

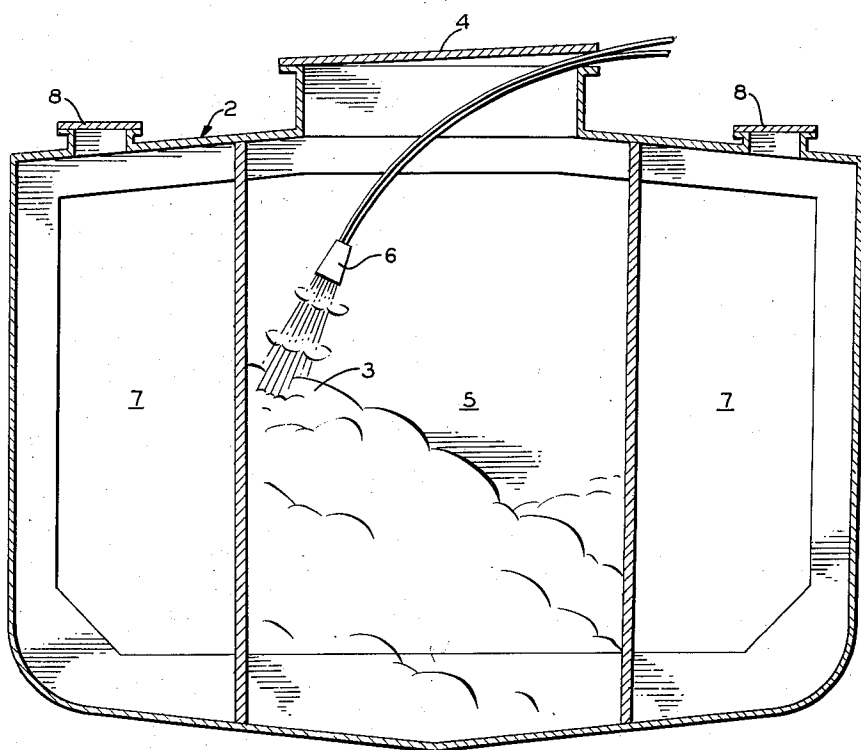
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METHOD OF INHIBITING CORROSION IN TANKERS

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METHOD OF INHIBITING CORROSION IN TANKERS

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This invention relates to a method of inhibiting the corrosion that occurs in the interior of tankers, and more particularly to the use of a fog of a corrosion inhibitor for such purpose.

Corrosion that occurs in the interior of tanker ships is a major problem in the shipping industry. Tankers that carry light oil products, such as gasoline and kerosene, are subjected to particularly severe corrosion. The light oil products dissolve any protective greasy film that may be present on the steel bulkheads. When the cargo is discharged, the light oil film remaining on the steel evaporates leaving clean steel exposed. In accordance with the usual practice in the industry, sufficient ballast water is then pumped into some of the tanks to render the ship seaworthy.

The readily available salt sea water, which is generally employed for ballast, rapidly corrodes the unprotected steel. Furthermore, the steel interior of the tanker which is not immersed in the salt water ballast is rusted by the moist salt atmosphere. Tankers carrying heavy oil products, such as crude oil, likewise suffer corrosion damage, although corrosion in such tankers is usually not as severe as in ships carrying the lighter, more volatile oil products.

The extent of corrosion damage in tankers is so great that tankers carrying the light oil products generally have only from six to ten years of operation before major repairs are required in order to maintain the structural strength and seaworthiness of the ships. It is generally accepted in the industry that the cost of repairing corrosion damage for a fleet of tankers may average as high as about \$50,000.00 per ship per year.

Many solutions to the tanker corrosion problem have been proposed, including protective coatings, cathodic protection, dehumidification, or corrosion inhibitors placed in the sea water ballast or sprayed directly against the surfaces of the tanks. Incorporation of corrosion inhibitors directly into gasoline cargos has also been proposed. However, material disadvantages have been encountered in all methods heretofore suggested which have prevented widespread acceptance of such methods by the industry. Protective coatings have been unsatisfactory because of their short life expectancy under the conditions encountered, and the difficulty and expense of cleaning the interior surfaces of the tanker sufficiently to provide a proper base for the coating. Dehumidification is expensive and not very successful when sea water ballast is carried. Cathodic protection and water soluble inhibitors dissolved in the sea water ballast are not too satisfactory since parts of the tanker not in contact with the sea water ballast remain unprotected by these methods. Furthermore, the regular use of water soluble inhibitors dissolved in the entire quantity of ballast water frequently costs more than the usual replacement of corroded steel because of the large amounts of water soluble inhibitor required.

Another proposed method of reducing tanker corrosion involves spraying a stream of a liquid corrosion inhibitor directly onto the interior surfaces of the tanker. However, an appreciable amount of corrosion inhibitor is re-

quired to cover the interior of a tanker when the inhibitor is sprayed onto surfaces. Consequently, the spray method is expensive, and it also presents a contamination problem since the considerable amount of sprayed corrosion inhibitor present in the tanker becomes mixed with the oil product cargo. The same objection also applies to the method in which the corrosion inhibitor is directly incorporated in the oil product cargo. In addition, it is difficult to direct a sprayed stream of corrosion inhibitor into all the nooks and crannies of the interior of a tanker since the drops of spray are sufficiently large to be strongly effected by gravitational force and fall downwards when the initial momentum of the spray is spent. As a result, it is apparent that a simple economical solution to the tanker corrosion problem would be of considerable value and importance.

In summary, this invention comprises the creation of a fog of a water insoluble corrosion inhibitor which preferably has a high affinity for metal, and the direction of such fog into the interior of a tanker to produce a film of corrosion inhibitor on all metal surfaces exposed to the fog. The corrosion inhibitor is preferably mixed with a liquid carrier before it is converted into a fog in order to reduce the viscosity of the corrosion inhibitor so that it may be readily atomized into a fog with a suitable gas, and so that the resultant film of corrosion inhibitor deposited on the metal will not be unnecessarily thick. The term fog as employed herein means an aerosol type colloidal dispersion in which particles of a corrosion inhibitor or solution of corrosion inhibitor in a carrier are dispersed in a gas.

The corrosion inhibitor fog is applied to the interior of the tanker after the oil product cargo has been discharged and before the water ballast is pumped into the tanker. Consequently, the film of water insoluble corrosion inhibitor formed on the interior of the tanker remains as a protective coating in tank compartments containing water ballast as well as in empty compartments until the water ballast is discharged at the end of the return voyage, and the film is broken upon addition of the next oil product cargo.

Some of the corrosion inhibitor fog introduced into the tank compartments is deposited on the residual liquid that is usually present at the bottom of tankers in service because of the difficulty in pumping the tank compartments completely dry. This liquid sloshes around due to rolling of the ship when the tanker is at sea, and causes the corrosion inhibitor which had been deposited on such liquid to be placed on the metal of the tank compartment. In tanks that are filled with ballast water, the corrosion inhibitor deposited on the liquid at the bottom of the tank rises on the surface of the ballast water as the compartment is filled, because the corrosion inhibitor is lighter than the ballast water. As the ballast water level rises, and also when it sloshes around due to the roll of the ship at sea, the corrosion inhibitor on its surface is likewise placed on the exposed metal in the compartment, thereby adding to the protective film of corrosion inhibitor.

Since the fog of corrosion inhibitor is a colloidal type dispersion which spreads to all accessible areas and deposits a film of corrosion inhibitor in all nooks and crannies, the fog may be introduced into the tanker from the outside of the tanker at almost any convenient location, such as a hatch. This advantage obtained by employing the method of this invention is due to the fact that for all practical purposes the fog is not effected by gravity in this method, as are the comparatively large particles of corrosion inhibitor in the spray method.

Furthermore, a relatively small amount of corrosion inhibitor fog applied in accordance with this invention provides protection for the entire interior of a tanker.

Consequently, the cost of inhibiting corrosion in this manner is very low in comparison to other methods, such as the spray method, and substantial savings may be effected. Also, the small amount of corrosion inhibitor that is introduced into the interior of the tanker is not sufficient to produce a cargo contamination problem.

The single figure of the drawing is a schematic vertical sectional view taken across the width of a tanker illustrating the manner in which the nozzle of a fog producing apparatus may be inserted through a hatch of a tanker to fill the interior with a fog of a corrosion inhibitor. The interior of tanker 2 is subjected to a corrosion inhibitor fog 3 introduced through hatch 4 into center tank compartment 5. The fog is created by any conventional atomizing fog producing means 6. Wing tanks 7 may be subjected to a fog of a corrosion inhibitor in the same manner by introducing the fog from the outside of the tanker through any suitable hatch openings 8 provided in such wing tanks 7.

In greater detail, any of the well-known efficient corrosion inhibitors that are water insoluble, have a greater affinity than water has for metal, and are substantially non-volatile at the usual temperatures encountered, may be employed for the purposes of this invention. The corrosion inhibitor must be substantially water insoluble so that it will not be dissolved when the water ballast is pumped into the tanker with resultant breaking of the protective film. Likewise, a high affinity for metal is desirable so that the corrosion inhibitor will preferentially adhere to the metal and not be floated off and displaced by water when the ballast water is added to the tanks. Organic corrosion inhibitors that have low interfacial tension display the desired preferential wetting of metal which enables them to displace water on metal surfaces.

The corrosion inhibitor should also be relatively non-volatile at the temperatures encountered so that it will remain a liquid fog at least until it has deposited on the tanker surfaces. If the corrosion inhibitor is converted into a gas when it is directed into the interior of the tanker and the gas subsequently condenses to a liquid, it does not form the desired continuous film on all interior surfaces of the tanker. The volatility of the corrosion inhibitor is a particular consideration when steam is used as the gaseous medium for dispersing the corrosion inhibitor.

Since the temperature of steam falls down rapidly to about 212° F. when ejected from the fog producing means 6, it is desirable to employ a corrosion inhibitor that does not have any substantial vapor pressure at that temperature. Corrosion inhibitors that have boiling points above 400° F. are usually substantially non-volatile at 212° F., and may be dispersed with steam without vaporizing to a gas. If a dispersing gas other than steam is employed at normal atmospheric temperature, the corrosion inhibitor need only be substantially non-volatile at the normal temperatures encountered.

An example of a suitable corrosion inhibitor is wool grease. Derivatives of wool grease that meet the foregoing requirements are also satisfactory. For example, wool grease in which all or a part of its free acidity is combined with the oxide of a divalent metal to form the corresponding metal soap is particularly useful for the purposes of this invention. Divalent metal soaps of sulfonic acids derived from petroleum, which are known as mahogany sulfonates, are also most useful corrosion inhibitors for application to the interior of tankers in the form of a fog.

The well-known corrosion inhibitors composed of fatty acids of long chain aliphatic amines and diamines provide another class of inhibitor that may be employed advantageously. One type of such a compound which produces excellent results because of the effectiveness of small amounts in reducing corrosion is the oleic acid soap of a diamine which contains both a primary and a

secondary amino group. The oleate of an amine having the structure $R-NH-CH_2-CH_2-CH_2-NH_2$ in which R is a mixture of straight chain saturated and unsaturated hydrocarbon radicals of 16 to 18 carbon atoms in length, is a specific example of this useful type of corrosion inhibitor. This amine is sold by Armour Chemical Co. under the name Duomeen-T. Either the dioleate or the mono-oleate of such amine can be readily prepared by merely mixing the amine with oleic acid in proper proportions, either in equimolar ratios for the mono-oleate, or two moles of the oleic acid to one mole of the amine for the dioleate, which is preferred. Although the foregoing compositions are examples of suitable corrosion inhibitors, any of the well-known corrosion inhibitors having the physical properties specified herein may be employed for inhibiting tanker corrosion by means of the fog of this invention. In general, compounds that may broadly be classified as substantially water insoluble soaps are preferred as corrosion inhibitors since they are effective in inhibiting corrosion even when present in small amounts.

A liquid carrier is preferably mixed with the corrosion inhibitor before it is converted into a fog in order to reduce the viscosity of the corrosion inhibitor. This is generally desirable since suitable corrosion inhibitors usually are too viscous to be readily converted into a true fog by conventional atomizing equipment. However, when the corrosion inhibitor is of a sufficiently low viscosity to enable it to be atomized into a fog without the necessity of prior dilution by a carrier, the carrier may be omitted.

In addition to its function in aiding the formation of a fog, the carrier provides a less viscous corrosion inhibitor solution which results in the deposit of a thinner film on metal surfaces than would otherwise be obtained. Also, the carrier acts as an extender for the corrosion inhibitor, and it enables a small amount of corrosion inhibitor to provide a thin continuous protective film over a large surface area. Consequently, the use of a carrier renders the method of this invention more efficient and economical.

Any liquid carrier that is water insoluble so that it will not dissolve in the water ballast, and which is a solvent for the corrosion inhibitor may be employed. Non-toxic carriers are preferred so that they will not be a health hazard. The viscosity of the carrier should preferably be in the range of from 35 to 200 Saybolt Universal at 100° F. so that it will provide a solution of inhibitor and carrier having a viscosity in that same approximate range when a major proportion of carrier is employed. A carrier that provides a viscosity of the solution of inhibitor and carrier of between about 100 and 200 Saybolt Universal at 100° F. is preferred, since this viscosity range has been found desirable for creation of a fog by conventional atomizing means. Also, optimum film coverage on the metal surfaces of the tanker is obtained with fogs created from solutions in such preferred viscosity range.

The carrier should also preferably be non-volatile at the temperatures to which the mixture is subjected, and be heat stable at such temperatures. In other words, the carrier should neither volatilize nor decompose during application of the material. Conversion of the carrier into a gas by either volatilization or chemical breakdown is undesirable, since as a gas it no longer serves as a carrier for the corrosion inhibitor. Generally, carriers that have average boiling points of at least 350° F. are suitable when steam is employed as the dispersing gas. If a gas at normal atmospheric temperatures is employed to atomize the corrosion inhibitor mixture, the carrier need only be stable and non-volatile at such normal atmospheric temperatures.

Liquid hydrocarbons having the properties specified are preferred as carriers since they are inexpensive, readily available, and provide excellent results. Suitable hydrocarbons may range in specific gravity between 0.85 and

1.05 and have aniline points between 0° F. and 200° F. The products sold by the petroleum refiners, such as petroleum spirits, aromatic type diluents, kerosene, mineral seal, gas oil, diesel fuel, neutral oil and transformer oil are specific examples of satisfactory liquid hydrocarbon carriers. In addition to these carriers, substituted products such as halogenated hydrocarbon derivatives including chlorinated paraffins and chlorinated diphenyls may be employed if desired when they have the specified physical properties. However, substituted hydrocarbons are more expensive than the regular petroleum products.

The proportional amount of corrosion inhibitor and carrier employed is not particularly critical as long as the viscosity of the solution enables it to be atomized and a fog created. With the efficient corrosion inhibitors named herein, such as the oleate of Duomeen-T sold by Armour Chemical Co., as little as 0.01% by weight corrosion inhibitor and 99.99% by weight carrier may be employed. With less efficient corrosion inhibitors a larger proportion of corrosion inhibitor is usually employed. Generally, it is not practical to employ more than 50% by weight corrosion inhibitor to 50% by weight of the less viscous carrier, since many suitable corrosion inhibitors are viscous and difficult to atomize. Also, it is usually preferable to employ a major proportion of the carrier since, as previously explained, the carrier acts as an extender for the corrosion inhibitor and renders the process more efficient. However, the carrier may be omitted in cases when the corrosion inhibitor can be atomized or fogged without prior dilution by a carrier. The solution of corrosion inhibitor and carrier may be prepared simply by thoroughly mixing the corrosion inhibitor together with the carrier in a suitable container.

With respect to fog producing means requiring a gas under pressure to create the fog, any gas may be utilized as the dispersing means for atomizing the corrosion inhibitor solution in order to create the fog. Such type of fog producing means is preferred. However, any type of mechanical fog producing means not requiring a gas may be employed. When a gas is employed to produce the fog, in order to reduce the possibility of fire or explosion in the tanker it is preferable to use an inert gas rather than a gas, such as air, which contains available oxygen.

Steam is extremely desirable and is preferred for atomizing the corrosion inhibitor solution since it is inert. Furthermore, substantially all tankers have an available source of steam supply. Consequently, steam provides a very economical source for the atomizing gas on the tanker. Flue gas is another atomizing gas that may be employed. Also, inert gases such as nitrogen or carbon dioxide are satisfactory, although they are relatively expensive.

Any conventional fog producing apparatus may be employed for creating a fog of the corrosion inhibitor solution. For example, in small scale operations, a Binks Paint Gun Model #29 with a 66 SF nozzle has proven to be very satisfactory. Nozzles of this type create a fog by diagonally directing two streams of the gas or steam dispersing means under pressure so that they cross at the base of the liquid corrosion inhibitor stream emerging from a central opening in between the gas streams. Larger scale atomization and creation of a fog may conveniently be carried out with fog generator heads such as in the Todd Insecticidal Fog Applicator which is sold by the Combustion Equipment Division of Todd Shipyards Corporation. Other atomizing equipment, such as that shown in United States Patent No. 2,321,792, may be employed. Sufficient corrosion inhibitor fog is directed into the interior of the tanker to produce a continuous film on the metal surfaces. The introduction of additional corrosion inhibitor fog after a film has been formed may be continued as a safety factor if desired as long as the excess

is not so great that a cargo contamination problem will be encountered. The film can be of any thickness as long as it remains unbroken. Good results have been obtained with film thicknesses of between 0.001 inch and 0.002 inch of the corrosion inhibitor solution as such thickness provides adequate protection for extended periods. However, the film thickness is not particularly critical. About 1.5 gallons or about 12 pounds of the solution of corrosion inhibitor and carrier covers 1000 square feet of metal surface with a film thickness of about 0.002 inch of corrosion inhibitor solution. However, this amount is not particularly critical since efficient corrosion inhibitors are effective in film thicknesses even less than 0.001 inch. The amount of gas required to atomize 12 pounds of solution varies with the type of atomizing equipment and the gas pressure. Approximately 200 cubic feet of gas at 60 pounds per square inch pressure may be employed to create a fog from 12 pounds of corrosion inhibitor solution that will adequately cover 1000 square feet of surface. Typical examples of solutions of corrosion inhibitor and carrier that have produced excellent results in preventing corrosion when applied to metal surfaces in the form of a fog are as follows:

Example I

	Percent by weight
Raw wool grease (corrosion inhibitor)	20
Petroleum distillate (specific gravity 0.88, viscosity 40 Saybolt Universal at 100° F., and aniline point of 100° F.) (carrier)	80
	100

Example II

Calcium soap of mahogany sulfonic acids (corrosion inhibitor)	10
Transformer oil (specific gravity .90, viscosity 60 Saybolt Universal at 100° F., and aniline point 175°) (carrier)	90
	100

Example III

Previously mentioned oleic acid soap of a diamine sold by Armour Chemical Co. under the name "Duomeen-T" (corrosion inhibitor)	5
Transformer oil (same as Example II) (carrier)	95
	100

The following is an example of the manner in which the center tank compartment 5 of a typical medium size gasoline tanker of modern design having a capacity of about 8,700 barrels (42 gallons per barrel) of gasoline and a total surface area of approximately 17,600 square feet of metal may be treated in accordance with this invention. The 17,600 square feet surface area of the center tank is composed of about 9,600 square feet of structural supporting members and about 8,000 square feet of plating. The usual tanker of this type contains eight separate center tank compartments 5 and a total of sixteen wing tanks 7. Each wing tank contains a total of about 12,800 square feet of surface area of which about 7,850 square feet is on structural supporting members and about 4,950 square feet is metal plating. The side wing tanks have a capacity of about 3,900 barrels of gasoline.

After the cargo of gasoline is discharged, introduce a fog of the corrosion inhibitor solution specified in the foregoing Example II from the outside of the ship through a hatch into the interior of the tank compartment, which is a center tank compartment 5 in this example. Create the fog by atomizing the solution of corrosion inhibitor and carrier, which solution has a viscosity of about 150 Saybolt Universal at 100° F., with any convenient atomizing means, such as a Binks spray gun, using steam as

the atomizing gas. The fog is introduced into the compartment by placing the atomizing nozzle through hatch opening 4 in the compartment, and the operator need not enter the compartment.

When the operator observes that the compartment is filled with fog, this insures that a film of corrosion inhibitor appears on all portions of the metal surfaces, and the operation is completed. About 25 gallons of the corrosion inhibitor-carrier solution covers the metal surface of a center tank compartment of the 17,600 square feet surface area specified including the bottom regardless of whether or not it has some residual liquid thereon, which amounts to about 1.5 gallons of corrosion inhibitor solution of every 1,000 square feet of surface to be protected. However, to insure complete coverage it is desirable to employ an excess of corrosion inhibitor solution to take care of voids and unusual conditions that may be encountered inside the compartment. Usually an excess of about up to 15% will be sufficient. As previously mentioned the amount of corrosion inhibitor-carrier solution specified provides a coating of about 0.002 inch thick, and lesser amounts may be employed since corrosion inhibitor solution coatings of less than 0.001 inch in thickness have been satisfactory for inhibiting corrosion. About 3,500 cubic feet of steam at 60 pounds per square inch pressure atomizes 25 gallons of corrosion inhibitor-carrier solution with the specified type of atomizing apparatus.

After a film of the solution of corrosion inhibitor and carrier has been deposited on the interior surfaces of the tanker compartment by a fog in the manner described, pump sea water ballast into the compartment in the customary manner in order to render the ship seaworthy. The corrosion that usually occurs in the compartment during the return voyage is inhibited by this method at a low cost, since the film of corrosion inhibitor protects the metal from the corrosive action of the sea water.

The sea water ballast is pumped out of the tank compartments after the return voyage, and the tanker is filled with its oil product cargo. The amount of corrosion inhibitor solution applied in accordance with this invention is not sufficient to cause a contamination problem even for example with the strict requirements applied to a cargo of aviation gasoline. With 25 gallons of corrosion inhibitor solution applied to the center tank compartment of 8,700 barrels (365,000 gallons), even if all of the corrosion inhibitor solution is dissolved in the cargo, the amount of corrosion inhibitor in the cargo will be only about 1 part in 15,000, or about 0.007%, which is well within the permissible contamination limits. Furthermore, the major proportion of the corrosion inhibitor solution is desirably a liquid hydrocarbon carrier which does not interfere with the combustion characteristics of the cargo. Consequently, the fog of this invention provides protection against corrosion without causing a cargo contamination problem.

I claim:

1. The method of inhibiting corrosion in the interior of an oil tanker or the like adapted to contain an oil cargo on one trip and water ballast on another trip whereby the water ballast would otherwise cause said corrosion, which comprises introducing into said interior a fog of a water insoluble corrosion inhibitor and a water insoluble carrier before said water ballast is added to said interior, filling said interior with said fog to form a protective film of said corrosion inhibitor on all the exposed surfaces of said interior, said corrosion inhibitor and said carrier being substantially non-volatile at the temperatures to which they are subjected while in said interior, and subsequently introducing water ballast into said interior.

2. The method of inhibiting corrosion in the interior of an oil tanker or the like adapted to contain an oil cargo on one trip and water ballast on another trip

whereby the water ballast would otherwise cause said corrosion, which comprises introducing into said interior before said water ballast is added thereto a fog of a composition comprising a water insoluble corrosion inhibitor present in an amount up to 50% by weight and dissolved in a water insoluble carrier, said carrier having a viscosity of from 35 to 200 Saybolt Universal at 100° F., filling said interior with said fog to form a protective film of said corrosion inhibitor on all the exposed surfaces of said interior, said composition of said corrosion inhibitor and said carrier being substantially non-volatile at the temperatures to which they are subjected while in said interior, and subsequently introducing water ballast into said interior.

3. The method of inhibiting corrosion in the interior of a tanker during the period in which the tanker contains water ballast, which comprises providing a water insoluble corrosion inhibitor having a viscosity enabling it to be atomized into a fog and which has a greater affinity than water has for metal, atomizing said corrosion inhibitor with a dispersing gas to form a fog, introducing said fog into the interior of said tanker while said interior is empty before addition of the water ballast, filling said interior with said fog to form a protective film of said corrosion inhibitor on all the exposed surfaces of said interior, said inhibitor being substantially non-volatile at the temperatures to which it is subjected while in said interior, and subsequently introducing water ballast into said interior.

4. The method of inhibiting corrosion in the interior of a tanker during the period in which the tanker contains water ballast, which comprises providing a liquid solution of a water insoluble corrosion inhibitor dissolved in a water insoluble liquid carrier, atomizing said solution with an inert dispersing gas to form a fog, introducing said fog into the interior of said tanker while said interior is empty and before addition of the water ballast, filling said interior with said fog to provide a protective film of said solution deposited on the metal surfaces of said interior, said solution being substantially non-volatile at the temperatures to which it is subjected while in said interior, and subsequently introducing water ballast into said interior.

5. The method of inhibiting corrosion in the interior of a tanker during the period in which the tanker contains water ballast, which comprises providing a solution of a water insoluble corrosion inhibitor having a boiling point of at least 400° F. dissolved in a water insoluble liquid carrier which has a boiling point of at least 350° F., atomizing said solution with steam to form a fog, introducing said fog into the interior of said tanker while said interior is empty and before addition of the water ballast, filling said interior with said fog to provide a protective film of said solution deposited on the metal surfaces of said interior, said solution being substantially non-volatile at the temperatures of said atomizing steam in said interior, and subsequently introducing water ballast into said interior.

6. The method of inhibiting corrosion in the interior of a tanker during the period in which the tanker contains water ballast, which comprises providing a solution of a water insoluble corrosion inhibitor present in an amount up to 50% by weight and dissolved in a water insoluble liquid carrier having a viscosity of between 35 to 200 Saybolt Universal at 100° F., atomizing said solution with a dispersing gas to form a fog, introducing said fog into the interior of said tanker while said interior is empty and before addition of the water ballast, filling said interior with said fog to provide a protective film of said solution deposited on the metal surfaces of said interior, said solution being substantially non-volatile at the temperatures to which it is subjected while in said interior, and subsequently introducing water ballast into said interior.

7. The method of inhibiting corrosion in the interior

of a tanker during the period in which the tanker contains water ballast, which comprises providing a solution of a water insoluble soap dissolved in a mineral oil, atomizing said solution with an inert dispersing gas to form a fog, introducing said fog into the interior of said tanker while said interior is empty and before addition of the water ballast, filling said interior with said fog to provide a protective film of said solution deposited on the metal surfaces of said interior, said solution being substantially non-volatile at the temperatures to which it is subjected while in said interior, and subsequently introducing water ballast into said interior.

8. The method of inhibiting corrosion in the interior of an oil tanker ship or the like during the period in which the tanker contains sea water ballast, which comprises providing a solution of a water insoluble soap corrosion inhibitor present in an amount up to 50% by weight and dissolved in a water insoluble mineral oil, said solution having a viscosity of between 100 and 200 Saybolt Universal at 100° F., and being substantially non-volatile at 212° F.; atomizing said solution with steam to form a fog; introducing said fog into the interior of said tanker while said interior is empty and before addition of the water ballast, filling said interior with said fog to provide a protective film of said solution deposited on the metal surfaces of said interior, and subsequently introducing water ballast into said interior.

9. The method of inhibiting corrosion in an interior compartment of a ship during the period in which the ship contains water ballast, the ship having an opening in said compartment and a source of steam supply on said ship, which comprises providing a water insoluble liquid composition that has the property of inhibiting corrosion of metal, utilizing said steam to atomize said composition and create a fog, before the addition of the

water ballast, introducing said fog from the outside of said compartment through said opening into said compartment until the interior of said compartment is filled with said fog to provide a thin protective film of said composition deposited on the metal surfaces in said compartment, said composition being substantially non-volatile at the temperature of said atomizing steam, and subsequently introducing water ballast into said compartment.

10. The method of protecting the interior metal compartment of a tanker ship after an oil cargo has been discharged from said compartment and which compartment is adapted to carry water ballast on a return trip, which comprises inhibiting corrosion of the metal in said compartment which would otherwise be caused by said water ballast by forming a fog of a solution of a water insoluble corrosion inhibitor dissolved in a water insoluble carrier, directing the fog into the interior of said compartment before said water ballast is added to the compartment, filling said compartment with said fog to form a protective film of said corrosion inhibitor on the all exposed interior surfaces of said compartment, said corrosion inhibitor and said carrier being substantially non-volatile at the temperatures to which they are subjected while in said compartment, and then introducing water ballast into said compartment.

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