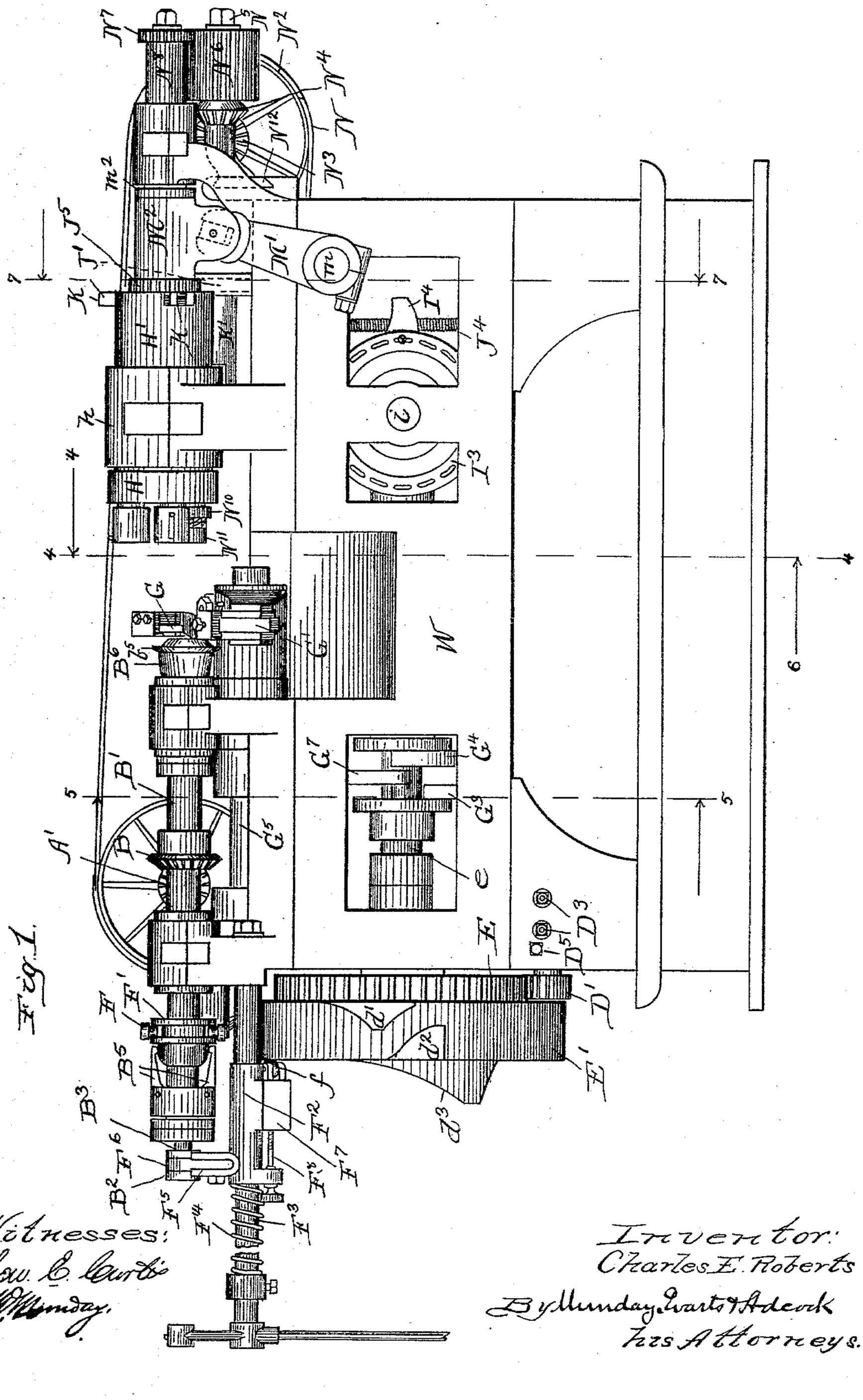
(No Model.) 6 Sheets—Sheet 1.

C. E. ROBERTS.

MACHINE FOR CUTTING SCREWS.

No. 552,969. Patented Jan. 14, 1896.



Witnesses:
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Inventor:
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His Attorneys.

(No Model.) 6 Sheets—Sheet 2.

C. E. ROBERTS.

MACHINE FOR CUTTING SCREWS.

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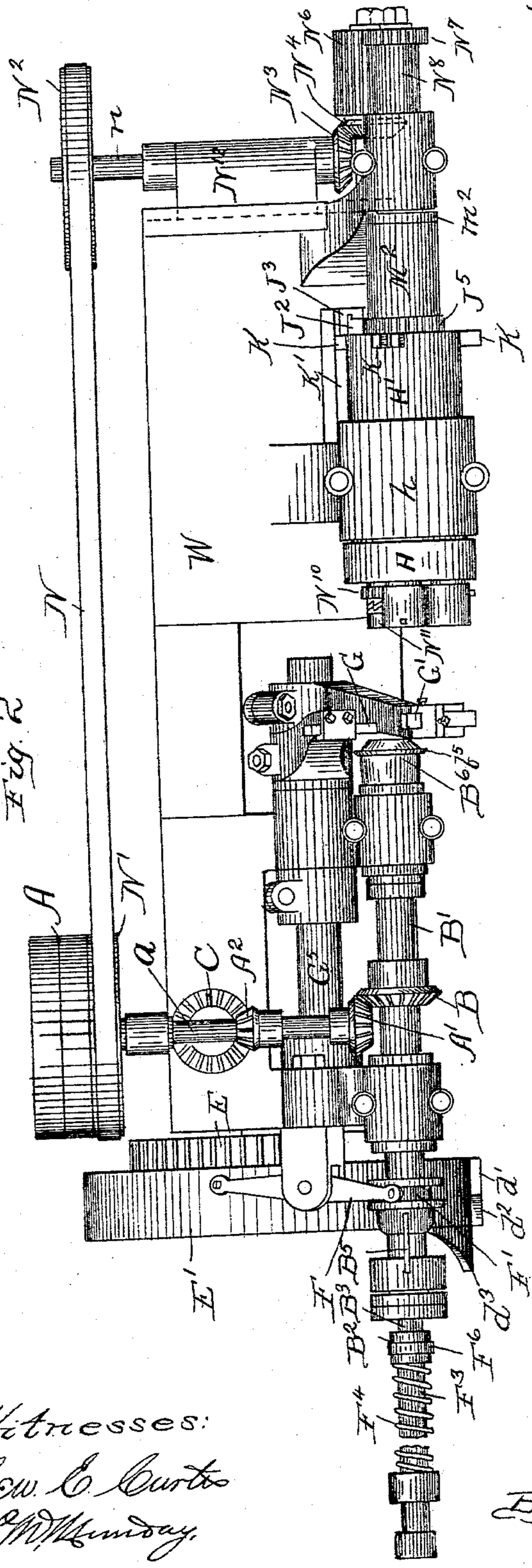

Fig. 2.

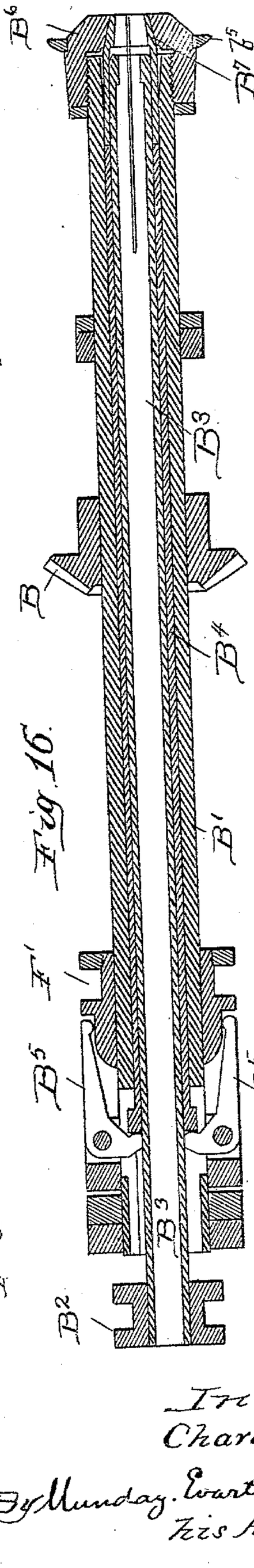

Fig. 1b.

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(No Model.) 6 Sheets—Sheet 3.

C. E. ROBERTS.

MACHINE FOR CUTTING SCREWS.

No. 552,969. Patented Jan. 14, 1896.

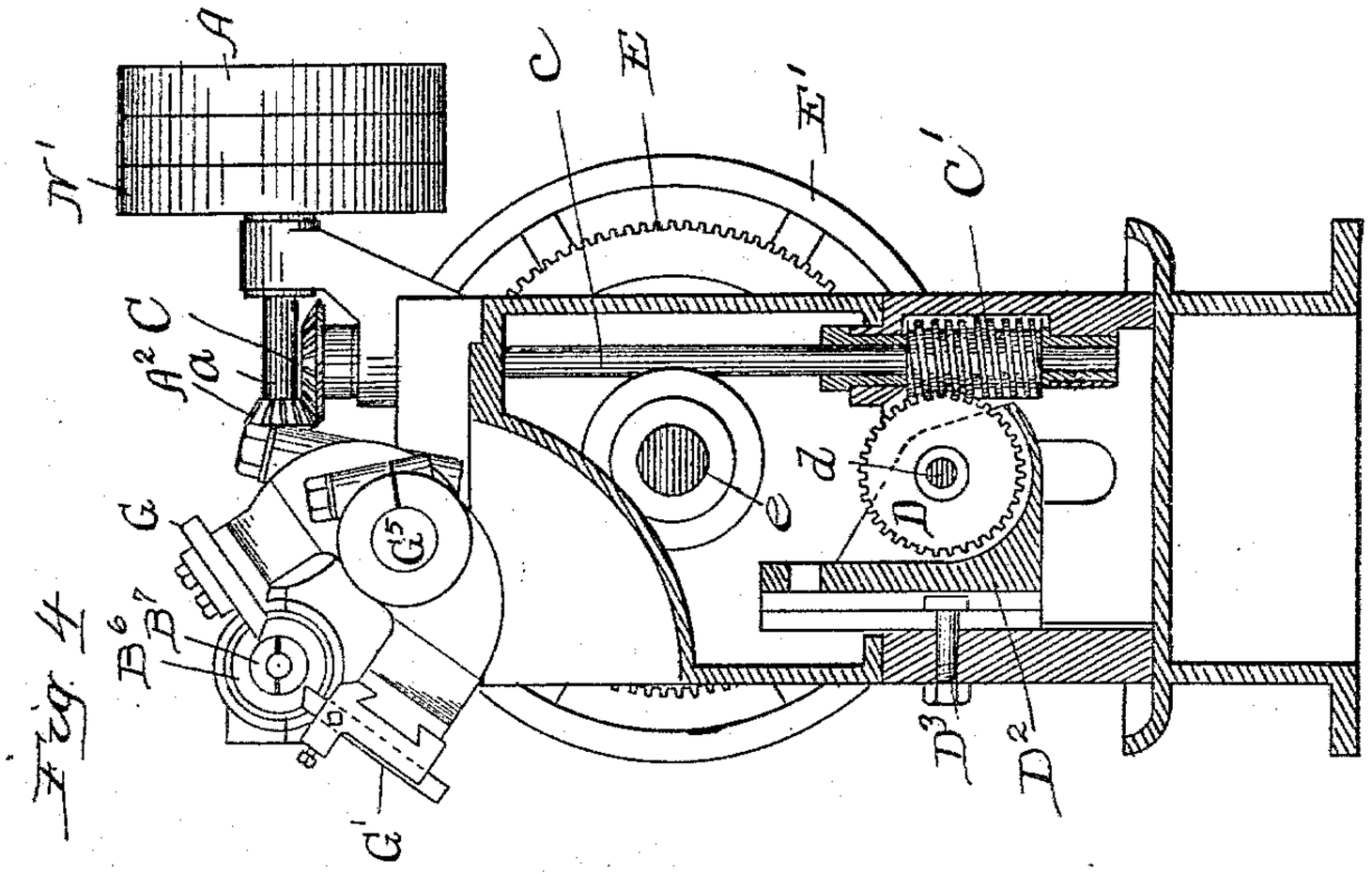

Fig. 4.

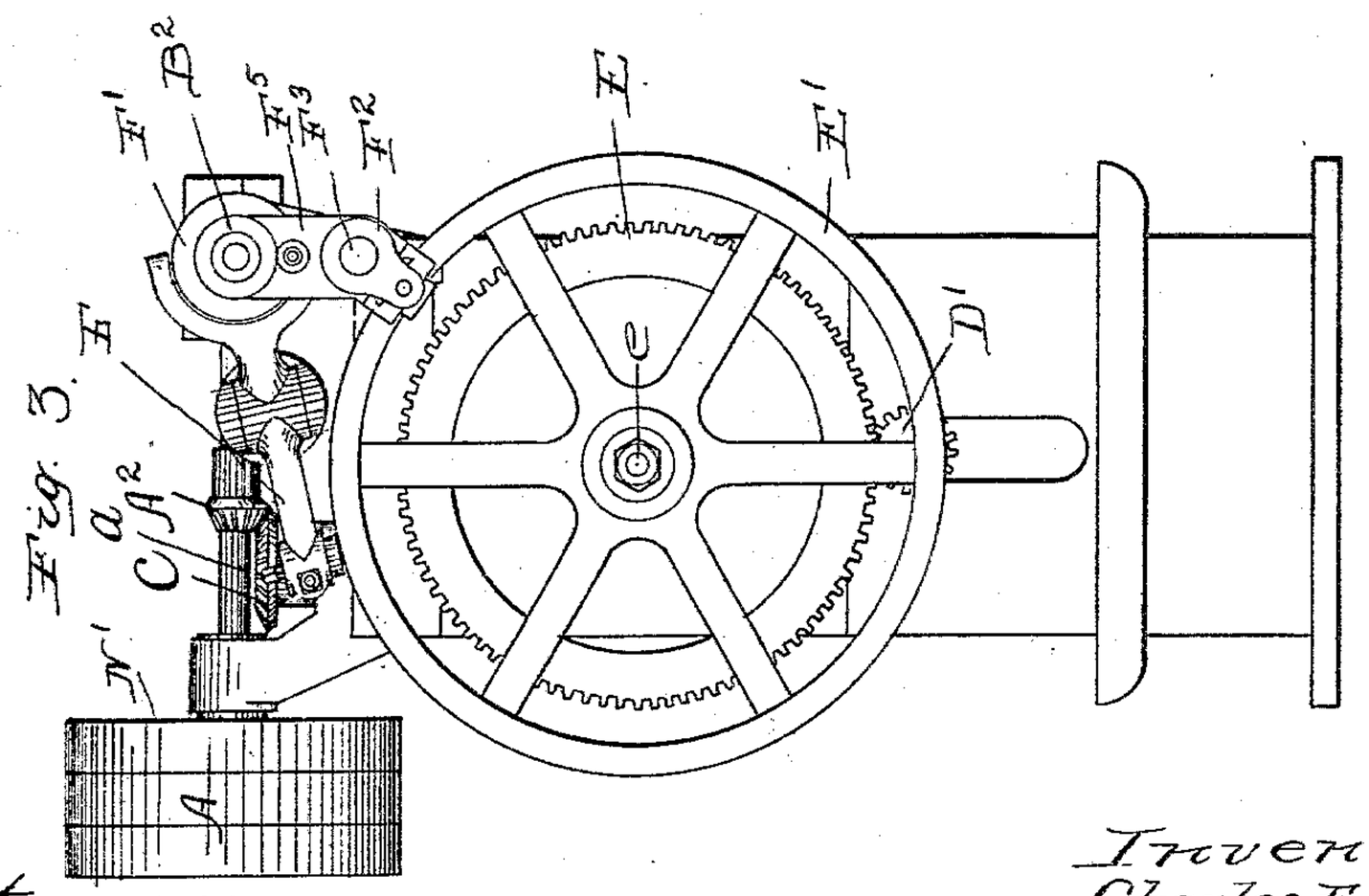

Fig. 3.

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(No Model.)

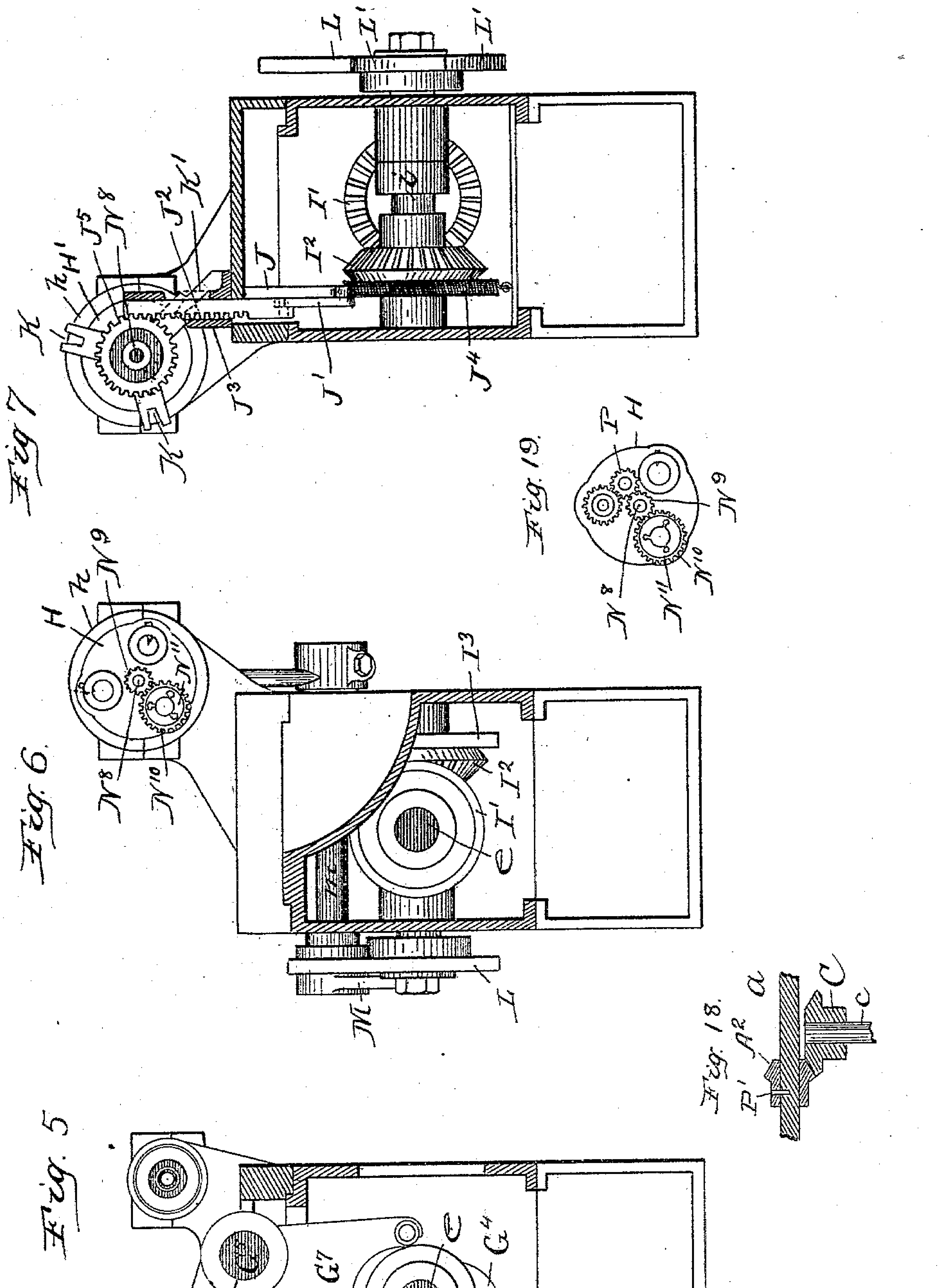
6 Sheets—Sheet 4.

C. E. ROBERTS.

MACHINE FOR CUTTING SCREWS.

No. 552,969.

Patented Jan. 14, 1896.



Witnesses:
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(No Model.) 6 Sheets—Sheet 5.

C. E. ROBERTS.

MACHINE FOR CUTTING SCREWS.

No. 552,969. Patented Jan. 14, 1896.

Fig. 9.

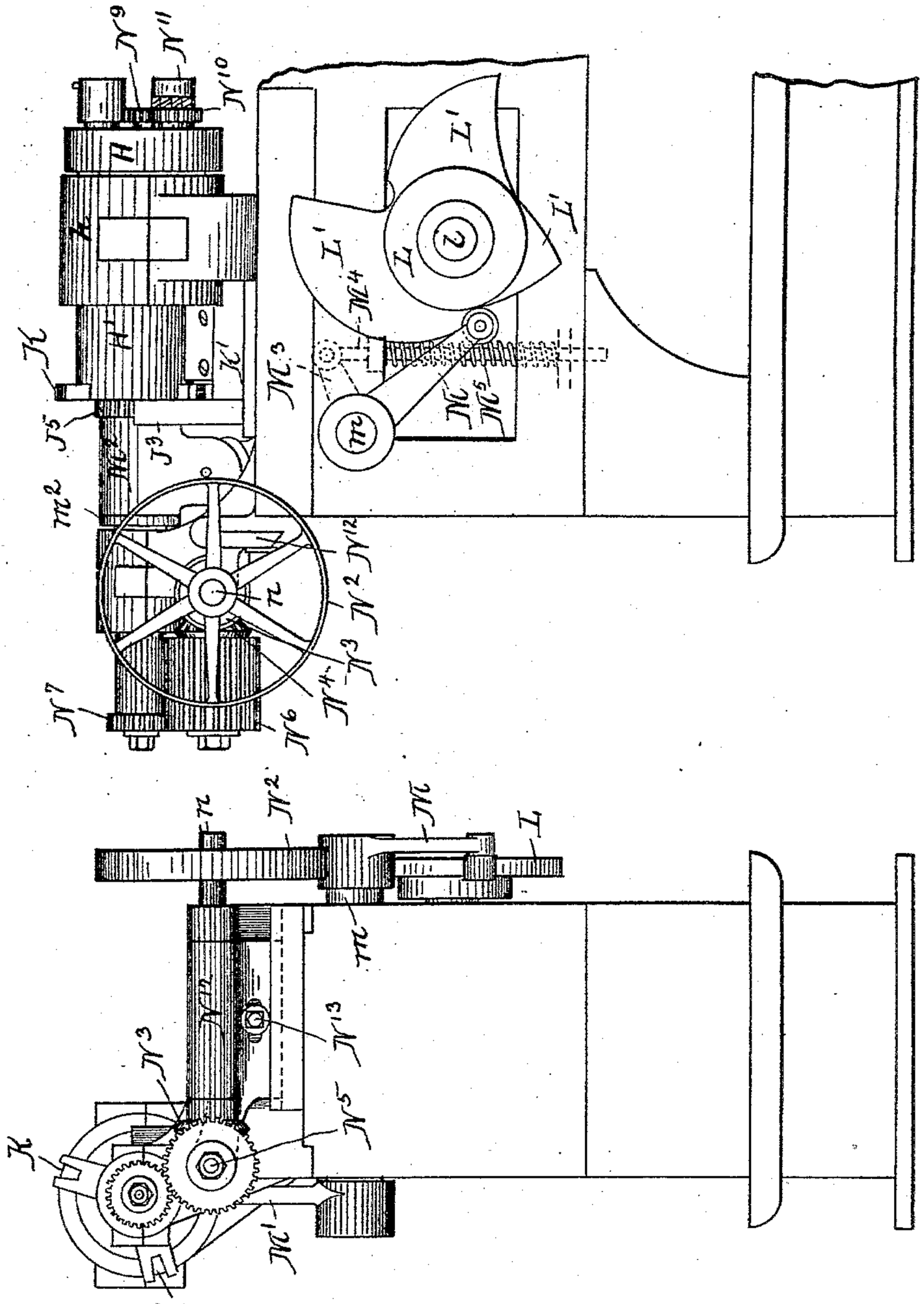

Fig. 8

Witnesses:
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(No Model.) 6 Sheets—Sheet 6.

C. E. ROBERTS.

MACHINE FOR CUTTING SCREWS.

No. 552,969. Patented Jan. 14, 1896.

Fig. 13.

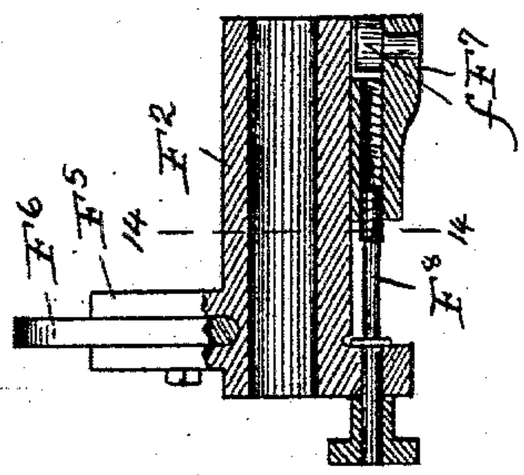

Fig. 14.

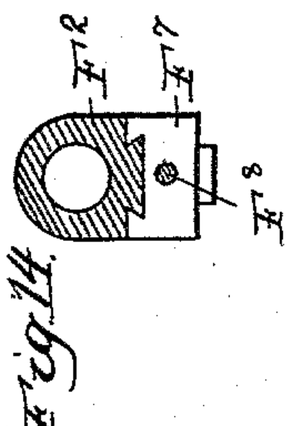

Fig. 15.

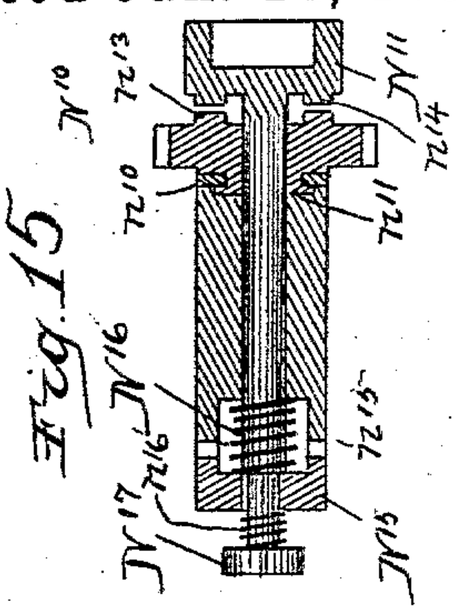

Fig. 11.

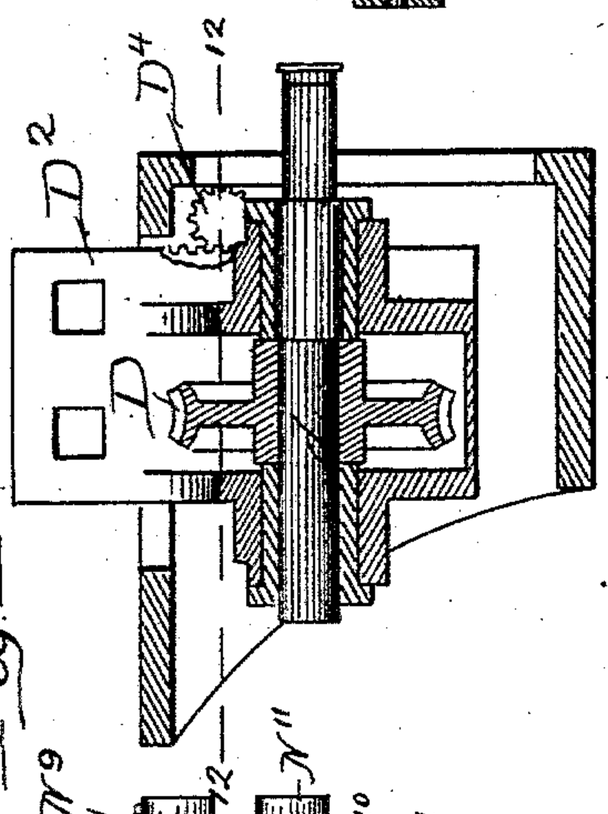

Fig. 12.

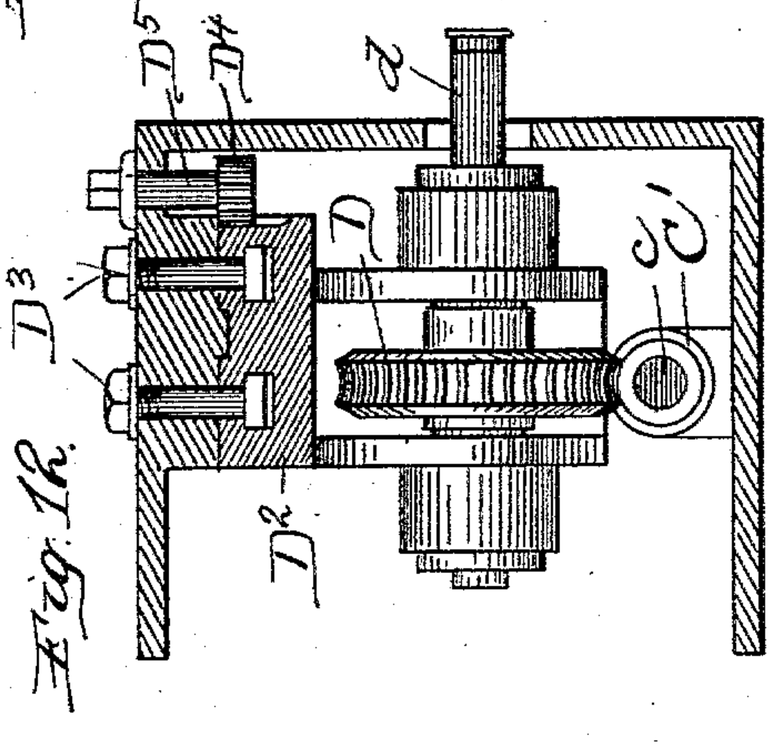

Fig. 10.

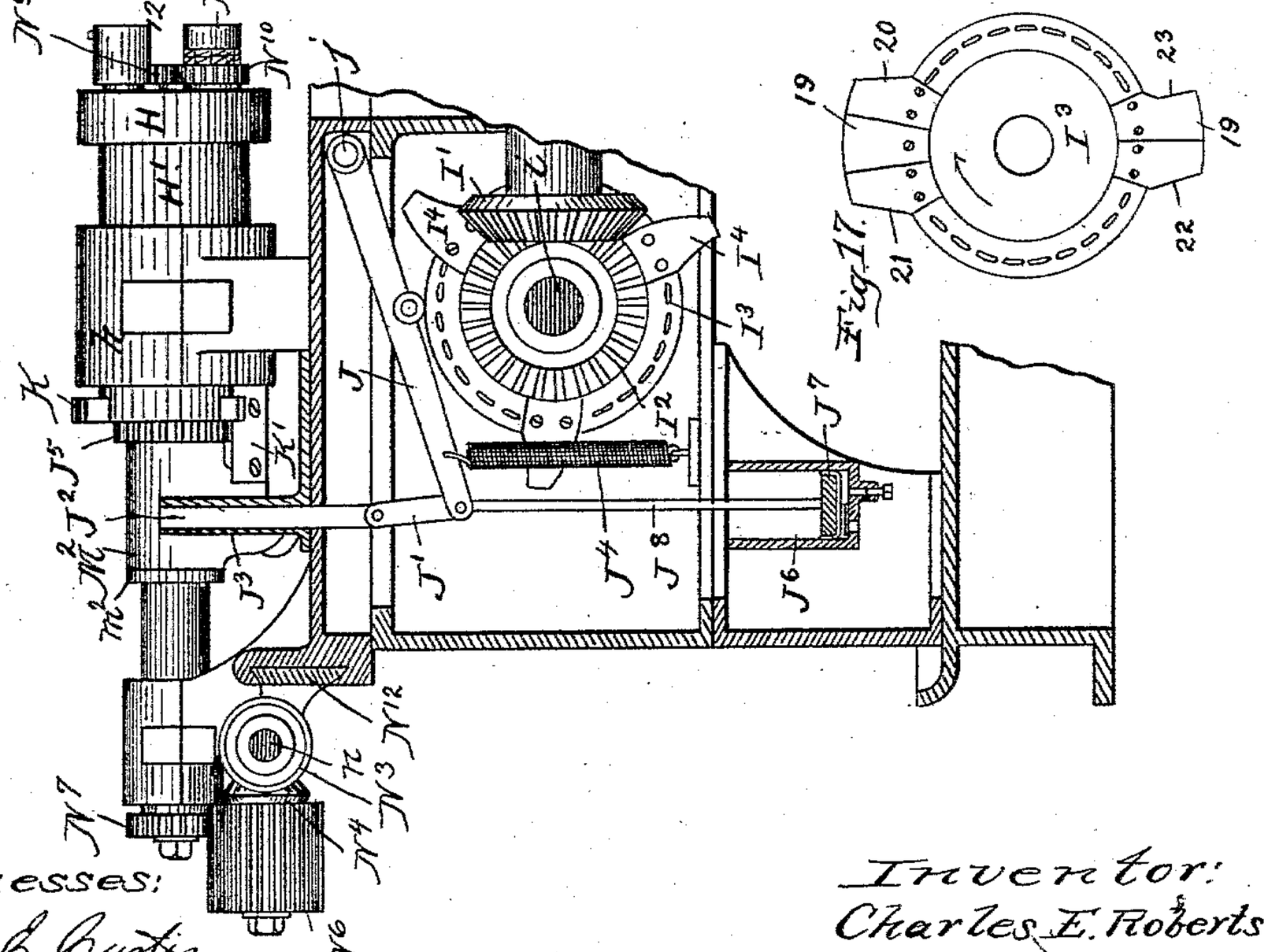

Fig. 17.

Witnesses:
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Inventor:
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By Munday, Evarts & Adcock.
His Attorneys

UNITED STATES PATENT OFFICE.

CHARLES E. ROBERTS, OF OAK PARK, ILLINOIS.

MACHINE FOR CUTTING SCREWS.

SPECIFICATION forming part of Letters Patent No. 552,969, dated January 14, 1896.

Application filed January 12, 1894. Serial No. 496,611. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. ROBERTS, a citizen of the United States, residing in Oak Park, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Machines for Cutting Screws, &c., of which the following is a specification.

This invention relates to an improved construction of machines for making various kinds of machine-screws from metal rods.

The machine is capable of doing a large variety of work and is readily changed so as to adapt it to the various sizes, pitch and styles, and one of my principal objects in the invention has been to render easy these changes. I have also endeavored to make the machine accurate in its operation, and also to obviate the difficulties present in other machines due to looseness of the parts caused by wear.

The invention consists in the novel construction of parts and novel combinations of parts hereinafter set forth.

Figure 1 is a side elevation, and Fig. 2 is a plan, of my new machine. Fig. 3 is an elevation of the end at which the stock is fed to the machine. Fig. 4 is a section on the line 4 4 of Fig. 1 looking in the direction of the arrow 4. Fig. 5 is a section on the line 5 5 of Fig. 1. Fig. 6 is a section on the line 4 4 of Fig. 1 looking in the direction of the arrow 6. Fig. 7 is a section on the line 7 7 of Fig. 1. Fig. 8 is an elevation of the end of the machine opposite to that given at Fig. 3. Fig. 9 is a partial elevation of the rear side of the end shown at Fig. 8. Fig. 10 is a longitudinal vertical section of the parts shown at Fig. 9. Fig. 11 is a vertical section of the adjustable bearing of the worm-gear shaft. Fig. 12 is a section on the line 12 12 of Fig. 11. Fig. 13 is a longitudinal section of a portion of the feeding devices. Fig. 14 is a section on the line 14 14 of Fig. 13. Fig. 15 is a section of the chuck or mechanism for holding the screw-threading die. Fig. 16 is a section of the feeding-spindles. Fig. 17 is a front view of the turret-cam which is employed when the turret is to be oscillated instead of rotated. Fig. 18 is a detail section showing the safety or breakable pin keying one of the driving-gears to its shaft, and Fig. 19 is an end view of the turret, showing the tool reversed in its rotation.

In the drawings, W represents a suitable frame wherein the moving parts of the machine may be supported and secured. Power is communicated to the machine by means of the pulley A upon the short shaft *a*, which preferably stands at right angles to the axial line of the machine, as thereby I am enabled to position the machine at right angles with the line or power shaft. This is a feature of value because it permits the compact massing of a plurality of the machines side by side and the driving of all by belts direct from the power-shaft to the pulleys A of the machines. The driving of the machines in this way is also advantageous because it renders unnecessary any belting to the spindles or turret-shafts and obviates the evil effects thereon of the belt strains.

The shaft *a* carries a bevel-gear A′, which meshes with the gear B upon the hollow spindle B′, and it also carries a second bevel-gear A^2, which meshes with a similar gear C upon the vertical shaft *c*, carrying a long worm C′, whereby the worm-wheel D upon the vertically-adjustable shaft *d* is driven. This latter shaft lies longitudinally of the machine, and in addition to the wheel D it carries a pinion D′, which meshes with the large gear E upon the cam-shaft *e*, which is placed above and parallel to shaft *d*. Through this cam-shaft the feeding movements both of the stock and the turret are regulated, and as those movements require different speeds for different work I obtain a large variety of speeds by changing the pinion D′ and adjusting the shaft *d* to maintain mesh between the gear E and the particular pinion D′ employed, the gear D and the worm remaining in engagement whatever the adjustment may be. This adjustability of the shaft *d* is obtained by giving it a bearing in a sliding block D^2, held to the vertical side of the machine by bolts D^3 and raised and lowered by the pinion D^4, meshing with rack-teeth formed upon the vertical side face of the block. The pinion D^4 is mounted upon a stud D^5, having a bearing in the frame of the machine and projecting outside of said frame, where it is shaped to receive a wrench. All this is clearly shown at Figs. 11 and 12.

The cam-shaft *e* carries a large cam-wheel E′, the cams *d′* d^2 of which actuate in both

directions a centrally-pivoted swinging lever F, the upper end of which lies in an annular groove of a slide F′ encircling the hollow spindle B′. The wheel E′ is also provided with a cam d^3, which acts upon a roller *f*, mounted in a slide F^2 encircling and moving upon a stationary rod F^3, and forces said slide outward against the reversely-acting spring F^4. The slide F^2 is provided with an upwardly-extending arm F^5, to which are secured the ends of the U-shaped piece F^6, whereby the slide is connected to the grooved collar B^2 upon the inner or feed spindle B^3. By this mechanism the movements of the slide are communicated to said spindle, the cam d^3 causing the backward movement which carries the spindle back upon the rod from which the screws are formed, so it may take a fresh hold thereon, and the spring causing the forward movement whereby the rod is fed forward. That portion F^7 of the slide F^2 in which the roller *f* is located is made in a separate piece from the main body of the slide and dovetailed on the latter, as seen at Figs. 13 and 14, so it may be adjusted to and from the cam d^3 by the screw F^8. By this means I am enabled to regulate the amount or length of the rod fed forward at each operation, the part F^7 being so moved as to cause the roller *f* to bear upon the cam throughout the whole length of the latter or through only a portion of its length.

The rod feeding and chucking devices are of the ordinary construction and consist of the feed-spindle B^3 which is split at one end and adapted to normally exert friction upon the rod from which the screws or other articles are cut, the grooved collar B^2 for sliding the feed-spindle, as already explained, and a chucking-spindle B^4 which encircles the feed-spindle and slides within the main spindle B′ in obedience to the elbow-levers B^5 whenever said levers are actuated by the sloping-faced slide F′, and forces the spring-chuck or collet B^7 into the chucking-head B^6, thereby compressing the spring-chuck upon and holding the rod while it is being operated upon by the several tools, said chucking-head B^6 and the rotating spindle B′ carrying the chucking-head and the rotating gear B, and also forming a support for the slide F′. The chucking-head is preferably provided with an outstanding annular flange b^5, which will serve to throw off such of the oil used to ease the cutting as may find its way onto the forward end of the spindles.

The cutting off of the screw or other piece of work after it has been made, and also the turning down of the under side of or the forming of the heads, are accomplished by two cutters G and G′ supported on a rock-shaft G^5 to which is attached an arm G^7, the lower end whereof is forked and is actuated to produce the rocking by cams G^3 and G^4 upon the cam-shaft *e*. The cutters are located upon opposite sides of the work, and the rock-shaft is actuated so as to bring the cutters into action alternately, the cams rocking it first in one direction and then in the other.

The tools for turning down the rods to the diameter required in the screws or other articles made in the machine and for threading them are mounted in the turret H secured upon the end of a shaft H′, which latter I make of large diameter at the end nearest the tools, as shown, so that the turret may be very rigidly and firmly held even when slid forward to the utmost of its limit in that direction, and so that it will not become loose in its bearing (shown at *h*.) The shaft or journal H′ lies horizontally and parallel with the axial line of the spindle B′ at one side of said line, so that the tools upon it may be brought in rotation to their proper acting positions. The turning of the turret for bringing the tools thus successively into operation I accomplish by the following mechanism: The cam-shaft *e* carries upon its farther end a bevel-gear I′ which meshes with a like gear I^2 upon the short cross-shaft *i*, and upon this shaft *i* is a cam-wheel I^3 carrying three cams or acting points I^4, each of which is adapted to lift a lever J pivoted at *j* and connected by a link J′ to a vertically-moving rack J^2 sliding in a way J^3. A spring J^4 returns the lever J after each lifting operation by the cams I^4. The lifting of the rack is intended to bring it into position where it may engage with the gear J^5 upon the turret-journal when the latter is slid back, as hereinafter more particularly set forth, and when the rack is drawn down by the spring J^4 it gives a partial rotation to the turret, being such an amount of rotation or oscillation as is required to bring the next tool into line for action.

While I have shown the turret as provided with three tools and a cam-wheel for turning it having three operating-points, it will be understood that the turret may carry any desired number of tools and that the cam should be provided with a corresponding number of operating-points. To oscillate the turret instead of rotating it, the acting cams of the wheel I^3 need only to be changed in a manner well understood by those skilled in such matters.

To insure the bringing of the tools in proper operating-line with regard to the work, and to hold them rigidly in that line while working, I provide upon the arbor of the turret the forks K, and place a stationary guide K′ longitudinally of the arbor and in such position relative to the forks that the latter will straddle the guide when the turret is moved up to the work. The guide is short enough so that it will not be in the way of the forks when the turret is turned, the latter operation occurring only when the turret has been moved back and away from the work sufficiently to carry the forks beyond the guide.

The sliding of the turret to and from the work is accomplished by the following mechanism: Upon the cross-shaft *i* already mentioned is a cam-wheel L having a number of operating segments or lobes L′ corresponding

to the number of operating-tools and shaped to impart the movements required to enable the several tools to do their work, and these points are adapted to move the arm M upon or attached to the rock-shaft *m*. Upon the farther end of shaft *m* is a lever M′ joined to a sleeve M^2 upon the turret-arbor and confined thereon between the collar m^2 and the gear J^5. A short arm M^3 extends from the shaft *m* and is pivotally joined to a vertically-sliding rod M^4, and upon this rod is a spring M^5 adapted to lift it. With this construction the sliding of the turret forward is accomplished by the action of the cams L′ upon the arm M, and its retraction is caused through the power of the spring M^5 acting upon the rod M^4 and arm M.

The rotating of the tools carried by the turret upon their own axes may be secured by the following devices: A belt N carries motion from the pulley N′ upon the drive-shaft *a* to a pulley N^2 upon a cross-shaft *n* at the rear of the machine. This shaft carries a bevel-gear N^3, meshing with a corresponding gear N^4 upon a short stud-shaft N^5, located below the rear end of the turret-arbor. Gear N^4 is rigidly united to a long pinion N^6, which engages a pinion N^7 upon a shaft N^8, extending axially through the turret-arbor to the front side of the turret and there provided with a pinion N^9. From this pinion N^9 power is taken to the several tools, or such of them as need to be rotated, by a suitable gear or gears N^{10}, mounted upon the stem of the die-holder or chuck N^{11} and shown at Fig. 15. The shafts *n* and N^5, it will be noticed, are both mounted in a bearing-block N^{12}, which is adjustable in the direction of the length of said shaft *n*. My object in this is to permit the changing of the gears N^6 and N^7 for the purpose of varying the speed imparted to the cutting tools or dies upon the turret, as is frequently necessary in changing the machine to adapt it to cut threads of different pitch, &c., and this is done without destroying the mesh of the beveled gears N^3 and N^4. The bearing-block is held in its adjusted position by the bolt N^{13}. By this feature the rotary speed imparted to the tools may be changed without making any change in the feeding or intermittent rotary movements of the turret, as these movements are imparted by actuating mechanism entirely independent of the mechanism which causes the rotation of the tools.

The speed of the rotation given the die exceeds the speed of rotation of the stock, so that both may be driven in the same direction and the die be drawn off by simply stopping its rotation in a manner now understood. In order to permit the proper operation of the dies I prefer to construct them as follows: The pinion N^{10} is loosely mounted upon the stem of the die-holder N^{11}, and it is also prevented from lateral movement by the ring n^{10} upon the die-holder engaging with the collar n^{11} upon the hub of the pinion. The pinion is also provided with clutching-teeth n^{13} adapted to engage with similar teeth n^{14} upon the rear face of the head of the die-holder. Splined upon that end of the die-holder stem which projects to the rear of the turret is a movable clutch piece or ring N^{15}, which may be made to engage with corresponding teeth n^{15} upon the rear face of the turret whenever the tool is to be stopped from rotating. A spring N^{16} encircles the stem of the die-holder between the turret and the ring N^{15}, and a second and stronger spring n^{16} is placed upon the shank between the button N^{17} and the outer side of ring N^{15}. With this construction the normal action of the springs is to keep the pinion and die-holder in engagement, so that the die is rotated; but this engagement is broken when the threading is completed by the cessation of the forward movement of the turret, and when the latter begins its return the clutch-collar N^{15} is naturally forced into engagement with the teeth n^{15}, which causes a stoppage of the rotation of the die, so that it is soon threaded off the screw. The second spring is a safety device, intended to obviate danger of stripping the thread from off the screw when the threading operation is completed, such as might result if in drawing backward the clutch-teeth N^{15} should fail to engage the teeth n^{15}.

When it is desired to use a boring-tool in the turret and to give such tool a rapid rotation, it may be done by employing an intermediate pinion P between the central pinion N^9 and the pinion N^{10} upon the holder carrying the boring-tool, as shown in Fig. 19. This intermediate pinion reverses the direction of the tool's rotation, so that it turns in a direction contrary to the stock, and so that its speed relative to the stock is equal to the sum of the speeds of both tool and stock. In this manner I obtain all the benefit of a rapid rotation by the tool without giving it in fact any great speed.

When it is desired to oscillate the turret instead of rotating it through complete revolutions, I arrange cams 19 upon the cam-wheel I^3 in some such manner as is shown at Fig. 17. In this arrangement, supposing the cam-wheel to be rotated in the direction indicated by the arrow, the cam-surface marked 20 will actuate the lever J and turn the turret through a partial revolution. While the roller of the lever is riding over the three cams which are placed in conjunction at this side of the cam-wheel the turret is moved back to the work, so that when the lever-roll passes down the incline 21 the spring J^4 will then return the rack and the latter will remain in its lower position until the lever-roll encounters the surface 22 of the cam-segments at the opposite side of the wheel and is lifted thereby. This last upward movement of the rack is, however, an idle one, inasmuch as at the time it takes place the turret is not in engagement with the rack, but such engagement takes place immediately afterward, so that when the roll passes down the incline 23

the spring will return the rack and also return the turret to its first position.

If preferred, the space between 21 and 22 may be filled so that the rack will remain raised until the turret is returned into engagement therewith.

In order to prevent the jarring which would be caused by the returning of the rack to its lower position under the force of the spring J^4 when cams having abrupt inclines like those shown are used, I provide the dash-pot J^6 and a piston J^7 working therein, the latter being joined to the swinging end of lever J by the rod J^8. This dash-pot eases the descent of the rack and prevents any jar to the machine, and also enables the machine to be operated at considerable speed without producing any objectionable shaking or jar.

It is desirable that all the cams upon the wheel I^3 be adjustable, and for that reason I provide said wheel with a series of openings around its rim, as shown, through which the bolts may be passed for securing the cams to the wheel in any position desired. Not only may the cams be adjusted as to position upon this wheel, but the cams themselves may be changed at will.

In order to obviate danger of breaking the working parts of the machine when any unusual strain comes upon or resistance is encountered by them, I key the gear A^2 to the driving-shaft by means of a pin P′, which is of sufficient strength only to insure the moving of the parts actuated through said gear under ordinary circumstances—that is to say, this pin has sufficient strength to drive said gear when the machine is doing its ordinary work, but when an unusual strain comes upon the gear the pin will break, and thus stop the parts actuated from it before any breakage of the machine occurs.

The importance of the ridge b^5 as a means of preventing the oil from entering between the spindle and its bearing will be understood when it is remembered that the oil thus diverted is illy fitted for use as a lubricant by reason of the presence in it of foreign matters, such as grit and small particles of metal severed in the cutting operations, &c., which are liable to do great damage if they find their way into the interior of the spindle-bearing.

The driving of the machine by means of a cross-shaft is not only attended with the benefits mentioned in a preceding part of this specification, but when the shaft is arranged as shown it is rendered an easy matter to take power from it to the various parts of the machine. Thus through the vertical shaft *c* the main cam-shaft is driven, the spindles are driven directly from the cross-shaft, and the turret-tools are rotated by power taken from the shaft by the belt N.

I claim—

1. The combination in a screw machine of a turret adapted to slide and to turn on its axis with mechanism for actuating said turret, an axial shaft for rotating the tools carried by the turret, a primary drive shaft, and independent power transmitting mechanisms, one carrying power from the drive shaft to the turret and the other from the drive shaft to the axial shaft, substantially as specified.

2. The combination in a screw machine of a primary drive shaft, a turret adapted to slide and to turn on its axis and mechanism carrying motion from said drive shaft to said turret and imparting said sliding and turning movement, with a continuously rotating shaft extending axially through the turret and serving to actuate the tools, and mechanism independent of the turret actuating mechanism carrying motion from the drive shaft to the axial shaft, substantially as specified.

3. In a screw machine a primary drive shaft and stock rotating mechanism geared to said drive shaft, in combination with the turret, the axial shaft and mechanism independent of the stock actuating mechanism for transmitting motion from the drive shaft to said axial shaft, substantially as specified.

4. In a screw machine a primary drive shaft and stock rotating mechanism geared to said drive shaft, in combination with the turret, actuating mechanism for the turret mechanically connected to the drive shaft, the axial shaft for rotating the tools in the turret, and mechanism independent of the stock actuating mechanism for carrying motion from the drive shaft to said axial shaft, substantially as specified.

5. The combination of a horizontal turret, and a shaft passing through the axis of said turret and provided with means for actuating the tool or tools, of mechanism for rotating said axial shaft independently of the turret, said mechanism embracing changeable gears and a shaft adjustable longitudinally so as to permit changes in the speed of said axial shaft, substantially as specified.

6. The combination of a horizontal turret, and a shaft passing through the axis of said turret and provided with means for actuating the tool or tools, of changeable gears and a shaft adjustable longitudinally, for driving said axial shaft, substantially as specified.

7. The combination with the axial shaft passing through the turret and conveying power to the tools carried by the turret, of the shafts *n* and N^5 having intermeshing gears, the adjustable block forming a bearing for said shafts, and gearing carrying motion from shaft N^5 to the axial shaft, substantially as specified.

8. The combination with the axial shaft passing through the turret and conveying power to the tools carried by the turret, of the shafts *n* and N^5 having intermeshing gears, the adjustable block forming a bearing for said shafts, and changeable gears carrying motion from shaft N^5 to the axial shaft, substantially as specified.

9. The combination with the horizontal turret and its axial shaft, of a drive shaft, mechanism for carrying power from the shaft to the turret, and mechanism independent of the turret mechanism carrying power from the drive shaft to the axial shaft, both said transmitting mechanisms being changeable to permit variations in the speed or timing of the parts, substantially as specified.

10. The combination with the turret of the cam shaft for actuating the turret, the changeable gears for actuating the cam shaft, the sliding block D^2 and the shaft *d* having a bearing therein, substantially as specified.

11. The combination with the turret, of the cam shaft from which the turret is actuated, the changeable gears for actuating said shaft, the shaft *d* carrying one of said gears, and the adjustable block D^2 supporting said shaft *d*, substantially as specified.

12. The combination with the turret, of the actuating mechanism therefor, the latter having changeable gears and an adjustable bearing block carrying the shaft of one of the changeable gears, substantially as specified.

13. The combination with worm C′ of gear D, shaft *d*, movable bearing D^2, and a pinion and rack for adjusting said bearing, substantially as specified.

14. In a screw machine a shaft *d* having a changeable gear and a movable bearing for said shaft inclosed in the machine frame, a pinion the axis whereof extends through the frame so as to be operable from the outside, and rack teeth upon the side of the bearing engaging the pinion, substantially as specified.

15. In a machine of the kind shown, a horizontal sliding tool turret having peripheral teeth, in combination with the rack J^2, meshing with the teeth of the turret when the latter is moved back from the work, the lever for moving the rack, the cams for actuating the lever in one direction, and the spring for actuating the lever in the other direction, substantially as specified.

16. In a machine of the kind shown, a horizontal sliding tool turret having peripheral teeth, in combination with the rack J^2, meshing with the teeth of the turret when the latter is moved back from the work, the lever for lifting the rack and a spring for depressing it, substantially as specified.

17. In a machine of the kind shown, a horizontal sliding tool turret having peripheral teeth, a rack meshing with said teeth when the turret is moved back from the work, and means for actuating said rack in turning the turret, substantially as specified.

18. In a machine of the kind shown, a horizontal sliding tool turret having peripheral teeth, a rack meshing with said teeth when the turret is moved back from the work, and means for positioning said rack and means for actuating it in turning the turret, substantially as specified.

19. In a machine of the kind shown, a horizontal sliding tool turret having a plurality of tools for operating upon the work, and also having peripheral teeth, a rack meshing with said teeth, and a rotating cam having upon its periphery a plurality of operating points corresponding to the tools in the turret and acting to move the rack, substantially as specified.

20. In a machine of the kind shown, a horizontal sliding tool turret having a plurality of tools for operating upon the work, and also having peripheral teeth, a rack meshing with said teeth, and a rotating cam having upon its periphery a plurality of operating points corresponding to the tools in the turret and acting to move the rack in one direction, and a spring for moving it in the reverse direction, substantially as specified.

21. The combination with the spindle and turret and the cam shaft from which they are actuated in their longitudinal movements, of the changeable gearing for driving said shaft, the adjustable shaft carrying one of the changeable gears, worm wheel D upon said adjustable shaft and the long worm for actuating said worm gear in any position of its shaft, substantially as specified.

22. In a screw cutting machine, the combination with the cross drive shaft, of the longitudinal spindle for rotating and feeding the stock geared directly to the shaft, a longitudinally movable and rotatable turret, rotatable tool holders carried by said turret, a longitudinal cam shaft, taking power from the drive shaft and controlling the feeding movements of both the spindle and the turret, and mechanism independent of the spindle and turret for transmitting power from the drive shaft to the tool holders, substantially as specified.

23. In a machine of the kind herein shown, a cam shaft *e* controlling the feeding movements of both the stock and the turret, in combination with changeable gears and an adjustable shaft for actuating said cam shaft, substantially as specified.

24. The combination in a screw machine, of the turret having a row of teeth around it, a vertically moving rack meshing with the teeth upon the turret, a lever for actuating the rack, a cam actuating the lever in one direction, a spring for actuating the lever in the other direction, and a dash pot the piston whereof is joined to the lever and cushions the movement imparted by the spring, substantially as specified.

CHARLES E. ROBERTS.

Witnesses:
EDW. S. EVARTS,
H. M. MUNDAY.