



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 038 852 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
27.09.2000 Bulletin 2000/39

(51) Int. Cl.⁷: **C04B 14/00**, B28B 11/00,
B44C 3/12

(21) Application number: **98954107.3**

(86) International application number:
PCT/CN98/00270

(22) Date of filing: **12.11.1998**

(87) International publication number:
WO 99/25662 (27.05.1999 Gazette 1999/21)

(84) Designated Contracting States:
DE ES FR GB IT

• **YANG, Xiaoxiao**
GuangDong Province 528000 (CN)

(30) Priority: **13.11.1997 CN 97114289**

(74) Representative:
Jackson, Derek Charles
Derek Jackson Associates,
The Old Yard,
Lower Town
Claines, Worcester WR3 7RY (GB)

(71) Applicant: **Yang, Dening**
Foshan City 528000 (CN)

(72) Inventors:
• **YANG, Dening**
GuangDong Province 528000 (CN)

(54) **MARBLE-LIKE CERAMIC SHEET MATERIAL AND METHOD FOR MANUFACTURING THE SAME**

(57) The disclosed marble-like ceramic sheet material has many colored silicate regions composed of silicate materials on the surface. In at least part of said colored silicate mass regions, there is a bleeding region whose color differs from those of the said colored sili-

cate mass. Also, there is a transition region formed between said adjacent colored silicate mass. The invention relates to a method for manufacturing the ceramic sheet material.

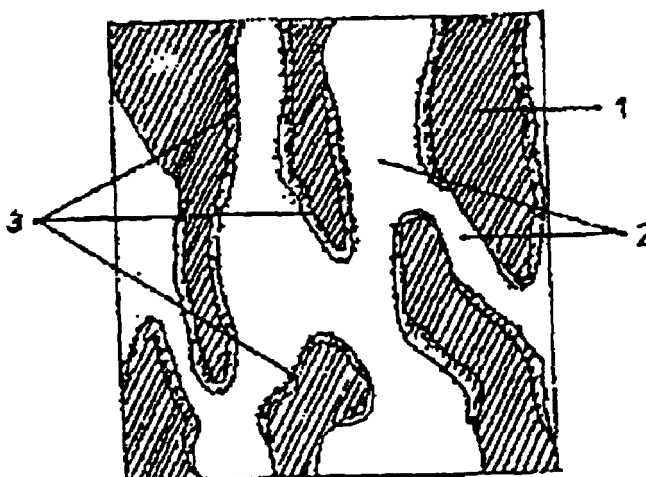


Fig. 2

EP 1 038 852 A1

Description

[0001] This invention involves in the 3D ceramic color pattern salt-soluble marble used as the decorative material, namely, a kind of new material applicable for decorating the permanent floors, wall and furniture surfaces.

[0002] For the vitrified ceramic tiles made of previous technologies, one kind is the single-color vitrified ceramic tile or small-grain (small grains finer than 20 mesh) and mixed-color vitrified ceramic tile which has single color, no pattern and is only applicable in narrow scope. The second kind is the colorful tile made of super fine powder with fine transition, which can display several colors with fine transition. However, such products have no repeatability due to the limitation of its technology. In the same batch, as the patterns and positions of color blocks change, it is impossible to keep the same pattern for every product. Besides, as the salt-soluble screening technology can only repeatedly print the same pattern, it will produce the distorted and confused pattern by combining the salt-soluble screening technology into the production of colorful tiles of super fine powder. For this reason, it is impossible and inapplicable to produce the colorful tiles of super fine powder with finer patterns provided by combining with the salt-soluble screening technique, and in fact, such fine product has never been seen. The third kind is the secondary or multiple feeding technology. Because this technology is lack of efficiency, namely, the more the colors in the product patterns, the more and the slower of feedings, it has basically not spread in large scale productions. Furthermore, as the powders of different colors are screened to the different positions inside the punching frame by twice or more times, it has caused many times of piling of freely falling bodies. During such feeding process, powders in different positions cross with each other and cause the confusion in large area due to their flow, making it difficult to combine the technology by screening the fine salt-soluble patterns with the same plate pattern into the secondary feeding and multiple feeding technique. Moreover, the efficiency in large scale production several times lower may restrict its cost, cause the limitations in its practical and scientific performances, and make it unable to produce the product with fine pattern structure mentioned in this invention. The fourth kind is the salt-soluble technique by silk screening the non-silicate ingredients. Because the salt-soluble color flow into the vitrified tile through the fine pore containing pigment powder to locally mix up with such powder during the production, such salt-soluble color flowing into the fine pores of vitrified powder forms the structure of color blocks after sintering. However, it can only create the patterns of light grayish blue, light brown, light grayish green and other similar colors. Different from the color block formed by ceramic powder containing pigment after sintering, it can not create the dark or bright compound color patterns of black, dark

gray, red, orange red, green, dark green, yellow and orange yellow like the silicate ceramic powder. The fifth kind is the crystal tile and color glazed tile, which has the glaze of about 0.2-1mm on the surface. Such uneven surface shall not be polished, for so long as it is polished, the pattern about 0.2-1mm thick will basically disappear, making it unable to become the product with the features of polished marble. The sixth kind is the technology for 3D ceramic granite and marble as my previous technical invention. The patterns of products adopting such technology have the perpendicular vertical surface and clear boundary. But, because the transition of colors of such patterns is not so good, it is only applicable for products with patterns of granite, but not the products with pattern of marble.

[0003] This invention has the following advantages: (1). The existing technology for salt-soluble color can not display the colors of natural marble such as black, dark gray, red, orange red, green, dark green, yellow, orange yellow, white and blue, while this invention can make it; (2). It adopts the new technique, to create the good transition on the boundary line in all color blocks of the product, which is better than those of the 3D ceramic granite and marble, and like those of natural marble. For the technology for 3D ceramic granite and marble, we can see that from the perpendicular cross section of the product, the boundary line has the 3D structure being perpendicular to the plane within 90 ± 20 degree, which is the very clear dual-color boundary lines on the surface. This is the vein structure for granite, but not for marble. Besides, in the dual-color boundary line of this invention, the color grains of fine meshes mix up with each other for over 1mm, and even 2-10mm, producing the veins of progressive and natural transition and mixing on the boundary of ceramic color blocks like those in the color blocks of marble. (3). Compared with secondary feeding and multiple feeding technology, this invention has the advantages of high efficiency, fine transition and find pattern stability. (4). It is found that in batch production, the main disadvantage in the process technology for super fine colorful tiles is the different positions of the color areas in color blocks of patterns on each product, while over 80% of color block patterns in this invention may be in consistency and repeat. Based on patterns of over two colors produced on the silicate powder, and the multi-layer controllable patterns of over three, four and five colors, it can display the rich and bright colors of natural marble such as black, dark gray, red, orange red, green, dark green, yellow and orange yellow. Because the product of this invention has the technical advantages of many color area, various bright block areas and consistent and repeated patterns (or features of patterns overlappable), it can adopt the salt-soluble technology of repeated screening to make richer and laminated combination, so that it can adopt the salt-soluble technique to express the fine crack veins and light transition in dark marble, and get rid off the defect that it is difficult to produce the fine patterns

in 3D ceramic granite and marble technique. By adopting the innovated technology better than 3D ceramic granite technique to make the salt-soluble treatment on the controllable and provided ceramic pigment pattern areas, it will achieve the more advanced product technology that those of the 3D ceramic granite with salt-soluble technology, of super thin colorful tile, of secondary feeding, of crystal tile and color glazed tile, and of pure salt-soluble technology.

[0004] This invention is neither the pure combination or obvious simple combination of several kinds of existing technologies, including my invention for 3D ceramic granite and marble, but the new concept and new method on the solid technical basis of the matured development and steady and large-scale put-into-production of 3D ceramic granite and marble technology to realize the technical target of controlled and natural color mixing. Only when the 3D ceramic granite and marble technology invented by me has already been used to many varieties of products, and each of such patterns has multi-color and stable ceramic marble patterns, it is possible to display the quality of natural marble in colors of black, dark gray, red, orange red, green, dark green, yellow, orange yellow, white and blue, to produce the technical effect of natural transition like that of the natural marble on the boundary of color blocks, and take the new technology of controlled vibration and oscillation in all directions to obtain the controlled natural effect on the boundary of color blocks of each product. Furthermore, as the pattern composed in the silicate color block of each product takes the given die mouth consistent with the pattern as the technical core, it has the excellent technical stability and repeatability, it is possible to carry out the salt-penetrating process on such technical basis. By adopting the salt-penetrating screen printing technology, we can show the overall pattern of the natural marble with vein transition by taking the silicate material of black, dark gray, red, orange red, green, blackish green, yellow, orange yellow, white, blue and pink and the technology in this invention and adopt the technology of screen printing process at the same time to show the fine spots and linear veins of the natural marble. On the contrary, without this technical foundation, it is impossible to produce the stable patterns, especially the stable dark pattern, nor the transition of mixing colors over 1-10mm, nor the basis for controlled and repeatable pattern, nor to work out the new technology combining the transition of silicate ceramic colors, especially the transition of dark colors and salt-soluble colors with the expression of points or lines. Besides, because this invention takes the ceramic color as the leading pattern, it produces the products with smaller color difference and higher rate of finished products in batch production than products adopting pure salt-soluble technology.

[0005] The products adopting this invention have not only the patterns composed of silicate of different colors which can be either bright, or stable, or deep or

light and the natural veins with natural mixing and transition between color blocks same as those of the natural marble, but also the spot and linear veins of fine natural marble produced by adopting the salt-penetrating screen printing technology. In addition, because it adopts the silicate pigment as the main tone, it can create the patterns of high repeatability and low color difference on products of the same batch. It has the pattern as fine and beautiful as the natural marble, and has the comprehensive advantages as being more wear-proof, harder, brighter, more corrosion resistant and radioactive radon-free than natural marble.

[0006] To sum up, the ceramic tiles adopting the previous technologies have the above defects, and can not produce the products with all above advantages. Therefore, this invention aims at providing a kind of 3D ceramic color pattern salt-soluble marble eliminating the above defects of previous technologies. It has the following characteristics:

1. A kind of 3D ceramic color-pattern salt-soluble marble, which has the patterns composed of silicate color blocks of two different colors such as red, yellow, blue, white, black and green, and the patterns composed of at least three different colors by adding a kind of salt-soluble color such as light gray, light brown, light grayish blue and light cream into the silicate color block. The features are: there are over 10 silicate blocks or salt-soluble areas over 5cm². From the surface of the product, we can see that the fine grains of different colors on the boundary line between the silicate blocks of two different colors mix with each other, with at least one boundary line having the mixing width of 1-10mm. In one product, the total length of one or several boundary lines may reach over 20cm. From the perpendicular cross section on the plane of the product, we can see that the area of silicate block patterns over 2mm thick has reached more than 30cm². over 80% of color blocks of different colors on each product in the same batch can overlap with each other in the shape and position, with the overlapping error in all directions not exceeding ± 3 cm. At least two kinds of silicate color blocks are single-color blocks of red, yellow, white, blue, black and green without adding other color grain powder, but not two or more color blocks composed of two or more color grains of red, yellow, white, blue, black and green.
2. The creativity and practical performance of this invention also lie in: at least two kind of silicate color blocks are two or more color blocks composed of two or more color grains of red, yellow, white, blue, black and green, or the color blocks composed of the mixed color and the single color, and achieves the greater expression effect. The characteristics also lie in, it may be the pattern composed of the silicate color blocks of more than four different colors, and the pattern composed of at least seven differ-

ent colors by adding three or more kinds of salt-soluble colors into the above silicate color blocks of more than four different colors, and expresses the richer laminations and colors of natural marble,

3. The creativity and practical performance of this invention also lie in: the powder fineness of the color grains mixing between color blocks may be over 60% of powder finer than 40 mesh, or over 60% of powder thicker than 40 mesh. The powder fineness of the color grains may be over 60% of powder finer than 100 mesh, or over 60% of powder finer than 500 mesh. The better the fineness of powder, the more natural the mixing of two colors, and the more lifelike decorative effect of natural marble.

4. The creativity and practical performance of this invention also lie in: there are at least 10 silicate blocks or salt-soluble areas over 5cm² with transitional color on the boundary line of the silicate pattern. From the surface of the product, we can see that the grains of different colors on the silicate color blocks of two different colors mix with other, with the mixing width of 1mm to 10mm, and total length of over 30cm, and without mixing with the two silicate color blocks. From the perpendicular cross section of the product, we can see that the boundary line has the 3D structure being perpendicular to the plane within 90±40 degree, shaping up the product by combining with the geometric 3D pattern with very clear boundary line on the surface. the products size from 40cm² like mosaic to 10m² like the huge marble slab, and the thickness from 3mm to 1000mm, and the different overall geometric shapes, including the shapes of plane plate, cylinder, arc plate, partially cylinder, ball, polygon, round, stripe or square. It may have the pattern composed of the color grains of single or different colors with the diameters from 1mm to 15mm and fine powders. The surface of the product can be polished or unpolished. The plane surface has the concave-convex antislip pattern with the depth from 0.1mm to 5mm, to create the effect of 3D pattern. The convex surface pattern can be polished or unpolished. Its production method as: powders of different colors come from the separate crossing of the die mouth made according to the pattern of the product by screening, blending or falling. The key point for this process is: to equip the vibration or screen device on the die mouth, suitably extend the displacement in all directions at the range of 0.1mm —20mm under control during vibration or screening, to achieve the better mixing effect on the boundary of two colors.

Figure 1 shows the plane drawing of 3D ceramic color pattern salt-soluble marble products as the first case of this invention: The pattern in oblique line portion 1 shows the silicate color area of

orange red, the pattern in white portion 2 shows the silicate color area of white, the black part 3 shows the grayish black area of the silicate material, small black dot 4 shows the white silicate material color area adding with light gray penetration, and circle part 5 shows the orange red silicate material color area adding with cream penetration, which becomes the cream red area after sintering.

Figure 2 is the local amplified plane figure for the boundary of silicate block areas of different colors of 3D ceramic color pattern salt-soluble marble as the first case of this invention. The pattern in oblique line portion 1 shows the silicate color area of orange red, the pattern in white portion 2 shows the silicate color area of white, and the oblique line 3 not linked up between the dotted line and actual line shows the natural mixing of orange red powder in the white powder, and the natural mixing of white powder in red powder.

Figure 3 is the comparison drawing for pattern positions of six products among a batch of 3D ceramic color pattern salt-soluble marble products as the first case of this invention. The shapes and positions of patterns in each area can be basically overlapped.

Figure 4 is the plane figure for the steel die mouth of 3D ceramic color pattern salt-soluble marble products as the first case of this invention: the oblique line portion 1 shows the die passage area for orange red powder. The white portion 2 shows the die passage area for white powder. The black portion 3 with white dots shows the die passage area for black and gray pigment. The thick line portion 4 shows the overlook position on the surface of steel die mouth.

[0007] Figure 1 is the plane figure for a piece of 200mm × 200mm 3D ceramic color pattern salt-soluble marble products of this invention. In this figure (Figure 1), the color blocks in above five portions make up the patterns of Norwegian red marble. From the plane figure in Figure 2, we can see that on the boundary of orange red and white silicate color blocks, the fine grains of both orange red and white mix with other, with the mixing width of about 2mm. From the local amplified drawing of vertical cross section of product in Figure 3, we can see that the fine grains of orange red and white mix with each other on the boundary in 3-dimensional lowering state, with the pattern thickness in both silicate orange red area and white area over 2mm. From the six same products in Figure 4, we can see that the positions and shapes of over 80% of color blocks in block patterns of different colors of each product can be overlapped, with the error of the overlapped portion in all directions not exceeding ± 3cm.

[0008] The product as the first case of this invention is fabricated as follows: respectively put the orange red, white, and grayish black powder for ceramic tiles into

three containers, and put the three sets of combined dies with provided mouth shapes matching the product patterns under the containers, press, flow or screen the powder into the punching frame of the press through the mouth of the combined mould as per the demand of the pattern. Or, press, flow or screen the powder into another tank container, and press, flow or screen into the punching frame again. Press, shape and dry the body, and prefire it to semi-finished product in the high-temperature process system with the temperature up to about 1000°C.

[0009] To form the mixing feature of powder under suitable control on the boundary during flow, press or screen, and create a certain feeling of transition in the color area of the product same as the natural marble, it is recommended to enlarge the horizontal moving on all sides for about 0.1mm-20mm to a certain extent during the vibration and shaking of the die mouth, so make the mixing effect of two colors on the concurrent line over 1 mm or within 2mm-10mm.

[0010] Then, take the screen printing and penetrating process for the semi-finished product, to print the light gray penetration on some white parts stipulated by the pattern, and print the light cream penetration on the orange red pattern stipulated. Finally, send the product into the firing process with the temperature up to about 1200°C, to produce this product.

[0011] Because the pattern in this invention is printed by the provided die mouth and the screen, 80% of patterns of the color blocks in the same batch of products can overlap with each other in the shape and position, with the overlapping error in all directions not exceeding $\pm 3\text{cm}$.

[0012] As this invention shows the feeling and laminated effect of the natural marble, there should be at least 10 blocks with color areas of over 5cm^2 .

[0013] In the case, we can adopt the silicate color blocks of different colors such as red, yellow, white, blue, black and green to make up the patterns, and adopt the different salt-soluble colors such as light gray, light brown, grayish blue, red and dark green to make up the patterns.

[0014] In the case, we can adopt at least two kinds of different silicate color blocks such as red, yellow, white, blue, black and green without adding other color grain powder to make up the patterns, at least three different colors by adding a kind of salt-soluble color such as light gray, light brown, light grayish blue and light cream into the silicate color block to make up the patterns. The features are: there are over 10 silicate blocks or salt-soluble areas over 5cm^2 . From the surface of the product, we can see that the fine grains of different colors on the boundary line between the silicate blocks of two different colors mix with each other, with at least one boundary line having the mixing width of 2-10mm. In one product, the total length of one or several boundary lines may reach over 20cm. From the perpendicular cross section on the plane of the product, we can see

that the area of silicate block patterns over 2mm thick has reached more than 30cm^2 . Over 80% patterns of color blocks of different colors on each product in the same batch can be in consistency, Over 80% of color blocks of different colors on each product can overlap with each other in the shape and position. At least two kinds of silicate color blocks are single-color blocks of red, yellow, white, blue, black and green without adding other color grain powder, but not two or more color blocks composed of two or more color grains of red, yellow, white, blue, black and green.

[0015] In the case, the silicate color blocks are two or more color blocks composed of two or more color grains of red, yellow, white, blue, black and green, or the color blocks composed of the mixed color and the single color.

[0016] In the case, the silicate color blocks may be the pattern composed of more than four different colors, and the pattern composed of at least seven different colors by adding three or more kinds of salt-soluble colors into the above silicate color blocks.

[0017] In the case, the silicate color blocks have the feature for the color grains mixed between different color blocks as: there are at least 60% color grains with the fineness finer than 40 mesh.

[0018] In the case, the silicate color blocks have the feature for the color grains mixed between different color blocks as: there are at least 60% color grains with the fineness thicker than 40 mesh.

[0019] In the case, the silicate color blocks have the feature for the color grains mixed between different color blocks as: there are at least 60% color grains with the fineness finer than 100 mesh.

[0020] In the case, the silicate color blocks have the feature for the color grains mixed between different color blocks as: there are at least 60% color grains with the fineness finer than 500 mesh.

[0021] In the case, the silicate color blocks have the feature as: there are at least 10 silicate blocks or salt-soluble areas over 5cm^2 with transitional color on the boundary line of the silicate pattern. From the surface of the product, we can see that the grains of different colors on the silicate color blocks of two different colors mix with other, with the mixing width of over 1mm and total length of over 30cm, and without mixing with the two silicate color blocks. From the perpendicular cross section of the product, we can see that the boundary line has the 3D structure being perpendicular to the plane within 90 ± 40 degree, shaping up the product by combining with the geometric 3D pattern with very clear boundary line on the surface.

[0022] In the case, the products size from 40cm^2 like mosaic to 10m^2 like the huge marble slab, and the thickness from 3mm to 1000mm, and the different overall geometric shapes, including the shapes of plane plate, cylinder, arc plate, partially cylinder, ball, polygon, round, stripe or square.

[0023] In the case, it may have the pattern com-

posed of the color grains of single or different colors with the diameters from 1mm to 15mm and fine powders.

[0024] In the case, the surface can be polished or unpolished.

[0025] In the case, the plane surface has the concave-convex antislip pattern with the depth from 0.1mm to 5mm, to create the effect of 3D pattern. The convex surface pattern can be polished or unpolished.

[0026] We have illustrated the 3D ceramic color pattern salt-soluble marble in this invention with examples. However, such illustration is the description of my opinion only, it is not the restriction to this invention. The protective range of this invention shall be determined by the Claim of Rights attached.

Claims

1. A kind of 3D ceramic color-pattern salt-soluble marble, which has the patterns composed of silicate color blocks of two different colors such as red, yellow, blue, white, black and green, and the patterns composed of at least three different colors by adding a kind of salt-soluble color such as light gray, light brown, light grayish blue and light cream into the silicate color block. The features are: there are over 10 silicate blocks or salt-soluble areas over 5cm². From the surface of the product, we can see that the fine grains of different colors on the boundary line between the silicate blocks of two different colors mix with each other, with at least one boundary line having the mixing width of 1-10mm. In one product, the total length of one or several boundary lines may reach over 20cm. From the perpendicular cross section on the plane of the product, we can see that the area of silicate block patterns over 2mm thick has reached more than 30cm².
2. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the features as: the product with above features, of which, over 80% of color blocks of different colors on each product in the same batch can overlap with each other in the shape and position, with the overlapping error in all directions not exceeding ± 3 cm.
3. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the feature as: the product with above features, of which, at least two kinds of silicate color blocks are single-color blocks of red, yellow, white, blue, black and green without adding other color grain powder, but not two or more color blocks composed of two or more color grains of red, yellow, white, blue, black and green.
4. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the feature as: at least two kind of silicate color blocks are two or more color blocks composed of two or more color
5. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the feature as: it may be the pattern composed of the silicate color blocks of more than four different colors, and the pattern composed of at least seven different colors by adding three or more kinds of salt-soluble colors into the above silicate color blocks of more than four different colors.
6. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the feature for the color grains mixed between different color blocks as: there are at least 60% color grains with the fineness finer than 40 mesh.
7. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the feature for the color grains mixed between different color blocks as: there are at least 60% color grains with the fineness thicker than 40 mesh.
8. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the feature for the color grains mixed between different color blocks as: there are at least 60% color grains with the fineness finer than 100 mesh.
9. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the feature for the color grains mixed between different color blocks as: there are at least 60% color grains with the fineness finer than 500 mesh.
10. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the feature as: there are at least 10 silicate blocks or salt-soluble areas over 5cm² with transitional color on the boundary line of the silicate pattern. From the surface of the product, we can see that the grains of different colors on the silicate color blocks of two different colors mix with other, with the mixing width of over 1mm and total length of over 30cm, and without mixing with the two silicate color blocks. From the perpendicular cross section of the product, we can see that the boundary line has the 3D structure being perpendicular to the plane within 90 $\pm$ 40 degree, shaping up the product by combining with the geometric 3D pattern with very clear boundary line on the surface.
11. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the feature as: the products size from 40cm² like mosaic to 10m² like the huge marble slab, and the thickness from 3mm

to 1000mm, and the different overall geometric shapes, including the shapes of plane plate, cylinder, arc plate, partially cylinder, ball, polygon, round, stripe or square.

5

12. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the feature as: it may have the pattern composed of the color grains of single or different colors with the diameters from 1mm to 15mm and fine powders.

10

13. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the feature as: the surface can be polished or unpolished.

15

14. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the feature as: the plane surface has the concave-convex antislip pattern with the depth from 0.1mm to 5mm, to create the effect of 3D pattern. The convex surface pattern can be polished or unpolished.

20

15. A kind of 3D ceramic color pattern salt-soluble marble described in Claim 1, with the production method as: powders of different colors come from the separate crossing of the die mouth made according to the pattern of the product by screening, blending or falling. The key point for this process is: to equip the vibration or screen device on the die mouth, suitably extend the displacement in all directions at the range of 0.1mm —20mm under control during vibration or screening, to achieve the better mixing effect on the boundary of two colors.

25

30

35

40

45

50

55



Fig. 1

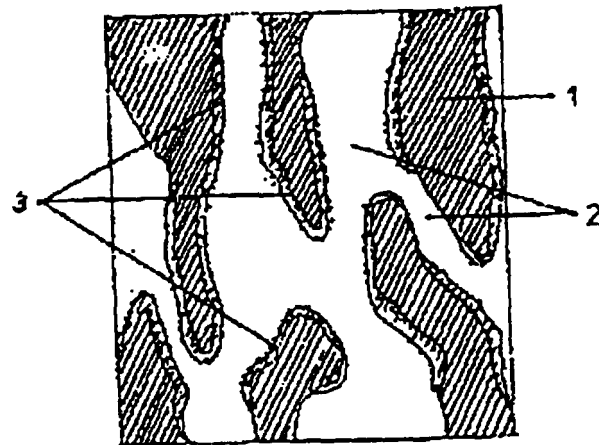
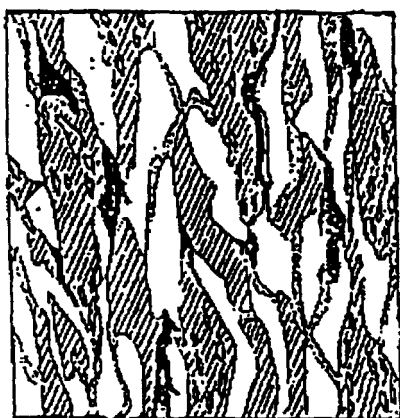
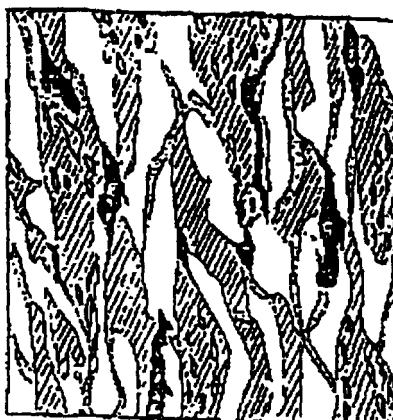


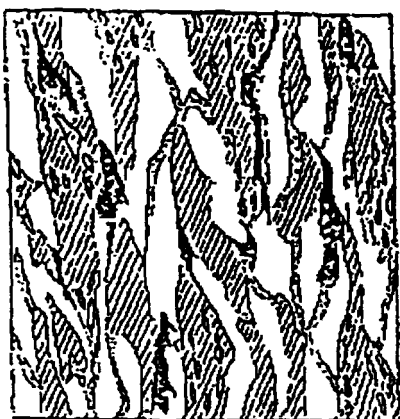
Fig. 2



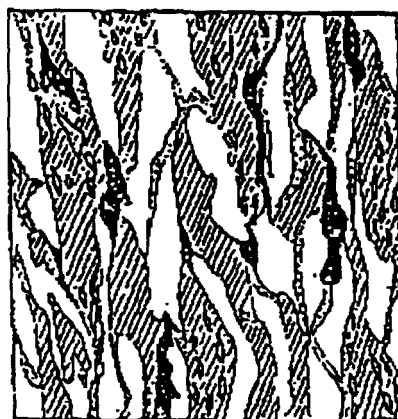
(A)



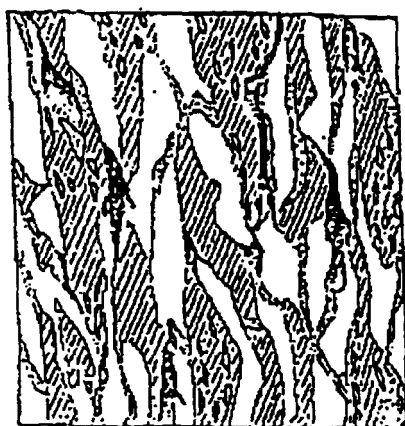
(B)



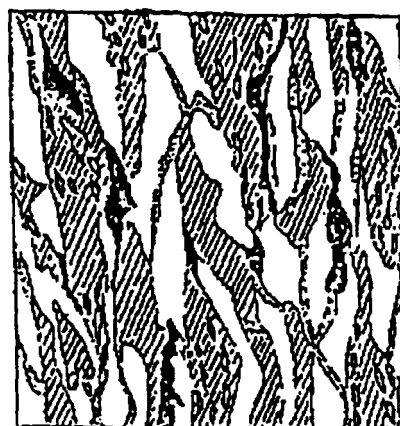
(C)



(D)



(E)



(F)

Fig. 3

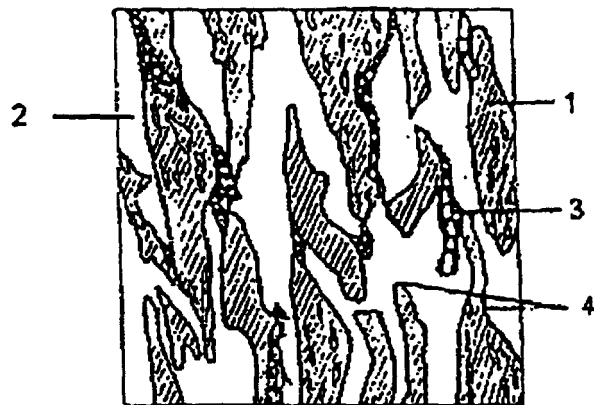


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN98/00270

A. CLASSIFICATION OF SUBJECT MATTER

C04B14/00,B28B11/00,B44C3/12

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched(classification system followed by classification symbols)

C04B14/00,B28B11/00,B44C3/12

Documentation searched other than minimum documentation to the extent that such documents are included in the field searched

CHINESE PATENT

Electronic data base consulted during the international search(name of data base and, where practicable, search terms used)

WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant claim No.
A	CN-A-1153751 (YANG, De Ning), 09.July 1997 (09.07.97), whole document	1 - 23
A	CN-A-88100494 (CHEN,Jing Xiu), 07.December 1988 (07.12.88) whole document	1 - 23
A	CN-A-1079214 (ZHAO,Ying), 08.December 1993 (08.12.93) whole document	1 - 23
A	CN-A-86108043 (ZHANG,Jing Ting), 22.June 1988 (22.06.88) whole document	1 - 23



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason(as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
26.March 1999 (26.03.99)

Date of mailing of the international search report

29 APR 1999 (29.04.99)

Name and mailing address of the ISA/
The Chinese Patent Office
6, Xitucheng Road, Haidian District,
Beijing, 100088, China

Authorized officer

YAN, Na

Facsimile No. 86-010-62019451

Telephone No. 86-10-62093017



Form PCT/ISA/210(second sheet)(July 1992)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN98/00270

Patent document cited in search report	Publication date	Patent family members	Publication date
CN-A-1153751	09.07.97	none	
CN-A-88100494	07.12.88	none	
CN-A-1079214	08.12.93	none	
CN-A-86108043	22.06.88	none	

Form PCT/ISA/210(patent family annex)(July 1992)