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COATING COMPOSITION

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8 Claims. (Cl. 134—26)

This invention relates to coating compositions and more particularly to improved coating compositions having pigments which are flake-like in shape, such as flake aluminum, finely divided metal foil, metal powders, etc.

Coating compositions containing metal powders and finely divided metals have been known for some time. In the early state of the art, it was customary to simply mix the finely divided metal into drying oils and varnishes. The paints obtained by this procedure gave a surface somewhat resembling metal in appearance, but it was usually rough and for the most part such films were very poor in durability.

When the technique was developed for preparing metals in very thin flakes, it became possible to manufacture coating compositions which gave films which were comparatively smooth, which possessed a decided metallic luster, and which had durability superior to that of the compositions made by the preceding method. It was found, however, that simple preparation of the metals in flake form was not sufficient to give a satisfactory paint. The physical properties of the vehicle, to a marked degree, influence the behavior of the metallic flakes suspended in it. When these flakes are dispersed in the proper type of vehicle, the surface tension relations of the substances involved are such that the flakes at and near the surface become orientated so that their plane of greatest cross section lies practically parallel to the plane of the surface of the liquid. This phenomenon is known as "leafing". Since the metallic flakes overlap, the surface which is presented to the weather is largely a surface of the metal itself and the resulting film has exceptionally good durability since the binder is protected from the action of the weather by a nearly continuous layer of metal. Leafing, therefore, is essential to maximum durability.

The nature of the binder is also a very important factor in securing satisfactory durability. It must, in itself, be chemically stable and resistant to the action of the weather in order that the flakes may be held firmly in place and continue to furnish protection.

In order that coating compositions containing flaked pigments may be applied efficiently, they must dry rapidly, and the film must be hard enough to resist abrasion and at the same time be somewhat flexible. These qualities must be secured without sacrificing leafing properties.

Oil and varnish compositions, such as mentioned, are deficient, either in the matter of drying or in durability. Leafing, in the case of varnish compositions, is usually good enough to give the desired decorative effect. In the case of untreated drying oils, leafing is not satisfactory.

Numerous other disadvantages are connected with the use of these oil and varnish compositions. In the case of those which contain relatively large amounts of oil, the films are apt to dry slowly and remain soft on the surface next to the article the lower part of the film only very slowly. This is due to the fact that the impermeability of the surface film which is formed by the leafing of the metal particles is so great, that oxygen reaches the lower part of the film only very slowly. This defect cannot be corrected by the selection of high boiling point solvents for the purpose of conferring improved drying properties to the film, because of the fact that the solvent is trapped beneath this impermeable film. In order to secure fast drying the quantity of oil must be diminished, and in the case of many of those compositions containing relatively small amounts of oil, the set-up of the film is so rapid that the leafing process does not have time to take place. Such vehicles have, in addition, a tendency to be brittle and in general possess in themselves poor durability.

It has also been proposed in the copending application of Horace H. Hopkins and John Richardson, Jr., Serial No. 511,922, filed on even date herewith, to use a solution or varnish of a polyhydric alcohol-polybasic acid resin modified with drying oils as a vehicle for flaked pigments in order to overcome the difficulties mentioned above. We have discovered, however, that certain modified polyhydric alcohol-polybasic acid resin solutions for use as a vehicle for flaked pigments may be improved considerably, over the short oil resin compositions of the mentioned application, with respect to leafing properties, flexibility and other desirable characteristics. This lack of flexibility is a serious drawback when the coating is applied over materials subject to large volume changes due to change in temperature.

This invention has as an object the preparation of improved coating compositions from metal flakes, metal powders and from flaked non-metallic pigments. Another object is to prepare coating compositions from these materials having superior leafing properties. Another object is to prepare coating compositions from materials mentioned above which shall have satisfactory flexibility for use over materials which are subject to large volume changes due to changes in temperature, etc. A still further object is to prepare coating compositions from these materials which yield

films having a durability greater than that of similar products now in use.

These objects are accomplished by using as the vehicles for pigments, such as described, solutions of polyhydric alcohol-polybasic acid resins containing appropriate driers and having the characteristics hereinafter set forth.

We have found that within the range of resin compositions mentioned below, films of the desired nature can be secured by keeping within certain limits the following properties:—

1. Acid number of resin
2. Viscosity of resin
3. Viscosity of resin solution

Resins suitable for the purposes of the present invention, the compositions of which are expressed in terms of the reacting ingredients, are indicated by the following examples:

Example 1	Parts by weight
Linseed oil	53.90
Glycerol	13.50
Phthalic anhydride	32.57
Litharge	.03
	100.00

The acid number of this resin was 5.

Example 2	Parts by weight
Soya bean oil	53.90
Glycerol	13.50
Phthalic anhydride	32.57
Litharge	.03
	100.00

The acid number of this resin was 4.

Example 3	Parts by weight
Linseed oil	59.20
Glycerol	12.75
Phthalic anhydride	28.00
Litharge	.05
	100.00

The acid number of this resin was 5.

Example 4	Parts by weight
Linseed oil	39.75
China wood oil	20.00
Glycerol	11.80
Phthalic anhydride	28.40
Litharge	.05
	100.00

The acid number of this resin was 8.

The resins were prepared from the above ingredients in the manner described in the copending application of Paul Robinson, Serial No. 370,727, filed June 13, 1929. The preparation of the resin in Example 1 may be taken as typical. The linseed oil, glycerol, and litharge are placed in a varnish kettle provided with a cover, mechanical stirrer, and an air-cooled reflux condenser. The materials are heated together at a temperature of about 250 degrees centigrade until the two liquid phases merge into a single phase. About 30 minutes will be required for this to take place. Vigorous agitation is maintained during this treatment and air is excluded by means of carbon dioxide. When this first stage is complete, phthalic anhydride is added, avoiding as much as possible the admission of air, and heating is continued at the same temperature until an acid number of about 5 is obtained. At this point the viscosity of the resin will be such that a 75% solution of it in mineral spirits will have a body equal to about "S" on the Gardner-Holdt scale.

These oil modified polyhydric alcohol-polybasic acid resins may also be made by using the drying oil acids instead of the drying oil as in the above examples. It is to be understood, therefore, that the term "drying oil" in the claims comprehends resins made either with the drying oil or the corresponding amount of the drying oil acids. The following is an example of a typical composition for a resin prepared from a drying oil acid.

Example 5	Parts by weight
Glycerol	17.10
Phthalic anhydride	27.10
Linseed oil acids	55.80
	100.00

The resin is prepared according to the common method of heating together all the ingredients until the desired acid number and viscosity is obtained. In this method of manufacture the drying oil is synthesized from the oil acid and glycerol during the formation of the resin.

The foregoing resins are put into solution, while still warm enough to be liquid, in a mixture such as the following, which was used to prepare a solution of the resin of Example 1.

Resin	50.00
Drier	4.80
Mineral spirits	45.20
	100.00

The resulting solution will have a specific gravity of about .926 and a viscosity between about "B" and about "F" on the Gardner-Holdt scale. In order to bring the viscosity within the desired limits, adjustment may be made by changing somewhat the amount of mineral spirits added. We have found, that for a given viscosity of the composition, the leafing properties are improved as the acid number of the resin decreases. The acid number of the resins should not, therefore, be greater than about 15 and preferably not greater than 10 in order to obtain compositions having the best leafing properties. The viscosity of the resin should be such that a 75% solution in mineral spirits will have a viscosity not less than "M" and not greater than "T" on the Gardner-Holdt scale. The viscosity of the resin solution used as the vehicle should be between about "A" and about "F" on the Gardner-Holdt scale. The quantity of drying oil incorporated into the resin should be sufficient to confer flexibility to the film. It is preferable that the resins used contain between 50% and 60% of oil, but compositions containing from 45% to 70% may be used. The amount of pigment used in this solution will vary greatly with its nature. In the case of aluminum, it may be from 1½ to 2½ pounds to the gallon of vehicle.

Although the examples given are confined to the use of linseed, China wood, and soya bean oil, it is to be understood that other oils such as perilla oil, menhaden oil, etc., may be used instead. Small amounts of other polyhydric alcohols, such as ethylene glycol may be substituted for part of the glycerol. Any of the driers commonly used in such resinous coating materials, may be employed. Other thinners than mineral spirits may be substituted, although it is ad-

visable to avoid the use of those having very high boiling points. As indicated in the examples, the preferred polyhydric alcohol is glycerol and the preferred polybasic acid is phthalic anhydride. Other polyhydric alcohols, and other polybasic acids known to those skilled in the art to be useful for making the type of resin disclosed herein, may, however, be used. While the practice of the present invention will produce a superior metal paint with metal pigments in powdered form, the advantages are more apparent when the pigment, whether a metal or non-metal, is in a flaked form. Our improved vehicle, because of its hard and rapid drying, its excellent leafing properties, flexibility and durability, is especially advantageous when used in connection with flake pigments as compared to vehicles such as the oil type, varnish type and certain synthetic resin vehicles now in use. This last-mentioned material does not "leaf" well enough to give satisfactory durability when compared to the products outlined in the present invention.

Of the flaked metal pigments heretofore mentioned, it is preferred to use flaked aluminum. Among the suitable non-metallic flaked pigments are certain sulfide pigments, graphite and finely divided mica. The flake-like pigments may, if desired, be coated with certain substances such as stearic acid, which are known to those skilled in the art of their manufacture to enhance leafing properties.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that we do not limit ourselves to the specific embodiments thereof except as defined in the appended claims.

We claim:

1. A coating composition comprising a flaked pigment, a drier and a solution in a volatile solvent of an oil modified polyhydric alcohol-polybasic acid resin having an acid number not greater than 15 comprised of the reaction product of a polyhydric alcohol, a polybasic acid and drying oil.

2. A coating composition comprising a flaked pigment, a drier and a solution in a volatile solvent of an oil modified polyhydric alcohol-polybasic acid resin comprised of the reaction product of a polyhydric alcohol, a polybasic acid and from about 45% to 70% by weight of drying oil, said resin having an acid number not greater than 15 and a viscosity of not less than M or greater than T on the Gardner-Holdt scale for a 75% solution of the resin in mineral spirits, said first named solution having a viscosity between the approximate limits of A to F on the Gardner-Holdt scale.

3. A coating composition comprising flaked aluminum, a drier and a solution in a volatile solvent of an oil modified polyhydric alcohol-polybasic acid resin comprised of the reaction product of a polyhydric alcohol, a polybasic acid and from about 45% to 70% by weight of drying oil, said resin having an acid number not greater than 15 and a viscosity of not less than M or greater than T on the Gardner-Holdt scale for a 75% solution of the resin in mineral spirits, said first named solution having a viscosity between the approximate limits of A to F on the Gardner-Holdt scale.

4. The coating composition of claim 1 in which the flaked pigment is flaked aluminum.

5. The coating composition of claim 1 in which the polyhydric alcohol is glycerol and the polybasic acid is phthalic anhydride.

6. The coating composition of claim 2 in which the polyhydric alcohol is glycerol and the polybasic acid is phthalic anhydride.

7. The coating composition of claim 3 in which the polyhydric alcohol is glycerol and the polybasic acid is phthalic anhydride.

8. A process of manufacturing a coating composition which comprises dissolving a glycerol phthalate resin modified with 45% to 70% by weight of drying oil and having an acid number not greater than 15 in sufficient thinner and drier mixture to produce a solution having a viscosity between the approximate limits of A to F on the Gardner-Holdt scale, and incorporating aluminum flake into said solution in about the ratio of from 1½ to 2½ pounds of flake aluminum to one gallon of solution.

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CERTIFICATE OF CORRECTION.

Patent No. 1,941,398. December 26, 1933.

JOHN W. ILIFF, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, line 64, strike out the words "the lower part of the film only very slowly" and insert instead being coated, for extended periods of time; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 20th day of February, A. D. 1934.

(Seal)

F. M. Hopkins
Acting Commissioner of Patents.