No. 642,312. Patented Jan. 30, 1900.

F. A. ERRINGTON.

AUTOMATICALLY OPENING OR CLOSING DIE.

(Application filed Oct. 25, 1899.)

(No Model.)

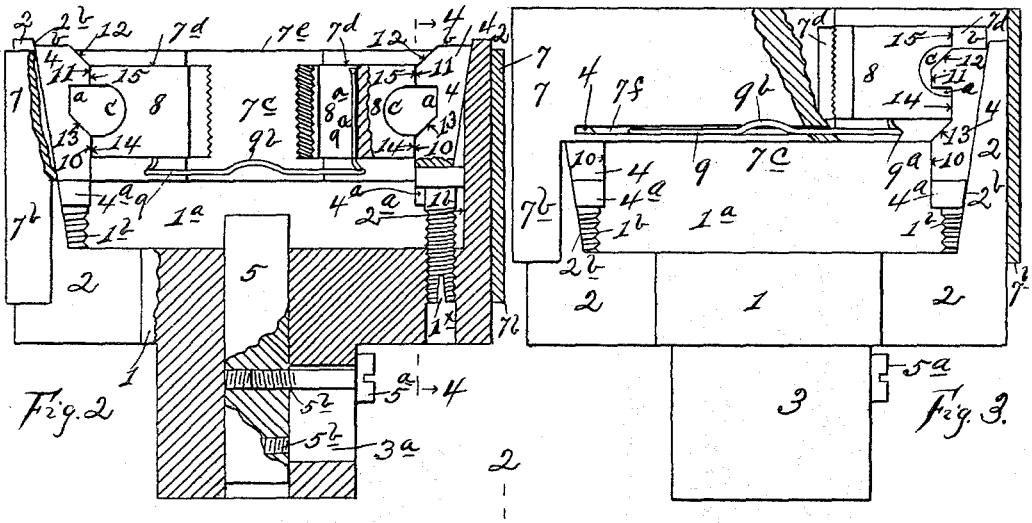

Fig. 2.

Fig. 3.

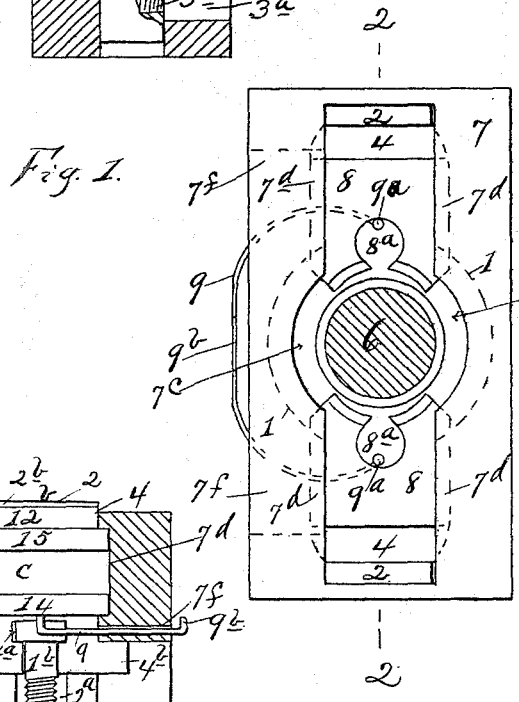

Fig. 1.

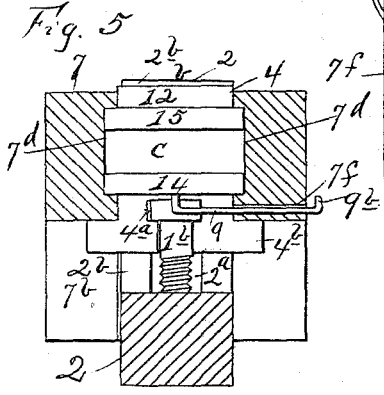

Fig. 5.

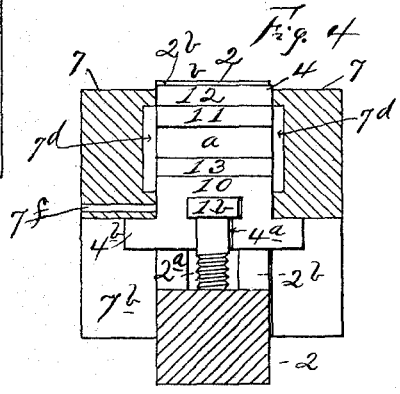

Fig. 4.

Witnesses:
R. Wilkens.
A. J. Wilson

Inventor
F. A. Errington

UNITED STATES PATENT OFFICE.

FRANKLIN A. ERRINGTON, OF NEW YORK, N. Y.

AUTOMATICALLY OPENING OR CLOSING DIE.

SPECIFICATION forming part of Letters Patent No. 642,312, dated January 30, 1900.

Application filed October 25, 1899. Serial No. 734,727. (No model.)

To all whom it may concern:

Be it known that I, FRANKLIN ALFRED ERRINGTON, a citizen of the United States of America, residing in New York city, borough of Richmond, county and State of New York, have invented certain new and useful Improvements in Automatically Opening or Closing Dies, of which the following is a specification.

My improvements relate more particularly to tools for cutting screw-threads wherein the dies are adapted to have sufficient movement axially and laterally of their supporting-body to open by coaction with the work or article upon which they cut screw-threads and to close through the medium of pressure exerted either against them or against the part along which they travel; and one object of my invention is to simplify and improve the construction of this class of tools to the end that the dies will be held accurately and firmly with respect to the diameter of the work or article operated upon while in the operative position and will yet be free to travel axially of the work according to the pitch of the threads being cut.

Another object of my invention is to facilitate the removal of the dies from the device.

Another object of the invention is to permit the dies to be turned one hundred and eighty degrees to reverse the ends of their cutting-faces and still permit the portions I term "external" thrust-faces to be formed upon the dies themselves.

Another object of the invention is to improve and simplify the arrangement of supporting and adjusting the internal thrust-faces of the body that coact with said external thrust-faces of the dies.

Another object of my invention is to provide an improved arrangement of spring to hold the dies in contact with the body thrust-faces to keep dirt, chips, &c., from getting between the thrust-faces, and generally to hold the parts in their proper positions while permitting their ready removal from the device; and my invention further consists in the novel details of improvement that will be more fully hereinafter set forth and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part hereof, wherein—

Figure 1 is an end view of a device embodying my invention, showing the parts in the open position, affording clearance between the dies for the removal of the work. Fig. 2 is a partly-sectional view on the line 2 2 in Fig. 1, the dies being shown in the closed or cutting position, half of the inner parts of the device being shown in full lines. Fig. 3 is a similar view, the dies being shown in the inoperative or open position. Fig. 4 is a vertical cross-section on the line 4 4 in Fig. 2 looking in the direction of the arrows; and Fig. 5 is a similar view taken on the same plane, but looking in the opposite direction.

Similar numerals and letters of reference indicate corresponding parts in the several views.

1 indicates the supporting-body of the device, shown provided with the shank 3 for connection with either the turret or live-spindle of a lathe or similar machine-tool. Abutments 2 project from body 1, with openings 1^a between them, which afford ready egress for the escape of chips, &c. The body 1 is preferably internally tapered on the inner surfaces of its abutments 2 at 2^b, and the said tapered faces are shown indented by grooves 2^a, shown placed diametrically opposite and extending parallel with the axis of body 1. I preferably provide body 1 with laterally-adjustable internal thrust-faces by placing them on adjusting-blocks 4, whose externally-tapered surfaces abut against the internally-tapered surfaces 2^b of abutments 2. To adjust the blocks 4 axially and laterally of body 1 and for holding them axially rigid in the position adjusted, I have shown the lower portion of each of the blocks 4 pierced by a T-slot 4^a, extending laterally of body 1. From each of said blocks 4 extends in a direction parallel with the axis of body 1 an adjusting and holding member, shown in the form of a flanged screw-threaded rod 1^b, whose flange and shank correspond in section with said T-slot 4^a. This slip-joint connection permits the part 1^b to rotate in slot 4^a independently of block 4 to adjust the block axially of body 1 in unison with adjusting-screw 1^b, the fit of the flange of said adjusting-screw being such as to hold said block 4 rigidly in position axially of body 1 when adjusted and yet permit said block to slide along said flange laterally

of body 1 independently of the adjusting-screw 1^b. The parts 1^b when in the form of screws preferably mesh with threaded bores shown in line therewith in body 1, and the lower ends of said screws are preferably split at $1^\times$, so as to have an outward spring tendency to bind in place, and at the same time this slot $1^\times$ will serve to receive a right-angle screw-driver or similar tool for operating the screw. As shown in Figs. 2 and 3, the flange of adjusting-screw 1^b extends through block 4 into the groove 2^a in its associate abutment 2, and by this means the part 1^b is brought about to the normal center of the adjusting-block 4 to maintain the maximum bearing thereupon, while said block 4 is moved laterally thereof during its axial adjustment by the internally-tapered surfaces 2^b of abutments 2. A die-holder 7 preferably surrounds the abutments 2 and is movable therealong axially of body 1. To limit the inward axial movement of die-holder 7, I provide upon blocks 4 lateral projections 4^b, which abut against the inner surface of die-holder 7, said die-holder being utilized as an adjusting-ring by adjusting said blocks 4 to bring their projections or lugs 4^b to bear simultaneously upon said inner surface of said die-holder. Alining-pieces 7^b project from the back of said die-holder 7 along and overlap the body 1. The die-holder 7 is provided with a die-chamber 7^c, whose side walls are preferably indented by internal slideways 7^d. A pair of threading dies or chasers 8 are inserted through the enlarged entrance 7^e to said die-chamber, said dies being substantially rectangular in cross-section and the ways 7^d being of such dimensions that the dies are a sliding fit therein. To enable the dies 8 to center themselves within reasonable limits relatively to the axis of rigidly-held work, the width of abutments 2 is such relatively to the width of die-chamber 7^c and its extensions along the overlapping portions 7^b (similar allowance being made in fitting screws 1^b to T-slots 4^a) that the die-holder 7 can have slight lateral movement upon said abutments at right angles to the lateral movement of dies 8 along said die-holder. (See Figs. 1, 4, and 5.) It being desirable to keep the dies 8 in contact with the adjusting-blocks 4, I provide a spring 9, preferably located in a slot 7^f, cut laterally through the die-holder at right angles to the axis of body 1. I preferably term said spring a "bow-spring," its ends 9^a being bent in such a manner as to enter clearance-holes 8^a provided in the dies, while its central bowed portion projects through the slot 7^f. To retain the spring 9 in slot 7^f, I have shown said spring waved or bent at an angle to said slot in the portion that normally projects beyond the upper surface of die-holder 7 at 9^b and so arranged as to be compressible when slipping through slot 7^f and to expand when therebeyond. The pressure of spring 9 also prevents accidental movement of blocks 4 laterally of body 1 independently of adjusting-screws 1^b.

The main object of my invention being to cause the dies 8 to contact or approach each other to the operative position and to expand or move away from each other to the open or inoperative position to release the work without reversing the direction of rotation of the driving member, I provide means whereby this opening and closing of the dies can be effected by and during their movement axially of body 1. For this purpose I have provided the body 1 with internal thrust-faces, preferably formed upon blocks 4 rather than integral with body 1, as aforesaid. To shorten the travel of the dies 8 axially of body 1 in passing from the operative to the open position, and vice versa, I provide each of the dies 8 at its end opposite its cutting-face with a plurality of external thrust-faces 14 15, the external thrust-face 14 being shown located farther within the body 1 than its associate external thrust-face 15, and said associate external thrust-faces are divided by a recess *c*, and I correspondingly divide the internal face of each of the blocks 4 by placing an internal thrust-face 10 farther within the body 1 than an associate internal thrust-face 11 in such a manner as to subdivide the internal face of block 4 to provide an intervening space or recess *a* to receive the inner external thrust-face 14 of the associate die when the dies 8 are in the open position. I preferably term the face 10 of each of the blocks 4 the "inner" internal thrust-face and its associate face 11 the "outer" internal thrust-face, said associate thrust-faces being preferably shown located in line and parallel with the axis of body 1 and separated from each other by an intervening recess *a*, which extends outwardly beyond its respective thrust-face 10, and I have provided a cam 13, leading from said recess *a* to its respective internal thrust-face 10. I have also provided a cam-face 12, leading from the space or recess *b*, that is beyond the outer internal face 11, said recess *b* corresponding in function with the recess *a*. Either or both of said cams may be used, as desired. Thus the opposed internal thrust-faces 10 11 and their associate cam-faces 12 13 and the recesses *a b* provide a die-chamber 7^c between the blocks 4 having a succession of inner and outer sections or portions of different diameters, the outer portion *a* of said chamber beyond its respective set of internal thrust-faces 10 and the outer portion *b* of said chamber beyond its respective set of internal thrust-faces 11 each being of greater diameter than the respective inner portions of said chamber between said internal thrust-faces. I preferably term the face 14 of each of the dies 8 the "inner" external thrust-face and its associate face 15 the "outer" external thrust-face, said associate thrust-faces being preferably shown located in line with each other and parallel with the axis of body 1 and having a recess *c* between them. The recess *c* is preferably located centrally of the die and extends thereacross at right angles to the axis

of body 1, rendering the thrust-faces 14 15 equal and the die reversible to bring the inner end of its cutting-face outward for presentation against the work when the outer end thereof has become worn. The thrust-faces 14 15 of the dies are adapted to bear upon the thrust-faces 10 11 of the blocks 4 when the dies are in the operative position, and the recesses *c* or the dies are adapted to receive the outer external thrust-faces 11 of the blocks when said dies are in the expanded or inoperative or work-releasing position, the body-recesses *a* of the blocks at the same time receiving the inner external thrust-faces 14 of the dies, while the spaces or recesses *b* beyond the blocks provide clearance for the outer external thrust-faces 15 of the dies. The dies are also adapted to coact with the cams 12 13 when said dies are being pushed inwardly axially of body 1, said cams pushing said dies inwardly laterally of body 1 during said inward axial movement until the external thrust-faces of the dies pass beyond the plane of the internal thrust-faces of the body, (on blocks 4,) whereupon the dies can be pushed farther inward axially of body 1 until the inner surface of die-holder 7 abuts against the lugs 4^a of blocks 4, which bring the external thrust-faces of the dies to register with the internal thrust-faces of the body in full engagement and the dies will be in the operative position. The planes of the thrust-faces all being shown parallel with the axis of body 1, the dies will retain a uniform cutting-diameter when moving axially of body 1 until such time as their external thrust-faces 14 15 slip off the internal thrust-faces 10 11, whereupon the dies will expand outwardly laterally of body 1. It will be understood that by adjusting the blocks 4 relatively to each other laterally of body 1 (by means of internally-tapered faces 2^b and adjusting-screws 1^b) the diameter between the cutting-faces of the dies when in the operative position can be varied to cut the size required. It will be understood that as the die-holder 7 moves axially of body 1 the dies will be carried in the same direction with it and that when moving axially of body 1 the thrust-faces of the dies will either move into engagement with the thrust-faces of the adjusting-blocks 4 or out of engagement therewith; also, that when said external thrust-faces of the dies move out of engagement with the internal thrust-faces of the blocks the projections of the dies upon which their inner external thrust-faces 14 are carried will mesh with the recesses *a* of the blocks in such manner as to prevent the escape of the die-holder from the abutment 2; likewise, that to remove the dies the blocks 4 must be moved laterally of the body 1 until their T-slots clear the flanges of screws 1^b, and to do this the spring 9 must be sufficiently compressed and be free to rise above the surface of die-holder 7. The reupon the blocks 4 are slipped out of the die-holder and one of the dies 8 is pushed into register with the central entrance portion 7^e of the die-chamber 7^e, whereupon the spring 9 slides along the slot 7^f and pushes the other die 8 over into the space left vacant by the removal of the abutment 2 and block 4 from that side, and then the first-mentioned die can be withdrawn through opening 7^e and out of engagement with the end 9^a of the spring. The other die is then pnshed over to the central opening 7^e, during which time the spring 9 slides along the slot 7^f in the opposite direction to permit the second die to be removed, as before, the spring 9 being retained in its slot 7^f by its waved or bent portion 9^b. The dies are inserted at the central opening 7^e by their clearance-holes 8^a receiving one end 9^a of spring 9 and then sliding along the ways 7^d until the other end of the spring 9 can mesh with the clearance-hole of the other die, which is similarly inserted. Then the blocks 4 are inserted between the dies and the alining-pieces 7^b, and then the abutments 2 are inserted between the blocks and said alining-pieces until the blocks 4 can be pressed together and their T-slots brought into mesh again with the flanges of the adjusting-screws 1^b, when the parts resume their proper relative positions under the influence of spring 9.

When it is desired to open the dies automatically by the inner end of the work abutting against an internal part of the device, I provide the shank 3 with a suitable bore to receive a stop 5, shown provided with tapped holes 5^b to receive a set-screw 5^a, which projects through an elongated slot 3^a in shank 3, the head of said screw 5^a bearing upon the outer surface of shank 3 to clamp stop 5 rigidly to body 1 when adjusted, said arrangement permitting said stop 5 to be externally adjusted.

The operation of the device may be described as follows: The parts being in the position shown in Fig. 3, with the die-holder 7 in the outward or open position of the dies, a rod or piece of work to be threaded is brought to bear against the outer face of one or both of the dies 8 or against the die-holder 7 (or pressure by any other means being brought to bear against the dies or die-holder) and pushes said die-holder axially along body 1, whereupon the dies will ride up the cam or cams 12 13 of the adjusting-blocks 4 toward each other laterally of body 1, and said pressure being continued said die-holder and dies will continue to move axially of body 1 until the die-holder comes to rest against the projections or lugs 4^a of blocks 4, whereupon the parts will be in their operative position, as illustrated in Fig. 2, with the dies closed. The threading of the work will now proceed until the advance of the work relatively to body 1 is stopped by some means, as by the inner end of the work abutting against the adjustable stop 5. The work or the tool continuing to rotate after the cessation of the relative axial movement of the work and body

1, the dies will immediately start to cut their way outwardly axially of body 1 along the work 6, whereupon the thrust-faces 14 15 of the dies will be drawn along the thrust-faces 10 11 of the blocks 4, but will continue to bear firmly upon the same during said axial movement of the dies 8, holding the dies 8 in perfect alinement and diameter of their cutting with relation to the axis of work 6 until the edges of the thrust-faces 14 15 of the dies slip off the outer edges of the thrust-faces 10 11 of the blocks 4, whereupon the dies 8 will expand laterally of the body 1 in passing from the inner to the outer portions of the die-chamber 7c, and the work 6 will be released from the dies 8.

I do not limit my invention to the details of construction shown and described, as they may be varied without departing from the spirit thereof.

Having now described my invention, what I claim is—

1. The combination with a body provided with a die-chamber having a succession of inner and outer sections located in line, each of said inner sections being provided with internal thrust-faces and being separated from its associate inner section by an outer section, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof, each of said dies being provided at its end opposite its cutting-face with a plurality of external thrust-faces that are correspondingly separated from each other and bear simultaneously upon said internal thrust-faces during operation, and each of said outer sections extending outwardly beyond the internal thrust-faces of its respective inner section to provide clearance for the respective external thrust-faces of the dies when in the open position, substantially as described.

2. The combination with a body provided with a die-chamber having a succession of inner and outer sections located in line, each of said inner sections being provided with internal thrust-faces and being separated from its associate inner section by an outer section, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof, each of said dies being provided at its end opposite its cutting-face with a plurality of external thrust-faces that are correspondingly separated from each other and bear simultaneously upon said internal thrust-faces during operation, and each of said outer sections extending outwardly beyond the internal thrust-faces of its respective inner section to provide clearance for the respective external thrust-faces of the dies when in the open position, said dies being movable axially of said body during operation independently of said internal thrust-faces, substantially as described.

3. The combination with a body provided with inner and outer internal thrust-faces, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof, each of said dies being provided at its end opposite its cutting-face with inner and outer external thrust-faces that bear against said internal thrust-faces during operation, each of said inner internal thrust-faces being located farther within said body than its associate outer internal thrust-face to provide an intervening space to receive the inner external thrust-face of the associate die when in the open position, substantially as described.

4. The combination with a body provided with inner and outer internal thrust-faces, the planes of said thrust-faces being parallel with the axis of said body, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof, each of said dies being provided at its end opposite its cutting-face with inner and outer external thrust-faces that bear against said internal thrust-faces during operation, each of said inner internal thrust-faces being located farther within said body than its associate outer internal thrust-face to provide an intervening space to receive the inner external thrust-face of the associate die when in the open position, substantially as described.

5. The combination with a supporting-body provided with inner and outer internal thrust-faces, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof, each of said dies being provided at its end opposite its cutting-face with inner and outer external thrust-faces that bear against said internal thrust-faces during operation, each of said inner internal thrust-faces being located farther within said body than its associate outer internal thrust-face to provide an intervening space to receive the inner external thrust-face of the associate die when in the open position, said dies being movable axially of said body during operation independently of said internal thrust-faces, substantially as described.

6. The combination with a supporting-body provided with inner and outer internal thrust-faces, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof, each of said dies being provided at its end opposite its cutting-face with inner and outer external thrust-faces that bear against said internal thrust-faces during operation, each of said inner internal thrust-faces being located farther within said body than its associate outer internal thrust-face to provide an intervening space to receive the inner external thrust-face of the associate die when in the open position, said dies being movable axially of said body during operation independently of said internal thrust-faces, and a cam or cams, substantially as described.

7. The combination with a body provided with inner and outer internal thrust-faces having a recess between them, of a plurality of dies connected with said body to rotate in

unison therewith and movable laterally thereof, each of said dies being provided at its end opposite its cutting-face with inner and outer external thrust-faces having a recess between them and being adapted to bear simultaneously upon the corresponding body thrust-faces during operation, substantially as described.

8. The combination with a supporting-body provided with inner and outer internal thrust-faces having a recess between them, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof, each of said dies being provided at its end opposite its cutting-face with inner and outer external thrust-faces having a recess between them and being adapted to bear simultaneously upon the corresponding body thrust-faces during operation, said dies being movable axially of said body during operation independently of said internal thrust-faces, substantially as described.

9. The combination with a supporting-body provided with inner and outer internal thrust-faces having a recess between them, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof, each of said dies being provided at its end opposite its cutting-face with inner and outer external thrust-faces having a recess between them and being adapted to bear simultaneously against the corresponding body thrust-faces during operation, and a cam or cams, substantially as described.

10. The combination with a body provided with inner and outer internal thrust-faces located in line and having a recess between them, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof, each of said dies being provided at its end opposite its cutting-face with inner and outer external thrust-faces located in line and having a recess between them, said die thrust-faces being adapted to bear against said body thrust-faces during operation and said body-recess to receive the inner external thrust-face of the die while the recess of the die receives the outer internal thrust-face of the body when said dies are in the open position, substantially as described.

11. The combination with a supporting-body provided with inner and outer internal thrust-faces located in line and having a recess between them, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof, each of said dies being provided at its end opposite its cutting-face with inner and outer external thrust-faces located in line and having a recess between them, said die thrust-faces being adapted to bear against said body thrust-faces during operation, and said dies being movable axially of said body during operation independently of said internal thrust-faces, substantially as described.

12. The combination with a body provided with inner and outer internal thrust-faces located in line and having a recess between them, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof, each of said dies being provided at its end opposite its cutting-face with inner and outer external thrust-faces located in line and having a recess between them extending centrally across the outer face of the die at right angles to the axis of said body to render the die reversible, said die thrust-faces being adapted to bear against said body thrust-faces during operation, substantially as described.

13. The combination with a supporting-body provided with adjusting-blocks, each of said adjusting-blocks having an internal thrust-face that is parallel with the axis of the body and means to adjust said blocks relatively to each other laterally of the body, of a die-holder connected with the body to rotate in unison therewith and movable axially thereof, and a plurality of dies movable along said die-holder laterally of the body and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable with said die-holder axially of said body during operation independently of said internal thrust-faces, substantially as described.

14. The combination with an internally-tapered supporting-body provided with externally-tapered adjusting-blocks having internal thrust-faces, said body being provided with screws adapted to have engagement with said blocks to lock them from movement axially of the body, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable axially of said body during operation independently of said internal thrust-faces, substantially as described.

15. The combination of a supporting-body provided with adjusting-blocks having internal thrust-faces, means to adjust said blocks axially and laterally of said body and means to hold said blocks from movement axially of said body while permitting them to have movement laterally thereof, with a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable axially of said body during operation independently of said internal thrust-faces, substantially as described.

16. The combination of a supporting-body provided with adjusting-blocks having internal thrust-faces, means to adjust said blocks relatively to each other laterally of said body

and adjusting-screws adjustably connected with said body, each of said blocks having a slip-joint connection with its associate adjusting-screw to move in unison therewith axially of the body and independently thereof laterally of the body, with a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable axially of said body during operation independently of said internal thrust-faces, substantially as described.

17. The combination of a body provided with internally-tapered abutments, each of said abutments having its tapered face indented by a groove extending therealong, adjusting-blocks having internal thrust-faces and provided with T-slots extending laterally of said body, flanged screws adjustably carried by said body and having their flanges in mesh with said T-slots and extending into said grooves, with a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable axially of said body during operation independently of said internal thrust-faces, substantially as described.

18. The combination with a supporting-body provided with adjusting-blocks having internal thrust-faces, of a die-holder connected with said body to rotate in unison therewith and movable axially thereof, said die-holder and blocks having abutting members to regulate the movement of said die-holder axially of said body, and a plurality of dies movable along said die-holder laterally of said body and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable with said die-holder axially of said body during operation independently of said internal thrust-faces, substantially as described.

19. The combination with a supporting-body provided with internal thrust-faces, of a die-holder connected with said body to rotate in unison therewith and movable axially thereof, and a plurality of dies movable along said die-holder laterally of said body and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable with said die-holder axially of said body during operation independently of said internal thrust-faces, said die-holder also having movement laterally of said body to permit said dies to center themselves with the axis of rigidly-held work, substantially as described.

20. The combination with a body provided with internal thrust-faces, of a plurality of independent dies connected with said body to rotate in unison therewith and movable laterally thereof and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, and a spring or springs to press said dies outwardly laterally of said body, substantially as described.

21. The combination with a supporting-body provided with internal thrust-faces, of a die-holder connected with said body to rotate in unison therewith and movable axially thereof, and a plurality of dies movable along said die-holder laterally of said body and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable with said die-holder axially of said body independently of said internal thrust-faces, and a spring or springs to press said dies outwardly laterally of said body, substantially as described.

22. The combination with a supporting-body provided with internal thrust-faces, of a die-holder connected with said body to rotate in unison therewith and movable axially thereof, and a plurality of dies movable along said die-holder laterally of said body and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable with said die-holder axially of said body independently of said internal thrust-faces, and a bow-spring having its ends adapted to press said dies apart, substantially as described.

23. The combination with a supporting-body provided with internal thrust-faces, of a die-holder connected with said body to rotate in unison therewith and movable axially thereof, and a plurality of dies movable along said die-holder laterally of said body and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable with said die-holder axially of said body independently of said internal thrust-faces, and a spring to press said dies outwardly laterally of said body, said die-holder having a slot to guide said spring, substantially as described.

24. The combination with a supporting-body provided with internal thrust-faces, of a die-holder connected with said body to rotate in unison therewith and movable axially thereof, and a plurality of dies movable along said die-holder laterally of said body and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable with said die-holder axially of said body independently of said internal thrust-faces, and a bow-spring having its ends bent into engagement with said dies, said die-holder having a slot extending laterally of said body to guide said

spring, and means to retain said spring in said slot, substantially as described.

25. The combination of a supporting-body provided with adjusting-blocks having internal thrust-faces, means to adjust said blocks relatively to each other laterally of said body and means to hold said blocks from movement axially of said body while permitting them to have movement laterally thereof, with a die-holder connected with said body to rotate in unison therewith and movable axially thereof, and a plurality of dies movable along said die-holder laterally of said body and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable with said die-holder axially of said body during operation independently of said internal thrust-faces, and a spring or springs to retain said adjusting-blocks in position, substantially as described.

26. The combination with an internally-tapered supporting-body provided with externally-tapered adjusting-blocks having internal thrust-faces and T-slots in their lower ends, flanged adjusting-screws adjustably carried by said body and having their flanges in mesh with said T-slots, said screws being rotatable independently of said blocks to adjust the latter axially of the body and said blocks being movable laterally of the body independently of said screws, a die-holder carried by said body to rotate in unison therewith, and a plurality of dies movable along said die-holder laterally of said body and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable with said die-holder axially of said body, of a spring or springs to retain said adjusting-blocks in mesh with said screws, substantially as described.

27. The combination with a supporting-body provided with inner and outer internal thrust-faces located in line and having a recess between them, a die-holder connected with said body to rotate in unison therewith and movable axially thereof, and a plurality of dies movable along said die-holder laterally of said body and with said die-holder axially of said body, each of said dies being provided at its end opposite its cutting-face with inner and outer external thrust-faces located in line and having a recess between them, of a spring or springs to press said dies apart to cause their inner external thrust-faces to mesh with the recesses between the inner and outer internal thrust-faces of the body to regulate the outward movement of the die-holder axially of the body, substantially as described.

28. The combination with a supporting-body provided with internal thrust-faces, of a plurality of independent dies connected with said body to rotate in unison therewith and movable laterally thereof and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable axially of said body during operation independently of said internal thrust-faces, and a die-holder movable axially of said body and provided with a slideway that meshes with said dies to connect said dies to move in unison with said die-holder axially of said body and independently of each other along said die-holder laterally of said body, substantially as described.

29. The combination with a body, of dies connected with said body to rotate in unison therewith and movable laterally thereof, said body having an elongated slot, and an adjustable stop having a projection secured thereto and extending through and movable axially of said body in said slot to permit said stop to be externally adjusted axially of said body, and means to retain said stop in position when adjusted, substantially as described.

30. The combination with a supporting-body provided with internal thrust-faces and means to adjust said thrust-faces relatively to each other laterally of said body, of a plurality of dies connected with said body to rotate in unison therewith and movable laterally thereof and provided at their ends opposite their cutting-faces with external thrust-faces that bear against said internal thrust-faces during operation, said dies being movable axially of said body during operation independently of said internal thrust-faces, substantially as described.

F. A. ERRINGTON.

Witnesses:
R. WILKENS,
D. J. WILSON.