Patented Nov. 4, 1941

2,261,716

UNITED STATES PATENT OFFICE

2,261,716

PIGMENT VEHICLE FOR COATING MATERIALS

Lloyd V. Casto, Detroit, Mich.

No Drawing. Application May 19, 1937, Serial No. 143,553

3 Claims. (Cl. 134—79)

The present invention is concerned with improvements in decorative coatings, utilized in finishing various articles of manufacture generally at the source of manufacture thereof and is directed particularly to that class of coatings having metallic flake particles incorporated therein; such particles being commercially known as "bronzing" powders. Powders of this type have been used heretofore for pigmenting purposes, mixed with a suitable vehicle for obtaining surface finishes having a metallic appearance, such as that of aluminum, bronze, etc. However, a characteristic of all such coating materials is that a very substantial percentage of the metallic flakes mixed therein settles out of the vehicle, thus necessitating constant agitating during the period of application of the material to the article being coated.

As distinguished from prior practices, the present invention is directed to the provision of coating materials comprising metallic flakes and a coating vehicle which will oppose any leafing action of the metallic particles, the components of the vehicle being such that the particles will remain suspended in the vehicle after the preparation thereof for considerable periods of time, and the particles will also remain in suspended condition in the vehicle when the vehicle is reduced with a thinner to spray-gun consistencies at the time the coating material is to be consumed by the manufacturer.

A further purpose of my present invention is to derive an intermediate compound, comprising a liquid carrier having metallic particles suspended therein, and of known physical and chemical composition, adapted to comprise part of an ultimate coating material, whereby certain optical effects of the metallic flakes upon the general appearance of the finish or coating, can be controlled accurately.

I have determined that such an intermediate compound utilizable for mixing with the ultimate coating material can be economically derived through the use of either a nitrated cotton or a synthetic resin base in solution, when the particle size of the flake material and the solvency factors of the liquid components of the vehicle are controlled.

For example, when a flake-suspending medium, comprising a low viscosity, nitro-cellulose base and a suitable solvent therefor, has introduced thereinto an aluminum flake pigment, ninety percent of the particles of which have an average flake particle area not greater than 5×10^{-7} cm.^{2} and the liquid and flake material are thoroughly mixed, the flake particles will remain in suspension in the liquid without settling therefrom for substantial periods of time, insofar as industrial usage thereof is concerned.

When it is desired to utilize a flake carrier comprising a synthetic base dissolved in a suitable solvent therefor, the materials selected should be such that the viscosity of the mix will not be below certain limits. The pigment flakes should be thoroughly mixed therewith. It will be found that the flake material will remain in suspension at the time this intermediate carrier is added to the final vehicle, providing the viscosity of the final coating material is not reduced too low. An example of suitable synthetic vehicle is disclosed in my co-pending application, Serial No. 143,554, filed May 19, 1937.

It is understood that either of the foregoing intermediate vehicles for the flake material will have mixed therein, subsequently, compatible dyes or coloring pigments for the purpose of obtaining the desired color effect in the ultimate coating; also, that other body media can be and usually are added to the intermediate coating mixture for the purpose of obtaining other physical characteristics, such as determination of drying time, durability, hardness, etc.

Examples of the foregoing complete coatings respectively are as follows:

Example 1.—Aluminum flake of a good commercial grade, in moist or paste form, was introduced into a thinned liquid comprising a low viscosity nitrated cotton base and a suitable solvent therefor, and this mixture was stirred or agitated for several hours to bring about physical separation of the particles adhering to each other in clusters and also to remove any stearic acid remaining on the particles as the result of the mode of manufacture thereof. This mixture was then permitted to stand to permit a settling out of the heavier particles and the finer particles were retained in suspension. The mixture with the suspended particles then was decanted or otherwise removed from the larger settled particles.

The foregoing flake base was added to a low-viscosity nitrocellulose lacquer, dissolved in a suitable solvent compatible to the foregoing ingredients and the resultant mixture comprised:

	Parts
Nitrated cottom gum	32
Nitrocellulose plasticizers	8
Nitrocellulose flake solution	44
Thinner	45

A transparent color was then added, the color being in solution and the solvent therefor being compatible to mixing with the components of the stated compound. The coating can be thinned further without precipitating any of the components thereof, providing the viscosity of the coating is maintained above thirty seconds when measured with a Ford cup viscometer number four orifice at 70° F.

Example 2.—Aluminum flake was introduced into a mixture of mineral spirits and high-flash naphtha, there being 224 parts of the former, and 56 parts of the naphtha. This material was subjected to constant agitation for a period of about six hours, whereby stearic acid carried by the flake material, was removed from the flake particles and the flake particles were minutely separated from each other, thereby eliminating physical adherance of the particles in clusters. This mixture was then permitted to stand for a few hours, whereupon the coarser flake particles settled out of the mixture and that portion of the mixture above the settled flake particles was removed. 218 parts of a phenol modified alkyd resin dissolved in xylol (this mixture having a solid content of about fifty percent by weight), was then mixed with the carrier having the aluminum flake particles suspended therein. Any desired coloring matter compatible with the components of the foregoing compound can then be added to the compound, and after a thorough mixing therewith the coating material is ready for shipment. The compound can be reduced with a thinner to a spray gun consistency,—that is, until its viscosity is reduced to about 39 seconds as measured in a Ford cup viscometer number four orifice at 70° F., the thinning down, in the example given, being effected by the use of a thinner comprising 224 parts of mineral spirits and 56 parts of high-flash naphtha, to the extent of fifty percent.

It should be noted in the synthetic example given that at the time the coating passes through the spray gun nozzle, the solids content of the compound is reduced to about 12½% (by weight) without including the solids factor of the aluminum flakes particles.

Clear low viscosity nitrated cotton lacquers have about a 13% solids content at spraying gravity and about the maximum solids content obtainable in nitrated cotton lacquers is from 32% to 33%. High viscosity nitrated cotton lacquers (about 22 second cotton) will take less maximum of pigment solids. Hence, it is apparent that the high viscosity nitrated cotton lacquers have a maximum solids limitation which is considerably less than the maximum solids limitation of a low viscosity nitrated cotton lacquer at practical spraying consistencies.

It will be found that classes of materials of which the foregoing formulae are examples only, can be manufactured and used without causing the settling or separation of the flake particles from the vehicle, and a surface coated therewith will have the desired color without a dominating metallic appearance. Likewise, no leafing effect will be apparent upon or near the surface of the coating.

A clear top coating or coating of clear lacquer can be applied over the pigmented coating for protective purposes and regardless of the color selected in making up the final coating mixture, the coated surface will have a subdued iridescent appearance.

It should be noted that the amount of solids given in the foregoing examples are quite low. Nevertheless, the coating materials have a high surface coating efficiency.

So-called "bronze powders" economically available, contain a high percentage of flake particles having the degree of minuteness hereinbefore stated, and these particles can be segregated in a practical, economical way, in the following manner: Powders are available in the form of wet pastes, the moisture-maintaining medium being chemically such as to be compatible to compounding or mixing with coating material ingredients, such as a nitrated cotton base and a solvent therefor. Commercial flakes paste can be mixed by stirring the same in such a solution and after permitting the mixture to stand for several hours, it will be found that practically all of the coarser particles will have settled to the bottom of the mixture, while about 90% of the finer particles, which have remained in suspension, will have an average area not greater than that hereinbefore defined. Preparation of the liquid with the suspended particles therein can be effected in any convenient way. Observation, by microscope, of a sample of this intermediate liquid with the flakes suspended therein, will disclose that the flake particles are in a dynamic suspension to a certain extent, and remain so for long periods of time, with only a small amount of settling of the flake particles after the initial settling of the larger particles from the flake-suspending liquid. Hence, quantities of this mixture can be prepared at one time. As stated, with this intermediate mixture available, different coating materials, insofar as color and viscosity variations are concerned, can then be made by mixing therewith transparent colors, plasticizers, thinners, etc., as may be desired. As the coating congeals upon the surface being decorated, its viscosity and density rise, thus holding the flake particles in random relationship throughout the coating cross-section.

Hence, final coating materials, prepared as described, will retain the flake particles in a suspended state, despite severe agitation during the drying period caused by the rapid volatilization of the solvent therefrom.

The foregoing disclosures are directed primarily to coating materials utilizable for finishing sheet-metal products, but can be adapted to wood, composition board, and other surfaces, as well as to use as a ground coating in processes for obtaining finishes of the design type.

In prior patents and applications therefor, I have set forth several developments directed to the so-called "sheen effect" reproductions which are observable to the discerning eye in the appearance of finished natural woods, marbles, textiles, etc., and I have set forth the attainment of the reproductions thereof by the use of various materials, such as an underlying base for an artistic design to be applied thereon, in which precipitated salts of the halogen family held in suspension, fish-scale and metallic particles, are used. While the halogen group of salts and the fish-scale, when used in a base coating, will be compatible to color matching when incorporated in a desired coating vehicle, such as a lacquer base in a volatile solvent, nevertheless the use of such materials for the purposes stated is quite expensive when compared to the use of the coating materials hereinbefore disclosed.

Casual observation does not reveal a metallic appearance in the ground coating surface thus obtained, for the coloring matter used in the mix-

ture will dominate the optical impression imparted by such a surface. Observation under a microscope will reveal, however, that some metal particles are substantially uniformly visible throughout the ground coat surface, and the extent of particle visibility can be varied, as described by varying the amount of the inital flake and carrier used. However, quantitative measurements of the light reflecting, diffracting and diffusing factors of the decorated surface, when compared with a metallic surface, disclose that the diffusion factor of a metallic surface is considerably less than said coated surface, and if a clear or transparent protective coating, which has about the same index of refraction as the body of the underlying coating (in the example given a protective coating of clear nitro-cellulose lacquer), is applied over said decorated surface, the amount of diffusely reflected light will be decreased. Usually the optical properties of a base surface are dependent upon the degree of roughness of the surface. However, for comparative purposes, I have prepared a surface with a coating, using fish-scale instead of aluminum flake, and find that while the coating with the fish-scale prouces a fine grained surface, as compared to the said coated surface containing the metallic flake, nevertheless the optical properties of the last-mentioned surface compare favorably with the fish-scale surface, due primarily to the presence of the highly reflecting aluminum particles randomly distributed throughout said surface.

Optical tests also disclose that a surface decorated with the foregoing described coating materials, (including aluminum flake particles of the smaller sizes, insofar as aluminum flake materials of commercial form are concerned), will have the optical characteristic of "changeability" to a marked extent, and this characteristic is highly desirable in a ground coating used in connection with an overlying transfer of a wood grain design or other overlying artistic design simulating the tracery of marble, textiles, etc., the appearance of which has the optical changeability factor referred to. When a clear protective coating is placed over the design transfer, this changeability characteristic of the ground coating becomes quite obvious between certain of the reflection angles of about 35 degrees to 60 degrees. A specular reflection is caused by the outer surface of the clear coating, as well as those flake surfaces which are parallel to the outer surface, but a diffuse reflection is caused by other flake particles which is non-metallic, due to the randomly distributed relationship of the majority of the flake particles, both on the base surface and below the base surface, and this diffuse reflection is a combination of scattering reflection and refraction caused by the randomly distributed particles. Hence, such a ground coating can have a matched color over which may be applied an open tracery design in the form of a wood grain, a marble, a textile or any other reproduction of an article of commerce having a certain amount of sheen and changeability effect in the surface appearance thereof, as will be found, for example, in the appearance of various walnut grains, mahogany grains, marbles, silks and other textiles.

I have set forth in my prior Patent No. 2,047,670, and my prior applications, Serial No. 34,034, filed July 31, 1935, and No. 11,496, filed March 16, 1935, the obtaining of such final appearance results by the use of fish-scales, certain types of halogen salts, such as mercurous chloride, the use of metallic flake materials in the transfer inks, and the use of millbright metal bases. The results obtained by the use of the methods and materials referred to in said patent and patent applications are satisfactory, but in the instant case the use of a ground coating, having size controlled aluminum flake particles maintained in suspension therein, greatly simplifies the manufacturing processes involved in obtaining the desired results.

It is to be understood, of course, that while I have given only two examples of a mixture and color for obtaining an ultimate coating not used in connection with a design tracery thereover, the amount of flake particles used in the coating and the coloring of the coating mixture, will vary in accordance with the manufacturers' requirements.

When the decorated finish comprises a reproduction of the appearance of a natural article, the ground coat color and sheen will be controlled to simulate the dominating natural color and sheen of the article.

Where straight ground colored coatings are to be used with a clear, protective coating of lacquer or other clear coating placed thereover, such mixtures can be standardized and the completed coating materials shipped for use at spray gun fluidities without any resulting settling of the flake particles from the coating material.

It is to be understood that, while I have given examples of the use of intermediate flake carriers comprising in one instance an intermediate carrier having a nitrocellulose base and in another a modified alkyd resin base, the invention can be practiced by using an oil varnish solution as an intermediate flake carrier, the adaptation of the same to the foregoing described processes being apparent to anyone skilled in the art in the light of the disclosures herein made.

I claim:

1. A ground coating composition comprising a colored vehicle including a film forming material and non-leafing metallic flake, said metallic flake consisting of particles at least 90% of which have an area not greater than .000,000,5 of a square centimeter and obtained by a process consisting in agitating bronze powder with a liquid compatible with the before mentioned vehicle to thereby suspend the finer metallic particles and permit the coarser particles to precipitate, and separating the liquid with the finer particles suspended therein from the coarser particles; the vehicle having a viscosity not less than 30 seconds, as measured with a Ford Cup viscometer No. 4 orifice at 70° F., and said particles being randomly distributed in the colored vehicle and not appearing metallic upon casual observation when the coating material is applied to a surface to be decorated.

2. A coating material according to claim 1, wherein the vehicle comprises a low viscosity nitro-cellulose lacquer and solvent therefor.

3. A coating material according to claim 1 wherein the vehicle includes a phenol modified alkyd resin.

LLOYD V. CASTO.