Vinyl Resins

Mr. G. L. VanLenten

Mr. R. C. Lyon

May 21, 1957

MIL-C-15328-A
(WP-1)

Gentlemen:

I have two requests from you gentlemen. Perhaps the information given below will be adequate for answering the questions that have been raised.

The total composition of this mixture is such that it may act as a skin irritant in some individuals. It should be handled in such a manner as to avoid prolonged and repeated contact of the skin with the same. As used it is a mild acid and the alcohols contained would have a drying effect on the skin. There is nothing contained in this formulation which would be expected to act as an active skin sensitizer. It is impossible to state that most any common material might not act on some individual as a sensitizer. As an example, wheat flour causes skin sensitizations among some bakers.

In respect to the Bakelite vinyl resin XYHL itself which is in this formulation, it is extremely inert physiologically and would not act as a skin irritant or be expected to be a skin sensitizer.

Very truly yours,

MEDICAL DIRECTOR

Thomas W. Hale, M. D.
rs

Mr. G. L. VanLenten

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Very truly yours,

MEDICAL DIRECTOR

Thomas W. Nale, M. D.
rs

Date 5/13 1957 To Mr. G. L. Vantenton

Location 720 80 East 42nd

R. C. Lyon Co. #11-X

The attached papers are referred to you for the purpose checked:

.....As per phone conversation.	.....Please note and return.
.....For approval, please.	.....Please note and forward to next person listed.
.....For your information and file.	.....Would like to discuss with you.
.....Please follow up.	.....Your comments, please.

REMARKS

Please give me the composition of WP-1 Wash Primer. I do not have such information

Please note report attached

Signed by: Thomas Neal

Form LAP 1213-R-C
Revised 3-1-41

UCC
063315

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FOR INTERNAL CORRESPONDENCE

BAKELITE COMPANY

UCC

30 EAST 42nd STREET, NEW YORK 17, NEW YORK

To (Name) Dr. T. W. Nale
Company Industrial Toxicology Dept.
Location Lincoln Building
Room 920

Date May 10, 1957

Originating Dept. Sales

Answering letter date

Copy to Mr. R. D. Swain

Subject Gilman Paint and Varnish Co.
Chatanooga, Tennessee
Att: Mr. R. C. Adams

Dear Dr. Nale:

The subject company has requested that we advise them of the toxilogical effects or properties of WP-1 Wash Primer. Mr. Adams of the subject company has advised that one of his customer's employees had gotten a rash while using WP-1. This is the first time his customer has used it and the customer's employees do not want to work with it. I pointed out that the individual may have an allergy and also that he might not have been as cautious with acid as he should have.

We would appreciate your advising Mr. Adams of your comments or recommendations.

Very truly yours,

George VanLenten

GLV:bm

G. L. VanLenten

RECEIVED

MAY 13 1957

INDUSTRIAL MEDICINE & TOXICOLOGY DEPARTMENT

UCC
063316

VINYLS

These resins offer a combination of properties for formulating primers and finishes having good toughness and adhesion, moisture-, salt spray-, chemical-, and solvent-resistance

By
W. H. McKnight*

W. H. McKnight

VINYL resins for surface coatings present a unique combination of properties which make them particularly adaptable for many applications. Coatings based on Bakelite vinyl chloride-acetate resins are easily applied by spraying, roll-coating, dipping, or brushing. These finishes have excellent toughness and flexibility. Metal sheets coated with a properly formulated and applied vinyl resin coating can be drawn, spun, crimped, or otherwise fabricated without loss of adhesion and without marring or cracking the finish. These resins are characterized by extreme chemical inertness. Properly formulated films are not attacked at normal temperatures by practically any strength of alkalies or mineral acids. They are completely insoluble in alcohols. Greases, oils, and aliphatic hydrocarbons do not dissolve them. They dissolve only in organic liquids such as ketones, esters, chlorinated hydrocarbons, and certain special solvents.

Some of the more important vinyl resin-based formulations, together with their properties and recommended uses, are included in this article. These vinyl resin-based coatings have been classified as:

(1) primers,

(2) intermediate or finish coats.

*W. H. McKnight is Fellow, Bakelite Fellowship, Mellon Institute, Pittsburgh, Pa.

Primers

Baking Primers

The most widely used general-purpose baking primers in the vinyl solution coatings field are the blue lead-resin VYHH primers. These primers can be formulated to give films with varying degrees of flexibility. Two examples of such formulations are represented by the following:

Basic blue lead sulfate	29.0	31.3
Bakelite vinyl resin VYHH	11.9	13.0
Flexol plasticizer DOP	2.2	3.4
Thinner Mixture*	56.9	52.3
Parts by weight	100.0	100.0

*40 per cent methyl isobutyl ketone
10 per cent ethyl butyl ketone
40 per cent toluene
10 per cent xylene

The above primers, as with most high gloss (or high-quality-type) vinyl coatings, are prepared by dispersing the pigment in a portion of the resin and plasticizer on a two-roll rubber-type mill or the equivalent. The "stock" or "chips" obtained are dissolved in solvent to form a paste which is then cut back with the balance of the vinyl resin solution to adjust the pigment-vehicle ratio. These primers require baking for ½ hour at 350 to 375 deg. F. to develop their excellent adhesion to smooth, clean steel. Either air-dry or baked finishes based on any of the vinyl chloride-vinyl acetate copolymer resins can be applied over these primers.

The proportion of stabilizing pigment can be decreased, and film strength and impermeability correspondingly increased, for use where milder baking conditions suffice, or where the type surface is sufficiently neutral in accelerating thermal degradation of the resin. Thus, over light gage tin plate, terne plate, or phosphate-treated steel the pigment/resin ratio can be lowered to 20 to 25/15, and baking time can be 15 to 20 minutes at 350 to 375 deg. F.

Since the dark color of the blue lead primer is sometimes difficult to maak, a light-colored primer of practically the same quality can be formulated as follows:

	XE-703
Basic white lead sulfate	15.8
Titanium dioxide rutile	6.6
Antimony oxide	0.7
Bakelite vinyl resin VYHH	14.7
Flexol plasticizer DOP	5.0
Thinner mixture*	57.2
Parts by weight	100.0

*40 per cent methyl isobutyl ketone
10 per cent ethyl butyl ketone
40 per cent toluene
10 per cent xylene

This primer is handled in the same manner as the two above. It should be baked for ½ hour at 350 to 365 deg. F. for best results.

Wash Primer

For complete air-dry systems, the metal conditioner or wash-coat type primers based on vinyl butyral resin XYHL give the best adhesion and general performance over clean, smooth steel in all laboratory tests. The three vinyl butyral resin primer formulas most generally recommended are given in Table I.

The base grinds (Table I) are prepared in a pebble mill using flint pebbles, to avoid iron contamination. The Government Specification MIL-C-15328-A base grind must be mixed with acid diluent just before use. This formulation deteriorates rapidly, and approximately eight hours after mixing, the coating has very poor ad-

hesion to metal. The other two base grinds may be mixed with acid diluent immediately and stored for at least one year without evidence of deterioration.

All of these primers show excellent performance, but there are some preferences for certain uses. WP-1 is the best overall metal conditioner for all types of metals, and for all service involving salt water exposure. The XE-5220 formulation should be used only on steel, and has shown excellent durability in industrial maintenance painting, especially when used with an aluminum pigmented vinyl resin VAGH topcoat. Although this type of coating will give satisfactory service when exposed to salt water, it is usually recommended for fresh water applications. In addition, XE-5220 films are not heat-stable at temperatures above 250 deg. F.

Formula Suggestion XE-5298 is a comparatively new formulation, which is recommended for application on steel. This one-package wash primer shows no evidence of loss of ability to adhere after up to one year of storage.

All wash primers can, of course, be used with many non-vinyl topcoats such as phenolics, alkyds, and oleoresinous paints, and will notably increase the adhesion and durability of these coatings. Of the vinyl solution coatings tested to date, only finishes based on Bakelite vinyl resin VAGH adhere to wash primers.

Base Grind	MIL-C-15328-A (WP-1)	XE-5220	XE-5298
Bakelite vinyl resin XYHL	7.2	9.0	9.0
Basic zinc chromate (low water solubility)	6.9	—	—
Lead chromate[1]	—	8.6	—
Chromic phosphate[2]	—	—	9.0
Talc[3]	1.1	1.4	1.4
Lampblack	Trace	—	—
Isopropanol (99 per cent)	48.7	53.0	54.5
N-butyl alcohol	16.1	—	—
Methyl isobutyl ketone	—	13.0	16.1
	80.0	85.0	90.0
Acid Diluent			
Phosphoric acid (85 per cent)	3.6	2.9	1.8
Water	3.2	2.9	1.8
Isopropanol (99 per cent)	13.2	9.2	6.4
	20.0	15.0	10.0
	100.0	100.0	100.0

(1) Such as "Imperial" A-548, Imperial Paper & Color Co., Glens Falls, N. Y.
(2) Such as du Pont G-727-D, E. I. du Pont de Nemours and Co., Wilmington, Del.
(3) Such as "Asbestine" 3X, International Talc 90 West St., New York, N. Y.

Table I. Three vinyl butyral resin formulations.

Low-Temperature Baking Primer

Another type of air-dry and low temperature baking primer is based upon vinyl resin VMCH. This resin is much like vinyl resin VYHH except that it contains a small proportion of strong polar groups (carboxyls) which enable it to bond tightly to clean metal and many other surfaces. Baking is not required for adhesion, but a forced-dry at temperatures up to 250 deg. F. is often used in industrial applications to speed release of solvents. Thus, since high temperature bakes are not needed, the stabilizing pigments required for the vinyl resin VYHH primers can be omitted. This is of especial interest in many metal decorating formulations.

Since vinyl resin VMCH depends for its good air-dry adhesion upon its un-neutralized carboxyl groups, care must be used to assure that these remain un-neutralized during preparation and storage. Pebble mills, using flint or ceramic pebbles, are suggested for the preparation of vinyl resin VMCH solution coatings. Containers should be tin lined or have a baked phenolic lining; the use of plain iron or steel equipment for preparing or storing solutions based on vinyl resin VMCH is not recommended. Furthermore, the inclusion of 0.1 to 0.3 per cent of propylene oxide in all solutions is a worth-while precaution. Other stabilizers may react with the carboxyl groups or otherwise interfere with adhesion, and should be selected only after careful trial. Other vinyl chloride-acetate resins can be used with vinyl resin VMCH without adverse effect on adhesion. This blending limit depends to some extent upon the specific formulation and use, but is often at least 50 per cent of the other resin, such as vinyl resin VYHH. This makes it convenient to use pigments dispersed in vinyl resin VYHH. This is the preferred practice for pigmenting VMCH coatings, because resin VMCH tends to exhibit some reactivity with certain of the more basic pigments, leading to gelation and loss of adhesion. In these cases, such as finishes containing the lead and zinc pigments, it is often desirable to use a two-package formulation, keeping the VYHH resin pigment dispersion and the VMCH resin solution apart until just before use.

In some instances, however, it is desirable to take advantage of the reactivity of vinyl resin VMCH with lead pigments to prepare baking primers which develop much improved resistance to solvents or plasticizers included in topcoats. A blue basic lead sulfate pigmented VMCH resin coating is handled as a two package system to forestall premature reaction and gelation. Many pigments, such as titanium dioxide, certain iron oxides, various inerts, and chromic phosphate show no reactivity and can be used in primer and finish coat formulations without any complications.

Representative vinyl resin VMCH primer formulations are given Table II.

Formula suggestions XE-766 and XE-5368 can be prepared entirely in a pebble mill, or the dispersion of TiO_2 for XE-766 can be made in vinyl resin VYHH on a two-roll mill. XE-771 and XE-5338 are prepared in two parts. The pigment in part A can be dispersed either by pebble mill or two-roll mill and subsequently blended with solution part B just prior to use. In XE-5338, the inclusion of high molecular weight vinyl resin VYDR makes the dried film more resistant when subsequent coats are applied and also contributes to overall film integrity.

Intermediate and Finish Coats

Three Distinct Types

The use of an intermediate coat implies that coatings of widely differing properties are being combined in a single system. The best example of this is the United States Navy ship-bottom system. In this system, three coatings are used to serve three distinct purposes. The wash primer is a metal conditioner which affords an excellent bond for subsequent coats and passivates the metal. The inter-

	XE-766	XE-771* A	XE-771* B
Titanium dioxide[1]	12.0	—	—
Basic zinc chromate[2]	—	3.8	—
Calcium carbonate[3]	—	1.3	—
Bakelite resin VMCH	8.0	—	5.0
Bakelite resin VYHH	8.0	5.0	—
Tricresyl phosphate	3.0	0.8	1.2
Methyl isobutyl ketone	34.5	19.6	21.9
Toluene	34.5	19.5	21.9
	100.0	50.0	50.0

Note: In XE-771, mix A and B just before use, to prevent gelation.

	XE-5368	XE-5338* A	XE-5338* B
Chromic phosphate[4]	16.0	—	—
Lead chromate[5]	—	5.72	—
Flexol plasticizer DOP	—	0.51	—
Tricresyl phosphate	4.0	2.40	—
Bakelite vinyl resin VMCH	16.0	—	6.72
Bakelite vinyl resin VYHH	—	1.11	—
Bakelite vinyl resin VYDR	—	5.30	—
Methyl isobutyl ketone	32.0	3.66	13.44
Toluene	32.0	—	13.44
Cyclohexanone	—	23.85	—
Methyl ethyl ketone	—	23.85	—
	100.0	66.40	33.60

*Note: Mix A and B just before use to prevent gelation.

(1) Such as "Titanox" A-168-LO, Titanium Pigment Corp., New York, N. Y.
(2) Such as du Pont Y-563-D, E. I. du Pont de Nemours Co., Wilmington, Del.
(3) Such as "Multifex" MM, Diamond Alkali Co., Cleveland, Ohio.
(4) Such as du Pont G-727-D, E. I. du Pont de Nemours and Co., Wilmington, Del.
(5) Such as Mineral Pigment M-1811, Mineral Pigments Corp., 1261 Broadway, New York, N. Y.

Table II. Primer formulations employing vinyl resin and lead pigment.

mediate, or anti-corrosive, coat acts as a moisture and corrosive salt barrier and contributes abrasion resistance and toughness to the whole system. The final, or anti-fouling, coat has none of the protective properties of the undercoats, but is intended solely to supply the poison that prevents growth of various marine organisms on the surface.

Generally speaking, in vinyl maintenance coating technology there is no need for the three distinct type of coatings used in the ship-bottom system. Very frequently, one or more coats of a finish based on vinyl resin VMCH, will do the job. However, by use of a vinyl resin VMCH primer, finish coats based on any of the copolymer resins can be applied, with resultant economies.

When a wash primer, or metal conditioner, is used, the system must consist of at least two or more separate coats. The wash primers are applied as an extremely thin film of 0.3 to 0.5 mils. This is for reasons of best performance as well as economy. Since vinyl resin VAGH is the only vinyl copolymer resin which adheres to the wash primer, the second coat must be based on this resin. For reasons of economy, subsequent coats are usually based on vinyl resin VYHH, although in some cases it may be less expensive to obtain the necessary thickness with vinyl resin VAGH based coating. The performance of topcoats based on either resin is equally good. A coating system utilizing one of the high molecular weight vinyl resins, such as resin VYDR, in the topcoat, could also be used at some sacrifice of coating solids. Such a coating based on resin VYDR shows to particular advantage where extraordinary chemical resistance is required or where the coating is subjected to temperatures above 150 deg. F. Also, it should be noted that the use of pigments or other modifiers susceptible to attack by moisture in an intermediate coat which is to be covered with a more resistant topcoat will lead to osmotic blisters.

The following, subject to the above limitations and suggestions, (Table III) are typical of formulations used for both intermediate and finish coats:

The formulas given in Table III are intended primarily for air-dry or baked maintenance systems where appearance is not of first importance. For this reason they may all be prepared in pebble mills. However, considerably better gloss and somewhat better overall durability is obtained if the finishes are prepared from two-roll mill chips or the equivalent. Aluminum pig-

	XE-5221[1]	XE-5322[2]	XE-5297[2]	XE-5295[2]	XE-5339
Bakelite vinyl resin VAGH	7.5	15.3	15.0	15.0	—
Bakelite vinyl resin VMCH	7.5	—	—	—	—
Bakelite vinyl resin VYDR	—	—	—	—	10.0
Leaded zinc oxide (35 per c nt)	—	12.4	—	—	—
Titanium dioxide/ antimony oxide (9/1)	—	2.9	11.0	—	—
Aluminum powder	6.7	—	—	—	4.0
Carbon black	—	—	0.2	—	—
Red lead (97 to 98 per cent)	—	—	—	22.0	—
Flexol plasticizer DOP	1.5	—	3.0	—	—
Tricresyl phosphate	—	3.1	—	1.5	—
Flexol plasticizer TWS	—	—	—	1.5	—
Methyl isobutyl ketone—Toluene (1:1)	76.8	66.3	70.8	60.0	—
Methyl ethyl ketone—Cyclohexanone (1:1)	—	—	—	—	86.0
	100.0	100.0	100.0	100.0	100.0

(1) Intended as a general-purpose coating to be used over either bare steel or wash primer.
(2) May be made with resin VYHH-1 when intended for use over resin VYHH-1 or resin VMCH primers, or for use as the third coat in wash primer systems.

Table III. Typical formulations used for both intermediate and finish coats.

	XE-5382	XE-5363	XE-5235
Bakelite vinyl resin VAGH	7.4	12.6	15.1
Urea-formaldehyde resin[1] (dry)	—	2.5	4.2
Alkyd resin[2] (dry)	17.9	—	—
Alkyd resin[3] (dry)	—	8.8	—
Bakelite resin BR-18774	—	0.2	3.2
Titanium dioxide/Antimony oxide (9/1)	25.7	13.9	—
Titanium dioxide	—	—	12.9
Flexol plasticizer DOP	—	1.7	1.6
*Thinner	49.0	60.3	63.0
	100.0	100.0	100.0

*20 per cent cyclohexanone or isophorone
30 per cent methyl isobutyl ketone
50 per cent Xylene

(1) Such as "Uformite" F-240, Rohm and Haas Co., The Resinous Prod. Div., Philadelphia, Pa.

(2) Such as "Duraplex" C-55X, Rohm and Haas Co., The Resinous Prod. Div., Philadelphia, Pa.

(3) "Duraplex" ND-77B, Rohm and Haas Co., The Resinous Prod. Div., Philadelphia, Pa

Table IV. Formulations of coatings employing vinyl resin blended with alkyds.

ments can be stirred in. Aluminum pastes containing mineral spirits or similar solvents are not generally satisfactory due to the precipitating action of aliphatic hydrocarbons, which results in poor adhesion. However, these pastes can be used by balancing the aliphatic thinner with more active solvents such as ketones of comparable boiling range.

Alkyd Blends

Vinyl resin VAGH can be blended with air-dry alkyd resins to formulate high gloss brushing finishes. Similar blends of resin VAGH with urea resins and epoxy materials give high gloss, heat-stable, thermosetting baking coatings. Formulas for representative coatings of these types are given in Table IV.

In the previous finishes, maximum gloss is obtained by dispersing the pigment in vinyl resin VAGH on a two-roll mill and incorporating this dispersion after dissolving it in a portion of the thinner to form a pigment paste. In the case of XE-5382, the pigment can be ground in a pebble mill with the alkyd or the alkyd-VAGH mixture. XE-5382 is intended primarily as an air-dry coating for brushing or spraying. It can be used over bare metal or any type of oleoresinous or vinyl butyral resin primer. Coatings XE-5235 and XE-5363 are for baking applications only. XE-5363 is a high gloss metal decorative type for applications such as automobile finishes and can be used over a phenolic or oleoresinous type primer-surfacer. A 45-minute bake at 250 deg. F. up to a 10-minute bake at 350 deg. F. is recommended. XE-5235 is a type used primarily for cap and closure coatings over black iron or tin plate sheet, with or without a primer or "size." It has steam process resistance superior to any unmodified vinyl coating and also has a much higher softening point. Because of this latter characteristic, sheets coated on one side and baked, can be coated on the other side, restacked and the second coat baked without marring or sticking during the operation. Baking schedules used for this type of coating usually are in the range of 5 to 15 minutes at 375 to 350 deg. F.

Organosol Finishes

In the metal decorative field, one type of vinyl finish which is just becoming recognized for its excellent abrasion resistance and general durability is the organosol metal finish. Based on vinyl resin VYNV-1, a very high molecular weight, high vinyl chloride content resin, this baking coating offers the ultimate in toughness, inertness and chemical resistance for vinyl coating materials. A typical formulation is given in Table V.

Manufacturing Procedure

Preparation of Organosol: Charge resin VYNV-1, diisobutyl ketone, diluent, and 1/3 Flexol plasticizer DOP into a pebble mill and grind until a good dispersion is obtained.

Preparation of Pigment Paste: Charge pigment, lecithin and remainder of plasticizer DOP to pebble mill and grind until a good dispersion is obtained. With some pigments, a minor amount of aromatic solvent may be required to obtain the optimum grinding consistency.

Preparation of Base Solution: Charge toluene into mixing kettle. Add resin VAGH slowly until all the resin is stirred in and thoroughly wet. Add methyl Cellosolve, with agitation. Slight heat, carefully applied, will facilitate solvation.

Preparation of Coating: Charge organosol into a mixer and add the pigment paste while agitating. When thoroughly mixed, add base solution with agitation. Pebble milling of the organosol coating will improve the smoothness of the coatings and the gloss of the film.

The inclusion of vinyl resin VAGH is necessary to prevent air-dry mud-cracking of this dispersion type coating and to promote adhesion to vinyl butyral resin wash primer. Thinning to adjust for spray viscosity must be done using a special thinner based on 15 per cent diisobutyl ketone and 85 per cent "Solvesso" #100.

This organosol metal finish can also be prepared with vinyl resin VMCH replacing vinyl VAGH. This formulation will adhere to bare steel, rather than to the wash primer, but the performance of the system under conditions of high humidity or water immersion is not as good as XDE-5197.

Organosol-type coatings require more care in both preparation and application than the solution coatings. Since

Table V. Formulation of baking organosol metal coating.

Formula	XDE-5197 Red Organosol Metal Coating Pounds	Gallons
Bakelite vinyl resin VYNV-1	20.7	1.78
Flexol plasticizer DOP	12.20	1.49
Diisobutyl ketone	7.20	1.08
High boiling diluent[1] (aromatic type)	21.70	3.01
Pigment[2]	3.50	0.22
Lecithin[3]	.05	—
Bakelite vinyl resin VAGH	5.20	0.45
Methyl Cellosolve	7.25	0.90
Toluene	21.80	3.06
Bakelite resin BR-18774	.40	.05
	100.00	12.04

(1) Such as "Solvesso" No. 100, Esso Standard Oil Co., New York, N. Y.

(2) Such as "BON" RT-565-D, E. I. du Pont de Nemours and Co., Wilmington, Del.

(3) Such as "Lecithin NS," Glidden Co. Soya Products Div., Chicago 39, Ill.

organosols are suspensions of resin particles in organic media, baking at approximately 350 deg. F. is necessary to fuse the particles into a homogeneous mass in the final film. The length of bake is dependent on the size and composition of the coated surface. Organosols normally bake to a satin finish, but a special technique can be used to obtain a high gloss if desired. In this procedure, the coating is applied and air-dried. It is then baked at a temperature of about 200 deg. F. to dry the film and partially gel the structure without fusing the particles together. At this point, the film can be sanded and polished very readily, and a high gloss developed by power-wheel buffing. After the desired smoothness and gloss is obtained, the finish is fused at 350 deg. F., hardening and toughening the coating while retaining the gloss and smoothness.

Very recently, a type of organosol metal finish which acquires gloss without buffing has been developed, based on vinyl resin VYCM. The development work on this coating indicates that the major factor governing the gloss of a pigmented organosol metal finish is the degree of dispersion at the time it is applied. Furthermore, formulations based on vinyl resin VYCM consistently give better gloss than those based on resin VYNV-1.

The suggested formulation in Table VI is a typical example of an organosol metal finish based on resin VYCM:

The pigment stock (Column A) is ground on a two-roll mill at a temperature of about 60 deg. C. Then 100 parts of the stock are cut with 80 parts of a thinner mixture, consisting of 25 per cent methyl Cellosolve solvent and 75 per cent toluene by weight, and the resultant mixture (Column B) is stirred until a smooth paste is obtained. The base organosol (Column C) is ground in a pebble mill for 72 hours, or until a uniform dispersion is obtained. The pigment paste, base organosol grind, and the other constituents (Column D) are mixed together and pebble-milled for an additional 24 hours to achieve the ultimate composition (Column E).

The coating, as formulated, is applied by spraying over metal primed with wash primer WP-1. After an air-dry of about 10 minutes, the coating is forced-dried for 10 minutes at 200 deg. F., and finally baked 5 minutes at 350 deg. F., to produce an organosol metal finish with superior gloss.

The terms Bakelite, Cellosolve, and Flexol are registered trade-marks of Union Carbide and Carbon Corp.

The data in this article defines the quality ordinarily to be expected of these resins and of certain coatings made from them, as measured by Bakelite Company's test methods. Because of the infinite variety in the nature of quality of ingredients used with these resins, and in the conditions under which they are processed, Bakelite Company is unable to guarantee like or optimum values for all coating properties and performance data.

Data and suggestions made in this article are not to be construed as recommendations to use any product in violation of existing patents covering any material or its use.

Table VI. Formulation of a high gloss organosol metal finish.

RESIN VYCM ORGANOSOL METAL FINISH XDE-28

	A	B	C	D	E
Ingredient	2-Roll Mill Stock	Pigment Paste	Base Organosol	Other Ingredients	Final Formula
Titanium dioxide[1]	64.8	22.50	—	—	22.50
Antimony oxide[2]	7.2	2.50	—	—	2.50
Bakelite vinyl resin VYCM	—	—	44.78	—	44.78
Bakelite vinyl resin VAGH	17.0	5.90	—	—	5.90
Flexol plasticizer DOP	9.0	3.13	—	6.52	9.65
Blown castor oil[3]	1.0	.35	—	—	.35
Stabilizer[4]	1.0	.35	—	—	.35
Methyl Cellosolve solvent	—	6.95	—	—	6.95
Toluene	—	20.80	—	—	20.80
Diisobutyl ketone	—	—	16.65	1.20	17.85
High boiling diluent[5] (aromatic type)	—	—	66.51	4.80	71.31
2-Ethylhexyl acetate	—	—	—	10.00	10.00
Indanthrene Blue Bakelite vinyl resin VAGH lacquer	—	—	—	Trace	Trace
Bakelite resin BR-18774	—	—	—	0.40	0.40
Total Parts by Weight	100	62.48	127.94	22.92	213.34
Total Solids, per cent	100	55.6	35.	—	40.4

(1) Such as "Titanox" A-168-LO, Titanium Pigment Corp., New York, N. Y.
(2) Such as "Timonox", Texas Mining and Smelting Company, Laredo, Texas.
(3) Such as "Bakers" No. 15, The Baker Castor Oil Company, New York, N. Y.
(4) Such as "Dyphos," National Lead Company New York, N. Y.
(5) Such as "Solvesso" No. 100, Esso Standard Oil Company, New York, N. Y.

BAKELITE COMPANY

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