United States Patent
Hoyne

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[54] APPARATUS FOR NECKING-IN AND FLANGING CAN BODIES

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[73] Assignee: American Can Company, New York, N.Y.

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[21] Appl. No.: 868,999

[52] U.S. Cl. ..... 72/94, 72/96, 113/120 AA
[51] Int. Cl. B21d 19/06
[58] Field of Search 72/82, 83, 84, 86, 91, 94, 72/102, 105, 109, 111, 120, 123, 124, 96

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Primary Examiner—Richard J. Herbst
Attorney—Robert P. Auber, George P. Ziehmer and Leonard R. Kohan

[57] ABSTRACT

A method and apparatus for forming a necked-in and flanged can body wherein an end of the body is forced by a spinning roll into a spinning groove, which is formed jointly by continuous groove segments formed both in a spinning pilot and in a spinning anvil, the spinning roll being movable to a limited degree axially of the body so that relative axial movement between the spinning members is obtained to permit the spinning operation to progress to completion. The axial movement of the movable spinning roll is obtained automatically by spring mounting it on its shaft so that it can slide along the shaft as the contour of the body changes.

26 Claims, 21 Drawing Figures

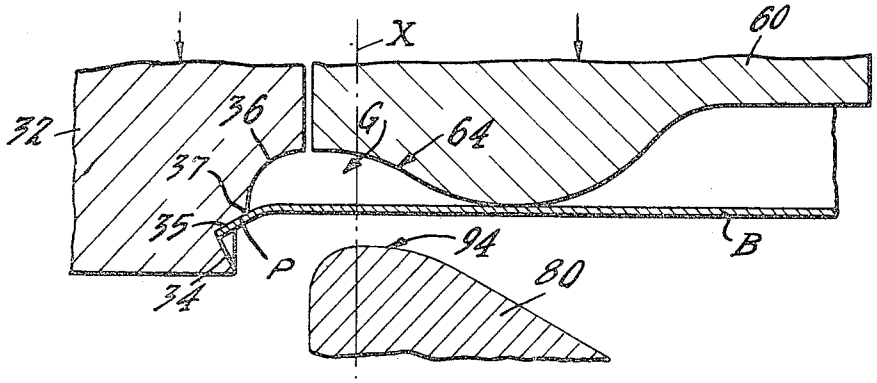


FIG. 1

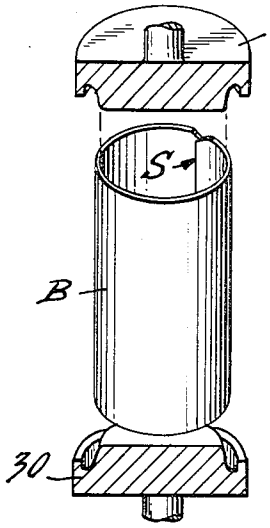


FIG. 2

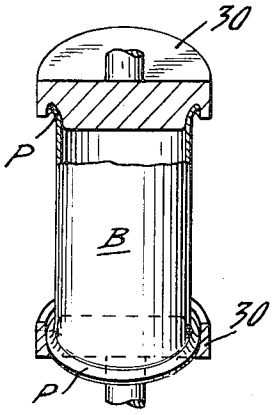


FIG. 3

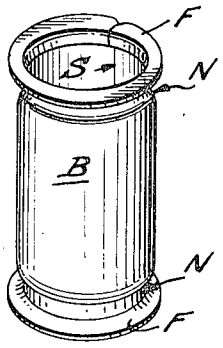


FIG. 4

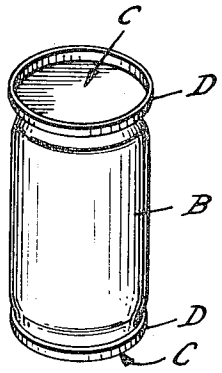


FIG. 5

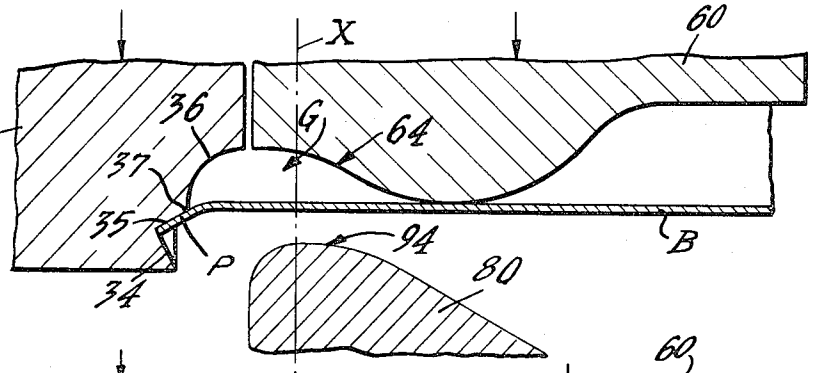


FIG. 6

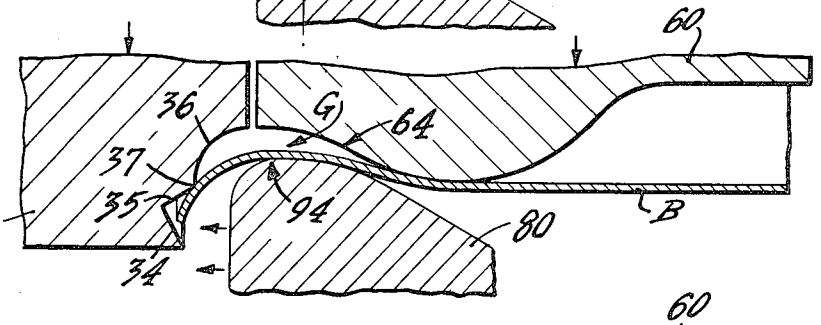
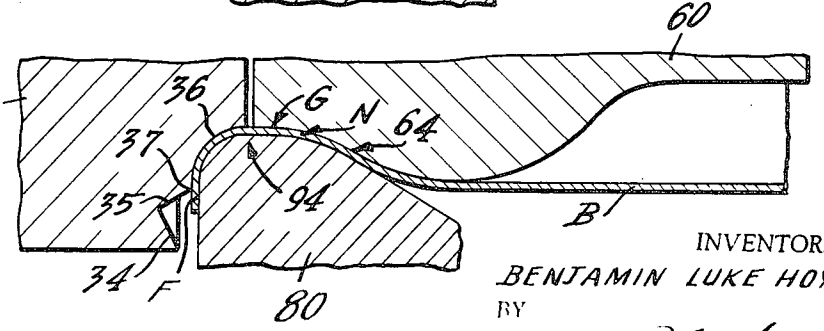


FIG. 7



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FIG. 8

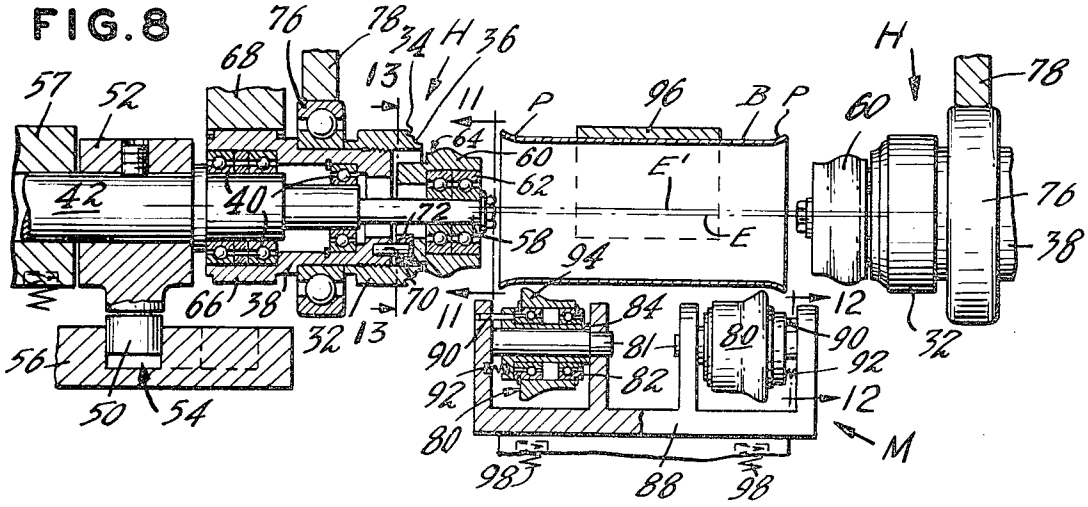


FIG. 9

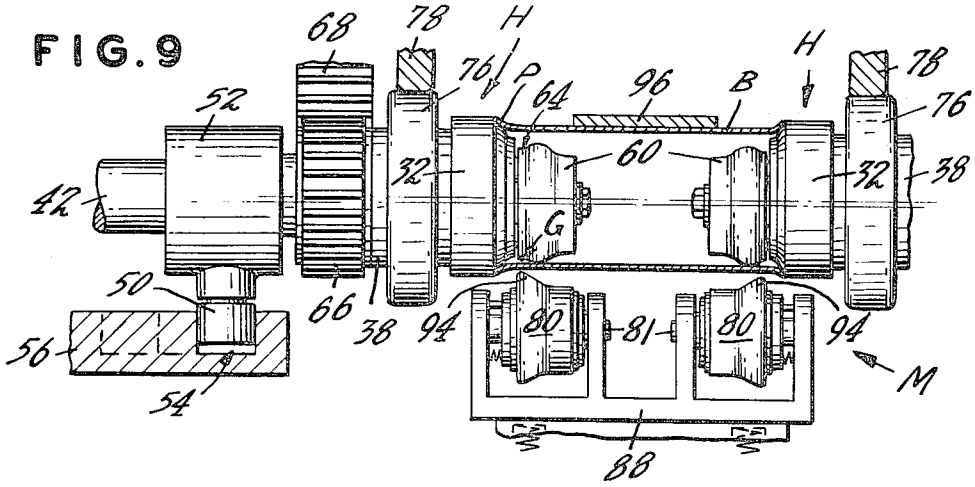
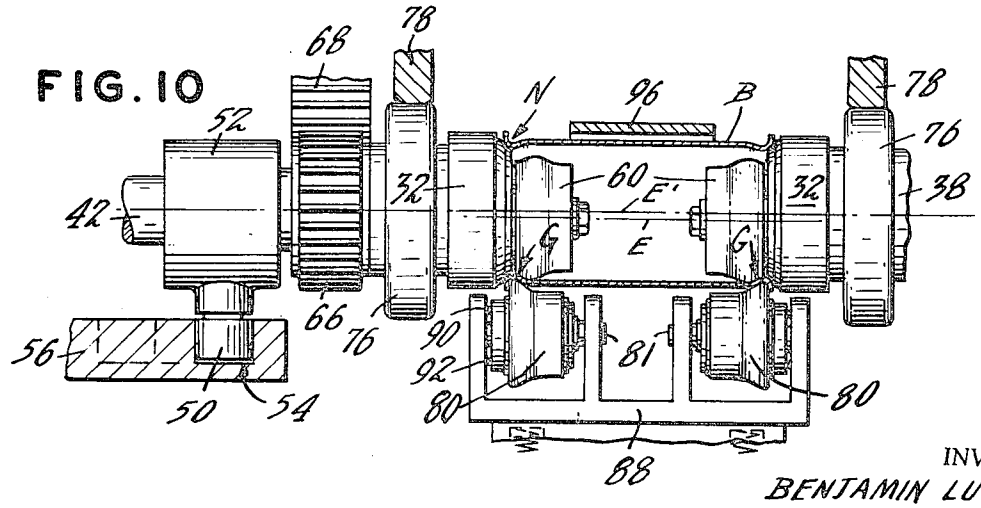


FIG. 10



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FIG. 11

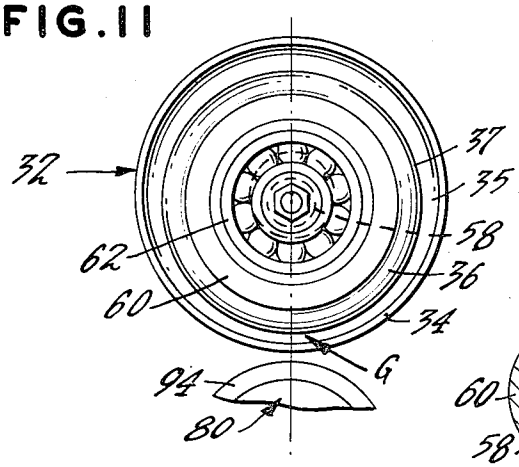
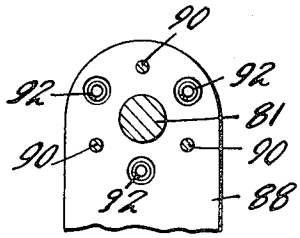


FIG. 12



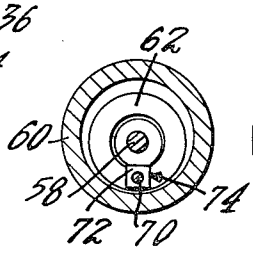


FIG. 13

FIG. 15

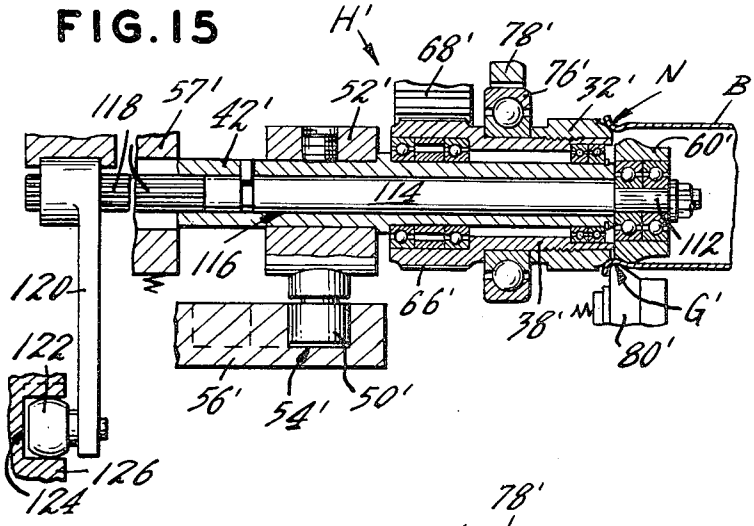


FIG. 17

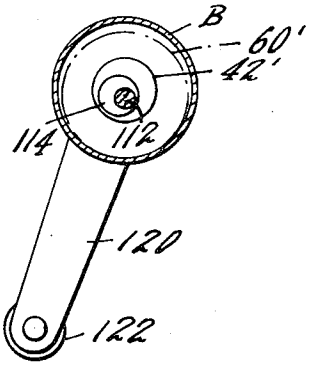


FIG. 14

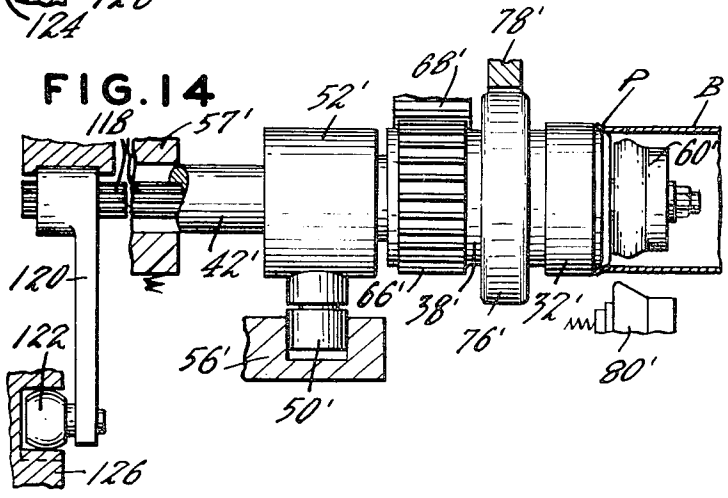
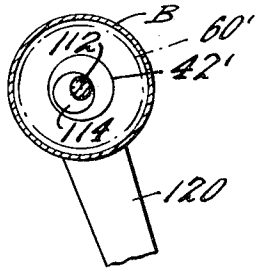


FIG. 16



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FIG. 18

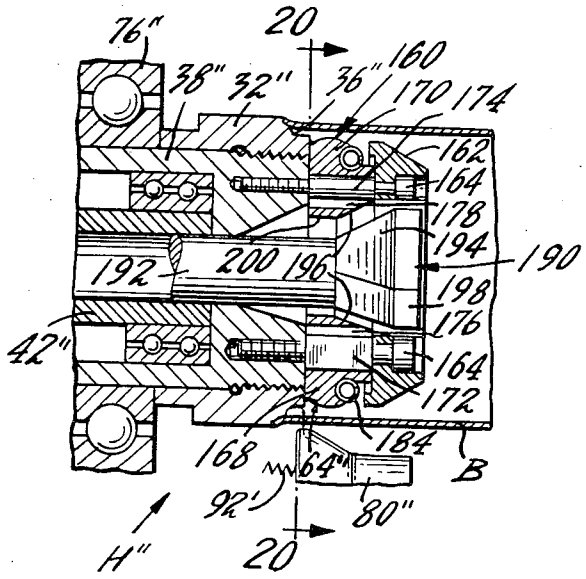


FIG. 20

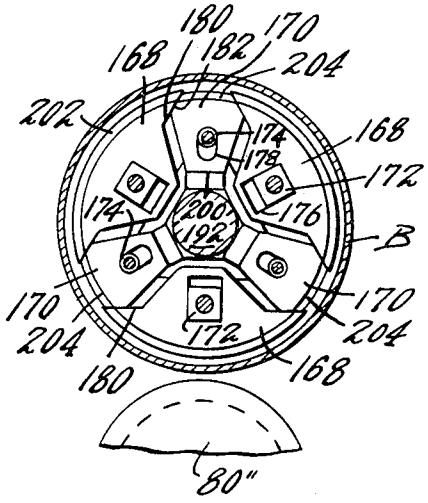


FIG. 19

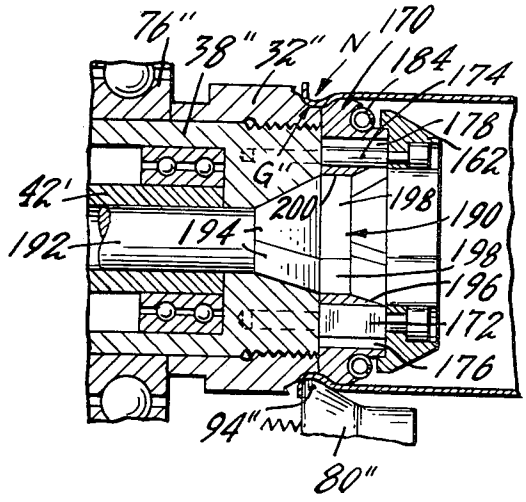
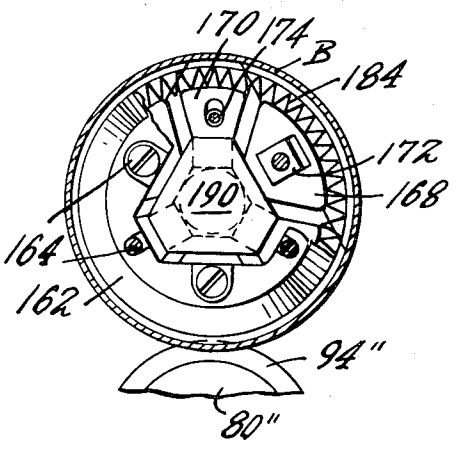


FIG. 21



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APPARATUS FOR NECKING-IN AND FLANGING CAN BODIES

BACKGROUND OF THE INVENTION

The present invention relates to metal receptacles such as beer and beverage cans which are made from thin metal stock. The bodies of such cans may be formed in a variety of ways, as by impact extrusion or in a drawing and ironing process, which methods produce bodies which are seamless and have only one open end, or from flat blanks which are formed into cylinders and have their longitudinal edges secured together in any conventional manner, as by soldering, welding, or by means of an organic adhesive, to form them into strong leakproof side seams. This latter type of can body has two open ends. In all types, the open ends are sealed by having separate can closures secured onto them in conventional multilayered double seams wherein the flanges of the can bodies and the end closures are interfolded together.

Until fairly recently, commercially produced can bodies were straight-sided, with the result that the double seams projected outwardly beyond the adjacent peripheral contour of the body wall. Recently, however, a demand has been created to have the open ends of the can bodies necked-in to such extent that the double seams do not project outwardly of the body wall, but rather form an extension of it. In other words, the external diameter of the double seam is desirably about equal to the external diameter of the can body. This construction provides a number of advantages, not the least of which is that it permits the use of a smaller sized, and consequently cheaper, end closure.

It is a relatively simple operation to form necked-in seamless can bodies, since the diameter of the can body end can easily be reduced in a die forming operation and the necked-in body thereafter flanged outwardly in a separate die flanging operation.

However, the die necking-in process is not adaptable to some types of side seamed can bodies because of the fact that the side seams are substantially thicker than the other portions of the body wall, and thus do not flow readily when subjected to this operation. As a result, tearing or objectionable wrinkling of the metal in or adjacent to the side seam is frequently experienced.

It has been found that vastly superior results in necking-in side seamed steel or aluminum can bodies can be obtained through the use of a spinning operation rather than a die-forming operation, since in a spinning operation the stresses to which the body is subjected are minimized and the extra thickness of the side seam can be readily accommodated.

SUMMARY OF THE INVENTION

The present invention provides a method and apparatus for forming necked-in and flanged can bodies in a metal spinning operation which is easily and readily effected on one or both ends of the body, as desired.

As the first step of the instant invention, each end of the body which is to be reformed is preferably subjected to a preflanging operation. Thereafter, the preflanged end is positioned on a rotatable spinning pilot which is formed with a shallow partial groove which is disposed within the end of the body. A

spinning anvil, also formed with a shallow partial groove, is disposed inwardly of the body with its partial groove juxtaposed with the partial groove of the spinning pilot so that these partial grooves are thus positioned to cooperate to jointly provide a full spinning groove having the desired configuration of the necked-in and flanged end of the can body.

A freely rotatable spinning roll have a peripheral contour which is complementary to that of the spinning groove is then pressed radially against the outside surface of the can body at a point outwardly of and slightly offset from the internal spinning groove.

As the spinning pilot is rotated, it in turn causes the can body to rotate relative to the spinning roll, and the inward movement of the spinning roll forces the body wall into the spinning groove, simultaneously effecting a flanging and a necking-in operation and giving the end of the body the desired final configuration, comprising a necked-in grooved section which terminates in an outwardly extending flange.

In order to provide a true spinning action wherein the spinning roll is located in optimum positions as the reshaping of the metal of the can body progresses, provision is made to permit relative longitudinal movement between the spinning roll and the spinning anvil. This is preferably done by spring mounting the spinning roll on its axis in such manner that it is located in a predetermined, slightly offset position relative to the spinning groove at the initiation of the spinning operation, but is free to move along its shaft and thus automatically and continuously seek out and assume its optimum positions as the spinning operation progresses to completion, at which time the spinning roll is fully aligned with the spinning groove and the body is subjected to a final, ironing operation as the spinning roll is fully home within the spinning groove. This ironing operation functions to remove any small wrinkles in the metal which might have been produced in the spinning operation.

While the instant invention is particularly useful in conjunction with can bodies having side seams, it is not so limited and can be used to neck-in and flange all types of can bodies, including those can bodies which are formed with conventional soldered side seams.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a straight-walled can body about to be subjected to the preflanging step of the instant method invention, parts being shown in section;

FIG. 2 is a perspective view of the can body after completion of the preflanging step; parts being shown in section;

FIG. 3 is a perspective view of the can body after completion of the necking-in and flanging operation;

FIG. 4 is a perspective view of the necked-in can body after both end closures have been seamed on to it;

FIGS. 5 – 7 are fragmentary detail views, on a greatly enlarged scale, illustrating how the metal at one end of a can body is progressively reshaped by the spinning tools which carry into effect the successive stages of the necking-in and flanging steps of the instant invention.

FIGS. 8 – 10 are vertical sectional views of one form of the spinning apparatus of the invention, illustrating the positions of the several parts during successive

stages of the necking-in and flanging operation, parts being broken away and other parts being shown in section;

FIGS. 11, 12 and 13 are sectional details, taken substantially along the lines 11—11, 12—12, and 13—13, respectively, in FIG. 8;

FIG. 14 is a plan view, corresponding generally to FIG. 9, showing the position of parts of a modified form of apparatus prior to the beginning of a necking-in and flanging operation with the spinning anvil concentric with the spinning pilot, to which position it is returned prior to its being withdrawn from the body after completion of the operation;

FIG. 15 is a view similar to FIG. 14 but showing the position of the parts during the final stage of the necking-in flanging operation with the spinning anvil eccentric with the spinning pilot;

FIGS. 16 and 17 are fragmentary end views, as seen from the right in FIGS. 14 and 15 respectively, illustrating the throw of the eccentric on which the spinning anvil is mounted;

FIG. 18 is vertical sectional detail on an enlarged scale, taken through a portion of a modified form of spinning head wherein the spinning anvil is formed of collapsible segments and is permanently concentric with the spinning pilot, the view being taken prior to the beginning of the necking-in and flanging operation and with the anvil segments in collapsed position;

FIG. 19 is a view, similar to FIG. 18, but showing the position of the parts at the conclusion of the flanging and necking-in operation with the anvil segments in expanded position;

FIG. 20 is a vertical section taken substantilly along the line 20 — 20 in FIG. 18; and

FIG. 21 is an end elevation, as seen from the right of FIG. 19.

DESCRIPTION OF THE INVENTION

As seen in the drawings, the basic purpose of this invention is to reform the initially straight marginal end portions of a cylindrical can body B, shown in FIG. 1, to the structure shown in FIG. 3, wherein the end portions are each provided with an outwardly extending full flange F and an inwardly grooved or necked-in portion N. After the body B has been thus necked-in and flanged, its open ends may be closed by means of end closures C (see FIG. 4) which are seamed onto the flanged body ends in conventional interfolded double seams D. However, the application of the end closures C to the body B is not a part of the instant invention.

The can body B as illustrated is preferably of the type which is formed from a flat, rectangular blank of thin metal, such as aluminum, tin plate, or tin-free steel, which is rolled into cylindrical form and has its longitudinal edges overlapped and secured together in a side seam S, which may be of any conventional type, such as soldered, welded, or adhesively bonded. Such bodies are conventionally formed with two open ends.

As a first step of the instant invention, both open ends of the body B are slightly flared outwardly in a preflanging operation which rounds up the ends and conditions them for the final necking-in and flanging operations. This preflanging step is effected by forcing a pair of preflanging dies 30 into the opposite ends of the body B to shape them into slightly flaring preflanges P, as seen in FIGS. 2 and 5.

The preflanged bodies B are then inserted into a flanging and necking-in machine M, as seen in FIGS. 8 – 13, which includes a pair of spinning heads H which operate simultaneously on the opposite ends of the body B to accomplish the remaining method steps of the instant invention. It will be understood that if only one end of the body B is to be necked-in and flanged, only one head H will be utilized, and the other end of the body B will be supported in any suitable manner.

Each head H includes a spinning ring or pilot 32, which is provided with a shallow annular V-shaped open groove 34 which is formed with a frusto-conical wall 35 which is designed to snugly receive the body preflange P, as best seen in FIG. 5. Each of the pilots 32 also has formed in it, inwardly of the groove 34, an annular rounded groove portion 36 which intersects with the groove 34 in an annular corner 37.

Each spinning pilot 32 is carried on a hollow sleeve 38 which is rotatable on bearings 40 which are carried by a stepped, non-rotatable shaft 42. Thus, the sleeve 38 and the pilot 32 are tied to and movable longitudinally with the shaft 42.

The shaft 42 carries a cam roller 50 which is mounted on a collar 52 which is secured to the shaft 42. The cam roller 50 operates in the groove 54 of a cam 56 of any suitable type which is designed to reciprocate the shaft 42 towards and away from the body B in a full forward and return stroke, with an intervening dwell period. It will be understood that suitable spring mounted bearings 57 (shown only at the left in FIG. 8) are provided for each shaft 42 outwardly of the collar 52.

The front end of each shaft 42 is formed into an integral, non-rotatable eccentric portion 58 which is of reduced diameter and has its centerline E eccentric with the center line E' of the main portion of the shaft 42 (see FIGS. 8–10). The inner end of the eccentric shaft portion 58 carries a circular spinning anvil 60 which is mounted for free rotation on a bearing 62 which is carried by the eccentric 58. Consequently, the anvil 60 is permanently eccentric to the pilot 32.

The peripheral portion of the anvil 60 having a bulbous configuration, the bulbous configuration forming an annular groove portion 64 in the anvil adjacent pilot 32. Because of the eccentricity of the anvil 60, the groove portion 64 is substantially tangential to, and in full alignment with, the groove portion 36 of the pilot 32 at only one point. At this point, the groove portions 36, 64 of the pilot 32 and the anvil 60, respectively, combine to provide a full spinning groove section G (see FIGS. 5, 9 and 11), having the desired interior configuration of the necked-in portion N of the can body B.

The outer end of each sleeve 38 is provided with gear teeth 66 which mesh with a drive gear 68 which is longitudinally movable with and rotates the sleeve 38 and, consequently, the pilot 32. The rotation of the sleeve 38 is transmitted to the anvil 60 through a pin 70, one end of which is mounted in inner end of the sleeve 38 and the other end of which is mounted in a small slide 72 (see FIGS. 8 and 13) which operates in a slot 74 which is formed in the adjacent end of the anvil 60. By virtue of this construction, the slide 72 reciprocates in the slot 74 as the sleeve 38 rotates to thus compensate for the eccentricity of the anvil 60.

Each sleeve 38 also carries a roller 76 which is engaged by a suitable pressure member 78 which may be a cam or a roll and which is longitudinally movable with the sleeve 38.

The machine M also includes a pair of spinning rolls 80 which are mounted for free rotation on bearings 82 carried on sleeves 84 which are slidable along shafts 81 mounted in a fixed holder 88 (see FIG. 8). The sleeves 84 are held against rotation around the shafts 86 by pins 90, and are normally held in an inward position by means of springs 92 (see FIGS. 8 and 12). The crown 94 of each spinning roll 80 has a configuration which is substantially complementary to that of the groove G, and which corresponds to the desired external configuration of the finished, flanged and necked-in end portion of the can body B.

As seen in FIG. 8, when the shafts 42 are in their retracted position, the spinning heads H, including the anvils 60, are spaced apart a distance greater than the length of the can body B. This permits the body B to be easily fed into position between the opposed heads H in concentric alignment with the pilots 32 in any suitable manner, as by hand or by means of a magnetic or gripper cradle 96 which forms a part of the machine and which may automatically transfer the body B from the preflanging dies 30.

When the can body B is thus positioned, the cams 56 are actuated in such manner as to move the heads H through their forward stroke to thereby insert the anvils 60 into the body B and to cause the preflanges P to be received in the grooves 34 of the pilots 32 (see FIG. 9). Thus, the body B is clamped between and supported and rotated by the rotating pilots 32. It will be noted that the anvils 60 just clear the interior surface of the body B as they move inwardly so that there is no interference between the body and the anvils.

After the body B has been thus clamped between the heads H, the pressure members 78 are moved against the rollers 76 to move the heads H towards the spinning rolls 80 to press the rotating body B against the spinning rolls 80, and thereby initiate the necking-in and flange forming steps of the invention.

As best seen in FIGS. 5 and 9, at the beginning of the spinning operation, the spinning rolls 80 are held in their normal, or inwardly retracted, position by the action of the springs 80. In this position, the crowns 94 of the rolls 92 are in adjacent opposing relationship to and in radial alignment with the anvil spinning groove portion 64 and are slightly axially i.e. longitudinally, off set from and not fully aligned with the full spinning groove G. Consequently, they make initial contact with the rotating body B along a line disposed approximately in the plane indicated as X in FIG. 5, and thus begin the spinning operation at this area.

As the pressure members 78 continue to move the heads H toward the rolls 80, the pressures on the rolls 80 exerted by the bulbous configuration of anvils 60, adjacent the arrow on the drawing for reference character 64, gradually overcome the pressure of the springs 92 and cause the rolls 80 to move outwardly on shaft 81 towards the ends of the can body B and vectorily into groove G as the spinning operation progresses. FIG. 6 shows an intermediate position wherein the spinning roll 80 has moved vectorily outwardly to some extent toward the edge of the body B and wherein the end portion of the body B has been partially spun into the groove G. As the body B is forced into the groove G, its preflanges P are forced out of the shallow grooves 34 and pivot around the annular corner 37. As a result of this, the preflanges P gradually assume positions of greater angularity with respect to the cylindrical wall of the body B, as seen in FIG. 6, and approach the desired angle of inclination of the finished flange F, which angle may range from about 80° to 90° relative to the axis of the can body B.

This operation progresses until the spinning rolls 80 move outwardly a sufficient distance to cause their crowns 94 to fully enter the spinning groove G, as seen in FIG. 7, at which time the spinning operation is substantially complete and the ends and the body B fully reformed into the necked-in portion N and the finished flange F. This can generally be accomplished during seven to 10 turns of the pilots 32. After the crown 94 thus fully enters the spinning groove G, the head H is rotated at least one more time to cause the spinning roll 80 to roll the metal in the necked-in portion H and flange F against the walls of the groove G to iron out any wrinkles which might have formed therein during the spinning operation and complete the spinning operation. The holder 88 may be mounted on heavy springs 98 to limit the pressures which are exerted during this latter portion of the operation.

During the spinning operation, the heads H are held in their forward, or dwell, position, by the cams 56. Thereafter, the pressure members 78 are retracted, and the spinning heads H returned to the position of FIG. 9 by the spring mounted bearings 57 to carry the finished body B away from the spinning rolls 80. The shafts 42 are thereupon moved through their return stroke by the cams 56 to withdrawn the heads H from within the can body B, which may then be moved to any suitable place of deposit by hand or by movement of the feed cradle 96.

Withdrawal of each anvil 60 from within the body B is easily effected even though, in the mechanism of FIGS. 8–10, no means are provided to remove the anvil 60 from its position behind the necked-in portion N of the body B. Because of the fact that the maximum diameter of the anvil 60 is somewhat less than the minimum internal diameter of the necked-in portion N, as the anvils 60 are pulled outwardly they automatically cam against the portions N and move the body B downwardly into a position wherein it is substantially concentric with the anvils 60, thus permitting withdrawal of the anvils 60 without interference between the anvils 60 and the body portions N. If desired, suitable pressure members (not shown) may be provided to bear against the body B and urge it downwardly to this concentric position.

If it is desired to avoid all contact between the anvils 60 and the necked-in body portion N during withdrawal of the anvil at the completion of the operation, the modified spinning head H' of FIGS. 14–17 may be utilized. In this embodiment of the invention, wherein those parts corresponding to the parts of the embodiment of FIGS. 8–13 are given primed identifying numbers, the spinning pilot 32' and sleeve 38' are mounted for rotation on a hollow, non-rotatable shaft 42' and is rotated by the meshing of the gear teeth 66' with the drive gear 68'. The shaft 42' carries the collar

52' and the cam roller 50' which operates in the groove 54' of cam 56', and is moved towards the spinning roll 80' by the pressure member 78' which engages against the roller 76'.

The embodiment of FIGS. 14–17 differs from that of FIGS. 8–13 in that the spinning anvil 60' is mounted so that it is concentric with the spinning pilot 32, initially at the time it is inserted into the can body B prior to the spinning operation, as seen in FIGS. 14 and 16, and again after completion of the spinning operation, when it is withdrawn from the flanged and necked-in body B. Between these times, and thus during the entire spinning operation, the spinning anvil 60' is moved to a position wherein it is eccentric to the pilot 32' , and so occupies the same position and functions in the same manner as does the anvil 60 of the mechanism FIGS. 8–13.

The movement which permits the centering of the anvil 60' relative to the pilot 32' during the forward and return stroke of the spinning head H' is made possible by mounting the anvil 60' on an eccentric portion 112 of a shaft 114 which in turn is eccentrically mounted in the bore 116 of the hollow shaft 42'. The shaft 114 has its outer end formed with splines 118 which slidably mesh with mating grooves (not shown) formed in a bore formed in one end of an arm 120, which arm carries at its other end a cam roller 122 which operates in a groove 124 of a cam 126.

As seen in FIGS. 14 and 16, during the forward stroke of the head H', the arm 120 is held by the cam 126 in a position wherein the eccentric shaft portion 112, and consequently the anvil 60', are concentric with the hollow shaft 42' and the pilot 32'. After the head H' has been inserted into the can body B, the cam 126 actuates the arm 120 to rotate the shaft 114 to a position wherein the spinning anvil 60' is eccentric to the pilot 32' so that the groove portion 36' of the pilot and the groove portion 64' of the anvil cooperate to form the full spinning groove portion G' in exactly the same manner as do the corresponding elements in the embodiment of FIGS. 8–13. The anvil 60' is held in this eccentric position while the spinning operation is effected in exactly the same manner as has been described in conjunction with FIGS. 8–13. After completion of the spinning operation, the arm 120 is returned to the position of FIG. 14 to center the anvil 60' with respect to the pilot 32' and the head H' is withdrawn from the flanged and necked-in body B without contact between the anvil and the body. It will be noted that the arm 120 does not move with the head H' by the cam 56', relative movement between the arm 120 and shaft 114 being permitted by the sliding of the shaft splines 118 in the grooves of the arm 120. It will also be noted that the anvil 60' in this embodiment of the invention is not positively driven. However, being idly mounted on the eccentric shaft portion 112 it will rotate during the spinning operation when it is engaged by the can body B, which in turn is rotated by the rotating pilot 32'. If desired, however, suitable drive means, such as that illustrated in FIG. 13 may be embodied in the head H' of FIGS. 14–17 to positively drive the anvil 60'. It will be understood that except for the provision for centering the anvil 60', the method of operation of the mechanism of FIGS. 14–17 is identical to that of the mechanism of FIGS. 8–13.

A third embodiment of the invention is disclosed in FIGS. 18–21, wherein a collapsible spinning anvil 160 is used instead of the eccentric anvils of FIGS. 8–17. This collapsible anvil 160 may be utilized in conjunction with a spinning head H'' which is a modification of the head H' of FIGS. 14–17. Those parts in the head H'' which directly correspond to parts shown in the head H' have been double primed.

As seen in FIG. 18, in this third embodiment of the invention, the spinning pilot 32'' is carried on a sleeve 38'' which is carried on a hollow non-rotating shaft 42'' and is rotated by a drive gear (not shown) which corresponds to the drive gear 68' of FIG. 8 and which meshes with teeth (not shown) formed integral with sleeve 38'' in the same manner as teeth 66' are formed integral with sleeve 38'.

The collapsible spinning anvil 160 is mounted between the end of the sleeve 38'' and a retaining ring or plate 162 which is secured in place by bolts 164 so that it rotates with the sleeve 38''.

The anvil 160 comprises a group of three large segments 168 and a group of three small segments 170 which alternate with the large segments 168. The segments 168, 170 are respectively mounted on small slide bushings 172, 174 which are carried by the bolts 164 and which respectively operate in radial bores 176, 178 which are formed in the segments.

The segments 168, 170 maintain sliding contact with each other along short walls 180, 182 formed respectively, therein, and are normally held in their radially inward, collapsed condition (see FIGS. 18, 20) by an endless circular spring 184 which is carried in short arcuate groove sections cut in the segments 168, 170. With the anvil 160 in this collapsed condition, the head H'' is inserted into the preflanged body B so that the preflange P is received in the groove of the rotating pilot 32'' as seen in FIG. 18. The body B thereafter rotates with the pilot. The insertion, and subsequent withdrawal of the head H'' is effected by reciprocation of the shaft 42'' in the manner described in reference to FIGS. 14 & 17.

With the body B thus positioned, the segments 168, 170 are cammed radially outwardly in their expanded position by a wedge 190 which is carried at the inner end of a rod 192 which is concentrically mounted within the hollow shaft 42'' and is moved outwardly (to the left as seen in FIG. 18) relative to the hollow shaft 42'' by any suitable mechanism such as a cam (not shown).

As a result, inclined faces 194 on the wedge 190 engage inclined faces 196 on the segments 168, 170 and force the segments outwardly until the wedge faces 194 ride off the segment faces 196 and the wedge 190 reaches its full home position of FIG. 19 wherein vertical walls 198 in the inner end of the wedge 190 engage corresponding vertical walls 200 on the segments 168, 170. In this position, the segments 168, 170 are fully expanded so that their arcuate circumferential faces 202, 204, respectively, cooperate to form a full circle. These faces 202, 204 are contoured to provide a circular anvil surface which includes a partial groove portion 64'' which is disposed contiguous the partial groove portion 36'' of the pilot 32'' and cooperates therewith to form full spinning groove G'' which extends for 360° in concentricity with the pilot 32'' and the can body B.

Thereafter, the rotating body B is pressed against the spinning roller 80'', which here again is initially axially offset from the groove G'' to the extent shown in FIG. 5, and the spinning operation is effected in the manner heretofore described to form the necked-in section N and the finished flange F. As seen in FIG. 19, at the completion of this operation, the spinning roll 80'' is fully aligned with and positioned within the groove G, having moved to this position from its initial position during the spinning operation.

After completion of the spinning operation, the rod 192 is moved to the right to release the anvil segments 168, 170 and the latter are moved inwardly to their collapsed position (see FIG. 18) by the spring 184, in which position they are radially inwardly of and fully clear of the necked-in section N of the body B. The head H'' is then moved to the left to withdraw the pilot 32'', the anvil 160, the rod 164 and the plate 162 from the body B without interference therewith, and the released body B is discharged in any suitable manner. Withdrawal of the anvil 160 from the body is made possible by the fact that its maximum diameter in collapsed condition is less than the minimum internal diameter of the necked-in body portion N, as also is the diameter of the plate 162.

It will be realized that in all versions of the machine, either one or two spinning heads may be utilized to operate upon the body B, depending on whether one or both ends of the body B are to be flanged and necked-in. If two heads are used, they are usually used simultaneously, but if desired, they may be employed sequentially to operate on one end of the body B at a time.

In addition, while the drawings show the spinning heads as being moved towards the spinning rolls, the necessary relative motion between those members may also be effected by moving the spinning rolls towards the heads.

While the preflanging step of FIG. 2 is desirable in order to round up the body B and condition it for reception on the flanging pilots, it may under some conditions be eliminated in which event the frustoconical wall 35 may either be retained, in which event it will effect a preflanging operation on the body, or be replaced by a substantially cylindrical wall which is parallel to the unflared end of the body B and which engages snugly within the body B when the pilot is moved into the body. In the latter event, substantially the same spinning operation is effected to fully flange and neck-in the body, the only difference being that the end of the body must be pivoted around the annular corner 37 through a somewhat greater angle.

One of the important advantages of the instant invention is that no loss in body height is suffered. In other words, the finished body B of FIG. 3 has the same height as a conventionally flanged, but unnecked-in, body would have if it were made from the straight walled body of FIG. 1. Thus, bodies B which are flanged and necked-in via the instant method may be run interchangeably with conventional straight-walled bodies without requiring a height and adjustment of the closing machine. This result, which is obtained because the spinning operation tends to cause the metal which is being spun to flow towards the end of the can and thus offset the loss of height which would normally result because of the radially inward displacement of this metal, is not obtained in a die necking-in operation. Thus, in the die necking-in operation, a loss of height in the body, relative to a conventional body, is suffered, and a longer body blank is required in order to obtain the conventional body height.

It will be understood that the direction of rotation of the can body B in relation to the spinning roll is usually immaterial, even in those instances where the can body B is formed with a double layer, lap type side seam in the area being reshaped. In other words, satisfactory results are obtainable regardless of whether the spinning roll rides into or off of the stepped overlap edge of the side seam. The same is generally true, regardless of the type of side seam used in the body B, as well as where seamless bodies are used.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction and arrangement of parts of the apparatus mentioned herein and in the steps and their order of accomplishment of the precess (method) described herein, without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the apparatus and process hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. A mechanism for necking-in and flanging an open-ended can body, comprising

a rotatable pilot having a groove portion therein, said pilot being engageable with the open end of the can body for effecting rotation of said body,

an anvil insertable into said can body and having a bulbous configuration, said configuration forming a groove portion in said anvil, said groove portions of said pilot and anvil being substantially contiguous with one another, to cooperatively provide a spinning groove disposed interiorly of said can body,

a spinning roll disposed outwardly of said can body and provided with a crown which is initially disposed in axially offset relationship to said spinning groove and in adjacent opposing radial alignment with said groove portion of said anvil,

means for effecting relative radial movement between said spinning roll and said spinning groove to bring the crown of said spinning roll into pressured contact with the outer surface of said can body outwardly of adjacent to said anvil to effect a spinning operation, and

means for effecting relative axial movement between said spinning roll and said spinning groove; said means for effecting relative radial movement, said means for effecting relative axial movement and said bulbous configuration of said anvil cooperating with each other as said spinning operation progresses to permit said crown to move vectorily and gradually spin a portion of said can body fully into said spinning groove to thereby cause said portion to assume the configuration thereof and thereby simultaneously form a neck and flange in said portion of said can body.

2. The mechanism of claim 1 wherein said means for effecting relative axial movement includes a shaft on

which said spinning roll is slideably mounted for free rotation thereon.

3. The mechanism of claim 2 wherein said means for effecting relative axial movement also includes spring means for biasing said roll in its initial position on said shaft and for allowing said roll to self-adjustingly move axially along said shaft against said bias as said spinning operation progresses.

4. The mechanism of claim 1 wherein said anvil is eccentric to and has its axis within said pilot.

5. The mechanism of claim 4 wherein said anvil has a maximum diameter less than the minimum internal diameter of the spun portion of said can body.

6. The mechanism of claim 5 wherein said anvil is moveable to a position concentric with said pilot after completion of the spinning operation.

7. The mechanism of claim 1 wherein said anvil is permanently concentric with said pilot.

8. The mechanism of claim 7 wherein said anvil is collapsible after completion of the spinning operation.

9. The mechanism of claim 1 wherein said pilot is provided with an annular wall which is engageable against the inner surface of the marginal edge portion of the open end of said can body.

10. The mechanism of claim 9 wherein said pilot wall is frusto-conical.

11. The mechanism of claim 10 wherein said pilot wall is cylindrical.

12. The mechanism of claim 9 wherein said pilot is provided with an annular corner between said wall and its groove portion which functions as a pivot corner around which a portion of said can body is pivoted during said spinning operation.

13. The mechanism of claim 1 wherein said pilot and anvil are tied together for simultaneous axial movement into and out of said can body end.

14. The mechanism of claim 13 wherein said anvil is free wheeling.

15. The mechanism of claim 14 wherein said anvil is rotated in time with said pilot.

16. The mechanism of claim 4 wherein there is provided a slideable driving connection between said pilot and anvil to compensate for the eccentricity of said anvil.

17. The mechanism of claim 1 wherein resilient means are provided to limit the pressure contact between said can body and said spinning roll.

18. A machine for necking-in and flanging a can body having both ends open, comprising

a pair of rotatable pilots having walls engageable with interior portions of the opposing ends of said can bodies,

a spinning anvil associated with each pilot having a bulbous configuration,

a partial spinning groove portion being formed in each pilot,

a partial spinning groove portion being formed in each anvil,

the partial spinning groove portions of the pilots and anvils being substantially contiguous and cooperating to form a full spinning groove,

means for moving said pilots and anvils longitudinally of said can body to insert said spinning grooves into opposite ends of said can body and to bring said pilots into engagement with said can body to effect rotation thereof,

a pair of spinning rolls disposed outwardly of said can body,

each of said rolls being formed with an annular crown which is initially slightly axially offset relative to and in adjacent opposing radial alignment with one of said full spinning grooves and is mounted for axial movement to fully align it with said groove,

means for withdrawing said anvils from said body, and

means for effecting relative radial movement between said body and said spinning rolls to bring the crowns of said rolls into pressured contact with the outer surface of said can body outwardly and adjacent to said anvil, said longitudinal moving means, said relative radial movement means, and said bulbous configuration of said anvil cooperating to thereby cause said crowns to vectorily spin said body fully into said spinning grooves, and to thereby simultaneously neck-in and flange said both ends of said can body.

19. The machine of claim 18 wherein each of said anvils is eccentric to and has its axes within its associated pilot while said body is being spun by said roll and has a maximum external diameter less than the minimum internal diameter of the adjacent spun portion of said can body.

20. The machine of claim 19 wherein said anvils are moveable to a position substantially concentric with said pilots during insertion and withdrawal of said anvils into and from said body.

21. The machine of claim 18 wherein said anvils are concentric with said pilots, and are collapsible to a reduced diametral dimension to facilitate insertion into and withdrawal from said body.

22. The machine of claim 21 wherein said anvils are rotatable.

23. The mechanism of claim 12 wherein said anvil is eccentric to and has its axis within said pilot.

24. A mechanism for necking-in and flanging an open-ended can body comprising

a rotatable pilot engageable with an open end of the can body for effecting rotation of said body, said pilot having

an annular stop wall engageable against the open end of the can body,

an interior annular wall engageable against the inner surface of the marginal edge portion of the open end of said can body,

a groove portion formed on said pilot interiorly of and adjoining said annular wall, and

an annular pivot corner between said annular wall and said pilot groove;

an anvil insertable into said can body and having a bulbous configuration, said configuration forming an adjoining groove portion therein, said anvil being permanently eccentric to said pilot and being separate from yet tied to said pilot for timed rotation therewith and for simultaneous axial movement into and out of said open end of said can body, said groove portions of said pilot and anvil being substantially contiguous to one another and cooperating with each other to provide a spinning groove disposed interiorly of said can body;

a spinning roll disposed outwardly of said can body and provided with a crown having the configuration of said spinning groove, said crown being initially disposed in axially offset relationship to said spinning groove and in adjacent opposing radial alignment with said groove portion of said anvil;

means for effecting relative radial movement between said spinning groove and said spinning roll to bring said crown of said spinning roll gradually radially into pressure contact with the outer surface of said can body outwardly of said anvil groove portion and adjacent said bulbous portion, to effect a spinning operation; and

means for effecting relative movement of said pilot said anvil and said spinning roll along their axes, said respective means for effecting relative radial and axial movement cooperating with each other and with said bulbous configuration of said anvil as said spinning operation progresses to permit said crown to move vectorily and gradually spin a portion of said can body fully into said spinning groove to thereby cause (1) said portion to assume the configuration thereof and (2) said marginal edge portion to leave said annular and stop walls and pivot around said corner, and thereby simultaneously form a neck and flange in said can body.

25. The mechanism of claim **23** wherein said means for effecting axial movement includes a shaft on which said spinning roll is slideably mounted for free rotation thereon, and spring means for biasing said roll in its initial position on said shaft and for allowing said roll to self-adjustingly move axially along said shaft against said bias as said spinning operation progresses.

26. The mechanism of claim **23** wherein said annular wall is frusto-conical.

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