No. 742,291. PATENTED OCT. 27, 1903.

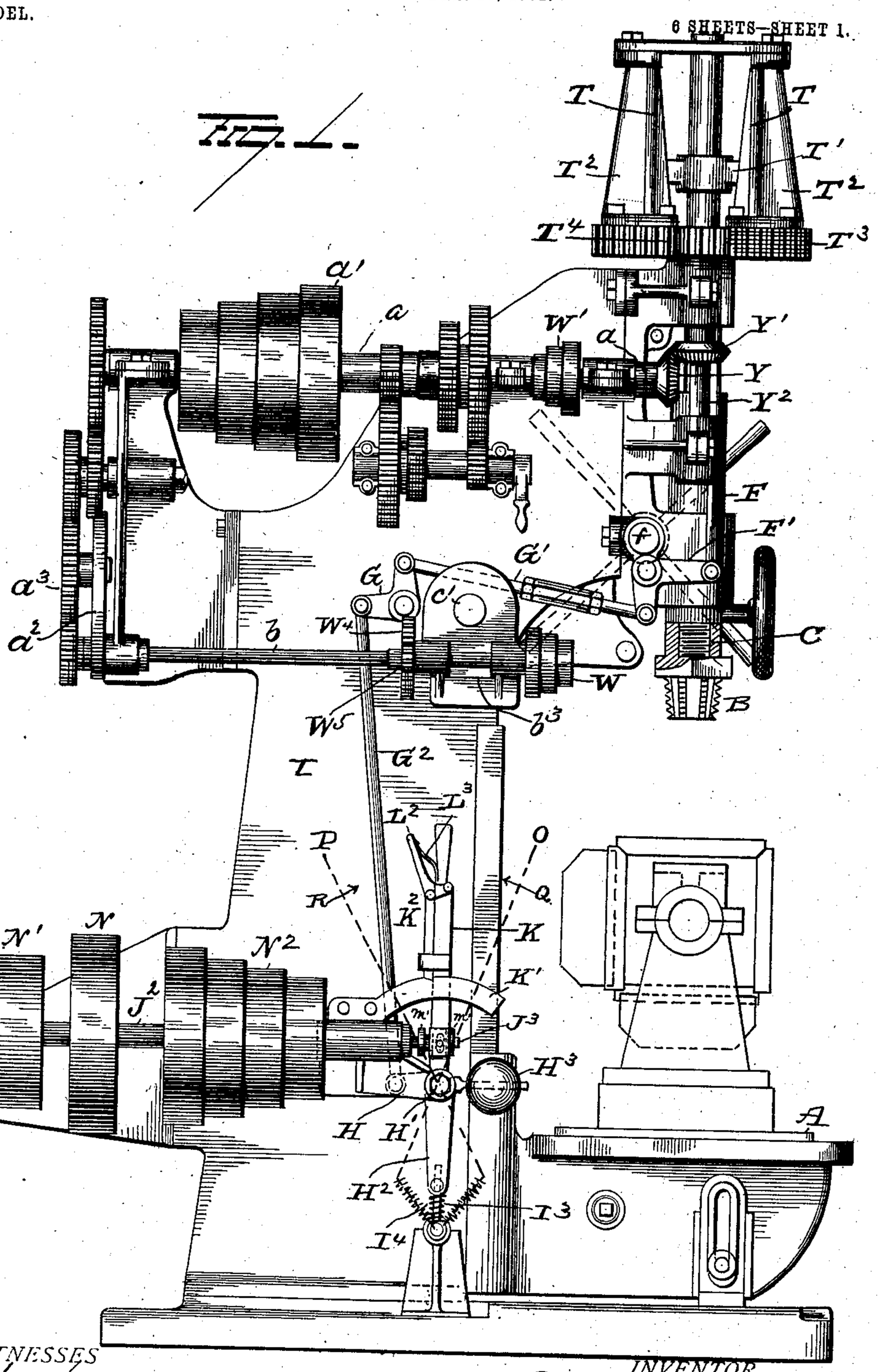
L. H. COLBURN.

UPRIGHT TAPPING AND BORING MACHINE.

APPLICATION FILED FEB. 19, 1902.

NO MODEL. 6 SHEETS—SHEET 1.

Fig. 1.



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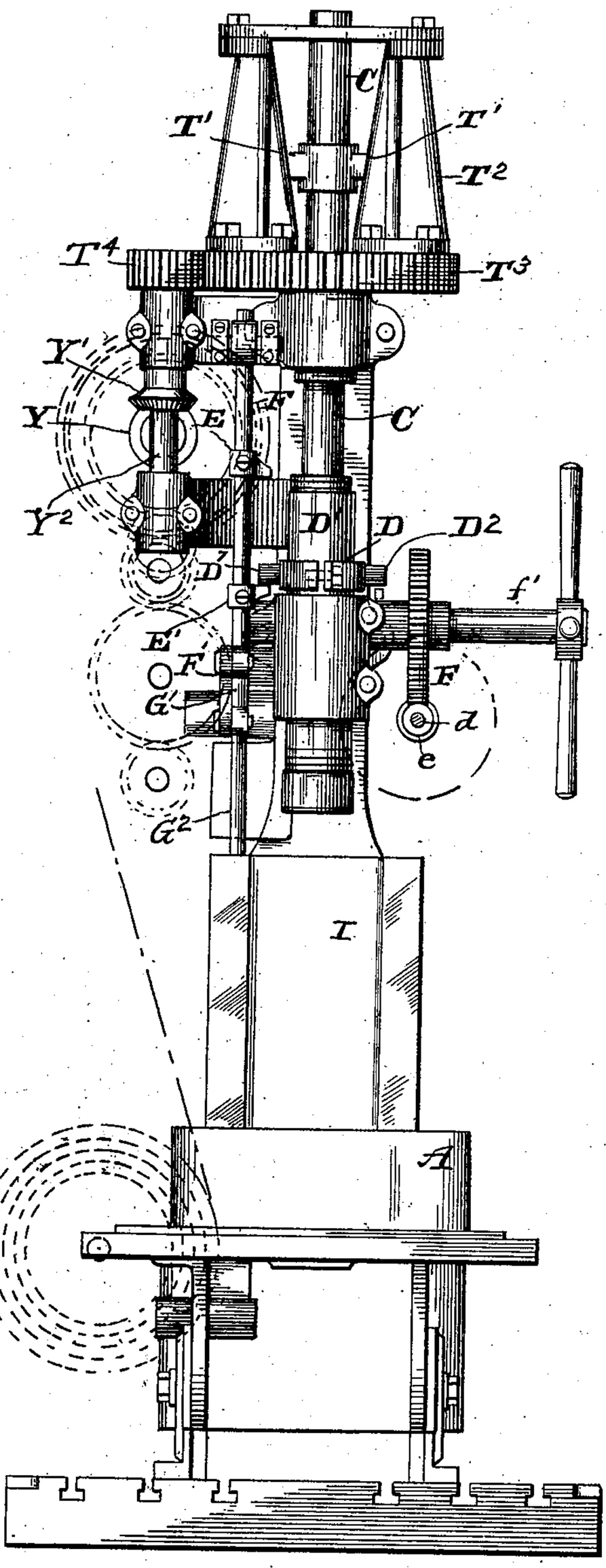

Fig. 2.

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FIG. 3.

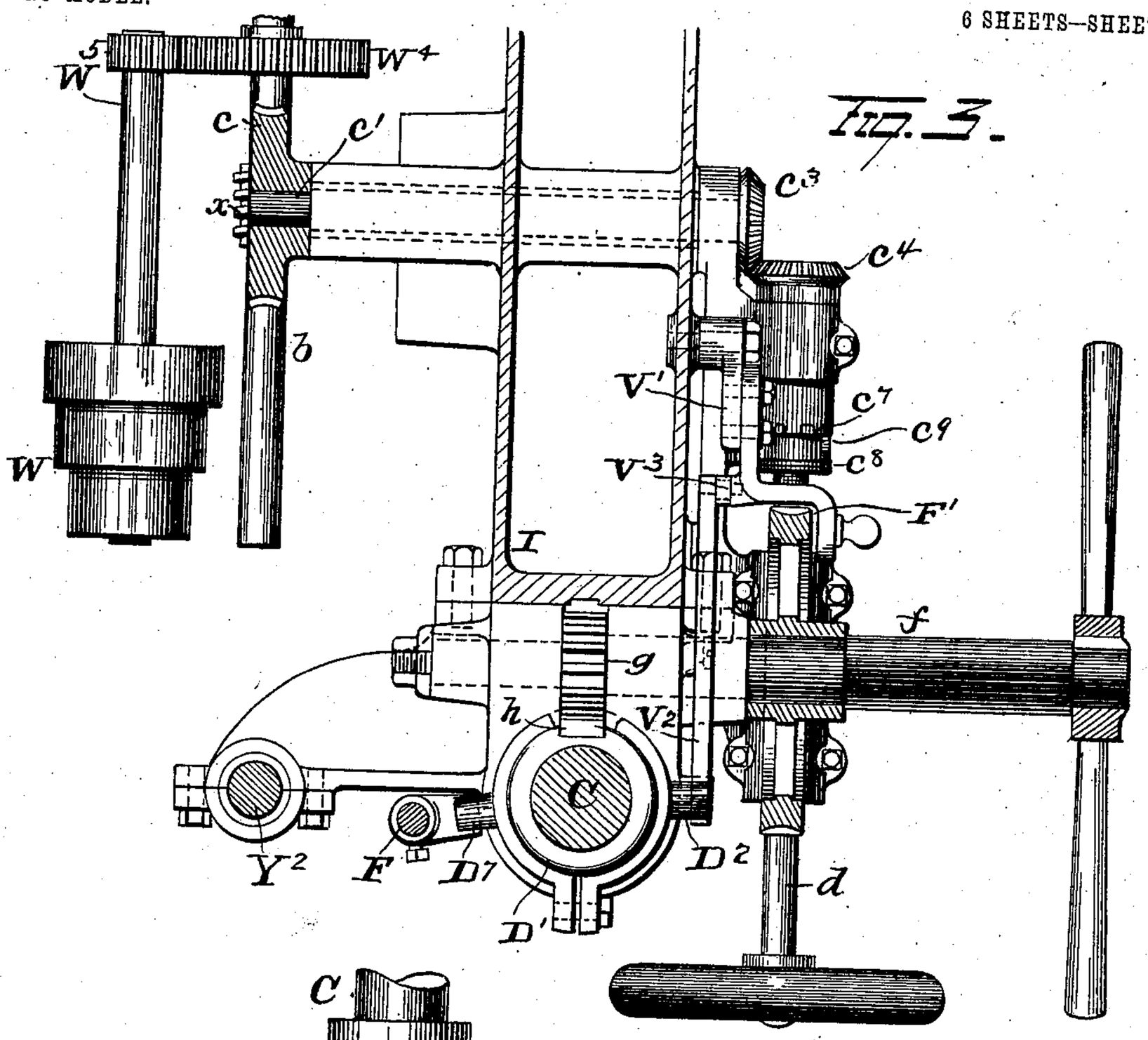
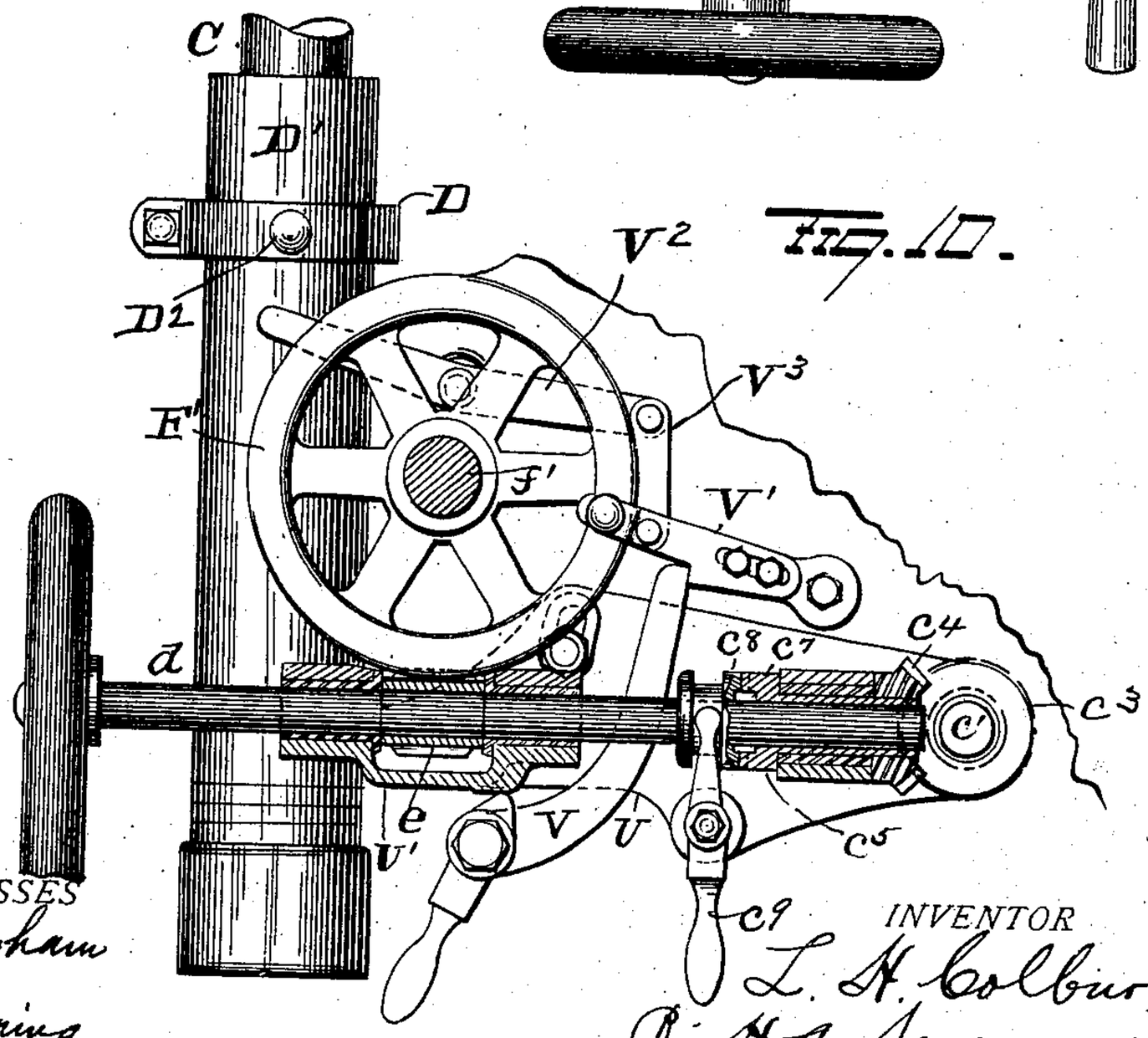


FIG. 10.



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NO MODEL. 6 SHEETS—SHEET 4.

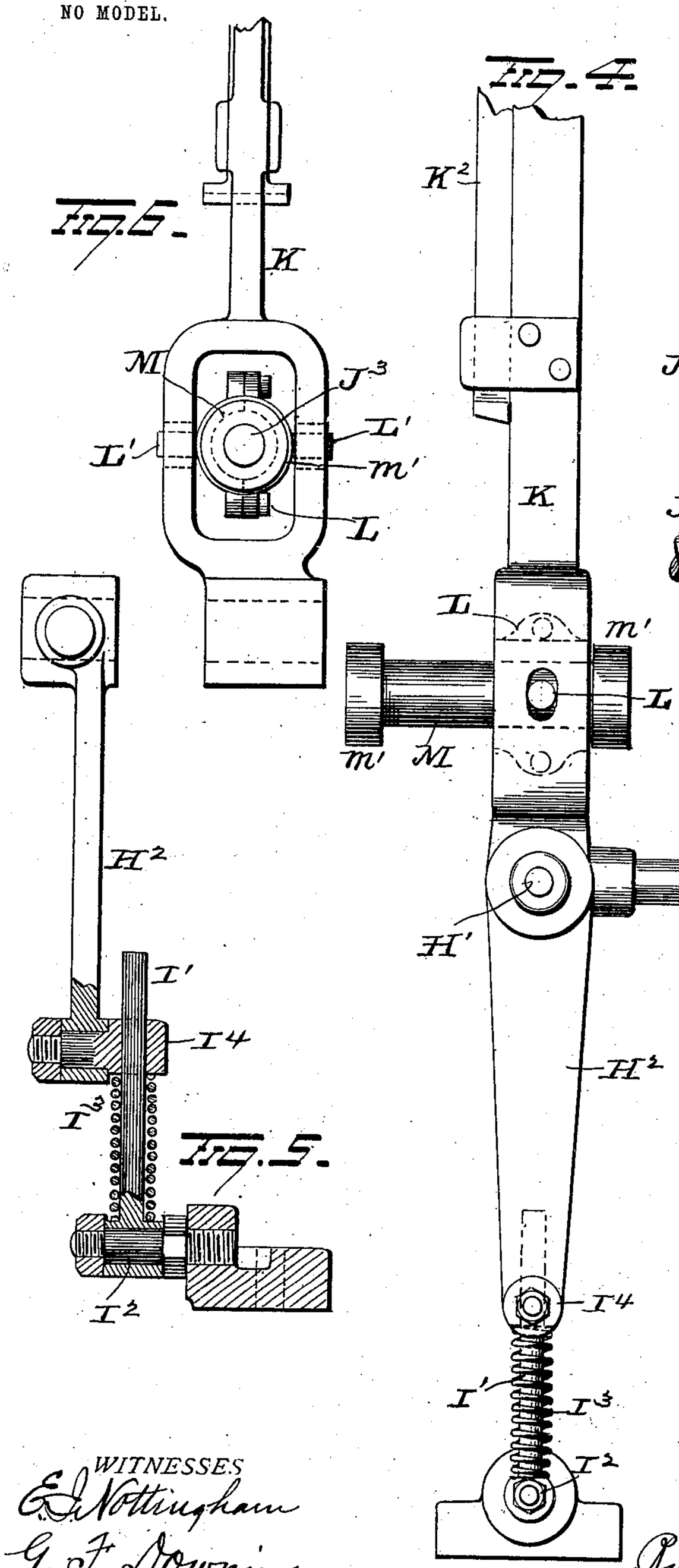

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

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NO MODEL. 6 SHEETS—SHEET 5.

Fig. 11.

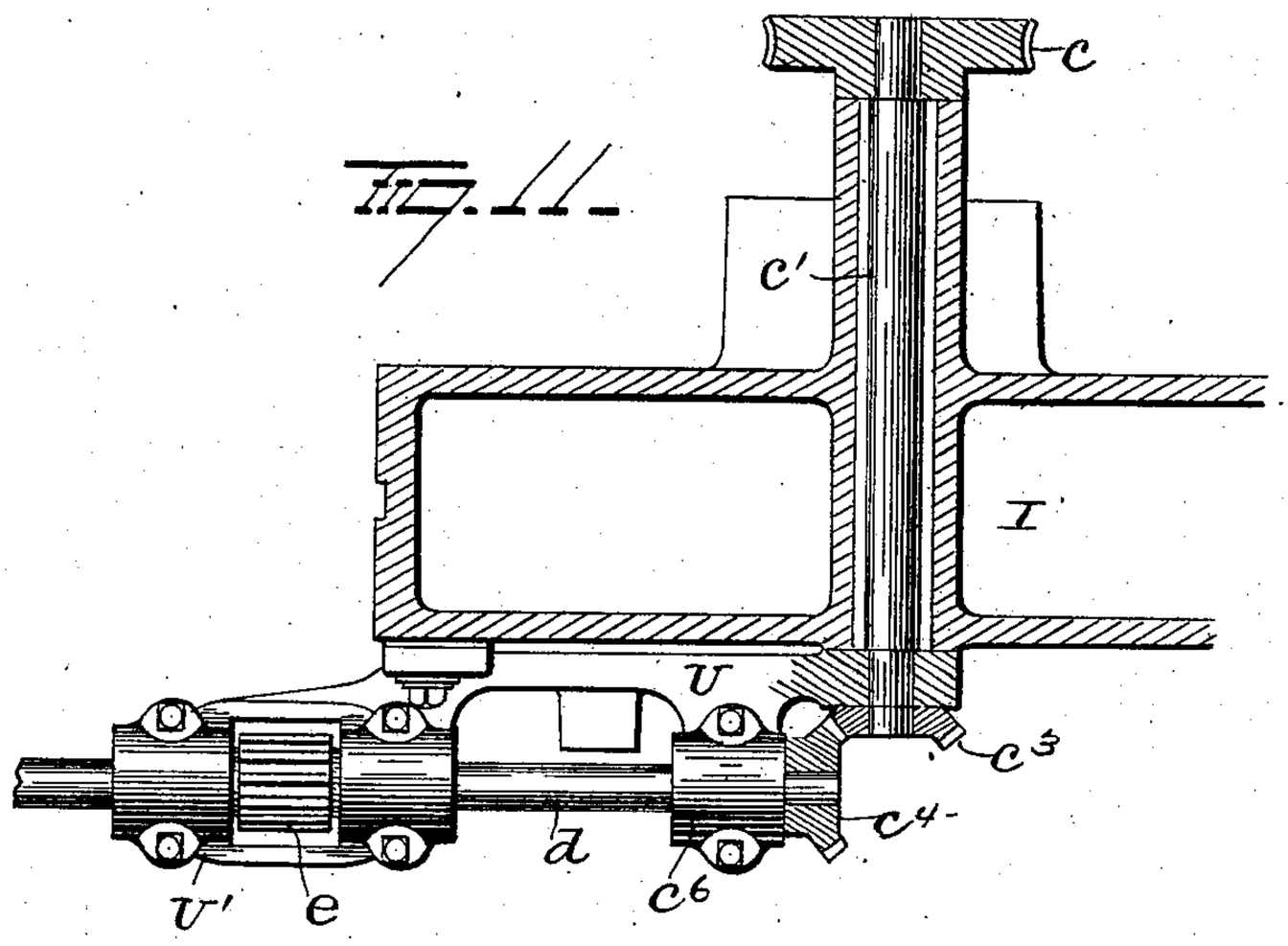
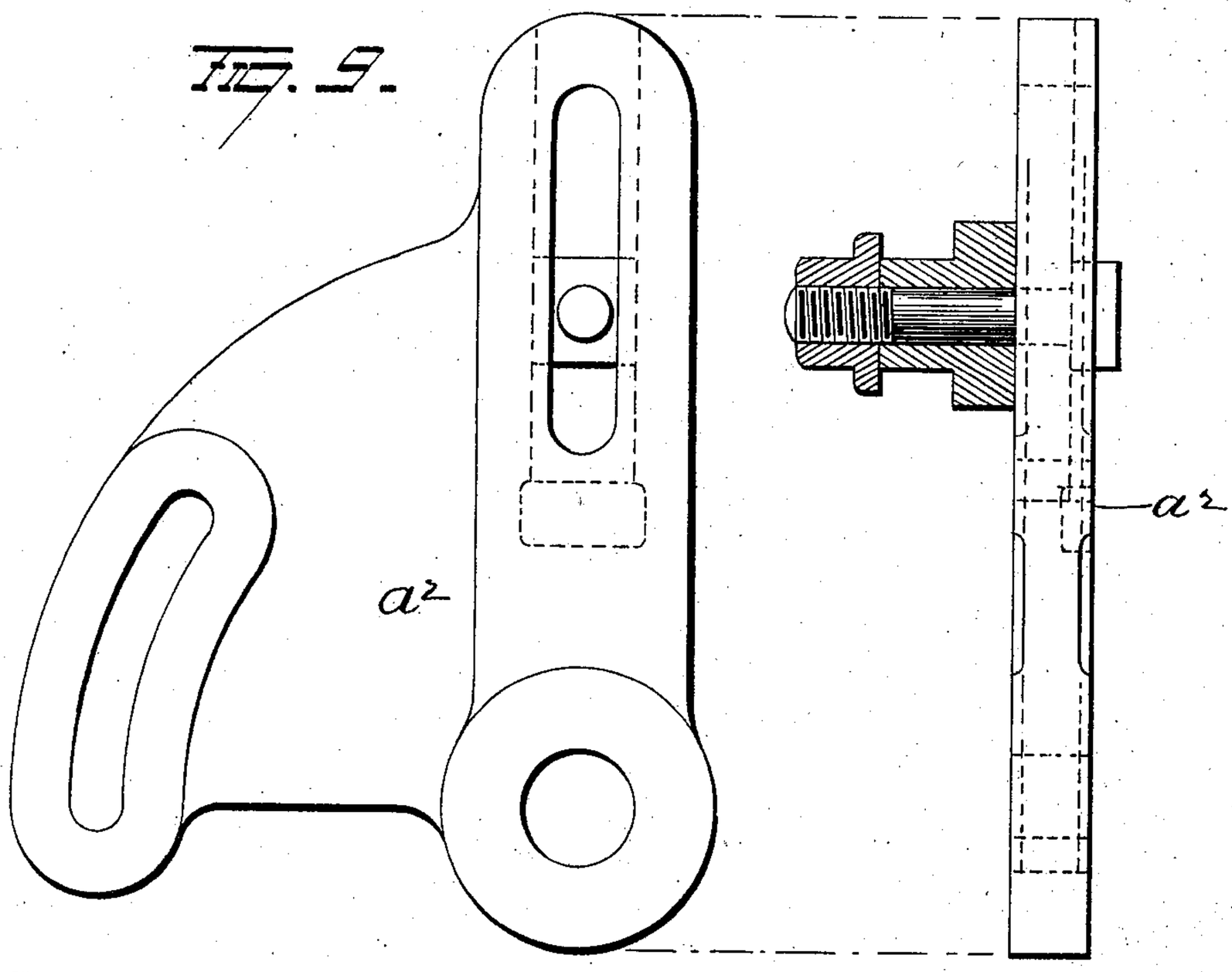


Fig. 9.



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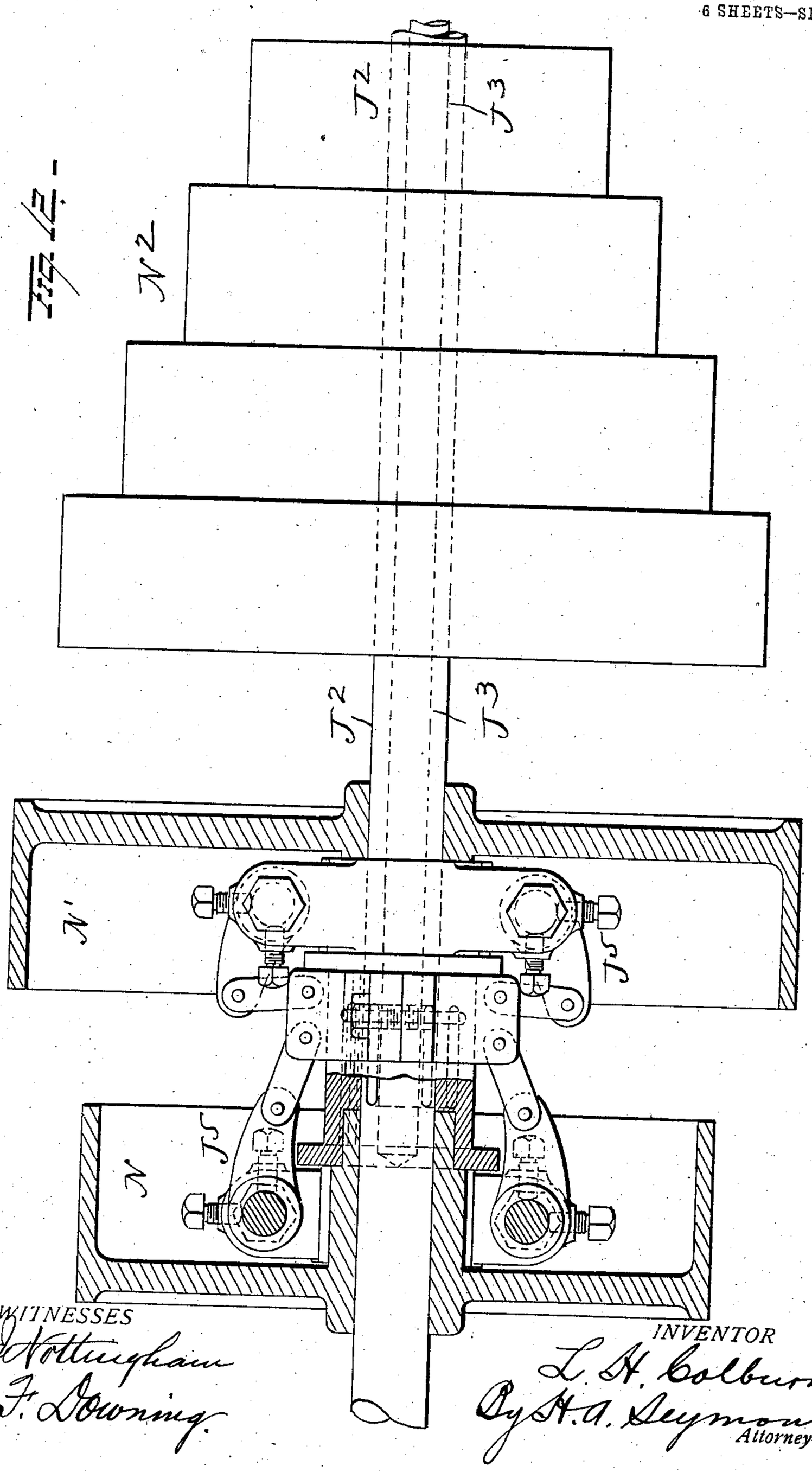
NO MODEL. 6 SHEETS—SHEET 6.



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No. 742,291. Patented October 27, 1903.

UNITED STATES PATENT OFFICE.

LESLIE H. COLBURN, OF FRANKLIN, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO BAKER BROTHERS, OF TOLEDO, OHIO.

UPRIGHT TAPPING AND BORING MACHINE.

SPECIFICATION forming part of Letters Patent No. 742,291, dated October 27, 1903.

Application filed February 19, 1902. Serial No. 94,762. (No model.)

To all whom it may concern:

Be it known that I, LESLIE H. COLBURN, of Franklin, in the county of Venango and State of Pennsylvania, have invented certain new and useful Improvements in Upright Tapping and Boring Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in upright tapping and boring machines, the object of the same being to provide a mechanism or machine by means of which the operations of the parts are after starting automatic in their actions, so that in tapping the tap will be automatically fed into the metal until it has reached the desired depth, where it will stop, reverse and feed out clear of the work, and finally stop altogether.

A further object is to provide means for feeding the spindle independently of the regular feed for drilling or boring, so that the feed will correspond to the same number of threads per inch as the tap, and thus prevent the tap from stripping or spoiling the threads, as would frequently happen if the tap were depended upon to do its own feeding.

With these ends in view my invention consists in the parts and combinations of parts, as will be more fully described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in side elevation of my improved machine. Fig. 2 is a view in front elevation, parts of the mechanism being omitted. Fig. 3 is a view in transverse section of a part of the machine, showing the feeding mechanism. Figs. 4 and 5 are detached views of the spring mechanism for imparting final impulse to the hand-lever. Figs. 6, 7, and 8 are detached views of the devices connecting the hand-lever and clutch-shifting rod. Fig. 9 is a view of the pivoted bracket for carrying a train of gears. Figs. 10 and 11 are views in section of the feeding mechanism for the spindle, and Fig. 12 is a detail view showing the clutch mechanism.

The main frame I of the machine is preferably made in one piece with projecting brackets or bosses, to which are secured the separable parts which carry shafts and other movable parts of the machine.

The main spindle C is mounted in the machine vertically above the table A, which supports the work, the latter being held in proper position on the table by any suitable device, such as a chuck, vise, or clamp or bolts. This spindle carries the tap B or boring-tool, as the case may be, and surrounding the spindle and held thereon against endwise movement is the sleeve or quill D′. Clamped to this quill D′ is the collar D, having a projection D^2 on one side for tripping the spindle feed when used for drilling or boring, as will be more fully described later on. This clamp-collar D has another projection D′ on its opposite side, which engages with the two collars E and E′ on the intermediate upright sliding rod F. This sliding rod is pivotally connected at its lower end with the bell-crank lever F′, and the latter is connected to bell-crank lever G by means of the extensible or adjustable rod G′. A longer rod G^2 connects bell-crank lever G to crank H, which latter is keyed rigidly to stud H′, mounted in a suitable bearing carried by the frame of the machine, and to this same stud H is keyed bell-crank lever H^2, which carries a weight H^3 on the arm thereof, which extends horizontally forward.

Mounted in the lower end of the vertical arm of the bell-crank H^2 is the movable stud I^4, which is enlarged at its outer end and provided with an opening therein for the passage of the pin or rod I′, which latter is fitted so as to slide freely therein. The lower end of pin I′ is enlarged for the passage of the stud I^2, which latter is screwed into a bracket, as shown in Fig. 5.

Embracing the rod I′ between the studs I^4 and I^2 is the coiled spring, which is of such length that when the pin or rod I′ is vertical or in line with the depending arm of the crank H^2 the spring is under tension or is compressed, and hence is in a condition to throw the bell-crank H^2 when the depending arm thereof is moved to either side of the dead-center. When the depending arm of the bell-crank H^2 and the pin or rod I′ are in line, the spring, although compressed to a great degree, does not exert any force tending to

move the bell-crank H^2 on its bearing-stud H'; but as soon as the alinement of these two parts is broken the bell-crank will be moved by the spring toward either of the positions represented by the dotted lines O and P in Fig. 1.

Mounted in suitable bearings at the side of the machine is the shaft J^2. This shaft is hollow throughout the whole or a portion of its length and carries a pair of friction-pulleys N and N' or equivalent gear-wheels and the cone driving-pulley N^2. Located within the hollow shaft J^2 and projecting therefrom at the front end is the shifter-rod J^3. This shifter-rod is connected at its rear end by any suitable means with clutches J^5 of any approved construction, which engage the pulleys N and N' for locking them to and releasing them from shaft J^2. Pulley N is the forward or feeding pulley, while pulley N' is the reversing-pulley, and both are coupled up to shaft J^2 by said clutches, so that when one is locked the other is released, and when the shaft J^2 is in an intermediate position both clutches are released.

The front or projecting end of rod J^3 carries a sleeve M, securely fastened thereto, the said sleeve being provided at its opposite ends with flanges m', (shown in Figs. 7 and 8,) which form abutments for the sliding collar L, mounted on said sleeve. This collar L is made in two parts, as shown in Figs. 6 and 8, to enable it to be readily assembled on the sleeve between the abutment or end flanges thereon and is of considerably less width than said sleeve, so as to permit of a sliding movement thereon between the end flanges or abutments. The collar L thus constructed and mounted is connected by the pintles L' thereon with the shifting-lever K, as clearly shown in Figs. 1 and 6. This lever K is keyed rigidly to stud H', passes upwardly between segments K', and terminates at its upper end in a handle and is provided at its upper end with a finger-lever L^2, carrying the locking-bar K^2, which latter is designed to engage a notch in the segments K' and prevent the upper end of lever from moving forwardly when the locking-bar is in the notch, the said locking-bar K^2 being normally held against the segments by the spring L^3, carried by the lever K and engaging the finger-lever L^2.

When the lever K is in a perpendicular position, as shown in full lines, Fig. 1, the clutch-pulleys are both disengaged from the shaft J^2 and the machine is at rest. When the parts are in these positions, the locking-bar rests in the notch in segments K', and the spring L^2 above acting thereon holds the parts rigidly in position. By simply disengaging the locking-bar from the segments K' the lever K will be free to be moved either forward or backward, carrying the shipper-rod J^3 with it, thus permitting the machine to be started, stopped, or reversed at will. The operation of this portion of the machine is as follows: The work to be operated upon is securely clamped by a chuck or other means upon the table A, after which the clamp-collar D should be adjusted on the quill or sleeve D', so that it will through its engagement with the collar E' upon the rod F actuate the reversing mechanism at the exact moment when the tap B has reached the desired depth, the actual contact between clamp-collar D, with collar E' on rod F, taking place some time before the actual stopping or reversing of the machine. As the spindle carrying the tool feeds downwardly the point is reached when the downward pressure on rod G^2 shifts or turns stud H' sufficiently to break the alinement of the depending arm of the bell-crank lever H^2 and the rod I', thus causing the lever K to move in the direction of the arrow Q, carrying with it the collar L, and as the collar L is considerably narrower than the sleeve M between the flanges m and starting from the extreme front or right-hand side, with the clutch-locking driving-pulley N clutched to shaft J^2, (which is the position of the parts when the machine is started,) the collar will travel some distance on collar M before it engages the opposite flange. Until this contact takes place there will be no movement of the shifter-rod J^3, and the machine will continue its forward movement until said rod has been shifted rearwardly to disconnect the forward pulley and couple up the reverse-pulley. At the start the lever K occupies a position illustrated by the dotted line O in Fig. 1, while the depending arm of bell-crank lever H^2 projects rearwardly, and held so by the spring I^3. As the lever K is forced over in the direction of the arrow Q the spring I^3 will be compressed until it stands perpendicularly or in alinement with the depending arm of bell-crank H^2. With the mechanism properly adjusted the collar L will not make contact with the rear flange of sleeve M until the lever K has passed the central position. As soon as the lever K, or rather the depending arm of bell-crank H^2, passes the perpendicular the spring I^3 exerts its energy and quickly throws the lever K over into the position indicated by line P in Fig. 1. The contact between the collar L and sleeve M on the shifting-rod J^3 moves the latter rearwardly, thus disengaging pulley N from shaft J^2 and clutching the reversing-pulley N', which operates to reverse the machine. As pulley N' is driven at a higher rate of speed than pulley N, the spindle is quickly reversed and the tap fed out of the work until it has reached a position where the work can be removed or its position changed without contacting with the tap. This reverse movement of the parts continues until the collar D on spindle makes contact with the stop or collar E on rod F, the said stop or collar E being so adjusted as to engage the collar D at the proper time for stopping the machine. As the shifting mechanism is reversed, as previously explained, and

the lever K moved in the direction of the arrow R, (see Fig. 1,) the parts are then so located that the collar L travels forwardly some distance on sleeve M before it contacts with the front or forward flange of the latter, which, as previously explained, actuates the shifter-rod J^3. This rod then moves forwardly until the locking-bar of the lever K engages the notch in the segment K', and when the parts are in these positions both clutches are disengaged from their pulleys N and N' and the machine comes to a stop. The notch is so shaped that it offers no resistance or obstruction whatever to the rearward movement of the lever K, but obstructs it on its forward movement at the time when the clutches are disconnected from the pulleys N and N'. To start the machine again, it is simply necessary for the operator to disengage the locking-bar K^2 and give the lever a slight pull forward, and after it has passed beyond the perpendicular the spring I^3 exerts its pressure and completes or materially assists in completing the throw, which movement, as before explained, clutches up the forward or feed pulley N and starts the machine. In the movements of the bell-crank lever H^2 the weight H^3 merely acts as a balance to offset the weight of the parts on the other side, so as to balance the moving parts.

The main spindle C, which carries the boring-tool or tap, is provided at its upper end at a point above the frame of the machine with a cross-bar T' or head adjustably or slidingly secured thereto by a key. The ends of this cross-bar rest and travel in slideways T, formed in brackets T^2, which latter are secured at their lower ends to the driving gear-wheel T^3, loosely embracing the spindle C and mounted on or in a suitable bearing carried by the top of the machine-frame I, the said brackets being connected together at their top by a suitable yoke. The driving gear-wheel T^3 meshes with the smaller pinion on shaft T^4, and motion is imparted to the latter through the drive-shaft *a*. The object in applying power to the spindle C through a cross-head secured thereto instead of through a gear-wheel secured directly to the spindle C is to reduce the strain to a minimum. In devices wherein the spindle is driven by means of a gear keyed directly to the shaft (the usual manner of driving drill-presses) the strain in heavy work is so excessive that the keys soon wear out; but I find in practice that with the construction shown this objection is to a large extent obviated, as the thrust is taken on nearly the same periphery as the teeth of the large gear, which practically eliminates the excessive friction which always occurs when the thrust is taken on a feather or key inside of the hub of the gear.

This machine has two methods of feeding the main spindle—one by means of a belt for such work as drilling and boring and another by means of gears, which latter give a positive feed that cannot slip. This latter is used for tapping, and by means of same any lead corresponding to the thread of the tap can be obtained by changing one gear for each lead, and all the ordinary leads from four to fourteen can be obtained in this manner.

The driving cone-pulley *a'* is mounted on shaft *a*, which imparts movements to the spindle. This cone-pulley *a'* receives its motion through a belt from cone-pulley N^2 and imparts it to the spindle, either by belt or gearing, as previously stated. The gearing comprises a train of pinions from shaft *a* to shaft *b*. One of these pinions a^3 is mounted on a swinging bracket a^2, and by removing this pinion and substituting another and then moving the bracket to a position where the substituted pinion engages its coacting pinions the lead will be changed.

The shaft *b* has secured to it a worm *x*, located within the casing b^3. (Shown in Fig. 1.) This worm engages a worm-gear *c*, (shown in Fig. 11,) fast on shaft *c*, which latter passes transversely through the frame of the machine and is provided on its opposite end with a bevel-pinion c^3, which engages a similar pinion c^4 on sleeve c^5. This sleeve is mounted in bearing c^6 and is provided at its front end with clutch-teeth c^7, which are designed to be engaged by the sliding clutch c^8, mounted to slide on shaft *d*. This clutch c^8 is actuated by hand-lever c^9 and operates to lock pinion c^4 to the shaft *d*. Shaft *d* also carries the worm *e*, which meshes with the worm-gear F', secured to the shaft *f'*, which also carries the pinion *g*, which directly engages the rack *h* on the quill or sleeve D', which, as previously stated, embraces the spindle, but is restrained against longitudinal movement thereon. The shaft *d* is supported at its front end in the tipping-box U, which latter is carried by the tipping-box frame U', pivoted at its rear end on shaft *c'*. This tipping-box is normally supported and sustained with the worm *e* on shaft *d* in contact with the worm-gear F by the lever V, which latter is pivoted to the frame of the machine below the tipping-box and extends upwardly in a position to be engaged by the latch V', also pivoted to the machine-frame. The forward end of latch V' is connected to lever V^2 by a link V^3, and the forward end of lever V^2 rests in a position to be engaged by the projection on collar D^2, which, as previously explained, is carried by the quill or sleeve on the spindle.

When the machine is used for tapping, the collar E' (the lower one on rod F) is adjusted so that the clamp-collar D engages with it and reverses the machine before the collar D contacts with the lever which trips the worm *e* on the shaft *d* out of mesh. Thus the mechanism can be set to operate without disengaging the worm-feed at all if it is desired to have the tap fed out by power. If it is desired to have the automatic return-feed disengaged, the collar E' can be set low enough on the rod F so that the clamp-collar D will

not engage it at all, but will trip the lever and release the worm from the worm-gear. The machine could then be reversed by hand and the tap allowed to feed out by means of its own threads.

When it is desired to use the machine for drilling and boring, the collar E′ should be set low enough on the rod F to be out of the way entirely and the reversing-gear made non-operative. This will allow the collar D to contact with the trip-lever at the desired moment and release the automatic feed.

Either the belt or gear feed can be used for boring, and the automatic stop will operate with either.

This construction of screw-shaft, screw tipping-box, and lever for holding same are fully disclosed in my Patent No. 599,551, dated February 22, 1898, and as the operation of these parts is fully disclosed in this patent a further specific reference to the construction or operation is not considered necessary to a full understanding of the invention herein claimed.

When it is desired to feed the spindle by means of a belt, the gearing is disconnected at the rear by simply loosening the stud which holds the bracket a^2 in place. This disconnects the shaft a from shaft b. On the front end of shaft b is secured a small cone-pulley W, which is connected by a belt to shaft a by another small cone-pulley W′. Hence with the belt in place on the cones and the gearing disconnected it will be seen that the feed of the spindle will be transmitted through the belt to shaft b and from the latter to the spindle by the mechanism already described. Secured on shaft b is a pinion W^4, which engages with a smaller pinion on parallel shaft W^5. The small cone-pulley W is designed to be secured to either the shaft b or shaft W^5, and when on the short shaft the feed is compounded and rendered more powerful and is used for taking heavy cuts. When a faster feed is wanted, the pulley is removed from shaft W^5 and placed directly on shaft b and the belt connecting the small cone-pulleys crossed. The shaft a carries the bevel-gear Y, which meshes with bevel-gear Y′, fast on the short shaft Y^2. This short shaft is suitably mounted in the frame of the machine parallel with the spindle C and carries at its upper end the pinion T^4, which latter engages the main driving-pinion T^3, which, as previously explained, rotates the spindle C, which is counterbalanced by a weight in the ordinary manner.

With the machine as above described the motions of the several parts are after starting entirely automatic in their operation, thus permitting the operator after he has started one machine to leave it and give his attention to others. These automatic devices stop the tap when it has reached a predetermined depth, reverse the direction of rotation of the spindle, feed the tap out of the work, and then stop the machine.

It is evident that many slight changes and alterations might be resorted to in the relative arrangement of parts herein shown and described without departing from the spirit and scope of my invention. Hence I would have it understood that I do not wish to confine myself to the exact construction herein shown and described; but,

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

1. The combination in a boring and tapping machine, of a driving-shaft, reversing mechanism for said shaft, a hand-lever for actuating said reversing mechanism, devices actuated by a moving part of the machine for imparting initial impulses to the hand-lever, spring mechanism for continuing the movements of said lever, and means for automatically locking the lever in a position with both clutches disconnected, after the machine has completed one full movement of its parts.

2. The combination in a boring and tapping machine, of a driving-shaft, reversing mechanism thereon, a longitudinally-movable rod for actuating said reversing mechanism, a flanged sleeve on said rod, a collar constructed to slide on the sleeve between the flanges, a hand-lever connected to said collar, means connecting a moving part of said machine with the hand-lever for imparting initial impulse thereto and spring mechanism for continuing the movements of said lever.

3. The combination in a boring and tapping machine, of a driving-shaft having loose pulleys thereon, clutches for said pulleys, a sliding rod having a flanged sleeve thereon, a sliding collar on said sleeve, a hand-lever connected to the sliding collar, an arm movable with the lever and projecting below the axis of the latter, a spring arranged with its long axis in line with the long axis of the lever and arm, when the latter are perpendicular, and means connecting said lever and a movable part of the machine whereby initial starting movement is imparted to the lever.

4. The combination in a boring and tapping machine, of a hand-lever fixed to a stud, a bell-crank lever also fixed to said stud and provided with a forwardly-projecting arm carrying a weight, and a depending arm arranged in line with the hand-lever, a spring arranged with its long axis in line with said lever and arm when the latter are perpendicular, a driving-shaft, reversing mechanism thereon, a sliding rod connecting said reversing mechanism and the hand-lever, and mechanism connecting the latter and a moving part of the machine, whereby initial starting movement is imparted to the hand-lever.

5. The combination in a boring and tapping machine, of a driving-shaft having reversing mechanism thereon, shifting-rod for the reversing mechanism, a hand-lever and a bell-crank lever fixed to a pivoted stud, a sliding connection between the hand-lever and the shifting-rod whereby the former can move

a limited distance without transmitting its movement to the latter, a weight on the bell-crank lever, spring mechanism substantially as described connected to the depending arm of said bell-crank lever, and a spindle and intermediate means actuated by the spindle for rocking the pivoted stud.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

LESLIE H. COLBURN.

Witnesses:
H. W. BRECKENRIDGE,
W. E. BARROW.