

PATENT SPECIFICATION

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DRAWINGS ATTACHED.

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COMPLETE SPECIFICATION.

End Closures for Containers.

5 We, RHEEM INTERNATIONAL INC., a Delaware, United States of America Corporation, of 400 Park Avenue, New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to end closures for containers, which may be constructed of medium gauge steel, such as 18 gauge, and yet will not crack or leak when the container is loaded and subjected to repetitive impacts of the type occurring, for example, during
15 transport of the container over long distances by truck.

Metal drums, or the like, having a wide range of sizes have long been utilised for storing and shipping pourable or other products. In general such drums have included a cylindrical body and heads respectively secured to the opposite ends of the body to provide end closures therefor. Typically, each head includes a circumferential knuckle extending arcuately longitudinally outwardly into the chime which in turn curves radially outwardly and longitudinally inwardly at its upper end over the rim of the body to terminate in a double lock seam therewith. In
30 addition, the central portion of each head radially inwardly of the knuckle is frequently domed to form a bilge for the purpose of increasing the capacity of the drum.

It has been found that drums, as described in the preceding paragraph, having bodies and heads both constructed of medium gauge steel, such as 18 gauge, as designed to have a capacity of for example 55 gallons, experience head failure under various circumstances. Head failure of these drums is particularly prevalent where the drums contain liquid weighing in excess of about 500

pounds and the drums are shipped by truck. During transit of the drums, the bottom heads thereof develop cracks in the vicinity of the knuckles and chimes which give rise to leaks. The cracks typically extend radially outward from points one to two inches from the chime straight to the knuckle radius and longitudinally outward along the chime to terminate at the seam radius. In addition, circumferential cracks are often exhibited in the vicinity of the knuckle which intersect the radial cracks. Apparently, the cracks are due to fatigue failure, the heads progressively cracking over a period of time under repetitive stresses. In this regard, it is presumed that radial bulges or creases are formed in the bottom head of the drum in the vicinity of the knuckle due to the impact force of the liquid acting thereon when, for example, the drum is dropped during the loading of a truck, the truck runs over some large holes or curbs, etc. The creases act as detrimental stress risers and result in flexing of the bottom head. Thereafter continued flexing of the head due to vibration of the liquid during the remainder of the route causes the creases or adjacent areas to crack by fatigue.

It is therefore an object of the present invention to provide an improved head for containers.

According to the present invention there is provided a metal end closure for a container, including a cylindrical chime, a flat annular region inwardly adjacent and perpendicular to said chime, a knuckle interconnecting said chime and annular region, a central circular region, a circumferential strengthening section which includes an inclined portion interconnecting said flat annular region and said central circular region, and said central circular region includes a central flat circular portion and a convex

annular portion extending between said flat circular portion and said strengthening section.

One embodiment of the present invention and modifications thereof, will now be described by way of example with reference to the accompanying drawings, in which:—

Figure 1 is a side elevation view of a drum with end closures or heads fitted.

Figure 2 is an enlarged fragmentary sectional view taken at a diametric plane through a head of the drum of Figure 1.

Figure 3 is a view similar to Figure 2 of a modified form of head.

Referring to Figure 1, there will be seen to be provided a metal drum 11 including a cylindrical tubular body 12 having similar top and bottom heads 13 secured in closing relation to the opposite ends thereof. The body 12 is preferably provided with a plurality of peripheral ribs 14 to strengthen the body in a conventional manner. In addition, the ends of the body are provided with radial outward and longitudinally inward L-shaped bent portions 16 adapted to cooperate with complementary radial inward and longitudinally outward U-shaped bent portions 17 provided at the peripheries of the heads 13 in the formation of double locked seams 18 serving to secure the heads to the body.

Considering now a preferred embodiment of the invention as depicted in Figures 1 and 2, the head 13 is provided with a flat annular region 19. The flat region terminates radially outward in a small radius circumferential knuckle 21 which in turn extends longitudinally outward into the longitudinal portion of the chime 22, which at its outer end extends radially outward and longitudinally inward to terminate in the L-shaped bent portion 17. The flat region 19 terminates radially inward in a shallow inclined step 23, which in the present instance is inclined radially inward and longitudinally outward with respect to the drum body 12, and comprises a strengthening section. The step in turn terminates inwardly in a bilge 24, which it is of importance to note includes a flat circular central portion 26 and convex annular portion 27 extending between portion 26 and step 23. The flat central portion 26 is slightly inwardly longitudinally spaced from the outer end of the chime 22.

With regard to the preferred relative dimensions of the various portions of the head 13, this may be conveniently expressed in terms of the head diameter, D , that is, the distance between the outside peripheral surface of the longitudinal portion of the chime. The radial width of the flat annular region 19 is advantageously about $1/45 D$, while the radius of knuckle 21 is about $1/90 D$. The height measured longitudinally of the container of step 23 is about $1/180 D$, and

this step is preferably at an angle of 45° to the flat region. It will be thus appreciated that unlike a conventional drum, the step is substantially more shallow. The flat central portion 26 is about $16/45 D$ while the radial width of the annular portion 27 is $187/720 D$. The longitudinal distance between the flat central portion 26 and flat annular region 19 (bilge height) is about $1/36 D$ and the longitudinal distance between annular region 19 and the outer end of the chime 22 is $5/144 D$. The radius of curvature of the convex annular portion 27 is $27/45 D$. It has been found in practice that heads in accordance with the present invention having the foregoing relative dimensions and constructed of sheet metal of a medium gauge in a range of about 22 to 16 gauge, do not exhibit cracking of the type previously discussed.

Considering now a specific example of a drum 11 having heads 13 in accordance with the present invention and designed for a capacity of 55 gallons, it should be noted that the body 12 has a $22\frac{1}{2}$ " inside diameter, $23\frac{7}{16}$ " outside diameter at the ribs 14, and a length of $34\frac{3}{4}$ ". The head diameter between the outside of the chime 22 is then $22\frac{1}{2}$ " as measured between the outside peripheral surface of the longitudinal portion of the chime. The longitudinal distance between the flat annular region 19 and outer end of the chime is $25/32$ " and the radius of knuckle 21 is $\frac{1}{4}$ ". The radial width of flat annular region 19 is $\frac{1}{2}$ " and the height measured longitudinally of the container of step 23 is $\frac{1}{8}$ ", which step is at an angle of 45° to the flat annular region. The flat circular central portion 26 has an 8" diameter and the radius of curvature of convex annular region 27 is $58\frac{1}{2}$ ". The bilge depth is then $\frac{1}{8}$ ". The particular drum just described may be made of any gauge sheet steel in a range of 22 to 16 gauge, or any combination of these gauges.

Although the longitudinally offset circumferential strengthening section has been provided as a shallow inclined step in the embodiments of the head hereinbefore described in detail, it will be appreciated that various alternatives may be employed such as that depicted in Figure 3. In this regard, a head 37 is provided which, as in the case of the heads 13 and 28, includes a chime 38 terminating at its outer end in an L-shaped bent portion 39 for facilitating securance of the head to the body of a drum by means of a double seam joint. The head is provided with a flat annular region 41 inwardly adjacent and perpendicular to the chime, which annular region outwardly merges smoothly with the chime through the intermediary of a small radius circumferential knuckle 42. As in the case of the head 13, head 37 includes a central bilge 43 having a flat centre and convex annular outer portion. In the present instance, however, the

strengthening section is provided as a circumferentially extending relatively shallow outwardly convex bead 44 interconnecting the inner portion of flat annular region 41 and the bilge 43.

The bead is inclined outwardly a short distance from the flat annular region to, in turn, recurve inwardly and merge smoothly with the bilge. The configuration of head 37 has likewise been found to be highly effective in preventing the formation of cracks.

The present invention thus provides end closures having a novel reinforcing configuration in the region inwardly adjacent the chime. As a result this region of the end closure is highly resistant to flexure and does not bulge or crease upon impact of liquid contents of the drum with the closure. Since the bulges are prevented from forming, the head does not crack.

WHAT WE CLAIM IS:—

1. A metal end closure for a container including a cylindrical chime, a flat annular region inwardly adjacent and perpendicular to said chime, a knuckle interconnecting said chime and annular region, a central circular region, a circumferential strengthening section which includes an inclined portion interconnecting said flat annular region and said central circular region and said central circular region includes a central flat circular

portion and a convex annular portion extending between said flat circular portion and said strengthening section.

2. A metal end closure according to claim 1 wherein said inclined portion is at an angle of about 45° to the flat annular region and extends a perpendicular distance of approximately $\frac{1}{8}$ inch from said region.

3. A metal end closure according to either of the previous claims wherein said central flat circular portion has a diameter of approximately $16/45 D$ and said convex annular portion has a radius of curvature of approximately $2.27/45D$ wherein D represents the distance between the outside peripheral surface of the longitudinal portion of the chime.

4. A metal end closure according to any of the previous claims wherein said strengthening section is an outwardly convex bead.

5. A metal end closure substantially as hereinbefore described with reference to Figs. 1 and 2, or Fig. 3 or Fig. 4 of the accompanying drawings.

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portion and a convex annular portion extending between said flat circular portion and said strengthening section.

2. A metal end closure according to claim 1 wherein said inclined portion is at an angle of about 45° to the flat annular region and extends a perpendicular distance of approximately $\frac{1}{8}$ inch from said region.

3. A metal end closure according to either of the previous claims wherein said central flat circular portion has a diameter of approximately $16/45 D$ and said convex annular portion has a radius of curvature of approximately $2.27/45D$ wherein D represents the distance between the outside peripheral surface of the longitudinal portion of the chime.

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