March 8, 1949. F. W. KRUEGER 2,463,701

CONTAINER AND CLOSURE

Filed June 23, 1945

FIG_3

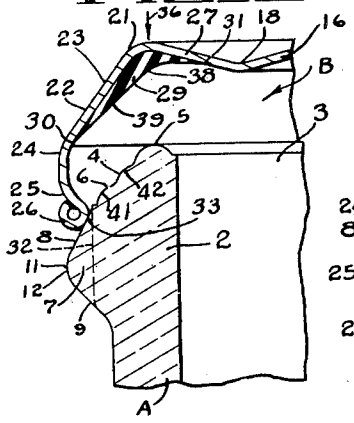



FIG_4

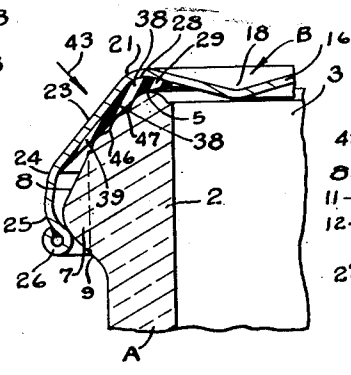



FIG_6

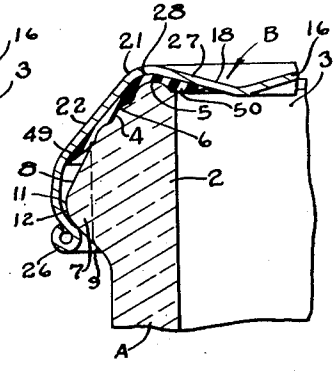



FIG_1

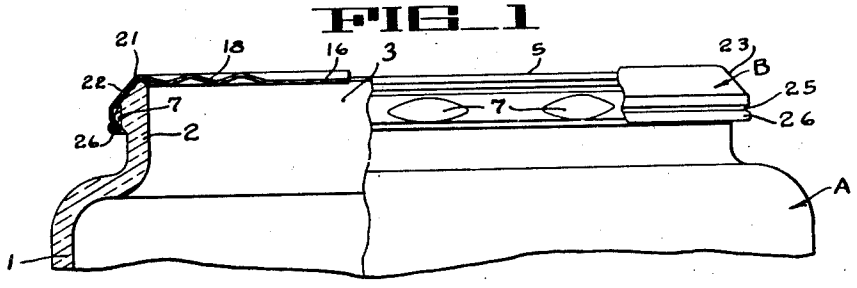
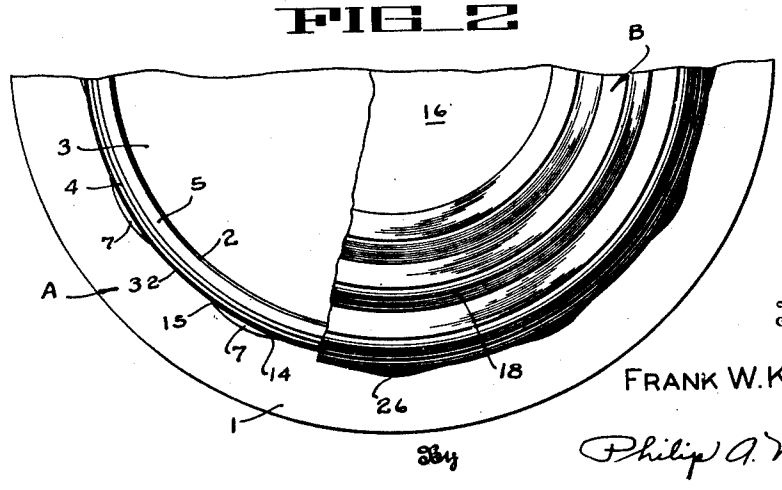



FIG_2




Inventor

FRANK W. KRUEGER

By Philip A. Minnis

Attorney

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## CONTAINER AND CLOSURE

Frank W. Krueger, San Jose, Calif., assignor to Food Machinery and Chemical Corporation, San Jose, Calif., a corporation of Delaware

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4 Claims. (Cl. 215—40)

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The present invention relates to a container and closure for hermetically packaging food products or other perishable materials.

More particularly, the present invention relates to a container and closure which may be advantageously used in connection with various packaging processes such as vapor sealing or vacuum closing and subsequent heat treatment to sterilize the contents thereof. However, the use of the container and closure is not restricted to the particular packaging processes referred to.

One object of the present invention is to provide a container and closure of high sealing efficiency.

Another object is to provide a container and closure of simple construction which may be cheaply manufactured and afford a considerable saving of tin-plate and sealing medium.

Another object is to provide a container and closure wherein the closure after its application to the container is held under spring tension on the container to hermetically seal the same and to automatically follow up displacement of the compound or thermo-plastic flow to mold the same to the sealing surface of the container and to maintain a hermetic seal during the thermo-plastic flow of the sealing medium and after the same has cooled and set.

Another object is to provide a closure which is pliable enough to shape itself to the irregularities of the finish of the neck of the container to thereby obtain in conjunction with the spring action of the cap a perfect hermetic seal so that largest manufacturing tolerances of the finish of the container are permissible.

Other and further objects of the present invention will become apparent from the following description and drawings in which:

Fig. 1 is a view partially in section and partially in elevation of the container and closure of the present invention, certain parts of the container and closure being broken away.

Fig. 2 is a plan view of a portion of the container and closure shown in Fig. 1.

Fig. 3 is an enlarged section of a portion of the neck of the container and a portion of the closure, the closure being positioned loosely on the neck of the container prior to its application thereto.

Fig. 4 is an enlarged view similar to Fig. 3 showing the closure applied to the container prior to heat treatment thereof.

Fig. 5 is an enlarged view similar to Fig. 4 but illustrating the sealing position of the closure on the container after heat treatment of the container to sterilize the contents thereof.

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Referring now to the drawings and especially to Figs. 1 to 3 thereof A indicates the container and B the closure therefor. The container is preferably made from glass, but if desired may be made from metal or plastic material and comprises a body portion 1 of any desired configuration and a neck portion 2 having an open mouth 3. The neck portion 2 comprises an outwardly declined annular sealing surface 4 terminating in an upper rounded edge or rim 5. The sealing surface 4 is provided with a plurality of annular corrugations 6. Disposed in spaced relation in a common horizontal plane along the periphery of the neck portion below the sealing surface 4 are a plurality of projections or lugs 7 each of which comprises an upper outwardly declined surface 8 and a lower inwardly declined surface 9, joined by a curved surface 11 forming a peak or ridge 12. The ridge 12 of each lug slopes in a horizontal plane gradually inward in opposite directions toward the periphery of the neck portion 2 as shown at 14 and 15 (Fig. 2) and merges into same.

The closure or cap (Figs. 1 to 3) comprises a top panel 16 which may be flat or preferably provided with a plurality of corrugations 18 to prevent paneling thereof when the closure is subjected to pressure or vacuum. The outer periphery of the top panel 16 is curved as shown at 21 and depending therefrom at an obtuse angle relative thereto is a skirt 22 comprising an outwardly declined portion 23, a curved portion 24 and a necked-in portion 25 terminating in an outwardly turned firm bead 26.

The curved periphery 21 and the adjacent portion 27 of the top panel 16 form in conjunction with the skirt portion 23 an annular groove 28 at the underside of the closure for the reception of a sealing ring or compound 29 which is applied thereto in the usual manner well known in the art. The thick portion of the sealing compound 29 is disposed directly beneath the rounded cap portion 21 while the remainder is tapered out in either direction radially of the cap extending over the entire lower surface of the upper skirt portion 23 and partially over the lower surface of the top panel portion 27 terminating at 30 and 31 on the skirt portion 23 and the portion 27 of the top panel, respectively.

The interior diameter of the bead 26 of the cap B is larger than the periphery of the inclined sealing surface 4 of the container, but smaller than the diameter of the periphery of the ridges

12. The inclination of the upper skirt portion 23 is considerably steeper than the inclination of the sealing surface 4 of the container. In the cap illustrated in Fig. 3 the portion 23 of the skirt 22 is downwardly declined approximately 55 degrees with respect to horizontal while the corrugated sealing surface 4 of the container is disposed at an inclination of about 45 degrees with respect to horizontal so that a difference of 10 degrees exists in the angular disposition between the skirt portion 23 of the closure and the sealing surface 4 of the container. The above mentioned angles are only given as an example and may be considerably varied. It is important however that a sufficient angular difference between the sealing surface of the container and the skirt of the cap is maintained to obtain a spring action of the cap in the manner as later described herein.

It will be noted from Fig. 3 that the rounded skirt portion 24, the necked-in skirt portion 25 and the bead 26 of the cap are of substantially hook-like configuration in cross-section so that when the cap is applied to the container as shown in Figs. 4 and 5, only the bead 26 engages the downwardly declined surfaces 9 of the lugs while the skirt portions 23, 24 and 25 remain always in spaced relation with respect to the neck of the container and the lugs thereof.

When the cap B is loosely applied to the neck of the container as shown in Fig. 3 the bead 26 is spaced from the periphery 32 of the neck or finish of the container so that an annular open space 33 between the bead 26 and periphery is maintained establishing communication between the exterior and interior of the container. Therefore, if the container and closure are used in connection with a closing machine of the vapor sealing or vacuum type, the steaming, vacuumizing or gassing operations prior or incident to the application of the cap to the container may be advantageously carried out with the cap in this position.

The cap is applied to the container by straight downward pressure in the direction of the arrow 36 (Fig. 3) upon the curved periphery 21 of the top panel 16, and the cap is driven onto the neck portion of the container while the annular bead 26 rides downwardly along the outwardly declined surfaces 8 of the lugs 7 and is forced over the ridges 12 thereof. During the downward travel of the bead 26 along the downwardly declined surfaces 8 and over the ridges 12 the bead is deformed into polygonal shape whereby the portions of the bead intermediate the lugs 7 are drawn inward and a spring tension is set up in the bead so that as soon as the bead 26 has passed over the ridges 12 it is drawn inward and forced against the inwardly declined surfaces 9 of the lugs thereby creating a downward pull on the cap.

While the cap is applied to the container in this manner, i. e., while the bead rides downwardly the outwardly declined surfaces 8 and is forced over the ridges 12 the entire skirt 22 is sprung outwardly relative to the top panel 16 whereby a spring tension is set up between the top panel and the skirt which tends to return the skirt to its normal position as shown in Fig. 3 after the bead 26 has passed the ridges 12 of the lugs and is drawn in against the lower surfaces 9 thereof (Fig. 4).

During the application of the cap to the container as above described the upper or thick portion 38 of the sealing ring 29 is pressed against the rounded rim 5 of the container by the downward pressure exerted upon the cap in the direction of arrow 36 while the portion 39 of the sealing ring adjacent the skirt portion 23 is pressed against the annular ridges 41 and 42 of the corrugated sealing surface 4 of the container by the combined action of the downward pressure exerted in the direction of arrow 36 and the inward pressure of the skirt in the direction of arrow 43 (Fig. 4) due to the spring tension set up between the skirt 22 and the top panel 16 of the cap, whereby a multiple sealing contact is obtained.



Since the greatest pressure is exerted upon the curved periphery of the cap the portion 38 of the sealing medium is considerably compressed while less compression of the portion 39 of the sealing medium adjacent the skirt portion 23 is obtained because the sealing medium is thinner in this region and less force is applied to the same.

Upon completion of the application of the cap to the container as above described, i. e., as soon as the bead 26 has passed over the ridges 12 of the lugs 7 and is drawn inwardly against the surfaces 9 of the lugs as shown in Fig. 4 the cap is held in firm sealing engagement with the container by the continuous downward pressure exerted upon the cap by the bead 26 as it tends to ride downwardly along the inwardly declined surface 9 of the lugs so that an efficient hermetic seal is obtained. Any displacement of the sealing medium is immediately taken up by a follow-up action due to the continuous downward pull exerted on the cap so that the sealing efficiency of the cap is always maintained irrespective of the resiliency of the sealing medium. It should further be noted that when the cap is in its applied position as shown in Fig. 4 the skirt portion 23 is still disposed at a different angle than the sealing surface 4 of the container and the skirt portions 23, 24 and 25 are spaced from the lugs 7 and the periphery 32 of the neck portion of the container so that they do not interfere with the follow-up action of the cap as above described.

The annular grooves 46 and 47 of the corrugated sealing surface are not filled by the sealing medium when the cap is in the sealing position as shown in Fig. 4. However if a sealing medium is employed which sinks into the annual grooves 46 and 47 and becomes more compressed under the continuous sealing pressure of the cap or if the sealing medium employed becomes thermo-plastic upon subsequent heat treatment of the container to sterilize the contents thereof the downward pull exerted by the bead upon the cap causes the same to follow-up the sinking-in or thermo-plastic flow of the sealing medium. During this follow-up action the sealing medium is forced into the annular grooves 46 and 47 of the corrugated sealing surface 4, is molded around the ridges 41, 42 and the rounded rim 5, and is squeezed into a layer of substantially even thickness between the ridges 41, 42 and the rim 5. Surplus sealing material is forced from between the sealing surface 4 of the container and the skirt portion 23 and rounded portion 21 of the top panel of the cap at 49 and 50 (Fig. 5).

Part of the thick portion 38 of the sealing material is pressed during this squeezing action toward the middle and lower portion of the annular sealing surface 4 and forces the skirt portion 23 into substantially parallel alignment with the sealing surface 4 of the container whereby the inward pressure of this skirt portion is increased and a firm hermetic seal between the sealing ring 29 and the entire sealing surface 4 of the container is obtained as shown in Fig. 5.

However even in this position and after the

sealing medium has set the rounded skirt portion 24 and the necked-in skirt portion 25 remain spaced from the lugs 7 so that the bead 26 is not restrained against further downward and inward travel along the inwardly declined lug surfaces 9 and maintains a continuous downward pull on the cap to sustain in connection with the inward pressure of the skirt 22 toward the sealing surface 4 a perfect hermetic seal and to permit further automatic follow-up movement of the cap if necessary.

From the above it is therefore apparent that at all times after the application of the cap and during any follow-up action thereof a perfect hermetic seal is maintained and that the spring tension set up in bead and between the top panel and the skirt rather than the resiliency of the sealing medium is utilized to establish and maintain said seal.

Due to irregularities of the shape of the container, and the finish thereof and irregularities of the sealing ring or compound lining of the cap, only the ridge 41 or the two ridges 41 and 42 may contact the sealing surface of the container when the cap is in the applied position as shown in Fig. 4. However even a contact of the sealing ring with only one ridge i. e. ridge 41 establishes a perfect hermetic seal. In any event, however, during subsequent follow-up movement due to sinking-in of the sealing compound or thermo-plastic flow thereof a sealing contact with the entire sealing surface 4 and a molding of the compound to the corrugations thereof is established as previously described herein.

The cap of the present invention may be preferably made from standard 95 lbs. tin-plate although heavier tin-plate or other materials such as terne-plate or black iron plate may be employed if desired, it should also be noted that lighter or heavier gauge plate material may be used for lower or higher vacuum seals or cooking pressures. However the tin-plate or other material selected for the manufacture of the cap should be such as to have the necessary resiliency to maintain an effective hermetic seal under the spring action of the bead and the skirt in the manner as herein explained.

The cap of the present invention may be manufactured in any conventional manner by a simple stamping operation which performs the necessary blanking, drawing and forming steps and may be subsequently completed in a curling or necking-in machine which performs the necking-in operation upon the skirt and curling of the lower edge thereof into a continuous bead. If desired, the cap may be made from plastic material and the same manufacturing procedure may be followed or the cap may be manufactured by molding or extrusion.

While I have described a particular embodiment of the present invention it will be understood however that various modifications and changes thereof may be made without departing from the spirit and scope of the appended claims.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent is:

1. In combination a container having an outwardly declined sealing surface on its top face terminating in a rounded rim at its mouth and a plurality of spaced projections on its periphery below said sealing surface each provided with an inwardly declined lower surface, and a cap



for closing said container comprising a top panel provided with a curved periphery, and a skirt depending at an obtuse angle from the periphery of the top panel and including an upper outwardly declined portion of slightly greater declination than the sealing surface of the container and an inwardly bowed portion at its lower end terminating in an annular necked-in bead, said cap having a sealing ring on its underside in the region of said curved periphery of the top panel and said outwardly declined skirt portion adapted to overlie the rim and declined sealing surface of the container when the cap is applied to the container, the inwardly bowed portion of the skirt being so disposed as to permit sole engagement of the necked-in bead with the declined lower surfaces of said projections when the bead is pressed over the projections in the application of the cap to the container and exerts a constant inward pressure against the lower surface of said projections whereby a constant downward pull of the cap relative to the container is effected and the difference in declination of the upper skirt portion relative to the outwardly declined sealing surface of the container causes a constant inward pressure of the sealing ring against said sealing surface under the constant downward pull of the cap relative to the container.

2. In combination a container having an outwardly declined sealing surface having a plurality of corrugations forming annular ridges on its top face and a plurality of spaced projections on its periphery below said sealing surface each provided with an inwardly declined lower surface, and a cap for hermetically sealing the container comprising a top panel, a skirt depending therefrom including an upper outwardly declined portion disposed at an obtuse angle from the periphery of the top panel and a necked-in lower portion provided with an annular bead at its lower end, and a sealing ring on the underside of the outwardly declined skirt portion, the declination of the upper skirt portion relative to the top panel and the disposition of the necked-in portion of the skirt relative to the bead and the upper skirt portion being such that when the cap is applied to the container with the sealing ring in sealing engagement with the ridges of the corrugations of the sealing surface of the container the bead is drawn under tension against the lower surfaces of the projections with the necked-in portion of the skirt spaced therefrom and the skirt is sprung outwardly to dispose the same substantially parallel to the sealing surface of the container whereby a continuous downward pull on the cap is maintained by the downward urge of the bead along the inwardly declined surfaces of the projections and a spring tension is set up in the skirt effecting a continuous inward pressure of the skirt toward the declined sealing surface of the container establishing and maintaining a hermetic seal between the sealing ring of the cap and the ridges of the sealing surface of the container and for following up thermo-plastic flow of the sealing ring upon subsequent heat treatment of the container or cap to thereby force the ring into the corrugations of the sealing surface and mold the ring thereto.

3. In combination a container having an outwardly declined sealing surface provided with undulations forming a plurality of annular rounded ridges on its top face and terminating at its upper end in a rounded rim and a plurality

of spaced projections on the periphery of the container below said sealing surface each provided with an inwardly declined lower surface, and a cap for hermetically sealing the container comprising a top panel provided with a curved portion at its periphery, a skirt depending therefrom including an upper portion outwardly declined at an obtuse angle relative to the top panel and a necked-in lower portion terminating in an annular bead, and a sealing ring on the underside of the curved portion of the top panel and the outwardly declined skirt portion, the declination of the upper skirt portion relative to the top panel and the disposition of the necked-in portion of the skirt relative to the bead and the upper skirt portion being such that when the cap is applied to the container with the sealing ring in sealing engagement with the annular ridges and the rounded rim of the sealing surface of the container the bead is deformed into polygonal shape and drawn under tension against the lower surfaces of the projections with the necked-in portion of the skirt spaced therefrom and the skirt is sprung outwardly relative to the top panel whereby a continuous downward pull on the cap is maintained by the downward urge of the bead along the inwardly declined surface of the projections and a continuous inward pressure of the skirt toward the declined sealing surface of the container is obtained for maintaining a hermetic seal between the sealing ring of the cap and the annular ridges and rounded rim of the sealing surface of the container and for effecting a follow up action of the cap relative to the sealing surface of the container upon displacement or thermo-plastic flow of the sealing ring to mold the ring to the undulations of



the sealing surface and to sustain the said hermetic seal.

4. In combination a container having an outwardly declined undulated sealing surface forming a plurality of annular ridges and valleys and a plurality of spaced projections on the periphery of the container below said sealing surface, and a cap for hermetically sealing the container comprising a top panel, a skirt disposed at an obtuse angle relative to the top panel, and a sealing ring on said top panel and skirt adapted to engage the undulated sealing surface of the container, said skirt having its lower end curved inwardly and terminating in an outwardly turned bead for engaging the projections on the container to retain the cap under continuous downward pressure on the container with the sealing ring in sealing contact with one or more of the annular ridges when the bead is forced over the projections in the application of the cap to the container and the skirt is placed under tension.

FRANK W. KRUEGER.


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