(No Model.)

2 Sheets—Sheet 1.

G. W. TOWER.

MACHINE FOR CUTTING SCREW TAPS.

No. 400,882. Patented Apr. 2, 1889.

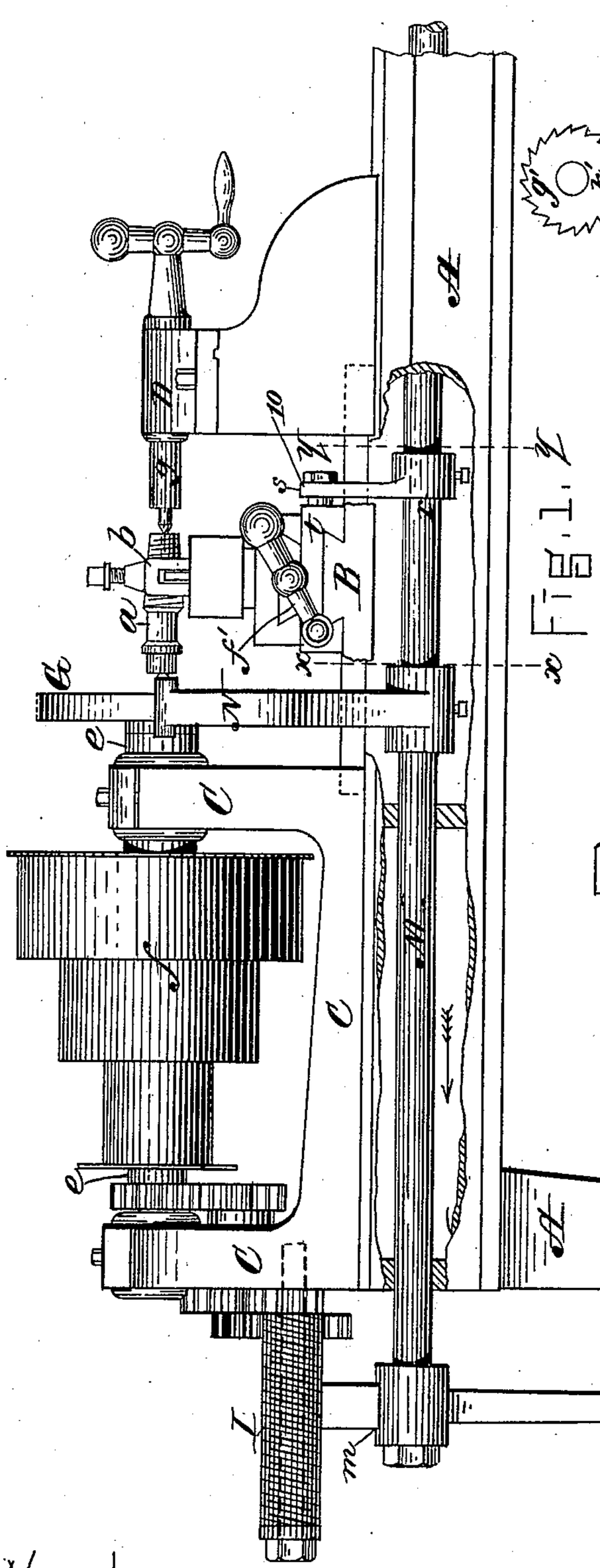

Fig. 1.

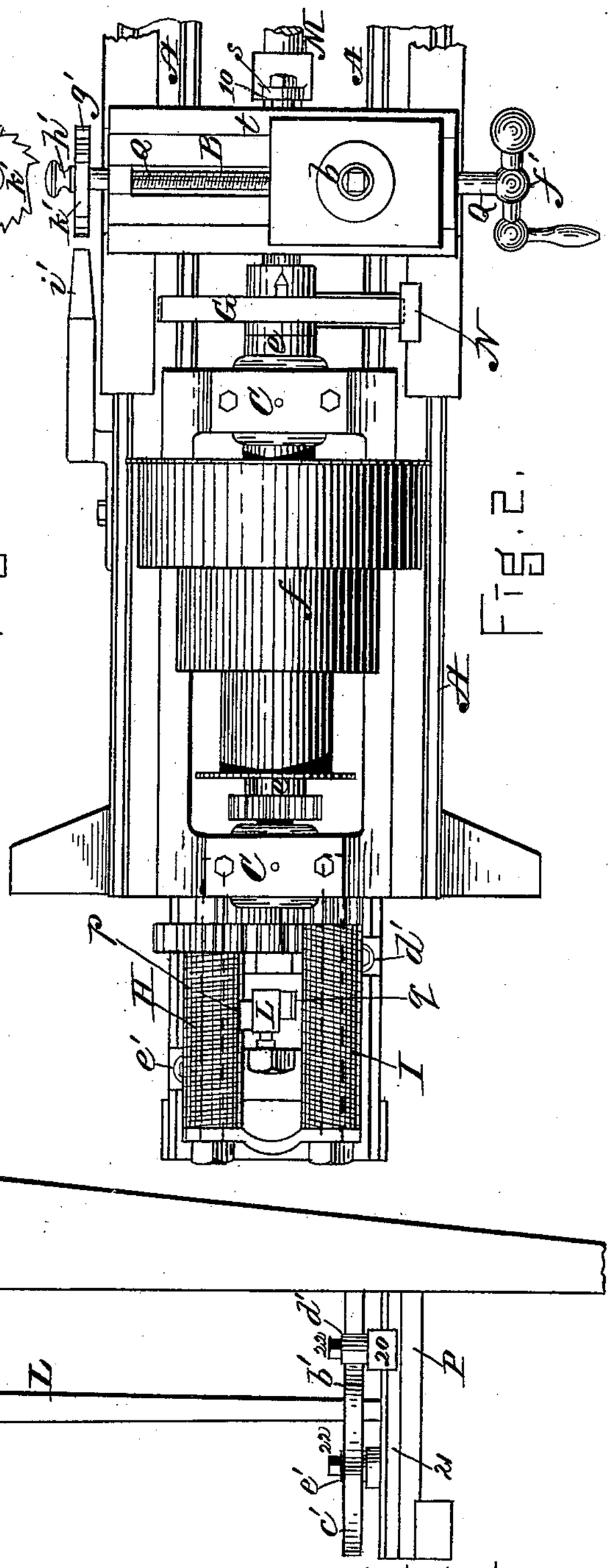

Fig. 2.

WITNESSES.

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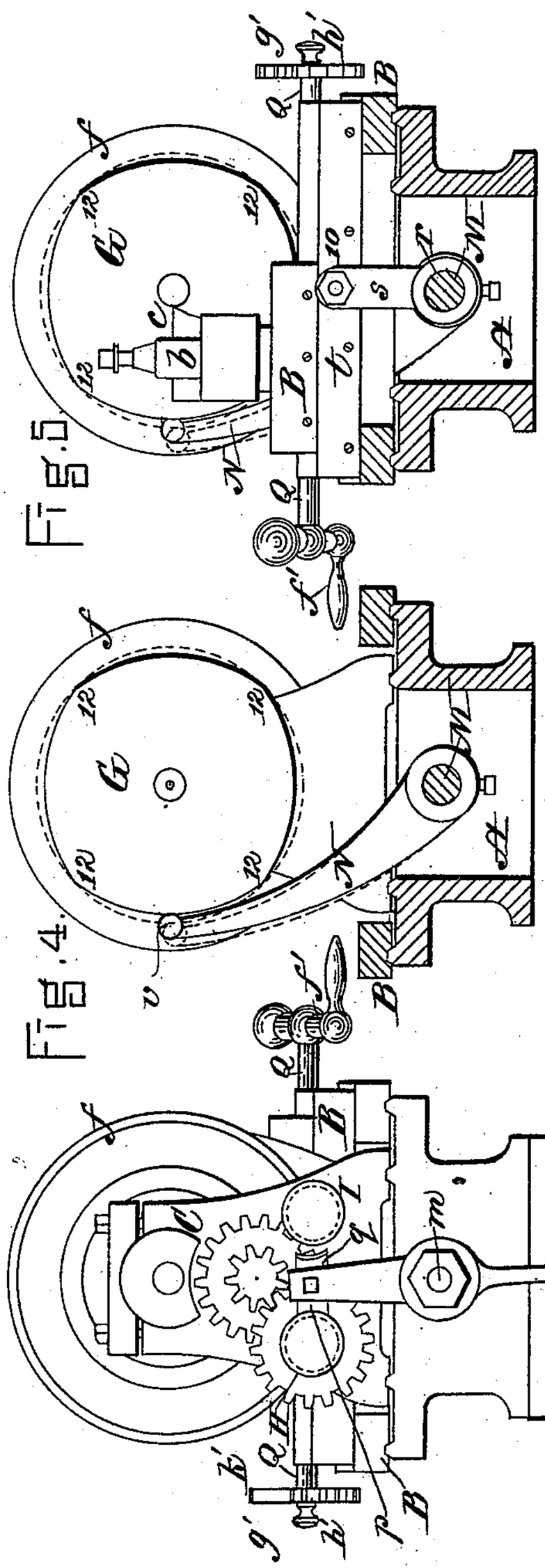

FIG. 5.

FIG. 4.

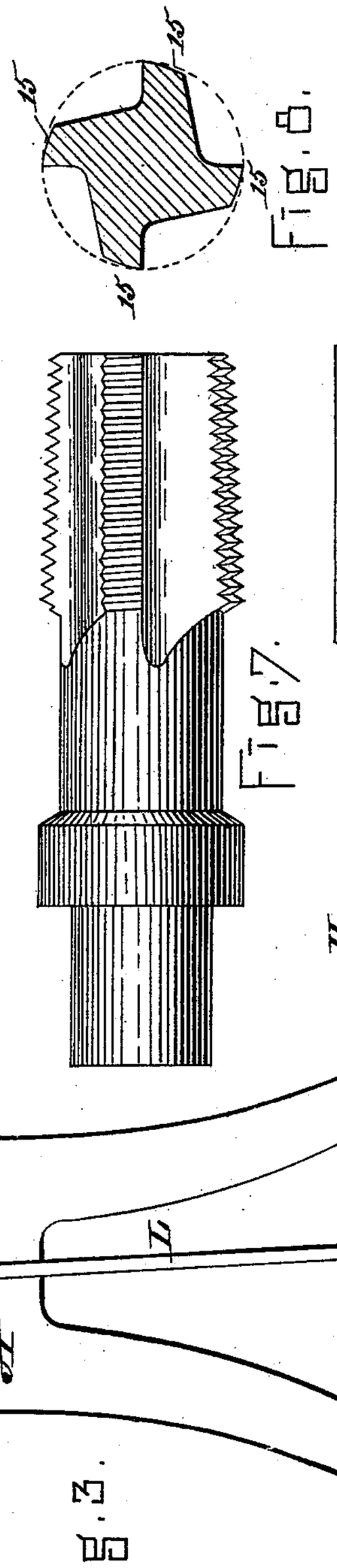

FIG. 6.

FIG. 7.

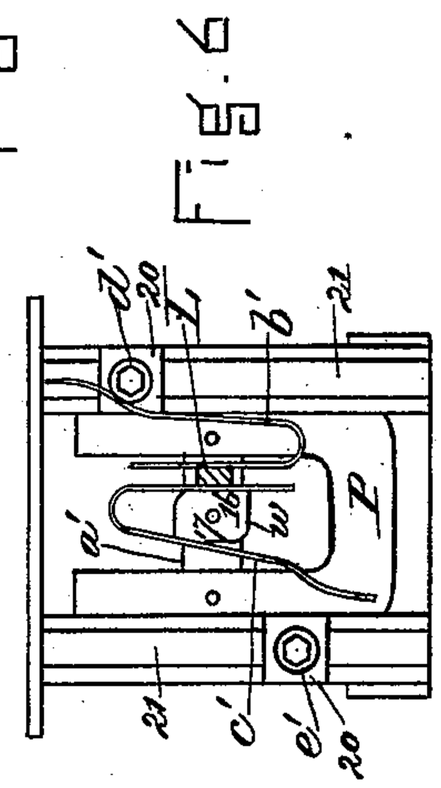

FIG. 8.

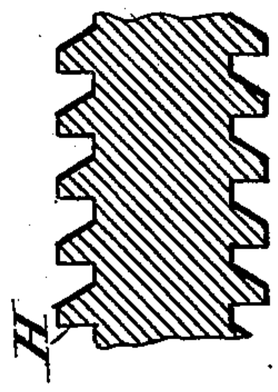

FIG. 9.

FIG. 3.

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UNITED STATES PATENT OFFICE.

GEORGE W. TOWER, OF BOSTON, MASSACHUSETTS.

MACHINE FOR CUTTING SCREW-TAPS.

SPECIFICATION forming part of Letters Patent No. 400,882, dated April 2, 1889.

Application filed August 22, 1888. Serial No. 283,487. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. TOWER, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Machines for Cutting Taps with Relieved Threads, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a front elevation of a portion of my improved machine for cutting taps with relieved threads, a portion of the front of the bed being broken away to show the rock-shaft and parts connected therewith. Fig. 2 is a plan of the same. Fig. 3 is an elevation of one end of the same. Fig. 4 is a transverse vertical section on the line *x x* of Fig. 1. Fig. 5 is a transverse vertical section on the line *y y* of Fig. 1. Fig. 6 is a horizontal section on the line *z z* of Fig. 3. Fig. 7 is an elevation (enlarged) of a tap cut by my improved machine. Fig. 8 is a transverse section of the same, showing the decrease in the diameter of the thread from the cutting-edge on one side of a groove backward to the edge of the next groove, which forms the "relief." Fig. 9 is a section (enlarged) of a portion of the feed-screw.

In cutting the threads of ordinary grooved screw-taps it is customary to incline the threads between the longitudinal grooves backward from a true circular curve, whereby they are decreased in diameter from the cutting-edge on one side of a groove backward to the edge of the next groove, in order to produce a relief, whereby the friction of the tool is reduced and its operation facilitated.

My invention has for its object to improve the construction of machines for cutting taps with relieved threads; and it consists in certain novel combinations of mechanical devices and details of construction, as hereinafter set forth and claimed, whereby a more desirable and effective machine of this character is produced than is now in ordinary use.

In the said drawings, A represents the bed or frame-work of the machine, upon suitable guideways on which slides an ordinary compound rest or tool-carriage, B, to which is secured the tool-post *b*, which carries the cutting-tool *c*.

C is the head-stock, which supports the live-spindle *e*, which is rotated by a pulley, *f*, over which passes a belt. (Not shown.)

D is the tail-stock, which contains the dead-spindle *g*, the grooved tap-blank *a*, Fig. 1, to be cut, being supported between the head and tail centers, and being dogged to a face-plate, G, at the end of the live-spindle *e*, to enable it to be rotated thereby.

At the left-hand end of the machine are two short horizontal right and left hand screws, H I, which are made tubular and revolve on studs projecting from the frame-work. These screws are connected in the ordinary manner by suitable gearing, as seen in Figs. 1, 2, and 3, with the live-spindle *e*, by which they are rotated, the gears being of such size and so arranged as to cause the screw I to rotate much faster than the screw H, for a purpose to be hereinafter described.

L is a lever, fulcrumed at *m* and carrying at its upper end two half-nuts, *p q*, adapted to engage, respectively, with the screws H I when brought into contact therewith by the movements of the lever L, as hereinafter described.

To the lever L is immovably secured one end of a horizontal rock-shaft, M, which is supported in suitable bearings in the frame-work, and has secured to it at *r* a crank-arm, *s*, the upper end of which is pivoted at 10 to the tool-slide *t* of the carriage B, whereby as the shaft M is rocked the cutting-tool *c* is caused to advance toward and recede from the work to cut the thread with a relief, as desired. The shaft M is rocked to produce this movement by means of a lever, N, immovably secured thereto at its lower end, and bearing at its upper end against the periphery of the face-plate G, which is made cam-shaped, thus forming a "pattern-wheel" with a series of elevations, 12, corresponding in number with the number of grooves and consequent sections of threads to be cut on the tap, the spring of the lower arm of the lever L, which is held at its lower end in a manner to be hereinafter described, allowing the lever N to be forced outward by the elevations 12, and also serving to keep the end of the lever N constantly

in contact with the face-plate G; and thus, as the face-plate is rotated, the shaft M is rocked by the lever N, the pattern-wheel G, by means of the lever N and connections described, thus controlling the movements of the cutting-tool and causing it to cut the several sections of the thread on the tap with a relief, as seen at 15 in Fig. 8.

The shaft M is reciprocated or traversed forward and back in the direction of its length to slide the tool-carriage B, connected therewith, on its ways and cause the tool *c* to move in the proper direction to cut the thread on the tap by means of the half-nuts *p q*, which, as previously described, are caused to engage alternately with the right and left hand revolving screws H I. When the nut *p* is engaged with the screw H, as seen in Figs. 2 and 3, the rock-shaft M is moved in the direction of the arrow, Fig. 1, causing the tool to traverse the work to cut the thread, and during this movement the lower end of the lever L is carried along in contact with one side of a guide plate or block, *w*, Fig. 6, supported on a cross-bar, *a'*, of a frame, P, secured to and projecting horizontally from the lower portion of the frame-work, the guide-plate serving to hold the lever L during its traverse in such positions as to insure the nuts *p q* being kept in engagement with the screws H I. The lever L has secured to it on opposite sides, as seen in Fig. 6, two flat U-shaped springs, *b' c'*, the outwardly-curved ends of which are alternately brought against two anti-friction rolls, *d' e'*, as the lever L is vibrated from side to side at the end of each traverse. When the lever L is passing along the side 16 of the guide-plate *w*, as seen in Fig. 6, the outwardly-curved end of the spring *b'* is brought against the roll *d'*, which puts a tension on the spring, and as soon as the end of the lever passes out of contact with the side 16 the spring *b'* throws it over in such manner as to cause the half-nut *p* to be disengaged from the screw H and the half-nut *q* to be thrown into engagement with the screw I. The tool *c* having been caused to recede from the work by this movement, the shaft M is moved in a direction contrary to the arrow by the screw I, which causes the lower end of the lever L to pass by the rounded corner of the guide-plate *w* and travel in contact with the side 17 of the guide-plate, which brings the outwardly-curved end of the spring *c'* against the roll *e'*, putting a tension on the same, whereby when the end of the lever L passes out of contact with the side 17 of the plate *w* it is thrown over to disengage the half-nut *q* from the screw I and bring the half-nut *p* again into engagement with the screw H, when the end of the lever L will again travel in contact with the side 16 of the guide-plate *w*, as before; and in this manner the half-nuts *p q* are automatically shifted, so as to engage alternately with the screws H I, whereby the tool, after being traversed across the work to cut the thread, is withdrawn therefrom and returned to its starting-point, ready to be again traversed in contact with the work, to make a second and deeper cut, the tool being traversed back and forth until the tap is cut to the desired depth and size.

The return-screw I is preferably made with a double or treble thread with considerable pitch, to produce a quick backward motion or return of the tool-carriage, ready for the next cut.

The anti-friction rolls *d' e'* are mounted on studs or screw-bolts projecting up from dove-tailed slides 20, moving on ways 21 of the frame P, whereby the rolls *d' e'* are made adjustable, to vary their positions, as desired.

The threads of the feed and return screws H I are preferably made of the form shown in Fig. 9—that is, with a face on the carrying side at right angles to the axial line of the screw, and tapering from the bottom toward the top on the opposite side or face, and with a flat top and bottom. This form of thread prevents the half-nuts from slipping on their screws H I and insures perfect and accurate work.

I will now describe the device by which the tool *c* is automatically fed forward at each backward or return traverse of the carriage to increase the depth of the cut in the tap until the thread is finished.

Q is the cross feed-screw, by which the slide *t*, which carries the tool-post *b*, is operated. This screw carries at its front end the ordinary crank-handle, *f'*, and at its rear end a ratchet-wheel, *g'*, which is adjustably secured to the screw Q, and is clamped when set by a screw, *h'*. This ratchet-wheel *g'* is brought at the end of each backward traverse of the carriage into contact with a stationary pawl, *i'*, secured to the frame-work, whereby it is moved a distance of one notch, thus rotating the feed-screw Q and advancing the tool to increase the depth of the cut. When the tap has been cut to the desired depth and size, a blank or toothless space, *k'*, on the ratchet-wheel is brought around opposite to the pawl *i'*, when the feed of the tool ceases; and it will be evident that by adjusting this wheel *g'* the toothless space *k'* can be set in such manner as to cause the feed of the tool to be automatically arrested after the tool has traversed the work any desired number of times and has penetrated to the desired depth.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a machine for cutting taps with relieved threads, the combination, with the head and tail centers for supporting the work and a slide-rest or tool-carriage, of the reciprocating rock-shaft M, connected with the tool-carriage and provided with means for transversely operating the tool-slide to cause the tool to move toward or from the work, a pattern-wheel or face-plate, G, having a cam-shaped periphery, and a lever secured to the reciprocating rock-shaft and bearing upon the

pattern-wheel, whereby the shaft M as it is moved longitudinally is rocked to cause the tool to advance and recede to cut a relieved thread on the tap, substantially as set forth.

2. In a machine for cutting taps with relieved threads, the combination, with the head and tail centers for supporting the work and a slide-rest or tool-carriage, of the reciprocating rock-shaft M, provided with a crank-arm, *s*, connected with the tool-slide *t* of the carriage, whereby the tool is caused to advance and recede as the shaft is rocked, the pattern-wheel or face-plate G, having a cam-shaped periphery, the lever N, secured to the rock-shaft and bearing on the pattern-wheel, whereby the shaft is rocked to operate the tool-slide transversely, the feed and return screws H I, geared to the live-spindle, and the lever L, connected with the rock-shaft M and provided with the half-nuts *p q*, the said lever L being vibrated to cause the half-nuts to alternately engage with the feed and return screws, whereby the tool-carriage is reciprocated, all operating substantially as described.

3. In a machine for cutting taps with relieved threads, the combination, with the reciprocating tool-carriage B, its operating rock-shaft M, the lever N, and pattern-wheel G, of the tool-slide *t* and the transverse feed-screw Q, for operating the same, provided with a ratchet-wheel, *g'*, having a blank or toothless portion, *k'*, and the stationary pawl *i'*, whereby the tool is advanced and its motion automatically arrested when the thread on the tap has been cut to the desired depth, substantially as set forth.

4. In a machine for cutting taps with relieved threads, the combination of the head and tail centers for supporting the work, a slide-rest or tool-carriage, the reciprocating rock-shaft M, connected with the tool-carriage and provided with means for transversely operating the tool-slide to cause the tool to move toward or from the work, a pattern-wheel or face-plate, G, having a cam-shaped periphery, a lever, N, secured to the reciprocating rock-shaft and bearing upon the pattern-wheel, the feed and return screws H I, the lever L, connected with the rock-shaft M, and having the half-nuts *p q* at its upper end and provided at its lower end with the springs *b' c'*, the guide-plate *w*, and the rolls *d' e'*, with which the springs are alternately brought into contact, all operating substantially in the manner and for the purpose set forth.

5. In a machine for cutting taps with relieved threads, the combination, with the reciprocating rock-shaft M, connected with the tool-carriage, and the lever N, attached to said rock-shaft and carrying the half-nuts *p q*, of the feed and return screws H I, having threads with a carrying-face at right angles to the axial line of the screw and tapering from the bottom toward the top on the opposite side or face, and having a flat top and bottom, whereby the half-nuts *p q* are held in constant engagement with the said feed and return screws and prevented from slipping thereon, substantially as described.

Witness my hand this 18th day of August, A. D. 1888.

GEORGE W. TOWER.

In presence of—
P. E. TESCHEMACHER,
HARRY W. AIKEN.