5 Sheets—Sheet 1.

L. W. STOCKWELL.

Machine for Making Metal Screws.

No. 200,155. Patented Feb. 12, 1878.

Fig. 1.

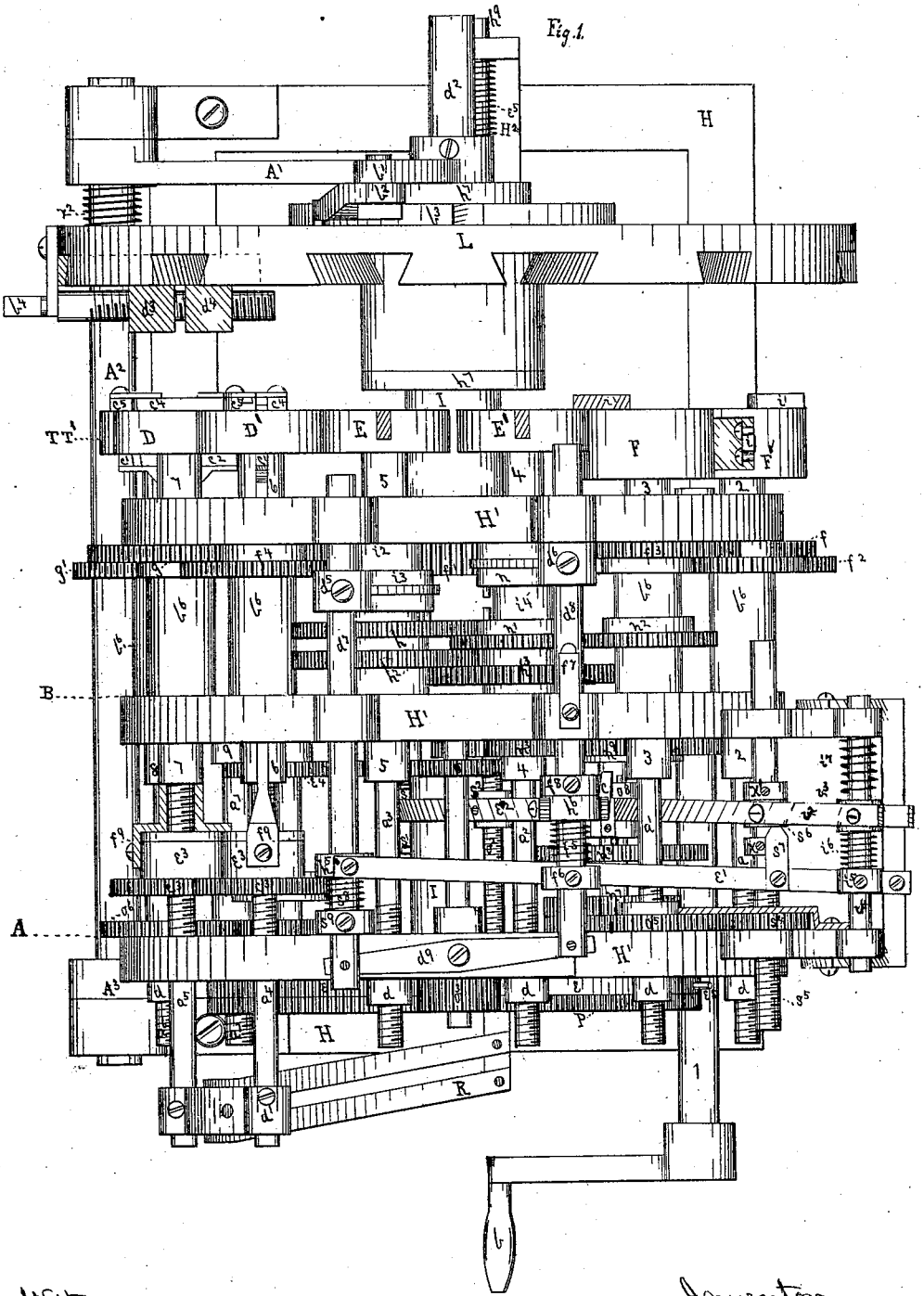

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Fig. 2.

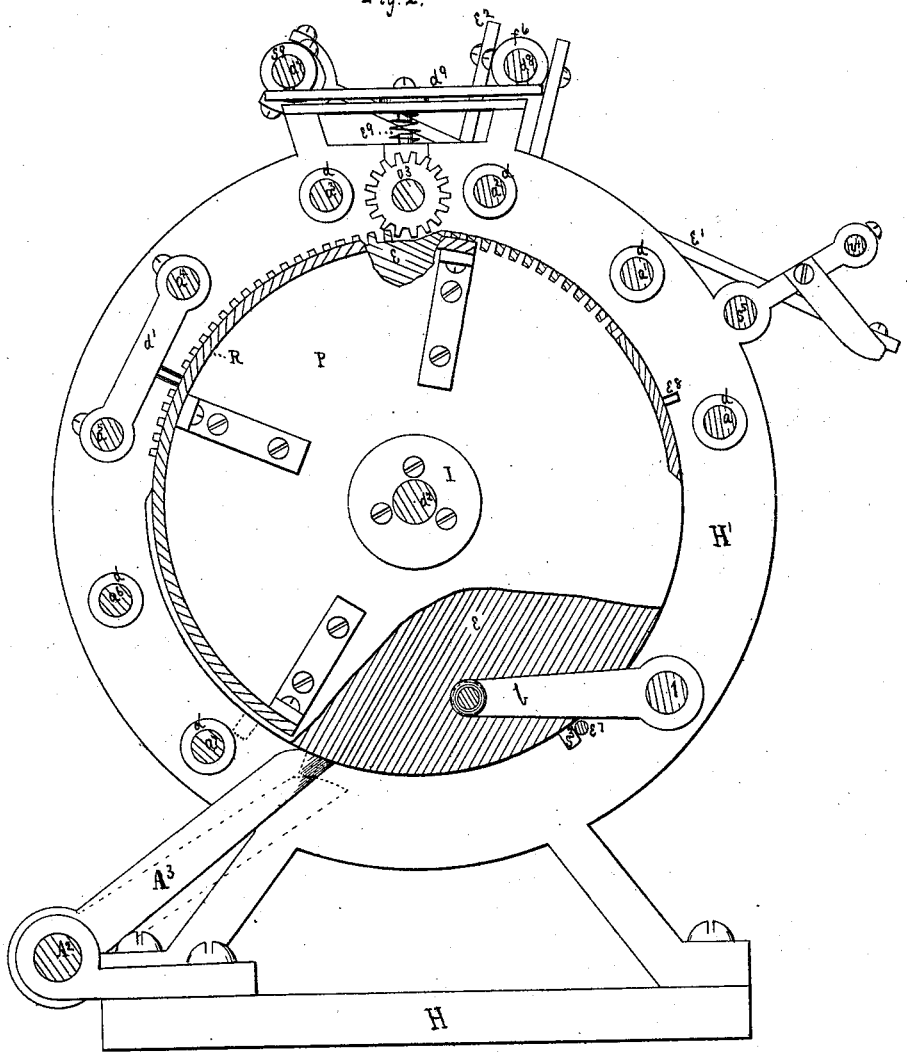
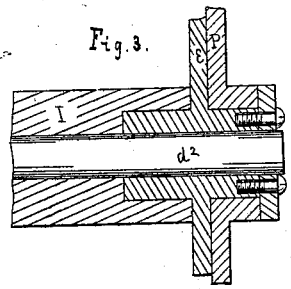


Fig. 3.



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5 Sheets—Sheet 3

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Fig. 4.

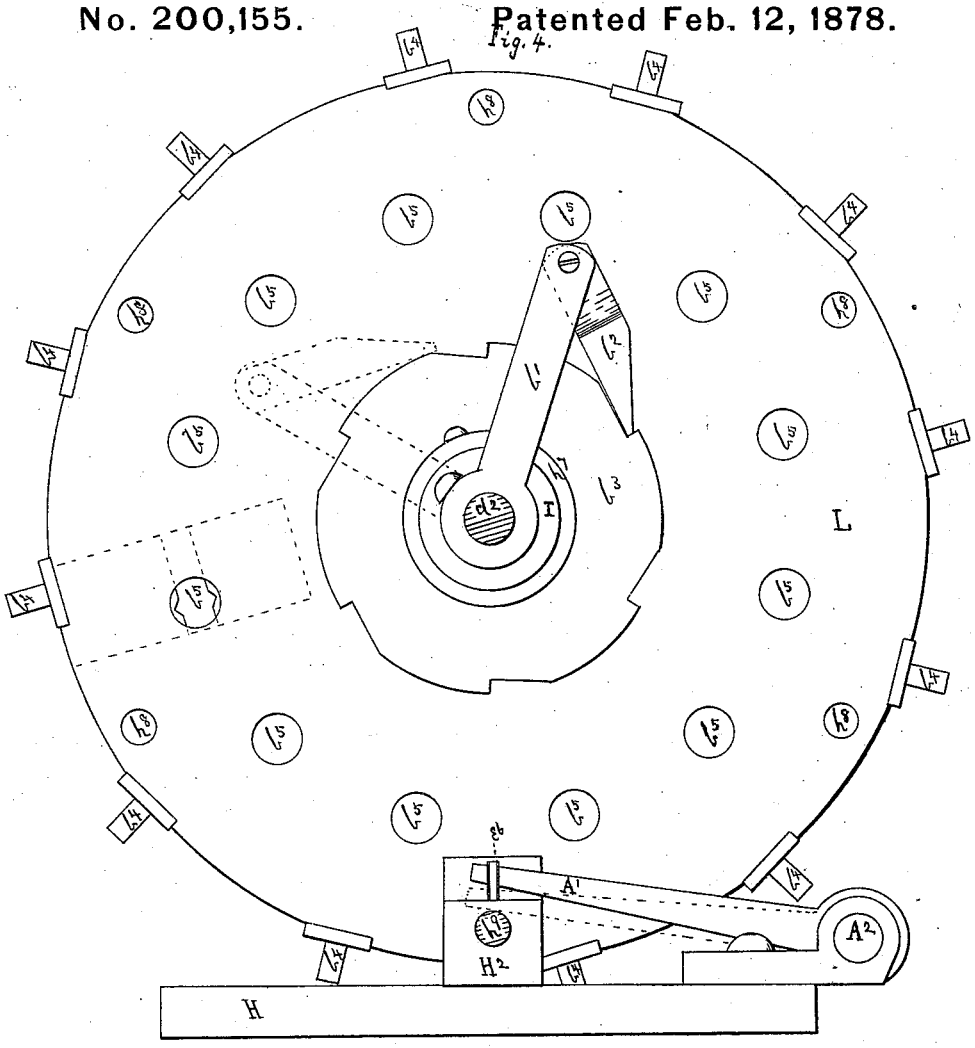

Fig. 5

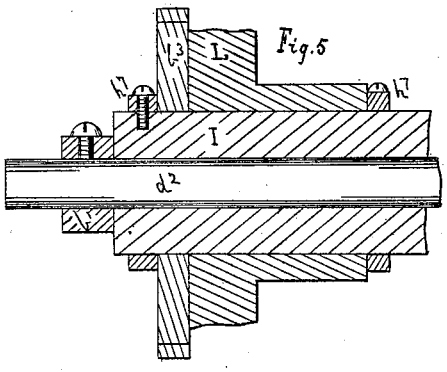

Fig. 6.

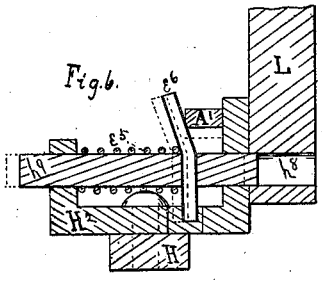

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Fig. 7.

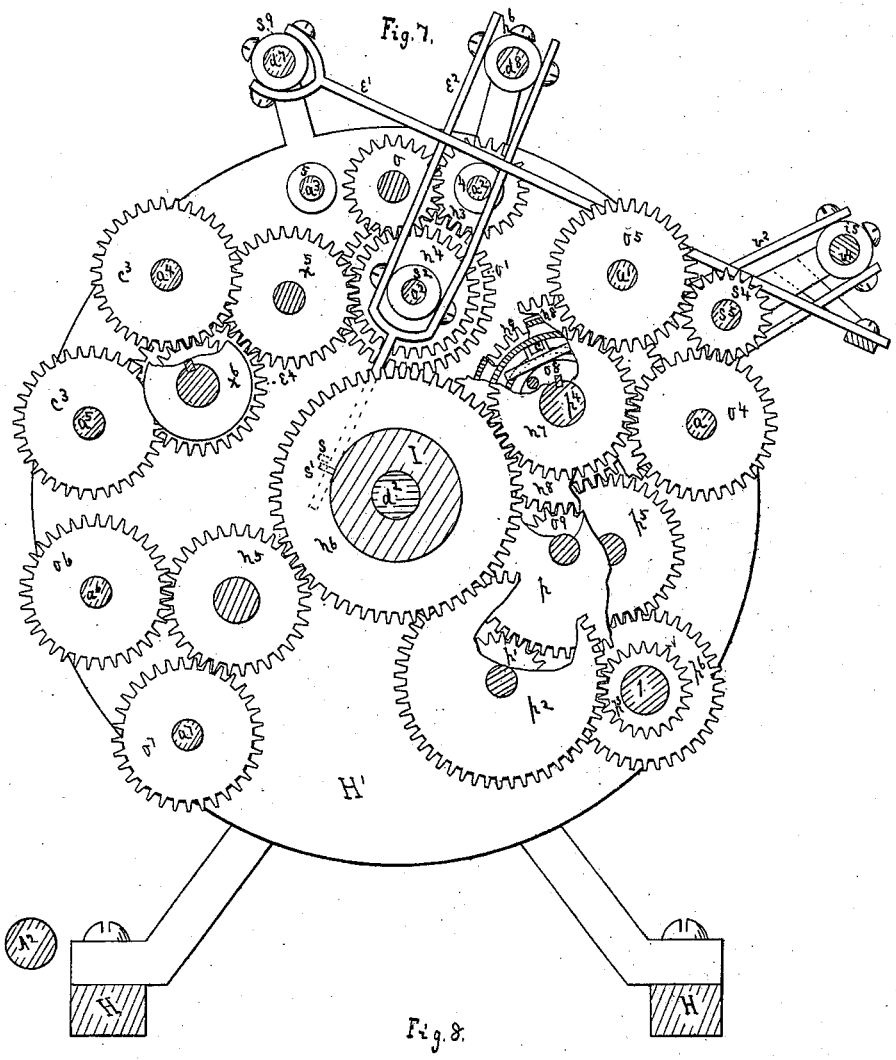
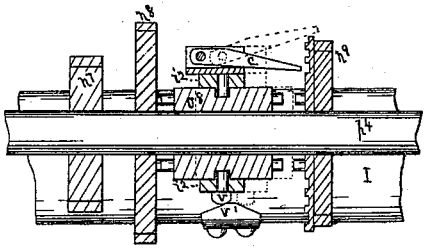


Fig. 8.



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L. W. STOCKWELL.

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Fig. 9.

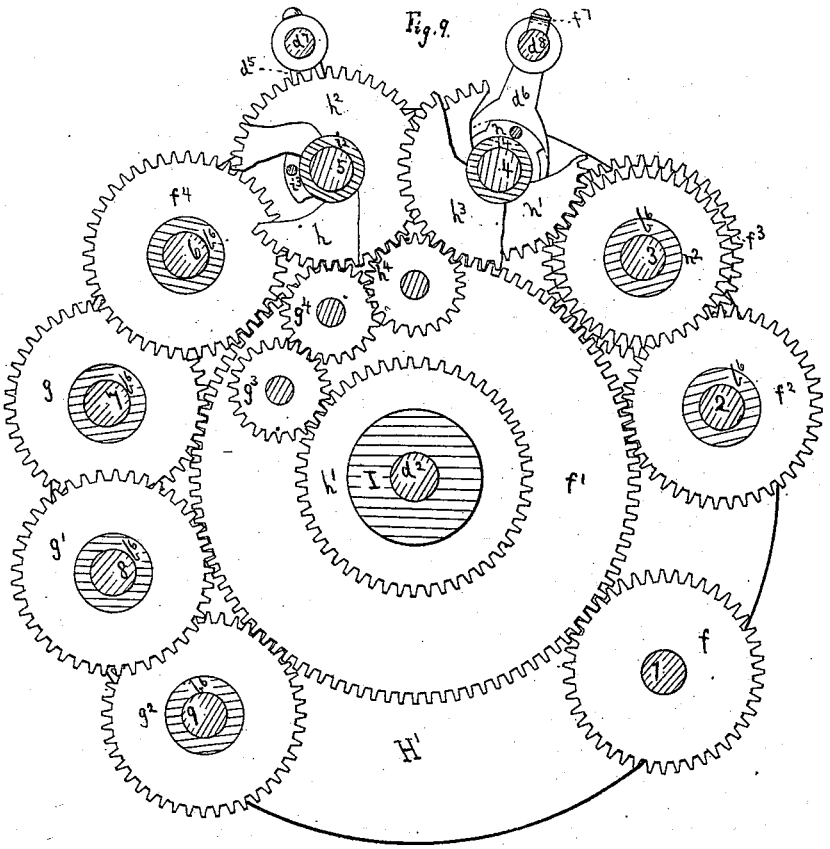


Fig. 10.

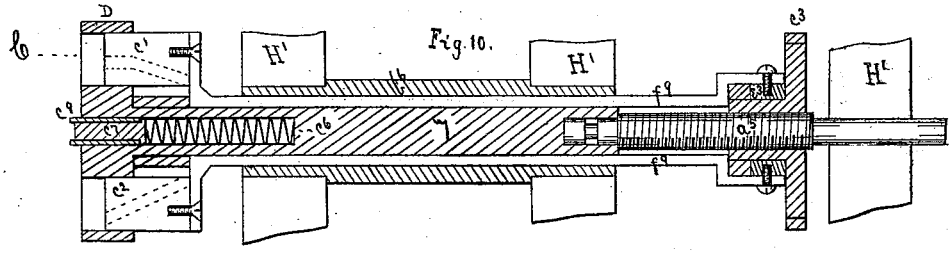


Fig. 11.

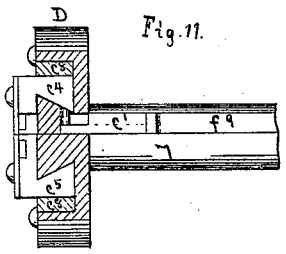
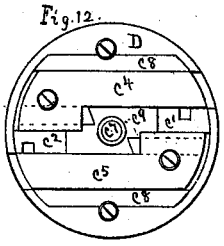


Fig. 12.



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UNITED STATES PATENT OFFICE.

LEVI W. STOCKWELL, OF RAVENNA, OHIO, ASSIGNOR TO STOCKWELL, BRAGG & CO., OF SAME PLACE.

IMPROVEMENT IN MACHINES FOR MAKING METAL SCREWS.

Specification forming part of Letters Patent No. **200,155**, dated February 12, 1878; application filed July 13, 1877.

To all whom it may concern:

Be it known that I, LEVI W. STOCKWELL, a resident of Ravenna, Portage county, Ohio, have invented a new and useful Improvement in Machines for Making Machine Screws, which improvement is fully set forth in the following specification, reference being had to the accompanying drawings.

The object of my invention is to perform all the necessary operations to manufacture from metallic rods and finish machine screws, the rods being held in a series of vises having intermittent rotation on a common axis, and being operated on simultaneously by tools in a series of rotating tool-chucks.

Figure 1 is a vertical or plan view of the machine. Fig. 2 is an end elevation. Fig. 3 is a section of parts shown in Fig. 2. Fig. 4 is an end elevation. Figs. 5 and 6 are sections of parts shown in Fig. 4. Fig. 7 is a cross-section at the dotted line A in Fig. 1. Fig. 8 is a cross-section of parts shown in Fig. 7. Fig. 9 is a cross-section at the dotted line B in Fig. 1. Fig. 10 is a section of the tool-chuck D and its spindle. Fig. 11 is a section of chuck D at the dotted line C in Fig. 10. Fig. 12 is a face view of chuck D.

The frame H is composed in part of three vertical circular plates, H^1 H^1 H^1, parallel with each other, which support all the shafts and tool-chuck spindles. Through the centers of these circular plates is attached a hollow cylinder, I, which extends through the center of the rod-carrier L.

There is a series of eight tool-chucks, F F′ E E′ D D′ T T′, arranged in a circle equally distant from each other. Their spindles 2 3 4 5 6 7 8 9 rotate in the circular parts of the frame near the circumference. In radial dovetail grooves on the inner side of the circular rod-carrier L is a series of vises (only one of which, d^3 d^4, is shown in Fig. 1) surrounding the hollow spindle I, and so placed that when the rod-carrier is turned on the cylinder I to its proper position eight of the vises will be in line with the spindles of the tool-chucks.

There is a hole, b^5, through the rod-carrier at each vise, and in line with the axes of the chuck-spindles, through which holes the rods to be operated on are inserted. The threading-chucks E E′ are moved forward and backward to thread the rods and withdraw from them by leading-screws a^2 a^3, firmly attached in the ends of the spindles, and turning in stationary threaded nuts d d in the frame.

The power is applied through crank b on main shaft 1, which is connected by its wheel f, Fig. 9, with wheel f^1, which turns loose on cylinder I. Wheel f^1 connects with and rotates wheels f^2 f^3 f^4 g g^1 g^2 and spindles 2 3 6 7 8 9 constantly in the same direction, the wheels being on sleeves b^6, feathered to the spindles. The spindles 4 5, which hold the threading-dies, are rotated to thread the rods by wheel h^1, which is attached to and turns with wheel f^1. Wheel h^1 connects with wheels g^3 g^4 h, the latter wheel being loose on sleeve i^2 and connected with clutch i^3, which slides on a feather on sleeve i^2. The sleeve connects by a feather with spindle 5, so as to rotate the spindle and permit it to slide in the sleeve. Wheel h^2 on sleeve i^2 rotates spindle 4 by means of the connecting-wheels h^4 h^3, the latter wheel being on sleeve i^4, which is connected by a feather with spindle 4.

The wheels h^3 n^1, sleeve i^4, and clutch n on spindle 4 are similar to wheels h^2 h, sleeve i^2, and clutch i^3 on spindle 5, Figs. 9 and 1. Wheels g^3 g^4 h^4 rotate on pins in the frame.

While spindles 4 5 are advancing and the dies are threading the rods, wheel h is in clutch, and wheel n^1 out of clutch and turning loose on sleeve i^4.

To reverse the motion of the threading-dies and withdraw them from the rods, clutch i^3 is disconnected from wheel h, and clutch n is connected with wheel n^1, and then wheel h turns loose on sleeve i^2, and the motion of spindles 4 5 is reversed by wheel n^1 and wheel n^2, Figs. 1 and 9, on spindle 3.

The clutches i^3 n have annular grooves, and are operated by arms d^5 d^6, which enter the clutch-grooves, and are attached to sliding rods d^7 d^8 in the frame. These rods are pivoted to swivel d^9, Figs. 1 and 2, so that by sliding one of the rods the other slides in the opposite direction.

The rods d^7 d^8 are operated by levers e^1 e^2. One end of lever e^1 connects with a sliding collar, h^5, on rod d^7, and the other end is piv-

oted to the frame. The upper end of lever e^2 connects with sliding collar h^6 on rod d^8, and its lower end extends between two pins, s s^1, Figs. 1 and 7, in the side of cylinder I, and intermediate the two ends it is pivoted to a threaded nut, s^2, on the screw o^2, which is turned in the frame by wheel o^1, Fig. 7, on the screw o^2, and connected with wheel n^3 on spindle 4.

While the threading-dies are operating on the rods, the rotation of screw o^2 moves nut s^2 and lever e^2 until its lower end is arrested by pin s^1, and the upper end, by compression of the spiral spring f^5 against collar f^6 on rod d^8, forces spring f^7, attached to the frame, out of a notch or depression in rod d^8, and then the action of spring f^5 slides rod d^8, and connects clutch n with wheel n^1, while swivel d^9 slides rod d^7, so as to disconnect clutch i^3 from wheel h. This reverses the motion of threading-chucks E E′, and withdraws them from the threaded rods. The length of the threads to be cut on the rods is determined by adjusting collar f^6 on rod d^8. While the threading-dies are thus withdrawing from the rods, the wheel n^3 on spindle 4, Figs. 7 and 1, re-reverses the motion of screw o^2, nut s^2, and lever e^2 till pin s arrests the lower end of lever e^3, and its upper end presses against collar f^8 on rod d^8, and slides the rod enough to disconnect clutch n from wheel n^1 without connecting clutch i^3 with wheel h. Both wheels, h and n^1, now turn loose, and the threading-chucks E E′ cease to rotate.

At the same time that the chucks E E′ advance to thread the rods, the chucks D D′ are more rapidly advanced to the proper position to shape the heads of other screws already threaded, and cut them off from the rods.

The bar d^1, Fig. 1, connects the outer ends of screws a^4 a^5, the inner ends of which are inserted in the ends of spindles 6 7. A pin through the side of each spindle 6 7, Fig. 10, enters an annular groove in each screw a^4 a^5, and holds it in the rotating spindle. The screws a^4 a^5 do not rotate. The bar d^1 is connected with the slotted cam R, Fig. 1, by a pin, so that by turning the cam to the left chucks D D′ are moved toward carrier L.

In Fig. 1 all the parts of the machine are in position for all the tool-chucks to advance simultaneously toward carrier L to operate on the rods.

The circular cam R, Figs. 1 and 2, is attached to one side of wheel P, a segment of which is toothed, having a slip-tooth at each end of the segment. It turns loose on the hub of wheel e, Fig. 3, which is attached to shaft d^2. Wheel P and cam R are turned to the left to move forward chucks D D′ by wheel o^3 on the same shaft with wheel o, which is connected by wheels n^4 o^1, Fig. 7, with wheel n^3 on spindle 4. When wheel P has been thus turned, the whole of its toothed segment is to the left of wheel o^3, which continues to rotate against the slip-tooth at the end of the segment.

The construction of chucks D D′ and connecting parts is shown in Figs. 10, 11, and 12.

When chuck D advances, the follower c^7, which slides in the bush c^9 in the hollow end of spindle 7, is forced back by the end of the threaded rod in carrier L against the spiral spring c^6 until the tools in the chuck are in position to shape the head of the screw and sever it from the rod.

The head-shaping tool is held in tool-holder c^4, and the cut-off tool in tool-holder c^5, which slide in half-dovetail parallel grooves nearly across the face of the chuck on opposite sides of the spindle. The holders c^4 c^5 are retained in their grooves by gibs c^8 c^8. The tools are held in opposits ends of the holders, so as to point toward each other, and in the other ends are pins, which enter convergent grooves in cams c^1 c^2. A part of the groove at the outer end of cam c^1 is parallel with the axis of spindle 7. The cams c^1 c^2 move in slots through opposite sides of chuck D, at right angles to the tool-holders. By drawing back cams c^1 c^2 the tools are fed on the rod till the pin in holder c^4, which carries the shaping-tool, enters the parallel part of the groove in cam c^1, when the head of the screw is sufficiently chamfered, and the shaping-tool ceases to feed, while the other tool continues to cut off the finished screw. To each cam c^1 c^2 is attached a rod, f^9 f^9, which slides in a groove lengthwise of spindle 7, and the other ends of rods f^9 f^9 are connected by pins with collar c^3. This collar is loose in an annular groove on the hub of wheel c^3, which is threaded, and turns in the thread of screw a^5.

The tools in chucks D D′ are fed by rotating the toothed wheels c^3 c^3, having a female screw, on the screws a^4 a^5, Fig. 7.

Wheel n^3 on the threading-spindle 4 is connected by wheels o^1 n^4 x^5 with wheel e^4. Wheel x^6 on the shaft of wheel e^4 rotates wheels c^3 c^3, which, as they move on the thread of screws a^4 a^5, slide wheel x^6 on its feathered shaft by means of flanges projecting from wheel x^6 on each side of wheels c^3 c^3.

When spindle 4 reverses its motion to withdraw the threading-dies, the motion of wheels c^3 c^3 is reversed, which slides cams c^1 c^2 toward carrier L, and thereby withdraws the tools in chucks D D′ from the severed screws, and permits the force of springs c^6 c^6 to eject the finished screws from spindles 6 and 7.

The reversal of the motion of spindle 4 also reverses the motion of wheel o^3, Figs. 1 and 2, and turns wheel P to the right, and cam R withdraws chucks D D′ from the carrier L before the tools in the chucks are withdrawn far enough to permit the finished screw to be ejected from spindles 6 7 by springs c^6 c^6. The inner end of follower c^7 is flanged, which prevents it, by contact with the inner end of bush c^9, from being ejected from the spindle with the screw.

The milling-tools in chucks T T′ partially mill the rods, and the tools i^1 i^1 in chucks F F′ finish the milling, and tool i, which is held in an opening in the side of each chuck F F′,

points the rod. These chucks are advanced to feed their tools by screws a a^1 a^6 a^7, Fig. 1. The screws are inserted in their spindles 2 3 8 9 in the same manner as screws a^4 a^5 in spindles 6 and 7.

The tools are fed by turning screws a a^1 a^6 a^7 in threaded nuts d d d d. The screws are rotated by wheels o^4 o^5 o^6 o^7, Fig. 7, which are feathered on the screws. These wheels are rotated to feed the tools by wheels n^5 n^6 n^7 n^8 o^9 p p^1 p^2, and by wheel p^3 on main shaft 1, wheel n^8, Fig. 8, being connected with clutch o^8, which is feathered on shaft p^4.

To withdraw the milling-chucks from the rods, clutch o^8 is disconnected from wheel n^8 and connected with wheel n^9, which is rotated by wheels p^5 p^6. Wheels n^8 n^9 on shaft p^4 rotate in opposite directions, and when both of them are disconnected from the clutch they turn loose on their shaft, and cease to move the gears which move the milling-chucks.

Clutch o^8 is operated by lever v^2, the inner end of which is connected by pins with an annular groove in the clutch, and its outer end pivoted to the sliding collar v^3 on shaft v^4. Intermediate the ends it is pivoted to a loose collar, s^6, Fig. 1, on the unthreaded part of screw s^5, and between the adjustable collars x x^1. Screw s^5 is turned in a female thread in the frame by wheel s^4, which is feathered to the screw and rotated by wheel o^4.

While the milling-chucks approach carrier L, the turning of screw s^5 causes collar x to move the outer end of lever v^2, so as to compress spring i^7 without disconnecting clutch o^8 from wheel n^8 until the compression of spring i^7 is sufficient to cause the cam-pin v, Fig. 8, on the bottom of lever v^2 to force down and pass over the apex of spring v^1, the other end of the spring being attached to cylinder I. The force of spring i^7 against lever v^2 then moves clutch o^8 toward wheel n^9; but the end of stop c, entering the groove in a scroll on the side of wheel n^9, arrests the clutch until, by the rotation of wheel n^9 with its scroll, the end of stop c is carried out of the scroll and passes above wheel n^9, which is then connected with clutch o^8, as shown by dotted lines in Fig. 8.

The time of the disconnection of clutch o^8 from wheels n^8 n^9 is determined by adjusting collar x, Fig. 1, on screw s^5 so that the pointing and milling tools in chucks F F′ T T′ will begin to point the rods just before the disconnection of the clutch and wheels. During the disconnection screw s^5 ceases to rotate, and chucks F F′ T T′ have no movement except rotation, and the pointing-tools finish the pointing of the rods and the milling-tools finish the milling by rotating in a plane at right angles to the rods.

The connection of clutch o^8 with wheel n^9 rotates screw s^5 in a direction opposite to its rotation when the connection was with wheel n^8, and while the milling-chucks are withdrawing collar x^1 forces the outer end of lever v^2 against the spiral spring i^6, compressing it against collar v^4 till the lower end of lever v^2 is forced back over the apex of spring v^1, Fig. 8, and clutch o^8 is again connected with wheel n^8. At the same time the sliding collar s^6 moves lever e^1 by contact with finger s^7, Fig. 1, on lever e^1, compressing spring s^8 against the adjustable collar s^9, so as to slide back rod d^7 and connect clutch i^3 with wheel h. The threading-chucks E E′ now begin to rotate and move toward carrier L, the threaded wheels o^4 o^5 o^6 o^7, Fig. 7, begin again to move the tools in each of the chucks D D′ toward each other, and the milling-chucks F F′ T T′ again advance toward carrier L.

Having described the mode of operations of the tool-chucks until all of them have been withdrawn from the rods, I will now describe the construction and operation of parts connected with carrier L.

Wheel P, Fig. 2, and wheel e, against its inner side, have the same diameter and a common center of motion. Wheel e has a toothed segment with a slip-tooth at each end, and is turned by wheel o^3. It is attached to shaft d^2, which turns in and extends through and beyond the hollow cylinder I and carrier L. When wheel P and cam R are turned to the right to withdraw chucks D D′, wheel e and shaft d^2 are turned with them until pawl b^2, Fig. 4, on the arm b^1, attached to the other end of shaft d^2, has moved back on ratchet b^3 a little more than one-sixth of a revolution to the position shown by the dotted lines in Fig. 4.

Ratchet b^3 has six notches on its circumference, equally distant from each other, for pawl b^2 to enter. It is attached to carrier L, which carries double as many vises as there are notches in ratchet b^3.

The carrier and ratchet are retained on cylinder I by collars h^7 h^7. There are six holes, h^8, through carrier L, equally distant from each other, into which stop h^9 is alternately forced by its spring e^5 to firmly hold the carrier in place while the tools are operating on the rods.

Stop h^9 slides in holes through guide H^2, bolted to the frame. The lower part of pin e^6, through stop h^9, extends into a slot in guide H^2, and keeps stop h^9 from turning. The part of the pin above the stop diverges from carrier L, so that by pressing down arm A^1 against the side of the pin, stop h^9 is forced out of hole h^8, leaving carrier L free to be turned by a forward movement of pawl b^2. The rock-shaft A^2, extending the whole length of the machine, turns in frame H.

Arms A^1 A^3, Figs. 4 and 2, are attached to the rock-shaft near its ends, so that by pressing down arm A^3 stop h^9 is forced out of carrier L.

The toothed segment of wheel e, Fig. 2, is of the requisite length to turn carrier L through the space of two tool-chucks, and when wheel e is turned alternately in opposite directions by wheel o^3, it is arrested by contact of one of the pins s^3 e^8 in its circumference with pin e^7 in the frame H^1. The pin s^3 is a spring, and

when wheel e is turning to the right to carry pawl b^2 over ratchet b^3, the spring-pin s^3 is pressed outward by the wedge-shaped side of arm A^3 without moving the arm, and stops at the position shown by dotted lines in Fig. 2, at the left of the arm. After chucks D D′ have been withdrawn and the finished screws have been ejected from them, the milling-chucks continue to operate for some time before they also are withdrawn from the rods, and in the meantime the operator of the machine releases the rods held in the two vises opposite chucks D D′ (only one of which is shown in Fig. 1) by turning the vise-screws b^4, Fig. 4, and moves the rods the proper distance for the length of the screw-bolt to be made, and closes the vise-jaws d^3 d^4 to hold them. When all the chucks have been withdrawn the connection of clutch i^3 with wheel h, Fig. 1, causes wheel o^3 to connect with the slip-teeth at the left-hand ends of the segments of wheels P and e and turn the wheels to the left. In so turning, the spring-pin s^3, coming in contact with arm A^3, presses it down to the position shown by dotted lines in Fig. 2, thereby forcing down arm A^1 against the side of pin e^6 to the position shown by dotted lines in Figs. 4 and 6, and sliding stop h^9 out of hole h^8 in carrier L before pawl b^2, moved by the turning of wheel e, enters its notch in ratchet b^3. The pawl then begins to turn carrier L, while spring-pin s^3, Fig. 2, is passing over the end of arm A^3. When pin s^3 has passed arm A^3 the arms A^1 A^3 are raised to their former position by the spiral spring x^2, Fig. 1, on shaft A^2. One end of spring x^2 is connected with the frame H, and the other end is under arm A^1. When the whole of the toothed segment of wheel e, Fig. 2, has been turned to the left hand of wheel o^3, pin s^3 is again in contact with pin e^7, and stop h^9, Fig. 4, by the force of spring e^5, enters one of holes h^8, to hold the carrier L firmly in position for the chucks to operate on the rods, which all the chucks, except chucks D D′, have been approaching since wheel e began turning.

In making connection between wheel o^3 and the segments of wheels P and e, if the ends of the teeth come in contact with each other, the shaft of wheel o^3 rises and compresses the spiral spring e^9, Fig. 2, which forces wheel o^3 back to position when the ends of the teeth have ceased to be in contact.

All parts of the machine are now in the position shown in Fig. 1, and wheel P, with its cam R, continues turning to the left to move chucks D D′ toward carrier L. The part of cam R with which bar d^1 connects while wheels e and P are turning together to the left is at right angles to the axes of the chucks, so that chucks D D′ are not moved toward carrier L until it has been turned so as to bring the rods which have just been threaded in chucks E E′, in line with the axes of chucks D D′.

I claim as my invention—

1. In a screw-cutting machine, a revolving series of non-rotating rod-holders, in combination with a series of rotating tools, adapted to operate simultaneously and successively on the rods to perform the operations of milling the rods, threading the screws, and severing the screws from the rods, the series of rod-holders being adapted to carry rods, which may be fed forward at each revolution of the series for the formation of screws, substantially as described.

2. The carrier L, in combination with stop h^9, spring x^2, arms A^1 A^3, spring-pin s^3, and wheel e, having a toothed segment, substantially as described.

3. The wheel P, having a toothed segment, and cam R, in combination with the bar d^1, rods a^4 a^5, spindles 6 7, and chucks D D′, substantially as described.

4. The wheels P and e, each having a toothed segment, in combination with wheel o^3, shaft d^2, carrier L, pawl b^2, ratchet b^3, and the cam R, bar d^1, rods a^4 a^5, spindles 6 7, and chucks D D′, substantially as described.

5. The cams e^1 e^2, in combination with rods f^9 f^9, screw-wheel c^3, and screw a^5, substantially as described.

6. The lever e^2 and screw o^2, in combination with rod d^8, collars f^8 f^6, spring f^5, clutch n, and pins s s^1, substantially as described.

7. The chuck E′ and wheel n^3, in combination with wheel o^1, screw o^2, lever e^2, rod d^8, and clutch n, substantially as described.

8. The clutch o^8, in combination with stop c and the scroll-wheel n^9, substantially as described.

9. The chuck F and screw s^5, in combination with wheels o^4 n^7, clutch o^8, stop c, wheel n^8, and scroll-wheel n^9, substantially as described.

10. The chuck F′, spindle 2, rod a, wheels o^4 s^4, screw s^5, collar s^6, lever e^1, collar h^5, spring s^8, rod d^7, clutch i^3, wheel h, spindle 5, and chuck E, substantially as described.

11. The clutch o^8, for withdrawing chucks F F′, in combination with lever v^2, screw s^5, collar x^1, lever e^1, rod d^7, and clutch i^3, substantially as described.

12. The combination of chuck F, spindle 3, sleeve b^6, and wheel n^2, with wheel n^1, clutch n, sleeve i^4, spindle 4, and chuck E′, substantially as described.

13. The cam R, a part of it being parallel with its line of motion, in combination with bar d^1, rod a^5, spindle 7, chuck D, and with the toothed segment-wheel P, wheel o^3, toothed segment-wheel e, shaft d^2, ratchet b^3, pawl b^2, and carrier L, substantially as described.

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Witnesses:
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