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C. H. DOUGLAS.

ENDLESS CHAIN MORTISING MACHINE.

No. 379,566. Patented Mar. 20, 1888.

Fig 1

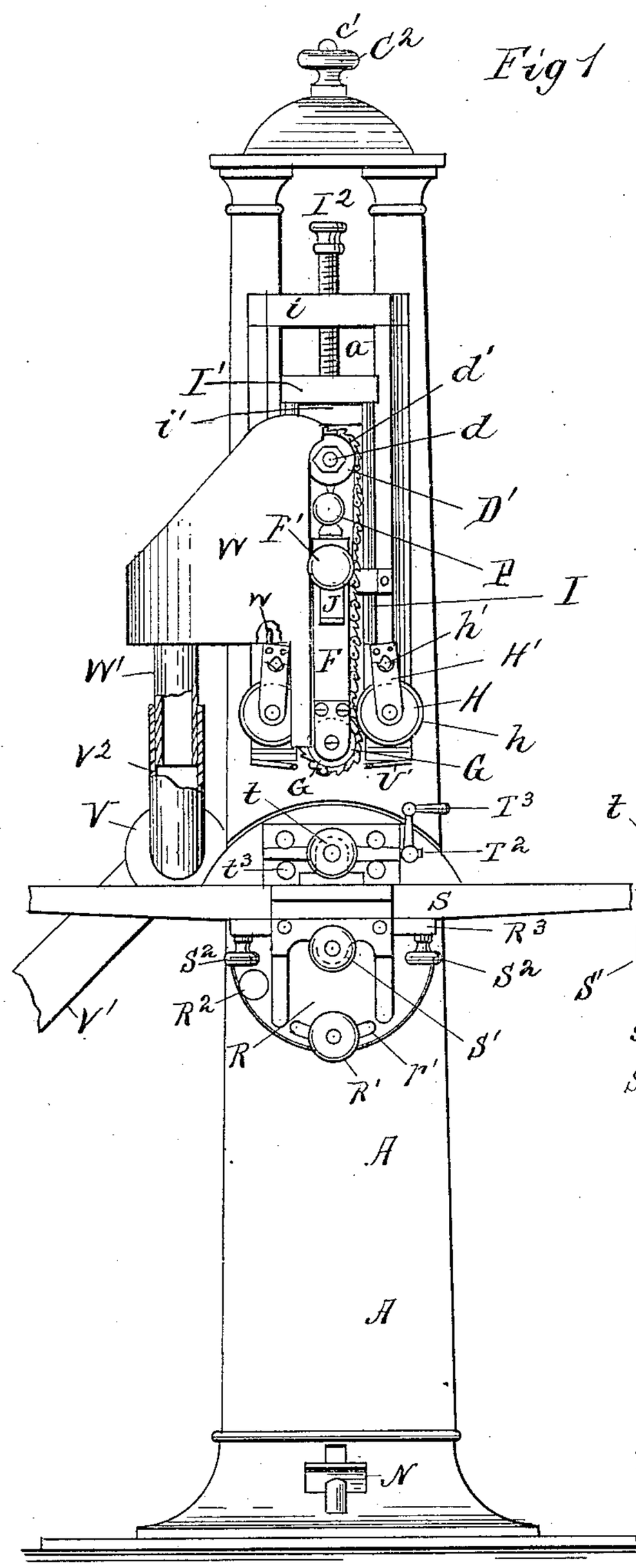
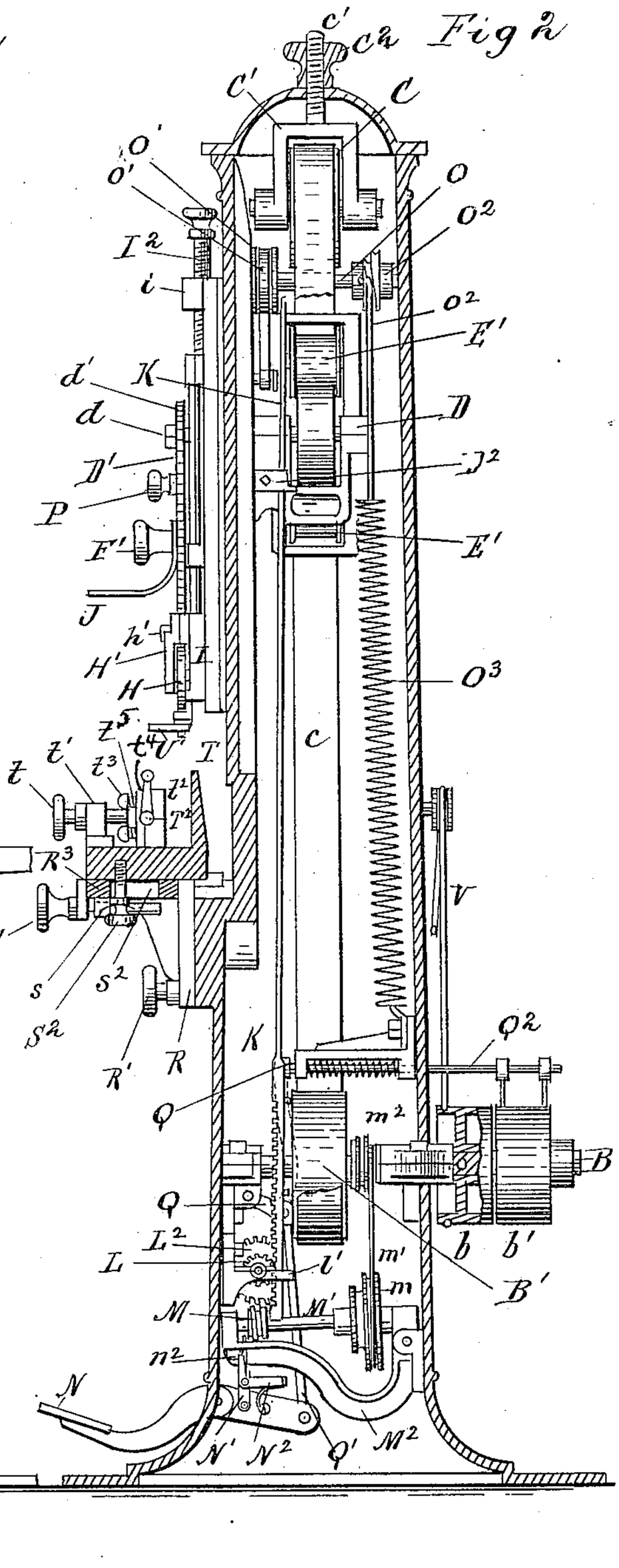


Fig 2



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C. H. DOUGLAS.

ENDLESS CHAIN MORTISING MACHINE.

No. 379,566. Patented Mar. 20, 1888.

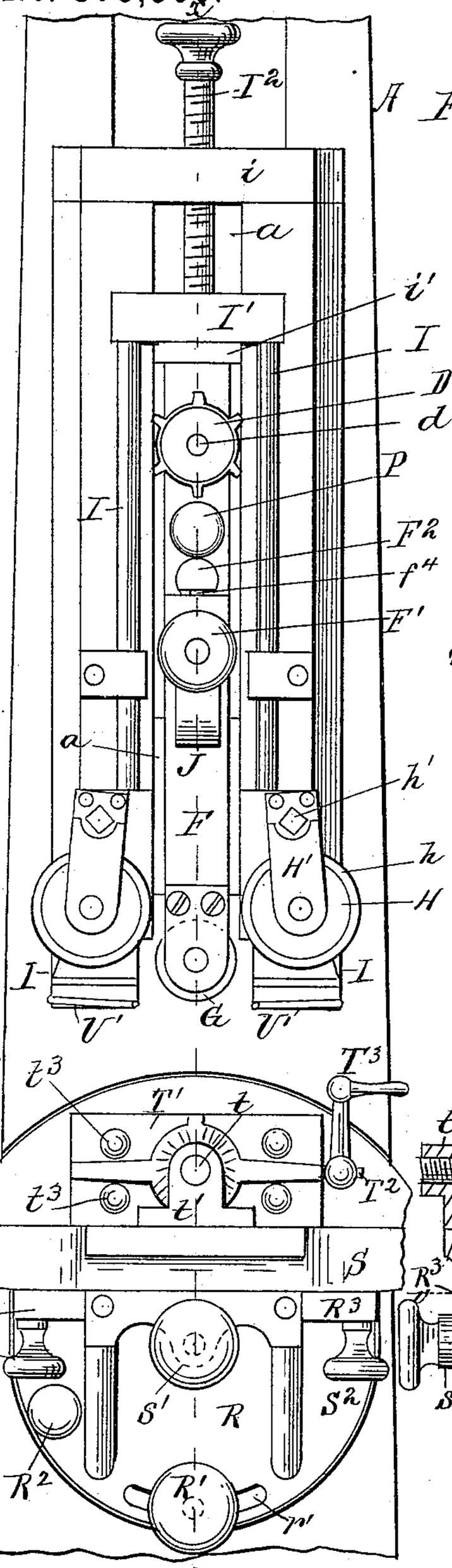

Fig 3

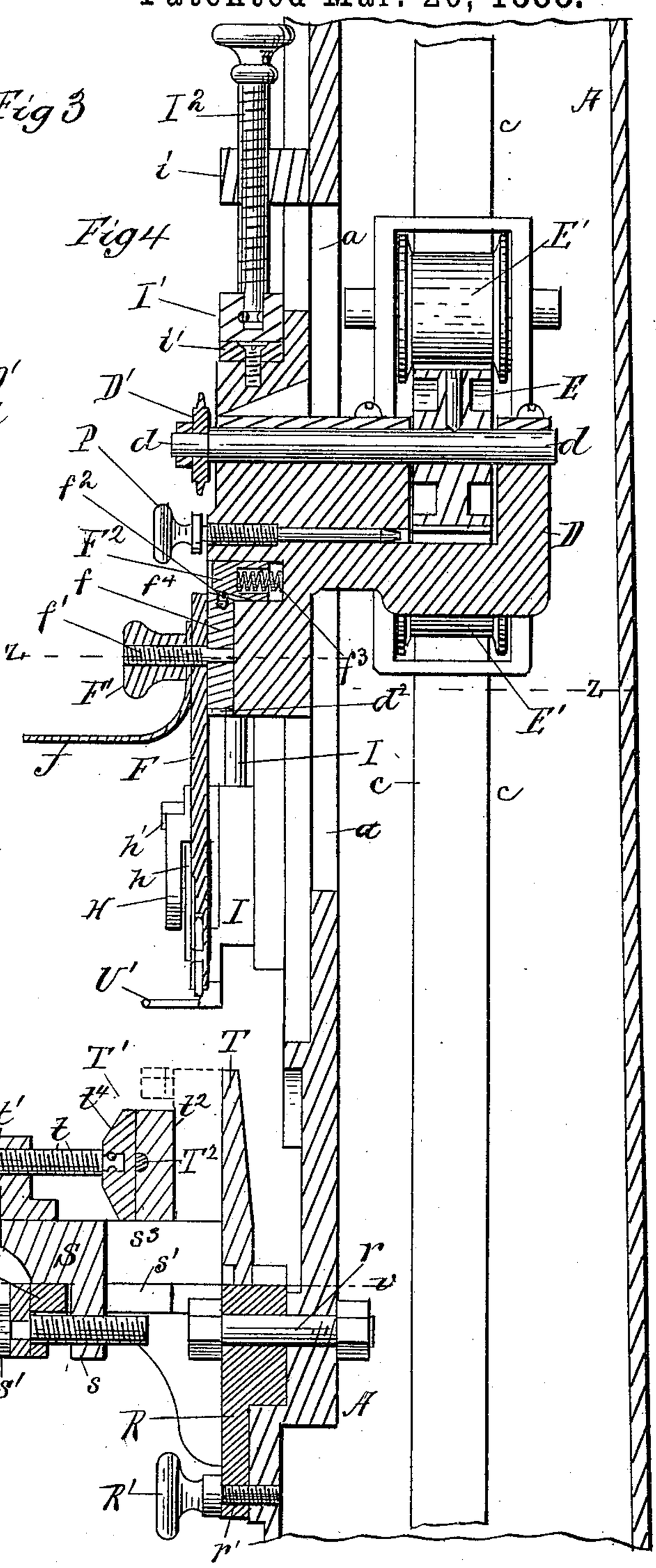

Fig 4

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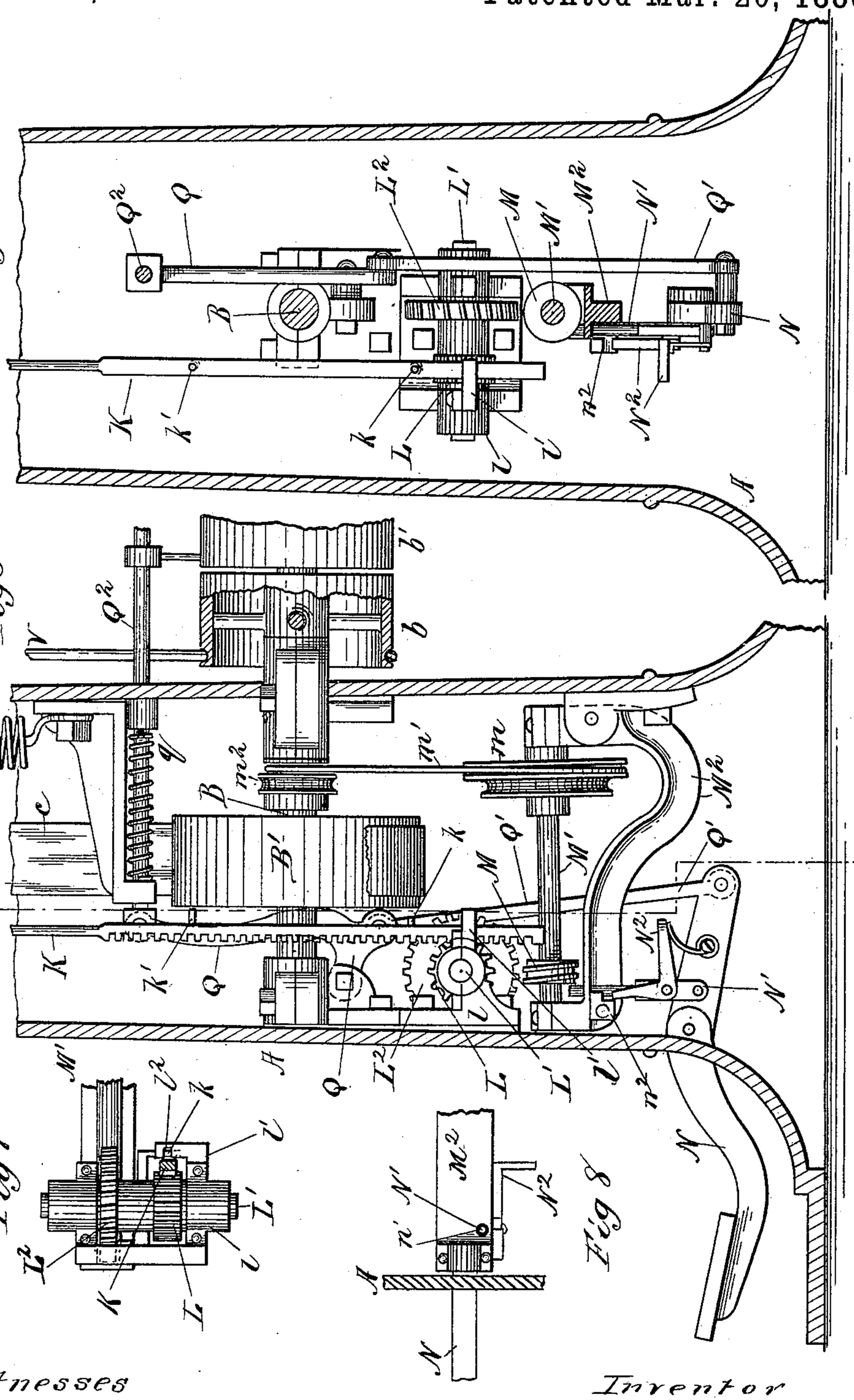
C. H. DOUGLAS.

ENDLESS CHAIN MORTISING MACHINE.

No. 379,566. Patented Mar. 20, 1888.

Fig 6



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(No Model.) 5 Sheets—Sheet 4.

C. H. DOUGLAS.

ENDLESS CHAIN MORTISING MACHINE.

No. 379,566. Patented Mar. 20, 1888.

Fig 9

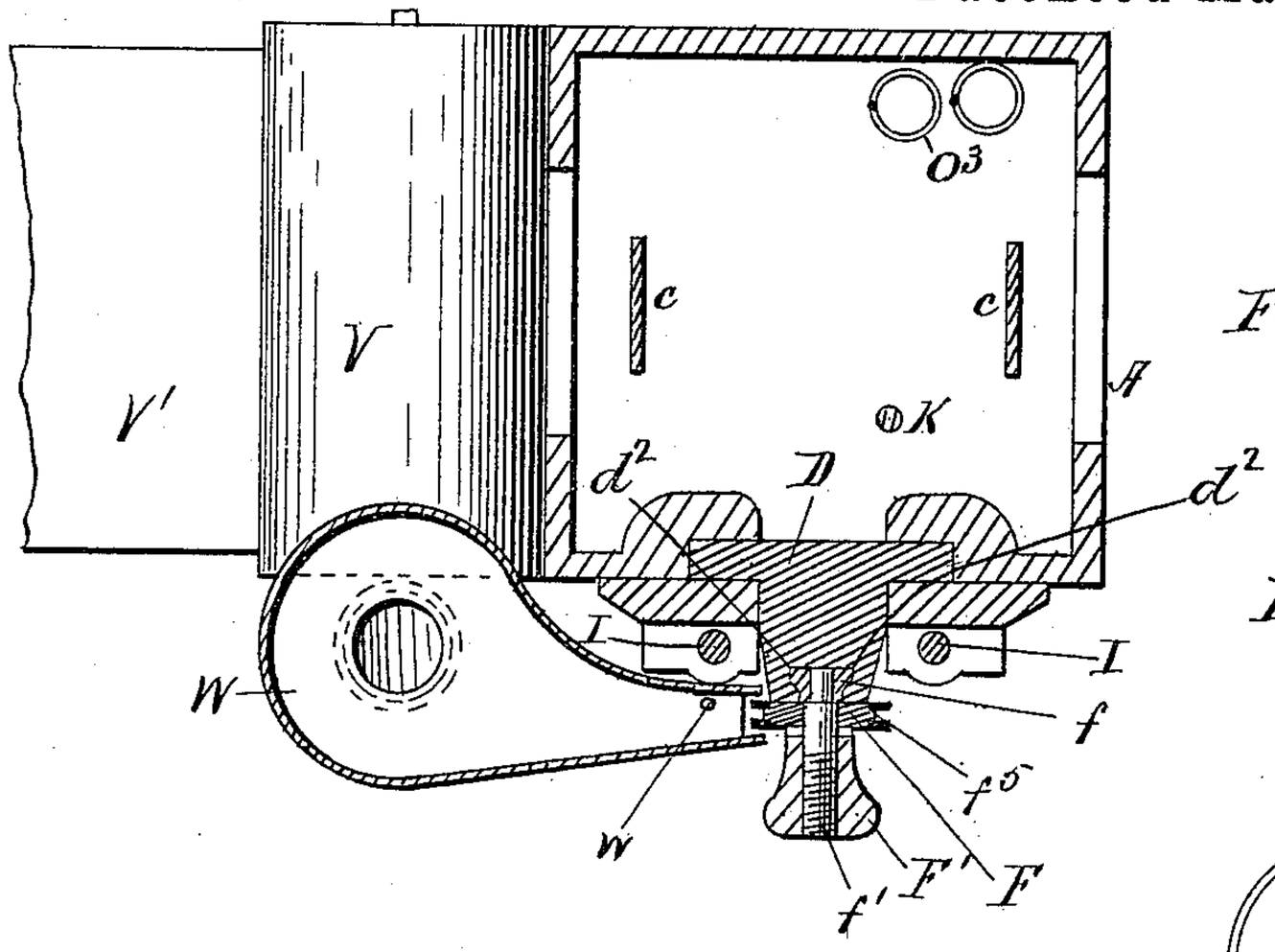


Fig 10

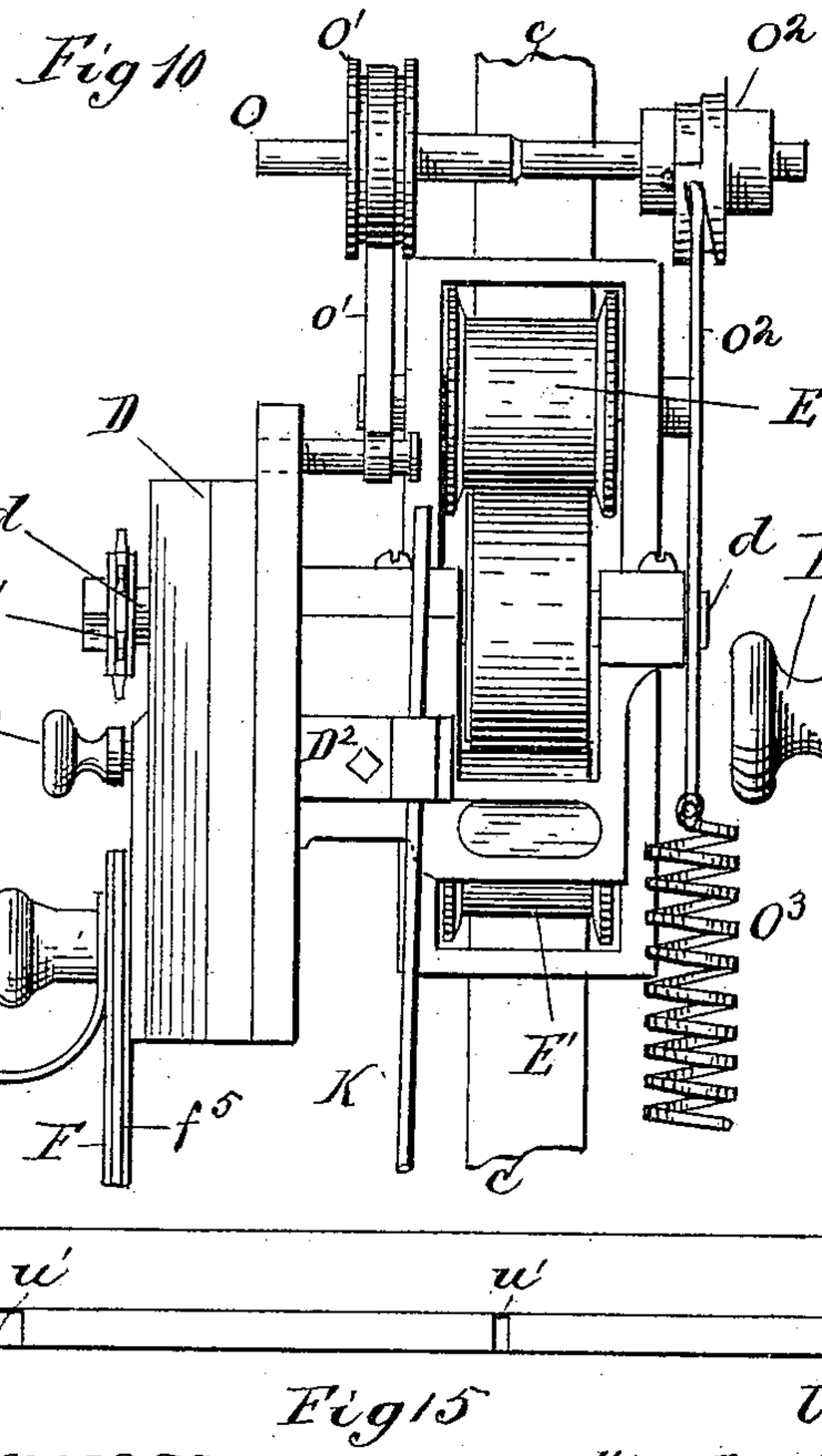


Fig 15

Fig 11

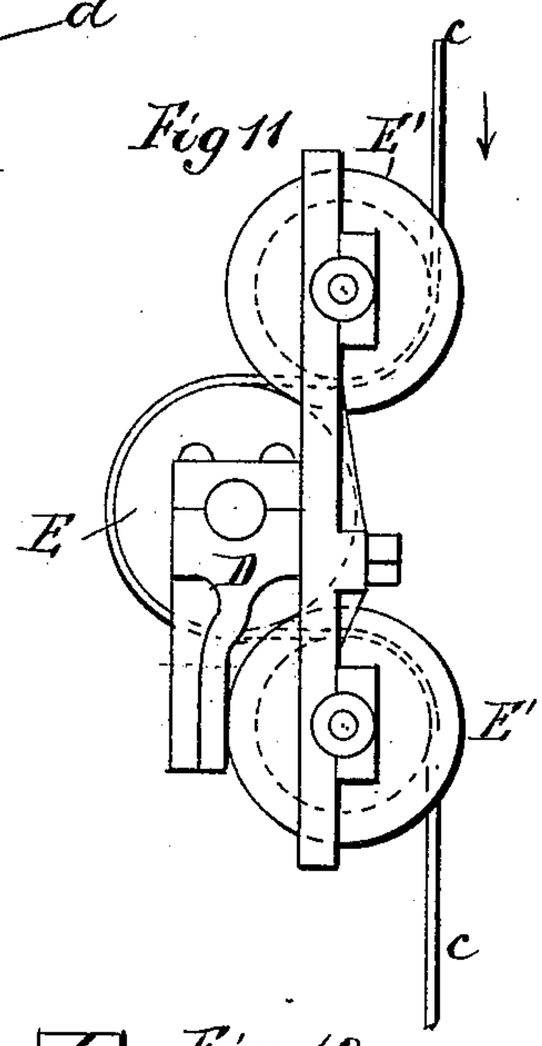


Fig 12

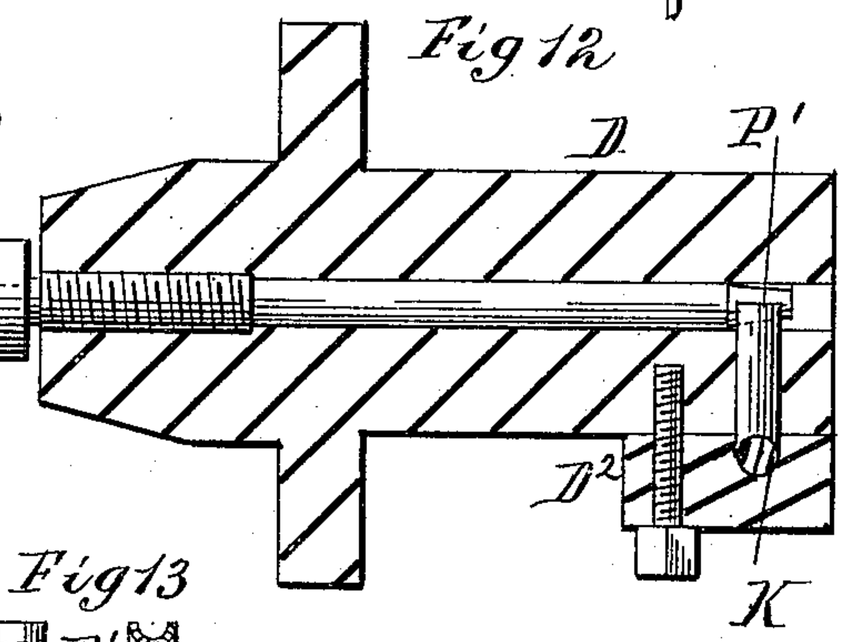


Fig 13

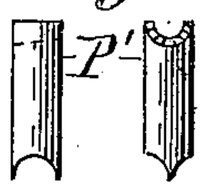


Fig 14

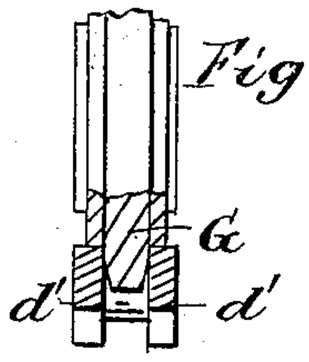
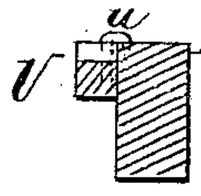


Fig 16



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(No Model.) 5 Sheets—Sheet 5.

C. H. DOUGLAS.

ENDLESS CHAIN MORTISING MACHINE.

No. 379,566. Patented Mar. 20, 1888.

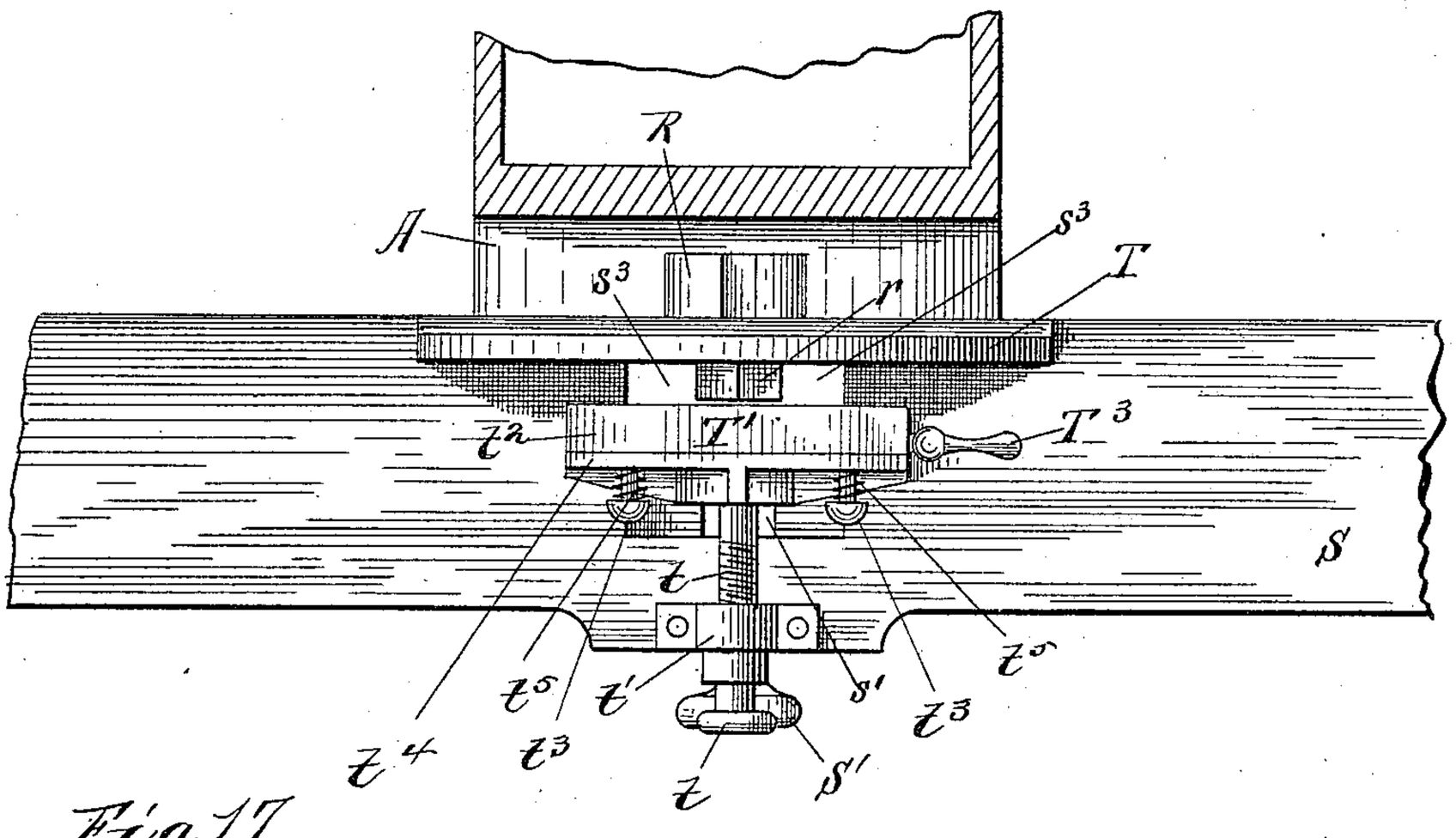

Fig. 17.

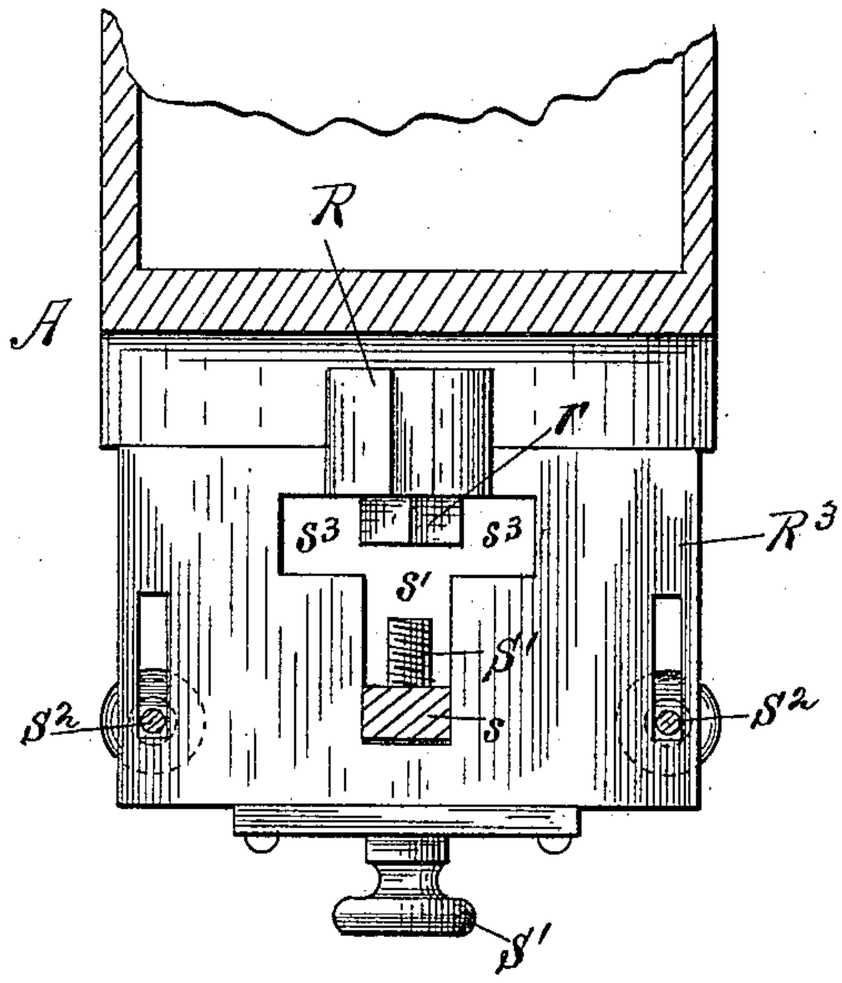

Fig. 18.

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UNITED STATES PATENT OFFICE.

CHARLES H. DOUGLAS, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE CHICAGO MORTISING MACHINE COMPANY, OF SAME PLACE.

ENDLESS-CHAIN MORTISING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 379,566, dated March 20, 1888.

Application filed August 24, 1885. Serial No. 175,252. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. DOUGLAS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Endless-Chain Mortising-Machines, which are fully set forth in the following specification, reference being had to the accompanying drawings, which form a portion of the same, in which—

Figure 1 is a front elevation of a machine embodying my invention; Fig. 2, a side elevation of the same, the casing or supporting-frame being in section to show the internal construction; Fig. 3, a front elevation, on an enlarged scale, of the upper portion of the machine; Fig. 4, a sectional view of the same, taken on the line *x x*, Fig. 3; Fig. 5, a side elevation of the lower portion of the machine, the casing being in section; Fig. 6, a vertical sectional view of the same, taken on the line *y y* of Fig. 5; Fig. 7, a detail plan view of the worm-wheel and pinion and the adjacent mechanism; Fig. 8, a detail plan view of the front end of the swinging frame which supports the screw-shaft; Fig. 9, a plan section taken on the line *z z* of Fig. 4; Fig. 10, a side elevation of the upper portion of the mechanism with the casing removed; Fig. 11, a rear elevation of the driving-pulleys which operate the sprocket-wheel shaft; Fig. 12, a detail plan section showing the locking mechanism for the adjustable rack-bar; Fig. 13, detail views of the locking-pin; Fig. 14, a detail view showing the relative construction of the endless-chain cutter and its supporting wheel or roller; Fig. 15, a plan view showing the gage-bar in position; Fig. 16, a sectional view of the same, taken on the line *w w* of Fig. 15; Fig. 17, a plan view of the work-holding table; and Fig. 18, a detail plan section thereof, taken on the line *v v* of Fig. 4.

Like letters refer to like parts in all the figures of the drawings.

My invention relates to mortising-machines, and more particularly to that class of machines known as "endless-chain mortising-machines," it being in the nature of an improvement upon the machine set forth in Letters Patent No. 194,869, granted to William W. Green, Jr., September 4, 1877.

I will now proceed to describe a machine in which my invention is practically carried out in one form, and will then particularly point out in the claims those features which I deem to be new and desire to protect by Letters Patent.

In the drawings, A represents the casing or frame which supports the various portions of the mechanism. This casing is preferably constructed in the form of a hollow pillar, of iron or other suitable material, a portion of the mechanism being arranged within this casing and being thereby protected from the shavings and chips which would otherwise tend to clog and destroy the same. It will of course be understood that suitable openings provided with doors for closing the same will be formed in the casing in order that the mechanism in its interior may be accessible.

B indicates the main or driving shaft, which is arranged in the present instance near the lower end of the casing and is provided externally with fast and loose pulleys *b b'*, and within the casing with a pulley, B', over which, and over a corresponding pulley, C, at the upper end of the casing, the driving-belt *c* passes. The upper pulley, C, is mounted in a yoke, C', provided with a screw-threaded extension, *c'*, extending up through the ground of the casing A, where it receives a nut, C^2, by means of which the upper pulley, C, may be readily raised or lowered to tighten the belt without stopping the operation of the machine.

D indicates a sliding frame, which is capable of vertical motion, as hereinafter described, and which carries the endless chain cutter and the mechanism for operating and guiding the same.

d indicates a shaft mounted in the sliding frame D and provided at its front end with a sprocket-wheel, D', by means of which the endless-chain cutter *d'* is operated. It will be observed that a portion of the sliding frame D extends outward through a vertical slot, *a*, in

the frame A, so that the endless-chain cutter and other external parts may be attached thereto on its external face.

The shaft *d* is provided near its inner end with a pulley, E, above and below which are arranged idle or guide pulleys E′, mounted in the sliding frame D, and over which the driving-belt *c* passes, in the manner shown in Fig. 11 of the drawings. It will be observed that the idle-pulleys E′ are so arranged that their outer portions are in line with the outermost portions of the pulleys B′ and C; or, in other words, a line tangent to the peripheries of these two pulleys will also be tangent to the peripheries of the two idle-pulleys. It is obvious that with this construction the sliding frame D may be moved up and down without in any way increasing or diminishing the tension of the driving-belt, so that whatever the position of the sliding frame may be within the limits of its movement, and whether the said frame be stationary or not, the sprocket-shaft *d* and sprocket-wheel D′, which operate the cutter, will be operated upon by the driving-belt in the same manner.

The endless-chain cutter is supported and guided by means of a tension-bar, F, attached to the external portion of the sliding frame D and extending downward, being provided at its lower end with the guiding and supporting roller G, over which the chain cutter passes, as shown in Fig. 1 of the drawings.

It is desirable to make the tension-bar F adjustable relatively to the frame D, on which it is mounted, in order to increase or diminish the tension on the chain, so as to tighten it for work or loosen it sufficiently to permit its removal, and this is preferably accomplished by means of a separate piece, *f*, mounted in ways d^2 in the frame D, which ways are of dovetail or other suitable shape. A screw-bolt, *f′* extends from the piece *f* through the tension-bar F, its projecting portion being provided with a clamping-nut, F′, by means of which the tension-bar may be clamped against the face of the frame D at any desired point, the face of the piece *f* being thereby caused to bear against the inclined walls of the ways d^2. It will be seen that by loosening the clamping-nut F′ the tension-bar may be raised, so as to shorten the distance between the sprocket-wheel D′ and supporting-roller G sufficiently to enable the operator to readily remove or apply the chain cutter, and when the cutter is applied the bar may be lowered to tighten the same, and then clamped in position by the clamping-nut. In order to prevent any possibility of this clamping device giving way and allowing the bar to yield upward, thus destroying the tension of the chain cutter when, it meets an obstacle in the shape of a knot or some similar substance in its work, I arrange above the upper end of the tension-bar or of the piece *f* a block, F^2, having its under surface adjacent to the said piece beveled off at a slight angle, as shown at f^2, the said block being arranged in a recess in the frame D, and being thrust normally outward by means of a suitable spring, f^3. The bevel on the under side of this block is so slight that no upward pressure exerted through the bar can cause it to recede, while at the same time as soon as the bar has passed the outer edge of the bevel the block will move forward, with the bevel always resting upon the upper end to the bar, and will thereby prevent its yielding upward. When it is desired to raise the bar, the block F^2 will first be thrust inward, when the bar will be readily raised past it, and when so raised the pressure of the block against the bar will retain the bar in its raised position, so that it will not be necessary to hold it up, either by hand or by means of the clamping-nut F′, during the operation of removing the chain or applying the same. A bearing-screw, f^4, may be placed in the upper end of the bar to bear against the block instead of having the bar bear directly against it, this screw serving to take up any wear which may occur.

The endless-chain cutter may be of any suitable construction; but the form I prefer is that set forth in an application for Letters Patent filed by me March 26, 1884, Serial No. 125,645. This cutter consists of alternate double and single links, the sides of the double links being separated by a space about equal to the thickness of the single link, while at the same time these double links are of a greater depth than the single links and extend below the same. In this construction the spaces between the sides of the double links serve to receive the projections on the sprocket-wheel D′. In order to guide the cutter chain properly the tension-bar F is provided upon its edges with a longitudinal rib or projection, f^5, which fits within the spaces of the double links, the rear edges of the sides of which extend beyond the rear edges of the single links, as hereinbefore described, for this purpose, as shown in Fig. 9 of the drawings.

The supporting-roller G is provided on each edge of its periphery with a slight bevel, as shown in Fig. 14 of the drawings, so that the projecting edges of the double links fit over the same in the manner shown in the said figure, whereby the chain is supported firmly in position at the point where it operates upon the material, and any lateral deviation of the same is prevented.

Heretofore, in chain mortising-machines, owing to the rapidity of travel of the chain cutter, this latter has a tendency to swell or bulge out between the two supporting-rollers and assume the form of a very much flattened ellipse. This occurs, too, in spite of the original tension given to the chain, since the heat generated by the working of the chain is sufficient to so expand the metal as to lengthen it. It is desirable, however, and in fact necessary to the successful operation of machines of this description, that the chain should be practically rigid at all points where it operates upon the material. In the case just referred to, where the chain assumes an ellipsoidal form,

it will be seen that those portions of the chain above the lower or supporting roller will extend outward beyond that portion of the chain which is supported by the roller, and will operate upon the walls of the mortise after that portion of the chain which is immediately supported by the roller has cut the mortise proper. This results not only in inaccuracy in the size of the mortise, but it also makes the walls of the mortise ragged and tends to destroy the chain. These difficulties I overcome in the following manner: Upon each side of the tension-bar I arrange a tension or deflecting roller, H, which bears against the chain and forces it inward above the roller, so that no portion therein, except that immediately supported by the roller G, can come in contact with the material operated upon. These tension-rollers H are provided upon their peripheries with a covering, *h*, of rubber or other suitable material, which will not injure or be injured by the cutting-teeth of the chain. The rollers are mounted so as to be adjustable toward and from the tension-bar, and the supporting roller G at the lower end of the tension-bar is constructed of a somewhat greater diameter than the width of the bar, so that it projects beyond the same on each edge. It will be seen that by adjusting the tension-rollers and causing them to bear against the chain it will be deflected inward toward the tension-bar above the supporting-roller, as shown in Fig. 1 of the drawings, and the tendency of that portion of the chain above the supporting-roller to spread laterally while in motion will be overcome, while at the same time that portion of the chain which is upon the supporting-roller will be held more firmly in place. By this means a true mortise will be cut without any tearing of the edges or damage to the material or chain.

The adjustment of the rollers H is preferably obtained in the following manner: The rollers are mounted on pendent arms H′, pivoted on bolts *h*′, which may be tightened up to clamp them in position after adjustment. These bolts may be attached directly to the frame A of the machine or to the lower extremity of an adjustable frame, I, whereby the rollers may be adjusted vertically as well as to and from the tension-bars. The frame I consists of suitable guide-rods passing through guides on the main frame, and having an upper cross-head, I′, in which is swiveled an adjusting-screw, I², which passes through a threaded aperture in a fixed cross-bar, *i*, near the top of the main frame. The cross head I′ of the frame I is arranged in the line of travel of the sliding frame D and forms the limit to the upward motion of that frame, a spring cushion, *i*′, of rubber or other suitable material, being provided at the upper end of the sliding frame D to break the shock of the contact of the said frame with the cross bar I′. It is obvious that as the frame I is adjusted in either direction its position will limit and define the extreme upward movement of the frame D, and the tension-rollers H, being mounted on the frame I, will always occupy the same relative position to the supporting-roller G at the lower end of the tension-bar when the sliding frame D and tension-bar are raised to their highest or normal position.

The position of the frame is controlled in the manner hereinafter described by springs which constantly tend to raise the same and hold it at the upper end of its path of travel, except when depressed by hand or by the mechanism provided for that purpose, as hereinafter described. In order to depress the frame by hand, a suitable handle, J, is provided, which is shown in the present instance as secured to the tension-bar by means of the clamping-nut F′; but any suitable attachment of the same may be provided.

Heretofore in chain mortising-machines the chain cutter has remained stationary with respect to the work-holding table or bed, which latter has been movable, so as to bring the work up to the cutter and feed it to the same to the extent necessary to form the mortise. In my machine it will be seen from the previous description that the endless-chain cutter is intended to be fed to the work, which latter is held stationary by the work-holding table while being operated upon. This movement of the chain cutter is effected by the vertical movement of the sliding frame D, which carries the same, and which may be actuated either by hand, as hereinbefore described, or by means of suitable automatic mechanism for the purpose. In the construction shown this mechanism consists of the rack bar K, secured to the sliding frame D, preferably in the manner hereinafter described, and extending downward from the same nearly to the bottom of the machine, where it meshes with a pinion, L, mounted on a shaft, L′, supported in a bracket-frame, *l*, secured to the side of the main frame or casing A. The bracket-frame *l* is also provided with an arm, *l*′, which embraces the rack-bar K and holds it in engagement with the pinion L. On the shaft L′ of the pinion L is arranged the worm-wheel L², and immediately below this worm-wheel is a screw, M, mounted on a shaft, M′, which is itself mounted in a swinging bracket-frame, M², the said screw M being adapted to mesh with the worm wheel L² when thrown into engagement with the same by the raising of the vibrating frame M². The worm-shaft M′ is provided with a pulley, *m*, connected by a belt, *m*′, with a pulley, *m*², on the main or driving shaft, B, the pulleys *m* *m*² being preferably so constructed as to enable the operator to vary the rate of speed of the belt *m*′, and consequently of the feed, by shifting the belt *m*′. It is obvious that when the vibrating frame M² is raised, so as to cause the screw M to mesh with the worm-wheel L², and thereby rotate the pinion L, this latter will, by means of the rack-bar K, cause the sliding frame D and the cutter carried thereby to descend.

In order to operate the vibrating frame M²,

I employ a foot-lever, N, which extends out beyond the casing A, to which it is pivoted, and is connected within the casing to the frame M^2 in such a manner that by depressing the lever the frame is raised to cause the feed to operate, and by removing the pressure on the lever the frame is depressed, thus stopping the feed. This latter operation is, however, preferably performed in an automatic manner, and to effect this result I employ a trip-connection between the lever N and the frame M^2, which consists of an arm, N′, pivoted to the lever and extending upward through a guiding-aperture, n', in the frame M^2, and a spring-pawl, N^2, pivoted upon the arm N′ and having one of its arms normally held in position to engage a shoulder, n^2, on the frame M^2. The other arm of the spring-pawl is arranged in the path of a pin, k, on the rack-bar K, which pin, when it engages with the pawl upon the descent of the rack-bar, will trip the pawl and cause it to be disengaged from the shoulder n^2, thereby allowing the frame M^2 to drop and causing the downward motion of the sliding frame and cutter attached thereto to cease.

The sliding frame and cutter are carried back to their original position by means of springs or weights, the construction which I deem preferable being that shown in the drawings, which consists of a shaft, O, provided near one end with a wheel or pulley, O′, to the periphery of which is attached one end of a strip, o', the other end of which is connected in any suitable manner to the sliding frame D. Near the other end of the shaft O is attached a scroll-wheel, O^2, to which is connected one end of a strap or band, o^2, the other end of which is suitably connected to one or more springs, O^3. The shaft O is located above the highest point of travel of the sliding frame D, and upon the descent of the frame the strap o' is uncoiled from the wheel O′, while the strap o^2 is coiled upon the scroll-wheel O^2, at the same time extending or drawing out the springs O^3. Upon the release of the sliding frame D, the action of the springs O^3 will uncoil the strap o^2 from the scroll-wheel O^2, and will at the same time coil the strap o' upon the wheel O′, thereby raising the sliding frame D to its original position. The upper end of the strap o^2 is connected to the scroll wheel O^2 at its point of largest diameter, so that as the said strap is being unwound from the scroll-wheel during the ascent of the sliding frame the tractile force exerted by the springs will be constantly equal, the spring, when at its greatest tension, operating upon the part of the scroll which is of the smallest diameter, and upon that part which is of the largest diameter when at its least tension. The belt c passes around the pulleys on the frame D in such a manner that as the frame rises it travels against the direction of the travel of the said belt, which acts as a brake to prevent a too rapid ascent of the frame. The cushion i', hereinbefore described, also acts in conjunction with the construction just described, and renders the stoppage of the sliding frame practically noiseless.

From this description it will be seen that as soon as the pin k on the rack-bar has tripped the spring-pawl N^2 the sliding frame D and the parts attached thereto will be returned to their normal position, in the manner hereinbefore described. It is desirable, however, that this tripping of the pawl should occur at various points in the downward course of the sliding frame and cutter, in order that mortises of various depths may be cut. In order to effect this the upper end of the rack-bar K is adjustably connected to the sliding frame. This connection is effected, preferably, in the manner shown in Figs. 12 and 13 of the drawings, in which P represents a bolt screwing into the frame D and having its inner end cone-shaped. The upper end of the rack-bar K, which is rounded, passes up through the slide, or, preferably, through a groove formed in the inner face of a separate piece, D^2, secured to the side of the frame.

P′ indicates a locking-pin, constructed substantially as shown in Figs. 12 and 13 of the drawings, and having one of its ends grooved transversely, as shown in the left-hand view of Fig. 13, and arranged to bear against the bar K, while its other end is provided with a transverse groove arranged at right angles to the former groove, as shown in the right-hand view of Fig. 13, so that said end is adapted to fit and bear against the conical end of the screw-bolt P. When it is desired to set the bar K to trip at any desired point, the screw-bolt P is unscrewed, so as to remove the pressure from the locking-pin P′, which, being in turn loosened, will allow the bar K to drop. The sliding frame D is then lowered to the point to which it is desired to have the frame descend when in operation, and the screw-bolt P is screwed up until the pressure of its conical end upon the locking-pin P′ causes the same to clamp the bar K in position. The bar K is provided above the pin k with a second pin, k'. This pin is at a distance above the pin k equal to the distance from the top of the bracket l to the spring-pawl N^2 when the latter is depressed. A notch or groove, l^2, is formed in the guiding-arm l', the said groove being of sufficient size to allow the pin k to pass through the same. The pin k' is, however, longer than the pin k, so that it cannot pass through the notch l^2. When the upper end of the bar K is unclamped, as hereinbefore described, this bar will drop until the pin K′ rests upon the arm l' and prevents its further descent. While in this position the pin k depresses the spring-pawl N^2. It is obvious that if the bar be locked to the slide at any given point to which the latter may be brought each time the slide returns to that point while in operation the pin k will trip the pawl N^2 and cause the downward motion of the slide to cease. By this means the parts

may be readily and accurately adjusted, so as to cause the cutter to cut a mortise of any desired depth within the limits of the machine.

Q indicates a bell-crank lever, pivoted to any suitable portion of the frame and having its lower end connected by a rod, Q′, to the extreme inner end of the foot-lever N. The upper end of the lever Q is pivoted to the belt-shifter Q^2, which latter is provided with a spring, *q*, which tends to thrust the belt shifter outward, and thereby keep the driving-belt upon the loose pulley *b*′. With this arrangement it will be seen that by depressing the foot-lever N the driving-belt is shifted from the loose to the fast pulley, thereby causing the chain cutter to rotate, while at the same time the vibrating frame M^2 is raised to cause the cutter to be fed to its work. Upon removing the pressure from the foot-lever, the spring *q* immediately operates to throw the belt from the fixed to the loose pulley, and thereby stop the operation of the machine.

The material to be mortised is held upon a suitable table during the operation of mortising, the construction I prefer for this purpose being that shown in the drawings, in which R represents a plate pivoted by means of a bolt, *r*, upon the front of the casing A, and having mounted upon it the bed-plate S. The plate R is vibratable around its pivot-bolt, being provided with a segmental slot, *r*′, through which passes a clamping-screw, R′, by means of which the said plate may be clamped in position after adjustment, thereby determining the plane in which the bed S is set relatively to a horizontal plane. By this means the work upon the bed S may be presented to the cutter at any desired angle within the limits of adjustment, the position most commonly the used being, however, a horizontal position. I provide in the plate R a locking-bolt, R^2, and form in the face of the casing a hole, which registers with the locking-bolt R^2 when the bed is horizontal. By this means the bed may be firmly locked in an exactly horizontal position in a very short space of time and without the trouble of verifying its level. The bed S is mounted upon a bearing-plate, R^3, extending outward at right angles from the plate R. A downward extension, *s*, of the bed passes through and fits within a slot, *s*′, in the bearing-plate R^3, which latter is provided with an adjusting-screw, S′, passing through a threaded aperture in the extension *s*, whereby the bed S may be adjusted to and from the path of the cutter. Two clamping-screws, S^2, extend upward through slots s^2 in the bearing-plate R^3 into the bed S, and serve to lock the bed in position after adjustment. These screws also serve, in conjunction with the extension *s*, to guide the bed while it is being adjusted by means of the screw S′. A suitable aperture, s^3, is formed in the bed, at the center thereof, to allow the cutter to pass completely through the material which rests upon the bed. The bed is provided with a clamping device for holding the material to be operated upon, consisting of a fixed jaw, T, and a movable jaw, T′, which latter may be adjusted toward and from the fixed jaw by means of an adjusting-screw, *t*, swiveled in the jaw T′ and passing through a fixed nut, *t*′. The movable jaw T′ is constructed in two parts, one of which, t^2, is provided with pins or bolts t^3, extending loosely through the other part, t^4, and having springs t^5, mounted on the bolts t^3 on the outer side of the part t^4, which tend to force the two parts t^2 t^4 together. In a bearing in the face of the part t^2, adjacent to the part t^4, is arranged a shaft, T^2, provided with a suitable handle, T^3, and having a portion of its surface flattened, as shown in Fig. 4 of the drawings. When this flattened portion coincides with the face of the part t^2, the two parts t^2 t^4 are in contact with each other, as shown in the drawings; but by rotating the shaft t^2 by means of the handle t^3 the part t^2 will be moved away from the part t^4 and toward the fixed jaw T. The object of this construction is as follows: When any quantity of material of a given size is to be operated upon, the movable jaw T′ is adjusted toward or from the fixed jaw T until it occupies such a position that upon rotating the shaft T^2 the part t^2 of the jaw T′ will clamp the material against the fixed jaw T. It will then be unnecessary to withdraw the entire jaw T′ by rotating the adjusting-screw *t* each time it is necessary to unclamp the material to change its position, the clamping and reclamping being accomplished by a slight rotating turn of the shaft T^2 in a rapid and effectual manner.

In order that the material to be operated upon may be readily placed upon the bed in a proper position to have the mortise cut on the exact point desired, I employ a gage-bar, U, constructed substantially as shown in Figs. 15 and 16 of the drawings. This gage-bar is provided with two or more hooks, *u*, by means of which it can be attached to the material to be operated upon, and has in its upper surface a series of grooves, *u*′, arranged at a distance apart equal to the length of the mortise which it is desired to cut. I have shown a series of three grooves, any two adjacent ones of which may be simultaneously used, as hereinafter described; but it will of course be understood that any desired number of grooves may be formed in the bar, although only two will be employed in conjunction with any given mortise. These grooves operate in conjunction with gage-wires U′, attached to the lower extremity of the frame I. The gage-bar U is attached to the material by means of the hooks *u* in such a manner that two of the grooves *u*′ are opposite the two extremities of the space to be mortised. The material is then placed upon the bed in such position that when the gage-wires U′ are brought down they will coincide with the grooves in the gage-bar, which will indicate that the material is in its proper position to be mortised. The gage-wires U′

are sufficiently elastic to permit them to be pulled down for this purpose, their elasticity returning them to their original position as soon as the position of the material has been verified. In case it is desired to cut a mortise of greater length than the size of the supporting-roller and chain cutter will cut at a single operation, the grooves in the gage-bar may be elongated to an extent equal to the excess of mortise desired, so that after the first portion of the mortise is cut the work may be unclamped and moved along until the relative position of the gage-wires and the end walls of the grooves indicates that it is in a proper position for the cutter to cut the excess. I have shown the two end grooves as elongated for this purpose to different extents, while the central groove is shown as not thus elongated.

In order to dispose of the chips and shavings produced by the operation of the machine, I employ an exhaust-fan, V, driven by a belt, *v*, from the fast pulley *b* on the driving-shaft. This exhaust-fan is provided with the usual discharge-pipe, V′, and with an upright inlet-pipe, V^2. To this latter is connected a shield or hood, W, constructed substantially as shown in Figs. 1 and 9 of the drawings, and extending from the top of the cutter when in its normal position nearly to the lower extremity thereof and covering that portion of the chain which ascends or comes from the wood when the machine is in operation. It will be seen that as the teeth of the chain cutter, after passing through the wood, ascend into the hood, carrying with them the shavings and chips, these latter will be carried off by the current of air created by the exhaust-fan and discharged through the pipe V′. The hood W is mounted upon the frame I, being preferably attached by means of one or more pins, *w*, which enter corresponding seats or loops in the hood, which latter is thus readily detached. Since the frame I, upon which the hood W is mounted, is adjustable, an adjustable connection between the said hood and the exhaust-fan is necessary, and this is preferably effected by means of a pipe, W′, which extends from the hood into the inlet-pipe V^2 and fits snugly therein, being capable, however, of a vertical motion within the same in the manner of a telescope-joint. It will of course be understood that the pipe W′ may be arranged outside of the pipe V^2 instead of inside the same, such an arrangement being a mere reversal of the construction shown.

The operation of my machine will be readily understood from the preceding description. The work-table being adjusted to the proper position and the work placed thereon and gaged and clamped, it is only necessary to depress the foot-lever, when the cutter will be rotated and carried downward into the material to the desired depth and automatically returned. As long as the foot-lever is held in a depressed position the cutter will rotate, and if the cutter and supporting-roller are not of sufficient size to make a mortise of the length desired the cutter may be depressed by hand after moving the material into proper position, and the remaining length of the mortise cut by a second operation. This may also be effected by allowing the foot-lever to rise and then depressing it again; but as this entails a partial stoppage of the motion of the chain, owing to the shifting of the belt, it is more desirable that this should be done by hand. The cutter may be raised and lowered entirely by hand without the use of automatic mechanism for that purpose, and this may be effected by only partially depressing the foot-lever, the construction of the parts being such that the belt is shifted before the vibrating frame is raised.

One especial advantage of the construction described is that as soon as the foot is removed from the foot-lever the spring-impelled belt-shifter immediately shifts the belt to the loose pulley, thereby rendering it impossible for the operator to leave the machine without its immediately stopping.

It is obvious that various modifications in the details of construction and arrangement of the parts may be made without departing from the principles of my invention, and I therefore do not wish to be understood as limiting myself strictly to the precise construction shown and described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a mortising-machine, the work-holding table, in combination with the sliding frame mounted to move to and from the said table, a sprocket-wheel and supporting-wheel mounted on said frame, an endless chain cutter passing over said wheels, a driving-pulley on the sprocket-wheel shaft, guide-pulleys mounted on said frame above and below the driving-pulley, and a suitably-actuated driving-belt passing over said guide-pulleys and around the driving-pulley, substantially as and for the purposes specified.

2. In a mortising-machine, the combination, with the upper and lower pulleys and the belt *c*, of the sliding frame D, the sprocket-shaft *d*, mounted in said frame and provided with sprocket-wheel D′, the supporting-wheel G, the endless-chain cutter passing around the said wheels, the pulley E on the sprocket-shaft, and the idle-pulleys E′, mounted in the sliding frame above and below the pulley E, substantially as and for the purposes specified.

3. In a mortising-machine, the work-holding table, in combination with the sliding frame mounted to move to and from said table, an adjustable tension-bar mounted on said frame and carrying a supporting-wheel, a sprocket-wheel mounted on a shaft in said frame, an endless-chain cutter passing over said wheels, a driving-pulley mounted on the sprocket-wheel shaft, guide-pulleys mounted on said

frame above and below the driving-pulley, and a suitably-actuated driving-belt passing over said guide-pulleys and around the driving-pulley, substantially as and for the purposes specified.

4. In a mortising-machine, the combination, with the frame *d*, having vertical dovetailed ways d^2, of the piece *f*, mounted to move in said ways and correspondingly dovetailed, the screw-bolt *f'*, secured to said piece and extending outward therefrom, the tension-bar F, resting against the face of the frame D and provided with an aperture through which the screw-bolt *f'* passes, and the external clamping-nut, F', mounted on said screw-bolt to clamp the piece *f* against its ways and the tension-bar F against the face of the frame D, substantially as and for the purposes specified.

5. In an endless-chain mortising-machine, the combination, with the tension-bar and the frame upon which it is mounted, of the block F^2, arranged immediately above the said bar in a suitable way or recess in the frame, said block being provided with a beveled under surface and with a suitable spring to thrust it normally outward, substantially as and for the purposes specified.

6. In an endless-chain mortising-machine, the combination, with the endless-chain cutter and its driving and supporting wheels, of the tension-rollers having smooth peripheries and arranged one on each side of the chain in the plane of motion thereof and bearing against the sides of the cutter above the lower wheel to deflect said portions inward and hold them clear of the walls of the mortise, substantially as and for the purposes specified.

7. In an endless-chain mortising-machine, the combination, with the endless-chain cutter and its driving and supporting wheels, said cutter being provided with cutting-teeth on its outer periphery, of the tension rollers provided with a peripheral covering, of soft rubber or the like, and arranged to bear against the toothed sides of the cutter to deflect the same inward, substantially as and for the purposes specified.

8. The combination, with the endless-chain cutter and its supporting and operating mechanism, of adjustable tension-rollers arranged to bear against the said cutter between its end supports, substantially as and for the purposes specified.

9. The combination, with the sprocket-wheel and tension-bar F and supporting-roller G, of greater diameter than said tension-bar, of the endless-chain cutter supported on said sprocket-wheel and supporting-roller, and the tension-rollers H, adjustable to deflect the said cutter inward toward the tension-bar above the supporting-roller, substantially as and for the purposes specified.

10. The combination, with the sliding frame D, which carries the endless-chain cutter, of the adjustable frame I, having cross-head I', to limit the upward motion of the sliding frame, the adjustable frame being vertically adjustable on the main frame, and the sliding frame working in the adjustable frame, substantially as and for the purposes specified.

11. The combination, with the sliding frame D, which carries the endless-chain cutter, of the adjustable frame I, having cross-head I', to limit the upward motion of the said frame, and a spring-cushion, *i'*, arranged between the sliding frame and cross-head, the adjustable frame being vertically adjustable on the main frame, and the sliding frame working in the adjustable frame, substantially as and for the purposes specified.

12. The combination, with the sliding frame D and endless chain cutter carried thereby, of the adjustable frame I, which limits the upward motion of the sliding frame, and the tension-rollers H, mounted on said adjustable frame, the adjustable frame being vertically adjustable on the main frame, and the sliding frame working in the adjustable frame, substantially as and for the purposes specified.

13. In an endless chain mortising-machine, the combination, with the sliding frame, the endless chain cutter provided with a driving-pulley and idle-pulleys, and the driving-belt, of springs arranged to lift said sliding frame and cutter when released after depression, substantially as and for the purposes specified.

14. In a mortising-machine, the combination, with the sliding frame, the endless-chain cutter mounted thereon and provided with a driving-pulley and idle-pulleys, and the driving-belt, of power-driven feed mechanism, substantially such as described, for depressing said frame and cutter, and springs for lifting the frame and cutter after depression, substantially as and for the purposes specified.

15. In a mortising-machine, the combination, with the main frame, the sliding frame, the endless-chain cutter mounted thereon, and means for driving said cutter, of a rack-bar secured to the sliding frame and extending downward therefrom to the base of the main frame, a pinion to mesh with the rack-bar, a worm-wheel arranged on the pinion shaft, a screw mounted in a vibrating frame and capable of meshing with the worm-wheel, and a foot-lever to raise and lower the vibrating frame, said foot-lever being mounted in the base of the main frame and extending to the front thereof, substantially as and for the purposes specified.

16. In a mortising-machine, the combination, with the sliding frame, the rack-bar provided with a pin, *k*, the screw mounted in the vibrating frame, and the gearing connecting the two, of the lever N, having a spring-pawl, one arm of which engages a shoulder on the vibrating frame, while the other arm is arranged in the path of the pin *k*, substantially as and for the purposes specified.

17. In a mortising machine, the combination, with the vibrating frame M^2, having guide-aperture *n'* and shoulder n^2, of the foot-lever N, having pivoted arm N', extending

through the guide-aperture, and spring-pawl N², pivoted to the said arm and adapted to engage the said shoulder, substantially as and for the purposes specified.

18. In a mortising-machine, the combination, with the sliding frame, the endless-chain cutter mounted thereon, and means for driving the said cutter, of the rack-bar adjustably connected to the sliding frame, means for operating the rack-bar, and the trip mechanism controlling the same and operated by the rack-bar, substantially as and for the purposes specified.

19. In a mortising-machine, the combination, with the sliding frame, the endless chain cutter mounted thereon, and means for operating the same, of springs to lift the said frame, the rack-bar adjustably connected to said frame, means for operating the rack-bar, and the trip mechanism controlling the same and operated by the rack-bar, substantially as and for the purposes specified.

20. The combination, with the trip mechanism, of the sliding frame and the rack-bar detachably clamped in the sliding frame and extending through the guide *l*, the said rack-bar being provided with a short pin, *k*, capable of passing through the guide to operate the trip mechanism, and a long pin, *k'*, which rests upon the guide when the rack is detached, substantially as and for the purposes specified.

21. The combination, with the sliding frame D, and the rack-bar K, extending through the same, of the conical-ended screw-bolt P and the locking-pin P', bearing against the conical end of the screw-bolt and against the rack-bar, substantially as and for the purposes specified.

22. In a mortising-machine, the combination, with the sliding frame and endless-chain cutter, of the main driving-belt and its fast and loose pulleys and belt-shifter, suitably connected to the cutter to drive the same, feed mechanism, substantially such as described, for operating the sliding frame, and a single foot-lever connected to and controlling both the belt-shifter and the feed mechanism, substantially as and for the purposes specified.

23. In a mortising-machine, the combination, with the sliding frame and endless chain cutter, of the feed mechanism to operate the sliding frame, the main shaft provided with fast and loose pulleys and a belt-shifter and suitably connected to the cutter to drive the same, a vibrating shaft driven from the main shaft and gearing with the feed mechanism when raised, and a single foot-lever connected to the belt-shifter and vibrating shaft, whereby when said lever is depressed the belt-shifter is first moved to start the cutter-driving mechanism and the vibrating shaft then raised to gear with and start the feed mechanism, substantially as and for the purposes specified.

24. In a mortising-machine, the combination, with the sliding frame and endless chain cutter mounted thereon, of the main shaft connected to the cutter by suitable belting and provided with fast and loose pulleys and a belt-shifter, a rack-bar attached to the sliding frame, a pinion to gear with the rack-bar, a worm-wheel on the pinion shaft, a vibrating frame, a shaft mounted in said frame and having a screw to gear with the worm-wheel, and a foot-lever connected to the belt shifter and having a spring-pawl to engage the vibrating frame, said pawl being arranged in the path of the rack-bar, substantially as and for the purposes specified.

25. In a mortising machine, the combination, with the bed and the fixed jaw, of the adjusting-screw *t*, the movable jaw T', composed of two parts—the one t^4 swiveled on the adjusting-screw and the other, t^2, held normally in contact with the part t^4 by suitable springs—and a shaft, T², mounted in one of the two parts and having a portion of its surface flattened, substantially as and for the purposes specified.

26. In a mortising-machine, the combination, with the bed and the fixed jaw T, of the movable jaw T', composed of two parts, t^2 t^4, held normally in contact by suitable springs, and a shaft, T², mounted in the part t^2 and having a portion of its surface flattened, substantially as and for the purposes specified.

27. The combination, with the gage-wires U', arranged on each side of the cutter, of the gage-bar U, provided with the grooves *u'*, to receive the gage-wires U', and hooks *u*, to secure the bar to the work, substantially as and for the purposes specified.

28. In a mortising-machine, the combination, with the endless-chain cutter and the wheels upon which it is mounted, of the exhaust-fan and the hood W, covering the ascending side of the cutter and extending over the top of the same where the cutter passes over the upper wheel, substantially as and for the purposes specified.

29. In a mortising-machine, the combination, with the endless chain cutter and the adjustable frame I, of the hood W, mounted on said frame, the exhaust-fan, and the telescope-joint connecting the fan and hood, substantially as and for the purposes specified.

30. The combination, with the endless cutter and the adjustable frame, of the hood mounted thereon, covering the ascending side of the cutter and having a downwardly-extending pipe, W', and the exhaust-fan provided with the pipe V², surrounding the pipe W', substantially as and for the purposes specified.

31. In a mortising-machine, the combination, with the sliding frame carrying the endless-chain cutter and its driving and guide pulleys, of the lower pulley, B', belt *c*, and upper pulley, C, mounted in the vertically-adjustable yoke C', substantially as and for the purposes specified.

32. In a mortising-machine, the combination, with the sliding frame and the endless-chain cutter and its driving and guide pulleys mounted thereon, of the lower pulley, B′, the belt *c*, the upper pulley, C, and the yoke C′, supporting the upper pulley and provided with the screw-threaded extension *c′*, passing through the crown of the casing and having the external nut, C^2, mounted thereon, substantially as and for the purposes specified.

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Witnesses:
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