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RUST PREVENTIVE COMPOUND

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

My invention relates to a composition of materials for preventing corrosion and particularly to such compositions for use in internal combustion engines.

The basic requirements for any rust preventive composition are:

1. The materials used must be non-corrosive themselves.
2. They must "wet" the metal to a greater degree than water "wets" the metal.
3. The composition must be chemically stable.
4. The composition must provide a film of proper thickness to insure the desired protection.

In addition to the usual requirements for preventing rusting or corrosion, there are the further problems in connection with internal combustion engines, of neutralizing the free acids formed as a product of the combustion of fuels particularly those containing sulphur and from the decomposition of lubricants due to cracking under conditions of high temperature, high temperatures and pressures, or chemical change such as oxidation. The free acids resulting from the above causes may be for example nitric acid, carbonic acid, sulphuric acid and complex organic acids some of which may be originally present in the lubricating oil or caused by oxidation thereof. These acids remain in the film of lubricating oil covering the engine parts even after the oil supply is drained and in order to prevent corrosion must be neutralized by the rust preventative compound if the latter is to be wholly effective. The rust preventative compound further must have the properties, of being completely miscible with the lubricating oil film contained in the engine in order to neutralize any free acids and penetrate to the base metal, of having suitable consistency for spray application, and of being removable with a readily available solvent.

I am aware that there are many rust preventive compounds on the market which have the basic requirements listed above, but the provision of a rust preventive compound having the additional requirements for a rust preventive compound for use with internal combustion engine presents a greatly aggravated problem. Heretofore, the compounds used for spray application have generally been of two classes; those employing an oil vehicle and those comprising a solute and a solvent.

In the first class, compounds using mineral oil or lard oil as the vehicle have been used. The compounds using mineral oil are unsatis-

factory because of lack of solubility therein of certain other valuable ingredients such as the neutralizing agents and soaps or emulsifying agents. The lard oil is unsatisfactory because of its low viscosity. When using a compound having a vehicle of too low viscosity, the film which is produced is not of satisfactory thickness to render it impervious to the action of the air and the elements. Likewise, since the film vehicle is of low viscosity, the tendency of it to flow makes it undesirable for vertical surfaces. One compound of this type, with which I am familiar, employed lard oil as the vehicle, triethanolamine as a neutralizing agent and had aluminum stearate added as a bodier to compensate for the low viscosity. Butyl alcohol was used as a thinner to provide the desired viscosity for spraying. This compound, while having satisfactory rust prevention characteristics, was unsatisfactory because of its lack of stability as a liquid. The aluminum stearate, which was added as a jellying or bodying agent, had to be added in such quantities, or was not sufficiently stable itself, that the homogeneity of the liquid could not be preserved during storage of the compound or at lower atmospheric temperatures, due to precipitation of the aluminum stearate.

In the second class, compounds have also been developed using a solute, such as a petrolatum derivative, in a suitable thinner. While these compounds leave a satisfactory film for protection of the metal, they were unsatisfactory because of their lack of stability as a liquid over the range of atmospheric temperatures that is encountered in engine storage facilities. In other words, in the lower temperature range, the solute will precipitate making it impossible to be sprayed. For uses where it is not desired to apply the compound by spraying, satisfactory compounds have been prepared in the paste, or semisolid, forms; but these compounds have either not been capable of reduction with a suitable thinner or, like the solutions mentioned above, would not provide a stable liquid over the range of operating atmospheric temperatures, when reduced with a thinner.

In the usual cases of application of a rust preventive compound, it is feasible to apply the compound by brushing, smearing or dipping. Where it is possible to apply by smearing, it is obvious that the material may have the consistency of paste which will of course provide a film of satisfactory thickness for affording the protection desired. However, it is not possible to apply the rust preventive compound to the interior of an internal combustion engine by any of the above methods without disassembling the engine. The preferred method of applying the rust preventive to the interior of an engine

is by spray application through a spark plug, or other opening. Therefore, it becomes necessary for this purpose to provide a rust preventive compound having the usual characteristics required of a rust preventive compound, and in addition, being in the form of a liquid having a suitable viscosity for spray application and yet having a sufficient body that the residual film that is left upon evaporation of the solvent will be of the proper thickness to provide the desired protection. In other words, the film must have non-flowing characteristics and be thick enough to exclude atmospheric elements from the metal surface.

It is, therefore, an object of my invention to provide a rust preventive compound that is miscible with lubricating oil, having a vehicle of sufficient body that it will provide a residual film of proper thickness, having a suitable neutralizing agent, and being capable of reduction with a suitable thinner for spray application.

It is another object of my invention to provide such a compound that is chemically and physically stable over the range of operating temperatures, both in its original form and when reduced with the thinner or diluent.

It is a further object of my invention to provide a rust preventive compound of the above described nature which when reduced with a suitable thinner, will be a fluid having a suitable viscosity for spraying over a range of atmospheric temperature at least as low as 30° F.

It is still another object of my invention to provide an ingredient for such rust preventive compound which has the property of increasing the "polarity" or adhesion of the material to the metal.

It is a still further object of my invention to provide an ingredient for such a rust preventive compound which will give shape to, or stiffen, the residual film left upon evaporation of the thinner when the material is applied by spray application.

It is still another object of my invention to provide a neutralizing agent for such rust preventive compound which will be equally effective in the presence of films of water or oil on the metal which is to be protected.

It is possible to combine one or more of the above objects by the use of certain materials, and it is therefore an object of my invention to provide a rust preventive compound having a maximum of the above properties with a minimum of ingredients. It is also an object of my invention to accomplish the above objectives by the use of ingredients which are commercially available and economical.

Other objects and advantages of my novel compositions will appear from the following description.

Having thus described the objectives of my invention, I will now describe a number of materials having the special characteristics desired and a number of formulae which I have found are effective to accomplish the above results.

While each of the above requirements presents a considerable problem, the first limiting consideration is the selection of a vehicle which will be miscible with mineral oil, have sufficient body to provide a residual, or final, film of sufficient thickness, be capable of reduction by a diluent, or thinner, to a viscosity for spray application and still be chemically stable and remain in fluid condition over a range of atmospheric temperatures to as low as 20° F. and be

readily removable by a solvent. I have found that soluble castor oil; that is, castor oil which has been treated to render it miscible with mineral oil, will meet this requirement to a considerable extent. Castor oil may be rendered miscible with mineral oil by well-known treatments such as suitable heat treatment, oxidation or other methods well known to the art.

In place of castor oil, a fatty oil vehicle miscible with mineral oil and of sufficient viscosity may be provided by the use of sperm oil, rapeseed oil or similar oils treated electrically and called voltolized oils. These and other nondrying fatty oils may also be treated as indicated above for castor oil.

However, it is desirable, for most purposes, to provide more body than is afforded by the treated oils themselves. This I have novelly done in one embodiment of my invention by employing the thickening action of the neutralizing agent.

The increase in acidity which usually occurs when a fatty oil is treated to increase viscosity is an advantage. The acids formed are neutralized by the subsequent addition of the neutralizing agent, and the soaps then formed are valuable emulsifying and neutralizing agents for any acids present in condensed moisture.

My invention contemplates the use of any organic base that is soluble in the vehicle used, and nonvolatile at atmospheric temperatures, for the neutralizing agent. Preferably, I use one of the amine compounds having suitable properties. I have found triethanolamine, triamylamine and di-ethyl phenol amine to be satisfactory amines for this purpose. A further consideration in the choice of neutralizing agent is its solubility in relation to oil and water films on the metals upon which the rust preventive compound is to be applied, which is specifically discussed herein with reference to the individual amines used. The strength of the organic base used, and the percentage, must not be excessive as otherwise the neutralizing agent itself will produce corrosion of the metals to which the compound is applied. The amount of neutralizing agent in the compound should be preferably greater than that required to neutralize the acidity of the ingredients of the compound, but should not be in excess of 10% of the non-volatile content of the compound when used for the prevention of corrosion in internal combustion engines, due to the low corrosion resistance of the lead alloys and copper alloys used in the bearings. It is to be understood that the percentage of neutralizing agent may vary with the degree of acidity which is expected to be encountered, and that for corrosion prevention work where no artificial acidity is likely to occur, the neutralizing agent may be omitted except to the extent necessary to neutralize the acidity of the compound.

In the embodiment of my invention using soluble castor oil as the vehicle, not only do the amines I use provide a neutralizing agent having satisfactory characteristics, but they also have the property of increasing the viscosity of, or thickening, the soluble castor oil thereby providing a vehicle with the necessary body.

Any thinner for soluble castor oil may be used to provide the desired viscosity for spray application providing the thinner does not itself introduce any qualities that are incompatible with those outlined for the rust preventive compound. I have found that butyl alcohol, toluene, xylene,

kerosene and similar petroleum distillates are quite satisfactory with perhaps the best results for a castor oil vehicle being obtained with butyl alcohol. An advantage in the use of petroleum distillate, or other good solvents for mineral oil, for the thinner is that when the composition is applied to a surface having a mineral oil film, miscibility therewith is facilitated.

A preferred formula of the material as thus compounded should have the general composition:

Castor oil treated to be soluble in mineral oil and to provide the desired viscosity.

Triethanolamine—preferably 2 to 3% by weight in excess of that required to neutralize the acidity of the castor oil, but may be present in a range from 0 to 10% in excess of that required to neutralize the acidity of the oil.

Butyl alcohol—sufficient to provide a satisfactory viscosity for spraying (preferably between 4 and 6 poisses—approximately 200 to 300 Saybolt Furoil viscosity at 77° F.). It will usually be found that not over 10% butyl alcohol will be required for this purpose.

It will be understood that the above formula is representative of a general formula for my invention in which any suitable vehicle or body portion having the above specified properties, whether it is compounded of one or more ingredients, can be used in place of the treated castor oil. Likewise, any organic base, which is not itself corrosive of metals encountered in internal combustion engines such as the iron and steel of the cylinder walls, aluminum of the pistons and lead and copper of the bearings, and which is soluble in the vehicle, may be used in place of the triethanolamine. In specific variations, triamylamine, di-ethyl phenol amine or any other satisfactory amine may be used as the neutralizing agent, and kerosene or any other thinner for soluble castor oil may be used.

It will also be understood that my invention with respect to any of the formulae contemplates the compounding of the ingredients with or without the thinner. That is, the materials may be prepared in paste or solid consistency and then be reduced with the thinner at the time of use, or the thinner may be added at the time of preparation of the compounds. Certain advantages of preparing the compound without the thinner will be obvious, such as greater economy in shipment, and greater safety in storage.

Another formula similar to the general formula given above but which has certain specific materials added and used for certain specific advantages is as follows:

	With thinner	Without thinner
Soluble castor oil (30-70)*	45	71.4
Lard oil (30-70)*	7.5	11.9
Petroleum asphalt	7.5	11.9
Petrolatum (H. M. P.)	3	4.8
"Hyamine A" (di-ethyl phenol amine)	37	
Toluene	100	100

*Of the vehicle portion.

In the above formula, it will be understood that the percentage composition given is illustrative of the preferred percentages in the formula, but that it may be varied within a range where each of the ingredients will be effective for the purpose for which each is used without detracting from the effectiveness of the other in-

gredients. In the above formula, the lard oil and soluble castor oil constitute the vehicle, the petroleum asphalt and petrolatum are agents added to the vehicle to increase the viscosity or body, and for certain special properties. The "Hyamine A" is the neutralizing agent and the toluene is the thinner or diluent.

An advantage of the combination of lard oil with the soluble castor oil is that castor oil is subject to "gumming" on long exposure to the air in thin films. Lard oil prevents this gumming. The relative percentages of lard oil and castor oil comprising the fatty oil or vehicle portions may vary from 30 to 70% lard oil and 30 to 70% castor oil. The vehicle may vary over a percentage range, for example, from 50 to 85%, depending on the percentage composition of the other ingredients, so long as there is sufficient fatty oil, together with the other nonvolatile constituents, to form a film of good thickness for affording the desired protection. The thickness of this film may vary, depending upon the characteristics of the material; namely, hardness, elasticity, and nonpermeability to air and water. It will also be understood that any equivalent nondrying fatty oil may be used for the vehicle.

The petrolatum (H. M. P. stands for high melting point) which is used to provide body or additional viscosity of the residual film is particularly effective for this purpose in that it has the viscosity characteristics of a solid, thereby stiffening the residual film. Its percentage in the thinned composition may vary over a range from 0 to 20%. In excess of this amount, it is difficult to prevent precipitation or wax formation at low temperatures.

Not only does the petroleum asphalt serve to increase the viscosity, or body, of the residual film, but it also increases the "polarity," or the quality of adhesion of the compound to the metal. This property is also associated with the wetting action of the material, thereby improving this basic requirement for a rust preventive compound. It also lowers the pour point of the mixture due to its action of inhibiting wax crystallization of the petrolatum. It is preferred that any mixture should pour at below 25° F. The percentage of asphalt in the above formula may vary over a range from 0 to 30%. The only limitation on the maximum amount of asphalt and/or petrolatum, or other equivalent materials such as waxes, resins, gums, and asphaltic resins used for increasing the viscosity or body of the residual film after evaporation of the thinner, or the viscosity of the paste when prepared or used without thinner, is that the percentage should not be so high that the final film will be hard, unyielding and not easily removable by washing with solvents.

The "Hyamine A" serves in the capacity of a neutralizing agent, but it has the advantage over triethanolamine in that it is appreciably soluble in either oil or water, but not completely soluble in either one. Triethanolamine is only slightly soluble in mineral oil and completely soluble in water. Therefore, it is possible that when a rust preventive compound containing triethanolamine is used in contact with a watery film containing the free acids resulting from combustion products, the watery film might extract the triethanolamine from the compound leaving none available for neutralizing the acids in the oil films. Such possibility will be avoided by the use of "Hyamine A" as the neutralizing agent. However, it is to be understood that any neutral-

izing agent having the characteristics described in the general considerations for a neutralizing agent may be used, and in the limitations of amount there given.

The thinner used may be any solvent for the mixture. In general one of the aromatic hydrocarbons will be satisfactory, with toluene being preferred. In the event that the compound is to be prepared without the thinner, it will be necessary to effect mutual solution of the ingredients at a temperature of about 350° F. When compounding the formula with the thinner, in the first instance, it will be found convenient to first dissolve the asphalts, gums, resins or waxes in the thinner and then mix with the vehicle.

Another formula which I have used effectively for providing a satisfactory rust preventive compound is the use of raw castor oil and the addition of a high viscosity mutual solvent for castor oil and mineral oil, such as diglycol oleate, dibutyl phthalate or glycerol oleate. The high viscosity mutual solvent serves both to render the raw castor oil miscible with mineral oil and to increase the viscosity, or body, of the vehicle sufficiently that the final film will be of the proper thickness for the desired protection. With this formula, I use for rust prevention of internal combustion engines, a neutralizing agent in a similar manner to that described in connection with the previous formulae, and likewise, a suitable thinner for spray application. The castor oil may range from 20 to 80% of the vehicle portion, and the mutual solvent may comprise the remainder. If desired, still other ingredients, such as asphalt and/or petrolatum may be added to impart special characteristics to the compound. In this case, the percentages of the castor oil and mutual solvent will be reduced to allow for the amount of the other ingredient or ingredients added.

As frequently stipulated throughout this specification, it is to be understood that my invention is not to be limited to the specific formulae or materials described, but is to be considered as including all equivalent materials and combinations which shall be included within the scope of the claims appended hereto. Likewise, it is not my intention to limit my invention to any particular application or the manner of application.

I claim:

1. An anti-corrosion coating composition for metals such as internal combustion engine parts and the like, and adapted to be applied in the presence of any mineral oil adhering to the surface of the metal to be protected, and containing free acids resulting from the combustion of fuel or decomposition of lubricants; comprising a vehicle of castor oil so treated by heat as to render it miscible with mineral oil, and triethanolamine in an amount slightly in excess of the amount required to neutralize the acidity of the castor oil, the excess amount of triethanolamine being sufficient to neutralize free acids in the mineral oil adhering to the metal to be protected, said excess amount of triethanolamine being not more than 10% by weight of the composition and said composition being such that—when reduced with a thinner to a viscosity suitable for spraying—the resultant liquid will remain fluid at temperatures as low as 20° F.

2. A composition for the prevention of corrosion of metals such as internal combustion engine parts and the like, and adapted to be applied in the presence of any mineral oil adhering

to the surface of the metal to be protected, and containing free acids resulting from the combustion of fuel or decomposition of lubricants; consisting of a non-drying fatty oil vehicle so treated by heat as to render it miscible with mineral oil and a neutralizing agent for neutralizing the said acids present on the surface to be protected, said neutralizing agent being non-corrosive to the metals to which it is to be applied, and being present in small amounts in excess of the amount required to neutralize the acidity of the other vehicle ingredients, the excess amounts of the said neutralizing agent being not more than 10% by weight of the composition and the said composition being such that—when reduced with a thinner to a viscosity suitable for spraying—the resultant liquid will remain fluid at temperatures as low as 20° F., said composition having a sufficient body, or viscosity, to provide a film of satisfactory thickness for the protection of the metal surface to which it is applied.

3. The composition for the prevention of corrosion of metals, as described in claim 2, in which petroleum asphalt is dissolved in the fatty oil vehicle and is effective for increasing the viscosity of said vehicle and for increasing the adhesion of said film to the metal surface.

4. The composition for the prevention of corrosion of metals, as described in claim 2, in which the neutralizing agent is an amine, substantially non-volatile at ordinary temperatures.

5. A composition for the prevention of corrosion of metals such as internal combustion engine parts and the like and adapted to be applied in the presence of any mineral oil adhering to the surface of the metal to be protected, and containing free acids resulting from the combustion of fuel or decomposition of lubricants; consisting of castor oil heat treated to render it miscible with mineral oil, lard oil, petroleum asphalt, petrolatum, and a neutralizing agent soluble in said oils and non-corrosive to the metals to which it is to be applied and being present in small amounts in excess of the amount required to neutralize the acidity of the other ingredients, the excess amount of the neutralizing agent being sufficient to neutralize free acids present in the mineral oil adhering to the metal to be protected, the excess amounts of the neutralizing agent being not more than 10% by weight of the composition and the said composition being such that—when reduced with a thinner to a viscosity suitable for spraying—the resultant liquid will remain fluid at temperatures as low as 20° F.

6. The composition as described in claim 5, in which the neutralizing agent is one of the group consisting of triethanolamine, triethylamine, and diethyl phenol amine.

7. The composition for preventing corrosion of metals as defined in claim 5, in which the treated castor oil and lard oil constitute 50% to 85% of the whole, the petroleum asphalt being present in a range not exceeding 30% and the petroleum being present in a range not exceeding 20%.

8. A composition for preventing the corrosion of metals such as internal combustion engine parts and the like and adapted to be applied in the presence of any mineral oil adhering to the surface of the metal to be protected, and containing free acids resulting from the combustion of fuel or the decomposition of lubricants; comprising raw castor oil, a mutual solvent for castor oil and mineral oil, and a neutraliz-

ing agent soluble in said mixture and non-corrosive to the metals to which it is to be applied and being present in small amounts in excess of the amount required to neutralize the acidity of the other ingredients, the excess amount of the neutralizing agent being sufficient to neutralize free acids present in mineral oil adhering to the metal to be protected, said excess amount of the neutralizing agent being not more than 10% by weight of the composition and said composition being such that—when reduced with a thinner to a viscosity suitable for spraying—the resultant liquid will remain fluid at temperatures as low as 20° F.

9. The composition for the prevention of corrosion of metals, such as described in claim 8, in which the mutual solvent comprises one of the group consisting of diglycol oleate, dibutyl phthalate, and glyceryl oleate.

10. The composition for the prevention of corrosion of metals, such as described in claim 8, in which the mutual solvent comprises a mixture of the group consisting of diglycol oleate, dibutyl phthalate, and glyceryl oleate.

11. A composition for the prevention of corrosion of metals such as internal combustion engine parts and the like and adapted to be ap-

plied in the presence of any mineral oil adhering to the surface of the metal to be protected, and containing free acids resulting from the combustion of fuel or the decomposition of lubricants; comprising as the base portion a volatilized non-drying fatty oil which is miscible with mineral oil and a neutralizing agent soluble in said fatty oil and non-corrosive to the metals to which it is to be applied, said neutralizing agent being present in small amounts in excess of the amount required to neutralize the acidity of the fatty oil, the excess amount of said neutralizing agent being sufficient to neutralize free acids present in mineral oil adhering to the surface of the parts to be protected, said excess amount of the neutralizing agent being not more than 10% by weight of the composition being such that—when reduced with a thinner to a viscosity suitable for spraying—the resultant liquid will remain fluid at temperatures as low as 20° F.

12. The composition for the prevention of corrosion of metals, as described in claim 11, in which the neutralizing agent is one of the group consisting of triethanolamine, triethylamine and diethyl phenol amine.

ERNEST R. IRWIN.