March 14, 1961 R. E. FORD 2,974,816

CLOSING AND SEALING BOTTLES AND OTHER RECEPTACLES

Filed July 1, 1957

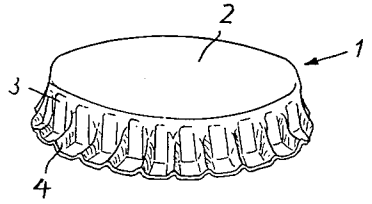


Fig.1

Fig.2

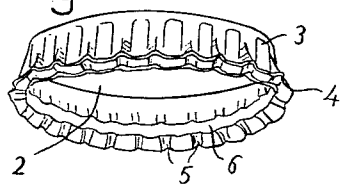


Fig.3

Fig.4

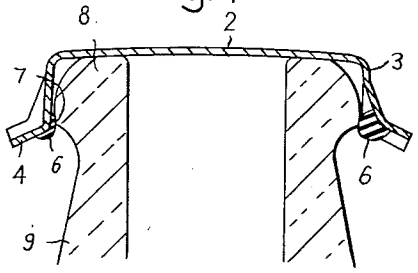


Fig.5

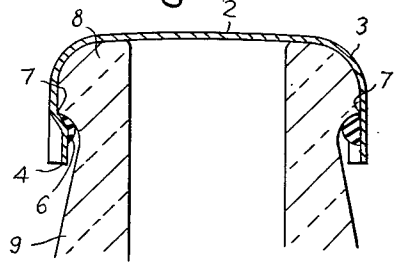


Fig.6

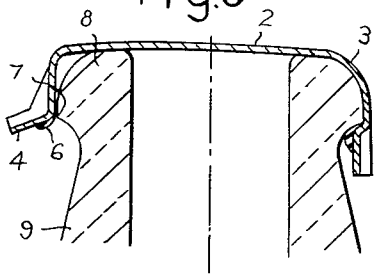


Fig.7

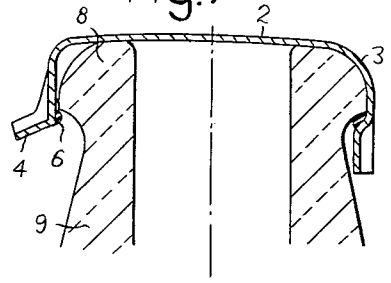


Fig.8

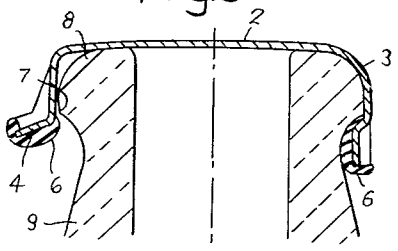
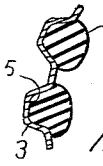


Fig.9



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United States Patent Office 2,974,816 Patented Mar. 14, 1961

2,974,816

CLOSING AND SEALING BOTTLES AND OTHER RECEPTACLES

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Filed July 1, 1957, Ser. No. 669,004

Claims priority, application Great Britain July 10, 1956

8 Claims. (Cl. 215—40)

This invention relates to a method of closing and sealing receptacles having a rim flange, especially bottles containing liquids under pressure, by means of crown caps, and to improved crown caps for carrying out the method.

The conventional crown cap as in use today, consisting of a cap made of tinplate with a corrugated skirt and fitted with a cork disc which seals against the top end or lip of the bottle, has remained substantially unchanged in design since it was first invented over 50 years ago. In some instances the cork disc has been replaced by a disc or annulus of resilient plastic material, which may be formed with annular ridges on its surface for increasing the resilience of the seal against the top of the bottle. In other instances the inside of the top of the cap has been covered entirely, or only partly by an annulus, of a resilient sealing compound which is compressed against the top of the bottle when the corrugated skirt is crimped around the rim flange. These alternatives to cork for the sealing gasket are generally more expensive than cork, or have other drawbacks compared with cork, and are only used in restricted cases, the conventional crown cork cap being still used most extensively for sealing bottles containing liquids under pressure.

Crown caps have almost exclusively been made of steel (tinplate) and despite extensive research and experiment, extending over very many years, to produce a crown cap made of aluminium or an aluminium alloy (hereinafter called "aluminium"), it has hitherto not been found possible to make an aluminium cap which will satisfactorily seal, and with the required margin of safety, the gas pressures experienced in bottled beers and mineral waters, without making the caps from aluminium of such a thickness that they cannot compete in price with the conventional cap made of tinplate of about .3 mm. thickness. Aluminium is more expensive than tinplate, for the same gauge material, and crown cork caps of conventional design but made of aluminium of .3 mm. thickness cannot consistently seal gas pressures in excess of 60–70 lbs. per square inch. The beer and mineral water bottling trade require that the cap should seal gas pressures of at least 120 lbs. per square inch.

The present invention provides a method of closing and sealing bottles and other receptacles with crown caps which presents such improved sealing that the crown caps can be made of aluminium of .3 mm. thickness whilst achieving effective sealing to withstand gas pressures of 120 lbs. per square inch or more.

The invention consists in the method, of closing and sealing receptacles having a rim flange, especially bottles containing liquids under pressure, by means of crown caps made of metal or other deformable material and comprising a top portion and a skirt having an outwardly flared edge part and provided with radially extending corrugations, said method consisting in closing each of the spaces formed by the internal radial channels of said corrugations and the rim flange, at least along part of its length by a resilient or deformable sealing compound provided on the internal surface of said skirt and extending at least partially below the rim flange of the said receptacle, the said closing being completed and sealing being achieved by forming the said outwardly flared edge part inwardly and downwardly whereby to fold the skirt around the rim flange and to compress the sealing compound between the skirt and the underside of the said rim flange.

The invention also consists in a receptacle closure comprising a receptacle having a rim flange around its neck to which is sealed a crown cap made of metal or other deformable materials with a top portion extending over the mouth of the receptacle and a corrugated skirt extending downwardly from the top portion and being formed inwardly beneath the rim flange to secure the cap on the receptacle, the bottom of the skirt beneath the rim flange being spaced from the receptacle so that its peripheral edge can be engaged by a conventional crown cap opener when the cap is to be removed, a resilient sealing compound, such as a rubberised compound, being adhesively secured to the interior of the cap and forming a sealing ring therearound at least at a zone which extends at least partially below the underside of the rim flange, said ring of sealing compound completely closing the spaces formed by the internal radial channels of the corrugations and the rim flange at least at said zone and being compressed and forming a gas-tight seal between the inwardly formed part of the corrugated skirt and the underside of the rim flange.

The invention further consists in a crown cap for bottles of the kind having a rim flange, the cap being made from metal or other deformable material with a top portion and a skirt having an outwardly flared edge part and provided with radially extending corrugations, wherein a resilient or deformable sealing compound, such as a rubberised compound, is applied and adhesively secured around the internal surface of the skirt in a quantity sufficient to fill or more than fill the internal radial channels of the corrugations at least in the zone approximately where the outwardly flared edge part joins the upper part of the skirt and to provide a continuous ring of sealing compound around said zone, said ring of sealing compound forming the sole means of making a gas-tight seal between the cap and the receptacle.

The invention also further consists in a crown cap for bottles of the kind having a rim flange, the cap being made from metal or other deformable material with a top portion and a skirt having an outwardly flared edge part and provided with radially extending corrugations, wherein a resilient or deformable sealing compound, such as a rubberised compound, is applied in the form of blobs into each of the internal radial channels of the corrugations at least in the zone approximately where the outwardly flared edge part joins the upper part of the skirt, the said sealing compound being adhesively secured in the said channels and the blobs being of such size that they will deform and flow together to form a continuous sealing ring around the said zone when the cap is crimped on to a receptacle, the said ring of sealing compound thereby produced forming the sole means of making a gas-tight seal between the cap and the receptacle.

By means of the invention it becomes possible to make crown caps from .3 mm. aluminium which will seal gas pressures of 120 lbs. per square inch. The conventional cork gasket is eliminated, which also results in a saving of metal due to the reduced blank diameter required, these savings in cost enabling the caps to be manufactured at a price which is competitive with conventional crown cork caps made of tinplate. Of course it is not essential that the novel closure caps according to this invention be made from aluminium; they can also be made of tinplate or other suitable metals and materials.

The gas-tight seal is effected solely by compressing the

sealing compound which closes the radial channels against and around the underside of the rim flange on the neck of the bottle when the cap is crimped on the bottle, for example by conventional crown cork capping machinery. Preferably the compound is applied around the said zone of the internal surface of the skirt to form a continuous sealing ring therearound, but the compound may be applied as blobs which plastically flow and merge together to form a continuous sealing ring when they are compressed by the crimping of the cap on a bottle. The adhesion between the compound and the cap must be sufficient to prevent unsticking during the cap applying and under the pressures applied by the crimping operation.

Preferably the interior surface of the cap is protected from the contents of the bottle by a layer of some suitable protective material, such as lacquer, or by some appropriate surface treatment. In the case of aluminium such a surface treatment may be anodising. The anodised surface may be coated with a protective lacquer, thus providing double protection for preventing contamination of the contents of the bottle by the metal of the cap. The anodising provides a hard surface layer which reduces the risk of abrasion when the caps rub together in the hopper of the cap applying machine. A lacquer coating not only prevents the contents of the bottle from coming into contact with the metal of the cap but also improves the adhesion of the sealing compound to the skirt.

In order that the invention may be more clearly understood, reference will now be made to the accompanying drawing, in which:

Figure 1 is a perspective view from above of a cap according to the invention,

Figure 2 is a perspective view of the cap from below,

Figure 3 is an enlarged section through a part of the cap skirt where the sealing compound is affixed,

Figure 4 is a section through a bottle neck with the cap in position before being compressed to seal it on to the bottle,

Figure 5 is a section similar to Figure 4 with the cap crimped and sealed on to the bottle neck,

Figures 6, 7 and 8 are sections through modified caps, the left half of each figure showing the cap fitted on to a bottle neck before crimping, and the right half of each figure showing the cap after crimping,

Figure 9 is an enlarged section similar to Figure 3, but showing a modified method of applying the sealing compound.

Referring to Figures 1 to 5 of the drawing, the cap 1 is punched, for instance from sheet or strip aluminium, and is formed to provide the top portion 2 and the downwardly depending corrugated skirt portion 3, the edge part 4 of the skirt being flared outwardly. The corrugations extend radially relative to the top portion 2 and form radial channels 5 around the interior of the skirt. The internal surface of the cap is coated with a vinyl lacquer, and around the zone of the knee where the outwardly flared edge part 4 joins the upper part of the skirt 3 there is applied, in a semi-liquid state, a quantity of a resilient or deformable sealing compound, preferably a rubberised compound, in a quantity sufficient to fill or more than fill the internal radial channels 5 in this zone and to form a continuous ring 6 of the compound therearound as shown in Figures 2 and 3. The compound is then solidified, for example by heating, which may also effect any vulcanisation which may be necessary. When the compound solidifies, it firmly adheres to the lacquered internal surface of the said zone of the skirt and forms a resilient sealing ring therearound. A suitable sealing compound is No. G485 marketed by Messrs. Dewey Almy Limited. On a cap having a 26 mm. diameter skirt a quantity of 160 milligrammes of sealing compound has proved adequate for producing a continuous sealing ring which will effect a gas-tight seal according to this invention.

The depth of the upper part of the corrugated skirt 3 down to the zone where the ring 6 of sealing compound is applied is such that when the cap is fitted on to a bottle neck this ring of sealing compound will lie at least partially just below the bottom corner 7 of the rim flange 8 on the bottle neck 9, so that when the flared edge part 4 is formed inwardly and downwardly by the crimping operation, for example by a conventional crown cap sealing machine, the skirt will be folded around the bottom corner 7 of the rim flange and compress the ring 6 of sealing compound between the skirt and the underside of the rim flange 8, thereby closing the spaces formed by the internal radial channels 5 and the rim flange and forming a gas-tight seal around the underside of the rim flange as shown in Figure 5. The internal dimensions of the skirt 3 are preferably such that when the requisite quantity of sealing compound is applied, the internal diameter of the sealing ring will be slightly smaller than the maximum diameter of the rim flange (which is the diameter of the corner 7) and will snap over the rim flange when the cap is applied to the bottle.

When the cap is crimped and sealed in position on the bottle as shown in Figure 5, the edge part 4 of the skirt still remains spaced from the bottle neck so that it can be engaged by a conventional crown cap opener for removing the cap from the bottle.

The ring 6 of sealing compound constitutes the sole means of making a gas-tight seal between the cap and the bottle. As distinguished from the conventional crown cork cap which effects sealing at the top of the neck by the cork liner in the cap being compressed against the top of the neck when its skirt is formed under the rim flange, the seal formed with the cap according to this invention is effected by the sealing compound which closes the radial channels and is compressed, in a continuous ring, against the underside of the rim flange and the adjacent portion of the neck by the skirt of the cap. When the cap is sealed in position, the gas pressure within the bottle tends to press the ring of sealing compound into even tighter sealing contact with the underside of the rim flange. The sealing compound which closes the radial channels not only prevent leakage through these channels but also prevents the ingress of dirt through the channels to the rim flange, thus making the closure more hygienic.

Closure caps constructed as above described and made from strip aluminium of .3 mm. thickness have, under test, satisfactorily maintained a gas-tight seal against gas pressures within the bottles of 160–175 lbs. per square inch, which has hitherto not been possible with aluminium caps made from aluminium of such thickness. By reason of the omission of the cork liner the depth of the upper part of the skirt is reduced which enables the blank diameter from which the cap is formed to be reduced, thereby effecting a saving in material. A further reduction in blank diameter is possible with aluminium by reason of the crimping operation drawing down the relatively soft metal around the curved top lip of the rim flange, as shown in Figure 5, and thereby slightly lengthening the skirt.

In the embodiment shown in Figures 1 to 5, the sealing compound is applied to extend both just above and below the knee where the outwardly flared edge part 4 joins the upper part of the skirt. In the modification shown in Fig. 6, the ring of sealing compound 6 is applied only to the outwardly flared edge part 4 just below the knee. In the further modification shown in Fig. 7, the sealing compound 6 is applied at a position just above the knee. In each case the sealing ring 6 is compressed into gas-tight sealing engagement with the underside of the rim flange, when the cap is crimped, exactly as with the first embodiment. With the embodiment of Fig. 6, the depth

of the skirt 3 above the knee can be slightly less than with the embodiment of Fig. 7.

In the embodiments described the sealing compound has been applied to fill the radial channels 5 along part of their length. If desired the radial channels 5 may be filled along their entire length. Further, instead of applying the sealing compound to form a continuous ring around the interior of the skirt, each channel may be individually over-filled with a blob of compound as shown in Fig. 9, the individual blobs being of such size that the blobs will deform and flow together to form a continuous sealing ring around the underside of the rim flange when the cap is crimped on to the bottle.

Whilst the invention is of particular importance for making closure caps, from sheet aluminium, the caps can, of course, be made from tinplate. By reason of the improved sealing properties of the cap the gauge of the tinplate can be reduced below that normally used for crown cork caps. There is also a saving in cost by the reduction in blank diameter and in the elimination of the cork liner. To reduce the risk of scratching the protective lacquer over the interior of the cap by the sharp edges of other caps, when the caps tumble together in the hopper of the cap applying machine, the sealing compound can be applied in a somewhat larger quantity so as also to cover the raw edges of the steel caps as shown in Fig. 8. Such edge protection also reduces the risk of the user scratching his hand if the cap opener slips while the cap is being removed.

The closure cap according to this invention is also suitable for closing bottles containing sterilised milk, the cap being able to withstand both the pressures occurring in the bottle during sterilisation and the vacuum created in the bottle on cooling.

I claim:

1. In combination, a receptacle having a rim flange to which is sealed a crown cap made of deformable material with a top disc portion extending over the mouth of the receptacle and a corrugated skirt extending downwardly from the top portion and inwardly beneath the rim flange to secure the cap on the bottle, the bottom of the skirt beneath the rim flange being spaced from the receptacle so that its peripheral edge can be engaged by a conventional crown cap opener when the cap is to be removed, and a resilient sealing compound which is adhesively secured to the interior of the skirt and forms a sealing ring therearound at a zone which extends at least partially below the underside of the rim flange, said ring of sealing compound completely closing the spaces formed by the internal radial channels of the corrugations and the rim flange at said zone and being compressed and forming a gas-tight seal between the inwardly extending part of the corrugated skirt and the underside of the rim flange.

2. In combination, a receptacle having a rim flange to which is sealed a crown cap made of aluminium with a top disc portion extending over the mouth of the receptacle and a corrugated skirt extending downwardly from the top portion and inwardly beneath the rim flange to secure the cap on the bottle, the interior surface of the skirt being coated with a lacquer, and a resilient sealing compound which is adhesively secured to the lacquer on the interior of the skirt and forms a sealing ring therearound at a zone which extends at least partially below the underside of the rim flange, said ring of sealing compound completely closing the spaces formed by the internal radial channels of the corrugations and the rim flange at said zone and being compressed and forming a gas-tight seal between the inwardly extending part of the corrugated skirt and the underside of the rim flange.

3. A crown cap for receptacles having a rim flange, the cap being made from deformable material with a top portion and a skirt having an outwardly flared edge part and provided with radially extending corrugations, and a deformable sealing compound applied in the form of blobs into each of the internal radial channels of the corrugations at least in the zone approximately where the outwardly flared edge part joins the upper part of the skirt, the said sealing compound being adhesively secured in the said channels and the blobs being of such size that they will deform and flow together to form a continuous sealing ring around the said zone when the cap is crimped on to a receptacle.

4. A crown cap for receptacles having a rim flange, the cap being made from metal with a top portion and a skirt having an outwardly flared edge part and provided with radially extending corrugations, a coating of lacquer on the internal surface of the cap, and a resilient sealing compound applied in the form of blobs into each of the internal radial channels of the corrugations at least in the zone approximately where the outwardly flared edge part joins the upper part of the skirt, the said sealing compound being adhesively secured to the lacquer coating in the said channels and the blobs being of such size that they will deform and flow together to form a continuous sealing ring around the said zone when the cap is crimped on to a receptacle.

5. A crown cap for receptacles having a rim flange, the cap being made from aluminium with a top portion and a skirt having an outwardly flared edge part and provided with radially extending corrugations, a coating of lacquer on at least the internal surface of the skirt of the aluminium cap, and a resilient sealing compound applied in the form of blobs into each of the internal radial channels of the corrugations at least in the zone approximately where the outwardly flared edge part joins the upper part of the skirt, the said sealing compound being adhesively secured to the lacquer coating in the said channels and the blobs being of such size that they will deform and flow together to form a continuous sealing ring around the said zone when the cap is crimped on to a receptacle.

6. A sealed package comprising a receptacle, the interior of which is under greater than atmospheric pressure, said receptacle having a rim flange to which is sealed a crown cap made of deformable material with a top disc portion extending over the mouth of the receptacle and a corrugated skirt extending downwardly from the top portion and inwardly beneath the rim flange to secure the cap on the bottle, and a resilient sealing compound which is adhesively secured to the interior of the skirt and forms a sealing ring therearound at a zone which extends at least partially below the underside of the rim flange, said ring of sealing compound completely closing the spaces formed by the internal radial channels of the corrugations and the rim flange at said zone and being compressed and forming a gas-tight seal between the inwardly extending part of the corrugated skirt and the underside of the rim flange.

7. A crown cap for the top of a receptacle of the type having a rim flange, said cap being made of a metal and comprising a top disc encircled by a depending peripheral skirt long enough to extend below said rim flange, said skirt being provided with radially extending corrugations and comprising an upper part joined to said top disc and an outwardly flared edge part depending from said upper part, and a resilient sealing compound adhesively secured to the internal surface of the skirt at least in the zone approximately where said edge part and said upper part adjoin, said sealing compound filling in the corrugations on the internal surface of said skirt in said zone and projecting inwardly to form a continuous sealing ring positioned to engage under said rim flange when said skirt is crimped onto said receptacle top.

8. A crown cap for the top of a receptacle of the type having a rim flange, said cap being made of aluminum and comprising a top disc encircled by a depending peripheral skirt long enough to extend below said rim flange, said skirt being provided with radially extending corrugations and comprising an upper part joined to said top disc and an outwardly flared edge part depending

from said upper part, a coating of lacquer on the internal surface of said skirt, and a resilient sealing compound adhesively secured to the lacquer on the internal surface of the skirt at least in the zone approximately where said edge part and said upper part adjoin, said sealing compound filling in the corrugations on the internal surface of said skirt in said zone and projecting inwardly to form a continuous sealing ring positioned to engage under said rim flange when said skirt is crimped onto said receptacle top.

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