(No Model.) 3 Sheets—Sheet 1.

C. A. JOHNSON.

DIE FOR CUTTING SCREW THREADS.

No. 427,872. Patented May 13, 1890.

Fig. 1.

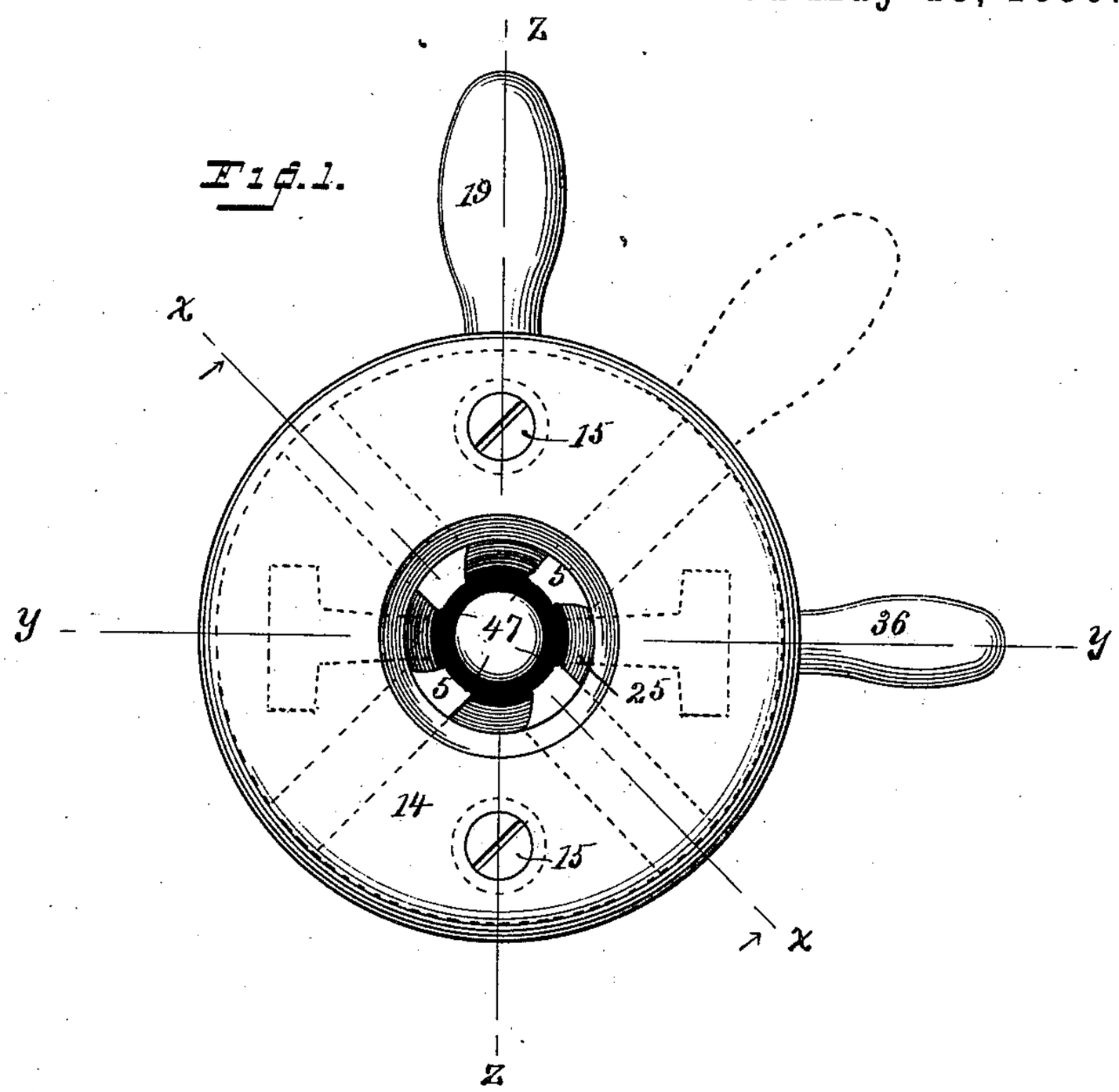
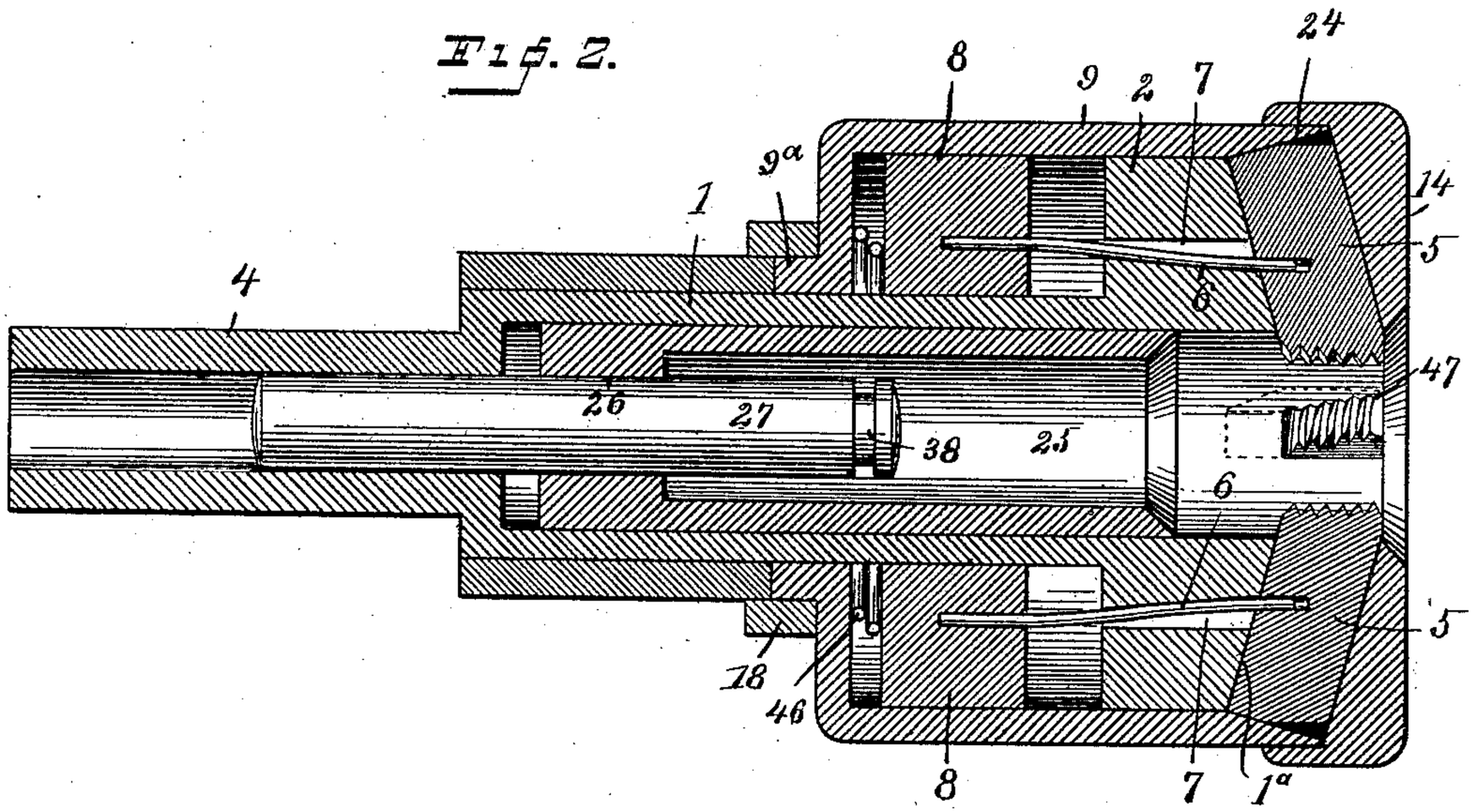


Fig. 2.



WITNESSES

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

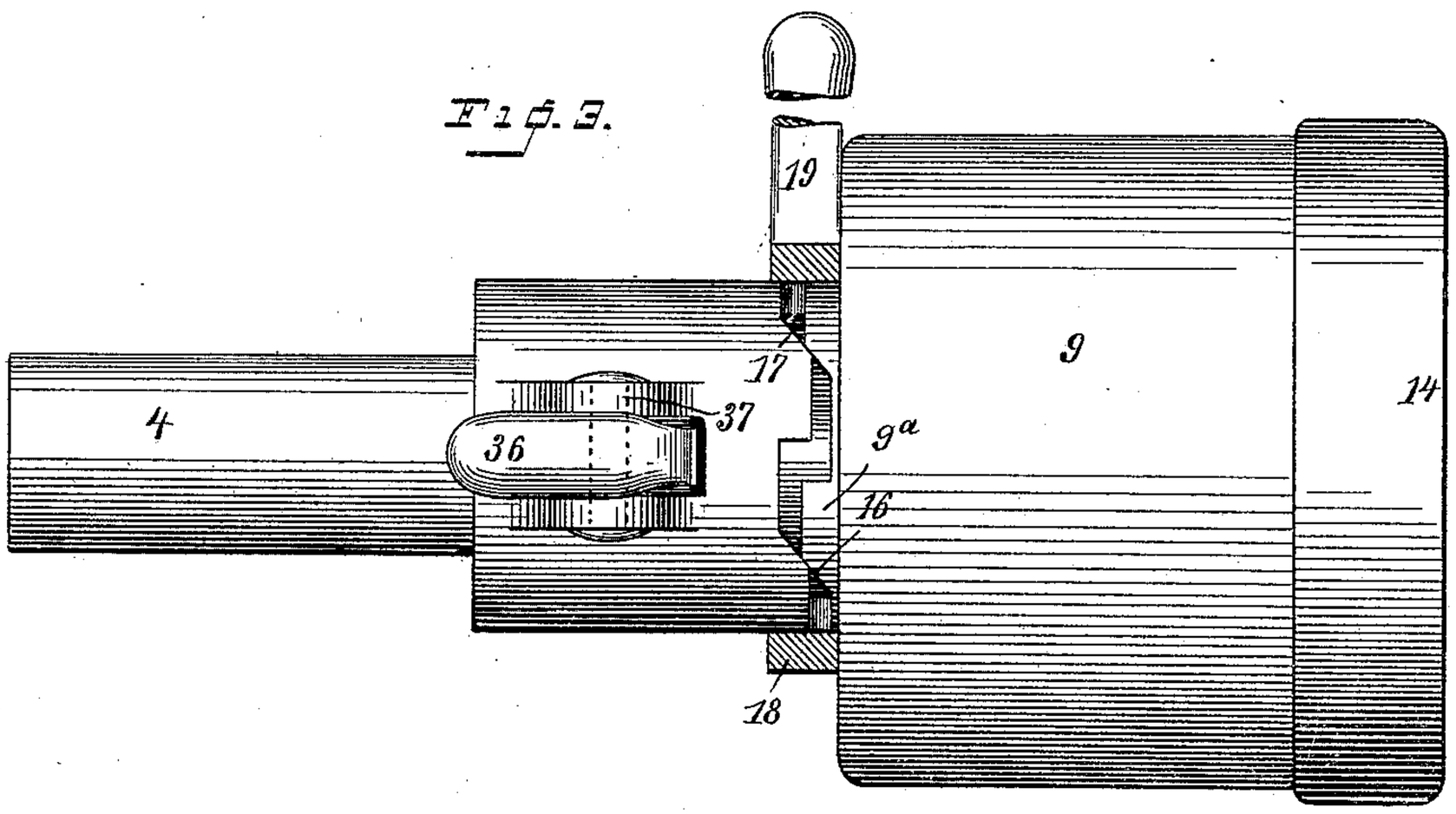

Fig. 8.

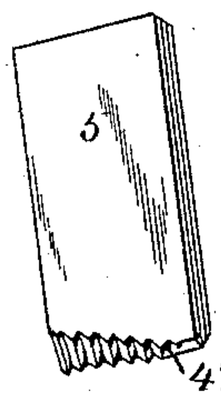

Fig. 9.

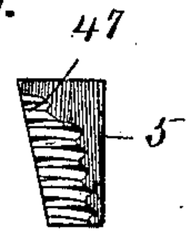

Fig. 10.

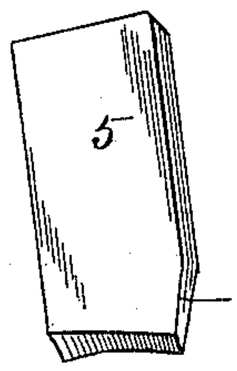

Fig. 4.

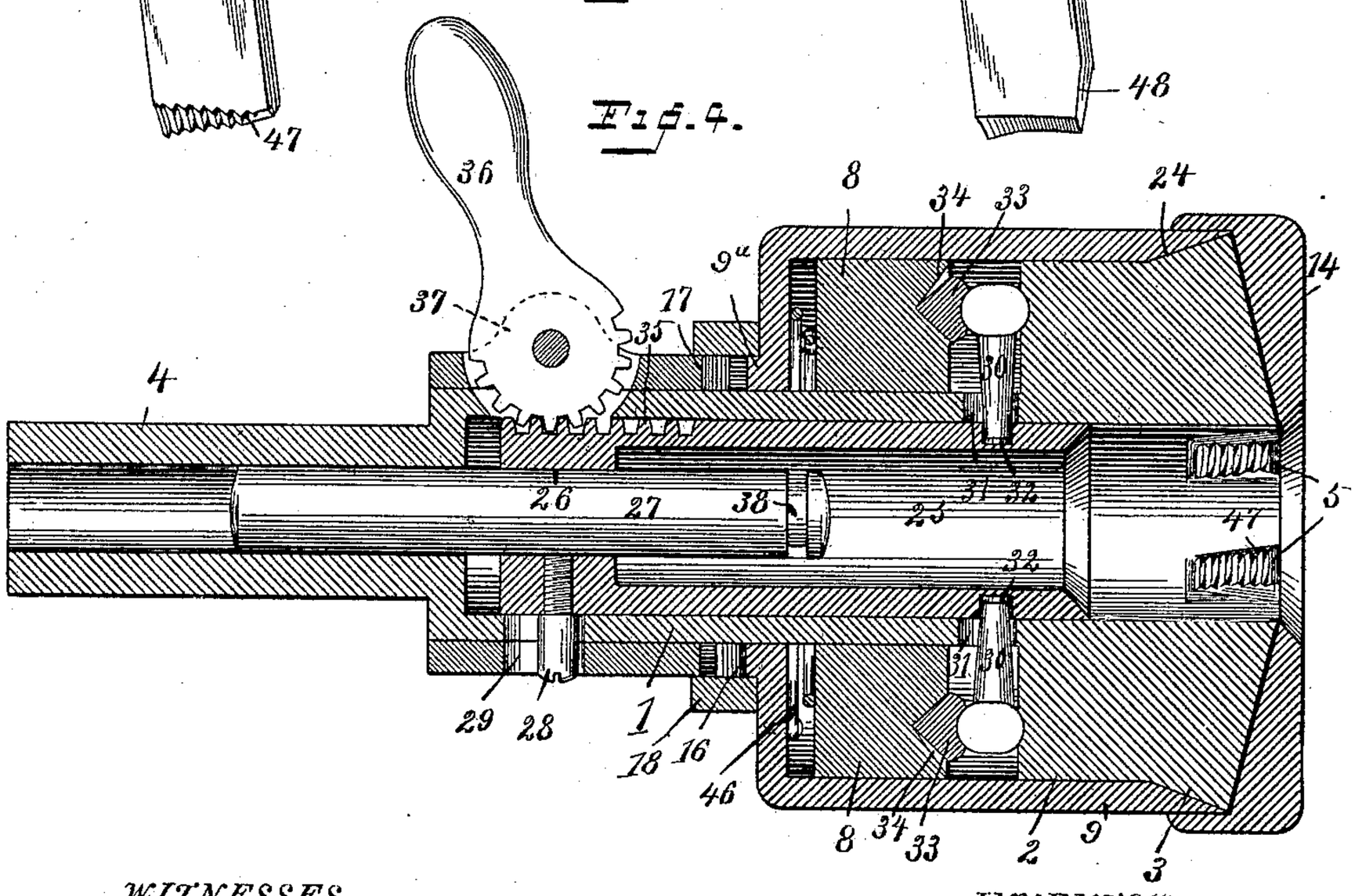

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Fig. 5.

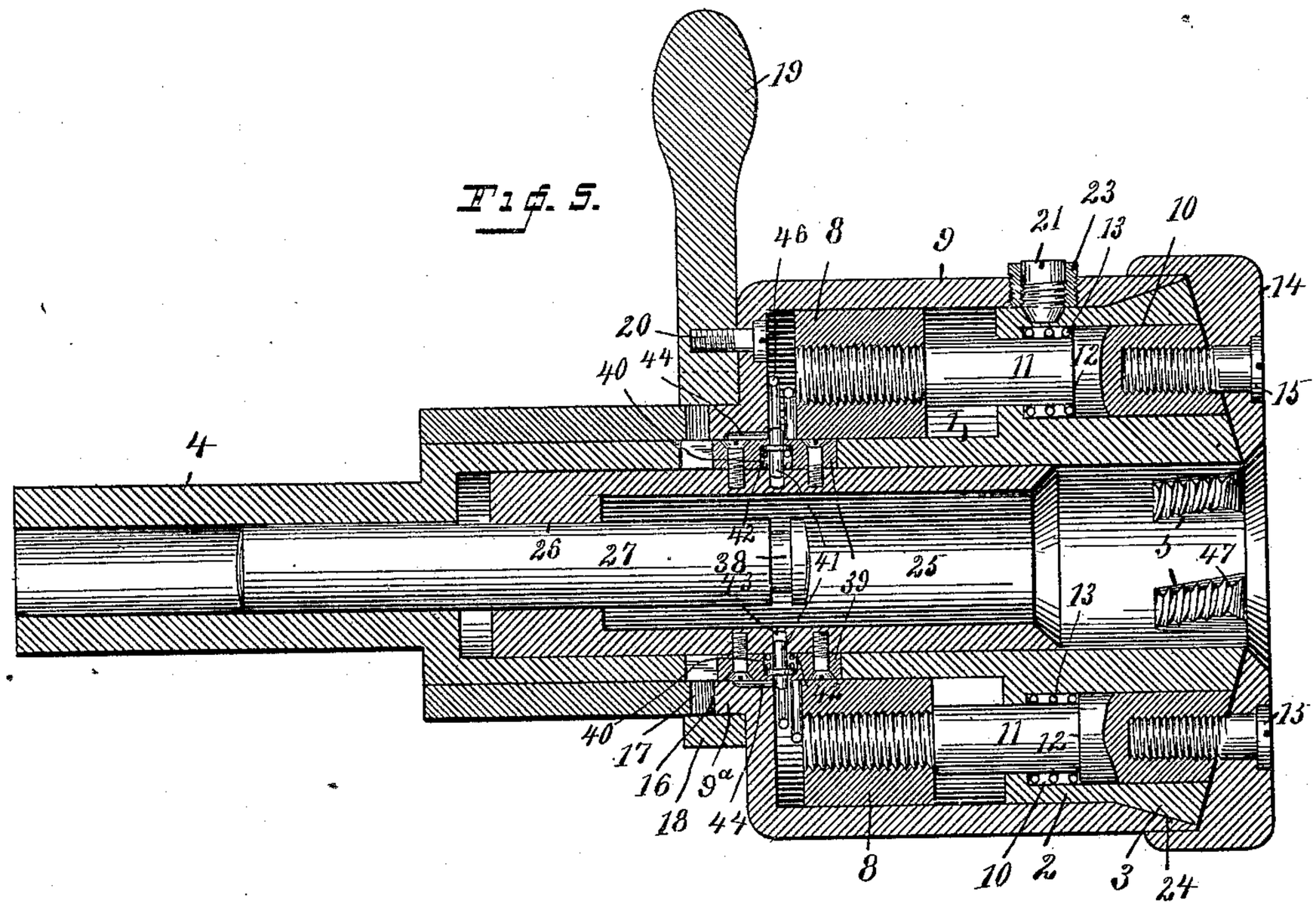


Fig. 6.

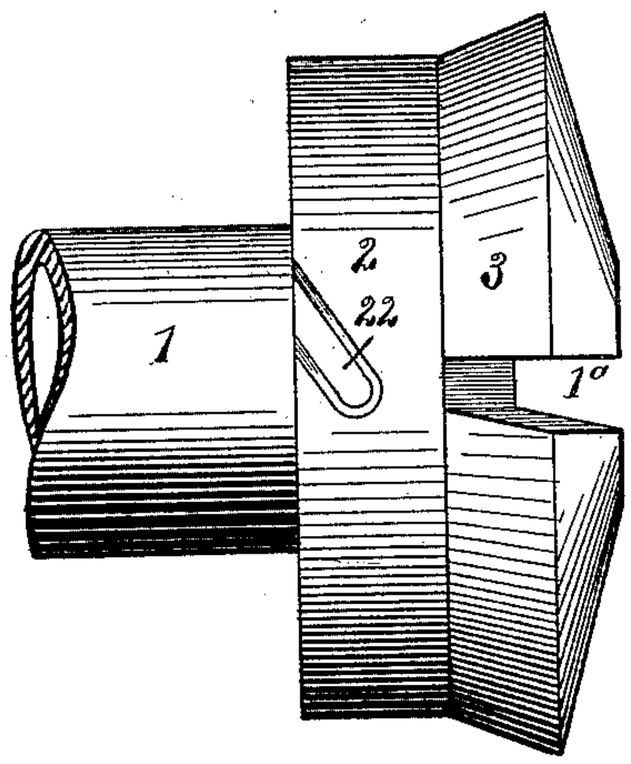
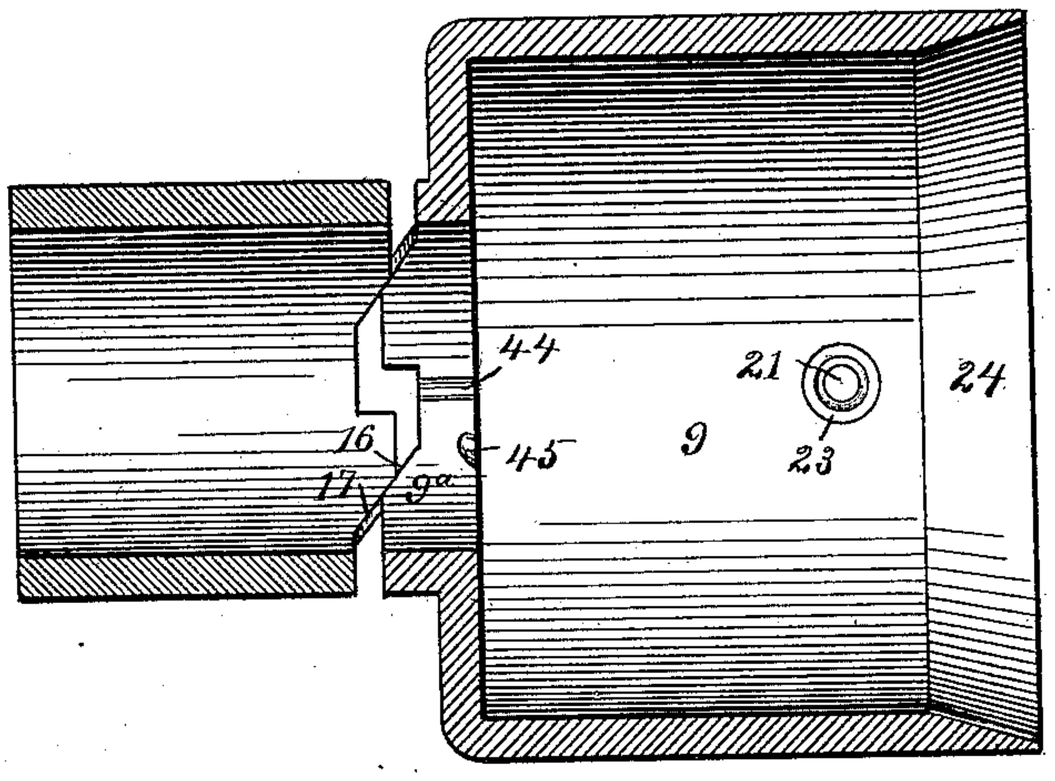


Fig. 7.



WITNESSES

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UNITED STATES PATENT OFFICE.

CHARLES A. JOHNSON, OF BRIDGEPORT, CONNECTICUT.

DIE FOR CUTTING SCREW-THREADS.

SPECIFICATION forming part of Letters Patent No. 427,872, dated May 13, 1890.

Application filed February 3, 1890. Serial No. 338,984. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. JOHNSON, a subject of the King of Sweden, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Thread-Cutters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has for its object to produce a machine-tool of this class adapted for general use, and especially adapted for use upon turret-lathes, which may be set to cut any desired length of thread upon a rod or bolt, and which, when the required length of thread has been cut, will act automatically to retract the jaws and release the bolt, the cutter-head, moreover, being equally well adapted to carry the various cutting and turning-down tools commonly used in connection with turret-lathes.

With these ends in view, and in order to generally improve the construction and operation of this class of machines, I have devised the simple and novel construction of parts and combinations of elements of which the following description, in connection with the accompanying drawings, is a specification, numbers being used to denote the several parts.

In order to avoid multiplicity of drawings, while at the same time the invention shall be made clear to those familiar with the art, I have illustrated one position of all of the parts fully by means of sectional views, but have shown the parts in one position only. It is believed that the reverse position will be clearly understood from the description in connection with the illustrations given, all of the views showing the position of the parts at the instant that the dies are thrown into operative position and before the die-actuating mechanism has returned to its normal position.

Figure 1 is a front elevation; Fig. 2, a longitudinal section on the line *x x* in Fig. 1; Fig. 4, a longitudinal section on the line *y y* in Fig. 1; Fig. 5, a longitudinal section on the line *z z* in Fig. 1; Fig. 3, an elevation as seen from the right in Fig. 1; Fig. 6, an elevation of the forward end of the head detached; Fig. 7, a longitudinal section of the rotating outer shell and the cam-sleeve detached, showing the cam-inclines by which the sleeve is moved forward to set the dies; Fig. 8, a perspective of a thread-cutting die detached; Fig. 9, a front elevation of a die; and Fig. 10 is a perspective of a novel form of cutter, which may be substituted for the dies.

1 denotes the head, having the usual central opening, at the outer end of which is a cylindrical enlargement 2 and an outwardly and upwardly beveled enlargement 3, all preferably cast, however, in a single piece. The shank 4, which is tubular, is attached in any ordinary or preferred manner to the turret of the lathe. (Not shown.)

5 denotes the dies, the front ends of which are beveled, and which lie in correspondingly-shaped recesses 1^a in the head, and are adapted to be thrown forward, so that their cutting-faces extend into the central opening. In practice the dies are made slightly wider than the recesses in the head and project beyond the head sufficiently to permit them to be clamped by the cap and locked in position, as will presently be fully explained. The dies are thrown to their retracted position, when released, by means of springs 6, which loosely engage the dies and extend backward through openings 7 in the head, the openings being made sufficiently large to allow them to work freely, the rear ends of said springs being fixed in a ring 8, which is adapted to slide longitudinally on the head and fills the space between the head and shell 9, the shell having rotary motion independently of the ring, as will presently be explained. In the forward end of the head are sockets 10, (see Fig. 5,) which receive the enlarged outer ends of rods 11. These rods are provided with shoulders 12. Between these shoulders and the bases of the sockets are springs 13, the action of which is to force the rods outward—that is, toward the right—as seen in Fig. 5. The reduced ends of these rods pass through the bottoms of the sockets and are threaded to engage ring 8, as clearly shown in said figure. At the forward end of the head is a cap 14, which is rigidly secured to rods 11 by screws 15, passing in from the front. At the rear end of the shell and projecting backward therefrom is a hub 9^a, having cam-inclines

16, which are adapted to engage corresponding inclines on a sleeve 17, (see Figs. 5 and 7,) which is rigidly secured to the head ordinarily in practice by a drive fit. Outside of sleeve 17, and covering both sets of cam-inclines as well as the space between them when the dies are at their closed position, as shown in the drawings, is a collar 18, which is provided with an operating-handle 19, this handle being rigidly secured to the shell by a screw 20, passing through the shell from the inner side and engaging the handle. (See Fig. 5.)

21 denotes a set-screw, which passes through the shell, and the point of which engages an inclined groove 22 in the head. (See Figs. 5, 6, and 7.) It will be noticed (see Figs. 5 and 6) that the point of the screw and the edge of the groove are both beveled. This is in order to give the greatest nicety of adjustment in stopping the forward movement of the shell when the dies are thrown to their closed position. Should it be required to throw the dies farther in, the set-screw is turned outward slightly. If they are not to be thrown forward quite so far, the screw is turned inward. The engagement of the beveled point of the set-screw with the inner end of the beveled groove stops the forward movement of the shell and also the inward movement of the dies. In practice I preferably seat this set-screw in a hardened bushing 23, itself threaded to engage the shell, instead of seating the set-screw directly in the shell. The bushing holds the screw very much steadier than would be possible if it were seated in the shell, and may itself be adjusted if necessary. It will be noticed that the forward end of the shell is beveled downward and inward, as at 24. This bevel is adapted to engage corresponding bevels at the outer ends of the dies to force the latter inward, when the shell is moved forward by engagement of cam-inclines 16 on the shell with the corresponding inclines on sleeve 17.

The normal position of handle 19, which operates the shell, is somewhat to the right of the position shown in full lines in Figs. 1, 3, and 5, the approximate normal position of this handle being indicated by dotted lines in Fig. 1. To throw the dies from the retracted to the closed position, the operator moves handle 19 from the position shown in dotted lines in Fig. 1 to the position shown in full lines. This movement causes the cam-inclines on the shell to engage the corresponding inclines on the sleeve 17, thereby moving the shell forward, as clearly shown in Figs. 4, 5, and 7.

In order to lock the dies in the closed position after they have been thrown to said position by oscillation of the shell in the manner just described, and also to automatically release the dies after the threading of the bolt or rod has been completed, I provide certain mechanism, which I will now describe. 25 is a sliding piece adapted to reciprocate within the central opening in the head. The base—that is, the inner end of this piece—is closed by a solid web of metal, through which is an opening 26. 27 denotes a plunger, against which the end of the bolt (not shown) strikes in its forward movement at the completion of the threading operation. This plunger is adjustably secured in position in sliding piece 25 in any suitable manner, preferably by means of a set-screw 28 in said piece, the head of which is elongated and extends outward through a slot 29 through the head and sleeve 17. 30 denotes toggles, the shanks of which pass through slots 31 in the head and engage sockets 32 in piece 25. The heads 30^a of these toggles bear, respectively, against the back of cylindrical enlargement 2 upon the head and rocking pieces 33, which lie in V-shaped slots 34 in the forward face of ring 8, these slots being wider than the rocking pieces, so as to permit said pieces to swing on their bases, as will presently be described. The shape of the toggles, as seen in elevation, is shown in dotted lines in Fig. 1. The heads 30^a of the toggles are preferably made elliptical in cross-section, and their sides are rounded, as shown in Fig. 4, their opposite sides lying in correspondingly-rounded sockets in the rear face of the enlargement of the head and the faces of the rocking pieces. At the rear end of piece 25 are rack-teeth 35, which are engaged by corresponding teeth at the inner end of a toothed lever 36, pivoted between ears 37 upon the outer side of the head. (See Figs. 3 and 4.) After the dies have been thrown to their closed position the operator, by means of toothed lever 36, throws piece 25 forward from its retracted position to the position shown in Fig. 4. This movement carries forward the shanks of the toggles and swings the heads thereof and the rocking pieces to the position shown in Fig. 4. This throws ring 8 backward, and consequently, by means of threaded rods 11 and screws 15, (see Fig. 5,) draws the cap inward tightly against the dies, locking them rigidly at their closed position. (See Fig. 2.) This forward movement of piece 25 also sets the plunger so that it will release the dies at the instant the threading operation is completed, it being of course understood that before threading a lot of bolts or rods the plunger is so adjusted that the required length of thread will be cut upon each. As the threading operation is completed the rod or bolt in its forward movement engages the plunger and moves it, together with sliding piece 25, backward. This movement also carries the shanks of the toggles backward, tilting the elliptical heads, so that they lie obliquely relatively to the position shown in Fig. 4, throwing the rocking pieces outward, so that the backward pressure against ring 8 is entirely released, and by means of threaded rods 11 and screws 15 releasing the pressure of the cap upon the dies, so that die-springs 6 act instantly to throw the dies

to their retracted position. It will of course be understood that this same movement will have carried toothed lever 36 from the position shown in Fig. 4 to its reverse position (not shown)—that is, the position in which it is ready to be operated to lock the dies after they have been moved inward again to thread another bolt. It will be noticed that I provide a groove 38 near the forward end of the plunger. This is in order that a tool may be readily inserted into the central opening in the head and seize the plunger by means of the slot to move it in or out in changing the adjustment, set-screw 28 being loosened and then tightened up again as soon as the proper adjustment is secured.

It will of course be understood that in working this tool rapidly upon a lathe the operator can ordinarily spare but one hand to operate the tool. I therefore provide a locking device which acts automatically to hold the dies at their closed position until they can be rigidly locked there in the manner just described, so that the operator is enabled to use the same hand to operate toothed lever 36 to lock the dies that has just operated handle 19 to oscillate the shell and throw the dies to their closed position. On opposite sides of piece 25 are blocks 39, provided with sockets 40, within which are spring-actuated pins 41. These pins are provided with flanges or shoulders and a spring 42, bearing against piece 25, and the flange or shoulder acts to force said pins outward, the outer ends of the pins passing through holes in the blocks at the bottoms of sockets 40. Holes 43 are provided in piece 25 to receive the inner ends of the pins when they are forced inward, as will presently be explained. On the inner side of hub 9^a and directly opposite each other are longitudinal grooves 44, which are adapted to receive the outer ends of pins 41, and just back of these grooves—that is, in position to receive the ends of the pins when the shell is oscillated and guide them into position to drop into grooves 44—are inclined notches 45, both of said grooves being shown in Fig. 5, and one groove and one of the notches in Fig. 7.

46 denotes a coil-spring, one end of which is connected to ring 8 and the other to shell 9, the action of this spring being to return the shell and handle 19 to their normal position after the dies have been locked in their closed position—that is to say, this spring acts to move handle 19 from the position shown in full lines to approximately the position shown in dotted lines in Fig. 1, in which position it remains during the threading of the bolt and the releasing of the dies, and until it is again seized and swung to the position shown in full lines to throw the dies forward to their operative position again, in which position they are temporarily locked by pins 41 until toothed lever 36 can be operated to cause them to be rigidly clamped in position by the cap.

In practice any ordinary or preferred style of dies may be used, although I preferably use the form of die illustrated in Figs. 8 and 9 and shown in operative position in Figs. 1, 2, 4, and 5.

My novel die differs from the dies heretofore used in this class of machines in that the thread-cutting teeth upon the operative face of the die have a spiral engagement with the surface of the rod or bolt upon which they are acting. I thereby insure that the cutting-threads of the die shall engage as large a proportion as possible of the periphery of the rod, at the same time reducing the size of the die and the contact-surface thereof. It is believed that this spiral engagement of the dies with the rod to be threaded will be clearly understood from Figs. 8 and 9 in connection with Figs. 2, 4, and 5. The first cut of the die upon the rod is at the point denoted by 47. It will be seen in Fig. 1 that this point is considerably forward of the central line of the die and of course of the central line of the rod to be threaded. The front end of the first tooth lies farthest forward, and of course does the most work. The front end of the next tooth lies farther back than the end of the first tooth—that is, not so far toward the right and higher up on the rod. The front end of the third tooth lies farther back than the front end of the second tooth and still higher up on the rod, and so on. It will thus be seen that a horizontal line intersecting the front end of each tooth will lie back of the corresponding line of the tooth next in front of it and in front of the corresponding line of the tooth next behind it, each tooth from the first tooth backward commencing to act higher up on the surface of the rod to be threaded, the last tooth commencing to act nearly or quite at the top of the rod. The curvature of the opposite side of the die—that is, the right side, as seen in Fig. 1—corresponds with the curvature of the side that first engages the rod—that is, the left side, as seen in Fig. 1. In the first tooth, for instance, it is not necessary that the tooth should extend but little, if any, past the central line of the rod that is being threaded, although I have shown it as extending past the center in the drawings. The next tooth upon the right side will extend farther over past the center, the third one still farther, until the last tooth will extend over as far on the opposite side—that is, the right side of the center of the rod—as the first tooth extended over on the left—that is, the front side—of the rod. The essential principle that I carry out is that of a spiral engagement between the teeth and the rod to be acted upon. The first teeth of course do the most work, the rear teeth serving to finish the thread and at the same time to assist in holding the rod firmly.

I find in practice with my novel dies that I get a firmer hold upon the rod than has heretofore been possible and with a shorter bearing, which makes the machine run more

easily and effects a saving in power. Another important feature of my novel dies is, that they are made widest at their outer ends, the back—that is, the right side, as seen in Figs. 1 and 9—being straight, and the front—that is, the left side, as shown in Figs. 1 and 9—tapering backward and inward, it being understood, of course, that the head, as seen in Fig. 1, rotates from right to left. By beveling the dies upon the front side I am enabled to hold them perfectly firmly at all times in their sockets and prevent the slightest shaking, and by making them straight upon the rear side I give them a perfectly firm support, it being understood, of course, that the pressure is toward the back, so that if they were tapering—that is, wedge-shaped—upon both sides the strain in use would tend to force them out of the sockets and would place unnecessary strain upon the locking mechanism. I have described this novel tool as a thread-cutter; but it will of course be apparent that it is equally adapted to hold any other style of cutter.

In Fig. 10 I have illustrated an ordinary style of cutter for turning down bolts and rods. In cutters of this class I make the inner ends—that is, the contact portion with the part of the rod that has been turned down—spiral, the same as in a thread-cutting die, the cutting-edge at the outer end being indicated by 48. It will of course be understood that the sockets or recesses in the head to receive the dies are made to taper inward upon the front—that is, the right side—and are straight upon the back—that is, the left side—to correspond with the shape of the dies or cutters, the shape of this recess being clearly illustrated at 1^a in Fig. 6. This construction prevents the dies from becoming loose under any circumstances, as the inward pressure of the cap will force them into the beveled recesses tightly at all times.

The operation of the entire device is as follows: Suppose the parts to be in the reverse position from that shown in the drawings—that is to say, sliding piece 25 and the plunger retracted, the heads of the toggles lying obliquely, the rocking pieces tilted outward, and the dies retracted. Handle 19 would then be in the position shown in dotted lines in Fig. 1 and toothed lever 36 would be swung forward. I have not shown the bolt or rod to be operated upon or the chuck for carrying the rod, as that forms no portion of my invention. It is sufficient to say that the rod or bolt is carried by a suitable chuck and is rotated thereby. In starting, the operator first closes the dies by movement of handle 19 from the position shown in dotted lines in Fig. 1 to the position shown in full lines. This movement oscillates the shell, and by movement of the cam-inclines forces the shell forward, the bevel at the forward end of the shell acting upon the rear ends of the dies to force them inward. As the shell begins to move forward the spring-actuated pins 41 will pass into inclined notches 45, ride up upon the inner surface of hub 9^a, and will then drop into longitudinal grooves 44. It will of course be understood that this oscillation of the head has been made against the power of spring 46, and that the engagement of the pins with grooves 44 will hold the parts in the position in which they have been placed. This, however, is only a temporary locking of the dies to enable the operator to release handle 19 and use his hand to operate toothed lever 36. The operation of this lever moves forward piece 25, and the plunger swings the shanks of the toggles forward and the heads of the toggles into the horizontal position, as in Fig. 4, at the same time swinging the rocking pieces inward. This forces ring 8 backward and, through threaded rods 11 and screws 15, draws the cap inward upon the dies, forcing them into the beveled recesses and locking them firmly in position. The forward movement of the sliding piece carries spring-actuated pins forward entirely out of grooves 44, that being the exact position of parts shown in Fig. 5. At this instant—that is, as soon as the pins pass out from the grooves—spring 46 will act to oscillate the shell backward to its normal position, this position not being shown in the drawings. After this movement has taken place the ends of pins 41 will be in front of inclined notches 45, but some distance therefrom, in which position they will remain until the engagement of the rod that is being threaded with the plunger shall force sliding piece 25 backward until said pin is ready to enter the notch, as just described. This backward movement of the plunger and sliding piece 25 tilts the toggles, swings the rocking pieces outward, releases the pressure against the ring, and consequently the pressure of the cap upon the dies, and allows the die-springs to force the latter outward, this operation being repeated each time a rod or bolt is threaded, the action being practically instantaneous in use. It will of course be understood that the lathe to which this tool is applied forms no portion of my invention, and that it is operated in the usual or any preferred manner, the head and turret, if used, being upon the slide of the lathe.

In using threading-dies the automatic feed of the lathe is not used, but the slide and head are drawn forward by the engagement of the threading-dies with the rod or bolt that is being acted upon as the latter is rotated, the slide of the lathe and the head being of course moved forward by hand until the threads of the dies are firmly in engagement with the rod or bolt.

When using a cutting or turning-down tool—such, for instance, as illustrated in Fig. 10—the usual feed of the lathe is utilized to move the slide and head forward.

Having thus described my invention, I claim—

1. The combination, with the dies and a rotating forwardly-movable shell for moving

them inward, of spring-actuated pins engaging grooves in the shell to hold the latter in position after the forward movement.

2. The combination, with the dies, an oscillating forwardly-movable shell for throwing them inward, and spring-actuated pins engaging slots in the shell, of a spring 46, one end of which is connected to the shell to carry the latter backward to its normal position when the pins pass out of the slots.

3. The combination, with the dies, cap 14, ring 8, and rigid connections between said cap and ring, of rocking pieces 33, toggles 30, and sliding pieces 25, engaging the shanks of the toggles to oscillate the heads thereof and swing the rocking pieces inward or outward to lock or release the dies.

4. The combination, with the dies and the shell beveled at its forward end to engage the dies and having inclines 16, of a stationary ring having corresponding inclines, whereby when the shell is oscillated it is moved forward by the engagement of the inclines, causing the bevel to force the dies inward.

5. The combination, with the head having beveled groove 22, and the dies, of the oscillating forwardly-movable shell and a set-screw beveled at its point to engage the groove, whereby the forward movement of the shell and the inward movement of the dies may be adjusted.

6. The combination, with the head having beveled groove 22, the dies, and the shell beveled at its forward end to engage the dies and having inclines 16, of a set-screw 21, beveled at its point to engage the groove, and a stationary ring having inclines engaging inclines 16, whereby when the shell is oscillated it is moved forward by the engagement of the inclines, forcing the dies inward until its movement is stopped by the engagement of the set-screw with the groove.

7. The combination, with the head having beveled groove 22, the dies, and the shell beveled at its forward end to engage the dies and having inclines 16, of a set-screw 21 in a bushing in the shell, the point of which is beveled to engage the groove, and a stationary ring having inclines engaged by inclines 16, whereby when the shell is oscillated it is moved forward, as and for the purpose set forth.

8. The combination, with the head having sockets 10, the dies, and cap 14, of ring 8, rods 11, connected to the ring and to the cap and having shoulders in the sockets, and springs in said sockets acting against the shoulders to force the cap outward and to release the dies.

9. The combination, with the head having sockets 10, the dies, and cap 14, of ring 8, rods 11, connected to the ring and to the cap and having shoulders in the sockets, springs in said sockets acting to force the cap outward to release the dies, and toggle mechanism engaging the ring to move the cap inward to lock the dies.

10. The head having beveled inclined groove 22 and sockets to receive the dies, in combination with the oscillating forwardly-movable shell having a bevel at its forward end to force the dies inward, and a bevel-pointed set-screw engaging the groove to limit the forward movement of the shell.

11. The combination, with the head, ring 8, cap 14, and rigid connections between said cap and ring, of the toggles and rocking pieces and a sliding piece whereby the toggles are operated, as and for the purpose set forth.

12. In a tool of the class described, locking mechanism consisting, essentially, of a cap, ring, rigid connections between said cap and ring, rocking pieces, and toggles having heads engaging the rocking pieces.

13. The combination, with the dies and an oscillating forwardly-movable shell having a bevel to force the dies inward, and grooves 44, of spring-actuated pins 41, adapted to engage said grooves, as and for the purpose set forth.

14. The combination, with the dies and an oscillating forwardly-movable shell having a bevel to force the dies inward, and grooves 44, of reciprocating cylindrical piece 25, carrying spring-actuated pins adapted to engage grooves 44 to lock the parts in position after the movement of the shell, and spring 46, adapted to return the shell to its normal position after the forward movement of piece 25 has carried the pins beyond the grooves.

15. In a tool of the class described, the combination, with an oscillating forwardly-movable shell having grooves 44 and inclined notches 45, of longitudinally-moving piece 25, spring-actuated pins carried thereby, which enter the notches and engage the grooves when the shell is moved forward, locking the latter in position, and a spring 46, acting to return the shell to its normal position when the forward movement of piece 25 has carried the pins out of the slots.

16. In a tool of the class described, a head having recesses 1^a, straight upon the back and inclining inward and backward on the front, in combination with dies widest at their outer ends, straight upon the back, and tapering inward and backward upon the front, and a cap acting to force said dies backward into the recesses to lock them firmly in position.

17. The head having recesses 1^a, straight upon the back sides and tapering upon the front sides, in combination with dies shaped to correspond with said recesses, and a cap acting to force the dies into said recesses, as and for the purpose set forth.

18. The head having recesses 1^a, straig upon the back sides and tapering upon the front sides, and dies shaped to correspond with said recesses, in combination with cap 14, ring 8, rigid connections between said cap and ring, and toggle mechanism adapted to draw the cap inward to clamp the dies in the recesses.

19. The head having recesses 1^a, shaped as described, dies shaped to correspond therewith, ring 8, cap 14, and rigid connections be-

tween said cap and ring, in combination with rocking pieces 33, engaging sockets in the ring, toggles having elliptical heads engaging the rocking pieces and the head, and a sliding piece by which the toggles are operated, as and for the purpose set forth.

20. A die for cutting threads having a spiral operative surface, the first thread adapted to engage a rod past the center on the right side, and each succeeding thread upon the right side adapted to engage a rod higher up and extending a corresponding distance downward on the opposite side, substantially as described.

21. A threading-die widest upon its outer end, straight upon its back side, and tapering backward and inward on its front side, as and for the purpose set forth.

22. A threading-die widest at its outer end, straight upon its back side, and tapering backward and inward upon its front side, and having cutting-teeth upon its inner edge arranged in spiral form, the front teeth extending farthest over on the front side in cutting and the rear teeth extending a corresponding distance over upon the back side, as and for the purpose set forth.

23. A thread-cutting die the first tooth of which extends past the central line of the die and of the rod to be threaded, each succeeding tooth beginning nearer to the central line and extending a greater distance over past the central line on the opposite side.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES A. JOHNSON.

Witnesses:
A. M. WOOSTER,
ARLEY I. MUNSON.