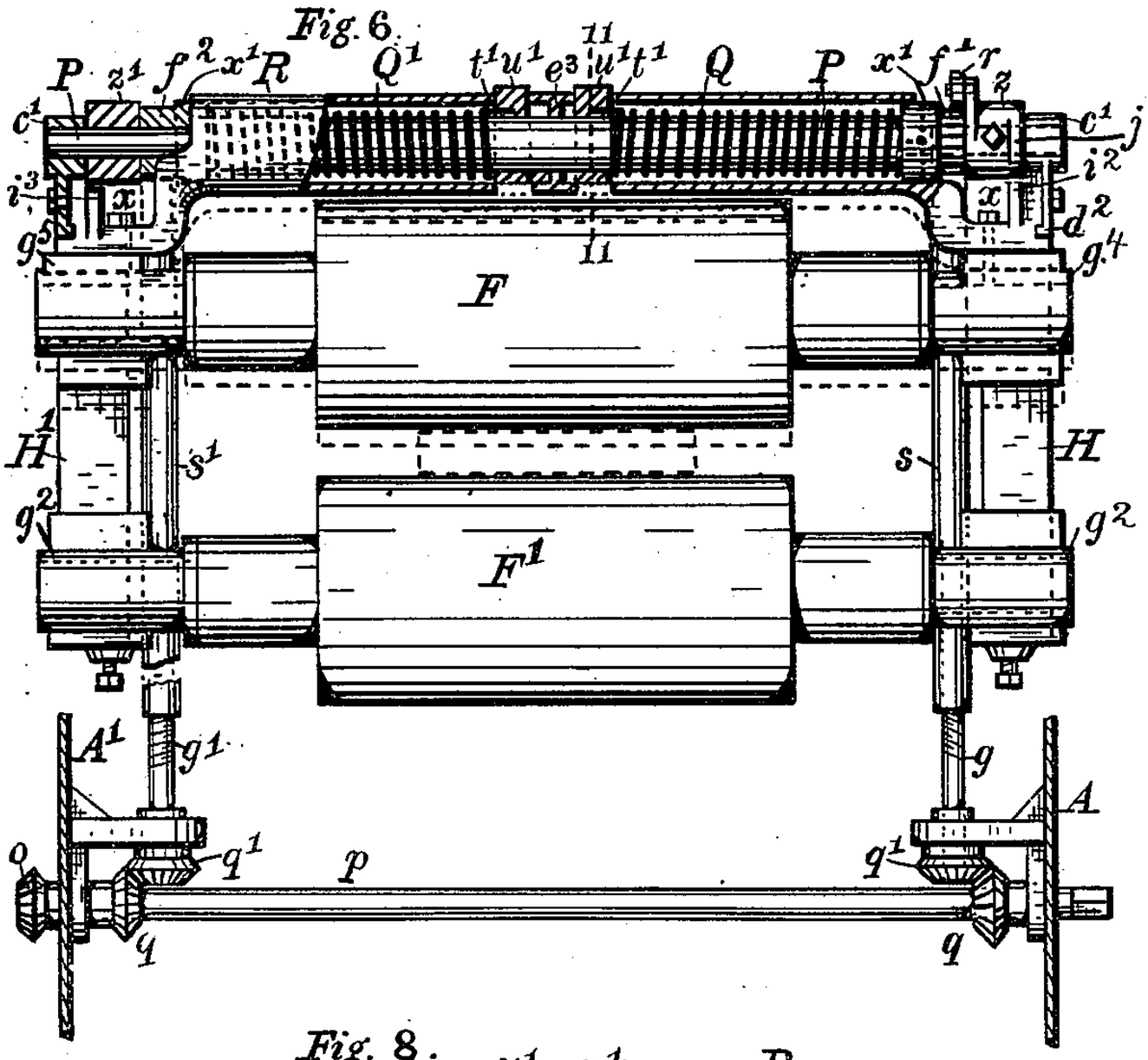
J. S. GRAHAM.

PLANING MACHINE.

(Application filed May 18, 1896.)

(No Model.) 10 Sheets—Sheet 3

Fig. 6.



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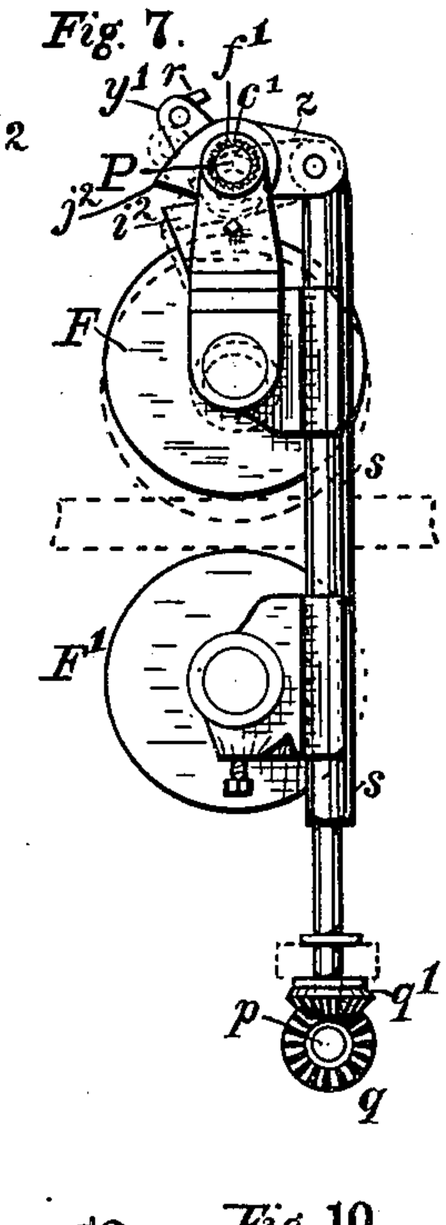

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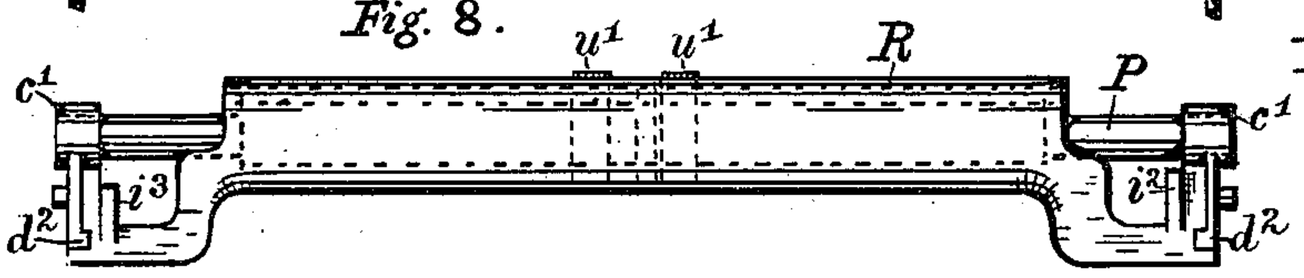
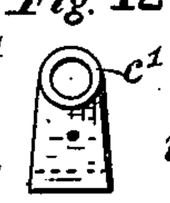


Fig. 12.



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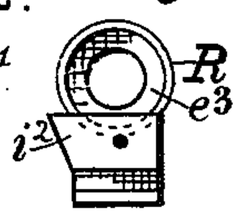

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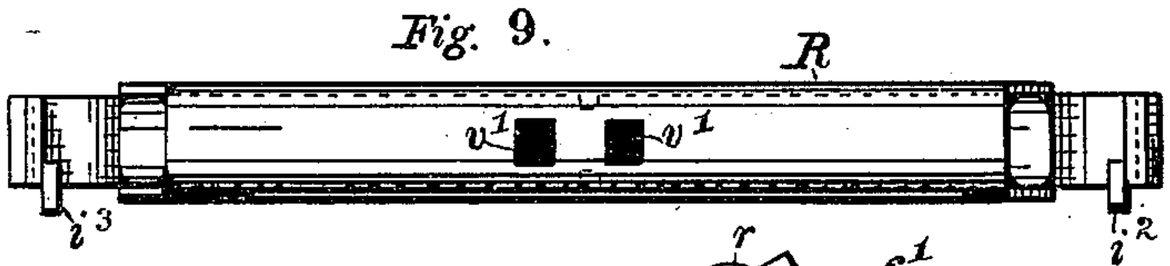

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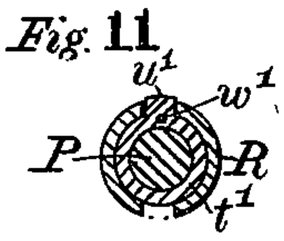

Fig. 13.

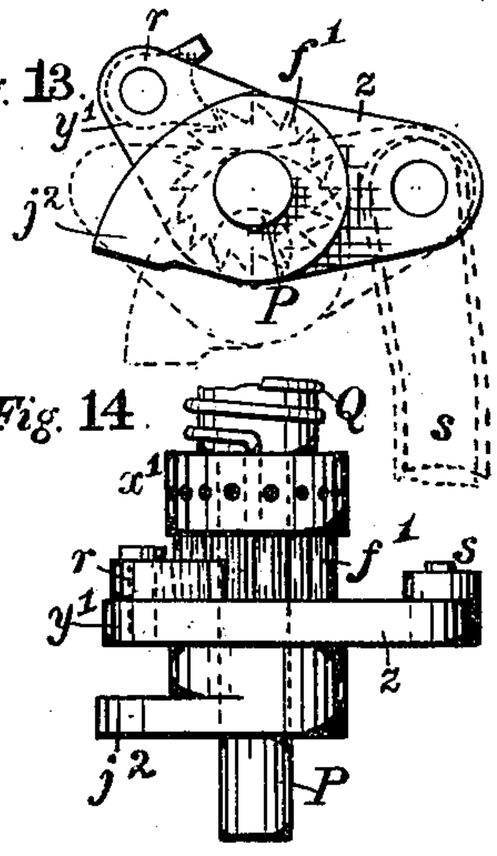

Fig. 14.

Witnesses:
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No. 666,898. Patented Jan. 29, 1901.

J. S. GRAHAM.

PLANING MACHINE.

(Application filed May 18, 1896.)

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Fig. 15.

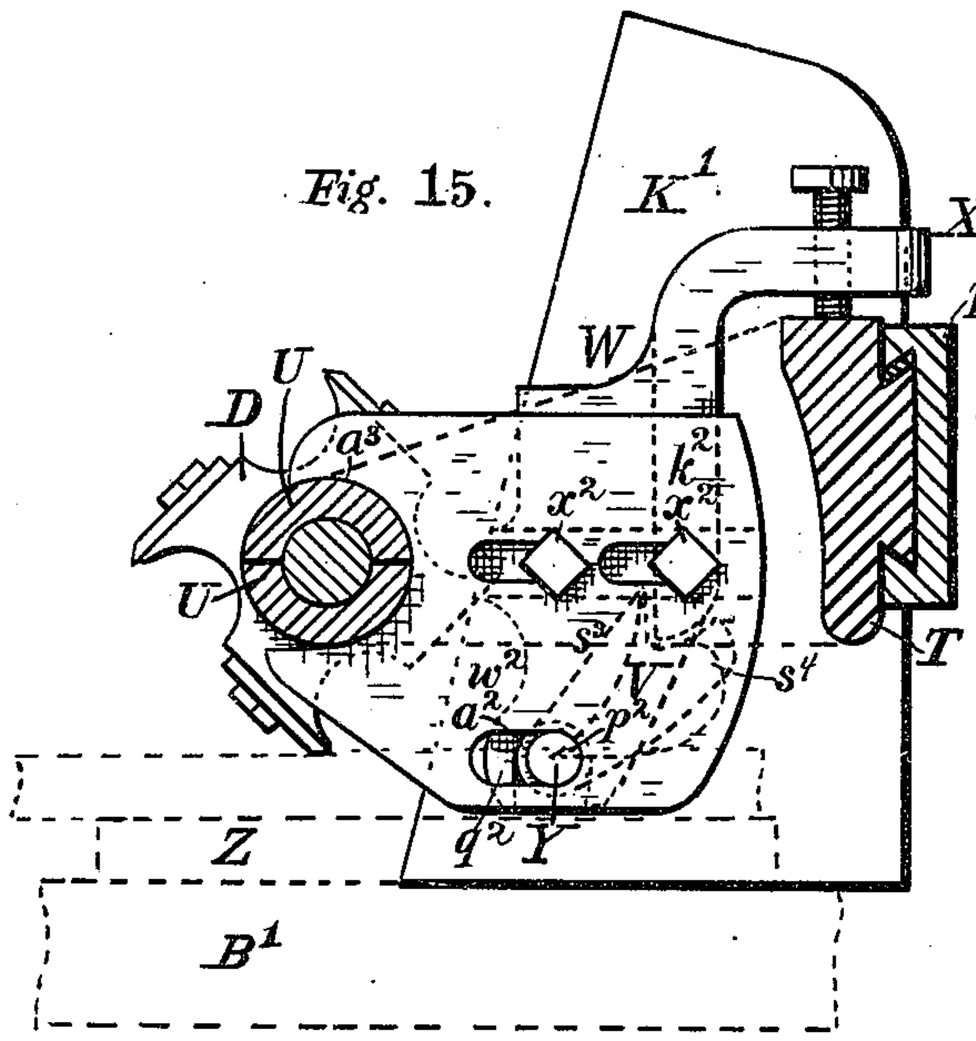
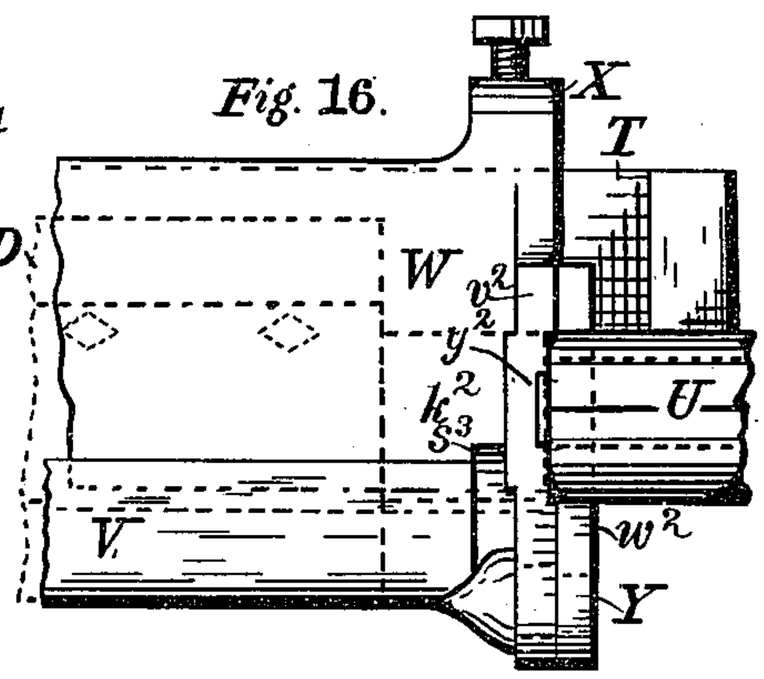


Fig. 16.



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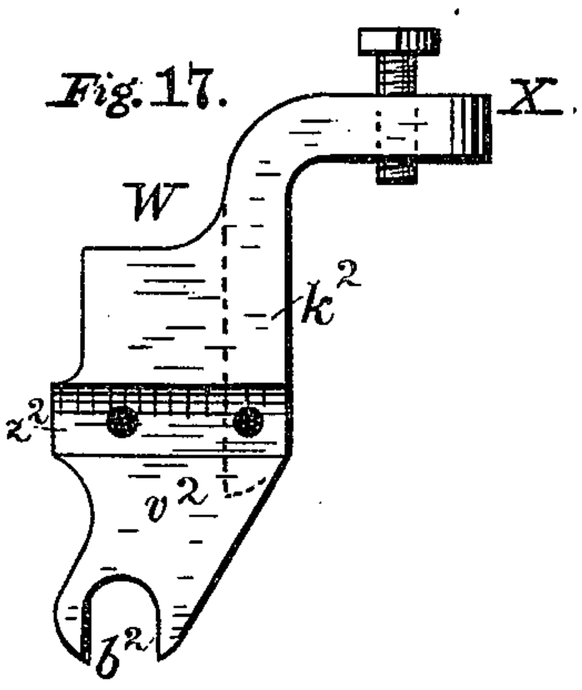
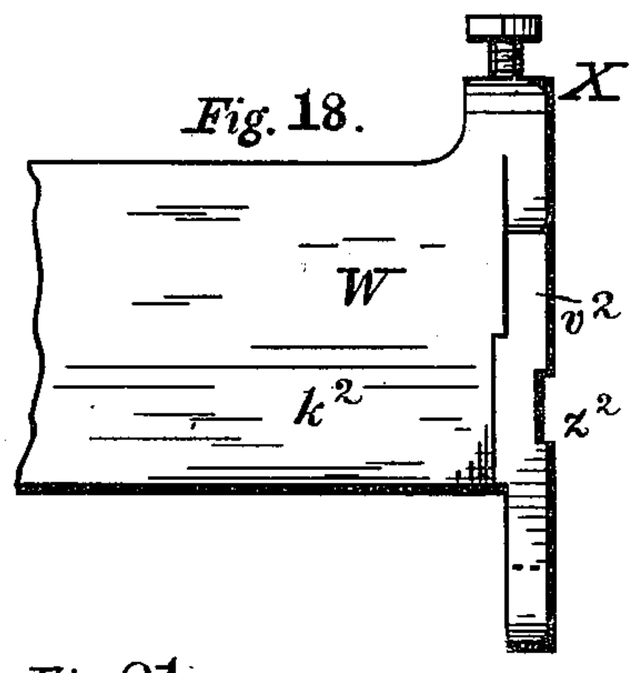


Fig. 18.



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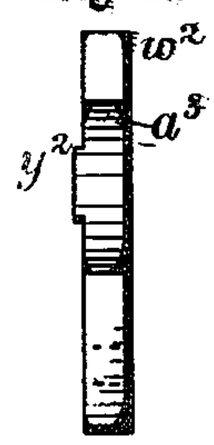

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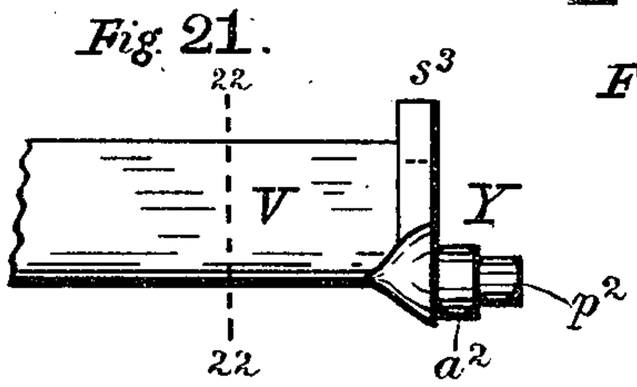

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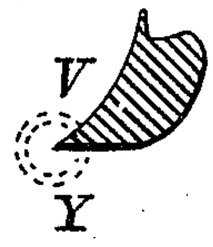

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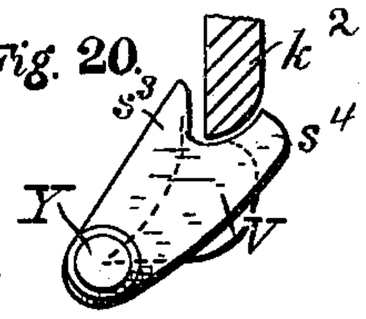

Witnesses:
G. S. Dey.
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No. 666,898.

Patented Jan. 29, 1901.

J. S. GRAHAM.

PLANING MACHINE.

(No Model.)

(Application filed May 18, 1896.)

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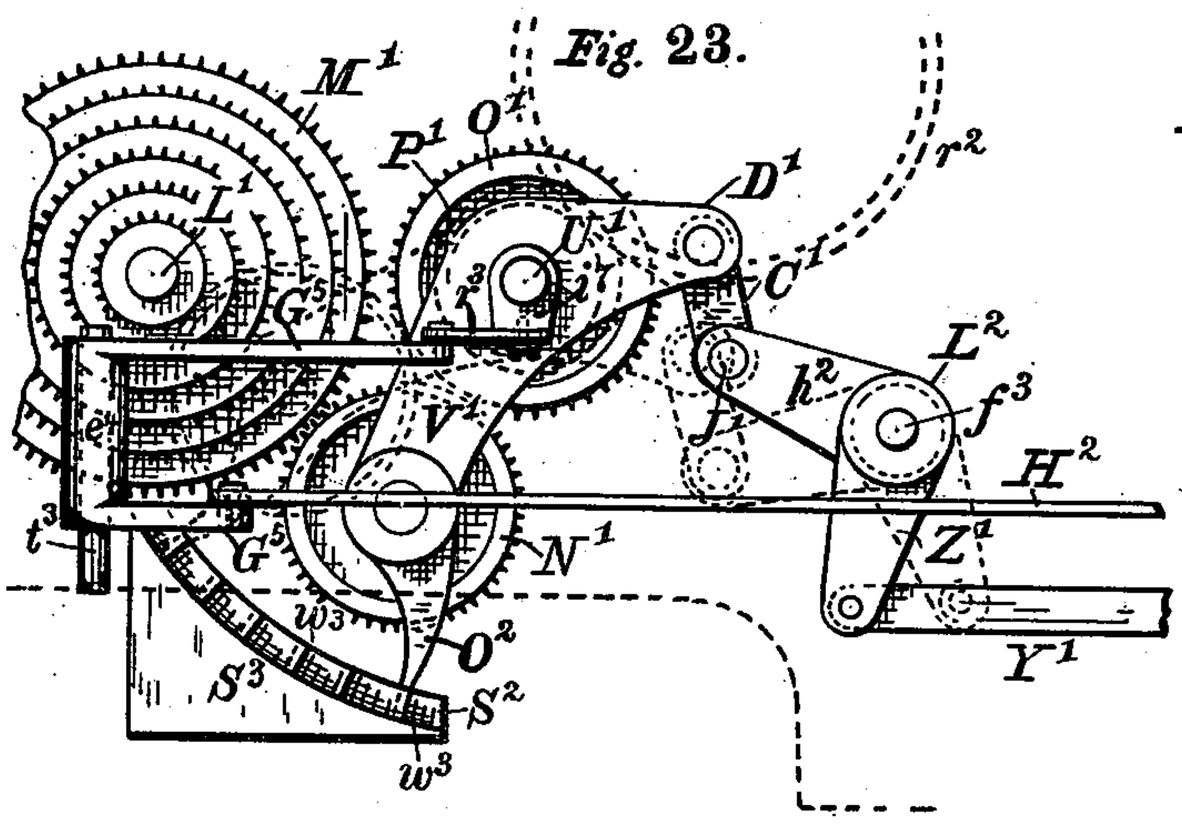
Fig. 23.



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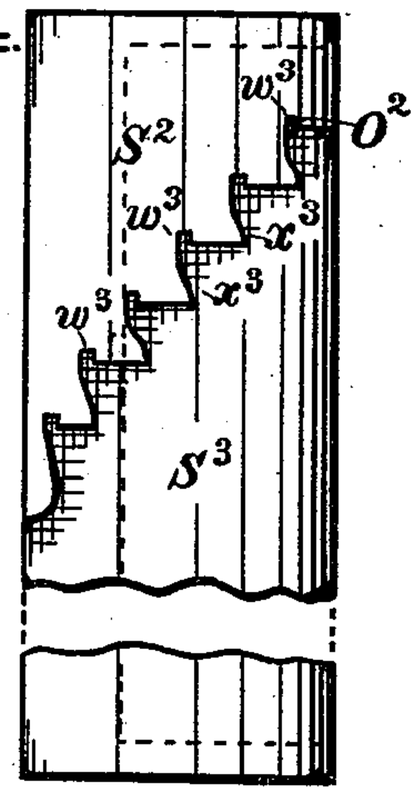

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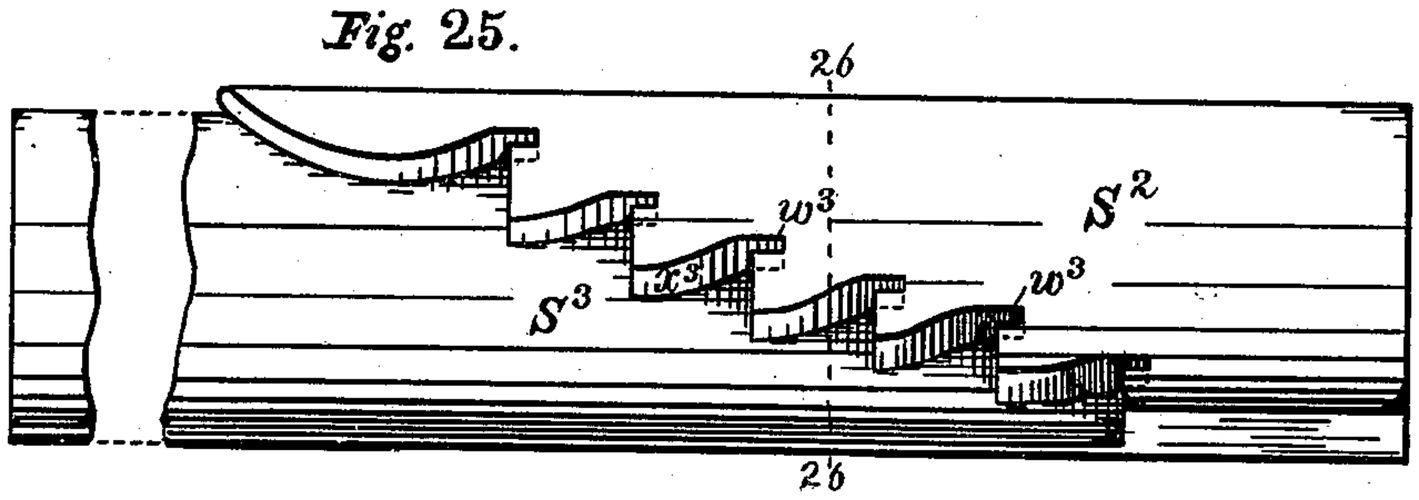

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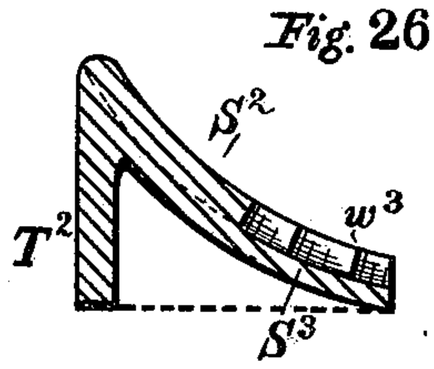

Witnesses:

E. S. Dey.

C. G. Cranwell

Inventor:

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By Geo. B. Selden.

Atty

No. 666,898. Patented Jan. 29, 1901.

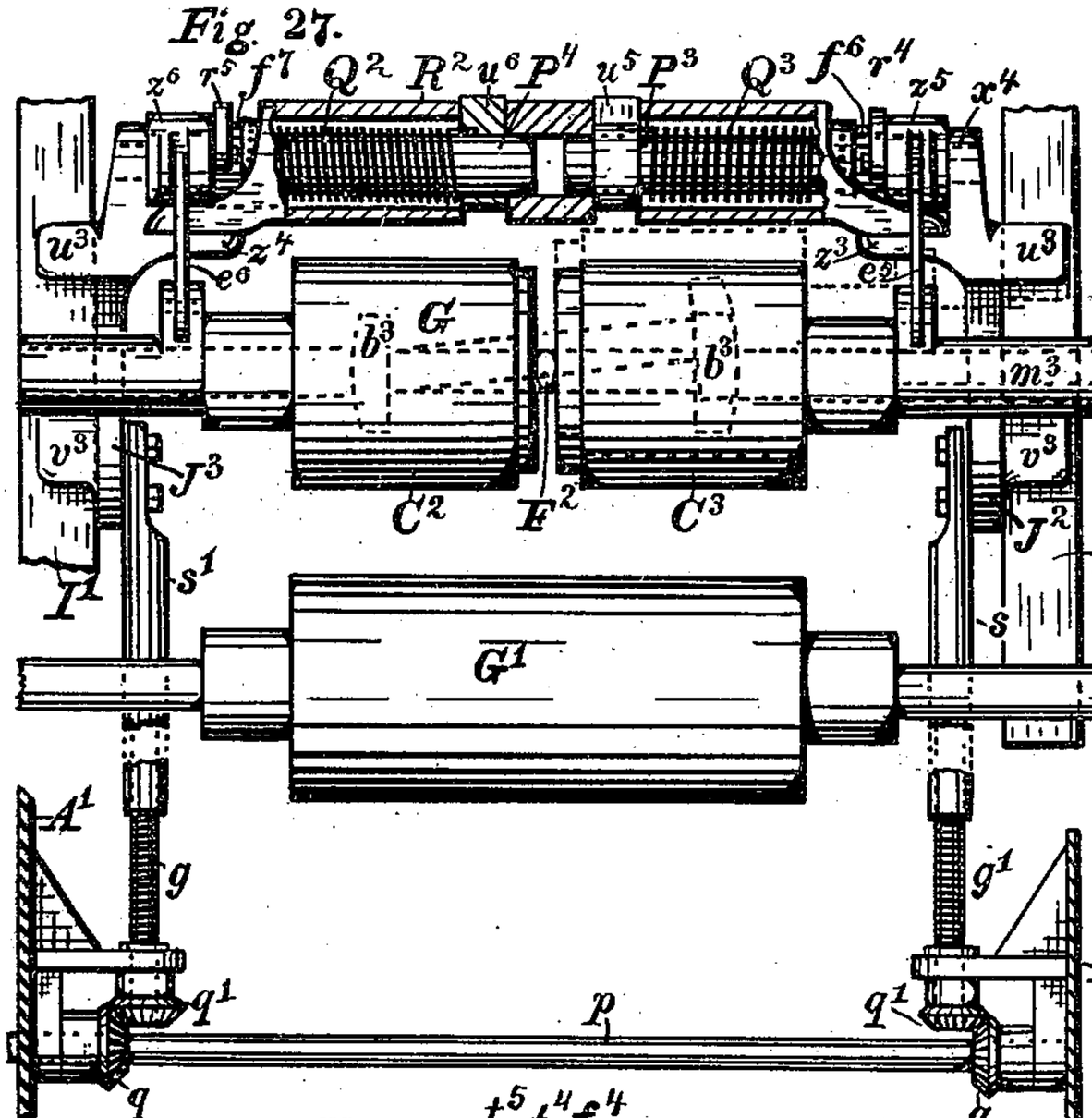
J. S. GRAHAM.

PLANING MACHINE.

(Application filed May 18, 1896.)

(No Model.) 10 Sheets—Sheet 6.

Fig. 27.



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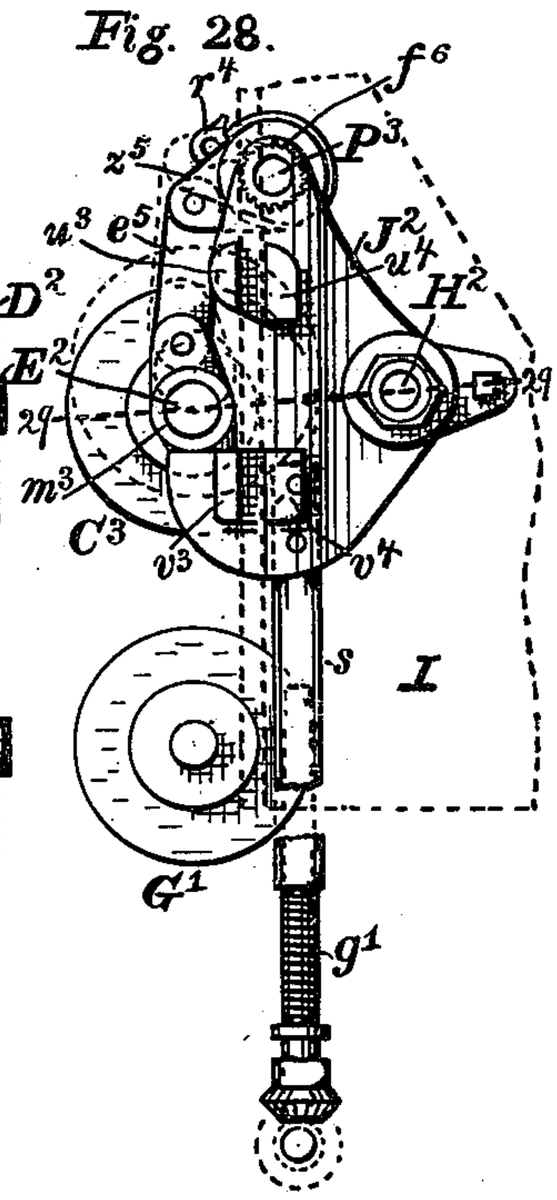

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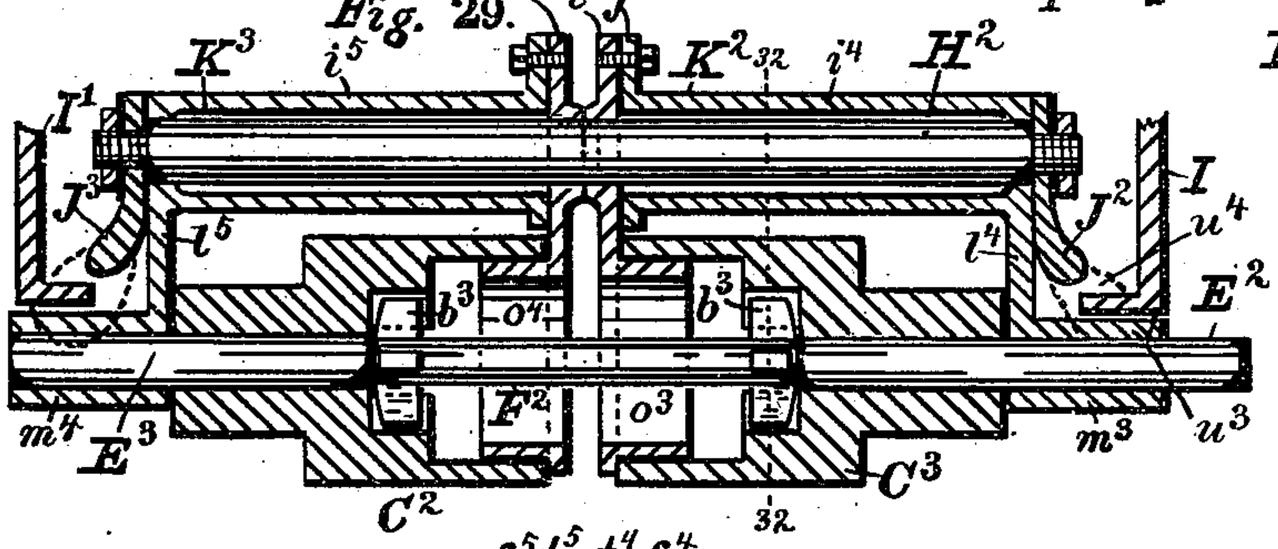

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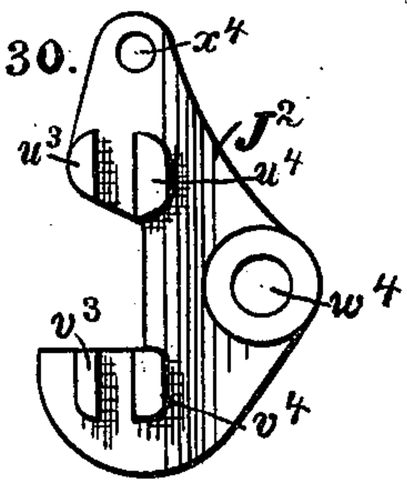

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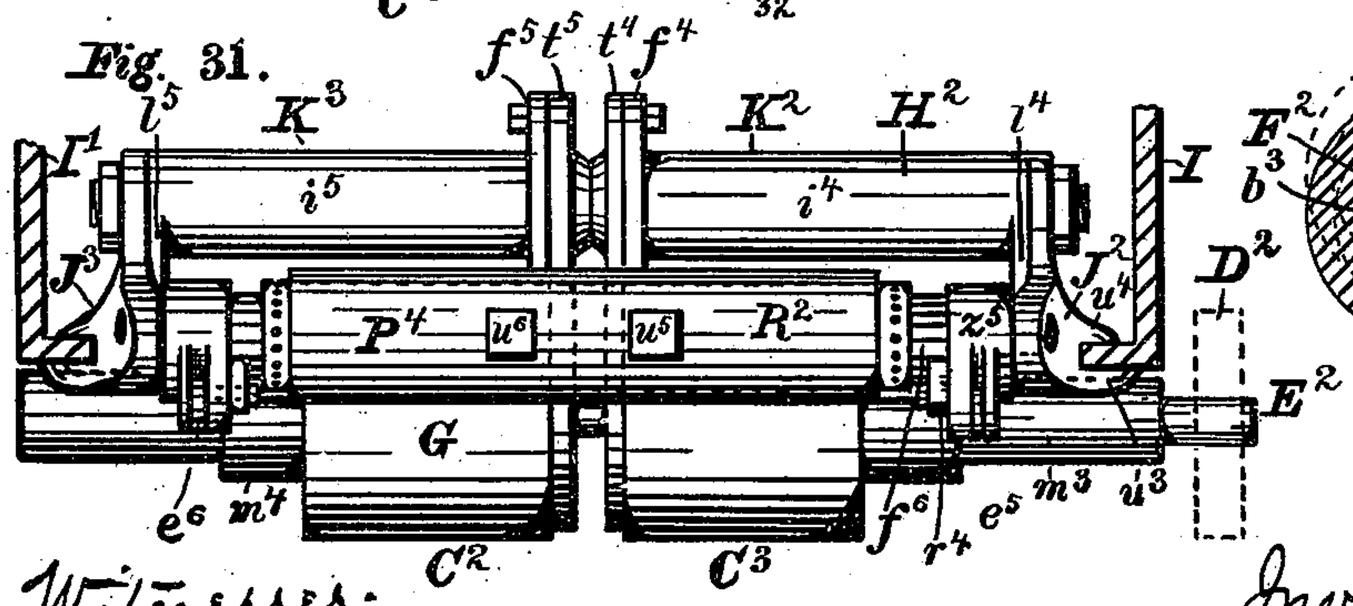

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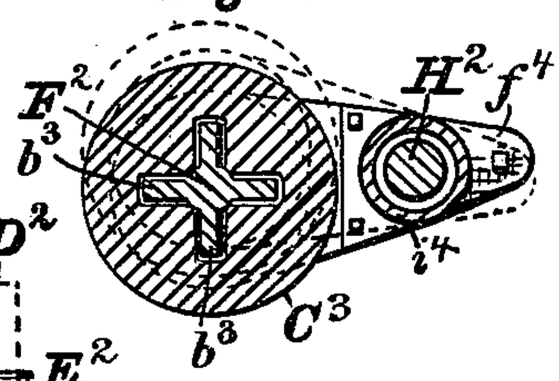

Witnesses:
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Inventor:
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No. 666,898. Patented Jan. 29, 1901.

J. S. GRAHAM.

PLANING MACHINE.

(No Model.) (Application filed May 18, 1896.)

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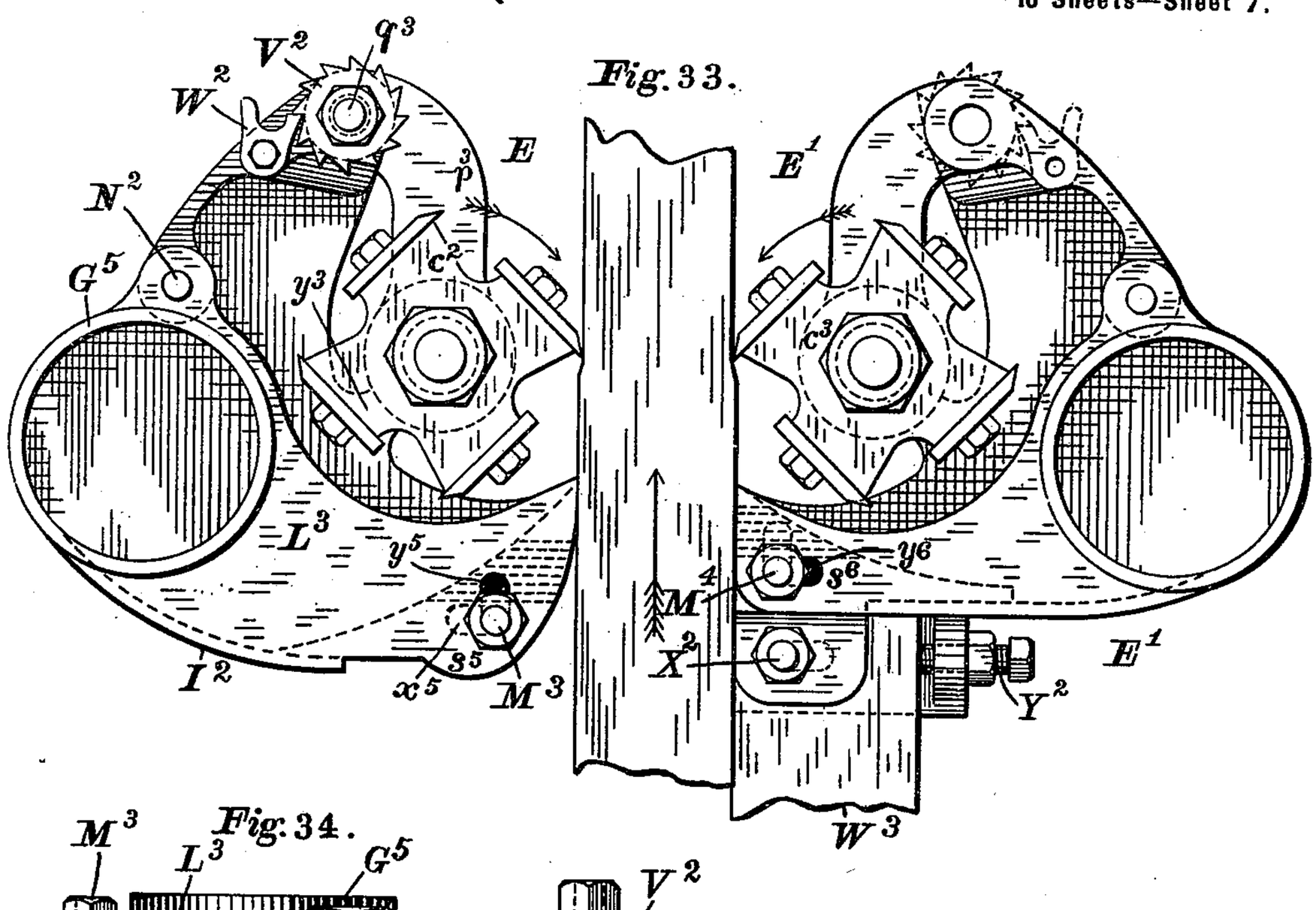
Fig. 33.



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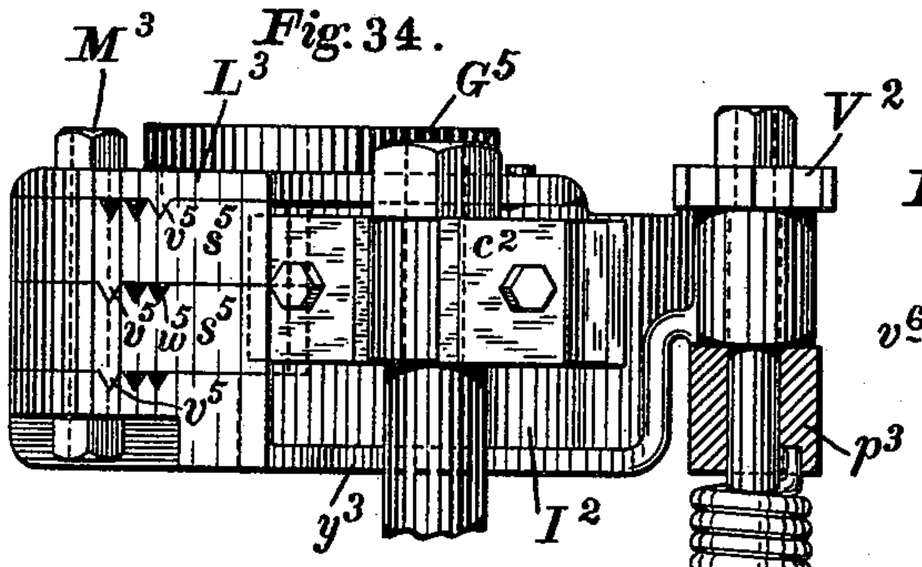

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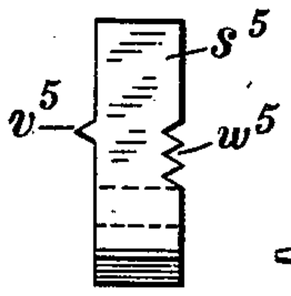

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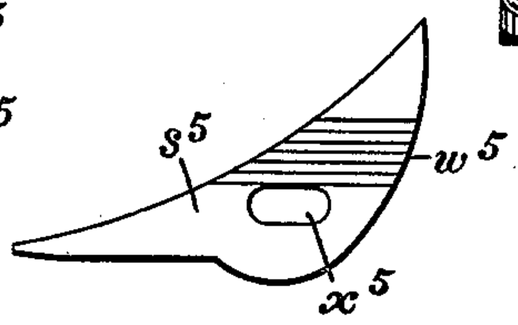


Fig. 38.

Fig. 39.

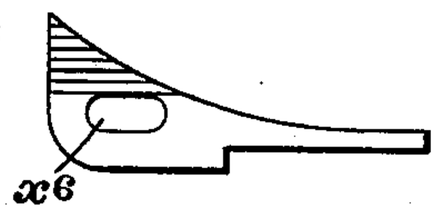
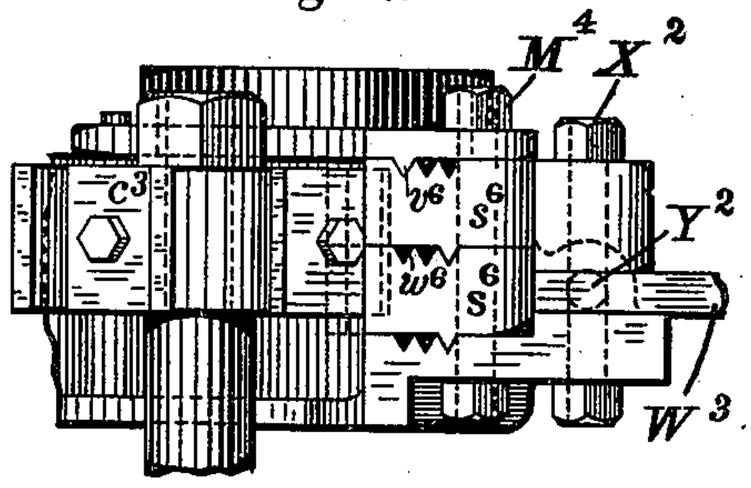


Fig. 37.



Witnesses:
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Inventor:
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J. S. GRAHAM.

PLANING MACHINE.

(Application filed May 18, 1896.)

(No Model.) 10 Sheets—Sheet 8.

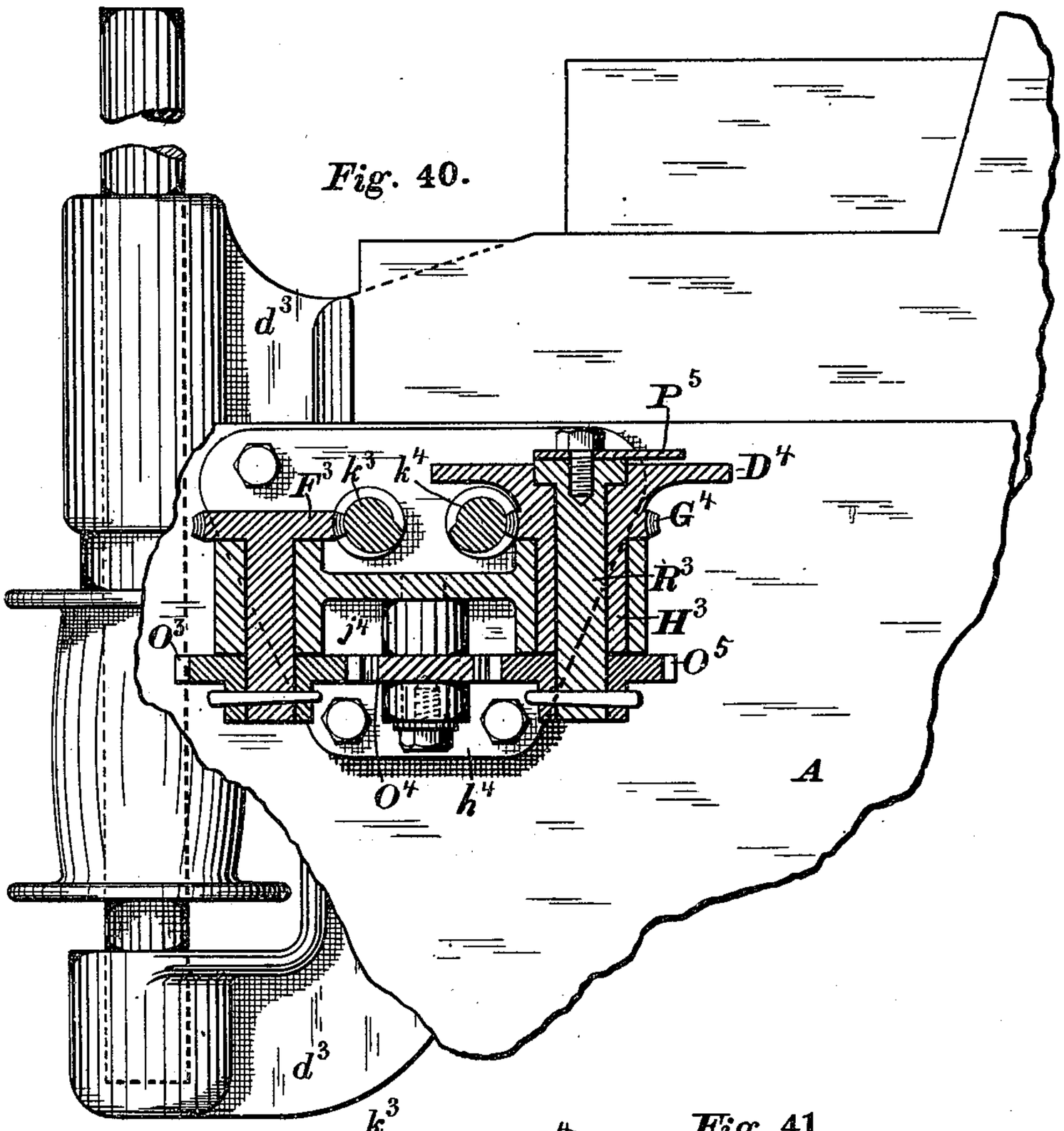

Fig. 40.

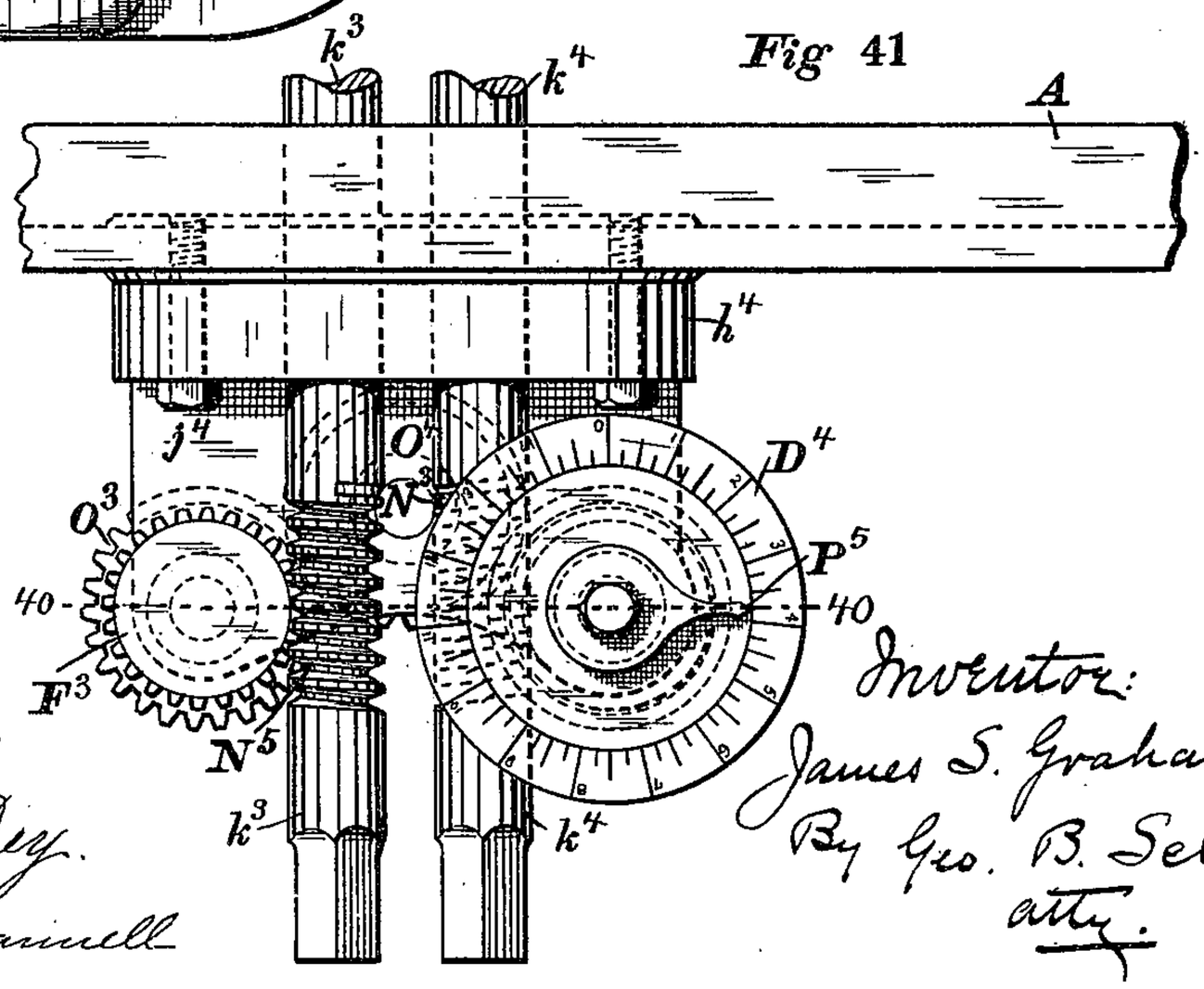

Fig 41

Witnesses:
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No. 666,898. Patented Jan. 29, 1901.

J. S. GRAHAM.

PLANING MACHINE.

(Application filed May 18, 1896.)

(No Model.) 10 Sheets—Sheet 9.

Fig. 42.

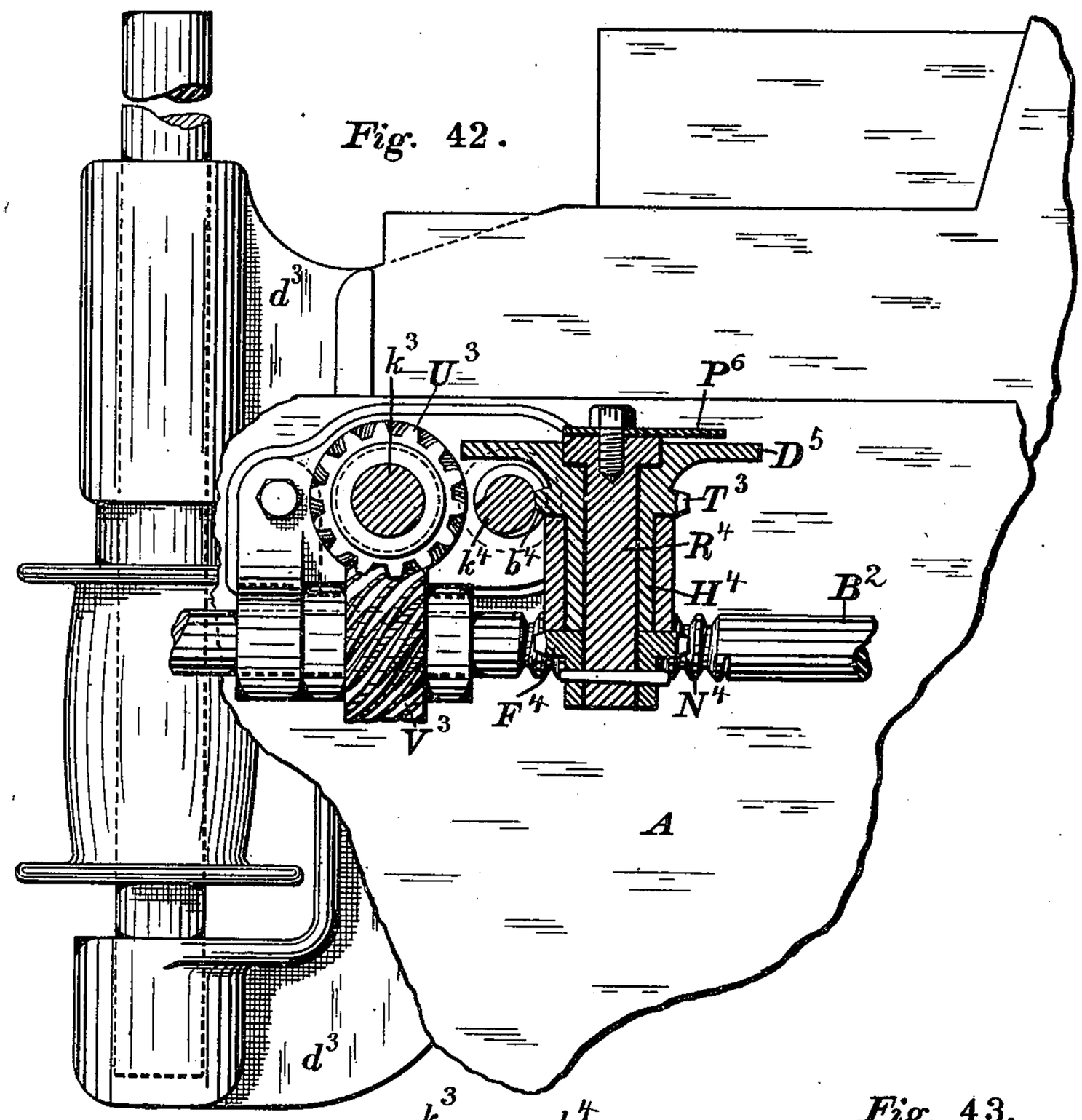
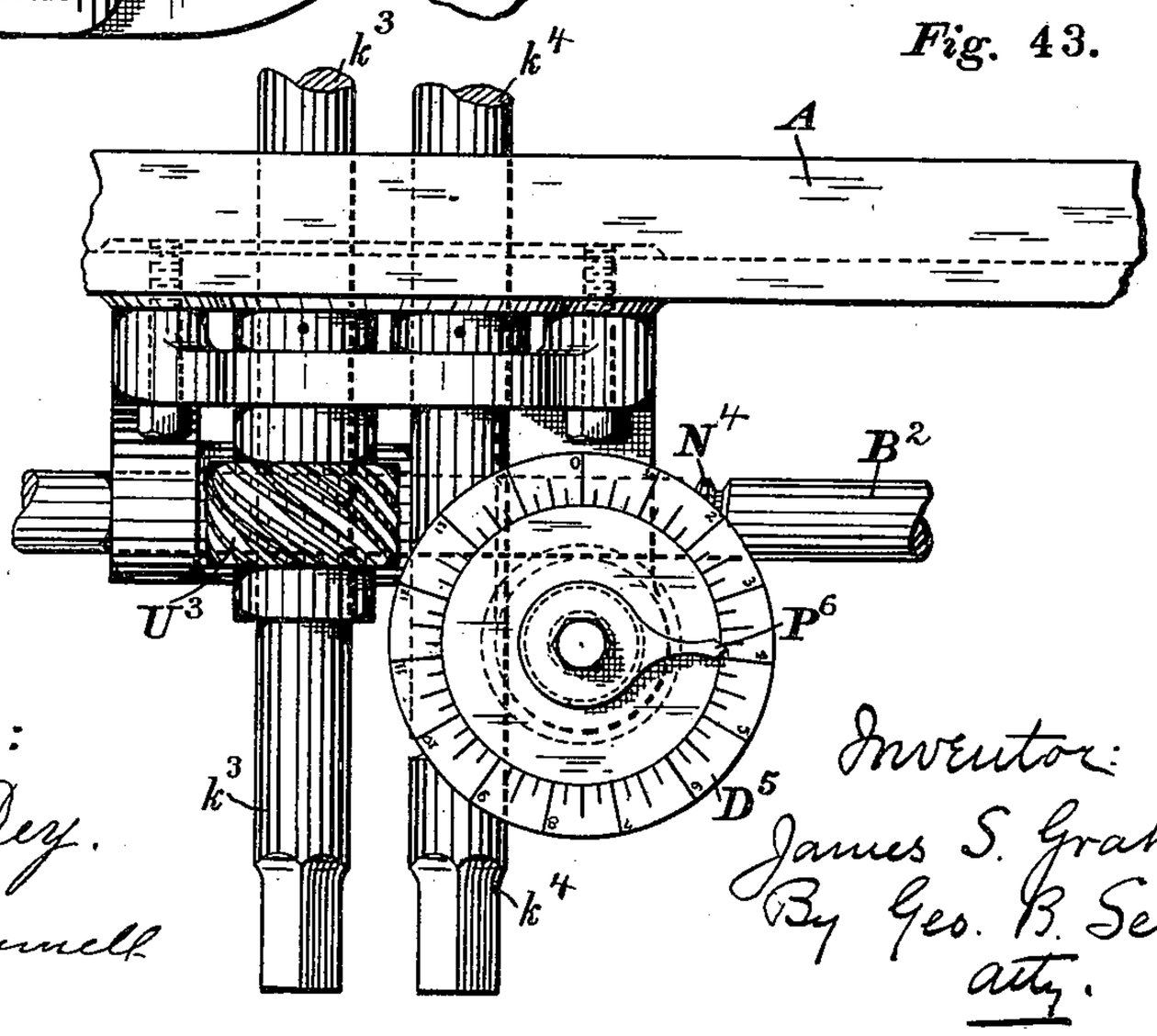


Fig. 43.



Witnesses:
G. S. Dey.
C. F. Cramell

Inventor:
James S. Graham.
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PLANING MACHINE.

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(No Model.) 10 Sheets—Sheet 10.

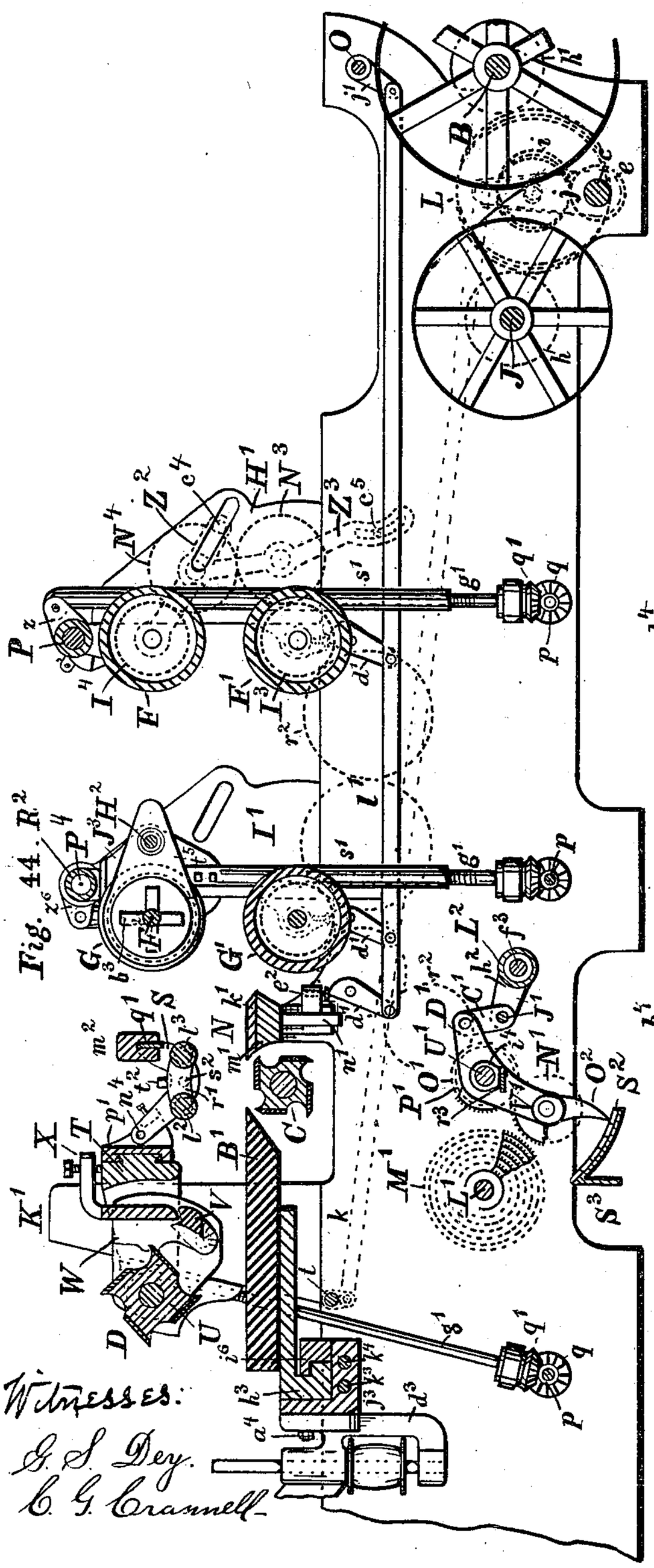

Fig. 44.

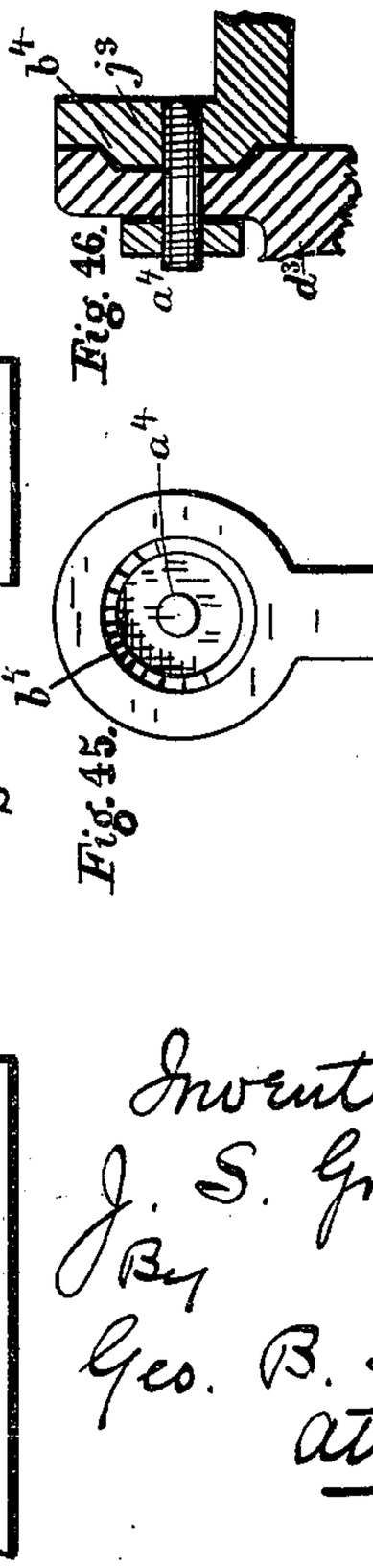

Fig. 46.

Fig. 45.

Witnesses:
G. S. Dey.
C. G. Crannell.

Inventor;
J. S. Graham,
By
Geo. B. Selden,
Atty.

UNITED STATES PATENT OFFICE.

JAMES S. GRAHAM, OF ROCHESTER, NEW YORK, ASSIGNOR TO THE J. S. GRAHAM MACHINE COMPANY, OF SAME PLACE.

PLANING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 666,898, dated January 29, 1901.

Application filed May 18, 1896. Serial No. 591,912. (No model.)

To all whom it may concern:

Be it known that I, JAMES S. GRAHAM, a citizen of the United States, residing at Rochester, in the county of Monroe, in the State of New York, have invented certain Improvements in Planing-Machines, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to certain improvements in the construction of planing and matching machines, which improvements are fully described and illustrated in the following specification and the accompanying drawings, the novel features thereof being specified in the claims annexed to the said specification.

In the accompanying drawings, representing a planing and matching machine containing my improvements, Figure 1 is a side elevation. Fig. 2 is a transverse section on the line 2 2, Fig. 1. Fig. 3 is a partial plan view of the pressure device above the under cutter. Fig. 4 is a partial plan view of the throat-piece of the under cutter. Fig. 5 is a plan view of the frame. Fig. 6 is a rear elevation of the first pair of feed-rolls. Fig. 7 is a side elevation of the same. Fig. 8 is a rear elevation of the transverse sleeve. Fig. 9 is a plan view of the same. Fig. 10 is an end view of the same. Fig. 11 is a section on the line 11 11, Fig. 6. Fig. 12 is a side view of the cap at the end of the spring-shaft. Fig. 13 is a side view of the pivoted arm. Fig. 14 is a plan view of the pivoted arm and ratchet and pawl. Fig. 15 is a side view of the upper cutter and its chip-breaker. Fig. 16 is a partial rear elevation of the chip-breaker of the upper cutter. Fig. 17 is a side elevation of the frame of the chip-breaker. Fig. 18 is a partial rear elevation of the same. Fig. 19 is a rear elevation of the adjustable end plates of the chip-breaker frame. Fig. 20 is a side view of the chip-breaker. Fig. 21 is a partial rear elevation of the same. Fig. 22 is a section of the same on the line 22 22, Fig. 21. Fig. 23 is a side elevation of the change-speed gearing. Fig. 24 represents the notched locking-plate as seen from above. Fig. 25 represents the same as seen from the right hand in Fig. 23. Fig. 26 is a section of the same on the line 26 26, Fig. 25. Fig. 27 is a rear elevation, partly in section, of the divided feed-rolls. Fig. 28 is a side elevation of the same. Fig. 29 is a section on the line 29 29, Fig. 28. Fig. 30 is a side view of the sliding bracket detached. Fig. 31 is a plan view of the divided feed-rolls. Fig. 32 is a section on the line 32 32, Fig. 29. Fig. 33 is a plan view of the matcher-heads and chip-breakers. Fig. 34 represents the left-hand chip-breaker and hood as seen from the inside. Figs. 35 and 36 represent different views of one of the nosepieces of the left-hand chip-breaker. Fig. 37 represents the right-hand chip-breaker and hood as seen from the inside. Figs. 38 and 39 represent one of the nosepieces of the right-hand chip-breaker. Fig. 40 is a sectional elevation of the device for gaging the width of the boards. Fig. 41 is a plan view of the same. Fig. 42 is a sectional elevation representing a modification of the same. Fig. 43 is a plan view of the said modification. Fig. 44 is a central longitudinal section of my improved planing-machine. Figs. 45 and 46 are respectively face and sectional views of the matcher-bracket.

In the accompanying drawings, A A′ represent the side frames; B, the main driving-shaft; C, the under cutter; D, the upper cutter; E E′, the matcher-cutters, and F F′ and G G′ the first and second pairs of feed-rolls.

H H′ and I I′ represent the standards for the first and second pairs of feed-rolls, and K the standards for the upper cutter.

Motion is transmitted from a pulley on the driving-shaft to the upper cutter D by means of the belt *a* and to the under cutter C by means of the underlying belt *b* running around a pulley on the shaft J.

The mechanism for raising or lowering the upper feed-rolls and the upper cutter by the power of the machine consists, essentially, of the friction-wheel L, the shaft *c*, worm *d*, worm-gear *f*, side shaft M, and screws *g g′*. The friction-wheel L is arranged to be shifted slightly, so as to bring it in contact with either one or the other of the pulleys *h h′* on the shafts B and J, which revolve in opposite directions, so that the rolls may be raised or lowered, while, when the wheel occupies the central position, out of contact with either of the pulleys *h h′*, the feed-rolls will remain

fixed in any position to which they may have been adjusted. The shaft *c* is arranged transversely, being supported in suitable journals in the side frames and provided at one end with the gear *e* and at the other with the worm *d*. The friction-wheel L is carried by a stud *m* on the arm *j*, Fig. 2, which arm swings on the shaft *c*. The wheel L revolves freely on the stud *m*, being attached to the gear *i*, which meshes with the gear *e* on the shaft *c*. By shifting the arm *j* slightly in one direction or the other the friction-wheel is made to contact with one of the pulleys *h h'*, which impart motion to the wheel which is transmitted to side shaft M by the gears *i e*, shaft *c*, and worm and worm-gear *d f*. At suitable points below the feed-rolls the side shaft is provided with the bevel-gears *n n' n²*, which mesh with corresponding gears *o o' o²* on the transverse shafts *p*, Figs. 5, 6, and 7, supported by the side frames. The shafts *p* are provided with the bevels *q*, which mesh with bevels *q'* on the lifting-screws *g g'*, which are threaded into the rods or tubes *s s'*, connected with the journal-boxes of the upper rolls F and G and of the upper cutter D. It will be understood that these rolls and the cutter are raised or lowered simultaneously by turning the screws *g g'* in one direction or the other and that the requisite motion of these screws will be secured by putting the friction-wheel L in contact with one or the other of the pulleys *h h'*. The movement of the arm *j*, by which contact is produced between the friction-wheel and the pulleys is controlled by a rock-shaft *t*, Figs. 1 and 5, and a connection *k*. The rock-shaft is provided with a crank *u* at one end, and the connection *k* is pivoted at one end to a pin on the crank and at the other end to the upper end of the arm *j*. The rock-shaft and connection enable the operator to adjust the rolls and cutter while standing opposite the cutter in position to observe the scale and index which are usually applied to the cutter-standard and journal-box to indicate the thickness of the lumber planed. The operator applies a wrench to the end of the rock-shaft and by turning it in one direction or the other brings the wheel L in contact with one or the other of the pulleys *h h'*, thereby raising or lowering the upper feed-rolls and the upper cutter to any desired degree. The screws *g g'* are supported in suitable brackets attached to the side frames.

It will be understood that, although I prefer the arrangement shown, the side shaft M may be located inside the frame and on either side of the machine.

In order to provide for raising or lowering the upper cutter independently of the feed-rolls, the bevel *n²* is splined on the side shaft, so that it may be moved lengthwise thereon and disconnected from its corresponding bevel, in which case the cutter may be raised or lowered by hand by a crank applied to the shaft *v* of the gear *w*, which meshes with a gear on the transverse shaft which drives the screws which raise or lower the upper cutter. The gear *n²* is carried by a journal-box arranged to slide lengthwise of the shaft and provided with a cam *a'* and hand-lever *b'*, by which the gear is shifted. The journal-box is attached to a plate which slides parallel to the side shaft in suitable ways on the side frame. Any suitable clutch may be employed for the purpose of disconnecting the gear *n²* from the side shaft M, so as to permit the independent adjustment of the upper feed-rolls and the upper cutter.

In order to provide for the simultaneous adjustment of the lower feed-rolls F' and G' and the throat-piece N of the under cutter C, I employ the rock-shaft O, provided with cranks at its ends which are connected to the pivoted cam-levers *d'*, which support the lower rolls and the under cutter. The cam-levers *d'* are pivoted on studs inserted in the side frames, their upper ends being given an eccentric or cam-like form, so that on swinging their lower ends from left to right in Fig. 1 the rolls F' G' and the throat-piece N will settle down from their own weight. The journal-boxes *g² g³* of the lower feed-rolls may rest directly on the cam-levers or they may be provided with adjusting-screws *e'*, by which independent adjustment of the rolls and the throat-piece may be secured. These adjusting-screws are inserted into the journal-boxes from below and are preferably provided with jam-nuts, the heads of the screws resting directly on the cam-levers. These screws also enable me to adjust the lower rolls for level. The rock-shaft is provided with a handle *i'*, and a scale and clamping-screw *j'*, Fig. 1, may be arranged so as to indicate the amount of cut permitted to the under cutter and to secure the lower rolls and the throat-piece in any desired position of adjustment. The cranks on the rock-shaft are connected to the cam-levers by the connections *l'*. The throat-piece consists of a wear-plate *k'*, secured on a cross-bar *m'*, which has at each end an upright flange or web *n³*, which fits in grooves in the inner sides of the frames. The flanges *n³* slide up and down in the grooves as the cam-levers are adjusted. The throat-piece is provided with the adjusting-screws *e²*, which bear on the cam-levers. The operator when he desires to vary the amount of the cutting done by the under cutter adjusts the position of the cam-levers by turning the rock-shaft O in one direction or the other, thereby raising or lowering the lower feed-rolls and the throat-piece. The cam-levers being all connected together by the connecting-bars *l'*, the cranks and the transverse shaft O, the rolls, and the throat-piece are adjusted simultaneously and equally at each end.

The arrangement and construction of the first pair of feed-rolls will be understood from Figs. 1 and 6 to 14, inclusive. The upper feed-roll F is forced down upon the lumber by the spring or springs shown in the upper part of Fig. 6. The lifting-rods *s s'* are connected to

arms $z\,z'$, which as the roll F rises operate to compress the spring. In Fig. 1 the parts are represented in the positions they occupy when the machine is empty, while in Figs. 6 and 7 the parts are shown in full lines in the positions they assume when lumber is passing through between the rolls and in dotted lines in the positions occupied by them when the machine is not at work. As the upper roll F rises it carries up the shaft P and the spring or springs Q Q', and, since the spring is connected at one end to the shaft and at the other to the swinging arm z, which is held down by the lifting-rod, the upward movement of the upper roll compresses the spring. Provision is made for securing tension on the spring and for adjusting such tension by means of a ratchet and pawl. The journal-boxes g^4 g^5 of the upper roll F are connected together above the roll by a hollow transverse sleeve R, which is bolted to the boxes, as indicated at x, Fig. 6. The sleeve R incloses the shaft P and the spring or springs Q Q', being made of a suitable form, with down-turned ends, as shown. The shaft P is supported at each end by caps c', which are screwed onto the ends of the sleeve R, as represented, a lip d^2, Fig. 6, on the cap entering a groove in the end of the sleeve to hold the cap in place. The shaft P is also supported by an internal collar e^3, cast on the interior of the sleeve at the middle of its length. The arms $z\,z'$ are attached to the shaft P by set-screws or other suitable devices, so as to turn therewith. The outer ends of the springs Q Q', if two springs are used, are attached either directly to the arms $z\,z'$ or indirectly for the purpose of adjusting the tension to the ratchets f' f^2, which are connected with the arms by the pawls r. The inner ends of the springs are inserted in blocks t' t', which are prevented from turning in the sleeve by projections u' entering openings v', Fig. 9, in the sleeve. In assembling the parts the blocks are inserted into the open ends of the sleeve, with the lugs u' extending lengthwise, and the lugs are then inserted in the openings v' by turning the blocks up into their proper positions. The ends of the springs are inserted in holes w', Fig. 11, in the blocks t'. In a similar manner the outer ends of the springs are inserted in holes in the arms $z\,z'$ or in the hub x', Fig. 14, of the ratchet f'. The ratchet is loose on the shaft, and the hub x' is provided with a series of holes or otherwise arranged so that the ratchet may be turned by a rod or a wrench for the purpose of adjusting the tension of the spring. The pawl r is pivoted on a lug y', projecting from the arm z. It will be understood that as the roll rises the sleeve also rises, the shaft, ratchets, and arms turn in the sleeve, and the spring or springs are compressed. The shaft P equalizes the resistance of the roll to being raised at each end of the roll. The tension of the springs, and consequently the pressure of the roll on the lumber passing below it, is readily adjusted by turning the ratchet. Stops are provided to limit the downward movement of the roll. These stops consist of projecting lugs i^2 i^3 on the sleeve R and of the corresponding flanges j^2 on the arms $z\,z'$. When the machine is empty, the opposing edges of the stops i^2 i^3 and of the lugs j^2 are in contact with each otner; but when lumber is being fed the lugs separate from the stops as the roll rises and the shaft P turns, as indicated by the full lines in Fig. 7, to a greater or less degree, according to the distance which the roll rises. The journal-boxes g^4 g^5 of the upper roll are gibbed onto the standards H H' in any usual or preferred way, so that the roll can travel freely up or down on the standards either when adjusting itself to the inequalities of the lumber below it or when being adjusted up or down for different thicknesses of lumber by the lifting-screws g g', as already described. The journal-boxes g^2 of the lower feed-roll F' are also gibbed on the standards. The hubs x' of the ratchets are preferably arranged to project a short distance into the open ends of the sleeve R.

The arrangement and construction of the pressure device above the under cutter C will be understood from Figs. 1 and 3. Pressure is applied to the lumber over the under cutter by means of the rollers l^2 l^3, supported in a pivoted frame S and held down by one or more weights m^2. The frame S is pivoted at n^4 to lugs on a laterally-adjustable bar p', which is arranged to be shifted on the frame T, which carries the journal-boxes U of the upper cutter D. The object of this lateral adjustment of the pressure device is to bring narrow boards when fed on one side of the machine under the center of the length of the rollers l^2 l^3. The bar p' and the frame T are connected together by a dovetail or other suitable joint, a set-screw or other device being employed to secure the bar in the desired position on the frame. It will be observed also that the pressure device moves up and down with the upper cutter D whenever the latter is adjusted. q^4 is the cross-bar of the frame S, to which the weight m^2 is applied. The rollers l^2 l^3 are carried by an inner movable frame r', pivoted at s^2 to the frame S. This construction allows the rollers to adjust themselves slightly to the roughness of the lumber passing under them, a suitable stop being provided to limit this movement by extending the cross-bar t^2 of the inner frame r' over the ends of the frame S, as indicated in Fig. 3. The frame S may be turned up entirely out of the way to afford access to the under cutter C.

U represents the journal-box for the shaft of the upper cutter, which is clamped to the standards K by a bolt engaging with a nut in a T-headed slot in the standards or in any other suitable way. The frame T connects the journal-boxes of the upper cutter on the opposite sides of the machine and also supports the chip-breaker for the upper cutter,

which is represented in Figs. 15 to 20, inclusive. The chip-breaker V consists of a plate of proper form adapted to the purpose adjustably pivoted in a movable frame W, which swings about the axis of the cutter D. The construction of the movable frame W will be understood from the end view, Fig. 17, and the rear view, Fig. 18, of one end of the frame. It consists of a transverse plate k^2, having at each end the wings v^2, which project toward the cutter-shaft. X represents arms, provided with set-screws, which project over the frame T and by which the position of the frame W and chip-breaker V relatively to the cutter may be adjusted. The end plates w^2 are attached to the wings v^2 by one or more bolts x^2, Fig. 15, a projecting rib y^2 being fitted into a groove z^2 in the wings to insure the proper location of the end plates relatively to the wings. On their rear edges the end plates w^2 are provided with a circular notch a^3, which fits the journal-boxes U of the cutter on each side just inside the arms of the frame T. The frame W and the chip-breaker are therefore permitted to swing concentrically with the axis of the cutter. The form of the chip-breaker will be understood from the sectional view Fig. 22. At each end it is provided with a pivot Y, of two different diameters, the larger inner portion a^2, Fig. 21, of which fits a circular notch b^2, Fig. 17, in the wings v^2, while the outer smaller portion p^2 of the pivot fits a slotted opening q^2, Fig. 15, in the end plates w^2. The construction described permits the adjustment of the chip-breaker to and from the cutter by means of the bolts x^2, the smaller part p^2 of the pivot Y being adjustable in the slot q^2. In Fig. 15 the parts are shown in the position they occupy when the chip-breaker is arranged at its greatest distance from the cutter; but it will be understood that by slacking the bolts x^2 the frame w and the chip-breaker V may be adjusted toward the cutter. The chip-breaker V is permitted to rock on its pivots to a certain degree. This result is secured by providing the chip-breaker with the lugs s^3 s^4, Fig. 20, with a notch between them, into which the lower edge of the plate k^2 engages. This construction allows a limited amount of oscillation in the chip-breaker as the lumber passes under it. Z, Fig. 15, is a wear-plate supported on the bed B'. The machine is of course provided with a suitable bed on which the lumber is fed.

The mechanism for driving the feed-rolls at variable speeds consists, essentially, of the transverse shaft L', Figs. 5 and 23, carrying a cone of gears M' and operating to transmit motion at different speeds to the feed-rolls through the swinging gear N', the gear O', pinion P', and any suitable train of gearing r^2. The gear O' is supported on a transverse shaft U', which drives the train of gearing r^2 by the pinion P'. Any suitable kind of expansion-gearing may be employed between the upper and lower feed-rolls. In the arrangement shown the gear I^3, Fig. 44, on the shaft of the lower feed-roll F' drives the gear I^4 on the shaft of the upper roll F by the intermediate gears N^3 N^4, which are supported by links, so that they always remain in mesh with each other and with the gears on the rolls. The gear N^4 is carried by a link Z^2, which is pivoted on the roll-shaft and is provided with a pin c^4, which slides in a slot in the standard. The gear N^3 is carried by a link Z^3, which is pivoted on the stud carrying the gear N^4 and is provided at its lower end with a curved slot which slides on a pin c^5, inserted in the side frame, so that the gear N^3 while traveling up and down will be always properly in mesh with the gear I^3. A pivoted link may also be employed between the roll-shaft and stud of the gear N^3. A similar arrangement is adopted on the other pair of feed-rolls. The shaft L' and its cone of gears are driven in any convenient manner, as by the belt R' from the pulley S' on the main shaft B. This arrangement is convenient, as in case it is desired to change the rate of feed the operator throws off the belt R' between the pulley S' and the pulley T' on the cone-shaft L'. The swinging gear N' is arranged so as to be engaged with any one of the gears of the cone M', so as to transmit motion at different speeds to the feed-rolls. The shafts L' and U' revolve in suitable journals on the frame, being located at such a distance apart that the gear O' does not engage with any of the cone-gears M'. The gear O' is splined on the shaft U', so that it can be adjusted across the machine lengthwise of the shaft. The swinging gear N' is carried by the frame V', which is free to turn on the shaft U', so that the gear N' may be engaged with any one of the cone of gears M'. The gears O' and N' are always in mesh with each other. The gears O' and N' and the frame V' are adjustable simultaneously lengthwise of the shaft U', so as to bring the gear N' in the proper position laterally to engage with any of the cone-gears when swung into mesh by the movement of the frame V'. The movements of the two gears are controlled by the levers W' and X', Fig. 1, one of which, W', shifts the gears O' N' and the frame V' lengthwise on the shaft U' and the other, X', swings the gear N' and frame V' to or from the cone of gears M'. These levers W' and X' are pivoted to the frame in such position as to be conveniently under the control of the operator at the feed end of the machine. The lever X' is connected by a rod or bar Y' with a bent lever Z', pivoted to the frame, and the lever Z' is connected by a link C' with the projecting arm D' of the swinging frame V'. Motion of the upper end of the lever X' in either direction will thus shift the gear N' into or out of mesh with the gears of the cone. In Fig. 23 the gear N' is shown engaged with the largest cone-gear in full lines, and its position when in mesh with the smallest cone-gear is repre-

sented by dotted lines. Any desired number of cone-gears may be employed, producing as many different speeds of the feed-rolls. In order to permit of the adjustment of the frame V′ and the gears across the machine, the bent lever Z′ is constructed with a shaft J′, Figs. 5 and 23, on which the connection C′ slides. The bent lever is most conveniently made of a sleeve L^2, arranged to turn on a transverse rod f^3 and provided with the arms h^2, which carry the shaft J′. The three shafts U′, J′, and f^3 are arranged parallel with each other, so that as the frame V′ slides along the shaft U′ the connection C′ slides on the shaft f^3. The lever W′ is provided with a notched sector M^2, Fig. 1, and a suitable spring or other catch adapted to engage in any of the notches and to hold the parts in any desired position, with the gear N′ in the proper plane to engage with any one of the cone-gears. The lever W′ is arranged to shift the swinging gear N′, the gear O′, and the frame V′ laterally across the machine by the bent lever G^5, the connection H^2, and the pitman r^3. The bent lever G^5 is pivoted on a stud t^3, carried by a suitable bracket u^2, Fig. 5, attached to the frame. One end of the lever is pivoted to the connection H^2 and the other to the pitman r^3. The lever is provided with a sleeve e^4, Fig. 23, by which its arms are separated from each other. The pitman is pivoted to a boss i^7 on the frame V′. It will thus be seen that the motion of the lever W′ will be transmitted to shift the gear N′ and its attached parts laterally across the machine, so that the gear occupies the same plane as any of the cone-gears, and that it will be held in such position by the engagement of the catch on the lever with the notched sector M^2. The gear N′ is held in mesh with any of the cone-gears by the arm O^2 of the frame V′, which engages with the notches of the cylindrical notched plate S^2, the construction of which will be understood from Figs. 23 to 26, inclusive. The arm O^2 projects downward from the frame V′ and its point engages with any one of a series of notches w^3 in the cylindrical plate S^2. The plate S^2 is made of a curved form, having its center in the axis of the shaft U′, and consequently the notches w^3 occupy positions where the point of the arm O^2 may engage with any one of them. The notches extend lengthwise of the plate a sufficient distance to engage and hold the point of the arm, (see O^2, Fig. 24,) so that the gear N′ cannot escape from meshing with one of the cone-gears. In order to prevent the ends of the teeth on the gear N′ from striking the ends of the teeth of one of the cone-gears, the edge of the notch is bent outward, so that as the gear is shifted laterally it is held away from the cone-gear by the arm O^2 resting on the curved surface x^3 until the ends of its teeth have passed beyond the ends of the teeth on the cone-gear, after which the teeth are permitted to engage, the points of the teeth on one passing into the openings between the teeth of the other. When the operator desires to change the rate of the feed, he operates the lever W′ and brings the gear N′ in line with the cone-gear, which will give the desired speed, and then by the lever X′ brings the point of the arm O^2 against one of the curved surfaces x^3, corresponding with the chosen cone-gear, and then engages the gear N′ in mesh with the particular gear-cone by a further movement of the lever W′, the point of the arm sliding along the curved surface and permitting the arm and gear to approach the cone-gear and engaging the teeth. The notched plate S^2 is supported in place in any suitable way. In the drawings it is shown as extended across the machine by a corresponding plate S^3 of larger curve and provided with a stiffening-rib T^2, Fig. 26, and with end plates which are bolted to the side frames.

Figs. 27 to 32 represent the divided feed-roll. The lower roll G′ is supported by any suitable journal-boxes arranged in any suitable manner on the standards I I′. Provision may be made for adjusting the lower roll up and down, as already described, and the rolls are driven by any suitable train of gearing with suitable expansion-gearing between the upper and lower rolls. The upper roll G is divided into two parts or sections C^2 C^3, the section C^3 being driven by gear D^2, Fig. 27, and shaft E^2, while the section C^2 is driven from C^3 by the connection F^2, which permits one of the sections to rise higher than the other, as indicated by the full and dotted lines in Fig. 27. At either end the connection F^2 is provided with a joint consisting of a number of radial arms fitting a recess of corresponding shape in the opposing roll-sections C^2 C^3, so as to form what are practically universal couplings, which permit the unequal rise or fall of either roll, while securing their simultaneous revolution. The preferred arrangement will be understood from Figs. 29 and 32, in which the radial arms, which are preferably four in number, are represented at b^3 fitting corresponding recesses in the opposing faces of ends of the hollow spaces of the roll-sections. It will of course be understood that any other form of universal joint may be employed, that the number and arrangement of the radial arms may be varied, and that the arms may be on the roll-sections and the recesses on the ends of the connection F^2. In the construction shown the arms b^3 are forged with the connection—a simple and cheap form of construction. The roll-sections are pivoted, so that they may rise and fall independently on the shaft H^2, Figs. 28, 29, 31, and 32, which shaft is itself supported by arms or brackets J^2 J^3, which are adjustable on the standards I I′, being connected with the screws g g' of the lifting mechanism by the internally-threaded rods s s'. The roll-sections C^2 C^3 are supported at both their inner and outer ends by a frame which is pivoted to swing on the shaft H^2. These frames are independent of each other, and the rolls

are held down upon the lumber by the springs Q^2 Q^3, Fig. 27. The frame K^2 for the roll C^3 consists of a hollow sleeve i^4, Figs. 29 and 32, surrounding the shaft H^2 and provided at its outer end with the arm l^4, which carries the journal-box m^3, in which the outer end of the shaft E^2 of the roll-section C^3 revolves. At its inner end the sleeve i^4 is provided with a flange f^4, to which is bolted an arm or plate t^4, which reaches inward between the inner ends of the roll-sections and carries the ring or journal o^3, Fig. 29, which is fitted to and supports the inner end of the roll-section C^3. The inner end of the section C^3 revolves on the hollow journal o^3, its outer end being supported by the shaft E^2 in the journal-box m^3. The sleeve i^4 and the plate t^4 are fitted at either end of the frame K^2 to turn freely on the shaft H^2. It will be perceived that by the construction described the roll-section C^3 is permitted to swing on the shaft H^2, remaining always parallel with itself, and that this movement is independent of the corresponding section C^2. The shaft H^2 is attached at either end by nuts and keys or other suitable devices to the brackets J^2 J^3, which, however, are also connected together above the divided roll G by the hollow sleeve R^2, which incloses the springs Q^2 Q^3. The frame K^3, which carries the roll-section C^2, consists of parts similar to the frame K^2, already described. It is provided with the sleeve i^5 around the shaft H^2, the plate or arm t^5, which carries the journal-ring o^4 inside the inner end of the section C^2, and the arm l^5, which supports the journal m^4 at the outer end of the shaft E^3. The frame K^3 vibrates on the shaft H^2 as the section C^2 rises or falls with the varying thickness of the lumber passing under it, and this movement is entirely independent of the other section C^3, except that both are simultaneously adjusted up and down to adapt the machine to lumber of different thicknesses by the lifting-screws g g' and the lifting mechanism already described. The construction and arrangement of the adjustable brackets J^2 J^3 will be understood from Figs. 27, 28, and 30. They are provided with lugs or projections w^3 w^4 v^3 v^4, which fit against the opposing sides of the standards I I'. The web of the bracket is provided with the opening w^4, Fig. 30, which receives the end of the shaft H^2. It has also an upward projection provided with an opening x^4, Fig. 30, which receives the end of the shaft P^3, about which the spring Q^3 is coiled, and the arrangement is the same for the shaft P^4 and spring Q^2. There are also lugs or inward projections z^3 z^4, Fig. 27, on the brackets J^2 J^3, to which the sleeve R^2 is secured. As the roll-section C^3 rises it compresses the spring Q^3, and similarly as the section C^2 rises it compresses its spring Q^2. This result is produced by the connections e^5 e^6, which are connected to cranks to which the outer ends of the springs are attached. The inner end of the spring Q^3 of the section C^3 is inserted or otherwise attached to the collar u^5, Fig. 27, which has a lug engaging in a suitable opening in the sleeve R^2 in a manner similar to that already described, so that it cannot rotate on the shaft P^3. At its outer end the spring Q^3 is connected by an adjustable ratchet with the crank z^5, to which the upper end of the link e^5 is pivoted. As the roll-section C^3 rises it turns the crank z^5, and this compresses the spring Q^3, so that the requisite pressure on the lumber is secured. This movement of the section and crank is represented by the full and dotted lines in Fig. 28. While the outer end of the spring Q^3 may be directly connected to the crank z^5 in order to adjust the tension of the spring, I interpose the ratchet f^6 and pawl r^4, which is pivoted to the crank z^5. The outer end of the spring Q^3 is attached to the ratchet f^6 or to an enlarged collar thereon, which collar is preferably provided with a series of holes by inserting a rod in which the tension of the spring may be adjusted. The pawl may be provided with a suitable spring to secure its engagement with the ratchet. It will thus be seen that the spring Q^3, acting through crank z^5 and link e^5, presses the roll-section C^3 down on the lumber and that such pressure is adjustable by the employment of the ratchet. A similar construction is adapted for the other roll-section C^2. The journal-box m^4 is connected by the link e^6 with the crank z^6, which as it turns twists or compresses the spring Q^2 on the shaft P^4, which, it will be observed, is separate from the shaft P^3. The inner end of the spring Q^2 is held by the collar u^6. A ratchet and pawl f^7 r^5 are interposed between the spring Q^2 and the crank z^6, so as to make the tension of the spring and the pressure on the lumber adjustable in a manner similar to that already described. It is thus provided that the roll-section C^2 can rise and fall independently of the other section and its pressure on the lumber can be adjusted. The machine is thus adapted to feeding boards of two different thicknesses at the same time, while the divided roll permits of adjustment as a whole to lumber of different thicknesses. It will also be understood that my improved divided roll as herein described may be used independently, as well as in connection with the other improvements set forth in this application.

Either or both of the feed-rolls in front of the cutters may be provided with a divided feed-roll.

The matcher cutter-heads are represented in plan view in Fig. 33. They consist of any suitable rotary cutter-heads c^2 c^3, supported on upright shafts, which are driven from the main shaft B by quarter-twist belts which run over pulleys on the shaft J. The matcher-shafts are arranged so that they can be adjusted across the machine and also so that they may be set at angles with the vertical line for the purpose of dressing the edges of the lumber on a bevel. The frame of one of

the matcher-shafts is represented at d^3, Figs. 1 and 44, from which it will be seen that it is attached by a bolt a^4 to an adjustable angle-piece j^3, which is arranged to be shifted across the machine by the threaded rod k^4. A transverse bar h^3 extends across the machine between the side frames. This bar is provided with a projecting flange, to which the angle-plate j^3 is secured by the gib i^6. The screw k^4 is used to adjust one of the matchers and the screw k^3 the other. Around the bolt a^4 the matcher-bracket is provided with a circular recess which fits a corresponding boss on the angle-plate, the surfaces in contact being preferably conical, as indicated at b^4, Figs. 45 and 46, so that the bracket is firmly held in any position in which it may be set, either square with or inclined to the bed, by screwing up the nut on the end of the bolt. From the bracket an arm p^3 extends upward and outward and supports the spindle q^3 of the hood I^2 of the matcher-cutter, which is provided with the collar G^5 for the attachment of the suction-spout through which the chips are carried off. The hood I^2 swings on its pivot, being pressed toward the edge of the lumber by the spring U^2, one end of which is fastened to the spindle q^3 and the other to the journal at the upper end of the arm p^3. To get it out of the way, this spring U^2 is placed below the bed. At its upper end the spindle q^3 is provided with a ratchet V^2, with which a pawl w^2 on the hood engages, whereby provision is made for adjusting the tension of the spring. The lower plate of the hood may contact with the bracket p^3, as indicated at y^3, to limit the swinging movement.

The chip-breaker consists of one or more adjustable pieces s^5, Figs. 34, 35, and 36, which are made adjustable in two different directions, one to and from the lumber, to compensate for wear, and the other toward the cutter. The chip-breaker s^5 is clamped between the lower plate of the hood and the top plate L^3 by the bolt M^3. A pin or bolt at N^2, Fig. 33, also secures the plate L^3 to the hood. The chip-breaker s^5 is provided on one side with a rib v^5 and on the opposite side with a series of corresponding grooves w^5. Corresponding ribs or grooves are formed on the lower side of the plate L^3 and on the lower plate of the hood, so that when it is desired to adjust the chip-breaker toward the cutter the bolt M^3 is slacked and the chip-breaker moved the width of one of the ribs or grooves, being then secured in place with the rib in the groove next adjacent to the one it previously occupied. The slots y^5 in the upper and lower plates permit this adjustment. When two or more wearing-pieces s^5 are employed, they are adjustable relatively to each other in a similar manner, each piece being provided with the requisite ribs and grooves. The adjustment of the chip-breaker to and from the lumber is effected by means of the slot x^5 in the wearing-pieces, the ribs sliding lengthwise in the grooves. It will be observed that the slots y^5 and x^5 are placed at right angles to each other, and this construction, in connection with the ribs and grooves, permits the chip-breaker to be adjusted in the two directions mentioned.

The hood surrounding the matcher-head c^3 is constructed similarly to that already described. It is provided with the adjustable chip-breaker s^6, secured in place by the bolt M^4 and provided with the ribs and grooves v^5 w^6 and the slot x^6. y^6 is a slot in the upper plate of the hood. By these means provision is made for adjusting the chip-breaker in two different directions at right angles with each other in a manner similar to that already described with regard to the chip-breaker on the opposite side of the board. The hood for this cutter is, however, provided with the guide-bar W^3, along which the lumber runs and which is attached to the hood by the bolt X^2, passing through a suitable lug and made adjustable by the screw Y^2, which is threaded through a lug attached to the hood. The guide-bar W^3 is slotted where the bolt X^2 passes through it, and by means of the screw Y^2 the bar may be always kept in line with the wearing-surfaces of the chip-breaker s^6.

In order to facilitate the setting of the matcher-cutters at any desired distance apart in order to edge or match boards of any required width, I connect the adjusting-screws k^3 k^4, Figs. 1, 40, and 41, by worm or spur gearing, so that the space between the cutters at any given time is indicated by a pointer and dial on the outside of the machine. The dial is connected with one of the screws, so as to revolve when the screw is turned, and the pointer is connected with the other screw. It will be understood that one of the screws k^3 k^4 is threaded through the sliding block j^3, carrying one of the matcher-cutters, and that the other is threaded through the block carrying the other cutter. One of the rods passes through one of the blocks in an enlarged hole. D^4, Figs. 40 and 41, is the dial, and P^5 the pointer. Outside the frame the screw k^3 is provided with a worm-thread N^5, Fig. 41, which engages with a worm-gear F^3, which by a train of spur-gears O^3 O^4 O^5 transmits movement to the stem R^3 of the pointer P^5. Fig. 40 is a section parallel to the frame on the line 40 40, Fig. 41. The sleeve H^2 of the dial D^4 is provided with a worm-gear G^4, which meshes with a worm N^3 on the shaft k^4. It will be observed that the arrangement is such that the dial and pointer travel in opposite directions. The various parts of the mechanism are supported from the side frame A by the bracket j^4, attached to the frame by the plate H^4. This bracket is provided with suitable journals for the stem of the worm-gear F^3 and the sleeve of the dial. It also carries a stud on which the spur-gear O^3 revolves. The operation of this indicator will be readily understood from the preceding description. The dial being properly graduated

and marked, the position of the pointer on it shows instantly the distance between the cutters in inches or fractions of an inch.

In a modified form of the indicator for the matchers (represented in Figs. 42 and 43) I employ a side rod B^2, which extends along the frame in suitable journals and permits the setting of the cutters at any required distance apart by the operator while standing at the feed end of the planer. The arrangement is similar to that already described, worms and worm-gearing and a rotary dial and pointer being employed. D^5 is the graduated dial, and P^6 the counter. The side rod B^2 is provided with a worm N^4, which meshes with a worm-gear F^4 on the stem R^4, which carries the counter. The dial D^5 is revolved from the screw k^4 by the worm b^4, which meshes with the worm-gear T^3 on the sleeve H^4 of the dial. The screw k^3 is provided with the spiral gear U^3, which meshes with a corresponding spiral gear of equal size V^3, fastened on the side rod B^2. A suitable supporting-frame is employed to sustain the various parts. By turning the side rod the cutters are adjusted to any desired distance apart, and such distance is indicated by the pointer on the dial.

It will be understood that when a center guide between the matchers is used, so that two boards can be run at the same time to be jointed or matched on their outer edges only, the guide-bar W^3 should be omitted and the hood about the matcher c^3 provided with a spring and ratchet similar to those already described.

I claim—

1. The combination with suitable standards, of the upper and lower feed-rolls, the rock-shaft arranged parallel thereto, the support for the rock-shaft, the spiral spring applied to the rock-shaft, said spring being connected to the shaft and the frame of the machine whereby the spring is compressed when the roll is elevated and adapted to return the roll, substantially as described.

2. The combination with the standards H H′, of the feed-rolls F, F′, the rock-shaft P, spiral spring Q, crank z, and connection s, substantially as described.

3. The combination with the standards H H′, of the feed-rolls F F′, the rock-shaft P, spiral spring Q, cranks $z\,z'$, threaded connections $s\ s'$, and lifting-screws $g\ g'$, substantially as described.

4. The combination with suitable standards, of the upper and lower feed-rolls, the rock-shaft arranged parallel thereto, the support for the rock-shaft, the spiral spring applied to the rock-shaft, said spring being connected to the shaft and to the frame of the machine, and the ratchet mechanism between the spring and the connections, substantially as described.

5. The combination with the standards H H′, of the feed-rolls F F′, the rock-shaft P, the support R, spiral spring Q, crank and connection $z\ s$, and the ratchet and pawl $f'\ r$, substantially as described.

6. The combination with the standards H H′, of the feed-rolls F F′, the rock-shaft P, spiral spring Q, crank z provided with lug j', connection s, and journal-box g^4 having stop i^2, substantially as described.

7. The combination with the feed-rolls of a planing-machine and their driving-gearing, of the cone-gear M′, the laterally-adjustable gear O′, the swinging laterally-adjustable gear N′, and its supporting-frame, the notched plate S^2, and suitable levers and connections whereby the gear N′ may be adjusted and held in mesh with any of the cone-gears, substantially as described.

8. The combination with the cone-gears M′, of the adjustable swinging gear N′, the frame V′ having arm O^2, the notched plate S^2 having notches w^3 and inclined surfaces x^3, substantially as described.

9. The combination with the feeding mechanism of a planing-machine, of the driving-shaft L′ carrying cone-gears M′, the shaft U′ supporting adjustable gear O′, the swinging adjustable gear N′, and its frame V′, the notched plate S^2, the levers W′ and X′ and suitable connections, whereby the gears may be adjusted lengthwise on the shaft, and engaged with any of the cone-gears, substantially as described.

10. In combination, the upper and the lower cutter, of a yielding pressure device for the lower cutter, said pressure device being vertically adjustable with the upper cutter and comprising a frame carrying two pressure-rollers pivoted on its central axis in another pivoted frame arranged to be adjusted laterally across the machine, substantially as described.

11. In combination, the upper and the lower cutter, of a yielding pressure device for the lower cutter, said pressure device being vertically adjustable with the upper cutter and comprising a frame carrying two pressure-rollers pivoted on its central axis in another movable frame pivoted on a slide supported by the standards of the upper cutter and adjustable laterally across the machine, substantially as described.

12. The combination with the under cutter C and adjustable lower feed-roll G′, of the adjustable throat-plate N, the rock-shaft O′ and connections l', the cam-levers d' and adjusting-screws $e'\ e^2$, substantially as described.

13. The combination with the cutter D, of the frame W having notches b^2, the adjustable end plates w^3, having slots q^2, and the pivoted chip-breaker V, having bosses Y, substantially as described.

14. The combination with the section C^3 of the rock-shaft P^3, coiled spring Q^3, crank z^5 and connection e^5, substantially as described.

15. The combination with the section C^3 of

the rock-shaft P^3, coiled spring Q^3, crank z^5, ratchet f^6, pawl r^4, and connection e^5, substantially as described.

16. The combination with the sections C^2 C^3, having crank-arms connected therewith of the internal connection F^2 and suitable springs Q^2 Q^3 mediately fixed to the frame and to the crank-arms said arms being rocked by the rise and fall of the sections, whereby the sections are independently pressed against the lumber, substantially as described.

17. The combination with the sections C^2 C^3 having crank-arms connected therewith and the lifting-screws g g', of the internal connection F^2, and suitable springs Q^2 Q^3 mediately fixed to the frame and to the crank-arms said arms being rocked by the rise and fall of the sections, whereby the sections are independently pressed against the lumber, substantially as described.

18. The combination with the sections C^2 C^3 having crank-arms connected therewith of the internal connection F^2, the shaft H^2, swinging frames K^2 K^3, and the springs Q^2 Q^3, said springs being mediately fixed to the frame and to crank-arms moved by the rise or fall of the sections, substantially as described.

19. The combination with the adjusting-screws k^3 k^4 of the matchers of a planing-machine, of the rotary dial D^4 and rotary pointer P^5 and suitable connections between the screws and the dial and pointer, substantially as described.

20. The combination with the adjusting-screws k^3 k^4 of the matchers of a planing-machine, of the rotary dial D^4 and rotary pointer P^5, worms N^3 N^5, worm-gears O^3 G^4, and suitable connecting gearing, substantially as described.

21. The combination with the adjusting-screws k^3 k^4 of the matchers of a planing-machine, of the rotary dial D^4 and rotary pointer P^5, worms N^3 N^5, worm-gears O^3 G^4 and gears O^3, O^4 and O^5, substantially as described.

22. The combination with the adjusting-screws k^3 k^4 of the matchers of a planing-machine, of the rotary dial and rotary pointer, the side shaft B^2, and suitable connections, substantially as described.

23. The combination with the adjusting-screws k^3 k^4 of the matchers of a planing-machine, of the rotary dial D^5 and rotary pointer P^6, the spiral gears U^3 V^3, worm N^4, worm-gears F^4 T^3, and the worm on the shaft k^4, substantially as described.

JAMES S. GRAHAM.

Witnesses:
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H. LOEWER.