

Nov. 25, 1947.

B. R. BILLMEYER

2,431,303

CLOSURE

Filed Oct. 4, 1946

FIG.1

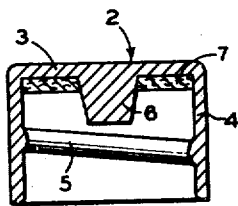


FIG.4

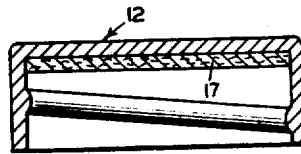


FIG.2

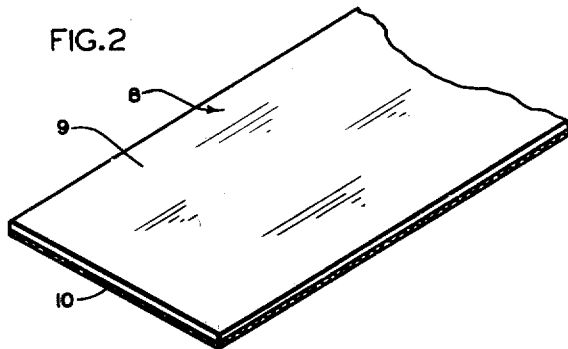


FIG.3

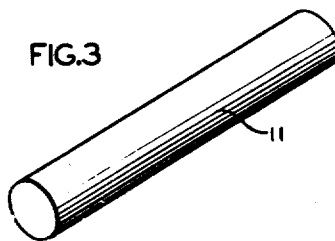


FIG.5



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2,431,303

CLOSURE

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Application October 4, 1946, Serial No. 701,169

6 Claims. (Cl. 215-40)

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This application is a continuation-in-part of my copending application Serial No. 570,333, filed December 29, 1944, and entitled "Closures."

This invention relates to closures and, more particularly, to a closure including an acid-resistant liner for sealing receptacles containing acidic materials.

The chief object of my invention is to provide a closure including a liner which is resistant to strong acids. An object of my invention is to provide a closure including an acid-resistant liner possessing increased resistance to cold flow and capable of wider application than liners of this type heretofore used. A further object of my invention is to provide an acid-resistant liner material which possesses limited thermoplasticity and which is reinforced to reduce its susceptibility to cold flow. A still further object is to provide an acid-resistant liner material which possesses increased tensile strength and is reinforced and strengthened to decrease cold flow in use.

This invention relates to a closure comprising, in combination, a cover, a skirt depending from the cover, and an acid-resistant liner placed within the skirt, said liner comprising an acid-resistant binder, an acid-inert inorganic filler, and acid-resistant fibers selected from the group consisting of polystyrene fibers, polyethylene fibers, polyvinylidene chloride fibers, vinylidene chloride-vinyl chloride copolymer fibers, and glass fibers, said fibers serving to strengthen and reinforce the same.

This invention further relates to an acid-resistant liner material for closures which comprises an acid-resistant binder, an acid-inert inorganic filler, and acid-resistant fibers selected from the group consisting of polystyrene fibers, polyethylene fibers, polyvinylidene chloride fibers, vinylidene chloride-vinyl chloride copolymer fibers, and glass fibers, said fibers serving to strengthen and reinforce the same.

The attached drawing illustrates a preferred embodiment of my invention, in which

Figure 1 is a sectional view of the closure of my invention;

Figure 2 is an isometric view of the preferred liner material of my invention;

Figure 3 is an isometric view, similar to Figure 2, of a modified form of liner material;

Figure 4 is a sectional view of a modified form of closure; and

Figure 5 is a sectional view illustrating a modified liner construction.

Referring to the drawing, there is shown in

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Figure 1 a closure 2 preferably molded of a resistant material, such as polystyrene, which includes a cover 3 having a skirt 4 depending therefrom. Skirt 4 is provided with means 5, for example, screw threads, adapted to engage similar means on a container to attach the closure thereto. The closure may be provided with a projection 6 if a ring type liner be used. Within the skirt 4 adjacent the cover 3 is disposed an acid-resistant ring liner or washer 7 formed as hereafter described. The acid-resistant liner 7 may be adhesively secured to the interior surface of cover 3 or it may be retained within the closure by the threads 5.

In Figure 4, there is illustrated a similar closure 12 except that the projection 6 is omitted; in this case, liner 17 is in the form of a disk which extends across the interior surface of the cover.

Liners 7 and 17 are formed of an acid-resistant binder, an acid-inert inorganic filler, and acid-resistant fibers which serve to strengthen and reinforce the same. The acid-resistant fibers may comprise fibers or filaments of polystyrene, polyethylene, polyvinylidene chloride, vinylidene chloride-vinyl chloride copolymer, glass, or mixtures thereof, and may be added to the compound in the form of loose fibers or filaments or the compound may be calendered upon a backing or base fabric woven therefrom. The acid-resistant binder may include polyisobutylene ("Vistanex") having a molecular weight of at least 60,000 and preferably between 80,000 and 100,000 blended with a vinyl chloride-acetate copolymer, such as "Vinylite VYNW" or "Geon," a polyvinyl chloride resin. Preferably, the compound contains a small amount of sulphur as a stabilizer and it may contain a small amount of carbon black as a pigment. It will be appreciated that other pigments may be used, if desired, but it is essential in my invention that such pigments be resistant to acids. The filler may comprise finely ground silica, such as 325 mesh silica; any suitable acid-inert inorganic filler which does not react with the acidic contents of the receptacle may be used in place of silica. For example, diatomaceous earth free from materials which would contaminate the contents of the receptacle may be substituted with satisfactory results.

Preferably, the compound including an acid-resistant binder and an acid-inert inorganic filler is calendered on a woven fabric formed from fibers or filaments of polystyrene, polyvinylidene chloride, vinylidene chloride-vinyl chloride copolymer, or glass. It will be appreciated such

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composition may be calendered as a coating on the woven fabric or, if desired, it may be calendered under sufficient pressure to force the compound within the interstices of the woven fabric. The fabric serves to reduce cold flow of the compound, increases the tensile strength of the liner material, and strengthens and reinforces the same. If desired, acid-resistant fibers or filaments, as described above, may be included in the compound and when so used, serve satisfactorily to strengthen and reinforce the same.

A preferred compound for the manufacture of the liner material of my invention is as follows:

Polyisobutylene (M. W. 80,000-100,000)	
	pounds... 10
"Vinylite"	do..... 9
Silica, 325 mesh	do..... 20
Sulphur	ounces... 1/3
Gastex	do..... 4

In the above compound, polyisobutylene and "Vinylite" are blended to form the acid-resistant binder. "Vinylite" is an unplasticized vinyl chloride-acetate copolymer containing a small amount of acetate. Gastex is a carbon black of the furnace black type and is used in the above compound as a pigment.

In the manufacture of the compound, the ingredients are milled together, the sulphur being added to the polyisobutylene, followed by the "Vinylite." Such ingredients are blended together and the Gastex and silica added thereto and thoroughly mixed therewith. The compound so formed is then calendered on a woven fabric backing formed of suitable acid-resistant fibers, such as those described above, and referring to Figure 2, forms a sheet 8 of liner material having a facing layer 9 of the above composition disposed upon a woven fabric backing 10. It will be appreciated the pressure of the calender, preferably, is such as to force composition 9 within the interstices of the woven fabric backing 10. Liners or rings are then cut from the sheet of material so formed and are placed in closures. It will be understood the composition may be calendered on both sides of the fabric backing if desired. This is shown in Figure 5 of the drawing where the foundation of woven fabric 13 supports layers 14 and 15.

In the modification of my invention, illustrated in Figure 3, acid-resistant fibers, as described above, are incorporated in the compound. To form this modification of my invention, acid-resistant fibers may be incorporated into the compound disclosed above in an amount falling within the range of 4 to 20 pounds. The acid-resistant fibers are thoroughly dispersed throughout the compound and the compound is then extruded to form the liner material into the desired cross-sectional shape. The rod 11 (Figure 3) so formed may be severed into disks or rings which are then disposed in closures. It will be appreciated, if desired, such compound reinforced by the acid-resistant fibers may be calendered into sheets from which disks are cut for insertion into closures.

My invention provides a closure containing a liner possessing excellent resistance to strong acids such as concentrated sulfuric acid, concentrated hydrochloric acid, and concentrated nitric acid. While the liner compound per se may be somewhat susceptible to cold flow, the reinforcement provided by the practice of my invention decreases the amount of cold flow in use and

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strengthens and reinforces the liner material. The liner material of my invention may be manufactured economically on equipment customarily used in the industry and possesses greater tensile strength than liners heretofore used to seal acidic compounds.

While I have described and illustrated a preferred embodiment of my invention, it will be understood my invention is not limited thereto since it may be otherwise embodied and practiced within the scope of the following claims.

I claim:

1. In a closure for sealing a container for strong acids such as concentrated sulfuric, hydrochloric, and nitric acids, the combination of a cover, a skirt depending from the cover, and a liner resistant to such acids disposed within the skirt, said liner comprising a mixture of polyisobutylene having a molecular weight of at least 60,000 and a material selected from the group consisting of vinyl chloride-acetate copolymer and polyvinyl chloride, an inorganic filler, and fibers selected from the group consisting of polystyrene fibers, polyethylene fibers, polyvinylidene chloride fibers, vinylidene chloride-vinyl chloride copolymer fibers, and glass fibers, said fibers serving to strengthen and reinforce the liner, all of the components of said liner being resistant to such acids.
2. In a closure for sealing a container for strong acids such as concentrated sulfuric, hydrochloric, and nitric acids, the combination of a cover, a skirt depending from the cover, and a liner resistant to such acids disposed within the skirt, said liner comprising a mixture of polyisobutylene having a molecular weight of at least 60,000, vinyl chloride-acetate copolymer, and finely ground silica disposed upon a fabric base woven from fibers selected from the group consisting of polystyrene fibers, polyethylene fibers, polyvinylidene chloride fibers, vinylidene chloride-vinyl chloride copolymer fibers, and glass fibers, said woven fabric serving to strengthen and reinforce the liner, all of the components of said liner being resistant to such acids.
3. In a closure for sealing a container for strong acids such as concentrated sulfuric, hydrochloric, and nitric acids, the combination of a cover, a skirt depending from the cover, and a liner resistant to such acids disposed within the skirt, said liner comprising a matrix of polyisobutylene having a molecular weight of at least 60,000 and vinyl chloride-acetate copolymer and a filler of finely ground silica, said matrix having dispersed throughout fibers selected from the group consisting of polystyrene fibers, polyethylene fibers, polyvinylidene chloride fibers, vinylidene chloride-vinyl chloride copolymer fibers, and glass fibers, said fibers serving to strengthen and reinforce the liner, all of the components of said liner being resistant to such acids.
4. A liner material for a closure for sealing a container for strong acids such as concentrated sulfuric, hydrochloric, and nitric acids which comprises a mixture of polyisobutylene having a molecular weight of at least 60,000 and a material selected from the group consisting of vinyl chloride-acetate copolymer and polyvinyl chloride, an inorganic filler, and fibers selected from the group consisting of polystyrene fibers, polyethylene fibers, polyvinylidene chloride fibers, vinylidene chloride-vinyl chloride copolymer fibers, and glass fibers, said fibers serving to strengthen and reinforce the liner, all of the components of the liner being resistant to such acids.
5. A liner material for a closure for sealing a

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container for strong acids such as concentrated sulfuric, hydrochloric, and nitric acids, which comprises a mixture of polyisobutylene having a molecular weight of at least 60,000, vinyl chloride-acetate copolymer, and finely ground silica calendered upon a foundation of fabric woven from fibers selected from the group consisting of polystyrene fibers, polyethylene fibers, polyvinylidene chloride fibers, vinylidene chloride-vinyl chloride copolymer fibers, and glass fibers, said fabric serving to strengthen and reinforce the liner, all of the components of the liner being resistant to such acids.

6. A liner material for a closure for sealing a

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BRUCE R. BILLMEYER.

Certificate of Correction

Patent No. 2,431,303.

November 25, 1947.

BRUCE R. BILLMEYER

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows: Column 1, line 40, for "chlorile-vinyl" read *chloride-vinyl*; column 2, line 53, for "polyvinylidine" read *polyvinylidene*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of February, A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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