

Sept. 5, 1944.

D. G. NELSON ET AL

2,357,683

MULTIPLE PUNCH PRESS

Filed Aug. 17, 1942

4 Sheets-Sheet 1

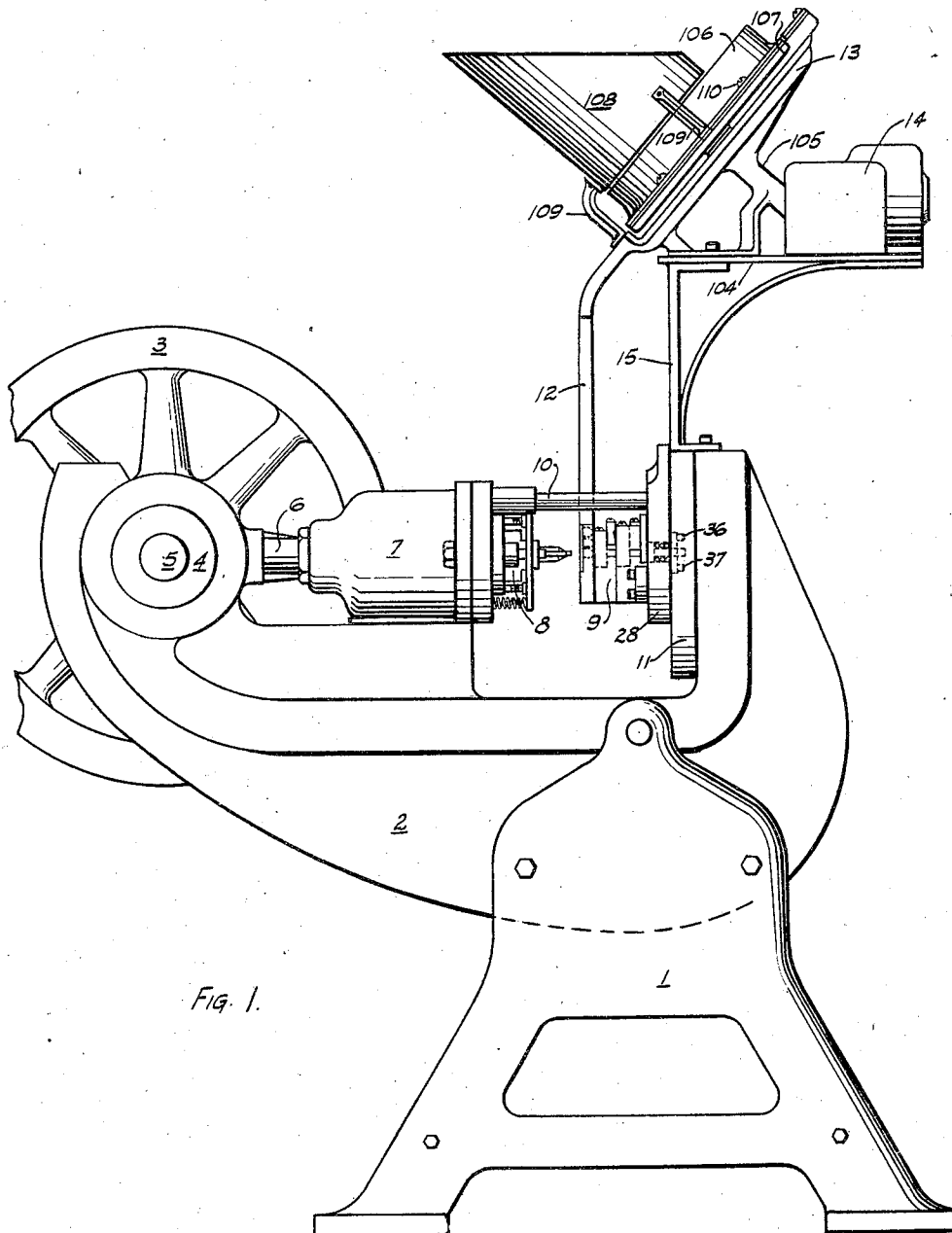


Fig. 1.

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4 Sheets-Sheet 2

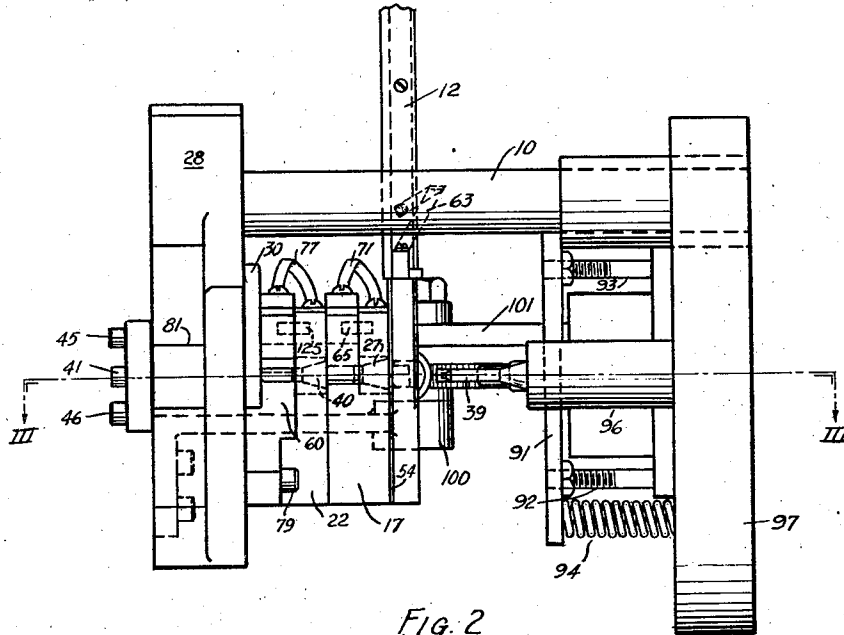


Fig. 2



Fig. 7



Fig. 8



Fig. 9

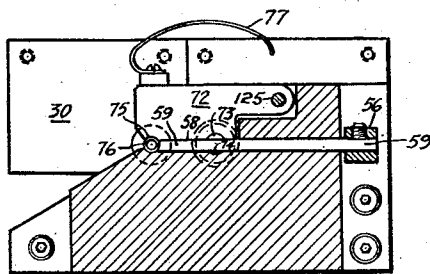


Fig. 5

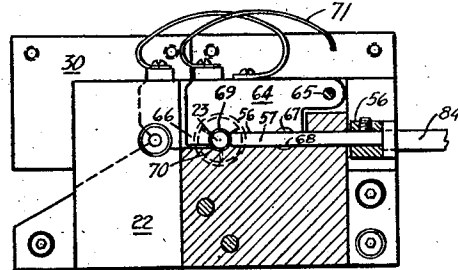


Fig. 6

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4 Sheets-Sheet 3

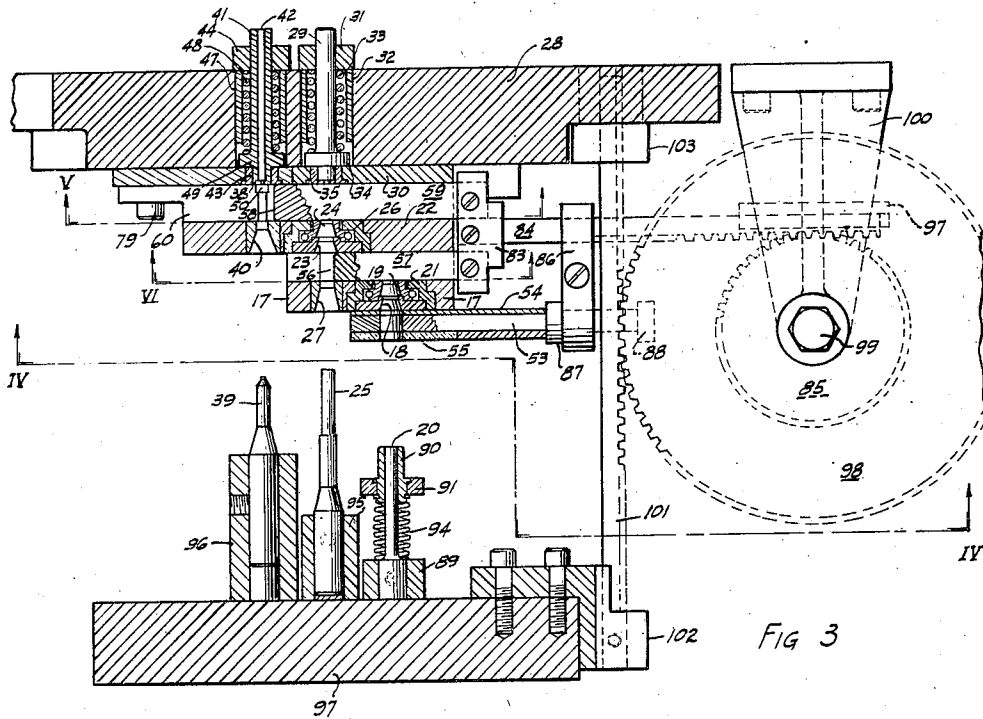


FIG 3

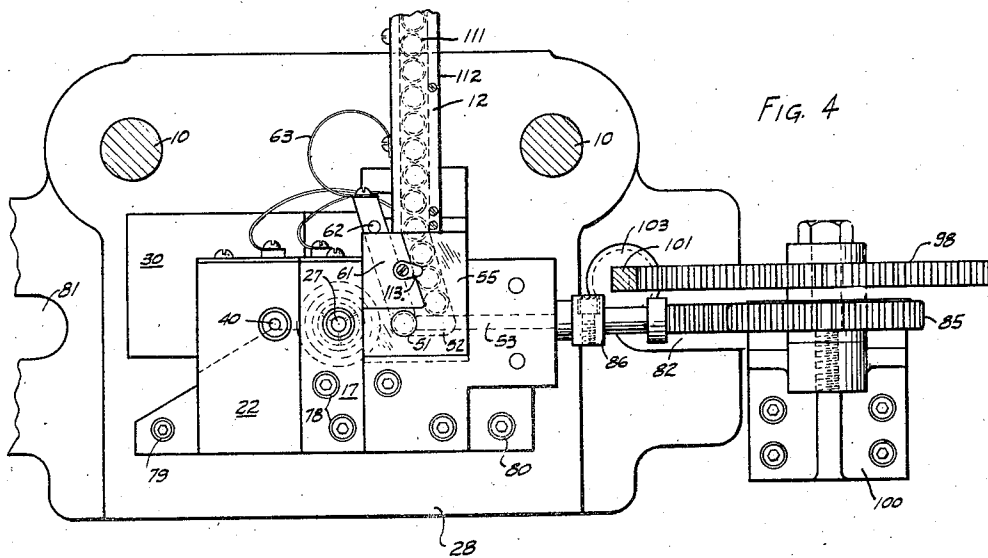


Fig. 4

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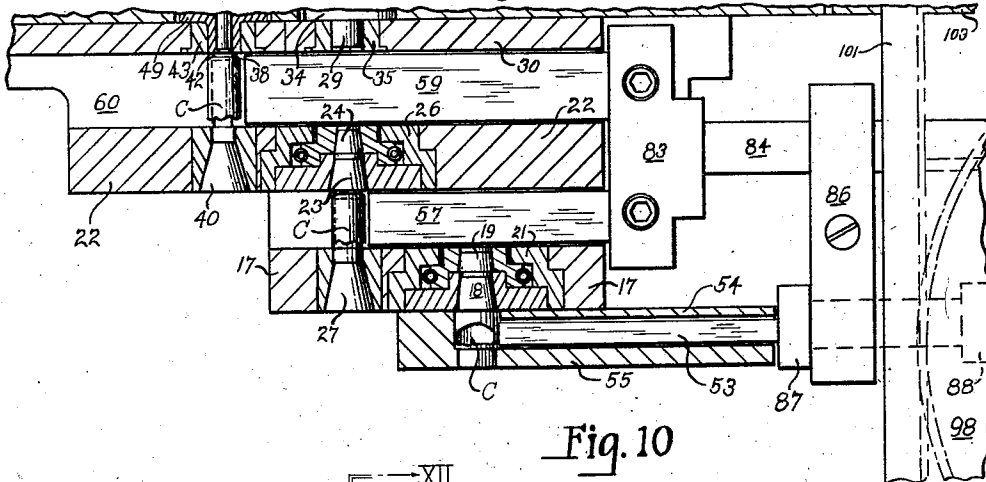


Fig. 10

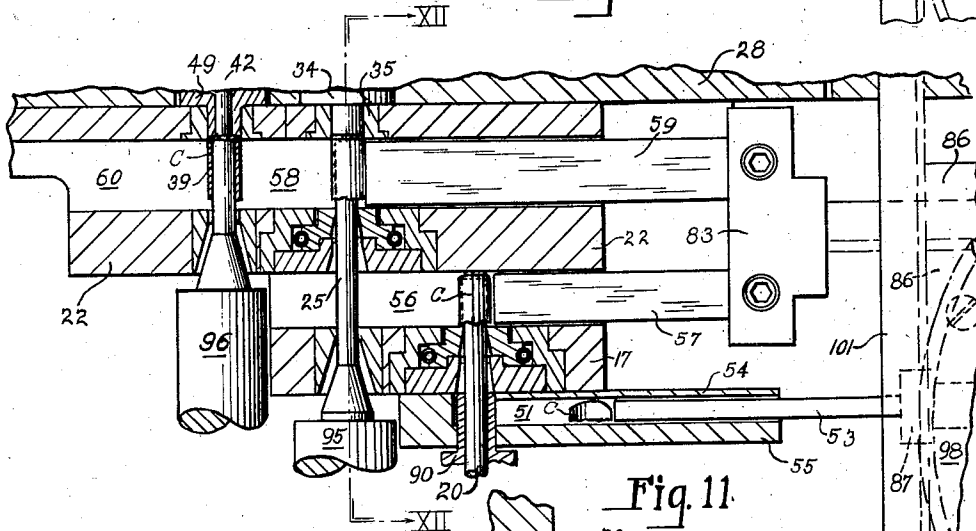


Fig. 11

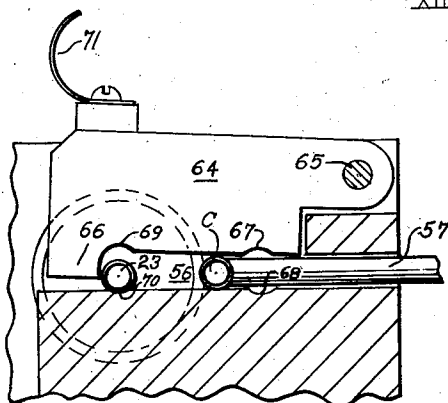


Fig. 13

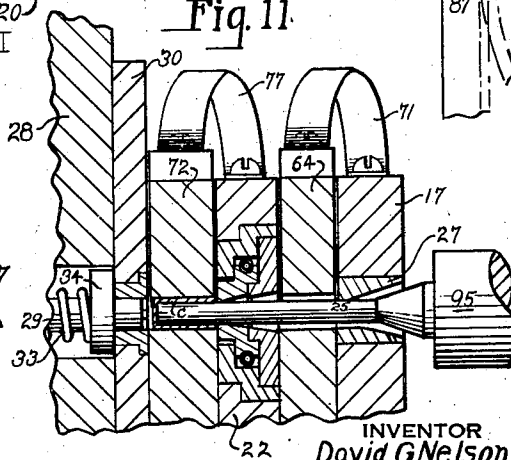


Fig. 12

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## UNITED STATES PATENT OFFICE

2,357,683

## MULTIPLE PUNCH PRESS

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Application August 17, 1942, Serial No. 455,028

7 Claims. (Cl. 113—38)

This invention relates to presses and more particularly to a multiple punch press for forming cup-shaped articles by uninterrupted successive operations.

The invention particularly pertains to an apparatus for fabricating by successive drawing operations cup-shaped articles from cylindrical blanks which have a convex or protuberant end and which also have a greater length than diameter, throughout most of the fabricating procedure. The apparatus comprising the invention consists broadly of a series of dies and corresponding reciprocable punches, wherein a preformed cup-shaped blank is forced through a die of a diameter somewhat smaller than the diameter of the original blank by a specific punch reciprocating in the die under pressure. The dies forming the aforementioned series in the present apparatus consist of a cylindrical member through which is provided a bore having a conical aperture for facilitating the entrance of the preformed blank and which is rigidly supported in a die block against the force applied by the operation in the die of a cylindrical punch. This die has been referred to in the art and will be referred to throughout the specification and appended claims as a push-through die in which a punch of the above-mentioned design operates.

The invention also contemplates the inclusion in the foregoing multiple press other specific metal forming operations which cooperate with the push-through die and constitute a part thereof or which perform metal working operations separate and distinct from the push-through die operation.

The present apparatus is particularly adapted to the fabrication of small diameter cup-shaped articles which, due to their particular shape and to their shape throughout the various stages of fabrication, do not readily lend themselves to fabrication in the multiple push-through die presses heretofore known and available.

One object of the invention is to provide a multiple punch press for the fabrication of elongated cup-shaped articles from cup-shaped blanks having protuberant bottoms wherein the blanks and partially formed articles are drawn by an uninterrupted series of step-by-step operations.

Still another object of the invention is to provide a multiple punch press for the fabrication of elongated cup-shaped articles from cup-shaped blanks by a series of rapid step-by-step operations wherein the blanks and partially

of push-through dies and punches reciprocating in said dies and are progressively advanced on their sides from one die to the next, succeeding die until the finished articles are ejected from the press.

Still another object of the invention is to provide a multiple punch press for the fabrication of cup-shaped articles from cup-shaped blanks which have irregularities in the form of ears and which as a result of these irregularities are of non-uniform height, wherein the blanks are progressively advanced from die to die on their sides and are maintained in substantially parallel relationship with the punches and dies throughout the progressive movement thereof.

Still another object of the invention is to provide a multiple punch press for forming cup-shaped metal articles by an uninterrupted series of step-by-step operations wherein more than one specific metal forming operation comprises the successive steps.

In the accompanying drawings which fully illustrate one embodiment of the present invention,

Figure 1 is an elevation of the assembled multiple press with the article transfer actuating means omitted for the purpose of clarity and with the punch and die assemblies shown in the press in their proper relationship to one another;

Figure 2 is a side elevation of the punch and die assembly removed from the press showing a portion of the blank delivery chute and the relationship of the punches to the dies;

Figure 3 is a section taken on line III—III of Figure 2, the article transfer actuating means and fingers, except the ends thereof, punches, screws and other similar members being shown in elevation;

Figure 4 is a front elevation of the die assembly taken on line IV—IV of Figure 3 showing the portion of the blank delivery chute;

Figure 5 is a section of the die assembly taken on line V—V of Figure 3;

Figure 6 is a section of the die assembly taken on line VI—VI of Figure 3;

Figure 7 is a side elevation of an original blank from which a finished elongated cup-shaped article is made;

Figure 8 is a side elevation of a partially formed article or blank showing a general shape at an intermediate step in the drawing operation; and

Figure 9 is a side elevation of the finished article.

tional view of the die assembly showing the punches withdrawn from the dies.

Figure 11 is the same view as Figure 10 with the punches shown at the completion of the drawing operation.

Figure 12 is a cross sectional view taken on line XII—XII of Figure 11.

Figure 13 is a portion of the view of Figure 6, showing the position of certain elements of the apparatus during the operation thereof.

Referring now to the drawings in which a preferred form of the present invention is shown and in which like reference numerals designate like parts throughout the several views, numeral 1 denotes a base having mounted thereon frame 2 on which are supported flywheel 3, bearings 4, crankshaft 5, connecting rod 6, ram 7, punch and die assemblies 8 and 9, guide pins 10, only one of which is shown, bolster 11, blank feeding chute 12 and a conventional blank hopper 13, its actuating mechanism 14 and support 15. Ram 7 is actuated through connecting rod 6 by conventional crankshaft 5 and motor-driven flywheel 3. While the crank has been employed as the actuating means in the preferred embodiment, any other suitable means may be used, for example, an eccentric bearing may be substituted for the crank.

In the die assembly 9, which comprises one of the principal features of the present invention, die block 17 is shown in which push-through die 18, stripper 19 for removing cup-shaped articles, designated as C, from punch 20 following the drawing operation, and die insert 21 are removably supported in a groove. In die block 22 die 23, stripper 24 for removing articles from punch 25, and die insert 26, all of which are identical in construction to the corresponding parts of die block 17, are also removably supported in a groove. Strippers 19 and 24 which consist of a ring of three segments held together by a coil spring and of an aperture somewhat smaller in diameter than that of the conforming aperture of the die, are seated in die inserts 21 and 26 with enough clearance to permit a slight expansion of the ring when the article being formed by the die is forced therethrough. To assist in centering punch 25 in die 23 during setting up operation, punch guide 27 is provided consisting of a removable bushing secured in die block 17.

Seated in die shoe 28 and aligned with push-through die 23 and punch 25 is anvil 29, the contact end of which is shaped to coin the closed end of the cup-shaped articles and which is retractably retained in the die shoe by plate 30, spacer ring 31, sleeve 32, and coil spring 33 seated on spacer ring 31 and collar 34. The contact end of anvil 29 is seated in nest 35 of plate 30. Spacer ring 31 is held in place by cap screws 36 and 37 shown in broken lines in Figure 1. By this construction when a cup-shaped article on the end of a punch following the forming operation in die 23 is forced into the hole in nest 35, the anvil is retracted until it strikes sleeve 32 whereupon the bottom of the article is coined and flattened and the corners are squared. When the punch retracts, the article is kicked from the hole in nest 35 by spring 33, pushing on collar 34 and spacer ring 31 to return anvil 29 to its original position, the position shown in Figure 3.

In the embodiment of the present invention shown here, a cutting-edge or piercing die 38 is provided for piercing the closed end of cup-shaped articles. The cutting edge which is seated in die shoe 28 and aligned with punch 39 and

guide 40 is a cylindrical member 41 having there-through an axially aligned hole 42, the cutting end of which is the size of the hole desired in the article and remainder of which is somewhat larger than the disc removed from the article during the piercing operation. The cylindrical member 41 is retractably retained in die shoe 28 by members similar to the retaining members of anvil 29, that is, by plate 30 and nest 43, spacer ring 44 secured to die shoe 28 by cap screws 45 and 46 shown in Figure 2, sleeve 47, coil spring 48 seated on spacer ring 44 and collar or stop 49. Coil spring 48 permits cylindrical member 41 of the cutting edge to retract under the force of punch 39 during the operation, thereby avoiding injury to the punch or die when an article becomes jammed therein or when the punch and die are not in true alignment. A chute the top end of which is shown at 50 is provided to remove by gravity the severed disc which failed to be rejected through hole 42 during the piercing operation.

In the die assembly, the push-through dies are arranged in offset relationship, as shown in Figure 3, in order that the partially formed articles of the shape hereinbefore referred to may be transferred from die to die with a movement of a minimum number of mechanical parts in timed relation with one another and with the movement of the punches reciprocating in the dies. Immediately in front of die block 17 and extending parallel therewith is a horizontal rectangular article transfer groove 51 which communicates with throat 52 of blank delivery chute 12 and with the entrance of die 18 and in which finger 53 reciprocates to move cup-shaped blanks from the throat to the first die. Groove 51 one end of which is closed to form a recess for aligning blanks with die 18 is defined on one side by metal plate 54 and on the other by glass or transparent plastic plate 55. Immediately behind die block 17 and parallel therewith is a second article transfer groove 56 which communicates with the exit of die 18 and with the entrance of die 23 and in which finger 57 reciprocates for moving partially formed articles from die 18 to die 23. A similar article transfer groove 58 is provided behind die block 22 in which finger 59 reciprocates for transferring partially formed articles from the exit of die 23 to the piercing die 38 and for ejecting the finished article from the press down chute 60. The contact end of each article transfer finger is arcuate to approximate the curvature of the cup-shaped article or blank.

To control the movement of the blanks and partially formed articles during transfer from chute to die and from die to die and to assist in aligning them with the dies and punches, a hold down block is preferably provided in each article transfer groove. Hold down block 61 of article transfer groove 51 may be clearly seen in Figure 4 wherein a portion is shown in broken lines. This block which has the appearance of a finger is supported by pin 62 and held in proper alignment with die 18 by a slot in which it slides up and down to permit a blank to slide beneath it and to align with die 18. Flat spring 63 one end of which is attached to one end of block 61 and the other end of which is attached to the blank chute 12 is employed to provide the proper pressure on the blank by the block. The blank contact end is arcuated similar to the contact end of finger 53. In article transfer groove 56 is hold down block 64 shown in detail in Figures 6, 12 and 13. This block is pivoted on pin 65

and supported in groove 56 in spaced relation to the bottom thereof by article stop 66 and finger 57. Aligning grooves 67 and 68 which are in alignment with die 18 retain the article deposited from punch 20 and die 18 at right angles with groove 56. Grooves 69 and 70 which are in alignment with die 23 align the articles therewith at the end of the transfer stroke. Flat spring 71, attached to hold down block 64 and die block 17, is provided to facilitate proper positioning of the block 64 and to impart the proper amount of friction between a partially formed article or blank and the bottom of groove 56. In article transfer groove 58 hold down block 72 and aligning grooves 73, 74, 75, and 76, shown in Figure 5, similar to those of transfer groove 58, are provided. The block 72 is pivoted on pin 125 and held in spaced relation to the bottom of groove 58 by finger 59. Flat spring 77 for adjusting the pressure which block 72 will exert on a partially formed article is attached to block 72 and to die block 22.

To form a rigid die assembly, die blocks and plates comprising the die assembly are held together by a plurality of machine screws 78 and the die assembly is supported on die shoe 28 by cap screws 79 and 80, shown on Figure 4. Die shoe 28 is rigidly supported on bolster 11 by suitable cap screws, not shown, in slots 81 and 82 of die shoe 28.

In article transfer means, fingers 57 and 59 are rigidly connected to each other by cross bar 83 and to reciprocating rack 84 running on pinion 85, whereby fingers 57 and 59 are caused to operate in unison from the exit of dies 18 and 23 to the entrance of die 23 and the cutting edge 38, respectively. Cross bar 86 is provided for reciprocating blank transfer finger 53 from throat 52 of chute 12 to die 18 and is rigidly clamped on rack 84 and is loosely fitted on finger 53 between stops 87 and 88 with sufficient clearance to permit the cross bar to slide on finger 53 between stops 87 and 88, thereby permitting the rack 84 to reciprocate farther than finger 53. The distance between the stops determines the length of the stroke of finger 53 by permitting cross bar 86 to advance and retract that distance without a corresponding movement of finger 53, the extent of the movement of finger 53 being the difference between that distance and the distance which rack 84 moves.

In punch assembly 8, shown in Figures 1, 2 and 3, the punches which have heretofore been incidentally referred to are arranged in horizontal alignment with one another and in alignment with their respective dies in which they operate. Punch 20 is firmly seated in punch holder 89. A cup centering device 90 consisting of a sleeve which is retractably mounted on punch 20 and held in proper operating position by cross arm 91 and guides 92 and 93 and coil springs 94, only one of which is shown in Figures 1 and 2, is provided for centering the blank on punch 20 and die 18. Punch 25, which is somewhat longer than punch 20 because die 23 in which it operates is offset to the rear of die 18, is firmly seated in punch holder 95. Punch 39 is designed to cooperate with cutting edge 38 and is securely held in punch holder 96. In this particular construction of the punch assembly, punch holders are fixed to punch plate 97 which is secured to the face of ram 7.

Referring now to the article transfer finger actuating means, shown clearly in Figures 3 and 4, rack 84 for reciprocating fingers 53, 57 and 59 is meshed with pinion 85 and is held in proper

relation thereto by bearing 97 shown by broken lines in Figure 3. Pinion 85 with gear 98 to which it is securely connected is journaled on shaft 89, supported by bracket 100 on bolster 11. Gear 98 is meshed with rack 101 which is held at one end by support 102, on punch plate 97 and which is supported at the other end by bearing 103 in die shoe 28. By the foregoing construction, rack 101 reciprocates when ram 7 and punches 20, 25, and 39 advance toward the dies and retract therefrom causing gear 98 and pinion 85 to oscillate in unison and rack 84 to reciprocate, thereby advancing and retracting fingers 53, 57 and 59. As shown in the drawings, gear 98 is larger than pinion 85 to permit the punches to travel a greater distance to and from the dies than the article transfer fingers need to travel to transfer a blank to the first die and partially formed articles from die to die.

A conventional blank hopper and delivery mechanism are shown in Figure 1 wherein 15 denotes the hopper support on which are supported platform 104, hopper frame 105, hopper actuating means 14, tumbling ring 106, and disc 107, shield 108, and shield supports 109. The actuating means is an electrical gear head motor secured to platform 104. Tumbling ring 106 and disc 107 which are held together by machine screws 110 to form a single rotating unit are rotated and supported by a shaft, not shown, journaled in hopper frame 105 and rotated by motor 14. Shield 108 is held in spaced relation to tumbling ring 106 by supports 109, only two being shown.

Chute 12 is provided for delivering the pre-formed cup-shaped blanks from hopper 13 to throat 52 in article transferring grooves 51. In the preferred embodiment, a chute consists of a rectangular trough the open side of which is closed by glass or transparent plastic plate 111 removably secured to the trough by strips 112. The glass is preferably on the side of the chute facing the punches. The lower end of chute 12 is closed with removable glass plate 55 held in place by turn button 113.

In operation of the present multiple press, with punches 20, 25 and 39 withdrawn from the dies 18, 23 and 38 and article transfer fingers 53, 57 and 59 advanced to the delivery position as shown in Figures 3 and 10, cup-shaped blanks are selected by rotation of tumbling ring 106 and disc 107, discharged into chute 12 and delivered down said chute to throat 52, coming to rest on finger 53 with their open ends facing the punches. Ram 7 and punches 20, 25 and 39 are advanced towards the dies 18, 23, and 38 by rotation of crankshaft 5, and reciprocation of connecting rod 6 and in unison therewith, rack 101 is advanced rotating gear 98 and pinion 85. Rack 84 running on pinion 85 retracts blank transfer finger 53 from beneath the column of blanks permitting the bottom blank to drop into groove 51 immediately in front of finger 53, and simultaneously therewith said rack also retracts fingers 57 and 59 to the right of dies 18 and 23, respectively. When punches 20 and 25 advance through their respective dies carrying the cup-shaped blanks, strippers 19 and 24 close around their respective punches behind the articles and when the punches retract deposit the articles in the article transfer grooves immediately in front of fingers 57 and 59 and in aligning grooves 67 and 68, and 73 and 74. Continued rotation of crankshaft 5 and reciprocation of connecting rod 6 withdraws ram 7 and punches 20, 25 and 39 to their original position. Withdrawal of rack 101 with ram 7 rotates gear 98 and pinion

85 in the opposite direction and advances rack 84 and article transfer fingers 53, 57 and 59, delivering a blank to die 18 and partially formed cup-shaped articles under pressure of hold down blocks 64 and 72 to aligning grooves 69 and 70, and 75 and 76 for the next succeeding forming operation and ejecting the finished article from the apparatus down chute 60. In die 38 the finished elongated cup-shaped article remains in alignment therewith after the forming operation to be ejected when the next article is advanced into position for forming by said die and punch. The foregoing operation is constantly repeated as one continuous operation.

In this embodiment of the present invention only two push-through dies are shown, these, in adjacent relationship, and only two other kinds of forming operations are included, one in conjunction with and forming a part of the push-through die operation and the other being a separate and distinct operation. It is to be understood that any plural number of push-through dies or any number of other specific forming operations may be employed without departing from the scope of the present invention. Furthermore, it is contemplated in this invention for the other specific metal forming operations to precede or to be interposed between the successive push-through die operations.

We claim:

1. In a multiple punch press for forming cup-shaped articles from cylindrical blanks having a closed protuberant end, a horizontally reciprocable ram, a plurality of punches on said ram, a plurality of push-through dies offset successively one behind the other on a common substantially horizontal plane for cooperating with said punches, means for delivering blanks to first die, means operating in timed relation with movement of said punches for progressively transferring article blanks from die to die on their sides, and means for maintaining said blanks in substantially parallel relationship with said punches and dies throughout progressive movement of said blanks from die to die and for aligning said blanks therewith including a yieldable hold down means.

2. In a multiple punch press for forming cup-shaped articles from cylindrical blanks having a closed protuberant end, a horizontally reciprocable ram, a plurality of punches on said ram, a plurality of push-through dies offset successively one behind the other on a common substantially horizontal plane for cooperating with said punches, means for delivering blanks to first die, means operating in timed relation with movement of said punches for progressively transferring article blanks from die to die on their sides, means for actuating said article transfer means in unison with said ram, and means for maintaining said blanks in substantially parallel relationship with said punches and dies throughout progressive movement of said blanks from die to die and for aligning said blanks therewith including a yieldable hold down means.

3. In a multiple punch press for forming cup-shaped articles from cylindrical blanks having a closed protuberant end, a horizontally reciprocable ram, a plurality of punches on said ram, a plurality of push-through dies offset one behind the other on a common substantially horizontal plane for cooperating with said punches, at least one die of another specific forming

operation, means for delivering blanks to first die, means operating in timed relation with movement of said punches for progressively transferring article blanks from die to die on their sides, means for actuating said blank transfer means in unison with said ram, and means for maintaining said blanks in substantially parallel relationship with said punches and dies throughout progressive movement of said blanks from die to die and for aligning said blanks therewith including a yieldable hold down means.

4. In a multiple punch press for forming small elongated cup-shaped articles from cylindrical blanks having a closed protuberant end, a horizontally reciprocable ram, a plurality of punches on said ram, a plurality of push-through dies offset one behind the other on a common substantially horizontal plane to cooperate with said punches, a piercing die, a chute for depositing blanks beside entrance of first die, a finger for aligning said blanks with first die, a groove and reciprocable finger therein for transferring blanks formed by said first die to a second die, groove and reciprocable finger therein for transferring blanks formed by said second die to said piercing die and for ejecting finished article from the press, hold down blocks in each blank transfer groove for maintaining said blanks in substantially parallel relationship to said punches and dies throughout progressive movement of said blanks from die to die, a rack and pinion for actuating in unison said article transfer fingers, a rack and gear operating in unison with said ram for actuating said rack and pinion, whereby said reciprocable punches and said article transfer fingers operate in timed relation to one another.

5. In a multiple punch press for forming small elongated cup-shaped articles from cylindrical blanks having a closed protuberant end, a horizontally reciprocable ram, a plurality of punches on said ram, a plurality of push-through dies offset one behind the other on a common substantially horizontal plane to cooperate with said punches, a chute for depositing blanks beside entrance of first die, a finger for aligning said blanks with first die, a groove and reciprocable finger therein for transferring blanks formed by said first die to a second die, groove and reciprocable finger therein for transferring blanks formed by said second die to a third die and for ejecting finished article from the press, hold down blocks in each transfer groove for maintaining said blanks in substantially parallel relationship to said punches and dies throughout progressive movement of said blanks from die to die, grooves in said hold down blocks and in said article transfer grooves at the entrance and exit of each of said push-through dies and in alignment therewith for aligning and retaining in alignment article blanks, means for actuating said blank transfer fingers in unison with said ram, whereby said reciprocable punches and said article transfer fingers operate in timed relation to one another.

6. In a multiple punch press for forming cup-shaped articles from cylindrical blanks having a closed protuberant end, a mechanism for transferring cup-shaped blanks from the exit of one die to the entrance of the next succeeding die, comprising a substantially horizontal article transfer groove, a finger adapted to reciprocate in said groove between the exit of one die and the entrance of the next succeeding die for advancing said blanks, a pivoted block in said

groove for frictionally engaging said blanks during their movement in said groove, and a yieldable means for causing said block to impart a predetermined amount of pressure on said blanks, whereby said blanks are maintained at all times in substantially parallel relationship with said dies.

7. In a multiple punch press for forming cup-shaped articles from cylindrical blanks having a closed protuberant end, a mechanism for transferring cup-shaped blanks from the exit of one die to the entrance of the next succeeding die, comprising a substantially horizontal article transfer groove, a finger adapted to reciprocate in said groove between the exit of one die and

the entrance of the next succeeding die for advancing said blanks, a pivoted block in said groove for frictionally engaging said blanks during their movement in said article transfer groove, a yieldable means for causing said block to impart a predetermined amount of pressure on said blanks, and transverse grooves in said block and in said article transfer groove at the exit and entrance of the dies and in alignment therewith, whereby said blanks are maintained at all times in substantially parallel relationship with said dies.

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