March 15, 1966 A. P. SCHOLTZ 3,240,383

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Fig. 1

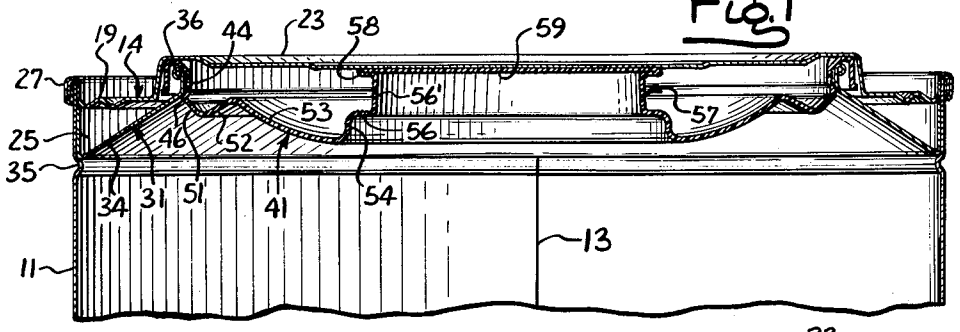


Fig. 2

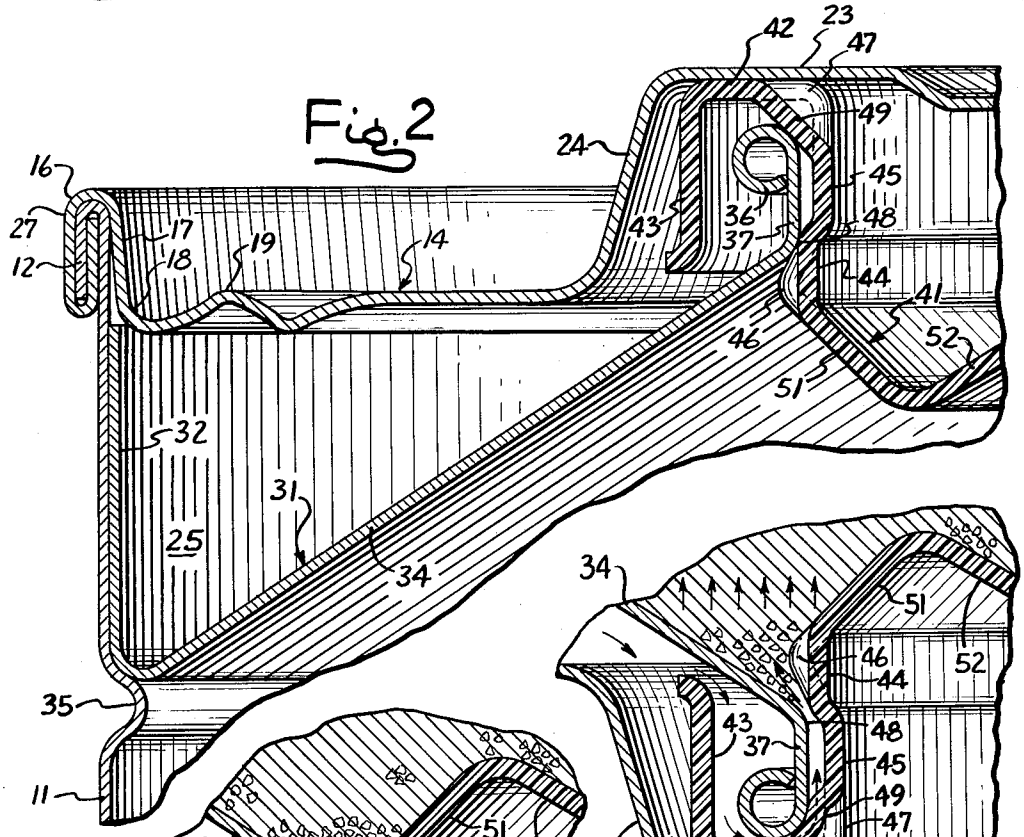


Fig. 3

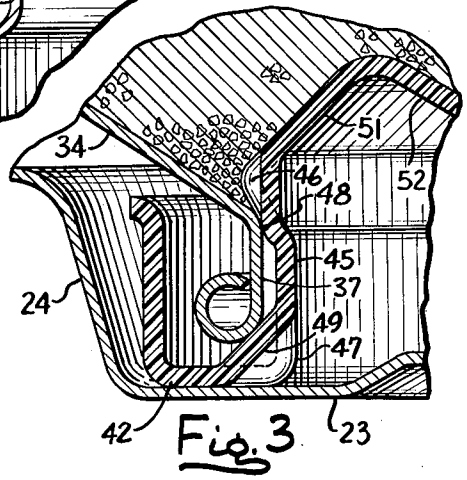


Fig. 4

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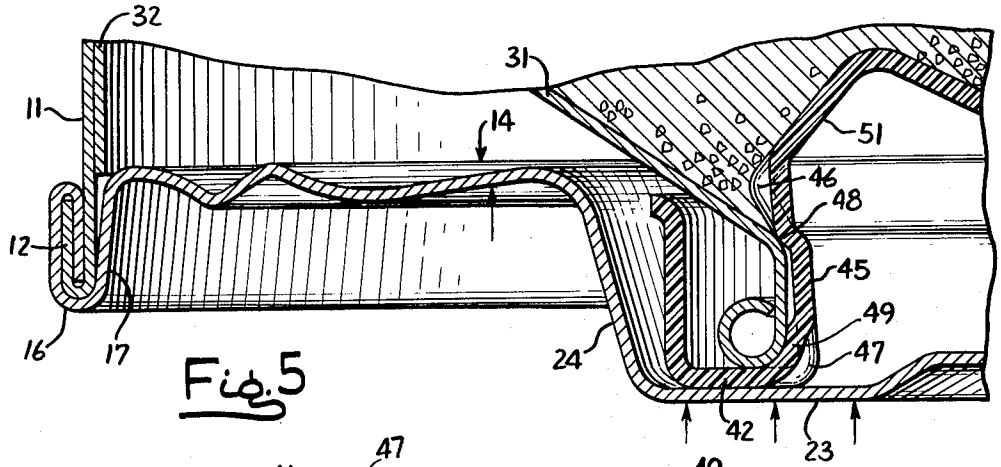


Fig. 5

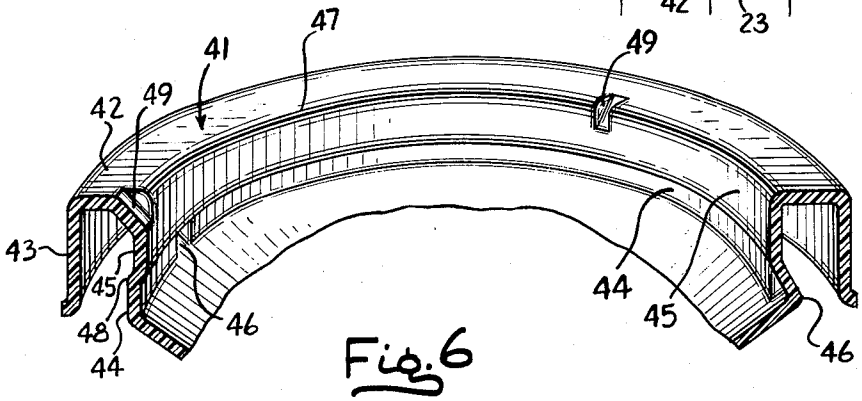


Fig. 6

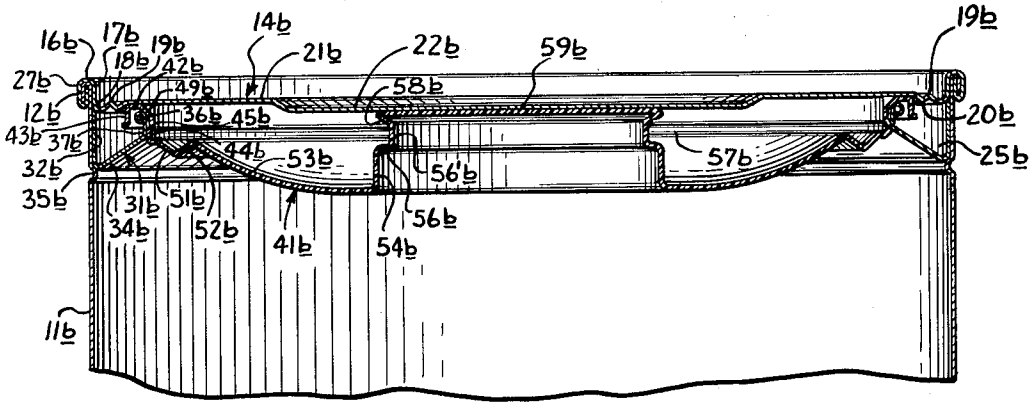


Fig. 7

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Fig. 8

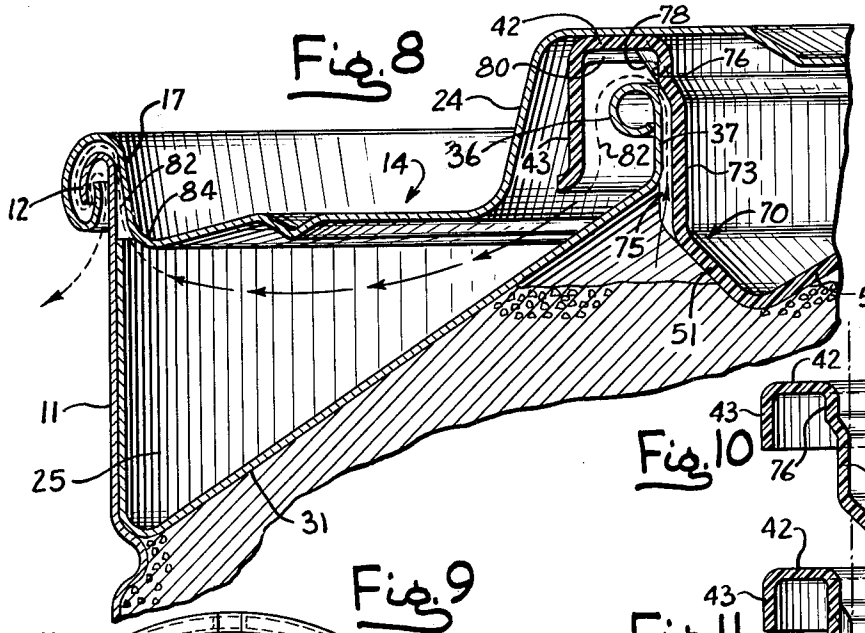


Fig. 10

Fig. 9

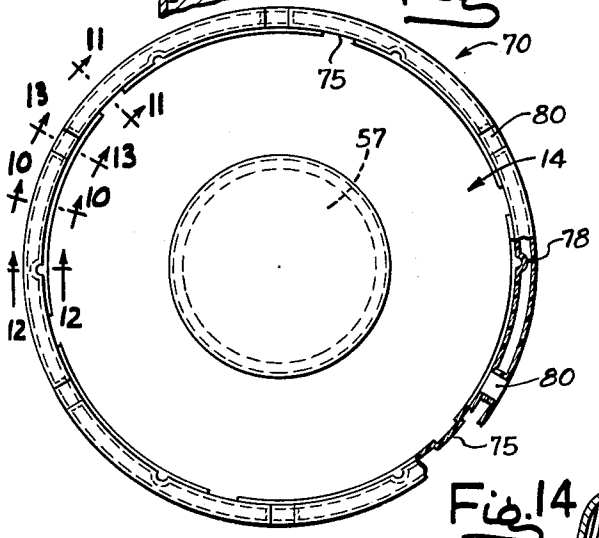


Fig. 11

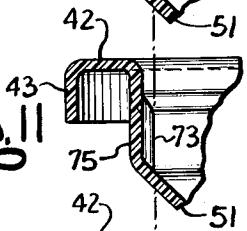


Fig. 12

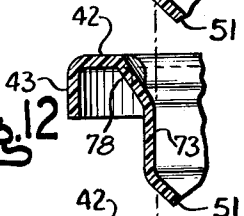


Fig. 13

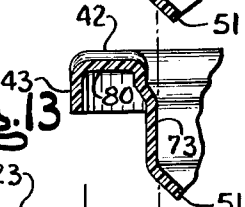


Fig. 14

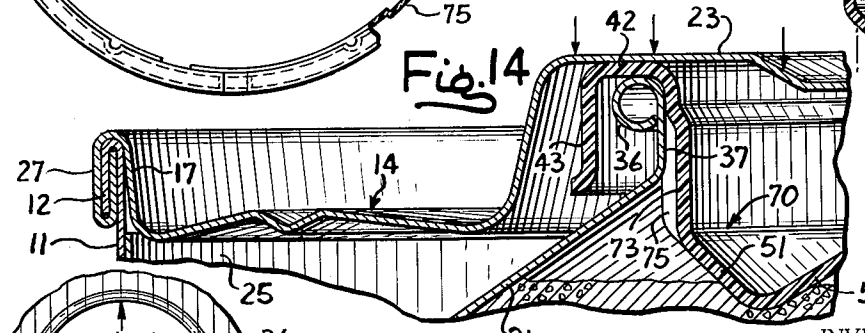
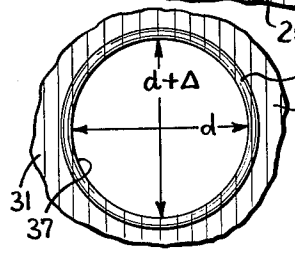


Fig. 15



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3,240,383

CAN

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Filed Jan. 2, 1962, Ser. No. 163,513
9 Claims. (Cl. 220—44)

This application is a continuation-in-part, of copending applications, Serial No. 43,574, filed July 18, 1960, and Serial No. 84,090, filed January 23, 1961, now Patent No. 3,149,743, granted September 22, 1964, and Serial No. 108,398, filed May 8, 1961, now Patent No. 3,133,669, granted May 19, 1964.

This invention relates to a new and improved can with inner replaceable closure overlaid by the usual top end and, more particularly, to a can so constructed as to facilitate rapid evacuation thereof including the headspace between the replaceable closure and the top end as well as the space on the opposite side of the replaceable closure.

At the present, vacuum packing of substances such as coffee is commonly practiced. The reclosure features of the present invention makes it particularly suitable for such products. A conventional vacuum seamer, well known in the canning art, may be used; such a seamer has a multiplicity of pockets in a turret. Filled, open top cans are fed into the pockets, carried around in a pressure below atmospheric until the interior pressure of the can and contents is equalized with the interior of the seamer, an end applied and seam sealed onto the can body, and the sealed can discharged. In using such a seamer with a can of the type described in the aforementioned copending applications, it is desirable that air in the headspace between the top end and reclosure cap should be evacuated before the can is sealed. The present invention has as a principal object the provision of a can that facilitates the accomplishment of this result, while retaining desirable novel features of the cans of the above-identified applications.

The reclosure cap of the present invention is formed of a deformable resilient plastic material which is so constructed that it deforms under pressure difference created during vacuumizing to form a vent or to facilitate air evacuation. Upon equalization of pressure between the zones above and below the cap the communication between the two zones is thereafter impeded, a feature which tends to retard deterioration of the contents after the consumer removes the top end of the can.

A further improvement of the present invention is in the construction of an integral lift knob on the cap. Such knob is used by the consumer to lift the cap for removal or replacement. The knob is preferably hollow and preferably has at its upper edge an outwardly projecting ridge which functions to keep the fingers from sliding relative to the cap when the cap is being pulled off the collar. The caps are constructed so that they may be stacked on top of each other for convenient storage and further to facilitate machine feeding the caps for positioning on the collars of cans. A feature of the present invention is the formation of the lift knob with an outwardly expanded step near the bottom of the wall of the lift knob, which step has an inside diameter to receive the rib of the next lowermost cap. In this manner the caps stack on top of each other in a stable arrangement and are slightly spaced apart at their outer peripheries so that a detent may be interposed in the space between the peripheries of the caps to facilitate automatic feeding of the caps from a stack one at a time.

A still further feature of the invention is the construction of the cap in such manner that it may rest on a horizontal surface in a stable manner. Alternatively, the caps may be fed along a horizontal table or moving belt. In such method of feeding, the construction of the cap

tends to prevent the caps from tilting as edgewise pressure is imparted and thus the construction hereinafter set forth in detail prevents jamming of the machinery for feeding the caps.

A further feature of the invention is the formation of an integral knob on a flexible cap, thereby facilitating removal and replacement of the cap. The knob may project upwardly from a depression in the center of the cap to enhance the natural flexibility of the plastic material of which the cap is constructed so that it snaps onto the collar and may be removed therefrom, but sufficient tension is imparted to the caps so that the contents are sealed by the cap gripping the bead on the collar.

Another object of the invention is the provision of a lifting knob on the replaceable inner closure so constructed that it is easily gripped by the fingers of the user and yet is shaped so that the closure may be molded in plastic without requiring the use of a split cavity mold.

Still another object of the invention is to provide a can having reclosure means in which the entire interior of the can in contact with the contents may be enameled, and no raw metal edge is present in a location where it might be contacted by the contents of the can.

Still another feature of the invention is the provision of a space between the reclosure cap and the can end, which space may be used for advertising circulars or premiums, directions for use of the contents of the can, or other purposes. A small package of additive such as a coloring material or flavor may be placed in the space between the cap and the end to be added to the contents of the can by the consumer as desired.

Further, it will be understood that a premium or the like may be inserted in the headspace above the reclosure cap and need not be provided with a special protective wrapping since it is isolated from the contents of the can.

An advantage of this invention is the fact that the can end may be severed easily by conventional can openers without leaving ragged, dangerous metal edges. Even the punch-and-cut blade type can opener operates well with this construction. The angle at which the user holds the blade is not so critical for proper cutting because the shape of the end and the collar direct the blade toward the proper angle.

It is a still further object of the present invention to provide a can of the above mentioned character wherein a reclosable cap may be put in place loosely so that it does not substatially interfere with the evacuation of the can and wherein after evacuation and sealing of the can end that overlies the reclosable cap, that cap will be automatically moved further into position to form a good, substantially air-tight closure.

It is a still further object of the present invention to provide a can with a reclosable cover which can is particularly adapted for vacuum packing and wherein the can opening and the cover therefor are so related that a loose air-leaking fit is initially obtained, to facilitate the evacuation and wherein the construction is such that after evacuation and removal of the evacuated sealed can from the vacuum chamber, the pressure to which the can is subjected causes such a deformation of the can metal, beyond its elastic limits, as to provide a snug fit of the reclosure whereby the reclosure is held in place even after repeated openings and reclosings.

It is a still further object of the present invention to provide a can structure wherein a rupturable can end that is seam sealed to the can body overlies and is spaced from a mouth defining ring on the inside of the can, the ring being spaced from the can end to permit flexing of the can end toward the ring an amount sufficent to move a reclosable cover to its ultimate desired position whereupon the ring then reenforces the can end against fur-

ther inward flexing. Because of this reenforcement it is possible to make the can end of thinner gauge material than would be possible if the ring were not in a position to limit the inward flexing movement of the can end. By making the can end of thinner gauge material it is possible to provide for a larger permissive flexing of the can end as the evacuated can is brought into the atmosphere from the evacuating chamber, thereby obtaining a larger permissive movement of the subjacent cap by the flexing of the can end.

The attainment of the above and further objects of the present invention will be apparent from the following specification taken in conjunction with the accompanying drawing forming a part thereof.

FIG. 1 is a fragmentary vertical mid-sectional view through the upper end of a can constructed in accordance with this invention showing the position of the parts prior to vacuumizing;

FIG. 2 is an enlarged view of a portion of FIG.1;

FIGS. 3 to 5, inclusive, are enlarged fragmentary sectional views showing sequential steps in the vacuumizing operation;

FIG. 6 is a fragmentary perspective view showing the rim of a cap constructed in accordance with this invention;

FIG. 7 is a view similar to FIG. 1 of a modification;

FIG. 8 is a fragmentary vertical mid-sectional view through the upper end of a can of a modified construction showing the relationship of the parts during vacuumization of the contents, and before completion of seaming of the top can end;

FIG. 9 is a top plan view of the cap of the can of FIG. 8;

FIGS. 10, 11, 12 and 13 are enlarged fragmentary sectional views taken along the lines **10—10, 11—11, 12—12,** and **13—13** of FIG. 9;

FIG. 14 is a fragmentary sectional view of the top portion of a completed can of FIG. 8; and

FIG. 15 is a top view in diagrammatic form, illustrating the out-of-roundness of the opening of the plug receiving ring of the finished can of FIG. 14.

Reference may now be had more particularly to the drawings wherein like reference numerals designate like parts throughout.

The present invention is applicable to an otherwise standard can such as a sanitary can, or it may be adapted for use with other can constructions, such as paint cans and other general line cans. A conventional can has a body **11**, which is customarily cylindrical in shape and seamed and soldered together in a conventional side seam **13**. An outwardly directed flange **12** is formed on the top and a similar flange is formed on the bottom of the body. In conventional can construction, an upper can end **14** is a disc of sheet metal having a trough **16** formed at the outer periphery and containing sealing compound (not shown). Inwardly of the trough **16** is a vertical seaming chuck wall **17** which in the present instance is of slightly less than conventional diameter to provide space for a collar hereinafter described. The chuck radius **18** at the bottom of wall **17** is somewhat greater than in conventional can ends, and a raised annular bead **19** is provided inwardly of radius **18**. The large radius **18** and the bead **19** tend to spring the severed end upward when it is cut by a can opener. The bead **19** further tends to localize the path of the blade of the can opener and prevent inward movement thereof, thereby improving the operation of the can opener. Further, the bead **19** tends to reduce wrinkling of the periphery of the disc that is cut from the can end **14**. This feature is desirable in that if the cut edge is wrinkled it tends to hook or snag at various points under the portion of the can end which remains seamed to the body, which makes removal of the disc of the can end difficult at times.

As shown in the accompanying drawings, the shape of the upper can end **14** is different from the conventional

construction in that an upwardly projecting dome **23** is provided. The upward extending wall **24** or flank of dome **23** is so dimensioned as to nest in the complementary recess in the bottom end of a super-imposed can (not shown).

The bottom end (not shown), opposite the end **14**, is substantially complementary in shape so that cans may be stacked end-to-end for storage and display without likelihood of tipping. One end of the can is applied at the can-making factory and the other end is applied at the cannery after the contents have been filled into the can. The latter operation is preferably performed in a vacuum seamer of any well-known construction wherein the can and its contents are carried in a vacuumized pocket and the end seamed onto the bottom flange of the can body while the interior is subject to vacuum. The benefits of vacuum packing are well understood in the canning art.

The present invention employs a collar **31** inside the upper end of the can and secured thereto. In the form shown in the accompanying drawings, the collar **31** has a vertical cylindrical side wall **32** having a diameter to fit inside the can body with a friction fit. The side wall **32** is sufficiently deep so that the collar is not severed when the upper can end **14** is cut by a conventional can opener. The body **11** is formed with an inwardly indented annular bead **35** which forms a positioning stop for the collar **31**. When the end **14** is double-seamed onto the body **11**, as indicated at **27**, the collar **31** is permanently secured to body **11**.

The collar **31** has a breast **34** slanting upwardly inwardly from the bottom of wall **32**, projecting into the dome **23** or stacking step of upper end **14** and terminating in an outwardly rolled bead **36** which is spaced slightly downwardly from the underside of dome **23**. It will be understood that the neck **37** of collar **31** may terminate in a curl, bead or hem and the term "bead" is used herein to include all such constructions. Preferably, the bead **36** projects upwardly and outwardly since in such construction there is no possibility of a raw edge of the metal coming in contact with the contents of the can, which might affect the color, odor or taste of the contents deleteriously, or be otherwise objectionable.

There is provided an improved reclosure cap **14** which snaps in place in the neck **37**. The cap **41** is preferably formed of a semi-rigid plastic, such as high-impact polystyrene, i.e., a polystyrene containing appreciable quantities of synthetic rubber. The cap has adjacent its periphery a narrow annular shoulder or wall **42**. Surrounding the outer edge of shoulder **42** is a short downwardly extending skirt **43** which surrounds the outside of bead **36**. On the inside edge of the shoulder **42** is a vertical wall **44** having at its upper end a reduced diameter section **45** immediately opposite the neck **37**, so that there is space between neck **37** and wall section **45**. A plurality of outwardly projecting nibs **46** are formed in wall **44**, said nibs engaging under the bottom edge of neck **37** to hold the cap detachably on the collar. The number and size of nibs **46** is subject to variation, but it has been found that five uniformly spaced apart nibs each having an arcuate length of about $\frac{5}{32}$ in. is satisfactory. These nibs **46** may be omitted and the holding action obtained by frictional engagement of the cap with the collar **37**.

Vents **49** are indented into corner **47** for a purpose hereinafter described in detail and effective when the can is vacuumized. The number and dimensions of vents **49** is subject to some variation, but it has been found that six vents each $\frac{5}{32}$ in. in arcuate length is satisfactory.

Inwardly of the bottom edge of wall **44**, the cap **41** is formed with a downwardly-inwardly slanted portion **51** which may be at an angle of about 45° to the horizontal, to facilitate proper seating of the cap on bead **36** if the user happens to position cap **41** eccentrically with re-

spect to collar 31. Inwardly of slanted surface 51 is an upwardly-inwardly slanted surface 52 rising to an elevation about equal to that of the bottom of wall 44. Inwardly of the upwardly-inwardly slanted surface 52 is an annular depression 53 having in cross-section an arcuate shape which conveniently receives the tips of the fingers of the user. The inner edge of depression 53 terminates in an upward vertical riser 54 which, in turn, merges into an inward horizontal shoulder 56. As hereinafter appears, the riser 54 and shoulder 56 constitute a "stacking step" useful when caps are piled on top of each other in a stack. Above the inner shoulder 56 is a vertical wall 56' of a lift knob 57 and at the top of the knob is an outwardly reversely bent rim 58 which prevents the fingers from sliding off surface 56'. The rim 58 merges with the top 59.

The rim 58 may be produced in various ways. However, a preferred form avoids the use of a split cavity mold. In the original form as received from the mold, the lift knob has a bulbous projection around its upper end. Such a shape may be stripped from a mold without using a split cavity. Before removal from the mold, downward pressure is applied on the top surface 59 by any convenient means and this results in a squeezing of the cap to form ridge 58.

The construction of cap 41 is of particular importance in handling the cap, as in connection with storing and transporting caps in stacks or in feeding the caps during assembly of the containers by automatic machinery. When the caps are thus stacked, the horizontal shoulder 56 of one cap rests upon the top 59 of the next lower cap and hence a stable stack is achieved. In this connection, it will be noted that the outside diameter of rim 58 is slightly less than the inside diameter of riser 54. In addition to the stability of the stack there is adequate space between the skirts 43 of superimposed caps of the stack so that a detent, which is part of one type of feeding means for feeding successive caps from the stack for assembly with the containers, may enter between successive caps.

Further, where the caps are fed horizontally along a belt or table, the shape of the cap also affords stability. Thus when fed along such horizontal surface the skirts 43 are in edge-to-edge relationship at a plane which is about half the height of the cap and the bottom of the cap is resting on a horizontal annular surface at the bottom edge of riser 54, which is of relatively large diameter. Thus the caps tend to remain in contact with the surface along which they are fed and do not tend to tip or climb over each other. This again provides a stable and effective means for feeding the caps during assembly of the containers.

Other features of the invention are likewise apparent. The location of bead 36 in proximity to the underside of dome 23 reenforces the dome and limits the extent that it concaves inwardly, particularly when the contents are packed under vacuum. Another feature of the construction is that by locating neck 37 inside the dome a smaller diameter neck results and this reduces the size of the reclosure cap 41 and decreases the quantity of plastic material required to form the cap. On the other hand, the cost of collar 31 is not ordinarily increased because if the collar is formed by punching out a ring of metal the outside diameter of the ring remains constant regardless of the size of neck 37 and the circle punched from the center of the ring is waste material.

In the modification of FIG. 7, the various parts have been given the same numerals as the corresponding parts in the previous embodiment, with the subscript "*b*" added. The end 14*b* is formed without a dome. Inwardly of bead 19*b* is an annular groove 20*b* and inwardly thereof an annular horizontal panel 21*b* and a central, slightly indented panel 22*b*. In this modification the collar 31*b* is of substantially greater inside diameter than collar 31 and its top elevation is also less in that it does not project upwardly into a dome. The cap 41*b* is of a greater diameter than cap 41, but in other respects the two are similarly constructed. Parts of the modification of FIG. 7, which are substantially the same as corresponding parts of FIGS. 1 to 6, are given the same reference numeral followed by the subscript *b* and are not further described herein in detail.

Turning now to FIG. 1, the upper end of the can is assembled at the can factory before the contents are filled and before the can is vacuumized. The position of the parts before filling of the can is shown enlarged in FIG. 2. It will be noted that nibs 46 engage under the bottom edge of neck 37. The shoulder 42 is not compressed by the underside of end 14, although it may be contacted thereby.

At the can factory, advertising circulars, premiums, directions, or small packages of additives may be placed on the closure cap 41 between the knob thereof and the wall 44.

When the partially completed cans are received in the cannery the top ends 14 are in place but the bottom can ends are not yet in place. The cans are filled in their upside down positions, as illustrated in FIG. 3. In this instance the contents may be ground coffee, shelled nuts or other non-liquid materials. By reason of the contact of the wall 44 with the neck 37 along circle 48 the contents do not spill through the cap 41, but are retained in place. Thus, FIG. 3 is essentially the same as FIG. 2, except for the inversion of the can. FIG. 4 illustrates the drawing of a vacuum by means of a vacuum seamer, or the like. The vacuum is drawn through the open bottom end of the can (which in inverted position is uppermost). As the can is being exhausted of air, the pressure above the cap 41 drops. Therefore because of the difference in pressure between the interior of the can and the headspace between the can end 14 and the cover 41, the cap 41 tends to move upwardly from the position of FIGURE 3 to that of FIGURE 4. Because of the resilient deformable nature of the plastic, the diagonal inwardly extending plastic material forming the vents 49 at the corner between the surface 42 and the surface 47 is slightly deformed, as shown in FIG. 4, thereby breaking the seal which formerly existed at circle 48. Hence air in the headspace passes inside skirt 43 and thence through vents 49 and through the space between neck 37 and wall section 45 into the interior of the can. This results in vacuumizing of the headspace of the can as well as the interior thereof. During evacuation of the can the cap 41 acts somewhat as a check valve, moving from the position of FIG. 3 to that of FIG. 4 so long as there is a preponderance of pressure in the headspace over the pressure in the vacuum chamber.

The now bottom end 14 is seamed onto the can while the can is in the vacuum chamber, forming a hermetic seal. When the can is discharged from the vacuum seamer, atmospheric pressure deforms the end 14 beyond its elastic limit, flexing it inwardly and causing the dome 23 to bear against shoulder 42. This seals the underside of shoulder 42 against bead 36. At the same time, the surface 47 deforms slightly as shown in FIG. 5 and a seal is restored along the circle 48. The inward movement of the can end 14 under the action of atmospheric pressure is limited or resisted by the resilience of the plastic cap 41 and by the top of the ring 31 both of which are thus put under resilient stress.

At the destination, the consumer cuts off the upper end 14 with a can opener in conventional manner. The depth of side wall 32 is such that the blade of the can opener does not sever the collar. Depressed radius 18 and raised bead 19 tend to locate the blade of the can opener in proper position, namely, at the bottom of radius 18 and to prevent the blade from being displaced from such position as it traverses the can. Thus, the angle at which the user holds the blade is not critical. Such posi-

tioning of the blade is particularly important when the "punch-and-lift" blade-type can opener is used. Further, the collar **31** is located in such position that it is not normally contacted by the can opener blade. However, if it is so contacted the collar tends to prevent the blade from penetrating downwardly too deeply and puncturing the collar. The shape of the end **14** improves the seam which can be attained.

When the end **14** has been cut away it releases its downward pressure on the cap **41** and the collar **31** which then flex upwardly and push the cut-out disc of the end **14** upwardly, thus facilitating removal of the cut-out disc.

It will further be seen that there is a trough **25** at the juncture of wall **32** and slanted stretch **34** of collar **31** in which particles of metal which may be dislodged when the end is cut collect and which are thereby prevented from falling into the contents of the can.

The space inside the lift knob cap **41** may be filled if desired. Thus, a pressed fiber material such as cellulose may be inserted in the hollow inside wall **57** and when such material is saturated with water it tends to keep the contents of the container moist, a feature which is desirable for products such as tobacco. A dehumidifying agent may likewise be inserted in the same location to keep powdered products dry and prevent caking and likewise an oxygen absorbing agent may be inserted.

Reference may now be had more particularly to the embodiment of the present invention illustrated in FIGS. 8 through 15. Insofar as the parts are of a construction identical with that of FIG. 1, identical reference numerals have been used and no repetition of the prior description is necessary.

An essential difference between the embodiment of FIGURES 8 through 15 and that of FIG. 1 lies in the construction of the reclosable cap, herein indicated by the reference numeral **70**, and the resulting differences in evacuation whereby the can may readily be filled and evacuated in its upright position, as distinguished from the filling of the can of FIG. 1 in its inverted position. This cup is made of the same material as was previously described. The portion of the cap that includes the slanted portion **51** and the parts surrounded thereby or radially inwardly thereof is identical with the cap of FIG. 1. The essential difference between this cap and the cap of FIG. 1 lies in the shape of the part of the cap between the slanted portion **51** and the skirt **43**. The slanted portion **51** terminates, at its outer periphery, in a substantially cylindrical wall **73** which is of an outside diameter slightly in excess of the inside diameter of the friction wall **37**, say of the order of a diameter which is 0.002" in excess of the internal diameter of the neck **37**.

The cylindrical wall **73** has a series of vertical vents **75** that are of a height greater than the vertical length of the neck and which terminate short of the bottom surface of the annular wall **42**, thus leaving a cylindrical friction ring wall **76** which is of an outside diameter in excess of the inside diameter of the neck **37**, the excess diameter being of the order of 0.02". Between the juncture of the inner surface of the wall or shoulder **42** and the outer surface of the cylindrical wall **73** there are a series of short, narrow sloping nibs **78**, in this instance three or six, spaced 120 degrees or 60 degrees apart. The underside of the wall or shoulder **42** has a series of horizontal nibs **80** projecting downwardly therefrom for forming an air passageway to the interior of the can during vacuumization. There are in this instance six nibs **80** spaced 60 degrees apart and spaced angularly from the nibs **78**.

The can received by the can processor from the can-making factory includes the body **11** having the bottom end seamed thereto and the collar **31** in place. Neither the upper can end **14** nor the cover **70** is in place. The processor fills the can through the opening defined by the bead **36** and the neck **37** and then places the cap **70** in position, as illustrated in FIG. 8. At this time the nibs **78** support the reclosable cap in the elevated position of FIG. 8 wherein the cylindrical friction wall **76** is above the neck. The vents **75** provide for an air flow passageway from the interior of the can, past the space between the neck **37** and the cap **70**, thence between the bead **36** and the skirt **43**. The can end **14** is then placed in position and the can is ready for vacuumization and for formation of the seam between the can end **14** and the can body **11**. Before the seam **27** (FIG. 14) is formed, there is an air flow path, indicated by the dotted line **82** whereby air may flow from the space **25** between the can end **14** and the ring **31** to the outside of the can. This is in communication with the interior of the can through the vents **75**. Thus the entire interior of the can is evacuated. During this time the cap **70** is in its elevated position permitting air flow between the interior of the can and the space **25**, thence to the outside of the can. Upon completion of the double seam **27** in the vacuum chamber the can is sealed. At this time the gas pressure within the can is equal to the gas pressure in the vacuum chamber where the can is located, that pressure being very low, so that there is a high vacuum in the can.

The nibs **80** may be omitted and the equivalent results obtained by making the shoulder **42** sufficiently thin so that it may flex sufficiently during vacuumization to allow air to pass from the interior of the can to the headspace between the collar **31** and the can end **14**. The same results may be obtained by sand blasting the surface of the mold where the bottom surface of the shoulder **42** is formed, so that the bottom surface of the shoulder **42** has a rough sand-blast-like finish rather than a smooth finish. That rough surface on the underside of the shoulder **42** will form air passageways between the bottom surface of the shoulder **42** and the bead **36**.

Upon removal of the can from the vacuum chamber the atmospheric pressure of approximately 15 pounds per square inch flexes the can end **14** downwardly to the position illustrated in FIG. 14, the top of the can end forcing the cap **70** to the position of FIG. 14 wherein the friction wall **76** engages the inner periphery of the neck **37** to form an air-tight closure and at the same time the nibs **80** (if there are such nibs) are compressed so that there is an air-tight closure between the top of the bead **36** and the bottom of the wall or shoulder **42**. The can end **14** in each of the different embodiments of the invention above described may be of comparatively thin material, substantially thinner than in standard, and its flexing continues until the shoulder **42** engages the bead **36** at which time the ring **31** reenforces the can end **14** and limits further inward movement to a small additional amount, during which time the breast **31** is flexed downwardly a small amount beyond its elastic limit. At this time the can end **14** has been flexed beyond its elastic limit and presses the cap **70** firmly in place, and holds the nibs **78** (or **49** in the can of FIGURE 2) compressed.

At this time the can end **14** is under stress, tending to move it upwardly, the stress being due to the tension under which the metal of the can end **14** has been placed, particularly the portion of the can end between the seam **27** and the wall or shoulder **42** of the reclosure cap. In addition, the can end **14** is being forced upwardly by the reaction of the bead **36** of the ring **31** and by the distortion of the nibs **78**, and by the small upward push of the breast **31**.

When the can is opened as by means of a can opener which cuts along a circle indicated at **84**, the severed disc is pushed upwardly by release of the internal stress in the disc **14** and by the force of the ring **31** and of the reclosure cap. This facilitates removal of the severed disc of the end **14**. The cap **70** (or **41** in FIGURE 1) may then be used as a reclosure cap.

In one construction the neck opening in the ring which engages the plastic plug was made 3.716" (diameter prior to vacuum packing) and the diameter of the friction wall **73** which comes in contact therewith was made 3.718". This 0.002" oversize would, ordinarily, not be tight enough

to give the feel of a tight closure which the consumer would like to have, nor would it be tight enough to hold on should the can be accidentally tipped over. However, after the can is vacuum packed, a different situation is brought into existence. Due to the particular shape of the ring **31** and perhaps due to the fact that the metal used in making it is light weight, the pressure of the atmosphere on top of the can end **14** which pushes downwardly on the cap **70** and the ring **31** causes the ring opening to become slightly oval-shaped. In one measurement the out-of-round condition of the neck **37** measured 0.014" between minimum and maximum ring opening diameters, with the narrowest diameter of 3.709" being across the grain of the metal of the ring **31** and the long diameter of 3.723" being with the grain of the metal. The grain of the metal determines which way the ring will become oval-shaped since less pressure is required to float metal across its grain than when forming metal with the grain. After vacuum packing, then, instead of having only 0.002" interference between the ring and the cap or plug, there is no interference on approximately half the circumference of the neck and 0.009" interference between the plastic cap and the narrow side of the neck opening. This 0.009" interference is sufficient to give a tight feel and to hold the closure cap in position should the can be accidentally tipped over after the can end **14** has been cut away. Due to the resilient nature of the plastic cover material, it conforms to the out-of-round shape of the neck opening each time that the reclosure cover is removed and replaced, and the plastic of the cover **70** does not set in the same out-of-round shape as that of the ring opening because the elastic limits of the plastic plug material have not been reached.

If desired, the neck opening **37** may be initially made out-of-round, the out-of-roundness being so oriented with respect to the grain of the metal that after vacuum packing and deformation by atmospheric pressure above referred to, the ring opening **37** then becomes perfectly round. This can be accomplished by making the ring opening of a larger diameter (for instance 3.723") with the grain of the metal and of a smaller diameter (for instance, 3.709") across the grain of the metal so that after vacuum packing it re-shapes to a true 3.716" round opening. Then a plastic plug with a friction wall of 3.723" rather than 3.71" would be used.

While the can of FIGURE 8 is adapted for filling from the top, followed by vacuumization before final sealing, this can may also be filled in its inverted position as in the manner illustrated in FIGURES 2 through 5. In this arrangement the hermetic double lock seam between the can end **14** and the can body **11** would be completed at the can-making factory, and the can thus partially completed, without the bottom can end in place, delivered to the cannery. There the can is filled in its inverted position and after vacuumization the missing can end is applied and lock seamed in place by a double lock seam such as the lock seam **27**.

It is to be noted that in each of the embodiments the top of the wall **32** terminates short of the double seam **27** and therefore the collar **31** does not increase the overall thickness of the seam **27**, and the chuck wall **17** is no further from the outside cylindrical surface of the seam **27** than in the case of an ordinary can that does not have the inner collar **31**. Therefore a conventional can opener may be used, and in such use it operates in its conventional manner.

In compliance with the requirements of the patent statutes, I have here shown a few preferred embodiments of the present invention. It is to be understood that these are merely illustrative of the principles of the invention. What is believed to be new and sought to be secured by Letters Patent is:

1. A container having a body, a collar tightly fitting within the body and having a neck ring defining an opening into the body, a cap for the opening, a flexible end closing said body and overlying the collar and the cap, said cap being a unitary piece of flexible plastic having means cooperating with the neck ring to form a vent for air flow between parts of the container on opposite sides of the cap, said means including an annular cap surface that engages the neck ring, said cap being flexed during evacuation of the container to separate said annular surface from said neck ring to facilitate communication through said vent for evacuation of the container including the headspace between the cap and the end by the flow of air through said vent, said end being flexible beyond its elastic limit by the preponderance of ambient pressure over that pressure within the container, a portion of the cap being in the path of flexure of said end and moved thereby to urge said annular surface into engagement with said neck ring.

2. A structure as defined in claim **1**, wherein the cap has an annular shoulder and the vent forming means further includes a projection on the shoulder.

3. A structure as defined in claim **3**, in which the neck ring has axially inner and outer portions and said annular surface engages said axially inner portion and said projection engages said axially outer portion.

4. A structure as defined in claim **1**, in which the neck ring has axially inner and outer portions and said annular surface engages said axially outer portion and said projection engages said axially inner portion.

5. A structure as defined in claim **1**, in which said annular surface seals against said neck ring.

6. In a container construction, a body; an end seamed on said body, a collar on the upper part of said body, cooperating means on said collar and body to secure said collar in position in said body, said collar being formed with a neck having a terminal bead, and a reclosure cap on said collar and under said end said cap being formed of a unitary piece of plastic material comprising an annular peripheral shoulder adapted to rest on said bead, vent forming means adapted to engage said bead, a wall depending from said shoulder and engaging the neck, and a central portion inward of said wall, said cap having a plurality of positions on said collar including a first position assumed when said body is at atmospheric pressure and in which said wall bears against said neck around its entire perimeter to form a closure therewith, a second position in which the interior of the can body is under vacuum and the headspace between the cap and end is above the pressure within said body and in which said wall is out of contact with said neck to provide communication through said vent between said cap and neck and into said body, and a third position in which the interior of said body and headspace are below atmospheric pressure and the exterior is at atmospheric pressure and in which said end is inwardly deformed, a portion of the cap being in the path of deformation of said end and being moved thereby to close said vent and seat said shoulder on said bead.

7. A container construction according to claim **6**, in which said end is formed with an upwardly bulging dome and said bead is disposed within said dome, said shoulder being disposed between said dome and bead.

8. A can comprising a can body having an enveloping body wall, an outer closure forming a hermetic seal across one end of said can body, the peripheral material of the closure and adjacent material of said wall being locked together in a seam extending completely around the body and surrounding the central axis of the body, said outer closure having a central portion through which said axis passes and a fracturable portion surrounding the central portion and being adjacent to said body wall, a collar in and adjacent to said end of the body, cooperating means on said collar and body to secure said collar in position in said body, said collar having a breast portion that extends radially inwardly toward said axis and also axially of said body wall and being formed with a terminal neck that is radially intermediate said axis and

fracturable portion and which neck defines an opening into the body, said neck integrally including a terminal bead, said collar defining an annular channel that underlies the fracturable portion by an amount sufficient to permit operation of a can-opening cutting tool for cutting the fracturable portion without cutting the collar, a removable and replaceable resilient plastic cap for closing said opening and underlying said outer closure and accessible upon fracture of said outer closure, said outer closure cooperating with the collar and cap to provide a head space at one end of the can body, said cap including an annular shoulder fitting on said bead and an annular wall that engages said neck, said cap having means deformable upon pressure differential across the cap to form a vent for air flow from the headspace to the interior of the can body, said cap having a plurality of positions on said collar including a first position assumed when the interior of said body is at atmospheric pressure in which said cap wall bears against said neck around its entire periphery to form a closure therewith, a second position in which the interior of said body is under vacuum and the pressure in the headspace is above the pressure within said body and in which said vent is open and wherein said cap wall is urged out of contact with said neck to vent air from the headspace to the interior of the can body, and a third position when the interior of said body and headspace are below atmospheric pressure and the exterior of the can is at atmospheric pressure in which said outer closure is inwardly deformed, a portion of the cap being in the path of deformation of said outer closure and being moved thereby to close said vent and seat said shoulder on said bead.

9. A can comprising a can body having an enveloping body wall, an outer closure forming a hermetic seal across one end of said can body, the peripheral material of the closure and adjacent material of said wall being locked together in a seam extending completely around the body and surrounding the central axis of the body, said outer closure having a central portion through which said axis passes and a fracturable portion surrounding the central portion and being adjacent to said body wall, a collar in and adjacent to said end of the body, cooperating means on said collar and body to secure said collar in position in said body, said collar having a breast portion that extends radially inwardly toward said axis and also axially of said body wall and being formed with a terminal neck that is radially intermediate said axis and fracturable portion and which neck defines an opening into

the body, said neck integrally including a terminal bead, a removable and replaceable resilient plastic cap for closing said opening and underlying said outer closure and accessible upon fracture of said outer closure, said outer closure cooperating with the collar and cap to provide a headspace at one end of the can body, said cap including an annular shoulder fitting on said bead and an annular wall that engages said neck, said cap having means deformable upon pressure differential across the cap to form a vent for air flow from the headspace to the interior of the can body, said cap having a plurality of positions on said collar including a first position assumed when the interior of said body is at atmospheric pressure in which said cap wall bears against said neck around its entire periphery to form a closure therewith, a second position in which the interior of said body is under vacuum and the pressure in the headspace is above the pressure within said body and in which said vent is open and wherein said cap wall is urged out of contact with said neck to vent air from the headspace to the interior of the can body, and a third position when the interior of said body and headspace are below atmospheric pressure and the exterior of the can is at atmospheric pressure in which said outer closure is inwardly deformed, a portion of the cap being in the path of deformation of said outer closure and being moved thereby to close said vent and seat said shoulder on said bead.

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