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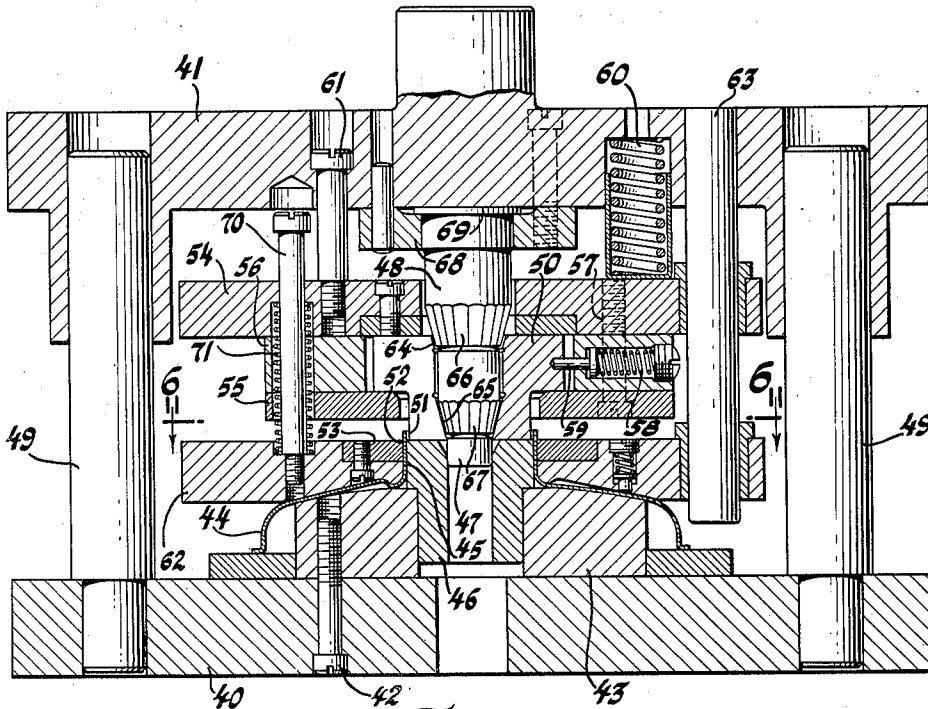
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2,229,393

TRIMMING DIE

Filed June 8, 1940

3 Sheets-Sheet 2



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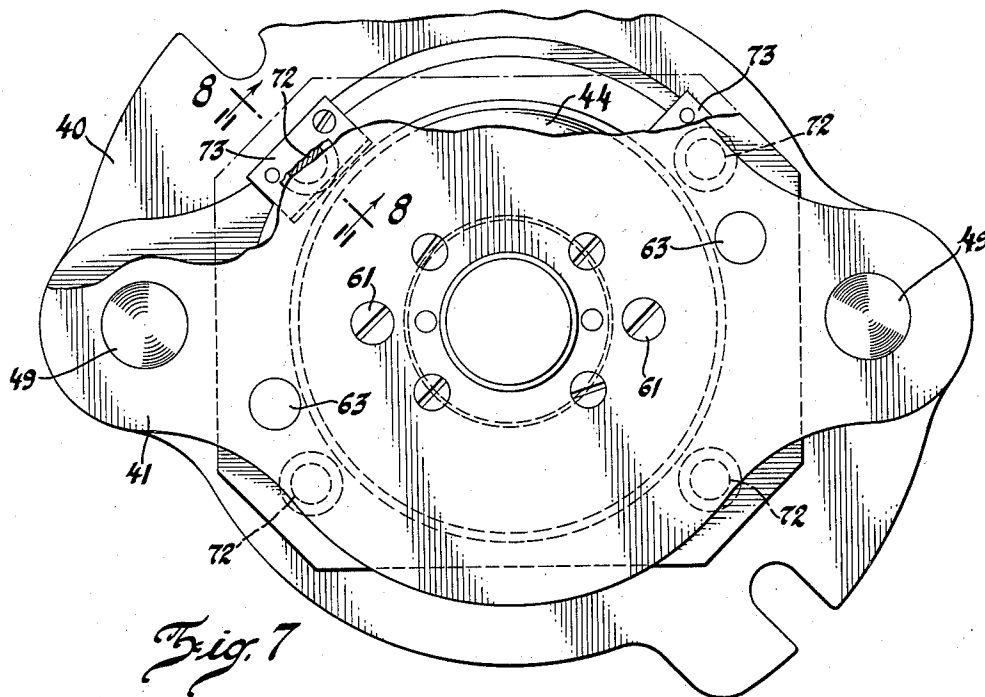


Fig. 7

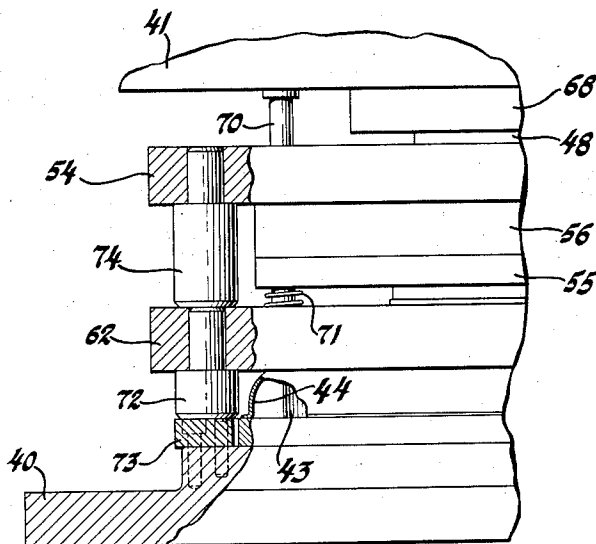


Fig. 8

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TRIMMING DIE

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6 Claims. (Cl. 164—18)

My invention relates to trimming die mechanism designed to smooth or trim the rough edge of a hollow article by a shearing operation performed upon such edge by a plurality of die segments which are moved simultaneously outward relative to the line of movement of a hollow vertically movable and expansible die member of which said segments form a part, such simultaneous movement being produced by cam mechanism arranged within the hollow expansible die member and acting upon said segments while downward movement of said expansible member and of said segments is prevented; so that the shearing operation is performed while the segments are located in a definite and predetermined plane, and are kept at a constant level during the trimming operation.

The drawings accompanying and forming a part of this application illustrate the preferred form of my invention, and the particular features wherein my invention consists are pointed out in the claims which conclude this description of my invention.

In the drawings:

Figure 1 is a view taken for the most part upon a vertical central plane, and showing one form of my invention.

Figure 2 is a view taken upon the same plane as Figure 1 and showing the parts in different positions, about half of the device being shown.

Figure 3 is a view showing a section upon a horizontal plane indicated by the line 3—3, Figure 1, looking down, and upon a much larger scale than in Figure 1.

Figure 4 is a view like Figure 1 but showing various parts of my invention as modified in form.

Figure 5 is a fragmentary view showing parts shown in Figure 4 in different positions.

Figure 6 is a view showing a section upon a much larger scale than Figure 4, and upon a horizontal plane indicated by the line 6—6, looking down.

Figure 7 is a view showing certain features of my invention in plan.

Figure 8 is a fragmentary view showing certain stop mechanism of my invention upon a vertical plane indicated by the line 8—8, Figure 7.

Referring now to the drawings, and first to Figures 1 to 3, the numeral 7 designates a base designed to be supported by the lower stationary bed plate of a suitable press; and 8 is a reciprocating head secured to and operated by the upper

movable head of the press, as through a shank 9 fitting within an opening in said head.

Resting upon the base 7 is a lower die member 10 having an opening 11 shaped to receive the article to be trimmed; the same being a dome-shaped metallic element 12 circular in cross-section in this particular case. This dome-shaped member fits closely within the opening 11 so that its comparatively thin wall is supported by the die member, and the upper surface of the die member provides an annular cutting or shearing edge at 13 surrounding the upper end of the opening 11. The reciprocating head 8 is guided in its movement by a plurality of guide members 14 carried by the base member 7 and extending into passages in the head.

The numeral 15 designates a hollow tubular die member the wall of which has a plurality of circumferentially disposed slots 16 extending from its lower end upward and ending near the upper end thereof whereby said wall is divided into a plurality of segments the lower ends of which, collectively, provide an annular cutting or shearing edge at 17, which cooperates with the cutting edge 13 to trim and smooth the upper free end of the air dome 12. A cross section much enlarged of this member is shown in Figure 3 and the same, being made of steel and being in form similar to a spring collet, I refer to it as a spring collet cutting or shearing die member. This die member has an internal inclined surface 18 near its lower end; and its upper end is threaded and screws into a collet carrying plate 19 which is acted upon by a series of stiff compression springs 20 housed in recesses in the head 8. Movement of the plate 19 away from the head 8 as the head rises, due to the springs 20, is limited by a plurality of stop and lost motion screws 21 carried by the plate 19, and the heads of which are free to move in passages provided for them in the head 8 as will be understood from Figures 1 and 2.

The numeral 22 designates a tubular die expanding member within and extending along the shearing die member 15 and having a conical portion 23 at its lower end which, as said member moves downward, acts to expand the lower end of the die member and cause a peripheral cutting edge 17 at the lower end thereof to shear off the free upper end of the air dome 12, as will be understood from Figure 2. The expanding member 22 is threaded at its upper end and screws into a supporting plate 24 which is fastened to the under side of the head 8 and is in effect a part of said head. The springs 20 and

the screws 21 extend through openings in the plate 24 in the particular form of my invention illustrated in Figures 1 and 2.

A series of stop blocks 26 carried by the lower die member 10 in the embodiment of my invention illustrated, arrest downward movement of the collet carrying plate 19 with the die member 15 in a position such that the cutting edge 17 thereof is level with or slightly above the cutting edge 13 of the lower die member, so that the two cutting edges will cooperate to shear off the upper end of the dome-shaped member 12 as the lower ends of the segments provided by slots 16 are forced outward by the conical portion 23 cooperating with the inclined surface 18 as hereinbefore explained.

The lower end of the expanding member 22 has a guide 27 which is slidable within the air dome 12 and which serves to keep the expanding member properly centered relative to the tubular die member 15, and particularly relative to the inclined surface 18 inside and at the lower end of said die; and within this member 22 and extending longitudinally thereof is a holding down member 28 the upper end of which is acted upon by a compression spring 29 housed within a recess in the head 8, and the lower end of which acts to press the air dome 12 against a supporting and expelling plunger 30 at the lower end of the opening 11, and which plunger is shown as abutting against the upper surface of the base 7. This plunger acts to lift the dome-shaped member 12 operated upon after the shearing operation has been performed to permit said member to be removed and replaced by another, to which end a pivotally supported lever 31 is provided which acts to lift said plunger 30. This lever is acted upon by a second lever 32 which later is operated by a tappet member 33 carried by the head 8, at the end of the upward movement of said head from the lowermost position in which it is shown in Figure 2; after such upward movement has withdrawn the guide 27 from the member 12 and moved the die member 15 into a position high enough above the lower die 10 to permit the removal of a trimmed air dome and the substitution of an untrimmed dome therefor, as will be understood.

Figure 1 shows the positions of the parts after an air dome to be trimmed has been placed in the opening 11 and when downward movement of the head 8 has moved the collet carrying plate 19 into contact with the upper ends of the stops 26, and the hollow die member 15 into the lowermost position in which it is shown in Figure 1.

Before attaining the position shown in Figure 1, the head 8, the hollow die member 15, the plate 19, the expanding member 22 and the guide 27 were moved into a higher position than the position in which they are shown to operate the ejecting plunger 30, and to permit the removal of the air dome trimmed during a previous operation and the placing of an untrimmed air dome in the opening 11; upward movement of said parts having been communicated to the plate 19 through the stop and lost motion screws 21. During its return movement from this higher but not illustrated position the guide 27 moved into the new untrimmed air dome, and the parts attained the positions in which they are shown in Figure 1. While in this higher position the lost motion screws 21 prevented the springs 20 from moving the collet carrying plate 19 too far away from the plate 24 which supports the expanding member 22, and from the under side of

the upper head 8 with which said plate 24 is always in contact.

Returning now to Figure 1 and remembering that the head 8 is already moving downward, that the collet carrying plate 19 has come into contact with the upper ends of the stop blocks 26, and that the lower end of the die member 15 is in approximately the same plane as the upper surface of the die 10, continued downward movement of the head acts through the spring 20 and the holding member 28 to press the air dome 12 into contact with the plunger 30; and as downward movement of the head continues against the opposing force of the springs 20 (downward movement of the collet carrying plate 19 being arrested by the stops 26) the collet expanding member 22 moves downward and the conical portion 23 thereof cooperates with the inclined surface 18 inside the collet, to expand the lower end of the collet and cause the cutting edge 17 to shear off or trim the upper edge of the air dome 12, as shown in Figure 2.

The head 8, the plate 24, the collet expanding member 22 and the holding member 28 and guide 27 are next moved upward (movement of the collet carrying plate 19 and of the spring collet member 15 being delayed by the springs 20) thus removing the conical portion 23 from the inclined surface 18 and permitting the lower end of the collet member 15 to collapse, see Figure 1. After this and as the parts move into a still higher position not illustrated the lost motion screws 21 cause the collet supporting plate 19 to move upward along with the head thereby moving the spring collet 15 high enough to permit the trimmed air dome to be removed and another to be put in place for a following sequence of operations such as are hereinbefore outlined; the ejecting plunger 30 having meanwhile been operated to lift the trimmed air dome and permit another to be placed in the opening 11 as above explained.

In the form of my invention shown in Figures 4 to 8, the numeral 40 designates a base designed to be supported by the bed plate of a suitable press; and 41 is a reciprocating head secured to and operated by the upper movable head of the press.

Resting upon and secured to the base 40 as by screws 42 is a supporting member 43 for a cover plate 44, having an upwardly extending neck 45 to be trimmed at its upper extremity; the supporting member having an annular bushing 46 which fits within the neck and which is in effect a part of the supporting member 43, and a central passage which guides the lower end 47 of a die expanding member 48 the structure and function of which will hereinafter appear. The reciprocating head 41 is guided in its movement by a plurality of guides 49 carried by the base 40 and extending upwardly and into passages in the head.

The numeral 50 designates a hollow tubular die member made up, as shown in Figure 6, of sixteen segments or parts identical in form with one another and the lower ends of which, considered collectively, provide an annular cutting or shearing edge at 51 which cooperates with an annular shearing edge 52 upon a die 53 to trim the upper end of the neck 45 of the cover plate 44 as indicated in Figure 5. The segments of this shearing die member operate between an upper collet carrying plate 54 and a lower annular guide 55; the two being spaced apart by an annular spring retaining member 56 and held together by a series 75

of screws, one of which is indicated by the numeral 57.

The segments of the die member 50 which correspond in structure and function with the segments of the spring collet member 15, are movable radially between the plate 54 and the guide 55 to an extent sufficient to accomplish the shearing of the upper end of the neck 45, as appears in Figures 4 and 5; and a series of springs 58 one only of which is shown are housed in radial recesses in the spring retaining member 56, and act through pushers 59 to force the segments of the die member 50 inward and toward the axis of said member.

A series of stiff compression springs 60 act against the upper collet carrying plate 54; and downward movement of said plate as the head 41 is moved upward to raise the die carrying plate 62 and die 53 to permit the removal of a trimmed cover plate and the replacement thereof by one the neck of which is to be trimmed, is limited by a series of stop and lost motion screws 61 acting the same as the screws 21 in the form of my invention illustrated in Figures 1 and 2 and as hereinbefore explained. The upper collet carrying plate 54, the lower die carrying plate 62 to which the die 53 is secured, and as necessarily follows the expansible spring die member 50 are guided in their movements by guides depending from the head 41 and one of which is indicated by the numeral 63.

The segments of the cutting or shearing die member 50 have each an internal inclined surface 64 at its upper end, and an internal inclined surface 65 at its lower end; and the die expanding member 48 hereinbefore referred to has external conical portions 66, 67 each comprising series of flattened surfaces, as shown, and which conical portions engage the internal inclined surfaces 64, 65 as the said member is forced downward, to thereby force the segments of the die member outward and trim the upper extremity of the neck 45 as shown in Figures 4 and 5; during which movement the lower end 47 of the expanding member is guided within the bushing 46 as hereinbefore explained. The expanding member 48 is secured to the upper head 41 so as to move therewith by an annular supporting member 68 secured to the under side of said head, and cooperating with a peripheral flange 69 at the upper end of said expanding member; and the numeral 70 designates a series of circumferentially spaced lifting screws carried by the die carrying plate 62 and extending through holes in the guide 55, in the annular spring retaining member 56 and in the collet carrying plate 54 and which screws act to lift the die carrying plate 62 when the heads of said screws come into contact with the upper surface of said plate 54 as said plate is moved upward by the lost motion screws 61 to permit a trimmed cover plate 44 to be removed and an untrimmed plate to be substituted therefor, as hereinbefore explained; the neck 45 of the cover plate surrounding and being positioned by the upper end of the bushing 46 as will be understood. The numeral 71 designates one of a series of compression springs weaker than the springs 60 and which surround the screws 70, and which yield after downward movement of the die carrying plate 62 is arrested and during continued downward movement of the parts 54, 55, 56 and of the die member 50 from their uppermost position not shown, and into the position in which they are shown in Figures 4 and 5, as will next appear.

The numerals 72, Figures 7 and 8, designate a series of stop blocks carried by the die carrying plate 62, and which engage hardened abutment plates 73 carried by the base 40 at the end of downward movement of the plate 62, to thereby arrest downward movement of said plate in a position such that the upper surface of the die 53 is at the proper level to bring about the shearing operation illustrated in Figure 5; and the numerals 74 designate a like number of stop blocks carried by the die carrying plate 54 and arranged in line with the stop blocks 72, and the purpose of which is to arrest downward movement of said plate and of the expansible die member 50 in a position such that the lower ends of the segments thereof are in or slightly above the plane of the upper surface of the die 53, so that the cutting edges 51, 52 may trim off the upper end of the neck 45, as illustrated in Figures 4 and 5. Downward movement as aforesaid is transmitted from the head 41 to the die carrying plate 62 through the springs 60, the die carrying plate 54 and the springs 71, and to the plate 54 and expansible die 50 through the springs 60 alone; and after downward movement of the plates 62 and 54 have been arrested by the stop blocks 72 and 74 further downward movement of the expanding member 48 causes the inclined surfaces 66 and 67 to act upon the inclined surfaces 64 and 65 upon the segments of the die member to thereby force said segments outward as shown in Figure 5 to accomplish the shearing of the upper end of the neck 45 of the cover plate.

Before a trimming or shearing operation the parts are in a position sufficiently above that in which they are shown to permit the removal of a trimmed cover plate 44 and the placing of an untrimmed plate upon the supporting member 43 with its neck surrounding the upper end of the bushing 46; and during the movement of the parts into this higher but not shown position the expanding member 48 has moved upward with the head 41, the plate 54 and the expanding die member 50 have been lifted by the lost motion screws 61, and the die carrying plate 62 has been lifted by the screws 70 sufficiently high to permit the removal of a trimmed cover plate and the substitution of an untrimmed one therefor as hereinbefore explained.

Downward movement of the parts moves the die carrying plate 62 into engagement with the cover plate 44, and the stop blocks 72 carried thereby into contact with the abutment plates 73, thus positioning the die 53 properly for the trimming operation to be performed upon the neck 45. This position of the die is in substantially the same plane as the upper surface of the annular bushing 46, although the bushing plays no part in determining the level of the die 53.

Continued downward movement acting through the springs 60 compresses the springs 71 thus pressing the cover plate against the supporting member 43, and moving the plate 54 downward to cause the stop blocks 74 carried thereby to contact with the upper surface of the die carrying plate 62, thus positioning the lower ends of the segments of the expanding die member 50 properly, as shown in Figure 4, for a shearing operation when the segments are forced outward during further downward movement of the head 41 and die expanding member 48; and final downward movement of the head and of the die expanding member subjects the springs 60 to compression and causes the conical portions 66, 67 of said member to force the segments of

the die member outward, by cooperation with the internal inclined surfaces 64, 65, thus accomplishing the shearing operation as illustrated in Figure 5, during which final movement the heads 5 of the stop and lost motion screws 61 move upward in the passages in the head 41 in which they are housed.

Having thus described and explained my invention I claim and desire to secure by Letters Patent:

1. In trimming die mechanism of the class described, a lower die member having an annular shearing edge at its upper end; a vertically movable upper die member having a plurality of radially movable segments each having a shearing edge, and which shearing edges are arranged to cooperate with the shearing edge of said lower die member; means for arresting downward movement of said upper die member when said shearing edges are all substantially in one single plane; and means for simultaneously forcing all of said segments outward and transverse to the direction of movement of said upper die member.

2. In trimming die mechanism of the class described, a lower die member adapted to provide external support for a tubular article to be trimmed, and having an annular shearing edge at its upper end; a hollow vertically movable upper die member having a plurality of radially movable segments each having a shearing edge, and which shearing edges are arranged to cooperate with the shearing edge of said lower die member; means for arresting downward movement of said upper die member when said shearing edges are all substantially in one single plane; and means within said upper die member for simultaneously forcing all of said segments outward and transverse to the direction of movement of said upper die member.

3. In trimming die mechanism of the class described, a lower die member having an annular shearing edge at its upper end; a hollow vertically movable upper die member having a plurality of radially movable segments each having a shearing edge, and which shearing edges are arranged to cooperate with the shearing edge of said lower die member; means for arresting downward movement of said upper die member when said shearing edges are all substantially in one single plane; a die expanding member within said upper die member, and means whereby movement imparted to said member is transmitted to said segments to move them simultaneously outward and transverse to the direction of movement of said upper die member while downward movement of said upper die member is arrested as aforesaid; and means for operating said die expanding member.

4. In trimming die mechanism of the class described, a lower die member having an annular shearing edge at its upper end; a hollow vertically movable upper die member having a plurality of radially movable segments each having a shearing edge, and which shearing edges are arranged to cooperate with the shearing edge of said lower die member; means for arresting

downward movement of said upper die member when said shearing edges are all substantially in one single plane; a vertically movable die expanding member within said upper die member and having an inclined surface which acts to force all of said segments outward while downward movement of said upper die member is arrested as aforesaid; and means for operating said die expanding member.

5. In trimming die mechanism of the class described, a stationary base having a support for an article to be trimmed; a lower vertically movable die carrying plate located above said base; a lower die member carried by said plate and having an annular shearing edge at its upper end; an upper vertically movable die carrying plate; an upper hollow expansible die member carried by said second plate and having a plurality of radially movable segments each having a shearing edge, and which shearing edges are arranged to cooperate with the shearing edge of said lower die member to trim an article held between said first named plate and said support; a vertically movable head; spring mechanism between said head and said upper die carrying plate and through which force is transmitted to said plate; means whereby said second plate is lifted by said head, and whereby said first plate is lifted by said second plate; a series of stops for arresting downward movement of said lower die carrying plate; a second series of stops for arresting downward movement of said upper die carrying plate when the shearing edges aforesaid are all substantially in one single plane; and a vertically movable die expanding member carried by said head and extending into said hollow upper die member, and having an inclined surface which acts to force all of said segments outward when downward movement of said two plates is arrested by said two series of stops.

6. In trimming die mechanism of the class described, a stationary base; means associated with said base for supporting an article to be trimmed; a lower die member having an annular shearing edge at its upper end; a vertically movable die carrying plate; a hollow expansible die member carried by said plate and having a plurality of radially movable segments each having a shearing edge, and which shearing edges are arranged to cooperate with the shearing edge of said lower die member to trim an article supported by said supporting means; a vertically movable head; spring mechanism between said head and said die carrying plate and through which force is transmitted from said head to said plate; means whereby said plate is lifted by said head; a series of stops for arresting downward movement of said die carrying plate when the shearing edges aforesaid are all substantially in one single plane; and a vertically movable die expanding member carried by said head and extending into said hollow upper die member, and having an inclined surface which acts to force all of said segments outward when downward movement of said die carrying plate is arrested by said series of stops.

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