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VAPOR-PHASE CORROSION INHIBITOR AND WRAPPING MATERIAL CONTAINING SAME

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This invention relates to an improvement in wrapping materials particularly adapted for use in encasing corrodible products. More particularly, this invention relates to a chemical formulation superbly suitable as a coating composition for conventionally employed paper wrappings for metal products.

Because of the high degree of physical and financial loss to corrosion many methods have been practiced through the years to protect fabricated metal products against atmospheric exposure. Direct coating of the metal itself with petroleum products and related coating materials has been largely supplanted by wrapping of the goods during the periods of storage, shipment and commercial handling in general. An example of this is the wide use now made of paper wrapping materials which method of wrapping eliminates any need for extensive cleaning of the protected articles.

Although the use of paper has gained wide application because of its suitability and ready availability, certain difficulties were attendant in its adaptability to the problems of packing corrodible metal products. Firstly, a paper had to be developed which would not have its natural dry strength unduly diminished when coated with petroleum and like materials that would wet the paper. Moreover, having achieved a satisfactory, relatively impervious paper it was realized that the problem of preventing corrosion as an incident in packaging entailed combating the effects of moisture entrapped within the package. In a similar manner it was learned that paper itself has an inherent inferiority as a wrapping material because of its natural acidity, this acidic characteristic being a considerable factor in effecting acid corrosion and in accelerating water corrosion of the packaged articles. These latter two problems have been the main concern of those in the art seeking to develop corrosion inhibiting wrapping materials.

Accordingly, it is an object of this invention to provide a superior corrosion inhibiting wrapping paper which will be impervious to exterior moisture and which will combat the effects of interior moisture that might be contained within the package.

It is a further object of this invention to provide a superior vapor-phase corrosion inhibitor which will function in an acid-containing environment.

These and other related objects are achieved in the present invention wherein I have discovered a particularly effective formulation for a vapor-phase corrosion inhibitor adaptable for use in wrapping papers. In greater detail, I have discovered that a certain combination of morpholine caprylate and dicyclohexylamine caprylate in paraffin oils possesses markedly superior ability as a vapor-phase corrosion inhibitor. Furthermore, such a formulation is shown to have particular merits because of its effectiveness at temperatures in a range lower than that necessary for prior art vapor-phase inhibitors.

In the course of extensive investigative testing a composition having a semi-solid nature at normal tempera-

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tures was prepared according to the following weight formulation:

	Percent
Dicyclohexylamine caprylate-----	8-15
Morpholine caprylate-----	1-2
Paraffin oils-----	83-91

All three of these constituents may be obtained from commercial sources. Alternatively, the caprylates can be prepared by reacting the amine with caprylic acid. In following the latter course, I have prepared dicyclohexylamine caprylate by reacting 57.6 g. of caprylic acid (Armour Neo-Fat 7) having a density at 68° F. of 0.907 with 72.4 g. of dicyclohexylamine having the same density. The reaction was suitably conducted at room temperature within the paraffin oil by adding the amine lastly with vigorous stirring to a solution of the acid in oil so as to discourage any gel formation. As for the morpholine caprylate, it can be prepared by adding 28.8 g. caprylic acid to 17.4 g. of morpholine (Union Carbide and Carbon) without any need for a solvent. Considerable latitude is allowed in selecting a suitable oil so long as it is a reasonably highly refined paraffin oil, the refining being required to minimize the content of any corrosive components that might otherwise be present in the oil.

In testing the corrosion inhibiting properties of such a composition specifically represented by a formulation of 8% dicyclohexylamine caprylate and 1% morpholine caprylate in oil kraft paper was dipped in the solution which had been heated to about 115° C. at which point the solution is completely liquid. In accelerated corrosion testing SAE 1045 stock was maintained at 59-61° C. in an atmosphere of water and the volatilized portion of the corrosion-inhibitor coated on kraft wrapping paper. By such testing techniques it was established that compositions falling within the general formulation stated above have proven far superior as vapor-phase corrosion inhibitors. Testing has shown, for example, that a formulation containing 10.3% dicyclohexylamine caprylate was effective while one containing 15.4% was doubtful and mixtures containing 20% and above were positively not effective.

In addition to its operativeness as a vapor phase component the morpholine caprylate contributes in a further fashion inasmuch as it serves to prevent dicyclohexylamine caprylate from forming a gel in the paraffin oil medium.

The particular attributes of this formula can be readily discerned when considered in light of the fact that a paraffin oil alone is not an effective corrosion inhibitor under the test conditions and, moreover, does not function well in an acidic atmosphere. Furthermore, any contribution that a paraffin oil can make in the way of a vapor-phase corrosion inhibitor is limited to higher temperatures whereas by the inclusion of these two other caprylate constituents the oil itself provides a measure of low temperature effectiveness.

A further advantage lies in the fact that as contrasted with corrosion-inhibitor formulations in paraffin waxes the liquid or semi-solid nature of my formulation is sufficient to form a moisture impermeable seal with paper and at the same time to provide a more effective vapor phase than is possible when paraffin wax is employed in the formulation. As used herein, the term "semi-solid" refers to a state of matter consisting of a dispersion of a minor proportion of solid material in a liquid medium, which dispersion is capable of flowing.

Having thus described my invention, what I claim is:
1. A composition of matter particularly adapted for use as a vapor-phase corrosion inhibitor consisting essentially of 8 to 15 weight percent of dicyclohexylamine

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caprylate, 1 to 2 weight percent of morpholine caprylate, and the remainder being refined paraffin oil.

2. A wrapping material for inhibiting rust and corrosion of metal-containing articles enclosed therein comprising a paper sheet material uniformly coated with a composition consisting essentially of 8 to 15 weight percent of dicyclohexylamine caprylate, 1 to 2 weight percent of morpholine caprylate and the remainder being refined paraffin oil.

3. A wrapping material effective in an acidic atmosphere for inhibiting rust and corrosion of metal-containing articles enclosed therein comprising a paper sheet material uniformly coated with a composition consisting essentially of 8 to 15 weight percent of dicyclohexylamine caprylate, 1 to 2 weight percent of morpholine caprylate and the remainder being refined paraffin oil.

4. A material in sheet form for inhibiting rust and cor-

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rosion of metal-containing articles enclosed therein comprising a paper sheet having a pH below 7.0 uniformly coated with a composition consisting essentially of 8 to 15 weight percent of dicyclohexylamine caprylate, 1 to 2 weight percent of morpholine caprylate and the remainder being refined paraffin oil.

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