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J. J. HITOV

2,982,436

SEALING CONSTRUCTION

Filed Feb. 1, 1957

FIG. 2.

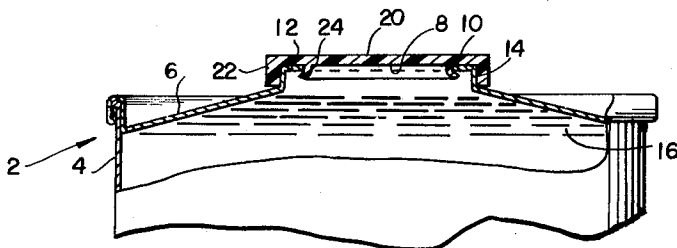


FIG. 1.

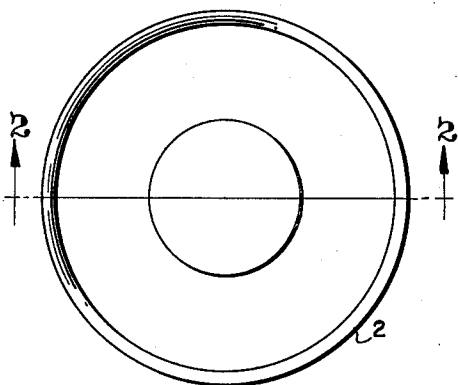


FIG. 3.

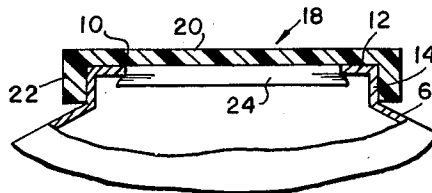


FIG. 6.

FIG. 4.

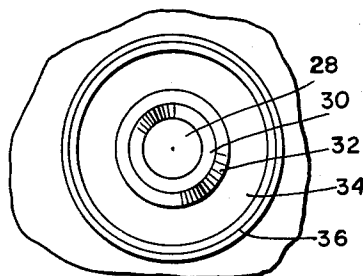
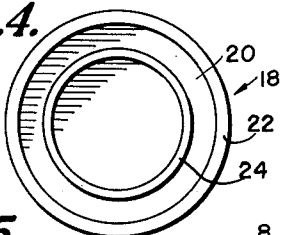


FIG. 5.

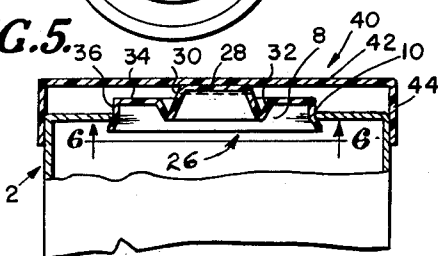
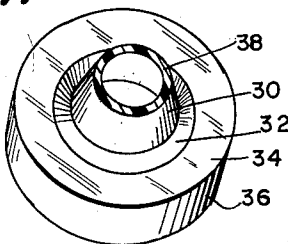


FIG. 7.



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2,982,436

SEALING CONSTRUCTION

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2 Claims. (Cl. 220—24)

This invention relates to a novel combination of a metal container and a plastic closure therefor.

It is an object of the invention to form a more effective seal between a metal container and a plastic closure therefor.

A further object is to effectively seal the raw metal wall of an opening in a metal container.

An additional object is to eliminate the necessity for employing a rolled edge for the opening in a metal container which is to be sealed by a closure.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

It is conventional practice today to have a rolled edge for the opening in a metal container. While a raw metal edge is more economical to produce than a rolled edge, it has the disadvantage that it is normally difficult to make a satisfactory seal with the closure. There are several reasons for this. Thus, when a conventional steel can has a protective lacquer coating, the protective coating is removed at the raw edge and it is relatively costly to relacquer the exposed edge. Similarly, if a steel container has a conventional coating of tin, the latter is cut through in making the opening and the raw steel is exposed.

It has now been found that the raw metal edge can be effectively sealed by a plastic closure which is swellable in a liquid within the container but which is not completely dissolved by the liquid.

The metal container can be cylindrical, rectangular or of other shape. While the novel means of sealing is of particular advantage when the opening in the container has a raw metal edge, it is also effective when the opening has a rolled edge.

The swelling agent or liquid employed will depend on the particular plastic. Polyethylene, which is the preferred plastic, when placed in contact with certain solvents will swell appreciably due to the absorption of the liquid by the solid polymer even at temperatures at which there is no appreciable solution of the polymer in the liquid.

Hydrocarbons, dialkyl ethers and haloalkylcarbons which are absorbed readily by polyethylene are especially effective as liquids which are useful in swelling this polymer.

The following table shows the absorption of various liquids in 48 hours at 20° C. by one gram of polyethylene in a sheet 1 mm. thick.

Table I

Liquid:	Volume absorbed (ml.)
Cyclohexane	0.20
Carbon tetrachloride	0.19

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Liquid:	Volume absorbed (ml.)
n-Heptane	0.15
Benzene	0.10
Ethyl ether	0.10
Amyl acetate	0.03
Nitrobenzene	0.015
Amyl alcohol	0.004

By briefly heating the metal container and plastic closure, the sealing can be completed in short order. Thus, using a hydrocarbon oil which at 20° C. has an equilibrium absorption in polyethylene of 5.2%, the effect of temperature on initial absorption of the oil in the polyethylene is shown in the following table.

Table II

Temperature ° C.:	Initial absorption rate, percent/hour
20	0.2
40	1.2
60	10.0
75	36.0

While the liquid in the container can be placed in direct contact with the polyethylene closure, this is not normally essential since the vapors rising from the liquid usually will be sufficient to supply the necessary swelling.

The invention will be more readily understood from a consideration of the drawings which present certain preferred embodiments and wherein:

Figure 1 is a top plan view of one form of the invention;

Figure 2 is a section on the line 2—2 of Figure 1;

Figure 3 is a fragmentary sectional view showing the sealing flange in elevation;

Figure 4 is a bottom plan view of the closure employed in Figure 3;

Figure 5 is a sectional view of an alternative form of the invention;

Figure 6 is a bottom plan view on the line 6—6 of Figure 5; and

Figure 7 is a perspective view of the closure shown in Figure 5.

Referring more specifically to Figure 1 of the drawings, there is provided a metal (steel) container 2 having a conventional vinyl chloride-vinyl acetate lacquer coating. The container has a side wall 4 and a top wall 6. The top wall has a central opening 8 which is formed by cutting a piece out of the top wall. As a result of this cutting operation, the wall or edge 10 of the opening is of raw, sharp metal. The top wall comprises a horizontal flange 12 beginning at the opening, a downwardly directed flange side wall 14 and a frusto-conical wall 6 which terminates at the side wall 4.

A liquid 16, e.g., benzene, which swells polyethylene is placed in the container 2 and then a polyethylene closure 18 is placed on the container to seal the opening 8. The closure 18 comprises a top portion 20, a downwardly directed outer wall 22 fitting tightly around the container flange side wall 14 and a downwardly directed flange 24 tightly engaging the raw metal wall 10. The seal between the closure and the container is strengthened due to the swelling of the polyethylene as it comes in contact with the solvent vapors.

In the form of the invention as shown in Figures 5 to 7, there is provided a metal cylindrical container 2 with a central opening 8 in one end thereof. The opening has a side wall 10 of the raw metal. The container has in it CCl₄. A polyethylene closure 26 is placed on the container to seal the opening 8. The closure 26 comprises a flat central top portion 28, a downwardly and outwardly tapered wall 30 therefrom, and upwardly and outwardly extending wall 32 beginning at the bottom of wall 30 and terminating in a horizontal portion 34 and a downwardly directed flange 36 at the end thereof tight-

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ly engaging raw metal wall 10. Tight sealing is accomplished by the CCl_4 vapors swelling the polyethylene closure.

The walls 30 and 32 impart a certain amount of flexibility to the closure and also serve to form a pouring spout as described below. In this embodiment it is possible to open the container merely by cutting the top portion 28 of the closure to provide an open end 38, as shown in Figure 5 by the dotted lines. The open end serves as a pouring spout. Thereafter the container can be effectively closed by providing a cap 40 having a top 42 and a side wall 44 which fits tightly around the container wall. The cap 40 can be made of polyethylene or other plastic.

The two-piece construction of Figures 5-7 is the presently preferred form of the invention. It should be noted that in this two-piece design there will not be an adequate seal if the spout 28 is initially open rather than closed, as shown in Figure 5. The two-piece closure with an open spout will leak when held in an inverted position. The time for leakage to develop depends upon the solvent in the container and the temperature. With the closed spout, leakage does not develop.

I claim:

1. In combination a metal container having a liquid therein, an opening in one end of said container, a raw, sharp substantially vertical metal wall for said opening, a substantially horizontal outwardly extending flange from said wall terminating in a downwardly directed side wall, a polyethylene closure for said opening, said closure comprising a substantially flat central top portion, a first downwardly and outwardly extending wall from said top portion, an upwardly and outwardly extending wall beginning at the bottom of said first wall and terminating in a horizontal outwardly extending portion and a downwardly directed flange at the end thereof tightly engaging said raw, sharp metal wall, said polyethylene being swella-

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ble by said liquid to form said tight engagement, and a plastic cap for said closure.

2. In combination, a metal container having a liquid therein, an opening in one end of said container, a thin, raw, sharp edge defining said opening, and a plastic closure for said container, said closure having a skirt portion with an outwardly projecting lower end, said skirt portion extending at least partially within said opening and in sealing engagement with said sharp edge, said lower end extending under said edge, said closure having a frusto-conical central portion, and a planar flange extending laterally of said central portion and joined to said central portion by a depending inwardly sloped wall, said skirt portion depending from the periphery of said flange, said plastic being swellable by said liquid to expand said closure whereby the opening in said container is tightly sealed by said skirt portion, and said sharp edge is protected.

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