April 15, 1969 R. W. YOUNG 3,438,550

FLUID CONTAINERS

Filed March 1, 1965

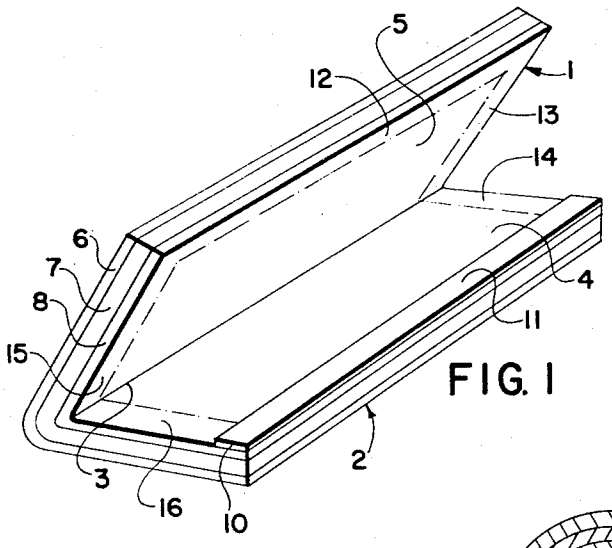

FIG. 1

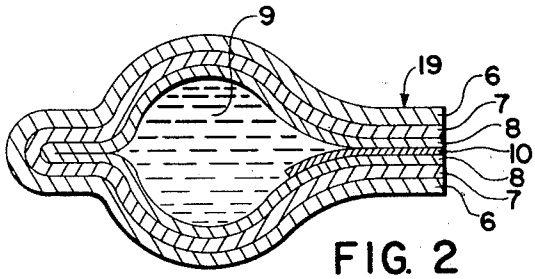

FIG. 2

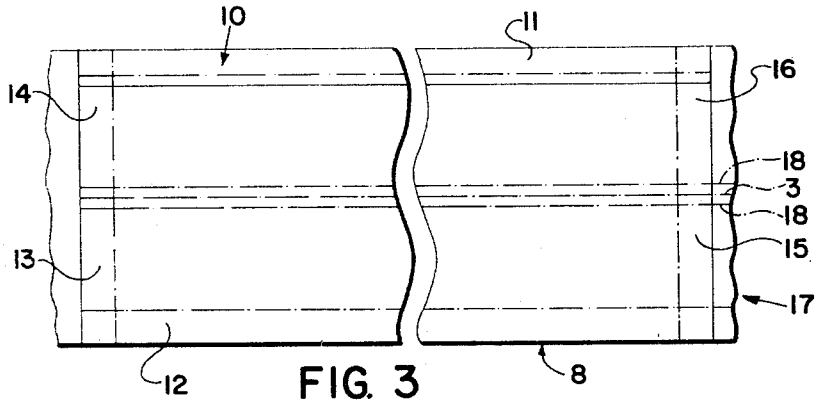

FIG. 3

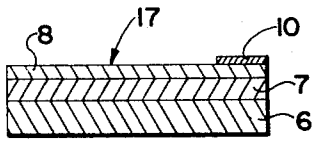

FIG. 4

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FLUID CONTAINERS

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U.S. Cl. 222—107 8 Claims

This invention relates to fluid containers and, more particularly, to fluid containers adapted to retain a photographic processing composition.

In the photographic processes identified hereinafter, frequently it is required that a small quantity of liquid material be applied in a relatively thin layer over a fairly large surface area. Specifically, for example, a photosensitive film may be processed by the application to a surface thereof of a layer of a liquid containing photographic processing reagents, for example, a silver halide developing composition of the type disclosed in U.S. Patent No. 2,543,181. In general, photographic fluid processing compositions possess a relatively limited shelf-life due to, in part, the degradation effects of environmental conditions upon the active components of the processing compositions. For example, the presence of environmental oxygen in contact with a liquid photographic processing composition generally provides for the oxidative degradation of various active components of the composition such as, for example, the photographic silver halide developing agents retained within such formulations, which may be further catalyzed by contact between the liquid and the container retaining same, where such retaining means are not inert with respect to the liquid. In an effort to provide fluid containers particularly adapted to retain a relatively small quantity of liquid material for the above-identified purpose, several patents have been issued directly relating to the construction of such fluid containers. U.S. Patents Nos. 2,543,181, 2,634,886, 2,653,732, 2,674,532, 2,702,146, 2,723,051, 2,750,075, 2,903,829, 3,056,491, and 3,056,492 disclose fluid containers particularly adapted to retain photographic processing compositions which are formed of a plurality of layers including, respectively, an outer layer, for example, kraft paper; a layer of metallic foil, for example, lead foil; and an inner lining, or layer, of a thermoplastic resin, for example, a polyvinyl acetal such as polyvinyl butyral, polyvinyl chloride, and the like.

Employment of the containers set forth in the prior art to retain a fluid photographic processing composition, over an extended period of time, results in some deterioration of the respective processing composition due to contact with environmental vapor, irrespective of the fact that such containers are "substantially" impervious to vapor. The access of fluid photographic processing composition to vapor contact, derived from the external environment, even to a limited extent, provides progressive deterioration of the relative stability of the processing composition. In addition, the presence of minute defects in the polymeric inner liner such as, for example, pinholes and the like, arising during fabrication of the container, further adversely affect the stability of the retained fluid compositions, by providing contact of the liquid with the potentially active metallic foil stratum of the container.

The present invention, however, comprehends an inexpensive, preferably disposable, inert container particularly adapted to provide for retention of a liquid such as a photographic processing composition, which is in a quantity sufficient to carry out a single application to the respective surface of the sheet, or sheets, to be treated, wherein the retained liquid is effectively insulated from contact with externally derived vapor whereby to enhance the storage stability of such liquid, and wherein the fluid

contents of the container are maintained in condition for direct application of said surfaces in an efficient and economical manner, especially, when such container is directly affixed to, or in apposition to, a surface to be treated.

The objects of the present invention are therefore to provide improved fluid containers, that is, inert fluid containers which effectively insulate and retain a liquid medium from contact with externally derived vapor.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the product possessing the features, properties and the relation of components which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

FIGURE 1 is a perspective view of one form of fluid container prior to introduction of a liquid thereinto and subsequent closure of the container walls;

FIG. 2 is a cross-sectional view comprising the fluid container of FIGURE 1 after introduction of a fluid photographic processing composition and closure of said container's walls;

FIG. 3 is a fragmentary plan view of the continuous material which is used in the formation of the container blanks of FIGURE 1; and

FIG. 4 is a cross-sectional view of the continuous material of FIG. 3.

In one embodiment, the container will be an elongated structure, having a length of at least twice its width, and is relatively flat, having a depth which is only a fraction of its width. The container also will be deformable in its filled and sealed condition so that it can be curved in the direction of its width, for example, about a radius equal to its width, without danger of rupturing its seal. A sealed passage will extend the length of the container along one edge thereof and will be the weakest of the edge seals which define the liquid containing cavity and which confine the contents of said cavity.

The present invention is specifically concerned with improved fluid containers, of the last-mentioned type, which include, in general, a relatively thin, flexible layer of glass having a continuous polymeric layer superposed on one surface, preferably a laminate structure comprising a relatively thin, flexible layer of glass having a continuous polymeric layer contiguous each surface, and, most preferably, a laminate which includes an outer layer comprising a continuous polymeric layer, a layer of glass, and a polymeric inner lining, or layer, inert with respect to the photographic processing composition to be retained therein, for example, inert to the conventional, highly caustic, organic nitrogen-containing photographic processing compositions commercially employed in the photographic industry.

In addition, the present invention is concerned with providing frangible containers, of the last-mentioned type, possessing at least one flexible and deformable wall, which exhibits differential strength of the container's respective edge seals, thus facilitating substantially uniform rupture and distribution of the container's retained fluid contents, by means of a predetermined passage orifice, upon the application of stress to the container's deformable surfaces.

The container is most preferably formed from a single, essentially rectangular blank folded medially, as illustrated in FIGURE 1. The container is constructed of a multilayer material comprising walls **1** and **2**, said individual walls being formed by medial fold **3**. A surface portion

of one of said walls as, for example, portion **4** of wall **2**, is suitable for receiving and in part confining said liquid, and a substantially equal surface portion of the other of said walls as, for example, surface portion **5** of wall **1** is suitable for further confining said fluid upon closure of said walls. The container may also be formed from two essentially rectangular blanks secured together at marginal edges. It is so simply constructed that the container blank of FIG. 3, from which the container is formed, may be cut without waste from a continuous strip of laminated sheet material, permitting the material of the container walls to be processed and the container to be filled, sealed and served as part of one continuous operation.

The aforesaid fluid container is preferably constructed, as illustrated in FIG. 2, of an outer polymeric layer **6** as a backing layer, said outer layer **6** being preferably formed of a thin, deformable, tough polymeric material, generally in the order of 0.5 mil in thickness as, for example, a polyester such as polyethylene terephthalate and the like. A thin film, or sheet, **7** comprising glass approximately 0.5 mil in thickness, and having its dimensions predetermined according to the intended use, has layer **6** suitably adhered thereto and/or coated thereon as, for example, by means of a conventional adhesive composition such as Du Pont Adhesive No. 46,950 (trade designation of E. I. du Pont de Nemours and Co., Wilmington, Del., for a commercially distributed polyester resin adhesive) where layer **6** comprises a polyester. A layer **8** comprising a thermoplastic material, inert to the fluid composition to be retained within the container, for example, fluid photographic processing composition **9**, such as polymerized vinyl chloride, for example, 90% vinyl chloride and 10% vinyl acetate, approximating 1.5 mils in thickness, the aforementioned polyester, approximating 0.5 mil in thickness, preferably overcoated with, or having adhered by means of the last-identified adhesive, polymerized vinyl chloride, polymerized vinyl butyral, and the like, approximating 1.5 mils in thickness, is suitably adhered to and/or coated on the opposite surface of layer **7**.

Where desired, however, the illustrated container may comprise glass layer **7** and inner liner, or layer **8**, as the sole essential layers forming the container walls, whereupon glass layer **7** is in effect the outer layer of the walls.

The respective polymeric layers, coating or liners may be adhered to the glass layer by any of the coating and/or laminating procedures well known to the art. Where the polymeric layer, or layers, are pre-cast and then laminated to the glass layer, it will be preferred to utilize an adhesive coating or layer, which adhesive layer is itself stable, or stabilized, against interaction with the container's fluid contents, and is selected based upon its adhesive capacity with respect to effecting a uniform bond between the selected polymeric film and the glass. The employment of an intermediate adhesive layer also affords an additional layer enhancing the stability of the container, and its retained liquid, by providing an added barrier coating for retaining the container's liquid contents. Alternatively, the polymeric layers may be directly coated on the glass layer, for example, by hot melt extrusion of thermoplastic polymer, for example, a thermoplastic vinyl polymer, such as polymerized vinyl chloride or a thermoplastic olefinic polymer such as polymerized ethylene or propylene, or the like, on the respective surface, or surfaces, of the glass layer.

In the completed, closed, liquid-carrying container, polymeric layer **8** serves both to substantially prevent direct contact of the retained fluid with vapor impervious glass layer **7** and as a means of bonding together the facing marginal portions of said container bordering the enclosed liquid when, for example, the marginal portions are subjected to direct sealing by means of heat and/or pressure and/or an adhesive composition and thus, upon bonding of said portions, provides means for sealing the liquid within the container.

The last-mentioned adhesive composition, illustrated by numeral **10**, may be overlaid on a marginal portion **11** of polymeric layer **8** which, when bonded to a facing marginal polymeric portion **12**, may serve as a means for bonding the facing marginal portions differentially with respect to other facing marginal portions **13**, **14**, **15** and **16**.

Upon closure of walls **1** and **2**, marginal surface portions **11**, **13** and **15** come into contact with marginal surface portions **12**, **14** and **16**, respectively, and may be suitably bonded together, as previously noted, and, when thus bonded, provide, in conjunction with fold **3**, means for effecting a completely sealed enclosure, or space.

Referring to FIG. 3, there is shown a blank **17** from which a preferred embodiment of the present invention's novel container may be formed, said blank **17**, as shown, being substantially rectangular in shape and having a length equal to the container length and a width approximately twice the width of the finished, filled container. As previously stated, blank **17** is preferably formed of a composite, deformable sheet material described above and comprising the plurality of strata illustrated in FIG. 4.

Outer polymeric layer **6**, present in the preferred embodiment illustrated, as the aforementioned backing or support layer, has contiguous thereto layer **7** which, as detailed, is a thin film, or sheet, of vapor-impervious glass. Contiguous the opposite surface of said glass layer **7**, is layer **8** of thermoplastic material inert to, for example, fluid photographic processing composition. Layers **6** and **8** are relatively thin, generally being in the order of 0.5 mil in thickness, and, as a practical matter, in the preferred embodiment need only be sufficiently thick to be characterized as continuous.

Along one edge of blank **17**, there may be provided a strip **10** of a suitable thermoplastic composition which exhibits, preferably, a lesser adhesive affinity for polymeric layer **8** than the latter has for itself, for example, upon direct sealing and/or by means of the adhesive employed to affix marginal surface portions **13** to **14** and **15** to **16**.

Container **19**, illustrated in FIG. 2, is formed by folding blank **17** along a substantially medial line **3** extending the length of the container and then securing together the faces of marginal portions **13** to **14** and **15** to **16** along the edges of the container and the facing marginal surface portions **11** to **12** along the long edge of the container. As previously mentioned, the several marginal portions may be secured together by the application of heat and/or pressure and, in addition, it may be preferable to adhesively secure together a narrow strip **18** of the container walls adjacent to the fold line **3**. This latter provides a thin leading edge for the container over which a suitable pressure applying device, such as a pressure roll, or doctor blade, may readily advance to compress the container walls and to thereby effect the release of the container contents by differential hydraulic rupture of the sealed marginal surfaces, preferably along the long edge of the container. As illustrated, the seal along the long edge of the container is preferably effected between inner polymeric layer **8** and the material of strip **10** which, as hereinbefore indicated, may be a material which possesses a lesser adhesive affinity for polymeric layer **8** than the polymeric layer does for itself as adhered in the remaining marginal portions. Thus the latter bonds exhibit an adhesive capacity substantially stronger than the seal along the long edge.

This structure assures a unidirectional release of the container's contents upon application of compressive force to the walls of the container. In one preferred embodiment, to insure a uniform separation of the marginal portions along the long edge of the container, when the container is subjected to a liquid releasing force, strip **10** not only extends to the very edge of the container but is also substantially wider than the width of the seal between marginal portions **11** and **12** and additionally extends within the liquid confining cavity of the container, as

shown in FIG. 2. A further precaution against the hazard of an uneven seal consists in displacing the blank containing strip **10** beyond the long edge of the blank to which it is adhered. As a result, strip **10** projects beyond both long edges of the bond.

Where inner polymeric layer **8** comprises the previously-identified preferred polymer, polyvinyl chloride, coating **10** may comprise any one of the following illustrative compositions:

(1) 50 cc. of a 10% solution of Saran F–120 (trade name of Dow Chemical Company, Midland, Mich., for a thermoplastic resin produced by the polymerization of vinylidene chloride) in methyl ethyl ketone and 10 cc. of a 10% solution of nitrocellulose in methyl ethyl ketone;

(2) 100 cc. of a composition comprising: 10.0 g. of Acryloid B–75 (solid) [trade name of Rohm & Haas Company, Philadelphia, Pa., for an acrylic ester resin], 3.4 g. of ½ second cellulose nitrate, and 86.5 cc. of ethyl acetate;

(3) 80 cc. of a 10% solution of ethyl cellulose in methyl ethyl ketone and 20 cc. of a 10% solution of Acryloid B–72; and

(4) 100 cc. of a composition comprising: 5 g. of Bakelite NYGV and 5 g. of Bakelite NYGL (trade names of Bakelite Corporation, a division of Union Carbide and Carbon Corporation, New York, N.Y., for polyacrylonitrile-polyvinyl chloride resins), 100 cc. of acetone, 1 g. of Saran F–120 and 3 g. of Acryloid B–72 (solid).

Wherein inner liner **8** comprises a polyvinyl acetal such as polyvinyl formal, polyvinyl acetal, polyvinyl butyral, and the like, preferably polyvinyl butyral, thermoplastic adhesive coating **10** may comprise, for example, ethyl cellulose, a mixture comprising ethyl cellulose and paraffin at a ratio of ~1:1, and the like.

In the formation of the container, the contents may be introduced as the container's walls are being sealed together. For example, the long edges of the container may be sealed together before the blank is severed from the stock of material from which it is formed. During the sealing together of the long edges, the desired quantity of liquid content for the container is introduced between the secured walls of the blank and thereafter the short edges are sealed together and the finished container severed from the remainder of the sheet stock. Under these conditions, the sealing is preferably effected by the application of heat and/or pressure, and uniform heat and/or pressure may be employed to all marginal portions being sealed together in view of the differential between the adhesive properties of strip **10** and those of polymeric layer **8**. In the alternative, differential heat and/or pressure and/or marginal dimensions may be employed to effect differential adhesion between marginal portions **11** and **12** and the remaining marginal portions of the container, for providing a portion of the container prone to controlled fracture, or separation, to obtain directional release of the retained fluid composition.

In one preferred form of the container for spreading a liquid photographic processing composition to a thickness of approximately 0.003 of an inch of an area approximately 3 inches by 4 inches, a container 3½ inches long and having maximum thickness of 1/16 of an inch can be used. The overall width of such container will be approximately ¾ of an inch and the width of the seals at the marginal areas will be approximately 3/16 of an inch, while the seal at the release edge of the container will be approximately 1/16 of an inch. The overall thickness of the sheet materials from which the container walls are formed may be approximately 0.0025 of an inch with each of layers **6**, **7** and **8** approximately 0.0005 of an inch thick and adhesive layers intermediate layers **6** and **7** and intermediate layers **7** and **8** approximately 0.0005 of an inch thick.

The relative maximum thickness of flexible, deformable glass layer **7** is only restricted by the relative degree of end use flexibility required of the container's walls. Recognizing that the flexibility of the glass layer will be directly related to the relative thickness of the layer, and the fact that flexibility, in general, increases with a decrease in thickness, the specific thickness employed, in a given instance, will be selected in accordance with the flexibility required by the end use. In addition to the fact that the glass layer provides a container with essentially zero degree of permeability to gaseous and liquid materials, the substantially chemically inert glass layer also possesses a low coefficient of thermal expansion and conductivity, less weight and superior puncture resistance, when compared with the prior art's metallic foil layers, as well as an essentially zero degree change of dimension with change in the relative humidity of the storage environment. Thus there is provided a container, for the storage of sensitive photographic processing compositions, which possess essentially zero degree of permeability to atmospheric gases and zero degree of permeability with respect to the escape of such liquids through the walls of the container, by reason of a vapor barrier layer which is chemically inert to the retained processing composition and which exhibits a high degree of flexibility as well as strength.

The aforesaid material and constructions provide a container capable of substantially confining a liquid photographic processing composition adapted for processing an exposed photosensitive film, said containers effectively preventing loss of liquid content due to exudation, absorption, evaporation, and the like, and acting to preserve said fluid substantially free from environmental contamination. It will be understood that the liquid may be introduced into the container in an inert atmosphere.

It will be further understood that both the form and capacity of the container and the dimensions thereof are predetermined relative to the intended use of the subject container. It will be apparent that alternative forms and arrangements thereof may be provided within the scope of the invention. Such modifications may, for example, comprise a liquid-carrying portion of the container having either a greater or lesser traverse or longitudinal dimension than the container shown, or the modified container may have separable marginal surface portions for releasing the retained fluid which vary from the straight-line portions illustrated above, or the container may be fabricated in accordance with the parameters set forth in U.S. Patent No. 3,037,670.

Since certain changes may be made in the above product without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A rupturable, single use container having a pair of opposed walls secured together to provide a liquid retaining cavity, at least one of said walls being flexible and deformable, each of said walls comprising a plurality of layers, at least one of said layers consisting essentially of a continuous glass film, the inner layer of each of said walls comprising a polymeric material inert to the liquid to be retained within said cavity, and the bonded marginal portions of one edge of said pair of opposed walls exhibiting substantially less adhesive capacity than the remaining marginal portions of said pair of opposed walls.

2. A rupturable, single use fluid container as defined in claim **1**, wherein said polymeric material comprises polyvinyl chloride.

3. A rupturable, single use fluid container as defined in claim **1**, wherein said polymeric material comprises polyvinyl butyral.

4. A rupturable, single use fluid container as defined in claim **1**, wherein said glass layer is positioned intermediate said inner layer and an outer layer comprising a polymeric material.

5. A rupturable, single use fluid container as defined in claim 4, wherein said polymeric material comprising said outer layer comprises polyethylene terephthalate.

6. A rupturable, single use fluid container as defined in claim 1, wherein a thermoplastic adhesive is positioned between the bonded marginal portions of said edge exhibiting substantially less adhesive capacity than said remaining marginal portions, said thermoplastic adhesive exhibiting substantially less adhesive affinity for said polymeric material than said polymeric material exhibits for itself, said remaining marginal portions being adhered together by said polymeric material bonded to itself, whereby said container preferentially opens along said bonded marginal portions of said edge exhibiting substantially less adhesive capacity, upon application of pressure to said container.

7. A rupturable, single use fluid container as defined in claim 1, wherein said liquid containing cavity retains a photographic processing composition.

8. A rupturable, single use fluid container having a pair of opposed walls secured together to provide a liquid retaining cavity, at least one of said walls being flexible and deformable, each of said walls comprising

a plurality of essential layers, said plurality of layers including successively an outer layer comprising polyethylene terephthalate, a layer comprising a continuous glass sheet, and an inner layer comprising polyvinyl chloride, and the bonded marginal portions of one edge of said pair of opposed walls exhibiting substantially less adhesive capacity than the remaining marginal portions of said pair of opposed walls.

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