

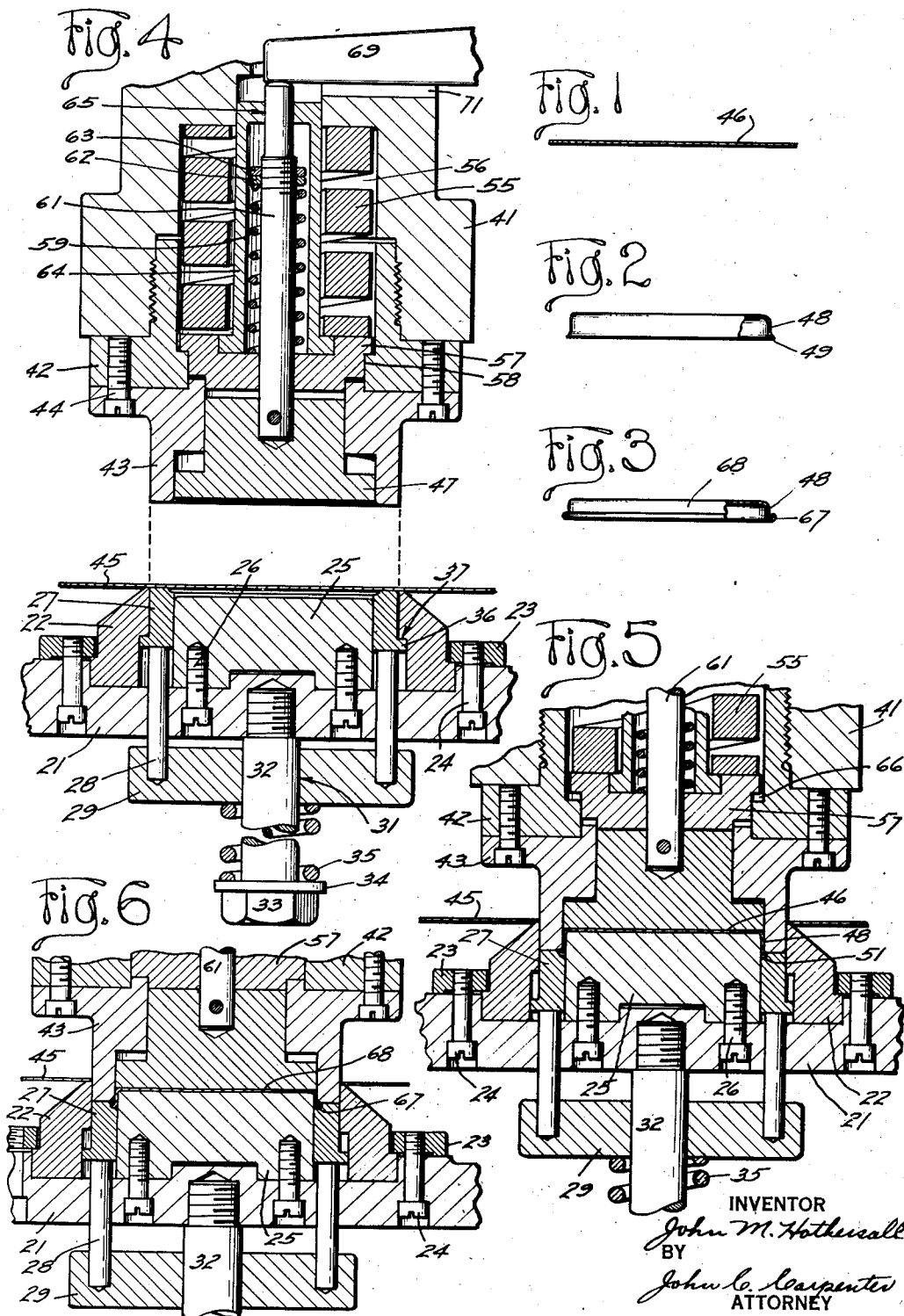
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APPARATUS FOR FORMING SHEET METAL CAPS

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## UNITED STATES PATENT OFFICE

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## APPARATUS FOR FORMING SHEET METAL CAPS

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The present invention relates to an apparatus for forming sheet metal caps and has particular reference to a self-contained press mechanism wherein a series of operations are performed upon the cap during its formation.

The present invention is an improvement on the apparatus disclosed in United States Letters Patent No. 1,482,732 issued February 5th, 1924 to Amos Calleson on apparatus for forming sheet metal caps. The present invention employs the same die parts and some of the same type of punch parts, the invention relating particularly to a more sturdy punch construction, and one adapted to easy removal and replacement for a wider range of cap styles. The punch parts embodied in the present construction are particularly easy to assemble permitting their ready changing for operation on different cap sizes and shapes. This is advantageous in factories having relatively small production in one cap size or style but manufacturing a range of different caps on the same press mechanism.

The principal object of the present invention is the provision of a cap forming mechanism having punch and die members for drawing the cap into cup shape and curling, or otherwise bending, its edge, all of these operations being performed during one cycle of movement of the mechanism without the use of outside or other independent forming means.

An important object of the present invention is the provision of a cap forming mechanism having punch and die members for shaping the cap, which are quickly and easily removable in changing for different cap styles.

A further important object of the invention is the provision of a cap forming mechanism adapted to sever a disc from a strip of sheet metal and to form and completely shape the cap within one operating stroke of the forming mechanism.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accom-

panying drawing, discloses a preferred embodiment thereof.

Referring to the drawing:—

Figure 1 is a sectional view of a disc from which the cap is formed, according to the present invention.

Fig. 2 is a side elevation of the drawn cap, partly in section, illustrating an incomplete stage of the forming operation.

Fig. 3 is a view similar to Fig. 2 illustrating the completely formed cap.

Fig. 4 is a transverse sectional view taken through the cap forming apparatus of the present invention, parts being broken away, the view illustrating the relation of parts prior to the cap severing and forming operation.

Fig. 5 is a view similar to Fig. 4 illustrating the forming mechanism at the end of the forward stroke of the apparatus.

Fig. 6 is a view similar to Fig. 4 illustrating the forming mechanism at the completion of the cap forming operation.

In the present embodiment of the invention, there is illustrated a cutting die for first severing a disc from a strip of sheet material, but parts of the apparatus are equally well adapted to form the finished cap from a disc which has already been provided.

The apparatus is embodied in a standard form of press and consists of a die plate 21 (Figs. 4, 5 and 6) which is mounted on a press bed in the usual and preferred manner, and which supports an annular die cut-edge 22 securely held in position by a clamp ring 23 and bolts 24. Mounted concentric with the cut-edge 22 is a die center or anvil 25 bolted in position by screws 26 holding the anvil on the plate 21. The outer walls of anvil 25 are spaced from the inner wall of the cut-edge 22 and a draw ring 27 operates vertically within this space.

Draw ring 27 is connected by pins 28 with a disc 29 having a center bore 31 through which passes a bolt 32 threadedly secured to the plate 21 and extending beneath the disc 29. A head 33 formed on the bolt 32 holds a washer 34 against one end of a coil spring 35 interposed between the washer 34 and the

disc 29, the spring being mounted on the bolt 32. Spring 35 normally holds the disc 29 and the draw ring 27 in an upward position with its face flush with the upper face of cutedge 22, a shouldered flange 36 carried by the cutedge 27 engaging at such time a shoulder 37 formed in the cutedge 22 (see Fig. 4). The parts just described constitute the die elements for the apparatus.

The punch parts of the apparatus are carried by a slide 41 mounted to move up and down above the die parts. Slide 41 may be of the usual and preferred type of press construction. A collar 42 is threadedly secured to the slide 41 and carries a punch cutedge 43 secured by bolts 44 to the collar 42. Punch cutedge 43 moves in axial alignment with the die cutedge 22 and the draw ring 27. As slide 41 is lowered the lower surface of cutedge 43 engages a strip 45 of sheet material which is fed in suitable manner over the upper surface of the die parts. Cooperation of the cutedge 43 with the die cutedge 22 severs a disc 46 (Fig. 1) from the strip 45. Prior to severing, the strip 45 is engaged with a slip grip by the parts 43 and 27, these constituting clamping instrumentalities which move downwardly and carry the severed disc 46 from its place in the strip 45.

As the instrumentalities 27 and 43 continue their downward movement, disc 46 is brought into engagement with the anvil 25 of the die mechanism. Simultaneously with this action, a punch pad 47 located inside of the cutedge 43 engages the upper surface of the disc 46 and clamps it against the anvil 25 holding the disc at its central part during the continued lowering of the instrumentalities 27 and 43. Continued downward movement of these instrumentalities withdraws the edge of disc 46 from its slip grip between the die ring 27 and the cutedge 43 and bends it to a position at right angles to its former position, thus forming a flange 48 (Fig. 5).

Downward movement of the draw ring 27 under the influence of the descending cutedge 43 carried by the slide 41 is resisted by spring 35 which permits moving of the shouldered flange 36 of the draw ring from the shoulder 37 of the cutedge 22. In its lowermost position (Fig. 5) the bottom of the cutedge 43 is slightly above an outer edge 49 of the flange 48, this edge being thus left projecting (see also Fig. 2). In this lowermost position of the clamping instrumentalities 27 and 43, this projecting edge 49 rests within a rounded groove cut in the upper corner of the draw ring 27, this groove constituting a curling die 51.

Further operation on the incompleated cap constitutes a curling or altering of the projecting edge 49 and in the present instance, this altering operation takes place as the

punch and die parts are restored to their normal separated position or in other words, on the return stroke of the press. To insure the proper holding of the incompleated cap on its anvil 25 during the edge curling operation, there is provided a spring organization illustrated in detail in Fig. 4.

This organization comprises a relatively powerful coil spring 55 positioned within a chamber 56 formed in the lower end of slide 41 and the lower end of spring 55 rests against a disc 57 shouldered at 58 on the collar 42. Spring 55 is at all times under compression, the normal position forcing the disc 57 against its shouldered seat in the collar 42, as illustrated in Fig. 4. Normally the punch pad 47, which is located beneath the disc 57 is held upwardly in contact with its lower surface by means of a coil spring 59 surrounding a vertical stem 61 secured to pad 47, the spring resting at its lower end on the disc 57 and at its upper end engaging an adjusting nut 62 threadedly secured to the stem 61. A locknut 63 holds the nut 62 in adjusted position. Spring 59 is enclosed within a spring barrel 64 resting upon the disc 57, the upper end of stem 61 projecting through a vertical bore 65 formed in the barrel.

As the punch pad 47 clamps the severed disc 46 against the anvil 25, as previously described, further downward movement of the slide 41 takes place but the disc 57 which is in engagement against the punch pad 47, and the latter, are both blocked from further movement. As the slide 41, collar 42 and cutedge 43 continue to move spring 55 yields and becoming further compressed permits the collar 42 to move from its engagement with shoulder 58 until the lowermost position of the cutedge 43 and draw ring 27 is reached, this being at the end of the forward operating stroke. In this lowermost position (Fig. 5), the spring 55 is under its greatest compression and a space 66 is left between disc 57 and its shoulder 58.

As slide 41 is raised upon the beginning of its return stroke, cutedge 43 moves upwardly permitting draw ring 27 to follow, the spring 35 holding the draw ring in contact with the rising cutedge. During this movement and until space 66 is closed by the rising collar 42, spring 55 holds the punch pad 47 and the incompleated cap resting on the anvil 25. Simultaneously with this return movement, curling die 51 engaging the projecting edge 49 of the incompleated cap, curls or bends it forming a curled edge 67 and thus providing a completely formed cap 68 (Figs. 3 and 6).

Following this curling operation and during continued upward movement of the cutedge 43, disc 57 is picked up by the shoulder 58 on the collar 42, after which, the punch pad 47 moves upwardly with the cutedge 43. The completely formed cap 68 rests within

the cutedge 43 and as the slide 41 reaches the end of its upward movement, the upper end of stem 61 strikes against an abutment 69 (Fig. 4) mounted in a stationary position on the frame parts of the press. A slot 71 cut in the slide 41 permits free movement of the slide 41 at all times. Stem 61 and punch pad 47 are thereupon held from further movement and continued movement of the slide parts knocks off or ejects the cap 68 from the punch mechanism, spring 59 yielding at such time.

When a different shape or size of cap is to be made, die plate 21 with all of the die parts carried thereby is removed from the press and replaced by a new die unit. The punch parts to be changed are all carried by the collar 42 and upon unthreading this collar from the slide 41 the parts carried thereby are removed therewith and a new set of parts is substituted by screwing in a new collar 42. In this manner the apparatus is changed over for a different cap with the least number of operations.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In a cap forming apparatus, the combination of a pair of opposed, substantially concentric instrumentalities having a forward and a return movement and clamping a disc positioned therebetween in a slip grip, devices including a punch pad and an anvil coactive with said instrumentalities and operating during their forward movement to draw the said disc from between the clamping surfaces of said instrumentalities and into them one of them thereby shaping the disc into a cap having its edge left projecting, a curling die formed in one of said instrumentalities and positioned in alignment with the projecting edge of said cap, a relatively strong spring moving with a said instrumentality for engaging said punch pad and resiliently holding the drawn cap against said anvil during a part of the forward and a part of the return movement, said organization permitting initial return movement of the instrumentalities while holding the drawn cap, whereby said curling die engages the projecting edge of said cap and reshapes it to provide a completely formed cap, and spring means for normally pressing said punch pad upwardly relative to said strong spring.

2. In a cap forming apparatus, the combination of a pair of opposed, substantially

concentric instrumentalities having a forward and a return movement and clamping a disc positioned therebetween in a slip grip, devices including a punch pad and an anvil coactive with said instrumentalities and operating during their forward movement to draw the said disc from between the clamping surfaces of said instrumentalities and into one of them thereby shaping the disc into a cap having its edge left projecting, a curling die formed in one of said instrumentalities and positioned in alignment with the projecting edge of said cap, a relatively strong spring moving with a said instrumentality for engaging said punch pad and resiliently holding the drawn cap against said punch pad and resiliently holding the drawn cap against said anvil during a part of the forward and a part of the return movement, said organization permitting initial return movement of the instrumentalities while holding the drawn cap, whereby said curling die engages the projecting edge of said cap and reshapes it to provide a completely formed cap, and relatively light resilient means for normally pressing said punch pad upwardly relative to said strong spring.

3. In a cap forming apparatus, the combination of a pair of opposed, substantially concentric instrumentalities having a forward and a return movement and clamping a disc positioned therebetween in a slip grip, devices including a punch pad and an anvil coactive with said instrumentalities and operating during their forward movement to draw the said disc from between the clamping surfaces of said instrumentalities and into them one of them thereby shaping the disc into a cap having its edge left projecting, a curling die formed in one of said instrumentalities and positioned in alignment with the projecting edge of said cap, a spring organization comprising a relatively heavy spring and a disc pressed thereby moving with a said instrumentality for engaging said punch pad and resiliently holding the drawn cap against said anvil during a part of the forward and a part of the return movement, said organization permitting initial return movement of the instrumentalities while holding the drawn cap, and said organization including a spring for normally pressing said punch pad upwardly against another part of said spring organization, whereby said curling die engages the projecting edge of said cap and reshapes it to provide a completely formed cap, and means for removing said spring organization and one of said instrumentalities from the apparatus.

4. In a cap-forming apparatus, the combination of an opposing anvil and punch pad, a draw ring and die surrounding said anvil, a reciprocating die containing said punch

pad, a relatively strong spring interposed between the reciprocating die and punch pad, and a relatively weak spring operating to withdraw the punch pad within said reciprocating die.

5 5. In a cap-forming apparatus, the combination of an opposing anvil and punch pad, a draw ring and die surrounding said anvil, a reciprocating die containing said punch  
10 pad, a relatively strong spring interposed between the reciprocating die and punch pad, a disc interposed between said strong spring and the punch pad, and a relatively weaker spring operating to withdraw the  
15 punch pad within said reciprocating die.

6. In a cap-forming apparatus, the combination of an opposing anvil and punch pad, a draw ring and die surrounding said anvil, a reciprocating die containing said punch  
20 pad, a relatively strong spring interposed between the reciprocating die and punch pad, a relatively weaker spring operating to withdraw the punch pad within said reciprocating die, and a barrel within said strong  
25 spring and enclosing said weaker spring.

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