

Nov. 12, 1946.

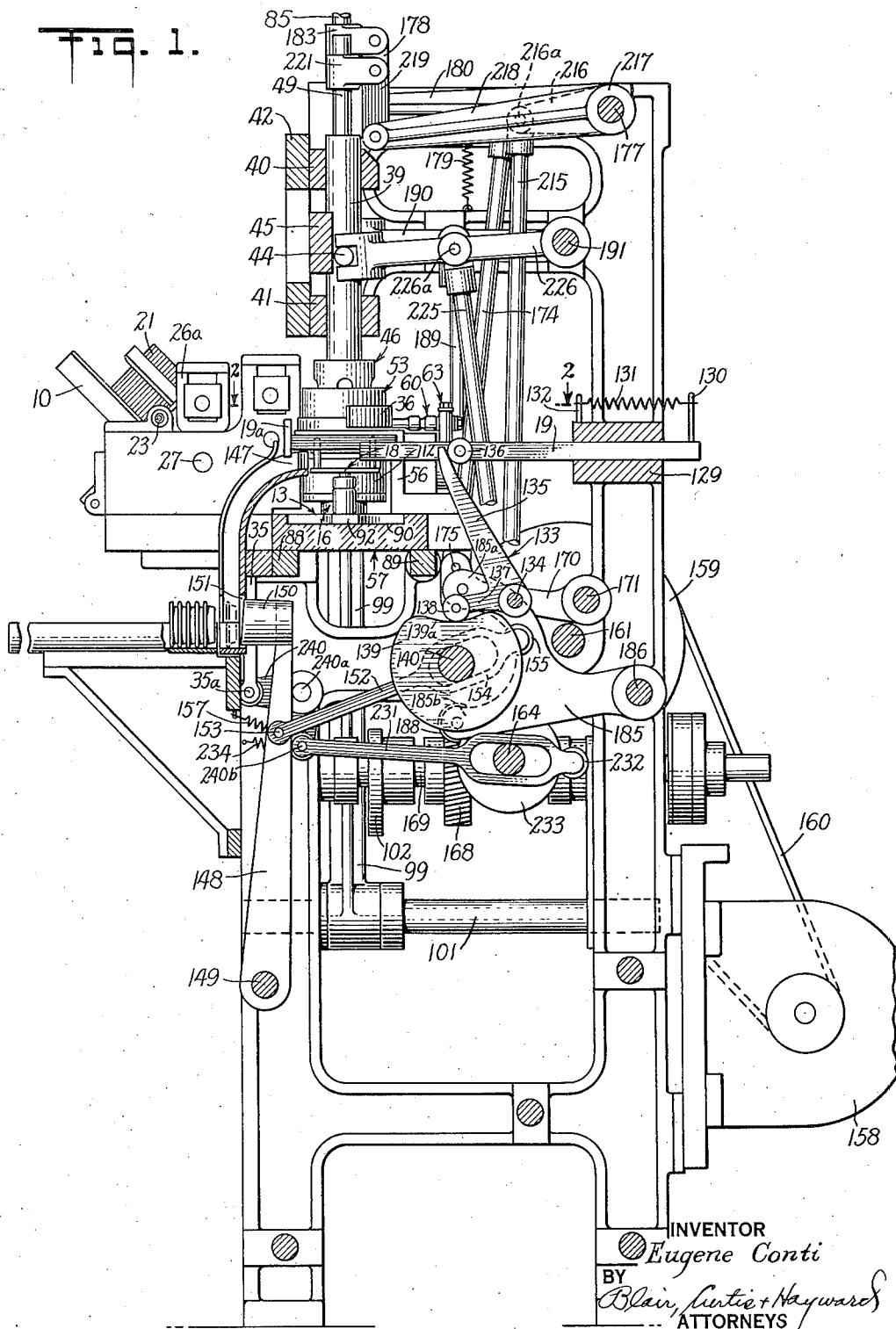
E. CONTI

2,411,082

CUP FORMING MACHINE

Filed Feb. 27, 1943

5 Sheets-Sheet 1



Nov. 12, 1946.

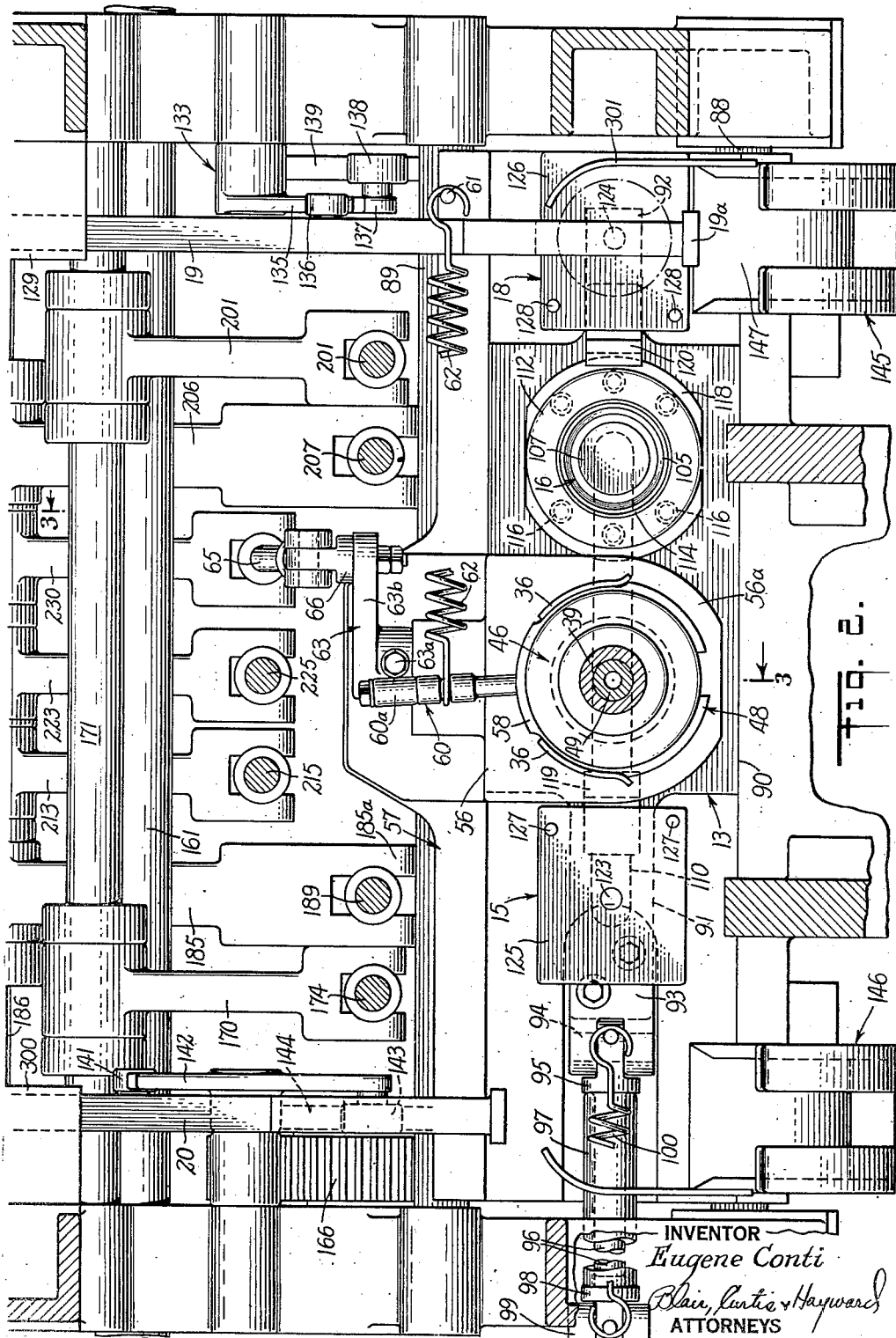
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CUP FORMING MACHINE

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5 Sheets-Sheet 2



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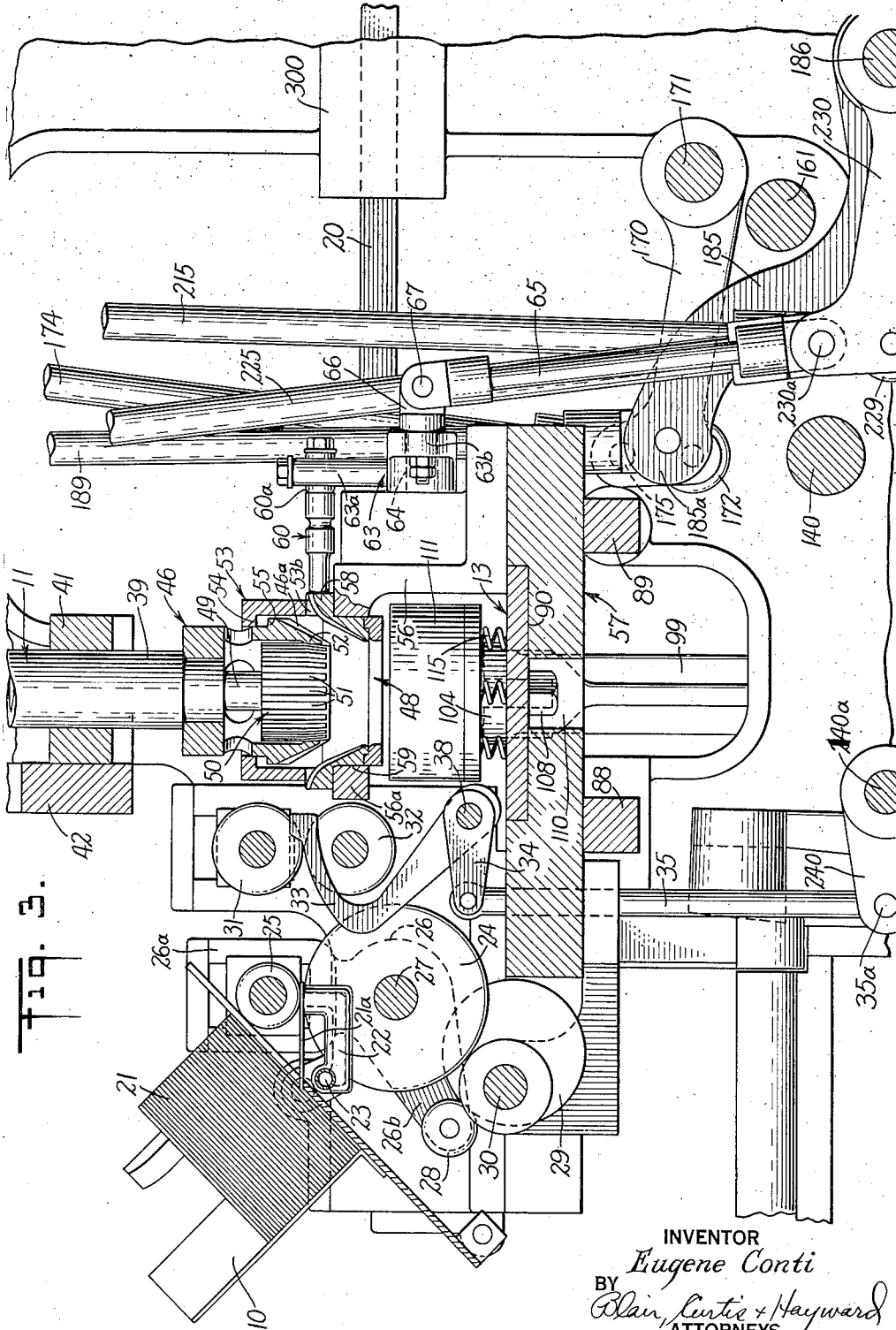
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CUP FORMING MACHINE

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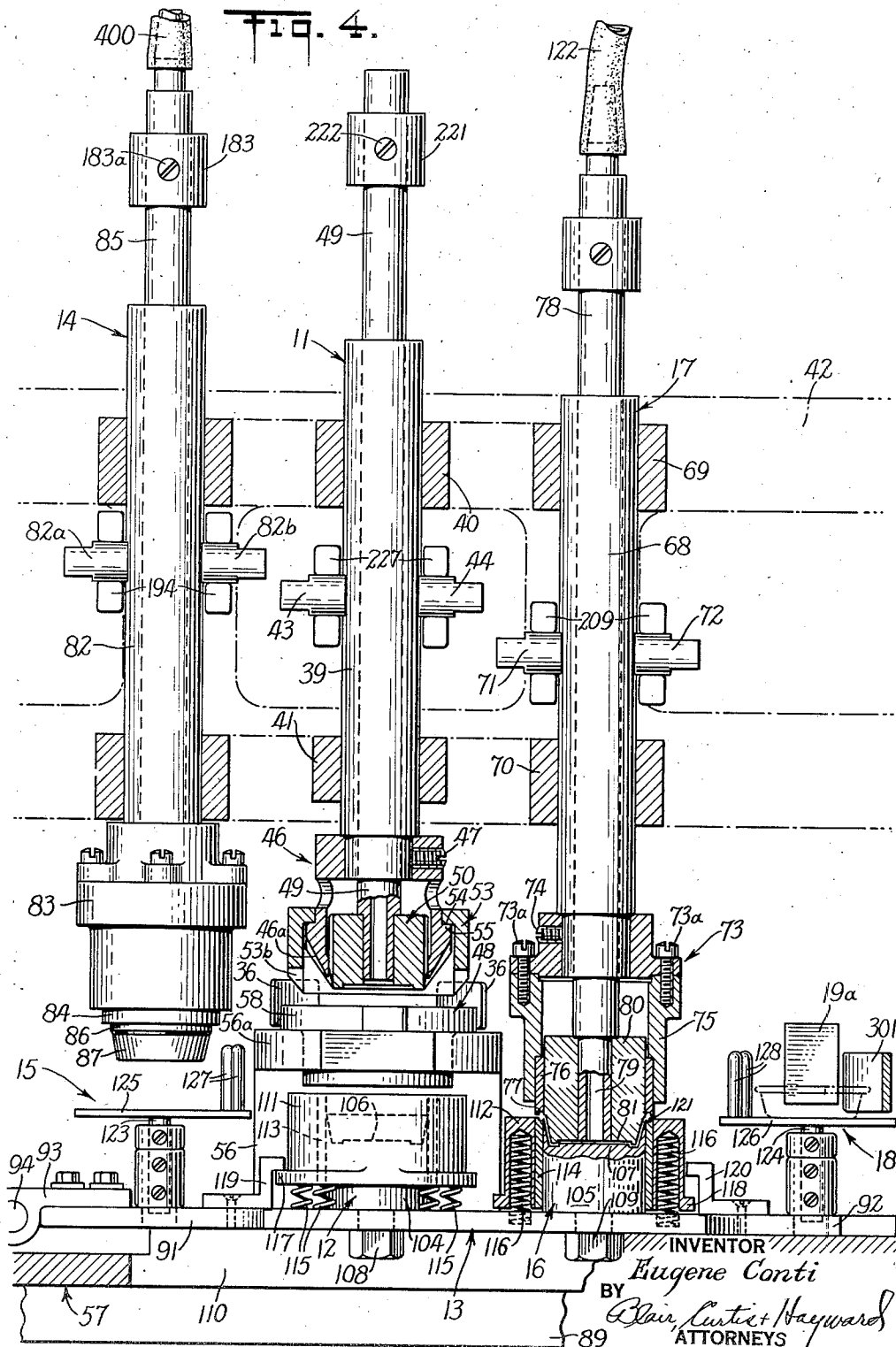
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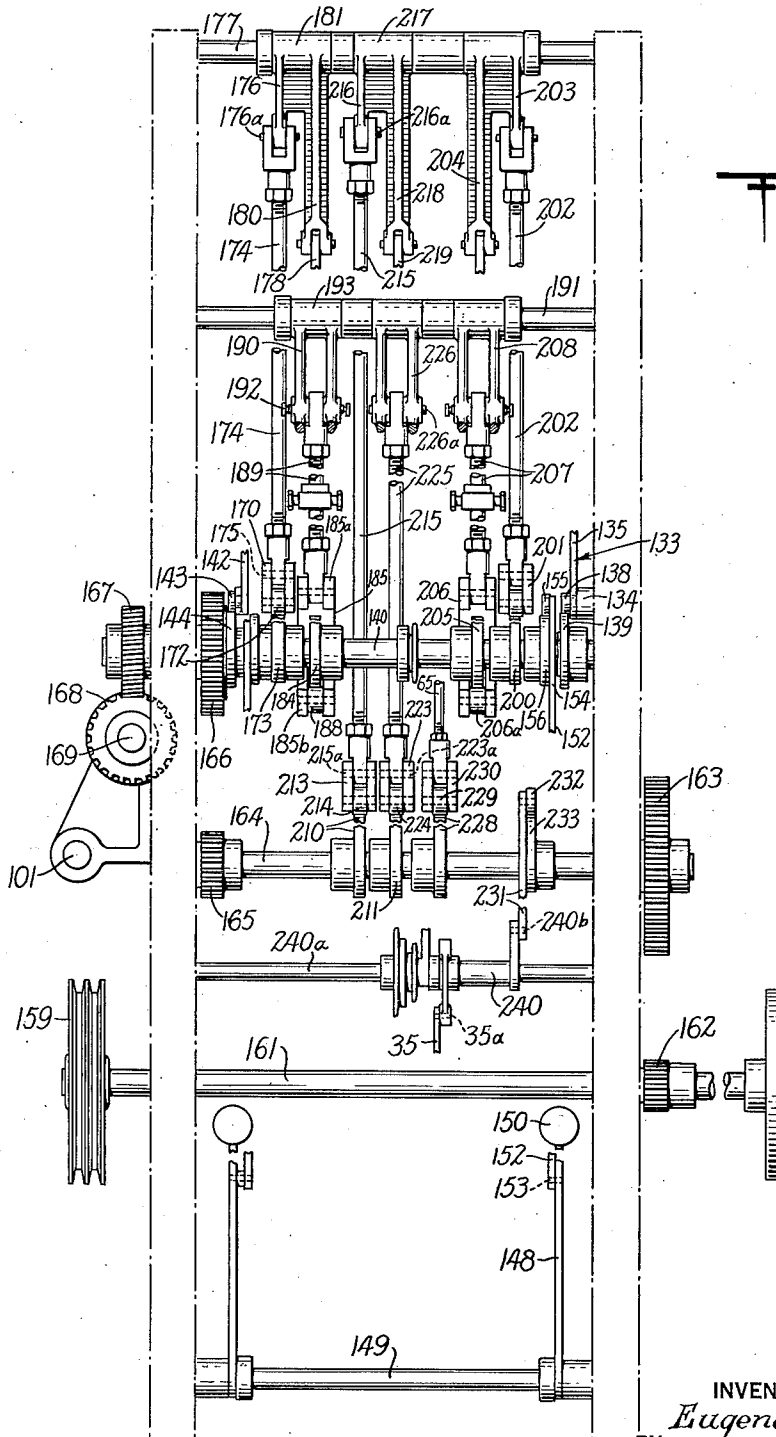


Fig. 5.

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UNITED STATES PATENT OFFICE

2,411,082

CUP FORMING MACHINE

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Application February 27, 1943, Serial No. 477,381

23 Claims. (Cl. 93—60)

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This invention relates to a machine for and method of forming cups from paper or like materials.

One of the objects of this invention is to provide a new and improved cup forming machine. Another object of this invention is to provide a machine of the above character which is simple, thoroughly practical, and durable. Another object is to provide a machine of the above character which forms cups rapidly and efficiently. Another object of this invention is to provide a cup forming machine which requires a minimum of attention during operation and thus is inexpensive to operate. Another object of this invention is to provide a new and improved method of forming cups. A further object of this invention is to provide a rapid and efficient method of forming cups. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, arrangements of parts, and in the several steps and relation and order of each of the same to one or more of the others, all as will be illustratively described herein and the scope of the application of which will be indicated in the following claims.

In the drawings in which is shown one of the various possible embodiments of this invention,

Figure 1 is a staggered vertical section taken through the right side of the machine, certain parts of the machine being removed for purposes of clarity;

Figure 2 is a horizontal section of the machine taken on the line 2—2 of Figure 1, certain parts of the machine being removed for purposes of clarity;

Figure 3 is a vertical section taken through the center of the machine on the line 3—3 of Figure 2;

Figure 4 is a front view of the center portion of the machine, certain parts being in elevation and others in section; and,

Figure 5 is a diagrammatical view of the machine's driving mechanism taken from the front of the machine.

Similar reference characters refer to similar parts throughout the several views of the drawings.

In forming cups on this machine, blanks are fed from a hopper 10 (Figure 1) beneath the die of a primary plunger and male die assembly, generally indicated at 11 (Figures 1 and 4), which coacts with a die, generally indicated at 48 (Figure 4), of a primary female die assembly

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to pleat the sides of the blanks. Said plunger assembly 11 then presses the pleated blank into a secondary female die assembly generally indicated at 12. This die assembly, which is mounted on a slide plate or slidable carrier generally indicated at 13, then shifts to the left, as viewed in this figure, so that it is positioned beneath the die of a secondary plunger and male die assembly generally indicated at 14. This assembly, which carries a secondary male die, coacts with the secondary female die assembly 12 to form the bottom of the cup and fold a lip thereon. After this operation, plunger assembly 14 by suction lifts the cup out of die 12, and when the carriage moves back to its first position, it drops this cup onto a delivery tray generally indicated at 15.

During the time that plunger assembly 14 is acting upon the pleated blank in die assembly 12, plunger assembly 11 is pleating another blank above the die assembly generally indicated at 16, and on completion of the pleating, the pleated blank is pressed into this die assembly. When slide plate 13 shifts and plunger assembly 14 is dropping a completed cup upon delivery tray 15, secondary plunger assembly 17 forms and folds a lip on the pleated blank in die assembly 16. The completed cup is then raised by plunger assembly 17 and, when the slide plate 13 moves back in the opposite direction, is dropped onto a delivery tray generally indicated at 18. The cups are removed from delivery trays 15 and 18 by a pair of pusher members 19 and 20 (Figures 2 and 4) which move forwardly across the trays 18 and 15 to push the cups off of their respective delivery trays.

Thus, the primary plunger assembly 11 pleats blanks and places them in die assemblies 12 and 16. The secondary plunger assemblies form and fold lips on the cups, remove them from die assemblies 12 and 16, and place them on delivery trays 15 and 18. In operation, the plunger assembly pleats a blank and places it in a die assembly. One of the secondary plunger assemblies is forming and placing a lip on a pleated blank, and the other secondary plunger assembly is dropping a completed cup on a delivery tray. When these operations have been performed, the slide plate 13 shifts, the primary plunger assembly pleats another blank, and the operations of the secondary plunger assemblies are reversed.

Referring to Figure 3, hopper 10 carries a stack of blanks 21. These blanks are removed from the hopper one at a time by a suction finger 22 which pivots on a pin 23. Suction finger 22

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is positioned between a pair of feed discs 24 and, after gripping a blank 21a, moves or bends it downwardly so that the righthand portion of the blank, as viewed in Figure 3, is positioned on the top edges of the feed discs 24. Feed discs 24

coact with feed roll 25 to feed blanks into the machine. To periodically move feed roll 25 out of the path of movement of suction finger 22, the roll is mounted on an arm 25a of a bell crank 26. This bell crank pivots on the shaft 27 of feed discs 24 and carries a cam roller 28 on its other arm 26b. A cam 29 mounted on shaft 30 acts upon cam roller 28 to rock bell crank 26 and thus move feed roll 25 out of the path of suction finger 22 as the finger swings upwardly to grasp a blank and then swings back to bend said blank downwardly. After a blank is placed in the position of blank 21a, Figure 3, the feed roll 25 swings back into operative relation with feed discs 24 and the blank to feed the blank into the machine.

Each blank, as it is moved to the right by feed roll 25 and feed discs 24, is fed between two pairs of feed discs 31 and 32. These feed discs, which feed the blank beneath the primary plunger assembly 11 (Figures 3 and 4), are spaced to permit movement of a positioning finger 33 (Figure 3) therebetween. Positioning finger 33 moves upwardly between the pairs of feed discs 31 and 32 after the feed discs have fed a blank beneath plunger assembly 11 and pushes the blank to the right, as viewed in Figure 3, into engagement with a vertical guide plate 36 (Figures 2, 3 and 4). Positioning finger 33, which is pivotally mounted on a shaft 38 (Figure 3), is moved by a crank 34 (Figure 3) and link 35, which is actuated by mechanism to be described more fully hereinafter.

Plunger assembly 11 includes a sleeve 39 (Figure 4) slidably mounted for vertical movement with respect to the machine in bearings 40 and 41 (Figures 1 and 4). These bearings are secured to a front plate 42, which forms a part of the framework of the machine. Sleeve 39 carries a pair of pins 43 and 44 (Figures 1 and 4) which extend outwardly from the sides thereof. The front surfaces of these pins contact slide plates, such as slide plate 45 (Figure 1), which coact with the pins to prevent rotational movement of sleeve 39 in bearings 40 and 41. The lower end of the sleeve 39 has a hollow male die member, generally indicated at 46 (Figures 3 and 4), connected thereto by set screw 47 (Figure 4). The die 46a of die member 46 coacts with a female die, generally indicated at 48 (Figures 3 and 4), to pleat the sides of the paper blank beneath plunger assembly 11, all as will be described fully hereinafter.

A rod 49 (Figures 3 and 4) is slidably mounted within sleeve 39 and has a cylindrically shaped seating member or head, generally indicated at 50, secured to its lower end. This head is positioned within hollow die member 46 and has vertical splines 51 (Figure 3) thereon which coact with vertical splines 52 formed on the inner surface of die member 46 to prevent rotational movement of head 50 with respect to die member 46. A retaining ring, generally indicated at 53, is mounted on die member 46 and has an annular flange 54 extending inwardly from its upper edge which coacts with a shoulder 55 on die member 46 to hold the ring in assembled relationship with the die member as the die member is raised (Figure 4) and to permit vertical movement of the ring with respect to the die member when the die member is lowered (Figure 3).

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Female die 48, which is positioned below and in co-axial alignment with male die member 46, is mounted on a bracket 56 secured to a bed plate generally indicated at 57 (Figure 3). This die has an annular flange 58 extending outwardly from the upper portions thereof over bracket 56, and the lower portion of the die is cylindrically shaped and has a slightly smaller diameter than the diameter of a hole 59 in bracket 56 through which it extends, thus permitting rotational movement of the die with respect to bracket 56. Die 48 has an arm, generally indicated at 60, extending rearwardly therefrom (Figures 1, 2 and 3) and connected to a pin 61 on bed plate 57 by a spring 62 (Figure 2). This spring through arm 60 resiliently urges die 48 to move in a clockwise direction as viewed in Figure 2.

The outer portion of arm 60 has a bearing surface 60a thereon which coacts with a bearing surface on the upper portion of an arm 63a of a bell crank generally indicated at 63. Bell crank 63 (Figure 3) is pivotally mounted on bracket 56 by a pin 64. The other arm 63b of the bell crank (Figures 2 and 3) is pivotally connected to a link 65 by bracket 66 and pivot pin 67 (Figure 3). Link 65 is moved with a reciprocating action in a vertical direction by mechanism to be described more fully hereinafter, and each time the link 65 moves upwardly, as viewed in Figure 3, it acts through bell crank 63 and arm 60 to give die 48 a rotational twist.

In operation, a blank is fed beneath plunger assembly 11 when it is in the position shown in Figure 4 so that it abuts against guide plate 36 (Figures 2 and 4). The rod 49 and sleeve 39 are then moved downwardly through mechanism to be described more fully hereinafter, and retaining ring 53 is the first portion of the plunger assembly to contact the blank. As is best shown in Figure 4, the lower edge 53a of retaining ring 53 tapers inwardly, and this edge carries a plurality of grooves 53b complementary to the pleating grooves in female die 48. This ring holds the blank in position as the rod 49 and sleeve 11 move downwardly together (Figure 3) to seat the male die 46 in the female die 48. These dies carry complementary pleating grooves which are so shaped that, when female die 48 is twisted by arm 60, the side of the blank is pleated.

During the formation of the pleating grooves, the male die 46 is prevented from rotational movement because of its connection to sleeve 39. After the blank has been pleated by the twisting of die 48, spring 62 (Figure 2) moves the die 48 into its original position. Next, sleeve 39 moves upwardly slightly to move die 46a out of contact with die 48, and rod 49 with its head 50 moves downwardly to press the pleated blank through the open bottom of the female die 48 (Figure 3) into either female die assembly 12 (Figure 4) or die assembly 16, whichever is positioned beneath die 48.

As plunger assemblies 14 and 17 (Figure 4) are substantially similar in construction, the description of more specific details of construction will be limited to plunger assembly 17. This assembly includes a sleeve 68 mounted for vertical sliding movement with respect to the machine in bearings 69 and 70 mounted on front plate 42 (Figure 1). Sleeve 68 (Figure 4) has a pair of pins 71 and 72 extending outwardly from the sides thereof which coact with slide plates similar to slide plate 45 (Figure 1) to prevent rotational movement of the sleeve with respect to bearings 69 and 70. Sleeve 68 has a head

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generally indicated at 73 connected thereto by a set screw 74. The lower portion of head 73 consists of an annular ring member 75 which is secured to the upper portion of the head by screws 73a. A cylindrically shaped die member 76 is mounted within the lower portion of annular ring 75 and extends therebelow. The lower edge of this die member has a groove 77 therein which coacts with another die to form a lip on each cup it acts upon, all as will be fully described hereinafter.

A rod 78 having a hole 79 extending through its center is mounted for vertical sliding movement within sleeve 68. A cylindrically shaped seating member as head 80 is mounted on the lower end of rod 78 and is of a slightly smaller diameter than the inner diameter of die member 76. The lower portion of head 80 is shaped to form a male die 81 which is adapted to coact with the female die assembly 16. Means are provided to move both sleeve 68 and rod 78 upwardly and downwardly with respect to the machine both in unison and as separate elements, all as will be described fully hereinafter.

Plunger assembly 14 includes a sleeve 82 having a head 83 and die member 84 mounted thereon. Rod 85 has a head 86 mounted on its lower end and a hole extending through the rod extends through head 86. The lower portion of head 86 is shaped to form a male die 87 which coacts with female die assembly 12 during the operation of the machine. In this plunger assembly, rod 85 and sleeve 82 with their connected parts also are moved upwardly and downwardly both in unison and as separate elements by means to be described more fully hereinafter.

Bed plate 57 (Figures 2, 3 and 4) extends transversely across the machine in a horizontal plane and is supported by framework braces 88 and 89 (Figures 1 and 2). This plate has a way 90 (Figures 2 and 3) cut therein which extends throughout the length of the bed plate and within which slide plate 13 is mounted. Slide plate 13 (Figure 2), which is of rectangular shape, has a pair of tongues 91 and 92 (Figures 2 and 4) extending outwardly from the ends thereof. A bracket 93 is connected to the end of tongue 91, and this bracket is pivotally connected by pin 94 (Figure 2) to the head 95 of a cylindrically shaped piston member 96. Piston member 96 is slidably mounted within a sleeve 97, the head 98 of which is pivotally connected to the upper end of a rocker arm 99. A spring 100 connected to piston member head 95 and to sleeve head 98 resiliently urges these heads toward each other to maintain piston member 96 within sleeve 97. Thus, piston member 96, sleeve 97, and spring 100 form a resilient connection between the slide plate and the upper end of rocker arm 99 (Figure 2). Thus, if at any time the slide plate should be stuck in the position shown in Figure 2, this assembly would permit the rocker arm to move outwardly without damage to the dies or whatever part of the machine that was causing the slide plate to stick.

Rocker arm 99, which is resiliently urged to the right, as viewed in Figure 2, by a spring (not shown), extends downwardly to shaft 101 (Figure 1) on which it is pivotally mounted. The rocker arm is moved by a cam 102 mounted upon shaft 101 which is driven by means to be disclosed more fully hereinafter. Thus, as rocker arm 99 moves with a reciprocating action, slide plate 13 will be moved back and forth on bed plate 57 beneath the plunger assemblies. 75

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Cam 102 is so shaped that there will be a definite time interval between movements of the rocker arm, thus providing a time interval to permit the plunger assemblies to accomplish their various functions on each stroke.

The secondary female die assemblies 12 and 16 (Figure 4) are substantially similar in construction and include rigidly mounted platen or anvil die members 104 and 105, respectively. Die portions 106 and 107 are cut into the upper faces of said platen or anvil members 104 and 105, respectively, which are secured to slide plate 13 by screws 108 and 109. Bed plate 57 is cut out at 110 to accommodate the heads of screws 108 and 109 as slide plate 13 moves with respect to bed plate 57.

Mounted on anvils 104 and 105 are a pair of cylindrically shaped casing members 111 and 112 having die members 113 and 114 fitted therein in any suitable manner, such as by a force fit. The inner diameters of die members 113 and 114 are preferably slightly greater than the outer diameters of anvils 104 and 105, thus permitting vertical movement of casing members 111 and 112 with respect thereto. Casing members 111 and 112 are resiliently pressed or biased upwardly by sets of springs 115 and 116, the upper ends of which extend into holes formed in casing members 111 and 112 and the lower ends of which extend into holes formed in slide plate 13.

Casing members 111 and 112 have annular flanges 117 and 118, respectively, extending out from their lower edges which coact with brackets 119 and 120 secured to slide plate 13 to limit the upward movement of the casing members with respect to anvils 104 and 105. As is best shown on die member 114, the upper edge of each member has a groove, such as groove 121, which coacts with the groove 77 formed in the lower end of die member 76 to form a lip upon the cup, all as will be described fully hereinafter.

Normally the secondary female die assemblies 12 and 16 are positioned with respect to slide plate 13 in the position of die assembly 12 (Figure 4). After a partly formed or pleated blank has been pressed into the secondary female die then positioned beneath plunger assembly 11 by head 50, the pleated blank is moved beneath either plunger assembly 14 or plunger assembly 17 by female die assembly 12 or by die assembly 16, moving with carrier 13. When a female die assembly, such as die assembly 16 (Figure 4), is so positioned beneath a secondary male die and plunger assembly, the seating head 80 of the plunger assembly moves downwardly until the die 81 thereon seats in the die 107 of anvil member 105. Next, sleeve 68 moves downwardly, and the groove 77 on die member 76 contacts the upper edge of the pleated die blank positioned in the female die assembly 16. Groove 77 then coacts with groove 121 on die member 114 to roll the edge of the blank as it continues to move downwardly. During this time groove 121 in die member 114 is resiliently urged upwardly toward groove 77 by the springs acting between slide plate 13 and casing member 112. Downward movement of head 80 is continued until casing member 112 is moved to a position just above slide plate 13.

Next, suction is applied through a hose 122 connected to rod 78 which acts through the hole 79 extending through rod 78 to move the finished cup upwardly out of female die assembly 16 as plunger assembly 17 moves upwardly. When the plunger assembly is in a raised position such

as the position of plunger assembly 14 in Figure 4, the slide plate shifts to position delivery tray 18 beneath plunger assembly 17. Then the suction pressure is released dropping the finished cup onto the delivery tray.

Delivery trays 15 and 13 are mounted upon tongues 91 and 92 (Figure 2) of slide plate 13 in any suitable manner, such as by posts 123 and 124 (Figure 4). These trays have flat bottom plates 125 and 126 (Figures 2 and 4), and each has a pair of pins 127 and 128 extending vertically adjacent the edges thereof next to female die assemblies 12 and 16, respectively. These pins serve to prevent a cup from sliding off plates 125 and 126 when slide plate 13 moves to position the delivery tray in front of pusher members 20 and 19.

As the mounting and mechanism for moving pusher members 19 and 20 are substantially similar, specific description of the mounting and mechanism for moving these members will be limited to member 19. Referring to Figure 1, the right-hand portion of member 19 extends through and is slidably mounted in a block 129 mounted on the framework of the machine. A pin 130 mounted on the end of member 19 is connected by a spring 131 to a pin 132 mounted on block 129. This spring resiliently urges pusher member 19 to the left, as viewed in Figure 1. The left-hand end of pusher member 19 carries a face plate 13a which acts upon the cups to push each one off delivery tray 18 when tray 18 is positioned in front of member 19.

Pusher member 19 is moved by a bell crank generally indicated at 133. This bell crank is pivotally mounted on the framework of the machine by a pin 134, and its upper arm 135 contacts a roller 136 mounted on pusher member 19. The other arm 137 of bell crank 133 carries a cam roller 138 (Figures 1 and 5) which coacts with a cam 139 mounted on shaft 140 to move the bell crank 133 with a reciprocating action. From the shape of cam 139 (Figure 1) it will be noted that, when cam roller 138 rides on the concave portion 139a of cam 139, spring 131 is permitted to move pusher member 19 to the left, as viewed in Figure 1. When the cam roller 138 is riding on the other portion of cam 139, the upper arm 135 of bell crank 133 moves to the right, as viewed in Figure 1, acting through roller 136 to move the left end portion of pusher member 19 out of the path of delivery tray 18.

Pusher member 20, which is mounted on block 300 (Figure 3), has a roller 141 (Figure 2) mounted thereon which coacts with bell crank 142, cam roller 143 (Figures 2 and 5), and cam 144 to move pusher member 20 (Figure 2) with an action similar to the action of pusher member 19. Cam 144 is mounted on shaft 140 (Figure 1) and permits the spring of pusher member 20 to move across its delivery tray 15 when tray 15 is positioned in front of it.

When a finished cup is removed from a delivery tray by pusher member 19 or pusher member 20, it enters chutes generally indicated at 145 and 146 (Figure 2). As the chutes and the mechanism related to each of them are substantially similar, details of construction will be limited to chute 145. The upper end of chute 145 (Figure 1) has a mouth 147 (Figures 1 and 2) which is positioned adjacent the front edge of delivery tray 18 when the slide plate 13 is at the right-hand end of its stroke, as viewed in Figure 2. As the cups are pushed from the tray, they are guided into mouth 147 by guide plate 301 (Figure

2) and slide downwardly therein (Figure 1). As the width of the chute is slightly greater than the depth of a cup, cups passing down the chute are positioned on edge when they strike the bottom thereof. To remove the cups from the bottom of the chute, an arm 148 pivoted on shaft 149 is provided. A spring 157 connected to arm 148 and the framework of the machine resiliently urges arm 148 to the left as viewed in Figure 1. The upper end of this arm carries a head 150 which is adapted to enter a hole 151 in the rear of chute 145 adjacent the bottom thereof. Arm 148 has a link 152 pivotally connected thereto by a pin 153. This link has a split portion 154 therein extending around shaft 149, and its right-hand end, as viewed in Figure 1, carries a cam roller 155 which rides on a cam 156 (Figure 5) mounted on shaft 149. Cam 156 acting through link 152 (Figure 1) coacts with spring 157 to cause arm 148 to move with a reciprocating action, and this movement is timed so that head 150 moves to the left, as viewed in Figure 1, each time a cup drops to the bottom of chute 145.

In operation, the primary plunger assembly 11 moves downwardly pleating the cup blank by co-action with the primary female die 43 and placing or seating it in the secondary female die assembly positioned therebeneath. At this time one of the secondary male die and plunger assemblies as 14 or 17, is moving down and forming and placing a lip on a pleated blank while the other secondary plunger assembly is dropping a finished cup onto its delivery tray. Thus, primary plunger assembly 11 moves downwardly once for each downward movement of each of the secondary plunger assemblies, and accordingly, plunger assembly 11 makes two strokes for each stroke of plunger assembly 14 or plunger assembly 17. Furthermore, as pointed out hereinabove, the sleeve and rod of each plunger assembly move downwardly and upwardly both in unison and as separate elements.

The motive power for moving the sleeves and rods and other moving parts of the machine is supplied by a motor 158 (Figure 1) secured to the framework of the machine. Motor 158 (Figure 1) drives a pulley 159 (Figures 1 and 5) through belt 160 (Figure 1). Pulley 159 is connected to the end of shaft 161 mounted on bearings on the framework of the machine. A gear 162 (Figure 5) keyed to the right end of shaft 161 as viewed in Figure 5 meshes with a gear 163 keyed to shaft 164. At the opposite end of shaft 164 a gear 165 keyed thereto meshes with a gear 166 mounted on shaft 140. The left-hand end of shaft 140 (Figure 5) has a helical gear 167 keyed thereto which drives a helical gear 168. Helical gear 168 is keyed to shaft 169 which is mounted on bearings on the side of the machine. Gear 166 has twice the circumference of gear 165 so that gear 166 makes one revolution for two revolutions of shaft 164.

The moving parts of plunger assemblies 14 and 17 are actuated by cams mounted on shaft 140. As the mechanisms for actuating the plunger assemblies are substantially similar, specific description will be limited to the mechanism driving plunger assembly 14. Referring to Figure 3, a cam roller arm 170 is pivotally mounted on a shaft 171 extending transversely across and secured to the framework of the machine. Cam roller arm 170 (Figures 1 and 2) carries a cam roller 172 (Figures 3 and 5) which rides on a cam 173 (Figure 5) keyed to shaft 140. A rod 174 (Figures 1, 3 and 5) is pivotally

connected by pin 175 (Figures 1 and 3) to cam roller arm 170 above cam roller 172. Rod 174 extends upwardly and is pivotally connected to an arm 176 (Figure 5) by a pin 176a. Arm 176 has a hub 181 which is mounted on a shaft 177 extending transversely across the machine and which has another arm 180 (Figures 1 and 5) extending forwardly therefrom across the machine. A link 178 (Figure 1) is pivotally connected to the forward end of arm 180 and extends vertically thereabove. Link 178 is pivotally connected by pin 182 to a bracket 183 connected to the upper end of rod 85 (Figure 4) by set screw 183a. A spring 179 (Figure 1) connected to arm 180 and the framework of the machine resiliently urges arm 180 downwardly. Thus, cam 174 coacting with spring 179 moves rod 85 upwardly and downwardly as the cam 174 is turned by shaft 140.

Referring to Figure 5, a cam 184 is mounted on shaft 140 adjacent cam 173. A cam roller arm 185 (Figures 1, 3 and 5) having upper and lower arm portions 185a and 185b (Figure 1) extending above and below cam 184 is pivotally mounted on a shaft 186 (Figure 1) extending transversely across the machine. Portion 185b has a cam roller 188 (Figures 1 and 5) mounted thereon adjacent the end thereof. This cam roller coacts with a spring (not shown) resiliently urging arm 185 upwardly to move rod 189 (Figures 1 and 5) upwardly and downwardly as the cam rotates. Rod 189 is pivotally connected by pin 192 (Figure 5) to the center portion of an arm 190 (Figures 1 and 5). Arm 190 is pivotally mounted by hub 193 (Figure 5) on a shaft 191 extending transversely across the rear of the machine. The forward end of arm 190 (Figures 1 and 4) has a yoke 194 (Figure 4) thereon, the arms of which extend around sleeve 82 to engage pins 82a and 82b. Thus, the reciprocating action of rod 189 is transmitted through arm 190 to sleeve 82 (Figure 4) to move the die member 84 connected to its lower end upwardly and downwardly.

Referring to Figure 4, rod 78 of plunger assembly 17 is operated by cam 200 (Figure 5) through mechanism similar to the mechanism operating rod 85. This mechanism includes a cam roller arm 201 which actuates arms 203 and 204 through a rod 202. Cam 200 coacts with a spring (not shown), which resiliently urges arm 204, and thus rod 202, downwardly, to cause rod 78 to move upwardly and downwardly with respect to slide plate 13 (Figure 4). The sleeve 68 (Figure 4) of plunger assembly 17 is actuated by a cam 205 (Figure 5) through a cam roller arm 206 which is similar to arm 185 (Figure 1), a cam roller 206a, a rod 207, and an arm 208 operatively connected by a yoke 209 (Figure 4) to sleeve pins 71 and 72. Cam 205 coacts with a spring (not shown) resiliently urging cam roller arm 206 upwardly to move the sleeve 68 upwardly and downwardly.

Thus, plunger assemblies 14 and 17 (Figure 4) are actuated by cams mounted on shaft 140 (Figure 5). The high portions of these cams are positioned on opposite sides of shaft 140, thus causing plunger assembly 17 to be at the bottom of its stroke when plunger assembly 14 is at the top of its stroke and plunger assembly 17 to be at the top of its stroke when plunger assembly 14 is at the bottom of its stroke. Furthermore, each plunger assembly moves downwardly and upwardly once during each revolution of shaft 140.

The rod and sleeve of plunger assembly 11 (Figure 4) are actuated by cams 210 and 211 (Figure 5), respectively, which are keyed to shaft 164. A cam roller arm 213 (Figures 2 and 5), which is similar in construction to cam roller arm 170 (Figure 3) is pivotally mounted on shaft 186 (Figure 3) extending transversely across the machine. This cam roller arm 213 has a cam roller 214 which rides upon the periphery of cam 210. A rod 215 is pivotally connected to the forward end of cam roller arm 213 above cam roller 214 by a pin 215a. The upper end of rod 215 (Figures 1 and 5) is pivotally connected to the end of arm 216 by a pin 216a (Figure 5). Arm 216 is pivotally mounted on shaft 177 by a hub 217 and is connected through this hub to an arm 218 (Figures 1 and 5) which extends forwardly across the machine. The forward end of this arm is pivotally connected to a link 219 (Figure 1), the upper end of which is pivotally connected by a pin 220 to bracket 221. Bracket 221 (Figure 4) is connected to rod 49 by set screw 222.

Sleeve 39 is driven by a cam roller arm 223 (Figures 2 and 5) which is similar in construction to cam roller arm 170 (Figure 3) and is pivotally mounted on shaft 186. The forward end of cam roller arm 223 carries a cam roller 224 adapted to ride on the periphery of cam 211. A rod 225 (Figures 1, 3 and 5) extends vertically above cam roller arm 223 and is pivotally connected to the forward end of cam roller arm 223 by a pin 223a. The upper end of rod 225 is pivotally connected to the center portion of arm 226 (Figures 1 and 5) by a pivot pin 226a. Arm 226 is pivotally mounted on shaft 191, and its forward end carries a yoke 227 (Figures 1 and 4) the arms of which extend around sleeve 39 and engage pins 43 and 44. Spring means (not shown) is provided to resiliently urge arm 226 and thus rod 225 downwardly. Thus, cam 211 acting in conjunction with the spring means serves to move sleeve 39 upwardly and downwardly during operation of the machine. As shaft 164 is driven at twice the rate of shaft 140, plunger assembly 17 moves downwardly two times for each downward movement of either plunger assembly 14 or plunger assembly 17.

For actuating the die twist or primary female die rotating mechanism of the die member 46 positioned beneath plunger assembly 11 (Figures 3 and 4), a cam 228 (Figure 5) is mounted on shaft 164. This cam coacts with a cam roller 229 (Figure 3) mounted on a cam roller arm 230 (Figures 2 and 5) which is pivotally mounted on shaft 186. A link 65, which is pivotally connected at its upper end to bracket 66 (Figure 3), is pivotally connected to the forward end of arm 230 by a pin 230a. Cam 228 (Figure 5) acting through cam roller 29 (Figure 3), cam roller arm 230, and link 65 serves to twist die 48 each time shaft 164 makes a revolution. This rotative or twisting action, which is effected through bell crank 63 and arm 60 as described hereinabove, is timed so that die 48 is twisted or rotated in relation to male die 46 when said die member 46 is seated in die 48.

Referring to Figure 3, positioning finger 33 is actuated by link 35, as described hereinabove. The lower end of link 35 is pivotally connected by pin 35a (Figures 1 and 3) to one arm of a bell crank 240. Bell crank 240 is pivotally mounted on the framework of the machine by pin 240a, and its other arm is pivotally connected by a pin 240b to a link 231 (Figure 1). Link 231 extends

rearwardly in the machine around shaft 164 and has a cam roller 232 on its rear end. This cam roller rides on a cam 233 (Figure 5) keyed to shaft 164. A spring 234 (Figure 1) connected to the lower arm of bell crank 240 resiliently urges the bell crank to move in a clockwise direction, as viewed in this figure. Thus, cam 233 (Figure 5) coacting with spring 234 (Figure 1) serves to actuate link 35 (Figure 3) to move positioning finger 33. As cam 233 (Figure 5) is mounted on the same shaft as the cams actuating plunger assembly 11, movement of positioning finger 33 is timed to position a blank beneath the die member 46 of plunger assembly 11 before each downward stroke of die member 46 (Figure 3).

As described hereinabove, slide plate 13 (Figure 1) is moved with a reciprocating action by rocker arm 99 and cam 102. Cam 102 is mounted on shaft 169 (Figures 1 and 5) which is turned through helical gears 168 and 167. As helical gears 168 and 167 are of the same size, shaft 169 makes a complete revolution for each revolution of shaft 140 (Figure 5). As shaft 140 controls the movements of plunger assemblies 14 and 17 and as shaft 169 makes a revolution for each revolution of shaft 140, the movement of slide plate 13 (Figure 1) by rocker arm 99 is timed so that it shifts twice for each revolution of shaft 140 (Figure 5).

In operation, blanks are fed from hopper 10 (Figure 3) by the feeding mechanism beneath the plunger assembly 11. Positioning finger 33 at this time comes up and pushes the blank inwardly so that its rear edge contacts vertical guide plate 36 (Figure 4). During this time the suction supplied by hose 400 through rod 85 of plunger assembly 14 (Figure 4) is released, and the cup on male die 87 drops on delivery tray 15. Also, at the same time plunger assembly 17 is moving downwardly to seat its die in the female die assembly 16 and fold a lip on the edge of the pleated blank in the die assembly. Plunger assembly 11 moves downwardly until die member 46 seats in die 48. Then die 48 is twisted by arm 60 (Figure 1) and the mechanism connected thereto to pleat the side wall of the cup. Next the rod 49 of plunger assembly 11 moves downwardly to place the pleated blank in the female die assembly 12 positioned therebeneath, after which plunger assemblies 11 and 17 move upwardly, plunger assembly 17 carrying a completed cup with it by suction. Then rocker arm 99 (Figure 1) shifts slide plate 13 (Figure 4) to the left, as viewed in this figure, placing the pleated blank in die assembly 12 beneath plunger assembly 14 and carrying the completed cup on delivery tray 15 to a position in front of pusher member 20 (Figure 2). The delivery tray 18 moves beneath plunger assembly 17, and female die assembly 16 moves beneath plunger assembly 11. During the next period, the cup on plunger assembly 17 is dropped on delivery tray 16; the blank beneath plunger 11 is pleated and then positioned in female die assembly 16; and the pleated blank in female die assembly 12 is formed between dies 87 and 106, a lip being placed thereon by the grooves in die members 84 and 113. At this time delivery tray 15 is positioned in front of pusher member 20 (Figure 2), and the pusher member moves the completed cup from this tray into the delivery chute. The cams on shafts 140, 164 and 169 are all timed to actuate their related mechanisms in the proper sequence to insure the above operation.

Thus a cup-forming machine and method of 75

forming cups has been disclosed by which cups may be rapidly and economically manufactured. It will thus be seen that I have provided a thoroughly efficient and practical machine for forming cups and method of forming cups in which the several objects hereinabove referred to, as well as many others, are successfully accomplished.

As many possible embodiments may be made of the mechanical features of the above invention, and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinabove set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a cup-forming machine, in combination, a primary male die assembly, a primary female die assembly in fixed co-axial relation thereto a secondary male die assembly, means for actuating said die assemblies, a secondary female die assembly movable to and from operative co-axial relation to said primary and said secondary male die assemblies, means for moving said secondary female die assembly to alternately position it beneath said primary and secondary male die assemblies, and means for feeding blanks to said primary male and female die assemblies, said primary male die assembly having portions coacting with said primary female die assembly to shape certain portions of a blank, and other portions movable to convey said partly shaped blank from said primary male and female die assemblies into operative position in relation to said secondary female die assembly said secondary female die assembly then moving said partly shaped blank into operative position in relation to said secondary male die assembly which then coacts with said secondary female die assembly to complete the formation of the cup.

2. In a cup-forming machine, in combination, a primary male die assembly, a secondary male die assembly, means for actuating said die assemblies, a primary female die assembly, a secondary female die assembly movable to and from operative co-axial relation thereto, means for moving said secondary female die assembly to alternately position it in operative relation thereto said secondary male die assembly and said primary male and female die assemblies, means for feeding blanks to said primary male and female die assemblies, said primary male die assembly having portions coacting with said primary female die assembly to shape portions of a blank and other portions to move the shaped blank from said primary male and female die assemblies toward said secondary female die assembly, said secondary female die assembly then moving said shaped blank beneath said secondary male die assembly which then coacts with said secondary female die assembly to complete the formation of the cup, means on said secondary male die assembly for removing the completed cup from said secondary female die assembly, and tray means mounted to move with said secondary female die assembly, said tray means being positioned beneath said secondary male die assembly when said secondary female die assembly is positioned beneath said primary die assembly, said cup removing means being adapted to drop the completed cup removed from said secondary female die assembly on said tray at the same time a blank is being shaped by said primary male and female die assemblies.

3. In a cup-forming machine, in combination,

a primary male die assembly, a secondary male die assembly, means for actuating said die assemblies, a primary female die assembly, a secondary female die assembly, means for moving said secondary female die assembly to alternately position it beneath said secondary male die assembly and said primary male and female die assemblies, means for feeding blanks initially to said primary male and female die assemblies, said primary male die assembly having portions coacting with said primary female die assembly to shape portions of a blank and other portions to move said shaped blank from said primary male and female die assemblies into operative relation to said secondary female die assembly, said primary female die assembly then moving said shaped blank beneath said secondary male die assembly which then coacts with said secondary female die assembly to complete the formation of the cup, suction means on said secondary male die assembly for removing the completed cup from said secondary female die assembly, tray means mounted to move with said secondary female die assembly, said tray means being positioned beneath said secondary male die assembly when said secondary female die assembly is positioned beneath said primary male die assembly, said suction means being adapted to drop the completed cup removed from said secondary female die assembly on said tray when a blank is being shaped by said primary male and female die assemblies, and means for removing said cup from said tray when said secondary female die assembly is positioned beneath said secondary male die assembly.

4. In a cup-forming machine, in combination, a primary male die assembly, a primary female die assembly in fixed co-axial relation thereto a secondary male die assembly, means for actuating said male die assemblies, a slidable die carrier, a secondary female die assembly mounted thereon, means for moving said carrier with a reciprocating action to alternately position said secondary female die assembly beneath said primary and said secondary male die assemblies, and means for feeding blanks initially to said primary male and female die assemblies, said primary male die assembly coacting with said primary female die assembly to shape portions of a blank, means for moving said blank from said primary male and female die assemblies into operative engagement with said secondary female die assembly, and said secondary female die assembly on being moved by said carrier into operative relation to said secondary male die assembly coacting therewith to complete the formation of the cup.

5. In a cup-forming machine, in combination, a primary male die assembly having a seating head and a primary male die member, a secondary male die assembly, means for driving said male die assemblies a primary female die assembly, a secondary female die assembly, and means for alternately positioning said secondary female die assembly beneath said secondary male die assembly and said primary male and female die assemblies, said secondary male die assembly having portions adapted to move upwardly and downwardly with respect to and coacting with said secondary female die assembly, said secondary female die assembly including a rigidly mounted center bottoming anvil member and a rim forming die member mounted thereon for vertical movement with respect thereto, said seating head being arranged and adapted to move

toward said anvil independently of said primary male die member said secondary male die assembly including an inner bottoming die member for coacting with said center bottoming anvil member and an outer rim forming die member for coacting with said first mentioned rim forming die member, said inner bottoming die member being movable independently of said second mentioned rim forming die member, whereby said secondary male die assembly and said secondary female die assembly cooperate to effect two shaping operations on a cup blank during one downward movement of said secondary male die assembly.

6. In a cup-forming machine, in combination, a primary male die assembly, a secondary male die assembly, means for actuating said die assemblies, a primary female die assembly, a secondary female die assembly, means for moving said secondary female die assembly with a reciprocating action to alternately position it beneath said primary and secondary male die assemblies, means for feeding a blank beneath said primary male die assembly, said primary male die assembly including an outer die member and an inner seating member movable independently of each other, said primary female die assembly coacting with said outer primary male die member to former portions of the blank and said secondary female die assembly coacting with the secondary male die assembly to form other portions of said cup, means for preventing rotational movement of said outer male die member, and means for rotating said primary female die assembly in relation to said outer primary male die member, whereby said primary female die assembly and said outer primary male die member co-act to pleat side wall portion of a blank, and means for moving said blank from said primary female die assembly into operative relation to said secondary female die assembly, said shaped blank being then moved with said secondary female die assembly into operative position beneath said secondary male die assembly which then coacts with said secondary female die assembly to complete the formation of the cup.

7. In a cup-forming machine, in combination, a primary male die assembly, a pair of secondary male die assemblies, means for actuating said primary and secondary male die assemblies, a primary female die assembly, a pair of secondary female die assemblies, means for shifting said secondary female die assemblies in unison with a reciprocating action to alternately position each of said secondary female die assemblies first under said primary male and female die assemblies and then under one of said secondary male die assemblies, means for feeding blanks beneath said primary male die assembly, said primary male die assembly initially forming portions of said blanks with said primary female die assembly, and means for moving a partly formed blank from said primary male and female die assemblies into operative relation to one of said secondary female die assemblies, said secondary female die assemblies, on shifting with a partly formed blank to operative position beneath a secondary male die assembly, completing the formation of the blanks.

8. In a cup-forming machine, in combination, a primary male die assembly, a pair of secondary male die assemblies, means for actuating said primary and secondary male die assemblies, a slidably mounted die assembly carrier, a pair of

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secondary female die assemblies mounted on said carrier, means for moving said carrier with a reciprocating action to alternately position each of said secondary female die assemblies first under said primary male die assembly and then under one of said secondary male die assemblies, means for feeding blanks beneath said primary male die assembly, means cooperating therewith to form portions of said blanks, and means for moving said formed blanks from said primary male die assembly and into operative position in relation to one of said secondary female die assemblies said primary male die assembly alternately forming portions of said blanks while one of said secondary female die assemblies forms other portions of said blank beneath one of said secondary male die assemblies whereby formation of the blanks into cups is completed.

9. In a cup-forming machine, in combination, a primary male die assembly, a pair of secondary male die assemblies, means for driving said primary and secondary male die assemblies, a pair of primary female die assemblies, a secondary female die assembly positioned beneath said primary male die assembly, means for feeding blanks between said primary male die assembly and said secondary female die assemblies, said primary male die assembly including two portions movable with respect to each other, one of said portions coacting with said secondary female die assembly to form portions of blanks and the other of said portions then coacting with each of said primary female die assemblies in turn to form other portions of blanks, means for moving said primary female die assemblies in unison with a reciprocating action to alternately position each of said primary female die assemblies first under said primary male die assembly and then under its related secondary male die assembly, each of said female die assemblies on shifting positioning the partly formed blanks carried by them beneath their respective secondary male die assembly with which they coact to complete the formation of a cup while said primary male die assembly is coacting with said secondary female die assembly and the other primary female die assembly to form another blank.

10. In a cup-forming machine, in combination, a primary male die assembly, a pair of secondary male die assemblies, means for driving said primary and secondary male die assemblies, a pair of primary female die assemblies, a secondary female die assembly positioned beneath said primary male die assembly, means for feeding blanks between said primary male die assembly and said secondary female die assemblies, said primary male die assembly including two portions movable with respect to each other, one of said portions coacting with said secondary female die assembly to form portions of blanks and the other of said portions then coacting with each of said primary female die assemblies in turn to form other portions of blanks, means for preventing rotational movement of said primary male die assembly with respect to said secondary female die assembly, and means for twisting said secondary female die assembly with respect to the outer portion of said primary male die assembly whereby the outer portion of said primary male die assembly and said secondary female die assembly coact to pleat a blank when they are in seated relationship with respect to each other, means for moving said primary fe-

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male die assemblies in unison with a reciprocating action to alternately position each of said primary female die assemblies first under said primary male die assembly and then under its related secondary male die assembly, each of said female die assemblies on shifting positioning the partly formed blanks carried by them beneath their respective secondary male die assembly with which they coact to complete the formation of a cup while said primary male die assembly is coacting with said secondary female die assembly and the other primary female die assembly to form another blank.

11. In a cup-forming machine, in combination, a primary male die assembly, a pair of secondary male die assemblies, means for driving said primary and secondary male die assemblies, a pair of primary female die assemblies, a secondary female die assembly positioned beneath said primary male die assembly, means for feeding blanks between said primary male die assembly and said secondary female die assemblies, said primary male die assembly including two portions movable with respect to each other, one of said portions coacting with said secondary female die assembly to form portions of blanks and the other of said portions then coacting with each of said primary female die assemblies in turn to form other portions of blanks, slide means, means mounting said primary female die assemblies on said slide means, means moving said slide means with a reciprocating action to alternately position said primary female die assemblies under said primary male die assembly, each of said female die assemblies on shifting positioning the partly formed blanks carried by them beneath their respective secondary male die assembly with which they coact to complete the formation of a cup while said primary male die assembly is coacting with said secondary female die assembly and the other primary female die assembly to form another blank, and means on said secondary male die assemblies for removing completed cups from said primary female die assemblies.

12. The method of forming paper cups which includes the steps of: feeding a blank between a primary male die assembly and a female die assembly, forming portions of the blank between said primary male die assembly and said female die assembly, shifting the partly formed blank in said female die assembly beneath a secondary male die assembly, completing the formation of said blank between said secondary male die assembly and said female die assembly, feeding another blank beneath said primary die assembly as said first female die assembly is shifted, forming portions of this blank between said primary die assembly and a second female die assembly as said first blank is being formed between said secondary male die assembly and said first female die assembly, and shifting said second female die assembly with the partly formed blank therein beneath another secondary male die assembly as said first female die assembly is shifting back under said primary die assembly and completing the formation of said second blank between said second female die assembly and said second male die assembly.

13. The method of forming paper cups which includes the steps of: feeding a blank between a primary male die assembly and a female die assembly, forming portions of the blank between said primary male die assembly and said female die assembly, shifting the partly formed blank

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in said female die assembly beneath a secondary male die assembly, completing the formation of said blank between said secondary male die assembly and said female die assembly, removing completed cups from said female die assembly and dropping the completed cup on a tray moving in unison with said female die assembly when said female die assembly moves back under said primary male die assembly, feeding another blank beneath said primary die assembly as said first female die assembly is shifted, forming portions of this blank between said primary die assembly and a second female die assembly as said first blank is being formed between said secondary male die assembly and said first female die assembly, and shifting said second female die assembly with the partly formed blank therein beneath another secondary male die assembly as said first female die assembly is shifting back under said primary die assembly and completing the formation of said second blank between said second female die assembly and said second male die assembly.

14. In a cup forming machine, the combination of a primary male blank forming die member, a primary female blank forming die member mounted in fixed co-axial relation therewith, means for moving said primary male blank forming die member toward and from said primary female blank forming die member, a blank seating member mounted concentrically with said primary male blank forming die member and movable therewith toward and independently thereof beyond said primary female blank forming die member, a secondary blank forming female die member movable into and out of operative position in relation to said blank seating member, and means for moving said seating member independently of said primary male blank forming die member beyond said primary female blank forming die member and toward said secondary blank forming female die member when the latter is in operative relation to said blank seating member.

15. In a cup forming machine, the combination of a primary male blank forming die member, a primary female blank forming die member mounted in fixed co-axial relation therewith and rotatable in relation thereto, means for moving said primary male blank forming die member toward and from said primary female blank forming die member, means for rotating said primary female blank forming die member, a blank seating member mounted concentrically with said primary male blank forming die member, and means operatively interposed between said last mentioned members and arranged and adapted to lock said primary male die member against rotation when said primary female die member is rotated.

16. In a cup forming machine the combination of a male die assembly including a bottoming die and a first rim forming die concentric therewith, a female die assembly having a rigidly mounted bottoming anvil member and a second rim forming die concentric therewith, means for moving said male die assembly toward said female die assembly, and means for moving said central bottoming die independently of said first rim forming die toward said rigidly mounted central bottoming anvil member.

17. In a cup forming machine, the combination of a primary male die assembly, a secondary male die assembly, means for actuating said die assemblies, a primary female die assembly, a die

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assembly carrier, a pair of secondary female die assemblies mounted thereon in spaced relation, means for moving said carrier with a reciprocating action to alternately position one or the other of said secondary female die assemblies beneath said primary and secondary die assemblies respectively, means for feeding blanks beneath said primary male die assembly, said primary male die assembly including an outer die member and an inner seating member movable independently of each other, said primary female die assembly co-acting with said outer primary die member to form portions of a blank and said inner seating member operating to seat the blank in one of said secondary female die assemblies, and means for moving said die carrier whereby said secondary female die assembly is shifted with said shaped blank to an operative position beneath said secondary male die assembly and the other of said secondary female die assemblies is shifted to an operative position beneath said primary male die assembly.

18. In a cup forming machine, the combination of a pair of spaced secondary male die assemblies, a primary male die assembly arranged between said secondary male die assemblies, means for actuating said primary and secondary male die assemblies, a slidably mounted die carrier, a pair of secondary female die assemblies mounted on said carrier and movable with reciprocating motion thereof to alternately position one and then the other of said secondary female die assemblies first under said primary male die assembly and then under one of said secondary male die assemblies, means for feeding blanks to operative position in relation to said primary male die assembly, a primary female die cooperating with portions of said primary male die assembly to form certain parts of said blanks and means cooperating with other portions of said primary die assembly to move said formed parts of said blanks into seating engagement with one of said secondary female die assemblies, means for shifting said carrier in one direction to position one of said secondary female die assemblies and the partly formed blank in operative relation to one of the secondary male die assemblies where the formation of the cup from the blank is completed, and in the opposite direction to position the other of said secondary female die assemblies in operative relation to the other of said secondary male die assemblies, and means on each of said secondary male die assemblies for removing completed cups from said secondary female die assemblies.

19. In a cup-forming machine, in combination, a primary male die assembly, a pair of secondary male die assemblies, means for driving said primary and secondary male die assemblies, a pair of secondary female die assemblies, a primary female die assembly positioned beneath said primary male die assembly, means for feeding blanks between said primary male and female die assemblies, said primary male die assembly including two portions movable with respect to each other, one of said portions co-acting with said primary female die assembly to form portions of blanks and the other of said portions then co-acting with each of said secondary female die assemblies in turn to move said blanks into seated engagement therewith, means for moving said secondary female die assemblies in unison with a reciprocating action to alternately position each of said secondary female die assemblies first under said primary male die as-

sembly and then under its related secondary male die assembly, each of said secondary female die assemblies, on shifting, being arranged and adapted to position the partly formed blanks carried by them opposite their respective secondary male die assemblies with which they co-act to complete the formation of a cup while said primary male die assembly is co-acting with said primary female die assembly and the other secondary female die assembly to form and seat another blank.

20. In a cup-forming machine, in combination, a primary male die assembly, a pair of secondary male die assemblies, means for driving said primary and secondary male die assemblies, a pair of secondary female die assemblies, a primary female die assembly positioned beneath said primary male die assembly, means for feeding blanks to said primary male and female die assemblies, said primary male die assembly including two portions movable with respect to each other, one of said portions coacting with said primary female die assembly to form portions of blanks and the other of said portions then coacting with each of said secondary female die assemblies in turn, means for preventing rotational movement of said primary male die assembly with respect to said primary female die assembly, and means for twisting said primary female die assembly with respect to the outer portion of said primary male die assembly whereby the outer portion of said primary male die assembly and said primary female die assembly coact to pleat a blank when they are in seated relationship with respect to each other, means for moving said secondary female die assemblies in unison with a reciprocating action to alternately position each of said secondary female die assemblies first under said primary male die assembly and then under its related secondary male die assembly, each of said secondary female die assemblies, on shifting, positioning the partly formed blanks carried by them beneath their respective secondary male die assemblies with which they coact to complete the formation of a cup while said primary male die assembly is coacting with said primary female die assembly and the other secondary female die assembly to form another blank.

21. In a cup-forming machine, in combination, a primary male die assembly, a pair of secondary male die assemblies, means for driving said primary and secondary male die assemblies, a pair of secondary female die assemblies, a primary female die assembly positioned beneath said primary male die assembly, means for feeding blanks to said primary male and female die assemblies, said primary male die assembly including two portions movable with respect to each other, one of said portions coacting with said primary fe-

male die assembly to form portions of blanks and the other of said portions then coacting with each of said secondary female die assemblies in turn, slide means, means mounting said secondary female die assemblies on said slide means, means moving said slide means with a reciprocating action to alternately position said secondary female die assemblies under said primary male die assembly, each of said secondary female die assemblies, on shifting, positioning the partly formed blanks carried by them beneath their respective secondary male die assemblies with which they coact to complete the formation of a cup while said primary male die assembly is coacting with said primary female die assembly and the other secondary female die assembly to form another blank, and means on said secondary male die assemblies for removing completed cups from said secondary female die assemblies.

22. The method of forming paper cups which includes the steps of: feeding a first blank between primary male and female die assemblies, forming portions of the blank between said primary male and female die assemblies, shifting the partly formed blank from said primary female die assembly to a secondary female die assembly, completing the formation of said blank between a secondary male die assembly and said secondary female die assembly, feeding another blank to said primary male and female die assemblies as said first blank is shifted, forming portions of said other blank between said primary male and female die assemblies as said first blank is being completed and shifting said other secondary female die assembly with the partly formed blank therein beneath another secondary male die assembly, as said first secondary female die assembly is shifting back under said primary male and female die assemblies, and completing the formation of said second blank between said other secondary female die assembly and said other secondary male die assembly.

23. In a cup forming machine, the combination of spaced secondary male die assemblies, a primary male die assembly mounted between said secondaries, a reciprocable die carrier, means for reciprocating said carrier, spaced secondary female dies mounted on said carrier, each movable therewith into and out of operative relation to said primary die assembly and one of said secondary die assemblies, means for effecting blank forming operation of said primary and said secondary die assemblies, and means operatively connected therewith and with said carrier reciprocating means to feed blanks to said primary die assembly between successive reciprocative movements of said carrier.

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