

2,716,611

RUST PREVENTIVE COMPOSITION

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The present invention relates to rust preventive compositions and particularly to rust inhibitors of the type adapted to leave an adherent film on the surface to be protected.

In the prior art numerous compositions have been proposed for the purpose of preventing the rusting of ferrous metals. The rusting of steel and iron machinery and other structures is an extremely serious problem involving the deterioration of many millions of dollars worth of property annually. A substantial number of rust preventive compositions have been prepared with a view to meeting the urgent demand for better protection against rust. This pertains particularly to uses in warm and humid climates, but applies generally in all climates. Among such prior art compositions are those prepared with a mineral oil base containing such additives as sorbitan mono-oleate and related esters as in the United States patent to Duncan No. 2,434,490, and those containing sulfonates and animal fats, waxes, etc., e. g., degreas as in the United States patent to Lebo No. 2,182,992.

In general the rust preventive compositions of the prior art may be divided into two general types. One of these is the adherent film type where a volatile solvent is evaporated, or partially evaporated, to leave a relatively dense coating deposited upon the surface to be protected. Another is the type where an oil based composition is applied to the surface to be protected by dipping, spraying, painting or slushing without particular regard to the formation of a relatively hard adherent film. The present invention relates particularly to the second of these types, although in many instances a relatively volatile solvent oil may advantageously be used.

The patent to Duncan, U. S. No. 2,434,490, mentioned above, describes the use of a long chain fatty ester of sorbitan, e. g. the mono-oleate, sold under the trade name "Span 80," as a rust inhibiting additive for lubricating oils. As a matter of fact a composition of mineral lubricating oil containing this partial ester in fairly large proportions, e. g. 5% or so, is a very satisfactory rust inhibitor for many purposes. It is somewhat expensive, however. Moreover, it does not possess sufficient rust preventive properties for some purposes. It has now been discovered that a combination of sorbitan mono-oleate or of one of the analogous long chain (C₁₂ to C₂₂) fatty acid partial esters of polyhydric alcohols may be used in synergistic combinations with microcrystalline wax in a suitable oil vehicle to make an extremely potent rust inhibiting composition of the deposited film type. Other partial esters than sorbitan mono-oleate may be used such as pentaerythritol mono-oleate, the di-oleates of sorbitan, mannitan, pentaerythritol and related polyhydric alcohols, and although somewhat less satisfactory, the corresponding partial stearic and palmitic acid esters of these alcohols.

The microcrystalline wax to be used should be distinguished from wax containing materials like petrolatum. Microcrystalline petroleum wax is a solid, ductile, wax-

2

like mixture of high molecular weight hydrocarbon composition, separated from that part of crude petroleum, commonly designated heavy lubricating and cylinder oil fractions, by solvent dilution and settling, or by solvent precipitation, or by solvent dilution and centrifuging, or by combinations of these methods. It is distinguished by its solid wax-like appearance at room temperature (77° F.), difficult deformation with considerable pressure, and high viscosity (60–90 seconds Saybolt Universal at 210° F.) when melted. Its melting point ranges from 140° F. to 190° F., its color from black to essentially colorless and its penetration is below 40 mm./10 at 77° F. ASTM. This material may be prepared by substantially removing the oil content of petrolatum, and therefore its oil content is below 10% as determined by the ASTM solvent-dilution method using secondary butyl acetate as the solvent.

In general the present invention contemplates the combination of proportions of 0.1 to 5% by weight, based on the total composition of C₁₂ to C₂₂ fatty acid partial esters of the aliphatic polyhydric alcohols having less than about 8 carbon atoms, particularly the hexitan and erythritol type, in combination with proportions of from about 1.0 to about 10%, preferably 2 to about 8%, of microcrystalline wax in a suitable mineral oil solvent.

While proportions of the partial ester employed may vary between 0.1 and 5% of the weight of the total composition, proportions of 0.2 to about 3% are specifically preferred. Amounts in the neighborhood of 0.5 to 1% are considered the most satisfactory. The optimum proportions of microcrystalline wax appears to be in the neighborhood of 5% but may be somewhat higher or lower.

The solvent hydrocarbon oil may be a straight lubricating oil of medium or light viscosity, for example from about 35 to 150 S. S. U. viscosity at 210° F. or a mixture of such a lubricating oil with a volatile solvent hydrocarbon such as a light naphtha. Naphtha may be used straight as the hydrocarbon solvent but it is preferred to use a major proportion of oil of lubricating grade for most purposes.

While the theory involved is not clearly understood outstanding results seem to be achieved by an optimum combination of microcrystalline wax with the partial ester. In general the partial esters are surface active or so-called "wetting" agents. They apparently have some affinity for water as well as being oil soluble. It seems likely that this property enables them to hold water out of contact with the metal surface to be protected. In combination with the film forming microcrystalline wax they afford protection against rust for periods much longer than either ingredient alone as is thoroughly shown by the following data.

Example I

A composition was prepared using a fairly light acid treated naphthenic lubricating oil of about 40 S. S. U. viscosity at 210° F., together with 1% by weight, based on the total composition, of sorbitan mono-oleate ("Span 80") and 5% of microcrystalline wax. The particular microcrystalline wax used had a melting point of 175° F., and a penetration, as indicated in the Standard ASTM grease penetrometer, of 14 mm./10. It had an oil content of 2.3%. The oil alone gave protection against rust to a sand-blasted steel panel in a standard humidity cabinet (A. N.-H-31 Humidity Cabinet Test) for only two hours. The base oil with 1% partial ester alone gave protection for twenty-four hours. The base oil with 5% by weight of microcrystalline wax alone gave protection for sixteen hours. These figures should be compared with the humidity cabinet life of 672 hours for the composition of Example I.

Example II

Another test was conducted on another occasion using the same base oil with 1% of the partial ester "Span 80" and no wax. In this test the rust resisting life was only seven hours. When 2.5% of microcrystalline wax was added to the oil containing 1% ester, the life increased to forty-eight hours in the humidity cabinet test. When the microcrystalline wax was further increased to 5% by weight of the total composition the humidity cabinet life increased very greatly to a total of 420 hours.

Example III

The same base oil as in the preceding examples was blended with only 0.5% by weight of the partial ester ("Span 80") and 5% of the same microcrystalline wax. In two standard humidity cabinet tests this oil gave test lives of 480 and 504 or an average of 492 hours.

Example IV

Examples II and III were repeated, using only 0.25% by weight of the sorbitan mono-oleate ester. This material was considerably less effective in preventing rust than that of the previous examples. It showed a humidity cabinet test life of 196 and 240 hours in two tests, averaging 218 hours. Apparently this approaches the lower limit of useful proportions of the ester.

As indicated above other surface active agents of the partial ester type, such as pentaerythritol mono-oleate, have a synergistic action with microcrystalline wax. This is further shown by the following data. The base oil containing 1% pentaerythritol without wax has a humidity cabinet life of only about 24 hours.

Example V

The same base oil as used above, i. e. a naphthenic oil, conventionally refined by distilling and acid treating, of 40 S. S. U. viscosity at 210° F., was blended with 1% by weight of pentaerythritol mono-oleate and 5% of the microcrystalline wax of Example II. In two separate tests this composition gave 744 hours life in the standard humidity cabinet.

Example VI

Example V was repeated, using petrolatum of 162° F. melting point, penetration value 48 mm./10, in proportions of 5% instead of microcrystalline wax. Since petrolatum contains some microcrystalline wax it was thought the two might be interchangeable. Results showed that this clearly is not so. This composition had a test life in the humidity cabinet of less than 20 hours.

Example VII

The base oil used in the previous examples was blended with 1% by weight of sorbitan mono-oleate and 5% of the same petrolatum as a check on Example VI. This composition was even worse as a rust inhibitor. It had a humidity cabinet test life of only four hours in each of two tests.

Example VIII

In an effort to determine whether the resins obtained from paraffinic oils by propane extraction might be substituted for microcrystalline wax the following composition was prepared. The same base oil as above was blended with 1% by weight of sorbitan mono-oleate and 5% by weight of a viscous petroleum resin available commercially (Pennzoil resin C-7730). Results were very unsatisfactory. The composition showed a humidity cabinet life of only four hours in each of two separate tests.

The above tests appear to indicate that at least the other materials tested, i. e. petrolatum and extracted petroleum resins, are far inferior to microcrystalline wax for purposes of the present invention. Since these are close to the latter in origin and general nature, the micro wax appears to have unique properties. This is true at least in synergism with the long chain fatty acid partial esters of polyhydric alcohols.

It will be understood that the proportions of the various ingredients may be varied within limits mentioned above and that other relatively inert additives may be used in the oils such as anti-oxidants, metal deactivators, and other usual types of additives. When volatile solvents are desired they may be substituted for all, but preferably for only part of the lubricating grade mineral oil. The other modifications and variations will suggest themselves to those skilled in the art.

What is claimed is:

1. A rust inhibiting composition consisting essentially of a major proportion of mineral base solvent oil, about 2 to 8% by weight based on the total composition of, microcrystalline wax of melting point between 140° and 190° F. and penetration below 40 mm./10 at 77° F., ASTM, as a primary film forming agent, and 0.2 to 3% of a long chain fatty acid partial ester of polyhydric alcohol as a surface active and synergistic rust inhibiting agent, said fatty acid portion of the partial ester containing from about 12 to 22 carbon atoms and said polyhydric alcohol portion is selected from the group consisting of sorbitan, mannitan and pentaerythritol.

2. Composition according to claim 1 wherein said solvent oil is primarily a mineral base lubricating oil.

3. Composition according to claim 1 wherein said solvent oil comprises a volatile naphtha.

4. Composition according to claim 1 wherein the partial ester is sorbitan mono-oleate.

5. Composition according to claim 1 wherein the partial ester is pentaerythritol mono-oleate.

References Cited in the file of this patent**UNITED STATES PATENTS**

2,359,946	Sudholz et al. -----	Oct. 10, 1944
2,535,604	Schiermeier et al. -----	Dec. 26, 1950
2,564,422	Barnum -----	Aug. 14, 1951
2,564,423	Barnum -----	Aug. 14, 1951
2,580,036	Matuszak et al. -----	Dec. 25, 1951