Aug. 20, 1946. R. W. ERDLE 2,406,208

CERAMIC ARTICLE AND MATERIAL AND METHOD FOR COLORING OR SHADING THE SAME

Filed March 4, 1944

Fig. 1.

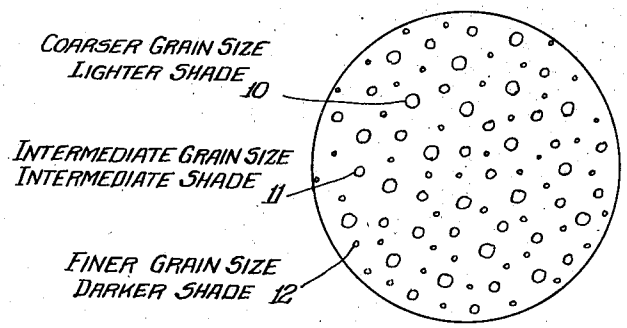


Fig. 2.

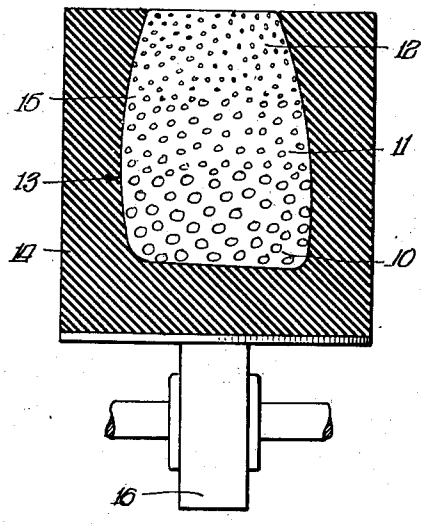
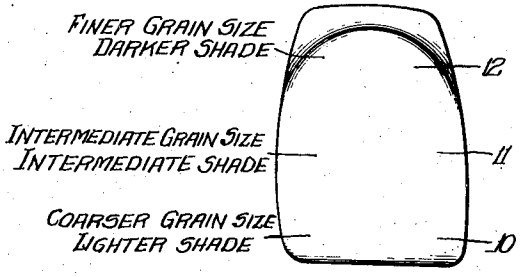


Fig. 3.



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CERAMIC ARTICLE AND MATERIAL AND METHOD FOR COLORING OR SHADING THE SAME

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9 Claims. (Cl. 32—8)

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This invention relates, in general, to ceramic articles and material and method for producing the same, and has particular relation to an improved material and method for producing different shades or colors along different portions of such articles and to the articles thus produced.

While the invention is particularly adapted for producing from a single porcelain mix commercial runs of artificial teeth having uniformly throughout the run of teeth different shades along different portions of such teeth accurately to match a standard shade guide or the natural teeth, it is to be understood that the invention, in its broader aspects, is not limited to this particular use but may be employed in all similar work—for example, for producing different shades or colors along different portions of other ceramic articles.

Heretofore, in order to produce different shades in different parts of an artificial tooth, porcelains of different colors were manufactured. These porcelain powders of different colors were mixed with distilled water, or other suitable binders, into separate porcelain mixes, one for each color. The lighter color porcelain mix and a definite amount of it was placed in the tooth cavity of the mold. Through gravity or vibration, for example, in the manner set forth and claimed in my prior U. S. Patent No. 2,196,258, issued April 9, 1940, this porcelain mix would flow to the lower part of the mold cavity and form the incisal part of the tooth. The second color mix of porcelain, having the color of the middle section of the tooth, was then introduced into the mold cavity, and finally a third color porcelain mix, having the color of the gingival part of the tooth, was introduced into the mold cavity.

It was not always necessary to use three different colored porcelain mixes to produce a tooth having the definite shades along different parts thereof. It was found that by carefully mixing the colored porcelain powders, two different colored porcelain mixes could be used to produce a porcelain tooth of a given shade.

In order to produce a given shade in a porcelain tooth with two or more different colored porcelains, the operator must exercise extreme care to put the proper amount of the different colored porcelain mixes into the tooth mold. The time element is also of great importance. If too much time elapses between the filling operations of the different porcelain colors, a sharp line will appear on the tooth, caused by the different colored porcelain mixes. If there is insufficient time between the filling operations, the porcelain colors

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will run together in the tooth mold, and the porcelain tooth so produced will have substantially one color. This, of course, is undesirable.

In handling two or more porcelain mixes which have different colors, considerable time is consumed, and the results depend upon the skill of the operator. Teeth are produced in this manner in different dental laboratories throughout the country and in other countries. They have to match a standard or given shade guide, and because the resulting shading of a tooth depends to a large extent on the skill of the operator it has been difficult to obtain reasonably accurate matches of manufactured teeth with a standard or given shade guide.

One of the main objects of the present invention is to overcome the difficulties above set forth and other difficulties previously encountered in the production of porcelain teeth.

Another object of the invention is to provide for automatically shading a tooth correctly, thereby raising the standard of the teeth.

Another object of the invention is to provide for producing a tooth with its parts of different shades from a single porcelain mix, thereby reducing the labor cost and eliminating any error an operator may make in handling two or more different colored porcelain mixes to fill the tooth mold cavity.

Another object of the invention is to provide an improved tooth porcelain and an improved tooth porcelain mix; also an improved method for assuring a better shading of the porcelain teeth and that the different shades in different parts of each tooth of a commercial run of teeth will uniformly and accurately match a standard or given shade guide.

Further objects and advantages of the invention will be apparent from the following detailed description, taken in connection with the accompanying drawing.

In the drawing:

Figure 1 is a micro enlargement showing a typical section of a porcelain powder embodying the present invention;

Figure 2 shows, more or less diagrammatically, a mold having a tooth cavity filled with the single porcelain mix of the present invention; and

Figure 3 is an enlarged perspective view of a tooth formed according to the present invention.

Referring, in general, to the more or less diagrammatic illustrations in the drawing, I provide, according to the present invention, a new and improved porcelain which may be referred to as

a "single mix porcelain," to distinguish from the plural mix porcelains previously employed.

As shown diagrammatically in Figure 1, this new and improved porcelain has relatively coarse porcelain particles 10 made of a lighter shade porcelain having, for example, the color of the incisal part of the tooth. It also has finer porcelain particles 11, and still finer porcelain particles 12. The particles 11, which are of a grain size next smaller than the grain size of the particles 10, are made of a darker shade, having the color of the middle part of the tooth. The particles 12, of next smaller grain size, are made of a still darker shade, having the color of the gingival part of the tooth.

The porcelain particles 10, 11, and 12, of different colors or shades and different grain sizes, and in predetermined amounts, are mixed together to produce a single porcelain powder having all of the colors or shades required in a porcelain tooth. The single porcelain mix is produced by thoroughly mixing this mixture of porcelain particles 10, 11, and 12 with a definite amount of distilled water, or other suitable binder, to produce a single porcelain mix of the desired consistency and having all of the required colors or shades in the single porcelain mix.

The tooth cavity 13 of the mold is then filled with this single porcelain mix, as shown at 15, thus introducing all of the representative lots of porcelain particles 10, 11, and 12 into the cavity 13 completely to fill the same in a single operation and without successively introducing porcelain mixes of different colors into different parts of the mold cavity, as heretofore required. The porcelain mix 15 is introduced into the mold cavity 13 while all of the various porcelain particles 10, 11, and 12 are in complete suspension in the binder. This assures the desired shading of the tooth, and also assures that the different shades in different parts of each tooth of a commercial run of teeth will accurately and uniformly match, for example, a standard or given shade guide.

All of the porcelain particles 10, 11, and 12 of different colors and different grain sizes may be kept in complete suspension during introduction of the single porcelain mix into the mold cavity 13 and up to that time, for example, by the method and means disclosed and claimed in my copending application Serial No. 522,706, filed February 17, 1944.

The mold 14 may be a flexible mold of the character described and claimed in my prior U. S. Patent No. 2,337,036, issued December 21, 1943, although, of course, this may vary within the scope of the present invention.

Upon filling the mold cavity 13 with the single porcelain mix, the mold 14 and porcelain mix 15 in the cavity 13 thereof are vibrated, for example, as more fully described and claimed in my prior U. S. Patent No. 2,196,258, issued April 9, 1940. Vibrating means for this purpose is shown more or less diagrammatically at 16. The particular manner in which the desired vibration is secured, and the particular form of the vibrating means may, of course, vary widely.

The different size porcelain particles 10, 11, and 12 have different settling characteristics. The particles 10, which are coarser or of larger grain size, will settle at once to the bottom of the mold cavity 13. The next finer particles 11 settle over the coarser particles 10, and where particles 12 of a third grain size are employed, as described, these still finer particles 12 settle over the particles 11 of intermediate grain size. In this manner the correctly colored porcelain particles pack into the proper parts of the mold cavity 13 to produce by the different settling or packing characteristics of the different size particles the different colors or shades in the different parts of the tooth. The finer porcelain particles will fill in the spaces between the coarser particles to produce an accurate and uniform overall blending of colors so that the resulting tooth will follow the shade of natural teeth.

After the tooth, as shown at 17 in Figure 3, is removed from the mold 14, it may be dried and fire-hardened and glazed as more fully disclosed in my previously mentioned U. S. Patent No. 2,196,258. The porcelain tooth 17 selected for illustration is an anterior tooth, but, of course, this may vary. The incisal part 19 of the tooth 17 is formed by the coarser grain particles 10 having the color of the incisal shade of the tooth. The middle part 20 of the tooth is formed by the next finer particles 11 having the color of the middle part of the tooth. The gingival part 21 is formed by the next finer particles 12 having the color of the gingival part of the tooth.

From the foregoing description it will now be apparent that the use of the single mix porcelain has the advantage of automatically shading a tooth correctly, thereby raising the standard of teeth produced according to the present invention. The filling of the tooth mold cavity 13 involves the handling of only one porcelain mix, which reduces considerably the labor cost for producing porcelain teeth. The use of the single mix porcelain eliminates also any error an operator may make by handling two or more different colored porcelains to fill a tooth mold cavity. As a result, I secure better shading or coloring of the tooth, and I assure uniform and accurate matching of all teeth of a given commercial run of teeth with a standard or given shade guide.

If desired, some of the porcelain particles 10 may be uncolored and other of such particles 10 may be colored to shade the incisal part of the tooth by a blending of the colored and uncolored porcelain. Likewise, some of the porcelain particles 11 and/or some of the particles 12 may be uncolored and other of such particles may be colored to shade the tooth along its middle and gingival parts by a blending of these colored and uncolored porcelain particles.

One suitable porcelain for purposes of the present invention is composed of minerals and mainly of nepheline syenite, as more fully described in my prior U. S. Patent No. 2,334,319, issued November 16, 1943. This particular material is referred to for purposes of illustration, it being understood that other ceramic materials and like materials may be employed within the scope of the broader aspects of the present invention.

I have described the invention in connection with the details of a particular embodiment, but I do not intend thereby to limit the invention to such details, nor do I intend to be limited to the particular embodiment and relation of the essential features shown and described.

I claim:

1. A unitary dental porcelain mix comprising a liquid binder and differentially ground particles of porcelain initially, and prior to grinding, of different colors and in which the differentially ground porcelain particles initially of different colors are combined in proportions adapted to produce by the different settling characteristics

of the different size particles a predetermined shaded coloring effect in an article formed of such mix.

2. An improved dental porcelain mix comprising a liquid binder having mixed therewith relatively coarse porcelain particles colored to produce the desired color along the incisal portion of a tooth, finer particles of the same porcelain material but of a different color to produce a different color along the middle third of the tooth, and still finer particles of the same porcelain material but of a still different color to produce a further color along the gingival portion of the tooth.

3. As a new article of manufacture, a ceramic article having different colored or shaded portions with relatively coarse and colored or shaded ceramic particles forming one of the colored or shaded portions of the article and finer ceramic particles of a different color or shade forming another portion of the article.

4. As a new article of manufacture, a porcelain tooth having different shades along different portions thereof with one portion formed of relatively coarse porcelain particles shaded to produce the desired shade along said portion and another portion formed of finer porcelain particles of a different shade to produce a different shade along said other portion of the tooth.

5. As a new article of manufacture, a porcelain tooth having an incisal portion formed of relatively coarse porcelain particles shaded to produce the desired shade along the incisal portion and a gingival portion formed of finer porcelain particles colored or shaded to produce a different shade along the gingival portion of the tooth.

6. As a new article of manufacture, a porcelain tooth having an incisal portion formed of relatively coarse porcelain particles shaded to produce the desired shade along the incisal portion, a middle third portion formed of finer porcelain particles shaded to produce a different shade along said portion, and a gingival portion formed of a still finer porcelain particles shaded to produce a still different shade along the gingival portion of the tooth.

7. As a new article of manufacture, a ceramic article having a shaded coloring effect with relatively coarsely ground ceramic particles initially, and prior to grinding, of one color forming one of the colored portions of the article, and relatively finely ground particles initially, and prior to grinding, of a different color forming another portion of the article.

8. As a new article of manufacture, a porcelain tooth having an incisal portion formed of relatively coarsely ground porcelain particles initially, and prior to grinding, of a relatively lighter color to produce the desired color along the incisal portion of the tooth, and a gingival portion formed of relatively finer ground porcelain particles initially, and prior to grinding, of a relatively darker color to produce a different color along the gingival portion of the tooth.

9. A unitary ground porcelain material comprising differentially ground particles of porcelain initially, and prior to grinding, of different colors and in which the differentially ground porcelain particles initially of different colors are combined in proportions adapted to produce by the different settling characteristics of the different size particles a predetermined shaded coloring effect in an article formed of the material.

REINER W. ERDLE.