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(54) **LIGHTWEIGHT CLOSURE WITH TAMPER BAND**

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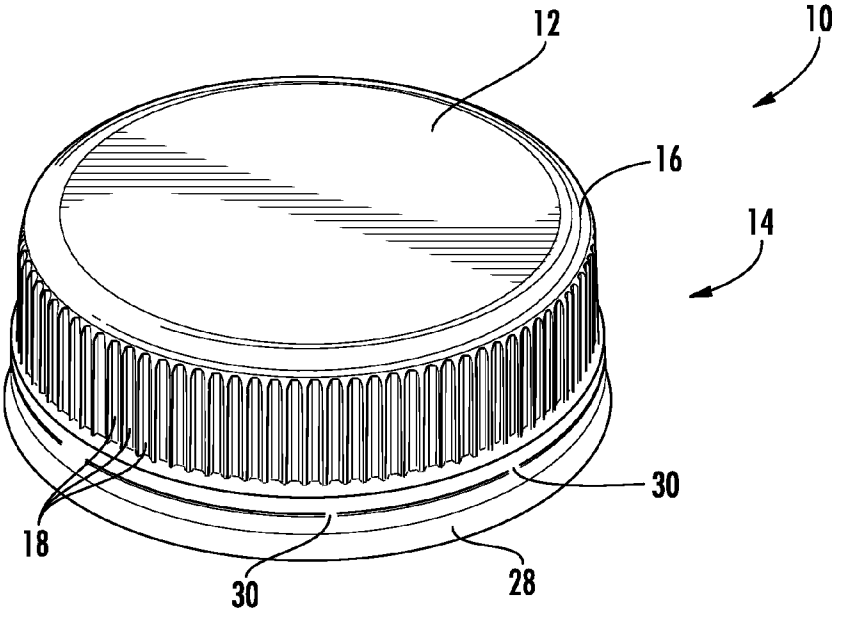
(57) **ABSTRACT**

A light weight, reinforced, molded, plastic closure is provided. The closure includes an end wall and a sidewall. A portion of the end has been substantially thinned such that the portion of the end wall is substantially thinner than other portions of the closure such as the sidewall or outer peripheral end wall area. The closure may also include interrupted threads that also contributes to the low weight of the closure.



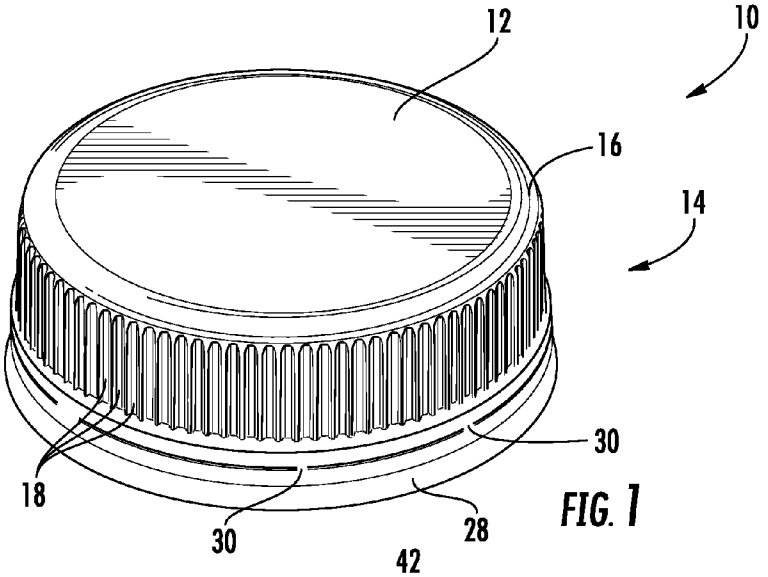


FIG. 1

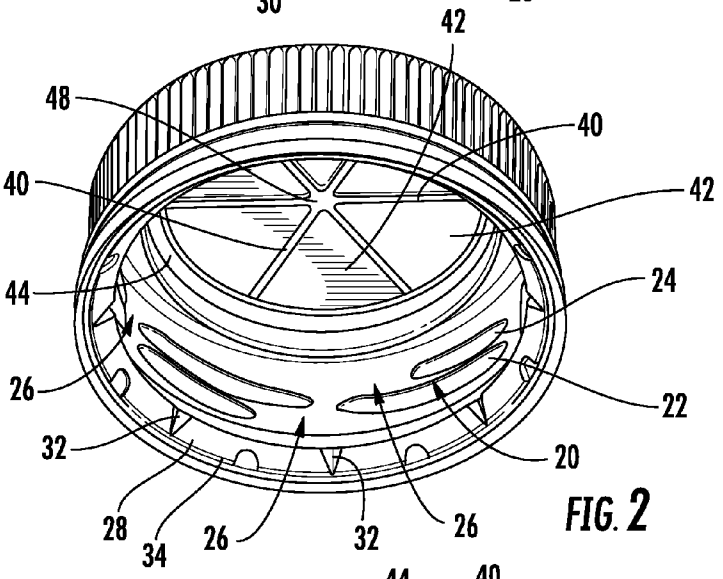


FIG. 2

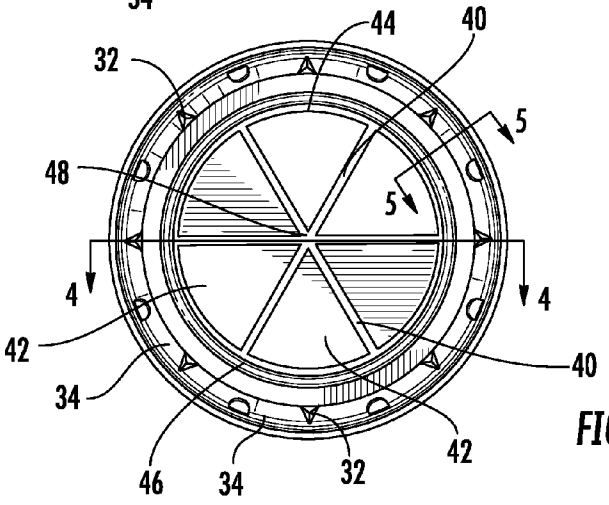


FIG. 3

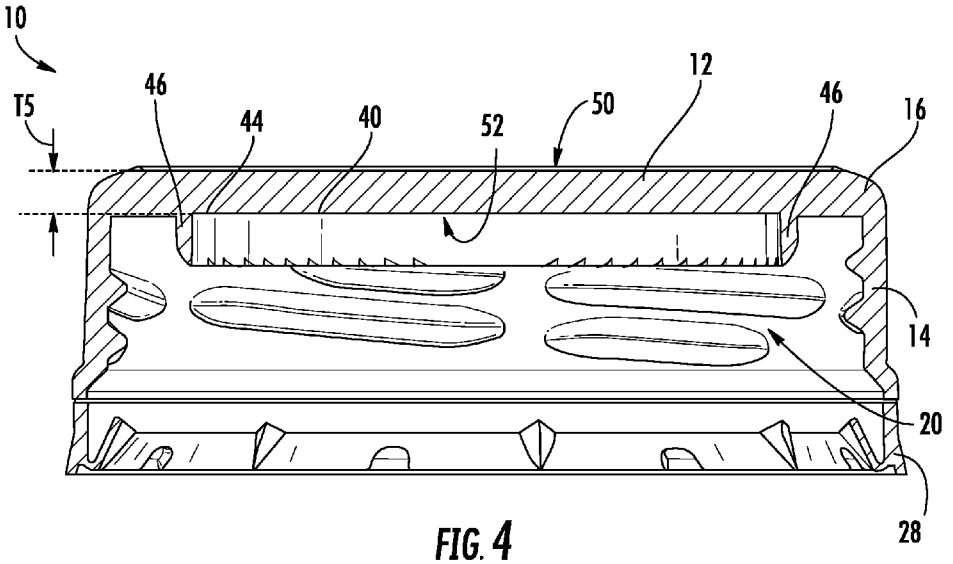


FIG. 4

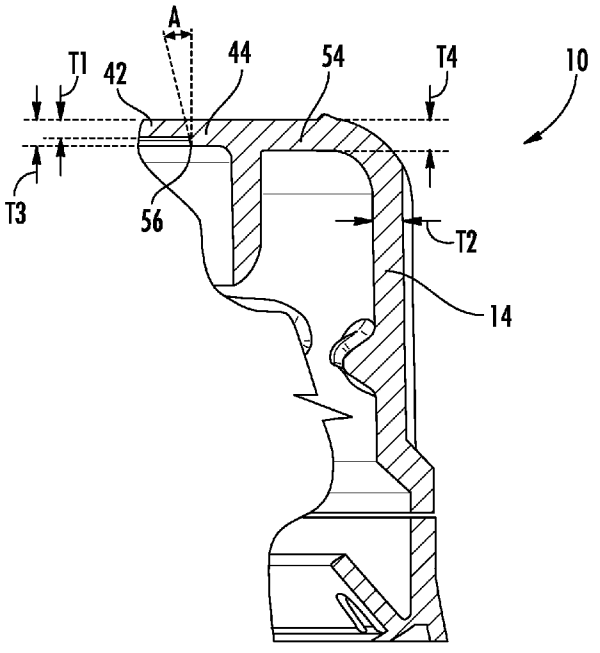


FIG. 5

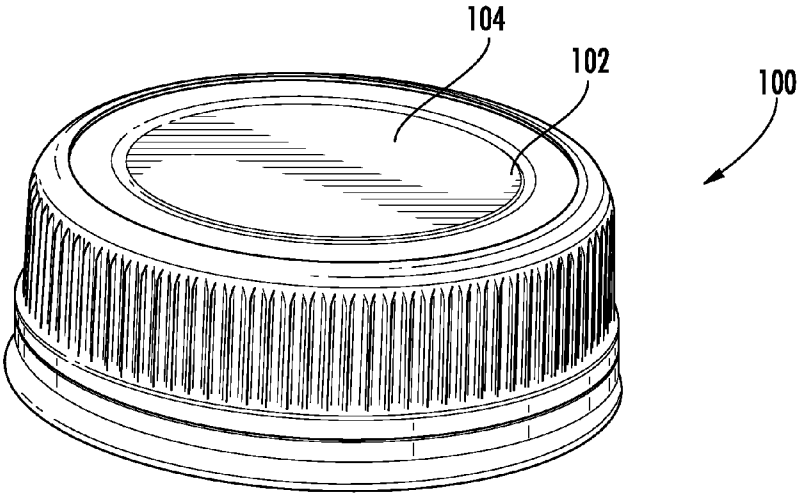


FIG. 6

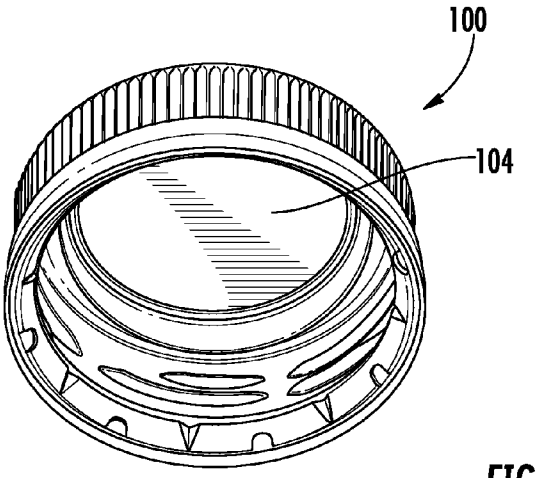


FIG. 7

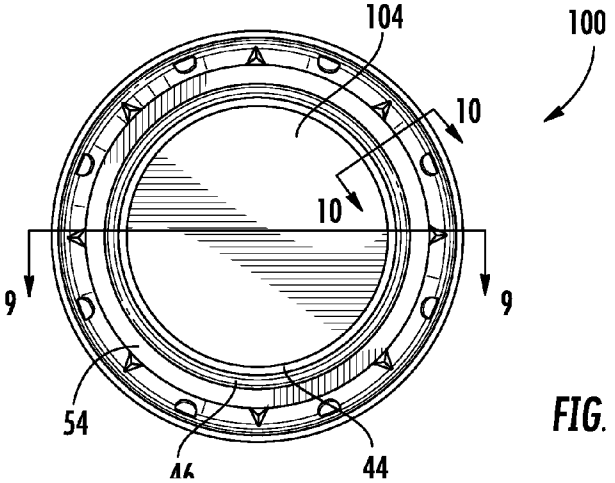


FIG. 8

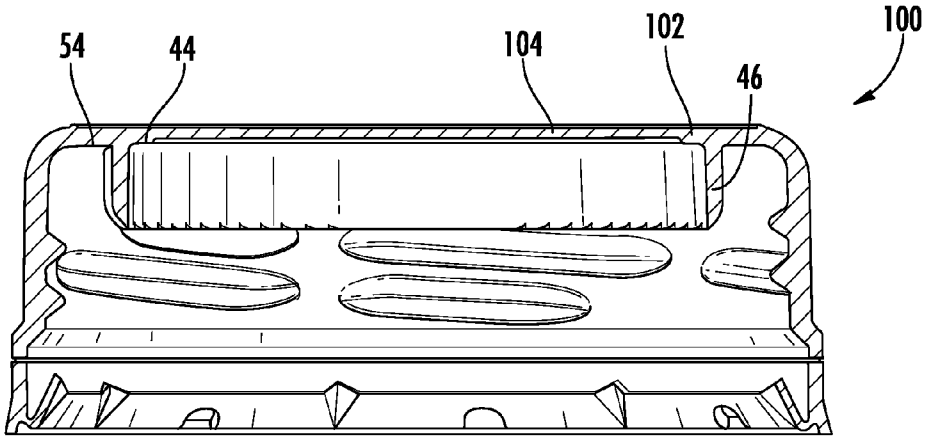


FIG. 9

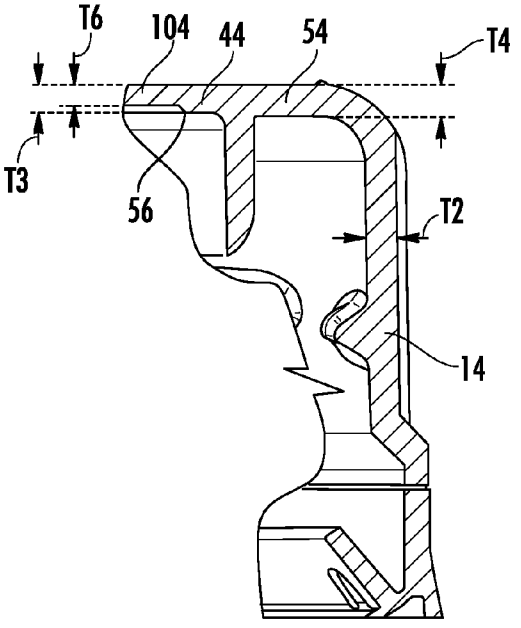


FIG. 10

LIGHTWEIGHT CLOSURE WITH TAMPER BAND

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a closure for closing a container such as a dairy container. In particular, the present invention relates to a closure having one or more feature providing a strong or reinforced closure while also allowing the total weight of the closure to be decreased relative to conventional closures.

SUMMARY OF THE INVENTION

[0002] One embodiment of the invention relates to a light weight, reinforced, molded, plastic closure. The closure includes an end wall including an outer peripheral edge, an upper surface, a lower surface and a first thickness measured between the upper and lower surfaces. The closure includes a sidewall extending downward and away from the outer peripheral edge of the end wall, and the sidewall includes an inner surface, an outer surface and a second thickness measured between the inner and outer surfaces. The closure includes a container engagement structure extending radially inward from the inner surface of the sidewall. The closure includes a tamper-indicating band extending from a lower end of the sidewall, and the tamper-indicating band has a frangible section configured to break upon opening to provide a visual indication that the closure had been opened. The closure includes a plurality of raised ribs extending radially outward from the outer surface of the sidewall and extending along the sidewall at least a portion of the distance between the outer peripheral edge and the tamper-indicating band. The first thickness is less than 75% of the second thickness.

[0003] Another embodiment of the invention relates to a plastic closure. The closure includes an end wall having an outer peripheral edge, an upper surface, a lower surface and a first thickness measured between the upper and lower surfaces. The closure includes a sidewall extending downward and away from the outer peripheral edge of the end wall, and the sidewall includes an inner surface and an outer surface. The closure includes a container engagement structure extending radially inward from the inner surface of the sidewall. The closure includes a tamper-indicating band extending from a lower end of the sidewall, and the tamper-indicating band has a frangible section configured to break upon opening to provide a visual indication that the closure had been opened. The closure includes a plug extending downward from the lower surface of the end wall, and the plug is a continuous wall located within the outer peripheral edge of the end wall. The end wall includes an inner portion located within the plug and an outer portion located between the plug and the outer peripheral edge of the end wall. The first thickness is a thickness of the inner portion of the end wall, and the outer portion of the end wall has a second thickness. The first thickness is less than 75% of the second thickness.

[0004] Another embodiment of the invention relates to a molded, plastic closure. The closure includes an end wall including an outer peripheral edge, an upper surface, a lower surface and a first thickness measured between the upper and lower surfaces. The closure includes a sidewall extending downward and away from the outer peripheral edge of the end wall. The sidewall includes an inner surface, an outer surface and a second thickness measured between the inner and outer surfaces. The closure includes threading comprising a series of threads configured to engage cooperating threads of a container, and each thread of the threading includes at least four interrupts in which a section of the inner surface of the sidewall is located along the path of the thread. The closure includes a tamper-indicating band extending from a lower end of the sidewall, and the tamper-indicating band has a frangible section configured to break upon opening to provide a visual indication that the closure had been opened. The closure includes a sealing ring extending downward from the lower surface of the end wall, and the sealing ring is a circumferentially continuous annular wall and is substantially concentric with the outer peripheral edge of the end wall. The end wall includes an inner portion located within the sealing ring and an outer portion located between the sealing ring and the outer peripheral edge of the end wall. The first thickness is a thickness of the inner portion of the end wall, and the outer portion of the end wall has a third thickness. The first thickness is less than 75% of the second thickness and less than 75% of the third thickness, and at least 60% of the area of the lower surface of the end wall is located within the sealing ring.

[0005] Various embodiments of the invention relate to any of the features, structures, elements, parameters, method steps, systems, components, subsystems, etc. described and shown herein, and various embodiments of the invention relate to any combination the features, structures, elements, parameters, method steps, systems, components, subsystems, etc. described and shown herein.

[0006] Alternative exemplary embodiments relate to other features and combinations of features as may be generally recited in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] This application will become more fully understood from the following detailed description, taken in conjunction with the accompanying figures, wherein like reference numerals refer to like elements in which:

[0008] FIG. **1** is a perspective view from above of a closure according to an exemplary embodiment;

[0009] FIG. **2** is perspective view from below of the closure of FIG. **1** according to an exemplary embodiment;

[0010] FIG. **3** is a bottom plan view of the closure of FIG. **1** according to an exemplary embodiment;

[0011] FIG. **4** is a side cross-sectional view of the closure of FIG. **1** taken along line **4-4** shown in FIG. **3** according to an exemplary embodiment;

[0012] FIG. **5** is a detailed side cross-sectional view of the closure of FIG. **1** taken along line **5-5** shown in FIG. **4** according to an exemplary embodiment;

[0013] FIG. **6** is a perspective view from above of a closure according to another exemplary embodiment;

[0014] FIG. **7** is perspective view from below of the closure of FIG. **6** according to an exemplary embodiment;

[0015] FIG. **8** is a bottom plan view of the closure of FIG. **6** according to an exemplary embodiment;

[0016] FIG. **9** is a side cross-sectional view of the closure of FIG. **6** taken along line **9-9** shown in FIG. **8** according to an exemplary embodiment;

[0017] FIG. **10** is a detailed side cross-sectional view of the closure of FIG. **6** taken along line **10-10** shown in FIG. **8** according to an exemplary embodiment;

DETAILED DESCRIPTION

[0018] Referring generally to the figures, a lightweight closure having one or more reinforcement element is shown. In general, the closures discussed herein have a thin end wall and interrupted threading that allows the closure to be made using less material than typical conventional closures. However, reducing the amount of material (e.g., plastic) contained within the closure tends to result in a closure that is more prone to breakage or failure. Accordingly, the closure discussed herein includes various reinforcing elements that Applicant's have found provide both a lightweight closure and one that is sufficiently strong. For example, the closure discussed herein includes one or more localized thickened section in the end wall of the closure that provides strength at key areas of the closure (e.g., areas that tend to experience higher forces during filling, capping or handling) while allowing less material to be used in other areas. In addition, the features of the closure discussed herein provides higher capping efficiency (at least in some capping environments). For example it has been found that the closure discussed herein is flexible such that the closure is able to be bent slightly to snap the threading into place in situations where the capping machine has misaligned the closure with the container threading. This bending and increased capping efficiency is not provided by more rigid conventional closures.

[0019] Referring to FIG. **1**, a closure **10** is shown according to an exemplary embodiment. Closure **10** includes an end wall or top portion, shown as an top panel **12**. As shown, top panel **12** is generally circular in shape and is generally planar (i.e., the outer surface of top panel **12** is flat, positioned substantially in a single plane, shown as a generally horizontal plane in FIG. **1**A). Closure **10** includes a sidewall, shown as skirt **14**, and a transition section, shown as a corner section **16**. Corner section **16** extends outwardly and downwardly from the outer, peripheral edge of top panel **12**, and skirt **14** extends downwardly from the outer, peripheral edge of corner section **16**. As shown in FIG. **1**, skirt **14** is generally annular in cross-section and is substantially perpendicular to the plane defined by top panel **12**. Closure **10** also includes a plurality of raised ribs **18** extending radially outward from an outer surface of skirt **14**. As shown ribs **18** extend vertically along at least a portion of the vertical length of the outer surface of skirt **14**. Ribs **18** provide a texture or gripping surface that may facilitate opening of the closure.

[0020] As shown in FIG. **2**, closure **10** includes a container engagement structure, shown as threading **20**. Threading **20** extends inwardly from the inner surface of skirt **14**. Threading **20** is configured to engage corresponding threading present on the container to which closure **10** is attached. In various other embodiments, closure **10** may include other engagement structures, such as snap beads, lugs, etc.

[0021] In the embodiment shown, threading **20** comprises a series of raised, radially inwardly extending threads, shown as threads **22** and **24**. As will be understood threads **22** and **24** generally follow a helical path along the inner surface of closure **10** which allows the threads to engage the cooperating structures on the container. As shown in FIG. **2**, each of the threads of threading **20** includes at least one, and more specifically, at least four, interrupts **26**. Interrupts **26** are breaks in the thread such that a portion of the inner surface of skirt **14** having the same thickness as other regions of skirt **14** without threads are located along the path of adjacent thread sections. In other words, because threading **20** is formed by localized increase in thickness of the material of the closure to form the thread structure, interrupts **26** are simply regions where the increased thickness that forms that thread has not been formed.

[0022] Referring to FIGS. **1** and **2**, skirt **14** may include a tamper evidencing structure. In this embodiment, skirt **14** includes a tamper band **28** coupled to a lower end of skirt **14** by series of frangible connections **30**. Upon application of twisting force to closure **10** to remove closure **10** from a container neck, frangible connections **30** are configured to break, separating tamper band **28** from skirt **14**. This separation provides a visual indication to the user or purchaser of the container including closure **10** of whether closure **10** has previously been removed from the container.

[0023] As shown in FIG. **3**, tamper band **28** includes a plurality of pleats **32** and plurality of curved band sections **34** located between pleats **32**. In general, pleats **32** engage cooperating structures on the neck of the container to prevent closure **10** from being removed from the container without frangible connections **30** breaking. Further, pleats **32** also facilitate application of closure **10** on to the container by allowing tamper band **28** to expand without breaking frangible connections **30**. In the exemplary embodiment shown, closure **10** includes eight pleats **32** and eight curved band sections **34** located between each pleat **32** around the circumference of tamper band **28**. In other embodiments, closure **10** may include 6, 10, 12, 14, etc. pleats **32** depending on the size and application for a particular closure **10**.

[0024] As shown in FIG. **3**, closure **10** includes plurality of radially extending ribs, shown as reinforcement ribs **40**. As will be explained in more detail below, reinforcement ribs **40** are thickened sections of top panel **12** that act to reinforce thin end wall sections **42**. As shown in FIGS. **2** and **3**, reinforcement ribs **40** extend radially outward in a star-like shape to thickened end wall section **44** adjacent to sealing ring **46**. In this embodiment, reinforcement ribs **40** extend outward from a raised hub section **48** which is located at the center point of top panel **12**. As shown in FIG. **3**, both inner thickened end wall section **44** and sealing ring **46** are concentric with the outer peripheral edge of top panel **12** and with each other, and in the embodiment shown are concentric around hub **48**.

[0025] In various embodiments, sealing ring **46** is positioned such that a substantial portion of the area of top panel **12** is located within the inner radially facing surface of sealing ring **46**. In one embodiment, at least 60%, and more specifically, at least 70% of the area of top panel **12** is located within the inner radially facing surface of sealing ring **46**. In various embodiments, these relative percentages may relate to the area of the upper surface and/or the lower surface of top panel **12**.

[0026] Referring to FIG. **4**, a cross-sectional view taken through one of the reinforcement ribs **40** is shown according to an exemplary embodiment. As can be seen in FIG. **4**, the thickness of reinforcement ribs **40**, shown as T**5**, is the distance between upper surface **50** and lower surface **52** of closure **10**, and in the embodiment shown, the thickness of reinforcement rib **40** is substantially the same as the thickness through inner thickened end wall section **44**. Further, sealing ring **46** extends downward from lower surface **52** of top panel **12** forming a substantially annular ring within closure **10**. In various embodiments, sealing ring **46** is an annular, uninterrupted, continuous ring or wall extending

360 degrees from lower surface **52**. As will be understood, sealing ring **46** acts to engage a portion of the neck of the container to which closure **10** is attached to form a seal. In general, thickened end wall section **44** provides a reinforced area between thin end wall section **42** and sealing ring **46** that limits or prevents distortion of the end wall as sealing ring **46** engages with a container neck during sealing.

[0027] Referring to FIG. **5**, details of the thinned sections and the reinforcement sections of closure **10** are shown. Thin end wall section **42** of top panel **12** has a thickness shown as T**1**. Skirt **14** has a thickness shown as T**2** which is the base sidewall thickness at a position between raised ribs **18** and at a position not occupied by threading **20**. Thickened end wall section **44** has a thickness shown as T**3**.

[0028] In various embodiments, T**1** is less than 75% of T**2** and T**3**, and more specifically is less than 70% of T**2** and T**3**. In various embodiments, T**1** is between 0.01 inches and 0.03 inches, specifically is between 0.015 inches and 0.028 inches and more specifically is 0.020 inches plus or minus 0.003 inches. In various embodiments, T**2** is between 0.025 inches and 0.045 inches, specifically is between 0.030 inches and 0.040 inches and more specifically is 0.032 inches plus or minus 0.003 inches. In various embodiments, T**3** is between 0.02 inches and 0.04 inches, specifically is between 0.025 inches and 0.035 inches and more specifically is 0.030 inches plus or minus 0.003 inches.

[0029] As shown in FIG. **5**, top panel **12** includes an outer portion **54**. Outer portion **54** is located outside of sealing ring **46** and is concentric with sealing ring **46**, the outer peripheral edge of top panel **12**, and with inner thickened end wall section **44**. Outer portion **54** has a thickness shown as T**4**. In various embodiments, T**1** is less than 75% of T**4**, and more specifically is less than 70% of T**4**. Similar to thickened end wall section **44**, thickened outer portion **54** also acts to support sealing ring **46**. In various embodiments, T**4** is between 0.025 inches and 0.045 inches, specifically is between 0.030 inches and 0.040 inches and more specifically is 0.035 inches plus or minus 0.003 inches.

[0030] As shown in FIG. **5**, lower surface **52** of top panel **12** includes an angled transition section **56**. Angled transition section **56** provides a gradual transition between the lower thickness of thinned end wall sections **42** and thickened end wall section **44**. In the embodiment shown, angled transition section **56** defines an angle A relative to an axis perpendicular to top panel **12**. In various embodiments, angle A is between 0 and 20 degrees, specifically between 1 and 9 degrees, and more specifically is 5 degrees plus or minus 1 degree.

[0031] Referring back to FIG. **4**, reinforcement ribs **40** have a thickness T**5**. In one embodiment, T**5** is the same as T**3** discussed above. In various embodiments, T**1** is less than 75% of T**5** and more specifically is less than 70% of T**5**. In various embodiments, T**5** is between 0.02 inches and 0.04 inches, specifically is between 0.025 inches and 0.035 inches and more specifically is 0.030 inches plus or minus 0.003 inches.

[0032] In order to provide substantial light weighting and materials savings, a substantial portion of top panel **12** is formed at thickness T**1**. In various embodiments, at least 50% of top panel **12** has a thickness at T**1** as discussed herein, and in a specific embodiment, at least 75% of top panel **12** has a thickness at T**1** as discussed herein. In various embodiments, the percent of top panel **12** having thickness T**1** is determined by the percentage of the surface area of lower surface **52** at which top panel **12** has thicknesses of T**1** as discussed herein relative to the total surface area of lower surface **52**. In various embodiments, the absolute and relative thicknesses discussed herein may relate to the average thicknesses within particular regions of the closure, and in other embodiments, the absolute and relative thicknesses discussed herein may relate to a thickness measured at one or more positions within a particular regions of closure **10**.

[0033] In various exemplary embodiments, Applicants have found that the various relative thicknesses, absolute thicknesses and dimensions discussed herein provide various functional improvements including a satisfactorily strong closure while also reducing the overall weight of the closure. In addition, the closure design discussed herein provides a cap that maintains a seal on a container while also having a reduced weight. Further, the closure design discussed herein provides a cap that decreases the rate of capping errors by the capping machinery due to the flexibility of the lightweight closure (particularly in skirt **14** provided by interrupted threading **20**). This flexibility allows snap on of closure **10** in the event of misalignment of the threads of the closure and of the cap. These functional improvements are believed to result directly from the various relative thicknesses and absolute thicknesses discussed herein while at the same time providing a strong, robust, break-resistant closure able to seal tightly onto the container neck.

[0034] Referring to FIGS. **6-10**, another embodiment of reinforced, light weight closure, shown as closure **100**, is shown. Closure **100** is substantially the same as closure **10** except as discussed herein. Closure **100** includes an top panel **102** that is relative thin and light-weighted relative to other portions of closure **100**. As can be seen in FIGS. **7** and **8**, top panel **102** does not include reinforcement ribs. Rather, as shown in FIG. **9**, top panel **102** has a circular shaped thin central section **104** that has a substantially consistent thickness within thickened end wall section **44**. In various embodiments, thin central section **104** may have a thickness that is not as thin as sections of **42** of closure **10**, but rather reinforces thin central section **104** by having a slightly higher but even thickness.

[0035] Referring to FIG. **10**, thinned central section **104** has a thickness shown as T**6**. In various embodiments, T**6** is less than 75% of T**2**, T**3** and T**4**, and more specifically is less than 70% of T**2**, T**3** and T**4**. In various embodiments, T**6** is between 0.01 inches and 0.03 inches, specifically is between 0.015 inches and 0.028 inches and more specifically is 0.022 inches plus or minus 0.003 inches.

[0036] In order to provide substantial light weighting and materials savings a substantial portion of top panel **102** is formed at thickness T**6**. In various embodiments, at least 50% of top panel **102** has a thickness at T**6** as discussed herein, and in a specific embodiment, at least 75% of top panel **12** has a thickness at T**6** as discussed herein. In various embodiments, the percent of top panel **102** having thickness T**6** is determined by the percentage of the surface area of lower surface **52** at which top panel **102** thicknesses T**6** as discussed herein relative to the total surface area of lower surface **52**. In various embodiments, the absolute and relative thicknesses discussed herein may relate to the average thicknesses within particular regions of closure **100**, and in other embodiments, the absolute and relative thicknesses discussed herein may relate to a thickness measured at one or more positions within a particular regions of closure **100**.

[0037] In various embodiments, the closures discussed herein may be used to seal a wide variety of containers. In various embodiments, the closures discussed herein are closures suitable for maintaining a hermetic seal. In various embodiments, closure **10** is a closure configured to seal a container configured to hold consumable or edible products (e.g., beverages, water, food, etc.). In various embodiments, closure **10** is configured to seal a container that is a molded (e.g., blow-molded) thermoplastic beverage container configured to hermetically hold a beverage (e.g., water, juice, fortified or nutrient water, tea, sports drink, energy drink, milk, milk-based beverages, etc.). In other embodiments, closure **10** can be used to seal a wide variety of containers including pouches, jars, metal bottles, paper board cartons, etc. In a specific embodiment, closure **10** is configured to seal a dairy container, such as a milk jug or milk carton.

[0038] In various embodiments, the closure and spout discussed herein are made from plastic. In various embodiments, the closure and spout are made from compression molded plastic, and in other embodiments, the closure and spout are made from injection molded plastic. In various embodiments, the plastics include PE, PP, PET, PVC, etc.

[0039] It should be understood that the figures illustrate the exemplary embodiments in detail, and it should be understood that the present application is not limited to the details or methodology set forth in the description or illustrated in the figures. It should also be understood that the terminology is for the purpose of description only and should not be regarded as limiting.

[0040] Further modifications and alternative embodiments of various aspects of the invention will be apparent to those skilled in the art in view of this description. Accordingly, this description is to be construed as illustrative only. The construction and arrangements, shown in the various exemplary embodiments, are illustrative only. Although only a few embodiments have been described in detail in this disclosure, many modifications are possible (e.g., variations in sizes, dimensions, structures, shapes and proportions of the various elements, values of parameters, mounting arrangements, use of materials, colors, orientations, etc.) without materially departing from the novel teachings and advantages of the subject matter described herein. Some elements shown as integrally formed may be constructed of multiple parts or elements, the position of elements may be reversed or otherwise varied, and the nature or number of discrete elements or positions may be altered or varied. The order or sequence of any process, logical algorithm, or method steps may be varied or re-sequenced according to alternative embodiments. Other substitutions, modifications, changes and omissions may also be made in the design, operating conditions and arrangement of the various exemplary embodiments without departing from the scope of the present invention.

[0041] For purposes of this disclosure, the term "coupled" means the joining of two components directly or indirectly to one another. Such joining may be stationary in nature or movable in nature. Such joining may be achieved with the two members and any additional intermediate members being integrally formed as a single unitary body with one another or with the two members or the two members and any additional member being attached to one another. Such joining may be permanent in nature or alternatively may be removable or releasable in nature.

[0042] In various exemplary embodiments, the relative dimensions, including angles, lengths and radii, as shown in the Figures are to scale. Actual measurements of the Figures will disclose relative dimensions, angles and proportions of the various exemplary embodiments. Various exemplary embodiments extend to various ranges around the absolute and relative dimensions, angles and proportions that may be determined from the Figures. Various exemplary embodiments include any combination of one or more relative dimensions or angles that may be determined from the Figures. Further, actual dimensions not expressly set out in this description can be determined by using the ratios of dimensions measured in the Figures in combination with the express dimensions set out in this description. It should also be understood that the terminology is for the purpose of description only and should not be regarded as limiting.

1. A light weight, reinforced, molded, plastic closure comprising:

an end wall including an outer peripheral edge, an upper surface, a lower surface and a first thickness measured between the upper and lower surfaces;

a sidewall extending downward and away from the outer peripheral edge of the end wall, the sidewall including an inner surface, an outer surface and a second thickness measured between the inner and outer surfaces;

a container engagement structure extending radially inward from the inner surface of the sidewall;

a tamper-indicating band extending from a lower end of the sidewall, the tamper-indicating band having a frangible section configured to break upon opening to provide a visual indication that the closure had been opened; and

a plurality of raised ribs extending radially outward from the outer surface of the sidewall and extending along the sidewall at least a portion of the distance between the outer peripheral edge and the tamper-indicating band;

a circumferentially continuous annular wall extending downward from the lower surface of the end wall;

the end wall including an inner section having an outer peripheral edge adjacent an inner surface of the annular wall and a center portion, the outer peripheral edge of the inner section and the center portion each having a third thickness;

at least a portion of the inner section located between the center portion and the outer peripheral edge of the inner section having a thickness equal to the first thickness;

wherein the first thickness is less than the third thickness; and

wherein the first thickness is less than 75% of the second thickness.

2. The closure of claim **1**, wherein the end wall includes an outer portion located between the annular wall and the outer peripheral edge of the end wall, wherein the outer portion of the end wall has a fourth thickness, wherein the first thickness is less than 75% of the fourth thickness.

3. The closure of claim **2** wherein the container engagement structure includes a threading comprising a series of threads configured to engage cooperating threads of a container, wherein each thread of the threading includes at least one interrupt in which a section of the inner surface of the sidewall is located along the path of the thread.

4. The closure of claim 3 wherein at least 60% of the area of the lower surface of the end wall is located within the annular wall, wherein each thread of the threading includes at least three interrupts.

5. The closure of claim 2, wherein the first thickness is less than 75% of the third thickness.

6. The closure of claim 5 wherein the first thickness is between 0.01 inches and 0.03 inches, wherein the second thickness is between 0.025 inches and 0.035 inches, wherein the fourth thickness is between 0.03 inches and 0.04 inches, and wherein the third thickness is between 0.02 inches and 0.04 inches.

7. The closure of claim 5 further comprising a series of radial ribs located along the end wall and extending radially outward from a center point of the end wall, wherein the radial ribs have a fifth thickness, wherein the first thickness is less than 75% of the fifth thickness.

8. The closure of claim 1 wherein at least 50% of the end wall has a thickness that is less than 75% of the second thickness.

9. The closure of claim 1 wherein the second thickness is measured between opposing vertical portions of the inner surface and outer surface of the sidewall at a position above the container engagement structure.

10. A plastic closure, comprising:

an end wall including an outer peripheral edge, an upper surface, a lower surface and a first thickness measured between the upper and lower surfaces;

a sidewall extending downward and away from the outer peripheral edge of the end wall, the sidewall including an inner surface and an outer surface;

a container engagement structure extending radially inward from the inner surface of the sidewall;

a tamper-indicating band extending from a lower end of the sidewall, the tamper-indicating band having a frangible section configured to break upon opening to provide a visual indication that the closure had been opened; and

a plug extending downward from the lower surface of the end wall, wherein the plug is a continuous wall located within the outer peripheral edge of the end wall;

wherein the end wall includes an inner portion located within the plug and an outer portion located between the plug and the outer peripheral edge of the end wall, the outer portion having a first peripheral edge located adjacent an outer surface of the plug and a second peripheral edge located adjacent the outer peripheral edge of the end wall;

wherein the first thickness is a thickness of the inner portion of the end wall;

wherein at least a portion of the outer portion of the end wall has a second thickness;

wherein the first thickness is less than 75% of the second thickness; and

wherein the thickness of the first peripheral edge is substantially the same as the thickness of the second peripheral edge.

11. The closure of claim 10 wherein the sidewall includes a third thickness measured between the inner and outer surfaces, wherein the first thickness is less than 75% of the third thickness.

12. The closure of claim 11 wherein the container engagement structure includes a threading comprising a series of threads configured to engage cooperating threads of a container, wherein each thread of the threading includes at least one interrupt in which a section of the inner surface of the sidewall is located along the path of the thread.

13. The closure of claim 12 wherein at least 60% of the area of the lower surface of the end wall is located within the plug, wherein each thread of the threading includes at least three interrupts.

14. The closure of claim 13 wherein the inner portion of the end wall includes a thickened region that transitions into an inner surface of the sealing ring, the thickened region concentric with the plug and with the outer peripheral edge of the end wall, wherein the thickened region has a fourth thickness, wherein the first thickness is less than 75% of the fourth thickness.

15. The closure of claim 14 further comprising a series of ribs extending radially outward from a center point of the end wall, wherein the ribs have a fifth thickness, wherein the first thickness is less than 75% of the fifth thickness.

16. The closure of claim 15 wherein at least 50% of the end wall has a thickness that is less than 75% of the second thickness.

17. The closure of claim 16 wherein the first thickness is between 0.01 inches and 0.03 inches, wherein the second thickness is between 0.025 inches and 0.035 inches, wherein the third thickness is between 0.03 inches and 0.04 inches, and wherein the fourth thickness is between 0.025 inches and 0.035 inches.

18. The closure of claim 10 wherein the second thickness is measured between opposing vertical portions of the inner surface and outer surface of the sidewall at a position above the container engagement structure.

19. A molded, plastic closure comprising:

an end wall including an outer peripheral edge, an upper surface, a lower surface and a first thickness measured between the upper and lower surfaces;

a sidewall extending downward and away from the outer peripheral edge of the end wall, the sidewall including an inner surface, an outer surface and a second thickness measured between the inner and outer surfaces;

threading comprising a series of threads configured to engage cooperating threads of a container, wherein each thread of the threading includes at least three interrupts in which a section of the inner surface of the sidewall is located along the path of the thread;

a tamper-indicating band extending from a lower end of the sidewall, the tamper-indicating band having a frangible section configured to break upon opening to provide a visual indication that the closure had been opened; and

a sealing ring extending downward from the lower surface of the end wall, wherein the sealing ring is a circumferentially continuous annular wall and is substantially concentric with the outer peripheral edge of the end wall;

wherein the end wall includes an inner portion located within the sealing ring and an outer portion located between the sealing ring and the outer peripheral edge of the end wall, the inner portion having an outer periphery extending circumferentially about and adjacent to an inner surface of the sealing ring;

wherein the first thickness is a thickness of the inner portion of the end wall;

wherein the outer portion of the end wall has a third thickness;

wherein the first thickness is less than 75% of the second thickness and less than 75% of the third thickness;

wherein at least 60% of the area of the lower surface of the end wall is located within the sealing ring; and

wherein the thickness of the closure as measured about the outer periphery of the inner portion is substantially constant about the entirety of the circumference of the outer periphery.

20. The closure of claim **19** wherein the first thickness is between 0.01 inches and 0.03 inches, wherein the second thickness is between 0.025 inches and 0.035 inches, wherein the third thickness is between 0.03 inches and 0.04 inches.

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