(No Model.) 5 Sheets—Sheet 1.

F. KINGSTON.

MACHINE FOR CUTTING, BUNDLING, AND BINDING FIRE WOOD.

No. 369,603. Patented Sept. 6, 1887.

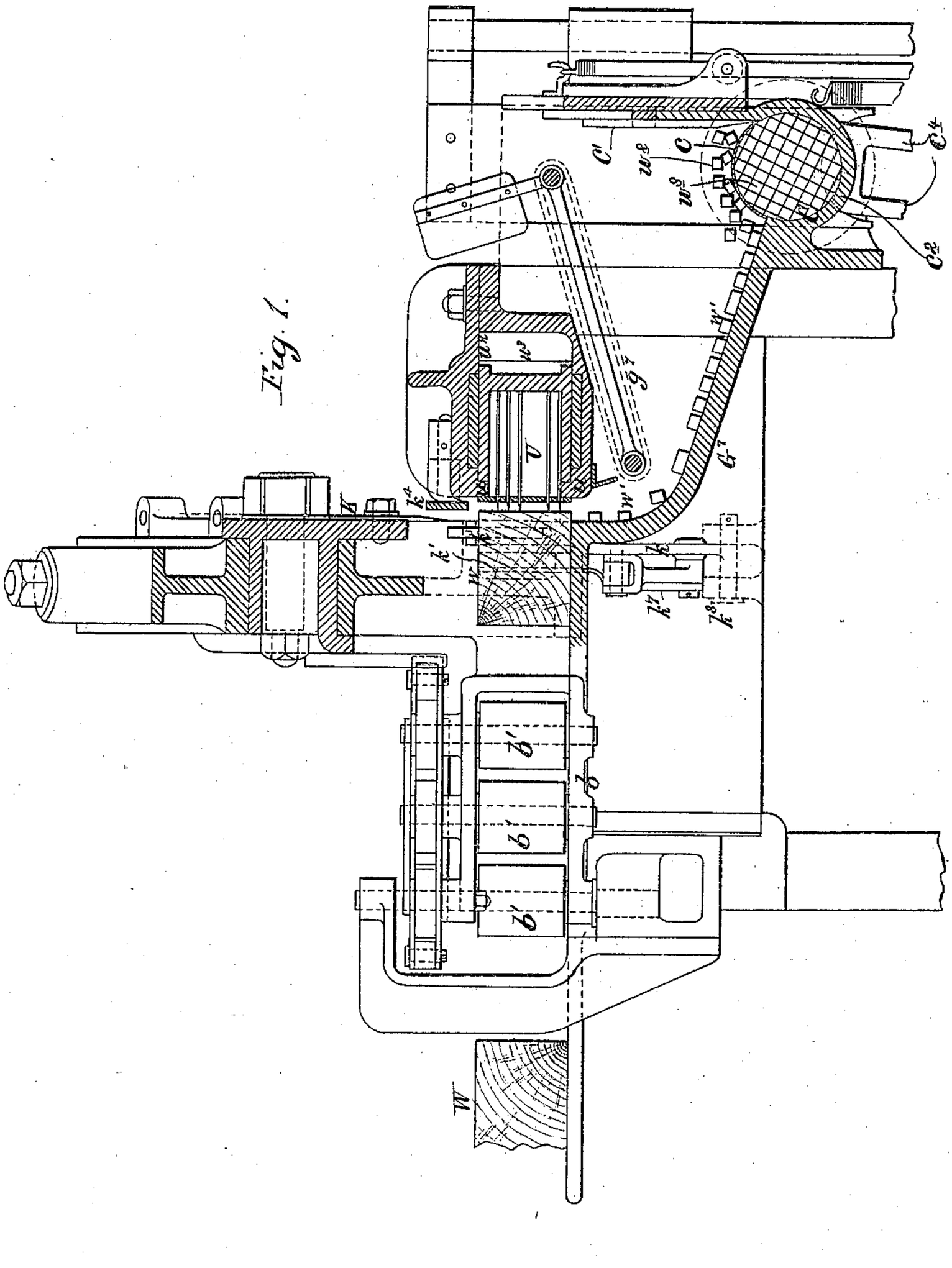

Fig. 1.

Witnesses.
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Inventor.
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By James L. Norris.
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(No Model.) 5 Sheets—Sheet 2.

F. KINGSTON.

MACHINE FOR CUTTING, BUNDLING, AND BINDING FIRE WOOD.

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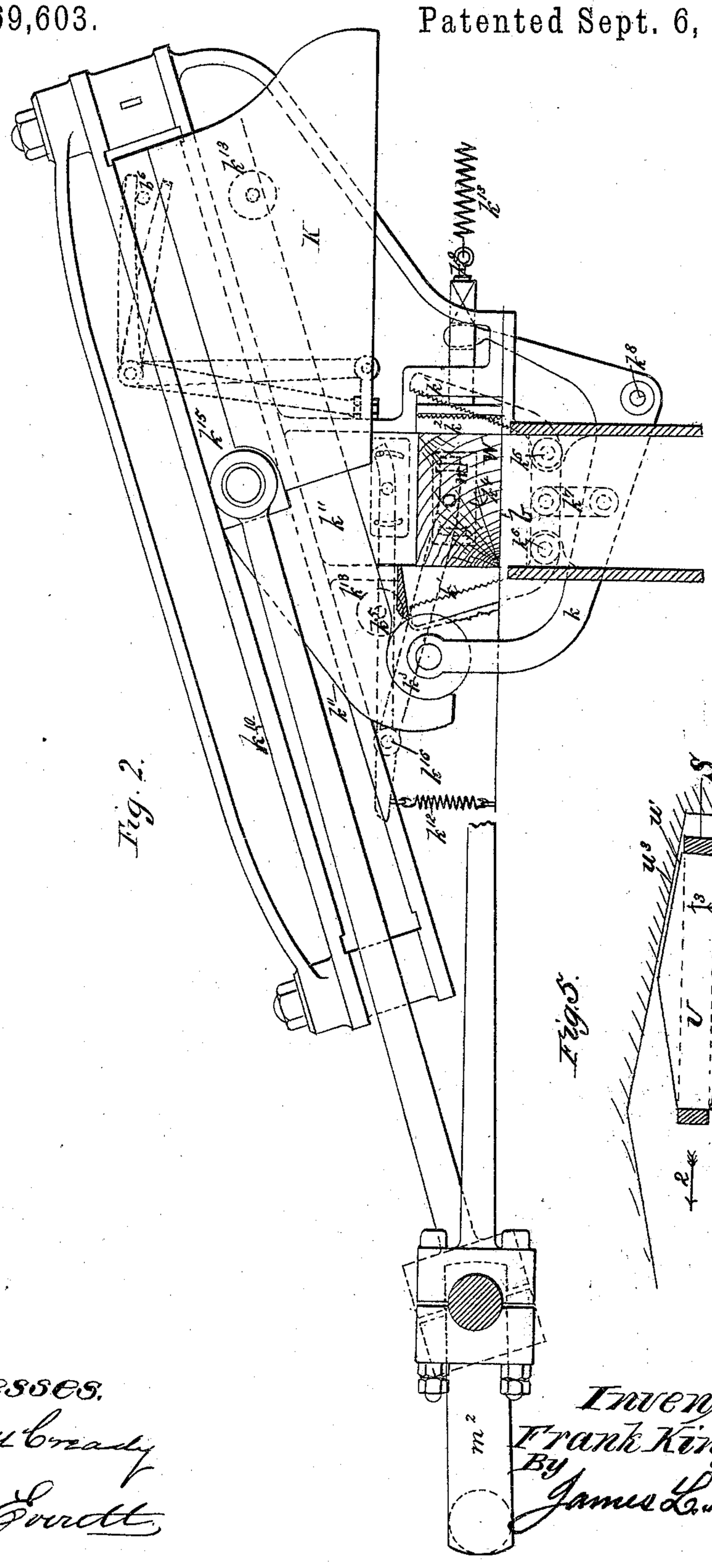

Fig. 2.

Fig. 3.

Witnesses.
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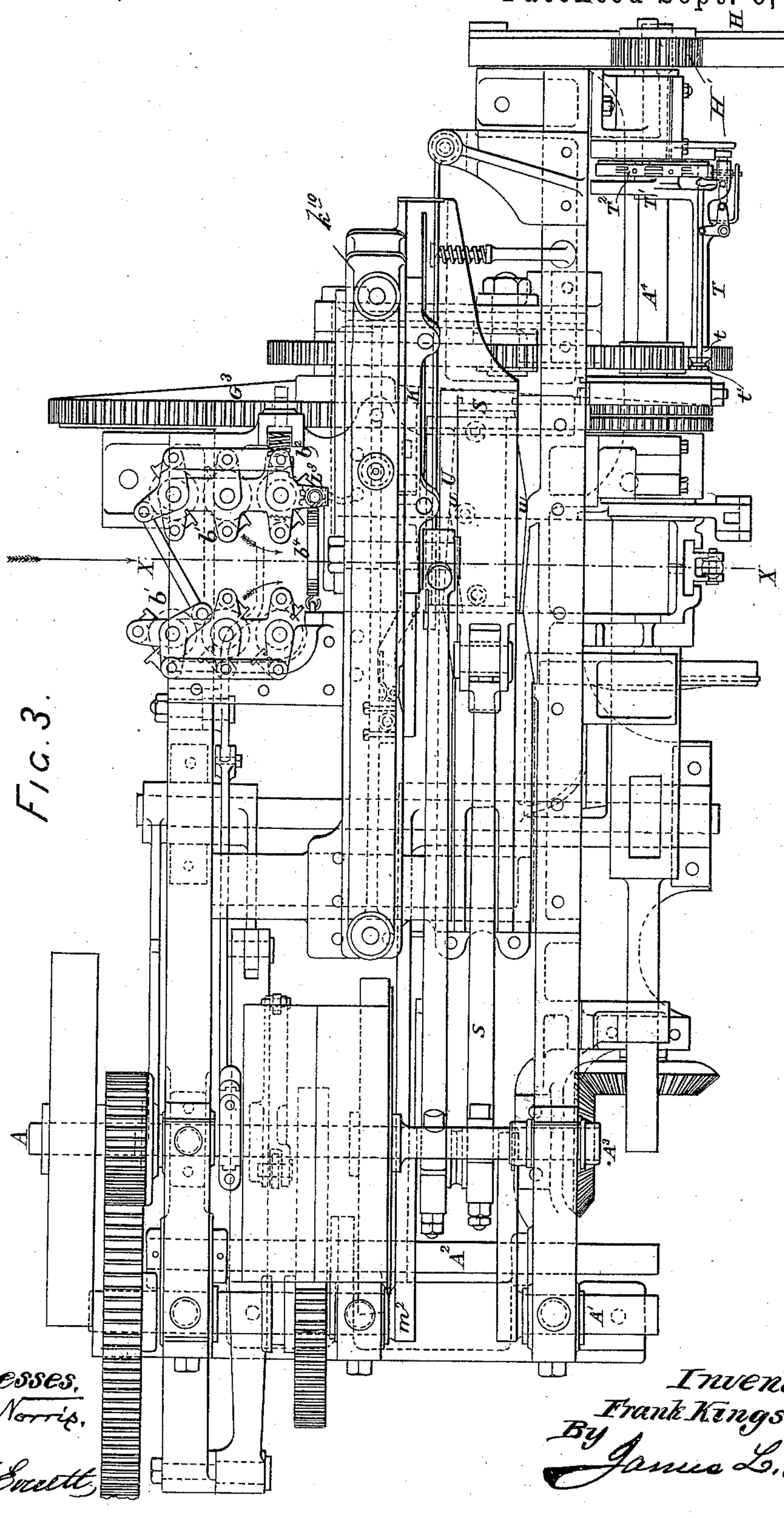
(No Model.) 5 Sheets—Sheet 3.

F. KINGSTON.

MACHINE FOR CUTTING, BUNDLING, AND BINDING FIRE WOOD.

No. 369,603. Patented Sept. 6, 1887.

FIG. 3.



Witnesses,
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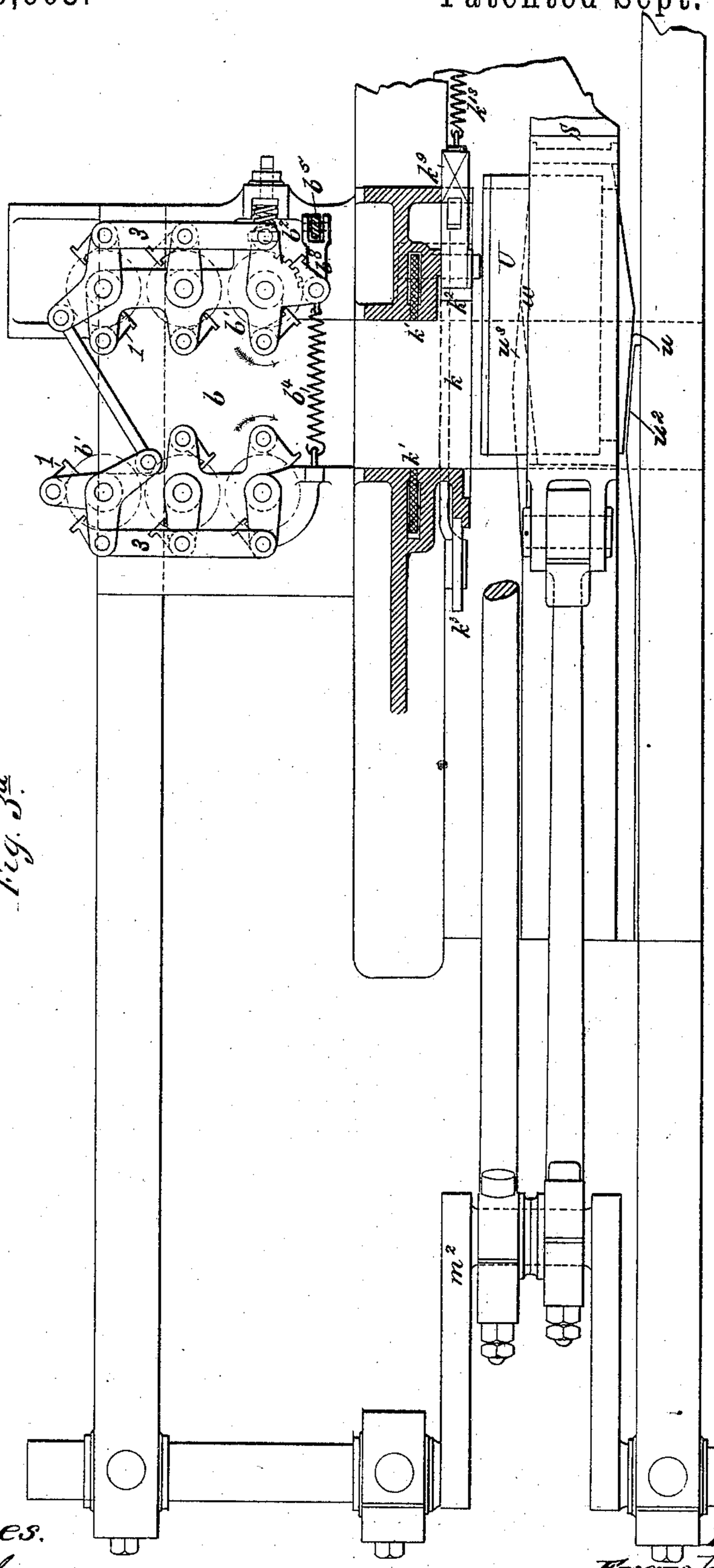
(No Model.) 5 Sheets—Sheet 4.

F. KINGSTON.

MACHINE FOR CUTTING, BUNDLING, AND BINDING FIRE WOOD.

No. 369,603. Patented Sept. 6, 1887.



Witnesses.
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(No Model.) 5 Sheets—Sheet 5.

F. KINGSTON.

MACHINE FOR CUTTING, BUNDLING, AND BINDING FIRE WOOD.

No. 369,603. Patented Sept. 6, 1887.

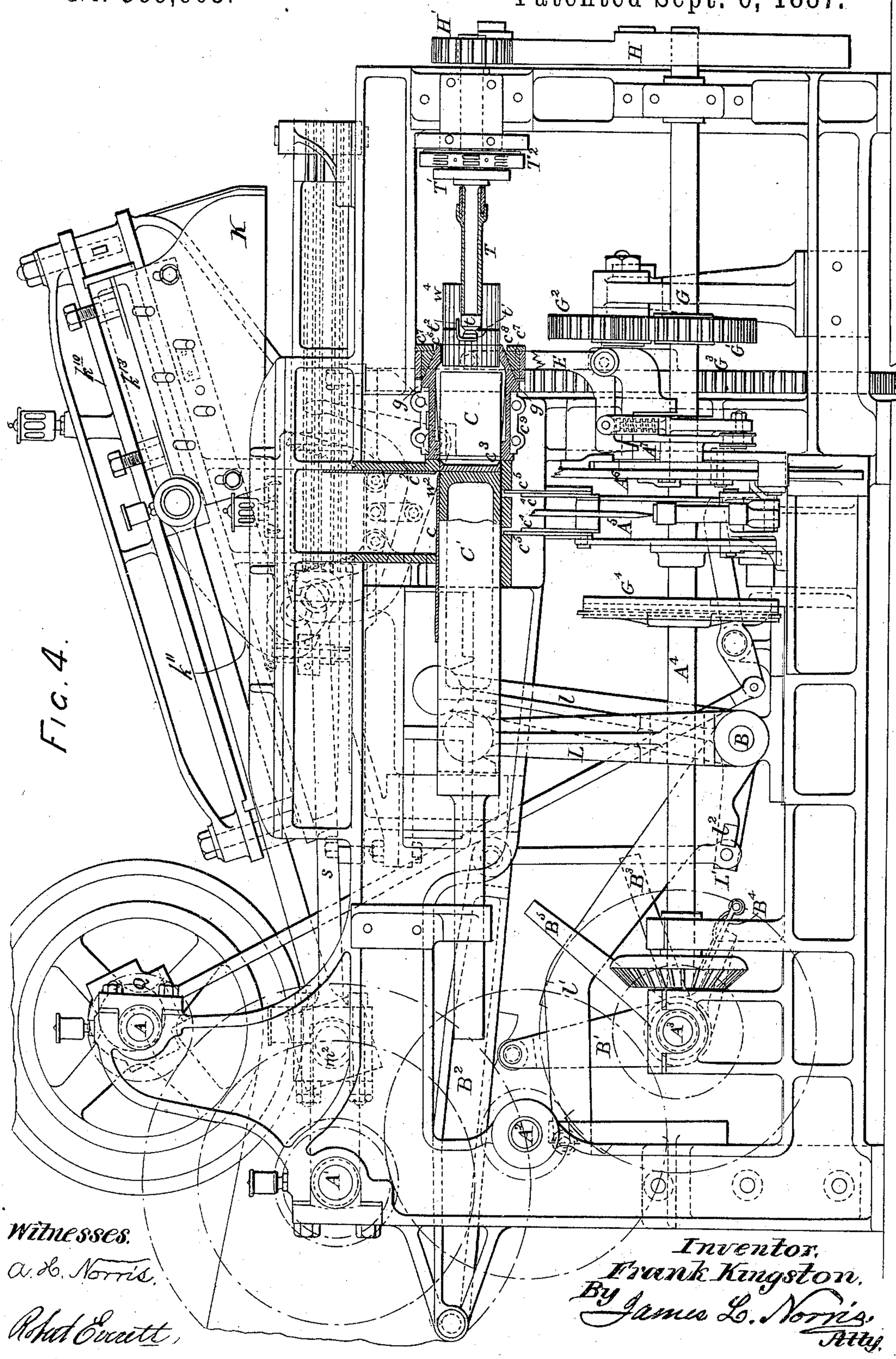

FIG. 4.

Witnesses.
A. H. Norris.
Robt Everett,

Inventor.
Frank Kingston.
By James L. Norris.
Atty.

UNITED STATES PATENT OFFICE.

FRANK KINGSTON, OF ST. JOHN'S, COUNTY OF KENT, ENGLAND.

MACHINE FOR CUTTING, BUNDLING, AND BINDING FIRE-WOOD.

SPECIFICATION forming part of Letters Patent No. 369,603, dated September 6, 1887.

Application filed October 8, 1886. Serial No. 215,704. (No model.) Patented in England December 24, 1885, No. 15,899; in Norway October 2, 1886, No. 291, and in Canada October 18, 1886, No. 25,157.

To all whom it may concern:

Be it known that I, FRANK KINGSTON, a citizen of England, residing at Bolden Street, St. John's, in the county of Kent, England, have invented a new and useful Machine for Cutting, Bundling, and Binding Fire-Wood, (for which I have obtained patents in Great Britain, No. 15,899, dated December 24, 1885; Norway, No. 291, dated October 2, 1886, and Canada, No. 25,157, dated October 18, 1886,) of which the following is a specification.

In my specification to Letters Patent No. 332,155 I described machinery for cutting blocks of wood into sticks suitable for lighting fires, aggregating these sticks into cylindrical bundles, and binding each bundle by adhesive cord. My present invention relates to a machine for effecting continuously these operations in a more simple and expeditious manner, as I will now describe.

The wood blocks—generally about six inches long, five to eleven inches broad, and three inches thick—are fed successively in the direction of their breadth onto a table, on which they lie on their flat. The ends of the blocks being pressed by vertical serrated rollers, which move step by step round, the blocks are advanced step by step about half an inch at a time through a mouth-piece. In the interval between each step of advance and the next the block then lying in the mouth-piece, with about half an inch of its breadth protruding beyond it, is firmly held by reciprocating clamps. While it is so held a set of thin knife-blades, from four to six in number, parallel to one another, are caused to travel horizontally with an obliquely advancing and retreating movement along the protruded face of the block, cutting into it a number of parallel lines of incision. On their retreat a knife-blade descends with an oblique movement in the vertical plane along the face of the mouth-piece, cutting off the protruded portion of the block; but this portion, having been already divided by the knife-blades, is shorn off, not in one piece or slat, but as a set of separate sticks of the dimensions desired for fire-wood, the dimensions being determined by the width between the parallel knife-blades and the protrusion of the block beyond the mouth-piece. The sticks thus cut off from the block descend guided into a cavity constituting a hopper, below which is the cylinder, in which the sticks are collected in bundles, and from which the bundles are successively protruded to be bound and ejected, as described in my specification above referred to. The sticks pass into the cylinder through a slot in its side. In this cylinder there is a support receiving the sticks as they drop onto it, and descending as more and more sticks accumulate over it until the cylinder is filled. There are also on the lower side of the cylinder shakers, which maintain a certain agitation of the sticks to make them lie all approximately parallel to the axis of the cylinder, which at this time is closed at one end by a sluice-diaphragm and at the other end by a plunger, which is then stationary. When the cylinder is filled with sticks, a slide advances, closing the lateral slot, the sluice-diaphragm is withdrawn, leaving one end of the cylinder open, and then the plunger advances beyond the sluice-diaphragm, pushing the mass of sticks in the cylinder forward, so that they project rather more than half their length beyond the mouth of the cylinder. When they are thus protruded, the plunger retreats and the sluice-diaphragm closes behind the sticks and the slide covering the lateral slot retreats, so that the cylinder is again ready to receive a fresh charge of sticks, many of which have accumulated above the opening while it was closed. In order to insure their dropping into the cylinder, a vertical slide descends, breaking through them. While the cylinder is receiving this fresh charge the bundle that had been protruded is clamped tightly by a contracting action of the mouth of the cylinder, and is tied in the following manner: An arm holding between jaws the end of a string which passes through a vessel containing melted pitchy cement moves around the protruded bundle, thus winding on it a convolution of the adhesive string, which is then released from the jaws. The arm now remaining stationary, the bundle itself is carried round by revolution of the mouth of the cylinder winding on additional convolutions of string, and then at a certain point of the revolution the string is again gripped by the jaws, that which had

been wound on the bundle being cut from that which is held by the arm. The bundle being thus tightly bound, the grip of the cylinder-mouth is released, the sluice-diaphragm is withdrawn, and the plunger advances, thrusting forward a succeeding bundle, by which the bound bundle is pushed entirely out, the succeeding bundle taking its place to be clamped, bound, and thrust out in its turn. As above stated, the string for binding the bundle is cemented prior to its application, and consequently it will adhere to the outer pieces of wood comprising the bundle, and likewise the coils of string will adhere to each other, thereby firmly holding the bundle and rendering it unnecessary to tie the ends of the string together or use other fastening devices. The various movements mentioned above are imparted from one rotating main shaft working by suitable gearing to other shafts with the necessary cranks, cams, levers, and other moving parts, as will be understood on reference to the drawings, which represent a machine such as was partly described in my before-mentioned specification, with modifications according to my present invention—that is to say:

Figure 1 is a transverse section of the machine on the line *x x* of Fig. 3. Fig. 2 is a part elevation showing the arrangement for clamping a wood block while its face is cut. Fig. 3 is a plan, and Fig. 3ª is a part plan, shown partly in section, where the cutting of the block is effected. Fig. 4 is an elevation of the back of the machine, with the bundling-cylinder shown in section; and Fig. 5 is a diagram illustrating the manner in which the slides operate.

The blocks of wood, W, laid on the feed-table *b*, are fed forward intermittently by the serrated rollers *b'*, which are worked by pawls acting on ratchet-wheels on the axes of the rollers, the pawls 1 being all connected together by bars 3 and moved to and fro by a connection to the slide of the reciprocating knife K, as hereinafter described, so that every time the knife makes its upstroke backward the blocks of wood held between the rollers *b'* are advanced about half an inch, the foremost block *w* being thus caused to protrude about half an inch beyond the mouth along which the knife K has to descend. One of the rollers *b'* is pressed by a spring, b^2, and this may be applied to the other rollers on one side of the feed-table, the better to insure the grip of the rollers in feeding the blocks forward. The feed-rollers *b'*, as before stated, are operated by the knife K, and one manner of effecting this is to draw the bell-crank lever b^3 in one direction by the spring b^4, Fig. 3ª, and to link said bell-crank lever to a bell-crank lever, b^5, mounted on the guide or framing k^{10} of the knife-slide k^{15}. When the slide with the knife approaches the upper end of its stroke, a stud, b^6, in the knife-slide raises the tail end of the lever b^5, and thus moves the bell-crank lever b^3 in opposition to the spring b^4, causing the pawls 1 to turn the feed-rollers *b'* partially around, thereby advancing the block of wood gripped between them. As the knife K descends, the stud b^6 passes away from the tail end of the lever b^5, and thereupon the spring b^4 causes the bell-crank lever b^3 and all the pawls to make a back-stroke, the respective pawls escaping or slipping past the ratchet-teeth. While the foremost block *w* is in its protruded position, two serrated cheeks, *k'*, fitted to slide in slots in the sides of the mouth-piece, and a serrated presser, k^2, are advanced to grip the block *w* and to hold it firmly in position. These cheeks *k'* and the presser k^2 are worked by a lever, *k*, on which there is a roller, k^3, that is acted on by a cam-slope, k^5, as hereinafter explained, so that, except during the latter part of the backward upstroke of the knife K and the first part of its forward downstroke, the block *w* is firmly held. The said cheeks *k'* are formed on bent levers pivoted at k^6 k^6, and having their short arms connected by a link, k^7, to the lever *k*, which is pivoted at k^8 and has its upper arm engaged in a slot in a sliding stem, k^9, of the presser k^2. When the knife K begins its downstroke, the cam-slope k^5, which is formed on the lower edge of a plate, k^{11}, secured to the knife-slide k^{15}, presses down the roller k^3, and the lower edge of the said plate holds said roller down during the downstroke of said knife, and also during its return-stroke, until the cam-slope k^5 again presents itself to the roller k^3. The depression of the lever *k* draws down the link k^7, and consequently the cheeks *k'* clamp and firmly hold the block *w*. The presser k^4 is carried by one end of a lever, k^{14}, pivoted near its other end, as at k^{16}, the tail end of the lever being acted on by a spring, k^{12}, which normally holds the presser in its elevated position.

On the side of the knife K is mounted a roller or stud, k^{13}, which, when the knife approaches the end of its downstroke, bears against the lever k^{14}, and thereby depresses the pusher k^4. The two positions of the pusher, its carrying-lever k^{14}, and the roller k^{13} are shown in Fig. 2. As the knife makes its upstroke the lever k^{14} is released and the spring k^{12} raises the pusher k^4.

For the purpose of retracting the cheeks *k'* any suitable means may be used; but I prefer a spring, k^{13}, applied to the stem k^9, which, when roller k^3 is released, draws the stem outward and swings the lever *k* to its normal position.

The pusher k^4 is preferably a plate pivoted to its carrying-lever k^{14}, with freedom of play on its pivot, limited by studs engaged in slots of the plate, Fig. 2.

While the block *w* is held a slide, S, linked to the same crank, m^2, that works the knife K, makes its stroke toward the left. Within the slide S is fitted a transverse slide, U, having projecting from its face several knife-blades. At the front and back of the slide U there are sloping edges *u u'*, which work against fixed slopes u^2 u^3 on the framing. As the slide S is moved to and fro, these slopes cause the inter-

nal slide, U, with its knife-blades, to be protruded and retracted, and thus while the wood block *w* is held as above described these knife-blades pass along and into its face, making a number of parallel incisions about half an inch deep.

Referring to what I term the "diagram," Fig. 5, it will be seen that the slide U is within the slide S. The slopes *u u'* on the slide U bear against the fixed slopes w^2 w^3 of the machine-frame. The slide U, which carries its knives, is free to slide transversely in the slide S. Obviously, when the latter is moved by crank m^2 in the direction of the arrow 2, the fixed inclined edge or slope u^2, along which the slide U is guided, will, by acting on the slope *u* of the slide, cause said slide U to move transversely in the direction of the arrow 3, and when the slide S is moved in the opposite direction the slope *u'* of the slide U will, by the fixed slope u^3, move the slide U transversely in the opposite direction. To avoid confusion I have omitted from Figs. 3 and 4 of the drawings certain of the details which are shown in Figs. 2 and 3ª. These incisions having been made by the knives of U, the knife K descends obliquely and cuts from the block *w* its front portion as a number of separate sticks, *w'*, which drop down a curved sloping guide, G^7, and pass on to the cylinder C, in which they are collected in bundles. To insure the descent of the separated sticks *w'*, a pusher, k^4, worked by the slide of the knife K at the time when that knife has completed its cut, is made to descend and push the separated sticks *w'* down, so as to leave in front of the block *w* space for its next advance. Also, a continuously-traveling chain, g^7, if there should be any gathering of the sticks *w'* at the curve of G^7, serves to push them toward the cylinder C. In the cylinder C the sticks are collected, and each cylindrical bundle thus formed is compressed, bound with string, and ejected, as described in my former specification. The parts of the apparatus for effecting these latter operations being substantially similar to those previously described, I do not now claim them; but for greater clearness I will describe them.

The cylinder C is in Fig. 1 shown filled with sticks w^3, separated from those w^2 above by a slide, *c*. When the cylinder is emptied of the sticks w^3, as will hereinafter be described, the slide *c* is retracted, leaving the upper side of the cylinder C open under w^2. The sticks w^2 thereupon fall into the cylinder; but as they sometimes form themselves into an arch, which might prevent them from falling, a knife, *c'*, descending, breaks up the arch and insures that the sticks w^2 drop into the cylinder to take the place formerly occupied by w^3.

On referring now to Fig. 4, which is an elevation of the back of the machine, showing the cylinder C in longitudinal section, the parts belonging to this cylinder are shown in the position occupied by them just before the cylinder is about to receive a fresh charge of sticks w^3. Within the cylinder is a plunger, C', having a chisel-edge at c^3. When this plunger has completely retreated to the left just beyond the opening under w^2, the slide *c* is retracted, leaving that opening free, and a sluice-diaphragm c^2 descends across the cylinder, closing it. The sticks then descend into the space in the cylinder between c^2 in front and the plunger behind. But in order to insure that the sticks shall descend in altitudes approximately parallel to the axis of the cylinder, two blades, c^4, in the first place ascend through slots in the lower side of the cylinder, and, receiving the sticks on their upper edges, they gradually descend, the sticks following them; also, two other blades, c^5, having a rapid reciprocation vertically, act as shakers, causing the sticks to arrange themselves parallel, or nearly so, to the axis of the cylinder. When the space in the cylinder is filled with sticks, the slide *c* advances, separating those w^3 in the cylinder from those w^2 accumulating above, the sluice-diaphragm c^2 ascends, leaving the cylinder open in front, and thereupon the plunger C' advances to the right (its chisel-edge c^3 clearing away in front of it any fragments of wood) and pushes the mass of sticks as a cylindrical bundle to the position w^4, protruded a little more than half its length beyond the mouth of the cylinder. Leaving the bundle w^4 in that position to be clamped and bound, as will presently be described, the plunger C' retreats, c^2 descends, *c* is withdrawn, and the cylinder C receives a fresh charge of sticks. The movements of the plunger C' and of the slide *c* are effected, respectively, by levers L and *l*, worked, as shown in Fig. 4, by wipers and arms on a secondary shaft, A^3, of the machine. A roller on an arm, B', acting on a beam, B^2, moves the lever L to the right, and thus advances the plunger C'. An arm, B^3, acting on the arm L' of the lever L, moves the lever L to the left, and thus retracts the plunger C'. A roller on an arm, B^4, acting on the arm *l'* of the lever *l*, causes *l* to move to the right, and thus advances the slide *c*. An arm, B^5, acting on a projection, l^2, causes *l* to move to the left, thus retracting the slide *c*. The protruded bundle w^4 is in the first place clamped. For this purpose the mouth of the cylinder, which consists of a number of segmental pieces, c^6, each sloped outside and fixed to the end of a blade-spring, is contracted by causing these segments to be pressed inward by means of a hollow cone, c^7, which is pushed back by a ring, c^8. While the bundle w^4 is thus clamped the binding operation is effected.

A tubular arm, T, standing forward like a crank-pin from a counterbalanced arm, T', has at its end a boss, *t*, sloped off in front, and on a spindle, which is fitted to revolve and slide longitudinally within T, there is fixed another boss, *t'*, sloped off in rear. On *t* and *t'* are fixed cutting-chisels, and on *t'* is also fixed a bent wire, t^2. The end of a string which passes through a heated pot of pitchy cement being held clamped between *t* and *t'*, the arm T makes nearly a revolution round the bundle

w^4, thus laying round it nearly one complete convolution of the adhesive string, and then, t' separating a little from t, and so leaving the string free, the wire t^2 makes a revolution, wiping the string out from between t and t' and pressing it onto the bundle. The arm T now rests, while the front part of the cylinder C, which is fitted in a bearing, c^9, and has on it a toothed ring, g, is caused to make several revolutions, the bundle w^4 revolving with it and winding onto itself the free string in several convolutions, and the arm T again moves a little onward until it again engages the string between t and t', whereupon t' is retracted, so as to clamp the string, and the cutters on t and t' sever the string which is on the bundle from that which is held between t and t'. The bundle being thus bound in its clamped condition, the ring c^8 is retracted and the segments c^6 spring a little backward, releasing the bundle. The plunger C′ now comes forward, pressing before it a fresh bundle, which extrudes the bound bundle w^4 from the cylinder-mouth and takes its place, to be clamped and bound in its turn.

Such being the successive operations performed on the wood by the parts described, the mechanism by which these parts are caused to make their respective movements may be varied. As these movements are all of a reciprocating or intermittent character, they may generally be effected by cranks, eccentrics, cams, wipers, or their equivalents worked by rotating shafts. I have shown in the drawings one form of such mechanism, to which, however, I make no claim. The prime moving-shaft A, driven by any suitable motor, drives by gearing at a slower speed the second shaft A′. This again by reducing-gear drives A^2, and A^2 by reducing-gear drives A^3, which by miter-gear drives at equal speed the shaft A^4. The crank m^2 on the shaft A′ works the knives, as above described. A chain-wheel, G^4, on the shaft A^4 works the chain g^7. An eccentric, Q, on the shaft A, along with suitable cams and wipers at A^5 and A^6, works the knife c', the sluice-diaphragm c^2, and the blades c^4 and c^5, which serve to arrange the sticks in the cylinder C. At A^7 a cam on A^4 works a bell-crank lever, E, by which the ring that clamps the segments c^6 is moved to and fro. At G there is on A^4 a toothed wheel, which through intermediate wheels, G′ and G^2, works a large toothed wheel, G^3, that is geared with the toothed ring g on the mouth of the cylinder C, causing the mouth to revolve while the bundle w^4 is held clamped within it, so as to wind several convolutions of string on the bundle.

On the end of shaft A^4 there is a wheel, H, mutilated or only partly toothed, with suitable wiper to bring into gear and drive the pinion H′, which carries round the binding-arm T. On a disk, T^2, behind T′ are cam projections, which give the required movements to t' and t^2.

Having thus described my invention, what I claim is—

In a machine for cutting, bundling, and binding fire-wood, in combination with the knife K, the lever k, gripping-cheeks k', and presser k^2, the compound slide S and U, with its knife-blades and slopes, and the fixed slope on the framing, arranged and operating substantially as herein described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 23d day of September, A. D. 1886.

FRANK KINGSTON.

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