(No Model.) 8 Sheets—Sheet 1.

E. HORTON.

MACHINE FOR MAKING METAL SCREWS.

No. 379,577. Patented Mar. 20, 1888.

FIG 1

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(No Model.) 8 Sheets—Sheet 2.

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MACHINE FOR MAKING METAL SCREWS.

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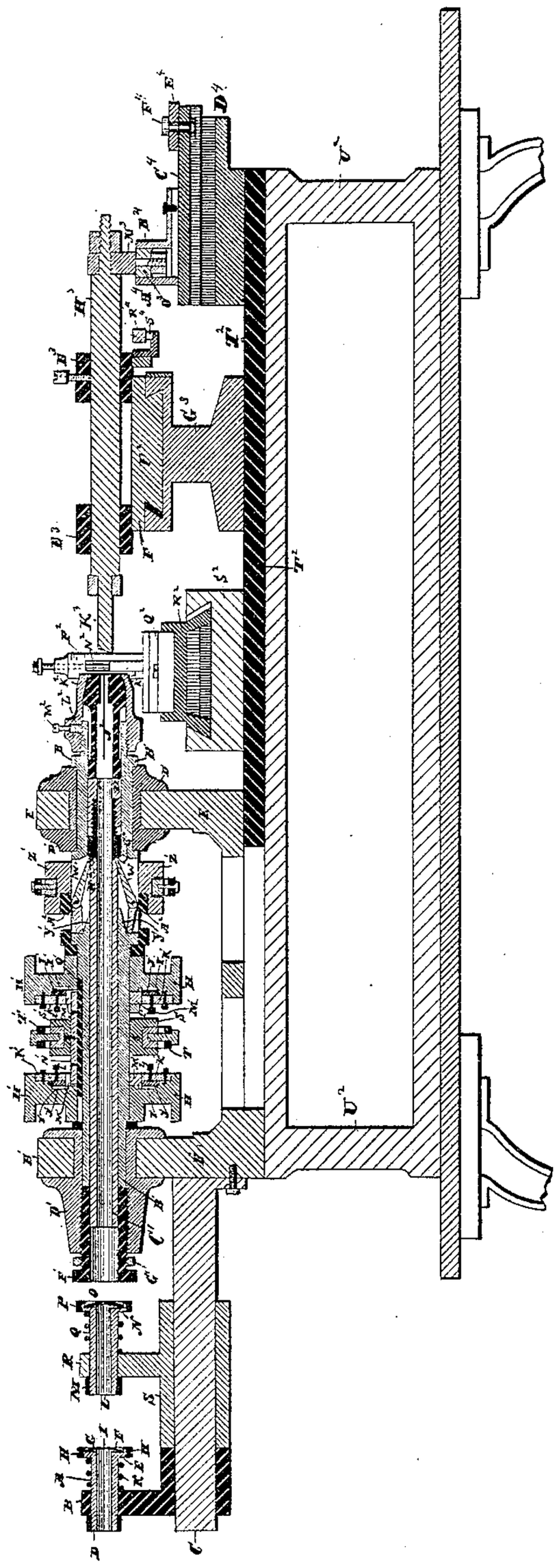
FIG 2



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(No Model.) 8 Sheets—Sheet 3.

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Fig. 3

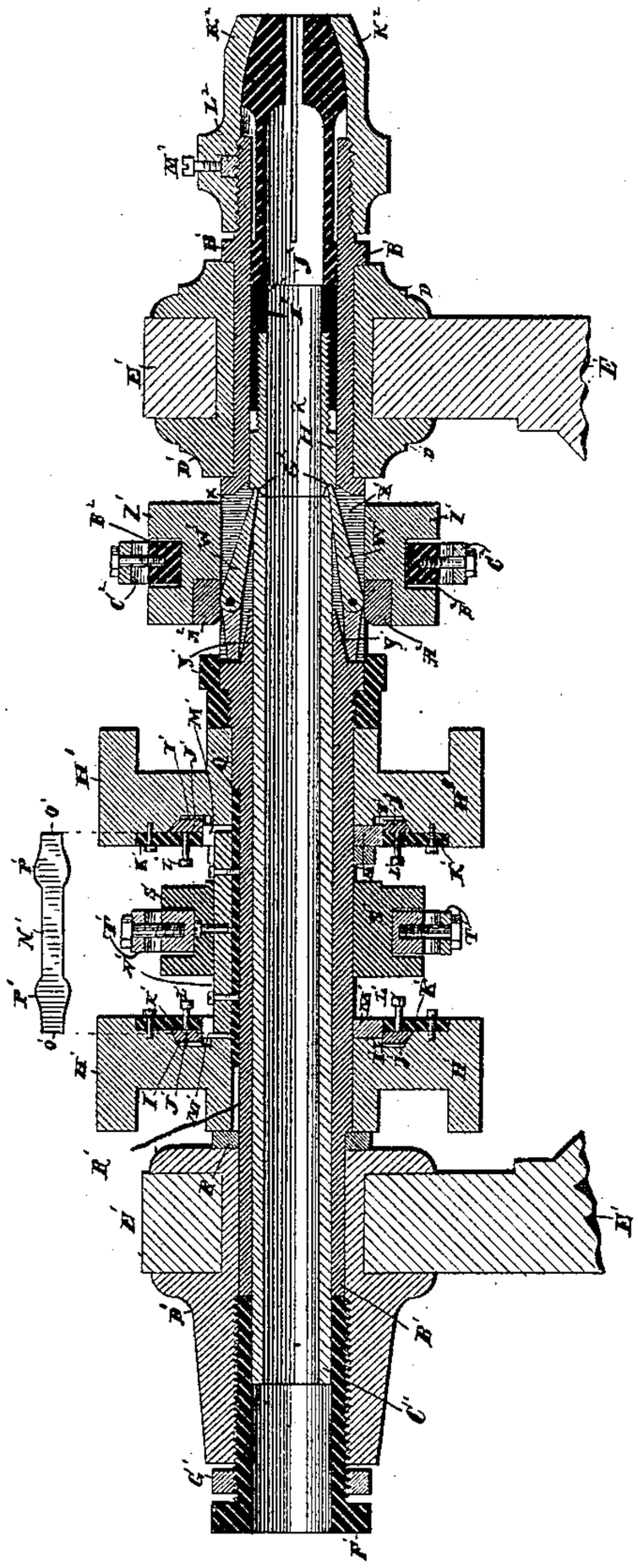

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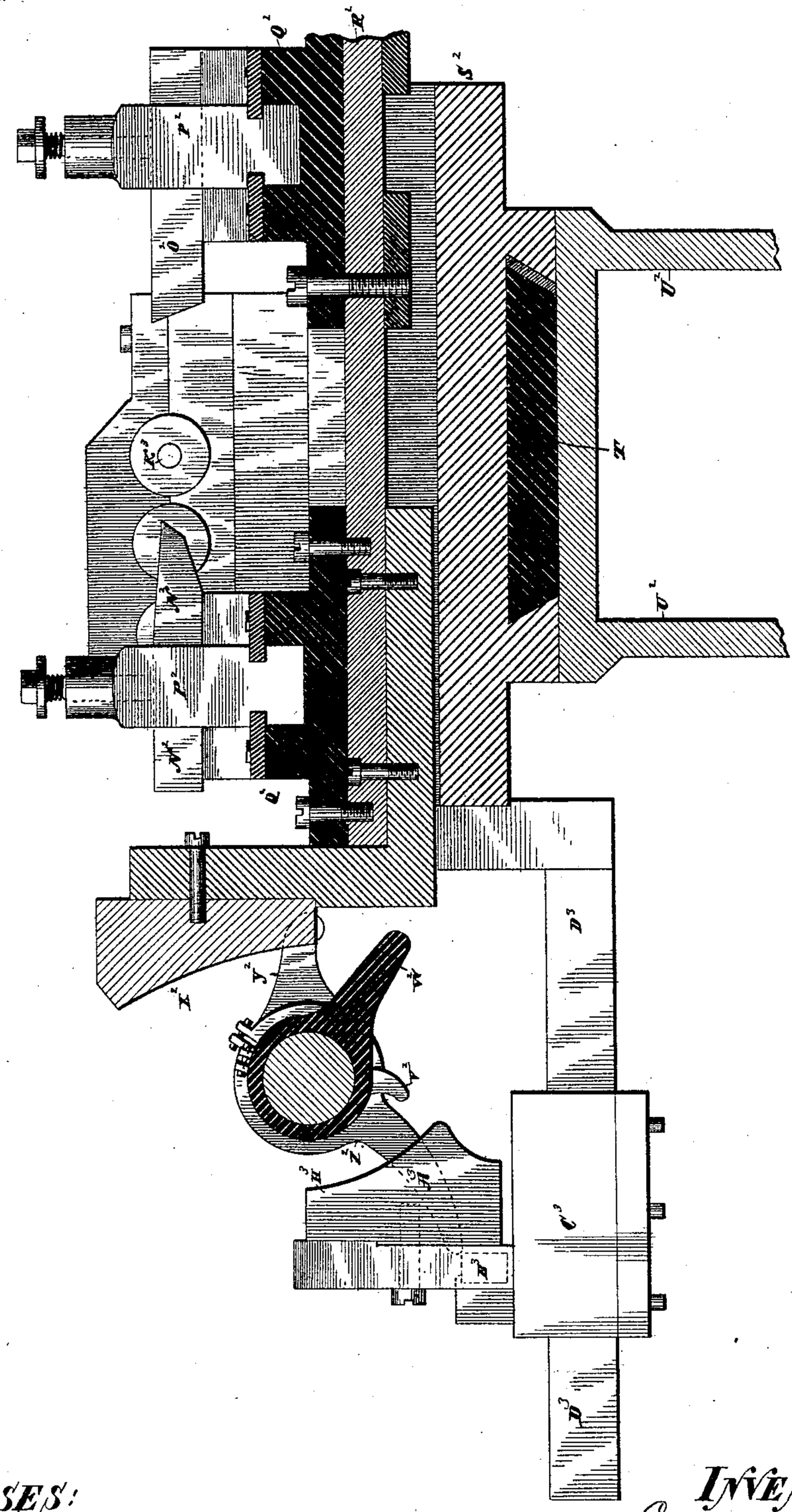
Fig. 4



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(No Model.) 8 Sheets—Sheet 5.

E. HORTON.

MACHINE FOR MAKING METAL SCREWS.

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FIG. 5

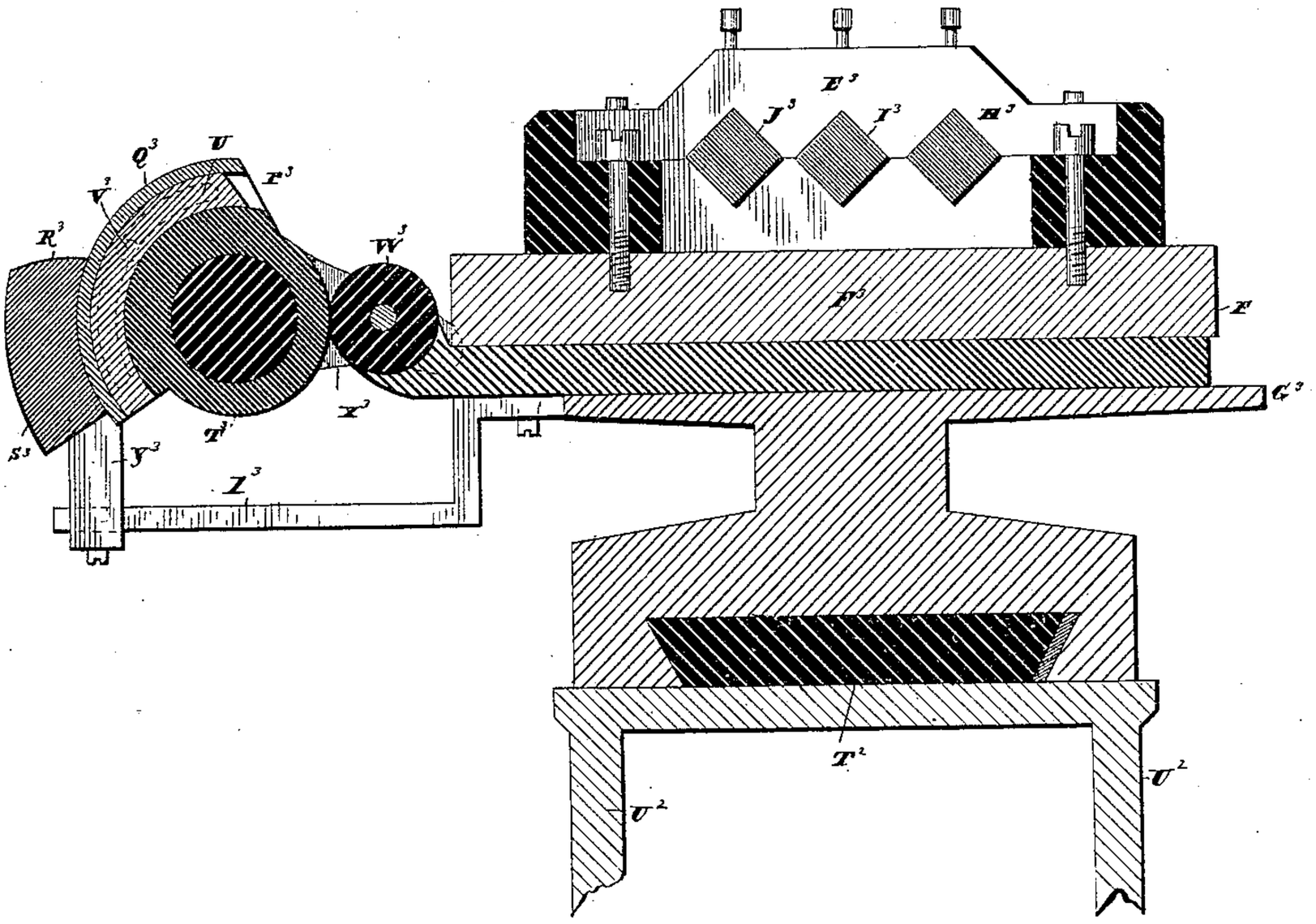


FIG. 6

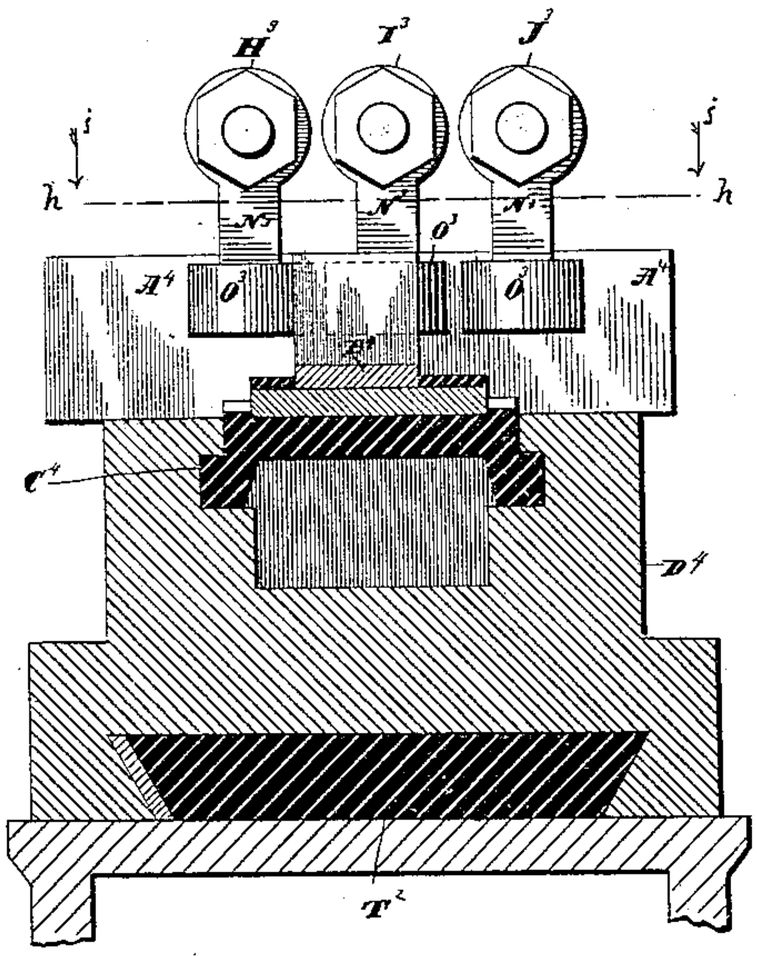
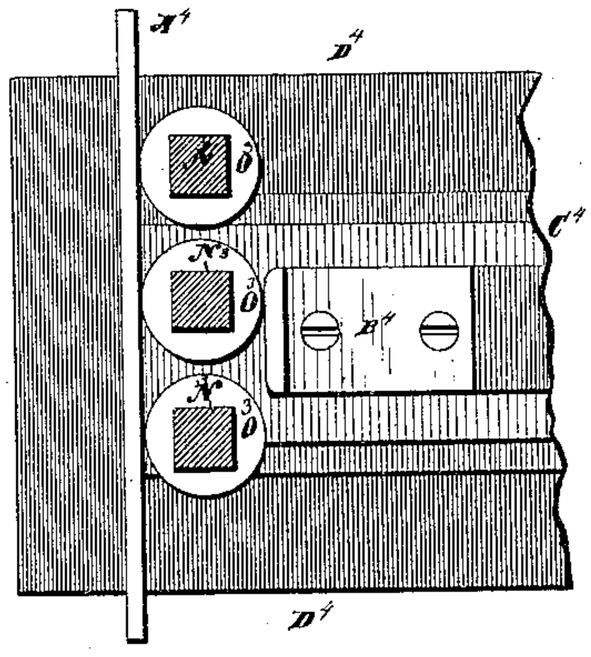


FIG. 7



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E. HORTON.

MACHINE FOR MAKING METAL SCREWS.

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FIG. 8

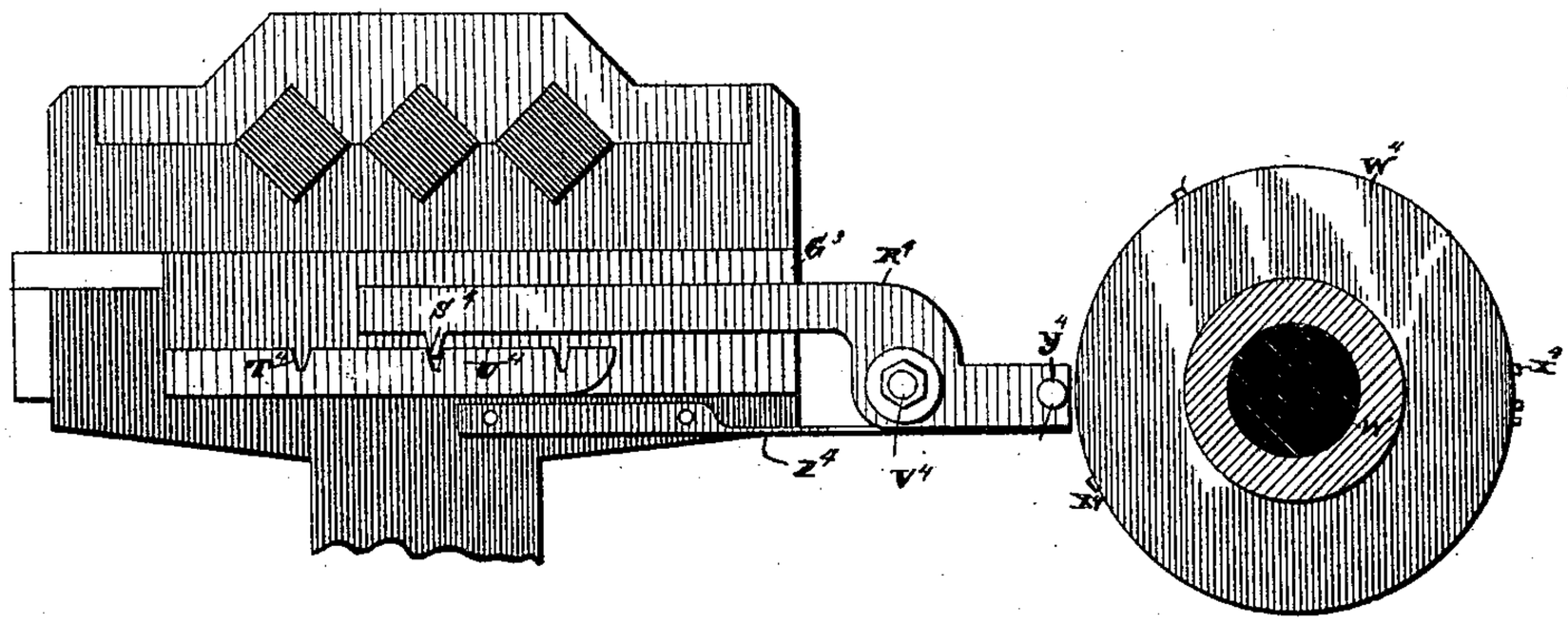


FIG. 9

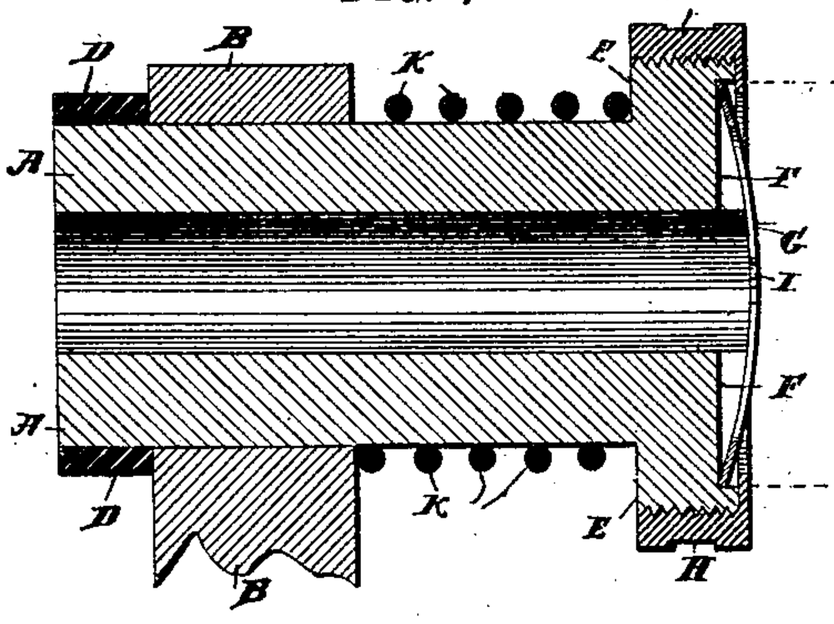
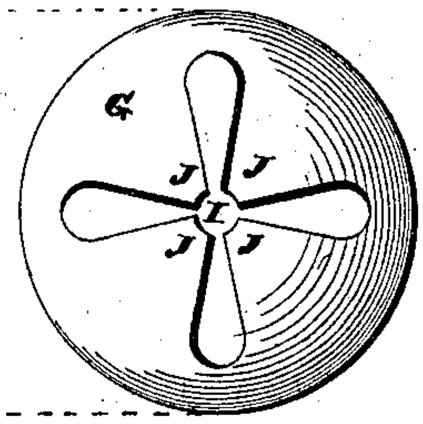


FIG 10



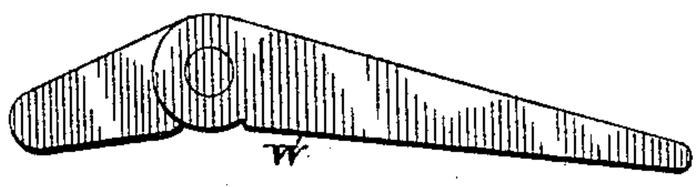


FIG. 11

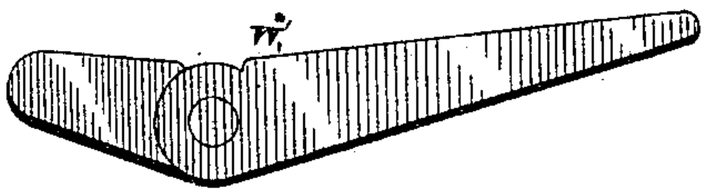
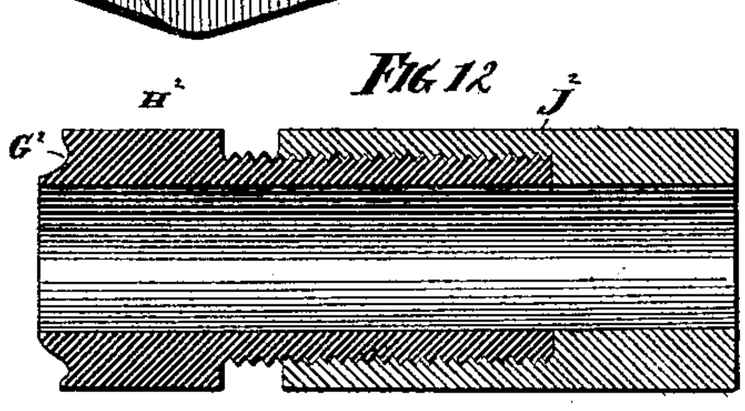


FIG 12



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(No Model.) 8 Sheets—Sheet 7.

E. HORTON.

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FIG. 15

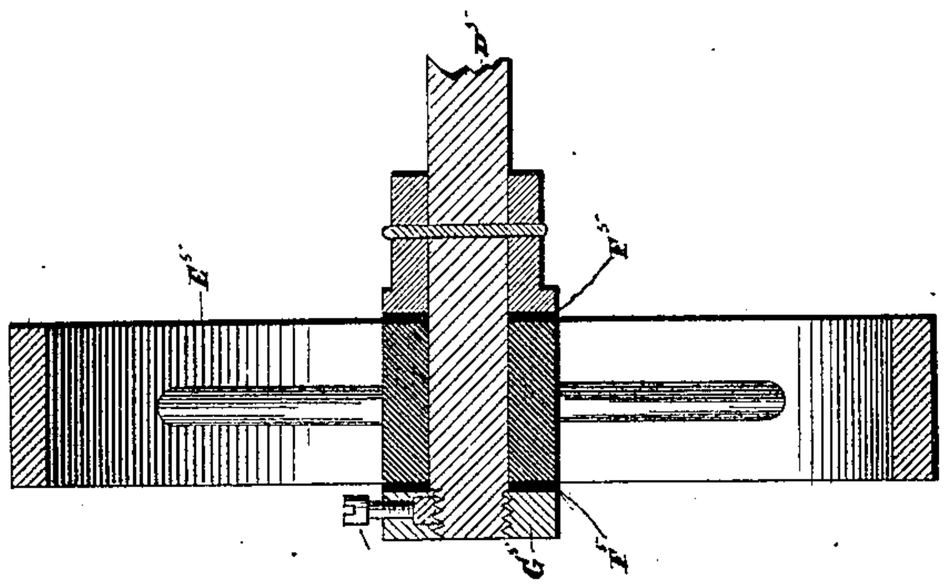


FIG. 14

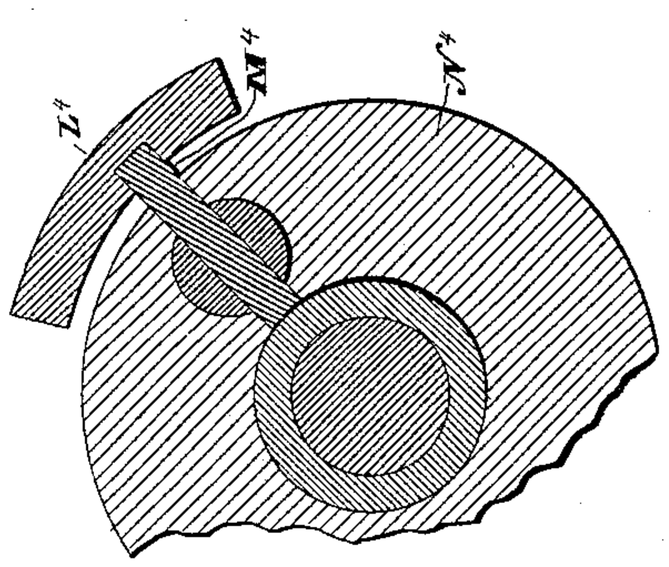
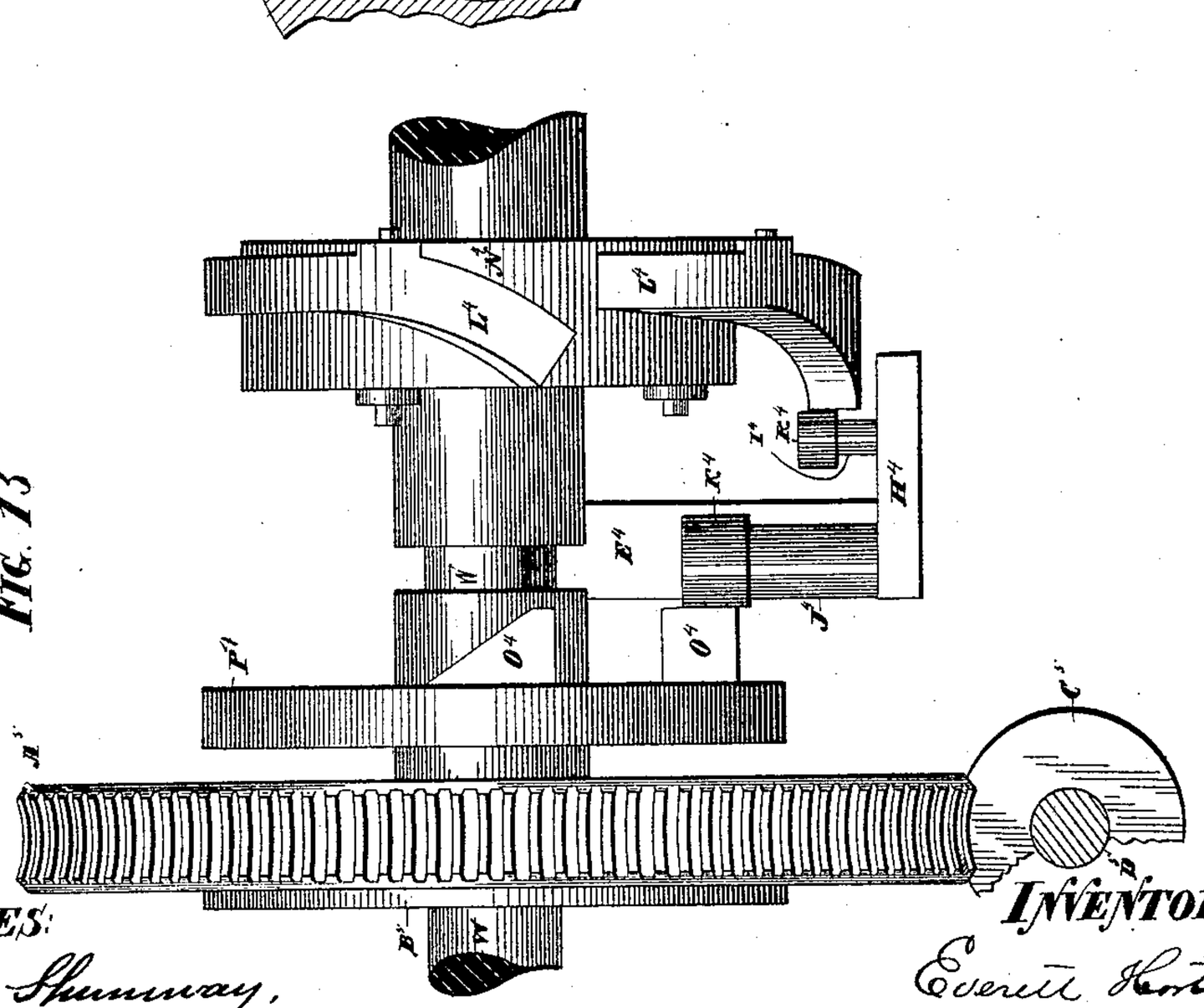


FIG. 13



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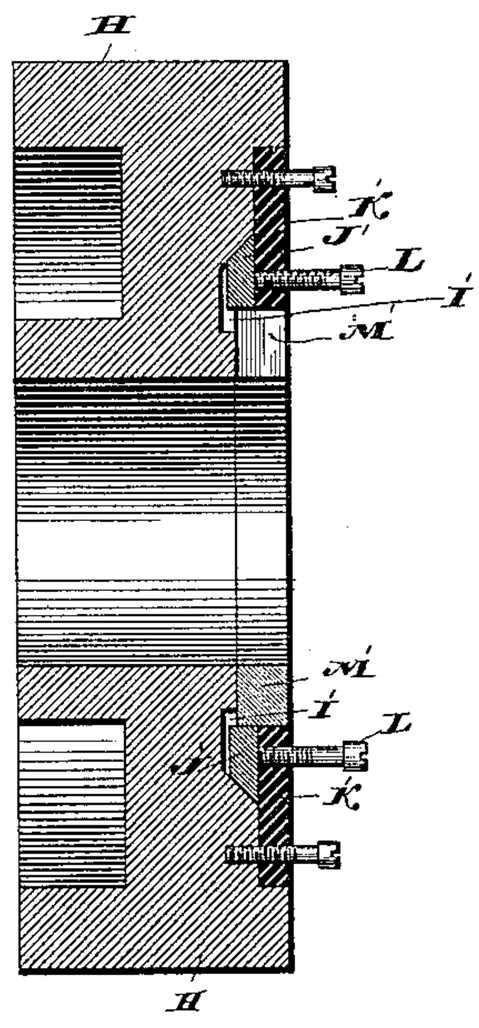
MACHINE FOR MAKING METAL SCREWS.

No. 379,577. Patented Mar. 20, 1888.

Fig. 16



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UNITED STATES PATENT OFFICE.

EVERETT HORTON, OF BRISTOL, CONNECTICUT.

MACHINE FOR MAKING METAL SCREWS.

SPECIFICATION forming part of Letters Patent No. 379,577, dated March 20, 1888.

Application filed July 30, 1886. Serial No. 209,509. (No model.)

To all whom it may concern:

Be it known that I, EVERETT HORTON, residing at Bristol, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Automatic Machines for Making Screws and other Turned Work; and I do declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to an improvement in automatic machinery for making screws and other work which may be turned from wire rods, the object being to produce a machine of reliable, precise, and efficient operation adapted to be adjusted for a very wide range of work and having a large capacity for production.

With these ends in view my invention consists in certain details of construction and combinations of parts, as will be hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a plan view of a machine embodying my invention. Fig. 2 is a view in vertical longitudinal section on the line *a a* of the preceding figure and looking in the direction of the arrows *b b*. Fig. 3 is a similar enlarged view of the spindle and the mechanisms associated with it. Fig. 4 is an enlarged view, partly in transverse section and partly in elevation, on the line *c c* of Fig. 1, looking in the direction of the arrows *d d*, and showing the cutting-off tool, one of the forming-tools, their carriage, and the means for actuating it. Fig. 5 is a similar view on the line *e e* of Fig. 1, looking in the same direction, and showing the tool-carriage and the connections for reciprocating it. Fig. 6 is a similar view on the line *f f* of the same figure, looking in the direction of the arrows *g g*, and showing the ends of the tool-slides. Fig. 7 is a horizontal section on the line *h h* of Fig. 6, looking in the direction of the arrows *i i*. Fig. 8 is a transverse section on the line *j j* of Fig. 1, looking in the direction of the arrows *k k*, and showing the mechanism for locking the tool-carriage at the end of each of its forward movements. Fig. 9 is a detached view in central longitudinal section of the rear sleeve of the feeding mechanism. Fig. 10 is a view of the disk spring of such mechanism in front elevation. Fig. 11 is a detached view of the jointed chuck-closing levers. Fig. 12 is a detached sectional view of the adjustable sleeve. Fig. 13 is an enlarged view in side elevation of the cam and lever connections for advancing and retiring the tool-slides. Fig. 14 is a broken sectional view of the peripheral cam shown in the preceding figure. Fig. 15 is a sectional view showing the driving-wheel and its automatic safety friction-stop, and Fig. 16 is a detached view in central section of one of the loose pulleys for rotating the spindle.

Stock in the form of wire rods is fed into the machine through a sleeve, A, mounted so as to rotate and reciprocate in a bearing, B, secured to a horizontal arm, C, and provided at its rear end with a collar, D, and at its forward end with a circular exteriorly-threaded flange, E, having in its forward face a recess, F, receiving a spring-disk, G, held in place by a knurled cap, H, screwing onto the said collar, the said disk having a central aperture, I, and radially slotted to form a circular series of spring-arms, J, engaging with the rod which passes through the aperture. A spiral spring, K, interposed between the bearing B and the flange E, permits the sleeve to yield and retire when the rod is pushed back by the gaging mechanism, as will be hereinafter set forth.

In line with and in front of the parts described is another sleeve, L, having a collar, M, flange N, spring O, cap P, and spiral spring Q, the said parts corresponding in construction to the parts above mentioned, and mounted in a bearing, R, located upon a slide, S, reciprocated upon the said arm C through a lever, T, fulcrumed upon a slide, U, located upon an arm, V, and actuated by a double cam mounted upon the driving-shaft W and composed of two grooved disks, X X, each having a cam-block, Y, provided with a stem, Z, and a circular series of holes, A′, through which the said blocks are shifted.

In front of and in line with the sleeve last mentioned is a spindle, B′, inclosing a tube, C′, and journaled in two two-part boxes, D′ D′, mounted in the uprights E′ E′, the rear box carrying an adjustable step, F′, provided with a check-nut, G′, and impinging against the rear end of the spindle and taking up end-play therein. The said spindle is intermit-

tently rotated in opposite directions by means of pulleys H′ H′, loosely mounted upon it and respectively belted for opposite rotation. These pulleys are alternately coupled with the spindle by means of a key, N′, having straight-sided ends O′ and wedge-shaped portions P′ P′, as shown. Such key is secured to a spline, Q′, located in a slot, R′, in the spindle, and to a grooved disk, S′, rotating with the spindle, and reciprocated by the forked ends of a lever, T′, fulcrumed at U′, and actuated by a double cam, V′, mounted on the driving-shaft W and made like the cam previously described. The opposite ends of the said key extend between the adjacent ends of sectional hardened-steel rings M′ M′, surrounding the spindle and respectively located in circular recesses I′ I′, formed in the inner faces of the pulleys H′ H′, the outer walls or edges of such recesses being beveled. Each of the said pulleys is provided with a sectional brass ring, J′, located in its recess, and having a beveled outer edge bearing upon the outer wall thereof, the two beveled surfaces adapting the ring to be forced toward or into the bottom of the recess and thus contracted. For this purpose the recess is made of sufficient depth to permit a lateral adjustment of the brass ring, which, it may here be noted, is normally out of contact with the hardened-steel ring surrounded by it. Each pulley is also provided with an annular plate, K′, secured to its inner face and holding the brass ring in place and carrying screws L′ L′, impinging against such ring and operating, when turned inward, to force it into or toward the bottom of its recess, as described, and so contract it, whereby provision is made for compensating for wear between the brass and steel rings and for regulating their coupling action. Normally, as before explained, the brass and steel rings of the respective pulleys are free from each other, and the pulleys and brass rings rotate freely upon the spindle and around the steel rings. When, however, in the reciprocation of the key its wedge-shaped portions are entered between the ends of the steel rings, the same are expanded into the brass rings, whereby the pulleys and spindle are coupled together. The coupling so secured is broken as soon as the wedge-shaped portions of the key are retracted from the steel rings, from which, however, the straight-sided ends of the key are never entirely disengaged.

Two jointed levers, W′ W′, are located in elongated slots X′ X′, formed toward the forward end and upon opposite sides of the spindle, the rear ends of such levers being supported upon an incline, Y′, as shown. The fulcra of these levers are just above the line of the spindle, beyond which they normally project and into which they are forced for their extension by a ring, Z′, having a hardened beveled ring, A^2, set into it, and provided with a groove, B^2, receiving the forked end C^2 of a lever, D^2, fulcrumed on a stud, E^2, and actuated by a double cam, F^2, mounted upon the driving-shaft W and made like the cams previously described. The forward ends of the said jointed levers rest in a groove, G^2, formed in the rear end of an adjustable sleeve composed of the parts H^2 and I^2, and forming an extension of the forward end of the tube C′, located within the spindle. The forward end of the said adjustable sleeve impinges against the rear end of the split body J^2 of the chuck, the forward end of such body being beveled to conform to the contracted opening of the shell K^2 of the chuck, and the said shell being screwed in to the extreme forward end of the spindle and provided with a brass gib, L^2, and screw M^2, for locking it in any desired adjustment thereon. When the jointed levers are forced into the spindle, they are nearly straightened and extended, and push forward the adjustable sleeve and the split body of the chuck, whereby the forward end of the latter is drawn together and the chuck closed by the contracting walls of the shell. When the ring A^2 is moved out of range of the levers, the same, having their fulcra located outside of the line of the pressure upon their ends, are contracted or thrown out by the split body of the chuck, which springs back and opens when relieved of forward pressure.

A cutting-off tool, N^2, and a forming-tool, O^2, located in front, on opposite sides of and at right angles with the chuck, are respectively mounted in posts P^2 P^2, adapted to be adjusted in the direction of the spindle in blocks Q^2 Q^2, mounted in a carriage, R^2, adapted to be reciprocated transversely or at right angles with the spindle upon a bed, S^2, longitudinally adjustable upon a slide, T^2, secured to the frame U^2 of the machine, the said carriage being advanced by a clearance-cam, V^2, and a cutting-off cam, W^2, co-operating with a cam-faced block, X^2, secured to the said carriage and retracted by a forming-cam, Y^2, and a clearance-cam, Z^2, respectively co-operating with blocks A^3 and B^3, adjustably secured to an adjustable slide, C^3, located upon a horizontal arm, D^3, extending laterally from the carriage, the said cams V^2, W^2, Y^2, and Z^2 being mounted upon the driving-shaft of the machine. In front of the carriage described and in line with the spindle is located the tool-carriage E^3, secured to a slide, F^3, mounted for transverse reciprocation upon a carriage, G^3, itself mounted for longitudinal reciprocation upon the slide T^2, before mentioned. As herein shown, the said tool carriage carries three parallel square slides, H^3 I^3 J^3, adapted to be reciprocated in line with the spindle and respectively provided with a gage, K^3, a mill, L^3, and a die, M^3, the opposite ends of the slides being provided with depending arms N^3, each furnished at its lower end with an anti-friction roll, O^3, as shown. The carriage is advanced step by step in three movements by a cam having the faces P^3, Q^3, and R^3, and composed of two parts, S^3 and T^3, tongued and grooved together, and the latter being adjustable on the former through a seg-

mental slot, U^3, and a bolt, V^3, and the former being secured to the driving-shaft, the said faces of the cam engaging with an anti-friction roll, W^3, carried by the carriage, which is retracted by a cam, X^3, also mounted upon the driving-shaft W and co-operating with an adjustable block, Y^3, mounted upon a horizontal arm, Z^3, extending laterally from the said carriage. The tool-carrying slides H^3 I^3 J^3 are independently advanced and retired in line with the spindle by a transverse frame, A^4, and an upright arm, B^4, respectively located on opposite sides of the rolls O^3 and secured to a slide, C^4, mounted for longitudinal reciprocation upon a carriage, D^4, mounted for similar movement upon the slide T^2 of the machine. The slide C^4 is reciprocated for independently advancing and retiring the tool-carrying slides through a lever, E^4, connected with the slide through a bolt, F^4, and fulcrumed to an upright stud, G^4, carried by the carriage D^4, the lever being provided at its opposite or lower end with a lateral extension, H^4, to which are secured two uprights, I^4 and J^4, carrying anti-friction rolls K^4, through which the lever is actuated, the roll of the upright I^4 being engaged for advancing the slide C^4, and hence the tool-carrying slides, by the three peripheral cams L^4, mounted on spindles M^4, entering the periphery of a collar, N^4, adjustably secured to the shaft W, while the roll of the upright J is engaged for retracting the slide C^4, and hence the tool-carrying slides, by the three cam-blocks O^4, adjustably secured to the face of a collar, P^4, mounted upon the said driving-shaft and provided with a circular series of holes, through which the said blocks are shifted. There being three each of the cams L^4 and O^4, the slide C^4 is advanced and retracted three times, or once for each of the tool-carrying slides, during each rotation of the driving-shaft.

The tool-carriage E^3 is locked against lateral movement during the advancement and retraction of the respective tool carrying slides by a locking-arm, R^4, provided upon its under face with a finger, S^4, entering notches T^4 formed in a plate, U^4, secured to the carriage, the said arm being fulcrumed upon a stud, V^4, carried by the carriage G^3 and actuated in the lifting of the finger out of the notches T^4 by a tripper or collar, W^4, mounted upon the driving-shaft W and provided with pins X^4, located in its periphery and engaging with a pin, Y^4, carried by the lever, which is normally depressed upon the plate S^4 by a spring, Z^4, secured to the said carriage, as shown.

The said driving-shaft W carries a gear-wheel, A^5, connected with clutch mechanism B^5 and meshing into a worm-gear, C^5, mounted on a shaft, D^5, carrying the driving-pulley E^5, frictionally secured to the shaft between paper friction-disks F^5, through which and the collar G^5 the pulley is coupled to the shaft under just sufficient friction to drive the machine, which is stopped and saved from injury when anything breaks or impedes it by the slipping of the pulley upon the shaft.

Having described my invention in detail, I will now proceed to set forth the method of its operation.

Let it be assumed that the machine has been properly timed, that a rod has been fed through the spindle, and that a screw or whatever other article the machine has been set to produce has just been cut from its forward end. Under the conditions named the next action of the machine is to move the disk-spring O away from the adjacent end of the spindle. In doing this the spring slides on the rod; but when the spring is moved forward it seizes the rod with a positive grip and feeds it through the spindle and chuck, the latter being open and the tool-carriage being at this time locked in its retracted position adjacent to the driving-shaft, with its gage K^3 directly in front of the projecting forward end of the rod. At this time also the arm B^4 is located directly behind the roll O^3, carried at the lower end of the arm N^3 of the slide H^3, carrying the said gage. The slide C^4, carrying the arm B^4, is now moved forward through its connections with the driving-shaft, and through the said arm moves the slide H^3, whereby the gage carried by the same pushes back the rod and leaves it in exactly the right position, the springs K and Q retiring as the rod is pushed back, to prevent it from being forced back through the springs, with the effect of impairing their grip upon it. Meanwhile the ring A^2 has been moved, through its connections with the driving-shaft, over the jointed levers W′ W′, gradually forcing the same into the slots X′ X′, whereby the levers are extended and push forward the adjustable sleeve, (composed of the parts H^2 and I^2,) which in turn pushes forward the split body J^2 of the chuck into the chuck-shell K^2, secured to the spindle, which is not longitudinally movable. This operates to close the forward end of the split body J^2, which bites the rod and holds it firmly immediately after the gage has done its work. Meanwhile the gage and its slide have been retracted through the frame A^4 of the slide C^4, the latter being moved back through its connections with the driving-shaft. The tool-carriage E^3 is now unlocked by the actuation of the locking-arm R^4 by the pins S^4 in the tripper or collar W^4 and advanced to bring its mill L^3 in line with the work and locked in this position. This leaves the rear end of the slide I^3, carrying this tool, in front of the arm B^4, which in the actuation of the slide C^4 now moves the tool-slide forward and the mill on to the work. Meanwhile the forming-tool O^2 is also brought up to the work by the retraction of the carriage R^2 by the forming-cam Y^2, so that they operate together and co-operate to support the work each for the other. This work done, the mill is retired by the retraction of the slide I^3 through the frame A^4, the slide C^4, and the operative connections of the

latter, while the carriage R^2 is advanced by the clearance-cam V^2 to move the cutting-off tool N^2 out of the way of the die N^3. The tool-carriage is now unlocked again by the lifting of the locking-arm R^4 by the pins S^4 in the collar W^4 and advanced by the face R^3 of the sectional cam to bring the die M^3 in line with the work and the rear end of the slide J^3 in line with the arm B^4 of the slide C^4, the carriage being also locked in this position. The die is then advanced to the work through its slide J^3, the arm B^4, the slide C^4, and the connections of the latter, and after it has done its work it is retired by the frame A^4 and the said slide C^4, as above described. The cutting-off cam W^2 now advances the carriage R^2 to bring the cutting-off tool N^2 into play for cutting off the work. Meanwhile the retracting-cam X^3 is operating to draw back the tool-carriage to its retracted position near the driving-shaft, in which its gage is in line with the rod After the cutting-off tool has done its work, the carriage R^2 is retracted by the clearance-cam Z^2 to move the forming-tool out of the way of the gage K^3. Through its connections with the driving-shaft the ring A^2 is now moved to one side of the joined levers W' W', which, having their fulcra outside of the line of pressure upon their ends, are at once thrown out and virtually shortened by the recoil of the split body Y^2 of the chuck, the same releasing its grip upon the rod, which is again fed forward, pushed back by the gage, gripped by the chuck, and so on through the operations just above detailed. Special mention of the reversal of the spindle through the friction-clutch has not been made. The times for such reversals will depend upon the work being done.

It is to be noted particularly of this machine that the feed is positive and reliable, that the cutting-tools are solidly supported and operate with superior precision, and that the machine is in every particular constructed to be adjusted for securing a wide range of work and perfect timing of the parts. The cutting-tools employed will of course be selected with reference to the work to be done.

I would have it understood that I do not limit myself to the exact construction and arrangement of parts herein shown and described, but hold myself at liberty to make such changes and alterations as fairly fall within the spirit and scope of my invention.

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

1. In an automatic turning-machine, a disk-spring having a central opening and radially slotted to form spring-arms for engagement with stock fed through such opening, substantially as set forth.

2. In an automatic turning-machine, a disk-spring having a central opening and radially slotted to form spring-arms for engagement with stock fed through such opening, a casing for such spring, and a cap for the casing, substantially as set forth.

3. In an automatic turning-machine, a disk-spring having a central opening and radial slots entering the same, a movable support for such spring, a spring for holding such support in place, and gaging mechanism for gaging the stock after it has been fed forward through the spring, substantially as set forth.

4. The combination, with a loose pulley having a beveled recess in one of its faces, of a beveled sectional ring located in such recess and means for adjusting such ring laterally in its recess for contracting it, substantially as set forth.

5. The combination, with a loose pulley having a recess in one of its faces, of two concentric rings located in such recess and means for expanding the inner ring into the outer ring, substantially as set forth.

6. The combination, with a loose pulley having a beveled recess in one of its faces, of a beveled sectional ring located in such recess, a sectional ring located within the said beveled ring, and a key for expanding the inner ring into the outer ring, substantially as set forth.

7. The combination, with a loose pulley having a recess in one of its faces, of a beveled sectional ring located in such recess, means for laterally adjusting such ring in the recess to contract it, a sectional ring located within the said beveled ring, and a key for expanding the inner ring into the outer ring, substantially as set forth.

8. The combination, with a loose pulley having a beveled recess in one of its faces, of a beveled sectional ring located in such recess, a sectional ring located within the beveled ring, an annular plate secured to the pulley over the recess therein and carrying screws for laterally adjusting the beveled ring for contracting it, and means for expanding the inner ring into the outer ring, substantially as set forth.

9. The combination, with a loose pulley having a recess in one of its faces, of a sectional ring located in such recess and a key having a straight-sided end and a wedge-shaped portion for expanding such ring, substantially as set forth.

10. In an automatic turning-machine, the combination, with a spindle, of jointed chuck-closing levers located in slots therein and having their rear ends supported upon an incline, a sleeve having its rear end grooved to receive the forward ends of the levers and its forward end threaded, a chuck having a split body internally threaded at its rear end to receive the threaded forward end of the sleeve, and means for straightening the levers to close the chuck, substantially as set forth.

11. In an automatic turning-machine, the combination, with a spindle and feeding mechanism, of a carriage located at the forward end of the spindle and reciprocating at a right angle thereto, two tools located in such carriage, adjustable cam-blocks carried by the

carriage at one end thereof, and an adjustable operating and clearance cam for each tool located upon a rotary shaft and between the said cam-blocks, substantially as set forth.

12. In an automatic turning-machine, the combination, with a spindle and feeding mechanism, of a tool-carriage reciprocating at a right angle to the spindle, tool-slides mounted in said carriage, means for moving the carriage step by step to successively bring its different slides in position for operation, and a reciprocating slide for independently advancing each of the tool-slides, substantially as set forth.

13. In an automatic turning-machine, the combination, with a spindle and feeding mechanism, of a tool-carriage reciprocating at a right angle to the spindle, tool-slides mounted in said carriage, means for moving the carriage step by step to successively bring its different slides into position for operation, and a reciprocating arm and frame co-operating to independently advance and retire the tool-slides, substantially as set forth.

14. In an automatic turning-machine, the combination, with a spindle and feeding mechanism, of a tool-carriage, tool-slides mounted in said carriage, means for independently advancing and retiring them, and an adjustable cam for moving the carriage step by step, and consisting of two parts tongued or grooved together and adjustable through a segmented slot and bolt, substantially as set forth.

15. In an automatic turning-machine, the combination, with a spindle and feeding mechanism, of a tool-carriage, tool-slides mounted in such carriage, means for independently advancing and retiring them and for advancing the carriage step by step to bring them into position, and a locking-arm engaging with the carriage and operated by a tripper and a spring, substantially as set forth.

16. In an automatic turning-machine, the combination, with a spindle and feeding mechanism, of a tool-carriage, tool-slides mounted therein and provided with tools and depending arms, means for advancing the carriage step by step to bring the slides into position, a slide carrying a frame and an arm respectively located on opposite sides of the depending arms of the tool-slides, and means for advancing and retiring such slide for each of the tool-slides, substantially as set forth.

17. In an automatic turning-machine, the combination, with a spindle and feeding mechanism, of cutting-tools and means for operating them, driving-connections, and adjustable friction-disks coupling such connections with the machine and forming an automatic safety-stop therefor, substantially as set forth.

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

EVERETT HORTON.

Witnesses:
JOSEPH R. FORD,
E. H. ROGERS.