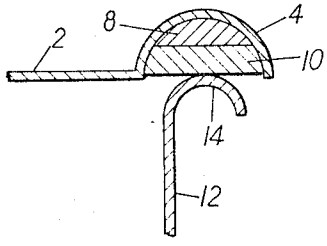
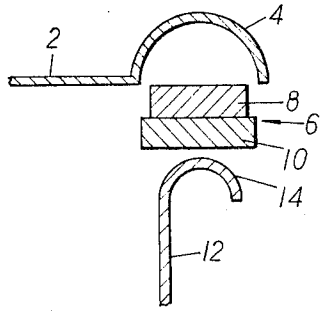
Sept. 20, 1966 J. C. McCOLL 3,273,743

SEALING

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-FIG. 1.-





-FIG. 2.-

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SEALING

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The present invention is concerned with improvements in or relating to sealing, and in particular to sealing of a container having at least one removable lid, e.g. a cask, keg, drum or American pail.

Containers having removable lids are usually constructed such that the end of the body of the drum which is to receive the lid is curled over usually outwardly to form a lip and the edge of the lid is provided with a turned-over portion which forms round the perimeter of the lid a semi-circular groove, known as a "curl," which cooperates with the lip of the container.

Usually when such containers are used to carry or store materials, such as chemicals, a seal is provided between the lid and the end of the container to prevent escape of the material from the inside of the drum and also to exclude water and air as much as possible from the interior of the container. The seal is usually located in the curl of the lid such that when the lid is placed over the end of the container the seal lies between the curl of the lid and the lip of the container. When a closure band is applied to the container to force the lid and the container together the seal is compressed between the curl of the lid and the lip of the container, thus forming a seal between the lid and the container.

Such seals have been manufactured from a variety of materials including solid rubber, sponge rubber, expanded rubber, cotton, asbestos, cord and paper. The sealing member is generally made of rectangular cross-section and these sealing members tend to fall out of the curl of the lid when the lid is turned over to place it on the container. These sealing members of rectangular cross-section may also become twisted when the lid is placed in position thus causing an imperfect seal between the lid and the container.

To overcome these problems it has been proposed to attach the seal into the "curl" of the lid by means of an adhesive, either flowed into the curl before the sealing member is placed into position or disposed on the back of the sealing member. The first of these two methods involves two processes usually with a time lapse in between since after the adhesive has been applied to the curl of the lid, it is normally necessary to allow the adhesive to partially "gel" before the sealing member is placed in position. The second method also involves two stages either removing a backing strip to uncover the adhesive and then placing the sealing member in the curl of the lid, or applying an adhesive to the back of the sealing member and then placing said sealing member into the "curl" of the lid. In all these methods involving the use of adhesive, the process of putting the seal in position is difficult due to the necessity of handling adhesive. Also such sealing members may become twisted when the lid is placed in position thus causing an imperfect seal.

It has also been proposed to use a sealing member of the same cross-section as the curl of the lid but such sealing members also require the use of adhesive to retain them in position in the curl of the lid when it is turned over. Further, such sealing members having the same cross-section as the curl of the lid are generally more expensive to produce than the rectangular cross-section sealing members.

Further, when the seal has to be fixed to the curl of the lid with adhesive, it is generally difficult to remove the seal after use and when removed such a seal is not normally in a fit condition to be used again.

It has also been proposed to flow a rubber compound in a liquid state into the curl of the lid and then cure or age the rubber compound while it is in position so that the compound is retained in the lid. This method, however, usually involves the use of expensive machinery for applying and curing the compound, and in any event often the compound very quickly takes a permanent set with the result that leakage may occur.

It is now proposed to use a sealing member comprising a first layer of a resiliently deformable material of such a bulk density that it will conform to the shape of the curl and a second layer of a resiliently deformable material having a greater bulk density than said first layer. The sealing member fits into the curl such that the first layer is remote from the mouth of the curl and the second layer is in the mouth of the curl. On applying pressure to the sealing member the first layer conforms to the contour of the curl and the second layer wedges in place in the curl.

According to the present invention therefore there is provided a sealing member, for a drum having a removable lid, said lid having a curl comprising, a first layer of a resiliently deformable material of such a bulk density that it will conform to the shape of the curl and a second layer of a resiliently deformable material having a bulk density greater than that of said first layer.

Further according to the present invention there is provided a drum comprising a removable lid having a curl, and a body having a lip, having a seal as described above disposed between said curl and said lip. The first layer is preferably narrower than the second layer, said second layer preferably being of the same width as the curl of the lid. The first layer generally has a cellular structure and is usually of an intercellular structure. The first layer may be composed of an expanded, preferably foamed, rubber or a cellular, preferably foamed, material selected from the class of compounds generally known as plastics, e.g. polyethers, polyesters or polyurethanes. The bulk density of said first layer is preferably not greater than 5 lb./cu. ft. and more preferably has a bulk density of from 1½ to 2 lb./cu. ft. This first layer is preferably made of an expanded polyurethane of the polyether or polyester type.

These expanded polyurethanes may be prepared by reacting a polyester of a polyether resin containing primary or secondary hydroxyl groups with an organic isocyanate containing one or more reactive —N=C=O groups and water in the presence of a suitable catalyst. The mixture is expanded into a cellular structure by carbon dioxide formed by reaction of the isocyanate with water. The second layer may have the same chemical composition as the first layer but in general made from a rubber which may be a natural or synthetic rubber and is preferably a cellular rubber. An example of a preferred rubber which may be used is neoprene. The bulk density of the second layer is preferably no less than 10 lb./cu. ft. and more preferably the second layer has a bulk density of from 16 to 45 lb./cu. ft. Most preferably the bulk density of said second layer is from 30 to 45 lb./cu. ft.

The two layers may be composed of materials of the same chemical compositions or of materials of different chemical compositions. If the two layers are of different chemical composition, sheets of the two materials are first bonded together using any suitable adhesive e.g. a rubber adhesive, and then cut into strips. These strips are then cut to length and the two ends of the strip scarfed and jointed with a suitable adhesive. If

the two layers have the same chemical composition, the two layers may be prepared in one operation and then the sheet cut into strips and formed into sealing rings as previously described, or the two layers may be prepared separately and then bonded together as described above.

In order to prevent the adhesive used to bond together the two layers of material, and/or the two ends of the strips, from adhering to the lid and/or the body of the drum, it is preferred that the sealing member is sprayed with a silicone fluid prior to use.

The invention will now be further illustrated by way of example and with reference to the accompanying drawing FIG. 1 of which shows a section of a drum sealing ring assembly and FIG. 2 shows an exploded view of the same assembly.

Referring to FIGS. 1 and 2, lid has a curl **4** formed in the periphery thereof. Sealing member 6 comprises a first layer **8** of a resiliently deformable material of such a bulk density that it will conform to the shape of the curl **4** and a second layer **10** wider than said first layer **8** said second layer **10** being composed of a resiliently deformable material having a bulk density greater than the bulk density of said first layer **8**. Drum body **12** has a turned-over portion or lip **14** adapted to cooperate with the curl **4** of the lid **2**.

To assemble the drum and seal, the seal **6** is pressed by hand into the curl **4** of the lid **2**. The lid **2** is then placed onto the body **12** of the drum such that the seal **6** is disposed between the curl **4** and the lip **14**. The lid **2** is then pressed down on the body **12** thus deforming the seal **6** and forming a seal between the body **12** and the lid **2** of the drum. A closure means (not shown) is then applied to maintain the lid and drum in position until it is desired to break the seal. The preferred closure means is a closure band.

The invention will now be further described with reference to the following examples which are not intended to limit the invention in any way.

Example I

A sheet of sponge rubber of 3/16" thickness having a bulk density of 45 lb. per cu. ft. and hardness value of 15/20 lbs. per sq. inch at 25% compression, was bonded on to an expanded polyurethane sheet of ¼" thickness having a bulk density of 1½ to 1¾ lb. per cubic ft. and a compression set of 6% at 90% compression. The bonding agent was a two part cold curing synthetic/rubber/resin.

The following mix was used to prepare the expanded polyurethane:

Polyether triol, polymer	100
Stannous cetoate	0.3
Water	3.6
Triethylene diamine	0.2
Silicone oil	1.5
Toluene di-isocyanate	46.0

The sponge rubber of this composite sheet was then subjected to a fine mist of silicone fluid, the silicone content being 100%.

The composite sheet was then cut by a strip cutter to a width calculated to be a fit into the greatest width of the curl of the lid to be sealed. This strip was then cut to a length suitable to fill the whole of the curl of the lid. The cutting of the ends being scarfed on identical angles. The ends were then solutioned with the adhesive as used above, so that the sponge or expanded rubber joined to itself and the plastic foam joined to itself, thereby forming a ring.

The ring seal thus made was placed in the curl of the lid, and pushed slightly into position by applying pressure by an identical lid. The lid was then placed on the body of the drum, and the closing band placed in position. When the closing band was removed the seal was firmly

fixed in the lid, and did not come out of the curl when the lid was dropped on the floor from the height of 4 feet.

A tacky substance (rubber solution) was applied to the bead or top of the drum body where it would come into contact with the sponge rubber, and the drum was closed again, when the lid was removed no tack took place between the drum body and the seal owing to the silicone treatment described above.

Test for sealing: A 45 gallon drum (22" dia.) was filled with water. The lid (to which had been fitted the seal as described above) was placed in position and the closing band clamped in position. The drum was then inverted. After 3 days the lid was removed—no seepage or leakage had occurred. The lid was put back again and during 10 days no leakage took place. The lid was again removed, the seal extracted, examined, refitted, and retested. Again no leakage took place.

Example II

The procedure of Example I was repeated using an expaned synthetic rubber sheet having a bulk density of 16/20 lbs. per cubic foot and a compression set of 10% at 40% compression and the expanded polyurethane described in Example I.

Example III

The procedure of Example I was repeated using a sheet of sponge rubber of 3/16" thickness having a bulk density of 13 lbs. per cubic foot and an expanded polyurethane sheet of ¼" thickness having a bulk density of 2½/3 lbs. per cubic foot. The bonding agent used was a two part cold curing synthetic/rubber/resin.

The following mix was used to prepare the expanded polyurethane.

Polyether triol	100.0
Silicone oil	0.6
Dibutyltin diacetate	0.1
N-ethyl morpholine	0.4
Tri ethylene diamine	0.2
Water	2.8
Tolylene di-isocyanate (80/20 2,4–2,6 isomer)	36.6

It is to be understood that numerous variations in the composition of the mix used to prepare the polyurethane may be used and the above mix is only given by way of example.

The construction of the sealing ring made in accordance with the invention gives it a long and useful life, saves a considerable time in fitting, can be easily removed should the container need cleaning and so enables the container to be sold at a lower price. The heavier density material and/or the lighter density material can be of such quality to be suitable for containers in which are packed materials having a deleterious effect on natural rubbers. The seal made of different materials per se synthetics. The seal described is much better in appearance than the normal methods employed.

Although the present invention has been described with reference to the specific details of certain embodiments thereof, it is not intended that such details should be regarded as limitations upon the scope of the invention except in so far as included in the accompanying claims.

I claim:

1. The combination of a container lid having a peripheral curl of substantially semi-circular transverse cross-section and a sealing member disposed within said curl, said sealing member comprising a first layer composed of a resiliently deformable material having a bulk density of from 1½ to 2 lbs. per cubic foot and a second layer composed of a resiliently deformable material having a bulk density of from 30 to 45 lbs. per cubic foot, said sealing member being applied to said lid by pressing said member into said curl so that the first layer conforms to

the contour of the curl and the second layer wedges in place in the opening of the curl.

2. The combination of claim 1 wherein the first layer is composed of resiliently deformable foamed polyurethane and the second layer is composed of a resiliently deformable cellular rubber.

3. The combination of claim 2 wherein said first layer is narrower than said second layer.

4. The combination of claim 1 wherein the bulk density of the first layer is from ½ to 5 lbs. per cubic foot and the bulk density of the second layer is 10 to 45 lbs. per cubic foot.

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