

Feb. 6, 1962

G. C. BULL
METHODS AND APPARATUS FOR CONDITIONING HOLLOW
ARTICLES AGAINST CORROSION
Filed Nov. 19, 1959

3,020,121

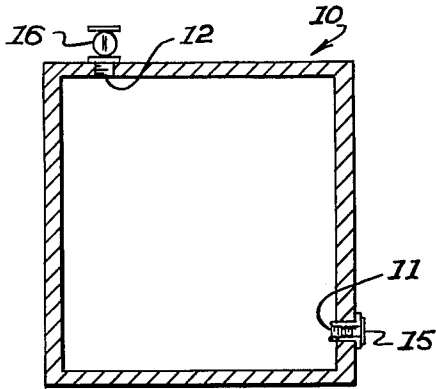


FIG. 1

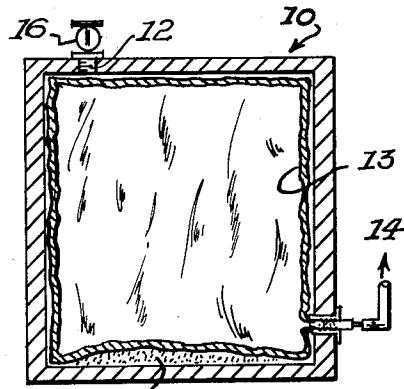


FIG. 2

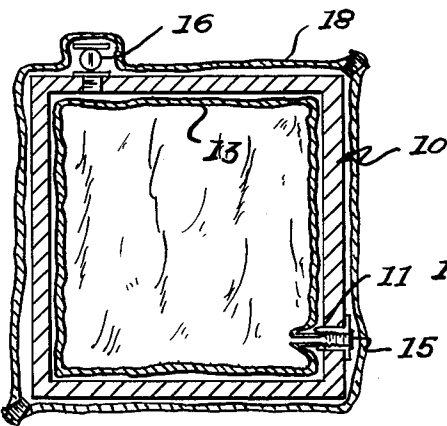


FIG. 3

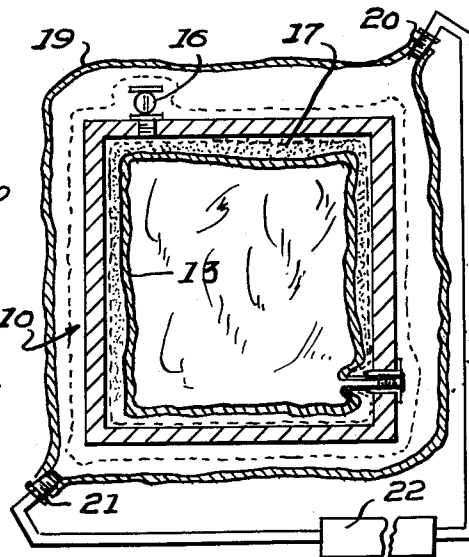


FIG. 4

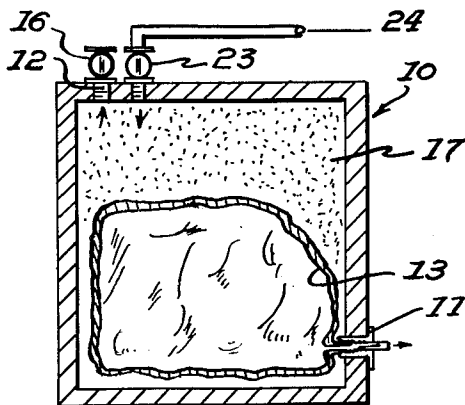


FIG. 5

INVENTOR.
GLEN C. BULL
BY
H. N. Patterson, Jr.
his attorney

1

3,020,121

METHODS AND APPARATUS FOR CONDITIONING HOLLOW ARTICLES AGAINST CORROSION

Glen C. Bull, 2300 Quebec St. NW., Washington, D.C.

Filed Nov. 19, 1959, Ser. No. 854,179

5 Claims. (Cl. 21-2.5)

The present invention relates to packaging and storing and more particularly and specifically to methods and apparatus for conditioning hollow, partially hollow or recessed articles in corrosion inhibiting and preventive condition. This application is a continuation-in-part of co-pending application Serial No. 255,675, now Patent No. 2,914,377.

Certain prior methods and apparatus have been used for the purpose of conditioning articles of hollow or partially hollow construction against corrosion while said articles are stored for unlimited periods of time.

Certain of these prior conditioning methods and apparatus have included the steps of completely coating the interior and parts of the exterior surfaces of hollow articles with grease or thick petroleum base inhibitors and then sealing the exterior openings in said article with masking or stripping means to prevent ingress of corrosive element bearing medium from outside of the article.

Other prior methods and apparatus for storing hollow or partially hollow articles in corrosion inhibiting condition have included the provision of a sealable housing for the reception of the articles and the continuous circulation of inert mediums through said housing in contact with the stored articles, or the circulation of dry, heated air through said housing to substantially reduce the possibility of corrosive action to the article.

Still other prior methods of conditioning hollow or substantially hollow articles have included the steps of coating or covering the external surfaces of the article with corrosive inhibiting agents of petroleum base or the like, of sealing all openings into the article and of then evacuating the interior of the article to produce as perfect a vacuum as possible therein for the purpose of removing therefrom corrosive element bearing mediums.

All of these prior methods have inherent disadvantages in their operation and apparatus and they present numerous problems which arise both during the conditioning period as well as at that time when it becomes desirable to place the articles in serviceable condition.

Some of the disadvantages and problems inherent in these prior methods include the undesirable pressure differentials created inside and outside of the article when the interior thereof is evacuated thereby subjecting the article to danger of collapse as well as establishing an external pressure which greatly reduces the efficiency of the seals provided against ingress of external mediums. Further, the time and labor necessary in the removal of the usual corrosion inhibiting agents of petroleum base or the like which are applied in some of these methods is very substantial and costly.

It is therefore a general object of the present invention to provide methods and apparatus for conditioning hollow or partially hollow or recessed articles against corrosion which substantially eliminate all of the disadvantages and problems inherent in prior methods and apparatus.

Another object of the present invention lies in the provision of methods and apparatus for expelling substantially all of the corrosive element bearing mediums from within the interior of the article which are normally present therein and for providing a continuous and efficient external seal about the entire outer surface of the article to prevent corrosive action on the external surfaces, at the same time preventing the ingress of corrosive element bearing mediums into the article.

2

A further object of the present invention resides in the provision of methods and apparatus for the placement of inert mediums within an article and for sealing the article externally over its entire surface without the intermixture of the corrosive element bearing mediums normally present with the article with the inert material as it is supplied thereto thus eliminating any possible contamination of the inert material.

Still a further and important object of the present invention lies in the provision of methods and apparatus for expelling substantially all of the corrosive element bearing mediums normally present within the article by enclosing the gaseous contents of the article within a flexible container which substantially fills the article, and by surrounding the article with a flexible container which may be evacuated to bring the container into surface to surface contact with the external surface of the article and which surrounding container may be inflated and deflated alternately to cause breathing of the internal container for the purpose of pumping residual-free mediums outwardly from the article.

Yet another object of the instant invention is the provision of methods and apparatus for conditioning the interior of hollow or partially hollow articles against corrosion which eliminate the necessity of removing hard-to-remove coatings and inhibiting agents from the surfaces of the article prior to making the article available for use.

Still a further object of the present invention is the provision of methods and apparatus for conditioning hollow or partially hollow articles against corrosion which eliminate the necessity of evacuating the interior of the article in order to remove the corrosive element bearing mediums normally present therein.

Other objects of the present invention are inherent in the simple and inexpensive nature of the apparatus used and the steps necessary to the performance of the methods.

Still further and additional objects and advantages of the invention and of the methods and apparatus constituting parts thereof will become readily apparent to those skilled in the art when the following description and claims are read in the light of the accompanying drawings.

The nature of the present invention as it relates to methods may be stated in general terms as including the steps of inflating a flexible bag within the interior or recesses of the article to enlarge the bag to substantially fill the entire interior or recess of the article thus expelling substantially all of the corrosive element bearing medium normally present therein, sealing openings in the exterior of the article and eliminating substantially all of the corrosive element bearing medium surrounding and in contact with the exterior of the article by enclosing the article in a flexible container and evacuating said container to collapse the same to a close surface to surface contact with the exterior surfaces of the article, or in lieu of collapsing the external container, supplying a fixed amount of or a continuous circulation of an inert medium to or through the external container under pressure sufficient to maintain it in an inflated condition.

In the instance of the latter application of the external container to the article where the container is maintained in a condition of pressured inflation the additional steps constituting certain of the methods include the alternate increase and decrease of the inflation pressure of the container to cause breathing of the internal flexible bag thus pumping any residual mediums from within the interior of the article causing their circulation therein and their egress therefrom.

For the purposes of the present disclosure and description of the methods and apparatus constituting the instant invention and to enable a clear understanding thereof

3

by persons skilled in the art the article illustrated in the accompanying drawings as a hollow or recessed article to be conditioned interiorly and exteriorly against corrosion is shown and described as a cylindrical tank. However, it is fully contemplated that any article including vehicles, aircraft or smaller industrial articles may be conditioned by the methods and apparatus taught herein without departing from the scope of the present invention as it is defined in the appended claims.

Turning now to the accompanying drawings in which like numerals designate similar parts throughout the several views:

FIG. 1 is a sectional elevation of the hollow article to be conditioned;

FIG. 2 is a sectional elevation of the hollow article with the inner flexible bag inflated, one step in the method;

FIG. 3 is a sectional elevation with the inner bag inflated and with the outer container in a collapsed condition;

FIG. 4 is a vertical section illustrating the outer bag in pressured inflation with a continuous circulation of inert medium therethrough with alternate positions of the inner and outer bag shown in dotted line, one step in the modified method;

FIG. 5 is a sectional elevation with the inner bag partially inflated, another modified method step.

Turning to the accompanying drawings the reference numeral 10 generally designates a hollow article shown as a cylindrical tank provided with an access opening 11 and an exhaust opening 12.

In order to condition the interior of the tank 10 against corrosion over a long period of storage an inflatable bag 13 of a suitable flexible plastic or like air-tight material is introduced into the container or tank 10 through the access opening 11 and the bag 13 is inflated from a suitable source 14 to cause the bag to expand to substantially fill the entire interior of the tank expelling the corrosive element bearing mediums normally present therein outwardly through the exhaust opening 12.

When the bag 13 has been completely inflated to fill the tank it is sealed and the access opening 11 is closed and sealed by a suitable means 15 and the exhaust opening is closed and sealed by a suitable means 16.

At this point the interior of the tank is filled with a gaseous medium which is entirely enclosed within a flexible air-tight bag which prevents the mediums within the interior of the tank from contacting and attacking the interior surfaces thereof.

It is contemplated that prior to the inflation of the flexible bag 13 inside the tank a corrosion inhibiting agent 17 in a dust or granular form such as the vapor phase inhibitors now available commercially may be introduced or sprayed into the interior of the article or they may be applied to the exterior of the bag where they will be properly located in close proximity to the interior surfaces of the tank.

Once the interior of the tank has been conditioned as described above it is contemplated that two possible methods may be employed for the conditioning of the exterior surfaces of the tank, either of which method will satisfactorily and efficiently protect the exterior surfaces against corrosion.

The first method contemplated for exterior protection of the tank includes the surrounding of the tank with a flexible container or bag 18 of similar material to that constituting the inner bag and to evacuating the outer bag or container 18 to cause it to collapse tightly about the tank in surface to surface contact with the exterior surfaces thereof. This evacuation may be accomplished by drawing a vacuum within the container from a point exterior thereof and it is additionally contemplated that the outer container should be provided about its inner surface or through the medium of a dust spray with a

4

quantity of a corrosion inhibiting agent such as the aforementioned vapor phase inhibitors.

At this point the tank is now protected internally and externally against the corrosive action of any elements which might be present in the normal medium filling and surrounding such a tank in its normal condition. Additionally, the tank is now maintained in a sealed condition against the ingress of any external corrosive element bearing mediums which might surround the outer air-tight container.

The second method contemplated for conditioning the exterior surfaces of the tank 10 against corrosion includes the placement of a flexible bag or container 19 entirely about the tank which container is provided with an inlet opening 20 and an outlet 21 which openings are connected to a source 22 of an inert medium such as carbon dioxide, nitrogen, freon, helium or the like, or of dry, heated, non-corrosive air and such medium or air is continuously circulated from said source through said outer inflated container in contact with the exterior surfaces of the tank thereby inhibiting corrosive action on said surfaces.

In the circulation of the inert material or dried air through the outer inflated bag 19 the circulation pressure of the medium may be alternately increased and decreased to create an alternating pressure differential between the interior of the outer container and the interior of the inner bag. This alternating pressure differential between the bag interiors will cause the inner bag to expand and contact within the interior of the tank thus causing a pumped circulation of the residual mediums therein and at the same time giving activation to the granular corrosion inhibiting agents contained therein for an increased protective measure against interior corrosion of the tank.

There is no intention herein to limit the means by which the inner bag may be caused to expand or contract alternately to a change in the pressure of the circulated inert medium since other methods such as heat differentials may be employed to accomplish such breathing action.

With reference to FIG. 5 of the drawings there is illustrated a modified step in the method of purging corrosive element bearing mediums from the tank 10 by means of an inflatable balloon and an external source of inert material such as an inert gas or dry air.

In this contemplated step, the balloon is inserted through a sealed coupling member into the interior of the tank and the exhaust fitting 12 is opened to permit the expulsion of the free mediums within the tank outwardly thereof upon inflation of the balloon. When the balloon has been inflated to its full inflated position the exhaust opening 12 is closed and a second fitting 23, connected to a source of inert material 24, is opened and the inert material under pressure flows into the tank with the simultaneous release of the pressure from within the inflated balloon whereupon the balloon will be completely deflated and the tank will be substantially filled with the inert medium.

This step or process may be repeated for as many times as is desired for the purpose of approaching a perfect condition of evacuation of moisture or corrosive element bearing mediums from within the tank. This condition is accomplished by reason of the fact that each cycle of the bag inflation, tank interior medium exhaust, and subsequent inert medium ingress serves to completely dehydrate any corrosive element bearing mediums which are normally residually remaining within the tank by a common dilution process. After the practice of this particular phase of the methods herein contained and described the bag is then finally inflated expelling substantially all of the residual mediums within the tank, the tank is sealed in a closed condition and then methods for protecting the exterior of the tank such as are herein described may be practiced.

The specific methods of sealing the exhaust and access openings of the tank, the materials used and the specific

5

corrosion inhibiting agents enumerated are not set forth for the purpose of limitation but are merely examples of the possible applications of the methods and apparatus broadly described herein.

Accordingly methods and apparatus for the conditioning of hollow or partially hollow articles against corrosion are described and explained herein which methods and apparatus satisfy the aforementioned objects and advantages and attain the new and improved results specified.

I claim:

1. A method of conditioning hollow and partially hollow articles against corrosion including inflating a flexible container within the hollow of the article to substantially fill the hollow and expel the free atmosphere therefrom, sealing all the exterior openings in the article communicating with the hollow therein, surrounding the article with a second flexible container, applying a corrosion inhibiting agent on the exterior of the innermost container, and supplying a continuous circulation of an inert medium through the outer container in contact with the exterior surface of the hollow article.

2. A method of conditioning hollow and partially hollow articles against corrosion including inflating a flexible container within the hollow of the article to substantially fill the hollow and expel the free atmosphere therefrom, sealing all the exterior openings in the article communicating with the hollow therein, surrounding the article with a second flexible container, supplying a continuous circulation of an inert medium through the outer container in contact with the exterior surface of the hollow article, and alternating the supply pressure of said inert medium to the outer container to cause expansion and contraction of the inner container.

6

3. A method as defined in claim 2 which includes the step of applying a corrosion inhibiting agent exteriorly of the inner flexible container.

4. A method as defined in claim 2 including the step of periodically injecting a supply of granular corrosion inhibiting agent into the circulating inert medium.

5. A method of removing substantially all corrosive element bearing mediums from within a hollow article including the steps of sealing the hollow article leaving an access and discharge entry means, inserting a flexible inflatable container through the entry opening within the article, inflating said flexible container to expel the residual mediums outwardly of the discharge of said article, connecting said discharge with a pressured source of an inert medium, releasing the pressure on said inflatable container to permit the simultaneous ingress of inert medium with deflation of said container, disconnecting said inert source from said discharge, opening said discharge and simultaneously inflating said flexible container to a completely inflated condition, and closing said discharge to complete one cycle of a repetitive method whereby the interior of said article can be substantially completely purged of any corrosive element bearing medium through the dehydration thereof by dilution from said inert medium, and thereafter surrounding the article with a second flexible container, and evacuating the second container to collapse the same in close surface to surface contact with the article exterior.

References Cited in the file of this patent

UNITED STATES PATENTS

2,638,263	Jesnig	May 12, 1953
2,914,377	Bull	Nov. 24, 1959