Aug. 24, 1948. G. KEITH 2,447,581

SEALING CAP FOR VACUUM BOTTLES AND THE LIKE

Filed July 28, 1944

FIG. 1.

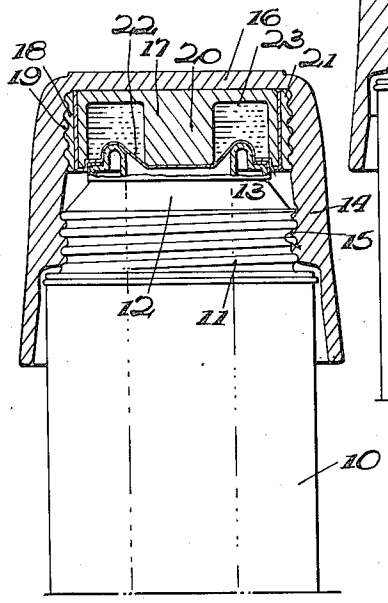


FIG. 2.

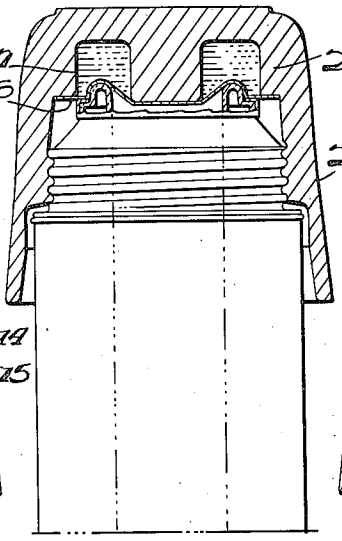


FIG. 3.

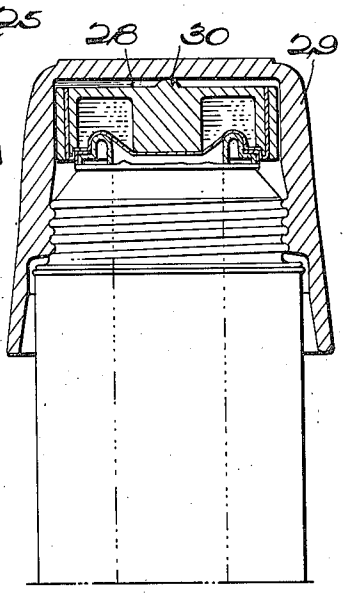
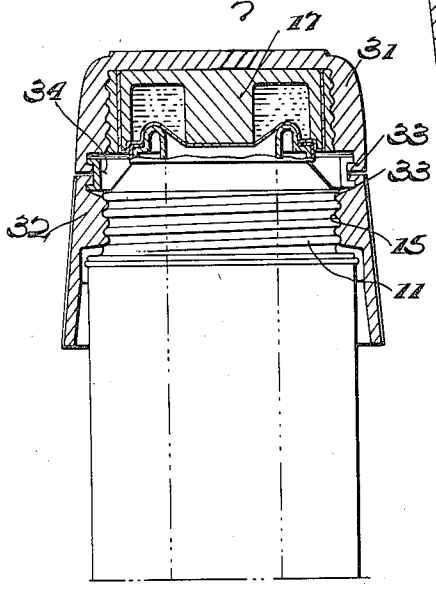


FIG. 4.



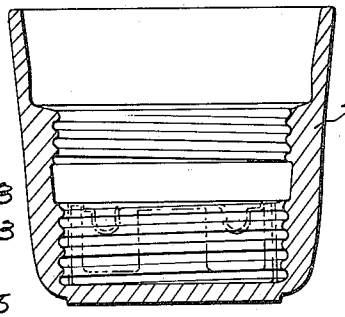


FIG. 5.

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SEALING CAP FOR VACUUM BOTTLES AND THE LIKE

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Application July 28, 1944, Serial No. 546,955

2 Claims. (Cl. 215—43)

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The present invention relates to sealing caps or closures for containers and more particularly provides a novel device which is adapted to serve as a closure for sealing a vacuum or "Thermos" bottle and to function, when removed from the bottle, as a cup into which the bottle contents may be poured for drinking, measuring or the like.

The standard prior art vacuum bottle includes a more or less conventional cork or plug for closing the bottle orifice. The bottle casing is generally threaded near its upper end to receive a cup which covers the cork and protects it and the surrounding area of the bottle, which is made of glass and is therefore quite fragile. This arrangement is unsatisfactory for a number of reasons, and the present invention aims to improve it by providing a very simple and inexpensive combined seal and cup which has the following principal advantages:

1. The operation of attaching the cup to the bottle casing automatically seals the bottle.

2. The seal is superior to the usual inserted cork or plug.

3. The seal is positive and pressure-proof to a high degree, so that carbonated beverages can be kept in the bottle.

4. The condition of the seal, i. e., whether the closure is loose or tightly in place, can be observed from the relation of the cap on the bottle casing, so that it becomes a simple matter to detect a loose closure and tighten it. In the prior art structures the cork could become loose under the cap and leaking of the contents of the bottle would constitute the first intimation of looseness.

6. The cap is readily useful as a drinking cup or as a cup for other purposes.

6. It is a simple and easy matter to mount the seal in place with considerable sealing pressure applied in a manner and a direction which cannot injure the fragile material of which the bottle is made. Removal is just as easy, even though the seal be tightly pressed against the bottle orifice.

7. The sealing element of the cup may, in one form of embodiment, be readily removed from the cup for repair or replacement.

8. The device may be and preferably is made of material which is inert to all beverages and the like with which a vacuum bottle might be expected to be filled.

9. Even in those embodiments in which the sealing body is detachable from the cup element, the two parts may be connected to constitute in effect a single member, so that the annoyance of losing the cork of the prior art is entirely eliminated.

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10. The sealing body is chambered and contains a fluid fill having high insulating value, so that preservation of the temperature of the bottle contents is promoted.

11. The whole structure is adapted to be made of inexpensive, non-critical materials.

The means by which the foregoing and other objects and advantages are attained will, it is believed, be evident to those skilled in the art from the following specification, considered in connection with the accompanying drawing, which specification and drawing disclose certain preferred embodiments of the invention. It is to be understood that other and further modified forms of the invention are contemplated; hence the appended claims are to be construed broadly and without limitation to the illustrated embodiments except to the extent required by the express terms of the claims.

In the accompanying drawing which forms part of this application for letters patent and in which the same reference character indicates the same part of the several views,

Figure 1 is a diametrical lengthwise section through one embodiment of the invention, shown placed in operative, sealing position on a conventional type of vacuum bottle;

Figs. 2, 3 and 4 are similar views of modifications; and

Fig. 5 is a similar view of the novel device, shown removed from the bottle and inverted so as to serve as a cup for drinking, measuring or other purpose.

Referring now to this drawing, the reference numeral 10 designates the outer shell or casing of a conventional type of vacuum or "Thermos" bottle. This shell is generally made of sheet metal, but it may be made of glass. hard rubber or other well known plastic compositions, and is formed near its upper end with a radially reduced portion having coarse screwthreads 11 surmounted by a generally tapering portion 12 which terminates just short of the protruding end of the bottle per se 13, which is usually made of thin glass having hollow walls which are constructed to have high insulation value, as by being internally silvered and providing a vacuum chamber. In some cases, notably the so-called picnic jugs, the internal bottle is made of solid crockery of low heat-conductivity, or it is a double walled shell filled with insulation such as rock wool, exfoliated vermiculite or the equivalent. It is to be understood that my invention is unconcerned

with the particular structure of the bottle or its casing and relates solely to the cap structure which will now be described.

The shape of the cap may be that of the conventional prior art cup, being, as shown at 14 in Fig. 1, nearly cylindrical but somewhat tapered toward its normally upper, closed end or base. It is customary to make such a cap outwardly beaded near its lower, open end or rim to improve its appearance and increase its strength. The cap is made of any suitable relatively rigid material, such as hard rubber or even metal, but I prefer to use some appropriate plastic, such as Bakelite or other phenolic condensation product, or any thermoplastic or thermosetting material which will be proof against temperatures in the range to which the cap may be subjected. The present market affords many kinds of such materials, and no further specification of them is necessary.

Inasmuch as the cap is to be held secured to the bottle casing, it is conveniently threaded internally more or less near its rim as shown at 15, so as to mesh with the threads 11 of the bottle casing. If the casing is formed otherwise than with threads 11, as with a bayonet slot, clamping or other type of fastening means, the cup is of course complementally formed. It is broadly necessary only that the cap and bottle casing be arranged to be secured together. Screwthreading is in my opinion the easiest and most practical expedient for this purpose.

The normally upper, closed end or base 16 of the cup contains a sealing body 17. In Fig. 1 this body is detachable from the cup, being held therein by engagement of its external screwthreads 18 with internal screwthreads 19 formed in the cup near the base. The diameter of the threaded body 17 is made sufficiently smaller than the diameter of the upper portions of the cup to permit easy entry of the body into the cup and ready engagement of the threads 18 and 19. The body 17, in the form shown in Fig. 1, is made in three parts, comprising a central plug 20, a surrounding sleeve 21, and an interposed diaphragm 22 which is cup-shaped and generally cylindrical in shape, having its outer wall securely and permanently clamped between the parts 20 and 21 and having its base or bottom spanning and covering the central, inwardly facing surface area of the sealing body 17. This area is provided with a comparatively deep annular groove 23 which, being covered by the diaphragm 22, constitutes a closed recess or chamber. This chamber is filled, or substantially filled, with a fluid which will be more particularly described hereinafter.

The diaphragm is made of sheet material which is flexible or yieldable, being in this respect different from the material of which the sealing body 17 and the cap 14 are made. To make the diaphragm I may use any one of a number of materials which are now extensively available, such as "Neoprene" (chlorobutadiene polymer made by E. I. du Pont de Nemours & Co., Wilmington, Del.), "Resistoflex" (polyvinyl alcohol) or butadienestyrene copolymer. Of course suitable natural rubber compositions may be used as well as the synthetic materials, it being necessary only that the diaphragm have the physical properties of sufficient strength to resist such sealing pressures as may be imposed on it in ordinary use of the vacuum bottle and that it be moderately flexible or elastic so as to yield in response to such pressures.

The three parts 20, 21 and 22 of the sealing body 17 are permanently secured together by cementing, wedge fitting, autogenous welding or otherwise. The fluid fill may be a relatively incompressible liquid, such as a neutral oil or water having incorporated in it some freezing point depressant, or it may be a compressible gas, such as air. While these two classes of fluids act differently in respect of compressibility, both support the diaphragm in such a way as to make it an effective seal for the bottle orifice when the sealing body is pressed down on the orifice, as by screwing the cap down more or less tightly on the bottle casing in the illustrated embodiments of the invention. The outer surface of the diaphragm is best made reasonably smooth, as is also the lip of the bottle 13, but there are of course inevitable more or less microscopic inequalities that militate against good sealing. However, pressing the sealing body against the bottle results in yielding of the diaphragm at its various points of contact with the bottle lip, permitted by a shifting of the fill if the fill be a liquid or compression of the fill if it be a gas. In either case the surface of the diaphragm which engages the surface of the bottle lip becomes distorted sufficiently to conform to inequalities in the bottle lip and provide an excellent seal. It will be obvious that by the simple expedient of screwing the cap down farther on the bottle the tightness of the seal may be increased by increasing the pressure of the sealed surfaces, and no reasonable amount of pressure will injure the bottle material because all such pressure is applied endwise to the bottle, a direction in which it is of course able to withstand much greater stresses than it could withstand radially, as in the case of an insertible cork or other plug.

Fig. 2 shows a modification which includes, in lieu of the detachable and removable sealing body 17 of Fig. 1, a counterpart 24 which is integral with the cup body 25. In this case the diaphragm 26 is a disk, made of the same material as the cup-shaped diaphragm 22, which is cemented or autogenously welded to the inner surface of the base 24. The annular recess or chamber 27 is filled the same as the chamber 23, and the whole structure functions in the same way as the embodiment illustrated in Fig. 1 except of course that the sealing body is not removable.

Fig. 3 illustrates a further modification in which the sealing body is made separate from the cup 29 and may be loosely fitted therein so as to be readily removable therefrom. If the bearing surface of the sealing body on the base of the cup is made fairly small, as by providing it with the central boss 30, the sealing body readily turns in the cup. This constitutes an advantage of considerable importance, particularly when the diaphragm is made quite thin or of material which does not have great strength, because the diaphragm does not turn in rubbing contact with the end of the bottle 13 as it does in the embodiments shown in Figs. 1 and 2. Instead, the diaphragm and the entire sealing body 28 are pressed in a straight axial direction, with no rotation, against the end of the bottle when the cup is screwed down on the bottle, and of course move straight in the opposite direction when the cup is unscrewed. Wear of the diaphragm is thus completely eliminated.

Fig. 4 shows another embodiment in which rubbing of the diaphragm on the bottle end is eliminated. In this construction the sealing body may be made in any of the ways hereinabove dis-

closed. However, the cup is made in two parts, one containing the sealing body and the other bearing the internal threads which engage the threads on the bottle, and these two parts are made relatively rotatable so that the part which engages the bottle can be turned down on the bottle or unscrewed from the bottle without causing the part which contains the diaphragm to turn on the bottle end.

In Fig. 4, the base member of the cap is designated 31 and the rim member is designated 32. The base member contains the sealing body 17 and the rim member is provided with the threads 15 which engage the threads 11 of the bottle. Each of these members is provided with an annular groove 33 in its inside near the end which engages the end of the cooperating member to compose the complete cup. A split ring 34 of outwardly facing channel shape, made of appropriate somewhat flexible plastic material, is sprung into position so that its flanges fit into the grooves 33 and hold the two cup members together against endwise or axial separation while permitting relative rotation. Thus the member 32 may be turned on the bottle without turning the member 31 or the sealing body 17, and in this way wear of the diaphragm is prevented.

Fig. 5 shows the cup 14 of Fig. 1 detached from the bottle and inverted for use as a drinking cup or for any other purpose. The sealing body may be removed for such use, or it may be left in. Of course the integral sealing body 24 of the Fig. 2 cup cannot be removed, but this does not impair the usefulness of the cup for drinking or other use because the material of which the sealing body is made is entirely tasteless and inert to all the beverages or other commodities which would ordinarily be put into a vacuum bottle.

It will be noted that in all embodiments of the invention the fluid-filled recess or chamber is wide enough and deep enough to permit the full expected degree of distortion of the diaphragm which may result from the tightest possible screwing down of the cap on the bottle casing. For the same reason, the clearances between the end of the bottle shell and the inner surface of the fluid-filled chamber are kept wide. It will be understood that the purpose is to permit the bottle end to penetrate, through all ranges of adjustment of the cup on the bottle, into the recess or chamber and be resisted only by the cushioning action of the diaphragm backed by the fluid fill.

I claim:

1. A combined sealing cap and drinking cup element for a vacuum bottle having an orifice lip, said element comprising a cup provided with a rim and a base and having detachably positioned in its base a plug provided with an annular recess containing a fluid, a flexible diaphragm secured to the plug and covering the fluid, and internal thread means provided in the cup adjacent to its rim for engaging the bottle and holding the cup thereon with the lip of the bottle pressing the diaphragm into the recess.

2. A combined sealing cap and drinking cup element for a vacuum bottle having an orifice lip, said element comprising a cup provided with a rim and a base and having in its base a plug provided with a fluid-filled annular recess having between its inner and outer edges a width which is greater than the thickness of the orifice lip of the bottle, a flexible diaphragm covering the recess and holding the fluid therein, in combination with internal thread means provided in the cup adjacent to its rim for engaging the bottle and causing the lip of the bottle to press the diaphragm into the recess when the element is turned on the bottle and adjacent to its base for detachably securing said plug in the cup.

GLENN KEITH.

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