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(54) **Method for forming a bottom-profiled cup**

Verfahren zum Herstellen eines Behälters mit profiliertem Boden

Procédé pour former une coupelle avec un fond profilé

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(56) References cited:
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US-A- 3 902 347
US-A- 4 043 169

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Description

[0001] This invention relates generally to a method for forming drawn containers. More particularly, the invention relates to a method for forming a drawn cup having a profiled bottom.

[0002] One of the initial steps in forming cylindrical containers such as cans for carbonated beverages is forming a cup. A typical cup includes a circular base connected to a cylindrical sidewall. The cup is typically shorter and wider than a finished container. As such, the cups are typically subjected to a variety of additional processes that further form the cup into a finished container.

[0003] Container manufacturing lines operate at high speeds to produce large quantities of containers. Throughout these manufacturing lines, the container elements are transported from one work station to another work station where different forming processes are performed. One of the problems encountered in designing the manufacturing lines is that the container elements often become deformed when being transported from station to station. As the speed of the lines increases, the number of container elements that become deformed increases. This problem is aggravated by the constantly increasing economic pressures to reduce the gauge of the material used to form the containers. The deformations are caused by the collisions between the container elements and contact between the container elements and the machinery.

[0004] One deformation problem occurs after the initial step of forming a cup from a flat blank of material has occurred. The cups are generally intended to have circular bottoms with straight, cylindrical sidewalls. Later processes that further form these cups include tooling designed to operate on substantially cylindrical cups. After the cups are initially formed, however, various forces can cause the cups to warp. If a cup is sufficiently warped, the container eventually formed from it must be discarded as waste. Additionally, tooling damage and/or jamming can occur. It has therefore become desirable to form a cup that is more resistant to warping and deformation.

[0005] GB-A-2 316 029 discloses a method of forming a bottom-profiled cup which solves the above-mentioned problems.

[0006] Additionally, inasmuch as these systems are quite expensive, it is desirable to retrofit existing double action presses to enable them to function as originally designed as well as function to achieve this result.

[0007] Accordingly, it is an object of this invention to provide a phase angle on the cam or crank which drives the press which can be utilized to operate the press in a conventional double action press for both the normal operation for which such presses are employed as well as with the improved method.

[0008] In general, the apparatus utilized to form a cup having a profiled bottom according to the present invention includes an annular draw die, a punch assembly configured to travel through the draw die, a die core disposed in the path of the punch assembly, and a ring pad disposed about the die core and also in the path of the punch assembly.

[0009] The method of forming a cup having a profiled bottom according to the present invention includes the steps of blanking a section of material at a first level of a double action press, drawing the blank over a draw die with a punch assembly to form a cup, carrying the cup to a second level of the press with the punch assembly, drawing the cup on a die core with one element of the punch assembly to profile the bottom of the cup, returning the profiled cup to the second level of the press, and ejecting the profiled cup from the press.

[0010] The phase angle of the cam or crank is set so that the angle between the inner and outer slide exceeds 80° to achieve proper liftoff timing. The inner slide stroke is set to provide additional stroke for drawing the cup into the reform pad.

[0011] These and other objects of the invention, as well as the advantages thereof over existing and prior art forms, which will be apparent in view of the following detailed description, are accomplished by means hereinafter described and claimed and illustrated in the accompanying drawings.

FIGURE 1 is a sectional perspective view of a cup having a profiled bottom made by the apparatus and method of the present invention.

FIGURE 2 is an elevational view, partially in section, showing the tooling of the present invention at the beginning of the blanking and drawing operation.

FIGURE 3 is a view similar to Fig. 2, showing the position of the tooling during the first drawing operation.

FIGURE 4 is a view similar to Fig. 2, showing the position of the tooling after the first drawing operation;

FIGURE 5 is a view similar to Fig. 2, showing the position of the tooling after the second drawing operation.

FIGURE 6 is a view similar to Fig. 2, showing the position of the tooling after a cup having a profiled bottom has been formed according to the method of the present invention.

FIGURE 7 is a timing diagram.

FIGURE 8 is a series of sectional elevational views showing the cup in various stages of forming.

[0012] A cup having a profiled bottom formed by the apparatus and method of the present invention is depicted in Fig. 1 and is indicated generally by the numeral 10. The profiled cup 10 includes a generally cylindrical outer wall 11 that is connected at its bottom edge to the outer edge of an annular outer bottom wall 12. A generally cylindrical inner wall 13 extends upwardly from the inner edge of the outer bottom wall 12 in concentricity

with outer wall 11 and connects with a generally circular inner bottom wall 14.

[0013] Referring now to Fig. 2 of the drawings, it will be assumed that the tooling illustrated therein is incorporated into a double acting press of the type well known in this art. It will also be assumed that the material M will be fed into the press either from sheet or coil stock, as desired.

[0014] With these assumptions in mind, and still referring to Fig. 2, a sectional view of the tooling of the apparatus of the present invention may be seen. Thus, an annular draw die 20 is carried by the press wall 21. A draw pad 22 is disposed above the draw die 20 and is carried by the outer slide 23 of the double action press. The outer slide 23 is reciprocal to move the draw pad 22 upwardly away from draw die 20 and downwardly against draw die 20.

[0015] A cut edge 24 is disposed radially outward of the draw pad 22 on the outer slide and is operable to blank material M after the outer slide 23 lowers the draw pad 22 to clamp the material M against the draw die 20. A cut edge support pad 25 is supported by a spring 26 and is disposed beneath the cut edge 24. Thus, when the cut edge 24 has blanked material M, the scrap material 27 that is radially outward of the cut edge 24 is carried by the support pad 25 and the circular blank 28 that is radially inward of the cut edge 24 is held between the draw die 20 and the draw pad 22.

[0016] A punch assembly 30 is disposed radially inward of the draw pad 22 and is carried by an inner slide 31 of the press. The inner slide 31 is reciprocal to cause the punch assembly 30 to translate vertically through the draw die 20. The punch assembly 30 includes a centrally-disposed punch core 32 partially surrounded by an annular punch ring 33. The punch core 32 has a substantially flat bottom and a fluid passage 34 extending therethrough. The fluid passage 34 is selectively connected to a source of fluid pressure (not shown) such as pressurized air and is used for cup removal purposes as will be subsequently described.

[0017] When the punch assembly 30 is in the position depicted in Figs. 2 through 4 and Fig. 6, the bottom surfaces of the punch core 32 and the punch ring 33 are substantially coplanar. The inner slide 31 is, however, operable to cause the punch ring 33 to move independently of punch core 32. For a purpose that will be subsequently described, the punch ring 33 may be moved downwardly, past the punch core 32 such that the bottom surface of the punch ring 33 is disposed below the bottom surface of the punch core 32. However, a pair of cooperating shoulders 35 formed in the punch core 32 and punch ring 33 prevent the bottom surface of the punch ring 33 from being raised above the bottom surface of the punch core 32.

[0018] In cooperation with the draw die 20, the press wall 21 forms a substantially cylindrical chamber 40 configured to receive the punch assembly 30 and the drawn cup 10. On one side of the chamber 40, a fluid line 41 extends through the press wall 21. The fluid line 41 is selectively connected to a source of pressurized fluid, such as air, for a purpose that will be subsequently described. Opposite the fluid line 41, the press wall 21 has an opening 42 that is configured to allow a drawn cup 10 to pass therethrough to exit the chamber 40.

[0019] The bottom of the chamber 40 is formed by the cooperation of an inner die core 50 and a ring pad 51 that encircles the inner die core 50. When the inner die core 50 and the ring pad 51 are in the position depicted in Figs. 2 through 4 and Fig. 6, the upper surfaces of the inner die core 50 and the ring pad 51 are substantially coplanar. The inner die core 50 is carried by lower platen 52 and is stationary during the cup forming process. The ring pad 51 is, however, carried by a plurality of springs 53 that allow the ring pad 51 to be translated vertically with respect to the inner die core 50 under pressure from punch ring 33, as will be described. A pair of shoulders 54 formed in the lower platen 52 and the ring pad 51 cooperate to prevent the upper surface of the ring pad 51 from rising above the level of the upper surface of the inner die core 50.

[0020] Cups 10 having profiled bottoms are formed using the apparatus of the present invention in accordance with the following method. A sheet of material M is inserted at a first level of the press between the draw die 20 and the draw pad 22. Once the material M is correctly positioned, the outer slide 23 moves the draw pad 22 against the material M, thereby clamping the material M between the draw pad 22 and the draw die 20. Continued advance of outer slide 23 then causes the cut edge 24 to cut a substantially circular blank 28 out of the material M. The scrap material 27 is carried by the support 25 while the blank 28 remains clamped between the draw die 20 and the draw pad 22, as depicted in Fig. 2.

[0021] After the material M has been blanked, the inner slide 31 causes the punch assembly 30 to move against the blank 26 and through the draw die 20. This movement causes the blank 28 to be drawn over edge 20a of the draw die 20, and the outer wall 11 of the cup 10 begins to be formed as may be seen in Fig. 3. As the punch assembly 30 is moving through the draw die 20, the clamping pressure between the draw die 20 and the draw pad 22 is controlled by the outer slide 23.

[0022] The punch assembly 30 continues to move through the draw die 20 until the entire blank 28 is drawn over the draw die 20, forming a cup 60. The inner slide 31 then continues to move the punch assembly 30 and the cup 60 downwardly to a second press level. The cup 60 remains on the punch assembly 30 as is shown in Fig. 4. When the punch core 32 bottoms out on the inner core die 50, the inner slide 31 causes the punch ring 33 to continue moving downwardly against the ring pad 51, overcoming the force of springs 53. This movement of the punch ring 33 causes bottom wall of the cup 60 to be drawn over the edge 50a of inner die core 50 to profile the bottom of the cup 60. As may be seen in Fig. 5, the

extension of the punch ring 33 has formed the inner bottom wall 14 and outer bottom wall 12 of the profiled cup 10 as well as the generally cylindrical inner wall 13.

[0023] After the punch ring 33 has been fully extended, the inner slide 31 reverses its movement and the punch ring 33 is retracted. The springs 53 disposed beneath the ring pad 51 force the ring pad 51 upwardly against the punch ring 33 and force the cup 10 back to the second level of the press. The shoulders 54 and the shoulders 35 meet simultaneously and prevent the ring pad 51 from rising further and cause punch ring 33 and the punch core 32 to begin rising together. As the punch assembly 30 is retracted, the cup 10 has the tendency to remain on the punch assembly 30. Activation of the fluid line 34 disposed in the punch core 32 provides a pneumatic force that helps to separate the cup 10 from the punch assembly 30, as may be seen in Fig. 6. The fluid line 41 in the press wall 21 is then activated to create a pneumatic force that pushes the cup 10 out of the opening 42 in the press wall 21, following which it may be transferred to other apparatus for further operations.

[0024] As noted, it is desirable to utilize the method and apparatus of the present apparatus in a double acting press. These presses are large and expensive and have many uses in the can industry. It is believed that by employing certain parameters in the setting of the phase angles, such presses can be retrofit to enable the present invention to be practiced.

[0025] To this end, and referring to FIGURES 7 and 8 of the drawings, it will be seen that the phase angle between the inner and outer slides has been set to exceed 80° in order to achieve proper liftoff timing. Additionally, in the specific example illustrated, the stroke of the inner slide 31 exceeds 5.0" to provide additional stroke for driving the cup over the inner die core 50 to profile the bottom of the cup. The outer slide stroke is set for travel of the slide and the tooling in the range of 2.0" to 3.0".

[0026] While a full and complete description of the invention has been set forth in accordance with the dictates of the patent statutes, it should be understood that modification can be resorted to without departing from the scope of the appended claims.

Claims

1. A method of forming a bottom-profiled cup from a sheet of material in a double-acting press having inner (31) and outer slides (23) by forming a cup blanked (28) from the sheet of material at the first level by holding the material between a draw pad (22) carried by the outer slide (23), moving a punch (30) carried by the inner slide (31) against the cup blank (28) to draw the material to a cup shape at a second level, profiling the bottom of the cup at the second level, retracting the inner slide (31) and removing the profiled cup at the second level, **characterized by** the phase angle on the cam or crank of the press between the inner (31) and outer slides (23) of the press exceeding 80°.

2. The method of claim 1 wherein the stroke of the inner slide (31) exceeds 12,7 cm and the stroke of the outer slide (23) is in a range from about 5,08 cm to about 7,62 cm.

Patentansprüche

1. Verfahren der Formung eines bodenprofilierten Bechers aus einer Metallplatte in einer zweifach wirkenden, innere (31) und äußere (23) Schlitten aufweisenden Presse, mittels Formung eines ausgestanzten Bechers (28) aus der Materialplatte in einer ersten Ebene durch Halten des Materials unter einem durch den äußeren Schlitten (23) beförderten Ziehblock (22), Bewegung eines durch den inneren Schlitten (31) beförderten Ausstanzers (30) gegen den Becherformling (28), um das Material in einer zweiten Ebene zu einer Becherform zu ziehen, Profilierung des Becherbodens in der zweiten Ebene, Zurückziehung des inneren Schlittens (31) und Entfernung des profilierten Bechers in der zweiten Ebene, **dadurch charakterisiert,** dass der Phasenwinkel zwischen den inneren (31) und äußeren (23) Schlitten der Presse auf der Steuerkurve oder Kurbel der Presse größer ist als 80°.

2. Verfahren gemäß Anspruch 1, **dadurch gekennzeichnet, dass** der Hub des inneren Schlittens (31) größer ist als 12,7 cm und der Hub des äußeren Schlittens (23) im Bereich von etwa 5,08 cm bis etwa 7,62 cm liegt.

Revendications

1. Procédé pour la formation d'une coupelle à fond profilé à partir d'une feuille de matériau dans une presse à double effet comportant des coulisseaux internes (31) et externes (23) en formant une coupelle ébauchée (28) à partir de la feuille de matériau eu premier niveau en maintenant le matériau entre un bloc d'emboutissage (22) monté sur le coulisseau externe (23) , déplaçant un poinçon (30) porté par le coulisseau interne (31) contre l'ébauche de coupelle (28) pour emboutir le matériau en une forme de coupelle à un second niveau, en profilant le fond de la coupelle au second niveau, en faisant rentrer le coulisseau interne (31) et en enlevant la coupelle profilée au second niveau,
caractérisé par l'angle de phase sur la came ou manivelle de la presse entre les coulisseaux interne (31) et externe (23) de la presse, dépassant 80°.

2. Procédé selon la revendication 1, dans lequel la

course du coulisseau interne (31) dépasse 12,7 cm et la course du coulisseau externe (23) se situe dans une plage allant d'environ 5,08 cm à environ 7,62 cm.

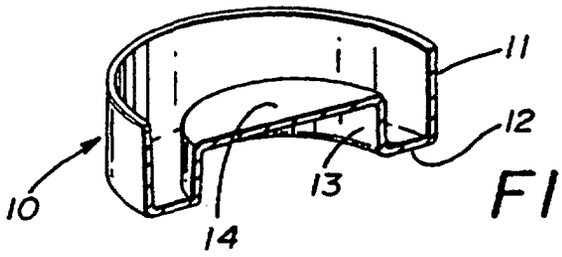
11
12
13
14
10

FIG. 1

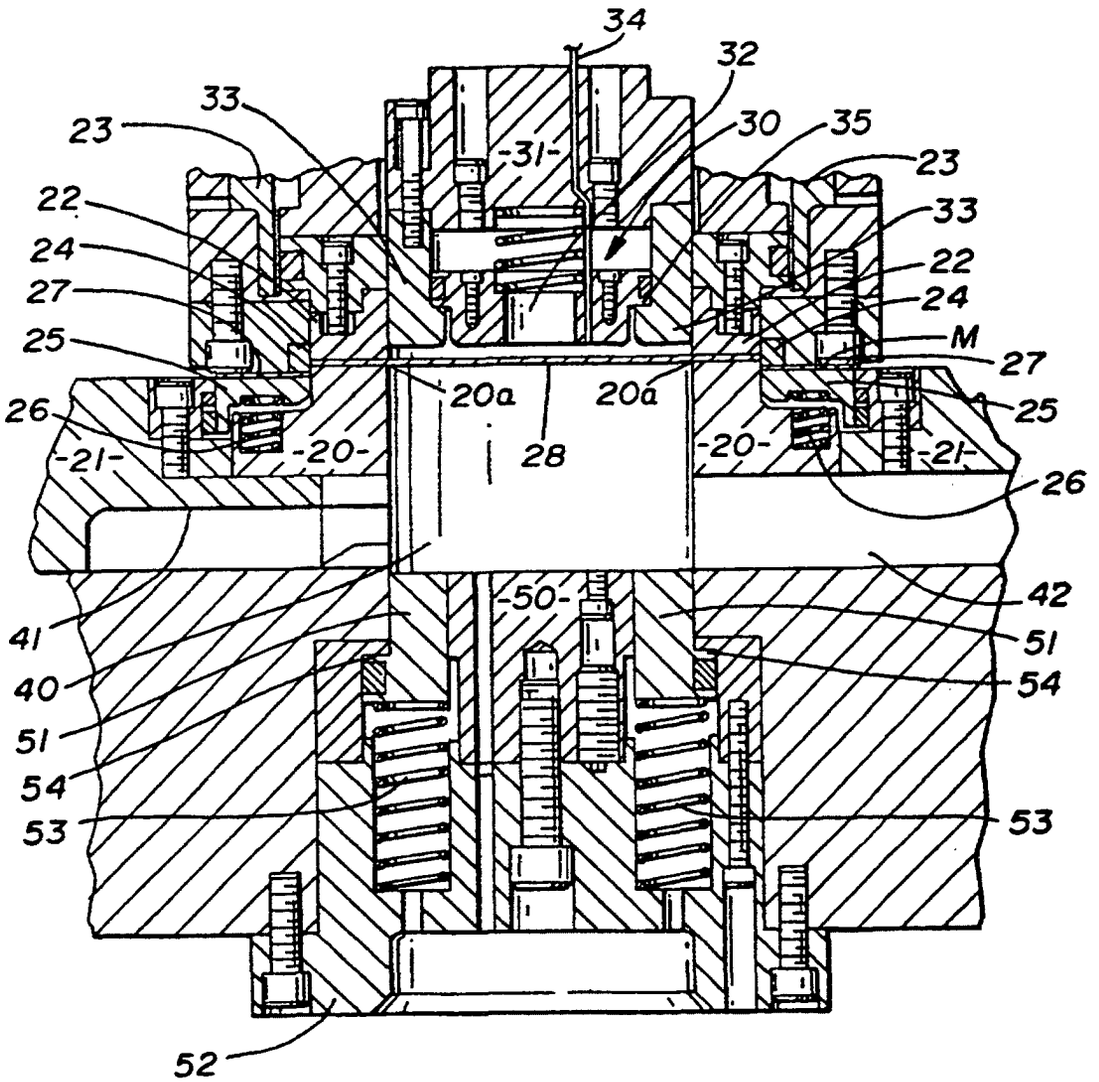
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FIG. 2

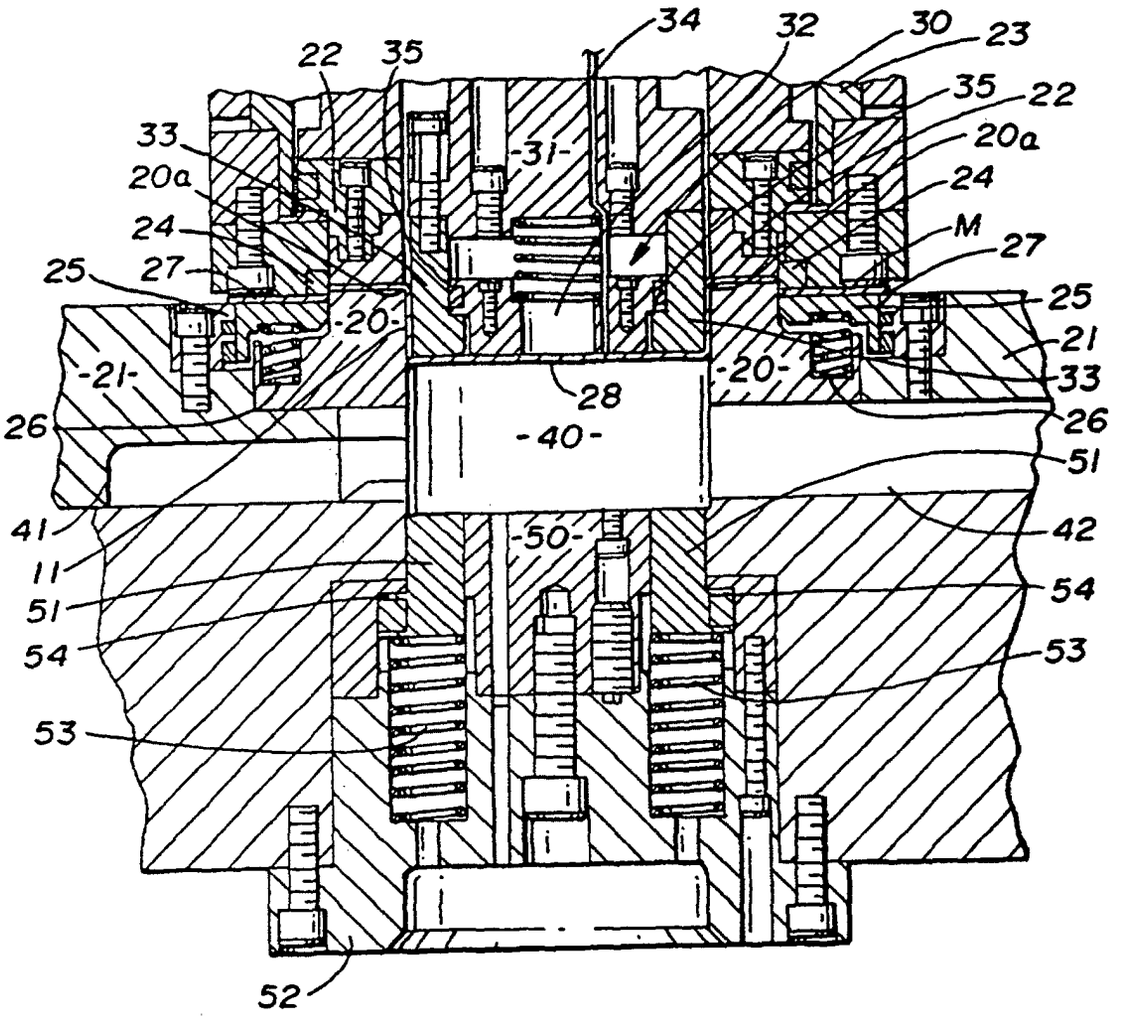
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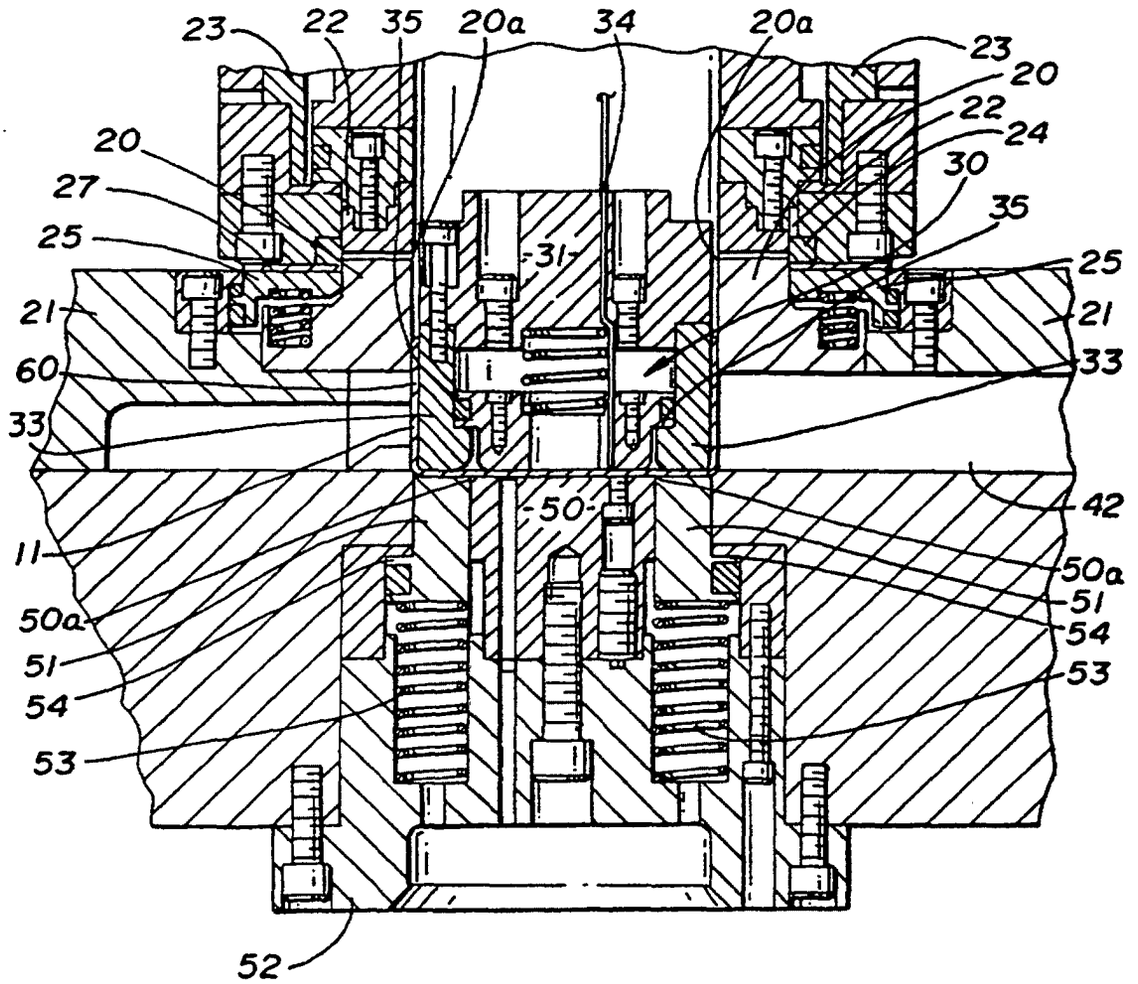
FIG. 3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11
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52
31
50

FIG. 4

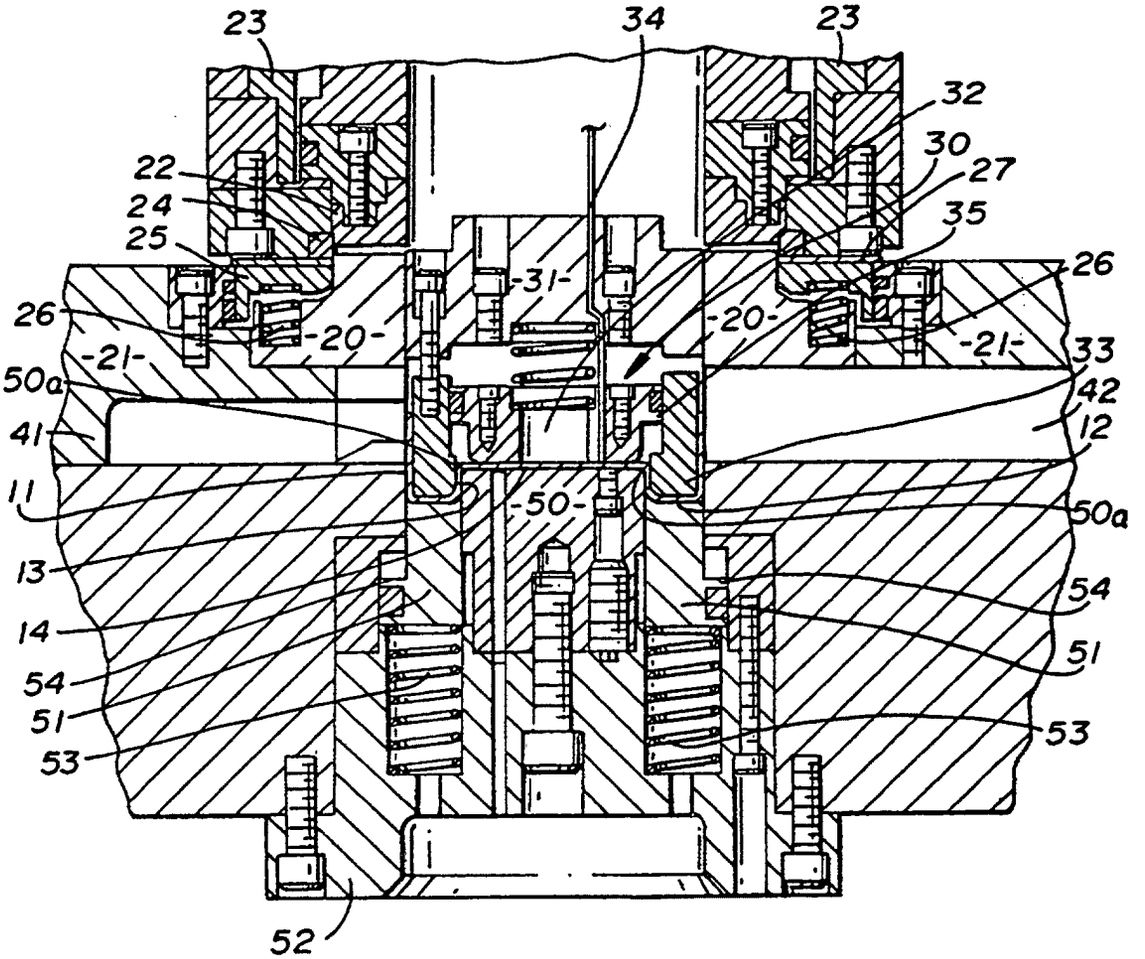
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FIG. 5

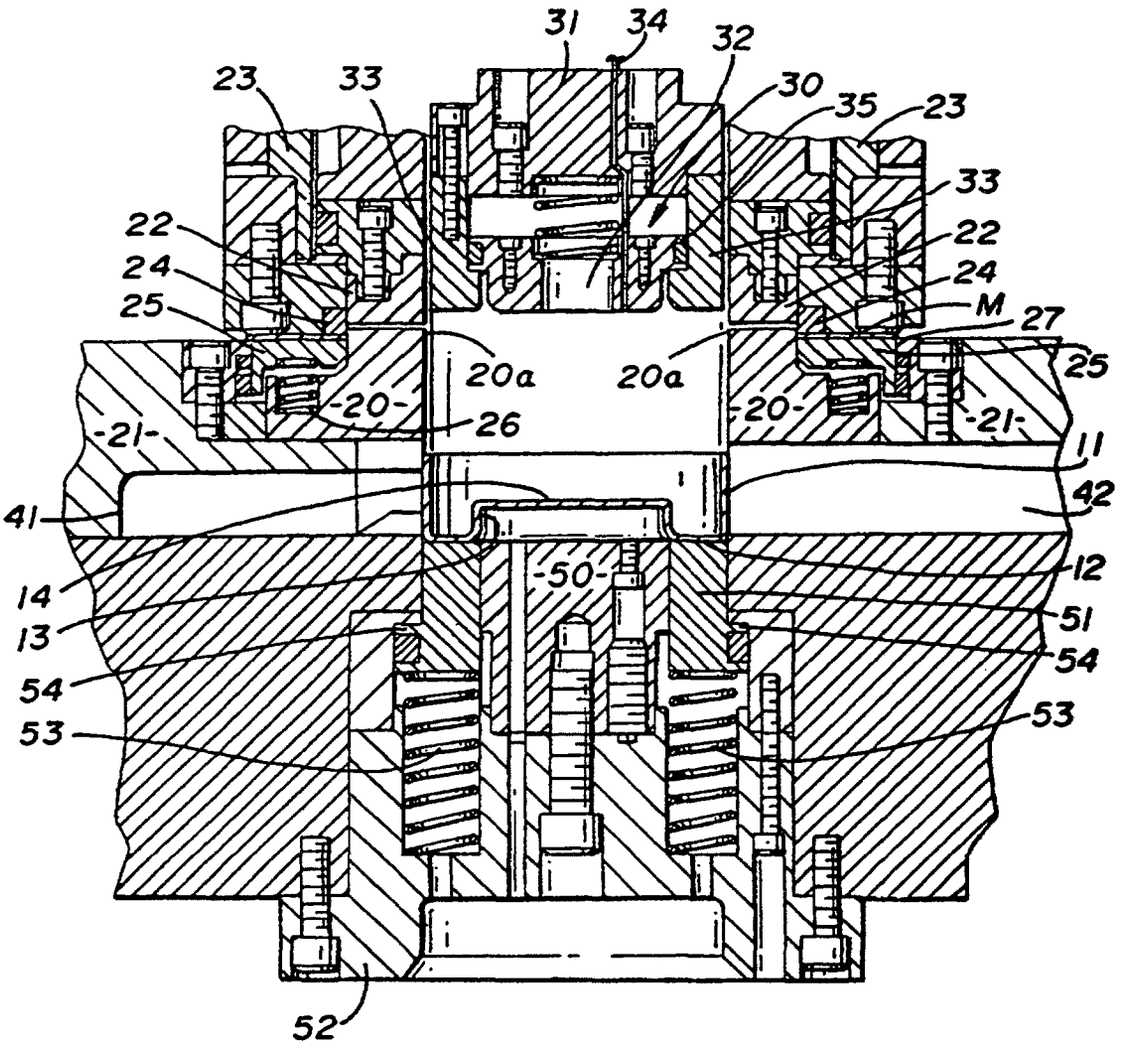
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FIG. 6

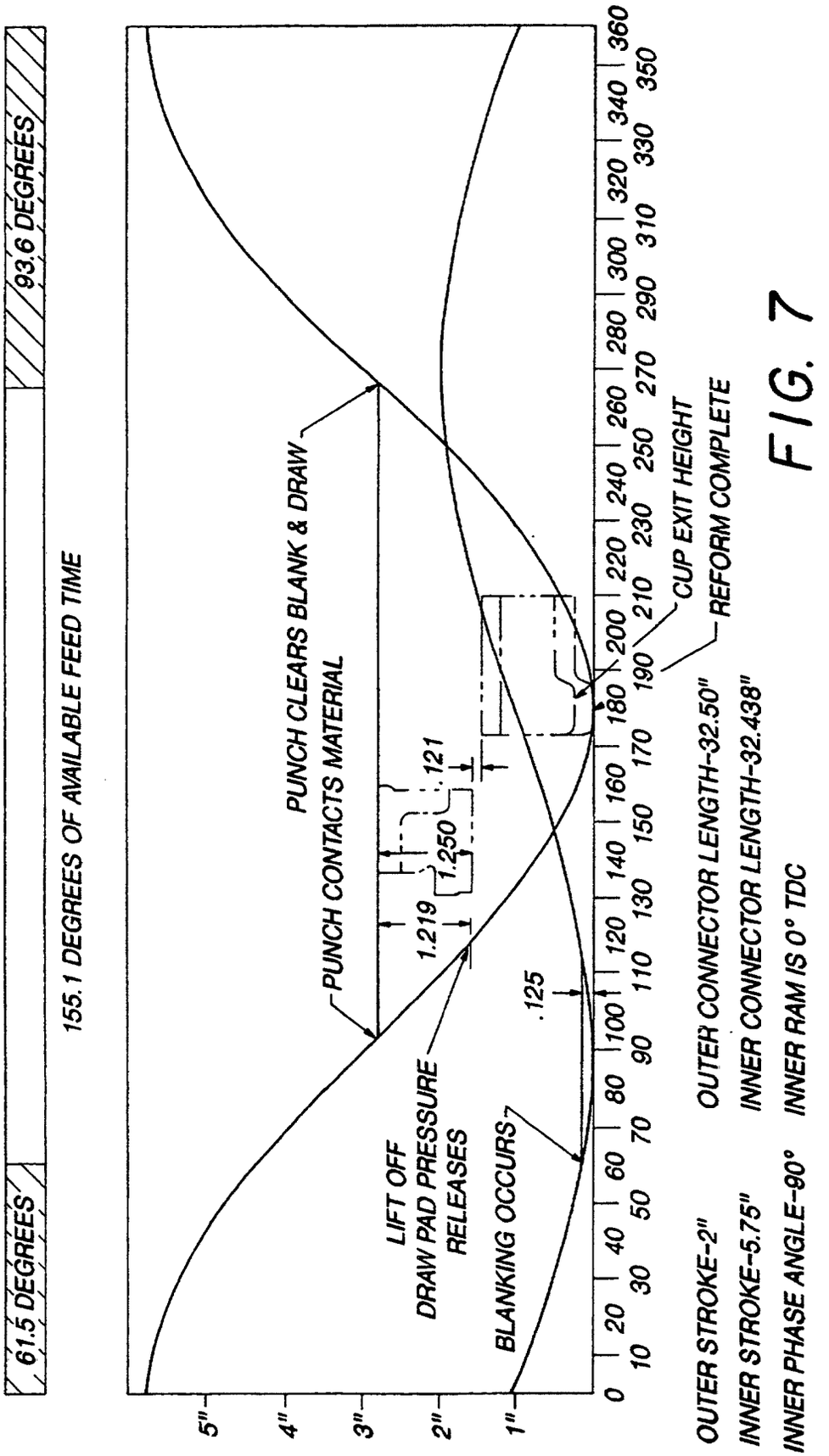
61.5 DEGREES
93.6 DEGREES
155.1 DEGREES OF AVAILABLE FEED TIME
PUNCH CLEARS BLANK & DRAW
PUNCH CONTACTS MATERIAL
LIFT OFF
DRAW PAD PRESSURE
RELEASES
BLANKING OCCURS
1.219
1.250
.121
.125
CUP EXIT HEIGHT
REFORM COMPLETE
5"
4"
3"
2"
1"
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360
OUTER STROKE-2"
INNER STROKE-5.75"
INNER PHASE ANGLE-90°
OUTER CONNECTOR LENGTH-32.50"
INNER CONNECTOR LENGTH-32.438"
INNER RAM IS 0° TDC

FIG. 7

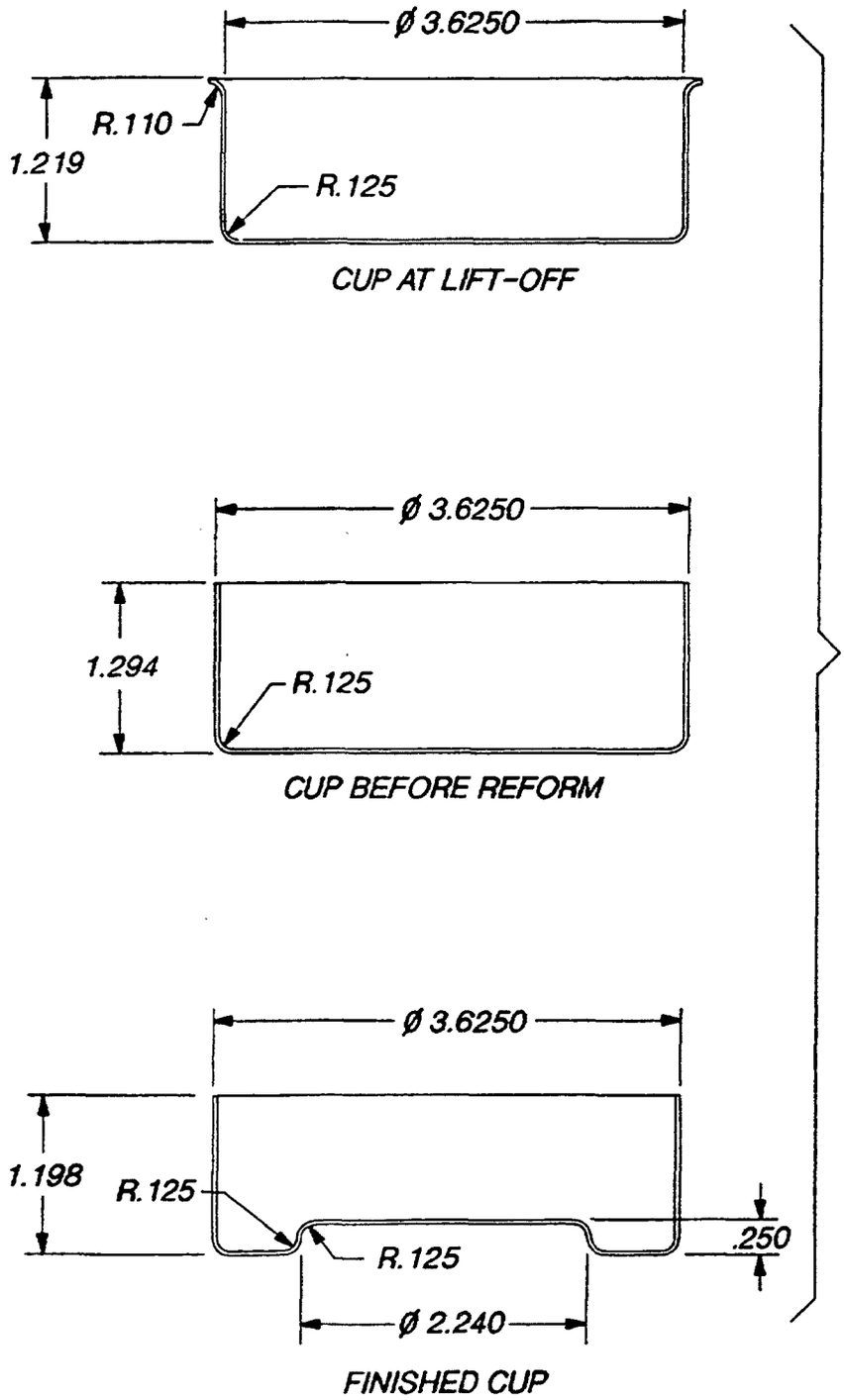
Ø 3.6250
R.110
1.219
R.125
CUP AT LIFT-OFF
Ø 3.6250
1.294
R.125
CUP BEFORE REFORM
Ø 3.6250
1.198
R.125
R.125
.250
Ø 2.240
FINISHED CUP

FIG. 8