United States Patent Office

2,836,499

Patented May 27, 1958

2,836,499

CORROSION INHIBITING METHOD AND COMPOSITION

John F. Lyons, Rolling Hills, Calif., assignor to The Texas Company, New York, N. Y., a corporation of Delaware

No Drawing. Application May 28, 1954
Serial No. 433,257

2 Claims. (Cl. 106—14)

The present invention relates to a novel corrosion inhibiting composition for coating metal bodies to prevent corrosion, and to a novel method for protecting such metal bodies from corrosion. It is particularly concerned with such a composition and method for preventing the rusting of steel and other ferrous metal bodies.

It is well known that metal bodies, particularly those of ferrous metal, tend to corrode after various fabricating operations have been performed upon them. To reduce corrosion it has been customary to coat such metal bodies with an oily composition between mill operations. An especially difficult problem has been presented when steel bodies are heated to a high temperature and then quenched in a molten salt bath. When ordinary coating oils are applied to such a steel body after removal from the salt bath, it is found that those sections of the body incrusted with salt still tend to rust excessively because the salt is deliquescent and absorbs moisture from the atmosphere, thus setting up a localized rusting condition which is not alleviated by ordinary oils.

In an effort to solve the problem described above, salt-quenched steel bodies were coated with a petrolatum base compound composed essentially of petrolatum, lubricating oil, a light petroleum solvent, and rust inhibiting ingredients. When this compound was mixed with an equal volume of kerosene and applied to salt quenched steel bodies it was found that oxidation was prevented on those metal surfaces which were free from salt, but that severe corrosion still occurred on those areas which were incrusted with deliquescent salt, probably because absorbed moisture could not be displaced.

In accordance with the present invention a novel corrosion inhibiting composition is provided which overcomes the disadvantages discussed above. In its broadest aspects the novel composition is composed predominantly of a soluble oil (say 60–72% by weight), petrolatum (say 27–39% by weight), and at least one rust inhibiting compound (say up to 3% by weight). The soluble oil is believed to act by displacing moisture from the salt incrusted areas, by forming an emulsion with the moisture thereby making the affected areas wettable with the petrolatum composition, or by a combination of both actions. In any event, corrosion is effectively prevented in such areas by coating them with my novel corrosion inhibiting composition.

The described composition can be applied to metal surfaces in any suitable way, as by brushing, spraying, or dipping.

A soluble oil is an oil solution that disperses readily when added to water; it is a clear oil solution that is self-emulsifying when combined with water. Soluble oils are prepared by making a solution of the oil and various soaps and emulsifying agents producing clear solutions. When water is mixed with the soluble oil a milky emulsion is readily formed.

The preferred soluble oils are prepared from distillate mineral lubricating oils, particularly naphthenic oils and oils of low or medium viscosity. The lubricating oil

may be compounded with various oil-soluble alkali metal soaps such as rosin soap, or emulsifying materials such as sulfonates, particularly mahogany sulfonates, naphthenates and resinates. Various substances may be included in the soluble oil mixture, such as mutual solvents of the oil and water, emulsifying agents, and viscosity reducing solvents. Higher boiling alcohols improve the emulsifying properites. The soluble oil sloutions are homogeneous or clear solutions and when they are added to water readily form highly stable emulsions.

By way of example, a soluble oil was prepared from the following materials; ranges of composition being specified for the more important ingredients:

	Example, weight percent	Advantageous Range, weight percent
Sodium sulfonate oil mixture	16.0	14–18
Gum rosin	4.2	3–5
Naphthenic acid	7.1	6–8
Sodium hydroxide (49%)	2.0	1–3
Ethylene glycol monobutyl ether	1.0	
Water	0.9	
Lubricating oil, 70 S. U. S.	68.8	60–75

The lubricating oil used in the preparation of this soluble oil was a naphthenic base lubricating oil having a viscosity of 70–75 seconds at 100° F. Saybolt Universal (70–75 S. U. S. at 100° F.), a gravity of 22–25° API, and a flash point, COC, of 290° F. minimum.

The sodium sulfonate oil mixture was obtained by treating mineral lubricating oil with sulfuric acid and caustic soda and extracting the sodium sulfonates (a form of mahogany sulfonate). The extracted sulfonates were fluxed with lubricating oil to form the sodium sulfonate oil mixture.

The rosin was dissolved in some of the lubricating oil and sodium sulfonate oil mixture under the application of heat. The naphthenic acid and the caustic solution were added and saponification effected to form sodium naphthenate and rosin soap, after which the water, the ethylene glycol monobutyl ether and the rest of the sodium sulfonate oil mixture and lubricating oil were added.

The petrolatum and one or more corrosion inhibitors can be incorporated with the above-described soluble oil in any suitable way. A petrolatum base compound containing corrosion inhibitors advantageously is made up separately, and then this compound is later combined with the soluble oil.

In one example of how to make up a petrolatum base compound the ingredients listed below are mixed together in the specified proportions while heating mildly as at 100° F., for fluidity. Ranges are specified on the more important ingredients.

	Example, Weight Percent	Advantageous Range, Weight Percent
Stoddard solvent	22.2	15–30
Petrolatum	47.9	40–56
Lubricating oil	23.7	20–30
Refined wool grease	3.7	
Rust inhibitor	1.98	up to 4
aluminum stearate	(0.58)	
butyl stearate	(1.0)	
sodium chromate decahydrate	(0.4)	
Water	0.5	
Sodium soap of wool grease	0.02	

The Stoddard solvent is an example of a type of light volatile petroleum solvent that can be employed to prepare a petrolatum base compound of the desired con-

sistency, others being light and heavy kerosenes or naphthas. A suitable Stoddard solvent is one having a gravity of 46–50° API, 50% of which distills below 350° F. and 90% of which distills below 375° F.

A suitable petrolatum for the composition of the invention is one having a melting point of 115–157° F., a penetration at 77° F. of 60–150, a Saybolt Universal viscosity at 210° F. of 95–105 seconds, and a flash point, COC, of 480° F. minimum.

The lubricating mineral oil used in the petrolatum base compound may be a naphthene base distillate lubricating oil such as one having a Saybolt Universal viscosity at 100° F. of 200–216 seconds, a gravity of 20–23° API, and a flash point, COC, of 330° F. minimum. Another suitable lubricating oil is a steam-refined cylinder stock having a Saybolt Universal viscosity at 210° F. of 155–163 seconds, a flash point, COC, of 525° F. minimum, and a gravity of 21–24° API. I prefer to use a mixture of these two types of lubricating oil in such proportions by volume that the petrolatum base compound contains about 8.1% by weight of the former as a softening agent for the petrolatum, and about 15.6% by weight of the latter to soften the petrolatum and provide a smooth blend. Ranges of 5–10% and 10–20%, respectively, are suitable.

In the petrolatum base compound described above, the principal rust inhibitors are the aluminum stearate, butyl stearate, and sodium chromate decahydrate. These should be present in such quantity as to provide in the final composition a corrosion-inhibiting amount up to 3% by weight.

While one petrolatum base compound has been described in detail above, it is evident that all of the minor constituents described need not necessarily be present to provide the important fundamental advantages of the present invention. It also should be aparent that additional ingredients may be included without substantially altering the corrosion inhibiting properties of the composition. For example, among the specified ingredients which may be omitted without sacrificing important properties are the refined wool grease, water, and sodium soap of wool grease. Also, the three primary corrosion inhibitors may be replaced by one or two of the same group, or entirely different corrosion inhibitors may be included in the composition.

After separately preparing the soluble oil and the petrolatum base compound by the procedures described in detail above, the two are combined and mixed to produce the novel composition of the present invention. I have found that superior results are obtained by combining the components in the proportions of one gallon (7.8 lbs.) of soluble oil to 1.1 gallons (8 lbs.) of petrolatum base compound.

After thorough mixing in a suitable container, the resulting mixture is diluted with a light volatile petroleum solvent such as kerosene or Stoddard solvent in an amount equal to the volume of the mixture before dilution. Thus 2.1 gallons (14.3 lbs.) of kerosene can be combined with the mixture described above to produce a final composition which is applied to salt quenched steel bodies for preventing their corrosion after removal from the salt quenching bath.

A wide range of proportions of the three components may be employed with satisfactory results, e. g., 5–10 pounds each of soluble oil and petrolatum base compound, and 10–20 pounds of solvent.

A suitable Stoddard solvent has been described in detail above. A suitable kerosene is one having a gravity of 41–45° API, 10% of which distills below 347° F. and 95% of which distills below 465° F.

The ingredients of the composition of the invention have been described in detail above as employed in formulating the individual soluble oil and petrolatum base compounds. For a more complete teaching of the present invention there is set forth below the proportions by weight of the added ingredients based on the final diluted rust inhibiting composition, advantageous ranges being specified for the more important ingredients:

	Example, Weight, Percent	Advantageous, Range, Weight, Percent
Light Petroleum Solvent	53.3	44–58
Kerosene	(47.4)	
Stoddard Solvent	(5.9)	
Petrolatum	12.7	10–15
Lubricating Oil	27.2	20–30
70 S. U. S.	(20.8)	
Cylinder Stock	(4.2)	
200 S. U. S.	(2.2)	
Naphthenic Acid	1.9	1–3
Gum Rosin	1.1	.6–1.6
Refined Wool Grease	1.0	
Water	.7	
Sodium Sulfonate	.6	.4–.8
Ethylene Glycol Monobutyl Ether	.3	
Sodium Hydroxide (49%)	.3	.2–.4
Rust Inhibitor	.6	.35–.75
Aluminum Stearate	(.2)	
Butyl Stearate	(.3)	
Sodium Chromate Decahydrate	(.1)	
Sodium Soap of Wool Grease	.01	
Balance of incidental ingredients and impurities.		

Any amount of the rust inhibitor is helpful, a corrosion inhibiting amount up to 1.5% usually being completely satisfactory (up to about 3% based on the composition without solvent).

In an example of how the corrosion inhibiting composition of the invention was employed, a composition was made up as described above and field tested for several months by coating salt-quenched steel articles. Excellent results have been obtained in preventing corrosion, based on visual observation. Furthemore, it has been found that the novel corrosion preventive coating is easily cleaned from the metal parts in a degreaser preparatory to sending the parts through other steps in the manufacturing process.

Obviously, many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. A rust inhibiting coating composition characterized by the ability to prevent rusting of areas on salt quenched steel articles which are encrusted with residual salt, said composition consisting essentially of 44–58% by weight of light volatile petroleum solvent, the balance being a mixture of a rust inhibiting compound, petrolatum and soluble oil, said mixture consisting essentially of a corrosion inhibiting amount up to 3% by weight of at least one rust inhibiting compound selected from the group consisting of butyl stearate, aluminum stearate and sodium chromate decahydrate, 27–39% by weight of petrolatum and 60–72% by weight of a soluble oil, said soluble oil having as essential components 60–75% by weight of lubricating oil, 14–18% by weight of sodium sulfonate derived from treating mineral lubricating oil with sulfuric acid and caustic soda, rosin soap derived from treating with caustic soda 3–5% by weight of gum rosin based on said soluble oil, sodium naphthenate derived from treating with caustic soda 6–8% by weight of naphthenic acid based on said soluble oil and an effective amount up to about 1% by weight of ethylene glycol monobutyl ether.

2. A method of protecting from rusting an area on a salt quenched steel article which is encrusted with residual salt, said method comprising applying to said area a rust inhibiting coating of a composition consisting essentially of 44–58% by weight of a light volatile petroleum solvent, the balance being a mixture of a rust inhibiting compound, petrolatum and soluble oil, said mixture consisting essentially of a corrosion inhibiting

amount up to 3% by weight of at least one rust inhibiting compound selected from the group consisting of butyl stearate, aluminum stearate and sodium chromate decahydrate, 27–39% by weight of petrolatum, and 60–72% by weight of soluble oil, said soluble oil having as essential components 60–75% by weight of lubricating oil, 14–18% by weight of sodium sulfonate derived from treating mineral lubricating oil with sulfuric acid and caustic soda, rosin soap derived from treating with caustic soda 3–5% by weight of gum rosin based on said soluble oil, sodium naphthenate derived from treating with caustic soda 6–8% by weight of naphthenic acid based on said

soluble oil and an effective amount up to about 1% by weight of ethylene glycol monobutyl ether.

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