(No Model.)

5 Sheets—Sheet 1.

A. JOHNSTON.

METAL SCREW MACHINE.

No. 267,213. Patented Nov. 7, 1882.

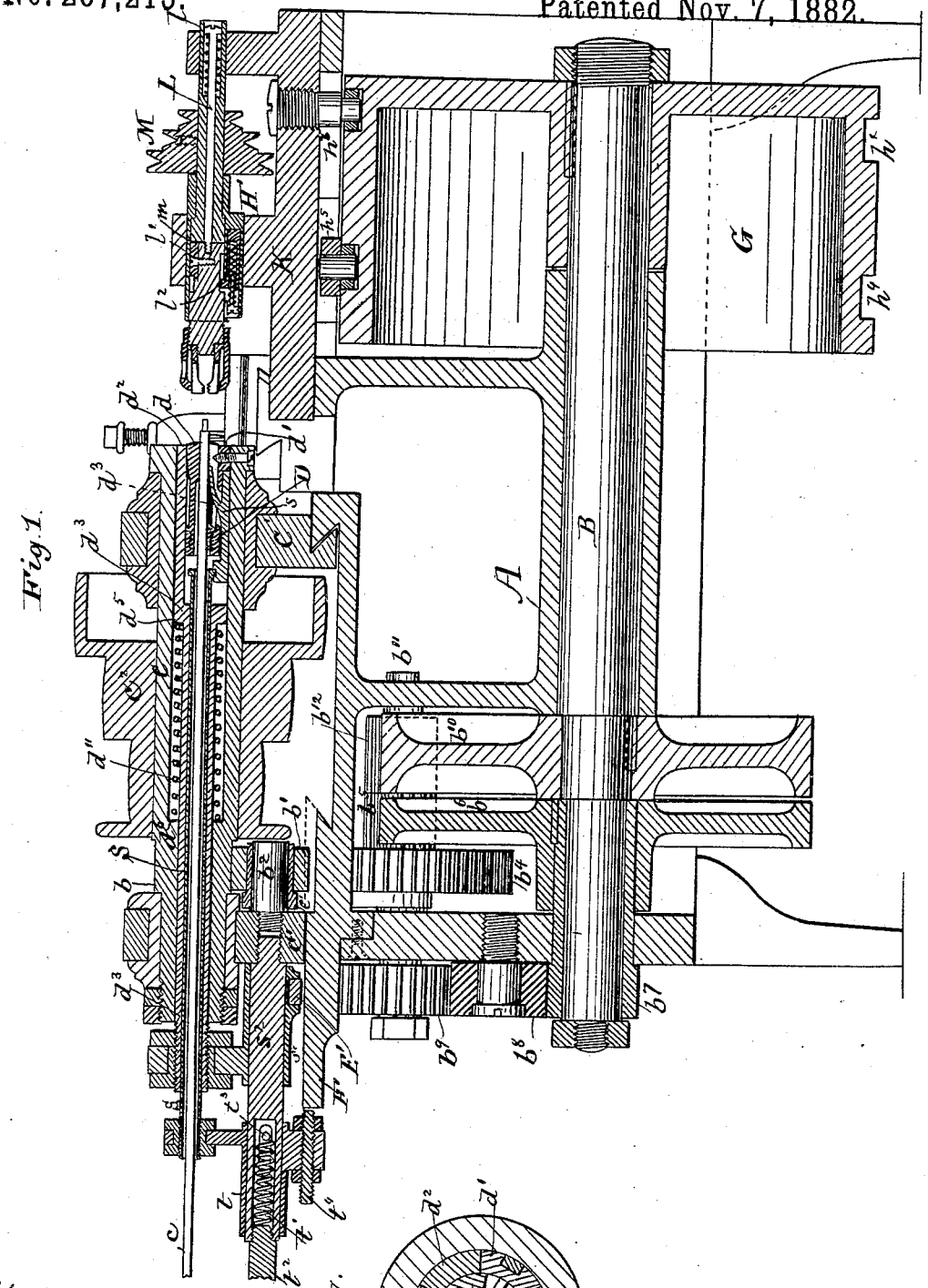

Fig. 1.

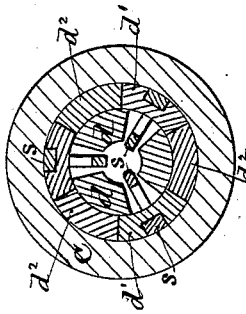

Fig. 7.

Witnesses.
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Philip Dallaven

Inventor:
Allen Johnston
by A. Pollok
his Atty.

(No Model.) 5 Sheets—Sheet 2.

A. JOHNSTON.

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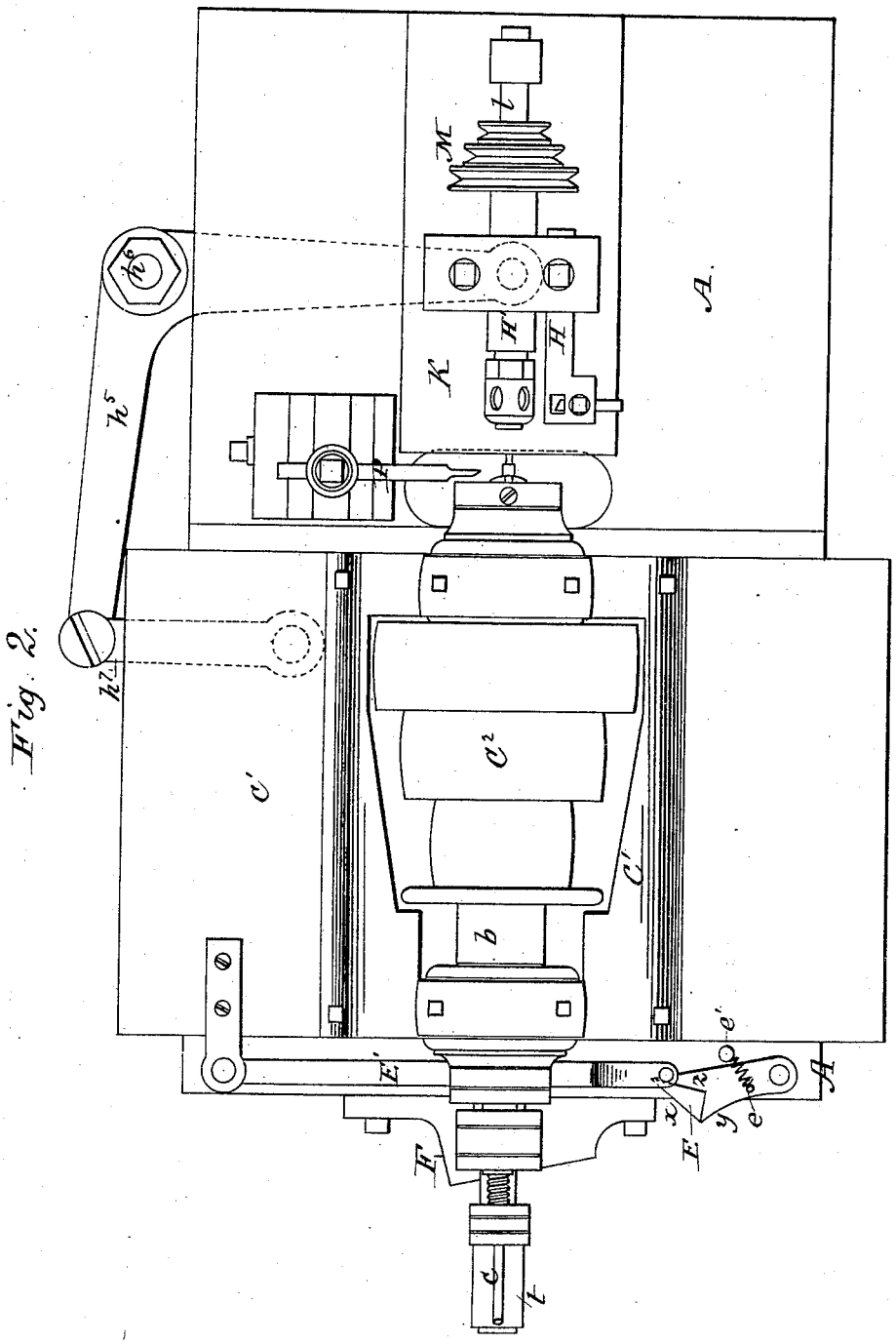

Fig. 2.

Witnesses:
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A. JOHNSTON.

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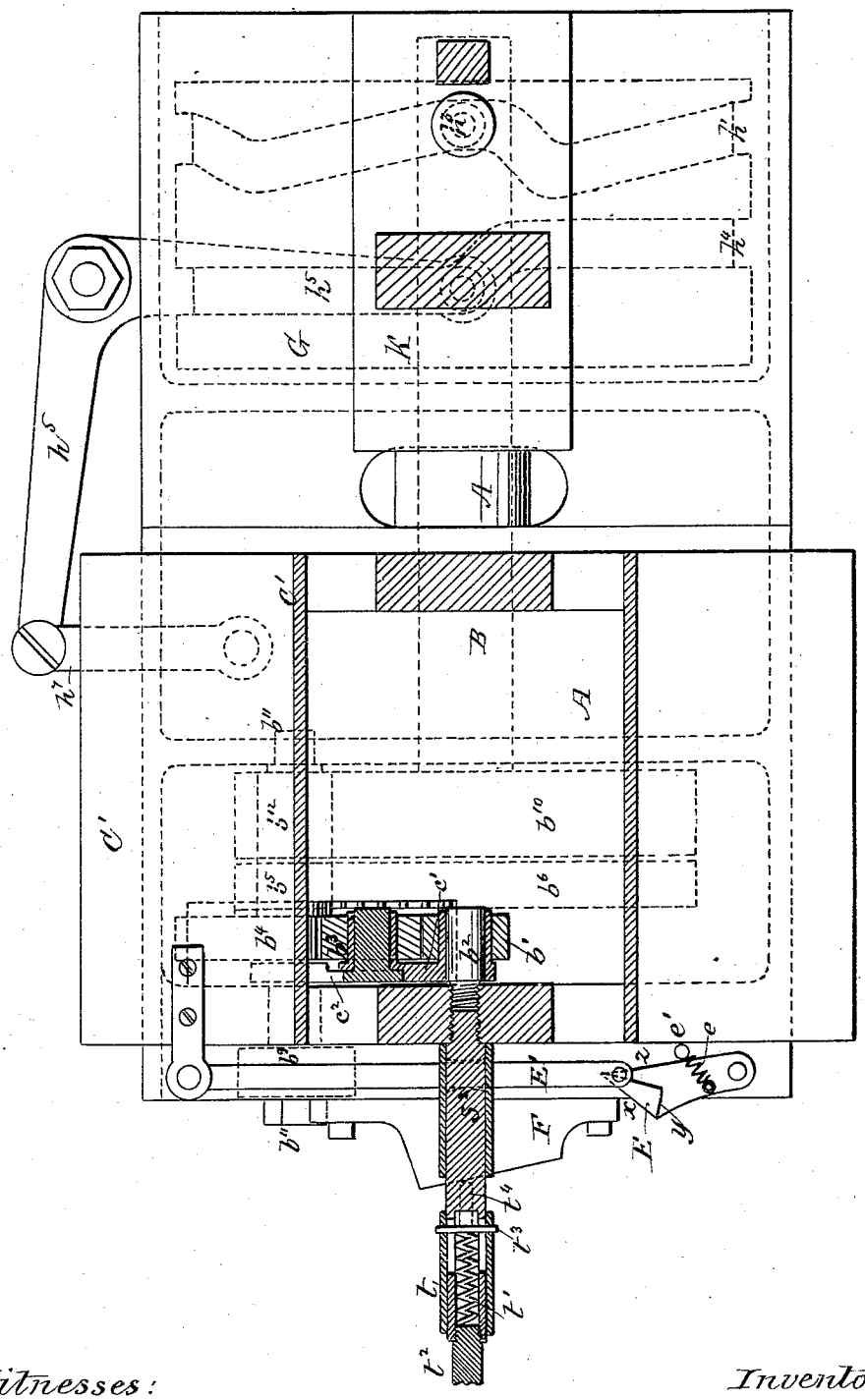
Fig. 3.



Witnesses:

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A. JOHNSTON.

METAL SCREW MACHINE.

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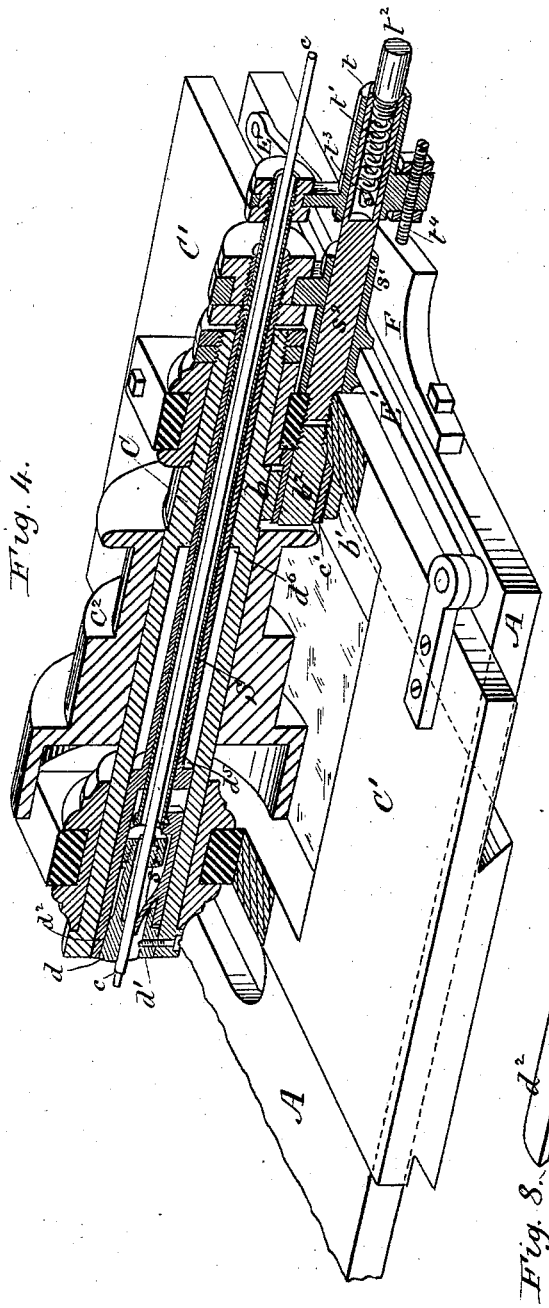

Fig. 4.

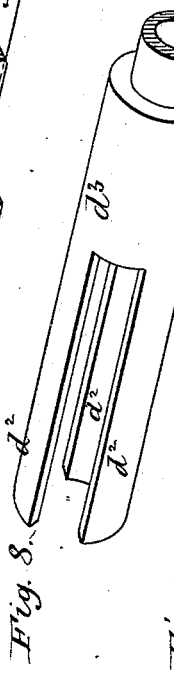

Fig. 8.

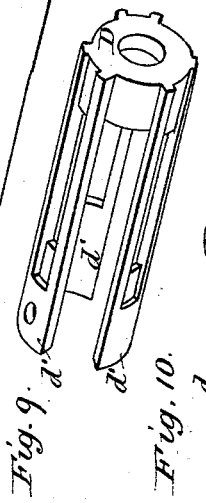

Fig. 9.

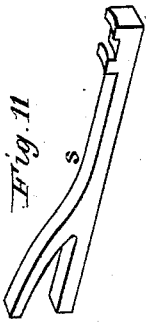

Fig. 11.

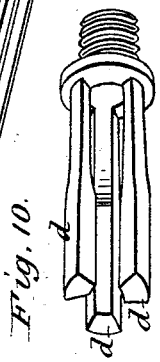

Fig. 10.

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METAL SCREW MACHINE.

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Fig. 6.

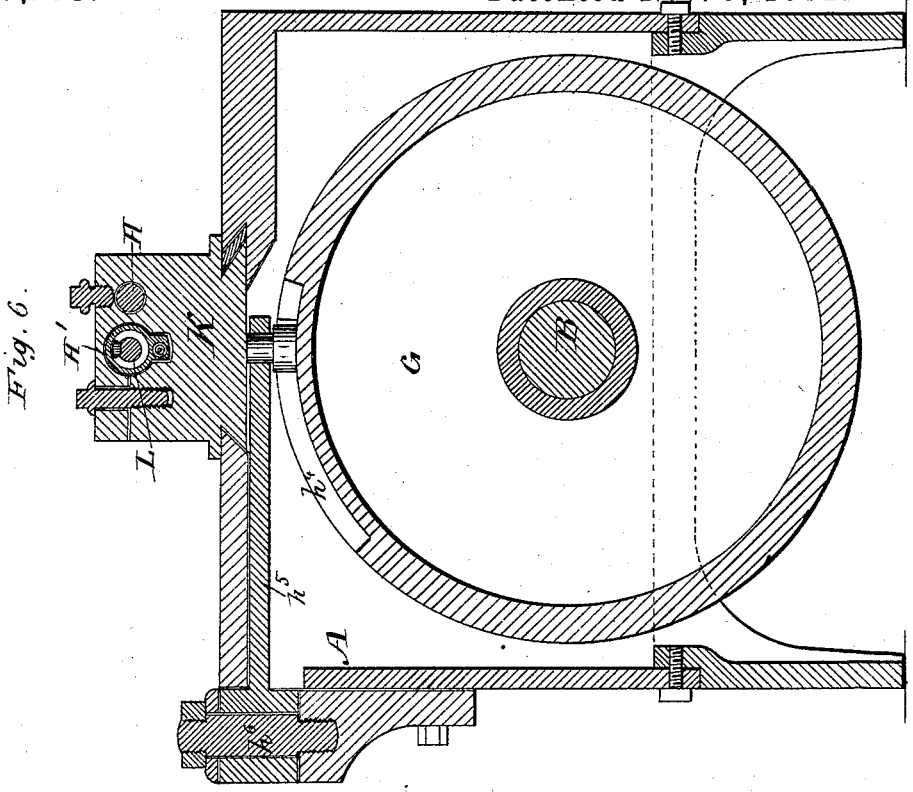
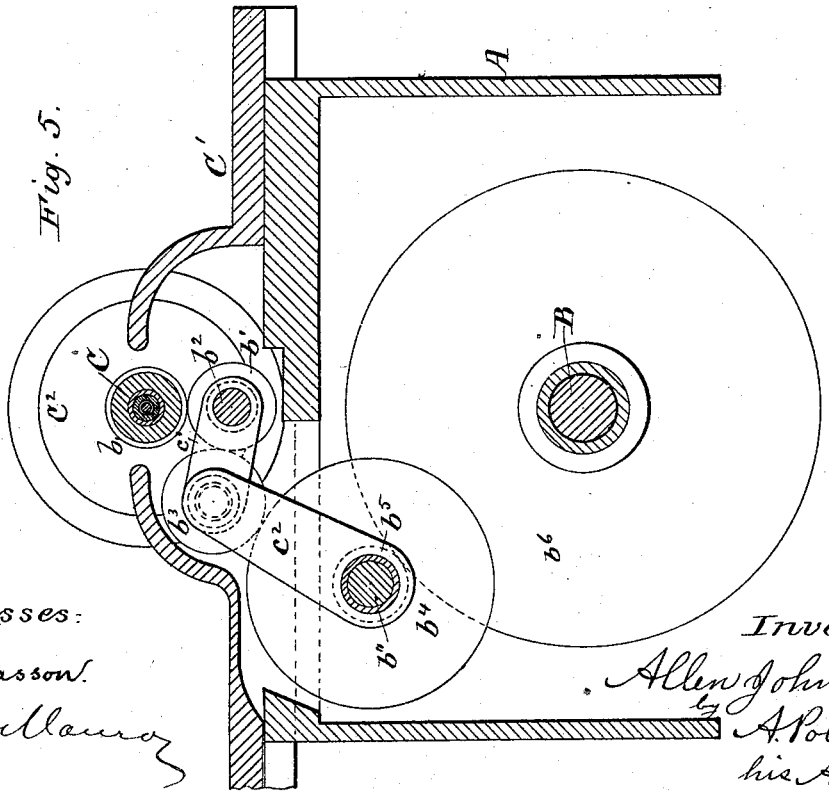


Fig. 5.



Witnesses:
E. E. Masson.
Philip Pollock

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Allen Johnston
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UNITED STATES PATENT OFFICE.

ALLEN JOHNSTON, OF OTTUMWA, IOWA.

METAL-SCREW MACHINE.

SPECIFICATION forming part of Letters Patent No. 267,213, dated November 7, 1882.

Application filed July 21, 1881. (No model.)

To all whom it may concern:

Be it known that I, ALLEN JOHNSTON, of Ottumwa, Wapello county, 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 screws from the end of a rod, wherein the rod is fed intermittingly through a hollow spindle and between the jaws of an automatic chuck, and is subjected to the successive operation of the tools for forming the screw, although it is applicable in part to machines making screws from blanks, and to hand-machines which require one or more of the screw-making operations to be performed by the hand of an operator. It has special reference to the mechanism for presenting the rod held by the chuck to the action of the various tools, and to the feeder for advancing the rod.

Heretofore the tools—a milling or turning-down tool and a threading tool or die, with sometimes a length-gage, cutting-off and even other tools—have ordinarily been held in a turret which is carried by a slide reciprocating lengthwise of the machine, and to which a partial rotation, always in the same direction, is imparted at each reciprocation of the slide. In some cases, also, where a series of chucks have been employed, an intermittent rotary motion has been imparted to them.

In other applications of my own, and in Letters Patent No. 241,806, granted to me May 24, 1881, machines are shown in which the tools are carried by a slide or tool-holder having an intermittent motion laterally back and forth across the axis of the chuck, and in which also a proper longitudinal reciprocation is imparted to the necessary tools.

The present invention differs from all these in having the chuck and the cutting-tools carried by independent slides or reciprocatory supports movable the one laterally, the other longitudinally.

It consists in the combination of the chuck, the cutting-tools, and the independent slides or reciprocatory supports with the cams and connections hereinafter described, or with equivalent automatic mechanism for imparting to said slide the requisite movements.

It further comprises other combinations of the chuck and its slide or reciprocatory support with various elements of a screw-machine, as hereinafter specified.

Machines of the improved construction are simple and efficient, and the necessary stability in operation of the tools and other parts is secured without requiring heavy masses to be moved at high speed, as in the ordinary forms of machine.

The invention further consists in forming the feed-clamp for advancing the rod of a number of small springs, preferably three, and combining with them a distinct operating-tube. In the friction devices heretofore employed the springs have been formed by splitting the end of the tube. The improved construction has advantage in that the springs can be removed and replaced by others without changing the operating-tube, and also that they can be adapted to operate in closer proximity to the chuck-jaws.

The accompanying drawings, which form a part of this specification, illustrate a machine embodying the invention, Figure 1 being a central vertical longitudinal section, Fig. 2 a plan, Fig. 3 a plan partly in horizontal section, Fig. 4 a partial view in perspective and vertical section, and Figs. 5 and 6 cross-sections, of the machine; Fig. 7, a cross-section of the chuck, showing the feeding-springs in position; Figs. 8, 9, and 10, views in perspective of the parts of the chuck—to wit, the wedges, the stay-pieces, and the chuck-jaws; and Fig. 11, a perspective view of one of the feeding-springs.

Similar letters of reference indicate like parts on all the figures where they occur.

A is the frame of the machine; B, the main shaft, carrying the cams for bringing the tools successively into action; C, the chuck-spindle; H, the milling-tool; H′, the threading-tool, and P the cutting-off tool.

The hollow chuck-spindle C is supported in bearings on the slide C′, movable laterally back and forth in ways on the machine-frame. It is revolved by means of a cone-pulley, C^2, and is moved laterally back and forth by means of a cam, h^4, through the lever h^5, pivoted at h^6 to the machine-frame, and a connecting-rod, h^7, jointed to said lever and to the slide C′. The cam h^4 is formed on the periphery of a drum, G, keyed to the shaft B. Within the

head of the chuck-spindle, which is solid, are placed the chuck-jaws and operating-wedges, the feed-springs, and a series of stay-pieces to hold the other parts in position.

The chuck-jaws d are formed by splitting a hollow conical tube a portion of its length into, say, three portions, and hollowing out these portions on the exterior, so as to give the necessary spring to the jaws. The wedges d^2, equal in number to the jaws, are formed by milling slots in the end of tube d^3, provided with a conical interior corresponding with the conical exterior of the chuck-jaws. The chuck-jaws are screwed into the tube D, which is bored out at the end to receive them, and is grooved and slotted, so as to leave guideways for the wedges d^2. The stay-pieces d', which remain between the guideways and alternate with the wedges, (see Fig. 7,) are fastened by screws to the head of the spindle. As shown, the ends of these screws project between the chuck-jaws. The tube D, with the stay-pieces, is also grooved (see Fig. 9) to receive the springs s, which project inward between the chuck-jaws and bear constantly against the rod or stock c. The springs are connected at their rear ends with the operating-tube S by a collar on said tube. The tube d^3 is pressed forward, so as to tighten the jaws of the chuck upon the stock, by means of the spiral spring d'', surrounding the tube d^3, and fitting against a shoulder, d^5, on said tube and a similar shoulder, d^6, on the interior of the spindle. The tube d^3 is retracted, so as to relieve the stock or rod c from the pressure of the chuck-jaws at each lateral reciprocation of the chuck, by means of a cam, E, and a lever, E′. The cam is formed on a piece which is pivoted to the frame of the machine, and is combined with a spring, e, tending to hold said piece against a stop, e'. The cam E has three faces, x y z, over which, in the order given, the end of lever E′ moves. This lever is pivoted to the slide C′, and is connected with the tube d^3 through the intermediary of a slide, s', and a collar on the tube. The slide s' moves on a rod, s^2, screwed or otherwise fastened to the slide C′. When the chuck and its slide have reached the end of their movement in the direction of the cutting-off tool P and begin to return, the end of the lever E′ rides over the face x of cam E, and this, being inclined, forces the lever outward (to the left in Fig. 2) and retracts the tube d^3, with its wedges d^2, against the force of the spring d''. By the time the chuck is brought opposite the milling-tool H the lever E′ has reached the end of face x of cam E and has been drawn by the pressure of the spring d'' over the cam-face y. At the same time the tube d^3 and the chuck-wedges d^2 have been forced forward and closed the chuck-jaws d upon the rod or screw-stock c. When the chuck is moved again in the direction of the cutting-off tool P the end of lever E′ rides over the face z of cam E and pushes it back against the tension of spring e.

The feeding-tube S is connected with a slide, t, by means of a collar on the tube and a fork on the slide. The slide t works on the rod s^2, and is combined with a spring, t', which is placed in the hollowed-out end of rod s^2, and is arranged to bear at one end against a bar, t^2, screwed into the end of the rod s^2, and at the other against a bolt, t^3, fastened to the slide t. In a depending lug of the slide is a screw, t^4, provided with jam-nuts and adjustable in the lug. The end of the screw is opposite the face of a cam, F, bolted to the machine-frame, and at each lateral movement of the chuck-slide C′ in the direction of the cutting-off tool is, with the slide t, feed-tube S, and springs s, forced rearward by said cam a distance equal to the length of the screws which are being made. The distance is regulated by adjusting the position of the screw t^4 in the lug. On the return movement of the chuck-slide the feed-tube and springs are advanced by the spring t'. The rearward movement of the feed-tube and springs takes place when the chuck-jaws are closed, so that the springs s merely slip over the screw-stock c; but the advance takes place while the pressure of the chuck-jaws is relieved by the action of the face x of cam E on lever E′, and feeds the stock forward a screw's length. The bar t^2 carries a support for the outer end of the screw-stock.

Motion is communicated from the chuck-spindle to the shaft B through a train of gears, substantially as shown in the before-mentioned patent, except that a series of linked gears (shown in Figs. 3 and 5) are interposed, so as to allow lateral movement to the chuck-spindle. The gear b on the chuck-spindle meshes with the gear b', that is supported on a stud, b^2, screwed to the chuck-slide. The gear b' meshes with the idler b^3, supported on a pin at the junction of the links c' c^2, and the said idler with the gear b^4. The links c' c^2 are supported loosely, the one on the stud b^2, and the other on the shaft b^{11}, which is supported in bearings in the machine-frame. The gear b^4 is keyed to a sleeve loose on the shaft b^{11}, to which sleeve a pinion, b^5, (shown in dotted lines, Fig. 3,) is also made fast. The pinion b^5 meshes with the gear b^6, which is keyed to a loose sleeve on the shaft B. A pinion, b^7, Fig. 1, cut upon this sleeve, meshes with an idler, b^8, which may be adjustable on an arc-limb, for the purpose of changing the gears and altering the speed. The idler b^8 meshes with a gear, b^9, fixed on the shaft b^{11}, from which motion is communicated to the gear b^{10} by means of a pinion, b^{12}, keyed to the shaft b^{11} just back of the said gear b^{10}. The latter is keyed to the main shaft B.

K is a sliding tool-holder supported in ways in the machine-frame, so as to be movable in the direction of the axis of the chuck. It is reciprocated by the cam h' through the intermediary of a pin, h^3, secured to said tool-holder. The tools H H′ are secured in said tool-holder. The milling-tool H is or may be of any usual or suitable construction. The threading-tool shown is that described in the before-

mentioned patent in an improved form, but may be of any ordinary construction, provided suitable reversing-gear or other mechanism be employed to unthread it after it has accomplished its work. As shown, the threading-instrument is carried by a spindle, L, supported in a loose sleeve, *l*, with which it is engaged by a clutch, *m*, except during the unthreading operation, when, being drawn forward in the sleeve, it is held stationary by the engagement of a projection, *l'*, on the spindle with a clutch-bar, l^2, fitted in a recess in the tool-body. The sleeve *l* is revolved by a belt on the pulley M in the same direction as the chuck-spindle, but at a higher speed. Both rotate in opposite directions to the chuck-spindle in the ordinary screw-machines. The cutting-off tool is adjustably secured to the machine-frame.

In operation, after a screw has been severed from the rod or stock by the cutting-off tool, the chuck-slide C' is shifted laterally to bring the rod or stock in line with the milling-tool, and during this lateral movement the stock is advanced a screw's length by the friction feed-clamp, composed of the springs *s*, as already explained. The tool-holder K is then advanced. The milling-tool turns down or bores the stock, which is held firmly and revolved by the chuck, to the required distance. The tool-holder is then withdrawn. The chuck-slide is shifted laterally to bring the stock in line with the threading-tool. The latter is advanced with the tool-holder K to cut the thread. It is withdrawn, and the chuck-slide is again shifted laterally to bring the stock in contact with the cutting-off tool to sever the newly-made screw.

Various modifications may be made in the construction of the machine without departing from the spirit of the invention, although that shown is considered the best method of carrying the invention into effect.

Portions of the invention may be employed without the others. For example, instead of a two-motion friction feed-clamp, a four-motion feed-clamp such as described in my application of even date herewith could be used; and the threading-tool, instead of being run with a belt, could be connected with the chuck-spindle by toothed gearing, as shown in said application.

Instead of a feed-clamp, a length-gage on the tool-holder could be employed, and instead of having the cutting-off tool attached to the machine-frame it could be carried by the tool-holder; but both these changes would necessitate an increased number of movements of the chuck-slide and tool-holder, which is not desirable.

The main shaft and chuck-spindle, instead of being connected by gearing, could be run by separate belts.

The lateral back-and-forth movement of the chuck, instead of being rectilinear, could be in curved lines or in short circular arcs; and the chuck, instead of being supported in a slide, might be carried in a vibratory frame, the tools being properly arranged in the tool-holder to be in line with the axis of the chuck when shifted.

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

1. The combination of the chuck, the series of cutting-tools, the independent slides or reciprocatory supports for the chuck, and the tools, respectively, and the cams and connections or equivalent automatic mechanism for moving said slides or supports back and forth, the one laterally, the other longitudinally, substantially as described.

2. The combination of the chuck adapted to receive a long rod or screw-stock, the chuck-slide or reciprocatory support for the chuck, the feeder for advancing the rod or screw-stock through the chuck, the sliding or reciprocatory tool-holder, the milling and threading tools, and the cutting-off tool, the said chuck-slide and tool-holder being independently supported in the machine-frame and movable in directions at right angles to each other, substantially as described.

3. The combination of the chuck adapted to receive a long rod or screw-stock, the slide or reciprocatory support for the chuck, the feeder for advancing the rod or screw-stock through the chuck, the sliding or reciprocatory tool-holder, one or more cutting-tools—such as milling and threading tools—carried by said holder, the cutting-off tool, and the cams and connections or equivalent automatic mechanism for shifting the chuck slide or support, for operating the feeder and for moving the tool-holder back and forth, substantially as described.

4. The combination, with a revolving chuck and cams and connections or equivalent mechanism for moving said chuck laterally back and forth, of a system of linked gears or equivalent gearing connecting the chuck-spindle and the said cams, substantially as described.

5. The combination of the revolving chuck adapted to receive a long rod or screw-stock, the transverse chuck-slide or laterally reciprocatory support for the chuck, the feed-clamp movable with said chuck, the means for releasing and restoring the bite of the chuck-jaws, and the means for advancing the feed-clamp while the bite is released, substantially as described.

6. The combination of the revolving chuck adapted to receive a long rod or screw-stock, the transverse chuck-slide or laterally reciprocatory support for the chuck, the feeder for advancing the rod or screw-stock through the chuck, and the stationary cutting-off tool, substantially as described.

7. The combination of the chuck adapted to receive a long rod or screw-stock, the transverse chuck-slide or laterally reciprocatory support, the feeder, the longitudinally sliding or reciprocatory tool-holder, and the stationary cutting-off tool, substantially as described.

8. The combination, with the chuck, of the feed-clamp comprising the independent

springs movable in guides, and the tube connected with said springs by the collar, substantially as described.

9. The combination, with the chuck and hollow chuck-spindle adapted to receive a long rod or screw-stock, and the feeding means, such as described, of the lateral slide or reciprocatory support for the chuck and chuck-spindle, the stationary cam, and the mechanism between the cam and the chuck-jaws for opening and closing said jaws by the reciprocatory movement of said chuck and its slide or support, substantially as described.

10. The combination, with the chuck adapted to receive a long rod or screw-stock, of the transverse chuck-slide or laterally reciprocatory support, the feeder for advancing the rod or screw-stock, and the stationary cams and connections for opening and closing the chuck-jaws and for operating the feeder, substantially as described.

11. The combination of the chuck adapted to receive a long rod or screw-stock, the chuck-slide or laterally-movable support, the cams and connections for moving said support back and forth, the feeder, the stationary cams and connections for operating said feeder, the longitudinally-sliding tool-holder, the cams and connections for moving the said tool-holder back and forth, and the stationary cutting-off tool, substantially as described.

12. The combination, in a chuck, with the chuck-jaws, wedges, and stay-pieces, of springs supported in grooves in the stay-pieces and projecting between the chuck-jaws, substantially as described.

13. A screw-machine comprising, in combination, the chuck, the hollow chuck-spindle mounted on the laterally-movable support, the tool-holder, the cams and connections or equivalent mechanism for reciprocating the said chuck-spindle in the lateral and the tool-holder in the longitudinal direction, the gearing connecting said cams with the said chuck-spindle, the cut-off tool, and the means, as indicated, for feeding the rod through the chuck, substantially as described.

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

ALLEN JOHNSTON.

Witnesses:

PHILIP MAURO,

C. J. HEDRICK.