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HEAT-RESISTANT COATING COMPOSITION

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This invention relates to a protective finish for metals and, more particularly, to an improved finish for objects made of ferrous metals and alloys that are subjected to high temperatures.

Ordinarily, the mufflers and exhaust pipes of passenger cars, trucks, and the like are painted with an organic coating composition which serves as a temporary decorative and protective finish until the parts are used. When such parts are placed in service, however, the finish soon becomes charred and blistered due to the high temperatures (500–1000° F.) encountered. Furthermore, some of the by-products of combustion of motor fuel are acidic in character and attack the finish, with a resulting corrosion. Consequently, these parts are among the first to fail by rusting or corrosion and require early replacement.

The principal object of this invention is to provide an improved heat resistant aluminum finish which will withstand temperatures up to 1000° F. without the failure by charring, flaking, blistering, peeling, discoloration, or embrittlement which is characteristic of prior coating compositions.

Another object is to provide an improved finish for metal articles, such as automotive mufflers and exhaust pipes, which will withstand chemical corrosion incident to the acidic by-products of combustion of motor fuels, and thus prolong their useful life.

A further object of the invention is to provide a decorative and protective finish for metal surfaces normally subjected to exhaust gases, flame, and high temperatures, which can be easily applied to a fabricated article by brushing, spraying, or dipping.

Other objects will be apparent as the description proceeds.

These objects are accomplished in accordance with the present invention by preparing a coating composition comprising a resinous vehicle composed of non-oxidizable organic ingredients, fine aluminum particles, and a particular metal drier solution of the type normally used to promote oxidation of drying oils.

Even though my composition contains no drying oils or oxidizable resins, the drier solution is added to provide a quantity of metal which will be reduced by the organic matter in the com-

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position at the elevated temperature encountered. When reduced, this metal becomes fused with the aluminum pigment particles on the coated surface, and produces a decorative and protective coating that is resistant to heat, rust, and corrosion.

This invention is illustrated by the following example:

Example

	Per cent
Coumarone-indene resin	13.3
Tricresyl phosphate	13.3
Ethyl cellulose (10 centipoises)	6.7
Xylol	43.3
Aluminum paste	10.0
Lead naphthenate (30% metallic lead)	13.4
	100.0

The coumarone-indene resin used was Neville Resin Company's "Nevinol," which is a non-oxidizable polymer having the consistency of a viscous liquid and distilling entirely at 572–698° F.

The coumarone-indene resin and the tricresyl phosphate were first charged into an ordinary varnish kettle and heated to approximately 325° F. The ethyl cellulose was then added with continued heating until a temperature of about 375° F. was obtained. The mixture was agitated to uniformly disperse the resulting molten ethyl cellulose. Xylol was then added with stirring and the batch was allowed to cool to room temperature. The liquid product thus obtained was poured slowly into the aluminum paste and agitated until the aluminum particles were thoroughly dispersed. The lead naphthenate was then added with additional stirring.

The coating composition thus formed was brushed out on a steel panel and baked for one-half hour at 400° F. It was then subjected to a temperature of approximately 1000° F. for a period of four hours. After this severe test, there was no charring, flaking, blistering, peeling, discoloration, or embrittlement of the finish.

In a 40-day laboratory test, steel panels finished with this coating successfully withstood corrosive fumes of the type encountered in the exhaust from combustion motors, such as weak concentrations of hydrobromic acid or sulphuric acid fumes.

The composition of the above example may be made suitable for dip or spray coating by adding solvent, such as xylol.

As shown in the above example, best results are obtained when the aluminum pigment is introduced into the composition in paste form, such as a paste containing 66% aluminum pigment and 34% mineral spirits.

However, an equivalent amount of dry aluminum pigment particles may be dispersed in the lead naphthenate solution alone and then added to the non-oxidizing vehicle. The finish obtained with a coating composition thus produced has a comparable heat resistance to that obtained with the aluminum is introduced in paste form. Alternatively, the dry aluminum flakes may be dispersed directly in the non-oxidizing vehicle with favorable results.

It has been found that, when aluminum pigment (in paste or dry form) is dispersed in the lead naphthenate solution and the non-oxidizing vehicle omitted, a finish of comparable heat resistance is obtained, but such finish is relatively soft and easily marred even after a bake of four hours at 400° F., and is also relatively deficient in leafing and application properties.

Where desired, the coumarone-indene resin and ethyl cellulose disclosed in the above example may be replaced by other non-oxidizable ingredients, such as cellulose acetate.

I have found that while lead naphthenate is suitable for the stated purpose, copper, iron, manganese, cobalt, or zinc naphthenates do not work. Furthermore, my tests have shown that blistering is encountered with heating to 700–800° F. if the lead is introduced in the form of resinate or oleate, or combinations of these.

It is preferable to use a highly concentrated lead naphthenate solution, such as a 30% solution. The quantity used should be such that the final coating composition will contain from 1 to 5 parts of lead to 8 parts of aluminum, although best results are obtained when the ratio is from 2:8 to about 5:8.

On air-drying, the finish loses most of its tackiness in a few hours, but remains soft and easily marred for several days. Therefore, it is preferred to force-dry the finish at temperatures of 350° F. or more; for example, a baking schedule equivalent to one-half hour at 400° F. However, baking at higher temperatures than 350–400° F., or for longer periods of time, does not embrittle the finish or impair its adhesion to the substrate. Baking produces a uniform silver-like coating as it causes a rearrangement, or "leafing," of the aluminum particles, and brush marks and other film imperfections, such as runs or sags, become obliterated. A wet film applied to an article, such as the metal smoke stack of a furnace, produces a coating of the same order of hardness and appearance as that described above as soon as it becomes heated in use.

My improved finish will withstand several hours heating at 1000° F. (a temperature at which sheet metal normally glows orange-red) without charring, flaking, blistering, peeling, discoloration, or embrittlement.

The superior heat and flame resistance of my new coatings over conventional coating compositions containing oxidizable oils or resins, is readily apparent when it is recalled that the time-honored method of removing dried ordinary paint film consists of passing a blow torch flame rapidly over the surface and scraping off the blistered film. A temperature as high as 800° F. is rarely encountered during such a process. My heat resistant composition is relatively unaffected by such flame treatment or even when subjected to higher temperatures.

After the metal of the lead naphthenate solution and the aluminum become fused together, and are in effect plated onto the substrate, the coating cannot be scratched off like a conventional paint film, and the article has the appearance of an aluminum part.

The coating compositions of this invention are highly useful in the decoration and protection of metal which is to be subjected to temperatures of up to about 1000° F., or when it is desired to simulate an aluminum appearance, rather than a black or gray iron appearance, by the application of a paint coating. Because of their resistance to weak concentrations of corrosive acid fumes, the coating compositions of this invention may also be applied as a matter of economy to ordinary iron and steel surfaces where more expensive alloys are now required. Specifically, this coating composition has a definite improvement in heat resistance compared to conventional paints now applied to tail pipes, stoves, furnaces, exhaust stacks, smoke pipes, and like objects, which are subjected to temperatures of 600° F. and over for extended periods, or even to such high temperatures as to cause them to glow.

An additional, unexpected and novel use for the coating compositions of this invention has been found on certain aircraft wing and fuselage surfaces where former finishes were readily discolored or burned off by the hot exhaust from the motors. The product of this invention was applied to these areas on an airplane and was found to be undamaged after six months' use.

The coating compositions of this invention will withstand higher temperatures, or the same elevated temperature for a longer time, without charring, flaking, blistering, peeling, discoloration, or embrittlement, than any heretofore existing aluminum organic coating composition. Most heat resistant paints available today are intended for applications where temperatures do not exceed 800° F. Heated side by side with the product of this invention, the film of the best prior art heat-resistant paint blistered, caught fire, and finally charred, whereas the coating composition embodying this invention was unaffected.

It is apparent that many different embodiments of this invention may be made without departing from the spirit and scope thereof; and, therefore, it is not intended to be limited except as indicated in the appended claims.

I claim:

1. A heat resistant coating composition, comprising a non-oxidizable coumarone-indene resin which is a viscous liquid distilling entirely at 572–698° F., a plasticizer, ethyl cellulose, xylol, and a substantial amount of aluminum pigment and lead naphthenate, the ratio of metal in the lead naphthenate to aluminum pigment being from 1:8 to 5:8.

2. A heat resistant coating composition, comprising by weight 13.3% of a non-oxidizable coumarone-indene resin which is a viscous liquid distilling entirely at 572–698° F., 13.3% tricresyl phosphate, 6.7% ethyl cellulose, 43.3% xylol, 10% aluminum paste containing 66% aluminum, and 13.4% lead naphthenate solution containing 30% lead.

3. A heat resistant coating composition comprising aluminum pigment and lead naphthenate

in substantial amount, and a non-oxidizable resinous vehicle selected from the group consisting of (*a*) non-oxidizable coumarone-indene resin which is a viscous liquid distilling entirely at 572–698° F. and ethyl cellulose, and (*b*) cellulose acetate, the ratio of metal in the lead naphthenate to aluminum pigment being from 1:8 to 5:8.

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