May 17, 1966 L. S. SURTEES ETAL 3,252,155

LIQUID RECEPTACLE AND METHOD FOR PREPARING SAME

Filed May 18, 1962

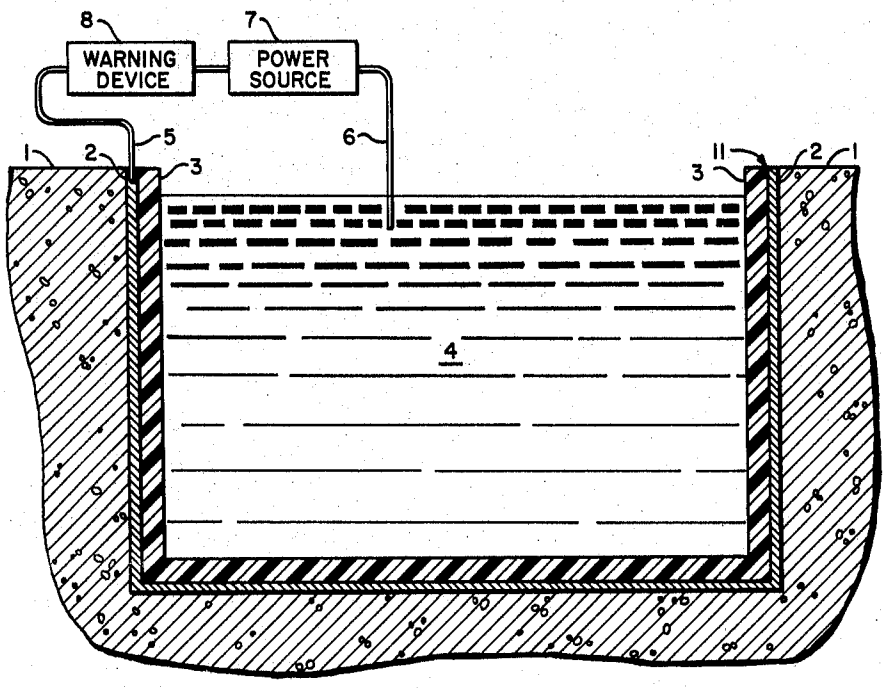

FIG. 1

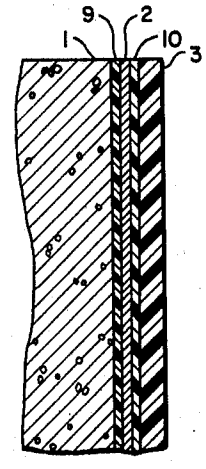

FIG. 2

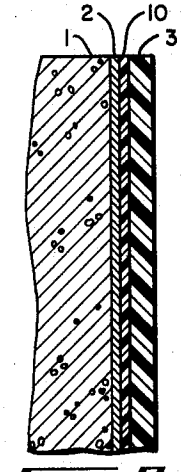

FIG. 3

INVENTOR
LYLL S. SURTEES
GERALD J. BENARD
BY: W. G. Addison
ATTORNEY

United States Patent Office 3,252,155 Patented May 17, 1966

3,252,155

LIQUID RECEPTACLE AND METHOD FOR PREPARING SAME

Lyll S. Surtees and Gerald J. Benard, Trona, Calif., assignors to American Potash & Chemical Corporation, Los Angeles, Calif., a corporation of Delaware

Filed May 18, 1962, Ser. No. 195,899
1 Claim. (Cl. 340—242)

The present invention relates to liquid receptacles and, more particularly, to novel lined liquid receptacles and their methods of preparation.

Considerable difficulty has been experienced in applying liquid-impervious linings over porous bases. Often, particularly when the liquid-impervious linings are polymerized in situ, blisters, fissures and other irregularities develop in the lining. Such irregularities cause the lining to leak, thus destroying its usefulness.

In the past, various attempts have been made to overcome these difficulties by, for example, utilizing substantially non-porous bases and/or by applying excessively thick liquid-impervious linings. Where a large area is involved, such as in swimming pools or in chemical storage basins or other tanks made of masonry, the preparation of masonry of high enough quality to substantially reduce its porosity is often prohibitively expensive. Also it is often necessary to line an existing liquid receptacle which has not originally intended to carry a lining. For this reason, the application of liquid-impervious liners which are polymerized in situ to masonry bases is often considered impracticable and other less satisfactory bases such as wood or steel are reverted to.

The use, heretofore, of excessively thick liquid-impervious liners to prevent leaks in the lining has been unsuccessful, generally.

Liquid receptacles having a liquid-impervious liner positioned over a non-electrically conductive base, have suffered, heretofore, from the distinct disadvantage that no positive means has been available for detecting leaks before deterioration of the base has resulted. For this reason, it has been impossible to determine whether or not such a lining contains undetected leaks prior to filling a lined receptacle with liquid. This problem has led to the use of excessively thick linings or to the use of entirely different receptacles.

Broadly and in accordance with this invention, it has been determined that a lining, having the structure described more fully hereafter, of a liquid-impervious non-conductive liquid barrier and a continuous electrically conductive metal foil positioned over a porous non-conductive base, provides positive means of leak detection and a reliable liner of minimum thickness.

Referring to the drawings, FIG. 1 depicts, in cross-section, a liquid receptacle embodying the liner construction of this invention.

FIG. 2 depicts, in cross-section, a preferred liner construction in accordance with this invention.

FIG. 3 depicts, in cross-section, another embodiment of the liner construction according to this invention.

Referring particularly to FIG. 1, a porous base, referred to generally by reference numeral **1**, forms the supporting means over which a liner, referred to generally by reference numeral **11**, is positioned. The liner comprises a metal foil **2** and a liquid barrier **3**. The porous base **1** can be of any porous material such as, for example, masonry. The surface of base **1** which receives the metal

foil **2** is generally finished in some manner so that it presents a relatively smooth surface to receive the metal foil **2**. Conventional finishing treatments which are suitable include, for example, careful troweling and smoothing of the uncured material or sandblasting of the base after it has hardened.

The metal foil **2** can be affixed to the base **1** by any convenient means, for example, by mechanical attachments, not shown. or by adhesives, such as adhesive layer **9** illustrated in FIG. 2.

The metal foil **2** is characterized by having ductility and weight such that it can be conveniently applied and irremovably secured to the contours of the base **1**. These foils should be reasonably free of oil, dust and other surface impurities which might prevent adhesion of the foil to the base or the liquid barrier to the foil. Metal foils which can be used according to this invention comprise any of the electrically conductive metals including, for example, aluminum, copper, tin, iron or alloys or mixtures of two or more. Aluminum and alloys thereof have been found to be particularly useful since they are excellent conductors of electricity and are readily applicable to and tightly adherent to the base **1**.

It has been determined that the metal foil, to be satisfactory, should have a thickness of from about 0.5 mil to about 6 mils. Foil of this thickness is easy to apply because it possesses sufficient rigidity to be handled without excessive tearing and is sufficiently thin to conform and adhere well to the precise contours of the base **1**. Foil which is thinner than the limits given above tends to tear too easily; thicker foil is difficult to apply and does not adhere well to the base. It has been determined that, in certain instances, the rigidity of the foil can be increased without increasing the thickness, by quilting or otherwise imparting a non-uniform surface to the foil. Such increased rigidity increases the ease with which the foil may be applied and handled and the adherence of the foil to the base.

The liquid barrier **3** is applied over the foil **2** with or without the use of an adhesive layer **10**, shown in FIG. 2. The liquid barrier **3** can comprise any of the natural or synthetic resins, elastomers, rubbers, paints and the like, such as polyester, polyvinylchloride, polyacrylate, asphalt and the like. The liquid barrier **3** can be reinforced by any of the conventional reinforcement or filler means such as fiber glass, woven mesh and the like.

Reference numeral **4** in FIG. 1 indicates the liquid to be contained in the receptacle. Base **1** should be kept out of contact with liquid **4** since any prolonged contact may cause loss of the liquid, deteriorate the base and/or contaminate the liquid. Typical liquids include, for example, aqueous chemical solutions, hydrocarbons such as crude oil and refined products such as fuel oil, kerosene, gasoline and the like.

Many lined vessels of large surface area are employed in the chemical industry for settling basins, waste purification, solar ponds, storage basins, reaction vessels and as holding areas within a process stream. The present invention is applicable, of course, to all such vessels. In many instances, the liquid to be retained within the receptacle is electrically conductive. This electrical conductance property can be utilized in conjunction with the structure according to this invention to provide a means of leak detection.

Leaks in the structures of this invention can be detected instantaneously as they develop, through a leak detection

means comprising foil 2, a first electrical contact 5, a warning means 8, a source of current 7 and a second electrical contact 6. As shown in FIG. 1, electrical contact 6 is immersed in the liquid 4, electrical contact 5 connects foil 2 with warning means 8, and electrical current is supplied from source 7.

If there are leaks in the liquid barrier 3, liquid 4 will be in contact with metal foil 2. Electrical current flowing through liquid 4 into any opening in liquid barrier 3 and thus to the metal foil 2 will complete the circuit and automatically actuate warning means 8. Warning means 8 can be either visual or audible, for example, a light, a horn, a bell, a buzzer or the like. This system provides a constant check which immediately and automatically detects any leak as soon as it develops in a receptacle containing an electrolyte, before any substantial damage has occurred.

It is an important feature that the leak detection means of this invention can be employed to detect leaks in the liquid barrier 3 even when an electrically conductive liquid is not present in the receptacle. Thus, if electrical contact 6 is attached to a sponge, not shown, which has been soaked with a good electrolyte, and the sponge is moved slowly over the surface of liquid barrier 3, any leaks in the liquid barrier will be immediately detected by the warning means 8. The electrolyte in the sponge will penetrate any defects in the liquid barrier and contact the metal foil whereupon the circuit is completed and the warning means will be actuated. In accordance with this feature, it is possible to insure that no leaks are present in the liquid barrier 3 before any of the liquid 4 is introduced into the receptacle.

Referring specifically to FIG. 2, a first layer 9 of adhesive material is applied between the base 1 and the foil 2. A second layer 10 of the same or different adhesive is applied between the foil 2 and the liquid barrier 3. Second layer 10 can serve as a prime coat for liquid barrier 3. The first adhesive layer 9 serves to attach the foil 2 firmly to the base 1. Although this layer of adhesive is not essential, it has been determined that fewer leaks and better results are obtained if this layer of adhesive is employed.

Any adhesive material can be used as layers 9 and 10. Suitable materials comprise a liquid pre-polymer applied to the base 1 and polymerized in situ, a strip of adhesive film having both its surfaces gummed or the like. Since, in some cases, it is difficult to apply adhesive film which has been pre-gummed on both sides, it is preferred to use an adhesive material comprising a liquid pre-polymer which is applied as liquid and polymerized in situ. These liquid pre-polymers also adhere more uniformly to the precise contour of the base than do the gummed films. Particularly suitable adhesive materials comprise epoxy resins. These resins are applied and then cured in situ by the use of chemical agents, for example, amines, polyamides, and the like. These chemical agents can be applied before or after the resin is deposited in place.

The adhesive layers 9 and 10 can be the same or different. Conveniently, the adhesive in layer 10 is the same as that in layer 9 since this provides uniform adhesion to the foil 2 by both the base 1 and the liquid barrier 3. Also, the use of a single material for both adhesive layers 9 and 10 reduces the equipment and materials required to complete a particular structure. The adhesive in layer 9 must be compatible with base 1 and foil 2, while adhesive layer 10 must be compatible with foil 2 and liquid barrier 3.

Referring particularly to FIG. 3, the foil 2 is attached to base 1 by mechanical means, not shown. Such mechanical means include brads driven through foil 2 into base 1 with the resulting punctures in foil 2 being carefully sealed. If desired, foil 2 can be applied to the base 1 simply by carefully contouring the foil 2 to the shape of base 1 so that the foil 2 adheres closely to the base 1 without further attaching means. This contouring can be accomplished, for example, by rolling or brushing the foil onto the base. This method of applying the foil to the base 1 has been found to be very suitable in applications where the surface to which the foil is applied is horizontal. This method of adhesion is not limited, however, to horizontal surfaces since it can be employed on substantially vertical surfaces. As shown in FIG. 3, the liquid barrier 3 can be attached to the foil 2 by means of an adhesive layer 10. The nature of the adhesive layer 10 and the means of applying it are described more fully above with reference to FIG. 2.

The base 1 as described above can be of any porous material; however, it preferably is a porous masonry material such as, for example, concrete, brick, cinder block and the like.

One particular application for our structure is in porous concrete swimming pools which have polyester linings. Use of the structure of this invention provides a quick, convenient and inexpensive means for detecting leaks, both prior to initial filling of the swimming pool and during the use of the swimming pool. A further application for the structure of this invention is in large underground fuel tanks wherein it is essential to detect the presence of any leaks in the liner prior to introduction of fuel into the storage tanks. Leaks in such storage tanks can be detected by passing an electrolyte-soaked sponge connected to electrical contact 6 over the surfaces of the lined storage tank, before it is filled with fuel. The warning system described above with reference to FIG. 1 is employed to detect any leaks.

The metal foil 2 has an important function in eliminating the development of blisters and fissures in polymeric liquid barriers which are polymerized in situ on porous bases. The mechanism by which the metal foil 2 prevents the formation of blisters during polymerization and thereafter is not fully understood. While we do not wish to be limited to any particular theory, it is believed that the metal foil 2 acts as a vapor barrier during and after curing of the polymeric liquid barrier so that vapors from the porous base do not force portions of the uncured or semi-cured liquid barrier away from the base. While the precise function of the metal foil in this matter is not understood, it has been determined that the use of this metal foil enables the production of large lined receptacles which contain no blisters or irregularities in the lining. This is in sharp contrast to linings which are produced by substantially the same procedures and materials without the use of the metal foil. These linings on porous bases are substantially worthless because they are filled with blisters and fissures. Often, these linings, which are applied over a porous base, contain more surface area which is filled with blisters than surface area which is firmly adhered to the base. For this reason, it is essential to use a metal foil in producing lined receptacles which have porous bases.

The use of the metal foil 2 in a leak detection means in the structure of this invention, provides a highly advantageous system which provides, among other features, the hitherto unavailable dual features of positive leak detection and uniform high quality linings over low cost, porous, non-conductive bases.

As will be understood by those skilled in the art, what has been described is the preferred embodiment of the invention; however, many modifications, changes and substitutions can be made therein without departing from the scope and the spirit of the following claim.

We claim:

A method for preparing a liquid receptacle which comprises: applying an electrically conductive metal foil having a thickness of from about 0.5 mil to about 6 mils to a porous masonry base; applying an uncured electrically

non-conductive liquid-impervious barrier liner to said foil and permitting the same to cure in situ against said foil; and testing for leaks in said cured barrier liner by connecting leak detection means to the foil, passing an electrical contact probe over said barrier liner to subject the barrier to an electrical potential and determining if a leak exists therein.

References Cited by the Examiner

UNITED STATES PATENTS

1,952,705	3/1934	Egloff et al.	50—159 X
2,036,123	3/1936	Dahlander	50—160 X
2,205,534	6/1940	Lytle	50—268 X
2,372,489	3/1945	Hampson.	

3,048,294	8/1962	Osborn.
3,056,492	10/1962	Campbell.
3,064,874	11/1962	Kauffeld.

FOREIGN PATENTS

1,063,318	12/1953	France.
355,594	8/1931	Great Britain.

OTHER REFERENCES

Concrete: "Concrete Sealed by Glass Cloth and Resin," by J. Delmonte; June 1949; pages 12 and 45.

NEIL C. READ, *Primary Examiner.*

DANIEL K. MYER, *Assistant Examiner.*