(No Model.) 3 Sheets—Sheet 1.

A. JOHNSTON.

METAL SCREW MACHINE.

No. 267,214. Patented Nov. 7, 1882.

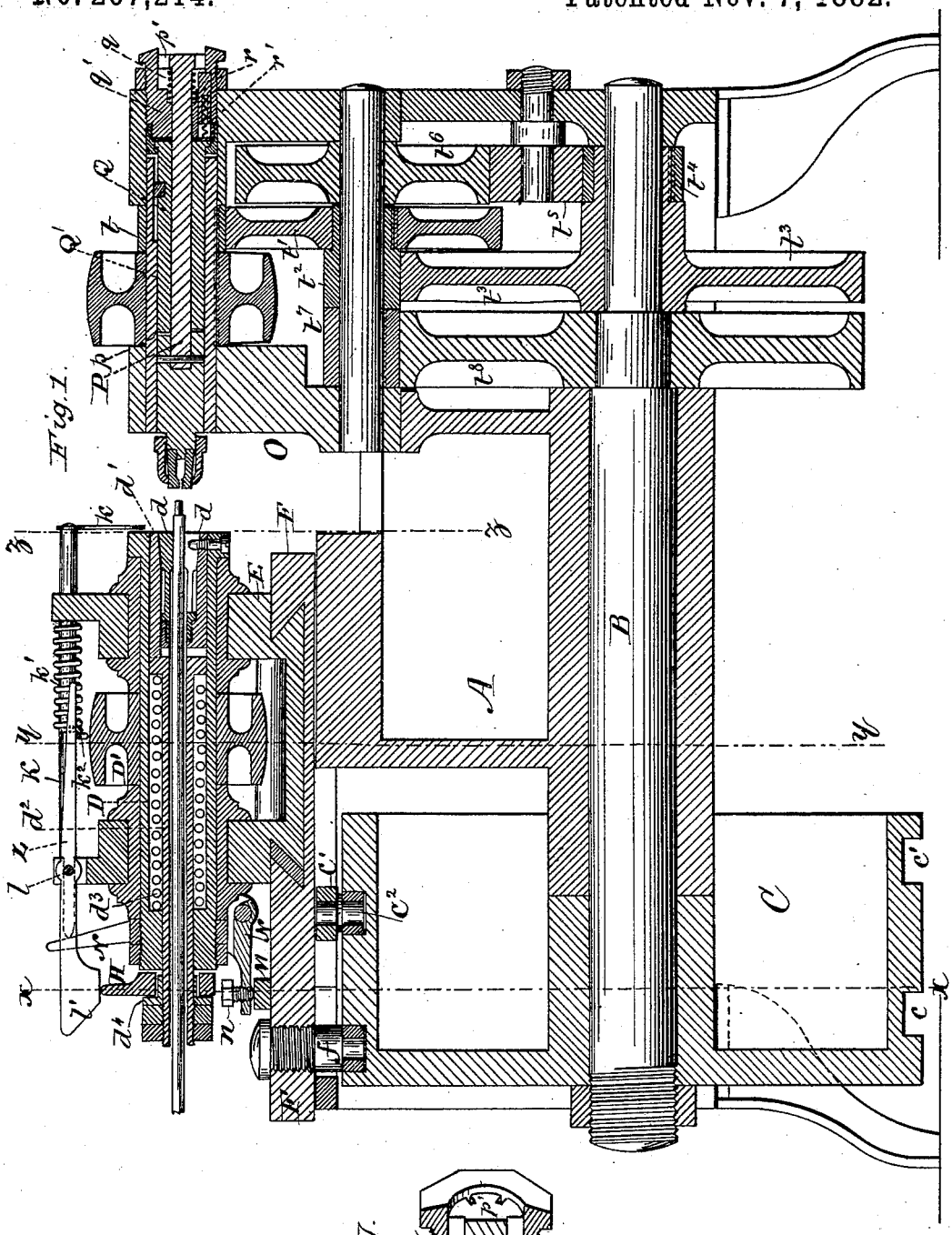

Fig. 1.

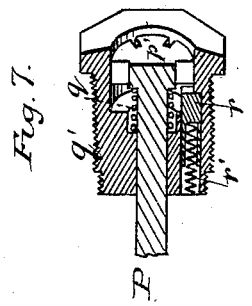

Fig. 7.

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Philip Mauro

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Allen Johnston
by A. Pollok
his attorney

(No Model.) 3 Sheets—Sheet 2.

A. JOHNSTON.

METAL SCREW MACHINE.

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Fig. 2.

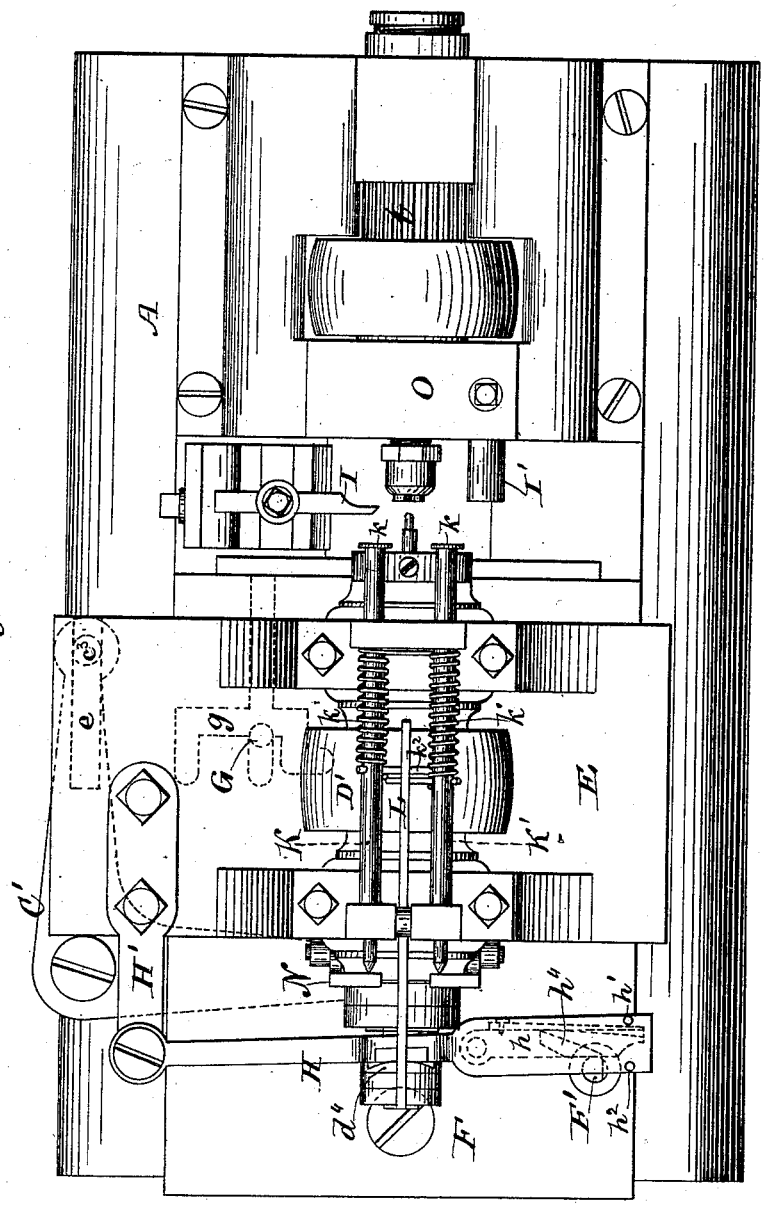
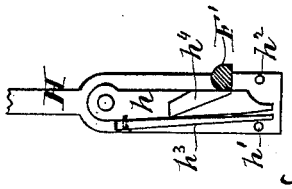


Fig. 6.



Witnesses:
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(No Model.) 3 Sheets—Sheet 3.

A. JOHNSTON.

METAL SCREW MACHINE.

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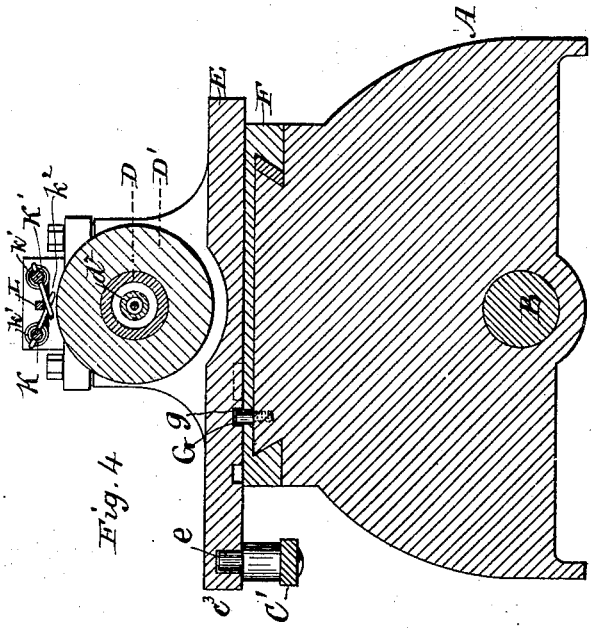

Fig. 4.

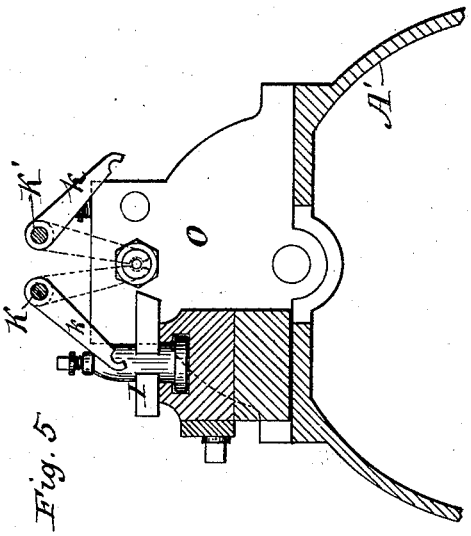

Fig. 5.

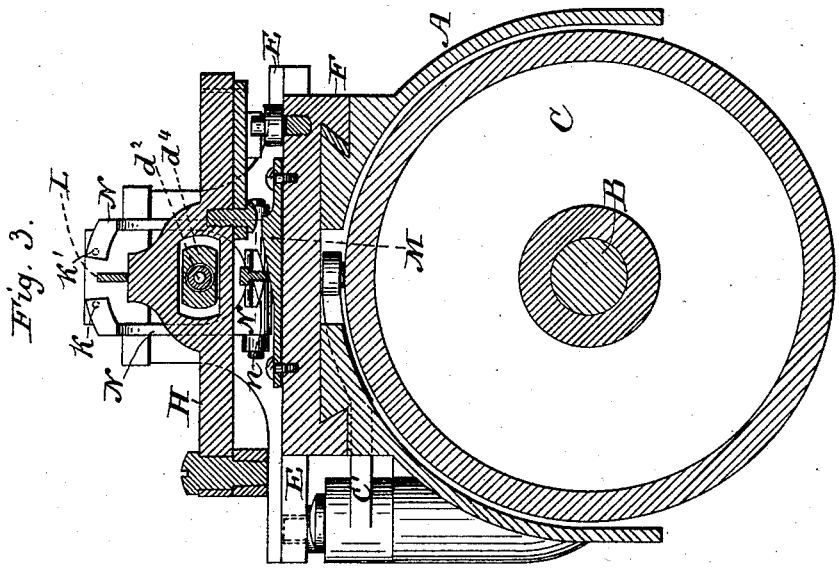

Fig. 3.

Witnesses:

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his attorney.

UNITED STATES PATENT OFFICE.

ALLEN JOHNSTON, OF OTTUMWA, IOWA.

METAL-SCREW MACHINE.

SPECIFICATION forming part of Letters Patent No. 267,214, dated November 7, 1882.

Application filed October 28, 1881. (No model.)

To all whom it may concern:

Be it known that I, ALLEN JOHNSTON, of Ottumwa, in the county of Wapello and State of Iowa, have invented a new and useful Improvement in Metal-Screw Machines, which improvement is fully set forth in the following specification.

This invention relates more particularly to automatic machines for making metal or machine screws from a rod, although applicable, at least in part, to other machines; and it involves an improvement in the general arrangement of the machine, in the feeding mechanism, in the screw-threading mechanism, and also in the special construction and combination of the different parts.

Heretofore the tools for turning down and threading the rod have been moved back and forth to cause them to act upon the rod in a revolving chuck. In the present invention this motion is imparted to the chuck. Lateral movement to bring the several tools in line with the rod or axis of the chuck is also imparted to the chuck, the tools being held in a stationary support or supports.

Heretofore the clamp by which the rod is fed at intervals between the chuck-jaws has been placed inside or back of the jaws, so that the rod is pushed forward. In the present invention the clamp is placed outside the jaws, so as to act upon the projecting portion of the rod. A friction-clamp could be used for the purpose; but a four-motion-feed clamp which successively grasps and advances the rod, releases it, and returns is deemed most advantageous. It constitutes itself a portion of the invention.

It may be observed that a four-motion-feed clamp arranged in front of the chuck has heretofore been used in a machine for making needle-blanks from a wire, and that this combination broadly constitutes, therefore, no part of the present invention.

The screw-threading mechanism in this invention operates on the principle described in Letters Patent No. 241,806, granted to me May 24, 1881, but is somewhat modified in its details, whereby greater simplicity and strength are secured.

The particular construction and manner of combining the several parts are set forth below.

The accompanying drawings, which form a part of this specification, represent a screw-machine embodying the invention.

Figure 1 is a central vertical longitudinal section; Fig. 2, a plan; Figs. 3, 4, and 5, cross-sections on dotted lines $x\,x$, $y\,y$, and $z\,z$, respectively, Fig. 1; and Fig. 6 is a bottom view, showing the cams for releasing the chuck-jaws at intervals to allow the feed to be made. Fig. 7 is a detail view in perspective and section.

A is the machine-frame, on which the various parts are mounted. The main shaft B turns in bearings in the frame and carries the cam-drum C, by which the chuck is shifted to bring the tools successively into action. The chuck is carried by a spindle, D, mounted in bearings on a laterally-movable support or slide, E, which is itself carried by a longitudinally-movable support or slide, F, the terms "lateral" and "longitudinal" having reference to the axis of the chuck. The slide F is supported in ways of the machine-frame, the slide E in ways of the slide F. A pin, G, screwed into or otherwise fastened to the machine-frame, projects into a groove, *g*, in the bottom of the slide E, and holds the latter from lateral motion during the advance and return or longitudinal movements of the slide. It also prevents longitudinal movement while the lateral shifting takes place. The slide F is reciprocated back and forth by means of the irregular cam *c* on the face of the drum C, through the pin *f*, fixed to said slide and projecting into the groove constituting the cam. The slide E of course partakes of the movement of the slide F in the direction of the axis of the chuck. It is shifted laterally at intervals by means of the cam *c'* on drum C, the motion being communicated through a lever, C', pivoted to the machine-frame, and carrying at one end a pin, c^2, projecting into the groove constituting the cam *c'*, and at the other with a pin, c^3, projecting into a groove, *e*, in the slide E. A link could be used instead of the groove-and-pin connection, if desired. The chuck-spindle D is turned by a belt running on a pulley, D', fixed on the spindle. It is revolved opposite to the direction in which chuck-spindles ordinarily run.

The chuck may be of any ordinary or suitable construction. As shown, it is composed of spring-jaws *d*, formed of one split piece and held in the solid head of the chuck-spindle, and operated by wedges *d'*, formed in one piece with the tube d^2 and working between the chuck-jaws *d* and the head of the spindle.

A spring, d^3, surrounding the tube d^2, presses the wedges forward and holds the chuck-jaws closed except when tube d^2 is drawn back against its pressure to release the jaws and allow the rod to be fed. At the rear end of the tube d^2 is a collar, d^4, loosely surrounding the tube, and fitting within an opening in the lever H. This lever is pivoted to an arm, H′, rigidly attached to the slide E. At its outer or free end is a cam-piece, h, pivoted to the under side of the lever. (Shown in dotted lines, Fig. 2, and in full lines, Fig. 6.) The outer end of the cam-piece plays between the pins h' h^2. A spring, h^3, tends to force this end away from the pin h'. Below the piece h, and fixed thereto, is a cam, h^4.

Fixed to the slide F is a pin, F′, with which the cam h^4 works. When the slide E, with the chuck and chuck-spindle, is moved in the direction of the cutting-off tool I, (up, Fig. 2,) the cam h^4, as it moves over the pin F′, is simply forced back against the pressure of the spring h^3. As soon, however, as the slide E reaches the end of its movement, or shortly before, the cam is released from the pin F′, and the cam-piece h is forced by the action of the spring h^3 over against the pin h^2, so that on the return movement of the slide a new surface of the cam is in contact with the pin F, and by the action of the latter the outer end of the lever is pressed back, (to the left, Figs. 1 and 2,) withdrawing the tube d^2 and wedges d' and releasing the grip of the chuck-jaws upon the rod or screw-stock. While the jaws are free the rod or screw-stock is advanced the length of a screw.

Mounted upon the slide E, above the chuck-spindle, are the two shafts K K′, capable of limited longitudinal and rotary motion. Upon their front ends are arms k, extending down in front of the chuck on opposite sides of the axis thereof, and arranged to grasp between them, when closed, the rod or screw-stock projecting through the chuck. These arms constitute, therefore, the feed-clamp.

Surrounding each shaft K K′ is a spiral spring, k', which tends to turn its shaft so as to bring the lower ends of the arms k together, and thus close the feed-clamp, and also to hold the shaft and arms in their rearmost position, (to the left in Figs. 1 and 2.) A latch, L, pivoted at l, bears at its front end on the pins k^2, projecting from the shafts K K′. Its rear end rests upon the lever H, and is provided with an incline or cam surface, l', over which said lever works. In the position shown in Fig. 1 the rear of latch L is held up by the lever H and the arms of the feed-clamp are separated, as shown in full lines, Fig. 5. When, however, the lever is drawn back by the action of the pin F′ on the cam h^4, the incline l' allows the rear of the latch to fall, and the springs k', being liberated, bring the clamping-arms k together, as shown in dotted lines, Fig. 5. The rod or screw-stock is thus grasped by the feed-clamp outside the chuck at the same time that the jaws of the latter are released. The forward movement of the feed-clamp and the rod or screw-stock is effected by the action of a cam, M, fixed to the slide F, upon a bent lever, N, pivoted on the slide E. The upright arm of this lever is forked, so as to straddle the chuck-spindle, and bears against the rear end of the shafts K K′. The horizontal arm is provided with a set-screw, n, which bears upon the cam M, and by the adjustment of which the forward movement of the shafts and feed-cam can be regulated. The cam M operates the lever N after the feed-clamp has closed. The rod or screw-stock is therefore advanced during the return (down, Fig. 2) movement of the slide E and chuck. The feed is completed before the end of this movement, when the cam h^4 is released from the pin F′, and the lever H and tube d^2 being forced forward by the spring d^3 and the rear of latch L raised, the arms of the feed-clamp are separated and release the rod or screw-stock, and the chuck-jaws are forced together and grasp it. The chuck-jaws being rotary, while the feed-clamp is not, they are made to open a short time before and to close a short time after the feed-clamp. During the movement of the slide E and chuck toward the cutting-off tool the set-screw n in lever N moves down the cam M, and the springs k' return the feed-clamp to the position shown without effect upon the rod or screw-stock. The cutting-off tool I is secured to the machine-frame in any suitable way, and the turning-down tool I′ is held in a socket of the tool-holder O, which is itself bolted to the machine-frame; or, if desired, the tool may be otherwise held in position. The die or turning-down tool is carried by a spindle, P, loosely supported in a sleeve, Q, engaged by and revolving with an external sleeve, Q′, to which power is communicated by a belt on a pulley keyed thereto. The pulley is revolved in the same direction as that on the chuck-spindle, but at a higher speed.

Between the die-spindle P and the sleeve Q is a clutch, p, one part being carried by the die-spindle and the other by the sleeve. A spiral spring, q, surrounding the die-spindle and interposed between the head p' on the rear thereof and the stationary nut q', tends to hold the two parts of the chuck in engagement, so that the motion of the sleeves Q Q′ is communicated to the die-spindle. This is capable of a limited endwise movement, so that it can be drawn forward in the sleeve Q′, thus disengaging the clutch p. When the clutch p is just disengaged the die-spindle is left free to revolve; but when said spindle is drawn still further forward it is engaged by a stop-clutch, which holds it stationary. A clutch-piece, r, is fitted in a recess in the stationary nut q', together with a spring, r', interposed between the clutch-piece and the end of the recess, so that it tends to force the latter outward, (to the right, Fig. 1.) The head p', at the rear of the spindle, is provided with a series of notches in its rim, and when the die-spindle is drawn forward one of these notches

is engaged by the clutch-piece r, and the spindle is held stationary.

The thread is cut upon the rod or screw-stock by the die or threading-tool revolving faster than the chuck; but when the thread is completed the die-spindle is drawn forward and the clutch p is released, and the die-spindle then continues to revolve at the same speed as the chuck until engaged and stopped by the clutch-piece r. The continued revolution of the rod or screw-stock with the chuck releases it from or unthreads the die. Should the notch in head p' at the rear of the die-spindle be not fairly engaged by the clutch-piece r, the spring r' yields and allows the die-spindle to turn until the next notch comes opposite, when it forces the clutch-piece into the same. A limited endwise movement is allowed the die-spindle while held from revolving by the clutch-piece r.

Motion is communicated to the main shaft B from the sleeve Q' by means of a train of reducing spur-gearing, comprising the gear t, fixed to the sleeve, the gear t^8, keyed to the main shaft, and the intermediate gears, t', t^2, t^3, t^4, t^5, t^6, and t^7, the large and small gears, t' and t^2, t^3 and t^4, t^6 and t^7, being connected so as to revolve at the same speed, and the gear t^5 being an idler, which may be carried on an arc-limb, so that gears of different sizes may be substituted for t^4 in order to change the speed. The system of gears is the same as described in my before-mentioned patent.

In working the following operations take place: After the rod or screw-stock has been inserted through the tube d^2, out between the chuck-jaws d, with a sufficient length projecting, and the chuck with said rod or screw-stock has been brought opposite the turning-down tool, with the axes in line, the slides E F, with the chuck, are advanced by the action of cam c, and the tool being brought into action reduces the rod or screw-stock to the desired length. The slides E F and the chuck are then brought back, and the slide E, with the chuck, is shifted by the action of the cam c' laterally, so as to bring the axes of the chuck and of the die or threading-tool in line. The chuck and rod are then advanced by the cam c, and when the desired length of thread has been cut they are drawn sharply back. The newly-cut thread being held in the die or threading-tool, the latter and the die-spindle follow the chuck. The clutch p is at once disengaged, the clutch-piece r is engaged, and the rod or screw-stock is released from the die or threading-tool by the conjoint action of its own revolution and backward movement, and the tension of the spring q serving to withdraw the die or threading-tool. When the thread is released the spring q at once disengages the die-spindle from the clutch-piece r, bringing the two parts of the clutch p into contact. After the chuck and slides have retreated the required distance the chuck and slide E are shifted laterally to bring the rod or screw-stock between the die or threading-tool and the cutting-off tool. The chuck and slides are then advanced, and while in the forward position the chuck and slide E are shifted laterally to bring the rod or stock in contact with the cutting-off tool, so as to sever the newly-formed screw. They are then moved back again. The chuck and slides are then backed, and the slide E is shifted laterally until the axes of the chuck and turning-down tool are in line. It is during this lateral movement that the chuck-jaws are released by the action of the pin F', cam h^4, and lever H, that the rod or screw-stock is grasped by arms k of the feed-clamp on the release of the latch L through the movement of lever H, and that the feed-clamp and rod or screw-stock are fed forward by the cam M and lever N a distance equal to a screw's length.

The operations before described are repeated indefinitely, fresh rods or screw-stocks being supplied as required.

Various modifications may be made in the details of the machine without departing from the spirit of this invention, and portions thereof may be used without the others. Instead of having separate belts on the chuck-spindle and sleeve of the die-spindle, they could be connected by toothed gearing, as in the manner shown in my application for Letters Patent for screw-machine, No. 38,250, filed July 21, 1881.

Other means than that shown could be used for tapping or cutting the thread—such, for example, as the reversing-gear ordinarily employed—or mechanism for running the die faster than the chuck in unthreading. A length-gage could be used instead of the improved feeding mechanism described, or any of the feeding devices before known could be so used—as, for example, that shown in my application for patent, No. 38,251, filed July 21, 1881. So, likewise, the feeding mechanism herein described could be used in other machines, the operating devices being suitably modified when required. The longitudinally-moving chuck could be combined with a laterally-moving tool-holder, or with a stationary tool-holder when only a die and cutting-off tool are to be used.

Instead of using a separate cam on the cam-drum for shifting the chuck laterally, a cam such as shown in my application for patent, No. 19,327, filed October 22, 1880, could be used.

The machine shown is entirely automatic; but hand-machines embodying the invention, at least in part, could be made. For example, using the cam for producing lateral movements described in my last-named application, the slide F could be reciprocated by a lever with handle—cam-drum, main shaft, and accessory parts being dispensed with. So, also, machines could be made to operate on blanks, or to make wood-screws embodying more or less of the invention. Instead of having the lateral movement of the chuck and its support in right lines, it could be made in a short arc or curved path.

Having now fully described my said invention and the manner of carrying the same into effect, I would observe that no claim is made herein to matter shown or claimed in my aforesaid Patent No. 241,806, dated May 24, 1881, or in my applications numbered and dated respectively 19,327, October 20, 1880, 38,250, July 21, 1881, and 38,251, July 21, 1881; but

What I do claim is—

1. The combination of the chuck, the hollow chuck-spindle, the pulley or its equivalent for revolving said chuck and spindle, the means for releasing at intervals the bite of the chuck-jaws and for feeding a long rod or screw-stock through said spindle, and the lateral and longitudinal slides or reciprocating supports, the one carried by the machine-frame, and the other, which forms the immediate support for the chuck, mounted in ways of the first slide, substantially as described.

2. The combination of the chuck adapted to receive a rod or long screw-stock, the longitudinal slide carrying said chuck, the means for relieving and restoring the pressure of the chuck-jaws, and the means for feeding the rod or screw-stock when the pressure of the chuck-jaws is relieved, said means operating independently of the longitudinal movement of said chuck, substantially as described.

3. The combination, with the milling and threading tools, of the chuck and the longitudinal and lateral slides or reciprocating supports, the one carrying the chuck and being mounted in the ways of the other, substantially as described.

4. The combination, with the milling and threading tools, the chuck, and the laterally and longitudinally movable slides or supports, the one carrying the chuck and being itself carried by and movable in ways of the other, of the cams and connections or equivalent automatic mechanism for shifting said slides or supports back and forth, substantially as described.

5. The combination of the chuck adapted to receive a long rod or screw-stock, the lateral and longitudinal slides or reciprocating supports, the one carrying the chuck and being itself carried by and movable in ways of the other, the feeder, the series of cutting-tools, including a cutting-off tool, and the cams and connections or equivalent automatic mechanism for reciprocating said slides or supports and for operating said feeder, substantially as described.

6. The combination, with the chuck, the milling-tool, the threading-tool, and the cutting-off tool, of the feed-clamp and its operating means, said clamp being arranged between the front of the chuck and the said milling and threading tools and out of the way of said cutting-off tool, substantially as described.

7. The combination, with the chuck and laterally-movable support therefor, of the feed-clamp, carried also by said support and arranged in front of the chuck, substantially as described.

8. The combination, with the chuck and the means for releasing at intervals the bite of the chuck-jaws of the feed-clamp, arranged in front of said chuck, the springs for closing and for advancing the clamp, and the cams and connections for opening and for returning the same, substantially as described.

9. The combination, with the chuck and laterally-moving support therefor, of the four-motion-feed clamp and cams and connections operated by the lateral movement of said chuck and its support to close the arms of said clamp, to advance the same, to open them, and return them, the operations being performed successively and in the order named, substantially as described.

10. The arms of the feed-clamp and their supporting-shafts, capable of limited longitudinal and rotary motions, in combination with the means for imparting positively such motions thereto in one direction, and the springs for returning the same, substantially as described.

11. The combination of the chuck and chuck-spindle, the arms of the feed-clamp, the shafts extending lengthwise of said spindle and carrying the said arms at their outer ends, and being capable of limited longitudinal and rotary motion, the springs surrounding the said shafts, the latch for governing their rotary motion, the lever for imparting their longitudinal motion, and operating-cams and connections, substantially as described.

12. The combination of the chuck, the support therefor, the cams and connections or equivalent automatic mechanism for imparting lateral and longitudinal motion to the chuck and its support, the die or threading-tool, and the cutting-off tool, both mounted on the stationary support or supports, substantially as described.

13. The combination of the chuck, the movable support therefor, cam-operated mechanism for shifting said chuck and support, the die or threading-tool comprising the die-spindle with the inclosing sleeve, the belt-pulley mounted on said sleeve, and gearing for communicating motion from said pulley to said cam mechanism, substantially as described.

14. An automatic screw-machine comprising, in combination, the chuck, lateral and longitudinal slides, the cams and connections or equivalent automatic mechanism for operating the same, the feed mechanism, with feed-clamp in front of said chuck, the devices fixed on said longitudinal slide for operating said feed mechanism, and the stationary tool-holder with threading and other tools mounted thereon, substantially as described.

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

ALLEN JOHNSTON.

Witnesses:
A. G. HARROW,
J. T. HACKWORTH.