

PATENT SPECIFICATION

(11) 1256 628

NO DRAWINGS

- (21) Application No. 5708/69 (22) Filed 3 Feb. 1969
 (31) Convention Application No. 708 785 (32) Filed 28 Feb. 1968 in
 (33) United States of America (US)
 (45) Complete Specification published 8 Dec. 1971
 (51) International Classification C 08 f 37/00, 41/02 // C 09 d 1/04,
 3/74, 5/10



- (52) Index at acceptance
 C3P 2C12A 2C14A 2C18 2C20C 2C8A 2C8B 2D1A1 2D8A
 2K7 2K8 4C12A 4C14A 4C18 4C20C 4C8A 4C8B
 4D3B1 4D8 4K8 7C12A 7C14A 7C18 7C20C 7C8A
 7C8B 7D2A1 7D8 7K2 7K8 8C12A 8C14A 8C18
 8C20C 8C8A 8C8B 8D2A 8D2B2 8D3A 8D8 8K2
 8K4 8K7 8K8
 B2E 193 197 19Y 209 20Y 258 30X 327 32Y 368 380 38X
 38Y 40X 40Y 412 41X 41Y 420 435 43Y 44Y 502
 505 507 50Y 51Y 533 535 536 545 546 547 54Y
 555 55Y 562 563 565 566 567 568 56Y 575 577
 57Y 588 58Y
 C1A D41 G12 G12D41 G44 G50

- (72) Inventors RONALD WENTWORTH BEERS and JULIAN
 LAKRITZ

(54) SILICATE-POLYMER LATEX VEHICLES

(71) We, ESSO RESEARCH AND ENGINEERING COMPANY, a Corporation duly organised and existing under the laws of the State of Delaware, United States of America, of Linden, New Jersey, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention is directed to a vehicle comprising an aqueous lithium silicate solution and an organic interpolymer latex; and to coatings made therefrom, which coatings possess good adhesion to any type of substrate commonly encountered in coating applications. The vehicles of the present invention have excellent package stability and film forming properties, and coating compositions made by pigmenting the vehicles with high loadings of zinc dust impart the same excellent corrosion resistance associated with the prior art zinc-rich inorganic coatings.

Heretofore, the prior art zinc-rich inorganic coatings had poor adhesion to metallic substrates unless the surface was properly prepared by sand-blasting the surface free of all contaminants, such as rust and mill scale. Such prior art zinc-rich inorganic coatings are illustrated by U.S. Patents 3,180,746 and 3,130,061.

The present invention is directed to an homogeneous vehicle for a zinc-enriched coating composition consisting essentially of (a) between 57 to 91 parts by weight of an

aqueous alkali-lithium silicate solution, said alkali and lithium silicates being employed in amounts sufficient to provide a molar ratio of X_2O , wherein X is one or more of sodium, potassium, and quaternary ammonium, to lithium oxide to silicon dioxide, respectively, within the range from 0 to 0.7 X_2O :0.3 to 1.0 Li_2O :2.5 to 4.5 SiO_2 ; (b) between 9 and 40 parts by weight of an organic interpolymer latex which is alkali stable; and (c) between 0 and 3 parts by weight of an alkali stable anionic surfactant; all said parts by weight being based on solids content, and the total of (a), (b) and (c) being 100 parts by wt.

The alkali-silicate solution is preferably a mixture of sodium and lithium silicates in amounts sufficient to provide the aforesaid molar ratio of sodium oxide to lithium oxide to silicon dioxide. If a quaternary ammonium compound is employed then this should be non-hygroscopic and water soluble. A preferred molar ratio of X_2O (X preferably being sodium) to lithium oxide to silicon dioxide, respectively, is within the range from 0.25 to 0.65 X_2O :0.35 to 0.75 Li_2O :2.5 to 4.5 SiO_2 . The vehicles of the present invention are suited for pigmentation with high loadings of zinc dust which produce a single-application zinc-enriched coating composition with excellent adhesion and protection against corrosion of the substrates.

The coating compositions of the present invention are usually packaged as two-component systems. The zinc dust and any other solid pigment used in the coating composition

tion is packaged as one component. The vehicle of the present invention together with any liquid additives is packaged as a second component. The two components are mixed prior to the application of the mixture to the desired surface. It has been found, according to the present invention, that less surface preparation is required than when prior-art zinc-rich inorganic coatings are used. Further, the coating compositions of the present invention become water insensitive within a short period of time and do not require the use of a curing agent. However, curing agents, such as phosphoric acid, may be used to accelerate the cure when adverse conditions are encountered, and inhibitors such as chromates may be added to the composition.

Typical formulations of the alkali-lithium silicate solution, organic interpolymer latex and anionic surfactant are given below:

<i>Parts by Wt. of Solids</i>				
	Alkali-lithium			
	silicate solution	91	69.0	57
	Interpolymer latex	9	29.5	40
25	Anionic Surfactant	0	1.5	3
		100	100.0	100

As noted above, the formulations are based on weight of solids. Formulations having the best properties as to adhesion and corrosion contain 15 to 30 parts by weight of solids of the interpolymer latex. The total solids of the silicate solutions is measured by heating a weighed quantity of the silicate solution at 110°C. for two hours and then weighing to determine the percent of solids. The total solids of the organic interpolymer latexes, on the other hand, are determined by heating at 105°C. for only 30 minutes.

The alkali-lithium silicate solutions of the present invention may be obtained by the addition of a sodium silicate solution to a sodium-lithium silicate solution having a molar ratio of 0.25 Na₂O:0.75 Li₂O:4.5 SiO₂ made in accordance with the disclosure of U.S. 3,180,746 and having a solids content of 25 to 30 percent by weight and a viscosity of between 30 to 40 centipoises (77°F.). Sodium silicate solutions having molar ratios of Na₂O:SiO₂ of between 1:2.4 to 1:3.75 may be added to the foregoing described sodium-lithium silicate solution to produce the alkali-lithium silicate solutions of the present invention. It is to be understood, however, that the alkali-lithium silicate solutions may also be produced directly by the method disclosed in U.S. 3,180,746 by adjusting the amounts of lithium hydroxide, and sodium, potassium or quaternary ammonium hydroxide added to the silica-containing materials, such as silicic acid or silica gel, before heating.

Furthermore, the alkali-lithium silicate solutions may be obtained by the addition of

lithium hydroxide and sodium, potassium or quaternary ammonium hydroxide to alkali stabilized colloidal silica solutions. The alkali stabilized colloidal silicas are marketed under the tradenames "Ludox" by E. I. du Pont de Nemours, "Syton" by Monsanto Chemical Company and "Nalcoag" by National Aluminate Company. "Ludox" and "Syton" are registered Trade Marks.

According to the present invention, it has been found that the addition of an organic interpolymer latex to the silicate solution provides a vehicle which has good adhesion to substrates commonly encountered in coating applications. The organic interpolymer latexes used in the present invention may be latexes of alkali-stable polymers of copolymerizable vinyl compounds which form interpolymers capable of being cast to form films from aqueous dispersions. The term "latex" designates an aqueous dispersion of the interpolymer which is present in the form of very fine particles.

Illustrative of the organic interpolymers which are used in the latexes of the present invention are the "polyacrylates" which term is used herein to mean polymers from (i) mixtures of esters of monovinylidene carboxylic acids, (ii) mixtures of monovinylidene carboxylic acids, or (iii) mixtures of the esters and the acids. Since the monomers when polymerized by themselves yield either soft or brittle polymers which do not have the desired film forming properties, a mixture of the monomers is used to form the desired interpolymers. Typical ester monomers which are used are methyl acrylate, methyl methacrylate, ethyl acrylate, ethyl methacrylate, propyl acrylate, propyl methacrylate, isopropyl acrylate, butyl acrylate, isobutyl acrylate, butyl methacrylate, tert-butyl acrylate, amyl methacrylate, 2-ethylhexyl acrylate, 2-ethylhexyl methacrylate, hexyl methacrylate, octyl methacrylate or other primary, secondary or tertiary alkyl having up to 18 carbon atoms, acrylates or methacrylates, or alkoxyalkyl acrylates or methacrylates such as butoxy ethyl acrylate or methacrylate. The acid monomers are preferably methacrylic or acrylic acid, but other acids having vinylidene groups such as itaconic acid, or the salts of the acids may be used. Further, the term "polyacrylates", includes interpolymers made predominantly of the foregoing (herein called "acrylic" monomers and minor amounts of acrylonitrile or methacrylonitrile, vinylacetate, a vinyl halide such as vinyl chloride, a vinyl aromatic such as styrene which co-polymerize with the monovinylidene ester and acid monomers. One very suitable polymer is a copolymer of styrene, acrylic monomer (as defined) and acrylonitrile. Specific interpolymers of the polyacrylate-type are disclosed in U.S. Patent 2,795,564.

Other organic interpolymers which may be used in the latexes of the present invention are

interpolymers of diolefins and vinyl compounds such as vinyl aromatic compounds, acrylonitrile, vinyl halides, fumaric acid or maleic acid, or salts of these, and the acrylates. The diolefin is preferably butadiene but isoprene and substituted butadiene such as 2,3-dimethyl-butadiene-1,3 may also be used. The preferred vinyl aromatic compound is styrene; however, lower alkyl substituted styrene, vinyl naphthalene, etc. may be used. Particular interpolymers containing the diolefin are disclosed in U.S. Patents 2,476,967 and 2,767,153.

Preferred interpolymers for use in the latex of the present invention are interpolymers from monomers of which at least one is a nitrogen compound having at least one reactive hydrogen attached to the nitrogen. Such interpolymers may contain aminoesters, cyclic amines, and heterocyclic nitrogen compounds, and are referred to generically herein as "aminoester type interpolymers". They have outstanding adhesion toward various substrates and exhibit outstanding solvent resistance. An especially suitable such interpolymers is one of which the other monomer is an acrylic monomer. Such interpolymers are illustrated in U.S. Patents 2,897,182; 2,980,652; 3,261,797; and 3,261,799.

It is preferred, according to the present invention, to use an anionic surfactant to improve the stability of the interpolymers latex, especially to improve shelf-life and wetting of the substrate by the formulated coating composition. By "shelf-life" is meant the ability of the vehicle to be stored for long periods of time without separation. A preferred anionic surfactant is the sodium salt of dodecylphenyl-ether sulfonate (for example, Benax 2A1, a product of the Dow Chemical Company; "BENAX" is a registered Trade Mark). Other suitable surfactants are those stable in alkali media such as alkali salts of acid phosphate esters of alcohols, phenols, ethoxylated derivatives of alcohols, alkyl phenols and the like. The phosphate esters are commercially available as Gafac (a product of the General Aniline Company; "GAFAC" is a registered Trade Mark).

A preferred vehicle of the present invention may be prepared by adjusting the alkali-lithium silicate solution and the stabilized interpolymers latex to approximately equal solids content and adding the silicate solution to the latex under good mixing. Alternatively, diluent water and stabilizing surfactant may be initially added to the latex, and the latex solution, adjusted to about the same solids content as the silicate solution, is then added to the alkali-lithium silicate solution while stirring at high speed. Either method of preparation yields a vehicle having a long shelf-life.

To the vehicles of the present invention is added zinc dust to form zinc-enriched coating compositions. The vehicles and zinc dust are

formulated in accordance with the following general formulations:

	Parts by Weight			
	Optimum			
Vehicle (26% NVM)	33	23.4	20	70
Zinc dust	67	76.6	80	
	100			

The coating compositions are described in terms of total weight. Thus, the vehicle when expressed as 26% NVM, means 26% non-volatile materials or total solids.

The zinc has a particle size between 2 to 50 microns in diameter and preferably the particles have a size within the range of 5 and 20 microns in diameter. The zinc may be added in an amount from 67% to 80% by weight of the coating composition, and the coating compositions will impart increasing corrosion resistance to metal, especially carbon steel, as the amount of zinc is increased.

In addition to the composition previously discussed, certain other materials, generally referred to as pigments, may be added singly, collectively, or in various combinations to impart certain desired properties to the coating compositions. Several of these "pigment additives" and the desirable characteristics they provide are as follows:

(1) Inorganic ceramic pigments (metallic oxides which alone or in various combinations yield desired colors)—Examples of the metallic oxide pigments are cobalt-aluminum, cobalt/chrome, cadmium, and cadmium-aluminum. The preferred pigments are those commonly used in tinting ceramics.

(2) Zinc oxide pigment—Enhances the abrasion resistance and overall "smoothness" of the coating surface by contributing comparatively minute (0.1—1 micron diameter) particles to the coating formulation.

(3) Aluminum silica-phosphate pigment—Performs the same function as zinc oxide.

(4) Titanium dioxide pigment—In addition to enhancing the abrasion resistance of the coating, titanium dioxide contributes its excellent hiding properties (brought about by a very high index of refraction).

The coating compositions of the present invention may be applied to metal surfaces which have been prepared by commercial sandblasting techniques or by wire brushing. The sandblasting needs only to remove loose mill scale and rust, and need not sandblast to white metal as is required for the commercially available prior art zinc-rich inorganic coating compositions. The coating compositions are applied to the surface by brushing, rolling or spraying to obtain a dry film thickness of 1 to 12 mils in thickness. A preferred dry film thickness is 3 to 6 mils. To obtain the preferred dry film thickness, a wet film of 6 to 10 mils of the

coating composition is applied to the surface.

- In the following Examples, Nos. 1 and 2 relate to preparations of alkali-lithium silicate solutions, and Examples 16 and 17 are comparative Examples. The remainder specifically illustrate the invention. Where percentages are given they are understood to be weight percents.

EXAMPLE 1

- A lithium-sodium silicate solution used in this invention without the addition of any additive materials may be formed in the following manner:

- Water, silica gel, lithium hydroxide, and sodium hydroxide are charged into a stainless steel pressure vessel equipped with an agitator. During the initial mixing of these ingredients, evolution of heat raises the temperature of the contents to 50°—55°C. The reactor is then sealed and the temperature of the reactants, under a continual agitation is raised to 150°C. for a period of time, which may vary from 30 to 90 minutes. After the vessel reaches about 150°C. and about 70 psi pressure, the contents are slowly cooled at a rate of 0.61°C. to 1.83°C. per minute. This will result in a temperature drop from 150°C. to 95°C. within 30 to 90 minutes. This completes the initial part of the reaction which forms the solid sodium-lithium silicates.

- The second part of the operation (below 95°C.) requires a longer period of time in order to effectively dissolve the solid silicates at the lower temperatures. The reduction of the temperature of the reactor contents from 95°C. to 40°C. is at a rate of 0.37°C. to 0.416°C. per minute and is accomplished in 150 minutes to 240 minutes. The last temperature drop from 40°C. to 25°C. may be conducted over a period of 60 to 120 minutes and a cooling rate of 0.25°C. to 0.125°C. per minute.

- Depending on the amount of water used, the vehicle may be used in different solid ratios, i.e. the total solids of the vehicle may vary from 10% to 45% by weight, preferably the solids contents is between 25% to 30% by weight.

EXAMPLE 2

- A vehicle was prepared in the manner described in Example 1 using the following ingredients:

	Parts by Weight
Sodium Hydroxide	8
Lithium Hydroxide Monohydrate	34
Silica Gel	126
Water	400

- This vehicle may be described at 0.25 Na₂O:0.75 Li₂O:4.5 SiO₂ or having a molar ratio of Li₂O to Na₂O of 3/1 and a molar ratio of SiO₂ to the combined Li₂O and Na₂O

of 4.5/1. The vehicle had a total solids content of about 27 weight percent but may vary between 26 to 28 weight percent. The viscosity of the vehicle was 36 to 37 centipoises (at 77°F), with a specific gravity of 1.194 to 1.195.

EXAMPLE 3

A vehicle of the present invention was prepared as follows:

Part A	Parts by Weight	
Sodium-Lithium Silicate Solution of Example 2	55.0	
Sodium Silicate Solution (1.0 Na ₂ O/3.22 SiO ₂)		75
37% Solids	10.0	
Water	4.0	
Part B		
Acrylic-Aminoester Latex*		
46% Solids	16.7	80
Benax† 2 Al (26% Solids)	1.5	
Water	12.8	
	100.0	

*Prepared according to U.S. Patent 2,980,652

†"BENAX" is a registered Trade Mark.

The diluted stabilized latex (Part B) is added to the mixed sodium-lithium-silicate solution (Part A) which is at approximately the same solids as the diluted latex. The addition is made slowly with good agitation.

EXAMPLE 4

A vehicle was prepared similarly as in Example 3 wherein the acrylic-aminoester latex was Rhoplex AC—61, a product of Rohm & Haas.

EXAMPLE 5

An alternative procedure for making the vehicles of the present invention is as follows:

	Parts by Weight	
Acrylic-Aminoester Latex*		
46% Solids	16.7	
Water	16.8	
Benax 2Al (26% Solids)	1.5	105
Sodium Silicate Solution (1.0 Na ₂ O/3.22 SiO ₂)		
37% Solids	10.0	
Sodium-Lithium Silicate Solution of Example 2	55.0	110
	100.0	

*Prepared according to U.S. Patent 2,980,652

The ingredients are all added in the order listed above with good mixing.

EXAMPLES 6—10

These examples illustrate vehicles prepared by compounding various organic interpolymers with alkali-lithium silicate solutions which may be used in the present invention. The various vehicles were prepared to determine the stability at or about room temperature (77°F.). Each of the vehicles which are set forth in Table 1 hereinafter exhibit outstanding stability.

EXAMPLES 11—15

To each of the vehicles of Examples 6—10 was added zinc dust to produce a zinc-enriched coating composition. The coating compositions were made up of about 23—24 parts by weight of the vehicle and about 76—77 parts by weight of zinc dust. The coating compositions were applied to sanded steel panels and then scribed to the bare metal. The panels were placed in a salt fog cabinet at 85°F. for 1500 hours. Each of the panels exhibited excellent protection to corrosion both at the scribes and overall.

Besides the foregoing coating compositions, systems were prepared containing various per-

centages of the organic interpolymer latex as compared to the alkali-lithium silicate solution. It was found that when the interpolymer latex was between 10 to 40% of the coating composition by wt. on a solids basis a suitable zinc enriched coating could be produced. While the ideal amount of the interpolymer required depended to some degree on the specific nature of the latex it was found that preferably 15—30% of the interpolymer latex was the optimum to obtain maximum corrosion protection.

The above coating compositions adhere to clean steel and will withstand extended immersion under running water after 24 hours. Salt fog exposures were run on sanded and sand-blasted steel panels for 1500 hours. Corrosion protection was comparable to conventional zinc-rich inorganic coating compositions. Normally, corrosion resistance is adversely affected by the addition of organic materials to inorganic coatings. Solvent and abrasion resistance were also of the same order of magnitude as those of the zinc-rich inorganics. Other latices known to the art do not exhibit good solvent resistance.

30

35

40

45

50

TABLE 1

Example	Parts by Weight				
	6	7	8	9	10
Sodium-lithium silicate Solution of Example 2 (26% solids)	55.8	55.8	55.8	55.8	55.8
Sodium Silicate Solution ("N" Sil) (26% Solids)	14.2	14.2	14.2	14.2	14.2
Water (added to latex before blending)	12.7	12.7	12.7	14.4	13.7
Interpolymer					
Methyl methacrylate/butyl acrylate/aminoester (Rhoplex AC-61, product of Rohm & Haas) (46% solids)	17.3				
Styrene/acrylonitrile/2-ethylhexyl acrylate (Ucar* 684, a product of Union Carbide) (45% solids)		17.3			
Ethyl methacrylate/2-ethylhexylacrylate/vinylacetate (Rhoplex MV-1, a product of Rohm & Haas) (46% solids)			17.3		
Acrylonitrile/butadiene/styrene (Hycar* 1877X8, a product of B. F. Goodrich) (50% solids)				15.6	
Styrene/butadiene (Dow* 762W, a product of Dow Chemical) (48% solids)					16.3

*Ucar, "Hycar" and "Dow" are registered Trade Marks.

The following examples illustrate a vehicle and coating composition where only sodium silicate is used.

EXAMPLE 16

- 5 A vehicle was made as follows:

	<i>Parts by Weight</i>
Sodium Silicate Solution (37% Solids)	58.5
10 Rhoplex AC-33 (A product of Rohm & Haas) (46% Solids)	28.0
Water (Distilled)	66.5
	153.0

- 15 The above vehicle separated into two phases, organic and inorganic, within 24 hours. The latex had a grainy appearance and after standing several weeks the top layer or organic phase formed a gel which was not easily redispersed. Such a vehicle would be completely unsatisfactory as a commercial product due to its extremely short shelf-life.

EXAMPLE 17

- 25 A zinc-enriched coating composition was prepared using the vehicle of Example 16 together with zinc dust as follows:

	<i>Parts by Weight</i>
Vehicle of Example 16	23.4
Zinc Dust	76.6
	100.0

- 30 The above zinc-rich coating composition was applied to sand-blasted steel. After 24 hours the coating was placed under running water. Within 15 minutes the coating had washed off to bare steel.

- 35 The foregoing Examples 16 and 17 illustrate the importance of the lithium in the coating compositions of the present invention as contrasted to the coating composition utilizing sodium silicate solution alone.

40 WHAT WE CLAIM IS:—

1. An homogeneous vehicle for a zinc-enriched coating composition consisting essentially of:

- 45 (a) between 57 to 91 parts by weight of an aqueous alkali-lithium silicate solution, said alkali and lithium silicates being employed in amounts sufficient to provide a molar ratio of X_2O , wherein X is one or more of sodium, potassium, and quaternary ammonium, to lithium oxide to silicon dioxide, respectively, within the range from 0 to 0.7 X_2O :0.3 to 1.0 Li_2O :2.5 to 4.5 SiO_2 ;

- 50 (b) between 9 and 40 parts by weight of an organic interpolymer latex which is alkali stable; and

- 55 (c) between 0 and 3 parts by weight of an alkali stable anionic surfactant; all said parts

by weight being based on solids content, and the total of (a), (b) and (c) being 100 parts by weight.

2. A vehicle according to claim 1 wherein the molar ratio of the alkali-lithium silicate solution is within the range from 0.25 to 0.65 X_2O :0.35 to 0.75 Li_2O :2.5 to 4.5 SiO_2 .

3. A vehicle according to claim 1 or 2 wherein X is sodium.

4. A vehicle according to claims 1—3 wherein the interpolymer of the organic interpolymer latex is an alkali stable polyacrylate interpolymer as herein defined.

5. A vehicle according to claims 1—3 wherein the interpolymer of the organic interpolymer latex is an acrylic-aminoester interpolymer as herein defined.

6. A vehicle according to any preceding claim and substantially as herein described.

7. A vehicle according to any of the preceding claims 1 to 5 and substantially as herein described with reference to any of Examples 3 to 10.

8. A coating composition which comprises (A) 20 to 33 parts by weight of a vehicle as claimed in any of claims 1—5 and (B) 67 to 80 parts by weight of zinc-dust of particle size 2 to 50 microns, (A) plus (B) being 100 parts by weight.

9. A coating composition which comprises (A) 20 to 33 parts by weight of a vehicle as claimed in any of claims 1—3 wherein the organic interpolymer is a styrene-acrylic monomer (as herein defined) acrylonitrile copolymer, and (B) 67 to 80 parts by weight of zinc-dust of particle size 2 to 50 microns; (A) plus (B) being 100 parts by weight.

10. A coating composition which comprises (A) 20 to 33 parts by weight of a vehicle as claimed in any of claims 1—3 wherein the organic interpolymer is a styrene-butadiene copolymer, and (B) 67 to 80 parts by weight of zinc-dust of particle size 2 to 50 microns; (A) plus (B) being 100 parts by weight.

11. A coating composition which comprises (A) 20 to 33 parts by weight of a vehicle as claimed in any of claims 1—3 wherein the organic interpolymer is a styrene-butadiene-acrylonitrile interpolymer, and (B) 67 to 80 parts by weight of zinc-dust of particle size 2 to 50 microns; (A) plus (B) being 100 parts by weight.

12. A coating composition as claimed in claim 8, in which the interpolymer of the interpolymer latex of the vehicle is an amino-ester interpolymer as herein defined.

13. A coating composition as claimed in any of claims 8 to 12 and substantially as herein described.

14. A coating composition as claimed in claim 8 and substantially as herein described with reference to any of Examples 11 to 15.

15. A container having in one compartment a liquid component comprising a vehicle as claimed in any one of claims 1 to 7, and

60

65

70

75

80

85

90

95

100

105

110

115

120



* C L H S *

7

1,256,628

7

The following examples illustrate a vehicle and coating composition where only sodium silicate is used.

EXAMPLE 16

5 A vehicle was made as follows:

	Parts by Weight
Sodium Silicate Solution (37% Solids)	58.5
10 Rhoplex AC-33 (A product of Rohm & Haas) (46% Solids)	28.0
Water (Distilled)	66.5
	153.0

15 The above vehicle separated into two phases, organic and inorganic, within 24 hours. The latex had a grainy appearance and after standing several weeks the top layer or organic phase formed a gel which was not easily redispersed. Such a vehicle would be completely
20 unsatisfactory as a commercial product due to its extremely short shelf-life.

EXAMPLE 17

25 A zinc-enriched coating composition was prepared using the vehicle of Example 16 together with zinc dust as follows:

	Parts by Weight
Vehicle of Example 16	23.4
Zinc Dust	76.6
	100.0

30 The above zinc-rich coating composition was applied to sand-blasted steel. After 24 hours the coating was placed under running water. Within 15 minutes the coating had washed off to bare steel.

35 The foregoing Examples 16 and 17 illustrate the importance of the lithium in the coating compositions of the present invention as contrasted to the coating composition utilizing sodium silicate solution alone.

40 WHAT WE CLAIM IS:—

1. An homogeneous vehicle for a zinc-enriched coating composition consisting essentially of:

45 (a) between 57 to 91 parts by weight of an aqueous alkali-lithium silicate solution, said alkali and lithium silicates being employed in amounts sufficient to provide a molar ratio of X_2O , wherein X is one or more of sodium, potassium, and quaternary ammonium, to lithium oxide to silicon dioxide, respectively,
50 within the range from 0 to 0.7 X_2O :0.3 to 1.0 Li_2O :2.5 to 4.5 SiO_2 ;

(b) between 9 and 40 parts by weight of an organic interpolymers latex which is alkali
55 stable; and

(c) between 0 and 3 parts by weight of an alkali stable anionic surfactant; all said parts

by weight being based on solids content, and the total of (a), (b) and (c) being 100 parts by weight.

2. A vehicle according to claim 1 wherein the molar ratio of the alkali-lithium silicate solution is within the range from 0.25 to 0.65 X_2O :0.35 to 0.75 Li_2O :2.5 to 4.5 SiO_2 .

3. A vehicle according to claim 1 or 2
65 wherein X is sodium.

4. A vehicle according to claims 1—3 wherein the interpolymers of the organic interpolymers latex is an alkali stable polyacrylate interpolymers as herein defined.

5. A vehicle according to claims 1—3 wherein the interpolymers of the organic interpolymers latex is an acrylic-aminoester interpolymers as herein defined.

6. A vehicle according to any preceding
75 claim and substantially as herein described.

7. A vehicle according to any of the preceding claims 1 to 5 and substantially as herein described with reference to any of Examples 3 to 10.

8. A coating composition which comprises (A) 20 to 33 parts by weight of a vehicle as claimed in any of claims 1—5 and (B) 67 to 80 parts by weight of zinc-dust of particle size 2 to 50 microns, (A) plus (B) being 100 parts by weight.

9. A coating composition which comprises (A) 20 to 33 parts by weight of a vehicle as claimed in any of claims 1—3 wherein the organic interpolymers is a styrene-acrylic monomer (as herein defined) acrylonitrile copolymer, and (B) 67 to 80 parts by weight of zinc-dust of particle size 2 to 50 microns; (A) plus (B) being 100 parts by weight.

10. A coating composition which comprises (A) 20 to 33 parts by weight of a vehicle as claimed in any of claims 1—3 wherein the organic interpolymers is a styrene-butadiene copolymer, and (B) 67 to 80 parts by weight of zinc-dust of particle size 2 to 50 microns; (A) plus (B) being 100 parts by weight.

11. A coating composition which comprises (A) 20 to 33 parts by weight of a vehicle as claimed in any of claims 1—3 wherein the organic interpolymers is a styrene-butadiene-acrylonitrile interpolymers, and (B) 67 to 80 parts by weight of zinc-dust of particle size 2 to 50 microns; (A) plus (B) being 100 parts by weight.

12. A coating composition as claimed in claim 8, in which the interpolymers of the interpolymers latex of the vehicle is an amino-ester interpolymers as herein defined.

13. A coating composition as claimed in any of claims 8 to 12 and substantially as herein
115 described.

14. A coating composition as claimed in claim 8 and substantially as herein described with reference to any of Examples 11 to 15.

15. A container having in one compartment
120 a liquid component comprising a vehicle as claimed in any one of claims 1 to 7, and

having in another compartment, isolated from the first, a solid component comprising zinc dust of particle size 2 to 50 microns.

K. J. VERYARD,
15, Suffolk Street, S.W.1.
Agent for the Applicants.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1971.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

