(Model.) 3 Sheets—Sheet 1.

S. H. & C. F. ROPER

METAL SCREW MACHINE.

No. 262,321. Patented Aug. 8, 1882.

Fig. 1

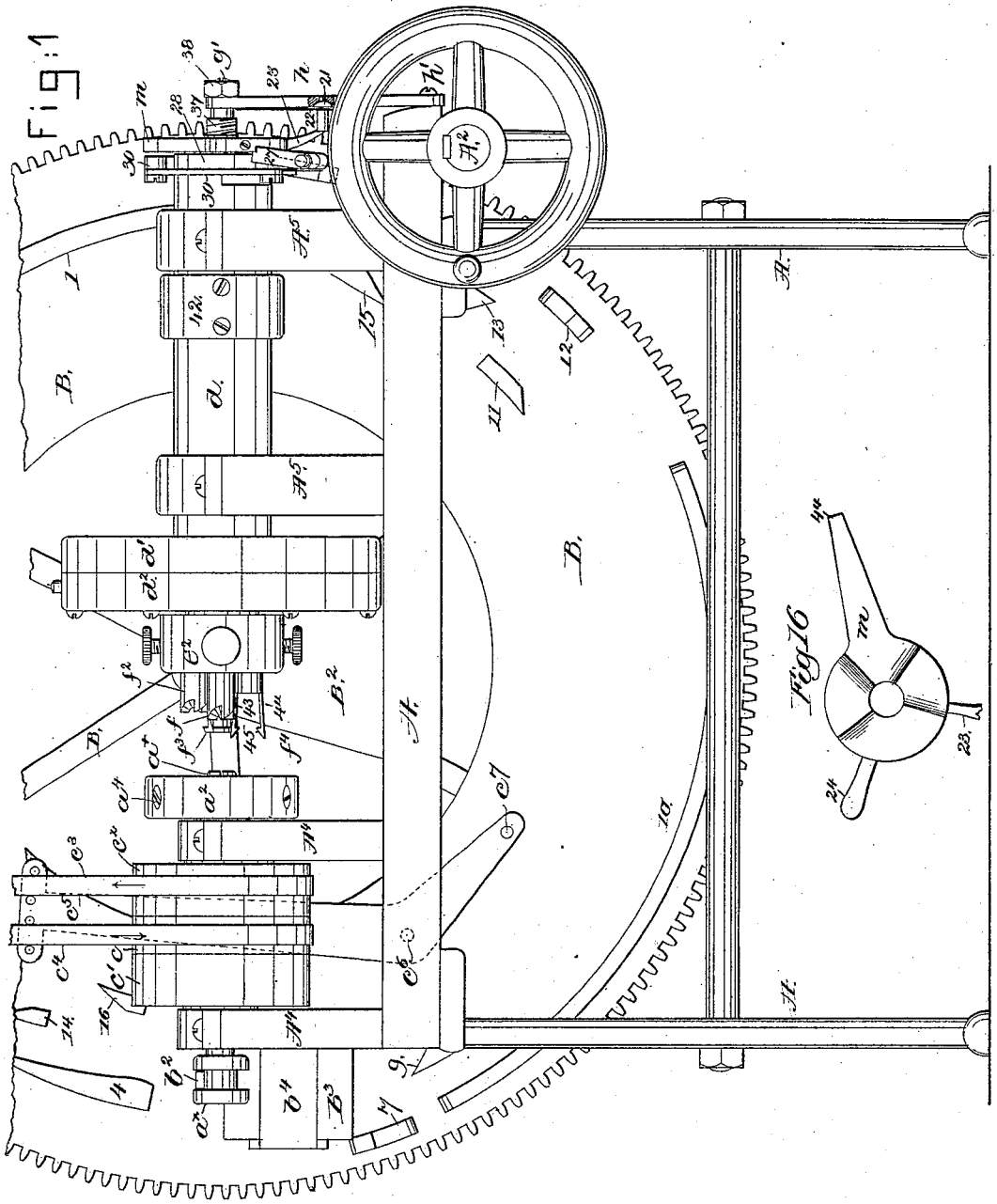

Fig. 16

Witnesses

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METAL SCREW MACHINE.

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Fig: 2.

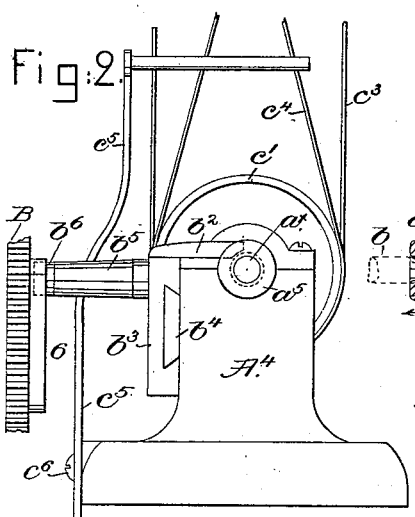


Fig: 3.

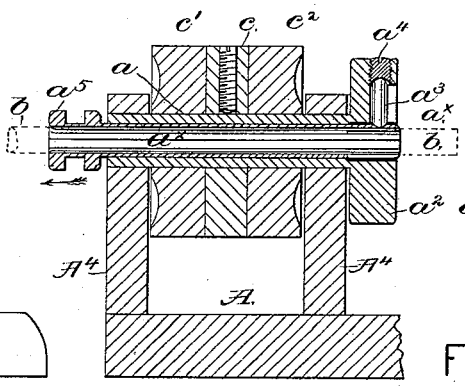


Fig: 4.

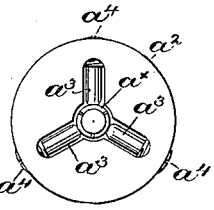


Fig: 5.

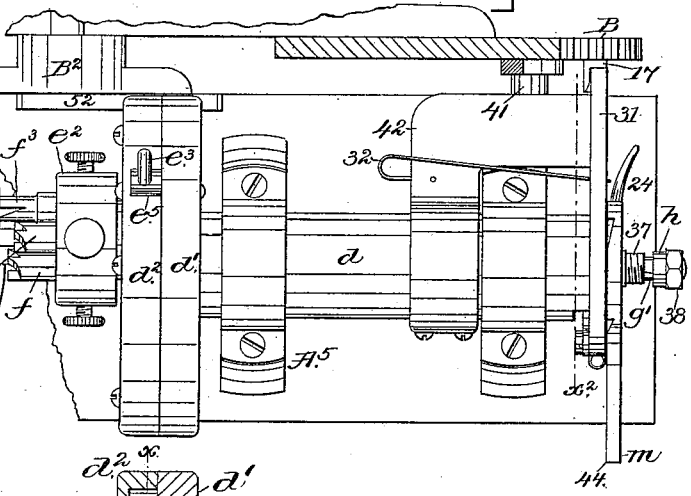


Fig: 6.

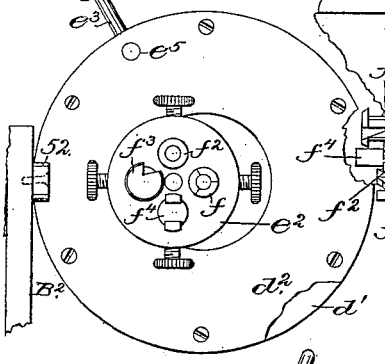


Fig: 8.

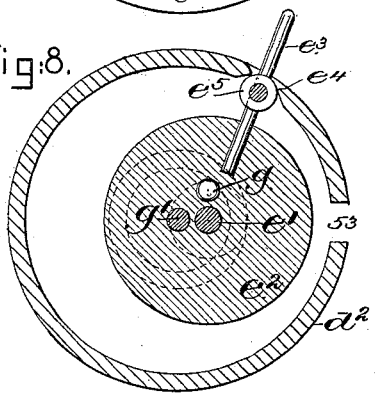


Fig: 7.

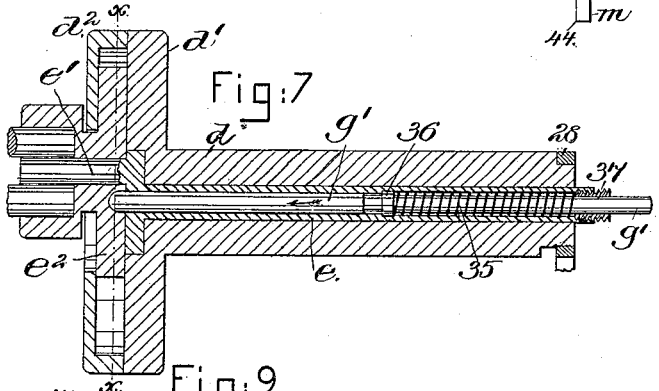
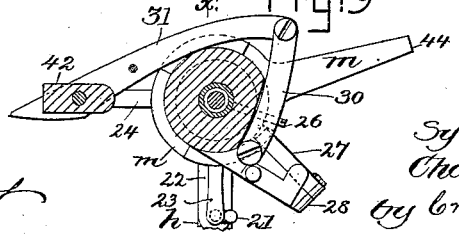


Fig: 9.



Witnesses.

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METAL SCREW MACHINE.

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Fig: 10.

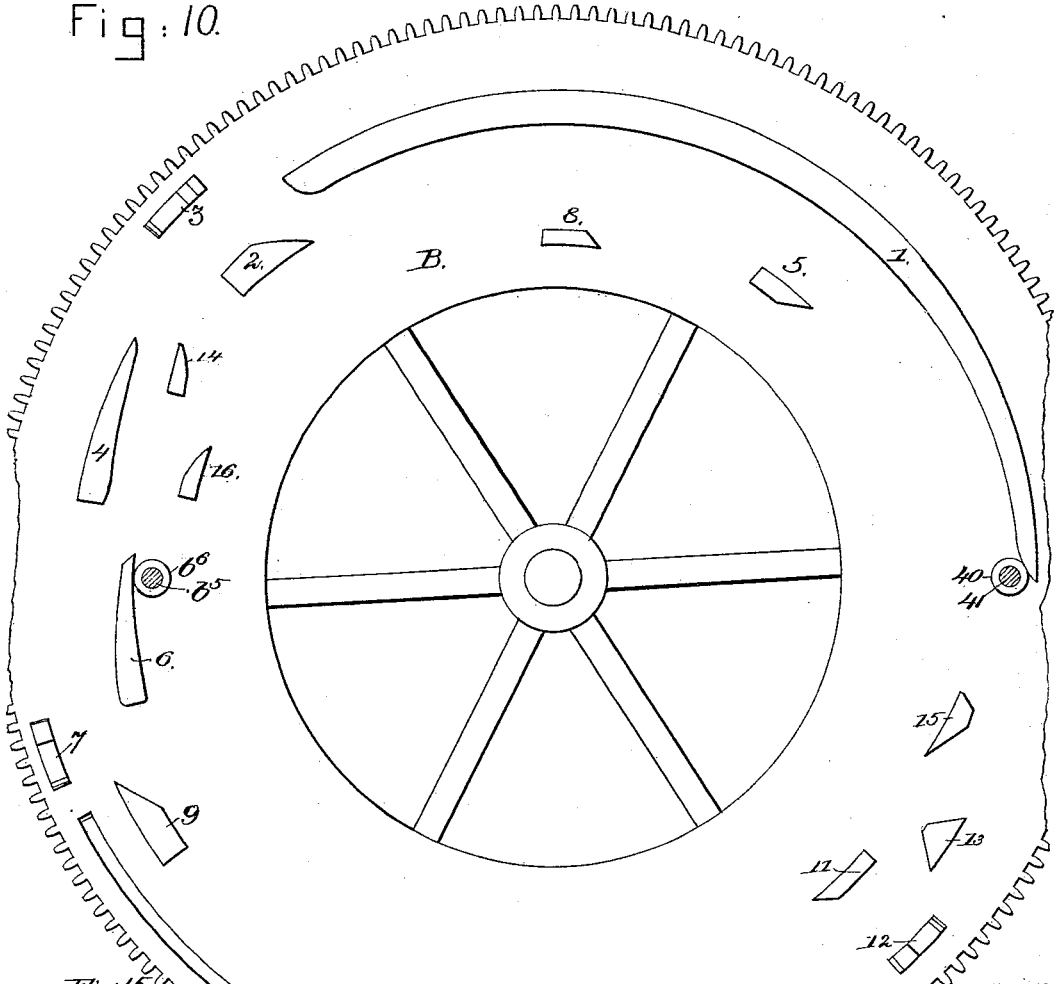


Fig. 15.

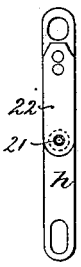


Fig. 14.

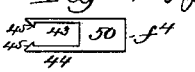


Fig. 13

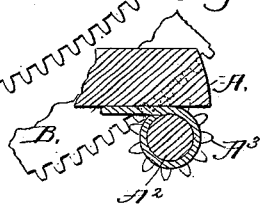


Fig: 12.

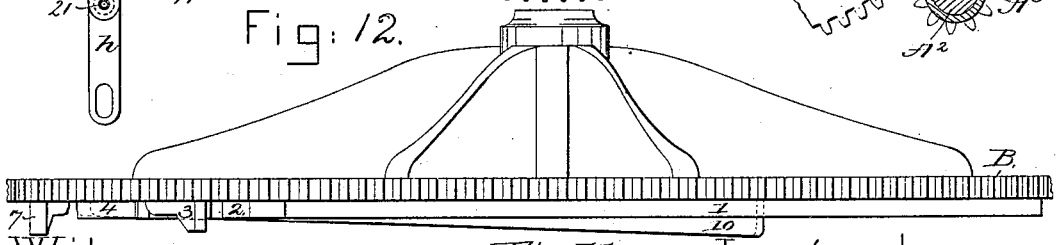
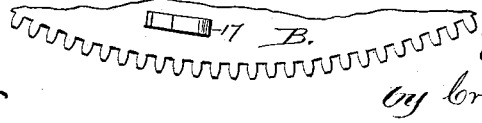


Fig. 11.



Witnesses.

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UNITED STATES PATENT OFFICE.

SYLVESTER H. ROPER AND CHARLES F. ROPER, OF BOSTON, MASS.

METAL-SCREW MACHINE.

SPECIFICATION forming part of Letters Patent No. 262,321, dated August 8, 1882.

Application filed April 17, 1882. (Model.)

To all whom it may concern:

Be it known that we, SYLVESTER H. ROPER and CHARLES F. ROPER, of Boston, county of Suffolk, and 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.

Our invention relates to that class of screw-making machines wherein the screws are made from a rod which is rotated by a chuck.

Our invention consists essentially in a tool-holder composed of a disk having a tail-piece combined with an intermittingly-revolving crank-pin and a reciprocating carriage, as will be described; also, in a tool-holder composed of a disk having a tail-piece, combined with an intermittingly-revolving crank-pin, a tubular shaft, a locking device for the tool-holder, and a reciprocating carriage, as will be hereinafter described; also, in mechanical details, as will be hereinafter particularly described.

Figure 1 represents in front side elevation a screw-making machine embodying our invention, the reducing-tool being in position to be operative. Fig. 2 is a left-hand elevation of part of Fig. 1. Fig. 3 is a horizontal central section of the chuck-spindle and pulleys thereon. Fig. 4 is a front end view of the chuck. Fig. 5 is a broken detail of the reciprocating carriage, the tool-holder, its tools, and part of the cam-disk. Fig. 6 is a left-hand end elevation of most of the parts shown in Fig. 5; Fig. 7, a longitudinal section taken through the reciprocating carriage and the tool-holder; Fig. 8, a section of Fig. 7 on the dotted line *x x;* Fig. 9, a section on the dotted line x^2, Fig. 5. Fig. 10 is a full view of the actuating cam-disk. Fig. 11 represents the piece of the disk broken from the right of Fig. 10. Fig. 12 is an edge view of Fig. 10; Fig. 13, a detail showing the rear end of the power-driven shaft and its pinion; Fig. 14, a detail of the rod-feeding device. Fig. 15 is a detail of the latch, and Fig. 16 a detail of the inner face of the ratchet-lever.

The frame-work A, of proper form to support the working parts, has a power-driven shaft, A^2, provided with a pinion, A^3, (see Fig. 13,) which engages the teeth of the large actuating cam-disk B, having its supporting-stud held in an upright, B^2, forming part of the frame-work. This cam-disk is provided with a series of cams, 1 to 17, inclusive, which, at the proper times, as will be herein described, come into position and actuate the different parts of the machine.

The standards A^4 of the frame-work serve as bearings for the spindle *a*, forming part of the chuck, the remaining part of the chuck being a head, a^2, a split tube, $a^\times$, a series of struts, a^3, preferably three, and adjustable fulcra for the outer ends of the said struts. The inner ends of the struts rest in depressions in the three prongs of the split forward end of the tube $a^\times$.

The rod *b*, (see dotted lines, Fig. 3,) from which the screws are to be made, is passed through the split tube $a^\times$, the latter being located within the hollow spindle *a*. The said rod *b* is grasped firmly between the spring-prongs formed by splitting the ends of the said tube $a^\times$ whenever the said tube is drawn back in the direction of the arrow, Fig. 3, by means of a finger, b^2, (see Figs. 1 and 2,) entering an annular groove in the collar A^5. The finger b^2 projects from a slide, b^3, fitted upon a guide, b^4, fixed to the standard A^4. The said slide b^3 is provided with a rearwardly-projecting stud, b^5, having a roll, b^6, which at the proper times is struck to move the slide and split tube $a^\times$ by the cams 14 and 16. When the cam 14 acts to move the slide b^3 and split tube forward, or in a direction the reverse of the arrow, Fig. 3, the inner ends of the struts will be moved outward, thus permitting the spring-prongs of the split tube to open. The prongs may be made to grasp a rod of greater or less diameter by adjusting the fulcra a^4 (shown as screws having concaved ends) so that the inner ends of the struts will be brought nearer together.

The spindle *a* has upon it one fast pulley, *c*, and two loose pulleys, c' c^2, to receive the open belt c^3 and the crossed belt c^4, controlled by a double-forked belt-shipper, c^5, pivoted to the frame-work at c^6, and provided with a suitable stud or roll, c^7, which at the proper times will be struck by the cams 5 and 8. The cam 8 moves the crossed belt c^4 upon the fast pulley to cause the rotation of the chuck and the rod *b*, held by it, in the forward direction to cut a screw, whereas when the threading-tool

is to be withdrawn from the threaded blank the cam 5 actuates the shipper to place the open belt c^3 upon the said fast pulley to reverse the direction of rotation of the chuck and rod.

The uprights A^5 serve as bearings for the hollow shank d of the reciprocating carriage composed of the said shank, a disk or head, d', and a cap, d^2. The shank d has connected with it an arm, 42, having a pin, 41, provided with a roll, 40, which at times is struck by one of the cams 2, 6, or 15 to impart to the carriage and tool-holder its movements toward and from the end of the rod b, as when reducing the blank or cutting a thread on the blank. The hollow shank receives through its center a second hollow shaft, e, provided at its forward end with a crank-pin, e', which is extended into the center of the tool-holder e^2, the flanged base of which is contained within the chamber between the head d' and the cap d^2, as in Fig. 7. The tool-holder has projecting from its outward end a reducing-tool, f, a threading-tool, f^2, a parting-tool, f^3, and a rod-feeding device, f^4, each properly clamped in the said holder by a suitable screw. The tool-holder has a tail-piece, e^3, extended through a swiveling block or bearing, e^5, having its journals in the head d' and cap d^2, the said tail-piece being also extended out through a hole, e^4, made in the said cap. (See Fig. 8.) The revolution of the crank-pin e' in engagement with the center of the tool-holder moves the tool-holder with it, revolving the tool-holder in an annular path, but without rotating the holder about its axis—viz., the crank-pin.

At suitable times while the tools are operating upon the rod b it is desirable to hold the holder e^2 in position. As herein shown, the tool-holder at its rear side is provided with two holes, g; but there may be more, if desired, one of which at the proper times will receive the front end of the locking device g', (shown as a rod extended through the hollow shaft e,) the said locking device when in engagement with one of the said holes g locking the tool-holder in place, and when not in one of the said holes the front end of the locking device is normally kept pressed against the rear of the holder by the spring 35, compressed between the collar 36 on the rod and a hollow screw, 37, screwed into shaft e. As herein shown, the holder has but two holes—one to lock it while the reducing-tool operates and the other while the threading-tool operates—and the locking device, Figs. 7 and 8, is in that hole which will effect the locking of the holder while the reducing-tool does its work.

The rear end of the locking device g' is connected loosely by nut 38 with the upper end of a lever, h, loosely pivoted at h' upon the frame-work, so that it may move with the locking device and carriage. This lever h is provided with a spring-latch (see detail, Fig. 15) composed of a pin, 21, having a large head acted upon by a spring, 22, so that the pin can tip sidewise when struck by either of the arms 23 24 of a ratchet-lever, m, fixed by screw 26 upon and adapted to rotate the hollow shaft e intermittingly, or when the tool-holder is to be revolved. The ratchet-lever m (see Fig. 16) has four teeth, one of which is engaged by the pawl 27 whenever it is desired to rotate the shaft e. This pawl is attached to a pawl-carrier, 28, loosely held at the outer end of the shank d, as shown in Figs. 1, 7, and 9. The pawl-carrier 28 is moved intermittingly by the link 30 and lever 31, the latter being acted upon by one of the cams 3, 7, 12, and 17 of the disk B to move it in one direction, the reverse movement of the said lever and pawl-carrier 28 being accomplished by spring 32. (See Fig. 5.)

The drawings, Figs. 7, 8, show the locking device as entered into one of the holes of the holder. Just before the hole in the holder which the said locking device is shown as having entered arrived opposite the end of the said locking device the arm 23 of the ratchet-lever m struck the pin 21 and pushed it aside, as in Fig. 9, its spring 22 permitting it to be tipped or turned to one side, and as the arm 23 arrived opposite the center of the lever h the hole g also arrived opposite the end of the locking device g', and the spring 35, before referred to, pushed the locking device forward in the direction of the arrow, Fig. 7, and caused it to enter the hole g, thus locking the holder e^2, as in Fig. 7. In this position the carriage is moved forward by cam 1 to force in this instance the reducing-tool on the rod, and as the carriage moves forward, carrying with it the locking device, the nut 38, acting on the lever h, moves its upper end forward, causing the said lever to occupy an inclined position, which change of position with relation to the arm 23, resting against the pin 21, causes the removal of the said pin from the edge of the said arm, and the pin, by the action of the spring 22, then assumes its normal position at right angles to the lever h, and consequently falls into position immediately at the rear side of the said arm, or into the dotted-line position, Fig. 9. The carriage is next drawn backward to remove the reducing-tool from the end of the rod b, preparatory to revolving the holder to bring the threading-tool f^2 into operative position, and the rear side of the arm 23 acts directly upon the end of the pin 21, pushes it and the lever h backward, and the latter, acting against the nut 38, withdraws the locking device from the holder, leaving it free to be moved as the shaft e is rotated one step by the devices before described. The arm 24 operates in like manner when the locking device is to be moved to lock and release the holder e^2 while the threading-tool f^2 operates.

The carrier-shank d is moved forward positively by one of the cams 1 or 4 to force the reducing-tool or threading-tool on the rod, and the lever m is carried forward with the said shank.

The shaft e, as it is rotated intermittingly by

the ratchet-lever, causes the crank-pin e', fitted loosely in the tool-holder, to travel in a circle and move with it the tool-holder; but the latter, by reason of its tail-piece e^3, extending into the oscillating bearing e^5, has only a vibratory reciprocating motion, the tool-holder always presenting the same tool uppermost with relation to the other fools of the holder; but each tool is brought into operation successively. The center line of shaft e always coincides with the center line of the chuck, and the tools are brought successively into the same line by the action of the crank-pin on the holder, but without rotating the holder.

Having described the construction of the different parts, we will now describe the operation of the machine in cutting a screw upon a rod.

The rod b having been placed in the chuck, and the chuck closed upon it by drawing the split tube $a^\times$ in the direction of the arrow, Fig. 3, the parts will be in the position Fig. 1, the cross-belt c^4 being on the fast pulley and rotating the chuck and rod forward. The reducing-tool f is opposite the end of the rod. In this condition the cam 1 strikes roll 40 on arm 42 and moves the carriage d forward slowly while the reducing-tool reduces the end of the rod b to form a blank. As the carriage was moved forward the pin 21, before described, dropped behind arm 23. The carriage having been moved fully forward, the cam 2 strikes the said roll 40 and moves the carriage backward, the arm 23 at the same time pushing backward the lever h, as before described, to withdraw the locking device g' from its engagement with the holder, leaving it free to be moved by the shaft e. When the carriage is fully back the cam 3 strikes the lever 31, moves the pawl-carrier 28, causes the pawl 27 to engage one of the teeth of the ratchet-lever m and turn the shaft e one step, which moves the tool-holder one step and places the threading-tool f^2 opposite the end of the rotating rod b. As the ratchet-lever m is so moved its second arm, 24, strikes the pin 21 of the latch mechanism before described, which is instrumental, as before stated, in controlling the engagement of the locking device with the holder, and operates as described of arm 23. The cam 3 having passed the end of lever 31, the spring 32 moves the pawl-carrier in the opposite direction, placing its pawl 28 in position to engage another tooth of the ratchet-lever. The holder being again locked by the locking device, the cam 4 strikes the roll 40, before described, and again moves the carriage forward to force the threading-tool upon the reduced end of the blank, and as the carriage reaches its forward position the pin 21, before described, springs behind the arm 24, to again effect the withdrawal of the locking device g' as the carriage is next drawn backward by the cam 6; but the carriage is not so drawn backward until after the cam 5 has struck and moved the shipper-lever c^5 to place the belt c^3 on the fast pulley, which automatically reverses the direction of rotation of the chuck and rod to enable the rod to be turned backward as the threading-tool is being drawn from its screw-threaded end by the backward movement of the carriage, then being effected by the cam 6. The threading-tool having been removed from the rod b and the holder released, the cam 7 strikes lever 31 and moves pawl-carrier 28 and pawl 27 to again rotate the shaft e one step to place the parting-tool f^3 in proper position, and at the same time cam 8 acts on the shipper-lever c^5 to again place belt c^4 on the fast pulley and rotate the rod b in the forward direction. The cam 7, as it passes the end of lever 31, permits the latter to be again moved by the spring 32 to turn the pawl-carrier 28 backward. The cam 9 next strikes the roll 40 and moves the carriage forward, placing the edge of the parting-tool f^3 opposite the rod, where the blank is to be separated from the rod. In this condition the long cam 10 strikes the end 44 of the ratchet-lever m, causing the said lever, fast on the shaft e, to turn the said shaft slowly, and with it move the tool-holder, thus forcing the sharpened edge of the parting-tool to enter the rotating rod and sever the blank from it. Next the cam 11 strikes roll 40, moves the carriage and holder backward, and the cam 12 then strikes lever 31 and again actuates it to turn the shaft e and holder another step, bringing the feeding device f^4 into line with the axis of the rotating rod, and the pawl-carrier is thrown back by spring 32, as before described. Next the cam 13 strikes roll 40, moves the carriage and holder forward, causing the spring-jaws 43 44 (see Figs. 1 and 14) of the feeding device to be forced upon the rod, the said jaws being beveled at their outer ends to facilitate their passage over the end of the rod. These jaws have cutting-teeth 45, which, as the rod is rotated between the jaws 43 44, owing to the spring nature of the jaws, are caused to cut a slight annular groove in the rod, so that as the carriage and holder are next drawn backward by the cam 15 (but the carriage and holder are not so drawn back until just after the cam 14 has acted upon the roll b^6 and moved the slide b^3 and split tube far enough in the direction opposite the arrow in Fig. 3 to release the rod b from the grasp of the chuck) the said rod so released and engaged by the teeth of the feeding device is drawn out from the chuck for a distance equal to the extent of backward movement of the holder e^2 and carriage, thus effecting the feeding of the rod b for a distance equal to the length desired for the next screw. Next the cam 16 strikes roll b^6, actuates the slide b^3, and again closes the chuck on the rod. Next cam 17 (see Fig. 11) strikes lever 31 and moves it to effect the rotation of the shaft e another step, bringing the reducing-tool into position opposite the end of the rotating rod, when the operation is again repeated, the holder in this last position being locked, as before described, by the locking device.

We do not desire to limit our invention to the exact mechanical details for rotating the shaft *e*.

The spring-jaws 43 44 of the feeding-tool are extended from a suitable shank, 50. (See Fig. 14.)

The part *d'* of the carriage is slotted at its edge, as at 53, Fig. 8, and receives a rigid guide, 52, attached to the upright B^2, (see Figs. 5 and 6.) thus preventing the rotation of the carriage which carries the tool-holder.

We claim—

1. In a screw-making machine, the rotating chuck and the sliding carriage, combined with the rotating shaft *e*, its crank-pin to actuate the tool-holder e^2, means to prevent the entire rotation of the said tool-holder on the said crank-pin, as set forth, and with the reducing and threading tools carried by the said holder, substantially as described.

2. The sliding carriage, the tool-holder thereon, its tail-piece, and the swiveling bearing, combined with the shaft *e*, its crank-pin, and with means to rotate the said shaft intermittingly, substantially as described.

3. The chuck herein described, it comprehending the longitudinally-movable split tube $a^\times$, the sleeve *a*, the head a^2, the struts a^3, and the adjustable fulcra a^4, all substantially as described.

4. The movable carriage, the rotating shaft *e*, its crank-pin, the tool-holder e^2, mounted thereon, and means to lock the said tool-holder in position as the carriage is being moved, combined with the reducing, threading, and feeding devices, substantially as and for the purpose described.

5. The tool-holder and the feeding-tool provided with cutting-teeth, combined with a chuck and means to move the tool-holder to draw or feed the rod forward through the said chuck, substantially as described.

6. The feeding-tool herein described, it comprehending the spring-jaws 43 44, provided with teeth 45, and extended from the holding-shank 50, substantially as described.

7. In a screw-making machine, the combination of the following instrumentalities, viz: the rotating chuck, the fast and loose pulleys thereon, the belt-shipper to control the position of the driving-belts on the said pulleys, the slide to open and close the chuck, the carriage, the tool-holder attached thereto, means to revolve but not to rotate the said tool-holder, the reducing, threading, and feeding tools carried by the said tool-holder, and the disk provided with a series of cams, as described, to actuate the said belt-shipper, slide, chuck, carriage, and tool-holder in the order and for the purpose set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

SYLVESTER H. ROPER.
CHARLES F. ROPER.

Witnesses:
G. W. GREGORY,
W. H. SIGSTON.