Oct. 6, 1931. F. MEIER 1,826,559

METHOD AND APPARATUS FOR FORMING CAN TOPS

Filed Feb. 23, 1929 4 Sheets-Sheet 1

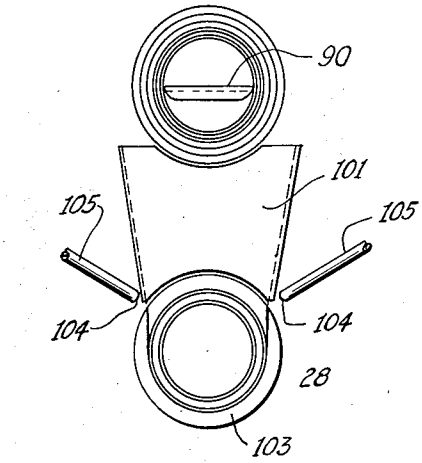


Fig. 2

Fig. 1

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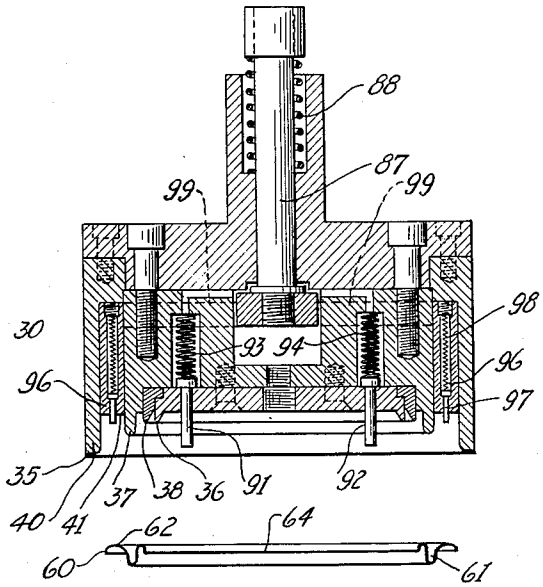


Fig. 3

Fig. 4

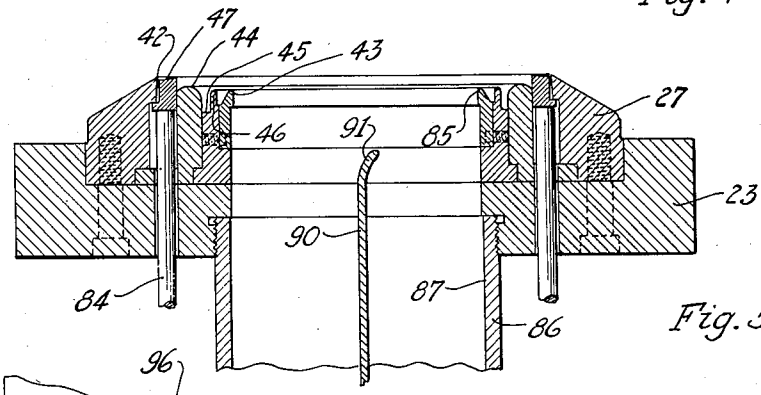


Fig. 5

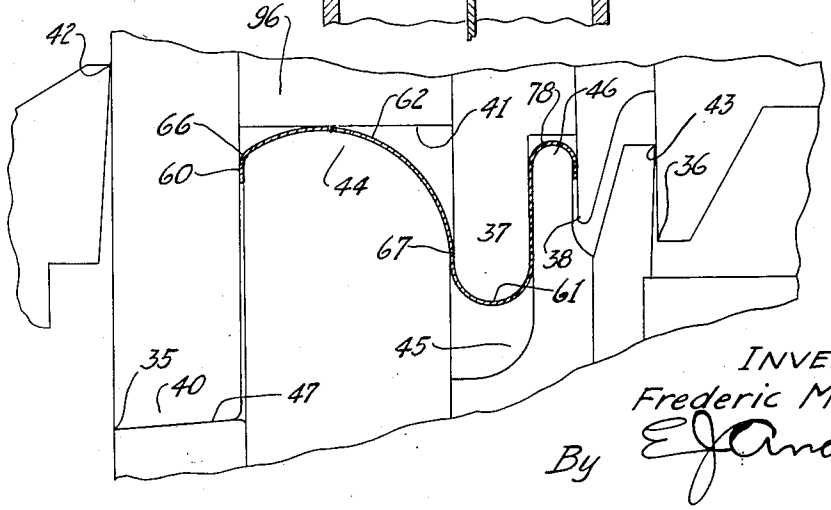


Fig. 6

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METHOD AND APPARATUS FOR FORMING CAN TOPS

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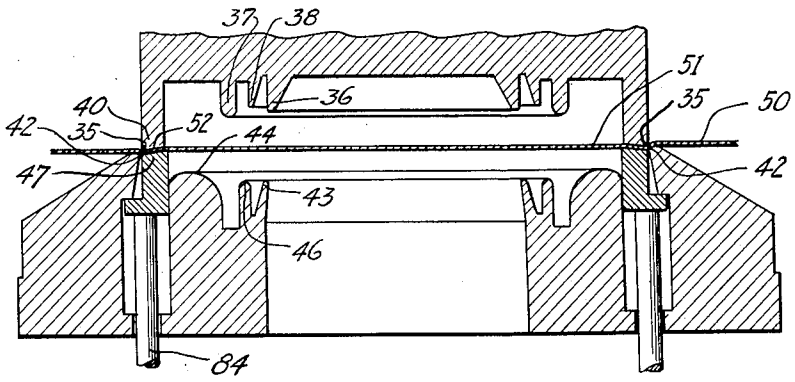


Fig. 7

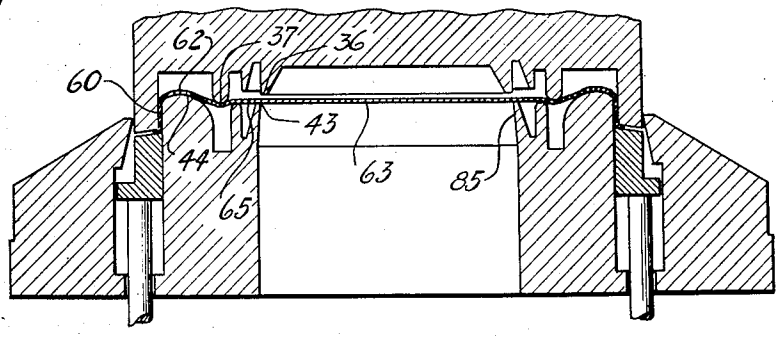


Fig. 8

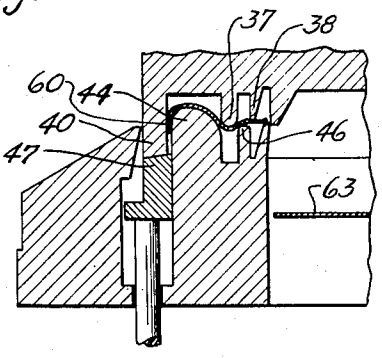


Fig. 9

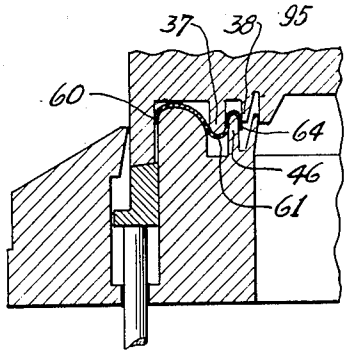


Fig. 10

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METHOD AND APPARATUS FOR FORMING CAN TOPS

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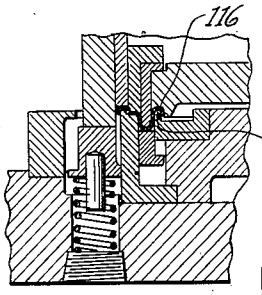


Fig. 15

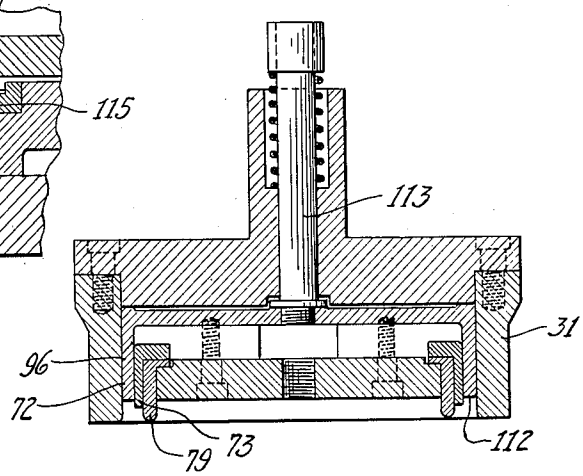


Fig. 11

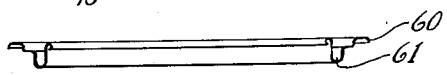


Fig. 12

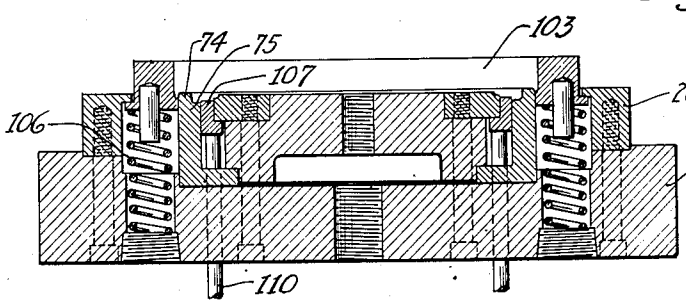


Fig. 13

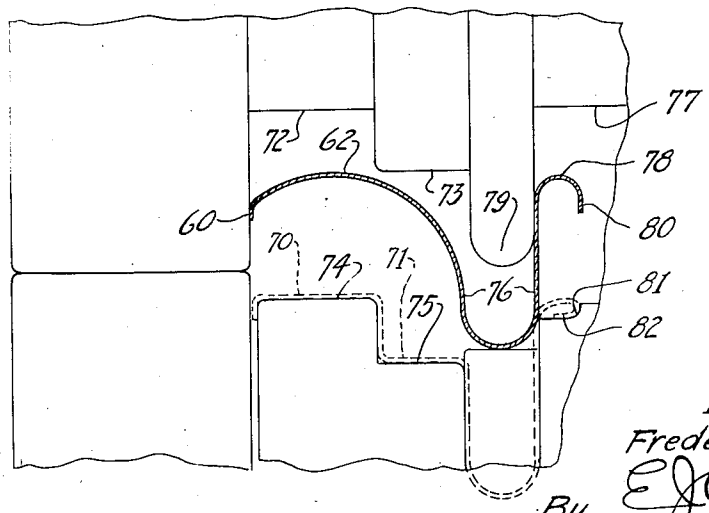


Fig. 14

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Patented Oct. 6, 1931 1,826,559

UNITED STATES PATENT OFFICE

FREDERIC MEIER, OF CHICAGO, ILLINOIS

METHOD AND APPARATUS FOR FORMING CAN TOPS

Application filed February 23, 1929. Serial No. 342,237.

This invention relates to a method for forming can tops and to apparatus for carrying out the method. One of the objects of the invention is to provide a method for forming can tops and, particularly, what are called by the trade, "double tite" tops. These tops consist of rings so formed as to provide double friction means for holding the closure on the top and for sealing the top. A feature of the method is to form these rings entirely automatically and in such a manner as to eliminate substantially all hazard of injury to the dies and punches. Another object is to very materially expedite the making of the rings. A further object is to eliminate certain movements of the blank which have hitherto been necessary in completing the rings. A further object of the invention is to provide suitable punch presses and punches and dies for carrying out the method, one feature of this object consisting in providing mechanism arranged so that the complete operation is carried out entirely automatically by means of one punch press with two punches thereon positioned in tandem, the two punches operating continuously.

Another object of the invention is to provide a method for forming rings of the nature specified of a given size out of smaller blanks than have hitherto been used, the method consisting in using more material from the central portion of the blank, so that both the outer diameter of the blank and the diameter of the opening of the blank will be smaller and, yet, the shape and size of the finished ring, as well as its weight, will be substantially the same as rings heretofore made. A further object of the invention is to provide for eliminating displacements of the material being operated on or other inadvertencies which result in distortion of material, injury to the product, and at times cause injury to the mechanism itself. And a further object is to provide for an improved method of disposing of the piercing circles or disks and also for obtaining the product with less power and with less expensive punches and dies than has been the case heretofore. Other objects of the invention will be apparent from a consideration of the accompanying drawings and the following description thereof:

Of the drawings, Fig. 1 is an elevation of a punch press, such as may be used in carrying out my method, certain portions of the press being broken away or omitted; Fig. 2 is a plan view of the dies of the press; Fig. 3 is an enlarged central sectional view of one of the punches of the press; Fig. 4 is a sectional view of a ring showing its form after the first operation; Fig. 5 is a central sectional view of the die which is used in conjunction with the punch of Fig. 3; Fig. 6 is an enlarged diagram indicating portions of the punch and press and a sectional view of the ring as formed by the first operation; Fig. 7 is an enlarged diagrammatic sectional view of the punch and die showing the first step in the operation of forming the ring; Fig. 8 is a similar view showing another step in the operation; Figs. 9 and 10 are similar fractional views showing a third and the final step in the first operation of forming the rings; Fig. 11 is a sectional view of the punch used for the final operation in forming the ring, the scale being similar to that of Figs. 3 and 5; Fig. 12 is a sectional view of the completed ring; Fig. 13 is a sectional view of the die used for the final operation; Fig. 14 is an enlarged diagrammatic view illustrating the relation of the punch and die on the ring during the final operation; and Fig. 15 is a modified form of punch and die used in the final operation for producing a modified form of ring.

It has been common to provide cans, pails and the like, with closures that are held on and sealed by friction between the closure itself and the top of the can, so that the can can be quickly opened and closed and kept substantially air-tight. In the formation of the tops of such cans, it has been common to provide what are called "double tite" tops, and a desirable form of such tops consists of an annular loop having two annular friction contact portions for sealing the closure onto the ring. Such a ring is illustrated by Fig. 12. It has been the purpose of my invention not to change the form of these rings, but to provide a better method of forming the rings

and improved apparatus for carrying out the method.

Heretofore, in the formation of these rings, it has been common to provide two or three sets of punches and dies operated on different punch presses and to include in the operation more or less handling by the operators of the unfinished product, one of the operations being to turn the ring over as it is being passed from one punch to another. My method consists in using only two punches and dies and in preferably combining them in the same punch press, so that the dies rest on the same bolster and the punches are fixed to the same cross bar so as to be operated simultaneously by the reciprocations of the cross head. Further, my method contemplates entirely automatic operation and, thus, eliminating altogether all handling of the rings in operation and, particularly, turning over the ring as it passes from one punch to the other. At the same time, the method consists in varying the operation of the punch and dies on the ring materially so as to allow blanks of less diameter to be used, thus allowing the use of narrow stock or sheets of material and, thus, reducing the cost of the material used. Although this is compensated for by the production of smaller piercing circles or disks from the center of the ring, yet, as will be understood, a very material saving of expense is brought about by using the material from the piercing disk and, at the same time, reducing the diameter of the periphery of the ring itself.

In carrying out my method, any suitable form of punch press may be used. I prefer a press 20, the operating axis of which is inclined about forty-five degrees to the vertical. The press comprises a support 21, a frame 22, a die bolster 23, a punch cross bar 24, a reciprocating bar 25 operated by the shaft 26, which has mounted thereon a fly-wheel 27. It will be understood that the shaft 26 and the bar 25 may be operated in any suitable manner. Mounted on the bolster are the dies 27 and 28 which cooperate with the punches 30 and 31. The punch 30 and die 27 are used in the first operation in forming the ring; the punch 31 and die 28 are used in the final operation. At the completion of the first operation, the ring, as hereinafter described, is automatically transmitted from the punch 30 to the die 28 where it is operated on and completed by the punch 31. The punch 30 comprises the external cutting edge 35 and the internal cutting edge 36, the annular forming ring 37 and the stock holding ring 38, and the clamping rings 40 and 41, while the die 23 has the corresponding cutting edges 42 and 43, and the forming rings 44 and 46, and the annular groove 45.

The first step of the first operation, Fig. 7, consists in cutting from the sheet 50, by means of the cutting edges 35 and 42, the blank 51 from which the ring is to be formed. The periphery 52 of the blank is clamped between the clamping rings 40 and 47, so as to hold the blank snugly around its outer edge. But, as the blank is forced downwardly onto the forming ring 44, the outer rim of the blank is turned inwardly as indicated in Fig. 8 to form the flange 60. This flange is held somewhat yieldingly between the clamping surfaces of the punch and the die and, as the forming ring 37 forms the loop 61 in the blank, the intermediate portion 62 of the ring is forced over the forming ring 44, and the upper portion of the flange 60 is pulled inwardly sufficiently to allow the proper formation of the blank, Fig. 9. The rings 40 and 44 prevent any material inward movement of the flange 60 during the remainder of the operation.

As the punch descends further, the piercing disk 63 is cut from the center of the blank by means of the cutting edges 36 and 43, and, the punch continuing downwardly, the ring is gradually formed to correspond to the ring of Fig. 4 by means of the forming surfaces of the punch and die.

As the punch descends, the stock holding ring 38 presses down on the ring and provides a means for preventing undesirable wrinkling of the material and also prevents undue outward drawing of the material. In general, the inward and outward drawing tendency of the punch and die are balanced by the rings 40 and 44 and the holding tendency of the rings 38 and 46.

Finally, as the punch descends, Fig. 10, the flange 64 is formed by the rings 38 and 46 and the loop 61 is completed by the ring 37. This completes the first operation.

In this process, when the piercing disk has been cut, the inner portion 65, Fig. 8, of the ring is forced outwardly by the forming surfaces as indicated in Fig. 6, so that the inner diameter of the ring is very materially larger than the outer diameter of the piercing disk. In order to accomplish this without injury to the material, the sides of the forming rings are not parallel but are slightly tapering, and a slight amount of clearance is allowed so that a suitable amount of draw is permissible without injury to the material being operated on. In the second operation, however, this material is firmly pressed together by the sides of the forming rings and the completed ring has the proper parallel friction surfaces.

By this method of operation, I am able to form the ring without drawing inwardly from the periphery any material portion of the material and the shortage of material resulting from the smaller outer diameter is compensated for by drawing material outwardly from the inner edge of the ring. It has been common heretofore in forming rings, during the first operation, to draw ma-

terial outwardly from the center somewhat, but the periphery of the ring is not formed into shape as is the case by my method. What corresponds to my flange 60, for instance, and the portion 62 is left substantially straight and unformed. As a consequence, the diameter of the blank from which the ring is formed must be great enough to allow for the turning in of the flange 60 and the proper bending of the portion 62 during the second or third operation and, hence, the diameter of the blank itself originally must be greater than is the case with my method.

The portion 62 of the ring formed by the first operation extending from the corner 66 to about the point 67 is formed by bending over the forming surface 44 as the ring 37 is forced downwardly. The formation of this portion 62 is important as the proper formation allows for the proper completion of the ring without distorting the flange 60 or the groove 61; and it also allows the passage from the first to the second operation without inverting the ring. In general, the formation of this portion 62 is as indicated in Fig. 6. While the exact shape of the portion 62 may be varied somewhat, yet, preferably, the shape of this portion is substantially as indicated in Fig. 6 and the radius of curvature at 66 adjacent the flange bend is much less than the radius of curvature of the remaining portion.

The various steps taken on the ring in the second operation are more or less apparent from the drawings. As is explained hereinafter, the ring is removed from the punch 30 and is passed, without inverting, onto the punch 28. During the second operation, the flange 60 is maintained substantially as shown in Figs. 6 and 10, but the portion 62 is formed into a cascade of annular steps 70 and 71 by means of the forming rings 72 and 73, acting in conjunction with the rings 74 and 75. At the same time, the walls 76 are made parallel and are firmly pressed into shape by the side walls of the forming ring 79 acting on the die. As the forming surface 77 of the punch presses down on the portion 78 of the ring, the edge 80, by means of the forming surface 81 of the die, is forced inwardly and the double edge 82 is finally formed, thus completing the ring.

In this manner, I produce a double tight ring of substantially the same shape as has been commonly made in the past, and the ring is formed with the same amount of material and with two operations only and without inverting the ring. By the use of my method, which allows a smaller blank than has been common for a given sized ring, I not only save material which is more valuable than the material of the disk which is cut out from the ring, but by making the diameter of the blank smaller, smaller external cutting surfaces are required, thus reducing the expense of the apparatus, and also reducing the power required to operate the punches in cutting out the blank.

This, in general, describes the method of operation of the punches and dies in forming the ring from the sheets of material, but various other steps are taken during the process, some of which comprise portions of my invention. One of these steps is the manner of disposing of the piercing disk. In carrying out my process, the disk, when cut from the central portion of the blank in forming the ring, is forced downwardly through the die instead of being pushed upwardly out of the die, as has been common heretofore.

In order to suitably dispose of the piercing disk 63, the opening 85 is continued through the die and bolster, somewhat enlarged below the cutting edge of the die, and registering with this opening is a tube 86 through the bore 87 of which the disk passes and then drops into the basket 88. To prevent any tendency of the disks to lodge in the bore of the tube 86, I provide axially across the center of the bore a guide plate 90 having its upper end bent to one side so that the disk, on striking this plate, is tilted to one side and drops down edgewise through the bore.

To force the disk through the die, I provide pins 91 and 92 backed by springs 93 and 94. When the disk is cut from the blank, these pins force it downwardly through the bore of the die, and to assist in tilting the disk edgewise, the spring 93 is made stronger, so as to push that side of that disk out more vigorously than the other side. However, if desired, the pin 91 may be made somewhat longer than the pin 92, and the tilting will also be accomplished.

Means are also provided for automatically passing the ring from one die to the other. The ring, after the first operation, is picked up by the punch 30, the knock-out ring 47 forcing it from the die 27. In forming the ring, the flange 60 tends to press out against the inner wall of the ring 40 of the punch and also the outer sides of the portions 78 tend to press against the walls of the adjacent surfaces of the rings 37 and 38 of the punch. As a consequence, as the ring is forced from the die by the knock-out ring 47, it is lifted by the punch. The knock-out ring 47 is slidably mounted in the punch, and as the punch descends the ring is forced inwardly by the punch against the resistance of the spring 83. This results by the pins 84, which are fixed to the ring, pressing against the collar 85 which is slidably mounted on the tube 86. As the punch rises the spring 83, acting on the knock-out ring, forces the can ring from the die.

As the punch rises, carrying with it the can ring, the knock-out ring 96 forces the ring

off from the punch; and the pins 97, backed by the springs 98, force the can ring away from the knock-out ring 96 if there is any tendency for it to stick to this ring.

The knock-out ring 96 is operated in the following manner: The ring is slidably mounted in the punch, and is fixed by cross bars 99 to a slidably mounted rod 87 which is yieldingly held in its upward position by the spring 88. As the punch rises, the upper end of the rod 87 strikes against an adjustable stop 89 fixed to the frame of the punch press, and the knock-out ring is thus forced downward relative to the punch.

As the can ring drops from the die 30, it passes into the chute 100 formed by the plates 101, 102 and the side plates, and the ring then passes down over the die 28, striking against the U-shaped flange 103, and then drops down onto the face of the die. In order to insure the ring being properly positioned on the die, I provide air-jets 104 which are continuously supplied with air under pressure passing through the pipes 105, and the force of the air passing from these jets snaps the ring firmly and accurately in place on the die. Obviously, if the ring was not exactly placed on the die, it might be injured and the die or the punch broken; so that to prevent this I provide the jets and position them somewhat as indicated. This produces air-pressure on two sides of the ring and, thus, brings the entire ring snugly in place. The flange 103 is slidably mounted in the die 23 and, as the punch descends, it is pressed downwardly against the springs 106.

At the end of the second operation, by means of the punch 31 and die 28, the ring is formed as indicated in Fig. 12 and it is then forced from the die by means of a knock-out ring 107. This ring is slidably mounted in the die 28 and is yieldingly held in its upper position by means of the spring 108. This spring is mounted on the rod 109 which is fixed to the bolster 23. The rods 110 are fixed to the ring 107 and to the slidably mounted collar 111 which is backed by the spring 108. Thus, as the punch is raised, the can ring is forced from the die by the knock-out ring actuated by the spring 108.

As the punch 31 rises, it carries with it the can ring, as was the case with the punch 30. But, upon reaching a predetermined adjustable position, the knock-out ring 112 forces the can ring from the punch. This ring 112 is slidably mounted in the punch and is operated by the rod 113 in a manner similar to the operation of the rod 87 on the ring 96. As the can ring drops from the punch and the press, it is disposed of in any suitable manner.

Modifications may be made in the apparatus and modified forms of rings might be made by those skilled in the art without departing from the spirit of my invention. For example, if desired, the flange 80 may be retained in the finished product without doubling it back as indicated in dotted lines in Fig. 14 at 82. This may be accomplished by the use of the modified punch and die illustrated by Fig. 15. In this case, a forming ring 115 is formed in the die and a corresponding forming groove 116 in the punch. By means of these forming members, the loop 78 is preserved without change during the final operation; or by varying the forms of these forming rings, the loop may be modified more or less by the final operation.

As much attention herein has necessarily been given to various details of the mechanism, I wish to call attention now specifically to the novel features of my method.

There is no novelty in forming double friction-tite can tops. In fact, it is old to form can tops having in general the same shape as mine. But the problem has been to produce such tops which will meet the requirements. The requirements are that there shall be no leakage of cans containing heavy liquids which undergo rough handling, and no liability of the tops being forced off. Also, the tops must be susceptible of reclosing after having been opened by the user. This necessitates the formation of friction-tite loops with no distortion of the metal of the friction portions; that is, the sides of the loop. As the bottom of the loop is the full width of the loop, all of the metal forming the loop sides must be drawn inwardly from portions outside of the loop. That is, the portions of the loop which must be substantially without any distortion must be transported from portions of the sheet metal outside of the loop.

There are, in general, three novel principles involved in my method, namely:

1. Forming the loop as the drawing of the metal towards the loop is being uniformly but yieldingly retarded by some clamping or braking means;

2. Suitably retarding the metal relatively on both sides of the loop; and

3. Drawing the metal towards and into the loop over upwardly projecting annular rounded surfaces.

The braking of the movement of the metal is accomplished in part by means of the outer and inner flange formers; and this braking results in yieldingly holding uniformly the entire outer and inner edges of the metal ring. This produces uniform stresses throughout all portions of the metal opposing the pull of the loop forming portions, and, thus, the metal is held uniformly taut over the annular upwardly projecting rounded surfaces. Without this uniform braking, certain weaker portions of the metal would yield more readily than other portions and defects would result.

The drawing of the metal is produced by

the formation of the loop which requires a large amount of additional metal; and distortion of the metal is prevented by the retarding and by causing the metal to flow over the suitably rounded surfaces. These surfaces not only provide suitable flow lines, but they allow for the elimination of all abrupt changes of shape, and the gradual bending allows for suitable shifting of the metal particles without distortion.

These three general features involve various details:

The outer retarding means comprise the flange-formers, and also the changes in form of the flange during the loop formation. The formation of the complete outer flange simultaneously with the formation of the loop is new. The old method was to form the flange after forming the loop. Forming the flange as the loop is formed provides suitable outer breaking means, and these are effective somewhat before the beginning of the formation of the inner flange. The inner retarding means at first consist of the sheet of metal itself, and as soon as the center disk is removed, the inner flange means uniformly retards the flow of metal towards the loop. Not only is the amount of braking or retardation equalized at all points on one side, but the relative amount on the two sides is suitably adjusted or equalized.

The rounded flow surfaces are adapted to the needs. Outside of the loop, the inflowing particles of metal are forced together, tending to form wrinkles. Hence, a wide annular upwardly projecting surface is provided with a large radius of curvature, so as to allow a more gradual flow and prevent thickening and wrinkling. Inside of the loop, the metal tends to spread out, and a narrow flow surface with a short radius of curvature is provided to prevent thinning of the metal. If these flow surfaces were flat, as has been the case in the past, the outer sides of the loop would tend to thicken in spots, and the inner side would have thin spots, and the outer is usually wrinkled, and the inner side sometimes torn more or less.

Another novel detail is the formation of the desired angular portions in the space between the outer flange and the loop after the loop drawing has been completed. The steps in this portion are formed by the second punch and die and, thus, drawing over angular surfaces, and producing abrupt angular changes, while drawing the loop is avoided. The distance along the rounded portion is the same as the distance along the steps, so that no drawing results when the steps are formed.

Another novel step is the truing up of the loop after the drawing of the metal. During the first operation, the loop is left with sides diverging slightly upwardly, and with the outer upper corner rounded somewhat more than is desired, in order to assist in preventing distortion. But, during the second operation, the sides are made parallel, the corner is made more abrupt, and any possible irregularities in the sides, particularly in the friction surfaces, are smoothed out.

I claim as my invention:

1. A punch press for forming devices, comprising two pairs of punches and dies, one of said pairs being higher than the other, and means for moving the devices from one pair to the other, said means comprising a knock-out on the die of one pair, a knock-out on the punch of that pair, and an inclined chute positioned between the two pairs, a guide for positioning the devices on the other die, and air-jet means for forcing the devices in position on the said other die.

2. A punch press as claimed in claim 1, in which said punches are mounted on a common reciprocatable cross bar.

3. A punch press as claimed in claim 1, in which one pair of the punches and dies have a pair of outer and a pair of inner cutting edges.

4. A method of making double friction-tite can tops, consisting in forming a ring of suitable sheet-metal material, and in forming in the central portion of the ring material a deep annular downwardly projecting loop, said loop being formed by drawing the material into the loop from both sides thereof over rounded surfaces.

5. A method of making double friction-tite can tops as claimed in claim 4 and, at the same time, yieldingly braking the outer and inner edges of the ring against movement towards the loop.

6. A method of making double friction-tite can tops as claimed in claim 4 and, at the same time, braking the outer and inner edges of the ring against movement towards the loop, the radius of curvature of the outer rounded surface being materially greater than that of the inner rounded surface.

7. A method of making double friction-tite can tops, consisting in forming a blank of sheet metal, in forming a downwardly projecting annular flange on the edge of said blank, and, while said flange is forming, in forming a deep annular loop inside of but spaced from said flange, said loop being formed by drawing metal into the loop over a rounded surface between said flange and loop.

8. A method of making double friction-tite can tops as claimed in claim 7 and, while said loop is forming, in forming an opening in the center of said blank, and in then drawing metal towards said loop from the portion inside of said loop over a rounded surface.

9. A method of making double friction-tite can tops as claimed in claim 7 and, while said loop is forming, in forming an opening

in the center of said blank, in then drawing metal towards said loop from the portion inside of said loop over a rounded surface, and at the same time yieldingly retarding the movement towards said loop of the metal surrounding said opening.

10. A method of forming can tops, consisting in cutting a blank from suitable material, in cutting a disk from the center of said blank, in forming intermediate the inner and outer edges of the blank a deep annular loop, and in suitably yieldingly braking the drawing of the material towards said loop on each side of said loop substantially from the time of the cutting of the disk, so as to avoid distortion of the material in the loop.

11. A method of forming can tops as claimed in claim 10, and in then snugly pressing together the surfaces of the material in each side of said loop, so as to provide smooth parallel surfaces.

12. A method of forming can tops as claimed in claim 10, and in simultaneously forming an annular angular flange on the inner edge of said blank.

13. A punch and die for forming can tops, the punch comprising an annular cutting ring, the outer edge of said ring having a cutting edge, the lower surface being inclined somewhat inwardly and upwardly, and the inner edge being rounded, said die comprising a yielding draw ring having a diameter substantially equal to that of the cutting ring, and a relatively wide upwardly projecting rounded surface immediately inside of said draw ring, said punch and die having means for forming a deep substantially parallel-sided annular loop projecting downwardly in the central portion of said top.

14. A punch and die for forming can tops as claimed in claim 13, in which said punch and die have means inside of said loop means for cutting out a disk, and for retarding the movement outwardly of the stock inside of said groove as said loop is forming.

15. A punch and die for forming material comprising means for cutting a central disk from said material, said die having an opening therethrough for said disks, means for tilting said disks relative to said die as they are passing through said opening, and a conduit registering with said opening, said conduit having a longitudinal central partition therein for guiding said disks edgewise through said conduit.

16. A punch and die for forming material comprising means for cutting a central disk from said material, said die having an opening therethrough for said disks, means for tilting said disks relative to said die as they are passing through said opening, said tilting means comprising a pair of resilient members adapted to act on said disks as they are being cut, the action of one of said members on said disks being greater than the other.

17. A punch and die for forming material comprising means for cutting a central disk from said material, said die having an opening therethrough for said disks, means for tilting said disks relative to said die as they are passing through said opening, said tilting means comprising a pair of slidably mounted pins and a spring adapted to force each of said pins against said disks, one of said springs being stronger than the other.

18. A punch and die for forming double-tite can tops, comprising means for cutting a blank from suitable stock, means for clamping the rim of said blank and forming an annular flange thereon, means for forming a deep annular loop in said blank inside of said flange as said clamping means and said flange forming means retard the movement inwardly of the material of said blank outside of said loop, means for cutting out a central opening in said blank, and means inside of said loop for retarding the outward movement of the material of said blank adjacent said opening as said groove is forming, said die having an upwardly projecting former ring on each side of said loop forming means, the surfaces of said forming rings being rounded and the outer one having the greater radius of curvature.

In testimony whereof, I hereunto set my hand.

FREDERIC MEIER.