

- [54] **METHOD AND APPARATUS FOR PRODUCING A STEPPED RIM ON A SEAMLESS CAN BODY**
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- [52] **U.S. Cl.**..... 113/7 A, 113/120 Y, 113/120 AA
- [51] **Int. Cl.**..... B21d 51/26
- [58] **Field of Search**..... 113/7 R, 7 A, 1 G, 113/120 H, 120 Y, 120 AA; 72/102, 105, 208

[56] **References Cited**

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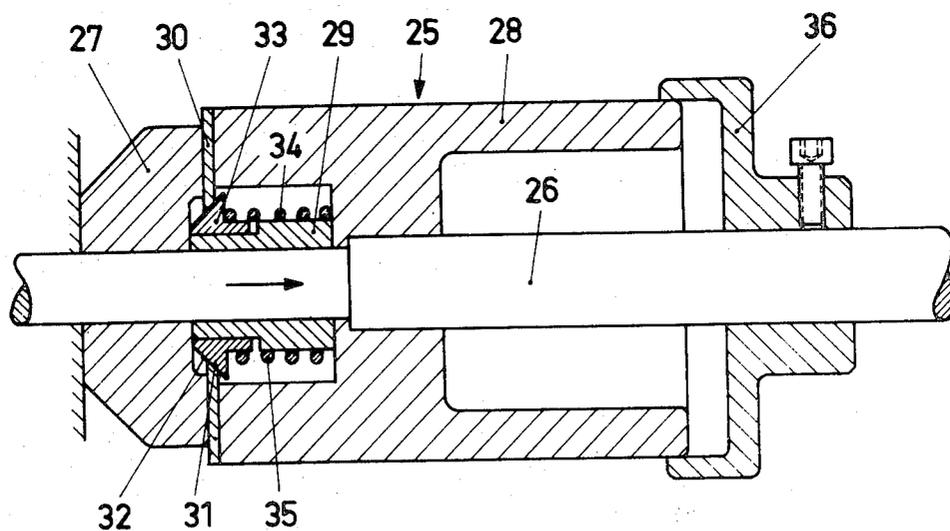
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[57] **ABSTRACT**

The invention refers to a method and an apparatus for producing a stepped rim on seamless can bodies by putting them on a rimming mandrel and applying a forming pressure by means of a cooperating roller, both mandrel and roller having parts movable eccentrically to their shaft during the forming of the rim, against the pressure of a spring.

3 Claims, 10 Drawing Figures



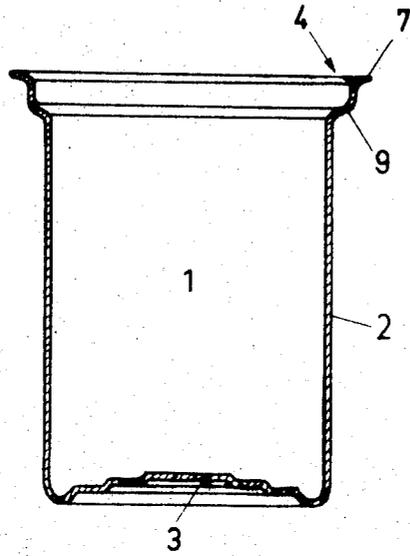


Fig. 1

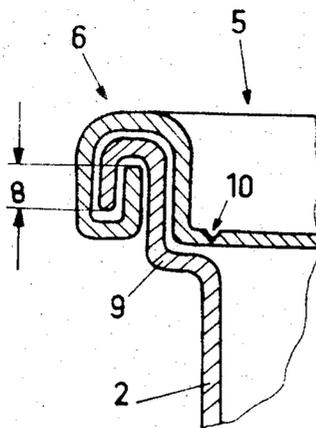


Fig. 2

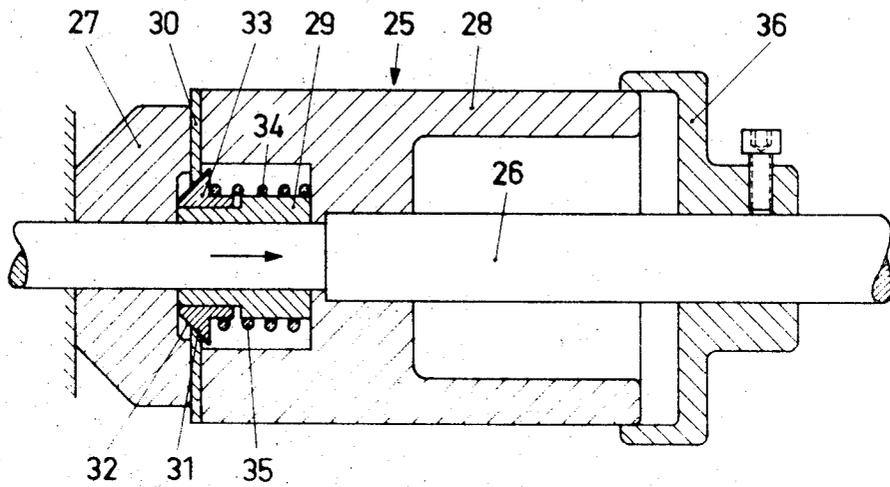


FIG. 4

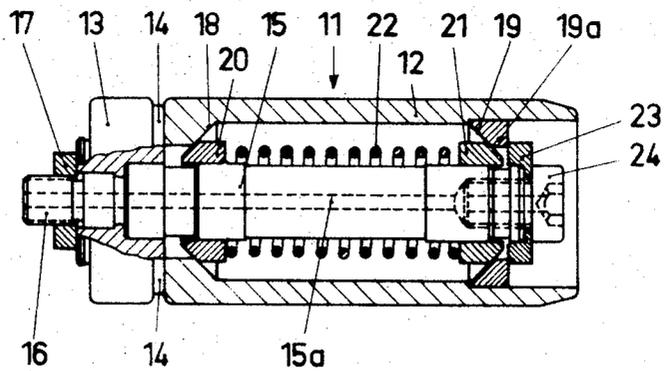


FIG. 3

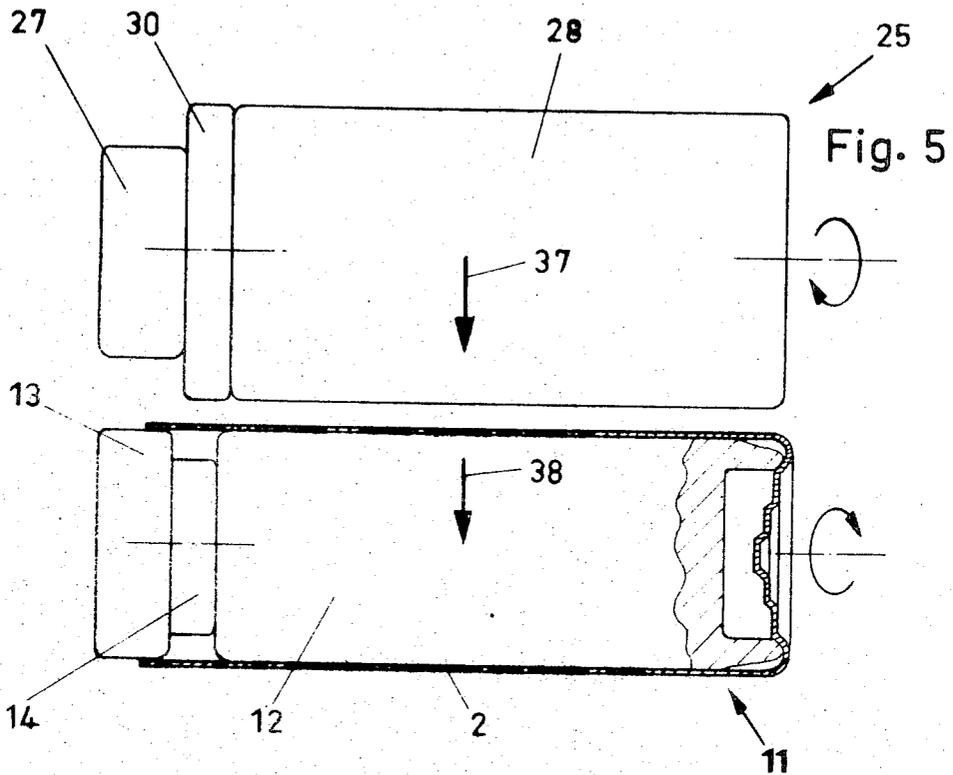
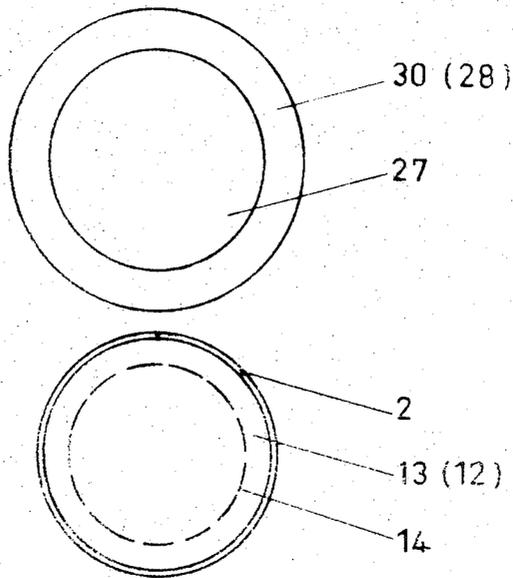
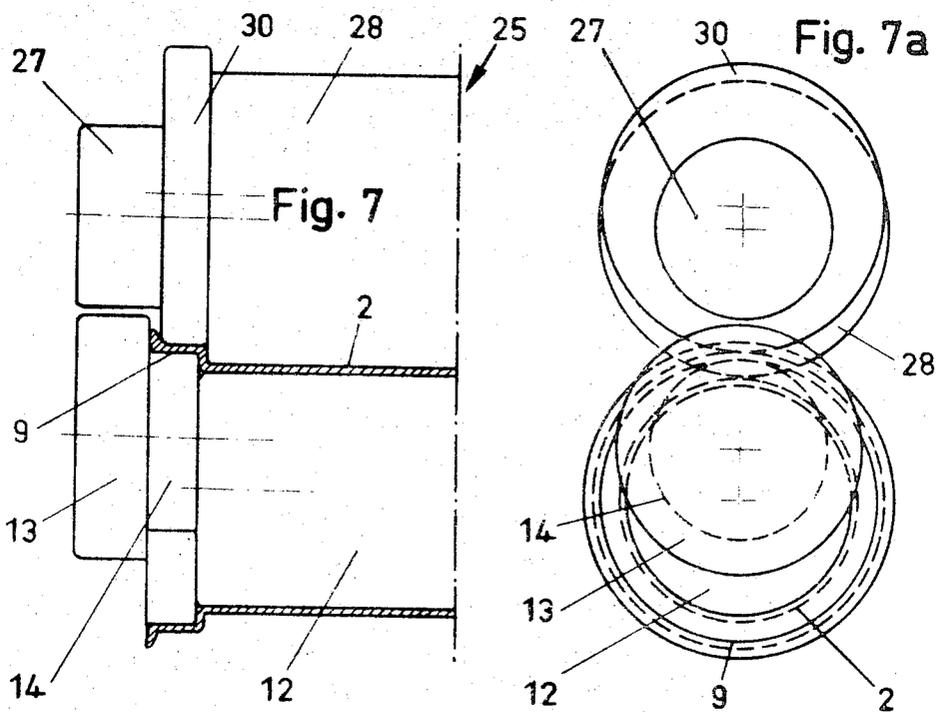
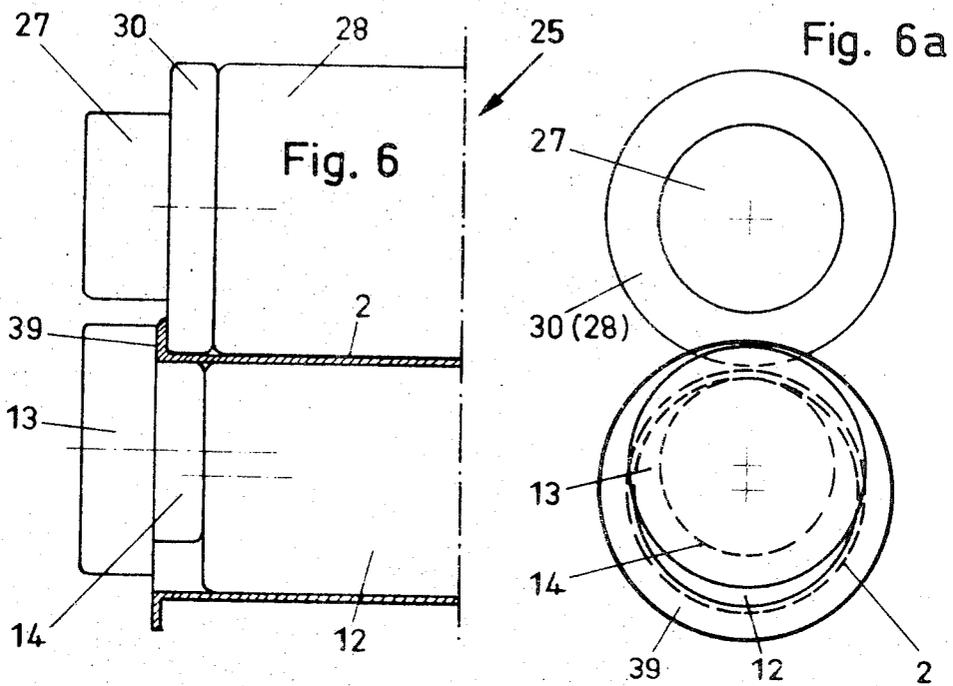


Fig. 5a





METHOD AND APPARATUS FOR PRODUCING A STEPPED RIM ON A SEAMLESS CAN BODY

The invention relates to a method and apparatus for producing a stepped rim on seamless can bodies made of sheet metal, e.g., tin plate, aluminium sheet, which are intended for use as packing containers e.g. for food and drinks. Such can bodies are often closed by a flanged lid provided with a circumferential tearing line having a folded seam with the stepped rim.

The production of stepped exactly stepped rim on seamless can bodies of sheet metal in a continuous manufacturing process is limited and dependent on the dimensions of the can body and introduces difficulties as soon as the body exceeds a certain proportion. If manufactured by deep drawing, the height of the can body is limited, namely to about three-fourths of the diameter. Furthermore, the production of a stepped rim at the end of the deep drawing process makes this operation difficult because the edge of the deep drawing tool has then to be modified according to the form of the desired rim, thus making this edge inadequate for the deep drawing itself.

Impact extrusion or deep drawing combined with rolling make possible the production of seamless can bodies with a height which exceeds the magnitude of the diameter, but difficulties generally appear in this connection on technical grounds in obtaining a usable stepped rim on such bodies:

By upsetting, only a simple rim but no stepped rim can be achieved. Earlier attempts have been made to produce stepped rims by a rolling process in seamless can bodies made by impact extrusion. The method of operation in this connection is, that with a particular position of the rimless can, the inner rimming roller is introduced into the can and the outer rimming roller approaches the latter radially until the rolled rim is ready.

In the course of this, both the rimming rollers and also the can turn around their axis in the same rotating direction. The inner rimming roller must, for this purpose, be at least smaller than the internal diameter of the can to be rimmed, which results in a point engagement with the can wall at the beginning of rimming and then a line engagement of the width of the rimming roller in the end phase of rimming. Limited by bad guiding of the cans, a stepped rim of precise measurements cannot be made by such a method. In addition there is the fact that, by the broadening of the body into a stepped rim, the diameter in this area is enlarged to a significant amount, which leads to large tensions in the material, these being effective in the direction of the centre of the can.

Such tensions lead to cracks in the neighbourhood of the so-called rim width, i.e., the upper rimmed edge of the stepped rim. In addition, the tensions more or less pull back the linearly progressing deformation achieved, so that the inner step of the stepped rim - seen in cross section - is very rounded or extends practically obliquely. In consequence, the exact introduction of the flanged lid and an unobstructed folding closure become impossible. The tearing line of the flanged lid does not come to lie on the step of the stepped rim. This has the result that the torn edge of the flanged lid remaining in the stepped rim after opening the can is smaller in diameter than the clear diameter of the can body. It thus projects and obstructs the emptying of

such contents which are desired in one piece, e.g., pasty products, prepared dishes, sausages with delicate skins etc. Moreover, danger of injury exists when handling the opened can at the stepped rim.

5 An object of the invention is to produce seamless can bodies of sheet metal with a stepped rim independently of the dimensions or proportions of the can, and to provide tools which make possible and simplify the production.

10 Such can bodies may be closed with a flanged lid and by a folded seam formed with the stepped rim, the diameter of the circumferential lid tearing line of the flanged lid being greater than the clear diameter of the can body. The tearing line lies thereby fully on the step of the stepped rim, but only in such a way that a full opening of the tear-off lid is permitted, thus unobstructing the emptying of the contents of the can.

15 The method of producing such a can body is characterised in that the edge of the can body which is to be rimmed is formed progressively by a rolling process as a continuous operation, a simple rim being rolled on the can edge of a width which is greater than the amount of the wall part above the steps to be formed into the can wall; thereupon the step is formed by a radially acting pressing action with continuous flow of material from the simple rim. A stepped rim produced in this way corresponds to all dimensional desires, is accurate and dimensionally stable in the step-shaped formation. Internally and/or externally lacquered cans can be deformed in this way without damage. One is independent of the proportions of the can.

20 The device for making the stepped rim includes a rimming mandrel and a profile roller cooperating with the mandrel, which are radially displaceable relatively to one another and can be pressed against one another, and in which at least one part is displaceable eccentrically in a transverse direction to the longitudinal axis of the mandrel of the profile roller respectively against the pressure of a spring.

25 In detail, the rimming mandrel advantageously consists of a cylindrical part receiving the can body to be rimmed and a part fixed to the shaft and is provided with a reduced shoulder. Thereby, the cylindrical mandrel part is eccentrically displaceable relatively to the shoulder mandrel part and to the mandrel shaft against the action of spring means. Suitably, the pressure profile roller has two parts of different diameters fixed to the shaft, between which an eccentrically displaceable annulus subjected to spring action is mounted, this annulus having the same diameter as the part of greater diameter fixed to the shaft. The radial movability of the cylindrical mandrel part and of the annulus preferably takes place by means of conical surfaces against axially displaceable conical rings which are under the pressure of axial spring means. The conical ring cooperating with the annulus is axially displaceable, this movement being limited by an abutment. By the cooperation of these two tools, the rimming mandrel and the profile roller, there results a rolling process for the production of a stepped rim, which exhibits a combination between rolling and pressing and makes possible the production of a cleanly formed and dimensionally stable stepped rim. With this tool, cans of all dimensions can be machined.

30 The invention will be explained below with reference to the constructional example shown in the drawing:

FIG. 1 is an axial section of a can body of sheet metal with a stepped rim;

FIG. 2 is an enlarged fragmentary section of the can body with a flanged lid with tearing ling in closed condition;

FIG. 3 shows the mandrel, partly in elevation, and partly in longitudinal section;

FIG. 4 shows the pressure roller in longitudinal section;

FIGS. 5 to 7 illustrate diagrammatically three phases of the cooperation of the mandrel and the pressure roller for production of the stepped rim on the can body.

The seamless can body 1 of sheet metal consists of a wall 2, a shaped bottom 3, and a stepped rim 4 on the upper edge of the wall 2. The body 1 can be prepared by impact extrusion, or by deep drawing and rolling, and may have a protective lacquer on the inner and/or outer sides. The can body 1 can have a height which is greater than its own diameter. The can body 1 is finally closed by a flanged lid 5, known per se, which is connected with the stepped rim 4 by a folded seam 6. The outer edge 7 of the stepped rim 4 must for this purpose be of such a width that the part 8 of said edge overlapping the lid flange amounts to at least 55 percent of the said outer edge. The step 9 of the stepped rim 4 must be so pronounced and so wide, that the lid 5 can rest on this step 9 and that the circumferentially extending tearing line 10 in the lid 5 comes to lie within the step 9 of the stepped rim so that after the opening of the lid the entire circumference of the inner wall of the can remains free of an edge. The tearing line of the lid has a greater diameter than the clear internal diameter of the body wall 2.

For the production of the stepped rim 4 a mandrel 11 is used which has a main cylindrical part 12 for the reception of the can body, and a part 13, which includes an offset shoulder 14. Both said parts are mounted on a shaft 15. The part 13 is fixed on the shaft 15 by a nut 17 screwed on to a threaded part 16. The cylindrical part 12 is displaceable eccentrically relatively to the shaft 15. For this purpose the cylindrical part 12 is provided with internal conical surfaces 18 and 19 which interengage with conical rings 20 and 21, which are displaceable axially on the shaft 15 and are under the action of a compression spring 22 placed between them and which surrounds the shaft. The cylindrical part 12 is prevented from displacement in the direction of the longitudinal axis. On the one hand the cylindrical part 12 engages the fixed part 13 and on the other hand a ring 19a carrying the conical surface 19, and with it the cylindrical part 12, is confined by a ring 23, which is fixed to the shaft 15 by a screw 24.

The pressure roller 25 of FIG. 4 has two parts, 27 and 28, fixed on a shaft 26, the part 27 being drawn up tightly against a sleeve 29 which abuts the part 28, by means of a nut or the like (not shown) provided on the shaft. Between the parts 27 and 28 there is an annulus 30, which is mounted to be radially displaceable. The annulus 30 has on its inner periphery an oblique face 31, which interengages with a conical surface 32 on an axially displaceable ring 33, which is under the action of a spring 34. The axial travel of the bush 33 is limited by an abutment 35 on the sleeve 29. At the free end of the fixed part 28 there is a coupling part 36 which locates the can axially during deformation. The mandrel 11 and the pressure roller 25 cooperate as follows :

As shown in FIG. 5, the can body with its wall 2 in undeformed condition, is pushed on to the mandrel 11 so that the wall 2 reaches to the part 13, overlapping the offset shoulder 14. The mandrel and pressure roller rotate in opposite directions. Then the pressure roller 25 is shifted towards the mandrel as indicated by the arrow 37 until the roller 25 comes into engagement with the can wall 2. Upon further radial displacement of the roller 25, the part 28 applies force to the radially displaceable part 12 of the mandrel 11 through the can wall, in the direction of the arrow 38, until the cylindrical part 12 has shifted eccentrically relatively to the shaft 15, into a position in which, in end view, the part 12 is tangential to the offset shoulder 14 (FIGS. 6 and 6a). In this way a simple rim 39 is rolled. That is to say, a first zone of the can wall 2 is deflected into a radially outward directed position. To accommodate and define the rim 39, the left hand radial face of the annulus 30 (as seen in FIGS. 5, 6 and 7) is offset slightly to the right relatively to the radial surface of the mandrel part 13 at the left of the shoulder 14.

During this first stage, the annulus 30 remains concentric with the roller shaft, as the force between the annulus and a second zone of the can wall which the annulus engages is not sufficient to cause the annulus 30 to shift against the action of the spring 34.

Upon further shifting of the roller axis towards the mandrel axis (FIGS. 7 and 7a), the second zone of the can wall is backed up by the shoulder 14, and so the annulus is caused to lag behind continuing movement of the part 28 of the roller. At the same time the part 12 of the mandrel becomes even further eccentric in relation to the part 13 with its shoulder 14.

In consequence, a cylindrical portion of can is created having a diameter greater than the majority of the can wall, and joined to it by a radial step. As this is happening, material flows into the cylindrical portion from the rim 39 which up till then has been too long. With increasing formation of the step, the width of the rim continuously reduces. To accommodate and define the step, the plane of the left hand of the roller part 28 (as seen in FIGS. 5, 6 and 7) is slightly offset to the right relatively to the plane of the left hand end of the mandrel part 12.

The final result is an exact and dimensionally stable stepped rim. The progress of production of the stepped rim thus divides itself into two stages: namely, the rolling of the rim and a pressing of the step as a deformation process through continuous flow of material from the simple rim originally formed.

After the stepped rim has been formed, the shafts of the roller and mandrel move apart, and the parts 12 and 30, in accordance with the speed of the stroke, return themselves to their positions centered on their shafts. The finished can body is then removed from the mandrel. This can take place pneumatically by supply of compressed air through a bore 15a in the shaft 15 of the mandrel 11.

For the forming operation both the mandrel and the roller may be driven or only the mandrel, the roller being idle. Hereabove the invention has been described in the case of a cylindrical can body. However, within the scope of the invention it would be possible to adapt the design of the apparatus for producing stepped rims on frusto-conical can bodies.

We claim:

1. Apparatus for producing a stepped rim on a seam-
less can body, comprising a mandrel adapted to receive
the can body, and a pressure roller adapted to engage
the exterior of the can body adjacent to the free edge
thereof, and means mounting the mandrel and the pres-
sure roller on parallel rotational axes which can be
shifted towards one another; the mandrel including a
main mandrel part which is displaceable to a position
eccentric to the mandrel axis and which has a circular
end, first spring means urging the main mandrel part to
a position concentric with the mandrel axis, and a sec-
ond mandrel part fixedly concentric with the mandrel
axis and having a first substantially cylindrical surface
adjacent to the said circular end of the main mandrel
part but of lesser diameter, a second substantially cylin-
drical surface spaced axially from said circular end, and
of the same diameter as the circular end, and a substan-
tially radial outwardly extending surface connecting
said first and second surfaces; and the pressure roller
including a first roller part fixedly concentric with the
roller axis and abreast of the main mandrel part and
having a circular end lying in a plane slightly offset
from the plane of said circular end of the main mandrel

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part, and a second roller part which is displaceable to
a position eccentric to the roller axis and is abreast of
the second mandrel part, and second spring means
urging the second roller part to a position concentric
with the roller axis, the second roller part having a cy-
lindrical surface adjacent to, and of equal diameter to,
said circular end of the first roller part, and a substan-
tially radial inwardly extending surface in a plane
slightly offset from that of said radial outwardly extend-
ing surface of the second mandrel part.

2. Apparatus according to claim 1, in which the first
spring means comprises an axially acting compression
spring, and two rings abutting opposite ends of the
spring, each engaging the main mandrel part on a frus-
to-conical surface.

3. Apparatus according to claim 1, in which the sec-
ond spring means comprises an axially acting compres-
sion spring, an abutment on the first roller part engag-
ing one end of the spring, and a ring abutting the other
end of the spring, the ring engaging the second roller
part on a frusto-conical surface.

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