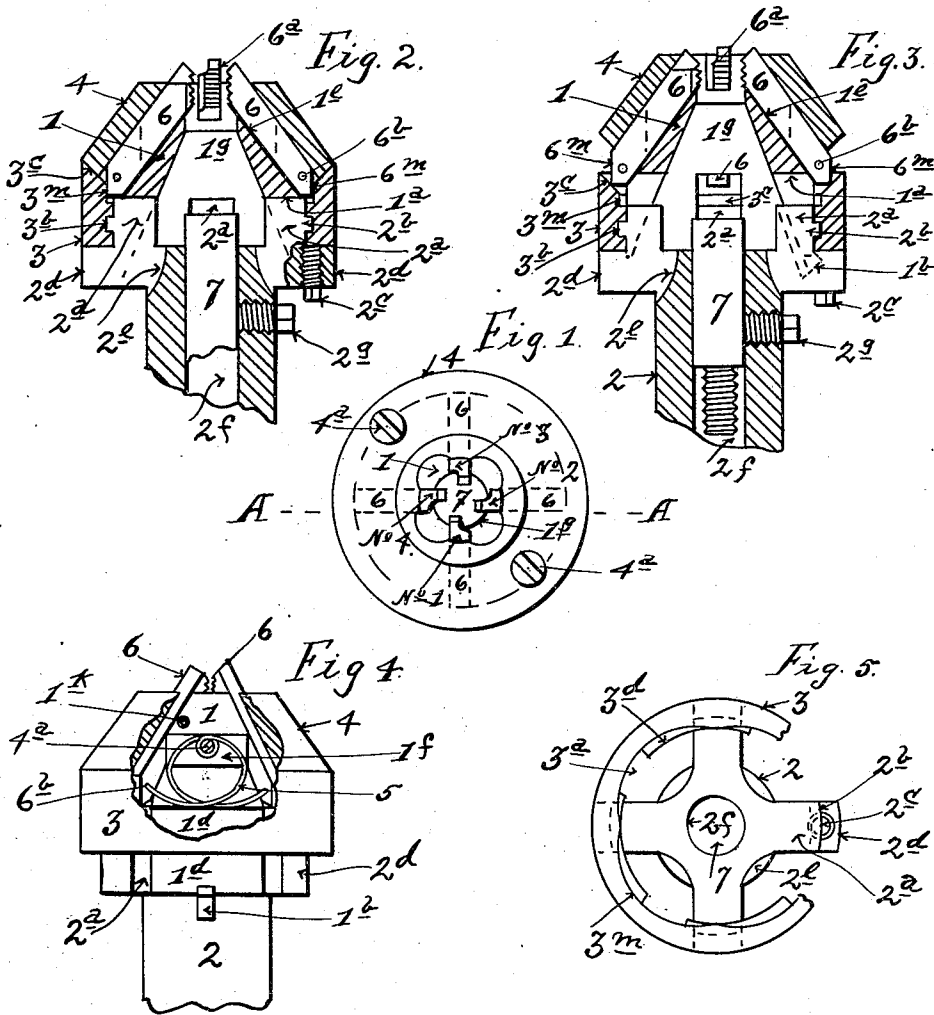


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AUTOMATICALLY OPENING DIE.
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AUTOMATICALLY-OPENING DIE.

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To all whom it may concern:

Be it known that I, FRANKLIN ALFRED ERRINGTON, a citizen of the United States of America, residing at No. 12 Townsend avenue, Stapleton, Staten Island, New York State, have invented new and useful Improvements in Automatically-Opening Dies, of which the following is a specification.

My improvements relate broadly to means whereby tangent screw-cutting teeth can be applied to the inner end-faces of radially-opening dies; and more particularly to an automatically opening die-head in which the spiral coaction of the teeth of the dies with the threads already cut upon the work by the dies causes the internal thrust-faces of a retaining-ring and the external thrust-faces of the dies to move longitudinally of the device along or independently of each other during the continuance of the cutting operation until the lateral bearing of said thrust-faces upon each other is terminated by said thrust-faces being thus moved out of line laterally with each other, whereupon the dies will expand along two converging angles at which I have placed the closing-cam face of the retaining-ring and the die-slideways of a die-holder, by which means I secure a novel mode of operation in that the dies are collapsed axially within the die-holder by the movement of the die-holder and the retaining-ring axially of each other, and the consequent coaction of the angular die-slideways of the die-holder and the angular closing cam-face of the retaining-ring with the dies during the radial expansion of the dies under the lateral outward pressure exerted by the teeth cut upon the work against the teeth upon the dies, whereby the dies are forced open at the forward angle of the closing cam-face upon the retaining-ring, thereby relieving the pressure of the dies upon the interior walls of the angular cap and minimizing the friction of the dies in their slideways at the instant that the dies are called upon to move therealong; and the invention further consists in the novel details of improvement and combination of parts as hereinafter described, illustrated in the drawings, and then pointed out in the claims.

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

Figure 1 is a front end view of a device embodying my invention, the parts being

shown in the closed, or cutting position of the dies; Fig. 2 is a vertical cross-section of Fig. 1 on the line A—A; Fig. 3 is a similar view to Fig. 2, except that the parts are shown in the open position of the dies; Fig. 4 is a side elevation of the device, the cap and retaining-ring being broken to show the connection of the expansion spring with the chasers, and also a tapped hole into which can be inserted a suitable clamping-screw to clamp the chasers in their respective positions in the head during the operation of localizing the teeth upon the chasers, as hereinafter described; Fig. 5 is a front view of the device with all parts of the cutting section of the device removed, showing the retaining, adjusting and driving section having a series of eccentric recesses cut in the internal side walls of the retaining-ring by which the cutting diameter of the dies can be adjusted.

The die-holder may be connected by various means with a driving or holding part or shank 2, but I have preferably formed a slip-joint connection between these two parts by the slots 1^a and the abutments 2^a by which these parts are here shown to intermesh to rotate in unison and have independent axial movement. A retaining-ring 3 is provided with slots 3^a (Fig. 5) by which it can be slipped over the arms 2^a until a groove 3^b, cut in the inner walls of ring 3, registers with projections 2^b provided on arms 2^a, whereby a turn of ring 3 will cause groove 3^b and projections 2^b to intermesh to hold the ring 3 from longitudinal movement relatively to shank 2, yet leave ring 3 free to rotate independently of shank 2. To regulate the rotation of ring 3 upon shank 2 I have tapped a clamp-screw 2^c through one of the shoulders 2^d of arms 2^a in such a manner as to engage the rear face of ring 3 and thereby clamp ring 3 in whatever position it may have been adjusted upon shank 2. I have preferably countersunk the outer or front face of ring 3 at an angle of 45 degrees to form a concentric closing-cam face 3^c, opening upon and extending forwardly and outwardly from four eccentric recesses 3^d cut in the interior side walls of ring 3, the side walls of said eccentric recesses 3^d providing adjustable internal thrust-faces 3^m. A yielding-catch 1^b is shown attached to the aligning-portion 1^a of the die-holder 1, to limit the forward axial movement of die-holder 1, and yet permit the operator to pull the die-

holder and all its cutting section entirely away from the retaining, adjusting and driving section of the device, and to replace the sections together again at will.

5 The front face of die-holder 1 I have preferably shown beveled at an angle of $37\frac{1}{2}$ degrees, and I have cut four die-bearings or die-slideways 1^e which are inclined to the axis of the body at the same angle; and to
10 complete these bearings I have fastened a correspondingly internally tapered cap 4 by two screws 4^a , around which I have entwined two expansion springs 5, located in spring-recesses formed by straightening a
15 portion of the die-holder 1 under the cap 4 at 1^f . The die-holder 1 is provided with an axial socket 1^s , from the front portion of which the die-slideways 1^e radiate, the rear portion preferably enlarging as it recedes and opening into indentures 2^e between the
20 arms 2^a , thereby offering a free passage for any chips that might enter the interior of the device. The side walls of socket 1^s form a seal to prevent the chips getting into the
25 working parts of the device.

In the die-slideways 1^e I place dies or chasers 6 having screw-cutting teeth 6^a at their opposing ends, and external thrust-faces 6^m at their outer ends which bear upon
30 the internal thrust-faces 3^m of ring 3. By rotating the ring 3 upon shank 2 the distance between the cutting teeth of the opposed dies 6 will be increased or diminished according to what portion of the side walls
35 of the eccentric recesses 3^a are brought to bear upon the ends 6^m of the dies 6, and when the desired cutting diameter is thus adjusted, that adjustment can be retained by means of the clamp-screw 2^e holding the
40 ring 3 from further rotation upon shank 2. Near the outer ends of dies 6 I have provided spring-holes 6^b to receive the ends of springs 5, the four dies being controlled by two springs 5, which also act as yielding
45 means to prevent the dies from falling out of the die-holder whenever the device is separated into its two sections, as heretofore explained.

While I may hob the dies in the usual
50 manner after fitting them to my device herein illustrated, yet the construction I have invented lends itself peculiarly to the application of the improved straight or tangent teeth that I have shown at 6^a ; inasmuch
55 as the usual method of fitting the dies to their bearings first and then cutting the teeth on the dies while the dies are locked in their cutting position and thus assure the cutting teeth being in spiral relation with
60 each other, can be reversed in making the chasers shown; so that it is now possible to use tangent teeth on the inner end-faces of radially opening dies under this new and improved construction, whereas the tangent
65 form of teeth has heretofore been limited in

its application to the side faces of dies that are rigidly held in pivotally movable holders, in which the dies are adjusted longitudinally with relation to each other and then
70 clamped in the proper spiral relation with each other to cut screw-threads upon the work,—all of which prohibits a compact and simple device such as herein set forth. By my method I mill or plane the desired pitch of screw-threads straight across the end-
75 faces 6^a of all the dies,—preferably when the blanks have been made the proper width to fit the bearings, but are left deeper than the depth of the bearings; I then put one of the dies (preferably one that I mark No. 1, see Fig. 1) into the die-holder and bring
80 it into mesh with the threaded end of mandrel 7 (which I reverse from the position shown in Figs. 2 and 3 for that purpose), and I clamp the die rigidly in position upon
85 the bottom of its die-slideway and in mesh with mandrel 7 by a suitable screw meshing with the tapped hole 1^k (Fig. 4), which thus also holds the mandrel 7 in place, the mandrel 7 being a nice fit in bore 2^f for that
90 purpose. The other three dies can then be arranged around the mandrel and similarly clamped in their respective spiral relations along the mandrel 7 and in the other three
95 die-slideways 1^e . The outsides of all the dies can then all be trued up with the axis of the device until they correspond with the surface of die No. 1, including the external thrust-faces 6^m and the stop-faces of the dies
100 6^n . The dies are then taken out of the holder and all machined to the same depth as the depth of the die-slideways 1^e and the starts put on as shown in the drawings, so that when reassembled in the device they will all
105 come in the proper spiral relation with each other.

The operation of the various parts when assembled together as described above and shown in the drawings is as follows:—The parts being in the cutting position illustrated in Fig. 2 and the device being either
110 rotated by suitable means applied to shank 2, or shank 2 being equivalently held and the work rotated against the dies, the dies will cut a screw-thread upon the work and the parts remain in the position shown in
115 Fig. 2 until the end of the work engages the stop or mandrel 7, which, being firmly clamped to shank 2 by stop-screw 2^e , will arrest the further advance of the work into
120 the device; whereupon, the outward axial movement of the dies will immediately commence and will continue during the cutting operation until the external thrust-faces 6^m of the dies 6 pass out of line laterally with
125 the internal thrust-faces 3^m of the ring 3, whereupon the converging angles of the closing cam-face 3^e and the inclined die-slideways 1^e will coact to move the die-holder 1 axially of the ring 3 by the lateral
130

outward pressure of the threads cut upon the work coacting against the threads of the dies to force the dies 6 radially outward and simultaneously forward along the forward angle of the closing cam-face 3°, bringing the parts of the device into the positions shown in Fig. 3 and thus permitting the work to be withdrawn without stopping or reversing the direction of rotation of the rotative part. When it is desired to again close the dies 6 into the cutting position, the operator pushes inwardly upon the smooth surface of the cap 4, thereby moving the die-holder 1 axially inward and causing the converging angles of the cam-face 3° and the die-slideways 1° to again coact to project the cutting ends of the dies beyond the face of the die-holder 1, and the continued pressure against cap 4 will replace all the parts in the cutting position illustrated in Fig. 2.

I am aware that inclined dies have been employed in devices that open automatically by an entirely different mode of operation involving a number of parts that obstruct and limit the application of such devices in practical use; whereas, I believe my device, made in two separable sections, the coacting parts of each being set at converging angles with each other that coact to open and close the dies by merely moving one of these sections axially of the other, to be entirely novel in conception, mode of operation and the functional effects secured by this construction, one of them being to enable my dies to cut closer to a flange upon work to be threaded than has heretofore been possible with an axially opening die, because of the unique ability of my device to collapse the dies within the die-holder during the radial opening of the dies; whereas in all previous direct-acting die-heads the dies and die-holder were rigidly connected from axial movement relatively to each other.

Having now described my invention what I claim is:—

1. The combination with a ring whose internal side walls provide internal thrust-faces terminating in a sloping cam-face extending forward and outward therefrom at an angle to the axis of said ring, of a die-holder having an axial socket and a plurality of die-slideways extending radially outward and backward therefrom at a converg-

ing angle with the angle of said cam-face, dies located in said die-slideways and movable therealong, the outer ends of said dies providing external thrust-faces that bear upon said internal thrust-faces during operation, said ring and said die-holder being movable the one axially of the other, during the cutting operation to bring the external thrust-faces of the dies out of line with the internal thrust-faces of the ring, substantially as described.

2. The combination with a ring whose internal side walls provide internal thrust-faces terminating in a sloping cam-face extending outward therefrom at an angle to the axis of said ring, of a die-holder having an axial socket and a plurality of die-slideways extending radially outward and backward therefrom at a converging angle with the angle of said cam-face, dies located in said die-slideways and movable therealong, the outer ends of said dies providing external thrust-faces that bear upon said internal thrust-faces during operation, said ring and said die-holder being movable the one axially of the other during the cutting operation, and a supporting body, said die-holder being connected with said body by a slip-joint to rotate in unison therewith and to have independent axial movement therealong, substantially as described.

3. The combination with a die-holder having an axial socket and a plurality of die-slideways extending radially therefrom, a plurality of dies located in said die-slideways and movable therealong, said dies having straight screw-cutting teeth upon their opposed faces that extend at right angles to the axis of said die-holder and tangent to a common circle when in the cutting position, each of said dies extending its maximum length in a direction radial to said die-holder and at right angles to the straight tangent teeth upon the inner face of the die, means to close to and retain said dies in the cutting position, and means to expand said dies radially therefrom, substantially as described.

New York, Jan. 4th, 1909.

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