Aug. 29, 1939. E. J. GREIF 2,170,946

MACHINE FOR FORMING BOTTLE NECKS UPON SHEET METAL TUBS

Original Filed July 18, 1936 3 Sheets-Sheet 1

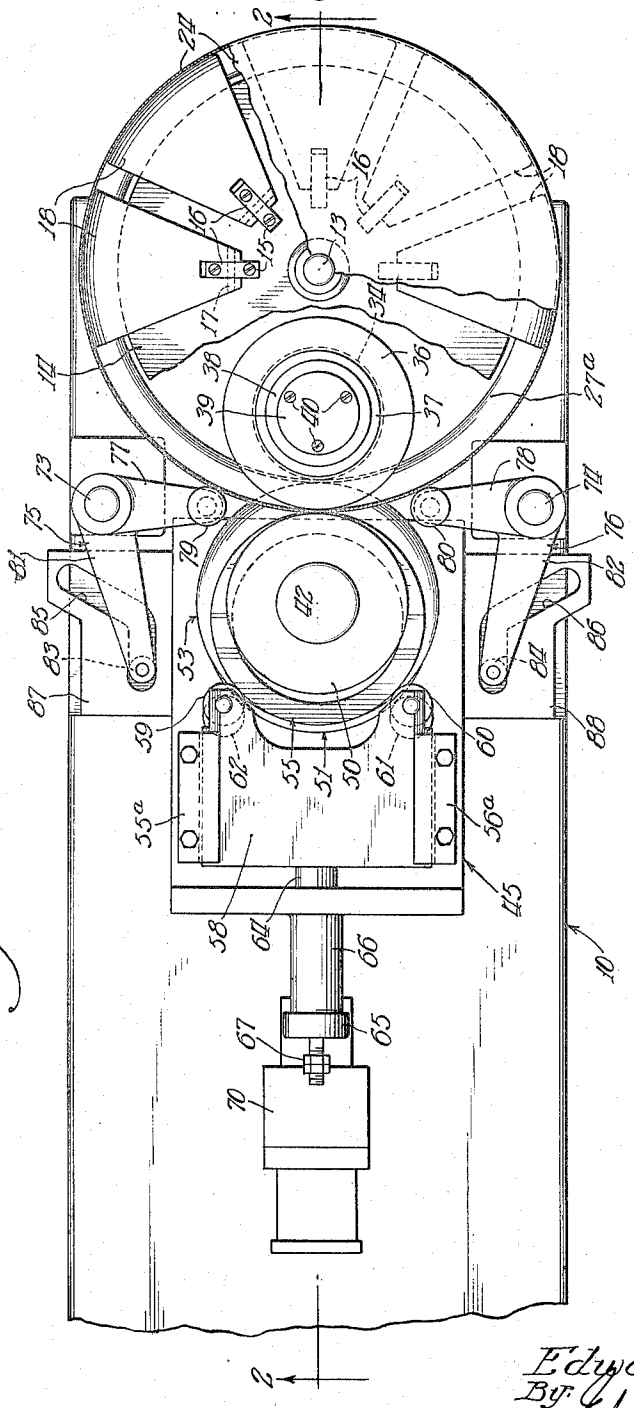


Fig. 1

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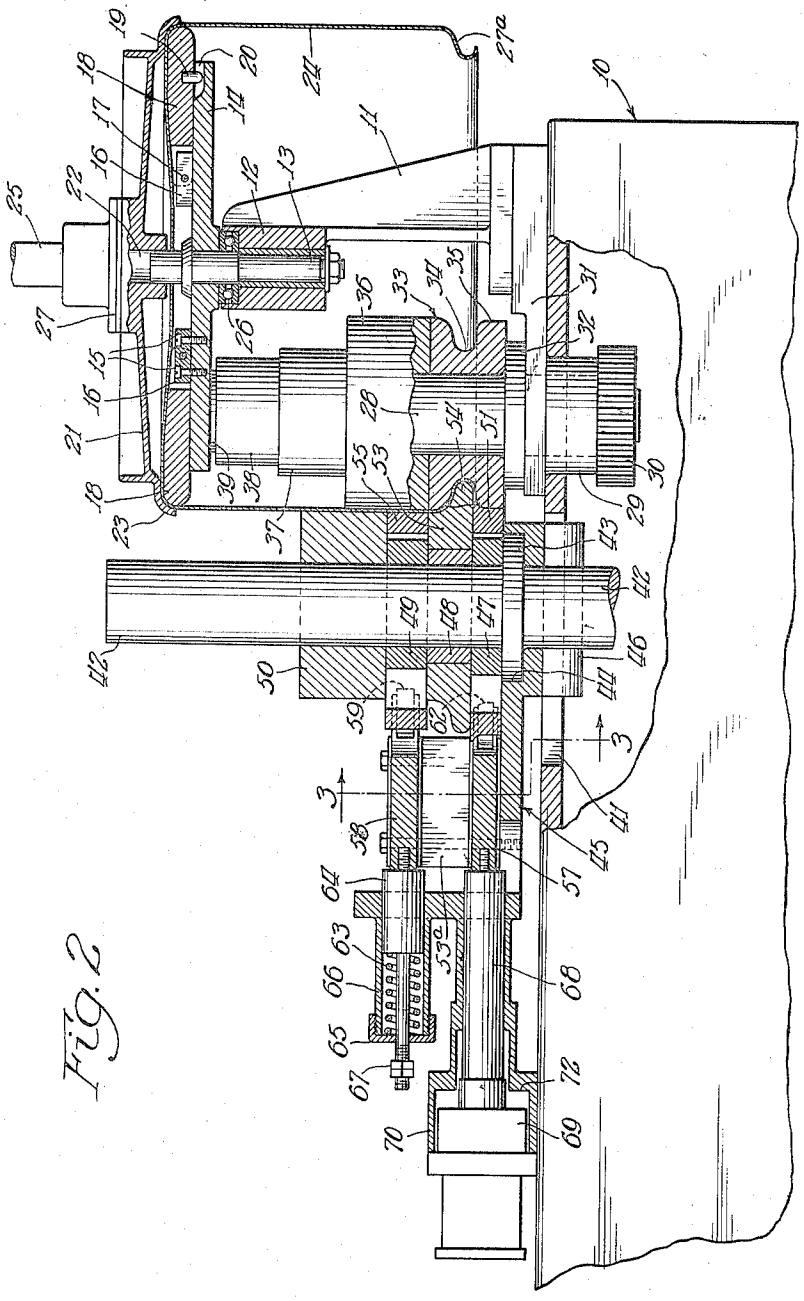


Fig. 2

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Fig. 3

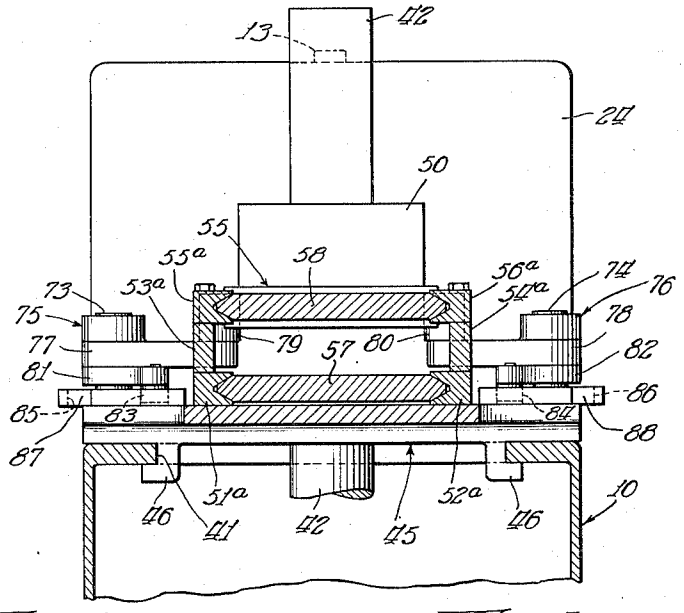


Fig. 4

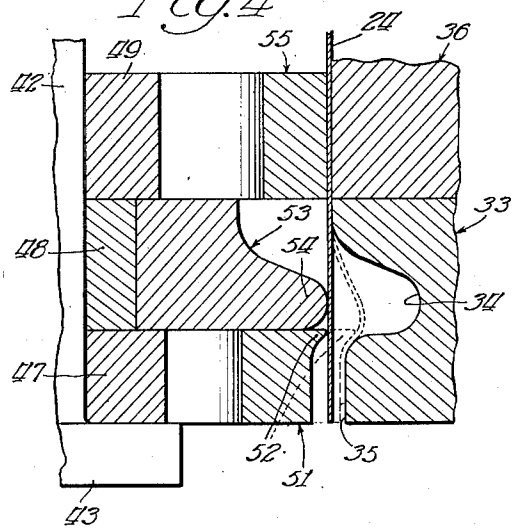
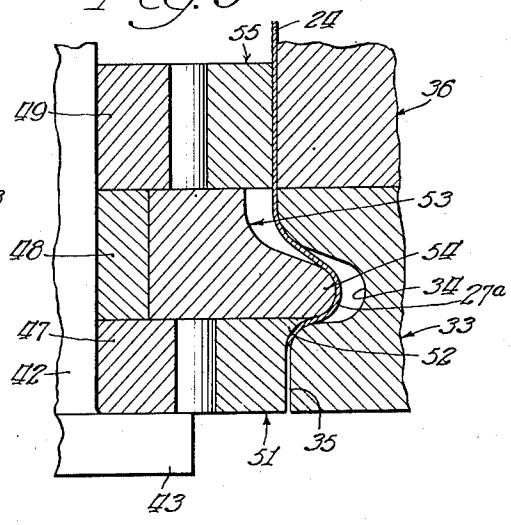


Fig. 5



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UNITED STATES PATENT OFFICE

2,170,946

MACHINE FOR FORMING BOTTLE NECKS UPON SHEET METAL TUBS

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Renewed February 3, 1939

13 Claims. (Cl. 113—52)

This invention has to do with sheet rolling apparatus, and relates particularly to a machine having a novel arrangement of rolls for feeding and drawing sheet stock in but one direction into a space between shaper surfaces of complemental rolls.

A rolling machine embodying the present invention is especially adapted to the art of making so-called bottle-neck tubs or containers which are closed at one end, and which are contracted at their opposite end about a lipped end opening. Because of the difficulties heretofore encountered in making the bottle-neck in sheet metal containers by reducing the size of the opening therein, some manufacturers prefer to use a separate piece of stock for forming that section having therein the opening. Such piece is first made of the desired shape and size, then the opening is formed at the end of the bottle-neck and lastly the piece may be seam welded to another part or parts forming the side walls and bottom of the container. This method of manufacture, however, is inherently disadvantageous because of the large amount of waste scrap cut away in the formation of the opening.

An object of the present invention is the provision of an improved rolling device cooperable supplementally with pressing and drawing apparatus in such a manner as to diminish the cost of manufacturing sheet material containers having a bottle-neck opening.

Another object of the present invention is the provision of a rolling device as the above, and which lends itself to a process of making from a single sheet of material, without appreciable waste, a bottle-neck container.

A further object of the present invention is the provision of an improved rolling device adapted to constrict and curl the marginal side wall edge about an end opening in a cylindrical container.

A still further object of the present invention is the provision of an improved mechanism for rolling and shaping sheet material while drawing in one direction laterally of the rolls a section of the material to be shaped.

With the above and other desirable objects in view, the invention is hereinafter described in conjunction with the accompanying three sheets of drawings hereby made a part of the specification, and wherein:

Fig. 1 is a plan view of a rolling machine embodying the present invention;

Fig. 2 is a vertical sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a transverse sectional view taken upon the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary sectional view illustrating the rollers of the machine as they appear during one period of operation; and

Fig. 5 is a view similar to Fig. 4 at a succeeding stage in the operation of the machine.

Throughout the following description and in the various figures of the drawings, the same reference characters are used for designating similar parts.

The invention will be described with particularity as it may be applied to a machine for forming bottle-neck tubs of sheet metal. It will be understood, of course, that the machine herein shown is illustrative only of a particular application of the invention, which is in no wise limited thereto.

Attention is first directed to Figs. 1, 2 and 3, where parts constructed in accordance with the invention will be seen supported upon a bench 10. A prime mover and control means for the apparatus may be housed by the bench 10. Disposed upon the top of bench 10 is a vertical bracket 11 having a bearing 12 for a vertical spindle 13. Said spindle 13 carries a horizontal plate 14, which has secured to the top thereof by means of screws 15 a plurality of radially arranged lugs 16. Pivotally secured at 17 to each of the lugs 16 is a generally sectorial piece 18. Lateral movement of the sectorial pieces 18 is prevented both by their pivotal connections at 17 and by studs 19 which project into grooves 20 in the upper face of the plate 14 when the pieces 18 are in their lower positions illustrated in Fig. 2.

Above the pivotal sectorial members 18 is a clamping plate 21 which has a central opening 22 for receiving the upper end of the spindle 13, whereby said plate 21 may be properly centered. A peripheral flange 23, curved slightly downwardly, is carried upon the clamping plate 21. When a partially completed container or tub 24 is held in the apparatus as shown in Fig. 2, and pressure is applied downwardly upon a spindle 25, the outer edge of the bottom of the container 24 will be tightly compressed between the curved flange 23 and the pivoted members 18. Ball bearing units 26 and 27 permit the plates 14 and 21 and the tub 24 carried thereby to rotate relatively to the spindle 25 and the bracket 12 with but little friction.

At the time the tub 24 is placed upon the machine, the inwardly disposed bottle-neck section 27a has not been formed and said container slides easily over the sectorial pieces 18. When the

tub 24 is lifted from the device, the bottle-neck section 27a will tilt the sectorial pieces 18 upwardly as it is withdrawn. Prior to the withdrawal of the tub 24 from the device, the clamping plate 21 is lifted by means of the stem 25 and shifted to one side out of vertical alignment with the tub. The spindle 25 is carried upon a horizontally pivotal arm (not shown).

Immediately to the left of bracket 11, Fig. 2, is a vertical shaft 28 suitably journalled in a bearing member 29 anchored in the top of the bench 10. The shaft 28 may be rotated by means of a gear 30, which may be entrained with prime mover apparatus within the bench 10. Suitably spaced from the top of the bench 10 by means of a section 31 of the bearing member 29 and by a flange 32 upon the shaft 28 is a roll 33 having therein a circumferential grooved shaper surface 34 and a guide surface 35. The roll 33 is keyed or otherwise suitably secured to the shaft 28 to rotate therewith. Above the roll 33 is a cylindrical roll 36 connected to the shaft 28 for common rotation. Superposed upon the roll 36 is a collar 37 and a cap 38, the latter having thereon a bearing plate 39 secured in place by means of screws 40, shown in Fig. 1. The bearing plate 39 is adapted to bear against the lower face of the rotatable plate 14, and thus prevent downward deflection of said plate during operation of the device as will be fully explained later.

Extending upwardly through an opening 41 in the top of the bench 10 is a shaft 42. Said shaft 42 is supported upon a flange 43 thereof rotatively journaled in a seat 44 in the frame of a reciprocal carriage indicated generally at 45. In Figs. 2 and 3, the carriage 45 will be seen to have L-shaped lugs 46, which engage opposite sides of the opening 41 in a manner holding the carriage 45 upon the top of the bench 10 and guiding the carriage in its reciprocal movement.

The shaft 42 has thereon four collars designated respectively 47, 48, 49 and 50. An oversize annular guide roll 51 is supported upon the carriage 45 and surrounds the collar 47. In Figs. 2, 4 and 5 it will be noted that the guide roll 51 has a curved flange-like section upon its upper side, the section being designated 52, and the curve thereon conforming to the curve upon the lower edge of the shaper groove 34 in the roll 33. Resting upon the collar 47 is the collar 48 and a shaper roll 53 having a rounded flange-like section 54 which is adapted to fit into the shaper groove 34 as illustrated in Fig. 2. The collar 48 serves as a bushing upon which the roll 53 may rotate. A third roll 55 of cylindrical profile is supported by the roll 53. Said roll 55 is an annulus of which the inside diameter is considerably greater than the outside diameter of the collar 49 in registry therewith. Likewise, the inside diameter of the roll 51 is greater than the outside diameter of the collar 47. Collar 50 prevents upward movement of the collars and rolls therebeneath upon the shaft 42.

A pair of grooved track members 51a and 52a may be seen in Fig. 3. Upon the track members 51a and 52a are spacer members 53a and 54a, said spacing members having thereon a second pair of track members 55a and 56a. Plates 57 and 58 are disposed reciprocally within the grooved tracks of the track members 51a, 52a, 55a, and 56a. The reciprocal plates 57 and 58 are respectively in the horizontal plane of the guide roll 51 and the retaining or holder roll 55. In Fig. 1, the plate 58 will be seen to carry a pair of rollers 59 and 60, which engage the outer periphery of the retaining roll 55. Also, in Fig. 1 and in Fig. 2 the lower plate 57 will be seen to carry similar rollers 61 and 62 which bear against the outer periphery of the guide roll 51. Plate 58 is constantly urged to the right, Fig. 2, by means of a spring 63 which presses against the back part of a plunger 64, which is connected to the plate 58 and against the cap 65 of a spring casing 66. The advancement of the plunger 64 and the plate 58 by the spring 63 may be limited by an adjustable nut 67 which is adapted to abut against the cap 65. The spring casing 66 is fixed upon the carriage 45, whereas the plunger 64 and the plate 58 are movable relatively thereto under the influence of the spring 63.

Also reciprocal in the carriage 45 is a plunger 68, Fig. 2, which is secured to the reciprocal plate 57. The left end of the plunger 68, Fig. 2, carries a piston 69 encased in a cylinder 70, which is secured to the carriage 45. When pressure fluid is introduced into the left end of the cylinder 70, Fig. 2, by means (not shown), the piston 69, the plunger 68 and the plate 57 will be urged to the right. During operation of the device, a pressure fluid is maintained in the left end of the cylinder 70 by said means (not shown) whereby the piston 69 is constantly urged to the right. Movement of the piston to the right is limited by the shoulder 72 within the cylinder walls.

Attention is now directed to Fig. 1, and particularly to upright pivot posts 73 and 74. Said posts carry, respectively, bell crank levers 75 and 76. Legs 77 and 78 of the bell crank levers carry rollers 79 and 80, whereas legs 81 and 82 carry cam rollers 83 and 84. In Fig. 3, where the rollers 79 and 80 are shown partly in dotted outline, it will be seen that the arms 77 and 78 carry said rollers at such an elevation that said rollers lie in substantially the same horizontal plane as the retainer or holder roll 55. Bell crank legs 81 and 82, however, are in a plane lower than the legs 77 and 78 and the rollers 83 and 84 depending from their lower sides are disposed in cam slots formed in cam blocks 87 and 88 secured to and movable with the carriage 45. Upon the carriage being moved to the right, Figs. 1 and 2, the rollers 83 and 84 acting in the cam grooves 85 and 86 of the cam blocks will cause the bell crank levers 75 and 76 to be rotated upon posts 73 and 74 in such a direction as to advance the rollers 79 and 80 into contact with the tub 24 carried upon the rotatable support therefor.

The operation of the device will now be described.

The apparatus here shown is adapted to perform an additional operation upon a partially prepared tub or container. When disposed upon the present apparatus, the tub 24 has cylindrical side walls and a bottom wall with a central aperture for receiving the upper end of the spindle 13. The clamping plate 21 is lifted and carried to one side while the tub 24 is inverted and telescoped over the pivoted members 18. This having been done, the clamping plate 21 is moved into alignment with the container holder apparatus and moved downwardly into the position shown in Fig. 2 whereby the bottom portion of the container 24 is firmly clasped in the device for rotation upon the bearings 26 and 27.

At this time, the carriage 45 will be retracted to the left, Figs. 1 and 2. While the carriage 45 is in its leftmost or retracted position, the spring pressed plate 58 and the fluid pressed plate 57 will be urged toward the right, and the rollers thereon will press the rolls 55 and 51 to the right

with respect to the carriage 45 until the inner peripheries of said rolls are brought to bear against the collars 49 and 47, respectively. In other words, as the device is shown in Fig. 2, the rolls 55 and 51 are pressed by the rollers of the plates 58 and 57 against the material of the container 24 and the roll 36. Now, if the carriage 45 were to be moved to the left, the roll 53 would be immediately withdrawn from the roll 33, whereas the rolls 55 and 51 would remain in the position shown until the collars 49 and 47 are carried far enough to the left to engage the inner peripheries of said rolls 55 and 51 for retracting said rolls to the left with the carriage.

When the tub 24 is first placed in the machine, the cylindrical side walls will be straight throughout as illustrated in Fig. 4. Means (not shown) is provided for rotating the gear 30 and the shaft 28 carrying the rolls 33 and 36. Means (not shown) is also provided for rotating the shaft 42, but in the opposite direction as the shaft 28. Shaft 42, is, of course, retractable with the carriage 45. Means (not shown) is provided for reciprocating the carriage 45 whereby to advance the same toward the rollers 33 and 36 and to retract the same from said rollers. Incident to the carriage 45 being advanced the retaining roll 55 will first be permitted to come in contact with the retaining surface of the roll 36 opposite thereto, as shown in Fig. 4. That is, when the collar 49 is advanced from the back side of the interior of the roll 55 the spring 63 becomes effective to press the roll 55 against the side wall of the container 24. When the carriage 45 is advanced still further, the shaper roll 53 will be projected slightly into the shaper section 34 of the roll 33, whereby the side wall of the container or tub is deflected in some such manner as shown in dotted outline in Fig. 4. By this time, the carriage will have been moved far enough to have advanced the collar 47 from contact with the interior of the roll 51, so that said roll may be urged by the pressure fluid in cylinder 70 into the position shown in dotted outline in Fig. 4. Meanwhile the rolls 55 and 36, 53 and 33, and 51, as well as the tub 24 have been rotating so that the dotted outline indentation in Fig. 4 represents a cross-section of a circumferential groove then formed in the tub. Because of the grip of the container sidewall between the retaining roll 55 and the retaining roll 36, that part of the tub wall gripped therebetween resists downward movement into the shaper sections of the rolls 53 and 33. The rolls 55 and 36 also keep the side wall of the tub smooth and regular by preventing buckling. Downward movement of the tub wall is precluded in part by the bearing plate 39, which is adapted to brush against the lower face of the turn table 14. Because of the bearing plate 39, any tension in that section of the tub wall in registry with the rolls of the device cannot deflect the turn table from the horizontal and as a consequence the tub side wall is fed accurately into the rolls.

The roll 51 is a guide roll and directs that portion of the tub side wall therebetween and the guide section 35 of the roll 33 into the shaper section 34 of said roll 33. It follows that the lower end of the tub side wall, Fig. 4, will be drawn upwardly as said wall is pressed into the circumferential groove in the roll 33. Such drawing upwardly of the lower end of the inverted container wall is illustrated in Figs. 4 and 5. In Fig. 2, the rolls upon the carriage 45 are shown in their completely advanced position and the edge of the container wall is illustrated in its most upwardly advanced position.

If it were not for the guide roll 51 and the cooperative opposed guides surface 35 upon the roll 33, the material about the edge of the tub opening would tend to pucker as it is drawn into the groove 34. However, when the roll 51 is used, the material is maintained perfectly smooth.

As a further means of preventing the side walls of the tub 24 buckling or distorting while being rolled, the rollers 79 and 80 are brought to bear against the container side walls in the manner hereinabove described. Elimination of wrinkles or irregularities in the inwardly deformed bottle-neck part 27^a of the tub 24 is further insured by the fact that the rollers acting thereon are relatively rotatable. Thus, the rollers are untrammeled in their direct action upon the parts or sections of the container wall compressed therebetween.

The machine is so adjusted with respect to the height of the tub side walls that during the rolling operation, the edge of the walls about the opening will be drawn upwardly and curled into the shape shown in Fig. 2. After completion of the rolling process, the carriage 45 together with the rolls thereon are retracted to the left, Fig. 2, until the rolls are carried out of contact with the side wall of the tub. The clamping plate 21 is then lifted and moved to one side, and thereafter the tub 24 is tilted slightly to carry its bottle-neck section 27^a laterally from the circumferential groove in the roll 33 and lifted upwardly. When the section 27^a comes in contact with the sector-like plates 18, said plates will be pivoted upwardly, and thus effectively contract so that said section may pass thereover. The tub 24 is subsequently taken to additional apparatus for performing a further operation to form a closed bead from the curled section about the bottle-neck opening.

It will be noted that substantially no material is wasted in the making of a tub or container by the process described in connection with the operation of the present device. The container is made from a single sheet of material, and the only waste involved will be such scrap as may be necessary to trim from about the open end to make the side walls of standard length prior to insertion in the present machine. The stamping and drawing apparatus for forming the cylindrical container for inserting in the present machine may be operated with such precision that but only a negligible amount will need to be trimmed from the open end of the cylindrical walls.

I claim:

1. Rolling mechanism comprising, roll means having thereon a circumferential shaper section and a holder section, a shaper roll, a holder roll, said roll means and said rolls being relatively movable, means yieldingly urging said holder roll and holder section into close cooperative proximity, releasable restraining means for said urging means, means for relatively moving said shaper roll and shaper section until said roll and section are in close cooperative proximity, and means for releasing said restraining means prior to said shaper roll and shaper section reaching such proximity.

2. In an apparatus for shaping material, a shaft, a roll mounted on said shaft, said roll having a cylindrical portion and a contoured portion,

a second shaft, a shaper roll mounted on said second shaft and adapted to cooperate with the contoured portion of said first mentioned roll, means for reciprocating one of said shafts relative to the other to advance the shaper roll into the contoured portion, means for supporting the material to be shaped between said rolls, and means for holding the material against lateral motion on the rolls, said last mentioned means being reciprocable relative to the shaper roll and adapted to hold the material against the cylindrical portion while said material is shaped by the shaper roll.

3. In an apparatus for shaping material, a shaft, a contoured roll mounted on said shaft, a second shaft, a shaper roll mounted on said second shaft and adapted to cooperate with the contoured roll, means for supporting the material between said rolls with the edge of the material extending beyond said contoured roll, means for reciprocating one of said shafts relative to the other, means for holding the material against lateral motion on the roll, and means for guiding the edge of the material into the contoured portion of said rolls, said holding and guiding means being reciprocable relative to the shaper roll and adapted to contact the material before it is shaped by said shaper roll.

4. In an apparatus for shaping material, a shaft, a roll mounted on said shaft, said roll having a cylindrical portion and a contoured portion, a second shaft reciprocable with respect to said first-mentioned shaft, a shaper roll mounted on said second shaft and adapted to cooperate with the contoured portion of said first-mentioned roll to shape the material, means for supporting the material between said rolls, a carriage mounted on said shaft and reciprocable therewith, means on said carriage for holding the material against lateral motion on the cylindrical portion of said first-mentioned roll, and a lost motion connection between said holding means and shaft, whereby movement of said shaft toward the contoured roll causes engagement of the holding means with the material prior to and during the forming of the material.

5. In an apparatus for shaping material, a shaft, a contoured roll mounted on said shaft, a second shaft reciprocable with respect to said first-mentioned shaft, a shaper roll mounted on said second shaft and adapted to cooperate with said first-mentioned roll to shape the material, means for supporting the material between the rolls with the edge of the material extending beyond said contoured roll, a carriage mounted on said shaft and reciprocable therewith, means on said carriage for guiding the edge of the material into the contoured roll, and a lost motion connection between the guiding means and shaft, whereby motion of said shaft towards the contoured roll causes engagement of the guiding means prior to and during the forming of the material.

6. In an apparatus for shaping material, a shaft, a roll mounted on said shaft, said roll having a cylindrical portion and a contoured portion, a second shaft, a shaper roll mounted on said second shaft and adapted to cooperate with the contoured portion to shape the material, means for supporting the material between said roll with the edge of the material extending beyond said contoured roll, means for reciprocating the second shaft with respect to said first-mentioned shaft, a carriage mounted on said second shaft and reciprocable therewith, holding and guiding means on the carriage for holding a predetermined portion of the material against lateral motion on the roll and for guiding the edge of the material into the contoured portion of the roll, and lost motion connections between the holding and guiding means and the shaft, whereby contact between said holding and guiding means and the material is established before the shaper roll contacts the material.

7. In an apparatus for shaping material, a shaft, a plurality of rolls mounted on said shafts, one of said rolls being a shaper roll, a second shaft, a complemental shaper roll mounted on said second shaft, said second shaft being shiftable with respect to said first-mentioned shaft to cause said shaper rolls to cooperate to shape the material, holder and guide rolls loosely mounted on said second shaft to permit rotation of said holder and guide rolls on centers located eccentrically of the axis of said second shaft, a carriage mounted on said shafts and shiftable therewith, means on said carriage continuously urging said holder and guide rolls toward said first-mentioned shaft, and means on said second shaft for restraining said urging means, whereby said holder and guide rolls hold the material prior to and during the shaping operation and guide the material into the shaper roll during the shaping operation.

8. An apparatus for shaping material as described in claim 7, said holder roll urging means comprising a plate, rollers on the plate adapted to contact said holder roll, and a compression spring disposed between the carriage and plate.

9. An apparatus for shaping material as described in claim 7, said guide roll urging means comprising a plate, rollers on the plate adapted to contact said guide roll, and a hydraulically-operated piston disposed between the plate and carriage.

10. An apparatus for shaping material comprising first and second shafts, a contoured roll mounted on said first shaft, a cylindrical roll also mounted on said first shaft and adjacent said contoured roll, a carriage, a bearing in said carriage, said second shaft being journalled in said bearing, a collar, a shaper roll adjacent said collar, a second collar adjacent said shaper roll, a roll adjacent said second collar, an annular guide roll surrounding said first collar, an annular holder roll surrounding said second collar, the inner diameter of said guide and holder rolls being greater than the outer diameters of the collars associated therewith, said guide and holder rolls being constrained to move in a plane normal to the axis of the second shaft, a plate slidably mounted on the carriage, rollers on said plate cooperating with the outer surface of the guide roll, hydraulic means disposed between the carriage and plate for urging said guide roll against the contoured roll, a second plate slidably mounted on the carriage, rollers on said second plate cooperating with the outer surface of the holder roll, a compression spring disposed between the carriage and second plate for urging said holder roll against the cylindrical roll, means for reciprocating said second shaft with respect to said first shaft, and means for supporting the material between said first and second shafts, whereby the material is held against deformation between the holder and cylindrical roll and guided into the shaper roll while said material is being shaped, and said holder, shaper and guide rolls are separated from the contoured and cylindrical roll after the shaping operation

to permit the removal of the material from between the rolls.

11. In an apparatus for shaping material, opposed apertured shaper rolls, opposed apertured holder rolls, a pair of shafts, each shaft being threaded through a shaper roll and a holder roll, the aperture in one holder roll being larger than the diameter of the shaft threaded therethrough, and means for urging said one holder roll against the other holder roll, said means being adapted to cause the point of tangency between said holder rolls to lie on a straight line connecting the axes of the shafts.

12. An apparatus as described in claim 11, said means comprising a forked plate, rollers at the ends of the tines of the fork, said rollers being equally spaced from the axis of the shaft threaded through the large apertured holder roll and contacting the outer surface of said holder roll and a spring biasing the plate toward the holder roll cooperating therewith.

13. In an apparatus for shaping material, opposed apertured shaper rolls, opposed apertured holder rolls, and opposed apertured guide rolls, a pair of shafts, one of said shafts being shiftable with respect to the other and each shaft being threaded through a holder roll, a shaper roll and a guide roll, the apertures in the holder roll and guide roll of the shaftable shaft being larger than the diameter of said shiftable shaft, a pair of forked plates, rollers at the ends of the tines of the forked plates, the rollers on each plate being equally spaced from the axis of the shiftable shaft, spring means urging the rollers of one of said plates against the holder roll, and fluid means urging the rollers of the other of said plates against the guide roll, whereby movement of the shiftable shaft toward the other shaft causes pressure to be exerted between the holder and guide rolls before pressure is exerted between the shaper rolls, the points of application of pressure lying on straight lines connecting the axes of the shafts.

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