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METALLIC PAINT

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ABSTRACT OF THE DISCLOSURE

An improved coating composition adapted to yield a finish having an appearance and texture similar to that of a mechanically finished metal surface is provided which includes a suitable film-forming vehicle and an improved pigment. The pigment comprises finely divided non-leaving flake aluminum particles in a size distribution ranging from approximately 30 microns to approximately 200 microns; a natural or synthetic pearl simulating agent; and large, inert particles of silica gel, all of which are distributed through the coating. A trace amount of yellow toning pigment such as burnt sienna may also be included.

This invention relates to improved finishes for metal castings and is specifically directed to an improved paint and pigment therefor which produces a bright, durable metallic finish.

At the present time, metal castings which are used as the outer housings for tools and appliances subjected to heavy duty professional use in industrial or commercial environments are frequently provided with a mechanical finish; that is, one achieved by mechanically abrading the external surface of the casting. This finish was developed as a result of a need for adequate appearance in environments where the tools or other appliances are subjected to long term wear in the presence of grease, grit, etc. and, frequently, subjected to abusive use either due to the nature of the job or due to careless handling by the operator. Given all of these conditions, the need is for a tough, durable finish which does not get dirty easily, does not easily show scratches or other abrasions and which, at least when new, is visually attractive.

The mechanical finish which has heretofore been the best available answer to these requirements is considerably more expensive than its mechanical function would require. Specifically, at least the exterior surface of the casting must be of high quality since blemishes or minor surface imperfections are not easily obscured by the mechanical finish; furthermore, the process of mechanically finishing the casting usually requires hand application of each individual casting to a rotating wire brush. Especially in this case, but also in other forms of mechanical finishing, the process is expensive and time consuming and it frequently produces a relatively non-uniform appearance. For example, it is obviously difficult to maneuver a complex casting so that all of the recesses, sloped and curved surfaces, etc. which may be clearly visible to an observer are subjected to the same amount of abrading by a wire brush as are received by the flat, broad area major surface portions of the casting.

Previous attempts have been made to produce a chemical coating which would adequately approximate the desired characteristics of mechanical finishes. However,

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these previous attempts have not been successful, largely because the coatings which can compete in cost with the mechanical finish have not been sufficiently durable. Another reason for this failure lies in the fact that professional users of devices such as portable power tools have learned to accept the mechanical finish as a standard and, especially because of the many failures of substitute finishes, are reluctant to accept new substitutes which are too obviously different from the mechanical finish to which they are accustomed. It is widely felt among such users that painted finishes will never be adequate to function in an industrial or commercial environment because they scratch easily and wear off and because the gloss of a painted finish quickly reveals abrasions and accumulated dirt. In fact, it is accepted practice in this industry to use the mechanically finished casting only on professional tools and to provide a painted surface only on tools intended for relatively light duty. This distinction is well known to the users of professional tools and they, accordingly, avoid painted tools.

In order to provide a chemical coating which can be used on tools for the professional market, therefore, it is necessary to accomplish two objectives. First, the coating must be at least as good in a functional sense as the mechanical finish and second, its appearance must be sufficiently close to that of the mechanically finished metal so that it is not rejected without being tried by the professional user. No previous chemical coating has met these objectives.

Accordingly, it is an object of this invention to provide a new and improved chemical coating for metallic castings.

It is a further object of this invention to provide a chemical finish which approximates the characteristics of a mechanically finished metal casting and which preserves a substantially new appearance for a longer period of time than mechanical finishes.

It is also an object of this invention to provide a chemical finish for metal castings which possesses similar functional characteristics to those of mechanical finishes but which is less expensive.

Another object of this invention is the provision of an improved covering which simulates the brightness, color and textural characteristics of mechanically finished metal.

Another object of this invention is the provision of an improved method of finishing metallic castings.

It is also an object of this invention to provide an improved pigment for use in a clear film-forming vehicle which produces brightness, color and textural characteristics in the film which are similar to those of wire-brushed aluminum.

Further objects and advantages of this invention will become apparent as the description and illustration thereof proceed.

Briefly, in accord with one embodiment of this invention, an improved coating composition adapted to yield a finish having an appearance and texture similar to that of a mechanically finished metal surface is provided which includes a suitable film-forming vehicle and an improved pigment. In accord with this invention, the pigment comprises finely divided non-leaving flake aluminum particles in a size distribution ranging from approximately 30 microns to approximately 200 microns; a natural or synthetic pearl simulating agent; and inert particles of silica gel, all of which are distributed through the coat-

ing. A trace amount of yellow toning pigment such as burnt sienna may also be included.

Previous attempts to produce a finishing composition of the type described above have failed for a number of reasons. One difficulty has been that of producing the reflectivity or brightness under incident light from any angle which is characteristic of mechanically finished metal such as wire brushed aluminum castings. Large aluminum particles can provide such reflectivity, but previously, such particles in a one-coat system produced a sandpaper-like texture which is not acceptable, particularly in the instance of castings which must be handled such as those for portable power tools. This textural characteristic has limited the maximum size of aluminum particles which could be used to a range which does not provide reflectivity but which only produces a gray color. Another difficulty in the provision of a suitable pigment is that of providing a light or whitish cast to the gray tone produced by small aluminum particles. The requirement that sufficient small aluminum particles be used to make the coating opaque and thus cover the underlying casting has also produced a darker tone of gray than that characteristic of wire brushed aluminum or other mechanically finished castings.

In addition to these difficulties in simulating the appearance of the brushed metal, it has not previously been possible to produce the textural characteristic of brushed metal.

In accord with the present invention, these difficulties are overcome by a unique combination of ingredients which produces a finish very similar to that of mechanically finished castings, in color, brightness and texture or "feel." In addition to reproducing these characteristics of mechanical finishes, it has also been discovered that this finish enables a substantial reduction in the cost of the casting since the composition which produces these characteristics also serves to obscure or hide surface blemishes or minor imperfections such as grinding wheel marks, small pock marks, etc. Finally, this coating has been found unexpectedly to be substantially more durable in appearance than mechanically finished castings.

In general terms, the composition which accomplishes these objectives includes first, a suitable film forming vehicle and second, an improved pigment combination. Any of the conventional transparent film-forming vehicles may be provided such as a chemically reactive or heat reactive vehicle, a nitrocellulose lacquer, or an acrylic alkyd. Of course, suitable solvents and/or diluents for the respective vehicle selected would be used. As a specific example, one vehicle which has been used is a heat reactive vehicle such as 72% soya alkyd and 28% Melamine. The solvent for this vehicle may comprise 90% aromatic hydrocarbon such as Xylol and Toluol combined with 10% butyl alcohol. In the wet state, the solvent is about 48% by weight of the enamel, the vehicle is about 40.5% by weight of the enamel and the pigment combination, described below, is about 11.5% by weight of the enamel.

The improved pigment in accord with the present invention includes, as a basic coloring and reflectivity agent, finely divided particles of non-leafing aluminum. The quantity of aluminum present is preferably from 15 to 30% by weight of the pigment. In accord with a specific novel feature of this invention, the particles of aluminum feature of this invention, the particles of aluminum range in size from approximately 30 microns to approximately 200 microns. The size distribution is such that the smaller aluminum particles provide an opaque, generally gray color while the larger particles provide reflectivity under both high and low angle incident light which is similar to that of mechanically finished metal. As a specific example, the material sold under the trade name Silvar 02 Non-leafing Aluminum, manufactured by the Silberline Manufacturing Company is suitable.

The exact size distribution of these aluminum particles is not critical. Generally, sufficient small particles should be included to produce the desired metallic gray appearance and to make the film opaque; at the same time, sufficient larger particles must be provided so as to produce the desired reflectivity. As a specific example, the following distribution, which is that of the Silvar 02, is suitable (the stated percentages are by weight of the total weight of aluminum): 6% is between 140 mesh and 100 mesh (105 to 149 microns); 30% is between 325 mesh and 140 mesh (44 to 105 microns); and 64% is between 400 mesh and 325 mesh (37 to 44 microns). Obviously, other distributions could be used which also would provide a quantity of glittering highlights in a gray background. It is preferred that at least 4% of the particles be above the 100 micron level to adequately approach the glitter of a mechanically finished metal. Particles above 200 microns produce too rough a surface.

The second ingredient in the novel pigment combination of this invention is a finely divided amorphous silica gel, preferably present in an amount ranging between 8 and 14% by weight. Among the significant characteristics of these particles are that they be inert in the film forming vehicle and solvents used, that they not significantly affect the metallic appearance provided by the rest of the pigment, that they remain substantially uniformly dispersed in the vehicle during and after application and that they be of suitable size to have a smoothing effect and reduce the roughness produced by the large aluminum particles. Specifically they must not dissolve, break up or swell in the enamel as is characteristic of previously used flattening agents. As a specific example, the silica gel manufactured and sold under the trade name Syloid 620 by the Davison Chemical Division of W. R. Grace & Company is suitable.

The function of these particles of silica is of particular importance in this combination. Although siliceous materials have previously been used as colloidal flattening agents to reduce gloss, it has not previously been realized that substantially larger, inert particles can be used for a different function. Specifically, the particles used in the practice of this invention should be at least 10 microns in diameter and preferably about 20 microns in diameter. The function of these particles is to remain inert and mechanically suspended rather than becoming a colloidal solution. This produces a smoothly roughened or "pebbled" texture on the surface and, more significantly, smooths out the sharpness which would otherwise be produced by the large size aluminum flakes described previously. Thus, the presence of the silica particles simultaneously provides the desired texture and permits the use of the large aluminum particles which are needed for reflectivity.

The pigment combination of this invention also includes approximately 30 to 80% by weight of the pigment of a pearl simulating agent which serves to add a milky-white tone to the gray color of the aluminum and to brighten its appearance. The agent used may comprise any of the known pearlescent compositions such as the natural extract from fish scales or the synthetic substitutes therefor such as crystallized mercuric chloride. As a specific, preferred example, the agent manufactured and sold under the trade name Pearl Affair NF-104-D by E. I. du Pont de Nemours and Company is suitable. This material comprises 30-40 micron platelets of mica coated with titanium dioxide. It functions to whiten the gray of the aluminum and may add a very light iridescent tone.

Finally, it is preferable to add a very small quantity of a yellowing toner such as burnt sienna to provide a slightly warmer tone. In fact, wire brushed aluminum has a very slight yellow tint and this is best achieved by adding about 0.05% by weight of the total pigment of burnt sienna. This quantity could vary between 0.01% and 0.1% depending on the appearance desired. In the examples and

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claims, this range is referred to as a trace amount. Of course, these paints may also include very small percentages of slip agents, anti-settling agents, stabilizers or other conventional additives which contribute to practical storage and application of a production coating.

In functional terms, the above described pigment combination in a suitable film has been found to provide all of the desired characteristics previously described. Specifically, a metallic coloration is provided by the combination of small aluminum particles and the pearl simulating agent. It is noted that pearl simulating agents have only a very weak effect on the color and therefore, it is necessary to use the relatively large percentage previously mentioned. Generally, combinations of these ingredients within the indicated ranges provide the warm whitish gray appearance characteristic of mechanically finished metal such as aluminum.

At the same time, the use of the large aluminum particles produces the points of high reflectivity to light of both high and low angle of incidence which are characteristic of mechanically finished metal. The pearl simulating agent also contributes to the brightness of the finish.

The inclusion of an inert material such as the silica gel serves a number of purposes. First, this material fills the interstitial spaces between the large aluminum particles and thus smooths the rough texture which would otherwise be characteristic of a coating including these particles. Secondly, the combination of particles in the mentioned percentages and sizes produces a surface having a feel very similar to the textured feel of a mechanically finished casting. Finally, this combination of particles including the silica produces a textured appearance which is similar to that of the mechanically finished casting.

The net effect of the use of this pigment combination in a suitable film is to produce a finish similar to mechanically finished castings; in fact, the appearance is so similar that many users cannot recognize it as a painted or chemical finish. In a comparison performed by a Neotec colorimeter, Colormate 2000 series, model 602D, a sample of a painted finish in accord with this invention was found to be within a class 1 color tolerance match in side-by-side comparison with a wire-brushed aluminum casting. In another comparison, 50X photomicrographs of such samples were visually indistinguishable.

Furthermore, the finish has been found to be substantially improved over a mechanical finish in several functional respects. It has been found that this finish is more durable in appearance than mechanical finishes since it is more resistant to light mechanical abrasion and scuffing. While the reason for this is not completely understood, it may be due to a cushioning effect provided by the use of the large silica gel particles and the mica flakes; in any event, tools with this finish maintain a substantially improved appearance as compared to mechanically finished tools in similar uses. Also of added importance is the fact that the chemical finish is not subject to oxidation as is a mechanically finished casting and thus it preserves a uniform appearance and does not become mottled or discolored due to aging or handling. Finally, the textured feel provides a non-slip surface which is of substantial benefit to the user.

It is noted that the coating of this invention provides a single coat finish over bare metal which can be applied by any of the several conventional application methods and either air dried or baked, depending on the film-forming vehicle selected. A particular feature of this composition is that the various ingredients of the pigment remain substantially uniformly dispersed throughout the vehicle during spraying and drying, thus producing uniform properties in the final finish. It will be recognized by those skilled in the art that modifications of the type and relative quantity of the vehicle and solvents may be made as required to accommodate the liquid paint to a particular

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form of application. The novelty of this invention lies primarily in the unique pigment combination and secondarily in the provision of a sprayable, one coat finish.

The specific examples set forth below illustrate the practice of this invention in a number of applications; however, it is not meant to limit the scope of this invention to the specific compositions set forth therein.

EXAMPLE 1

A baking enamel is prepared by mixing the following components:

	Percent by wt. of total
Vehicle.....	40.4
Soya alkyd.....	72
Melamine.....	28
Solvent.....	48.1
Xylol.....	90
Butyl alcohol.....	10
Pigment.....	11.5
Non-leafing aluminum flakes, random size, 30-200 microns.....	23.8
Mica platelets coated with titanium dioxide.....	64.8
Silica gel particles, approximately 20 microns.....	11.4
Burnt sienna.....	Trace

This paint is applied by spraying in a ransburgh electrostatic unit and is cured by baking for fifteen minutes at 275° F. This paint has an appearance and texture similar to that of a mechanically finished aluminum casting and maintains its appearance characteristic for a longer time than the mechanically finished casting.

EXAMPLE 2

A paint having the following composition is prepared:

	Percent by wt. of total
Vehicle.....	40.4
Soya alkyd.....	72
Melamine.....	28
Solvent.....	48.1
Xylol.....	90
Butyl alcohol.....	10
Pigment.....	11.5
Non-leafing aluminum flakes, random size, 30-200 microns.....	23.8
Mica platelets coated with titanium dioxide.....	64.8
Silica gel particles, approximately 20 microns.....	14.4
Burnt sienna.....	Trace

This paint is applied and dried in a manner similar to that indicated in Example 1. The appearance of the finished article is similar to that stated in Example 1 except that the overall appearance is not as bright as the normal appearance of a mechanically finished casting due to the slight excess of silica particles.

EXAMPLE 3

An air drying paint is prepared by mixing the following ingredients:

	Percent by weight of total
Vehicle.....	32.9
Styrenated alkyd.....	100
Solvent.....	56.4
Conventional aromatic solvents.....	100
Pigment.....	10.7
Non-leafing aluminum flakes, random size, 30-200 microns.....	23.8
Mica platelets coated with titanium dioxide.....	64.8
Silica gel particles, approximately 20 microns.....	11.4
Burnt sienna.....	Trace

This paint is applied by spraying to a metallic casting and exposed to air at room temperature until dried. The resultant article has an appearance similar to that described in the case of Example 1 and a similar texture. The durability of the appearance of this article is somewhat less than that of the paint stated in Example 1 but is still improved over that of conventional mechanical finishes.

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EXAMPLE 4

A paint is prepared by mixing the following ingredients:

	Percent by weight of total
Vehicle.....	40.4
Soya alkyl.....	72
Melamine.....	28
Solvent.....	48.1
Xylol.....	90
Butyl alcohol.....	10
Pigment.....	11.5
Non-leafing aluminum flakes, random size, 30-200 microns.....	17
Mica platelets coated with titanium dioxide.....	71
Silica gel particles, approximately 20 microns.....	12
Burnt sienna.....	Trace

This paint, when applied by spraying to a metallic casting and dried by baking for fifteen minutes at 275° F., has a similar appearance and texture to that stated in Example 1 except that the tone of the color is slightly lighter and the number of points of higher reflectivity is somewhat reduced.

As previously noted, these examples are not intended to limit the scope of this invention to the specific details set forth. For example, it has been determined that the amount of random sized non-leafing aluminum flake can vary between 15% and 30% by weight of the pigment combination; the pearl simulating agent can vary between 30% and 80%; and the inert particles can vary between 8% and 14%. The relative quantities of these elements selected in any given combination will depend on the precise appearance and texture desired. However, it will be found that, as the quantities used go beyond the noted limiting percentages, that the difference in texture or appearance between the painted article and a mechanically finish casting become excessive.

It will be apparent to those skilled in the art that many variations of the stated compositions can be made within the ranges set forth without departing from the objective of providing the above described finish. Accordingly, it is intended that the appended claims cover all such variations as come within the true spirit and scope of the invention.

We claim:

1. A coating composition adapted to yield a finish of high durability and having an appearance and texture similar to that of a mechanically finished metal surface comprising a polymeric film-forming vehicle and a pigment, said pigment consisting essentially of:

- from 15% to 30% by weight finely divided non-leafing aluminum particles, said particles being present in sizes ranging from approximately 30 microns to approximately 200 microns;
- from 30% to 80% by weight particles of a pearl-simulating agent for whitening the finish; and
- from 8% to 15% by weight particles of silica gel, said particles having an average diameter of at least 10 microns wherein said pigment is present in an amount sufficient to simulate the appearance of mechanically finished metal.

2. The coating composition claimed in claim 1 wherein said pigment also includes a trace amount of yellow toner.

3. The coating composition claimed in claim 2 wherein said toner comprises burnt sienna.

4. The coating composition claimed in claim 1 wherein said silica gel particles are sufficient in size and number to reduce the surface sharpness produced by said large particles of aluminum.

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5. The coating composition claimed in claim 1 wherein said particles of silica gel are not less than 10 microns in average diameter.

6. The coating composition claimed in claim 1 wherein said silica gel particles are present in an amount between 8% and 14% of said pigment and wherein the size of said silica gel particles is on the order of 20 microns.

7. The composition claimed in claim 1 wherein at least 4% of said aluminum particles are greater than 100 microns in size.

8. The coating composition claimed in claim 7 wherein the size distribution of said aluminum particles on a percent by weight basis is in accord with the following schedule: at least 4% is greater than 105 microns; at least 25% is between 44 microns and 105 microns; and at least 50% is less than 44 microns.

9. The composition claimed in claim 1 wherein said pearl simulating agent comprises platelets of mica coated with titanium dioxide.

10. The coating composition claimed in claim 9 wherein the major dimension of said mica platelets is on the order of 30 to 40 microns.

11. The coating composition claimed in claim 1 wherein sufficient pearl simulating agent is included in said pigment so as to produce a noticeably white tone in the resultant coating.

12. The coating composition claimed in claim 1 wherein the size of said silica gel particles is on the order of 20 microns whereby the sharpness produced by said aluminum flakes is smoothed and a textured surface results upon the application of said coating composition to a surface.

13. The coating composition claimed in claim 1 wherein at least 4% of said aluminum particles are greater than 100 microns in their major dimension.

14. The coating composition claimed in claim 1 wherein said pearl simulating agent produces a whitening effect in the color of the resultant composition; wherein sufficient large aluminum flakes having a major dimension greater than 100 microns are included to produce a glittering appearance due to the reflectivity of said large particles; and wherein said silica gel particles are of sufficient size to smooth the sharpness caused by said large aluminum particles whereby, upon application of said coating composition to a surface, an appearance and texture similar to a mechanically finished metal casting is produced.

15. The coating composition claimed in claim 14 wherein said pigment further comprises a trace amount of yellow toner.

16. A decorative coating for a metal surface comprising a substantially clear polymeric film having a pigment substantially uniformly distributed therein, said pigment consisting essentially of:

- from 15% to 30% by weight finely divided flake aluminum particles, said particles being present in sizes ranging from approximately 30 microns to approximately 200 microns;
- from 30% to 80% by weight particles of a pearl-simulating agent for whitening the appearance of said coating; and
- from 8% to 15% by weight particles of silica gel, said particles having an average diameter of at least 10 microns wherein said pigment is present in an amount sufficient to simulate the appearance of mechanically finished metal.

17. A decorative covering as claimed in claim 16 wherein at least a sufficient quantity of a small aluminum particles having a major dimension less than 100 microns are included so as to provide a generally gray color; at least a sufficient quantity of large aluminum particles are included to provide a visible number of points of high reflectivity to all angles of incident light;

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at least a sufficient quantity of said pearl simulating agent is included to whiten the gray color provided by said small aluminum particles; and

at least a sufficient quantity of said silica gel particles are provided having a sufficient size to produce a smoothly textured surface.

18. A decorative covering as claimed in claim 17 wherein said covering further comprises a trace amount of yellow toner.

19. A decorative coating composition for a metal casting having visible marks on the surface thereof, said coating presenting a discontinuous surface and appearance for masking said marks, said coating comprising a transparent polymeric film-forming vehicle and a pigment, said pigment consisting essentially of:

(a) from 15% to 30% by weight finely divided non-leaving aluminum particles, said particles being present in sizes ranging from approximately 30 microns to approximately 200 microns;

(b) from 30% to 80% by weight particles of a pearl-simulating agent; and

(c) from 8% to 14% by weight particles of silica gel, said particles having an average diameter of at least 10 microns wherein said pigment is present in an amount sufficient to simulate the appearance of a mechanically finished metal.

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References Cited

UNITED STATES PATENTS

3,300,428	1/1967	Schmidt	260—29.4
3,234,038	2/1966	Stephens	117—71
3,453,127	7/1969	Marotta et al.	106—192
3,455,826	7/1969	Teicher et al.	252—28
3,087,827	4/1963	Klenke et al.	106—291
3,372,047	3/1968	Linton	106—291
3,356,515	12/1967	McGlothlin	106—84
3,264,129	8/1966	Rolles	106—290
3,087,828	4/1963	Linton	106—291

OTHER REFERENCES

Formulation of Organic Coating, Gaynes, pp. 43—44, USPO Grp. 140.

Organic Coating Technology, Payne, pp. 1218—1222, Grp. 140.

Technical Bulletin, Cyloid Flatting Agents supplied by applicant as prior art.

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