

SPECIFICATION

MULTI-COLOURED PAINT COMPOSITION, AND METHOD FOR FORMING A PATTERN FACE

5 Technical Field

The present invention relates to a new water-in-water type multi-coloured paint composition.

Background of the Art

10 Hitherto, paints which are generally called flat paints have been frequently used at the time of painting interior or exterior faces of buildings, such as wall faces, ceilings and doors. Typical examples of the flat paints are paints prescribed in JIS K5663 "Synthetic Resin Emulsion Paints". Such a flat paint can exhibit
15 various colors by using pigments to perform color-adjustment. However, the color obtained by the flat paint is a single color, and a pattern wherein plural colors are present to be mixed cannot be shown by a single painting operation.

On the other hand, various paint compositions which can
20 show a multi-coloured pattern by a single painting operation are suggested. An idea about the composition of such a paint was started from a patent issued to P. Busch. A typical example thereof is an oil-in-water type multi-coloured paint made practicable by J. C. Zola as U.S. Patent No. 2591904 and Japanese Patent No. 231698.
25 Thereafter, home and foreign paint engineers have been developing various multi-coloured paints. These can be classified to i) an oil-in-water type (O/W type), ii) a water-in-oil type (W/O type), iii) an oil-in-oil type (O/O type), and iv) a water-in-water type (W/W type).

For example, Japan Patent Laid-Open Application (JP-A) No.
30 Hei9-302281 describes a multi-coloured paint comprising

enamel-dispersed particles obtained by dispersing enamel yielded by use of a copolymer containing a crosslinking functional group into an aqueous type dispersive medium and then incorporating a crosslinking component therein. However, the paint described in this publication is an oil-in-water type multi-coloured paint comprising an organic solvent in the enamel-dispersed particles. Thus, when the paint is dried, an odor of the solvent is generated. The enamel-dispersed particles in the publication have a high hardness, and a substantially spherical, three-dimensional shape. It is therefore difficult to form a flat and smooth paint film.

In water-in-water multi-coloured paints wherein aqueous type particles are dispersed in an aqueous type medium, a problem of generation of odor, as described above, can be largely improved. An example of such a water-in-water type multi-coloured paint is a paint described in Japan Patent 2651533. The paint in this publication is a paint comprising scaly gel colored particles made from sodium alginate, polyvinyl alcohol or the like and hollow particles such as hollow resin foams and inorganic balloons. When the paint in the publication is used, a relatively flat and smooth paint film can be formed. However, in the paint in the publication, the hollow particles have light scattering property; therefore, formed paint films become off-white so that the finished surfaces lack vividness.

Another example of the water-in-water multi-coloured paint is a paint described in Patent 2525197.

However, colored particles described in this publication are encapsulated particles, and a liquid aqueous-type paint is encapsulated in the particles. For this reason, the capsules break dependently on painting conditions so that a desired pattern may not be formed. In particular, when roller painting or brush painting is performed, problems such that a color oozes out from the particles

are easily caused. In the paint in the publication, the inside of the capsules is liquid; therefore, there also arises a problem that formed patterns vary easily in accordance with the temperature and painting pressure when the paint is applied.

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Disclosure of the Invention

In light of such problems, the present invention has been made. Objects thereof are to provide a practical water-in-water type multi-coloured paint which makes it possible to form a paint film excellent in flatness and smoothness, and a painting method thereof.

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A first object of this invention is to provide a water-in-water type multi-coloured paint which makes it possible to form a mat paint film excellent in flatness, smoothness and vividness.

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A second object of this invention is to provide a water-in-water type multi-coloured paint which makes it possible to form a certain flat and smoothness, Multi-Colored which is unchanged even if painting conditions such as a painting tool and painting temperature are changed.

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A third object of this invention is to provide a painting method which makes it possible to form a colorful, flat and smooth paint film face by roller painting or brush painting.

In order to solve these objects, the present inventor has been eagerly investigated.

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As a result, it has been found out that the first object can be solved by dispersing flat colored gel particles into a mat transparent paint comprising an aqueous resin and an extender pigment having a refractive index of 1.4 to 1.7.

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It also has been found out that the second object can be solved by adopting, as the flat colored gel particles, a gelatinized

product made from an aqueous resin (a), a color pigment (b), water (c) and a reactive compound (d) which can react in the presence of water.

That is, this invention has the following characteristics.

5 1. A water-in-water type multi-coloured paint composition, characterized in that at least one kind of flat colored gel particles is dispersed in a mat transparent paint comprising an aqueous resin and an extender pigment having a refractive index of 1.4 to 1.7.

2. A water-in-water type multi-coloured paint composition,
10 characterized in that at least one kind of flat colored gel particles is dispersed in a mat transparent paint comprising an aqueous resin and an extender pigment having a refractive index of 1.4 to 1.7, and

the flat colored gel particles are made of a gelatinized product made from an aqueous resin (a), a color pigment (b), water (c), and a
15 reactive compound (d) which can react in the presence of water.

3. A water-in-water type multi-coloured paint composition, characterized in that at least one kind of flat colored gel particles is dispersed in a mat transparent paint comprising an aqueous resin and an extender pigment having a refractive index of 1.4 to 1.7, and
20 the flat colored gel particles are:

particles gelatinized by mixing a water-based paint comprising an aqueous resin (a), a color pigment (b) and water (c) with a reactive compound (d) which can react in the presence of water.

25 4. A water-in-water type multi-coloured paint composition, characterized in that at least one kind of flat colored gel particles is dispersed in a transparent paint comprising an aqueous resin, and

the flat colored gel particles are made of a gelatinized product made from an aqueous resin (a), a color pigment (b), water (c), and a
30 reactive compound (d) which can react in the presence of water.

5. A water-in-water type multi-coloured paint composition, characterized in that at least one kind of flat colored gel particles is dispersed in a transparent paint comprising an aqueous resin, and the flat colored gel particles are:

5 particles gelatinized by mixing a water-based paint comprising an aqueous resin (a), a color pigment (b) and water (c) with a reactive compound (d) which can react in the presence of water.

6. The water-in-water type multi-coloured paint composition according to any one of 2. to 5., wherein the (a) component is an aqueous resin (a-1) having a reactive functional group, and the (d) component is a reactive compound (d-1) which can react with the (a-1) component in the presence of water.

7. The water-in-water type multi-coloured paint composition according to any one of 2. to 5., wherein the (d) component is a reactive compound (d-2) which can be self-condensed in the presence of water.

8. A water-in-water type multi-coloured paint composition, characterized in that at least one kind of flat colored gel particles is dispersed in a transparent paint comprising an aqueous resin and an extender pigment having a refractive index of 1.4 to 1.7, and the flat colored particles are:

particles obtained by dispersing a gelatinized product obtained by mixing a water-based paint comprising an aqueous resin (a-1) having a reactive functional group, a color pigment (b) and water (c) with a reactive compound (d) which can react in the presence of water, in the form of flat particles, into an aqueous dispersive medium, and further mixing a reactive compound (d-1) which can react with the (a-1) component in the presence of water with the resultant.

9. A water-in-water type multi-coloured paint composition, characterized in that at least one kind of flat colored gel particles is dispersed in a transparent paint comprising an aqueous resin, and the flat colored particles are:

5 particles obtained by dispersing a gelatinized product obtained by mixing a water-based paint comprising an aqueous resin (a-1) having a reactive functional group, a color pigment (b) and water (c) with a reactive compound (d) which can react in the presence of water, in the form of flat particles, into an aqueous dispersive
10 medium, and further mixing a reactive compound (d-1) which can react with the (a-1) component in the presence of water with the resultant.

10. The water-in-water type multi-coloured paint composition according to 8. or 9., wherein the (d) component is a reactive
15 compound (d-1) which can react with the (a-1) component in the presence of water.

11. The water-in-water type multi-coloured paint composition according to 8. or 9., wherein the (d) component is a reactive
20 compound (d-2) which can be self-condensed in the presence of water.

12. A method of forming a pattern face, characterized by making an undercoat layer on a substrate of a building from a colored mat undercoat paint, and then

forming a topcoat layer by applying the water-in-water type
25 multi-coloured paint composition according to any one of 1. to 11. with a roller or brush.

According to this invention, a practical water-in-water type multi-coloured paint capable of forming a paint film excellent in flatness and smoothness can be obtained.

30 Specifically, a water-in-water type multi-coloured paint

capable of forming a mat paint film excellent in flatness, smoothness and vividness can be obtained by dispersing flat colored gel particles into a mat transparent paint comprising an aqueous resin and an extender pigment having a refractive index of 1.4 to 1.7.

5 A water-in-water type multi-coloured paint capable of forming an unchanged flat and smooth colorful pattern even if painting conditions such as a painting tool and painting temperature are changed can be obtained by adopting, as the flat colored gel particles, a gelatinized product made from the aqueous resin (a), the color
10 pigment (b), the water (c), and the reactive compound (d) which can react in the presence of water.

Furthermore, according to this invention, a colorful, flat and smooth paint face can be formed by applying the above-mentioned water-in-water type multi-coloured paint composition with a roller
15 or brush.

Best Modes for Carrying Out the Invention

The present invention, together with embodiments thereof, will be described in detail hereinafter.

20 (Transparent paint)

In the composition of this invention, a transparent paint is used as a dispersive medium. This transparent paint comprises an aqueous resin as an essential component. It is sufficient that the degree of the transparency is such a degree that the flat colored gel
25 particles can be recognized by visual observation and vividness is not lost.

The aqueous resin in the transparent paint is a component having a function for fixing the colored gel particles when a paint film is formed. As such an aqueous resin, a water-dispersible resin
30 and/or a water-soluble resin can be used. Examples of the kind of

the resin include acryl resin, urethane resin, vinyl acetate resin, silicone resin, fluorine-contained resin, acryl-vinyl acetate resin, acryl-urethane resin, acryl-silicone resin, polyvinyl alcohol, and cellulose derivatives. One or more thereof can be used.

5 Such an aqueous resin may be a resin having a nature that crosslinking reaction is generated after a paint film is formed. By having such crosslinking reactivity, properties of a paint film such as water resistance, weather resistance, dirt resistance and chemical resistance can be made high.

10 In the case of forming a mat paint film, a mat transparent paint is suitable as the dispersive medium. This mat transparent paint can be obtained by mixing the above-mentioned transparent paint with an extender pigment having a refractive index of 1.4 to 1.7. By using such an extender pigment in the mat transparent
15 paint, the vividness of the paint film can be kept and at the same time mat effect can be obtained. Examples of the extender pigment which can be used include heavy calcium carbonate, calcite, light calcium carbonate, white carbon, talc, kaolin, clay, potter's clay, china clay, diatomaceous earth, barite powder, barium sulfate,
20 precipitating barium sulfate, silica sand, silica rock powder, quartz powder, and resin powder (except hollow material). These may be used alone or in a combination of two or more thereof. The refractive index is a value measured by use of an Abbe refractometer.

25 The average particle size of the extender pigment is usually 20 μm or less, preferably from 0.1 to 15 μm , and more preferably from 0.5 to 8 μm . By using the extender pigment having such an average particle size, the vividness of the paint film can be made higher. The average particle size referred to herein means a 50% particle size measured with a particle size distribution analyzer
30 using a centrifugal settlement system.

The blend ratio of the extender pigment in the mat transparent paint is usually from 5 to 200 parts by weight, preferably from 10 to 100 parts by weight per 100 parts by weight of solid content in the aqueous resin.

5 The "mat" in this invention includes not only ordinary mat but also only thirty-percent gloss, fifty-percent gloss and some other gloss. Specifically, in this invention, gloss can be specified by specular gloss. The specular gloss of the above-mentioned mat transparent paint is usually 40 or less, preferably 20 or less, and
10 more preferably 10 or less. The gloss of the mat transparent paint can be appropriately adjusted by selecting the kind and the particle size of the extender pigment(s) used in the mat paint, the blend ratio between the pigments, and other factors.

 The specular gloss is a value measured in accordance with 7.6
15 "Specular Gloss" in JIS K5400. Specifically, this is a value obtained by applying a paint to one surface of a glass plate with a B-type film applicator having a gap of 150 μm in length, placing the paint-applied surface horizontally, and measuring the specular gloss (measuring angle: 60 degrees) of the surface after drying the plate at
20 a temperature of 20°C and a relative humidity of 65% for 48 hours. (Flat colored gel particles)

 In the composition of this invention, flat colored gel particles (hereinafter referred to merely as "colored particles" on occasion) are dispersed in the above-mentioned transparent paint. In this
25 invention, a flat and smooth paint film can be formed by the matter that the shape of the colored particles is flat. The word "flat" used in this invention means the state that the ratio of the short diameter to the thickness is more than 1. The short diameter and the long diameter of the colored particles are not particularly limited, and are
30 usually from 0.01 to 10 mm, preferably from 0.1 to 5 mm, and more

preferably from 0.7 to 2 mm.

At least one kind of the colored particles must be contained in the composition. In order to show a colorful pattern face, it is desired that two or more kinds of colored particles having different color tones are contained. The color tone of the particles can be appropriately set dependently on a desired pattern. As the colored particles, particles having transparency may be contained.

The blend ratio of the colored particles is usually from 50 to 1000 parts by weight, preferably from 100 to 900 parts by weight, and more preferably from 200 to 800 parts by weight per 100 parts by weight of solid content in the aqueous resin contained in the transparent paint.

A gelatinized product made from an aqueous resin (a), a color pigment (b), water (c) and a reactive compound (d) which can react in the presence of water is preferable as the colored particles in the composition of this invention. Such colored particles have both of appropriate softness and strength, and an unchanged colorful pattern can be formed even if painting conditions such as a painting tool and painting temperature are changed. In the case of performing roller painting or brush painting as well as spray painting, it is possible to prevent the generation of ooze based on the pigment out of the colored particles, or others. It is therefore possible to obtain a water-in-water type multi-coloured paint which is also useful for roller painting or brush painting.

Specifically, such colored particles can be obtained by mixing the reactive compound (d) which can react in the presence of water with a water-based paint comprising the aqueous resin (a), the color pigment (b) and water (c) to gelatinize the water-based paint, and then dispersing this gelatinized product into the transparent paint.

The aqueous resin (hereinafter referred to the "(a)

component") in the water-based paint functions as a vehicle. A water-dispersible resin and/or a water-soluble resin can be used as the aqueous resin. Specific examples thereof include acryl resin emulsion, urethane resin emulsion, vinyl acetate resin emulsion, 5 silicone resin emulsion, fluorine-contained resin emulsion, acryl-vinyl acetate resin emulsion, acryl-urethane resin emulsion, acryl-silicone resin emulsion, polyvinyl alcohol, poly(meth)acrylic acid, polyethylene oxide, water-soluble urethane, bio gum, galactomannan derivatives, alginic acid or derivatives thereof, 10 cellulose derivatives, gelatin, casein, albumin, and products obtained by modifying them chemically by oxidization, methylation, carboxymethylation, hydroxyethylation, hydroxypropylation, sulfation, phosphorylation, or cationization. One or more thereof can be used.

15 The blend amount of the (a) component in the water-based paint is usually from 3 to 95% by weight, preferably from 5 to 80% by weight.

As the (a) component, an aqueous resin having a reactive functional group (hereinafter referred to as "(a-1)") can be used.

20 Such an (a-1) component can be appropriately used after combining with a (d-1) component, which will be described later.

Examples of the reactive functional group in the (a-1) component include carboxyl, epoxy, hydroxy, carbonyl, hydrazino, amino and alkoxysilyl groups.

25 As the color pigment (hereinafter referred to the "(b) component"), a pigment which is generally incorporated into paint can be used. Examples thereof include titanium oxide, zinc oxide, carbon black, lamp black, bone black, graphite, black iron oxide, copper chromium black, cobalt black, copper manganese iron black, 30 red oxide, Molybdate Orange, Permanent Red, Permanent Carmine,

Anthraquinone Red, Perylene Red, Quinacridon Red, yellow iron oxide, Titan Yellow, Fast Yellow, Benzimidazolone Yellow, chromium green, cobalt green, Phthalocyanine Green, ultramarine blue, Berlin Blue, cobalt blue, Phthalocyanine Blue, Qunacridone Violet,
5 Dioxazine Violet, aluminum pigment and pearl pigment. One or more thereof can be used.

The blend amount of the (b) component in the water-based paint is usually from 0.01 to 50% by weight, preferably from 0.5 to 40% by weight.

10 As a dispersing agent for the (b) component, a polymer dispersing agent is preferable since the color stability of the colored particles, in particular, the color stability at the time of storage at high temperature can be improved.

The molecular weight of such a polymer dispersing agent is
15 usually from 2000 to 100000, preferably from 5000 to 50000. Specific examples thereof include anionic polymer dispersing agents, nonionic polymer dispersing agents, cationic polymer dispersing agents, and amphoteric polymer dispersing agents. One or more thereof can be used. Among these, the cationic polymer dispersing
20 agents are preferable for this invention.

The HLB of the polymer dispersing agent is desirably from 3 to 15, more desirably from 5 to 10. When the polymer dispersing agent having such an HLB is used, the color stability of the colored particles can be further improved. The HLB is an abbreviation of
25 the balance between hydrophilicity and lipophilicity, and is a numerically-expressed strength ratio between hydrophilicity and lipophilicity of an amphipathic substance.

The reactive compound which can react in the presence of water (hereinafter referred to as the "(d) component") is a component
30 for gelatinizing the water-based paint comprising the

above-mentioned (a) to (c) components.

In the case that the (a-1) component is used as the (a) component in this invention, a reactive compound which can react with the (a-1) component in the presence of water (hereinafter referred to the "d-1 component") is preferable as the (d) component. The combination of reactive functional groups in the (a-1) component and the (d-1) component is not particularly limited if the combination makes the gelatinization possible. Examples thereof include combinations of a carboxyl group and a carbodiimide group, a carboxyl group and an epoxy group, a carboxyl group and an aziridine group, a carboxyl group and an oxazoline group, a hydroxyl group and an isocyanate group, a carbonyl group and a hydrazino group, an epoxy group and a hydrazino group, an epoxy group and an amino group, and alkoxysilyl groups among themselves. One or more of these combinations can be used.

Specific examples of the (d-1) component include materials described in Japanese Patent Laid-Open application Nos. Hei10-60272, Hei10-316930 and Hei11-60667 as compounds containing a carbodiimide group; polyethylene glycol diglycidyl ether, polyhydroxyalkane polyglycidyl ether, diglycerol polyglycidyl ether and sorbitol polyglycidyl ether as compounds containing an epoxy group; 2,2-bishydroxymethylbutanol-tris[3-(1-aziridinyl)propionate], 1,6-hexamethylenediethyleneurea, and diphenylmethane-bis-4,4'-N,N'-diethyleneurea as compounds containing an aziridine group; resins obtained by copolymerizing a polymerizable oxazoline compound such as 2-vinyl-2-oxazoline, 2-vinyl-4-methyl-2-oxazoline, 2-vinyl-5-methyl-2-oxazoline or 2-isopropenyl-2-oxazoline with a monomer which can be copolymerizable with the oxazoline compound, as compounds

containing an oxazoline group; tetramethylenediisocyanate, hexamethylenediisocyanate, isophoronediiisocyanate, or derivatives thereof as compounds containing an isocyanate group; and dihydrazide malonate, dihydrazide succinate, dihydrazide glutarate, dihydrazide adipate, dihydrazide sebacate, and dihydrazide maleate as compounds containing a hydrazino group.

As the (d) component, a reactive compound which can be self-condensed in the presence of water (hereinafter referred to the "(d-2) component") can also be used. When the (d-2) component is used, the (a) component is not particularly limited and may be an aqueous resin other than the (a-1) component.

As the (d-2) component, preferable is a hydrolytically condensing reactive compound containing an alkoxysilyl group. Examples of such a hydrolytically reactive compound include tetramethoxysilane, tetraethoxysilane, tetra n-propoxysilane, tetraisopropoxysilane, tetra n-butoxysilane, tetraisobutoxysilane, tetra sec-butoxysilane, tetra t-butoxysilane, tetraphenoxysilane, dimethoxydiethoxysilane, methyltrimethoxysilane, methyltriethoxysilane, ethyltrimethoxysilane, ethyltriethoxysilane, phenyltrimethoxysilane, dimethyldimethoxysilane, diethyldimethoxysilane, diphenyldimethoxysilane, γ -glycidoxypropyltrimethoxysilane, γ -glycidoxypropylmethyldimethoxysilane, γ -mercaptopropyltrimethoxysilane, γ -aminopropyltriethoxysilane, N-(β -aminoethyl)- γ -aminopropyltrimethoxysilane, N-(β -aminoethyl)- γ -aminopropylmethyldimethoxysilane, γ -methacryloxypropyltrimethoxysilane, γ -methacryloxypropylmethyldimethoxysilane, methyltrichlorosilane, and condensation products thereof. Alkoxysilane

compounds containing a carboxyl group, a hydroxyl group, a sulfonic group, an oxyalkylene group or the like can be used. These can be used alone or in combination of two or more thereof.

Among these, a tetraalkoxysilane compound is preferably used in this invention. The tetraalkoxysilane compound is a compound represented by $\text{RO}-(\text{Si}(\text{OR})_2\text{O})_n\text{-R}$ wherein R is an alkyl group and $n \geq 1$. In particular, in this invention, tetraalkoxysilane compounds wherein alkyl groups having 1 to 2 carbon atoms and alkyl groups having 3 or more carbon atoms (preferably 3 to 12) are present in a mixture form are most preferable.

The blend amount of the (d) component is usually from 0.1 to 10% by weight, preferably from 0.3 to 6% by weight of the water-based paint. In the case that the (d) component is a little, the capability of forming gel is insufficient. Thus, it is feared that the colored particles are broken at the time of painting (in particular, at the time of roller painting or brush painting). In the case that the (d) component is rich, the colored particles become hard so that a flat and smooth paint film is not easily obtained.

In order to promote the reaction of the (d) component, a catalyst for the (d) component can be mixed as necessary. Examples of such a catalyst include inorganic acids such as hydrochloric acid, sulfuric acid, nitric acid and phosphoric acid; organic acids such as acetic acid, benzenesulfonic acid and toluenesulfonic acid; alkali catalysts such as sodium hydroxide, potassium hydroxide, ammonia, and amine compounds; organic tin compounds such as dibutyltin dilaurate, dibutyltin dioctylate, and dibutyltin diacetate; organic aluminum compounds such as aluminum tris(acetylacetonate), and aluminum monoacetylacetonate bis(ethylacetoacetate); organic titanium compounds such as titanium tetrakis(acetylacetonate); organic

zirconium compounds such as zirconium tetrakis(cetylacetate);
and boron compounds such as boric acid.

(Process for producing a multi-coloured paint)

5 In the production of the composition of this invention, the (d)
component is first mixed with the water-based paint comprising the
(a) to (c) components, thereby preparing a gelatinized product. The
gelatinized product in this invention embraces all materials wherein
gelatinization reaction is started by the incorporation of the (d)
component regardless of the degree of the advance of the
10 gelatinization reaction.

The pH of the water-based paint for forming the gelatinized
product is not particularly limited if the gelatinization reaction can
be started. The pH is usually from 7 to 14. By setting the pH of the
water-based paint to such a value, a suitable reactivity can be
15 obtained, in particular, when the (d-2) is used as the (d) component.

It is advisable that the mixture of the water-based paint with
the (d) component is usually conducted at ambient temperature. In
order to promote the gelatinization reaction, heating may be
conducted.

20 Next, this gelatinized product is added to an aqueous
dispersive medium so as to be dispersed in a flat particle form. The
timing when the gelatinized product is added to the aqueous
dispersive medium can be appropriately set, and may be
immediately after the water-based paint is mixed with the (d)
25 component or after the resultant is allowed to stand for a given time.

As the aqueous dispersive medium, a part or the whole of the
transparent paint can be used. When the gelatinized product is
added to the aqueous dispersive medium, the aqueous resin may not
be contained in the aqueous dispersive medium and can be mixed in
30 a subsequent step.

In order to make the shape of the formed colored particles into a flat form, it is advisable to select or adjust appropriately the shape of stirring fans, the size and position of the stirring fans relative to a stirring tank, the rotation speed of the stirring fans, the viscosity of the water-based paint, the manner of adding the gelatinized product, the viscosity of the transparent paint, and so on. The particle size of the colored particles can be adjusted in the same way.

Since the shape of the colored particles is flat in this invention, a paint film excellent in flatness can be formed. The short diameter and the long diameter of the colored particles are not particularly limited, and are usually from 0.01 to 10 mm, preferably from 0.1 to 5 mm, and more preferably from 0.7 to 2 mm.

When the gelatinized product is dispersed in the aqueous dispersive medium, a dispersion stabilizer can also be used. Examples of such a dispersion stabilizer include magnesium salts, calcium salts, barium salts, aluminum salts, sodium salts, potassium salts, and borates.

A component for promoting reaction of unreacted portions of the colored particles can also be incorporated into the aqueous dispersive medium so as to conduct the more reliable gelatinization.

The pH of the aqueous dispersing medium is usually from 7 to 10, preferably from 7 to 9. In particular, when the (d-2) component is used, it is desired to set the pH of the aqueous dispersive medium into such a range.

In this invention, after the dispersion of the gelatinized product in the aqueous dispersive medium, the (d-1) can be further blend therewith. In this case, as the (a) component, the (a-1) component is used.

Through such a step, the (a-1) component and the (d-1)

component react with each other in the colored particle surface layer, so as to make the roller painting suitability or brush painting suitability of the multi-coloured paint still higher. As a result, properties of the paint film such as weather resistance and water resistance can also be improved.

The blend amount of the (d-1) component is usually from about 0.1 to 10% by weight of the colored particles. It is advisable that the blend of the (d-1) component is usually conducted at ambient temperature. Heating may be conducted as necessary.

In order to obtain the composition of this invention having two or more colored particles different in color tone, it is advisable to adopt, for example, the following methods:

a method of producing paints wherein colored particles in a single color are dispersed independently, and subsequently mixing these paints; or

a method of adding two or more gelatinized products different in color tone simultaneously or sequentially to the dispersive medium, and dispersing the products in the medium.

Into the composition of this invention, colored particles other than the flat colored gel particles can be incorporated. Examples of such colored particles include natural stone cracked products, colored aggregates, plastic pieces, rubber pieces, metal pieces, and inorganic mineral pieces.

In the composition of this invention, known additives for paint other than the above can be appropriately used. Examples of such additives include a pigment dispersing agent, an antifoamer, a thickener, an ultraviolet absorber, an antioxidant, an antifungal agent, a preservative, a film-forming aid, and an antifreezing agent. A color pigment may be added to the transparent paint unless the vividness of the resultant paint film is damaged. An extender

pigment or the like can be used in the water-based paint which makes the colored particles.

(Painting method)

The composition of this invention can be used for various purposes, for example, for building, building materials, civil engineering, woodwork, plastic products, metal products, non-ferrous metal products, and so on. Specifically, the composition can be used, for example, as a surface decorating material for various substrates such as concrete, mortal, siding board, extruded plates, plasterboard, perlite board, plywood, plastic board, metal plates, glass, and porcelain tiles. The surfaces of these substrates may be subjected to any surface treatment (for example, with a sealer, a surfacer, or filler). The substrate may be a substrate on which a paint film has already been formed, a substrate to which wallpaper is pasted, or some other substrate.

In this invention, it is desired to make an undercoat layer from a colored mat undercoat paint (hereinafter referred to merely as the "undercoat paint" on occasion) before the painting of the multi-coloured paint composition. Such an undercoat layer has, on the surface thereof, fine irregularities having a size in micrometer order. The fine irregularities causes an improvement in the painting workability of the multi-coloured paint (in particular, the painting workability at the time of roller painting or blush painting), so that a uniform and even pattern face can be formed. It is sufficient that the degree of coloration in the undercoat paint is such an extent that the substrate can be hidden.

Specifically, the gloss of the undercoat paint in this invention can be defined by the specular gloss thereof. The specular gloss of the undercoat paint is usually 40 or less, preferably 20 or less, and more preferably 10 or less. In the case that the specular gloss of the

undercoat paint is high, it is difficult that the undercoat paint is uniformly applied. The adjustment of the gloss of the undercoat paint can be appropriately performed by the kind and particle size of an extender pigment or extender pigments, which will be described later, the blend ratio between the pigments, and so on.

The undercoat paint can be produced by mixing the aqueous resin, the color pigment, and extender pigment(s).

As the aqueous resin, a water-dispersible resin and/or a water-soluble resin can be used. Examples of the kind of the resin include acryl resin, urethane resin, vinyl acetate resin, silicone resin, fluorine-contained resin, acryl/vinyl acetate resin, acryl/urethane resin, acryl/silicone resin, polyvinyl alcohol, and cellulose derivatives. One or more thereof can be used.

Such a water-dispersible resin or water-soluble resin may be a resin having a nature that crosslinking reaction is generated after the formation of a paint film. By having such crosslinking reactivity, properties of a paint film such as water resistance and adhesiveness can be made high. Moreover, in the case that the substrate contains lye, gum or the like, the oozing thereof can be prevented if a cationic aqueous resin is used.

Examples of the color pigment include titanium oxide, zinc oxide, carbon black, lamp black, bone black, graphite, black iron oxide, copper chromium black, cobalt black, copper manganese iron black, red iron oxide, Molybdate Orange, Permanent Red, Permanent Carmine, Anthraquinone Red, Perylene Red, Quinacridon Red, yellow iron oxide, Titan Yellow, Fast Yellow, Benzimidazolone Yellow, chromium green, cobalt green, Phthalocyanine Green, ultramarine blue, Berlin Blue, cobalt blue, Phthalocyanine Blue, Quinacridone Violet, Dioxazine Violet, aluminum pigment and pearl pigment. By using one or more of these color pigments, the undercoat paint can

be colored into a desired color tone.

Examples of the extender pigment include heavy calcium carbonate, calcite, light calcium carbonate, white carbon, talc, kaolin, clay, potter's clay, china clay, diatomaceous earth, barite powder, barium sulfate, precipitating barium sulfate, silica sand, silica rock powder, quartz powder, resin beads, glass beads, and hollow balloons. One or more thereof can be used. The average particle size of the extender pigment is usually from 0.1 to 500 μm , preferably from 1 to 200 μm .

About the blend ratio of each of the components in the undercoat paint, the amount of the color pigment is from 1 to 300 parts by weight (preferably from 5 to 200 parts by weight), and the amount of the extender pigment is from 5 to 300 parts by weight (preferably from 10 to 200 parts by weight) per 100 parts by weight of solid content in the aqueous resin.

In the undercoat paint, known additives for paint can be appropriately used besides the above-mentioned components. Examples of such additives include a pigment dispersing agent, an antifoamer, a thickener, an ultraviolet absorber, an antioxidant, an antifungal agent, a preservative, a film-forming aid, and an antifreezing agent.

The color tone of the undercoat paint is not particularly limited. It is desired that the color tone is a color which is approximate to that of at least one of the colored particles. By setting such a color tone, harmonious finish having a highly beautiful appearance can be obtained.

For the application of the undercoat paint, a roller, a brush, a trowel, a spray or the like can be used. In the case that the applicator is used indoors, a roller or a brush is preferable from the viewpoints of painting workability, applying and adhering ability,

and others. At the time of the application, the undercoat paint may be diluted with water. The applying amount of the undercoat paint is usually from 0.05 to 0.5 kg/m².

It is advisable that the drying of the undercoat paint after the application thereof is usually performed at ambient temperature, and optionally by heating. The time for the drying is usually from 0.5 to 5 hours. After drying the undercoat paint, the multi-coloured paint can be applied thereto.

When the multi-coloured paint is applied, various applicators such as a spay, a roller, a blush, and a trowel can be used. In particular, in the case that the colored particles are particles made from the (a) to (d) components, a roller or a blush is preferable.

If the colored particles are particles made from the (a) to (d) components, uniform finish can be obtained when different applicators are used for one surface to be applied. For this reason, finish giving no feeling of wrongness can be obtained in the case that a roller or a blush is used to repair after spray coating.

At the time of the application, the paint may be diluted with water. It is advisable that the blend amount of water is appropriately set, considering the kind of the applicator, the state of the undercoat for the application, the temperature at the time of the application, and others.

The applying amount of the composition of this invention is usually from 0.2 to 1.6 kg/m², preferably from 0.3 to 1.2 kg/m². It is advisable that the pattern face after the application of the composition of this invention may be usually dried at ambient temperature, and optionally by heating. The time for the drying is usually from 1 to 5 hours.

The top coat layer made from the multi-coloured paint may be a continuous layer or a discontinuous layer. In particular, in the

case that a colored mat paint is used for the undercoat layer, a pattern face giving no feeling of wrongness can be formed even if the top coat layer does not completely cover the undercoat layer.

5 Examples

Examples will be described hereinafter, thereby making the characteristics of this invention clearer.

The following ingredients were used in the production of a paint:

- 10 • Water-dispersible resin A: acrylic resin emulsion (styrene/methyl methacrylate/2-ethylhexyl acrylate copolymer, minimum film-forming temperature = 3°C, pH = 8.8, solid content = 50% by weight)
- Water-dispersible resin B: acrylic resin emulsion (styrene/methyl
15 methacrylate/2-ethylhexyl acrylate copolymer, minimum film-forming temperature = 2°C, pH = 6.2, solid content = 50% by weight)
- Water-dispersible resin C: carboxyl group-containing acrylic resin emulsion (methyl methacrylate/butyl acrylate/acrylic acid
20 copolymer, minimum film-forming temperature = 0°C, pH = 8.2, solid content = 50% by weight)
- Water-dispersible resin D: acrylic resin emulsion (styrene/butyl acrylate copolymer, minimum film-forming temperature = 0°C, solid content = 50% by weight)
- 25 • Water-soluble resin A: hydroxyethylcellulose powder
- Water-soluble resin B: 3% by weight galactomannan aqueous solution
- Pigment A: heavy calcium carbonate (refractive index = 1.50, average particle size = 8 μ m)
- 30 • Pigment B: silica rock powder (refractive index = 1.55, average

particle size = 2 μm)

• Pigment C: precipitating barium sulfate (refractive index = 1.64, average particle size = 4 μm)

5 • Pigment D: silica rock powder (refractive index = 1.55, average particle size = 50 μm)

• Pigment E: zinc oxide (refractive index = 2.01, average particle size = 0.2 μm)

• Pigment F: silica rock powder (refractive index = 1.55, average particle size = 150 μm)

10 • White pigment solution A: 60% by weight titanium oxide dispersed solution (dispersing agent: carbonic acid type dispersing agent, molecular weight = 1800)

• White pigment solution B: 60% by weight titanium oxide dispersed solution (dispersing agent: cationic polymer dispersing agent
15 (alkylene oxide adduct of alkylamine, molecular weight = 15000, HLB = 8))

• Black pigment solution A: 15% by weight black iron oxide dispersed solution (dispersing agent: carbonic acid type dispersing agent, molecular weight = 1800)

20 • Black pigment solution B: 15% by weight black iron oxide dispersed solution (dispersing agent: cationic polymer dispersing agent (alkylene oxide adduct of alkylamine, molecular weight = 15000, HLB = 8)

• Reactive compound A: butoxy-modified product of a
25 tetramethoxysilane condensate

• Reactive compound B: tetramethoxysilane condensate

• Reactive compound C:

2,2-bishydroxymethylbutanol-tris[3-(1-aziridinyl)propionate]

• pH adjustor: ammonia water

30 • Antifoamer: silicone type antifoamer

[Test Example 1]**(Production of multi-coloured paints)****Paint composition 1-A**

First, 200 parts by weight of the water-dispersing resin A were charged into a container. While stirring of the resin was performed in the state that the rotation speed of stirring fans was set to 1800 rpm, 3 parts by weight of the water-soluble resin A, 20 parts by weight of the pigment A, 1 part by weight of the antifoamer, and 250 parts by weight of water were added thereto and uniformly mixed, thereby producing a transparent paint 1-A. The pH of this transparent paint 1-A was 8.0, and the specular gloss was 8.

Next, 90 parts by weight of the water-dispersing resin A were charged into another container. While stirring of the resin was performed in the state that the rotation speed of stirring fans was set to 1800 rpm, 180 parts by weight of the water-soluble resin B, 90 parts by weight of the white pigment solution, 5 parts by weight of the antifoamer, 80 parts by weight of water, and 5 parts by weight of the reactive compound A were added thereto and uniformly mixed, thereby producing a white water-based paint 1-A. The pH of this water-based paint 1-A was 9.5.

To 474 parts by weight of the above-mentioned transparent paint 1-A were added 8 parts by weight of an aqueous 5% by weight ammonium borate solution as a dispersion stabilizer. The rotation speed of the stirring fans was set to 900 rpm to mix the solution uniformly. Thereafter, 450 parts by weight of the water-based paint 1-A were gradually added to and dispersed in the mixture while the stirring was further continued. In this way, a paint composition 1-A wherein flat white particles having a size of 0.8 to 1.2 mm were dispersed was yielded.

Paint composition 1-B

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-B wherein flat gray particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

Paint composition 1-C

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-C wherein flat black particles having a size of 0.8 to 1.2 mm were dispersed was yielded.

Paint composition 1-D

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-D wherein flat gray particles having a size of 0.8 to 1.6 mm were dispersed was yielded.

Paint composition 1-E

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-E wherein flat black particles having a size of 0.8 to 1.2 mm were dispersed was yielded.

Paint composition 1-F

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-F wherein flat gray particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

Paint composition 1-G

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-G wherein flat black particles having a size of 0.8 to 1.2 mm were dispersed was yielded.

Paint composition 1-H

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-H wherein flat gray particles having a size of 1.0 to 1.8 mm were dispersed was yielded.

Paint composition 1-I

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-I wherein flat black particles having a size of 1.2 to 1.6 mm were dispersed was yielded.

Paint composition 1-J

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-J wherein flat gray particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

Paint composition 1-K

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-K wherein flat black particles having a size of 0.8 to 1.2 mm were dispersed was yielded.

Paint composition 1-L

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-L wherein flat gray particles having a size of 1.0 to 1.8 mm were dispersed was yielded.

Paint composition 1-M

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-M wherein flat black particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

Paint composition 1-N

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-N wherein flat gray particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

Paint composition 1-O

A paint was produced in the same way as the paint composition 1-A except that respective ingredients were used at a blend ratio shown in Table 1. In this way, a paint composition 1-O wherein flat black particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

[Table 1]

	1-A	1-B	1-C	1-D	1-E	1-F	1-G	1-H	1-I	1-J	1-K	1-L	1-M	1-N	1-O
Transparent paint	Water-dispersing resin A	200	200	200	200	200	200	200	200	200	200	200	200	200	200
	Water-soluble resin A	3	4	4	4	4	4	4	4	4	4	4	4	4	4
	Pigment A	20	-	-	-	-	-	-	-	-	-	-	-	-	-
	Pigment B	-	35	-	35	-	35	35	35	35	35	-	-	-	-
	Pigment C	-	-	35	-	-	-	-	-	-	-	-	-	-	-
	Pigment D	-	-	-	-	-	-	-	-	-	-	35	35	-	-
	Pigment E	-	-	-	-	-	-	-	-	-	-	-	-	35	35
	Antifoamer	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Water	250	380	380	380	380	380	380	380	380	380	380	380	380	380
	Dispersion stabilizer	8	10	8	10	8	8	10	8	10	8	10	8	10	8
Water-based paint	pH	8.0	8.1	8.0	8.1	8.0	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.2	8.2
	Specular gloss	8	5	5	5	5	5	5	5	5	5	4	4	72	72
	Water-dispersing resin A	90	85	100	85	100	100	85	100	-	-	85	100	85	100
	Water-dispersing resin B	-	-	-	-	-	-	-	-	85	100	-	-	-	-
	Water-soluble resin B	180	250	200	250	200	200	250	200	250	200	250	200	250	200
	White pigment solution A	90	50	-	-	50	-	50	-	50	-	50	-	50	-
	White pigment solution B	-	-	-	50	-	-	-	-	-	-	-	-	-	-
	Black pigment solution A	-	50	100	-	50	100	50	100	50	100	50	100	50	100
	Black pigment solution B	-	-	-	50	100	-	-	-	-	-	-	-	-	-
	pH adjustor	-	-	4	-	4	4	-	4	-	-	-	4	-	4
	Antifoamer	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Water	80	50	70	50	70	70	50	70	50	70	50	70	50	70
	Reactive compound A	5	10	25	10	25	-	-	-	10	25	10	25	10	25
	Reactive compound B	-	-	-	-	-	-	10	25	-	-	-	-	-	-
	pH	9.5	9.2	11.5	9.0	11.2	9.0	11.4	9.1	11.2	6.4	9.2	11.5	9.2	11.5

All numerical values, except specular gloss and pH, in the table are values representing parts by weight.

(Example 1-1)

A sand skeleton roller was used to apply a multi-coloured paint wherein the paint composition 1-A and the paint composition 1-B were mixed at a weight ratio of 50:50, at an applying amount of 0.6 kg/m², to a slate plate which was beforehand coated with a gray sealer, and the paint was dried at ambient temperature for 24 hours. Thereafter, the state of the paint film was observed. In Example 1-1, a flat and smooth and highly vivid pattern paint film wherein white and gray were mixed was able to be formed. No abnormality was observed in the colored particles.

(Example 1-2)

Painting was performed in the same way as in Example 1-1 except that there was used a paint composition wherein the paint composition 1-A, the paint composition 1-B and the paint composition 1-C were mixed at a weight ratio of 80:10:10 as the multi-coloured paint.

In Example 1-2, a flat and smooth and highly vivid pattern paint film wherein white, gray and black were mixed was able to be formed. No abnormality was observed in the colored particles.

(Example 1-3)

Painting was performed in the same way as in Example 1-1 except that there was used a paint composition wherein the paint composition 1-D and the paint composition 1-E were mixed at a weight ratio of 50:50 as the multi-coloured paint.

In Example 1-3, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed. No abnormality was observed in the colored particles.

(Example 1-4)

Painting was performed in the same way as in Example 1-1 except that there was used a paint composition wherein the paint

composition 1-F and the paint composition 1-G were mixed at a weight ratio of 50:50 as the multi-coloured paint.

In Example 1-4, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed.

5 However, ooze in gray and black was generated from the colored particles.

(Example 1-5)

Painting was performed in the same way as in Example 1-1 except that there was used a paint composition wherein the paint
10 composition 1-H and the paint composition 1-I were mixed at a weight ratio of 50:50 as the multi-coloured paint.

In Example 1-5, a highly vivid pattern paint film wherein gray and black were mixed was able to be formed. However, the pattern was a pattern wherein irregularities were more conspicuous than
15 those in Example 1-1.

(Example 1-6)

Painting was performed in the same way as in Example 1-1 except that there was used a paint composition wherein the paint composition 1-J and the paint composition 1-K were mixed at a
20 weight ratio of 50:50 as the multi-coloured paint.

In Example 1-6, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed. However, ooze in gray and black was generated from the colored particles.

25 (Example 1-7)

Painting was performed in the same way as in Example 1-1 except that there was used a paint composition wherein the paint composition 1-L and the paint composition 1-M were mixed at a weight ratio of 50:50 as the multi-coloured paint.

30 In Example 1-7, a flat and smooth and highly vivid pattern

paint film wherein gray and black were mixed was able to be formed. However, the finish thereof was a finish which was slightly poorer in vividness than that of Example 1-1.

(Reference Example 1-1)

5 Painting was performed in the same way as in Example 1-1 except that there was used a paint composition wherein the paint composition 1-N and the paint composition 1-O were mixed at a weight ratio of 50:50 as the multi-coloured paint.

10 In Reference Example 1-1, the whole of the paint film was off-white, and no pattern paint film having high vividness was able to be formed.

[Test Example 2]

(Production of multi-coloured paints)

Paint composition 2-A

15 First, 200 parts by weight of the water-dispersing resin A were charged into a container. While stirring of the resin was performed in the state that the rotation speed of stirring fans was set to 1800 rpm, 4 parts by weight of the water-soluble resin A, 35 parts by weight of the pigment B, 1 part by weight of the antifoamer, and 380
20 parts by weight of water were added thereto and uniformly mixed, thereby producing a transparent paint 2-A. The pH of this transparent paint 2-A was 8.1, and the specular gloss was 5.

25 Next, 85 parts by weight of the water-dispersing resin C were charged into another container. While stirring of the resin was performed in the state that the rotation speed of stirring fans was set to 1800 rpm, 250 parts by weight of the water-soluble resin B, 50 parts by weight of the white pigment solution A, 50 parts by weight of the black pigment solution A, 5 parts by weight of the antifoamer, 50 parts by weight of water, and 3 parts by weight of the reactive
30 compound C were added thereto and uniformly mixed, thereby

producing a white water-based paint 2-A. The pH of this water-based paint 2-A was 8.9.

To 620 parts by weight of the above-mentioned transparent paint 2-A were added 10 parts by weight of an aqueous 5% by weight ammonium borate solution as a dispersion stabilizer. The rotation speed of the stirring fans was set to 900 rpm to mix the solution uniformly. Thereafter, 493 parts by weight of the water-based paint 2-A were gradually added to and dispersed in the mixture while the stirring was further continued. In this way, a paint composition 2-A wherein flat gray particles having a size of 0.7 to 1.2 mm were dispersed was yielded.

Paint composition 2-B

A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a blend ratio shown in Table 2. In this way, a paint composition 2-B wherein flat black particles having a size of 0.8 to 1.6 mm were dispersed was yielded.

Paint composition 2-C

A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a blend ratio shown in Table 2. In this way, a paint composition 2-C wherein flat gray particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

Paint composition 2-D

A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a blend ratio shown in Table 2. In this way, a paint composition 2-D wherein flat black particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

Paint composition 2-E

A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a blend ratio shown in Table 2. In this way, a paint composition 2-E wherein flat gray particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

Paint composition 2-F

A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a blend ratio shown in Table 2. In this way, a paint composition 2-F wherein flat black particles having a size of 0.8 to 1.5 mm were dispersed was yielded.

In the production of the paint compositions 2-E and F, a mixture of the water-based paint and the reactive compound C was added to and dispersed in the transparent paint, and subsequently the reactive compound C was further mixed therewith.

Paint composition 2-G

A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a blend ratio shown in Table 2. In this way, a paint composition 2-G wherein flat gray particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

Paint composition 2-H

A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a blend ratio shown in Table 2. In this way, a paint composition 2-H wherein flat black particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

In the production of the paint compositions 2-G and H, a mixture of the water-based paint and the reactive compound A was added to and dispersed in the transparent paint, and subsequently

the reactive compound C was further mixed therewith.

Paint composition 2-I

5 A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a blend ratio shown in Table 2. In this way, a paint composition 2-I wherein flat gray particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

Paint composition 2-J

10 A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a blend ratio shown in Table 2. In this way, a paint composition 2-J wherein flat black particles having a size of 0.8 to 1.5 mm were dispersed was yielded.

Paint composition 2-K

15 A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a blend ratio shown in Table 2. In this way, a paint composition 2-K wherein flat gray particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

20 Paint composition 2-L

A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a blend ratio shown in Table 2. In this way, a paint composition 2-L wherein flat black particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

Paint composition 2-M

25 A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a blend ratio shown in Table 2. In this way, a paint composition 2-M wherein flat gray particles having a size of 0.8 to 1.5 mm were

30

dispersed was yielded.

Paint composition 2-N

A paint was produced in the same way as the paint composition 2-A except that respective ingredients were used at a
5 **blend ratio shown in Table 2. In this way, a paint composition 2-N wherein flat black particles having a size of 1.0 to 1.6 mm were dispersed was yielded.**

[Table 2]

	2-A	2-B	2-C	2-D	2-E	2-F	2-G	2-H	2-I	2-J	2-K	2-L	2-M	2-N
Transparent paint	Water-dispersing resin A	200	200	200	200	200	200	200	200	200	200	200	200	200
	Water-soluble resin A	4	4	4	4	4	4	4	4	4	4	4	4	4
	Pigment B	35	35	35	35	35	35	35	-	-	35	35	-	-
	Pigment D	-	-	-	-	-	-	-	35	35	-	-	-	-
	Pigment E	-	-	-	-	-	-	-	-	-	-	-	35	35
	Antifoamer	1	1	1	1	1	1	1	1	1	1	1	1	1
	Water	380	380	380	380	380	380	380	380	380	380	380	380	380
	Dispersion stabilizer	10	8	10	8	8	10	8	10	8	10	8	10	8
	pH	8.1	8.0	8.1	8.0	8.1	8.0	8.1	8.0	8.1	8.1	8.0	8.2	8.1
	Specular gloss	5	5	5	5	5	5	5	4	4	5	5	72	72
Water-based paint	Water-dispersing resin A	-	-	-	-	-	-	-	-	-	85	100	-	-
	Water-dispersing resin C	85	100	85	100	100	85	100	85	100	-	-	85	100
	Water-soluble resin B	250	200	250	200	200	250	200	250	200	250	200	250	200
	White pigment solution A	50	-	-	-	-	-	-	50	-	50	-	50	-
	White pigment solution B	-	-	50	-	-	50	-	-	-	-	-	-	-
	Black pigment solution A	50	100	-	-	-	-	-	50	100	50	100	50	100
	Black pigment solution B	-	-	50	100	100	50	100	-	-	-	-	-	-
	pH adjustor	-	-	-	-	-	-	4	-	-	-	4	-	-
	Antifoamer	5	5	5	5	5	5	5	5	5	5	5	5	5
	Water	50	70	50	70	70	50	70	50	70	50	70	50	70
	Reactive compound A	-	-	-	-	-	-	25	-	-	-	-	-	-
	Reactive compound C	3	3	3	3	3	-	-	3	3	-	-	3	3
	pH	8.9	8.7	8.9	8.7	8.9	9.0	11.3	8.9	8.7	9.0	11.4	8.9	8.7
	Reactive compound C	-	-	-	-	3	1	1	-	-	-	-	-	-

All numerical values, except pH and specular gloss, in the table are values representing parts by weight.

(Example 2-1)

A sand skeleton roller was used to apply a multi-coloured paint wherein the paint composition 2-A and the paint composition 2-B were mixed at a weight ratio of 50:50, at an applying amount of 0.6 kg/m², to a slate plate which was beforehand coated with a gray sealer, and the paint was dried at ambient temperature for 24 hours. Thereafter, the state of the paint film was observed. In Example 2-1, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed. No abnormality was observed in the colored particles.

(Example 2-2)

Painting was performed in the same way as in Example 2-1 except that there was used a paint composition wherein the paint composition 2-C and the paint composition 2-D were mixed at a weight ratio of 50:50 as the multi-coloured paint.

In Example 2-2, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed. No abnormality was observed in the colored particles.

(Example 2-3)

Painting was performed in the same way as in Example 2-1 except that there was used a paint composition wherein the paint composition 2-E and the paint composition 2-F were mixed at a weight ratio of 50:50 as the multi-coloured paint.

In Example 2-3, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed. No abnormality was observed in the colored particles.

(Example 2-4)

Painting was performed in the same way as in Example 2-1 except that there was used a paint composition wherein the paint composition 2-G and the paint composition 2-H were mixed at a

weight ratio of 50:50 as the multi-coloured paint.

In Example 2-4, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed. No abnormality was observed in the colored particles.

5 (Example 2-5)

Painting was performed in the same way as in Example 2-1 except that there was used a paint composition wherein the paint composition 2-I and the paint composition 2-J were mixed at a weight ratio of 50:50 as the multi-coloured paint.

10 In Example 2-5, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed. However, the finish thereof was a finish which was slightly poorer in vividness than that of Example 2-1.

(Example 2-6)

15 Painting was performed in the same way as in Example 2-1 except that there was used a paint composition wherein the paint composition 2-K and the paint composition 2-L were mixed at a weight ratio of 50:50 as the multi-coloured paint.

20 In Example 2-6, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed. However, ooze in gray and black was generated from the colored particles.

(Reference Example 2-1)

25 Painting was performed in the same way as in Example 2-1 except that there was used a paint composition wherein the paint composition 2-M and the paint composition 2-N were mixed at a weight ratio of 50:50 as the multi-coloured paint.

30 In Reference Example 2-1, the whole of the paint film was off-white, and no pattern paint film having high vividness was able to be formed.

[Test Example 3]**(Production of multi-coloured paints)****Paint composition 3-A**

First, 200 parts by weight of the water-dispersing resin A were charged into a container. While stirring of the resin was performed in the state that the rotation speed of stirring fans was set to 1800 rpm, 3 parts by weight of the water-soluble resin A, 1 part by weight of the antifoamer, and 250 parts by weight of water were added thereto and uniformly mixed, thereby producing a transparent paint 3-A. The pH of this transparent paint 3-A was 8.1.

Next, 90 parts by weight of the water-dispersing resin A were charged into another container. While stirring of the resin was performed in the state that the rotation speed of stirring fans was set to 1800 rpm, 180 parts by weight of the water-soluble resin B, 90 parts by weight of the white pigment solution, 5 parts by weight of the antifoamer, and 80 parts by weight of water were added thereto and uniformly mixed, thereby producing a white water-based paint 3-A. The pH of this water-based paint 3-A was 9.5.

To 454 parts by weight of the above-mentioned transparent paint 3-A were added 8 parts by weight of an aqueous 5% by weight ammonium borate solution as a dispersion stabilizer. The rotation speed of the stirring fans was set to 900 rpm to mix the solution uniformly. Thereafter, a mixture of 445 parts by weight of the water-based paint 3-A and 5 parts by weight of the reactive compound A was gradually added to and dispersed in the mixture while the stirring was further continued. In this way, a paint composition 3-A wherein flat white particles having a size of 0.8 to 1.2 mm were dispersed was yielded.

Paint composition 3-B

A paint was produced in the same way as the paint

composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-B wherein flat gray particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

5 Paint composition 3-C

A paint was produced in the same way as the paint composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-C wherein flat black particles having a size of 0.8 to 1.2 mm were dispersed was yielded.

10 Paint composition 3-D

A paint was produced in the same way as the paint composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-D wherein flat gray particles having a size of 0.8 to 1.6 mm were dispersed was yielded.

15 Paint composition 3-E

A paint was produced in the same way as the paint composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-E wherein flat black particles having a size of 0.8 to 1.2 mm were dispersed was yielded.

20 Paint composition 3-F

A paint was produced in the same way as the paint composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-F wherein flat gray particles having a size of 1.0 to 1.8 mm were dispersed was yielded.

25 Paint composition 3-G

30 A paint was produced in the same way as the paint

composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-G wherein flat black particles having a size of 1.2 to 1.6 mm were dispersed was yielded.

5 Paint composition 3-H

A paint was produced in the same way as the paint composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-H wherein flat gray particles having a size of 0.8 to 1.5 mm were dispersed was yielded.

10 Paint composition 3-I

A paint was produced in the same way as the paint composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-I wherein flat black particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

15 Paint composition 3-J

A paint was produced in the same way as the paint composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-J wherein flat gray particles having a size of 1.2 to 1.8 mm were dispersed was yielded.

20 Paint composition 3-K

A paint was produced in the same way as the paint composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-K wherein flat black particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

In the production of the paint compositions 3-J and K, a mixture of the water-based paint and the reactive compound C was

added to and dispersed in the transparent paint, and subsequently the reactive compound C was further mixed therewith.

Paint composition 3-L

5 A paint was produced in the same way as the paint composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-L wherein flat gray particles having a size of 0.8 to 1.6 mm were dispersed was yielded.

Paint composition 3-M

10 A paint was produced in the same way as the paint composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-M wherein flat black particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

15 In the production of the paint compositions 3-L and M, a mixture of the water-based paint and the reactive compound A was added to and dispersed in the transparent paint, and subsequently the reactive compound C was further mixed therewith.

Paint composition 3-N

20 A paint was produced in the same way as the paint composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-H wherein flat gray particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

25 Paint composition 3-O

A paint was produced in the same way as the paint composition 3-A except that respective ingredients were used at a blend ratio shown in Table 3. In this way, a paint composition 3-I wherein flat black particles having a size of 0.8 to 1.2 mm were
30 dispersed was yielded.

[Table 3-1]

		3-A	3-B	3-C	3-D	3-E	3-F	3-G
Transparent paint	Water-dispersing resin A	200	200	200	200	200	200	200
	Water-soluble resin A	3	4	4	4	4	4	4
	Antifoamer	1	1	1	1	1	1	1
	Water	250	380	380	380	380	380	380
	Dispersion stabilizer	8	10	8	10	8	10	8
	PH	8.1	8.2	8.2	8.2	8.2	8.2	8.2
Water-based paint	Water-dispersing resin A	90	85	100	85	100	85	100
	Water-dispersing resin C	-	-	-	-	-	-	-
	Water-soluble resin B	180	250	200	250	200	250	200
	White pigment solution A	90	50	-	-	-	50	-
	White pigment solution B	-	-	-	50	-	-	-
	Black pigment solution A	-	50	100	-	-	50	100
	Black pigment solution B	-	-	-	50	100	-	-
	pH adjustor	-	-	4	-	4	-	4
	Antifoamer	5	5	5	5	5	5	5
	Water	80	50	70	50	70	50	70
	Reactive compound A	5	10	25	10	25	-	-
	Reactive compound B	-	-	-	-	-	10	25
	Reactive compound C	-	-	-	-	-	-	-
	pH	9.5	9.2	11.5	9.0	11.2	9.1	11.2
Reactive compound C		-	-	-	-	-	-	-

All numerical values, except pH, in the table are values representing parts by weight.

[Table 3-2]

		3-H	3-I	3-J	3-K	3-L	3-M	3-N	3-O
Transparent paint	Water-dispersing resin A	200	200	200	200	200	200	200	200
	Water-soluble resin A	4	4	4	4	4	4	4	4
	Antifoamer	1	1	1	1	1	1	1	1
	Water	380	380	380	380	380	380	380	380
	Dispersion stabilizer	10	8	10	8	10	8	10	8
	PH	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Water-based paint	Water-dispersing resin A	-	-	-	-	85	100	85	100
	Water-dispersing resin C	85	100	85	100	-	-	-	-
	Water-soluble resin B	250	200	250	200	250	200	250	200
	White pigment solution A	-	-	-	-	-	-	50	-
	White pigment solution B	50	-	50	-	50	-	-	-
	Black pigment solution A	-	-	-	-	-	-	50	100
	Black pigment solution B	50	100	50	100	50	100	-	-
	pH adjustor	-	-	-	-	-	4	-	4
	Antifoamer	5	5	5	5	5	5	5	5
	Water	50	70	50	70	50	70	50	70
	Reactive compound A	-	-	-	-	10	25	-	-
	Reactive compound B	-	-	-	-	-	-	-	-
	Reactive compound C	3	3	3	3	-	-	-	-
	PH	8.9	8.7	8.9	8.7	9.2	11.5	9.0	11.4
Reactive compound C		-	-	3	1	3	1	-	-

All numerical values, except pH, in the table are values representing parts by weight.

A sand skeleton roller was used to apply a multi-coloured paint wherein the paint composition 3-A and the paint composition 3-B were mixed at a weight ratio of 50:50, at an applying amount of 0.6 kg/m², to a slate plate which was beforehand coated with a gray sealer, and the paint was dried at ambient temperature for 24 hours. Thereafter, the state of the paint film was observed. In Example 3-1, a flat and smooth and highly vivid pattern paint film wherein white and gray were mixed was able to be formed. No abnormality was observed in the colored particles.

(Example 3-2)

Painting was performed in the same way as in Example 3-1 except that there was used a paint composition wherein the paint composition 3-A, the paint composition 3-B and the paint composition 3-C were mixed at a weight ratio of 80:10:10 as the multi-coloured paint.

In Example 3-2, a flat and smooth and highly vivid pattern paint film wherein white, gray and black were mixed was able to be formed. No abnormality was observed in the colored particles.

(Example 3-3)

Painting was performed in the same way as in Example 3-1 except that there was used a paint composition wherein the paint composition 3-D and the paint composition 3-E were mixed at a weight ratio of 50:50 as the multi-coloured paint.

In Example 3-3, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed. No abnormality was observed in the colored particles.

(Example 3-4)

Painting was performed in the same way as in Example 3-1 except that there was used a paint composition wherein the paint composition 3-F and the paint composition 3-G were mixed at a

weight ratio of 50:50 as the multi-coloured paint.

In Example 3-4, a highly vivid pattern paint film wherein gray and black were mixed was able to be formed. However, the pattern was a pattern wherein irregularities were more conspicuous than those in Example 3-1.

(Example 3-5)

Painting was performed in the same way as in Example 3-1 except that there was used a paint composition wherein the paint composition 3-H and the paint composition 3-I were mixed at a weight ratio of 50:50 as the multi-coloured paint.

In Example 3-5, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed. No abnormality was observed in the colored particles.

(Example 3-6)

Painting was performed in the same way as in Example 3-1 except that there was used a paint composition wherein the paint composition 3-J and the paint composition 3-K were mixed at a weight ratio of 50:50 as the multi-coloured paint.

In Example 3-6, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed. No abnormality was observed in the colored particles.

(Example 3-7)

Painting was performed in the same way as in Example 3-1 except that there was used a paint wherein the paint composition 3-L and the paint composition 3-M were mixed at a weight ratio of 50:50 as the multi-coloured paint.

In Example 3-7, a flat and smooth and highly vivid pattern paint film wherein gray and black were mixed was able to be formed. No abnormality was observed in the colored particles.

(Reference Example 3-1)

Painting was performed in the same way as in Example 3-1 except that there was used a paint wherein the paint composition 3-N and the paint composition 3-O were mixed at a weight ratio of 50:50 as the multi-coloured paint. However, ooze in gray and black was generated from the colored particles.

[Test Example 4]

(Production of undercoat paints)

Undercoat paint 4-A

Forty parts by weight of the white pigment solution A, 30 parts by weight of the black pigment solution A, 28 parts by weight of the pigment F and 1 part by weight of the antifoamer were uniformly mixed with 200 parts by weight of the water-dispersing resin D in a stirrer, thereby producing a gray undercoat paint 4-A. The specular gloss of this undercoat paint 4-A was 3.0.

Undercoat paint 4-B

Twenty parts by weight of the white pigment solution A, 15 parts by weight of the black pigment solution A, 5 parts by weight of the pigment F and 1 part by weight of the antifoamer were uniformly mixed with 200 parts by weight of the water-dispersing resin D in a stirrer, thereby producing a gray undercoat paint 4-B. The specular gloss of this undercoat paint 4-B was 35.

Undercoat paint 4-C

Twenty parts by weight of the white pigment solution A, 10 parts by weight of the black pigment solution A, and 1 part by weight of the antifoamer were uniformly mixed with 200 parts by weight of the water-dispersing resin D in a stirrer, thereby producing a gray undercoat paint 4-C. The specular gloss of this undercoat paint 4-C was 75.

(Production of multi-coloured paints)

Paint composition 4-A

First, 200 parts by weight of the water-dispersing resin A were charged into a container. While stirring of the resin was performed in the state that the rotation speed of stirring fans was set to 1800 rpm, 3 parts by weight of the water-soluble resin A, 20 parts by weight of the pigment B, 1 part by weight of the antifoamer, and 250 parts by weight of water were added thereto and uniformly mixed, thereby producing a transparent paint 4-A. The pH of this transparent paint 4-A was 8.2, and the specular gloss was 7.

Next, 90 parts by weight of the water-dispersing resin A were charged into another container. While stirring was performed in the state that the rotation speed of stirring fans was set to 1800 rpm, 180 parts by weight of the water-soluble resin B, 90 parts by weight of the white pigment solution A, 5 parts by weight of the antifoamer, 80 parts by weight of water, and 5 parts by weight of the reactive compound A were added thereto and uniformly mixed, thereby producing a white water-based paint 4-A. The pH of this water-based paint 4-A was 9.5.

To 474 parts by weight of the above-mentioned transparent paint 4-A were added 8 parts by weight of an aqueous 5% by weight ammonium borate solution as a dispersion stabilizer. The rotation speed of the stirring fans was set to 900 rpm to mix the solution uniformly. Thereafter, 450 parts by weight of the water-based paint 4-A were gradually added to and dispersed in the mixture while the stirring was further continued. In this way, a paint composition 4-A wherein flat white particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

Paint composition 4-B

A paint composition was produced in the same way as the paint composition 4-A except that respective ingredients were used at a blend ratio shown in Table 4. In this way, a paint composition

4-B wherein flat gray particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

Paint composition 4-C

5 A paint composition was produced in the same way as the paint composition 4-A except that respective ingredients were used at a blend ratio shown in Table 4. In this way, a paint composition 4-C wherein flat black particles having a size of 0.8 to 1.2 mm were dispersed was yielded.

Paint composition 4-D

10 A paint composition was produced in the same way as the paint composition 4-A except that respective ingredients were used at a blend ratio shown in Table 4. In this way, a paint composition 4-D wherein flat gray particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

15 Paint composition 4-E

A paint composition was produced in the same way as the paint composition 4-A except that respective ingredients were used at a blend ratio shown in Table 4. In this way, a paint composition 4-E wherein flat black particles having a size of 0.8 to 1.2 mm were dispersed was yielded.

Paint composition 4-F

20 A paint composition was produced in the same way as the paint composition 4-A except that respective ingredients were used at a blend ratio shown in Table 4. In this way, a paint composition 4-F wherein flat gray particles having a size of 1.0 to 1.8 mm were dispersed was yielded.

Paint composition 4-G

25 A paint composition was produced in the same way as the paint composition 4-A except that respective ingredients were used at a blend ratio shown in Table 4. In this way, a paint composition

30

4-G wherein flat black particles having a size of 1.2 to 1.6 mm were dispersed was yielded.

Paint composition 4-H

5 A paint composition was produced in the same way as the paint composition 4-A except that respective ingredients were used at a blend ratio shown in Table 4. In this way, a paint composition 4-H wherein flat gray particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

Paint composition 4-I

10 A paint composition was produced in the same way as the paint composition 4-A except that respective ingredients were used at a blend ratio shown in Table 4. In this way, a paint composition 4-I wherein flat black particles having a size of 0.8 to 1.2 mm were dispersed was yielded.

15 Paint composition 4-J

A paint composition was produced in the same way as the paint composition 4-A except that respective ingredients were used at a blend ratio shown in Table 4. In this way, a paint composition 4-J wherein flat gray particles having a size of 1.0 to 1.8 mm were dispersed was yielded.

Paint composition 4-K

20 A paint composition was produced in the same way as the paint composition 4-A except that respective ingredients were used at a blend ratio shown in Table 4. In this way, a paint composition 4-K wherein flat black particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

Paint composition 4-L

30 A paint composition was produced in the same way as the paint composition 4-A except that respective ingredients were used at a blend ratio shown in Table 4. In this way, a paint composition

4-L wherein flat gray particles having a size of 1.2 to 2.0 mm were dispersed was yielded.

Paint composition 4-M

5 **A paint composition was produced in the same way as the paint composition 4-A except that respective ingredients were used at a blend ratio shown in Table 4. In this way, a paint composition 4-M wherein flat black particles having a size of 1.0 to 1.6 mm were dispersed was yielded.**

[Table 4]

	4-A	4-B	4-C	4-D	4-E	4-F	4-G	4-H	4-I	4-J	4-K	4-L	4-M
Transparent paint	Water-dispersing resin A	200	200	200	200	200	200	200	200	200	200	200	200
	Water-soluble resin A	3	4	4	4	4	4	4	4	4	4	4	4
	Pigment B	20	35	35	35	35	35	35	35	-	-	-	-
	Pigment D	-	-	-	-	-	-	-	-	35	35	-	-
	Antifoamer	1	1	1	1	1	1	1	1	1	1	1	1
	Water	250	380	380	380	380	380	380	380	380	380	380	380
	Dispersion stabilizer	8	10	8	10	8	10	8	10	8	10	8	8
	pH	8.2	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.2	8.2
	Specular gloss	7	5	5	5	5	5	5	5	4	4	86	86
	Water-dispersing resin A	90	85	100	85	100	85	100	-	85	100	85	100
Water-based paint	Water-dispersing resin B	-	-	-	-	-	-	85	100	-	-	-	-
	Water-soluble resin B	180	250	200	250	200	250	200	200	250	200	250	200
	White pigment solution A	90	50	-	50	-	50	50	-	50	-	50	-
	Black pigment solution A	-	50	100	50	100	50	100	100	50	100	50	100
	pH adjustor	-	-	4	-	4	4	-	-	-	4	-	4
	Antifoamer	5	5	5	5	5	5	5	5	5	5	5	5
	Water	80	50	70	50	70	50	70	50	70	50	70	70
	Reactive compound A	5	10	25	-	-	-	10	25	10	25	10	25
	Reactive compound B	-	-	-	-	10	25	-	-	-	-	-	-
	pH	9.5	9.2	11.5	9.0	11.4	9.1	11.2	6.4	9.2	11.5	9.2	11.5

All numerical values, except specular gloss and pH, in the table are values representing parts by weight.

(Example 4-1)

A wool roller was used to apply the undercoat paint 4-A, at an applying amount of 0.3 kg/m², to a slate plate.

5 The resultant was dried at ambient temperature for 2 hours, and subsequently a sand skeleton roller was used to apply thereto a multi-coloured paint wherein the paint composition 4-A and the paint composition 4-B were mixed at a weight ratio of 50:50, at an applying amount of 0.6 kg/m². The state of the colored particles of the multi-coloured paint was observed. Abnormality was not
10 particularly recognized.

Next, the resultant was dried at ambient temperature for 24 hours. Thereafter, the state of the paint film was observed. The paint film formed in Example 4-1 had a flat and smooth pattern wherein white and gray were mixed, and the finish thereof was even
15 and uniform.

(Example 4-2)

Painting was performed in the same way as in Example 4-1 except that there was used a paint wherein the paint composition 4-A, the paint composition 4-B and the paint composition 4-C were
20 mixed at a weight ratio of 80:10:10 as the multi-coloured paint.

In Example 4-2, no abnormality was observed in the colored particles. The formed paint film had a flat and smooth pattern wherein white, gray and black were mixed, and the finish thereof was even and uniform.

25 (Example 4-3)

Painting was performed in the same way as in Example 4-1 except that there was used a paint wherein the paint composition 4-D and the paint composition 4-E were mixed at a weight ratio of 50:50 as the multi-coloured paint.

30 The paint film formed in Example 4-3 had a flat and smooth

pattern wherein gray and black were mixed. However, ooze in gray and black was generated from the colored particles.

(Example 4-4)

Painting was performed in the same way as in Example 4-1
5 except that there was used a paint wherein the paint composition 4-F and the paint composition 4-G were mixed at a weight ratio of 50:50 as the multi-coloured paint.

In Example 4-4, no abnormality was observed in the colored particles. The formed paint film had a pattern wherein gray and
10 black were mixed. However, the pattern was a pattern wherein irregularities were more conspicuous than that in Example 4-1.

(Example 4-5)

Painting was performed in the same way as in Example 4-1
except that there was used a paint wherein the paint composition
15 4-H and the paint composition 4-I were mixed at a weight ratio of 50:50 as the multi-coloured paint.

The paint film formed in Example 4-5 had a flat and smooth pattern wherein gray and black were mixed. However, ooze in gray and black was generated from the colored particles.

20 (Example 4-6)

Painting was performed in the same way as in Example 4-1 except that the undercoat paint 4-B was used as the undercoat paint.

The paint film formed in Example 4-6 had a flat and smooth pattern wherein gray and black were mixed. However, when the
25 multi-coloured paint was applied with the roller, the colored particles turned into the state that they were unevenly applied or adhered, and unevenness was generated in a part of the formed paint film.

(Example 4-7)

30 Painting was performed in the same way as in Example 4-1

except that there was used a paint wherein the paint composition 4-J and the paint composition 4-K were mixed at a weight ratio of 50:50 as the multi-coloured paint.

5 The paint film formed in Example 4-7 had a flat and smooth pattern wherein gray and black were mixed. However, the finish thereof was a finish which was poorer in vividness than that of Example 4-1.

(Reference Example 4-1)

10 Painting was performed in the same way as in Example 4-1 except that the undercoat paint 4-B was used as the undercoat paint and there was used a paint wherein the paint composition 4-L and the paint composition 4-M were mixed at a weight ratio of 50:50 as the multi-coloured paint.

15 In Reference Example 4-1, when the multi-coloured paint was applied with the roller, the colored particles turned into the state that they were unevenly applied or adhered, and marked unevenness was generated in the formed paint film.

(Reference Example 4-2)

20 Painting was performed in the same way as in Example 4-1 except that the undercoat paint 4-C was used as the undercoat paint.

In Reference Example 4-1, when the multi-coloured paint was applied with the roller, the colored particles turned into the state that they were unevenly applied or adhered, and marked unevenness was generated in the formed paint film.

25 [Test Example 5]

(Production of undercoat paints)

Undercoat paint 5-A

30 Forty parts by weight of the white pigment solution A, 30 parts by weight of the black pigment solution A, 28 parts by weight of the pigment F and 1 part by weight of the antifoamer were uniformly

mixed with 200 parts by weight of the water-dispersing resin D in a stirrer, thereby producing a gray undercoat paint 5-A. The specular gloss of this undercoat paint 5-A was 3.0.

Undercoat paint 5-B

5 Twenty parts by weight of the white pigment solution A, 15 parts by weight of the black pigment solution A, 5 parts by weight of the pigment F and 1 part by weight of the antifoamer were uniformly mixed with 200 parts by weight of the water-dispersing resin D in a stirrer, thereby producing a gray undercoat paint 5-B. The specular
10 gloss of this undercoat paint 5-B was 35.

Undercoat paint 5-C

Twenty parts by weight of the white pigment solution A, 10 parts by weight of the black pigment solution A, and 1 part by weight of the antifoamer were uniformly mixed with 200 parts by weight of
15 the water-dispersing resin D in a stirrer, thereby producing a gray undercoat paint 5-C. The specular gloss of this undercoat paint 5-C was 75.

(Production of multi-coloured paints)

Paint composition 5-A

20 First, 200 parts by weight of the water-dispersing resin A were charged into a container. While stirring of the resin was performed in the state that the rotation speed of stirring fans was set to 1800 rpm, 4 parts by weight of the water-soluble resin A, 35 parts by weight of the pigment B, 1 part by weight of the antifoamer, and 380
25 parts by weight of water were added thereto and uniformly mixed, thereby producing a transparent paint 5-A. The pH of this transparent paint 5-A was 8.1, and the specular gloss was 5.

Next, 85 parts by weight of the water-dispersing resin C were charged into another container. While stirring of the resin was
30 performed in the state that the rotation speed of stirring fans was set

to 1800 rpm, 250 parts by weight of the water-soluble resin B, 50 parts by weight of the white pigment solution A, 50 parts by weight of the black pigment solution A, 5 parts by weight of the antifoamer, 50 parts by weight of water, and 3 parts by weight of the reactive
5 compound C were added thereto and uniformly mixed, thereby producing a white water-based paint 5-A. The pH of this water-based paint 5-A was 8.9.

To 620 parts by weight of the above-mentioned transparent paint 5-A were added 10 parts by weight of an aqueous 5% by weight
10 ammonium borate solution as a dispersion stabilizer. The rotation speed of the stirring fans was set to 900 rpm to mix the solution uniformly. Thereafter, 493 parts by weight of the water-based paint 5-A were gradually added to and dispersed in the mixture while the stirring was further continued. In this way, a paint composition 5-A
15 wherein flat gray particles having a size of 0.7 to 1.2 mm were dispersed was yielded.

Paint composition 5-B

A paint was produced in the same way as the paint composition 5-A except that respective ingredients were used at a
20 blend ratio shown in Table 5. In this way, a paint composition 5-B wherein flat black particles having a size of 0.8 to 1.6 mm were dispersed was yielded.

Paint composition 5-C

A paint was produced in the same way as the paint composition 5-A except that respective ingredients were used at a
25 blend ratio shown in Table 5. In this way, a paint composition 5-C wherein flat gray particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

Paint composition 5-D

30 A paint was produced in the same way as the paint

composition 5-A except that respective ingredients were used at a blend ratio shown in Table 5. In this way, a paint composition 5-D wherein flat black particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

5 Paint composition 5-E

A paint was produced in the same way as the paint composition 5-A except that respective ingredients were used at a blend ratio shown in Table 5. In this way, a paint composition 5-E wherein flat gray particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

10 Paint composition 5-F

A paint was produced in the same way as the paint composition 5-A except that respective ingredients were used at a blend ratio shown in Table 5. In this way, a paint composition 5-F wherein flat black particles having a size of 0.8 to 1.5 mm were dispersed was yielded.

In the production of the paint compositions 5-E and F, a mixture of the water-based paint and the reactive compound C was added to and dispersed in the transparent paint, and subsequently the reactive compound C was further mixed therewith.

20 Paint composition 5-G

A paint was produced in the same way as the paint composition 5-A except that respective ingredients were used at a blend ratio shown in Table 5. In this way, a paint composition 5-G wherein flat gray particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

25 Paint composition 5-H

A paint was produced in the same way as the paint composition 5-A except that respective ingredients were used at a blend ratio shown in Table 5. In this way, a paint composition 5-H

wherein flat black particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

In the production of the paint compositions 5-G and H, a mixture of the water-based paint and the reactive compound A was added to and dispersed in the transparent paint, and subsequently the reactive compound C was further mixed therewith.

Paint composition 5-I

A paint was produced in the same way as the paint composition 5-A except that respective ingredients were used at a blend ratio shown in Table 5. In this way, a paint composition 5-I wherein flat gray particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

Paint composition 5-J

A paint was produced in the same way as the paint composition 5-A except that respective ingredients were used at a blend ratio shown in Table 5. In this way, a paint composition 5-J wherein flat black particles having a size of 0.8 to 1.5 mm were dispersed was yielded.

Paint composition 5-K

A paint was produced in the same way as the paint composition 5-A except that respective ingredients were used at a blend ratio shown in Table 5. In this way, a paint composition 5-K wherein flat gray particles having a size of 0.8 to 1.4 mm were dispersed was yielded.

Paint composition 5-L

A paint was produced in the same way as the paint composition 5-A except that respective ingredients were used at a blend ratio shown in Table 5. In this way, a paint composition 5-L wherein flat black particles having a size of 1.0 to 1.6 mm were dispersed was yielded.

Paint composition 5-M

A paint was produced in the same way as the paint composition 5-A except that respective ingredients were used at a blend ratio shown in Table 5. In this way, a paint composition 5-M wherein flat gray particles having a size of 1.0 to 1.8 mm were dispersed was yielded.

Paint composition 5-N

A paint was produced in the same way as the paint composition 5-A except that respective ingredients were used at a blend ratio shown in Table 5. In this way, a paint composition 5-N wherein flat black particles having a size of 1.2 to 1.8 mm were dispersed was yielded.

[Table 5]

	5-A	5-B	5-C	5-D	5-E	5-F	5-G	5-H	5-I	5-J	5-K	5-L	5-M	5-N
Transparent paint	Water-dispersing resin A	200	200	200	200	200	200	200	200	200	200	200	200	200
	Water-soluble resin A	4	4	4	4	4	4	4	4	4	4	4	4	4
	Pigment B	35	35	35	35	35	35	35	-	-	35	35	-	-
	Pigment D	-	-	-	-	-	-	-	35	35	-	-	-	-
	Antifoamer	1	1	1	1	1	1	1	1	1	1	1	1	1
	Water	380	380	380	380	380	380	380	380	380	380	380	380	380
Water-based paint	Dispersion stabilizer	10	8	10	8	10	8	10	10	8	10	8	10	8
	pH	8.1	8.0	8.1	8.0	8.1	8.0	8.1	8.1	8.1	8.1	8.0	8.1	8.0
	Specular gloss	5	5	5	5	5	5	5	4	4	5	5	86	86
	Water-dispersing resin A	-	-	-	-	-	-	-	-	-	85	100	-	-
	Water-dispersing resin C	85	100	85	100	85	100	100	85	100	-	-	85	100
	Water-soluble resin B	250	200	250	200	250	200	250	250	200	250	200	250	200
Reactive compound C	White pigment solution A	50	-	-	-	-	-	-	50	-	50	-	50	-
	White pigment solution B	-	-	50	-	-	50	-	-	-	-	-	-	-
	Black pigment solution A	50	100	-	-	-	-	-	50	100	50	100	50	100
	Black pigment solution B	-	-	50	100	100	50	100	-	-	-	-	-	-
	pH adjustor	-	-	-	-	-	-	4	-	-	-	4	-	-
	Antifoamer	5	5	5	5	5	5	5	5	5	5	5	5	5
	Water	50	70	50	70	50	50	70	50	70	50	70	50	70
	Reactive compound A	-	-	-	-	-	-	10	25	-	-	-	-	-
	Reactive compound C	3	3	3	3	3	-	-	3	3	-	-	3	3
	pH	8.9	8.7	8.9	8.7	8.9	9.0	11.3	8.9	8.7	9.0	11.4	8.9	8.7
Reactive compound C		-	-	-	-	3	1	1	-	-	-	-	-	-

All numerical values, except pH and specular gloss, in the table are values representing parts by weight.

(Example 5-1)

A wool roller was used to apply the undercoat paint 5-A, at an applying amount of 0.3 kg/m², to a slate plate.

5 The resultant was dried at ambient temperature for 2 hours, and subsequently a sand skeleton roller was used to apply thereto a multi-coloured paint wherein the paint composition 5-A and the paint composition 5-B were mixed at a weight ratio of 50:50, at an applying amount of 0.6 kg/m². The state of the colored particles of the multi-coloured paint was observed. Abnormality was not
10 particularly recognized.

Next, the resultant was dried at ambient temperature for 24 hours. Thereafter, the state of the paint film was observed. The paint film formed in Example 5-1 had a flat and smooth pattern wherein white and gray were mixed, and the finish thereof was even
15 and uniform.

(Example 5-2)

Painting was performed in the same way as in Example 5-1 except that there was used a paint wherein the paint composition 5-C and the paint composition 5-D were mixed at a weight ratio of
20 50:50 as the multi-coloured paint.

In Example 5-2, no abnormality was observed in the colored particles. The formed paint film had a flat and smooth pattern wherein white, gray and black were mixed, and the finish thereof was even and uniform.

25 (Example 5-3)

Painting was performed in the same way as in Example 5-1 except that there was used a paint wherein the paint composition 5-E and the paint composition 5-F were mixed at a weight ratio of 50:50 as the multi-coloured paint.

30 In Example 5-3, no abnormality was observed in the colored

particles. The formed paint film had a flat and smooth pattern wherein white, gray and black were mixed, and the finish thereof was even and uniform.

(Example 5-4)

5 Painting was performed in the same way as in Example 5-1 except that there was used a paint wherein the paint composition 5-G and the paint composition 5-H were mixed at a weight ratio of 50:50 as the multi-coloured paint.

10 In Example 5-4, no abnormality was observed in the colored particles. The formed paint film had a flat and smooth pattern wherein white, gray and black were mixed, and the finish thereof was even and uniform.

(Example 5-5)

15 Painting was performed in the same way as in Example 5-1 except that there was used a paint wherein the paint composition 5-I and the paint composition 5-J were mixed at a weight ratio of 50:50 as the multi-coloured paint.

20 The paint film formed in Example 5-5 had a flat and smooth pattern wherein gray and black were mixed. However, the finish thereof was a finish which was poorer in vividness than that of Example 5-1.

(Example 5-6)

25 Painting was performed in the same way as in Example 5-1 except that the undercoat paint 5-B was used as the undercoat paint.

30 The paint film formed in Example 5-6 had a flat and smooth pattern wherein gray and black were mixed. However, when the multi-coloured paint was applied with the roller, the colored particles turned into the state that they were unevenly applied or adhered, and unevenness was generated in a part of the formed paint film.

(Example 5-7)

Painting was performed in the same way as in Example 5-1 except that there was used a paint wherein the paint composition 5-K and the paint composition 5-L were mixed at a weight ratio of 50:50 as the multi-coloured paint.

The paint film formed in Example 5-7 had a flat and smooth pattern wherein gray and black were mixed. However, ooze in gray and black was generated from the colored particles.

(Reference Example 5-1)

Painting was performed in the same way as in Example 5-1 except that the undercoat paint 5-B was used as the undercoat paint and there was used a paint wherein the paint composition 5-M and the paint composition 5-N were mixed at a weight ratio of 50:50 as the multi-coloured paint.

In Reference Example 5-1, when the multi-coloured paint was applied with the roller, the colored particles turned into the state that they were unevenly applied or adhered, and marked unevenness was generated in the formed paint film.

(Reference Example 5-2)

Painting was performed in the same way as in Example 5-1 except that the undercoat paint 5-C was used as the undercoat paint.

In Reference Example 5-2, when the multi-coloured paint was applied with the roller, the colored particles turned into the state that they were unevenly applied or adhered, and marked unevenness was generated in the formed paint film.

Industrial Applicability

The water-in-water type multi-coloured paint composition of the present invention is capable of forming a mat paint film excellent in flatness, smoothness and vividness. The

water-in-water type multi-coloured paint composition of this invention is also capable of forming an unchanged flat and smooth colorful pattern even if painting conditions such as a painting tool and painting temperature are changed. Furthermore, according to

5 **this invention, a colorful, flat and smooth paint face can be formed by applying the above-mentioned water-in-water type multi-coloured paint composition with a roller or brush.**

CLAIMS

1. A water-in-water type multi-coloured paint composition, characterized in that at least one kind of flat colored gel particles is dispersed in a mat transparent paint comprising an aqueous resin
5 and an extender pigment having a refractive index of 1.4 to 1.7.

2. A water-in-water type multi-coloured paint composition, characterized in that at least one kind of flat colored gel particles is dispersed in a mat transparent paint comprising an aqueous resin and an extender pigment having a refractive index of 1.4 to 1.7, and
10 the flat colored gel particles are made of a gelatinized product made from an aqueous resin (a), a color pigment (b), water (c), and a reactive compound (d) which can react in the presence of water.

3. A water-in-water type multi-coloured paint composition, characterized in that at least one kind of flat colored gel particles is
15 dispersed in a mat transparent paint comprising an aqueous resin and an extender pigment having a refractive index of 1.4 to 1.7, and the flat colored gel particles are:
particles gelatinized by mixing a water-based paint comprising an aqueous resin (a), a color pigment (b) and water (c) with a reactive
20 compound (d) which can react in the presence of water.

4. A water-in-water type multi-coloured paint composition, characterized in that at least one kind of flat colored gel particles is dispersed in a transparent paint comprising an aqueous resin, and the flat colored gel particles are made of a gelatinized product made
25 from an aqueous resin (a), a color pigment (b), water (c), and a reactive compound (d) which can react in the presence of water.

5. A water-in-water type multi-coloured paint composition, characterized in that at least one kind of flat colored gel particles is dispersed in a transparent paint comprising an aqueous resin, and
30 the flat colored gel particles are:

particles gelatinized by mixing a water-based paint comprising an aqueous resin (a), a color pigment (b) and water (c) with a reactive compound (d) which can react in the presence of water.

6. The water-in-water type multi-coloured paint
5 composition according to any one of claims 2 to 5, wherein the (a) component is an aqueous resin (a-1) having a reactive functional group, and the (d) component is a reactive compound (d-1) which can react with the (a-1) component in the presence of water.

7. The water-in-water type multi-coloured paint
10 composition according to any one of claims 2 to 5, wherein the (d) component is a reactive compound (d-2) which can be self-condensed in the presence of water.

8. A water-in-water type multi-coloured paint composition,
characterized in that at least one kind of flat colored gel particles is
15 dispersed in a mat transparent paint comprising an aqueous resin and an extender pigment having a refractive index of 1.4 to 1.7, and the flat colored particles are:

particles obtained by dispersing a gelatinized product
obtained by mixing a water-based paint comprising an aqueous resin
20 (a-1) having a reactive functional group, a color pigment (b) and water (c) with a reactive compound (d) which can react in the presence of water, in the form of flat particles, into an aqueous dispersive medium, and further mixing a reactive compound (d-1) which can react with the (a-1) component in the presence of water with the
25 resultant.

9. A water-in-water type multi-coloured paint composition,
characterized in that at least one kind of flat colored gel particles is
dispersed in a transparent paint comprising an aqueous resin, and
the flat colored particles are:

30 particles obtained by dispersing a gelatinized product

obtained by mixing a water-based paint comprising an aqueous resin (a-1) having a reactive functional group, a color pigment (b) and water (c) with a reactive compound (d) which can react in the presence of water, in the form of flat particles, into an aqueous dispersive medium, and further mixing a reactive compound (d-1) which can react with the (a-1) component in the presence of water with the resultant.

10. The water-in-water type multi-coloured paint composition according to claim 8 or 9, wherein the (d) component is a reactive compound (d-1) which can react with the (a-1) component in the presence of water.

11. The water-in-water type multi-coloured paint composition according to claim 8 or 9, wherein the (d) component is a reactive compound (d-2) which can be self-condensed in the presence of water.

12. A method of forming a pattern face, characterized by making an undercoat layer on a substrate of a building from a colored mat undercoat paint, and then forming a topcoat layer by applying the water-in-water type multi-coloured paint composition according to any one of claims 1 to 11 with a roller or brush.