(No Model.) 3 Sheets—Sheet 1.

C. F. ROPER.

METAL SCREW MACHINE.

No. 263,357. Patented Aug. 29, 1882.

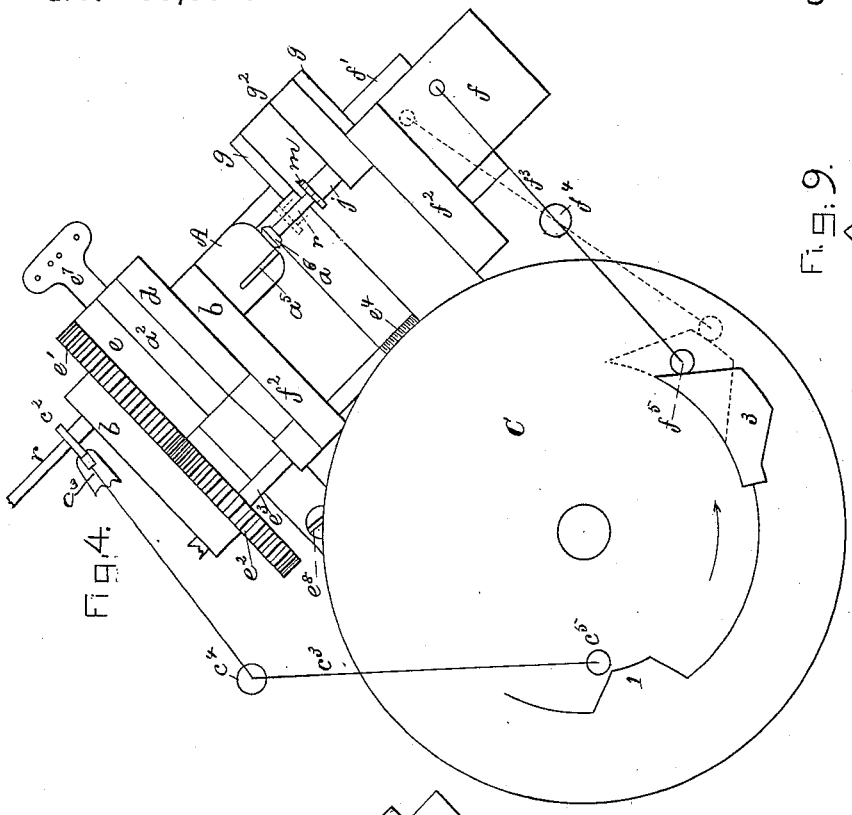

Fig. 4.

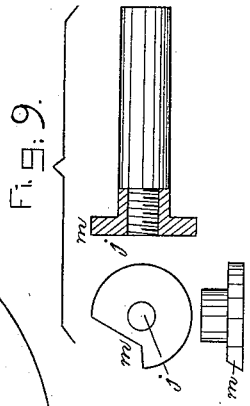

Fig. 9.

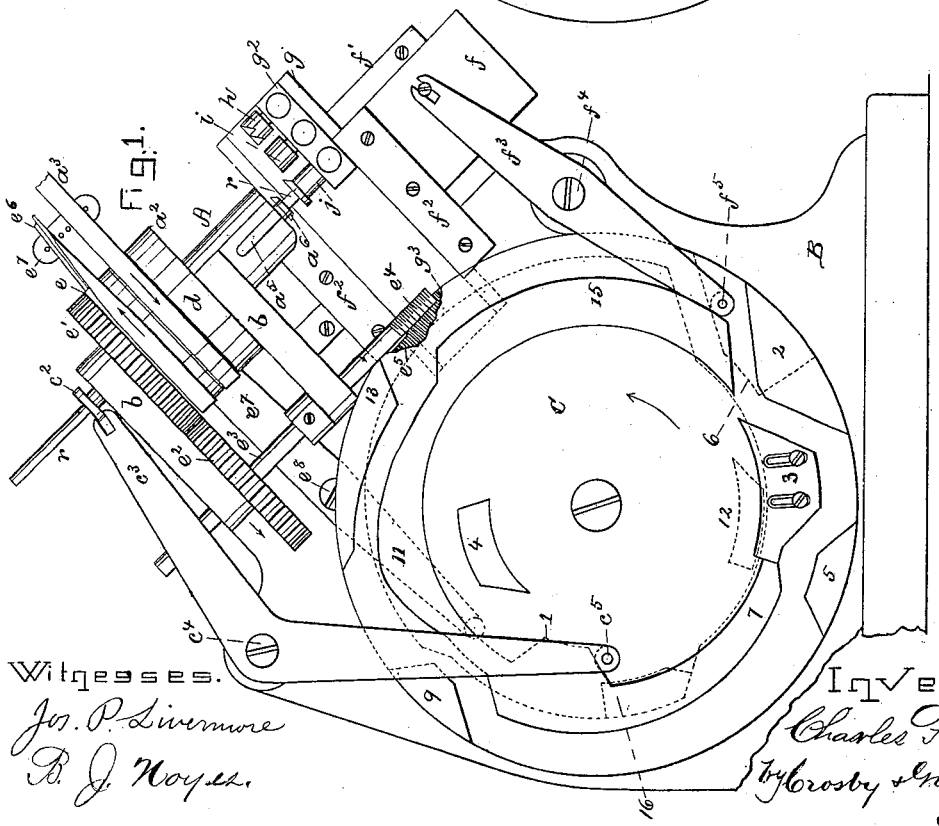

Fig. 1.

Witnesses.
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B. J. Noyes.

Inventor.
Charles F. Roper.
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Attys.

(No Model.) 3 Sheets—Sheet 2.

C. F. ROPER.

METAL SCREW MACHINE.

No. 263,357. Patented Aug. 29, 1882.

Fig. 2.

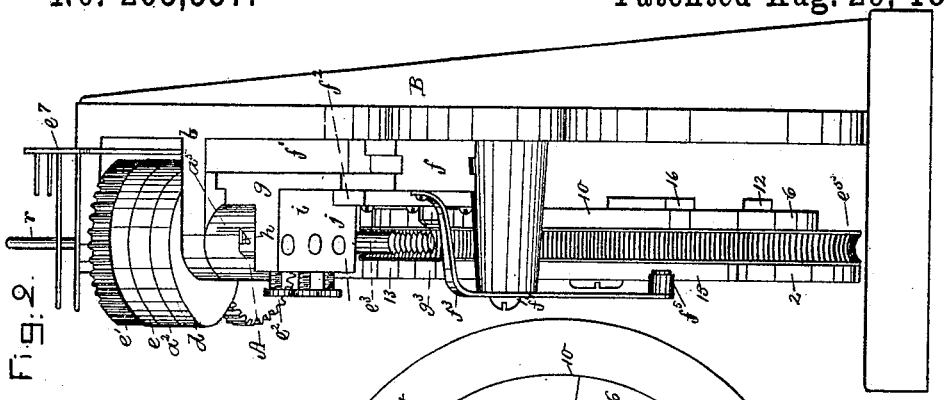


Fig. 3.

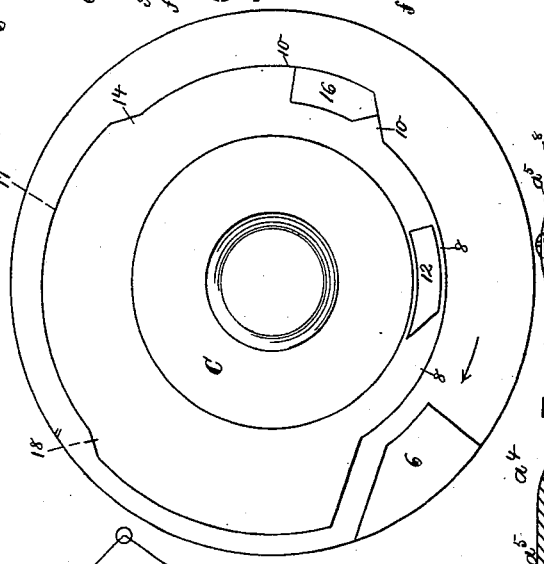
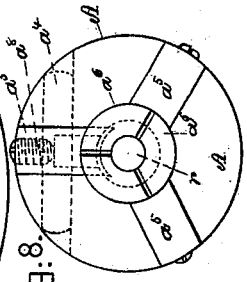


Fig. 8.



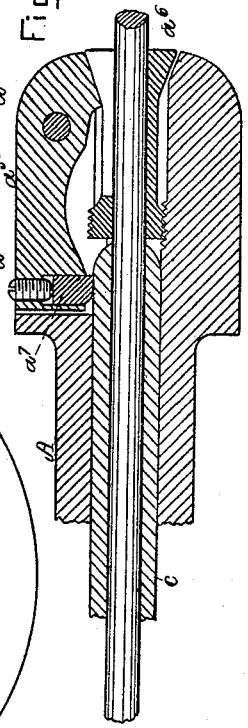
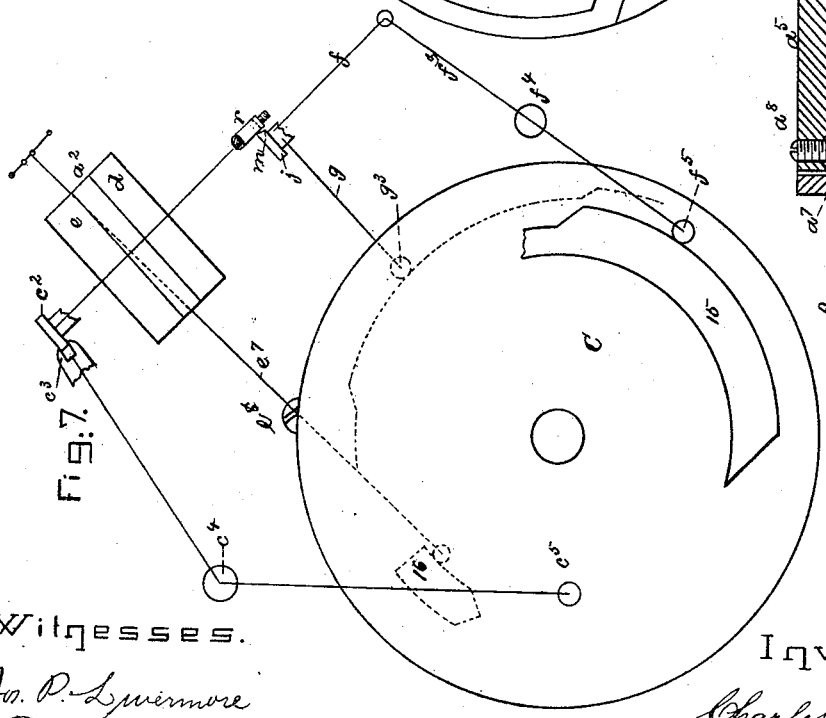


Fig. 7.



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(No Model.) 3 Sheets—Sheet 3.

C. F. ROPER.

METAL SCREW MACHINE.

No. 263,357. Patented Aug. 29, 1882.

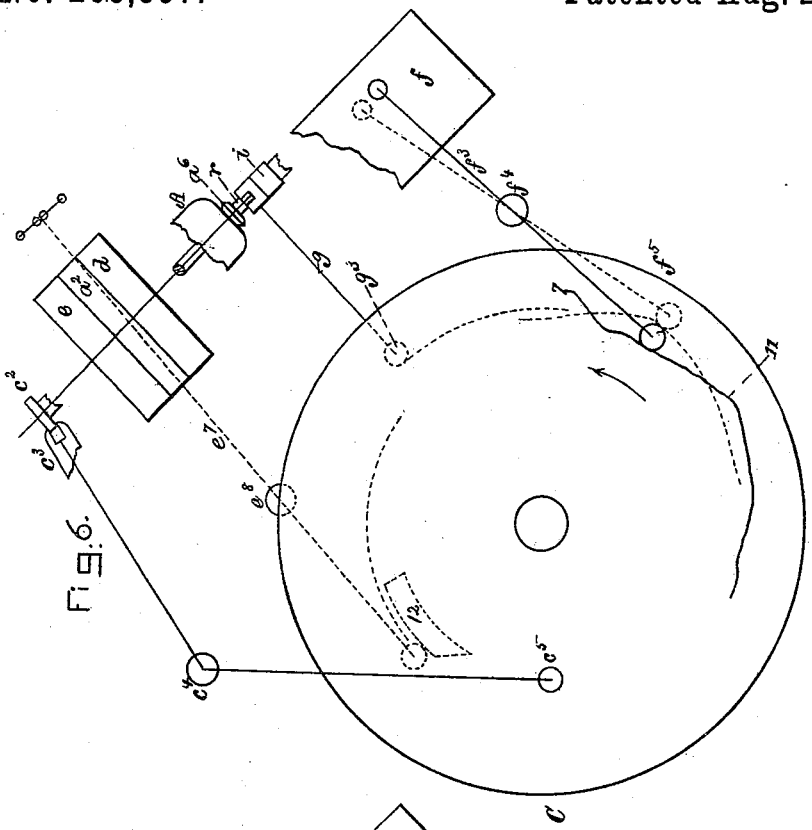

Fig. 6.

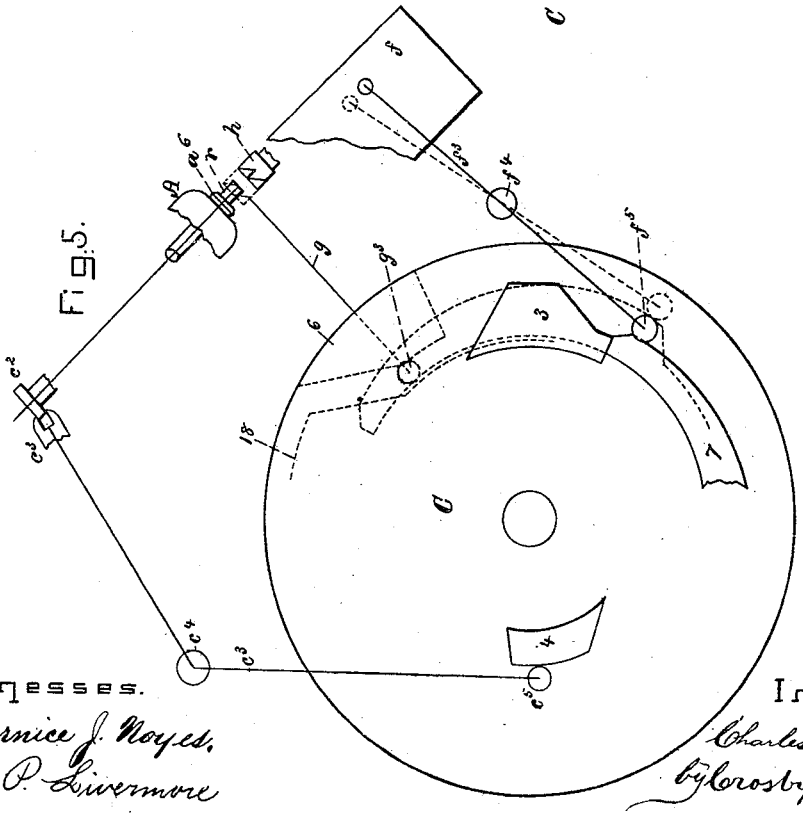

Fig. 5.

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UNITED STATES PATENT OFFICE.

CHARLES F. ROPER, OF BOSTON, MASSACHUSETTS.

METAL-SCREW MACHINE.

SPECIFICATION forming part of Letters Patent No. 263,357, dated August 29, 1882.

Application filed February 23, 1882. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. ROPER, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Metal-Screw Machines, of which the following description, in connection with the accompanying drawings, is a specification.

My invention in screw-making machines relates to that class of machines wherein a rod is milled or reduced in diameter according to the length of the screw, the milled part is threaded, and then the rod is cut off to form a screw.

This my improved machine embodies in its construction a chuck to grasp and rotate the rod, means to operate the chuck at the proper times, the rod being fed forward through the loosened chuck by its own gravity, a tool-carrying carriage reciprocated at right angles to the direction of the length of the rod, and a slide-frame to raise and lower the carriage; and my invention consists in said mechanisms, combined and co-operating together, as will be hereinafter more fully described at the end of this specification.

Figure 1 represents in side elevation a screw-making machine embodying my invention, the carriage and slide being in positions to bring the gage in position to insure the proper length of screw, the dotted lines showing the cam-projections at the rear of the one cam-carrying disk which imparts to the carriage, slide, and chuck their movements; Fig. 2, a front view of Fig. 1; Fig. 3, an inner side view of the cam-carrying disk. Fig. 4 is a detail showing in full lines the carriage and slide and the parts for moving the slide just after they have started to rise, with the rod resting on the length-gage, the dotted lines showing the said gage and lever and cam in the positions they will occupy when the rod has been carried up to its highest position by the length-gage. Fig. 5 is a diagram showing the milling-tool in position to be operated to mill the rod; Fig. 6, a diagram showing the threading-tool in position to thread the rod; Fig. 7, a diagram showing the parts in position to cut off the screw-threaded end of the rod; Fig. 8, an enlarged partial section and front end view of the rotating chuck, and Fig. 9 an enlarged detail of the length-gage and cutter.

The main or driven shaft A, supported on bearings *b b* of the frame-work B, has fixed to it the fast pulley a^2, which receives the open belt a^3. This shaft is hollow, as shown in Fig. 8, to contain the hollow wedge *c*, which receives the rod *r*, to be formed into screws, and at its lower end this shaft has pivoted to it, at a^4, the jaws a^5, which, operated by the wedge *c*, close the chuck a^6 upon the said rod *r*. This chuck is composed of a short sleeve screw-threaded at its rear end and screwed into the hollow shaft A, and split at its forward end to form three or more arms. (See Fig. 8.) The chuck is made conical externally at its outer end, and the arms receive against them the beveled ends of the jaw-levers a^5. The jaw-levers, at their rear ends, have adjusting devices a^7, controlled by adjusting-screws a^8. As the wedge *c* is forced forward, as in Fig. 8, it acts upon the jaw-levers and turns them, so that they act to close the chuck upon the rod *r* and rotate the rod in unison with the rotating chuck. This wedge, at its rear end, has a collar, c^2, which is herein shown as embraced by the forked end of a lever, c^3, pivoted at c^4, a roller or stud, c^5, being acted upon by the cam 1 to withdraw the wedge and by cam 4 to force the wedge in. Fig. 1 shows the wedge as just about to be lifted, and Fig. 5 as forced down to close the jaws and chuck, as in Fig. 8. Upon this hollow shaft A are placed two loose pulleys, *d e*. The loose pulley *e* has connected with it a toothed gear, *e'*, which engages a toothed gear, e^2, on the shaft e^3, provided at its lower end with a right-hand worm, e^4, which engages the worm-toothed part e^5 of and rotates the single cam-disk C in the direction of the arrow on it, Fig. 1, the said disk having been made by me to carry all the cams which are requisite to operate all the parts of the machine, as will be hereinafter described, thus enabling me to greatly simplify the machine and its cost, and at the same time secure uniformity of the action of the parts. When the shaft A is being rotated by the belt a^3 on the fast pulley, as in Fig. 1, and the rod is being rotated in the forward direction for work the crossed belt e^6 runs on the loose pulley *e*. These belts are both controlled by one belt-shipper, e^7, pivoted at e^8, it having at its opposite end a roller or stud which is acted

upon by the cam 12 at the rear side of the disk just after the threading-tool *i*, to be hereinafter described, has cut a thread on the rod *r* so as to move the shipper e^7 from the positions Figs. 1 and 7 to the position Fig. 6, transferring the belt a^3 upon the loose pulley *d* and the crossed belt partially on the fast pulley a^2, which crossed belt then acts to turn the shaft A in an opposite direction, and with it the rod *r*, to permit the said rod to be backed out of the threading-tool. The crossed belt is not shipped completely from the loose pulley *e*, but remains partly on it, and thus the said pulley is kept running, so as to continue the movement of the cam carrying disk C.

The slide *f*, fitted in ways *f'* of the framework, and provided with guides f^2 to receive the tool-carrying carriage *g*, is connected with one end of a lever, f^3, pivoted at f^4, it having a roller or stud, f^5, which is acted upon by the cams 2, 3, 5, 7, 9, 11, 13, and 15, as hereinafter described, to impart to the slide *f* and the parts carried by it their proper movements toward and from the rod *r* in the direction of the length of the said rod.

The tool-carrying carriage *g*, fitted to the guideways f^2 of the slide, has a tool-holding plate or projection, g^2, on which are secured the milling-tool *h*, the threading-tool *i*, and the length-gage *j*, a portion of the latter also, as herein shown, serving as the cutting-off device for the rod. The milling and the threading tools are of usual construction, and need not, therefore, be particularly described, more than to say that the milling-tool, when forced upward upon the rotating rod *r*, will mill or turn down the end of the rod, reducing it to the diameter desired for the shank of the screw to be made, and that the threading-tool will cut a thread of the desired pitch or kind on the rod as the latter is rotated in a forward direction by the straight belt a^3 on the fast pulley a^2. The rear or inner end of the carriage has upon it a roller or stud, g^3, (shown in Fig. 2 and in dotted lines in the diagrams Figs. 5 and 6,) which roller or stud is acted upon by cams located at the rear side of the disk C, the said cams moving the said carriage out and in at right angles to the movement of the slide *f*, to thus place the milling or threading tools or the length-gage and rod-cutter in proper position with relation to the end of the rod *r* to perform their different functions in the manufacture of screws from the rod *r*, which rod is placed and held in a position inclined preferably at about forty-five degrees from a perpendicular, as shown in the drawings, so that the rod, when released by the chuck, may descend easily by gravity. By placing the shaft A in an inclined position, rather than by placing it in vertical position, I am enabled to keep the rod *r* in such inclined position as to make it self-feeding, thus dispensing with the usual feeding devices for the rod, as would be necessary were the rod kept in horizontal position; and I am also enabled to lessen the strain upon the chuck.

The operation of my machine is as follows: It will be assumed that the cam 1 has moved the lever c^3 to withdraw the wedge c^2 and release the chuck from the rod, and that the rod, by its own gravity, has dropped, as in Fig. 4, and rests at its lower end upon the upper end of the length-gage *j*, which, when at its lowest point, occupies a position distant from the end of the chuck greater than the length of the screw to be made, such provision enabling a short piece, or the final piece of a rod of less length than the screw to be made, to drop out. As the rod *r* descended upon the length-gage, as described, the chuck being open, the slide *f* was placed in its lowest position by the action of the cam 2 on the roll f^5 of the lever f^3, as in Fig. 4. In this condition, the disk C being turned in the direction of the arrows, Figs. 1 and 4, the cam 3, shown adjustable in Fig. 1, strikes the roll f^5 and lifts the slide *f*, and with it the carriage and length-gage *j*, until the latter reaches the dotted-line position, Fig. 4, it in that position having lifted the loosely-held rod *r* and moved it backward through the chuck and wedge, leaving the lower end of the rod protruding beyond the chuck for a distance equal to the length of the screw to be made, the adjustment of the cam 3 enabling this length to be more or less. When the rod has been moved into proper position, according to the length of the screw to be made, the cam 4 strikes the roll of the lever c^3 and moves the wedge *c* to close the rotating chuck on, and so as to carry with it the rod *r*. The cam 5 then acts on the lever f^3 to again draw the slide *f* down and the length-gage away from the rod *r*, and when down the cam 6, at the rear of the disk *c*, (see Fig. 3, and dotted lines, Fig. 1,) acts on the roller or stud g^3 of the carriage *g* and draws it back toward the center of the disk C until the center of the milling-tool *h* is in line with the rod *r*, when the cam 7 commences to act and gradually moves the lever f^3 and slide *f* upward upon or about the end of the rotating rod, thus milling or reducing the end of the rod *r* to the proper diameter. During this milling operation the carriage is kept in position by the cam 8, (see Fig. 3, and also in dotted line in Fig. 1,) against which the roller or stud g^3 of the carriage *g* then rests. After the rotating rod has been milled the cam 9 (see Fig. 1) operates the lever f^3 to lower the slide *f* and withdraw the milling-tool *h* from the rod *r*. When the slide has been so lowered the cam 10, at the rear side of the disk, forces the carriage *g* outward until the center of the threading-tool *i* is placed opposite the end of the rotating rod *r*, when the slide *f* is raised by the action of cam 11, and causes the threading-tool to be forced over and along the rotating rod to thread its milled or reduced part, as usual. Just as the cam 11 produces its full stroke the cam 12, at the rear of the disk C, moves the shipper-lever e^7 and

ships the open belt a^3 from the fast pulley a^2, which change of belt immediately causes a reversal of the hollow shaft A and chuck and rod, enabling the screw-threaded end of the said rod to be withdrawn from the threading-tool *i* as the cam 13 comes into action on the lever f^3 and draws the slide *f* down. After the threading-tool has been drawn off the rod the cam 14, at the rear side of the disk C, (see Fig. 3,) acts to move outward the carriage *g* to bring the cutting-off device *m* (see enlarged view, Fig. 9, shown as an edge or annulus about the upper end of the length-gage) into line with the side of the rod *r*, when the cam 15 acts on the lever f^3 to again lift the slide *f* and carriage until the portion *m*, for cutting off the rod *r*, comes opposite that part of the rotating rod where the latter is to be cut off, when the cam 15 holds the slide steady in this position while the rod is being cut off. The edge of the cutter *m* or cutting-off device may be more or less beveled or inclined to cut off the rod *r* in any usual way. As the slide *f* is being raised, as described, to bring the cutting portion *m* into operative position the cam 16 at the rear of the disk C acts on the belt-shipper, as in Fig. 7, and moves the belts back into the position Fig. 1 to again rotate the rod in its original or forward direction. The cutter *m* having arrived into proper position to cut the rod, the cam 18, at the rear of the disk C, strikes the roller g^3 and moves the carriage outward, causing the said cutter to enter and cut off the rotating rod *r*. The screw having been cut off, the carriage *g* is moved outward far enough to place the central part of the length-gage under the rod *r*, when the chuck is loosened by withdrawing the wedge *c*, and the rod is left free to move down and follow the length-gage, carriage, and slide as they are again lowered, as first described, into the position Fig. 4.

I am aware that machines are now in operation for the automatic production of screws from a rod. By moving the slide diagonally upward and the carriage diagonally outward at right angles to the movement of the slide I am enabled to secure a very simple organization of parts, which may be built and run at the least possible expense and at rapid speed.

I have herein described and shown a chuck to rotate and release the rod, a longitudinally-moving slide, cams for actuating the same, a tool-holding carriage fitted in guideways on said slide, and mechanism for automatically moving said carriage transversely to bring the several tools successively into line with the axis of the chuck, and I have also shown and described, in combination with said chuck, slide, and tool-holder, milling and threading tools, and a length-gage; but such I do not claim broadly, as they form the subject-matter of another application.

I am aware that it is not new to feed the rod *r* forward through a chuck, and also that the rod has been fed forward by means of a weight connected by means of a cord with a follower placed against one end of the rod.

I claim—

1. The improved rod-rotating chuck herein described, it comprehending the hollow shaft A, open from end to end, the jaws a^5, pivoted thereon, the independent longitudinally-adjustable split spring-chuck, and the longitudinally-movable hollow wedge open from end to end and fitted within the shaft A and supporting the rod to be cut, the said wedge operating the said levers and permitting the rod inserted at one end of it to be delivered therefrom at its other end, all substantially as shown and described.

2. The rotating chuck-carrying shaft A, set at an incline to receive the rod *r* and render it self-feeding by reason of its own gravity, and the chuck to grasp and rotate the rod and slide and tool-carrying carriage thereon, combined with the length-gage secured to the said carriage, and upon which the end of the rod is dropped by its own gravity when released from the chuck, and with mechanism for operating the said carriage and slide, substantially as described.

3. The rotating chuck-carrying shaft A, set at an incline to receive the rod *r* and render it self-feeding, and the chuck to grasp and rotate the rod, and the slide and the tool-carrying carriage thereon, combined with the length-gage secured to the said carriage, and upon which the end of the rod is dropped by its own gravity when released from the chuck, and with the disk, cams thereon, and the lever to actuate the slide and force the rod back into and to be grasped by the chuck, substantially as described.

4. The rotating chuck-carrying hollow spindle A, its fast pulley, and two loose pulleys, *d* *e*, the worm-shaft e^3, connected with and driven from one of the said loose pulleys, and the disk C, its cams 16 and 12, and the belt-shipper, all combined and arranged substantially as and for the purpose described.

5. The rotating hollow shaft A, the tubular wedge c^2, fitted therein, the jaw-levers a^5, pivoted on the shaft A, the split chuck a^6, the rotating shaft e^3, and disk C, engaged and driven by it, provided with the cams 1 and 4, combined with the lever e^3 to operate the said wedge, the said hollow shaft and chuck being placed at an inclination from a horizontal plane to enable the rod to be fed forward by gravity alone, all substantially as shown and described.

6. In a metal-screw-cutting machine, the rotating hollow shaft and chuck to grasp and rotate a rod, the tool-carrying carriage *i*, having a milling or reducing tool and a threading-tool, and made movable in a plane at right angles to the said hollow shaft, and the reciprocating slide *f*, to move the tool-carrying carriage parallel with the said hollow shaft and toward and from the end of the rod held by the chuck, combined with the single rotating

disk C, having its axis at right angles to the axis of the rotating hollow shaft, and a series of cams, substantially as described, carried by the said disk, the said cams being adapted at the proper time to effect the grasping and releasing of the rod and the movement of the slide and its carriage, substantially as set forth.

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

CHARLES F. ROPER.

Witnesses:
G. W. GREGORY,
B. J. NOYES.