Aug. 26, 1969 M. E. McGUCKIN 3,463,339

SEALING ELEMENT

Filed April 25, 1966

Fig. 1.

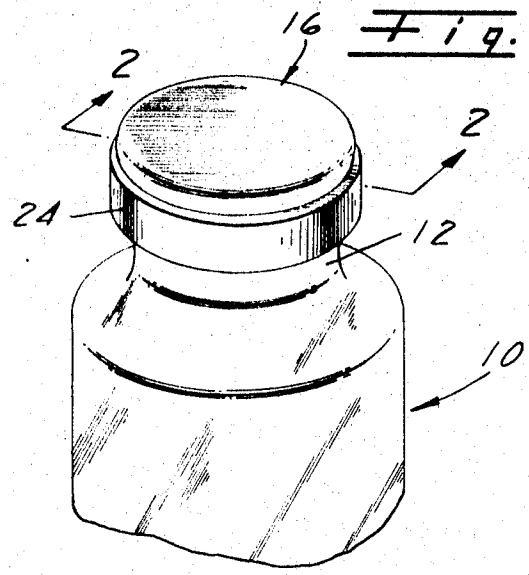


Fig. 2.

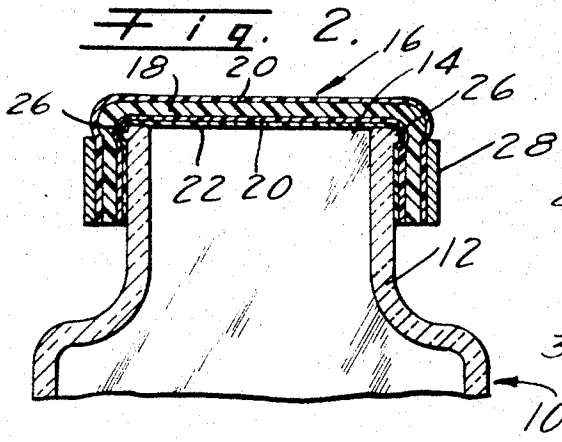
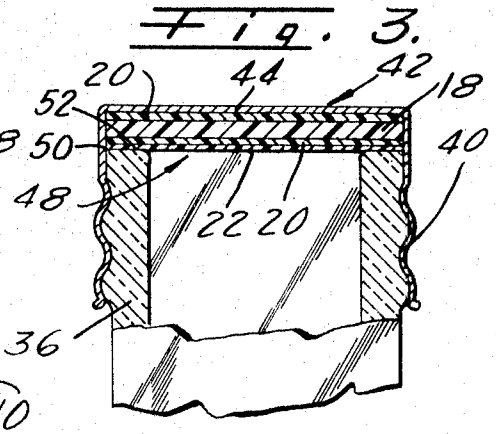


Fig. 3.



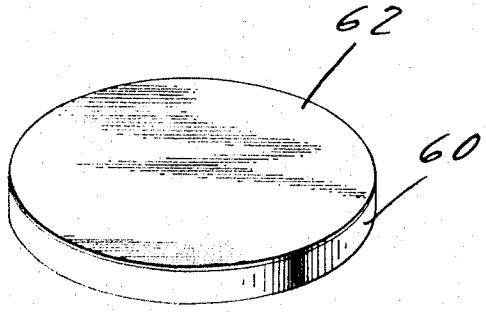


Fig. 4.

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3,463,339

SEALING ELEMENT

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ABSTRACT OF THE DISCLOSURE

A seal for containers such as bottles, flasks and the like having an opening, the seal being a laminated, self sealing diaphragm having layers of resilient material to which is bonded a very thin sheet or film of chemically inert material such as Teflon which is adapted to be placed over the container opening to protect the contents of the container from contaminants.

This invention relates generally to sealing devices and relates more particularly to sealing elements having a surface that eliminates contamination of materials which may come into contact therewith.

While the invention has particular utility embodied in seals or sealing elements in the medical and scientific fields, and is disclosed herein thus embodied, it is to be understood that its utility is not confined thereto.

For example, chemicals, medicines, vaccines and the like are put up in containers such as bottles, flasks, or the like provided with closures and there has been a problem in preventing such closures from contaminating or picking up contaminants which get into and contaminate the contents of such containers, which is very undesirable as it may render such contents unfit for use.

It is therefore an object of the present invention to provide sealing elements or means that solve this problem and overcome the difficulties involved therein.

It is another object of the invention to provide a sealing element of this character that presents a chemically inert surface to the interior of a container, the contents of which must be kept free of contamination.

It is still another object of the invention to provide a sealing element that may be used as a self sealing diaphragm for containers for vaccines, for example, wherein the diaphragm closes the mouth of the bottle and is penetrated by the needle of a hypodermic syringe or the like whereby the syringe may be filled with fluid in the container, whereafter the needle is withdrawn.

Many chemicals, medicines, and the like are put up in containers such as bottles, flasks et cetera having closures such as screw caps, for example, having seals therein which may contaminate the contents of the container or bottle and it is a further object of the invention to provide a sealing element or means for such containers which will prevent contamination of the contents of the containers.

There are, of course, many other uses for the invention where it is desired to prevent contamination of drugs, medicines, chemicals and the like.

In accordance with my inventive concept the sealing element or means is of laminated construction and broadly comprises at least one layer of resilient material to which is bonded a very thin sheet or film of material that is chemically inert, such film or layer being positioned so that the contents to be protected from contamination can only come into contact with said film, layer or ply.

The invention further provides at least one layer or lamination that functions to effect self sealing of the sealing element when punctured as, for example, by the needle of a hypodermic syringe or the like.

The characteristics and advantages of the invention are further sufficiently referred to in connection with the following detailed description of the accompanying drawings which represent certain embodiments. After considering these examples skilled persons will understand that many variations may be made without departing from the principles disclosed.

Referring to the drawings, which are for illustrative purposes only:

FIG. 1 is a perspective view of a portion of a container having one embodiment of the invention sealing the mouth thereof;

FIG. 2 is an enlarged sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is a sectional view of an alternative arrangement; and

FIG. 4 is an enlarged view of alternative embodiment of the invention.

Referring more particularly to FIGS. 1 and 2 of the drawings, there is shown a bottle, indicated generally at **10**, having a neck **12** with an opening or mouth **14**.

The diaphragm covering the mouth is indicated generally at **16** and is a laminated structure which comprises a plurality of layers of rubber, three layers of rubber being shown, and a layer or film of chemically inert material bonded to one side of the layers of rubber.

The inner layer of the rubber is indicated at **18** which is resilient and relatively soft, the outer layers **20** being relatively hard, the chemically inert layer or film, indicated at **22**, being of Teflon although other material that is chemically inert may be used. "Teflon" is the trademark of the Du Pont Company for their fluorocarbon resins.

Various suitable materials, of course may be used for the diaphragm. By way of example of the materials used and the method of making the diaphragm embodying the present invention, the central layer or lamination is soft silicone rubber comprising an unfilled compound 30–5 Shore A of approximately .075 of an inch in thickness. The adjacent layers **20** are hard red filled compound 60–5 Shore A. As stated above, the chemically inert layer is of Teflon.

Laminated sheets of suitable size ar molded. The material for the respective rubber laminations is put into a mold in liquid form, first a layer of the hard or harder material, then the softer layer, and then the other harder layer. The rubber is then cured in the usual manner.

The Teflon layer is bonded to one of the harder rubber layers after one side of said Teflon layer has been etched with a liquid sodium Teflon etch. The outer side of the rubber layer to which the Teflon layer is to be bonded is also etched with this liquid sodium etch in order to insure effective bonding together of these layers. The liquid sodium etch is a well known product of the Fluorocarbon Division of Ornamental Plastics, Inc. of Sheboygan, Wis. Bonding of the Teflon to the rubber is by means of a silane base or Silastic bonding material which is a well known product presently on the market. This bonding material is applied to the surfaces to be bonded together and then the surfaces to which the bonding material has been applied are brought together.

Means is provided for securing the diaphragm **16** on the neck of the bottle, said neck having an annular external bead **26** at the free end. This diaphragm securing means comprises an annular band **28** of metal or other suitable material.

In attaching the diaphragm to the bottle said diaphragm is disposed over the mouth **14** of bottle's neck with the Teflon layer exposed to the inside of the bottle. Thereafter the band **28** is forced onto said neck with a marginal portion of the diaphragm between the band and neck and tightly compressed against said neck by said band.

Because of the band **26** there is a portion of the diaphragm above the band that tends to extend outwardly of the upper edge of the band thereby serving as band retaining means which prevents the band from coming off the neck.

Thus the diaphragm is tightly stretched over the mouth of the bottle with the chemically inert layer of Teflon at the inner side and preventing contamination of the contents of the bottle.

When it is desired to charge of hypodermic needle, for example, the needle is pushed through the diaphragm with the free open end of the needle disposed in the liquid contents of the bottle. The plunger is then actuated to draw the liquid into the syringe barrel in the usual manner.

Upon removal of the needle from the diaphragm the rubber portion of the diaphragm, particularly the relatively soft central layer, closes the needle puncture very quickly so that possible contaminates will not enter the bottle through the needle puncture. The harder layers **20** of the diaphragm keep the soft central layer under a certain amount of compression or pressure and also prevent said central layer from extruding.

Referring to FIG. 3, there is shown the neck **36** of a bottle, said neck having external threads **38** thereon for threaded reception of the threads **40** of a generally cup shaped screw cap, indicated generally at **42** and of the usual well known construction. Cap **42** has a closed end defined by a wall **44** adjacent to which the cap has a plain cylindrical part **46** in which a cylindrical or circular sealing element, indicated generally at **48**, is disposed. Sealing element **48** is laminated and has the same layers or laminations as the previously described sealing element, said layers or laminations being given the same reference numerals as said previously described sealing element. The Teflon layer or lamination **22** is disposed to face the open end of the screw cap **42**.

When the screw cap is screwed onto the neck **36** of the bottle the seal **48** extends to the outer peripheral or cylindrical edge **50** of the open end of the neck and there is an annular peripheral portion or part of the inwardly facing Teflon layers **22** which is clamped tightly against the annular shoulder **52** at the outer end of the neck. Thus a chemically inert and clean or uncontaminated surface is presented to the contents of the bottle. Further, the resilient backing of that portion of the seal between the Teflon layer and the end wall **44** of the cap provides pressure to maintain the high effectiveness of the seal when the cap is screwed tightly onto the neck **26** of the bottle.

In FIG. 4 there is shown a laminated seal that has a relatively thick layer **60** of resilient material such as rubber, plastic or the like. To this layer **60** is bonded a sheet **62** or film or layer of chemically inert material, Teflon being the material used.

The seal shown in FIG. 4 is for use in screw caps and the like. Of course a diaphragm of this arrangement can be used as an alternative to the diaphragm described in connection with the arrangement of FIGS. 1 and 2.

In these various arrangements the chemically inert layer or sheet, such as Teflon, is etched and bonded to the outer surface of the adjacent layer. Basically or broadly the sealing element comprises the chemically inert layer secured to a back up layer or lamination. Especially good results are obtained with a resilient back up layer.

It should be pointed out that as used herein the term rubber includes similar materials such as plastic or the like having the required characteristics and qualities.

It is also to be understood that the etching and bonding materials are by way of example of materials that give excellent results but that there are other known etching and/or bonding materials that may be used.

The invention and its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction and arrangement of the parts of the invention without departing from the spirit and scope thereof or sacrificing its material advantages, the arrangements hereinbefore described being merely by way of example, and I do not wish to be restricted to the specific forms shown or uses mentioned except as defined in the accompanying claims.

I claim:

1. The combination of:

(A) a container having a neck with an opening at the free end of the neck and a bead about the free end of said neck;

(B) a sealing element comprising a diaphragm disposed over the opening, said diaphragm comprising

(a) at least one backing layer,

(b) and a layer of chemically inert Teflon secured to said backing layer, said layer of Teflon facing inwardly against the end of said neck;

(C) and a band forced onto the neck to a location below said bead, there being a portion of the diaphragm compressed between said band and the adjacent portion of said neck.

2. The combination of:

(A) a container having a neck with an opening at the free end thereof and a bead about said free end of said neck;

(B) a sealing element comprising a diaphragm disposed over the opening, said diaphragm comprising

(a) at least one backing layer of silicone rubber,

(b) and a layer of Teflon secured to said backing layer, said layer of Teflon facing said opening;

(C) and a band forced onto the neck to a location below said bead, there being a portion of the diaphragm compressed between said band and the adjacent portion of said neck.

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U.S. Cl. X.R.

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