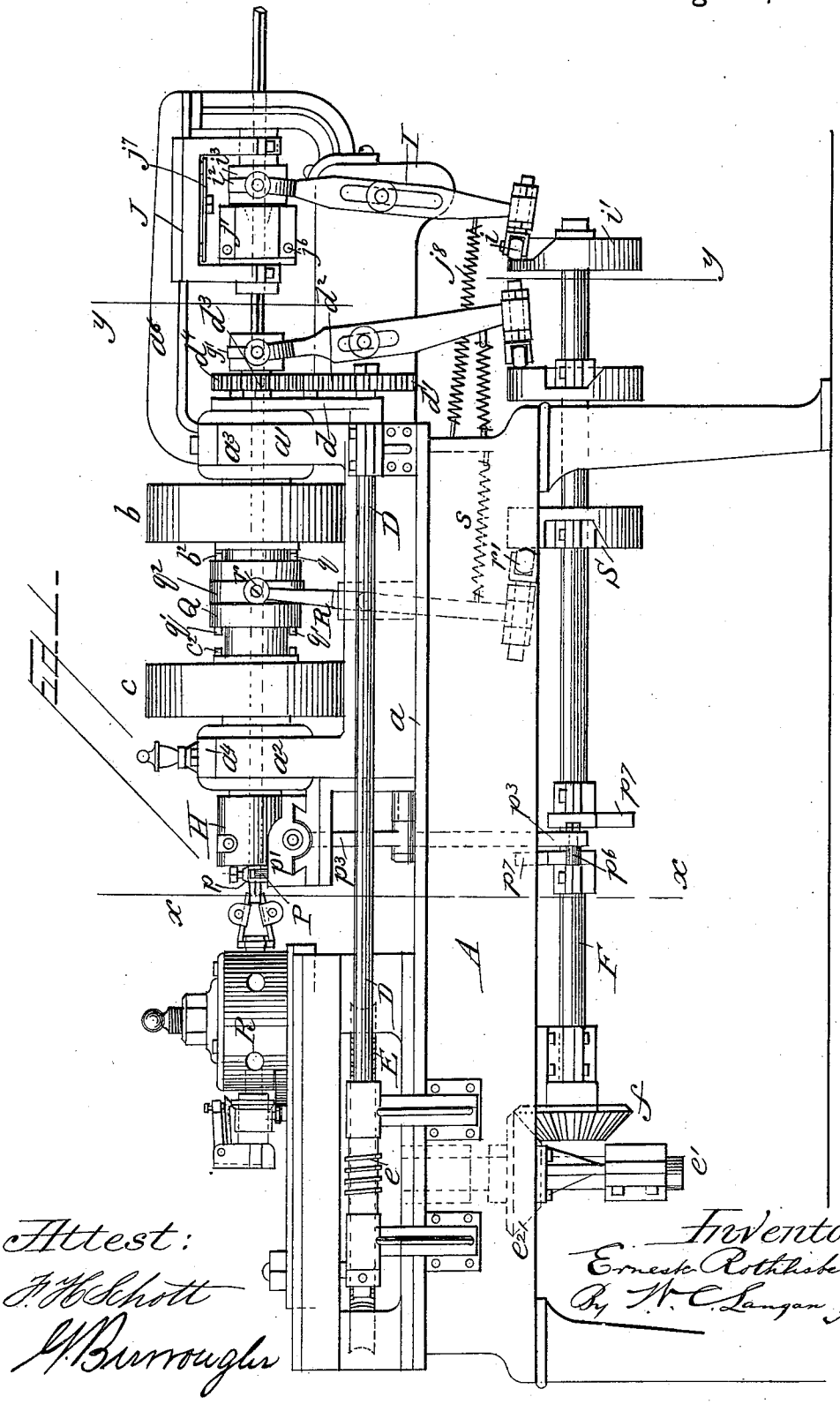
(No Model.) 7 Sheets—Sheet 1.

E. ROTHLISBERGER.

METAL SCREW MACHINE.

No. 434,204. Patented Aug. 12, 1890.



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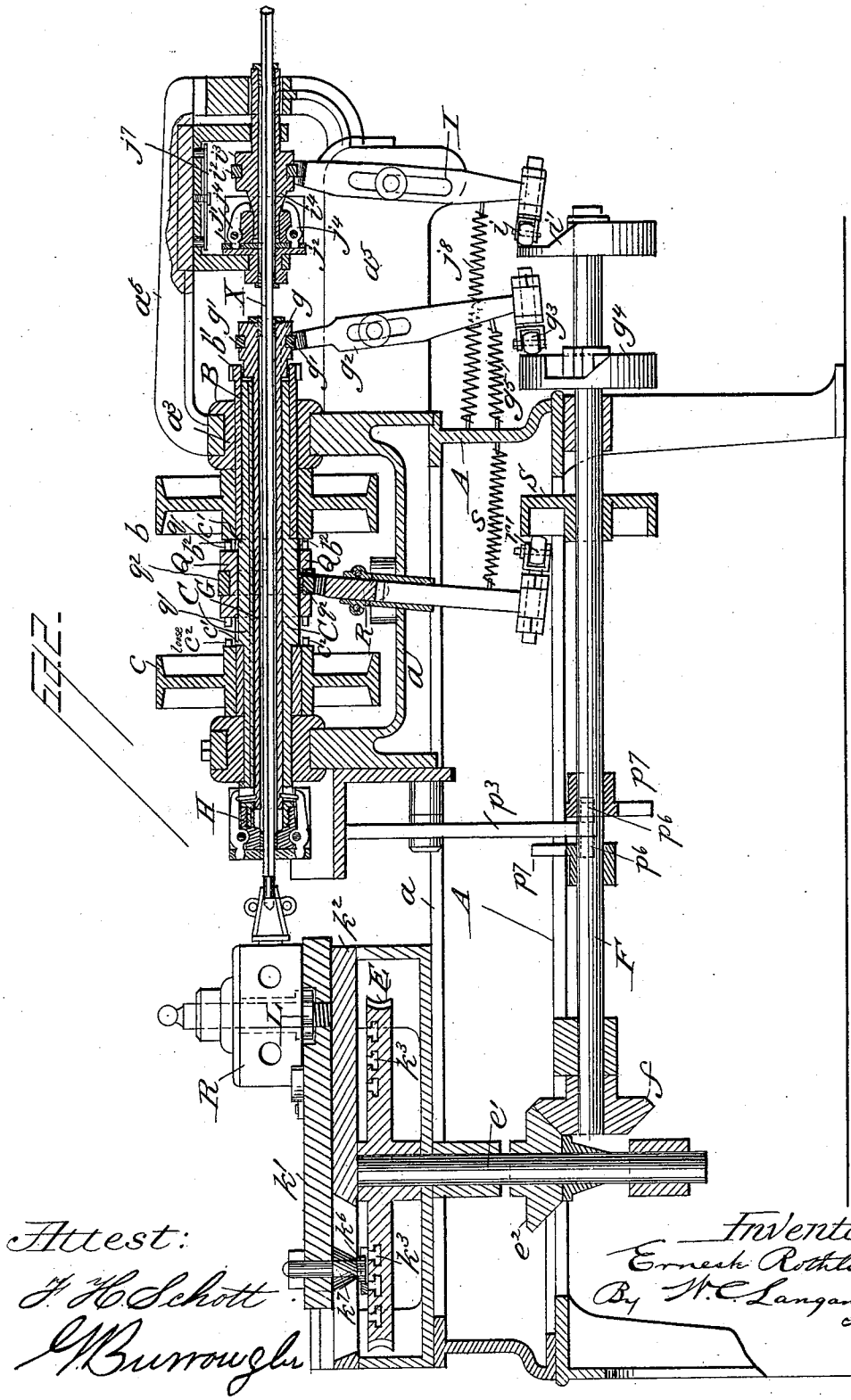
By N. C. Langan Atty.

(No Model.) 7 Sheets—Sheet 2.

E. ROTHLISBERGER.

METAL SCREW MACHINE.

No. 434,204. Patented Aug. 12, 1890.



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(No Model.) 7 Sheets—Sheet 3.

E. ROTHLISBERGER.

METAL SCREW MACHINE.

No. 434,204. Patented Aug. 12, 1890.

Fig. 3.

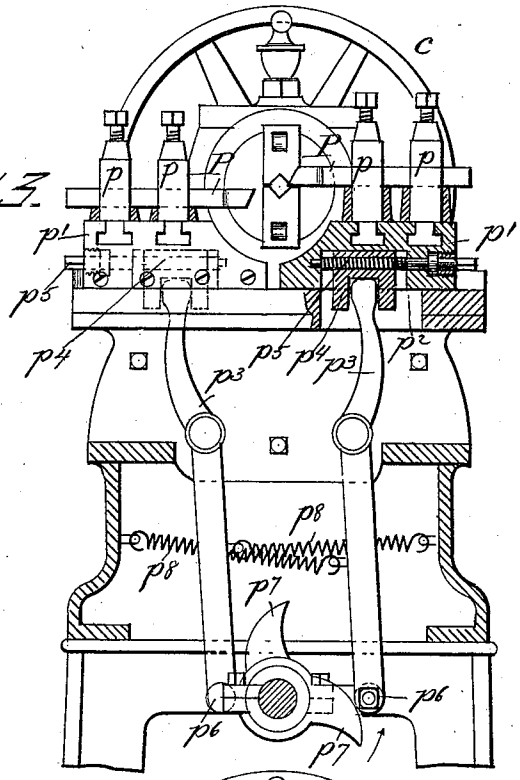
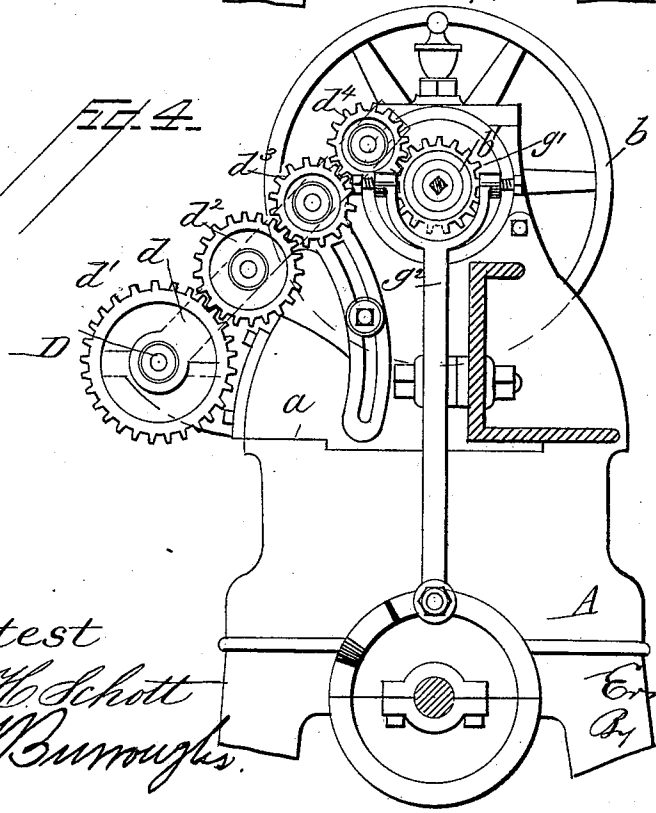


Fig. 4.



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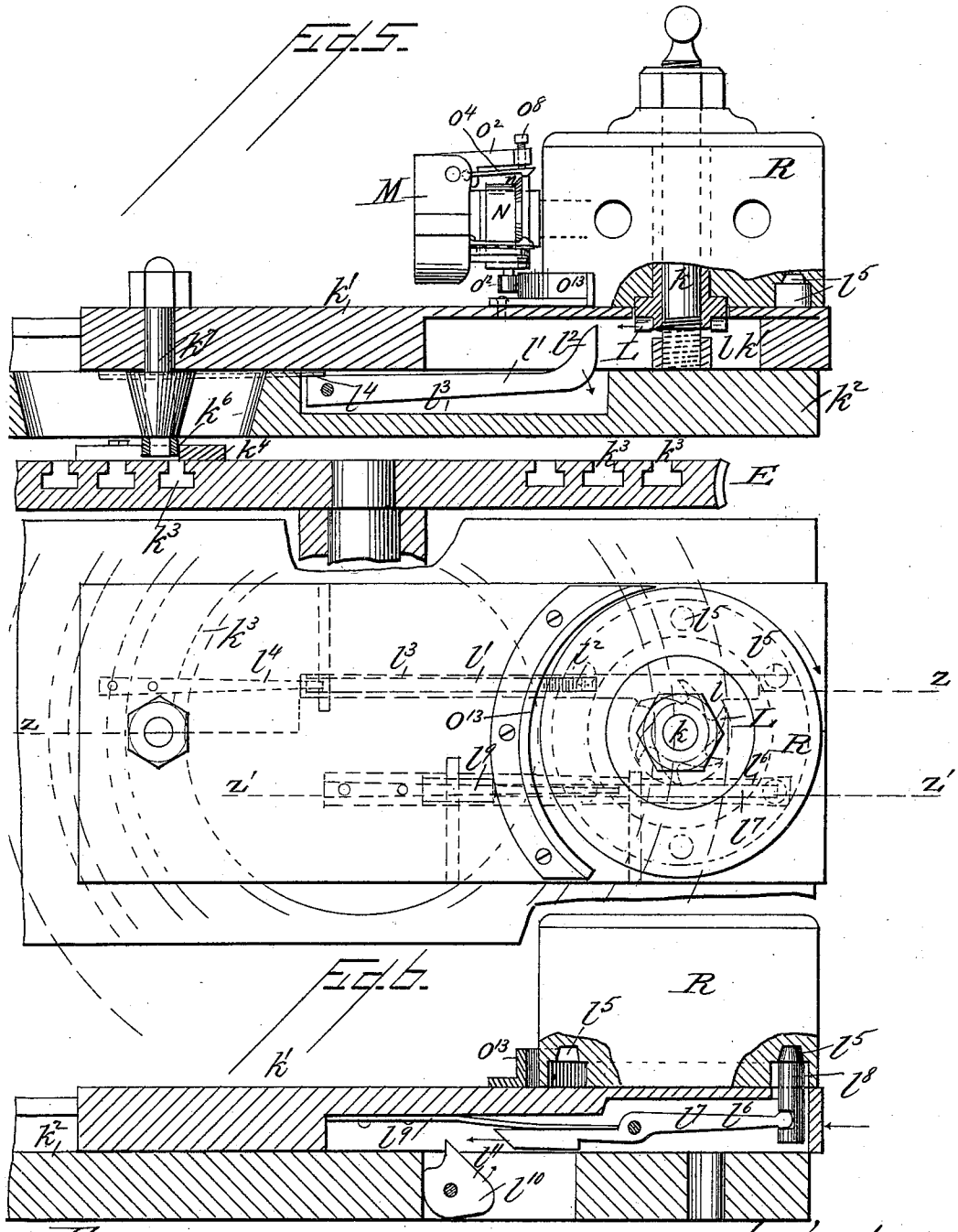
(No Model.) 7 Sheets—Sheet 4.

E. ROTHLISBERGER.

METAL SCREW MACHINE.

No. 434,204. Patented Aug. 12, 1890.



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E. ROTHLISBERGER.

METAL SCREW MACHINE.

No. 434,204. Patented Aug. 12, 1890.

Fig. 8.

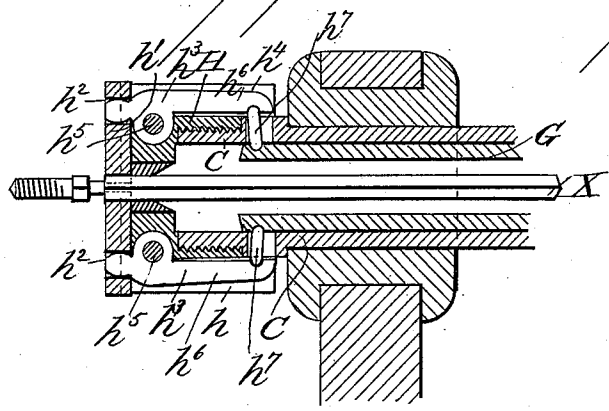


Fig. 10.

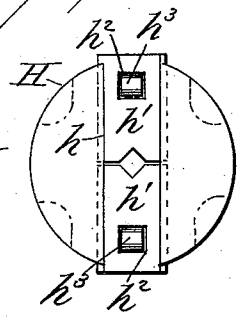


Fig. 11.

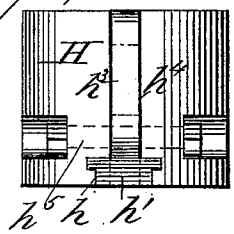
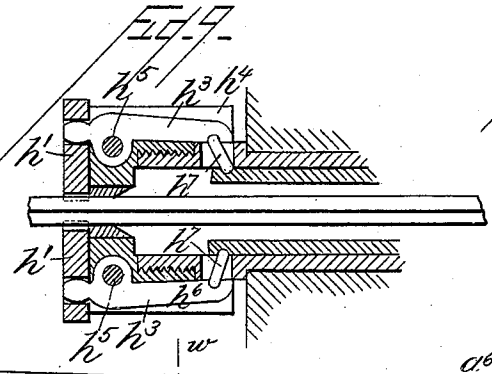


Fig. 9.



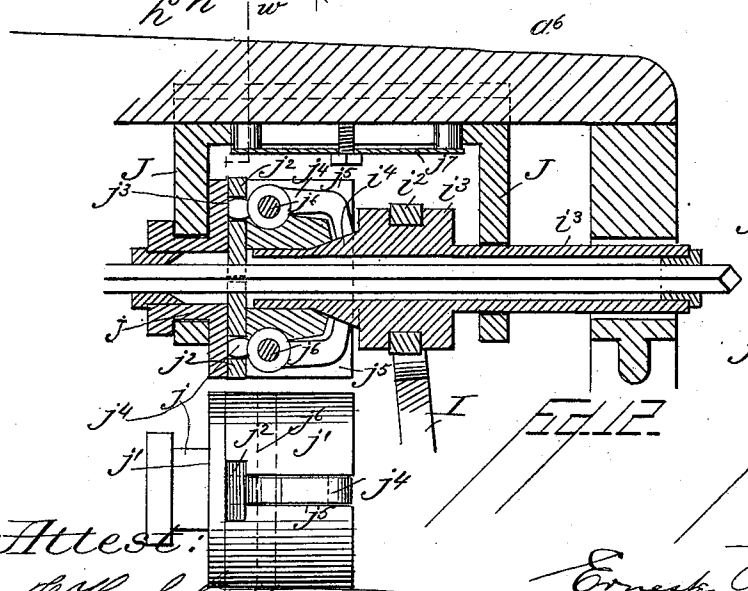


Fig. 12.

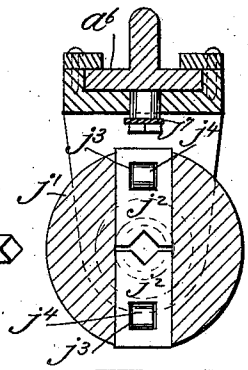


Fig. 13.

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METAL SCREW MACHINE.

No. 434,204. Patented Aug. 12, 1890.

Fig. 14.

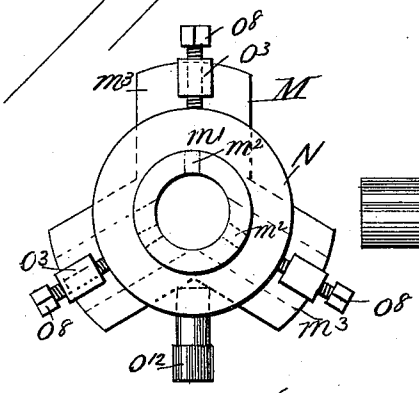


Fig. 15.

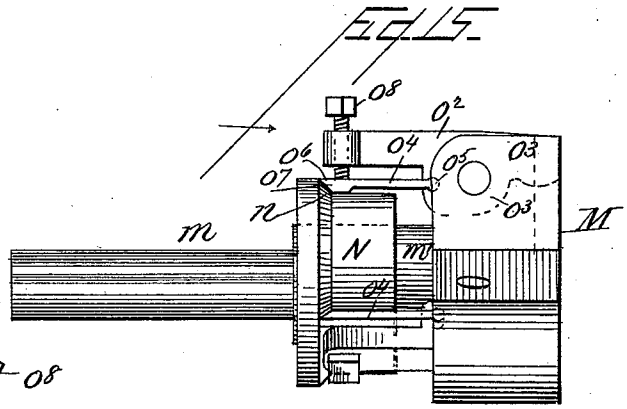


Fig. 16.

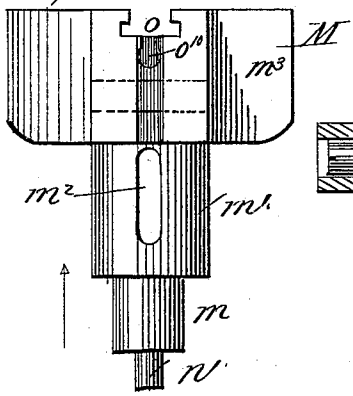


Fig. 17.

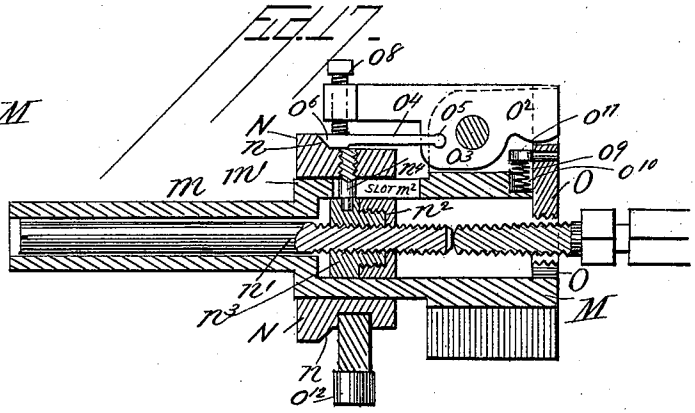


Fig. 19.

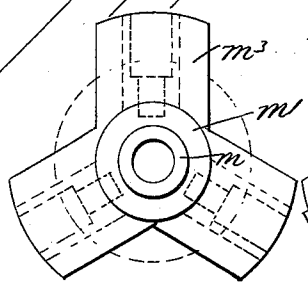


Fig. 20.

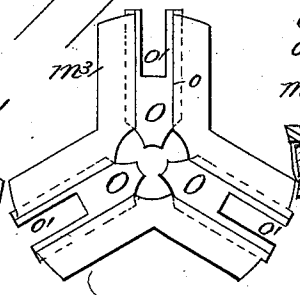
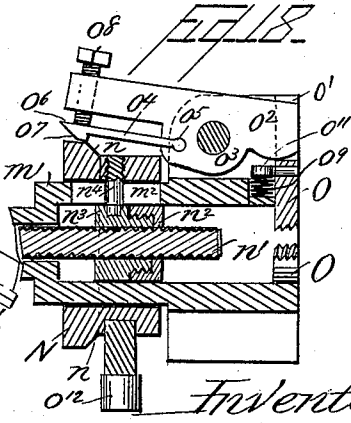
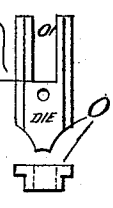


Fig. 18.





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E. ROTHLISBERGER.

METAL SCREW MACHINE.

No. 434,204. Patented Aug. 12, 1890.

Fig. 1.

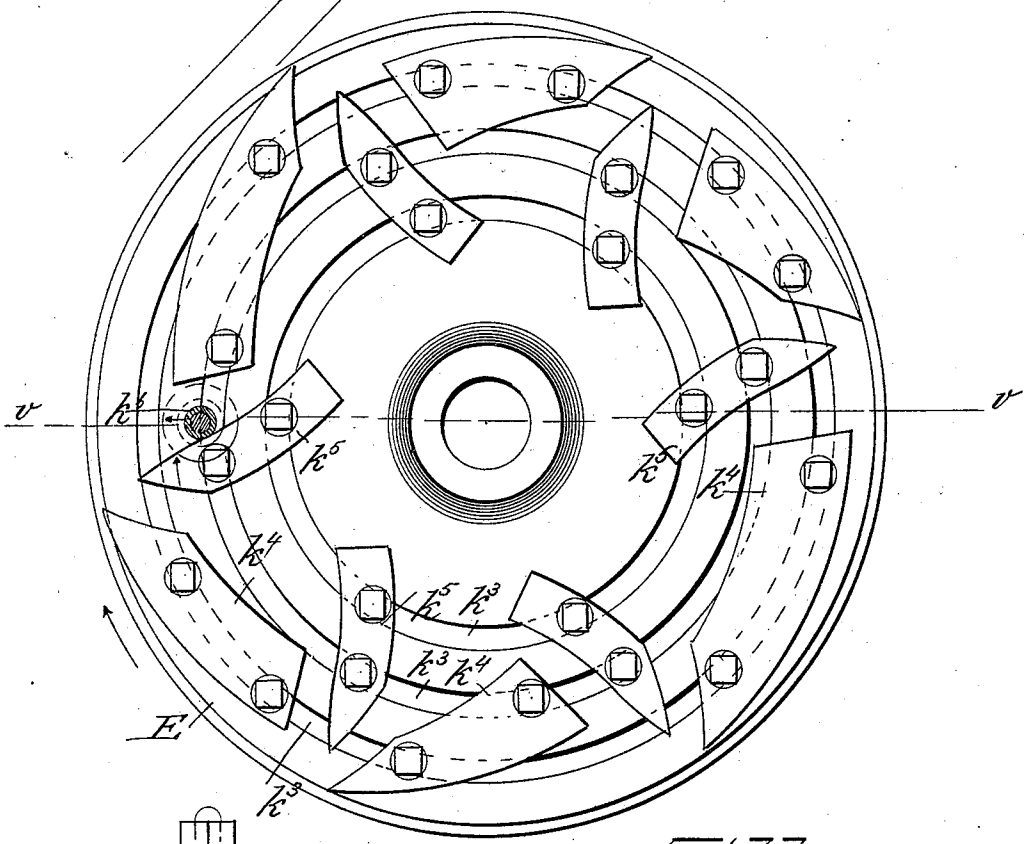
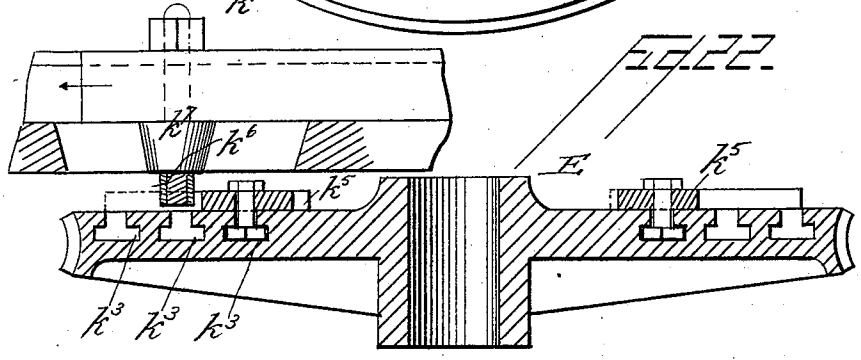


Fig. 2.



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By W. C. Langan Atty.

UNITED STATES PATENT OFFICE.

ERNESTE ROTHLISBERGER, OF LIMA, OHIO.

METAL-SCREW MACHINE.

SPECIFICATION forming part of Letters Patent No. 434,204, dated August 12, 1890.

Application filed January 25, 1890. Serial No. 338,109. (No model.)

To all whom it may concern:

Be it known that I, ERNESTE ROTHLISBERGER, a citizen of the United States, residing at Lima, in the county of Allen and State of Ohio, have invented certain new and useful Improvements in Metal-Screw Machines; and I do 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, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in machines for making bolts, the object being to provide means whereby the bolts may be turned down cylindrical, threaded, and cut from a straight rod rectangular in cross-section; and it consists in the construction and novel combination of parts hereinafter described, illustrated in the accompanying drawings, and pointed out in the claims hereto appended.

In the accompanying drawings, in which similar letters of reference designate corresponding parts, Figure 1 represents a side elevation of a machine embodying the invention. Fig. 2 represents a central vertical longitudinal section thereof. Fig. 3 represents a vertical transverse sectional view on the line $x\,x$ of Fig. 1, but with some parts slightly out of said line to show the interior arrangement thereof. Fig. 4 represents a vertical transverse section on the line $y\,y$ of Fig. 1, to show the connecting-gearing. Fig. 5 represents a longitudinal section of the worm-wheel, turret, turret-slide, and connected parts, on the line $z\,z$ of Fig. 6. Fig. 6 represents a detail plan view to further illustrate said parts. Fig. 7 represents a detail longitudinal sectional view on the line $z'\,z'$ of Fig. 6, of the mechanism to hold and release the turret. Figs. 8, 9, 10, and 11 are detail views, some sectional, showing the construction and operation of the clutch for the bolt-rod. Figs. 12 and 13 represent similar views of the feed-clutch for said rod. Fig. 14 is an end view of the roughing and threading die holder. Fig. 15 is a side view of said holder. Fig. 16 is a plan view of the same. Fig. 17 is an axial section of said holder with the dies opened apart. Fig. 18 is a similar section with the dies closed. Figs. 19 and 20 are detail views of the holder and dies. Fig. 21 is a plan view of the worm-wheel with cams attached. Fig. 22 is a section on the line $v\,v$ of Fig. 21.

Referring to the drawings by letter, A designates the main frame of the machine, supported upon suitable legs at its corners and having a horizontal bed a, which supports the portions of the main frame above itself and the bed-block on which the turret-slide, hereinafter described, moves. a' a^2 are standards rising from said bed a, and having similar bearings a^3 a^4 at their upper ends.

a^5 is a supporting-arm projecting horizontally forward from the front standard a', and a^6 is a similar arm projecting similarly forward and then descending to unite with the arm a^5.

B designates a sleeve turning in the front bearing a^3, and b is a drive-pulley secured to said sleeve just to the inner or rear side of said sleeve. The sleeve carries on its opposite or outer end a gear-wheel b', preferably integral therewith.

C is a long hollow spindle or shaft with its front portion inserted in the sleeve B, the adjacent end of which is flush with the outer surface of its middle portion, as shown in Fig. 2.

c is a pulley about equal in size to the drive-pulley b, turning loosely on the spindle C, the circumferential shoulders c' c' of the spindle being adjacent to the hub of the pulleys. The said pulleys may be driven by belts from any convenient motor and rotate in opposite directions, having suitable teeth b^2 and c^2, respectively, on the facing ends of their hubs, that engage corresponding teeth on a clutch thimble or sleeve mounted on the middle portion of the spindle C, and hereinafter more fully described.

D is a horizontal shaft, Figs. 1 and 3, mounted in suitable bearings secured to the main frame at one side thereof and passing through an opening in the lower end of a bearing-bar d, secured by bolts or otherwise to the front portion of the main frame. Upon the front end of the shaft D, to the outer side of the bearing-bar, is secured a gear-wheel d', that meshes with the lowest of a series of gear-wheels d^2 d^3 d^4, respectively, that are mounted

on short shafts, each having a bearing in the bar d, at a suitable point therein. The said gears intermesh from above downward. The highest wheel d^4 meshes with the gear-wheel b' on the sleeve B, and the gear-wheels d' d^2 d^3 d^4 diminish suitably in diameter upward, to give the lowest wheel d' the proper and desired rate of speed.

The shaft D has upon it between the bearings, secured to the main frame at the side of the bed-block for the turret-slide, a worm e, which meshes with a large horizontal worm-wheel E, mounted on the upper end of a vertical shaft e', that turns in bearings made on or secured to the main frame. Upon the shaft e' is a bevel-gear e^2, meshing with a similar gear f upon a horizontal shaft F, that turns in bearings depending from the main frame. The said shaft F operates the bolt-rod-gripping mechanism, the feeding mechanism, the reversing mechanism, and the bolt threading and cutting mechanism, and is itself rotated from the drive-pulley b and sleeve B by means of the connective gearing-shafts, worm-wheel, and worm hereinbefore described.

The bolt-rod-gripping mechanism is constructed as follows:

G is a hollow supporting-shaft surrounded by the spindle C, and with the bolt-rod X passing axially through it from its feed end, the rods being suitably supported by a collar or perforated block entering said end. The outer or feed end of the shaft G is enlarged or provided with a cylindrical head g, having a circumferential groove in which is seated a ring g', suitably divided and connected to and within the arms of the bifurcated upper end of a lever g^2 by pivotal screws. (See Fig. 3.) The said lever has a longitudinal slot about midway of its length, through which it is pivoted upon the side of the arm a^5 of the main frame, and at its lower end is pivoted between the arms of a bifurcated block on anti-friction rollers g^3, that bear against a cam-edged flange of a cam-disk g^4, mounted on the shaft F and turning therewith. The anti-friction roller g^3 and lower arm of the lever are drawn into the concavity of said cam-roller by a spring g^5, that connects said arm and the main frame.

Upon the inner or discharge end of the hollow spindle C is screwed a cylindrical head H, having a hollow interior, through which the bolt-rod X passes, and in transverse opposite slots h in said head move the gripping-jaws h', that hold the rod when it is being cut, the said slots h and jaws h' being rabbeted on corresponding edges to keep the latter in place, as seen in Fig. 11. The jaws h' have V-shaped notches in their ends to grip the bolt-rod, and are provided with openings h^2 for the insertion of the heads of the gripping-levers h^3, that lie in longitudinal recesses h^4 in the head H and are pivoted on the bolts or pivotal rods h^5 therein. The arms h^6 of said levers are connected by short links h^7 with the inner end of the hollow shaft H, the said links passing through suitable openings in the hollow spindle C. Thus when the shaft G is drawn outward by the lever and cam the ends of said arms h^6 are drawn together and the jaws moved outward, releasing the rod, so that the latter can be fed into the machine. When the shaft G is moved inward by the lever, the action is reversed, and the jaws hold the bolt-rod while it is being cut and formed.

The following is a description of the construction of the bolt-rod-feeding mechanism.

I is a slotted lever similar to the lever g^2 and similarly pivoted to the arm a^5 of the main frame, and i is an anti-friction roller mounted on the lower end of the lever I and engaging against the cam-flange of a cam-disk i', secured upon the shaft F. The upper end of the lever I is bifurcated and connected by pivotal pins or screws to a suitable ring i^2, seated in a circumferential groove in the cylindrical enlargement of a clutch-sleeve i^3, having an inwardly-looking conical part i^4 adjoining said enlargement.

J is a slide or carriage frame moving over the arm a^6 of the main frame upon flanges at its upper edges or plates bolted thereto and having depending arms, in the outer or front one of which the clutch-sleeve i^3 has a bearing, while in the inner depending arm the central boss j of a cylindrical block j' has a bearing.

j^2 j^2 are jaws sliding in transverse diametrically-opposite recesses in the block j', having V-shaped notches in their ends to grip the bolt-rod and provided with openings j^3 to receive the heads of the short gripping-levers j^4, that lie in longitudinal recesses j^5 in the block j'. Said levers j^4 are pivoted upon the pins j^6 and have their arms bent inward to rest upon the conical parts i^4 of the clutch-sleeve, so that when the lever I moves the said sleeve inward the said conical part will move said arms apart, and will consequently close the jaws on the bolt-rod. It will also move the bolt-rod, carriage-frame, and cylindrical block inward, or in the direction of feed, and to cause said frame and block to cease motion immediately at the end of each stroke of the clutch-sleeve i^3 a spring j^7 is secured centrally to the carriage-frame by a bolt or otherwise, and has on its ends little blocks, which pass through openings in the frame and bear against the under surface of the arm a^6 of the main frame, which gives the necessary friction to accomplish the desired result.

At openings of the clutch-sleeve, cylindrical clutch-block, and other parts, the bolt-rod is supported in proper line by collars or perforated blocks, as shown. A coiled or other spring j^8, connecting the lower arm of the lever I and the main frame, returns the clutch-sleeve after being moved inward by said lever. The parts are so arranged that the feed mechanism and gripping mechanism act alternately, one being at rest when the other is in action. By this means the bolt-rod can be fed up, released by the feed mechanism, and then held by the gripping mechanism till the bolt is cut and made.

The mechanism to reduce the rod and thread the bolt is constructed as follows:

R is a tool-holder or cylindrical turret to hold the reducing and thread-cutting dies, of which there are preferably six in number, three being roughing-tools and three threading-tools, a fuller description of which is hereinafter given. The said turret is provided with equidistant recesses or openings for the reception of the respective tools, Fig. 5, and is attached by a central vertical stem k to the turret-slide k', which is preferably rectangular and reciprocates upon its supporting-bed k^2 in suitable ways or guides made in the upper face of the latter. The worm-wheel E has in its upper face the annular recesses k^3 k^3, preferably three in number, concentric with its center, which recesses are T-shaped in construction. To the worm-wheel are attached by bolts or pins, the heads of which rest in said annular recesses, the series of pairs of curved edged cams, the members of each pair being designated k^4 k^5, respectively. The number of pairs of said cams is equal to that of the tools, both roughing and threading, attached to the turret—in this instance six. The operating-edges of said cams are more or less concave, and their points stand nearly out to the rim of the worm-wheel, from which the cams incline inward, the smaller reversing-cams k^5 in the opposite direction to and at a steeper inclination than the direct-acting cams k^4. The points of the reversing-cams also are slightly rounded on their operating-edges, as shown.

k^6 is an anti-friction roller mounted on the lower end of a stud k^7, depending from the turret-slide in the central line thereof near its outer or rear end and secured to said slide by a threaded stem and bolt, as shown. The said friction-roller is engaged by the point of one of the direct-acting cams k^4 and moved inward in a straight line by the concave operating-edge thereof as the worm-wheel rotates till it reaches the heel of said cam, operating when it engages against the operating-edge of the corresponding oppositely-inclined cam k^5, which moves it as far outward again. Of course the reciprocation of said rollers by means of the stem k^7 causes the turret-slide to reciprocate, and the reciprocation of the turret-frame causes the roughing and threading tools attached to the turret to move up to and from their work. The stem k^7 reciprocates in a suitable slot in the turret-slide support or bed k^2. (See Fig. 5.) Of course the turret must turn the sixth part of a rotation after each tool has operated to bring the succeeding tool in alignment to operate, and when said tool is in operation the position of the turret must be fixed. To accomplish the rotation, a wheel L, Figs. 5 and 6, having six equidistant hook-points, is secured to the lower end of the turret-stem k in a large recess l in the turret-slide, and a lever l', having an upturned point l^2, with its edge adjoining the upper edge of the shank inclined to slip over an obstruction, is pivoted in a recess l^3 in the slide-support, communicating with the recess in the turret-slide, a spring l^4 being secured in an outer or rearward extension of the recess l^3 and bearing downward upon the heel of the hook-lever l' to keep the latter horizontal and with its point erect. When the direct-acting cams move the turret-slide inward, the point l^2 of the lever l' will strike against one of the hook-teeth of the wheel l and turn said wheel one-sixth of a rotation. The turret then becomes locked by means hereinafter described, and the slide being returned outward the inclined edge of the point l^2 will ride under the succeeding tooth and will be brought into position again by the spring l^4.

The following is a means to lock the turret when in position. (See Figs. 6 and 7.)

l^5 l^5 are six equidistant vertical recesses in the base of the turret, any one of which may be turned to register with an opening passing down into the long recess l^6 in the turret-slide. In said recess is pivoted a double-armed lever l^7, having a head on one end that enters and holds in a notch in the side of a pin l^8, that stands up and down in the recess l^6, with its point ready to pass through the opening therefrom into one of the recesses l^5 in the turret. The opposite end of said lever has its end inclined inward and downward and is pressed down upon by a spring l^9, secured in the recess l^6.

l^{10} is a cam having an edge l^{11} inclined downward and inward and pivoted in a slot in the slide-support below the recess l^6 in the turret-slide. When the turret and slide move far enough outward or rearward, the inclined edge l^{11} impinges on the outer end of the lever l^7, and thereby depresses the pin l^8, so that the turret becomes unlocked from the slide and can be rotated by the described means. The unlocking happens just as the hooked lever l' and wheel are about to rotate the turret, and after said rotation the turret and slide are moved in the opposite direction and the spring l^9 causes the pin to again lock the turret.

The bolt-rod X is rotated by a sleeve-spindle and hollow shaft, through which it passes, and the tools attached to the turret do not rotate, but are merely moved up to and from their work by the mechanism described. Any style of die for said tools may be used; but the modification hereinafter described is that preferred. To use said dies the tool or die-holder must be made to receive said dies, and therefore must have a particular construction. M is one of said die-holders, having a hollow stem m, adapted to be received into one of the recesses made therefor in the turret. Outward from the said stem is the enlarged cylindric portion m', having three equidistant longitudinal slots m^2, and outward from said cylindrical portion are three similar equidistant radially-diverging blocks m^3.

N is a cam-sleeve sliding on the part m' of

the die-holder and having at its end nearest thereto a circumferential cam-flange, having the outer inclined cam side n.

n' is a rod standing axially in the die-holder and threaded therein, upon which threaded part are the adjusting-nuts n^2 n^3, the latter of which is connected with the sleeve N by the three rods or screws n^4, that pass through the slots m^2. Thus the sleeve N and bolt or rod n' must move together, being connected by said screws. The nut n^3 has a threaded boss that screws into a corresponding recess in the nut n^2, and c causes the nuts to lock together.

O O are screw-cutting dies having rabbeted edges to slide in corresponding radial recesses o o made for them in the outer portion m^3 of a die-holder M. The inner ends of each of said dies, which are three in number in each holder, has a proper concave cutting-edge, while its outer end is provided with a longitudinal open recess o' to receive the end of a lever o^2, that lies in a longitudinal recess in the corresponding block m^3, and has a rounded inward enlargement o^3, that is pivoted to said block m^3 inward from the die therein on a transverse bolt, as shown.

o^4 is a bar or arm having on one end a rounded head that fits in a similar socket o^5 in the inner edge of the lever o^8, its other end having a head o^6, the end edge o^7 of which inclines in such a direction as to rest upon the inclined side n of the flange of the cam-sleeve N.

o^8 o^8 are adjusting-screws that pass threaded openings in the inner ends of the levers o^3 and bear upon the corresponding bars o^4. As the outer ends of said levers press inward on the threading-dies, it is evident that any wear of said dies can be taken up by turning the screws o^8 inward.

o^9 o^9 are coiled springs seated in recesses o^{10} in the die-holder and pressing outward against projections o^{11} on the inner surfaces of the dies, to force the latter outward when they have been relieved from the pressure of the levers o^3.

o^{12} is an anti-friction roller mounted on a pin depending from the cam-sleeve N and bearing against the side of a curved cam o^{13}, secured to the turret-slide, but not concentric with the turret, the anti-friction roller engaging the surface of the cam outward from the turret at the end of the cam which is nearer the latter, so that the said roller and consequently the sleeve N will be drawn slightly away from the turret and the inclined edges o^7 of the arms or bars o^4 until the adjacent ends of the said bars rest upon the flange of the sleeve N and the levers o^3 drive the threading-dies inward on the bolt-rod and into position to cut.

When the turret has been turned into position and the dies have roughed out and threaded the bolt, the bars or arms a^4 are thrown off from the flange of the cam-sleeve N by the contact of the end of the bolt just formed and the rod n', the latter being driven back thereby and carrying with it the sleeve N. The bolt is then in condition to be cut from the bolt-rod by the mechanism herein-below described.

P P, Fig. 3, are cutter tools or knives mounted by suitable means upon tool-holders p p, and held thereto by set-screws, as shown. The said posts are attached to and held upon carriages or slides p' p', moving transversely upon ways made upon suitable portions of the main frame above the slots p^2 p^2 therein.

p^3 p^3 are similar double-armed levers pivoted on the main frame at proper points and with the heads on their upper ends entering sockets in the lower surfaces of the blocks p^4 p^4, which are held in place within the recesses in the under surfaces of the carriages by the adjusting-screws p^5 p^5 of ordinary construction.

p^6 p^6 are anti-friction rollers attached to the lower ends of the levers p^3 p^3, which rollers bear against the cams p^7 p^7, secured upon the shaft F and turning therewith. The motion of the knives inward when the cams and levers move the carriages inward severs the bolt from the bolt-rod. This takes place immediately after the roughing and threading mechanism have been drawn from the bolt.

p^8 p^8 are coiled springs connecting the levers with the main frame and returning the knives outward after the bolt is severed.

When no means are provided for separating or opening apart the thread-cutting dies after cutting the threads, the said dies could not be withdrawn without stripping the threads. To prevent this when ordinary threading-dies are used, the following mechanism is attached:

Q is a clutch thimble or sleeve splined on the spindle C, between the pulleys b and c, and provided with teeth q q' at its opposite ends, that respectively mesh with the teeth b^2 c^2 on the adjacent ends of the hubs of said pulleys, one pulley being in gear with said thimble when the other is out of gear therewith and the pulleys being rotated in opposite directions.

q^2 is a suitably-divided ring seated in a circumferential groove in the thimble Q, and R is a double-armed lever pivoted to the main frame at a proper point and with its upper end bifurcated and straddling said ring, to which the arms of the bifurcation are connected by pivotal pins or screws r. Attached to the lower end of said lever is a bifurcated block, in which is mounted an anti-friction roller r', that bears upon the cam-edge of the circumferential flange of a cam-disk S, mounted on the shaft F.

s is a spring connecting the lower arm of the lever R with the main frame. When the anti-friction roller r is on the uncut or straight edge of the flange of the cam-disk S, the lever holds the clutch-thimble coupled to the pulley b, and the spindle C rotates in the proper direction for the roughing and thread-cutting dies to operate on the bolt-rod; but when said

roller descends into the hollow of the cam-flange, the spring *s* uncouples the clutch-thimble from the pulley *c*, thereby reversing the motion of the spindle C, causing the bolt-rod to turn in the direction in which the threading-dies can disengage themselves therefrom without stripping the threads.

Thus by the described mechanism the square bolt-rod is fed by the feed-jaws into the hollow supporting-shaft at regular intervals, and when the said jaws close to act, the gripping-jaws hold the bolt-rod while the bolt is roughed and threaded and severed from the rod.

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

1. In a bolt-making machine, the combination of the carriage-frame sliding on an arm of the main frame, the spring secured centrally to said carriage-frame and having blocks or pins on its ends that pass through suitable openings and bear on the main frame, the cam-sleeve having a bearing in the outer depending arm of the carriage-frame and provided with a conical cam-surface, the cylindrical block having a boss journaled in a bearing in the inner depending arm of the carriage-frame, the feed-jaws sliding in recesses in said block, the levers pivoted in recesses in the block with their outer ends resting on the conical cam-surface of the cam-sleeve and their heads in openings in the feed-jaws, and mechanism, substantially as described, whereby the sleeve can be slid sufficiently far in between the levers to cause the jaws to grip the bolt-bar and thereby cause the carriage-frame, sleeve, and block to move together in the direction of feeding, substantially as specified.

2. The combination, with the carriage-frame, the spring attached thereto and provided with end blocks to provide friction on the main frame, the cam-sleeve and block having bearings in the depending arms of the carriage-frame, the sliding feed-jaws and the pivoted levers with their heads in openings in said jaws, and their outer ends resting on the conical part of the cam-sleeve, of the slotted lever pivoted to the main frame and having its upper end attached to a ring in a circumferential flange of the cam-sleeve, and a cam secured to a longitudinal shaft rotated by the drive-pulley by means of connecting-gearing and operating upon the lower end of the lever to move the cam-sleeve outward against the action of a spring which moves inward, substantially as specified.

3. In a bolt-making machine, the combination of the hollow supporting-shaft sliding slightly in and out of the rotary spindle, the hollow cylindrical head secured upon the inner end of said spindle, the gripping-jaws sliding in transverse recesses in said head, the levers pivoted in recesses in said head with their heads in openings in said jaws, and the links connecting the ends of said levers with the adjacent end of the hollow shaft, substantially as specified.

4. The combination, with the hollow supporting-shaft, the rotary spindle, the hollow cylindrical head, the gripping-jaws, the pivoted levers in the head, and the links connecting said levers and the adjacent end of the hollow shaft, of the slotted lever pivoted to the main frame and connected at its upper end with a ring in a circumferential groove in the hollow shaft, the anti-friction roller on the lower end of said lever, the cam bearing against said roller, and the spring connecting the lever and main frame and acting against the cam, substantially as specified.

5. In a bolt-making machine, the combination of the feed mechanism comprising the sliding carriage-frame, friction-spring, cam-sleeve, cylindrical block, feed-jaws, and the gripping mechanism comprising the hollow supporting-shaft, rotary spindle, cylindrical head, gripping-jaws, levers operating said jaws, and links connecting said levers to the hollow shaft of the levers, cams and springs constructed substantially as described, and causing said mechanisms to act alternately, one mechanism being at rest while the other is in operation, substantially as specified.

6. The combination of the sleeve carrying the driving-pulley, the gear-wheel on said sleeve, the longitudinal shaft mounted in bearings secured to the main frame, the gear-wheel on the front end of said shaft, the gearing connecting said gear-wheel and that on the sleeve, the worm on said longitudinal shaft, and the worm-wheel mounted on a vertical shaft and operating all the roughing-out and threading mechanism, substantially as specified.

7. The combination of the sleeve carrying the driving-pulley, the gear-wheel on said sleeve, the longitudinal shaft having a gear-wheel on its front end connected to the gear-wheel on the sleeve by intermeshing gearing, the worm on said shaft, the worm-wheel, the vertical worm-wheel shaft, the horizontal shaft carrying the cams to actuate the severing, reversing, gripping, and feeding mechanisms, and the gearing connecting said shaft and the worm-wheel shaft, substantially as specified.

8. The combination of the turret, the turret-slide, the worm-wheel having annular concentric recesses in its upper face, the direct acting and reversing cams attached to said worm-wheel by means of said recesses and bolts or screws, the stud depending from the turret-slide, and the anti-friction roller on the end of said stud to engage the said cams, substantially as specified.

9. The combination, with the turret, the vertical central turret-stem, the toothed wheel on the lower end of said turret-stem, the turret-slide, and the stud depending from the turret-slide through a slot in the slide-support and having an anti-friction roller on its lower end, of the worm-wheel, the cams at-

tached thereto, the hooked lever in a recess in the turret-slide support and projecting into a recess in said slide, and the spring pressing on the heel of said lever to keep the point thereof erect, substantially as specified.

10. The combination, with the turret having recesses in its base, the turret-slide having a recess communicating with any one of said locking recesses through an opening, the stud depending from the turret-slide with an anti-friction roller on its end, the worm-wheel and cams attached thereto to operate upon said roller and stud, of the pin in the recess in the slide, the double-armed lever pivoted in said recess with a head on one fitted in a notch in said pin, the spring to press down the opposite arm of the lever, and the cam pivoted in a slot in the turret-slide support to raise said end when the slide moves inward and thereby draw down the pin unlocking the turret, substantially as specified.

11. The combination, with the stud depending from the turret-slide, the worm-wheel and the cams thereon, of the toothed wheel on the turret-stem, the hooked lever, the spring to depress the heel of said lever, the locking-pin, the spring bearing on said lever, and the cam to act on the lever and depress the locking-pin to unlock the turret just before the hooked lever has operated upon the toothed wheel, substantially as specified.

12. The combination, with the knives, the tool parts to which said knives are attached, the carriages bearing said parts, and the adjustable recessed blocks below and within said carriages, of the double-armed pivoted levers with their heads in the recesses in said blocks, the cams on the shaft F to throw said heads inward, and the springs to reverse the motion of the levers, substantially as specified.

13. The combination, with the two pulleys rotating in opposite directions and having clutch-teeth on the facing ends of their hubs, of the clutch-thimble splined on the rotary spindle and having clutch-teeth on its respective ends to engage said clutch-teeth, the ring in a circumferential groove in said thimble, the double-arm pivoted lever having its upper end attached to said ring, the cam on the shaft F acting on the lower ends of said lever, and the spring acting on a lever in a direction opposite to that of the cam, substantially as specified.

14. The combination, with the turret and the curved cam on the turret-slide adjacent to but not concentric with the turret, of the die-holder attached to the turret and having longitudinal slots in its central portion, the cam-sleeve sliding upon said portion and provided with an inclined circumferential cam-surface, the rod in the hollow stem of the holder connected by nuts and screws or pins that pass through the said longitudinal slots in the holder, with the cam-sleeve, the roughing and threading dies, the levers pivoted in recesses in the holder and bearing on said dies, the bars or arms connected to said levers with their heads resting on the cam-sleeve in such a manner that the inclined ends of said heads can ride up on the inclined surface of the cam-sleeve flange, and the pin or stud depending from the cam-sleeve and preferably provided with an anti-friction roller to bear against the curved cam on the turret-slide and force the cam-sleeve inward with relation to the said arms or bars, and thereby tilt the levers and drive the dies inward, substantially as specified.

15. The combination, with the turret and curved cam on the turret-slide not concentric with the turret, of the die-holder, the cam-sleeve sliding thereon and provided with a circumferential inclined cam-surface, the rod in the stem of the holder connected by jam-nuts and screws or pins passing through slots in the holder with the cam-sleeve, the dies sliding in recesses in the holder, the pivoted levers bearing on said dies, the bars or arms connected to the said levers and having heads formed to ride up the inclined surface of the cam-sleeve, the pin or stud depending from said sleeve and having an anti-friction roller to engage the curved cam on the turret-slide, and the coiled springs in recesses in the holder bearing against lugs or projections on the dies outward when released by the levers, substantially as specified.

16. The combination, with the tool-holder, of the sliding dies, the cam-sleeve sliding on the holder, the levers pivoted to the holder and bearing on said dies, the arms or bars having at their inner ends rounded heads inserted in sockets in the levers and at their outer ends heads provided with outer inclined edges to slide upon the inclined surface of the cam-sleeve, and the adjusting-screws passing through threaded openings in the levers and bearing on the outer heads of the corresponding bars or arms, substantially as specified.

17. The combination, with the tool-holder having longitudinal slots at proper points, of the cam-sleeve sliding on said holder, and the rod in the hollow stem of the holder connected by jam-nuts and screws or pins passing through said slots to said sleeve, whereby when the end of said rod strikes the end of the screw just made the sleeve connected to said rod is carried outward in relation to the bars attached to the levers which move the dies inward and the latter are permitted to be pressed outward by suitable springs, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

ERNESTE ROTHLISBERGER.

Witnesses:
W. L. PARMENTER,
WILLIS V. MYERS.