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FINISHING COMPOSITION

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This invention relates to a finishing composition, and particularly to a material of the type of a gloss enamel or pigmented lacquer giving a film characterized by unusual brilliance, the appearance of depth and changing hue, freedom from visible non-uniformity which if present would constitute a mottled or dappled effect, and freedom from the opaque single-color appearance such as observed in conventional films colored by pigments of high hiding power.

In the formulation of enamels and lacquers, there have been many attempts to provide finishes showing a polychromatic effect and satisfactory durability and at the same time being suitable initially for application in high speed production. The polychromatic effect, as referred to herein, means changing tones of color of the finish when viewed over the contours of a body of curved surface or when viewed at varying angle on a flat surface. The effect appears as though the eye were seeing down through a layer of colored semi-transparent finishing material of varying depth, to a layer of highly reflecting material, or as though looking down through a layer of colored glass to a highly reflecting irregular (sparkling) background. Viewed at a distance, the background may appear continuous, but the irregularity or discontinuity thereof contributes to the varying color effect which is a feature of the invention.

The present invention provides a finishing composition adapted to leave a film which exhibits the desirable properties set forth. More specifically, the invention provides a finishing composition comprising translucent material in the form of very fine particles, a transparent non-volatile vehicle, and a limited proportion of light reflecting flake metal which in the film gives the discontinuous reflecting background referred to above. The translucency of the properly selected and prepared coloring material permits the use of such small proportions of the flake metal as to minimize undesired mottling.

The older types of finishing compositions containing flake metal were characterized, by contrast, by large percentages of the metal. As a result, a substantial proportion of the metal floated to the surface of the film, as the film formed. The particles at or near the surface reflected the light unchanged and appeared largely as aluminum platelets. In such older types of finishes, opaque pigments also in large proportions were widely used.

In the composition of my invention, the percentage of aluminum or other flake metal in the finish is very small. Hence there is little aluminum not only near the surface but also in each hypothetical layer below the surface to which light penetrates and from which it is reflected. As a result, light striking the film, penetrating to varying depths, and then being reflected to the eye of the observer, passes through relatively thick layers of the colored film. The effect is that of illumination of the platelets to a considerable depth within the film without the introduction of objectionable sparkling.

If these results are to be obtained, the coloring materials selected should have special properties. They should tend to have what appears to be a dyeing or staining action on the vehicle rather than a hiding or opacifying effect. Among those best suited are certain pigments commonly classed as organic, that is, those containing carbon. The pigment should be one that is adapted in conventional grinding procedure to become dispersed in the vehicle to particles that are very fine, say, predominantly of size not substantially larger than about 0.5 micron and usually below 0.2 micron, or not more than about half the average length of white light. The term "pigment" as used herein excludes aluminum or other flake metal used. In the form of the fine particles, the coloring material should be semi-transparent and, in a film of normal thickness, should obscure a background without making the film opaque. The pigment for outdoor use should be light stable. A single pigment, or a mixture of two or more suitable pigments may be used.

Coloring materials meeting these general requirements are illustrated by the following examples of materials that are satisfactory for the purpose: pigmentary multivalent metal ferrocyanides, particularly the iron blues such as ferric ferrocyanide; pigmentary multivalent metal phthallocyanines, as, for example, the lead phthallocyanine sometimes known as monastral green or the corresponding copper compound which is blue; an iron compound of nitroso naphthol (permansa green); yellow and green lakes or toners; many organic maroons such as toluidine maroon, indanthrene maroon or madder lake; and carbon black in very low concentrations. Another example of a satisfactory inorganic pigment is burnt umber if used in relatively low concentration.

If the pigment is of the type which is high in hiding properties, such as carbon black, it is preferably used in extremely small proportion. In any case the amount of total pigment is substantial, so as to establish the desired color, but not

substantially above about twenty-five parts for one hundred parts of the non-volatile vehicle (i. e. 20% of the aggregate film forming ingredients), proportions here and elsewhere herein being expressed as parts by weight.

The coloring material is brought to the desired degree of fineness and staining effect in any of the commonly-used processes or types of equipment. For dispersing finely divided coloring material in nitrocellulose compositions, for example, the two-roll rubber mill is particularly suited. For enamel dispersions, a steel-ball mill, pebble mill, five-roll mill, or Banbury mixer are suitable, the period of mill action in any case being such as to produce the fineness and dispersion desired. The flake metal such as aluminum powder may be incorporated into the composition either before or after the mill action.

The flake metal selected should be light reflecting to a high degree and without injurious effect upon the rest of the composition. Depending upon the color or other effects to be desired, there may be used powders of various tints, as, for example, H-scale (a crystalline mercurous chloride product), gold platelets, or fish scale. For most purposes, however, I use commercial grades of aluminum powder.

The flake metal selected may be used in proportions as low as about 0.01 part or as high as approximately 5 parts for 100 parts of total weight of pigment and flake metal. A proportion of the flake metal of the order of one-hundredth part is adequate for many purposes. An amount substantially in excess of 5 parts or so interferes with the desired translucency of the film.

Since, as already stated, the pigment employed ordinarily should not amount to more than 20% of the aggregate film forming ingredients, and since the aluminum used does not exceed 5 parts for 100 parts of total weight of pigment and metal, it follows that the aluminum employed should not be present in an amount to exceed 1% of the final film, and from what is stated above, it follows that in many cases .02% is sufficient.

As the non-volatile vehicle, there is used to advantage a material that after application and hardening of the finishing material is a transparent solid. Thus, there have been used to advantage alkyd resins, mixtures of alkyd and urea-aldehyde resins, polymerized vinyl compounds of resinous nature such as those known as Vinylite resins, and nitrocellulose compositions of the type of lacquer bases. In place of nitrocellulose compositions, there may be used cellulose acetate or acetate butyrate, or methyl, ethyl or like ether of cellulose with added materials conventionally used in making coating compositions including such cellulose derivatives. While oleoresinous compositions ordinarily used as the base for varnish may be employed as the non-volatile vehicle, such compositions are not recommended when durability of the film of finishing material is desired.

In addition to the pigment, flake metal, and non-volatile vehicle there is ordinarily employed a large proportion of volatile solvent or extender to make convenient the application of the finishing material to the article to be finished. The particular solvent or extender chosen will depend partly upon the rate of evaporation desired in the finishing composition and partly upon the nature of the non-volatile vehicle selected. When the vehicle selected is soluble in hydrocarbon liquids, then the volatile solvent is suitably of that nature, say a fraction of petroleum such as V. M. and P. naphtha or toluene, xylene, or a mixture of these materials. Such materials may constitute the major portion or all of the volatile solvent when the vehicle is an alkyd resin or an oleoresinous composition of the kind commonly used in varnishes. For vehicles that are not soluble in hydrocarbon solvents, there is used a known solvent for the vehicle. Thus there may be used esters, ketones, alcohols, and the like, either singly or mixed with each other or with hydrocarbons of the kind described, in such proportions as to make the solvent effective for the non-volatile vehicle present.

It will be understood that solvent is ordinarily included in the meaning of the term "vehicle." For convenience, however, I distinguish herein the non-volatile vehicle and the volatile solvent.

Suitable proportions of the various materials are illustrated in the formulas tabulated below:

EXAMPLE 1

A brilliant green enamel is made of the following composition:

Ingredient	Parts
Pigment	6
Aluminum Powder	.18
Carbon black (to tint)	Trace
Alkyd resin	31.5
Solvent, to make 100 parts.	

In the above formula the pigment may be advantageously permansa green or monastral green.

The same composition may be made as a blue enamel, by replacing the green pigment by a blue, such as ferric ferrocyanide or copper phthallocyanine.

The same composition may be made as a peacock blue, by using as the coloring material equal weights of monastral blue and monastral green.

EXAMPLE 2

A maroon lacquer is made of the following formula:

Ingredient	Parts
Pigment	4.5
Aluminum powder	0.074
Bone black (to tint)	0.25
Non-volatile vehicle	30
Solvent, to make 100 parts.	

Suitably, the maroon pigment used in the above formula is toluidine maroon and the vehicle is a composition of the lacquer base type, containing 50 parts of nitrocellulose, 40 parts of castor oil alkyd resin, and 10 parts of dibutyl phthalate plasticizer.

EXAMPLE 3

Maroon enamel

Material	Parts
Aluminum powder	.16
Carbon black	.05
Madder lake	1.5
Indanthrene maroon	1.5
Non-volatile alkyd resin	35.2
Drier, small amount.	
Volatile solvent	61.59

The drier is used in a conventional proportion adequate to promote hardening.

In the formula of this example, the total of coloring materials including aluminum is 3.21% of the weight of the whole composition and the content of aluminum is 5.1% of the total of coloring materials.

EXAMPLE 4

Green enamel

Material	Parts
Monastral green	8.650
Aluminum powder	.054
Yellow lake	.188
Carbon black	.108
Non-volatile vehicle	34.6
Solvent	56.4

In this formula, the coloring materials constitute 20.6% of the film-forming constituents and the aluminum 0.6% of the total of coloring materials.

EXAMPLE 5

Green lacquer

Material	Parts
Monastral green	4.27
Aluminum powder	.06
Bone black	.07
Low viscosity nitrocellulose	15
Alkyd resin	13.5
Dibutyl phthalate	1.5
Xylol	39.6
Butyl acetate	19.5
Butyl alcohol	6.5

In this formula, the coloring materials constitute 4.4% of the total and the aluminum 1.36% of the coloring materials.

EXAMPLE 6

Blue enamel

Material	Parts
Resin	35.4
Solvent	60.75
Aluminum powder	.18
Carbon black	.05
Iron blue	3.62

Here the aluminum constitutes 4.67% of the total of the coloring materials.

EXAMPLE 7

Blue enamel

Material	Parts
Resin	35.8
Solvent	60.57
Aluminum powder	0.03
Iron blue	3.58

Here the aluminum constitutes 0.83% of the total of the coloring materials.

The low proportion of coloring material and flake metal used by me is in sharp distinction from conventional practice, two typical enamels of usual type being of about the following composition:

Material	Parts	Parts
Resin	34.48	35.64
Solvent	63.1	61.9
Aluminum powder	0.75	0.36
Coloring materials	0.25	1.64
N. V. inerts	1.42	0.46
Per cent Al in total pigments	31.2	14.6

In making my improved finishing composition, usual equipment and technique are employed in compounding the selected materials. Thus, the pigments may be ground to the necessary fineness in the non-volatile vehicle, with all or part of the volatile solvent present at the time of grinding.

The enamels are applied in conventional manner to objects to be finished. Thus, in finishing an automobile body there may be first applied the metal primer which is then sanded down, next a surfacing composition, and finally the enamel, in as many coats as desired and with usual routine as to polishing.

My enamels made as described and applied to objects in the usual manner give a brilliant finish that is iridescent or polychromatic, exhibiting a high degree of change of color with varying angle of view of a plane surface or on viewing of a curved surface such as that of an automobile. The film is translucent, so that it gives on observation the impression of depth somewhat analogous to the appearance obtained on looking into a stained or colored glass, as distinguished from the effect of viewing an opaque painted surface. There is practically no mottling. Finally, the film is satisfactorily durable under ordinary conditions of use.

While the film is translucent, it does have adequate coloring and obscuring power, so that the final color on an automobile, for instance, is independent of the color of the primer or surfacing coats used.

It will be understood that the details given are for the purpose of illustration and that variations within the spirit of the invention are intended to be included within the scope of the appended claims.

What I claim is:

1. A finishing composition adapted, on application to an object, to give a finish characterized by its brilliance and appearance of depth, comprising a solution in a volatile solvent of a non-volatile vehicle adapted on drying to form an approximately transparent film, pigment dispersed in such vehicle predominantly in the form of particles of a size not substantially in excess of 0.5 micron and largely of a size equal to not more than one-half the average wave length of light, and metal flakes amounting to between about 0.01% and 5% of the aggregate of pigment and metal.

2. A composition as specified in claim 1, in which the metal flake does not exceed 1% of the aggregate solids.

3. A finishing composition adapted on application to an object to give a finish characterized by its brilliance and appearance of depth, comprising a solution in a volatile solvent of a non-volatile vehicle adapted on drying to form an approximately transparent film, pigment dispersed in such vehicle of a particle size such that part is over and a part under one-half the average wave length of light and in an amount sufficient to color the film but not exceeding 20% of the weight of the film so that the resulting film will be translucent, and reflective metal flake in an amount between 0.01 part and 5 parts for 100 parts of total weight of pigment and metal flake.

4. A composition as specified in claim 3 in which the vehicle comprises a resinous body.

5. A composition as specified in claim 3 in which the vehicle is a transparent alkyd and urea aldehyde resin composition.

6. A finishing composition adapted, on application to an object, to give a finish characterized by its brilliance and appearance of depth, comprising a solution in a volatile solvent of a non-volatile vehicle adapted on drying to form an approximately transparent film, pigment dispersed in such vehicle predominantly in the form of particles of a size not substantially in excess of 0.5 micron and largely of a size equal to not more than one-half the average wave length of light, and aluminum flakes amounting to between about 0.01% and 5% of the aggregate of pigment and metal.

7. A composition as specified in claim 6 in which the aluminum flake does not exceed 1% of the aggregate of pigment and aluminum flake.

8. A composition as specified in claim 6 in which the aluminum flake is between 0.6% and 5% of the aggregate of pigment and aluminum flake.

9. A finishing composition adapted on application to an object to give a finish characterized by its brilliance and appearance of depth, comprising a solution in a volatile solvent of a non-volatile vehicle adapted on drying to form an approximately transparent film, pigment dispersed in such vehicle of a particle size such that part is over and a part under one-half the average wave length of light and in an amount sufficient to color the film but not exceeding 20% of the weight of the film so that the resulting film will be translucent and aluminum flake in an amount between 0.01 part and 5 parts for 100 parts of total weight of pigment and metal flake.

10. A composition as specified in claim 9 in which the vehicle comprises a synthetic resinous body.

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