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W. I. GLADFELTER ET AL

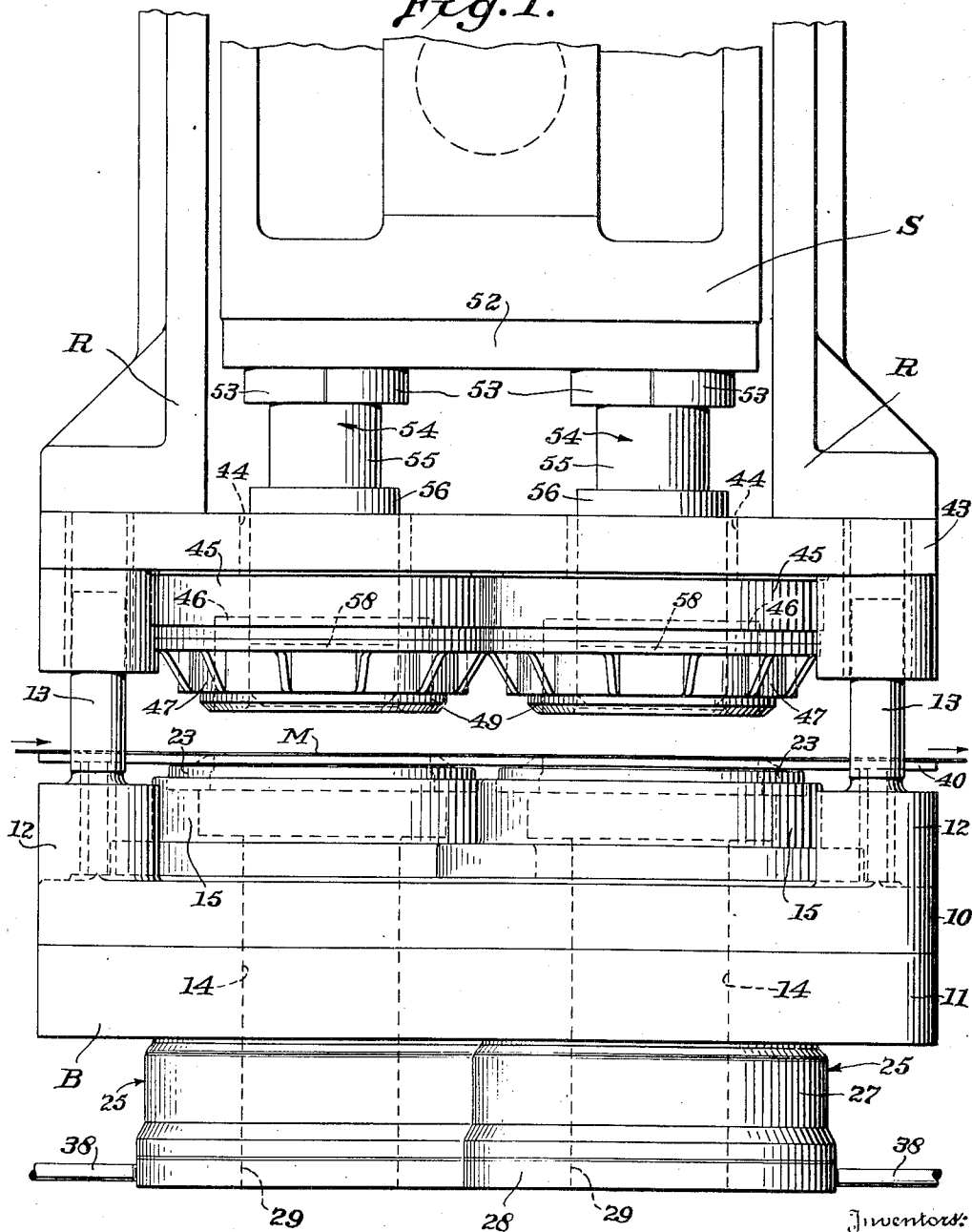
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4 Sheets-Sheet 1

Fig. 1.



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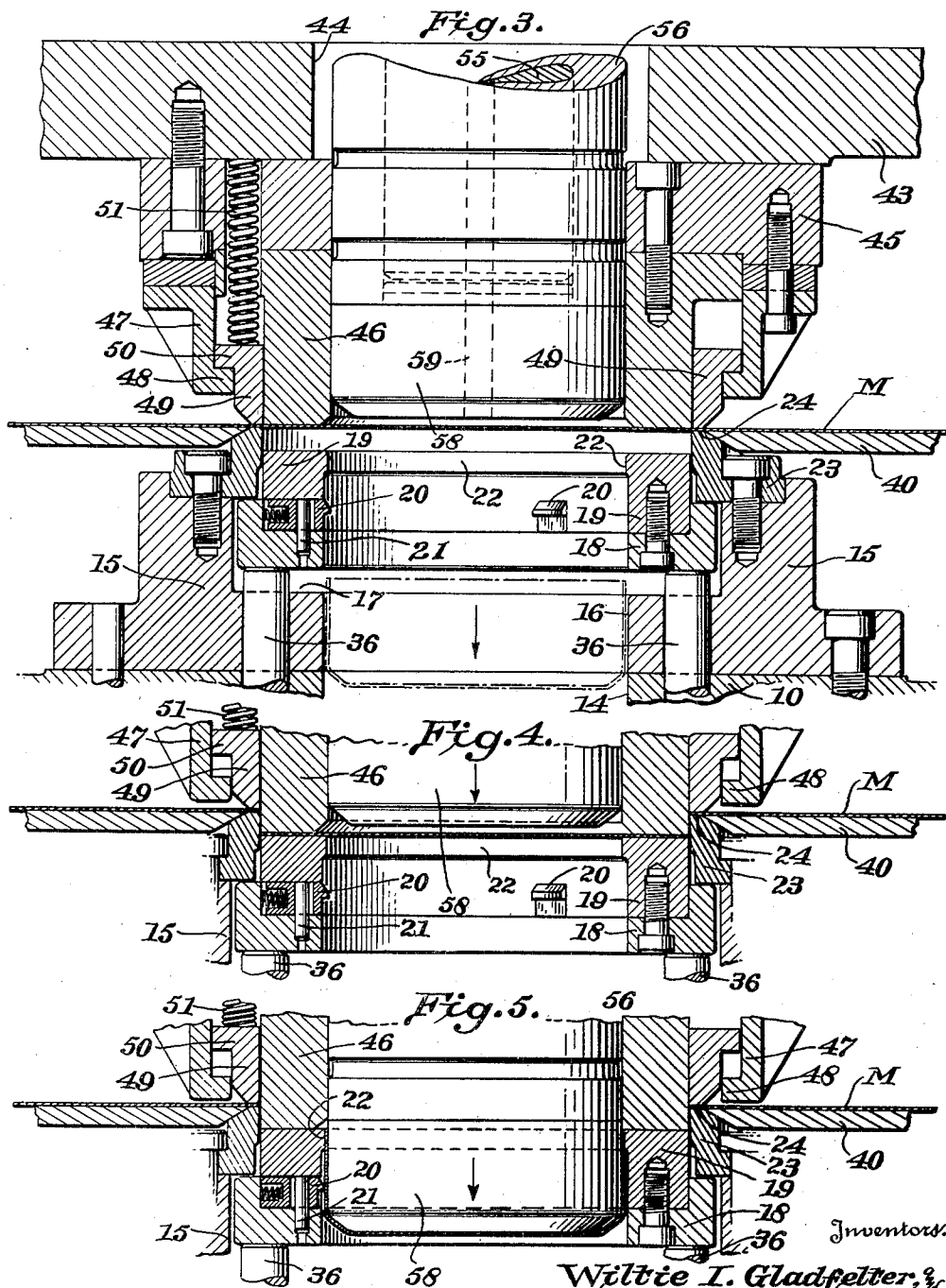
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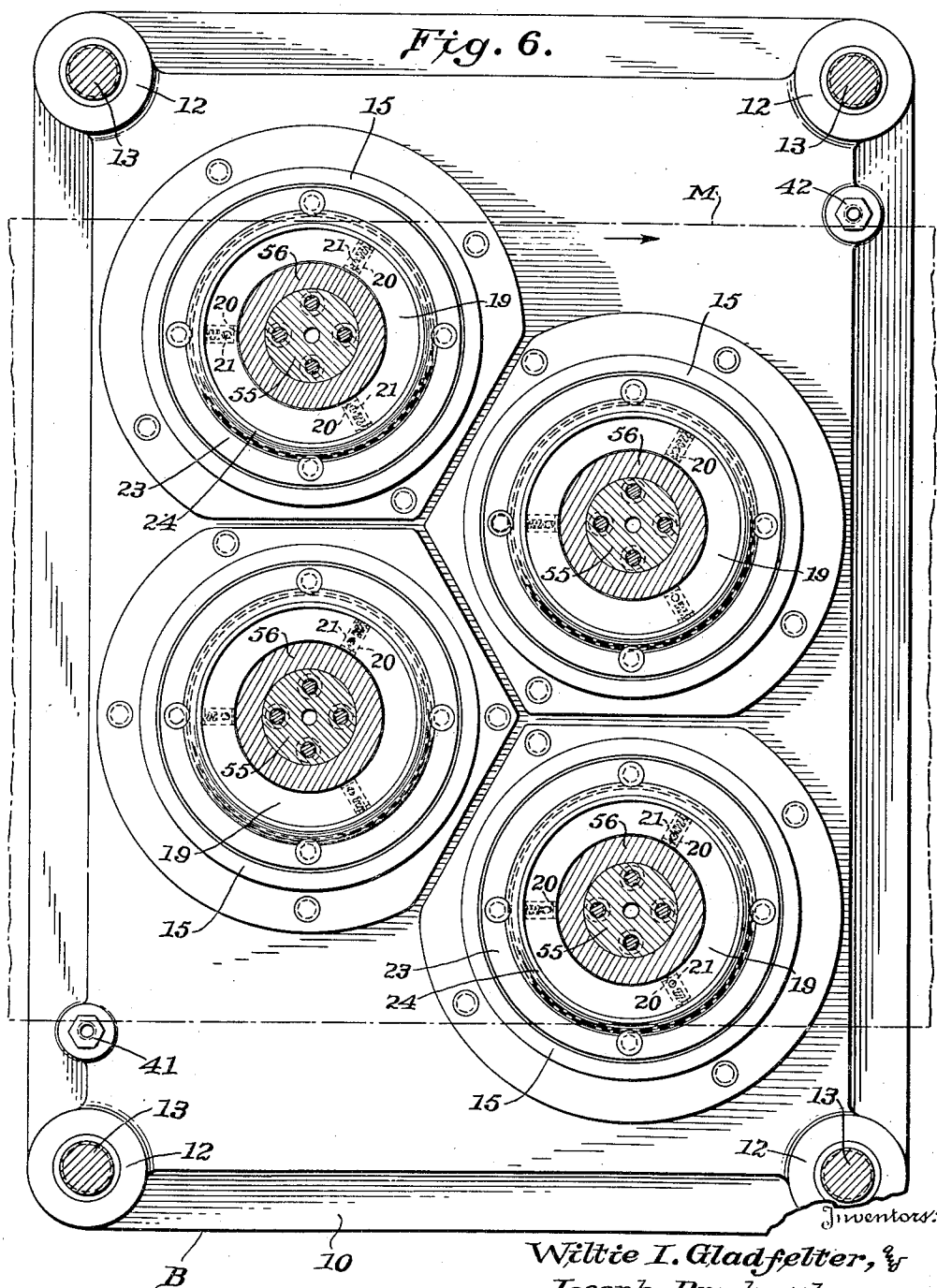
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UNITED STATES PATENT OFFICE

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CUPPING PRESS

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5 Claims. (Cl. 113—46)

This invention relates to presses designed to draw a cup from a blank, for example as the initial step in forming a drawn metal can. In preferred embodiment the invention relates to multiple presses wherein at each operation a plurality of blanks are cut and drawn. An object of the invention is to provide, in such a press, an improved cushion mounting for the drawing dies so as to secure perfect equalization of pressure on the blank margins during the drawing operation. Another object is to provide improved assemblies of blanking and forming elements, wherein, for instance, each assembly includes its individual stripper element operating downwardly on the scrap. Other objects will appear from the following description of an illustrative embodiment of the invention as shown in the accompanying drawings, in which:

Figure 1 is a side elevation of the press with its parts in rest position.

Figure 2 is a side elevation, partly in section, of the press, showing its parts in fully operated position.

Figure 3 is an axial section of the instrumentalities at one of the blanking and drawing stations with the parts shown engaging the stock just prior to the blanking operation.

Figure 4 is a view similar to that of Figure 3, showing the parts at the conclusion of the blanking operation and just prior to the drawing operation.

Figure 5 is a view similar to that of Figure 4 showing the parts at the completion of the drawing operation, but before stripping, and

Figure 6 is a section substantially on line 6—6 of Figure 2.

Referring to the drawings, reference character B designates a bolster or bed fixedly supported in any suitable manner and, as here shown, including top and bottom plates 10 and 11 secured together. These plates are rectangular in plan, and the top plate has at its corners upstanding bosses 12 having bores receiving upwardly projecting posts 13. The bolster is provided, as here shown, with four vertical through openings 14 which are in staggered relation in the direction of feed as indicated in Figure 6. The bores 14 are of a size to permit the formed article to drop freely therethrough.

Secured on top of the bolster at each opening 14 is a shoe 15 having a circular opening 16 registering with the opening 14. The shoe 15 has at its upper end an annular recess 17 in which is received an annular element 18 in an inner annular rabbet of which is secured a drawing die 19.

The bottom portion of die 19 is provided with a number of radial recesses in which are slidable stripping hooks 20, these being spring-pressed inwardly and stopped by axially extending pins 21 set in element 18 and projecting freely upwardly through radially elongated slots in members 20. The hooks have upwardly and outwardly inclined upper inner surfaces.

Element 18 and the lower portion of die 19 have the same internal diameter as opening 16, the upper portion of the die being slightly constricted to provide a drawing zone 22 whose diameter determines the outside diameter of the article to be drawn. Elements 18 and 19, in effect, together constitute a die which as a matter of convenient construction is formed in two parts.

Secured in an inner annular rabbet at the upper end of shoe 15 is a cutting ring 23 which overlies the outer margins of element 18, ring 23 having a circular opening in which die 19 is guided with capability of slight universal tiltability. The upper end of ring 23 is inwardly beveled to a flat surface 24 terminating inwardly in a circular cutting edge.

Secured to the bolster beneath each opening 14 is a ring 25 having an inner opening 26 of the same diameter as opening 14, and an outer axially extending flange 27. A ring 28 has an opening 29 of the same diameter as the opening 26, this opening being defined by an axially extending flange 30 whose upper end is engaged in a rabbet of ring 25, the outer margins of ring 28 being secured by screws to the lower end of flange 27 of ring 25. Rings 25 and 28 together constitute a ring with a closed annular chamber 31 having cylindrical side walls between which is slidable an annular piston 32 whose lower face is equipped with leathers 33 and 34 held in place by a clamping ring 35. The piston 32 is slightly universally tiltable or differentially movable. Thrust pins 36 slidable in bores extending through the bolster, shoe 15 and ring 25, bear at their upper ends against element 18 and at their lower ends against piston 32. Compression springs 37 are interposed between rings 28 and 35 and tend to hold die 19 in its uppermost position wherein the margins of element 18 abut the overhanging portion or ring 23, the latter thus serving as a retainer ring for the die. The effect is the same if the piston is held against the top of its chamber with the drawing die supported on the pins somewhat below the hold down member. In either case the die ring will be normally supported coaxially with the bolster opening. A pipe

38, connected with any suitable source of air under pressure, is connected into a passage 39 of ring 28, the passage 39 communicating with chamber 31 beneath piston 32.

Springs 37 hold piston 32 in its upper position in the idle condition of the press and make possible the use of a lower fluid pressure in chamber 31 in the operation of the press. While these springs are a useful addition, they are not necessarily an essential in the practice of the invention which contemplates that the die 19 shall be maintained against an air cushion during the drawing operation, the air cushion affording a perfect compensating effect so that uniform pressure on the blank margins will be secured. While the number of thrust elements 36 may be varied, eight has been found in use to be a desirable number, the elements being equi-distantly spaced apart on a circle.

A guide plate 40 is provided with four openings having beveled lower margins mating with the upper beveled portions of the cutting rings 23 as shown in Figures 2 to 5, outer marginal portions of the openings being supported on flat portions of rings 23. The free corner portions of the plate are supported on diagonally disposed posts 41 and 42, Figures 2 and 6, having shank portions threaded in the bolster, the plate being secured against the upper ends of the posts by means of flush screws. The plate may also be screwed to the rings 23.

A ram R supports at its lower end a rectangular plate 43 having corner bosses bored to slidably receive posts 13, the lower portion of the ram being thus suitably registered with the bolster. Plate 43 is provided with four openings 44 aligned with dies 19, and secured to the plate therebeneath at each opening is a shoe 45 having a central opening aligned with a die 19. Secured to each shoe 45 therebeneath is a combined cutting and drawing ring 46 which has an opening of the same diameter as that of the shoe, the rings being coaxial with the respective dies. Secured to the outer lower margins of each shoe 45 is a retainer ring 47 having a bottom internal annular flange 48 between which and the outer periphery of ring 46 there exists an annular space in which is guided a reciprocable clamping ring 49 having an outer upper annular flange 50 normally urged against flange 48 by a number (eight, for example, equally spaced) of compression springs as at 51, this relation of parts being shown in Figure 3. Ring 46 is of a diameter to enter ring 23 with a shearing effect on a strip or sheet of stock M disposed between the two. Clamp ring 49 registers with ring 23, is beveled as the latter, and its lower end is normally flush with the lower end of ring 46. The ram R is reciprocable by any conventional means.

Suitably guided in the arm R is a slide S having a lower head to which is secured a plate 52. Secured against the lower face of plate 52 by means of retainer rings 53 are four drawing punches 54 in coaxial relation, respectively, with dies 19. The punches project through openings 44 and are slidably guided in the openings of shoes 45 and rings 46. Each punch comprises a shank portion 55 having a lower cylindrical reduced portion embraced by a collar 56 held against a shoulder 57 by a head 58 which is secured by screws to the lower end of the shank, the head and shank having an axial air opening 59 radially branched to the atmosphere above collar 56. The slide S is reciprocable by any conventional means.

With the stock in the press opening as in Figure 1, the ram R is lowered and the rings 46 and 49 come against the top of the stock as shown in Figure 3. Further downward movement of the ram causes blanks to be cut between the several coacting rings 23 and 46, the marginal portions of the blanks to be engaged between the rings 46 and dies 19, and the marginal portions of the openings which have been formed in the stock to be gripped between rings 23 and 49 as permitted by the yieldable backing of rings 49. This relation of parts is shown in Figure 4. The blanks are evenly gripped throughout their peripheries with a force dependent upon the pressure in chamber 31, the dies accommodating themselves to the presented condition by reason of their self-adjustability. Slide S has ordinarily been lowered with the ram and up to this point their relation has not changed. The downward movement of the ram has now ceased, but the downward movement of the slide continues so that the punches draw the blanks to the cup form shown in Figure 5, the sides of the cups engaging the upper inclined surfaces of hooks 20 and forcing the hooks outwardly. At the end of the downward stroke of the punches, Figure 2, the hooks 20 spring over the upper edge of the cup, and as the slide and ram now return, the cups are stripped from the punches and fall away through the downward openings. As the ram moves upwardly, rings 49 are forced downwardly by springs 51 and strip the scrap from rings 46. The stock is now fed and the described cycle is repeated.

It will be understood that the described press is adapted to operate on either strip or sheet material and, of course, the drawing apparatus can operate equally well on preformed blanks. The invention is susceptible of varied embodiment and consequently it is to be understood that we do not limit ourselves to the specific disclosure herein except as in the following claims.

We claim:

1. A press comprising a bolster, a draw ring and a drawing punch reciprocable above said bolster, a drawing die cooperative with said ring and punch, retaining means on said bolster for said die permitting the die to adjust itself to accommodate irregularities of the marginal portion of a blank engaged between said die and ring, means defining a piston chamber below said die, a piston vertically movable in and slightly universally tiltably in said chamber, a number of spaced pins slidable in said bolster and constituting thrust transmitting means between said piston and said die, said pins supporting said die and directly contacting said piston and an inlet for pressure fluid below said piston.

2. A press comprising a bolster, a draw ring and drawing punch reciprocable above said bolster, a drawing die cooperative with said ring and punch and adapted to pass a formed article downwardly therethrough, retaining means on said bolster for said die permitting the die to adjust itself to accommodate irregularities of the marginal portion of a blank engaged between said die and ring, annular means beneath the die defining an annular piston chamber below the latter, said annular means being adapted to pass the formed article downwardly therethrough, an annular piston vertically movable and slightly universally tiltably in said chamber, a number of spaced pins slidable in said bolster and constituting thrust transmitting means be-

tween said piston and said die, and an inlet for pressure fluid below said piston.

3. A press comprising a bolster, a draw ring and a drawing punch reciprocable above said bolster, a drawing die cooperative with said ring and punch and adapted to pass a formed article downwardly therethrough, retaining means on said bolster for said die permitting the die to adjust itself to accommodate irregularities of the marginal portion of a blank engaged between said die and ring, said bolster having a through opening beneath said die through which a formed article can drop, an annular member secured beneath the bolster and defining a continuation of said opening, said member having an annular piston chamber therein, a piston in said chamber slightly universally tiltable therein, a number of pins slidable in said bolster and constituting thrust transmitting means between said piston and die, and an inlet for pressure fluid below said piston.

4. A press comprising a bolster, a draw ring and a drawing punch reciprocable above said bolster, a drawing die cooperative with said ring and punch and adapted to pass a formed article downwardly therethrough, retaining means on said bolster for said die permitting the die to adjust itself to accommodate irregularities of the marginal portion of a blank engaged between said die and ring, annular means beneath the die defining an annular piston chamber below the

latter, said annular means being adapted to pass the formed article downwardly therethrough, an annular piston vertically movable and slightly universally tiltable in said chamber, a number of spaced pins slidable in said bolster and constituting thrust transmitting means between said piston and said die, an inlet for pressure fluid below said piston, and a number of compression springs between said piston and the bottom wall of said chamber and normally supporting said piston.

5. A press comprising a bolster, a draw ring and a drawing punch reciprocable above said bolster, a drawing die cooperative with said ring and punch and adapted to pass a formed article downwardly therethrough, said bolster being provided with a through opening aligned with said die and through which a formed article can drop, mounting means for said die on said bolster rendering said die self-adjusting when a blank is engaged between it and said draw ring, said mounting means including independently movable thrust members disposed around said opening with their upper ends supporting said die, and differentially movable piston means fluid-cushioned from a single pressure source arranged around said opening and supporting said members for movement relative to each other whereby the self-adjustment of said die is permitted.

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