

PATENT SPECIFICATION

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(54) HYDRAULIC CEMENT COMPOSITION

(71) We, THE ASSOCIATED PORTLAND CEMENT MANUFACTURERS LIMITED, a British Company, of Portland House, Stag Place, London SW1E 5BJ, England, 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 relates to hydraulic cement compositions useful for application in the form of layers, for instance as paint or grouting material. The invention is described for convenience in this specification particularly with reference to paint.

Cement-based paint, referred to herein as cement paint, is well-known especially for application to external building surfaces, as a decorative material with waterproofing properties. An example of such a material is "Snowcem" (registered Trade Mark), which consists essentially of white Portland cement, finely divided calcium carbonate as a pigment and extender, a small proportion of titanium dioxide to improve opacity, a fatty acid to provide waterproofing properties and an accelerator to give desired setting properties. Such a composition is supplied in powder form to be mixed with water immediately before its use. Sand is also frequently added at this stage for the first coat to prevent shrinkage problems, provide a better key for the second coat and give greater opacity.

It is an object of the present invention to provide an improved composition of the foregoing general type, having improved brushability, being relatively drip-free compared with prior compositions, and having improved setting properties under low relative humidities.

The invention is based on the discovery that advantageously modified properties can be obtained in cement paint by incorporating an agent capable of thixotropic gel formation.

According to the invention a dry cement composition for making a cement-based paint or grout, comprises a major proportion by weight of a hydraulic cement capable of releasing

lime on contact with water, and a minor proportion by weight of a substance capable of forming a thixotropic gel with said lime in the presence of water. Preferably the usual further ingredients, such as pigment or extender, opacifying agent, waterproofing agent and setting accelerator are also incorporated in the dry composition.

The substance capable of forming a thixotropic gel is preferably aluminium sulphate, which may in practice contain up to 20 per cent by weight of alumina.

In this specification, "hydraulic cement" refers to a mineral substance which sets to a stony consistency upon the addition of water. The preferred hydraulic cement in the present invention is Portland cement but cements other than Portland cement can be used with the thixotropic gel-forming agent, such as aluminium sulphate, provided that they release lime when contacted with water. The lime reacts with the aluminium sulphate to produce an alumina gel. High alumina cement is an example of an alternative hydraulic cement.

The addition of aluminium sulphate to cement paint of the aforesaid type leads to considerable modification of the paint properties. The paint is more gelled in its early life and is capable of acting as a suspension aid for added sand. Using an iron-free grade of aluminium sulphate the gel-type cement paint is slightly brighter than prior cement paint.

Cement paints prepared with a customary water content are fuller bodied than hitherto when aluminium sulphate is incorporated, and they stiffen during their early life to a greater extent. Cement paint containing 5.0 per cent aluminium sulphate by weight based on the dry composition produces a full bodied paint with also non-drip properties after a ten minute standing period. The amount of gel formation when varying proportions of aluminium sulphate are added to a typical cement paint, measured over the first 15 minutes of paint life on an I.C.I. gel strength tester, is indicated in the following Table. A gel strength reading of 450 was the limit of the instrument.

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The ratio of water to powder was 0.4 in all cases.

% Aluminium Sulphate (17-18% Al_2O_3)	Gel Strength g.cm ⁻¹ , after					
	1 min	3 min	5 min	7 min	10 min	15 min
0	81	103	130	143	145	152
1	85	153	223	223	290	346
2	103	283	300	328	450	450
3	180	297	374	400	450	450
4	190	350	400	402	450	450
5	191	350	418	450	450	450

A typical and preferred cement paint modified by the incorporation of aluminium sulphate according to the present invention is as follows, the proportions being in percentages by weight.

White Portland cement *("Snowcrete")	78.17
Titanium dioxide	2.50
Whiting *("Snowcal")	10.00
Calcium chloride flake	5.32
Zinc oxide	0.18
Stearine	1.00
*"Alphanol" (I.C.I. Ltd., Wetting Agent)	0.33
Aluminium sulphate (iron-free, 17-18% alumina)	2.50
	100.00

(*registered Trade Marks)

The addition of sand to known cement paints modifies their behaviour and improves many of their properties, particularly adhesion to smooth dense surfaces with subsequently less risk of flaking. The advantages of sanded cement paint have been well established and include increased coating thickness, leading to greater weather resistance; better opacity especially under wet conditions, with longer life before reduced opacity makes further treatment necessary; improved setting and hardening with less risk of dusting under dry conditions; reduced drying shrinkage and moisture movement, leading to improved adhesion with less risk of flaking on smooth dense surfaces or surfaces bearing traces of soft material; provision of better key for subsequent treatments.

Sanded cement paints incur certain drawbacks, however, which become more pronounced as the sand content is raised. If the

paint is made too thin or if occasional stirring is omitted, sand settlement tends to occur. This leads to an uneven coating thickness and uneven sand distribution in the coating. With increased sand content, the cement paint is less easy to apply and more sensitive to suction with the risk of sand bunching, heavy brush marks, thick lap joints and uneven appearance. The sanded paints have a reduced area coverage and are susceptible to soiling in industrial areas.

According to a further feature of the invention we provide a gel-type cement paint as described above, with added sand. It has been found that the gel-type cement paint with added sand has better application properties than prior sanded paints. In particular there is no sedimentation of the sand.

The addition of sand to gel-type cement paint formulated according to the invention and containing 5.0 per cent aluminium sulphate shows that the sand is completely retained in suspension in amounts up to 50 per cent by weight. The application properties at high sand loadings are better than in the case of prior cement paint with sand. Cement paints containing 2 to 3 per cent of aluminium sulphate also completely retain sand in suspension in amounts of up to 30 per cent by weight and improve the application properties but to a lesser extent. The incorporation of sand in the gel-type cement paint may incur a slight reduction in brightness of the resulting paint film and a reduction in area coverage. The reduction in brightness may be counteracted by an increase in titanium dioxide content while retaining to a substantial extent the considerable saving in raw materials costs afforded by the addition of the sand.

The preferred proportion of aluminium sulphate to be used in cement paints or sanded cement paints according to the present inven-

tion is from 2 to 5 per cent by weight, most preferably 2.5 per cent.

The preferred proportion of sand in the sanded cement paints of the invention is from 20 to 40 per cent by weight of the un-sanded dry composition, preferably 25 per cent (equals 20 per cent by weight of the final composition).

A typical and preferred sanded cement paint composition according to the invention is as follows, the proportion being percentages by weight.

White Portland cement *("Snowcrete")	62.55
Titanium dioxide	2.80
Whiting *("Snowcal")	7.20
Calcium chloride flake	4.25
Stearine	0.80
Zinc oxide	0.14
Alphanol	0.26
Aluminium sulphate (iron-free, 17-18% alumina)	2.00
**"Cullamix" grade sand	20.00
	<u>100.00</u>

*(registered Trade Marks)

25 Apart from cement paint as such, another example of a Portland cement containing aluminium sulphate is as a grout. Cement grouts

are commonly used for sealing contracting joints in massive concrete structures, for repairing cracks in concrete and for tightening water-retaining structures. It is important that the grout should have good flow characteristics and be set free from bleeding, i.e. loss of water from the freshly mixed cementitious mass, which is accentuated in grouts by the frequent use of finely ground sand. This disadvantage is prevented by the addition of aluminium sulphate, according to the invention, without affecting the flow properties of the grout.

It will be appreciated that the gel structure of the compositions according to the invention assists in water retention and thus in the achievement of full hydration during the setting of the cement.

The following Examples are given for the purpose of illustrating the invention.

Eight compositions were produced by thoroughly milling together in two 45 minute stages the following ingredients in the proportions indicated, which are percentages by weight. The aluminium sulphate was added in the first stage.

Example I represents a known white cement paint, given for comparison, and Examples II, III and IV represent gel-paints according to the invention:

	I	II	III	IV
White cement *("Snowcrete")	80.81	75.88	80.79	78.17
Granular titanium dioxide	2.46	2.46	3.08	2.50
Whiting *("Snowcal")	9.85	9.85	4.22	10.00
Calcium chloride flake	5.35	5.35	5.35	5.32
Zinc oxide	0.16	0.16	0.16	0.18
Stearine	1.01	1.01	1.01	1.00
Alphanol	0.36	0.36	0.36	0.33
Aluminium sulphate, Fe-free; 17-18% Al ₂ O ₃	0.0	4.93	5.03	2.50
	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>

(*registered Trade Marks).

60 Example V is a comparison composition and Examples VI to VIII are examples of the

invention, all four being obtained by mixing 25 per cent by weight of sand to the respective

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products of Examples I to IV as they leave the mill, and blending for 10 to 15 minutes in a trough mixer.

5 A suitable sand is the 'T' grade of British Industrial Sands Limited, "Cullamix" (registered Trade Mark) grade sand.

10 The properties of the products of these eight Examples are compared in the following Tables 1 and 2. In the comparison, the following test methods are referred to.

Test Methods

15 **Paste Time:** time in seconds for 300 g. added powder to be completely wetted by 120 ml. water to form a smooth paste in a 600 ml. polythene beaker.

Temperature Rise: the increase from average initial temperatures to maximum temperature attained during the paste formation.

20 **Paint Yield:** calculated in litres per Kg. dry powder, from weight of 100 ml. paint.

Pail Life: working life of the paint determined by painting the rough side of hardboard at regular intervals during its life, and

taken as the time at which the paint did not spread and had severe brush marks.

25 **Colour:** colour of the powder set coating, brush applied and cured under standard conditions of 20°C and 85 per cent. R.H. for 24 hours between each of three coats, and measured on the Zeiss PMQ II Spectro-reflectometer.

30 **Opacity:** two coats of paint were brushed out on Sheen No. 102 Hiding Power Charts and cured at 20°C and 85 per cent R.H. with 24 hours between each coat. The charts were weighed before and after application of the paint and the amount of paint used was calculated in terms of its spreading rate in m²/Kg.

40 The reflectance of the paint film was measured over both black and white parts of the chart at 565 mμ on the Zeiss PMQ II Spectroreflectometer.

45 The paint coatings were then soaked in water for ten minutes, the excess water wiped off and the reflectance measured again over both the black and white.

$$\text{The contrast rate of opacity} = \frac{\text{Reflectance over white} - \text{Reflectance over black}}{\text{Reflectance over white}} \times 100$$

50 **Chalking rating:** an assessment of the dustiness of the set paint coating, measured by rubbing the painted surface lightly with a piece of velvet. A chalking rating of 10 represents no removal of powder and a rating of 0 complete removal of powder. The substrate was 1/4 inch hardboard and a backing coat of Brick Red Snowcem (0.012") was applied and cured at 20°C and 70 per cent R.H. for 24 hours. A 0.010 inch paint film was applied over the Brick Red Snowcem and cured at

20°C and 70 per cent R.H. for 24 hours.

Setting Times: British Standard Test method B.S. 12 Appendix F.

65 **Expansion:** British Standard test method B.S. 12 Appendix G

Drying shrinkage: A.S.T.M. C596—70 with the following modifications: neat drying powder instead of mortar; demoulding time of 4 hours; Demec measuring system.

70 **Compressive Strength:** British Standard test method B.S. 12 Appendix C.

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TABLE 1

Example No.	I	II	III	IV
Percent Aluminium sulphate	0	5.0	5.0	2.5
Paste time (secs)	8	8	8	8
Temperature rise °C	5.7	12.7	11.9	11.1
Water/powder ratio	0.60	0.60	0.60	0.60
Paint yield (l/kg)	0.94	0.94	0.94	0.93
Area coverage, 2 coats, m ² /Kg of dry powder,				
Rough side hardboard,	3.0	2.8	2.7	2.9
New rough-cast,	1.8	1.5	1.3	1.6
1:3 smooth rendered,	2.8	2.7	2.6	2.8
Pail Life (mins)				
20°C, 50% R.H.	145	135	160	145
32°C, 50% R.H.	110	80	65	100
Colour:				
Dry powder,				
tristimulus value X	86.0	86.3	84.9	84.6
tristimulus value Y	86.1	86.3	85.1	84.6
tristimulus value Z	80.0	80.6	78.6	78.0
Set coating on asbestos				
tristimulus value X	78.2	79.4	79.7	79.7
tristimulus value Y	78.5	79.5	79.8	79.7
tristimulus value Z	74.8	75.8	76.0	74.7
Opacity:				
Dry contrast ratio %	86.5	84.3	86.0	85.0
Damp contrast ratio %	71.1	73.4	75.0	70.7
Spreading rate (m ² /Kg)	9.2	8.0	8.0	8.3
Setting properties:				
Chalking rating,	10	10	10	10
B.S. 12 setting time,				
Initial (mins)	45	60	65	55
Final (mins)	60	75	85	60
B.S. 12 Le Chatelier expansion: (mins)	½	1	1	½
Wet expansion %	0.06	0.03	—	0.04
Drying shrinkage %	0.48	0.54	—	0.52
Compressive strengths:				
— 3 days	29.5	21.1	19.4	26.7
— 7 days	36.9	30.7	22.8	36.7
— 28 days	50.1	39.4	34.3	44.6

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TABLE 2

Example No.:	V	VI	VII	VIII
Percent Aluminium Sulphate	0	4.0	4.0	2.0
Sand %	20.0	20.0	20.0	20.0
Paste time (secs)	8	8	8	8
Temperature rise °C	3.7	9.4	8.7	6.9
Water/Powder ratio	0.50	0.55	0.60	0.55
Paint yield (l/kg)	0.87	0.88	0.97	0.87
Area coverage, 2 coats,				
m ² /Kg of dry powder,				
Rough side hardboard,	2.6	2.7	2.5	2.4
New rough-cast,	1.0	0.8	0.8	1.0
1:3 smooth rendered,	2.1	2.2	2.2	2.1
Pail Life (mins)				
20°C, 50% R.H.	145	155	160	165
32°C, 50% R.H.	120	80	70	125
Colour:				
Dry powder,				
tristimulus value X	83.7	85.3	84.2	83.1
tristimulus value Y	83.8	85.2	84.3	83.1
tristimulus value Z	78.3	79.8	78.6	78.0
Set coating on asbestos				
tristimulus value X	75.9	76.1	76.4	75.5
tristimulus value Y	76.0	76.2	76.9	75.8
tristimulus value Z	71.0	70.6	72.3	72.6
Set coating on smooth rendering				
tristimulus value X	76.9	78.3	78.6	76.5
tristimulus value Y	76.9	78.5	78.8	76.8
tristimulus value Z	71.5	73.5	73.6	72.6
Opacity:				
Dry contrast ratio %	88.4	88.5	88.9	88.5
Damp contrast ratio %	77.5	76.9	78.4	78.8
Spreading rate (M ² /Kg)	6.0	6.3	4.8	6.0
Setting properties:				
Chalking rating,	10	10	10	10
B.S. 12 setting time,				
Initial (mins)	45	60	80	75
Final (mins)	60	75	100	80
B.S. 12 Le Chatelier				
expansion (mins)	½	1	1	½
Wet expansion %	0.05	0.03	—	0.03
Drying shrinkage %	0.44	0.48	—	0.47
Compressive strengths:				
— 3 days	19.4	16.0	19.5	21.2
— 7 days	26.9	23.1	25.4	28.0
— 28 days	39.8	31.4	34.9	35.9

Particular comparative aspects of the foregoing Examples are discussed below.

5 Gel-type cement paints of the invention produce slightly thicker pastes on mixing, than the prior art paint of Example I but of smoother and creamier texture. The dilution with water to form a paint is easy and at the usual water/powder ratio of 0.6 the gel-type paints are stiffer and more full bodied than the prior paint. The gel-type paints are easily brushable at the full bodied consistency on all the surfaces usually painted with cement paint.

10 The 5.0 per cent gel-type paint of Example II stiffens further, after mixing, during the first ten minutes of its life and is almost non-drip. The 2.5 per cent gel-type paint of Example IV stiffens only very slightly after mixing and a waiting period is not necessary to obtain the final paint consistency. It is less bodied than the 5.0 per cent gel-type of Example II.

15 The temperature rise of the gel-type cement paints of Examples II to IV during mixing is higher than for Example I. The 5.0 per cent gel-type gives almost twice the rise of Example I whereas the 2.5 per cent gel-type is intermediate between the two. The high temperature rises do not however lead to flash setting or impair the paint-properties under laboratory conditions. The temperature rise for the gel-type paints is in part due to the heat of reaction between aluminium sulphate (a Lewis-acid) and water.

20 The brushability of the gel-type cement paints is better on all types of surface from smooth dense concrete to highly porous rough-cast. There is much less spattering during painting with the gel-type cement paints, resulting in a cleaner painting operation and less cleaning up afterwards. The 5.0 per cent gel-type is the best in this respect.

25 The paint yield of the gel-type cement paints and prior cement paint are similar. The area coverage of the gel-type paints on a surface of medium texture and suction is slightly lower than prior paint on account of the slightly greater film thickness.

30 The opacity of the gel-type cement paints is slightly better than that of the prior paint due to the slightly greater film thicknesses. The dry powder colour and set coating colour on glass of the gel-type paints are better than the prior paint. The tristimulus Y-value (=percent brightness) for the 5.0 per cent gel-type is 2.0 per cent higher than for the prior paint.

35 The pail life and B.S.12 setting times under laboratory conditions of gel-type cement paints are slightly longer than those of the prior paint, due to their slightly higher sulphate content. Elevated temperature pail lives at 32°C (90°F) of the gel-type paints are however shorter than for the prior paint, probably due to the temperature rise.

The gel-type paint films are harder than the prior art paint film when cured for 24 hours at 45—50 per cent relative humidity which indicates that the "gel" retained moisture in the film during hydration. This property is highly desirable and could enable the cement paint to be cured under conditions which at present are not suitable, such as in dry climates.

Le Chatelier Expansion according to B.S. 12 and wet expansion according to A.S.T.M. C.596—70 show that the extra sulphate in the gel-type cement paints does not lead to expansion. Drying shrinkage of gel-type paints is slightly more than with the prior paint.

The gel-type cement paints are weaker at all ages than the prior art paint, due to the diluent effect of the "gel" in the cement matrix.

Artificial weathering results, using method B.S. 3900 Part F.3, for a period of 900 hours, of the gel-type and prior art paints are similar.

Natural weathering for a period of one year has shown that the gel-type and prior paints are of similar durability. The 5.0 per cent gel-type chalks slightly less than the prior type at this time.

The T grade sand supplied by British Industrial Sands Ltd., for making "Cullamix" is almost colourless and of suitable particle size grading to give a pleasing texture in sanded cement paint.

The addition of sand (see Examples V to VIII) to gel-type and to prior cement paints has only a small effect on the time taken to wet the powder and form a paste. Sand does, however, have an auxiliary effect in facilitating dilution of the paste with further water to obtain a paint consistency. A minimum sand content of 20 per cent is required in this respect, and with this amount of sand it is possible to mix the sanded gel-type cement type paint and sanded prior art cement direct to a paint consistency without an intermediate paste stage. Slightly more air is entrained by single stage mixing but the powder is completely wetted.

Addition of sand to gel-type cement paints and prior paints reduces the proportion of water required for paint consistency and the paint yield is therefore reduced.

The addition of 25 per cent sand (=20 per cent content of sand in the sanded product) to the gel-type cement paints reduces the yield by about 8 per cent.

The paintability of gel-type cement paints with sand, as for prior paint with sand, declines as the proportion of sand is increased. A sand content of 40 per cent is the maximum that can be tolerated with any of the paints. At least 20 per cent is required for a reasonable texture on smooth surfaces. Below 10 per cent the discrete coated grains of sand

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can be observed and give the impression of badly mixed or lumpy paint.

The gel-type paints with sand have better brushability than has prior paint with sand on all surfaces. On high suction surfaces the tendency for sand bunching is reduced and on smooth dense surfaces the tendency for sand to become distributed along brush-marks is also reduced. The 5.0 per cent gel-type paint is the best of the gel-type paints in this respect.

There is no sedimentation of sand in the bucket with gel-type paints containing up to 20 per cent sand whereas there is some sedimentation with prior paint containing 20 per cent sand unless the paint is stirred frequently. At higher sand loadings the 5.0 per cent gel-type is able to suspend the sand entirely whereas the 2.5 per cent gel-type requires some stirring.

The area coverage measured on a surface of medium texture and porosity (rough side of hardboard) falls as the proportion of sand is increased. A 25 per cent addition of sand to the gel-type paint reduced the area coverage by about 25 per cent, and to prior paint by about 20 per cent.

The opacity is improved as the amount of sand is increased as a result of increased paint coating thickness. Gel-type and prior cement paints are similar in this respect.

The brightness of paint coatings is reduced as the amount of sand is increased. An addition of 25 per cent sand to the gel-type and prior paints reduces the brightness by about 3 per cent. Gel-type paints with sand are brighter than prior paint with sand. The 5.0 per cent gel-type paint with 25 per cent added sand is 2 per cent brighter than prior paint with 25 per cent added sand.

On the basis of the addition of "Cullamix" grade sand to the gel-type and prior paints it is concluded that at least a 25 per cent addition is necessary to obtain the maximum benefits from the sand in increased paint coating thickness, which will increase opacity and durability and also provide a pleasing texture. This amount of sand is known to improve the adhesion of prior cement paint.

The gel-type cement paints kept a 25 per cent addition of sand adequately in suspension and the 5 per cent gel-type had the better application properties.

Gel-type Example III differs from gel-type Examples II in its rheological characteristics. The powder is easy to mix with water to form a smooth paste and full bodied paint but stiffens more rapidly over the first ten minutes and continues to stiffen after this time during application. The other properties are similar to those of Example II apart from the set coating colour and opacity which are better as a result of the higher titanium dioxide content. Example VII, similar to Example III but with sand also stiffens con-

siderably during its early life and is similar to Example VI in other properties apart from the set coating colour and opacity which are better. The set coating colour is however duller than in the case of Example I.

The sand contents in samples from Examples VI to VII taken during packing show that the distribution of sand throughout the batches is excellent, all being between 19 per cent and 20 per cent.

Field trials have confirmed the advantages indicated for the gel-type cement paints illustrated in the foregoing Examples.

WHAT WE CLAIM IS:—

1. A dry cement composition for making a cement-based paint or grout, which comprises a major proportion by weight of a hydraulic cement capable of releasing lime on contact with water and a minor proportion by weight of a substance capable of forming a thixotropic gel with said lime in the presence of water, and optionally also containing a pigment or extender, an opacifying agent, a waterproofing agent, and a setting accelerator.

2. A composition according to Claim 1, wherein the substance capable of forming a thixotropic gel is an aluminium salt.

3. A composition according to Claim 2 which contains from 2 to 5 per cent by weight of aluminium salt.

4. A composition according to Claim 2 or 3, further containing sand.

5. A composition according to Claim 4, containing 2 to 3 per cent by weight of the aluminium salt and up to 30 per cent by weight of sand, the percentages being based on the weight of the composition without sand.

6. A composition according to Claim 4, containing 20 to 40 per cent by weight of sand based on the weight of the composition without sand.

7. A composition according to any of Claims 2 to 6, wherein the aluminium salt is aluminium sulphate.

8. A composition according to Claim 7, wherein the aluminium sulphate is an iron-free grade of aluminium sulphate.

9. A composition according to Claim 7 or 8, wherein the aluminium sulphate contains up to 20 per cent by weight of alumina.

10. A composition according to any preceding Claim, wherein the hydraulic cement is Portland cement.

11. A composition according to Claim 1 substantially as described with reference to foregoing Examples II, III, IV, VI, VII and VIII.

12. A paint comprising a cement composition according to any preceding Claim dispersed in water.

13. A paint according to Claim 12, having a weight ratio of water to powder of from 0.55 to 0.60.

can be observed and give the impression of badly mixed or lumpy paint.

The gel-type paints with sand have better brushability than has prior paint with sand on all surfaces. On high suction surfaces the tendency for sand bunching is reduced and on smooth dense surfaces the tendency for sand to become distributed along brush-marks is also reduced. The 5.0 per cent gel-type paint is the best of the gel-type paints in this respect.

There is no sedimentation of sand in the bucket with gel-type paints containing up to 20 per cent sand whereas there is some sedimentation with prior paint containing 20 per cent sand unless the paint is stirred frequently. At higher sand loadings the 5.0 per cent gel-type is able to suspend the sand entirely whereas the 2.5 per cent gel-type requires some stirring.

The area coverage measured on a surface of medium texture and porosity (rough side of hardboard) falls as the proportion of sand is increased. A 25 per cent addition of sand to the gel-type paint reduced the area coverage by about 25 per cent, and to prior paint by about 20 per cent.

The opacity is improved as the amount of sand is increased as a result of increased paint coating thickness. Gel-type and prior cement paints are similar in this respect.

The brightness of paint coatings is reduced as the amount of sand is increased. An addition of 25 per cent sand to the gel-type and prior paints reduces the brightness by about 3 per cent. Gel-type paints with sand are brighter than prior paint with sand. The 5.0 per cent gel-type paint with 25 per cent added sand is 2 per cent brighter than prior paint with 25 per cent added sand.

On the basis of the addition of "Cullamix" grade sand to the gel-type and prior paints it is concluded that at least a 25 per cent addition is necessary to obtain the maximum benefits from the sand in increased paint coating thickness, which will increase opacity and durability and also provide a pleasing texture. This amount of sand is known to improve the adhesion of prior cement paint.

The gel-type cement paints kept a 25 per cent addition of sand adequately in suspension and the 5 per cent gel-type had the better application properties.

Gel-type Example III differs from gel-type Examples II in its rheological characteristics. The powder is easy to mix with water to form a smooth paste and full bodied paint but stiffens more rapidly over the first ten minutes and continues to stiffen after this time during application. The other properties are similar to those of Example II apart from the set coating colour and opacity which are better as a result of the higher titanium dioxide content. Example VII, similar to Example III but with sand also stiffens con-

siderably during its early life and is similar to Example VI in other properties apart from the set coating colour and opacity which are better. The set coating colour is however duller than in the case of Example I.

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1. A dry cement composition for making a cement-based paint or grout, which comprises a major proportion by weight of a hydraulic cement capable of releasing lime on contact with water and a minor proportion by weight of a substance capable of forming a thixotropic gel with said lime in the presence of water, and optionally also containing a pigment or extender, an opacifying agent, a waterproofing agent, and a setting accelerator.

2. A composition according to Claim 1, wherein the substance capable of forming a thixotropic gel is an aluminium salt.

3. A composition according to Claim 2 which contains from 2 to 5 per cent by weight of aluminium salt.

4. A composition according to Claim 2 or 3, further containing sand.

5. A composition according to Claim 4, containing 2 to 3 per cent by weight of the aluminium salt and up to 30 per cent by weight of sand, the percentages being based on the weight of the composition without sand.

6. A composition according to Claim 4, containing 20 to 40 per cent by weight of sand based on the weight of the composition without sand.

7. A composition according to any of Claims 2 to 6, wherein the aluminium salt is aluminium sulphate.

8. A composition according to Claim 7, wherein the aluminium sulphate is an iron-free grade of aluminium sulphate.

9. A composition according to Claim 7 or 8, wherein the aluminium sulphate contains up to 20 per cent by weight of alumina.

10. A composition according to any preceding Claim, wherein the hydraulic cement is Portland cement.

11. A composition according to Claim 1 substantially as described with reference to foregoing Examples II, III, IV, VI, VII and VIII.

12. A paint comprising a cement composition according to any preceding Claim dispersed in water.

13. A paint according to Claim 12, having a weight ratio of water to powder of from 0.55 to 0.60.



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