3 Sheets—Sheet 1.

C. D. ROGERS.

Metal Screw Machine.

No. 203,946. Patented May 21, 1878.

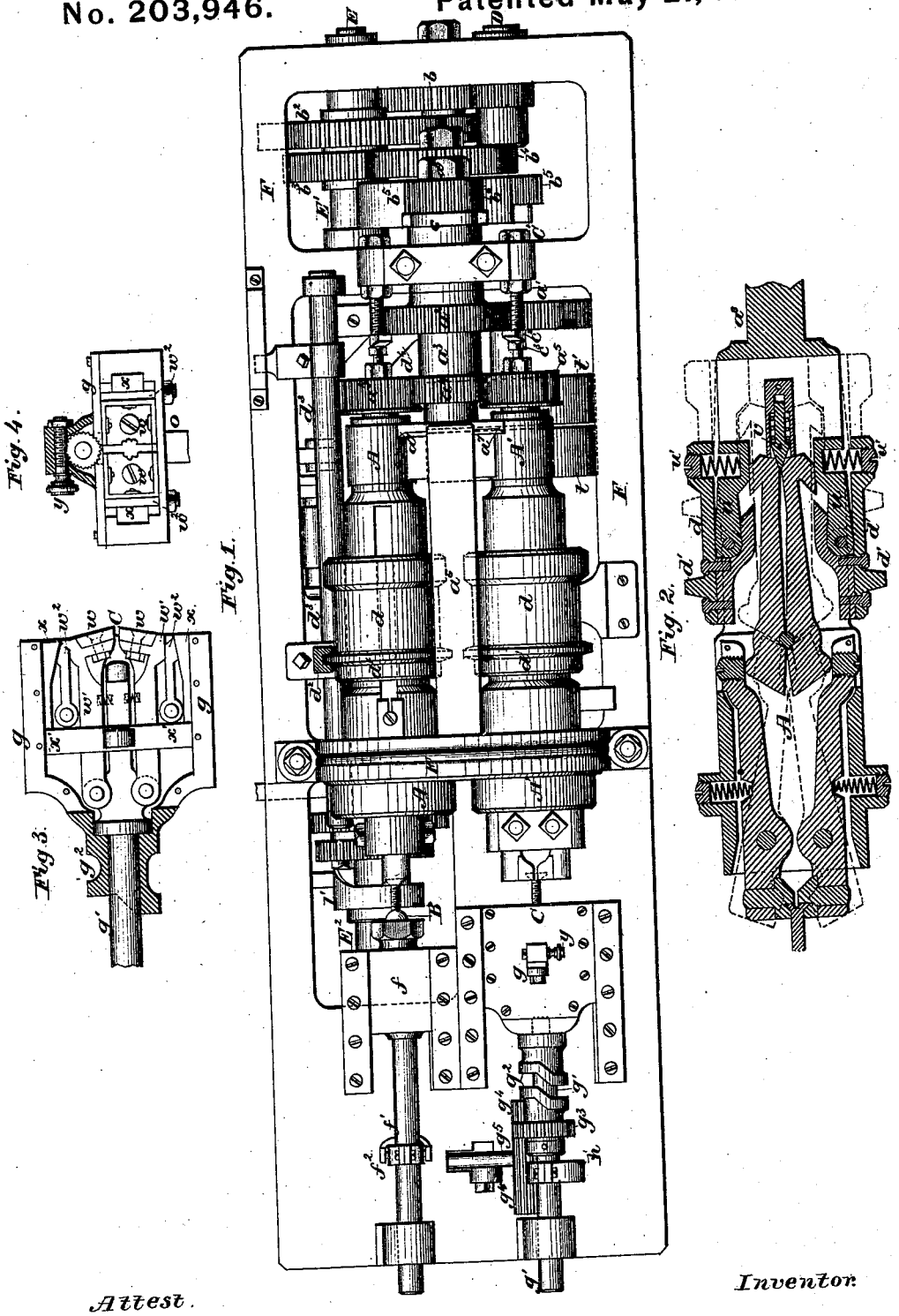

Fig. 1.

Fig. 4.

Fig. 3.

Fig. 2.

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George Fuller

J. C. B. Woods.

Inventor.

Charles D. Rogers

3 Sheets—Sheet 2.

C. D. ROGERS.

Metal Screw Machine.

No. 203,946. **Patented May 21, 1878.**

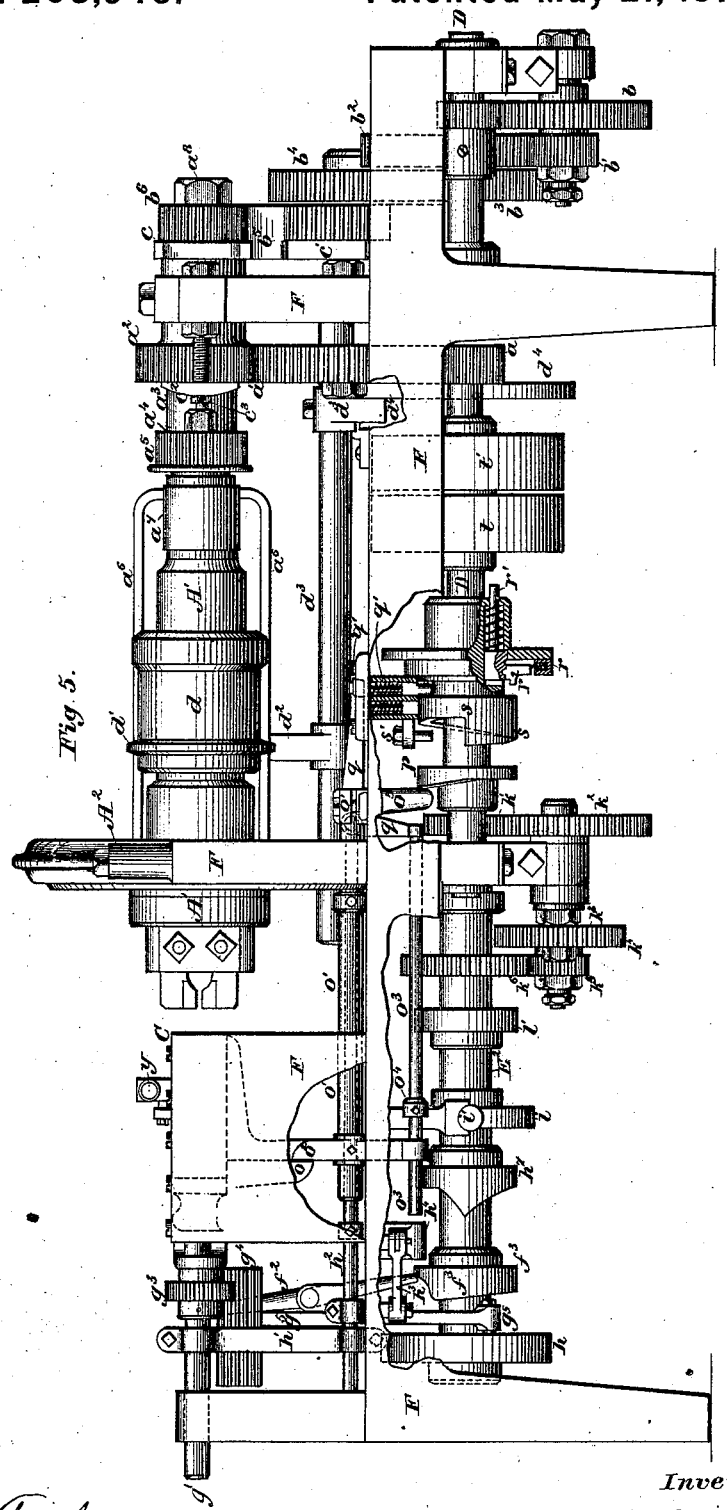

Fig. 5.

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Metal Screw Machine.

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Fig. 6.

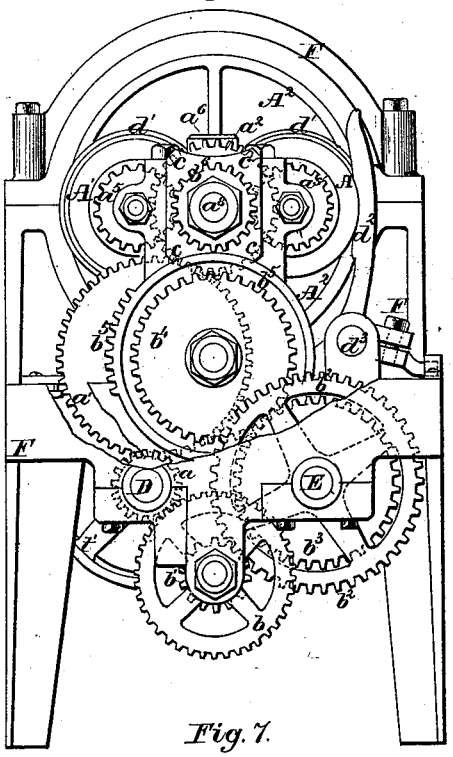


Fig. 7.

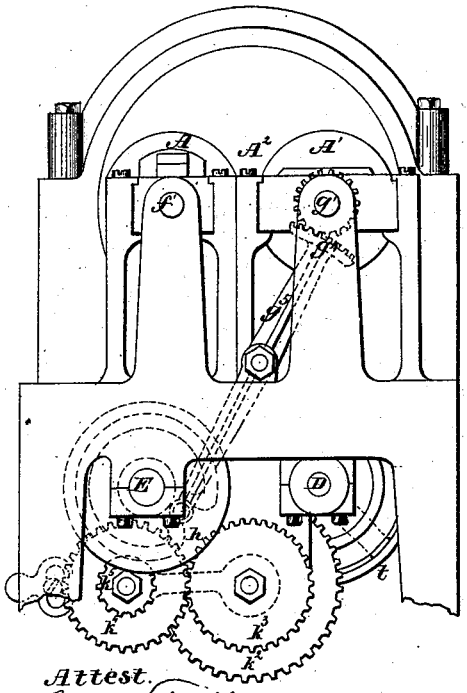
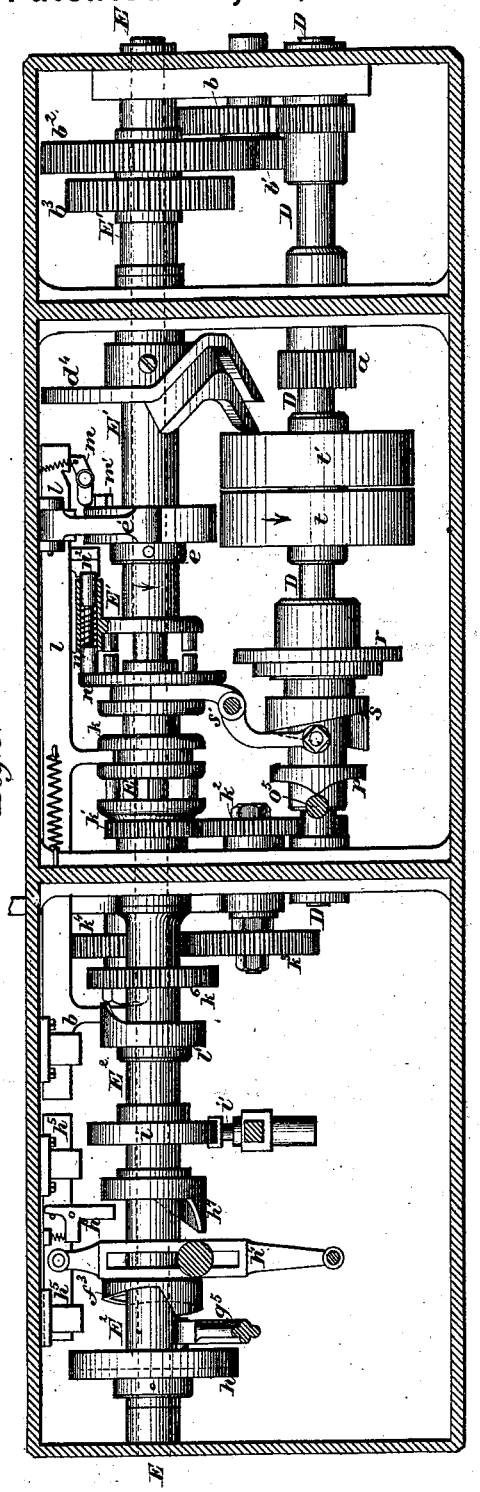


Fig. 8.



Attest.

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Inventor

Charles D. Rogers.

UNITED STATES PATENT OFFICE.

CHARLES D. ROGERS, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO THE AMERICAN SCREW COMPANY, OF SAME PLACE.

IMPROVEMENT IN METAL-SCREW MACHINES.

Specification forming part of Letters Patent No. **203,946,** dated May 21, 1878; application filed January 26, 1878.

To all whom it may concern:

Be it known that I, CHARLES D. ROGERS, of the city and county of Providence, in the State of Rhode Island, have invented certain new and useful Improvements in Screw-Machines; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part thereof, is a clear, true, and complete description of my invention, and of a machine embodying the several features thereof.

My improvements relate to that class of machines in which fine-threaded screws are made, and which embody threading-dies; and in my improved machine the threading operation alone can be performed, or simultaneously therewith the blanks may be so milled as to be properly pointed, their bodies made truly cylindrical with a precise and uniform diameter, and their heads squared up on the under side; or either one of these last-named operations may be performed, they depending wholly upon the character of the milling-tool employed.

The first part of my invention consists in the combination, with a pair of jaw-spindles which are capable of revolving on their own axes, and also on an intermediate axis common to both spindles, of threading-dies and a milling-tool, which accurately adjusts the blank axially in the jaw of one of the spindles, while pointing, reducing in diameter, and squaring up the head of the blank, or in performing either one of said operations, whereby no blank can be presented to the threading-dies unless held absolutely coincident with the axis of the jaw-spindle.

Jaw-spindles of the character named have heretofore been employed in combination with "shaving" and "nicking" tools, as in the Sloan machines, and also in connection with threading-dies and an edge-tool for pointing; but that class of tools does not possess the above-described centering capacity of a milling-tool, which is provided with an axial opening for receiving the whole or a portion of the body of the blank.

With a milling-tool which operates on the shank of a blank and determines its diameter, it is impossible for the dies and other portions of the machine to be injured, as is sometimes liable in case a larger blank by accident is encountered among those of a size to which the threading-dies have been adjusted.

In my improved machine I have embodied a novel organization of mechanism, which constitutes a portion of my invention, and consists, broadly stated, in the combination, with revolving griping-jaw spindles for holding the blanks, mounted in an intermittingly-revolving yoke-frame, and threading-dies, of a main and counter shaft, two cam-sleeves loosely mounted on the counter-shaft, and driven by it intermittingly, and a clutch for each sleeve connected with and controlled by the threading-dies.

It is not broadly new to control the changing movements in such machines by the threading-dies; but the novel combination of mechanism thus generally stated is thoroughly efficient, with the intermediate mechanism, for causing the jaws of one of the spindles to open and close, the threading-dies to close and advance, open and retreat, and the spindles to change position with reference to the threading-dies, and can be employed with or without the milling-tool.

Another feature of my invention relates to the yoke-frame in which the griping-jaw spindles are mounted. As heretofore constructed, the yoke-frame has been provided with a central shaft longer than the spindles, and provided with a bearing at each end. This central shaft, being long, is liable to spring, and its presence renders it necessary that long yokes be used and said spindles widely separated. The stopping and starting of these yoke-frames has therefore been heretofore attended with considerable shock, and a consequent liability of undue wear and breakage of the operative mechanism.

The object of my improvement in this connection is to so mount the spindles that they will be closely adjacent to each other, in order that when the frame revolves it will be done smoothly and without shock; and to these ends my invention further consists in a pair of griping-jaw spindles, mounted rotatively at one end in a circular head-plate which has a peripherical journal in an annular bearing on

the frame of the machine, and is connected to a yoke and axis for supporting the rear ends of the spindles.

The front end of the spindle is smaller than the central portion, owing to the complex mechanism within, which must have considerable bulk and strength to properly operate the griping-jaws; but the rear ends of the spindles are quite small, which permits them to be properly geared, even though the central surfaces of the spindles are barely separated. This portion of my improvement is applicable to shaving and nicking machines, and to any others in which the griping-jaw spindles and yoke-frame are of value.

Griping-jaw spindles in a yoke-frame, as heretofore constructed, are alternately placed into gear for revolving one of them, while the other spindle, if revolved simultaneously, is driven by a jockey-pulley.

In my machine both spindles continuously revolve when in working position, and they also, in fact, revolve during the rotation of the yoke-frame; and another feature of my invention consists in a pair of continuously-revolving griping-jaw spindles, mounted in a yoke-frame which intermittingly revolves, in combination with an intermediate sleeve on the axis of the frame which is geared to both spindles and continuously driven. This portion of my invention is also applicable to other machines.

The jaw-spindles employed by me are provided with a sliding sleeve and compound or thrusting levers which move with the sleeve for operating the jaws, substantially as heretofore.

As formerly constructed, however, if the jaws be adjusted to hold a blank-head of a certain size, they will not engage firmly with a smaller head, and if by accident a blank with a larger head be fed to the jaws, there is liability of breakage or injury to the whole or some portion of the jaw-operating mechanism, including all of that through which the requisite movements of the jaws are obtained.

Another object sought by me is a firm gripe of the jaws on heads of different sizes, which at the same time shall be yielding to that extent that no injury will be liable to result from the accidental feeding of a larger blank than those for which the jaws are generally adjusted; and to these ends my invention further consists in the combination, with a spindle containing the griping-jaws, thrusting-levers, and sliding sleeve, of cam-levers, which are pivoted to the sleeve and bear upon the rear ends of the thrusting-levers with yielding pressure when the sliding sleeve is moved forward.

It is important that this yielding pressure be adjustable; and to that end my invention further consists in the combination, with the griping-jaws, thrusting-levers, and yielding cam-levers, of springs which bear upon the levers and are adjustable to varied pressure.

The rear ends of the thrusting-levers, when pressed upon by the cam-levers, (all being in their most rearward position,) would be liable to be thrown to the one side or the other of the axial line of the spindle, and therefore, when next moved forward, the heads of the thrusting-levers would fail to properly engage with the rear ends of the griping-jaws, and this would inevitably be the result if one cam-lever spring should chance to be more powerful than the other; and for obviating this liability, and to always maintain the rear ends of the thrusting-levers in the same relation to each other and to the axial line of the spindle, my invention further consists, in the combination, with the griping-jaws, thrusting-levers, yielding cam-levers, and sliding sleeve, of a parting-block or guiding-block, which is interposed between the two rear ends of the thrusting-levers, and is provided with a spring which forces it forward, so that it moves in that direction with the thrusting-levers until no longer required, and also so that it may retreat when the levers move backward, meantime maintaining with its wedge-shaped head its guiding or parting capacity.

Certain portions of my invention relate to the thread-cutting dies. For threading fine machine-screws by machinery, solid dies have heretofore been generally used, and, although sectional or open dies have been successfully employed in bolt-threading machines, their application to the threading of small machine-screws has heretofore been objectionable to such an extent as to result in the almost exclusive use either of solid dies or sectional dies secured in solid heads.

It is well known to be difficult to work a thread close up under a squared head with dies as generally heretofore constructed; and also that those dies are frequently broken when such work is attempted, by reason of chips being interposed between the face of the die and the head of the screw, and open-bar dies for hand-plates have been heretofore inclined in their holders to obviate this difficulty.

It is also well known that solid dies are costly and liable to twist in hardening, and that these, as well as open dies, rigidly set in a head when used in threading-machines, require reverse rotation, or its equivalent, for release from threads cut by them, and also that solid dies cannot be relied upon for cutting fine machine-screws to scale, because in proportion as the dies are used they become worn and deliver screws of larger diameter than when new. With sectional or open dies and a novel adjustable feature hereinafter described, I am enabled to adjust the counterpart sections, so as to secure uniformity in the diameters of the screws cut by them regardless of the wear of the dies.

To economize in steel and in the labor of making the dies, as well as in the hardening thereof, I take a strip of steel of proper width, bevel its two edges by planing or milling, then drill and countersink at proper intervals holes for the center of each section, so that a screw

may secure them to a die-block, jaw, or holder. I then saw the bar into squares and bevel each end at the sawed portion, and then, while the sections are in pairs, properly secured, I drill and tap them successively on each of their four sides, so that one pair of sections will be equivalent to four solid dies. The distribution of metal in these sections of die is such that in hardening it is seldom, if ever, that one will be injured by warping or twisting. These items of economy are of great practical value; and one feature of my invention consists in a square-sided sectional threading-die, inwardly beveled at each edge, centrally drilled for a holding-screw, and provided with a threaded recess on each side, so that when two of them are attached to suitable jaws or a holder with coincident recesses, the die, as a whole, will have a front face which recedes on each side of the junction of the counterparts, whereby a thread may be cut to a shoulder or to the head of a screw, and the several before-enumerated advantages also attained.

Another feature of my invention relates to the adjustability of the open threading-dies within a die-block. As heretofore constructed, the dies of bolt-threading machines have been mounted on levers or jaws, which, when the die-block was advanced, would close the dies, and would open them or permit them to open when withdrawn, and the die-block used by me is of that class.

Although it is important in the making of fine machine-screws that they should all have the same diameter, and although to accomplish that result the dies must be capable of the nicest and most accurate adjustment, so far as my knowledge extends no dies in such blocks have ever heretofore been capable of such adjustment; and to that end my invention further consists in the combination, with a sliding die block or holder, its tail-rod, its die-jaws, and their actuating inclined planes, of an adjusting inclined plane or wedge-block to each jaw, which cause the dies to approach more or less closely to each other without changing the time of their opening or closing incident to the movement of the die-block. These adjusting-planes are wholly independent of the planes which close the jaws, although these latter have a rear abutment or bearing against the face of said adjusting-planes. The adjustable wedge-blocks are controlled by a thumb-screw, by which the finest possible adjustment of the dies may be effected.

Certain other portions of my invention will hereinafter be fully set forth in connection with the detailed description.

To more particularly describe my invention, I will refer to the accompanying three sheets of drawings, in which—

Figure 1, Sheet 1, is a top view of a complete machine embodying the several features of my invention. Fig. 2, Sheet 1, is a longitudinal central section of one of the jaw-spindles. Fig. 3, Sheet 1, is a top view of the threading die-holder with the top plate removed. Fig. 4, Sheet 1, is a front view of the die-holder and dies. Fig. 5, Sheet 2, is a side elevation of the machine with portions of the frame broken away. Fig. 6, Sheet 3, is a rear-end elevation of the same machine. Fig. 7, Sheet 3, is a front-end elevation. Fig. 8, Sheet 3, is a plan of the shafting beneath the top plate.

In order that the detailed description may be more easily understood, I will first describe in general terms the devices by which the screws are milled and threaded, without reference to the particular combinations of mechanism by which they are enabled to perform their several functions.

Duplicate griping-jaw spindles are shown at A A^1, which revolve on their own axes, and also at intervals on an axis common to both. Their jaws are opened and closed automatically at certain intervals, and any suitable feeding mechanism may be employed for delivering a blank to the jaws. No feeder is shown in the drawings.

The feeding and discharging are effected only when the spindle is on the same side of the machine as the milling-tool B, and in front thereof. The milling-tool may be so constructed as to point the blank, mill it to any desired diameter, and square up the head, or so as to execute either one of these operations; but it must perform either or all of them, as has been before herein stated, in such a manner as will positively assure true axial adjustment of the blank with relation to the axis of the jaw-spindle in order to be within the scope of one feature of my invention.

In similar machines heretofore pointing and threading have been performed; but the pointing-tools have not been of the milling-tool order, and hence have not contributed to the perfect axial adjustment of the blank in the jaw.

The milling-tools used by me are cylindrical, and have central openings to receive the whole or a portion of the shank of the blank, and the axis of said central opening is truly coincident with the axis of the jaw-spindle, and this positively insures such a correct axial adjustment of the blank in the jaw that when it is presented to the threading-dies C perfect uniform threading is attained, and the dies are not liable to be injured.

When the head is squared and the body of the blank milled while in the jaw, no damage accrues to the dies if a larger blank, by accident, should be fed to the jaw, because the milling-tool determines the diameter, and is in size adapted to co-operate with the threading-dies.

These parts are so geared and driven that when a blank is fed to spindle A, Fig. 1, the jaw closes, both spindles meantime revolving. After closing, the milling-tool B advances, and performs its duty of milling and correctly centering the blank, and then retires. The spindles then change position, the blank

being thereby presented to the threading-dies C, which advance and close upon the tip of the blank, and then, by the lead of the thread, are drawn forward to or near the head of the blank, as may have been predetermined, and when the proper length of thread has been cut the threading-dies open and promptly recede. During this threading operation another blank has been meantime presented by feeding mechanism (not shown) to the fellow spindle and milled, and after threading the spindles again revolve on their common axis to their former positions, the threaded screw is released from the jaw, and the same operations automatically repeated.

The jaw-spindles are continously revolved by a chain of gearing from the main shaft D, Figs. 5 and 8, commencing with gear a on said shaft, thence by larger gear a^1 above to gear a^2 on an intermediate sleeve, a^3, carrying gear a^4, which meshes on each side with gears a^5 on the jaw-spindles. The spindles continuously geared to the main shaft constitute one feature of my invention.

The spindles, near their front ends, have bearings in a circular head-plate, A^2, journaled at its periphery in an annular portion of the frame of the machine. This head-plate, at its rear side, is provided with two rearward-projecting arms, a^6, which connect at their rear end by a yoke, a^7, which has an axis, a^8, which extends through sleeve a^3 to the rear end of the machine. The axis a^8 is coincident with the center of the head-plate A^2, and its bearing is in a vertical portion of the frame F.

The circular head-plate and the axis, connected as described, constitute a yoke-frame of novel construction, and it will be seen that the spindles may be therein mounted in close proximity to each other, and that they may therefore be revolved by and with the frame, with a minimum of shock in starting and stopping. The rotation of the revolving spindles with their head-plate on axis a^8 is effected by gearing from the main shaft, through gears b and b^1 on a stud, to gear b^2 on counter-shaft E within cam-sleeve E^1, which is, in turn, revolved by shaft E at certain intervals, as hereinafter described, and communicates motion at said intervals, through gear b^3 on said sleeve, to an upper gear, b^4, on a stud connected with a mutilated or segmental gear, b^5, which, in turn, meshes at intervals with the gear b^6 on the outer end of the axis a^8, on which both spindles revolve. The axis a^8, inside of its gear, has a four-sided locking-plate, c, as heretofore, which revolves with the axis, and has on its opposite sides or edges a concave surface, which corresponds in outline with the periphery of the smooth portion of segmental gear b^5, which is as wide on its rim as the combined thickness of gear b^6 and plate c. Alongside of its teeth the rim of the segmental or broken gear is cut away, forming an opening or recess, c^1, Fig. 1, into which the advanced corner of the squared plate c is projected the moment that the broken gear teeth engage with the spindle axis gear b^6 and commence to revolve it; but, by the time a half-revolution of the yoke-frame axis is made, the opposite concave surface of the plate c comes in contact with the periphery of the broken gear. By this construction the spindles are absolutely locked in truly accurate positions, from which there can be no possible variation.

To prevent longitudinal movement of the spindles when revolving at their work, an abutting-plate, c^2, at the rear end of each, is provided, as heretofore, on the end of a threaded stem secured to the standard on the frame F, so that said plate may be accurately adjusted. The rear end of each spindle is also provided with an adjusting-screw, c^3, the head of which is is contact with the abutting-plate.

The jaws of the spindles are opened and closed by a sliding sleeve, d, on each spindle, as heretofore. Its flange d^1 enters a vertical recess in a vertical arm, d^2, whenever the spindles change position with their jaws closed. The vertical arm has a movement to and fro parallel with the spindle at proper intervals, and when moved rearward the jaws are opened, and when moved forward the jaws are closed. The sleeve-operating arm d^2 is mounted on a sliding rod, d^3, to which motion is imparted by the cam d^4 on the sleeve E^1, said cam being so shaped and timed as to move the sleeve d to and fro immediately after the spindles change position. The cam d^4 may be provided with two flanges or webs, as shown in the drawing, for imparting the two movements to the jaw-spindle sleeve; or the continuous web may alone be relied upon if the rod d^3 have a forked finger or stud, which loosely embraces the edge of the web. The sleeve E^1 has a stop-wheel, e, provided with a notch in its periphery, into which the toe of a spring-lever, e', enters after the sleeve has made a complete revolution for rotating the spindles on their common axis and opening and closing their jaws.

I will next describe how the milling-tool B is operated. In this machine said tool has only a movement toward and from the jaw of a spindle; but it may also be made to revolve on its own axis by means of a continuously-driven splined shaft, in a manner well known, within the cross-head, by which it is moved longitudinally. The milling-tool is mounted in the outer end of the cross-head f, fitted to guides in standards of frame F, and provided with tail-rod f^1, projecting from its rear through a guide in a standard at the end of the frame. To the tail-rod is pivoted the upper end of a lever, f^2, provided with a retractile spring (not shown) connected to the standard before referred to, by which the milling-tool is withdrawn after its work is completed. The lever f^2 is centrally pivoted to a short standard on the top plate of the frame, and its lower end, projecting downward through the top-plate, engages normally, by reason of its spring, with the side of a cam, f^3, on sleeve E^2, within which is extended the counter-shaft E, before

described. The cam f^3 has an easy gradual swell, by which the milling-tool is advanced, and an abrupt drop, which permits the retractile lever spring to act in promptly throwing the milling-tool backward.

Inasmuch as the length of thread in screws is largely varied according to their size, and as the threading operation must, in each case, be fully completed and the dies withdrawn before the spindles can change position, the threading-die block occupies an intermediate controlling position between the main shaft and all of the moving parts of the machine, excepting only the continuous rotation of each jaw-spindle on its own axis, these being always free to revolve while all other operations are suspended.

The threading-dies have been already designated, as at C, and although there are many novelties connected therewith, hereinafter to be set forth, they will now be referred to in general terms, in order to describe their general mode of operation and the manner in which they control the time at which other parts of the mechanism shall operate.

The dies are contained within a holder, g, (shown fully in Fig. 3,) fitted like a cross-head to guides in standards of frame F, and provided with a tail-rod, g^1, (connected with the die-jaws,) which extends rearward through a guide-bearing in a standard at the rear end of the frame. On the tail-rod, near its junction with the die-holder, is a cam, g^2, which loosely encircles the rod, and is connected with the die-holder g, also loosely mounted on the rod. Alongside the cam is a sleeved gear, g^3, with a cam which corresponds with cam g^2, their two faces being coincident, so that when the gear g^3 is turned on the tail-rod g^1 the two cam-faces will force the shell of the holder sufficiently forward to close the dies. The gear g^3 is rotated by a segmental gear-plate, g^4, on the upper end of a lever, g^5, which extends downward below its pivot through the top-plate of the machine, and thence curves toward the opposite side of the machine, and engages, by means of a finger and roller, with a cam-groove in the side of cam h on sleeve E^2 on counter-shaft E. This cam-groove is so shaped and timed that the lever is vibrated to and fro promptly once during the revolution of the cam, and this forward vibration rotates gear g^3 forward, forcing the die-holder forward and closing the jaws, after which the lever vibrates rearward, leaving gear g^3 and its cam ready to repeat the same movement. The combination of the geared lever g^5 with the gear and cam on the tail-rod, the dies, and the holder constitutes one portion of my invention.

After the die-holder has thus far been slightly advanced, it is then pressed forward with yielding pressure, so that the tip of the blank enters the threading-dies. This additional forward movement is effected by the arm h^1, secured to the die-holder tail-rod g^1 at its upper end, and at its lower end to a sliding rod, h^2, to which is connected an arm, h^3, linked below the bed-plate to the end of a centrally-pivoted lever, h^4, Fig. 8, the opposite end of which is pivoted to a sliding bar, h^5, mounted in guides at the opposite side of the machine on the frame. This bar is provided with a retractile spring, which so draws the bar that the tail-rod and die-holder is normally held at its most rearward position. The bar h^5 is also provided with a laterally-projecting but slightly-yielding spring-finger, h^6, with which a side cam, h^7, on sleeve E^2 engages at proper intervals, for forcing the die-holder forward with yielding pressure, as before stated. This sleeve E^2, acting, as it does, intermittingly, is provided with a notched stop-wheel, i, and a spring-plunger, i', which enters the notch in the wheel after each revolution and secures the proper rest at the proper moment. This combination, with the die-holder, the dies, tail-rod, its cam and geared lever, of the cam on sleeve E^2, the sliding-bar, and its spring-finger constitutes one portion of my invention.

From the description already given it will be clearly understood that the main shaft D and the counter-shaft E are continuously revolved, and that the counter-shaft E is within both cam-sleeves E^1 and E^2, and that these sleeves intermittingly make one complete rotation. The nature of the service performed by cam-sleeve E^1 is such that when rotatively connected with the counter-shaft it revolves therewith, and at the same speed; but cam-sleeve E^2 is so geared that it revolves at a much slower speed than the counter-shaft, because the milling-tool and the threading-dies are necessarily moved at slow speed. It has also before been stated that all of the intermittent movements of the mechanism are controlled by the dies, and it has been shown how many of these intermittent movements are executed by the alternate rotation of the sleeves E^1 and E^2. It is next in order to show how the two sleeves are rotatively connected with the counter-shaft E. This shaft, about midway of its length, is splined, and carries a sliding clutch, k, Fig. 8, provided with laterally-projecting pins for entering holes in the side of a plate alongside and attached to a gear, k^1, which is loosely mounted on said shaft. When this gear k^1 is, by its clutch, rotatively connected with shaft E, it communicates motion at slow speed to sleeve E^2 by way of the train of gearing mounted on studs, and an arm clearly shown at k^2 k^3 k^4 k^5 to gear k^6 on said sleeve, as seen in Figs. 5, 7, and 8.

The pin-clutch k is provided with a central annular groove in its periphery, which is occupied by a finger projecting laterally from a long spring shipper-bar, l, mounted in guides on that side of the frame of the machine. The spring of this bar acts in the direction of the gear k^1, and forces the pin-clutch into engagement therewith. When thus engaged, sleeve E^2 is completely rotated; but just before the stop-wheel i and its plunger co-operate

a side cam, l', on said sleeve commences to move the sliding bar l against its spring, thereby disconnecting the clutch k from gear k^1, and just before the disconnection is wholly effected the spring-plunger i' enters the V-shaped notch in the stop-wheel and accelerates the disconnection by slightly rotating the sleeve. The sliding bar having been thus moved against its spring, it is securely held by a spring lever or catch, m, pivoted to the frame of the machine near the opposite end of the bar, which engages with a notch or shoulder in the side of the bar when said notch reaches the end of the catch. (See Fig. 8.) The bar is thus securely held until such time as the sleeve E^1 is rotated, whereupon, after it has made one complete revolution, a lateral stud, m', in the side of the stop-wheel e, trips the spring-lever, releases the bar, and allows the pins of the clutch k to move in contact with the smooth side of the gear k^1 until the pin-holes therein are reached and entered, thus rotatively connecting shaft E with sleeve E^2.

I will next describe how sleeve E^1 is rotatively connected with its shaft E. On the central splined portion of shaft E, before described, is another pin-clutch, n, the pins of which engage with other pins projecting from the side of the adjacent end of the sleeve E^1. When the pins are locked with each other the sleeve is rotated with its shaft. A plunger, n^1, is mounted within a shell on the sleeve, parallel with it, in line with one of its pins, and provided with a spring, which forces the plunger away from the side of the clutch; but it is forced against its spring, and made to disconnect the clutch from the sleeve-pins by means of a stationary inclined plane, n^2, on the frame of the machine, the upper or thick end of which is shown in Fig. 8, which also shows the clutch n just disconnected thereby.

It has already been stated that the service performed by the cam-sleeve E^1 consists, consecutively, in rotating the spindles on their common axis for changing position, opening and closing the jaw of a spindle, and tripping the sliding bar which rotatively connects cam-sleeve E^2 with shaft E, this latter service being performed a little prior to the moment the stop-wheel e and its spring lever or finger e' co-operate. The time of connection of sleeve E^1 and shaft E varies according to the length of thread cut, or, in other words, the length of time required to properly cut a certain thread; and I will here state that the combination, with the counter-shaft and the two cam-sleeves, of the clutch which connects sleeve E^2 with the counter-shaft, and the spring shipper-bar which engages with the clutch and is moved longitudinally by a cam on said sleeve, the spring lever or finger which holds the shipper-bar when thus moved, and the catch-releasing device on sleeve E^1 for permitting the shipper to again connect the counter-shaft with sleeve E^2, constitutes one feature of my invention.

I will next explain how the threading-die executes its controlling power over sleeve E^1. In Fig. 5 one of the two standards in which the die-holder slides is broken away, revealing a pendent arm, o, which is attached to the shell of the die-holder, which has a sliding movement independent of the dies, but which, when the dies are closed, moves forward with them by the lead of the thread. The sliding rod h^2, before described, (see Fig. 5,) is here inclosed by a hollow rod, o^1, provided with a vertical arm, o^2, which extends upward for engagement with the pendent arm o, and which also extends below the bed-plate, where it loosely encircles the sliding rod o^3, which is provided with a collar, o^4, adjustable longitudinally thereon by a set-screw. The rod h^2, before described, by which the dies are forced forward under yielding pressure, imparts no movement to the hollow rod, but slides freely therein. The hollow rod o^1, at its outer end, is provided with a pendent arm, o^5, which is within the range of the edge of a side cam, p, loosely mounted on main shaft D. The lower sliding rod o^3, at its end, is connected with the lower arm of a vertical bell-crank lever, q. (See Fig. 5.) The upper or horizontal arm of the bell-crank lever q is connected with a vertical spring-pin, q', housed within a bracket on the frame of the machine, in line with, but at right angles to, the center of the main shaft D, and alongside of the face of an automatic clutch-plate, r, which is keyed to the main shaft, and is provided within its hub with a spring-bolt, r^1, and a radial spring-latch bolt, r^2, these being so placed with relation to each other that the inner end of the latch-bolt enters a concave recess in the side of the head of the bolt r^1, and prevents said bolt from projecting its head beyond the side of the clutch-plate at all times, except when the upper arm of the bell-crank lever q is so raised that an inclined cam-surface on the lower end of the vertical spring-pin causes the laterally-projecting finger on the spring-latch r^2 (clearly shown) to ride thereon as the clutch-plate revolves, whereby the latch-bolt is moved outward radially, thereby releasing the spring-bolt r^1 and permitting its head to project and enter a recess in the side of a sleeve, which carries the two cams s and p, and so to rotatively connect these cams with the main shaft throughout one complete revolution. The spring-bolt r^1, when it next reaches the spring-pin q', is forced backward by a side incline on the spring-rod out of engagement with the cam-sleeve, after which movement the latch r^2 re-engages with the spring-bolt, as before, and maintains its control until the bell-crank lever q again raises the spring-pin q', which, when in its normal depressed position, permits the finger of the latch to pass freely above it. The cams s and p having thus, by the forward terminal movement of the die-holder, been rotatively connected with the main shaft, perform respectively the following functions: Cam p engages with the pendent arm o^5 on hollow sliding rod o^1, and forces it and the die-holder

backward, and fully opens the dies. This mechanism, by which the die-block is moved backward, consisting in the combination, with the threading-dies, of the clutch *r* on the main shaft, controlled by the forward terminal movement of the dies, the cam *p* on the main shaft, driven by the clutch and the sliding rod o^1, constitutes another portion of my invention.

The side of the cam *s* engages with a stud on a lever-shipper, s^1, the opposite end of which occupies the annular groove in the pin-clutch *n*, which, being moved rotatively, connects the sleeve E^1 with shaft E, for consecutively changing the position of the spindles, opening and closing the jaws of one of them, and connecting sleeve E^2 with the shaft E, as described. The cams *s* and *p* being connected together, but loosely mounted on the main shaft, the cam *s* is provided with a recess in its periphery, and after each revolution this recess is occupied by the stop-pin shown in the bracket alongside the spring-pin *q'*, Fig. 8.

The novel combination of mechanism described, embracing the threading-dies, the main shaft, the counter-shaft, the two cam-sleeves and their clutches, the cam *s*, loosely mounted on the main shaft, the clutch-lever s^1, clutch *r*, keyed to the main shaft, the bell-crank lever *q*, and sliding rod o^3, controlled by the threading-dies, constitutes one portion of my invention, by which the dies, at their terminal forward movement, rotatively connect one sleeve to the counter-shaft, which, in turn, causes the spindles to change position, the jaws of one spindle to open and close, the disconnection of said sleeve from the counter-shaft, and the connection with said shaft of the second sleeve, which imparts to the threading-dies their initial movements.

The main shaft D is provided with the usual fast and loose pulleys, as at *t t'*.

With the general description of the effective movements of the spindles, milling-tool, and dies already given, and the detailed description of the mechanism by which each movement is attained, the operation of the machine will be fully understood.

I will now refer particularly to Fig. 2, which illustrates those portions of my invention which are contained within the jaw-spindles. The jaws, thrusting-levers, and sleeve *d* are all as heretofore; but the pivoted yielding cam-levers *u*, attached to the sleeve, their springs, and adjusting-screws *u'*, are novel. It will be seen that when the jaws are closed the springs on the levers *u* operate with a powerful but yielding pressure on the rear ends of the thrusting-levers, so that the jaws will be made to firmly hold blanks with heads of different sizes, without liability of injuring the jaw mechanism in case a larger head be inserted than those which they have been particularly adjusted to receive. By turning the screws *u'* the force of the springs may be graduated as desired.

It will be seen that, after the sleeve *d* has been moved rearward for opening the jaws, as indicated in dotted lines, either spring might so far prevail over the other as to throw the rear ends of the thrusting-levers to the one side of a central line, so that, when next advanced to close the jaws, they would not be moved truly, and would fail to properly cooperate on the jaws; and I therefore introduce the parting-block *v*, which is wedge-shaped in front, spindle-shaped at its rear, centrally located with its edge between the ends of the thrusting-levers, and provided with a spring, which forces it forward when the levers move forward, but which permit it to retire when the levers are moved rearward by the sleeve. It will be seen that this parting or guiding block will prevent either spring from forcing the rear ends of the thrusting-levers to the one side or the other, and invariably secure the proper position of the front ends of said levers with relation to the rear ends of the griping-jaws.

My improvements in the dies and their novel mode of adjustment are illustrated in Figs. 3 and 4, Sheet 1.

The sections of die *w* are secured to jaws w^1, which are pivoted at their rear ends to the tail-rod g^2. The die-holder casing *g* is capable of longitudinal movement independently of the tail-rod. The wedge-blocks w^2 are pivoted to the holder, so that the inclined planes on each side of the holder, when this latter is moved forward, cause the dies to close, and when moved backward permit their springs to throw them open, substantially as heretofore.

My improvement in this connection partially consists in the combination, with the jaw dies and holder, of inclined planes or wedge-blocks *x*, which are adjustable longitudinally within the holder. They are well fitted to slide within the holder, and are attached to a movable cross-bar, *x'*, having an upward-projecting lug, which extends through a slot in the top of the holder, and connects with a finely-threaded screw, which is tapped into a worm-gear actuated by a finely-threaded thumb-screw, *y*, in such a manner that by turning the thumb-screw the inclined planes may be withdrawn or advanced, and thereby cause the threading-dies to approach more or less closely to each other. It will be seen that this construction in no manner affects the time of the opening or closing of the jaws, because the adjustment is effected without changing the relations of the tail-rod and holder. It will also be seen that each section of die *w* is square, has a central hole for receiving a screw by which it is attached to its jaw, a threaded recess in each side, and is inwardly beveled on all sides, so that, when two of these sections are placed side by side for service, the front face of each inclines rearward from the threaded opening.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, with a pair of revolving griping-jaw spindles, capable of intermittent rotation on an axis common to both, substan-

tially as described, of threading-dies, and a milling-tool, which, in operating upon a blank, positively secures its axial adjustment in the jaw of one of the spindles, substantially as described, whereby, when the spindles change position, the blank is presented to the threading-dies truly coincident with the axis of the spindle and the center of the die, as set forth.

2. The combination, with revolving griping-jaw spindles in an intermittingly-revolving yoke-frame, and the threading-dies, of the counter-shaft, two cam-sleeves thereon, driven by it intermittingly, a clutch for each sleeve, and mechanism by which the clutches are connected with and controlled by the threading-dies, substantially as described, whereby the cam-sleeves alternate in their movements, and in regular order cause the jaw of one spindle to open and close, the threading-dies to close and advance, open and retreat, and the spindles to change with reference to the threading-dies, as set forth.

3. A pair of jaw-spindles mounted rotatively at one end in a circular head-plate, which revolves in an annular bearing, and is connected to a yoke and axis, which supports the rear ends of the spindles, substantially as described, the same constituting an improvement in a yoke-frame, whereby the spindles are placed closely side by side, and a smooth and easy change of position effected, as set forth.

4. A pair of continuously-revolving jaw-spindles mounted in a yoke-frame which intermittingly revolves, in combination with an intermediate sleeve on the axis of the frame, which is geared to both spindles and continuously driven, substantially as described.

5. The combination, with the spindle containing the jaws, thrusting-levers, and sliding sleeve, of cam-levers which bear upon the rear ends of the thrusting-levers with yielding pressure, substantially as described, whereby the jaws may be closed upon and made to hold the heads of blanks of various sizes, without liability of injury to the jaw-operating mechanism, as set forth.

6. The combination, with the jaws, thrusting-levers, sliding sleeve, and yielding cam-levers, of springs for the cam-levers, which are adjustable to varied pressure, substantially as described.

7. The combination, with the jaws, thrusting-levers, sliding sleeve, and yielding cam-levers, of a parting-block, which secures the proper relation of the thrusting-levers to each other and to the jaws, substantially as described.

8. A four-sided sectional threading-die, inwardly beveled at each edge, centrally drilled, and provided with threaded recesses, substantially as described, and for the purposes specified.

9. The combination, with threading-dies mounted on jaws attached to a tail-rod of a die-holder, inclosing the die-jaws, and provided with wedge-blocks for closing the dies, of adjustable wedge-blocks for causing the dies to approach more or less closely to each other without affecting the relations of the tail-rod and holder and the time of opening or closing the dies, substantially as described.

10. The combination, with threading-dies, mounted on jaws sliding within a die-holder and connected with a tail-rod, of a cam attached to the holder, a gear and cam on the tail-rod, and a vibrating lever provided with a segmental toothed plate, substantially as described, whereby the holder is advanced independently of the tail-rod and the dies closed, as set forth.

11. The combination, with the die-holder, the dies, the tail-rod, its cam and geared lever, of the cam on sleeve E^2, the sliding bar with spring-finger, and lever connecting with the tail-rod, substantially as described, whereby the dies after being closed are advanced with yielding pressure, as set forth.

12. The combination, with the threading-dies, the main shaft, the counter-shaft, the two cam-sleeves, and their clutches, of the cam *s*, loosely mounted on the main shaft, the clutch-lever s^1, the clutch *r*, keyed to the main shaft, the bell-crank lever *q*, and the sliding rod o^3, controlled by the threading-dies, substantially as described, whereby the dies at the terminal forward movement rotatively connect one of the sleeves to the counter-shaft, which sleeve, in turn, causes the spindles to change position and the jaws of one spindle to open and close, disconnect said sleeve from the counter-shaft, and connect said shaft with the second sleeve, substantially as set forth.

13. The combination, with the counter-shaft and the two cam-sleeves, of the clutch which connects sleeve E^2 with the shaft, a spring shipper-bar which engages with the clutch, and is moved longitudinally by a cam on said sleeve for opening the clutch, a spring lever or catch which holds the shipper when thus moved, and a catch-controlling device on sleeve E′, for permitting the shipper to again close its clutch, and thereby connect sleeve E^2 with the counter-shaft, substantially as described.

14. The combination, with the threading-dies, of the clutch *r* on the main shaft, controlled by the forward terminal movement of the dies, the cam *p* on main shaft, driven by the clutch, and the sliding-rod *o′*, which engages with the die-holder, substantially as described, whereby the dies are opened and the die holder or block moved backward after the threading operation, as set forth.

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