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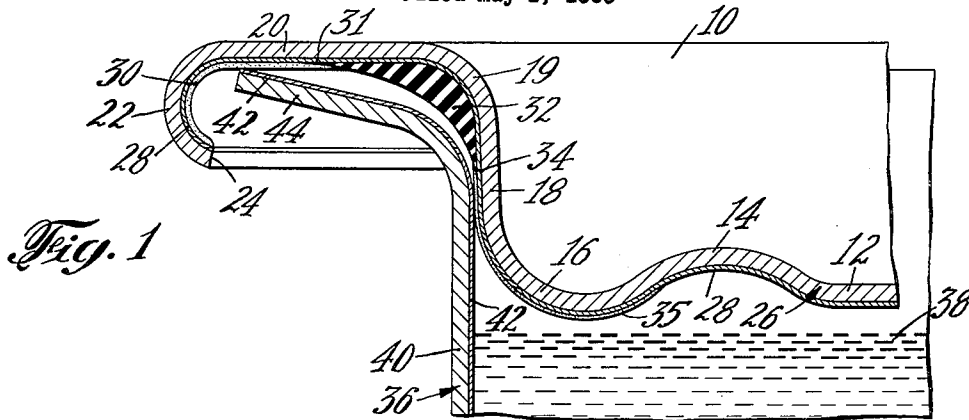
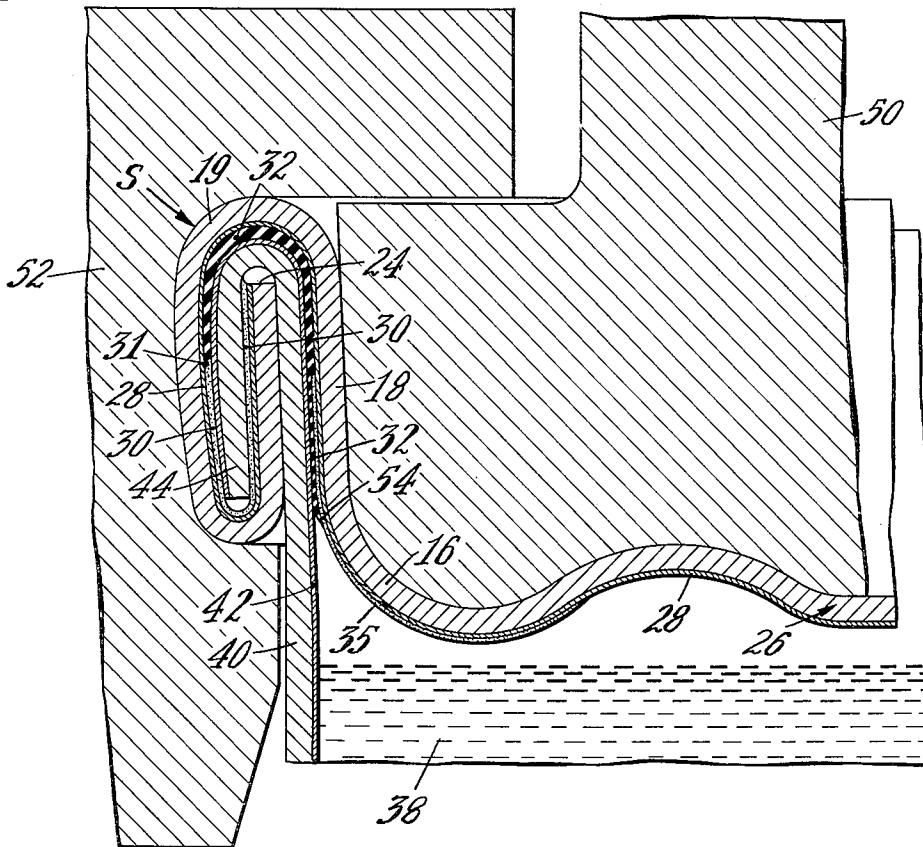


Fig. 2



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2,973,116

CONTAINER CLOSURE

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The present invention relates to container closures, and has particular reference to an end for a double seamed metal can which is provided with a multiple component lining system which functions not only to provide a tight, hermetic end seam but also to efficiently protect the metal in the end seam areas from attack by the product within the can.

In making the well known double seamed metal can for holding relatively corrosive products such as carbonated beverages, the can bodies and ends are usually coated interiorly with tin and a hard enamel or lacquer to prevent the product from coming into contact with the steel substrate of the container. During manufacture and closing of the can, however, this tin and enamel coating is subjected to shaping and forming pressures with the result that it sometimes is abraded and/or cracked or otherwise injured in such manner as to break its continuity and expose the underlying steel base of the can parts. As a result, the product gains access to the steel base of the can and reacts therewith to form iron salts which go into solution in the product and frequently adversely affect its flavor. Experience has shown that this breaking down of the can coating occurs most frequently in or immediately adjacent to the end double seams wherein the ends are secured to the can bodies.

One reason for this is that it is in this area that the end is worked most severely when it is drawn into its ultimate shape so that damage to its coating is present even prior to the double seaming operation. Another reason is that during the formation of the double seam, the countersink wall of the end and the contiguous portion of the opposed body wall are squeezed together under severe pressure to form the inner layers of the double seam. As a result, coating break down frequently occurs in this localized area which normally is unprotected by the end sealing compound and thus is easily accessible to the product.

In the conventional can end, a hard rubber-based lining compound is normally provided in the flange of the end in order to create a tight hermetic seal when the end is double seamed onto the can body. This compound is adherent to the enamel coating and prevents the product within the can from flowing into the interior layers of the double seam. However, the compound is usually so placed in the end channel that it extends from adjacent the flange curl to a point only partly up the countersink wall of the end. Complete coverage of the countersink wall by such compound prior to the sealing operation is rendered commercially impractical by the fact that if such compound is placed on the countersink wall of the end beyond the level of the edge of the flange curl, it comes into contact with and sticks to the adjacent can end when the ends are arranged in stack formation, thus causing blocking and misfeeding of the ends in the seaming machine. This hard compound which is used to obtain a good hermetic seal has little tendency to spread out or flow during the double seaming operation, with the result that portions of the vulnerable inner layers

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of the double seam remain uncovered and thus unprotected by compound in the finished end seam. If a softer, more flowable sealing compound is used, the seaming pressures can be utilized to cause the compound to be squeezed into this vulnerable area, but those soft compounds sacrifice sealing efficiency, with the result that the hermetic seal of the double seam is frequently adversely affected. Also, it is extremely difficult to prevent such compounds from being squeezed from the outer layers of the double seam onto the exterior of the seamed body.

The present invention provides an end construction which provides effective coverage of this vulnerable area, combined with the full sealing efficacy of the usual double seam. This is accomplished by utilizing a multicomponent lining system on the metal end wherein the components cooperate to provide a tightly sealed finished container which is highly resistant to metal pickup by the product.

The first component is a thin film of a comparatively hard, rubber-based sealing compound which extends from the curled flange edge to a line approximately midway of the flange.

The second component comprises a heavy application of a comparatively soft rubber-based sealing compound which extends inwardly along the flange from the hard sealing compound and thence along the outer portion of the countersink wall to the level of the flange curl. The amount of this component applied is in excess of the amount which can be accommodated in a finished double seam without displacement due to seaming pressures.

It is desirable to also utilize a third component comprising a very thin film of a flexible nonblocking wax to extend from the soft, rubber-based compound inwardly along the remaining or inner portion of the countersink wall and then around the curved wall at the base of the countersink wall, which curved wall is commonly known as the countersink radius. The coating in the areas covered by the wax is especially subject to cracking because of the severe drawing action which it undergoes in the end forming press and the main function of the wax is to seal off the cracks which are formed in these areas prior to the double seaming operation.

During the double seaming operation, the body and end flanges are rolled together to form the interlocked double seam. During the final portion of this operation, these flanges are squeezed or pressed together under considerable pressure in order to form a compact seam wherein the three sealing components are effectively disposed between all of the layers of the seam to provide a tight hermetic seam structure highly resistant to corrosion by the product. The first lining component, which is carried on the outer marginal portion of the end flange, is the comparative hard compound which is resistant to displacement due to the squeezing action of the metal seam layers upon it but which has excellent seal forming qualities. As a result, this compound stays in place, and provides a tight hermetic seal between the outer layers of the double seam.

The second component, which is disposed inwardly of the first component, is the softer, rubber-based compound which is applied in a quantity in excess of the amount needed to seal the area to which it is actually applied. This compound is extrudable at the room temperatures at which the double seaming operation takes place, and consequently is easily displaced when subjected to the squeezing pressures of the seaming operation. However, its displacement in a direction toward the peripheral edge of the can end is prevented by the first, non-squeezable compound, which completely fills the spaces between the outer seam layers and thus presents a barrier to the outward displacement of the squeezable compound. As a

result, this squeezable compound is forced to flow in the opposite direction, that is, inwardly, toward the interior of the can. Thus, it flows along the bottom countersink wall portion, covering the wax lining on this portion, and interposes itself between the portion of the countersink wall of the end and the opposing portion of the body wall immediately outwardly thereof, i.e. it completely fills up the space between the inner layers of the double seam.

As a result, this soft compound cooperates with the wax lining in this area to effectively seal whatever new cracks may be created in these very vulnerable inner layers of the double seam and thus prevents iron pickup which would otherwise result. The combined sealing action of this soft sealing compound and the wax is particularly effective in sealing new cracks formed in the enamel of the body wall.

The third component, the wax coating, being extremely thin, is substantially undisplaced by the seaming operation and thus functions, in the seamed can, to seal off the cracks in the can coating on the countersink radius wall, and, as just stated, cooperates with the extruded soft rubber based compound to seal off the base portion of the inner layers of the seam from the corrosive product contained in the can.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a vertical section taken through a marginal portion of a can end made according to the principles of the instant invention, the end being shown in position on the upper end of a can body preparatory to the double seaming operation, and

Fig. 2 is a vertical section on an enlarged scale, showing the portions of the can body and end shown in Fig. 1 interfolded to form a double seam, the figure also showing portions of the seaming chuck and the second operation seaming roll.

As a preferred and exemplary embodiment of the instant invention, the drawings disclose a marginal portion of a can end 10 which is usually but not necessarily circular in shape. The end is formed with a central panel 12 which is preferably formed with a shallow reinforcing bead 14 which in turn merges into a curved wall 16 commonly known in the can making art as the countersink radius. From here the end extends upwardly into an annular, substantially vertical wall 18 which is slightly inclined outwardly to permit stacking of the ends. The wall 18, which is commonly known as a countersink wall, curves outwardly around a corner 19 and merges into a horizontally extending flange 20 which at its outer end is provided with a downwardly and inwardly extending open curl 22 which terminates in a raw edge 24.

The can end 10 is formed from a steel base 26 which is usually coated on both sides with a thin layer of tin (not shown for the sake of simplicity). In addition, at least the inner surface of the end is provided with a thin coating 28 of a hard enamel or lacquer which, together with the tin, protects the steel base and prevents the product in the finished can from gaining access thereto. The can end 10 is shaped from a flat sheet of precoated tin plate by a drawing action in a can end forming press. As a result of the severe working of the metal which obtains during this drawing action, the inner coating of the end, particularly in the area of the countersink radius 16, the countersink wall 18, and the flange 20 is frequently abraded and cracked, thereby exposing the steel base 26.

In order to protect these abraded areas in the finished can and also to insure a completely hermetic seal in the finished double seam, a multi-component end lining system is provided for the end 10. The first component of this system comprises a thin film of a comparatively hard, rubber-based compound 30 which has the property of

being substantially non-extrudable at normal room temperatures. This compound 30 extends from the raw curl edge 24 completely around the curl 22 and then inwardly along the can flange 20 to a line 31 approximately midway thereof. The second component of the system comprises a comparatively soft, rubber-based compound 32 which has the property of being easily extrudable or squeezable at normal room temperatures and extends inwardly from the inner edge of the compound 30 along the remainder of the flange 20, around the curved corner 19, and partly along the upper portion of the countersink wall 18 to a line 34 which is approximately coplanar with the raw edge 24 of the flange curl 22. It would be desirable to extend this compound much further along the countersink wall 18 beyond this line 34, but this cannot be done as a practical commercial matter since the compound would come into contact with the subjacent end when the ends are stacked, and, being somewhat tacky, would adhere thereto with obviously undesirable results.

As seen in Fig. 1, the extrudable compound 32 is applied in an abnormally heavy layer, especially at the corner 19, in order to provide an amount of compound 32 in excess over that which would normally be required to form a seal between the portion of the end 10 which it initially covers and the facing portions of the can body in the final double seam. The reason for this excess will be hereinafter explained.

The third component of the end lining system of the instant invention is a very thin film of a flexible, non-blocking wax 35 which extends from the bottom edge 34 of the extrudable compound 32 along the lower part of the countersink wall 18 and around the countersink radius 16. As can be seen in the drawings, the wax 35 and the extrudable compound 32 cooperate to completely cover the inner coating 28 carried by the inner surfaces of the countersink wall 18 and the countersink radius 16. Thus, any cracks or abrasions which are formed in this portion of coating 28 during the end drawing operation are sealed off prior to the double seaming operation.

Figure 1 shows the lined can end 10 seated on the open upper end of a can body 36, which is filled with a corrosive liquid product 38 such as carbonated soda, preparatory to being double seamed thereto. The can body 36, as is the end 10, is formed of a steel substrate 40 which is coated on both sides with a thin layer of tin (not shown) and is also coated on at least its inner surface with a thin film of a hard protective enamel or lacquer 42. As seen in this figure, the body 36 is formed with an outwardly flaring flange 44 which is dimensioned to pass within the raw edge 24 of the end curl 22. The body 36 is preferably formed from a flat body blank bent to tubular form and provided with a lock and lap side seam (not shown).

With the end 10 thus positioned on the body 36, their adjacent parts are interfolded and pressed together to form a conventional multi-layer double seam which is generally indicated by the letter S in Fig. 2. This double seaming is effected by a conventional double seaming machine which includes among its operating parts a seaming chuck 50 which engages within the recessed portion of the end 10, and a first and a second operation seaming roll which engage against the exterior surfaces of the end flange 20 and curl 22 to reshape the parts and press them together to form the double seam S. In Figure 2 a fragmentary portion 52 of the second operation seaming roll is illustrated in its position at the completion of the double seaming operation. As can be seen in Fig. 2, the double seam comprises five layers of metal, the first three layers, reading from left to right in Fig. 2, comprising the interlocked end and body flanges 44 and 20, while the fourth layer comprises the upper portion of the body 36 and the fifth layer comprises the countersink wall 18 of the end 10. As also seen, the hard non-extrudable sealing compound 30 is not appreciably displaced by the seaming

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pressures exerted upon these parts by the seaming roll 52 and chuck 50. Thus, this compound 32 still covers only the portions of the end flange 20 to which it was originally applied, and thus is interposed between the three outer layers of the double seam A. In this position, it effectively seals these layers and provides the reliable hermetic seal which is required in a commercial double seam.

The double seaming action, however, causes the extrudable compound 32 to flow within the seam A. This can be easily observed by observing that the average thickness of the layer of this compound 32 in the finished double seam S is less than that of the layer originally applied, as seen in Fig. 1. The flow or extrusion of the extrudable compound 32 in a direction toward the outer layers of the double seam S is prevented by the fact that the non-extrudable film 30 completely fills the spaces between these outer layers and functions as a barrier or dam which bars the compounds 32 from squeezing outwardly. Thus, the extrudable compound 32 is forced to flow downwardly along the bottom portion of the countersink wall 18 toward the interior of the can, thus interposing itself between the two inner layers of the double seam S. The distance through which this extrudable compound 32 is squeezed depends, of course, upon the amount initially deposited on the end 10 and on the final dimensions of the double seam, which in turn depends on the seaming pressures utilized in forming the double seam. In practice, these factors are so adjusted that the compound 32 just reaches the base of the countersink wall 18, at about the point 54 at which the countersink radius 16 begins (see Fig. 2).

During this movement of the extrudable compound 32, it overlaps the wax 35 which coats the bottom portion of the countersink wall 18 and intermixes therewith to some extent. As a consequence, both the wax 35 and the compound 32 cooperate in sealing off the lower portion of the inner layer of the double seam S and thus plug up any gaps or discontinuities in the internal enamel and/or tin coatings of both the body 36 and end 10 in this area of the double seam, which area directly faces the interior of the finished can and thus would otherwise be exposed to the corrosive action of the contents.

As seen in Fig. 2, the thin wax film 35 remains substantially undisplaced by the double seaming action, although it may be thinned somewhat between the inner layers of the double seam S due to the pressures exerted on it. However the protection it affords to the countersink radius 16 remains unaffected by the double seaming operation.

It can thus be easily seen that as a result of the cooperative effect of the three components of the end lining system, the subject invention makes possible an improved double seamed container construction which is both hermetically tight and resistant to the corrosive action of the product.

It will be appreciated that the lining system of the instant invention is particularly effective in preventing corrosion in the cross-over area of a double seamed can. This cross-over area is the area at which the two thickness lap portion of the can usual lock and lap can body side seam extends upwardly into the double seam S. Since it is at this cross-over area that extra thicknesses of the can body must be dealt with during the double seaming operation, it is here that the greatest pressures are exerted and damage to the internal coatings of the can body and end most frequently occurs. The drawings do not disclose the construction of this cross-over area, but its construction is well known to everyone familiar with the can making art.

It will be obvious that substantial improvement in the performance of the finished can will result even if the wax lining component 35 is omitted, although the wax 35 is necessary for optimum performance. When the wax 35 is thus omitted, the non-extrudable compound 30 and the extrudable compound 32 still act in the herein-

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before described manner. Thus, the compound 30 still seals the outer seam layers and forms a barrier to the outward flow of the extrudable compound 32 with the result that the latter is squeezed into the space between the two inner layers of the double seam S to about the same extent as shown in Fig. 2. The protective action of the wax 35, is, of course, lacking in this modification of the instant invention.

No attempt has been made to describe in detail the composition of the various components of the end lining system since the exact formulations used are not believed to be an integral part of the invention and since it is believed that oneskilled in the art could readily select compounds which are suitable for the components. However, as examples of the general composition of rubber-based compounds suitable for use as the components 30 and 32, reference is made to the rubber-based compounds disclosed in United States Patents 2,593,681, 2,692,245, and 2,880,184.

As disclosed in these patents, the rubber-based compounds contain substantial proportions of natural and/or synthetic rubbers or rubber co-polymers. In addition, suitable proportions of tackifying or plastizing resins and fillers such as zinc oxide and/or clay are utilized. The extrudability or squeezability of such compounds can be readily controlled by varying the types of rubbers used and also by varying the types of fillers used. Thus, in order to obtain compounds which are substantially non-extrudable for the purposes of this invention, rubbers or rubber copolymers having high Mooney viscosities can be used; also, high percentages of zinc oxide filler can be used to increase the resistance of such compounds to extrusion at room temperatures. In order to obtain compounds which are extrudable for the purposes of this invention, rubbers or rubber copolymers having lower Mooney viscosities can be used, and clay fillers can be substituted in whole or in part for the zinc oxide fillers. Variations in the Mooney viscosity of the rubber component of these lining compounds are also obtainable by the complete or partial curing of the rubber such as disclosed in U.S. Patent 2,701,895.

It is difficult to give a specific description of the necessary physical properties of rubber-based compounds suitable for the purposes of this invention, since the commonly used viscosity and tensile strength tests have little or no value in describing the characteristics of the dry compounds as they appear on the can ends just prior to double seaming. However, the below described method of testing such films has been devised and is believed to offer a practical and useful guide in preparing suitable compounds:

Three strips of tin plate, one inch wide and about six inches long, are provided. One of these strips is dipped into the compound to be tested, drained and dried. The film thickness should be between .002" and .004" and as uniform as possible, and the compound should cover at least 3" of the strip length. After drying, the drip edge is cut off, care being taken to avoid a burr on the metal. One of the undipped strips is then placed on each side of the dipped strip in contact with two linear inches of the compound, giving a total of 4 square inches of contact area (2 inches on each side). The total length of the assembly is around 10 inches, with the two undipped strips protruding in one direction from the contact area and the undipped portion of the dipped strip protruding in the other direction. The contact area is then placed in a rubber faced clamp which covers the whole contact area and exerts a pressure of 180 lbs. per square inch on the contact area in a direction normal to the strip surfaces. The protruding ends of the assembly are then clamped in the jaws of a Riehle tensile machine, the single dipped strip being clamped in one jaw and the two undipped strips being clamped in the other jaw. The Riehle tensile machine is set for a speed of .2 inch per minute and, using the 1000 lb. range of the machine, the machine is

run until the maximum reading is obtained, at which point the needle will drift back. The maximum readings which are obtained will be a measure of the cohesiveness of the particular compound being measured and is correlated to the extrudability of the dry compound at room temperatures.

Using this method, it will be found that compounds which may be designated as "non-extrudable," as the term is used in the present specification and claims, and which are suitable for use as compound 30 of the drawing, have a range of 446 to 526 lbs. and an average of 498 lbs. as determined by this test, while compounds which may be considered "extrudable" as this term is herein used, and which are suitable for use as compound 32, have a range of 156 to 190 and an average of 173 lbs., as determined by this test.

The wax lining 35 preferably comprises a non-blocking flexible wax composition containing a major proportion (preferably at least 90%) of microcrystalline wax, and, if desired a minor proportion of other materials such as paraffin, and/or polyethylene, and/or butyl rubber, the latter materials being added, among other purposes, to reduce the brittleness of the composition. Examples of suitable compositions and the method of applying them to the can end are disclosed in U.S. patent application Serial No. 581,950, filed May 1, 1956, in the name of Raymond M. Bartlett.

In actual practice, it has been found practical to first apply the compound 32 to the can end 10, after which the compound 30 and the wax 35 may be applied in such manner as to slightly overlap the compound 32 to thus insure continuity of coverage. However, it should be understood that satisfactory results can be obtained even if gaps exist between the various components of the lining system.

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 arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In an interiorly coated can end member which is formed with a depressed panel, a countersink wall which extends upwardly from said panel and a peripheral flange which extends outwardly from said countersink wall at an angle thereto and terminates in an open edge curl which extends downwardly and inwardly toward said countersink wall, said countersink wall extending downwardly beyond the edge of said curl, and said flange and curl and said countersink wall being adapted to be interlocked in double seamed engagement with the marginal end portion of an interiorly coated can body, the improvement which comprises a multi-component lining system for said can end, the first component of said system comprising a thin layer of a rubber-based compound which is non-extrudable at normal room temperatures and is carried on the outer portion of said peripheral flange, and

the second component of said system comprising a heavy layer of a rubber-based compound which is extrudable at room temperatures and is carried on the inner portion of said peripheral flange and on a portion of said countersink wall above the plane of the edge of said flange curl, whereby when said end is secured to said can body in a double seam, said non-extrudable compound remains in place and creates a hermetic seal between the outer layers of said double seam and also forms a barrier against the movement of said extrudable compound toward the peripheral edge of said flange so that said extrudable compound is forced by the seaming pressures to flow in the opposite direction along said countersink wall toward the interior of the can to thereby interpose itself between and seal the inner layers of said double seam and shield them from the corrosive action of the product within the container.

2. In an interiorly coated can end member which is formed with a depressed panel, a countersink radius wall, a countersink wall which extends upwardly from said countersink radius wall, and a peripheral flange which extends outwardly from said countersink wall at an angle thereto and terminates in an open edge curl which extends downwardly and inwardly toward said countersink wall, said countersink wall extending downwardly beyond the edge of said curl, and said flange and curl and said countersink wall being adapted to be interlocked in double seamed engagement with the marginal end portion of an interiorly coated can body, the improvement which comprises a multi-component lining system for said can end, the first component of said system comprising a thin layer of a rubber-based compound which is non-extrudable at normal room temperatures and is carried on the outer portion of said peripheral flange, the second component of said system comprising a heavy layer of a rubber-based compound which is extrudable at room temperatures and is carried on the inner portion of said peripheral flange and on a portion of said countersink wall above the plane of the edge of said flange curl, the third component of said system comprising a thin film of a non-blocking wax which is deposited on the remaining portion of said countersink wall and on said curved countersink radius, whereby when said end is secured to said can body in a double seam, said non-extrudable compound remains in place and hermetically seals the outer layers of said seam and forms a barrier against the movement of said extrudable compound toward the peripheral edge of said flange so that said extrudable compound is forced to flow in the opposite direction along said countersink wall toward the interior of the can to cooperate with said wax film to fill and seal the space between the inner layers of said double seam and shield said layers from the corrosive action of the product within the container.

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