

Oct. 25, 1932.

G. R. JENESON

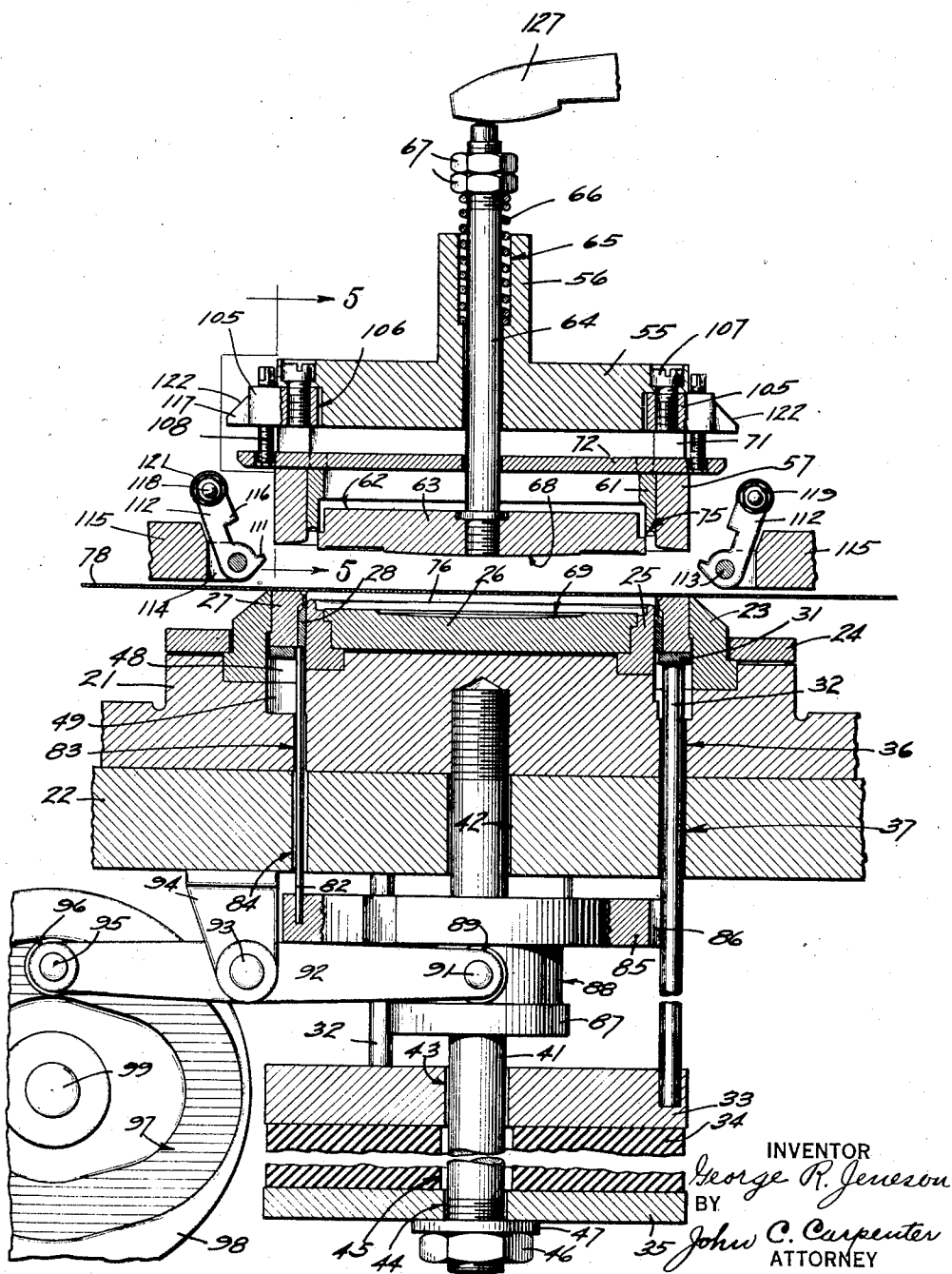
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APPARATUS FOR FORMING SHEET METAL CAPS

Filed Sept. 27, 1930

3 Sheets-Sheet 1

Fig. 1



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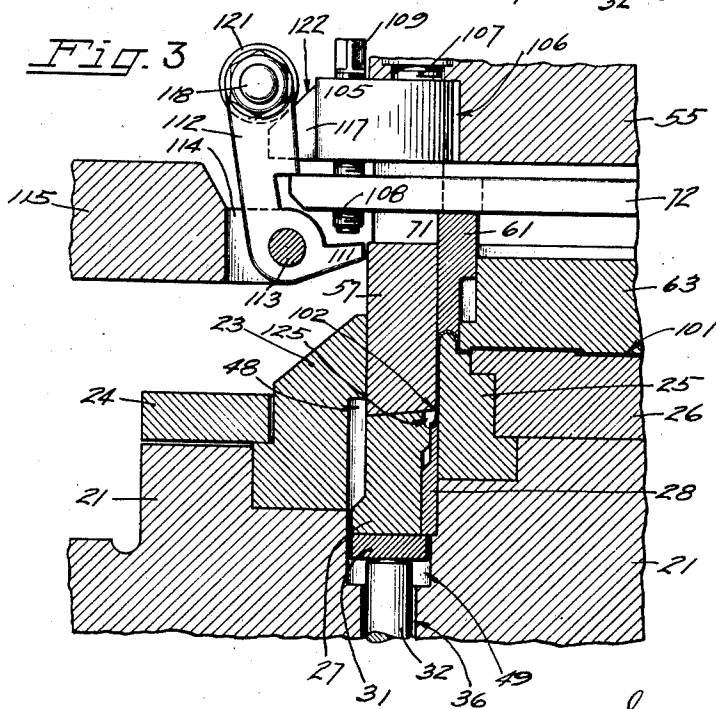
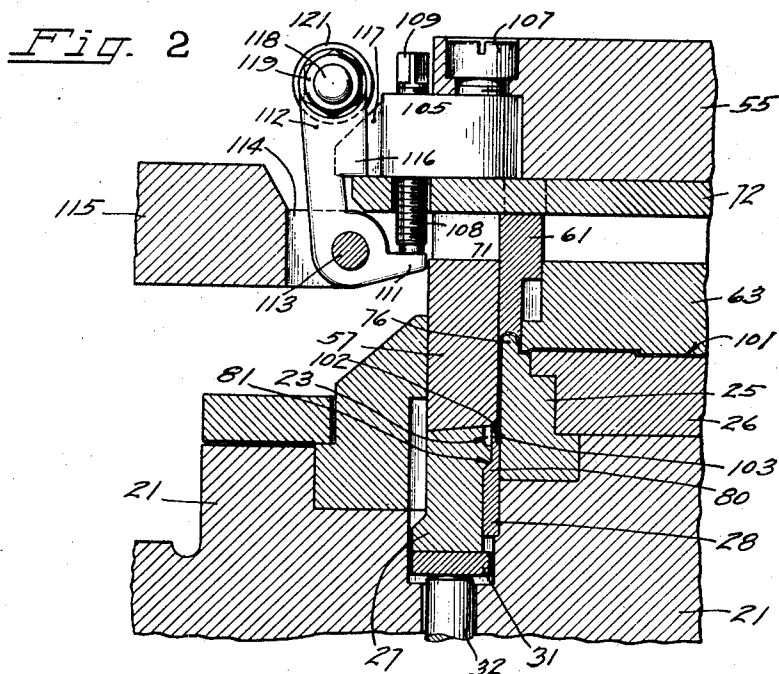
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3 Sheets-Sheet 3

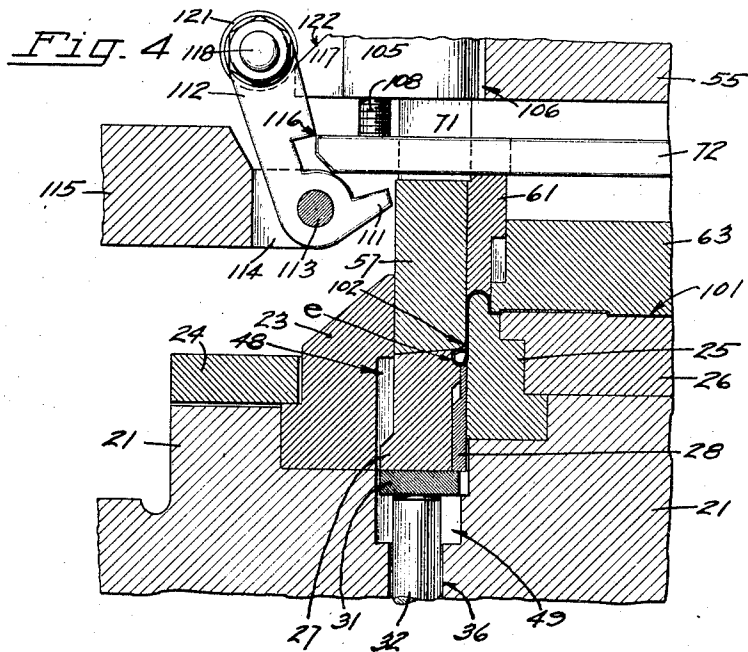


Fig. 6



Fig. 5

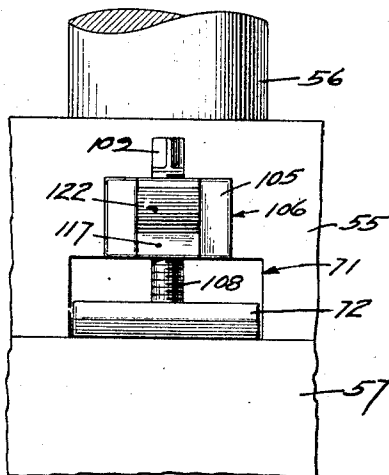


Fig. 7

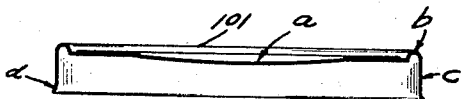
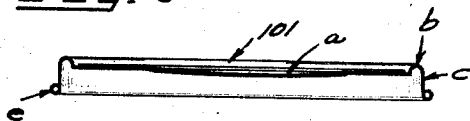


Fig. 8



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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 can during its formation.

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 by means of an independent curling die device, all of these operations being performed during one cycle of movement of the mechanism.

An important object of the invention is the provision of a cap forming mechanism which draws an incomplete cap or shell from flat stock while forming a peripheral edge or started flange between shaping members.

An important object of the invention is the provision of a locking device for holding the cap, after being partially drawn, during certain further stages of its formation.

An 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 in a novel and efficient manner within one operating stroke of the forming mechanism.

A further important object of the invention is the provision of a cap forming mechanism of the character described having a locking device for holding the partially formed cap during the time its edge is being curled, this holding device being adjustable in its time operation relative to the other operations of the mechanism.

Numerous other objects of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a transverse sectional view taken through a cap forming apparatus embodying the present invention, the view illustrating the relation of parts prior to operation on a strip of sheet material;

Figs. 2, 3 and 4 are enlarged fragmentary

views of a portion of the left-hand side of Fig. 1, these views illustrating different positions of the forming mechanism during the different stages of formation of the cap;

Fig. 5 is a fragmentary end elevation of the cap forming apparatus;

Fig. 6 is a sectional view of a disc of sheet material from which a cap is formed; and

Figs. 7 and 8 are sectional views of the cap in different stages of formation.

In the present embodiment of the invention there is illustrated a cutting die for first severing a disc from a strip of sheet material. It will be obvious that this step of cutting may be eliminated and a previously formed disc blank used in the first instance.

The apparatus disclosed for the purpose of illustrating the invention is embodied in a standard form of press and comprises a die plate 21 (Figs. 1 to 4 inclusive) which is mounted on a press bed or bolster plate 22 in the usual and preferred manner. The die plate 21 supports an annular die cutedge 23 securely held in position by a clamping ring 24.

Mounted concentric with the cutedge 23 is a die center or anvil consisting of an anvil ring 25 and an inserted panel block 26, the former being embedded in the die plate 21. The outer wall of the anvil ring 25 is spaced from the inner wall of the cutedge 23 and a draw ring 27 and a curling die 28 operate vertically within this space.

The draw ring 27 rests upon and is supported by an annular member 31 which, in turn, rests upon the upper ends of vertically extending rods 32 projecting from a disc 33 resting on a drawing rubber 34 which is confined between the disc 33 and a lower disc 35, as illustrated in Fig. 1. The rods 32 extend through vertical bores 36 and 37 formed respectively in the die plate 21 and in the bed 22 and these rods have vertical movement therein, as will be hereinafter described.

A bolt 41 is threadedly engaged in the die plate 21 and extends through an opening 42 formed in the bed 22. The lower end of the bolt extends through vertical bores 43 and 44 formed centrally of the discs 33 and

35. A vertical opening 45 cut centrally in the drawing rubber 34 provides clearance for this bolt 41. An initial compression of the drawing rubber 34 is adjustably made by a locknut 46 threadedly engaging the lower end of the bolt 41, a washer 47 being interposed between the disc 35 and the nut 46.

The cutedge 23 provides an annular chamber 48 interiorly thereof and this chamber unites with a depressed annular countersink 49 formed in the die plate. It is in these chambers 48 and 49 that the draw ring 27 and the annular member 31 move during certain operations of the mechanism. The parts of the press just described constitute the die elements for the apparatus.

The punch parts of the apparatus are carried in the usual manner as by a slide member which moves up and down above the die parts. This slide member forms no part of the novelty of the present invention and illustration and further description is, therefore, omitted. Such a slide, however, carries a punch member 55, having a usual form of stem 56. This punch member moves up and down above the die parts and carries an annular punch cutedge 57 which moves in alignment with the draw ring 27.

An annular holding ring or member 61 is located on the inside of the member 57 and has sliding vertical movement therein. This ring is counter-bored at 62 to provide sliding clearance for a combined knockout and forming pad 63 carried on the lower end of a knockout rod 64 extending upwardly through the punch member 55 and through its stem 56, as illustrated in Fig. 1.

The stem 56 is counter-bored at 65 and a spring 66 extends therein, encircling the upper end of the rod 64, the spring being confined between the stem and locknuts 67 which threadedly engage the upper end of the rod 64. A lower face 68 of the pad 63 is formed according to the panel configuration desired in the finished drawn cap and this surface cooperates with a similarly formed face 69 of the panel block 26.

The member 57 is slotted on opposite sides at 71 and a plate 72 (Figs. 1, 3 and 5) extends diametrically across the member and projects outwardly on both sides thereof. This plate 72 carries the holding ring 61 to which it is secured and controls its position during certain steps in the cap forming operation, as will be hereinafter described. A lower surface 75 of the ring 61 is profiled or shaped to fit the upper edge of the shell being drawn and this edge corresponds with a similarly formed upper edge 76 of the anvil 25.

The punch member 55 and parts carried thereby are first lowered for the cutting and cap forming operations and in this lowering action the member 57 comes down on to the strip designated by the numeral 78 and

clamps it against the draw ring 27, forcing it and the strip downwardly. The pad 63 also engages the strip as the outer cutting wall of the member 57 cooperates with the inner cutting wall of the member 23 and severs a disc 79 (Fig. 6) from the strip 78.

The members 57 and 27, in their clamping action on the disc, produce a slip grip which holds the outer edge of the disc during the drawing operation that immediately follows. This slip grip is produced in part by the resisting action of the drawing rubber 34 which at all times resists the downward movement of the member 27 under the depressing action of the moving parts 55 and 57. This drawing rubber resistance is transmitted through the annular member 31, its pins 32 and disc 33.

The curling die 28 (Fig. 2) is provided with a tapered shoulder 80 which is engaged by a similar shoulder 81 formed on the interior of the draw ring 27 and lowering movement of the latter forces the curling die downwardly therewith. The curling die 28 rests upon the upper ends of vertically extending pins 82 (Fig. 1) which extend through the chambers 48 and 49 through a vertical bore 83 formed in the die plate 21 and through a similar bore 84 formed in the bed 22.

The rods 82 at their lower ends are carried in a collar 85 which is slotted at 86 to provide clearance for the rods 32, the collar moving up and down with the curling die. The collar 85 has sliding movement on the bolt 41 and extends downwardly in a hub section 87 in which is cut a peripheral groove 88. A roller 89 loosely mounted on a pin 91 carried by one arm of a lever 92 operates within the groove 88.

The lever 92 rocks on a shaft 93 carried in a bracket 94 projecting downwardly from the bed 22. The opposite end of the lever 92 carries a pin 95 on which is rotatably mounted a roller 96 operating in a cam groove 97 formed in the face of a cam 98 which is carried by a shaft 99. Rotation of the shaft 99 is in synchronism with the raising and lowering of the punch member 55 and the cam 98 carried by the shaft thus controls rocking of the lever 92 and through the described connections raises and lowers the curling die 28. It will be understood that this cam 98 cooperates with the movement of the draw ring 27 when the latter is being depressed and when the shoulders 80 and 81 are locked together.

By the time the punch member 55 and the parts carried thereby, have reached the end of their downward travel, the disc 79 has been drawn off into a shell 101, (Figs. 2 and 7). In producing this shape, cooperation of the members 26 and 63 have formed the central panel *a*, the holding member 61 and the edge 76 of the anvil 25 have cooperated to form the upper curved ridge *b* of the shell

and an outer peripheral wall *c* of the shell has been drawn over the anvil 25 and inside of the member 57.

The two members 57 and 27 provide the proper slip grip throughout this drawing action and prevent formation of wrinkles. An edge *d* of the shell is not drawn off but is left projecting at a slight angle to wall *c* and is shaped between a convex edge 102 formed on the member 57 and a cooperating concave groove 103 formed on the upper edge of the curling die 28.

During the last part of the forward or downward stroke of the punch member 55, certain devices operate to lock the plate 72 in its lowermost position. These devices comprise a pair of blocks 105 (Fig. 1) inserted in slots 106 cut in opposite faces of the punch member 55, each block being held in its slot by a screw 107. Each block projects outwardly beyond the outer wall of the punch member 55 and carries a screw 108 threadedly secured therein, the screw having a squared head 109 adapted for engagement with a wrench or other tool for the purpose of adjustment.

Near the end of the downward movement of the member 55, the lower end of the screw 108 engages a projection 111 of a latch member 112 which is pivoted on a pin 113 carried in spaced lugs 114 formed in a stationary frame 115. This frame 115 is preferably a part of the press frame. The latch 112 is thereupon rotated on its pivot into the position illustrated in Fig. 2 wherein a shoulder 116 formed in the latch engages the outer end of the plate 72. The latch member 112 in this position rests along side a projection 117 of the block 105.

Each latch 112 carries a bolt 118 threadedly secured thereto and locked in place by a nut 119. A roller 121 is rotatably mounted on the bolt 118 and, therefore, moves with the latch member. An upper inclined cam surface 122 is formed on the upper edge of the projection 117 for a purpose which will now be described.

Beginning from the position assumed by the parts at the lowermost end of travel of the punch member 55 and the parts carried thereby (Fig. 2), consideration should be given to Fig. 3 which illustrates the parts after the first upward movement. The plate 72, it will be observed, is held by the latch members 112 and this retains the holding member 61 in lowered position on the drawn shell 101 holding the shell on the anvil 25.

During this initial upward movement the punch member 55 moves away from the upper surface of the plate 72 and the member 57 carries its rounded edge 102 away from the extending edge *d* of the shell 101. The curling die 28 remains in its lowermost position, the draw ring 27 moving upwardly and remaining in contact with the lifting punch

member 57, this following movement being effected by the drawing rubber 34. The shoulder 81 moves away from the shoulder 82, the annular member 31 moving upwardly into engagement with the lower edge of the curling die 28.

The parts are now in position for the curling operation which takes place as the punch member 55 continues its upward movement and until the parts are brought into the position illustrated in Fig. 4. During such movement the holding member 61 prevents any upward movement of the drawn shell 101.

The drawing rubber 34, acting through the annular member 31, causes the draw ring 27 to follow the rising punch member. Simultaneously the cam 98 rocks the lever 92 and lifts the curling die 28 in unison therewith. The edge *d*, resting against the rising curling die, is thus bent or curled outwardly and into an annular groove 125 formed on the inside wall adjacent the upper face of the draw ring 27. This wall forms a continuation of the concave upper die surface of the curling die 28 and completes the curling action on the edge of the shell forcing it upward and inward, thus producing an annular curled edge *e* (Figs. 4 and 8).

During such upward movement of the punch member 55, the tapered cam surfaces 122 of the blocks 105 engage their respective rollers 121 and swing the upper ends of the latch members 112 outwardly on their pivots 113 and into the position illustrated in Fig. 4 as the end of the curling operation takes place. The shoulder 116 of each latch 112 frees the end of the latched bar 72 and the remaining upward movement of the punch member 55 takes place without interference with these latch members.

During the final upward movement of the punch parts, the bottom edges of the slots 71 of the punch members 57 pick up the bar 72 and carry its holding member 61 upwardly, releasing the shell. The draw ring 27 at such time continues upwardly under the continued action of the drawing rubber 34. The shell 101, being also released from the holding action of the knockout pad 63, moves upwardly, the draw ring 27 acting as a knockout member for the shell.

The drawn shell is thus stripped from the anvil ring 25 and moves upwardly inside of the punch member 57. As the punch member 55 approaches the end of its upward stroke, the upper end of the knockout rod 64 (Fig. 1) is engaged by any suitable projecting member 127 associated with the press frame in any suitable manner. This momentarily stops the upward movement of the knockout rod 64 and the knockout pad 63 while the punch parts 55 and 57 continue upwardly to the end of their travel. This strips the drawn shell from the punch member 57 and allows it to fall out of the machine.

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, an anvil coactive with said instrumentalities during their forward movement for drawing said disc from between the slip grip of said instrumentalities and into one of them thereby shaping the disc into a cap having its edge left projecting, a curling die located within one of said instrumentalities and in alignment with the said projecting cap edge, and means for actuating said curling die during the return movement of said instrumentalities and shaping said projecting edge into an annular curl thereby producing a finished cap.

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, an anvil coactive with said instrumentalities during their forward movement for drawing said disc from between the slip grip of said instrumentalities and into one of them thereby shaping the disc into a cap having its edge left projecting, a holding member cooperating with said anvil for holding said cap thereon during the initial return movement of said instrumentalities, a curling die separate from the lower gripping instrumentality and located within one of said instrumentalities and in alignment with the said projecting cap edge, and means for actuating said curling die while the said cap is held on said anvil and shaping said projecting edge into an annular curl thereby producing a finished cap.

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, an anvil coactive with said instrumentalities during their forward movement for drawing said disc from between the slip grip of said instrumentalities and into one of them thereby shaping the disc into a cap having its edge left projecting, a holding member cooperating with said anvil for holding said cap thereon, locking devices for locking said holding member in cap holding position during the initial return movement of said instrumental-

ties, a curling die separate from the lower gripping instrumentality and located within one of said instrumentalities and in alignment with the said projecting cap edge, means for actuating said curling die while the said cap is held on said anvil and shaping said projecting edge into an annular curl, and means operating through said locking devices for releasing said holding member from cap holding position during the final return movement of said instrumentalities.

4. 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 strip of sheet material positioned therebetween in a slip grip, a die cooperating with said instrumentalities and cutting a disc from said strip, an anvil coactive with said instrumentalities during their forward movement for drawing said disc from between the slip grip of said instrumentalities and into one of them thereby shaping the disc into a cap having its edge left projecting, a curling die located within one of said instrumentalities and in alignment with the said projecting cap edge, and means for actuating said curling die during the return movement of said instrumentalities and shaping said projecting edge into an annular curl thereby producing a finished cap.

5. 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, an anvil coactive with said instrumentalities during their forward movement for drawing said disc from between the slip grip of said instrumentalities and into one of them thereby shaping the disc into a cap having its edge left projecting, a holding member cooperating with said anvil for holding said cap thereon, locking devices for locking said holding member in cap holding position during the initial return movement of said instrumentalities, a curling die located within one of said instrumentalities and in alignment with the said projecting cap edge, means for actuating said curling die while the said cap is held on said anvil and shaping said projecting edge into an annular curl, means operating through said locking devices for releasing said holding member from cap holding position during the final return movement of said instrumentalities, and adjusting means for altering the time of operation of said releasing means.

6. In a cap forming apparatus, the combination of a pair of opposed, substantially concentric instrumentalities for clamping a disc positioned therebetween in a slip grip, an anvil and a curling die separate from the lower gripping instrumentality and located in one of said instrumentalities, actuating

means for moving one of said instrumentalities and drawing said disc over said anvil into cap form with a projecting edge clamped and shaped between said curling die and said instrumentality, and means for actuating said curling die to reshape said projecting edge into annular curled form.

7. In a cap forming apparatus, the combination of a pair of opposed, substantially concentric instrumentalities for clamping a disc positioned therebetween in a slip grip, an anvil and a curling die located in one of said instrumentalities, actuating means for moving the other of said instrumentalities and drawing said disc from its slip grip and over said anvil into cap form, means for actuating said curling die operable separately from the lower gripping instrumentality to reshape the edge of said drawn cap into annular curled form, and devices preventing return of a part of said last mentioned instrumentality while holding said cap on said anvil during its edge curling operation.

8. 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, an anvil coactive with said instrumentalities during their forward movement for drawing said disc from said slip grip thereby shaping the disc into a cap, means for actuating said curling die during the return movement of a part of said instrumentalities and thereby curling the edge of said disc, and means for holding other parts of said instrumentalities in fixed position and said cap on said anvil during said edge curling operation.

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