

(No Model.)

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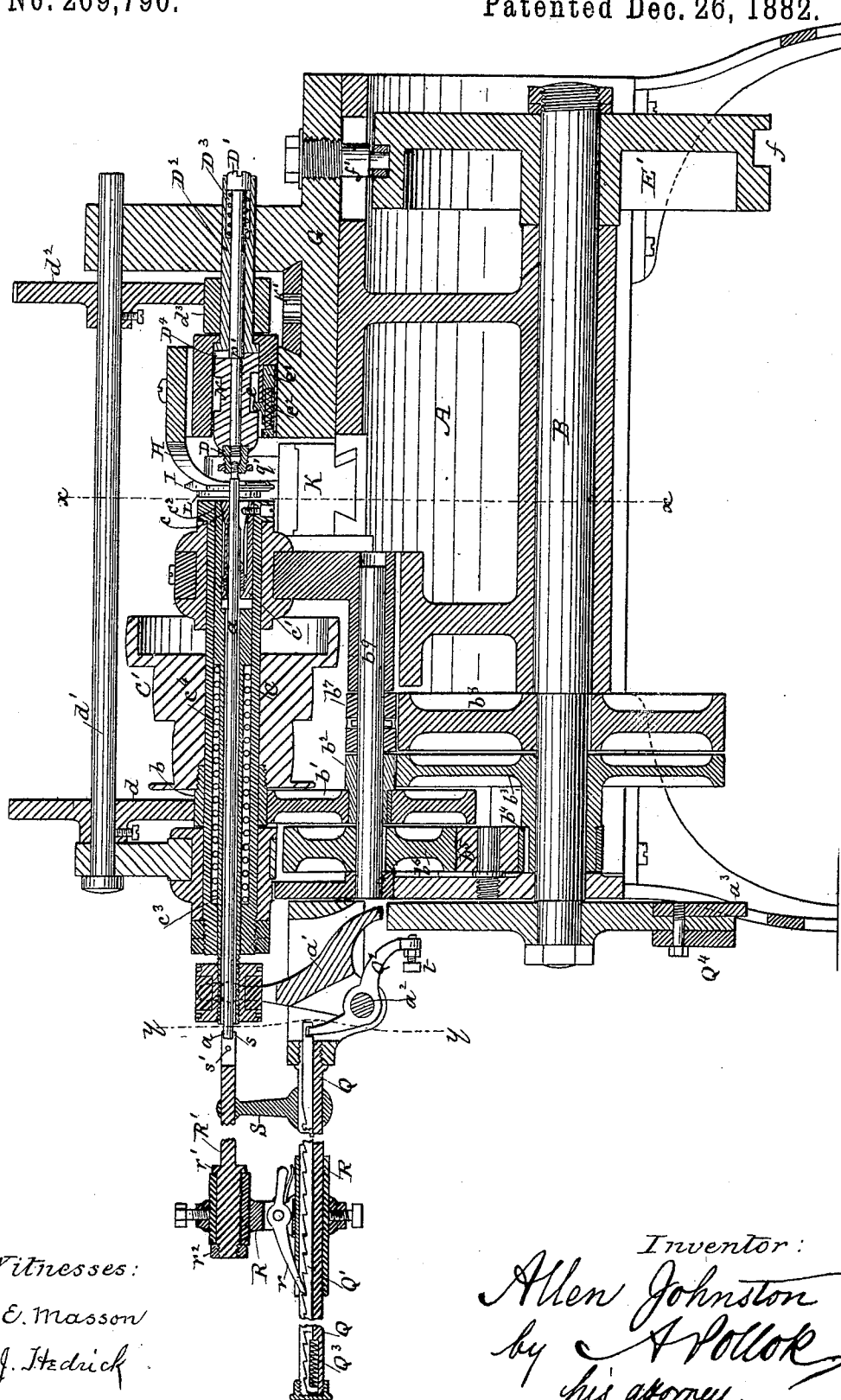
A. JOHNSTON.

METAL SCREW MACHINE.

No. 269,790.

Patented Dec. 26, 1882.

Fig. 1.



Witnesses:
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C. J. Hedrick

Inventor:
Allen Johnston
by A. Pollak
his attorney.

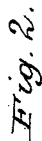
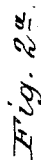
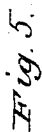
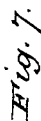
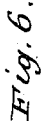
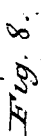
(No Model.)

3 Sheets—Sheet 2.

A. JOHNSTON.
METAL SCREW MACHINE.

No. 269,790.

Patented Dec. 26, 1882.



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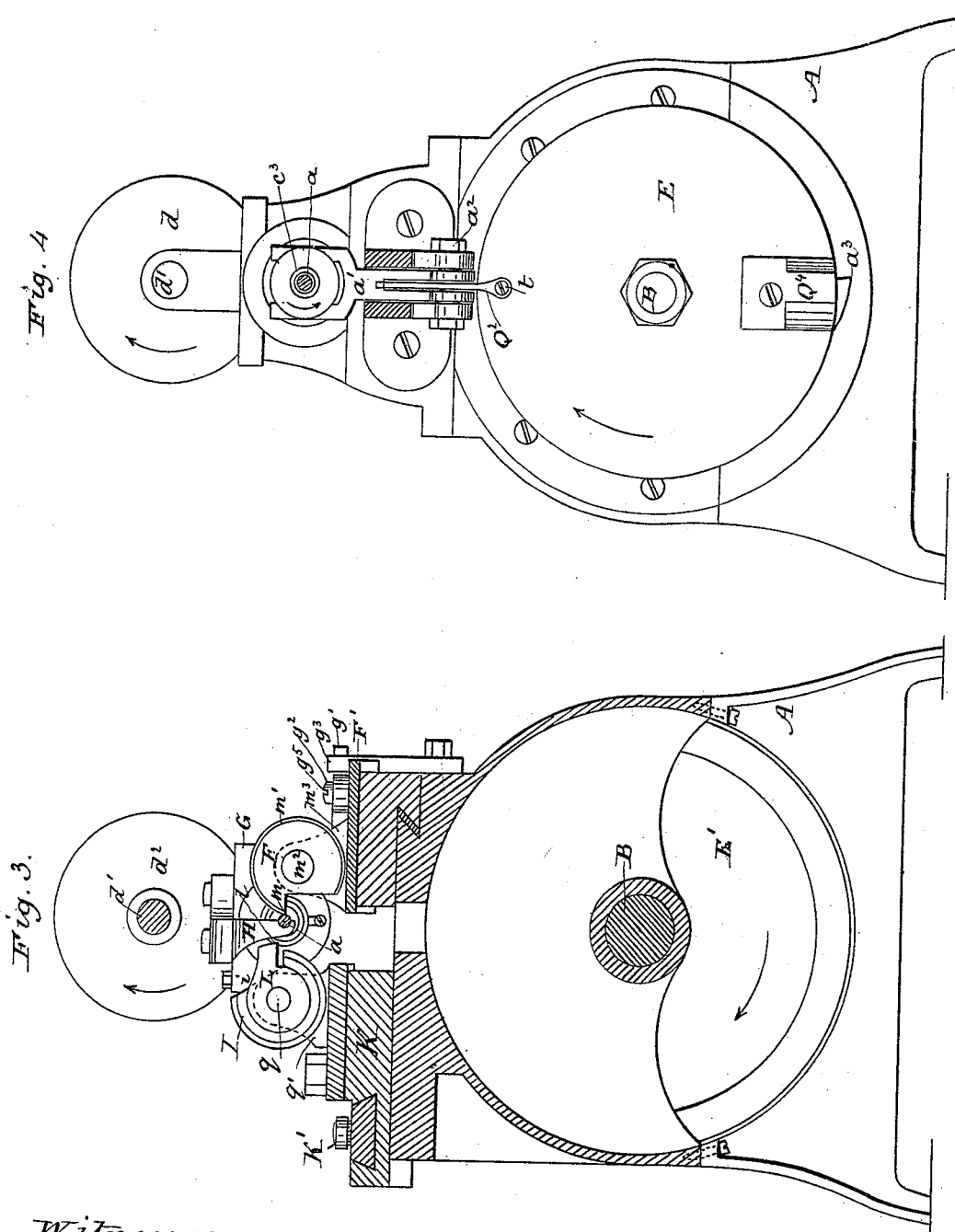
(No Model.)

3 Sheets—Sheet 3.

A. JOHNSTON.
METAL SCREW MACHINE.

No. 269,790.

Patented Dec. 26, 1882.



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UNITED STATES PATENT OFFICE.

ALLEN JOHNSTON, OF OTTUMWA, IOWA.

METAL-SCREW MACHINE.

SPECIFICATION forming part of Letters Patent No. 269,790, dated December 26, 1882.

Application filed February 15, 1882. (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.

The present invention, although applicable in part, at least, to other forms of screw-machines, is designed more particularly as an improvement on the machines for making metal or machine screws from a long rod or screw-stock which is at intervals, and in succession automatically fed forward, turned down, and threaded for a suitable distance, and then has the newly-formed screw severed.

The present invention has reference to the general combination and arrangement of the chuck for holding the screw-stock, the milling or turning-down tool, and die or threading tool; to the combination of the same elements with the cutting-off tool; to the form or construction of the turning-down, threading, and cutting-off tools; to a burnisher for removing the burr left by the cutting-off tool, and to the feeder or mechanism for advancing the rod or screw-stock.

The accompanying drawings, which form a part of this specification, represent a screw-machine constructed in accordance with the invention.

Figure 1 is a central vertical longitudinal section. Figs. 2 and 2^a together form a view in horizontal section and plan. Fig. 3 is a view in vertical cross-section on line *xx*, Fig. 1, and elevation, looking to the right. Fig. 4 is a similar view in section and elevation, the section being on line *yy*, Fig. 1; and Figs. 5, 6, 7, and 8 are perspective views of respectively the die of the threading-tool, the turning-down tool, the cutting-off tool, and the burnishing-tool or burnisher.

A is the machine-frame; B, a cam-shaft; C, the chuck-spindle, and D' the die-spindle or spindle of the threading-tool. The chuck-spindle is driven by a belt on the pulley C'. Motion is conveyed from the gear *b* on the chuck-spindle to the cam-shaft through the gears *b*¹ *b*², loose on the shaft *b*³, gears *b*³ *b*⁴, loose on a shaft, B, gear *b*⁵, supported in an arc-imb, gears *b*⁶ *b*⁷, keyed to shaft *b*⁸, and gear *b*⁸, keyed

to shaft B, or by other suitable gearing or mechanical connection. From the gear *b* motion is conveyed to the die D and its spindle D' through the gear *d* and shaft *d*¹, gear *d*², and gear *d*³, the gears *d* and *d*² being keyed on the shaft *d*¹, and the gear *d*³ on a sleeve, D², surrounding the die-spindle, and connected therewith by a clutch, D⁴, normally kept in engagement by spring D³. The effect of the gears *b* *d* *d*² *d*³ is to revolve the die D and spindle D' in the same direction as the chuck, but at a somewhat greater speed.

To regulate the speed of the die-spindle the gears *d*² *d*³ are made detachable, so that they can be replaced by gears of different relative size; or any other ordinary or suitable means of varying the motion conveyed by gearing can be employed.

The chuck may be of any ordinary or suitable construction. As shown, the chuck-jaws *c* are fastened at the rear end (left, Fig. 1) to a stay-piece, *c*¹, fastened by screws in the end of the chuck-spindle, and the said jaws are pressed inward to grasp the rod or screw-stock *a* by the wedges *c*² on the end of the tube *c*³, which latter is pressed forward by the spring *c*⁴. The tube *c*³, with its wedges, is at intervals drawn back against the pressure of the spring *c*⁴ to relieve the bite of the jaws *c* on the screw-stock *a* and allow the latter to be fed forward. The means for releasing the jaws comprise a bent lever, *a*¹, pivoted on a cross-shaft, *a*², and operated by a projection, *a*³, on the cam-disk E, itself keyed to the shaft B. On the opposite end of the shaft B is a cam-drum, E', by which the tools are made to operate on the screw-stock through suitable connections.

The threading-tool, as well as the other tools, to be hereinafter described, is brought into action while the screw-stock is held in the chuck. Being revolved faster than said chuck, it cuts the thread or the screw-stock in proportion to the difference in the velocities of rotation. In order to run the die off the newly-cut thread, the die and its spindle D' are held from turning by a projection, *e*, on the non-rotating clutch-bar *e*¹, which is supported in guides, and is capable of a slight forward movement against the pressure of the spring *e*².

So far, broadly considered, there is nothing

new in the machine. Reference may be had to Letters Patent No. 241,806, granted to me May 24, 1881, and to my application for patent, No. 38,250, dated July 21, 1881. The machinery explained is shown herein as being best suited for use in connection with the improvements constituting the present invention. These improvements are not, however, limited to such machinery.

The improvement in turning down and threading the screw-stock will now be described.

Instead of bringing the turning-down tool in line with the screw-stock, advancing it to mill said stock, returning or backing it off, and moving it out of the way, and then bringing the threading tool or die into position, the turning-down and threading tools are advanced together, and together act upon the screw-stock, the turning-down tool somewhat in advance of the threading-tool.

F is the milling or turning-down tool, carried by a slide, F', supported in ways of the slide G, which carries the die or threading-tool, and is itself supported in guides of the machine-frame. The slide G is moved longitudinally back and forth by means of the irregular cam *f* on the drum E' acting upon the pin *f'*, projecting downward from the slide G. One bearing of shaft *d'* is carried by slide G, and is capable of sliding on the shaft. The gear *d*³ is made long to allow the desired motion to the sleeve on which it is fixed without disengaging its teeth from those of gear *d*². The ways of slide F' are transverse to and preferably slightly oblique to the axis of the chuck and die-spindle.

The object of carrying the turning-down tool on a slide is mainly to enable it to be moved out of the way of the die or threading-tool after milling the desired length of screw-stock. This removal is necessary in making screws with shanks threaded to the head; but when sufficient length of the shank is left unthreaded it is not necessary, and then the slide permits an adjustment of the turning-down tool so as to leave a larger or smaller shank to the screw.

For removing the turning-down tool from the path of the threading-tool, a spring, *g*, latch *g'*, and locking-bar *g*² are combined with the slide F', and a fixed projection, *g*³, on the machine-frame. The spring *g* is fastened at one end to the slide G, and at its free end engages in a notch, *g*³, in the slide F'. The latch *g'* is pivoted to the slide G, and carries a spring, *g*⁷, which presses at its free end against a pin, *g*⁸, on the slide G. The locking-bar *g*² is fastened to the slide F' by the screws *g*⁴ *g*⁵, the screw *g*⁵ passing through a slot, *g*⁶, which allows to the bar *g*² an adjustment on the screw *g*⁴ as a center. During the action of the turning-down tool the slide F' is held in place against the pressure of the spring *g* by the engagement of the locking-bar *g*² with the latch *g'*. When the desired length of screw has been turned down or milled the latch *g'*

strikes the fixed projection *g*³, is retracted against the pressure of its spring *g*⁷, releasing the locking-bar *g*² and allowing the spring *g* to shift the slide F' and move the turning-tool F away from the screw-stock *a*. The slide G continues to advance until the thread has been cut, when it is returned by the action of the cam *f*. During the return movement the slide F' is moved toward the axis of the chuck by the contact of its inclined end with the fixed projection *g*³, the latch *g'* snaps into engagement with the locking-bar *g*², and the turning-down tool F is again in position for advancing to turn down or mill the stock *a* for another screw. By adjusting the position of the latch *g*² the position of the turning-down tool will be regulated to mill screw-shanks of different diameters.

The ways of the slide F' could be made at right angles to the axis of the chuck and die; but the oblique position shown is preferred, because it gives to the turning-down tool in withdrawing from the screw-stock a slight backward movement that offsets the forward movement of the slide G, so that the under side of the screw-head is left perfectly square.

The turning-down tool and threading-tool may be so arranged that the latter will not begin to cut the thread until the milling operation is completed; but they are so arranged that the threading-tool begins to act after the other tool has turned down the screw-stock for a short distance, and the two then continue to act together, and besides the saving of time and movement there is a special advantage in this when, as in the machine shown, the thread is cut by running the die faster than the chuck and screw-stock, which advantage is that the pressures of the die and turning-down tool, being in opposite directions, partly counterbalance each other and the strain on the chuck-jaws is relieved.

When the screw-shank is not to be threaded all the way up to the head the slide F' is held in place by the set-screw *h*, and the threading, which begins shortly after the turning down has commenced, stops at the same time with it.

In order to prevent the rod or screw-stock *a* from springing away from the turning-down tool, a supporting arm or rest, H, is used. This arm or rest is supported on the slide G independently of the turning-down or milling tool, and it bears against the screw-stock *a* on the side opposite from the said turning-down or milling tool. As shown, it bears against the full portion of the screw-stock; but it could be made also or instead to bear against the turned-down portion.

The cutting-off tool I is carried by a slide, K, supported in ways of the machine-frame transverse to the movement of the slide G. It is operated by a bent lever, K', pivoted at *k* to the machine-frame, and having its ends loosely connected respectively with the slide K and the slide G. During the retreat of the latter with the threading and turning-down tools,

the slide K and the cutting-off tool I are advanced, and the newly-formed screw is severed from the screw-stock by the cutting-off tool. When the slide G is again advanced the slide K is withdrawn. The lever K' could be operated by a separate cam on the drum E', as in my application before mentioned; but the construction shown is simpler and better, and is therefore claimed as an improvement.

In connection with the cutting-off tool, a burnisher, L, is employed to remove the burr left by the cutting-off tool. It is so placed that when advanced the cutting-edge l passes just over the screw-stock, removing any burr that may be thrown up by the cutting-off tool. The burnisher also serves as a rest or support to hold the rod or screw-stock up, or, rather, down, to the cutting-off tool. As shown, it is carried by the slide K, being attached to the same support as the cutting-off tool.

The several tools have heretofore been referred to generally, since tools of any ordinary or suitable construction may be used. The special form or construction of the tools, as shown, however, constitutes a part of the invention, and will next be described.

The turning-down tool F consists of a disk (see Fig. 6) with a portion removed, and ground to leave a cutting-edge, m , to act upon the screw-stock. The said disk is also provided with a boss, m' , which has a cutting-edge for shaving down the head of the screw, being made to form a smooth screw-head. The tool is supported by a bolt, m^2 , that passes through a central aperture in the disk and binds the latter against the upright m^3 on the slide F'. This style of tool lasts a long time, as the cutting-edge can be sharpened from time to time, and the tool used until almost the entire periphery is worn away. Moreover, after each grinding the cutting edge is always the same, so that the work done will be uniform. The new cutting-edge can be brought to the proper position relative to the stock by turning the disk-tool on the bolt m^2 and securing it in such position.

The die D is formed of a split tube or pipe cut away on the side, as shown at n , Fig. 5, and underneath, as at n' , to form the three jaws or spring-arms n^2 , having their cutting-edge on the inside. The outside of the arms is made tapering, and is threaded to receive a solid ring or nut, n^3 . By turning this nut toward the solid end of the die the ends of the spring-arms will be drawn together, owing to the taper form of the exterior, and by turning the nut in the opposite direction the ends of the spring-arms are allowed to separate, so that it is very easy to adjust the threading-die to the exact size wanted. When the jaws or spring-arms n^2 are drawn together each jaw so moves that certain parts tend directly toward the axis of the die, so that if their motion were continued they would pass through said axis, other parts passing to the side of the axis. The parts of each jaw which tend directly toward the axis

lie in the radial plane which, roughly speaking, bisects the base of the jaw. By shaping the notches n as shown this plane intersects the forward corner, n^4 , of the cutting-edge, or is brought close to said corner, so that whatever the adjustment of the cutting-edges toward and away from the axis of the die these corners will always be nearest the axis and act first upon the screw-shank. It is therefore practicable to grind the cutting-edges and set them until the die is worn out.

The die D is screwed on the end of the die-spindle. A head, N, is held on the spindle, between the die D and a shoulder, p' , on the die-spindle, and it is or may be keyed to said spindle. The head N is cut away on the periphery, as shown at P', Fig. 2, to leave an annular space for the reception of the projection e on the clutch-bar e' during the threading operation, and a stop, p^2 , to engage the said projection and hold the die and spindle stationary for unthreading the die. One part of the clutch D⁴ is also formed on this head. The cutting-off tool I, like the turning-down or milling tool, is discoidal and possesses the advantages before enumerated for that form of tool.

The burnisher L is made in the same form, only the curved edge constitutes a smaller part of a circle. As shown, both it and the cutting-off tool are supported on one bolt, q , which passes through their centers, and by which they are fastened to the upright q' on the slide K, and the burnisher is bent so that its periphery lies on the same plane with that of the cutting-off tool, the outer bent portion fitting in the recess i of the cutting-off tool.

The mechanism for feeding the rod or screw-stock a at intervals, when the bite of the chuck-jaws is released, will next be described.

A bar, Q, is screwed into the machine-frame, or otherwise supported. This bar is somewhat longer than the rods or stocks from which the screws are to be made. It is recessed on top to receive a rack-bar, Q', which is reciprocated in its recess by the lever Q² acting to move it forward, (to the right, Fig. 1,) and the spring Q³ acting to return it. The lever Q² is operated by the cam Q⁴ on the disk E.

Mounted on the bar Q is a sliding carriage, R, provided with a pawl, r , that takes into the teeth of the rack-bar Q'. A feed-bar, R', has its outer end supported and journaled in a bearing on the carriage R, and at its inner end it is connected with the outer end of a rod or screw-stock. The shoulder r' and nut r^2 on the feed-bar cause it to move back and forth with the carriage R. A supporting-guide, S, steadies the feed-bar.

The connection with the end of the rod or screw-stock is made by recessing the end, as at s , splitting it, and holding the two parts together by a clamp or set-screw, s' .

The feed-bar is cylindrical and smaller in diameter than the bore of the tube c^3 , and in operation it enters said tube, pushing the rod or screw-stock a in front of it. The intermit-

tent forward movement of the carriage R and feed-bar R' is communicated to them by the cam Q⁴ through the cam-lever Q², rack-bar Q', and pawl r. The forward movement takes
 5 place while the chuck-jaws are released from the screw-stock, and when said movement is completed the jaws again take hold of the rod or screw-stock, the cam Q⁴ passes away from the end of lever Q², allowing the spring Q³
 10 to assert itself and return the rack-bar without the carriage R, the pawl r' dropping into engagement with a new tooth.

The forward movement of the rack-bar can be regulated by means of the adjusting-screw
 15 at the lower end of the lever Q², which makes contact with cam Q⁴. The distance between the teeth of the rack-bar will ordinarily be equal to a screw's length, and by substituting rack-bars with different sizes of teeth the rod or
 20 screw-stock may be advanced the distance required by different lengths of screws. When a rod or screw-stock has been used up the carriage and feed-bar can be run back by hand. This feed mechanism is more positive in its
 25 action than the split tube commonly employed. It may be observed, however, that heretofore positively-operating mechanism has been used for feeding. For example, a carriage in which the rod or screw-stock is supported so as to
 30 be capable of revolution has been advanced step by step through the reciprocation of a rack-bar, and a feed-bar adapted to enter the hollow chuck-spindle has been advanced by a rack and pawl. These old apparatus are of
 35 course not included in the present invention.

Having explained the construction and operation of the several parts of the machine, a brief description of the operation of the entire machine will be given.

40 Motion being imparted to the chuck and its spindle C by a belt or pulley, C', and conveyed thence to the cam-shaft, B, and die D, and its spindle D', the die and its spindle revolving faster than the chuck, the tools commence to operate on the rod or screw-stock a, which, previous
 45 to the starting of the machine, has had its front end inserted through the tube c³ and between the chuck-jaws c, and the rear end clamped in the recessed end of the feed-bar R'. After the lever a' has been released by the cam a³, and
 50 the chuck-jaws c have taken hold of the rod or screw-stock a, the slide G is advanced slowly, bringing the turning-down tool F first into action, and then the threading-tool, the rod or
 55 screw-stock being held up to the turning-down tool by the arm or rest H. When the proper length of rod has been turned down by the tool F the latch g' strikes the fixed projection g³ and releases the locking-bar g², and the tool
 60 F is removed by the spring g. The threading-tool continues to cut until the movement of the slide G is reversed by the cam f. This cam, when the forward movement of the slide is finished, draws back the slide, suddenly disengaging the clutch D⁴ and engaging the stop-
 65 piece or clutch-bar e' with the projection p² on

the head N. The slide then continues to back off more slowly until the die D is released from the thread, and the cutting-off tool I and bur-
 70 nisher L have acted upon the rod, the former to sever the newly-formed screw and the latter to remove the burr thrown up by the former. The slide G, with the turning-down and threading tools, then begins its forward motion, when the
 75 chuck-jaws c are released by the cam a³, and at the same time the rod or screw-stock is advanced through them by the action of the cam Q⁴, lever Q², rack-bar Q', and pawl r. The chuck-jaws then resume their hold on the rod or screw-stock, the rack-bar is returned into
 80 position for a new feed, and the operations proceed as before. If the screws are to be threaded only part way to the head, the slide F will be held in position by the set-screw h.

It is obvious that modifications may be made
 85 in the details of construction without departing from the spirit of the invention, and that portions of the invention may be used without the others. For example, a die and turning-down tool, operating as described, could be
 90 combined with a chuck the rotation of which is reversed to unthread the die, or could be used in a machine in which the die is unthreaded by being run faster than the chuck, or in other machines.

95 The several parts of the invention, so far as applicable, can be used for making nuts or operating upon other articles, as well as for making screws. The machine may also be modified by supporting the tools on the machine-
 100 frame, and imparting longitudinal and lateral movement to the chuck instead of to the turning-down or milling tool and the threading-tool, as in the machine described in my application
 105 No. 44,688, filed October 28, 1881, only in such case it is obvious the lateral movement of the chuck will only be employed to sever the threaded screws. The invention is in part applicable to what are known as "hand machines," in contradistinction to automatic ma-
 110 chines.

Having now fully described my said invention and the manner of carrying the same into effect, what I claim is—

1. The combination, with the chuck adapted
 115 to receive a long rod or screw-stock, the means for relieving and restoring the pressure of the chuck-jaws and for advancing the rod or screw-stock when the pressure of the chuck-jaws is relieved, the cutting-off tool, and the longi-
 120 tudinal slide, of the threading and turning-down tools supported on said slide and adapted for simultaneous action, the said turning-down tool being supported within less than the distance of a screw's length immediately in ad-
 125 vance of the threading-tool, substantially as described.

2. The combination, with the chuck, of the screw-cutting die, and the turning-down tool supported within less than a screw's length in
 130 front of said die, and adjusted to turn down the screw-stock to the interior diameter of said

die, so that the turning down and threading proceed simultaneously, substantially as described.

3. The combination of the chuck, the longitudinal slide, the turning-down tool, the laterally-movable support for said tool, and automatic mechanism—such as the spring, latch, and releasing projection shown and described—for withdrawing the aforesaid support during the forward movement of said slide, substantially as set forth.

4. The combination of the chuck, the turning-down tool, an additional cutting-tool—such as the threading-tool—supported behind said turning-down tool, the longitudinal slide, the laterally-movable support for the turning-down tool, and the automatic mechanism for withdrawing the aforesaid support during the forward movement of said slide, said tools, together with the laterally-moving support for the turning-down tool, being carried by the longitudinal slide, substantially as described.

5. The combination of the chuck, the longitudinal slide, the turning-down tool, an additional cutting-tool—such as the threading-tool—supported behind said turning-down tool—the laterally-movable support for the turning-down tool, and the automatic mechanism for withdrawing and returning the said support, said tools, with the laterally-moving support for the turning-down tool, being carried by the longitudinal slide, substantially as described.

6. The combination, with the chuck, the threading-tool, and the mechanism for revolving the same, of the longitudinal slide, and the turning-down tool supported immediately in front of said threading-tool, the parts being constructed and arranged, substantially as described, so that the said tools act upon the screw-stock in opposite directions and in part, at least, simultaneously.

7. The combination of the chuck, the longitudinal slide, the threading-tool, the turning-down tool supported on said slide in front of said threading-tool, and the cam and connections or equivalent automatic mechanism for reciprocating said slide, substantially as described.

8. The combination of the chuck, the longitudinal slide, the threading-tool, the turning-down tool supported on said slide in front of said threading-tool, the laterally-movable support for the turning-down tool, the cam and connections or equivalent automatic mechanism for reciprocating said slide, and the automatic mechanism for withdrawing and returning the aforesaid support, substantially as described.

9. The combination, with the chuck adapted to receive a long rod or screw-stock and mechanism for feeding the said rod or stock a screw's length at a time, of the longitudinal slide, a cutting-tool—such as the threading-tool—supported on said slide, a second cutting-tool—such as the turning-down tool—supported also

on said slide in front of the first-named tool, the cutting-off tool, and the automatic mechanism for operating said cutting-off tool, substantially as described.

10. The combination of the chuck adapted to receive a long rod or screw-stock, mechanism for feeding the said rod or stock through the chuck, the longitudinal slide, a cutting-tool—such as the threading-tool—supported on said slide, a second cutting-tool—such as the turning-down tool—supported also on said slide in front of the first-named tool on a laterally-movable support, the automatic mechanism for withdrawing and returning the said support, the cutting-off tool, and the automatic mechanism for operating the same, substantially as described.

11. The combination of the chuck adapted to receive a long rod or screw-stock, automatic mechanism for feeding the said rod or screw-stock, the longitudinal slide, the cam and connections or equivalent automatic mechanism for reciprocating the said slide, two cutting-tools—such as the threading-tool and the turning-down tool—supported on the aforesaid slide the one behind the other, the cutting-off tool, and automatic mechanism for operating said cutting-off tool, substantially as described.

12. The combination of the chuck adapted to receive a rod or long screw-stock, automatic feeder for said rod or screw-stock, the longitudinal slide, the cam and connections or equivalent automatic mechanism for reciprocating said slide, the threading-tool supported on said slide, the turning-down tool supported also on said slide in front of said threading-tool, the laterally-movable support for the turning-down tool, the automatic mechanism for withdrawing and returning the same, the cutting-off tool, and the automatic mechanism for operating said cutting-off tool, substantially as described.

13. The combination, with the chuck, the longitudinal slide, and one or more cutting-tools—such as turning-down and threading tools—of the cutting-off tool and the device connecting its support with said slide so that the cutting-off tool is operated by the reciprocation of said slide, substantially as described.

14. In an automatic machine for forming screws from a long rod or screw-stock, the combination, with the chuck, of the automatic mechanism, substantially as described, for turning down and simultaneously threading the end of the rod or screw-stock and for severing the newly-formed screw.

15. The combination, with the threading-tool and the turning-down tool supported in front of said threading-tool, of the rest attached at the rear to the frame supporting the threading tool and projecting forward to a point opposite the turning-down tool, substantially as described.

16. The combination, with the chuck, the longitudinal slide, and the cam and connections or equivalent automatic mechanism for

reciprocating said slide, of the threading-tool, the turning-down tool, and the rest for holding the work to the turning-down tool, said tools and rest being carried by said slide, substantially as described.

17. The combination, with the chuck and cutting-off tool, of the burnisher for removing the burr thrown up by the said tool before the latter has completely severed the article, substantially as described.

18. The combination of the chuck, the threading-tool, the cutting-off tool, the burnisher, and mechanism for operating said devices, substantially as described.

19. The combination of a cutting-tool—such as the cutting-off tool—the burnisher for removing the burr thrown up by aforesaid tool, the common supporting-slide, and mechanism for reciprocating said slide, substantially as described.

20. The combination, with the chuck and the turning-down and threading tools of a screw-machine, of the automatic mechanism, substantially as described, for advancing the turning-down and threading tools, for moving the turning-down tool aside, for backing off the said tools, and for returning the turning-down tool into position for again acting upon the screw-stock, as set forth.

21. The combination, with the revolving chuck, the turning-down tool and threading-tool, and mechanism for bringing said tools successively into action—the threading-tool after the turning-down tool, and while the latter is acting upon the screw-stock—of mechanism for revolving the threading-tool in the same direction as the chuck, but at a different speed, so that the velocity of rotation of said screw-stock is greater with reference to said turning-down tool than to said threading-tool, substantially as described.

22. The combination of the discoidal cutting-off tool and the burnisher supported on a common center, substantially as described.

23. The discoidal turning-down tool provided with the boss adapted to shave the head at the same time that the turning-down operation is performed, substantially as described.

24. The split die having a tapering or conical exterior, screw-threaded as described, in combination with the nut or solid ring engaging said thread and adapted to adjust the po-

sition of the cutting-edges, substantially as described.

25. The split die having spring-jaws separated by wedge-shaped notches, whereof one side is parallel, or nearly so, with the longitudinal axis of the die, and the other side is inclined thereto, substantially as described.

26. The combination, with the chuck and mechanism for relieving and restoring the bite of the chuck-jaws, of the feed-bar journaled in the sliding carriage, and provided at its forward end with means for clamping the rod or screw-stock, and of mechanism for advancing said feed-bar and carriage step by step, substantially as described.

27. In a machine having a chuck and hollow chuck-spindle, the combination, with the sliding carriage, the pawl, the rack-bar, and mechanism for reciprocating the rack-bar, of the feed-bar adapted to enter the said spindle and journaled in the said carriage, substantially as described.

28. The combination, with the chuck, the mechanism for relieving and restoring the bite of the chuck-jaws, the tools for acting on the rod or screw-stock, and the operating mechanism, of the feeder comprising the sliding carriage, the pawl, the rack-bar, the feed-bar, and the cam for reciprocating the rack-bar, substantially as described.

29. The combination, with the longitudinal slide on which the threading-tool is mounted, and the transverse slide carrying the turning-down tool, of the spring attached at one end to the longitudinal slide and at the other engaging the transverse slide, the latch, the locking-bar, and the fixed projection on the machine-frame, substantially as described.

30. The combination, with the chuck, the longitudinal slide, and the threading-tool carried thereby, of the transverse slide for the turning-down tool, arranged slightly oblique to the axis of the threading-tool, substantially as described.

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

ALLEN JOHNSTON.

Witnesses:

J. T. HACKWORTH,
W. T. MAJOR.