

[54] **CURLER TOOL**

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113/120 V

[51] Int. Cl. B21d 51/00

[58] **Field of Search**..... 113/1 E, 1 F, 7 R, 113/7 A, 120 AA, 121 C, 120 V; 72/354; 220/67

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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.

3 Claims, 4 Drawing Figures

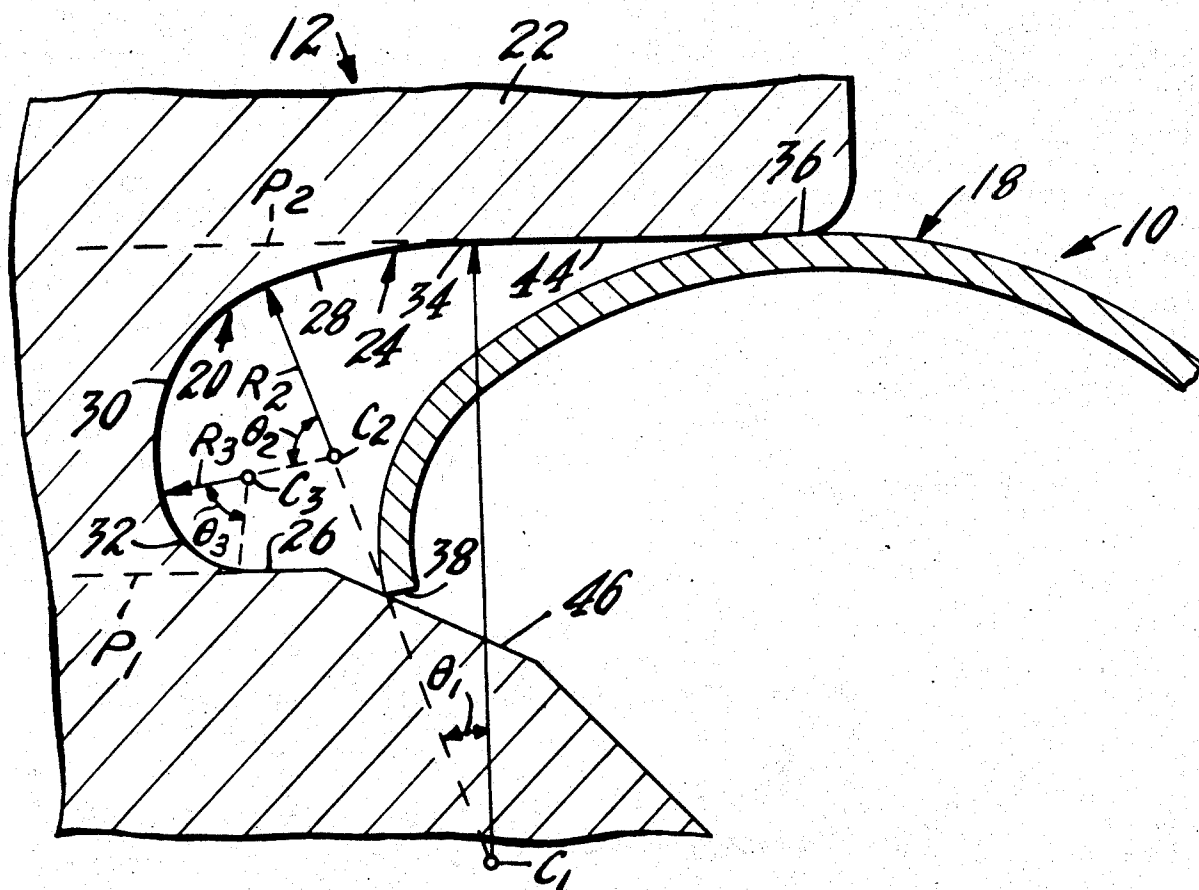


Fig. 2

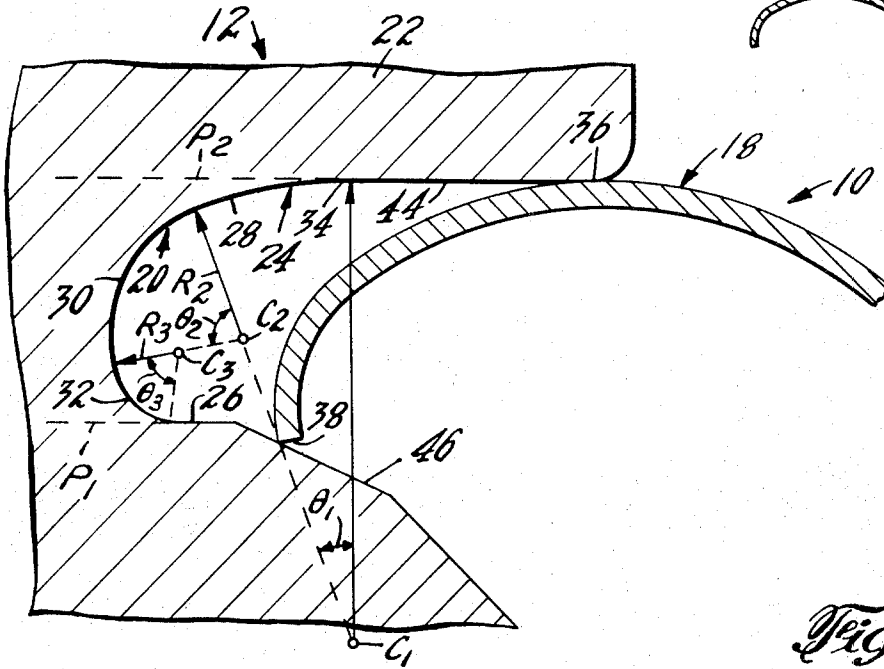


Fig. 1

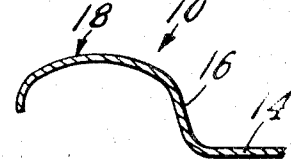


Fig. 3

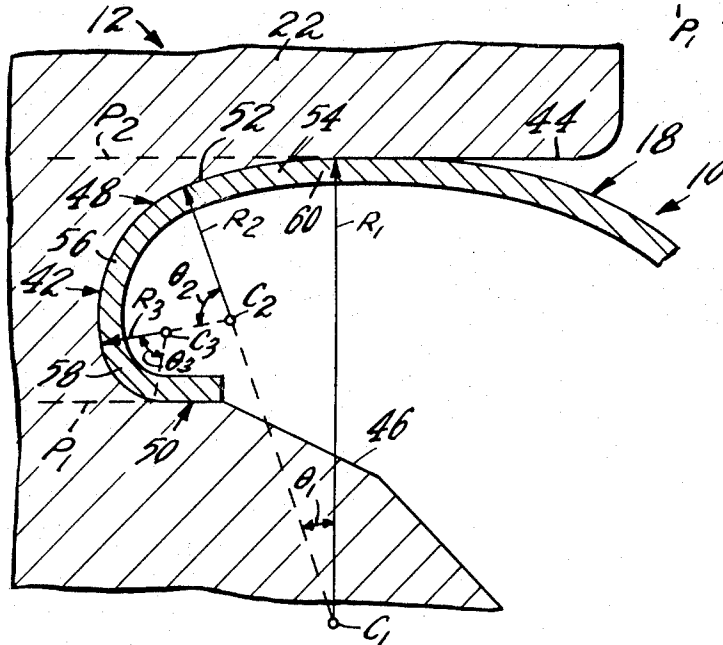
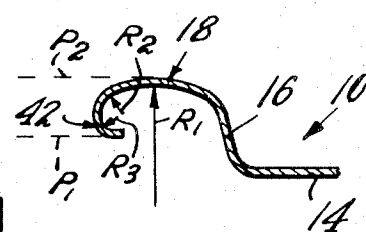


Fig. 4



CURLER TOOL

This is a division of application Ser. No. 152,066 filed June 11, 1971, now U.S. Pat. No. 3,715,054.

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 curlforming 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 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 curler tool for forming a continuous curl 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, said tool comprising: a body; and

a curl-forming groove formed in said body and defined by

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

2. A curler tool according to claim 1 wherein R_1 is approximately equal to $3R_2$, and approximately equal to $6R_3$.

3. A curler tool 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.

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