# United States Patent [19]

**Hilgenbrink**

[11] **3,763,807**

[45] **Oct. 9, 1973**


[54] **METHOD OF FORMING NECKED-IN CAN BODIES**


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[22] Filed: **Dec. 21, 1970**

[21] Appl. No.: **100,264**

[52] **U.S. Cl.** ..... **113/120 R**

[51] **Int. Cl.** ..... **B21d 51/00**

[58] **Field of Search** ..... 113/120 AA, 120 R, 113/120 S, 120 H, 116 R; 72/82, 370



[56] **References Cited**

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[57] **ABSTRACT**

This disclosure relates to the necking-in of can bodies. It has been found that by inwardly curling an end portion of a can body prior to the performing of a necking-in operation thereon, the usual wrinkle formation resulting from a conventional necking-in operation is eliminated. The precurling may be performed by a rolling operation or by a die forming operation.


**7 Claims, 5 Drawing Figures**

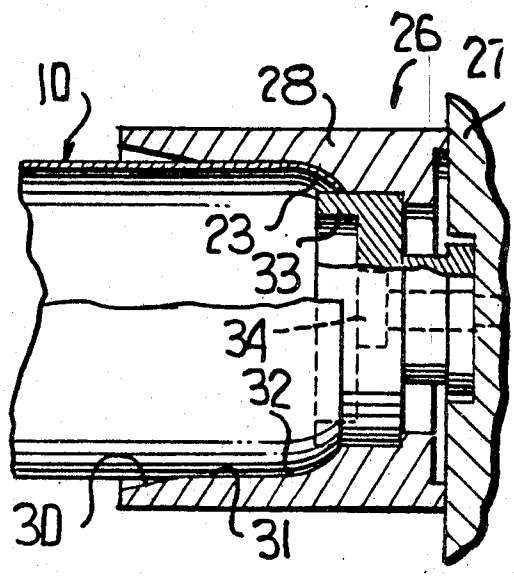


FIG.1

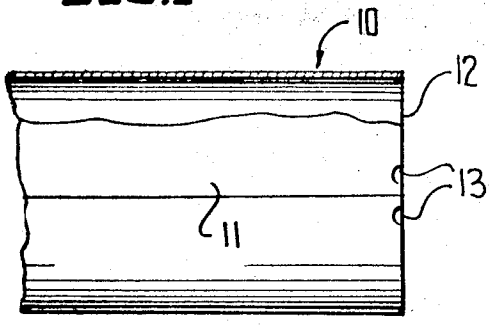



FIG.2

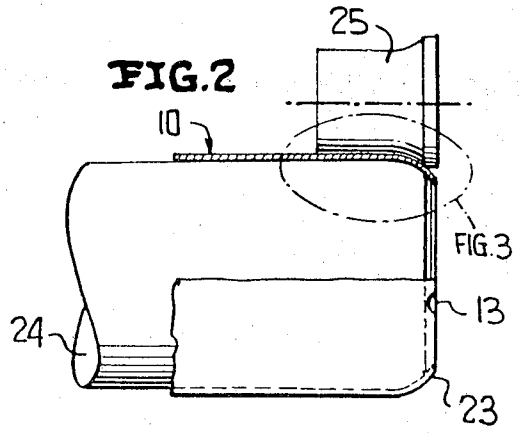



FIG.3

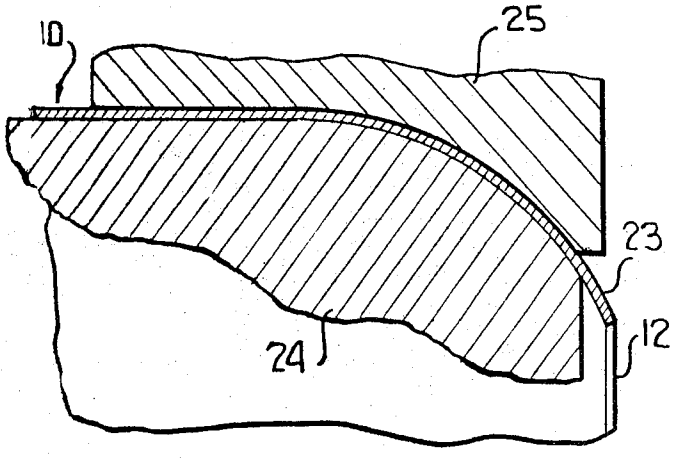



FIG.4

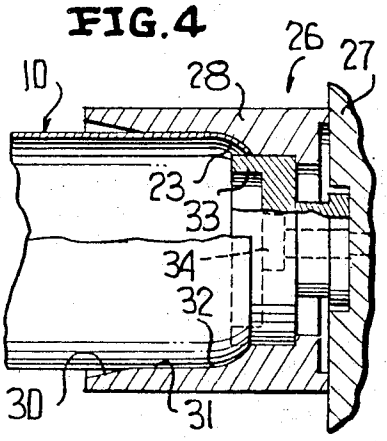
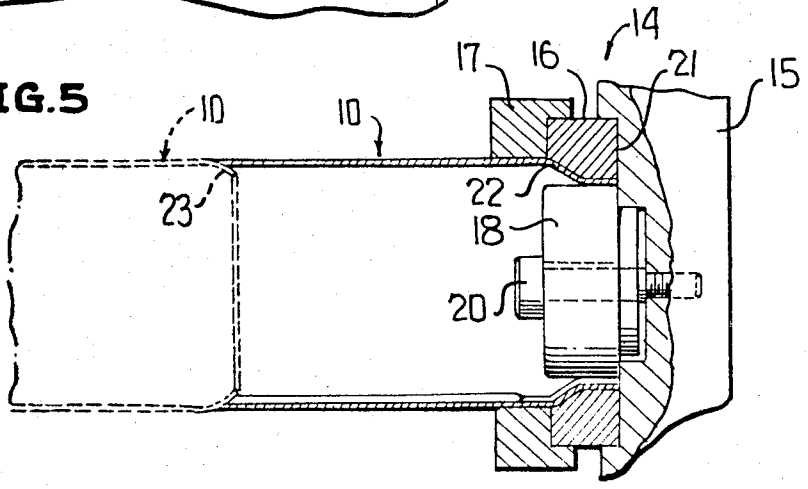



FIG.5



# METHOD OF FORMING NECKED-IN CAN BODIES

This invention relates in general to new and useful improvements in the manufacture of can bodies, and more particularly relates to the necking-in of an end portion of a can body so as to conform the same for the reception of a smaller diameter end or cover.

## BACKGROUND OF THE INVENTION

It is well known to neck-in end portions of can bodies for the receipt of smaller diameter ends or covers. However, in such necking-in operations, minute wrinkles or pleats are formed and during the forming of the usual seam between the can body and the attached end, these small wrinkles or pleats result in the formation of cracks and subsequent leaky cans.

A careful study of the undesirable formation of these wrinkles or pleats show that the instant the extreme end of the can body strikes the angled necking surface of the conventional necking die, these wrinkles or pleats began to form.

It is to be noted that the undesirable wrinkles or pleats are particularly troublesome with respect to welded seam can bodies which has stress relief indents or notches on opposite sides of the welded side seam. However, the problem of the wrinkle or pleat formation is not restricted to welded side seam can bodies, the undesirable wrinkle or pleat formation also being found when the can body side seams are of the bonded type or of the lap and lock solder type and have been necked-in.

## SUMMARY OF THE INVENTION

In accordance with this invention, it has been found that by precurling the end portion of a can body or other cylindrical member which is to be subjected to a necking-in operation, the usual wrinkling or pleating of the metal of the necked-in portion is greatly reduced if not entirely eliminated. Therefore, this invention has to do with the precurling of an end portion of a can body or other cylindrical member prior to the subjecting of the end portion to the usual necking-in die.

It has also been found that the inward curling of the can body end portion in advance of the presentation thereof to the conventional necking-in die greatly facilitates the necking-in operation providing for simplicity of tool design and advance speed of operation.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawing:

## IN THE DRAWING

FIG. 1 is an elevational view with parts broken away and shown in section of a welded seam can body having stretch relieving notches formed in the extreme end edge thereof on opposite sides of the side seam.

FIG. 2 is a side elevational view showing the can body of FIG. 1 having the end portion thereof precurled in a roll forming operation.

FIG. 3 is an enlargement of a portion of FIG. 2 and shows specifically the details of the curling operation.

FIG. 4 is a sectional view similar to FIG. 2 taken through a curling die showing the same being utilizing to precurl a can body.

FIG. 5 is a fragmentary sectional view through a customary type of necking-in die and shows the manner in which a precurled can body has the end portion thereof necked-in thereby.



Referring now to the drawing in detail, it will be seen that there is illustrated in FIG. 1 a typical can body which is to be necked-in in accordance with this invention, the can body being generally identified by the numeral **10**. The can body **10** is of a cylindrical construction and is provided with a longitudinal side seam **11**. The illustrated can body **10** has the side seam **11** thereof in the form of a welded side seam. However, in accordance with this invention, the side seam **11** could equally as well be of a bonded type construction or could be of a conventional lap and lock soldered construction. Particularly when the side seam **11** is a welded side seam, each end edge **12** of the can body **10** is provided with shallow stress relieving notches **13** closely adjacent to and on opposite sides of the side seam **11**.

Reference is now made to FIG. **5** wherein there is illustrated a conventional type of necking die, which is generally identified by the numeral **14**. The necking die **14** includes a support **15** to which there is secured a die ring **16** which, in turn, is provided with a lead in or adapter ring **17**. The necking die **14** also includes a die plug **18** which, in cooperation with the die **16** controls the sizing of the necked-in end portion of the can body. The plug **18** is mounted for limited radial shifting with respect to the support **15** and the die ring **16** by means of a fastener **20**.

It will be readily apparent from FIG. **5** that when the can body **10** is necked-in utilizing the necking die **14**, the main portion of the can body **10** remains of the original diameter and that the extreme end portion, which is necked-in, is also cylindrical, but of a reduced diameter. The necked-in end portion is identified by the numeral **21** and is connected to the remainder of the can body **10** by a generally cylindrical intermediate portion **22**.

When the can body **10** is necked in directly within the necking die **14**, axially extending wrinkles are formed circumferentially about the necked-in end portion **21**. This is particularly true when the end edge **12** of the can body is provided with the radius notches **13**. Wrinkles or pleats form in alignment with the radius notches **13**. Furthermore, it has been found that with wrinkles or pleats either before or during the seaming of an end to the can body **10**, cracks occur along the wrinkles or pleats which result in leaks in the finished can.

In accordance with this invention, it has been found that by precurling the end portion of the can body radially inwardly, as is illustrated on a large scale in FIG. **3**, formation of the pleats or wrinkles and the resultant cracks is substantially eliminated. The precurled end portion of the can body **10** is identified by the numeral **23** and the precurling occurs about a relatively small radius, but is limited to a radial inwardly curling of the end portion of the can body to a diameter no less than the diameter of the necked-in end portion **21**.

As is illustrated in FIG. **2** and **3**, the curl **23** may be formed by placing the can body **10** on a suitable mandrel **24** and progressively subjecting the end of the can body **10** to a rolling action by means of one or more rollers **25**. The mandrel **24**, in cooperation with the roller **25**, provides for the desired curl configuration.

Referring now to FIG. **4**, it will be seen that there is illustrated alternative apparatus for forming the curl

23. This apparatus is in the form of a die assembly which is generally identified by the numeral 26. The die assembly 26 includes a support 27 to which there is secured in any conventional manner an outer die ring 28. The die ring 28 is of an internal configuration which includes a lead-in angle 30, a guide portion 31, which corresponds to the diameter of the can body 10, and a curling radius 32. The die assembly 26 also includes a die center plug 33 which is seated in the die ring 28 and is secured to the support 27 by means of a fastener 34. The die center plug 33 projects axially into transverse alignment with the die radius 32 so as to limit the radial inward extent of the curl 23.

It is to be understood by limiting the inward curling of the end portion of the can body 10 to a diameter no less than the diameter of the necked-in end portion 21, the precurled can body may be readily necked-in utilizing the die 14 in the conventional manner. However, because the extreme end 12 of the can body 10 is already substantially at the final diameter of the necked-in end portion 21, when the extreme end 12 of the can body 10 strikes the necking die, there is no immediate formation of wrinkles or pleats as is customary. The preforming of the curl 23 in no way interferes with the necking-in operation and, in fact, facilitates the flow of metal as is required in the necking-in operation.

It is to be understood that the precurling of the can body may be readily accomplished in any desired manner which does not require an abrupt overstressing of the end edge of the can body and which will provide for a uniform curling of the end portion of the can body.

Although only several preferred die assemblies for forming the necked-in end on the can body have been specifically illustrated and described, and the invention, in the description thereof has been limited to a can body as the cylindrical member, it is to be understood that the invention is not so limited, and minor modifications may be made in the invention without departing from the spirit and scope of the invention, as defined by the appended claims.

I claim:

1. A method of necking-in an end portion of a can body having a side seam in a manner to eliminate wrinkling particularly adjacent the side seam, said method comprising the steps of first inwardly curling the can body end portion utilizing a curling device, and then applying a necking-in die assembly to the inwardly curled end portion only in an axial direction and further changing the configuration of said end portion from an inwardly curled configuration to a cylindrical configuration of reduced diameter as compared to the original diameter of the can body and a conical intermediate configuration joining the reduced diameter cylindrical configuration to the remainder of the can body.

2. The method of claim 1 wherein the inwardly curling of said end portion is restricted to a diameter at least as great as the diameter of said reduced diameter cylindrical configuration.

3. A method of necking-in an end portion of a can body having a side seam in a manner to eliminate wrinkling particularly adjacent the side seam, said method comprising the steps of first inwardly curling the can body end portion, and then applying a necking-in die assembly to the inwardly curled end portion and further changing the configuration of said end portion from an inwardly curled configuration to a cylindrical configuration of reduced diameter as compared to the original diameter of the can body and a conical intermediate configuration joining the reduced diameter cylindrical configuration to the remainder of the can body, together with the formation of stress relieving notches in the extreme end edge of said end portion in positions to be disposed on opposite sides of and closely adjacent said side seam, said notches being formed prior to said curling step.

4. The method of claim 3 wherein the inwardly curling of said end portion is restricted to a diameter at least as great as the diameter of said reduced diameter cylindrical configuration.

5. The method of claim 4 wherein said curling operation is accomplished by a rolling operation.

6. The method of claim 4 wherein said curling operation is accomplished by a die forming operation.

7. The method of claim 1 wherein the conical intermediate configuration is formed to be a straight line conical configuration.

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