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[54] CAN END CLOSURE CURL

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[52] **U.S. Cl.** .....**220/67,** 113/121 C

[51] **Int. Cl.** **B65d 7/42**

[58] **Field of Search**.....220/67; 112/121 C

[56] **References Cited**

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[57] **ABSTRACT**

A continuous curl formed on the periphery of a can end component prior to the first and second operations of double seaming the can end component to an end of a can body has an inner annular portion of a configuration substantially that of a surface of revolution generated by three successive merging arcs including an inner arc struck by a first radius R_1, a middle arc struck by a second radius R_2, and an outer arc struck by a third radius R_3, where $R_1 > R_2 > R_3$, and an outer annular portion of a configuration substantially that of a generally planar surface which is parallel to a plane formed by the innermost marginal edge of the inner arc of the inner annular portion of the continuous curl. A curler tool for forming the continuous curl has a curl-forming groove which has a contour substantially the same as the configuration of the inner and outer annular portions of the continuous curl formed by the curler tool.

6 Claims, 4 Drawing Figures

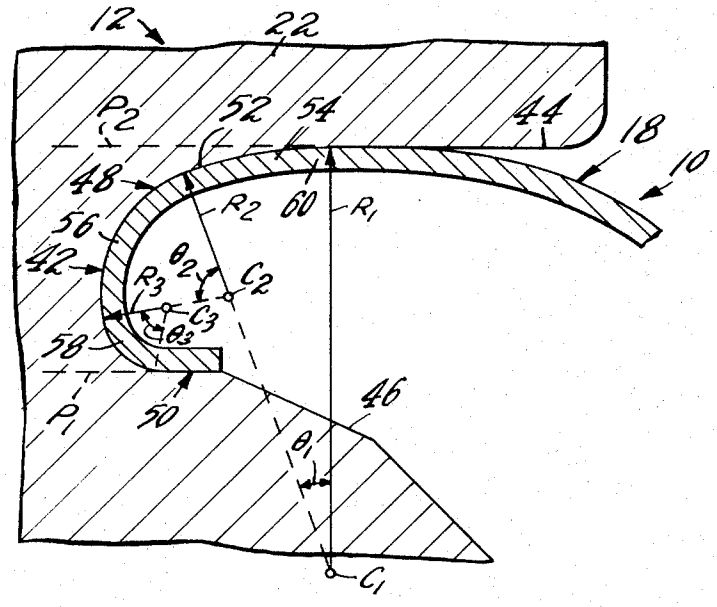


Fig. 1

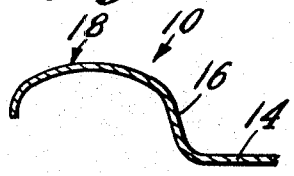


Fig. 2

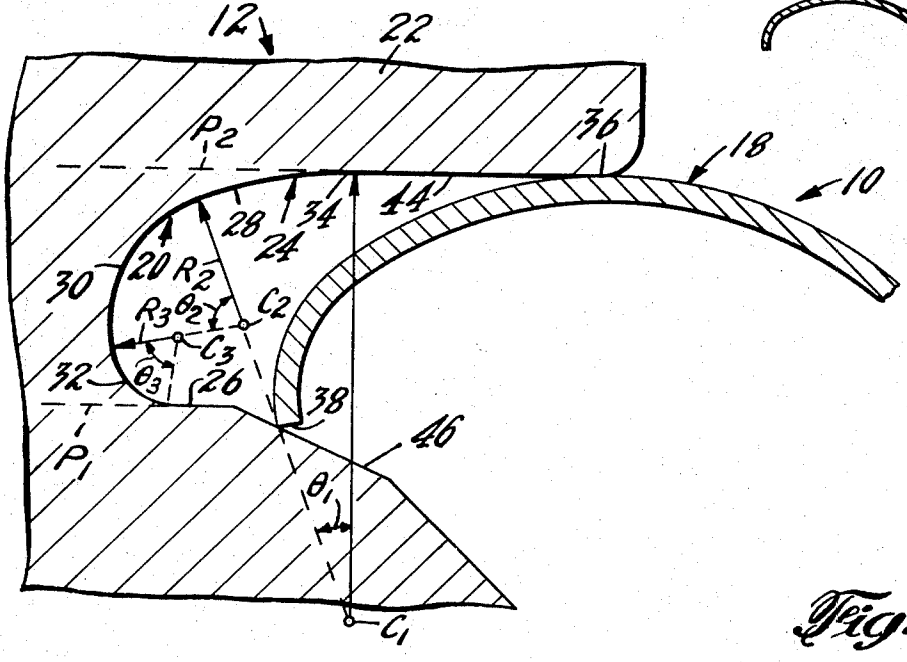


Fig. 4

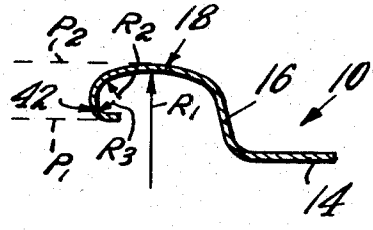
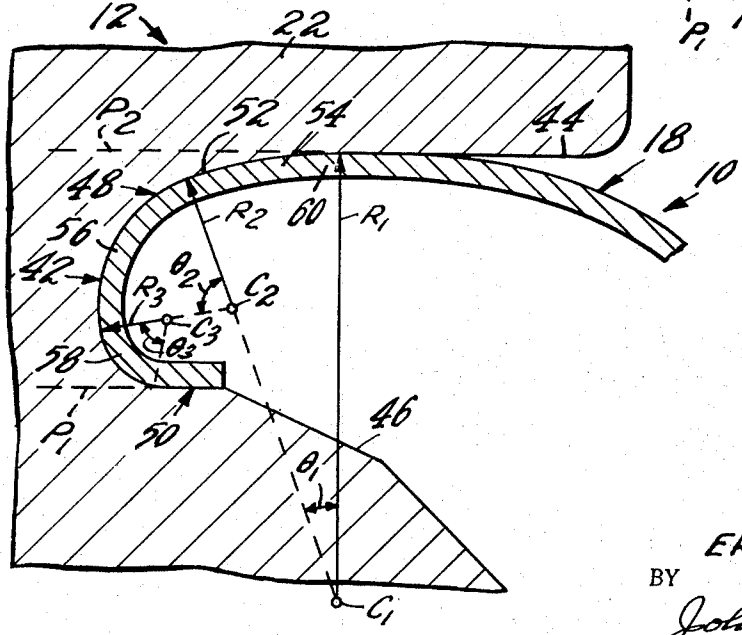


Fig. 3



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CAN END CLOSURE CURL

BACKGROUND OF THE INVENTION

The present invention relates generally to improved double seams and more particularly to a continuous curl formed on the periphery of a can end closure and a curler tool for making the same which allows for subsequent improved double seam formation.

In attempting to form double seams between a can body and a conventionally configured end closure formed of lightweight sheet metal of relatively high hardness, such as 80 pound to 95 pound DR9 tinplate, it has been found that deformities such as wrinkles are formed in the cover hook of the closure flange by the first operation double seaming roll concurrently as the roll forms the cover hook. These wrinkles not only result in unsightly double seams, but also break the continuity of the double seam and in some instances even result in perforation of the can body during the double seaming operations, and thus often prevent the formation of a tight hermetic seal between the can end closure and the can body.

Prior to this time, the curler tool which was used to form the curl on the end closure prior to the first and second operations double seaming, had a curl-forming groove with a single radiused contour, commonly within the range of from approximately 0.038 inch to 0.042 inch. When the outer marginal portion of this curl was subsequently reformed upwards into a cover hook feature during the first operation double seaming, wrinkles formed on the cover hook feature which subsequently adversely affected the formation of the double seam and the quality of the seal between the end closure and the can body as has been described hereinbefore.

This problem of wrinkle formation on the cover hook feature during the first operation double seaming has been greatly reduced or eliminated by the present invention. The curler tool of the present invention has a curl-forming groove of a particular contour which provides for the preforming of the cover hook feature on the curl in the curler operation prior to the first operation double seaming to thereby permit a reduction in the curl reforming work subsequently required in the first operation double seaming. This work reduction greatly reduces or eliminates the magnitude of the wrinkles formed on the cover hook feature during the first operation double seaming and results in an improved double seam. The continuous curl of the present invention, being formed by the curler tool, has a configuration substantially the same as the contour of the curler tool groove which forms the curl.

SUMMARY OF THE INVENTION

A continuous curl formed on the periphery of a can end component prior to the first and second operations of double seaming the can end component to an end of a can body has an inner annular portion of a configuration substantially that of a surface of revolution generated by three successive merging arcs including an inner arc struck by a first radius R_1, a middle arc struck by a second radius R_2, and an outer arc struck by a third radius R_3, where $R_1 > R_2 > R_3$, and an outer annular portion of a configuration substantially that of a generally planar surface which is parallel to a plane formed by the innermost marginal edge of the inner arc of the inner annular portion of the continuous curl. A curler tool for forming the continuous curl has a curl-forming groove of a contour substantially the same as the configuration of the inner and outer annular portions of the continuous curl formed by the curler tool.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a fragmentary sectional view of a can end closure as initially die-formed before being curled by the curler tool of the present invention;

FIG. **2** is an enlarged fragmentary sectional view of the can end closure of FIG. **1** and of the curler tool of the present invention showing the peripheral flange of the end closure aligned with the curler tool before the curl-forming operation;

FIG. **3** is an enlarged fragmentary sectional view of the end closure of FIG. **1** and of the curler tool showing the continuous curl of the present invention formed in the tool after the curl-forming operation; and

FIG. **4** is a fragmentary sectional view of the end closure of FIG. **1** showing the continuous curl of the present invention formed on the periphery of the end closure.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. **1** there is illustrated a fragmentary section of a circular tinplate can end closure, generally designated **10**, as initially die-formed before being curled by a curler tool, generally designated **12** (FIG. **2**).

The end closure **10** generally comprises a flat countersunk central panel **14** which merges at its outer end with a generally upwardly extending countersink wall **16** which in turn merges at its upper end with a generally outwardly extending, curved, annular flange **18**.

Referring now to FIG. **2**, the annular flange **18** of the end closure **10** is shown aligned with a curl-forming groove, generally designated **20**, formed in a body **22** of the curler tool **12**.

The curl-forming groove **20** is defined by an inner surface **24** and an outer surface **26**.

The inner surface **24** has a contour substantially that of a surface of revolution generated by three successive merging arcs. The first of the three successive arcs, defining an inner surface section **28**, is struck by a first radius R_1. The first radius R_1 strikes the first arc by sweeping through a first angle θ_1 about a first center of curvature C_1. The second of the three successive arcs, defining a middle surface section **30**, is struck by a second radius R_2. The second radius R_2 strikes the second arc by sweeping through a second angle θ_2 about a second center of curvature C_2, with the second center C_2 being located along the first radius R_1 at the end of its sweep through the first angle θ_1. The third of the three successive arcs, defining an outer surface section **32**, is struck by a third radius R_3. The third radius R_3 strikes the third arc by sweeping through a third angle θ_3 about a third center of curvature C_3, with the third center C_3 being located along the second radius R_2 at the end of its sweep through the second angle θ_2.

In the preferred embodiment of the curler tool **12**, the first radius R_1 is approximately equal to 0.166 inch and the first angle θ_1 is approximately equal to 20°, the second radius R_2 is approximately equal to 0.050 inch

and the second angle θ_2 is approximately equal to 80°, and the third radius R_3 is approximately equal to 0.025 inch and the third angle θ_3 is approximately equal to 75°.

The outer surface **26** of the curl-forming groove **20** has a contour substantially that of a generally planar surface which is in a plane P_1 substantially parallel to a plane P_2 formed by the innermost marginal edge **34** of the inner surface section **28** of the inner surface **24** of the curl-forming groove **20**.

Prior to the curl-forming operation, as shown in FIG. **2**, the marginal edges **36**, **38** of an outer portion **40** of the peripheral annular flange **18**, which portion **40** will be formed into a continuous curl **42** by the curler tool **12**, are brought into contact with the surfaces **44**, **46** of the curler tool **12**, the surfaces **44**, **46** being exterior respectively to the inner and outer surfaces **24**, **26** of the curl-forming groove **20**. In the curl-forming operation, the outer portion **40** is moved toward the curl-forming groove **20** which causes the reforming or "-molding" of the outer portion **40** into the configuration of the continuous curl **42** as shown in FIG. **3**.

As shown in FIG. **3**, the continuous curl **42** has a configuration which is substantially the same as the contour of the inner and outer surfaces **24**, **26** of the curl-forming groove **20** of the curler tool **12**. The curl **42** is comprised by an inner annular portion **48** and an outer annular portion **50**.

The inner annular portion **48** has a configuration substantially that of a surface of revolution generated by three successive merging arcs, where the surface of revolution is coincident with the exterior surface **52** of the inner annular portion **48**. The first of the three successive arcs, defining the exterior surface of an inner section **54** of the inner annular portion **48**, is struck by the first radius R_1. The first radius R_1 strikes the first arc by sweeping through the first angle θ_1, about the first center of curvature C_1. The second of the three successive arcs, defining the exterior surface of the middle section **56** of the inner annular portion **48**, is struck by the second radius R_2. The second radius R_2 strikes the second arc by sweeping through the second angle θ_2, about the second center of curvature C_2, with the second center C_2 being located along the first radius R_1 at the end of its sweep through the first angle θ_1. The third of the three successive arcs, defining the exterior surface of an outer section **58** of the inner annular portion **48**, is struck by the third radius R_3. The third radius R_3 strikes the third arc by sweeping through the third angle θ_3 about the third center of curvature C_3, with the third center C_3 being located along the second radius R_2 at the end of its sweep through the second angle θ_2.

The preferred lengths of the radii R_1, R_2, and R_3 and degrees of the angles θ_1, θ_2, and θ_3 are the same with regard to the continuous curl **42** as those given with regard to the curler tool **12**.

The exterior surface of the outer annular portion **50** of the continuous curl **42** has a configuration substantially that of a generally planar surface which is in the plane P_1 substantially parallel to the plane P_2 formed by the exterior surface of the innermost edge **60** of the inner section **54** of the inner annular portion **48** of the curl **42**.

In FIG. **4** there is illustrated a fragmentary section of the end closure **10** with the continuous curl **42** being formed on the periphery thereof.

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 scope of the invention without sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. A continuous curl formed on the periphery of a can end component prior to the first and second operations of double seaming said can end component to an end of a can body, comprising:

an inner annular portion of a configuration substantially that of a surface of revolution generated by three successive merging arcs including an inner arc struck by a first radius R_1, a middle arc struck by a second radius R_2, and an outer arc struck by a third radius R_3, where $R_1 > R_2 > R_3$; and

an outer portion of a configuration substantially that of an annular generally planar surface which is parallel to a plane formed by the innermost marginal edge of said inner arc.

2. A continuous curl according to claim **1** wherein R_1 is approximately equal to $3R_2$, and approximately equal to $6R_3$.

3. A continuous curl according to claim **1** wherein R_1 approximately equals 0.166 inch, R_2 approximately equals 0.050 inch, and R_3 approximately equals 0.025 inch.

4. A can end component for double seaming to an end of a can body, comprising:

a can end defining portion; and

an integral peripheral flange, said flange being annular in outline and having an outer portion in the form of a continuous curl, said curl having

an inner section of a configuration substantially that of a surface of revolution generated by three successive merging arcs including an inner arc struck by a first radius R_1, a middle arc struck by a second radius R_2, and an outer arc struck by a third radius R_3, where $R_1 > R_2 > R_3$, and

an outer section of a configuration substantially that of an annular generally planar surface which is in a plane substantially parallel to a plane formed by the innermost marginal edge of said inner arc.

5. A can end component according to claim **4** wherein R_1 is approximately equal to $3R_2$, and approximately equal to $6R_3$.

6. A can end component according to claim **4** wherein R_1 approximately equals 0.166 inch, R_2 approximately equals 0.050 inch, and R_3 approximately equals 0.025 inch.

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