W. W. CRATE.

METHOD OF MANUFACTURING ARTIFICIAL TEETH AND OTHER ARTICLES.

APPLICATION FILED JAN. 12, 1916.

1,218,779. Patented Mar. 13, 1917.

FIG. 1.

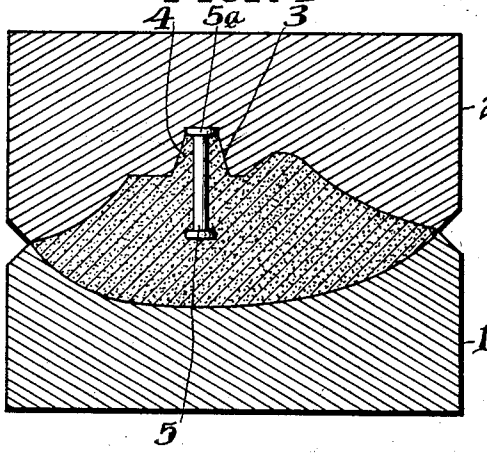


FIG. 6.

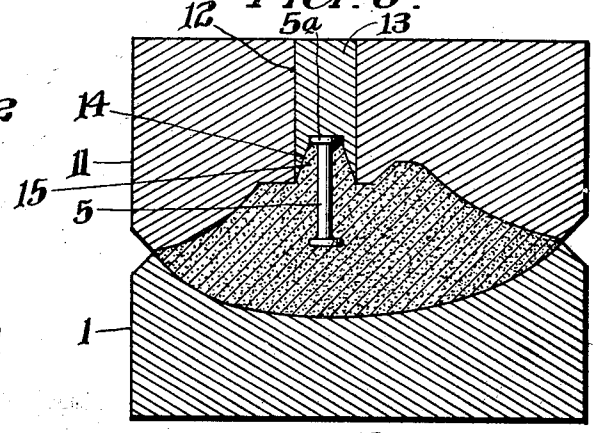


FIG. 2.



FIG. 3.

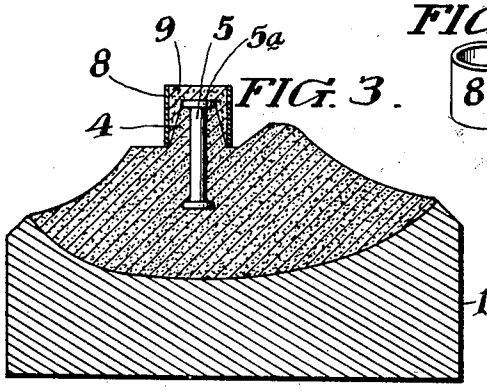


FIG. 7.

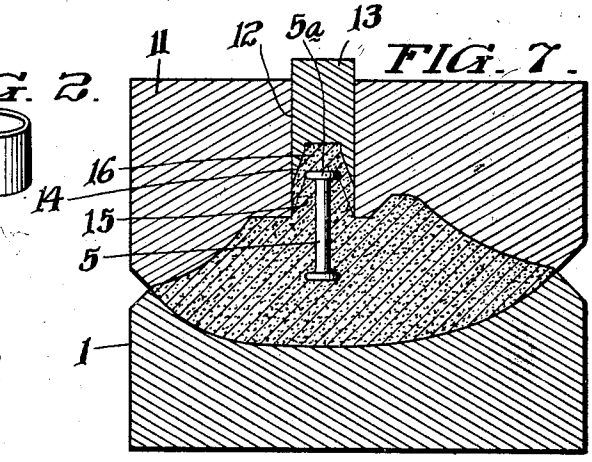


FIG. 4.

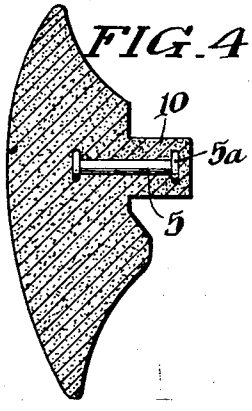


FIG. 5.

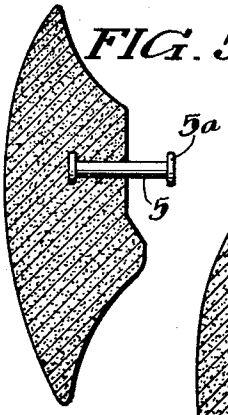
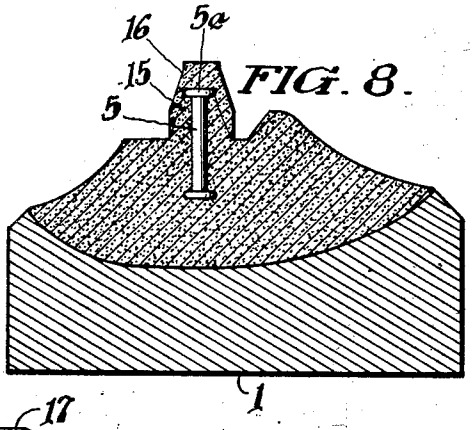


FIG. 8.



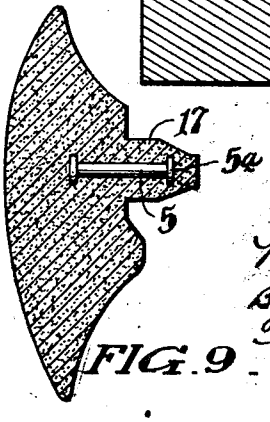


FIG. 9.

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METHOD OF MANUFACTURING ARTIFICIAL TEETH AND OTHER ARTICLES.

1,218,779. Specification of Letters Patent. Patented Mar. 13, 1917.

Application filed January 12, 1916. Serial No. 71,642.

To all whom it may concern:

Be it known that I, WALTER W. CRATE, a citizen of the United States, and a resident of the city of Camden, in the county of Camden, State of New Jersey, have invented certain new and useful Improvements in the Method of Manufacturing Artificial Teeth and other Articles, of which the following is a specification.

Artificial teeth or tooth facings are usually provided with an anchoring element of metal by means of which they are secured to a vulcanite plate or other support therefor. Portions of such elements, usually consisting of pins, are embedded in the plastic ceramic material as it is placed in the mold for forming the teeth, the remaining portions thereof projecting into depressions or holes formed in one part or section of the mold. These pins being thus embedded in the material of the teeth are subjected to high heat in the firing process with the result that only pins of certain material have heretofore been used satisfactorily. Platinum may be used for these anchor elements or pins and is satisfactory not only from the standpoint of its high fusing point but also in that it holds the teeth strongly to the plate during stress of mastication and resists the action of the acids of the mouth which may come in contact therewith after the teeth are placed in use. Nickel, for instance, also fuses at a point sufficiently high to enable it to resist the temperature at which the teeth are fired but in firing loses strength and does not stand well through the process of vulcanizing the rubber, nor does it withstand satisfactorily the action of the acids of the mouth.

I have discovered that if means be provided for sustaining or supporting the projecting portions of the anchoring pins, metals for such pins may be used which fuse at a point relatively low compared with that at which the porcelain of the tooth fuses. As a result of this discovery I am enabled to employ for such anchoring pins, as an instance, gold, which is strong and which resists the attacks of the acids of the mouth.

The purpose of my invention, therefore, is to provide an improved method of manufacture of artificial teeth, or other article subjected to a firing process, whereby the anchoring elements which are partially embedded in the teeth, or other article, may consist of metal which is fusible at a temperature which is low as compared with the temperature of fusion of the material of the teeth or other article and may be placed in position prior to the firing process in which the temperature is or may be raised to a point beyond that at which the metal fuses. By my process even though the metal of the anchoring elements should fuse during the firing process they do not lose their shape, identity or usefulness.

My invention also may be employed with advantage in the manufacture of artificial teeth provided with anchor elements consisting of metal fusible at higher temperatures, as high or even higher than that at which the ceramic material of the tooth fuses. Anchor elements of metal fusible at such temperatures would not be likely to be liquefied during the firing of the tooth but would become plastic and soft and consequently should be supported.

Many metals when heated in the air combine with oxygen to form an oxid and when cooled their surfaces are scaly, rough and discolored. If such metals be employed for the anchor elements of artificial teeth unless they are protected against such oxidation they would be weakened. By the employment of my invention which excludes the air from the anchor elements such oxidation and consequent roughening, discoloring and weakening are prevented.

The manner in which the method embodying my invention is carried out and the advantages thereof will be referred to in detail in the description thereof which follows.

In order that my said invention may be clearly understood and its purpose and advantages fully appreciated reference should be had to the accompanying drawing in which I have illustrated a way in which the same may be practised.

In the drawing:—

Figure 1 is a transverse sectional view of a mold having a cavity therein of the shape of the tooth desired to be molded and also showing the plastic material of the tooth therein;

Fig. 2 is a perspective view of a cylindrical tubular section adapted to be employed in connection with the carrying out of my process;

Fig. 3 is a transverse sectional view of a portion of a mold; also a tooth and the cylindrical, tubular member in Fig. 2 in sec-

tion, the main body of the tooth being shown after having been biscuited;

Fig. 4 is a longitudinal, sectional view of a tooth after the same has been fired and before the covering or protection for the projecting portion of the anchoring pin has been removed;

Fig. 5 is a view similar to Fig. 4 but showing the material surrounding the projecting portion of the pin removed;

Fig. 6 is a transverse sectional view of a mold having a tooth form therein, said figure showing a modification of the mold adapted for use in the covering of the projecting portion of the pin with protecting material;

Fig. 7 is a view similar to Fig. 6 but showing the projecting portion of the pin entirely covered;

Fig. 8 is a view showing a section of the mold with the tooth in position after the same has been biscuited;

Fig. 9 is a view similar to Fig. 4, the tooth with the projecting portion of material surrounding the projecting part of the anchoring pin having been fired; and

Fig. 10 is a view showing a mold in transverse section with an object therein, such as a tile, having an anchoring pin therein the sides of the projecting portion thereof being protected and supported by a surrounding wall of the material of which the body of the article is formed.

Referring to Figs. 1 to 5 of the drawings, 1 and 2 designate the coöperating parts of the mold having a recess or cavity therein in which the material of which the teeth are constructed is placed while in a plastic state and is then compacted and condensed and solidified by pressure.

It will be observed that in the part 2 of the mold I have provided a recess 3 which is of truncated cone shape and which permits a relatively thin portion of plastic material 4 to be formed around the sides of the projecting portion of the anchoring pin 5 below the head 5^a thereof. One end of this pin is embedded, as usual, a greater or less depth in the body of the tooth while the other end portion thereof projects beyond the inner surface of the tooth and constitutes the means by which the manufactured tooth is afterward fastened to a vulcanite plate or other suitable support. While the plastic material of the tooth is within the mold the mold and such material are heated to a temperature sufficient to thoroughly dry the plastic material. As a result of such drying the body of material is somewhat reduced or lessened and its porosity is increased. After having been thus heated the tooth is said to have been biscuited. In order that the projecting portion of the pin 5 may be entirely covered with material such as that of which the tooth is constructed, or other material having, for the purpose, desirable characteristics, I have provided a cylindrical tubular member such as 8 which is adapted to be placed in position as indicated in Fig. 3 for the purpose of holding a portion of material 9 upon the top of the projecting end of the pin and around the inclined sides of the truncated cone-shaped projecting portion 4. The tooth is then placed in a furnace, including the projecting portions 4 and 9, and is fired and is raised to a temperature sufficient to fuse the material of which the tooth is constructed. The supporting tubular section 8 consists of material which burns away during the firing process but before it does burn away the portion of material 9 has sufficiently dried out and hardened to retain its shape as shown in Fig. 4.

When the fusible material of the tooth including the material 9 fuses the latter merges into and combines with the projecting portion 4 so as to form a continuous integral projection such as is indicated at 10 in Fig. 4.

In Figs. 6 and 7 I have shown a mold consisting of the parts 1 and 11, the latter having an opening 12 therethrough which is closed by means of a plug 13 having a recess 14 in the inner end thereof. The pin 5 is embedded in the plastic material of the tooth in the same manner as described in connection with Figs. 1 and 3.

The parts 1 and 11 of the mold, after the plastic material has been placed in the cavity thereof, are pressed firmly together, the plug 12 being pushed into the position shown in Fig. 6. The projecting portion 15 of the plastic materal of the tooth surrounds the projecting portion of the pin 5 below the head 5^a thereof. After the plastic material has been thus formed and pressed into shape the plug 12 is removed in any suitable manner and a relatively small proportion of material 16 is then placed in the opening 12 and is pressed down upon the head 5^a of the pin and its side portions extend around the sides of the truncated cone-shaped projecting portion 15 as shown. The mold, consisting of the parts 1 and 11, is then heated to a relatively low temperature to dry out the plastic material in the manner described in connection with Figs. 1 and 3. After the tooth shown in Fig. 7 has been biscuited as just described it is then placed in a furnace and fired in the usual manner.

In the process of firing, the part 16, although placed in position subsequently to the formation of the projecting portion 5, unites with and becomes an integral part of such projecting portion as shown clearly at 17 in Fig. 9.

After having been fired as above described, the integral projecting portions 10 and 17 may be removed by taking a pair of pliers or pincers or some suitable equivalent tool and

squeezing or biting the same. Such projecting portions are thereby ruptured and caused to break and crack away leaving the projecting portion of the pin free and uncovered as indicated in Fig. 5. The rough unsmooth portion of surface upon the tooth created by breaking away the surrounding projecting portions 10 and 17 may, if desired, be polished so as to leave the inner side of the tooth smooth as indicated in Fig. 5.

If the material used for the pins be gold, as contemplated herein, it is needless to say that it would completely fuse at the temperature employed in the firing of the teeth, such temperature being sufficient to fuse the porcelain of the teeth. It makes no difference, however, if the metal of these pins does fuse because the projecting portions thereof are retained in substantially the shape or form in which they were originally introduced and when the teeth and the pins therein are cooled and the projecting protecting and supporting portions are removed from around the projecting ends of the pins it will be found that the projecting ends of the pins are of substantially the same shape as they were before being subjected to the heat of firing.

It will be understood that as the pins (of certain metals) are heated they expand and it might be thought that such expansion would cause the projecting surrounding and protecting portions to rupture and permit the metal to flow out upon being fused. Such, however, is not the case because as the ceramic or silicious material is heated and dried the walls thereof become porous, also they contract, thereby providing an increased space for the expanded metal of such pins.

When, however, the ceramic or silicious material fuses it moves or flows in toward or against and as it were hugs the pin tight and holds and retains it in its original shape.

Although I have described the manner in which the surrounding and protecting material may be placed in position about the projecting end portions of the anchoring element, it is to be understood that such surrounding and protecting portion of material may be otherwise placed in position. The essential idea of invention involved in the method invented by me is that when a plastic ceramic material (as illustrated in the manufacture of a tooth) is fired, the projecting end portions of the anchoring element shall be protected and supported by a surrounding body of material which retains its shape during the operation of firing the said material and which will support the said metal even though the latter should fuse and become liquid. My invention is of particular advantage and usefulness when employed in connection with anchoring elements consisting of metal which fuses at a relatively low temperature as compared with the fusing temperature of the substance of which the article into which it extends is composed.

It is apparent, therefore, that by the employment of my method in the production of artificial teeth, metal for the anchoring pins may be employed which is fusible at a lower temperature than the porcelain. Heretofore, as far as I am aware, this has not been feasible.

The principle of my invention may also be employed in the manufacture of objects from plastic material other than teeth, in which anchor elements of metal are provided having portions embedded within said objects and other portions projecting therefrom.

I claim:—

1. The method of manufacturing an artificial tooth having an anchor element of metal partially embedded in the material of said tooth, such metal fusing at a lower temperature than that at which the material of the tooth fuses, which comprises placing the said anchor element in position in the tooth while the material thereof is in a plastic state, entirely covering the projecting portion of said anchor element with a layer of the material of which the tooth is composed and thereafter heating the said tooth and layer to a temperature sufficient to fuse the material thereof.

2. The method of manufacturing an article from fusible plastic material having an anchor element of metal partially embedded therein which consists in placing the said element in position with a portion thereof embedded in said article and entirely covering the projecting portion of said element with a layer of material fusible only at a temperature equal to or greater than that at which the said plastic material of which the article consists is fusible and firing said article to fuse the same.

3. The method of manufacturing an article from fusible plastic material having an anchor element of metal partially embedded therein which consists in placing the said element in position with a portion thereof embedded in said article and entirely covering the projecting portion of said element with a layer of material fusible only at a temperature equal to or greater than that at which the said plastic material of which the article consists is fusible, firing said article to fuse the same and thereafter removing the said layer from the said projecting portion.

4. The method of manufacturing an artificial tooth having an anchor element of metal partially embedded in the material of said tooth, such metal fusing at a temperature lower than that at which the material of the tooth fuses, which comprises placing the said anchor element in position in the

tooth while the material thereof is in a plastic state entirely covering the projecting portion of said anchor element with a coating of material which is fusible only at a very high temperature and thereafter firing the said tooth, raising it to a temperature sufficient to fuse the material thereof.

5. The method of manufacturing an artificial tooth of fusible plastic material which consists in partially embedding a pin in the body portion of the plastic tooth form and surrounding the sides of the projecting portion of said pin with portions of the plastic material projecting from the body of said tooth form, placing a laterally confining wall around the said projecting portion of said material, placing plastic fusible material upon the top of the projecting portion of said pin and around the sides of the portion of material projecting from the said tooth form, firing the said tooth and the material which covers the projecting portion of the said pin and thereafter removing the covering from the projecting portion of said pin.

6. The method of manufacturing an article from fusible plastic material having an anchor element of metal which becomes softened by the application of heat at a lower temperature than that at which the material of which said article is composed is fusible, which consists in covering the sides and end of the projecting portion of said element with a material which will remain in position surrounding the said projecting portion when said article is fired and firing the said article to fuse the same, substantially as described.

In testimony that I claim the foregoing as my invention, I have hereunto signed my name this 11th day of January, A. D. 1916.

WALTER W. CRATE.