H. P. OSBORN.

ARTIFICIAL TOOTH AND METHOD OF MAKING THE SAME.

APPLICATION FILED MAY 10, 1910.

1,040,571.

Patented Oct. 8, 1912

3 SHEETS—SHEET 1.

Fig. 1.

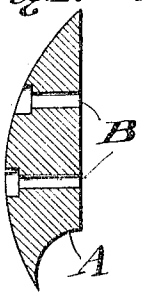


Fig. 2.

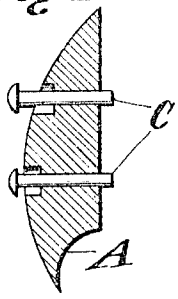


Fig. 3.

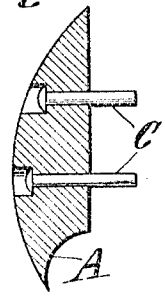


Fig. 4.

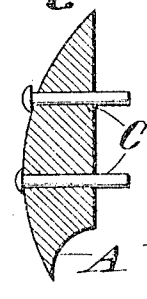


Fig. 5.

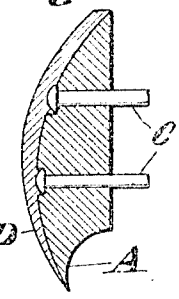


Fig. 6.

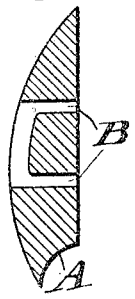


Fig. 7.

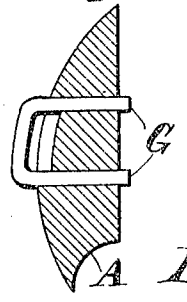


Fig. 8.

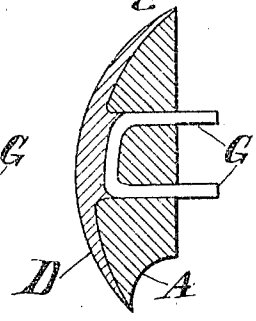


Fig. 9.

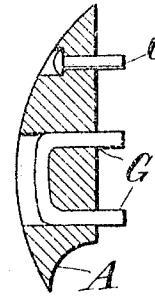


Fig. 10.

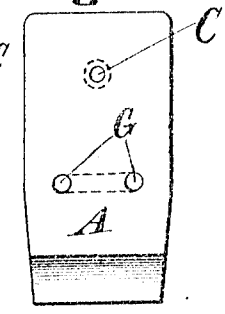


Fig. 11.

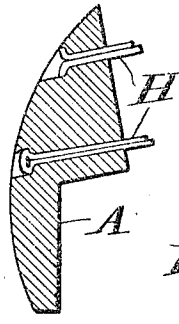


Fig. 12.

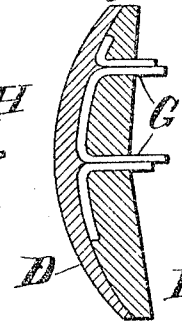
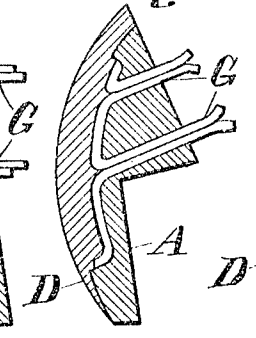


Fig. 13.



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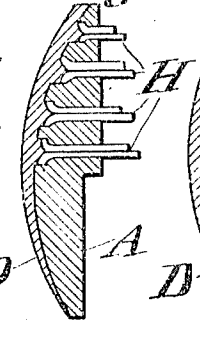
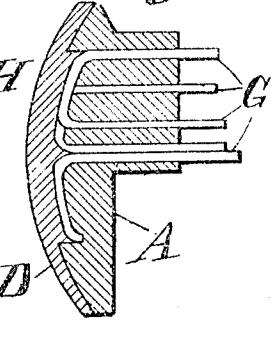


Fig. 15.



WITNESSES:

Rohe Meyer.

Chas. J. Barnett

INVENTOR

Henry P. Osborn

BY

H. M. Marble

Attorney

H. P. OSBORN.

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3 SHEETS—SHEET 2.

Fig. 16.

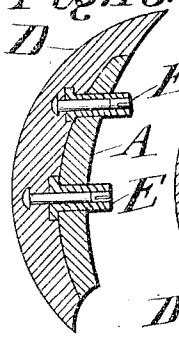


Fig. 17.

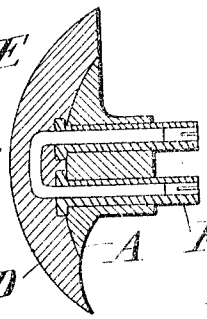


Fig. 18.

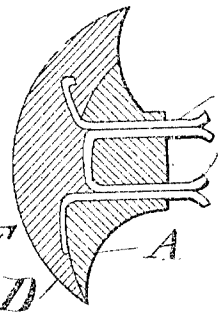


Fig. 19.

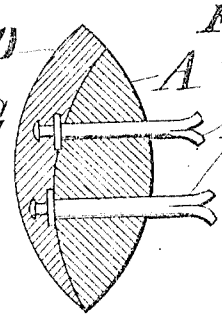


Fig. 30.

Fig. 31.

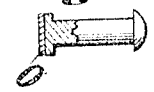


Fig. 20.

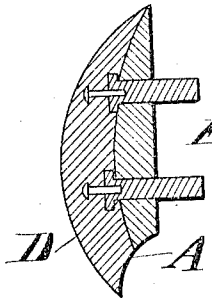


Fig. 21.

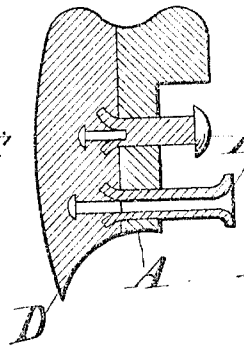


Fig. 22.

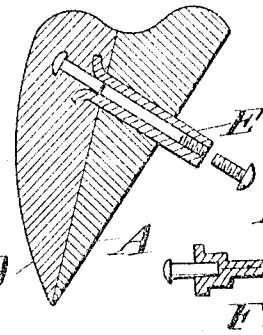


Fig. 27.

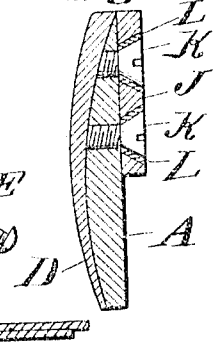
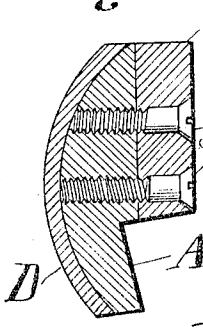


Fig. 23.

Fig. 24.



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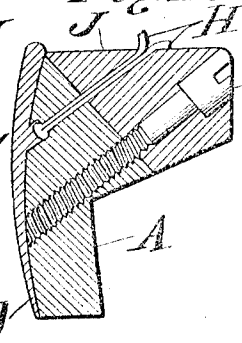

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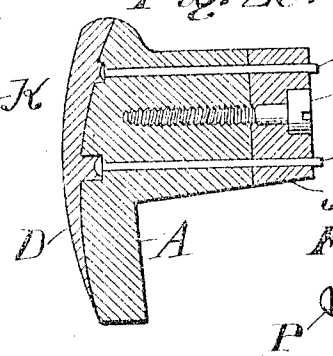

Fig. 29.

WITNESSES:

Rohe Meyer

M. J. Barrett

INVENTOR

Henry P. Osborn

BY

H. M. Marble

Attorney

H. P. OSBORN.

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3 SHEETS—SHEET 3.

Fig. 32.

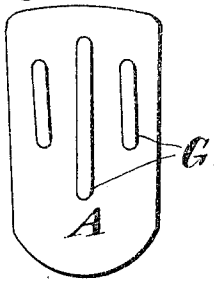


Fig. 33.

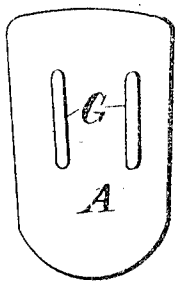


Fig. 34.

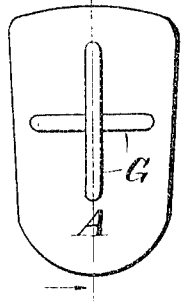


Fig. 35.

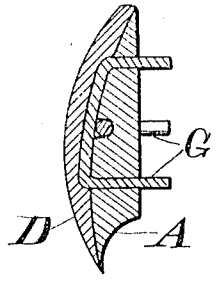


Fig. 36.

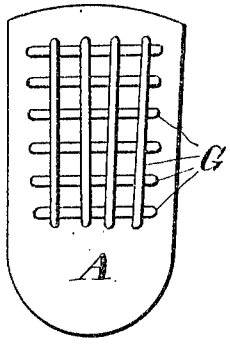


Fig. 37.

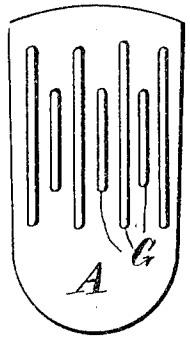


Fig. 38.

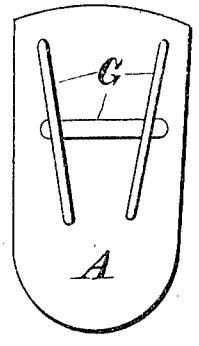


Fig. 41.

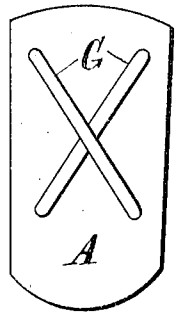


Fig. 39.

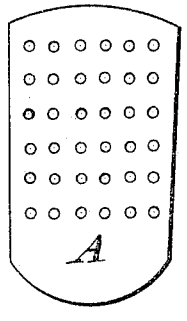


Fig. 40.

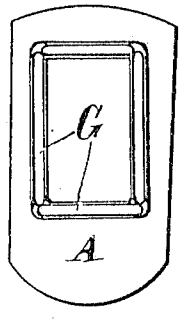
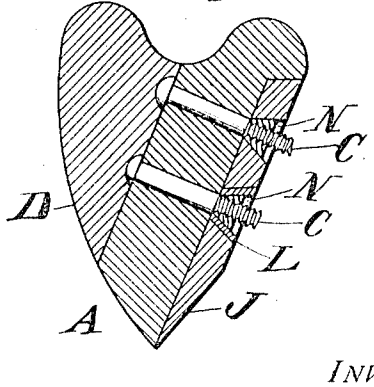


Fig. 28.



WITNESSES:

Rohe Meyer.

Wm. J. Barrett

INVENTOR

Henry P. Osborn

BY

H. M. Marble

Attorney

UNITED STATES PATENT OFFICE.

HENRY P. OSBORN, OF BAYONNE, NEW JERSEY.

ARTIFICIAL TOOTH AND METHOD OF MAKING THE SAME.

1,040,571. Specification of Letters Patent. Patented Oct. 8, 1912.

Application filed May 10, 1910. Serial No. 560,535.

To all whom it may concern:

Be it known that I, HENRY PORTER OSBORN, a citizen of the United States, residing at Bayonne, in the county of Hudson and State of New Jersey, have invented a new and useful Artificial Tooth and Method of Making Same, of which the following is a specification.

My invention relates to artificial teeth and methods of making the same, and comprises an improved method of making artificial teeth having pin-like anchors or their equivalent, whereby true surfaces are provided for engagement with the tooth backing; an improved manner of inserting the pins or other anchors in the teeth, whereby a very deep penetration of the substance of the tooth by the pins or other anchors is obtained, and liability of the teeth to crack is very greatly reduced; also various improved artificial tooth structures, improved anchors, and other features, as hereinafter described and particularly pointed out in the appended claims.

According to former methods of making artificial teeth provided with anchors, it has been the usual practice to insert these anchors into the teeth during molding, or before baking or "firing"; a method to which there are several serious objections, among which are, that the tooth is exceedingly apt to crack or cleave during baking or thereafter, owing to expansion of the anchors; that these anchors, unless made of platinum or platinum alloy or like noble metal, are apt to be greatly injured by the baking, and furthermore turn black, even within the tooth, their black color showing through the tooth; and that the tooth usually warps during the baking, leaving an uneven surface on the face from which the anchors project, which surface cannot be trued up properly thereafter, owing to the presence of the anchors, so that such teeth do not set close up against the backings to which they are subsequently fitted. Owing to the extreme probability that the tooth will crack during or after baking, if the anchors penetrate deeply into the tooth, and have embedded in the tooth heads of desirable breadth, it is the present practice to insert the anchor pins only a very small distance into the teeth and to provide them with very small heads, if any, with the result that the tooth is not as strong as it should be. It is also considered necessary to use platinum anchors, for all but the cheapest grades of teeth, notwithstanding the high cost of platinum, because nickel, the other most suitable metal, undergoes a peculiar change when heated in the furnace during the baking of the porcelain, becoming weak and friable, and likewise turning black.

According to my invention, the tooth comprises a body portion, usually formed of porcelain, and usually constituting the major fraction of the tooth, and in which are apertures for the reception of the anchor or anchors, and a facing; the heads of the anchors being sealed into the tooth by this facing. In forming such teeth, the tooth body is first molded and baked, before the facing is applied and before the anchors are applied. After baking, it is trued up, to gage, the surface or surfaces which are to engage or fit against a backing being ground, if necessary, until perfectly smooth and of the contour desired, whether that be flat, concave or convex; an operation which is very easily performed, since there are no anchor pins or the like in the way. The anchor pins or the like are then inserted, usually from the front of the tooth body, and are seated in suitable recesses provided to receive them, after which a facing, usually of enamel which melts at a relatively low temperature as compared with the body, is applied and baked on. Owing to the lower temperature required to bake the enamel, there is practically no liability to cracking of the tooth, nor is there the same risk of injuring the material of the anchors, when the latter are formed of nickel or like metal. It thus becomes practical to have the anchors penetrate the tooth very deeply, and to provide such anchors with very large heads, so that pressure between the anchors and the porcelain of the tooth is distributed over a large area, thereby minimizing chances of the tooth breaking subsequently or scaling from the backing. To prevent the anchors from showing black from the front or edges of the tooth, I cover them with a thin coating of platinum or other metal which does not turn black when heated, or at least cover the front portions of the anchors with such metal, or employ anchors, the inner or front portions of which are of metal which does not turn black. And sometimes I form the entire anchor of platinum or like metal.

I will now proceed to describe my invention with reference to the accompanying

drawings, which illustrate the method of making artificial teeth embodied in my invention and various forms of teeth constructed in accordance with my invention.

In said drawings:—Figure 1 shows a longitudinal section of one form of tooth body, prepared for the reception of anchor pins; Fig. 2 is a similar view showing the pins partly inserted, and Fig. 3 is a further similar view showing the pins fully in place; Fig 4 is a further similar view except that the tooth body there shown is not provided with recesses for the heads of the pins; and Fig. 5 shows a longitudinal section of the completed tooth; Fig. 6 is a view similar to Fig. 1, except that the tooth body there shown is recessed to receive an anchor of loop or staple form; Fig. 7 is a similar view showing the staple partly in place; and Fig. 8 is another similar view showing the completed tooth; Fig. 9 shows a longitudinal section of a tooth body similar to that shown in Figs. 6, 7 and 8, except that the staple is shown more near the base of the tooth, and a pin anchor is shown near the edge of the tooth; Fig. 10 shows a rear view of a tooth similar to that shown in Fig. 9, except that in this case the staple fastening is shown arranged transversely instead of longitudinally; Fig. 11 shows a longitudinal section of another slightly different form of tooth body, and illustrates the use of split anchor pins; and Figs. 12, 13, 14 and 15 are similar sections of completed teeth of various forms illustrating various manners of using split anchor pins; Fig. 16 is a longitudinal section of a tooth provided with anchor pins of compound construction comprising a front portion of noble metal and a main portion of base metal; Fig. 17 is a similar view of another form of tooth provided with a loop-form anchor of compound construction; Fig. 18 shows a longitudinal section of still another form of tooth provided with split pin anchors, a portion of one of the anchors extending well into the enamel; Fig. 19 shows a longitudinal section of another form of tooth provided with anchor pins of compound construction but of the pin construction illustrated in Fig. 16; Figs. 20, 21 and 22 show longitudinal sections of still other forms of teeth embodying further forms of anchor pins; Fig. 23 is a detail section of a further form of compound pin; Fig. 24 is a longitudinal section of an artificial tooth and backing, the tooth held to the backing by screws, the screw holes being closed at the front end, and the ends of the screws concealed, by the enamel facing; Figs. 25 and 26 are longitudinal sections of other forms of teeth and tooth-backings, illustrating the use in combination of screws and anchor pins for holding teeth to their backings; Figs. 27 and 28 show longitudinal sections of further forms of teeth and backings, the teeth being held to the backings by screws; Figs. 29, 30, and 31, show elevations and partial sections of various forms of compound anchor-pins; Figs. 32, 33 and 34 are front views of tooth bodies, showing said tooth bodies before the application of the enamel facing, and illustrating various arrangements of loop-form anchors, which may be employed to meet various conditions; Fig. 35 shows a longitudinal section of a completed tooth having the anchor-arrangement shown in Fig. 34; Figs. 36, 37 and 38 are views similar to Figs. 32, 33 and 34, but illustrate still further arrangements of loop-form anchors, designed particularly to reinforce and strengthen thin and weak teeth; Fig. 39 shows a face view of a tooth body provided with a large number of anchor holes into any of which the dentist may place anchor pins, according to the exigencies of the particular situation; and Figs. 40 and 41 are face views showing tooth bodies, illustrating still further permissible arrangements of anchors.

Referring first to Figs. 1 to 5 inclusive, A designates the main body of a tooth, provided with holes B for the reception of anchor pins C, and D designates a facing, of a relatively low-fusing enamel or like material, covering the front of the tooth body A and sealing in the pins C and completely covering their heads. In some cases, as indicated in Figs. 1, 2 and 3, the front sides of the tooth bodies A are deeply recessed, so as to receive completely the heads of pins C; but this is hardly necessary, as the enamel D completely covers said heads, very slight recessing, if any, as illustrated in Figs. 4 and 5, being sufficient. In forming such teeth, the bodies A are first molded, baked or fired, and then trued accurately to gage, particularly on the back, so that such back surface shall have precisely the contour desired, whether that be flat, as indicated in Figs. 1 to 9 inclusive, or of other contours, as illustrated, for example, in Figs. 11–19 inclusive. No matter how accurately teeth are molded, they undergo a great deal of shrinking, warping and twisting in firing, so that their backs must be put back to true form by grinding or like operation, after the firing, if they are to fit tightly to the tooth backing, as they should. Such truing of the bodies A is easy before the insertion of the anchor pins, whereas it is practically impossible after such pins have been inserted and baked in.

The tooth body having been molded, baked and trued, as above described, the anchor pins C are inserted in the holes B, formed during the molding of the body A, and an enamel facing D is molded over the face of the body A, covering the heads of the pins, after which the tooth is baked again, but only at the much lower tempera-

ture required to fuse the said enamel. Owing to the lower temperature at which the enamel is baked on, the tooth body does not warp or change form during the baking on of the enamel, and retains a true back surface. The tooth is then finished and ready to be applied to a backing.

The construction described not only permits a very deep penetration by the anchor pins of the tooth body, and permits the use of pins having very large heads, so as to distribute pressure over a relatively large area of the tooth body, but it also permits the tooth itself to be made quite thin, so permitting the backing to be made thick, stiff, and strong, so that it may lie closely to the tooth itself and support the same adequately. The strength of a tooth depends in a large degree upon the depth of penetration of the anchor pins. Hence by preference the anchor pins extend back clear to the facing, as shown in Fig. 5, or into the facing, as shown in Figs. 16, 17, 18, 19, 20, 21, and 22, (the method of construction herein described for the first time making this possible).

Where two anchor pins are to be used, instead of using two separate pins, as in Figs. 1 to 5 inclusive, I frequently prefer to use a loop or staple, the back of such loop forming in effect a very broad head for both legs or pins of the staple. Such a loop or staple is designated by letter G in Figs. 7, 8 and 9, and is also shown in various other views. Such construction has the very great advantage, that the anchor extends through the tooth longitudinally, for a great portion of its length, insuring against dropping off of fragments of porcelain in case cracks should develop in soldering, and holding the tooth to the back so firmly, and also so reinforcing the tooth, that small cracks, if they start, are not apt to spread.

Sometimes I employ for an anchor pin a split pin such as H, Fig. 11, usually consisting of two half-round wires the flat sides of which face each other so that the pin will fit within a round hole. In the use of a tooth having such a pin, the free ends of the half pins may be opened after being passed through a hole in the backing and then bent back against the back surface of the backing, as illustrated in Fig. 25, so holding the tooth firmly against the backing for soldering, by the mere opening of the ends of the anchor pins. Figs. 11, 12, 13, 14, 15, 18 and 19 illustrate various ways of using split anchors in teeth.

There is not the same occasion for using platinum pins in teeth constructed as herein described, as has existed in the prior art, because the pin is not exposed to the high temperature employed in firing the porcelain tooth body, and is little likely to be injured, if of nickel or like metal, by the lower temperature employed for fusing the enamel facing. But when, for any reason, it is not desired to rely solely on nickel, I frequently use a compound pin, such as E, Fig. 16, and F, Fig. 17, the inner or front portion of which is formed of platinum or platinum alloy, the outer or rear part being tubular, the front part fitting into the tube and being secured therein; this tubular part being of a cheaper metal, such for example as nickel. In the construction shown in Fig. 16, this outer hollow portion is headed at its inner end, while at the other end that portion of it which is to go through the backing is split so that it may be opened back of the backing and the two sides bent back against the rear side of the backing before soldering, as previously explained in connection with the split pin H of Fig. 11. The small inner headed pin, of platinum, extends into the facing D, in this construction, thus serving as additional means for holding the facing to the body of the tooth. A convenient form of combination pin of this nature is shown in Fig. 29, the said pin consisting of a split tube, O, of a relatively cheap metal, such as nickel, said tube having an open seam throughout its length and having at one end a head; and a small headed pin P, of platinum or like metal, set into tube O at its headed end. It will be noted that in these various forms of combination pin, the front portion is of platinum, and so will not show from the front of the tooth. Fig. 17 shows a staple anchor F of the combination construction described.

The loop anchor, if used, does not always extend longitudinally of the tooth. Fig. 10 shows a construction in which the loop anchor is arranged transversely.

Deep recessing of the heads of the pins into the body of the tooth, as indicated in Fig. 3, is sometimes desirable, when the pins consist entirely of some metal, such as nickel, which may turn black during the baking on of the enamel. In such case, after the insertion of the pins into the tooth body, and before the enamel facing is applied, the recesses in which the heads of the pins have been sunk are filled with a somewhat opaque porcelain before the application of the enamel facing, the covering of the heads in this manner preventing any dark color due to said heads showing through to the front of the tooth. But there is practically no occasion for using anchor pins which are not covered, on their front ends, at least, with a metal which will not turn black. The very front of the pin, at least, may usually have a thin covering of platinum or like metal. This is illustrated in Fig. 31, which shows a pin, the front of the head of which has soldered or otherwise secured to it a thin covering Q of platinum or like

material. The cost of such a pin is so very slightly greater than that of an all-nickel pin, that there is very little occasion for using an all-nickel pin. In Fig. 30 I show a pin of slightly different form, the front of which is provided with a similar platinum covering Q, for the same purpose.

In some cases I employ both an inserted pin anchor and a screw, for holding a tooth to the backing. This is illustrated in Figs. 25 and 26. In Fig. 25 A designates the tooth body, D the facing, J the backing, H a split pin anchor, and K a screw passing through the backing and threaded into the body of the tooth. The extreme ends of the split pin H have been bent back, as previously described, to cause said pin to help hold the tooth to the backing. In such teeth, threaded screw-holes for the reception of the screw, may be formed successfully by the method set forth in my Patent No. 865,314, dated September 3, 1907. In Fig. 26, a similar construction involving the use of two pins C is shown. It will be obvious that in case such a tooth as shown in either of these two figures is broken, in use, it may be removed readily, whether it be in place on a bridge or on a plate, and a new tooth of similar form substituted for it. Such substitution will be the more easy, in the case of teeth constructed as herein described, since the final grinding of the teeth, before the application of the enamel facing, will be with reference to standard gages, so that a broken tooth of one gage can always be duplicated exactly.

In the constructions shown in Figs. 24 and 25, the enamel facing D is applied after the baking of the tooth body and after the formation of the screw-threaded holes in the manner described in my prior patent above mentioned, and therefore hides completely the ends of the screws, preventing them from showing as dark spots from the front of the tooth.

Figs. 32–38 inclusive, 40 and 41, show various arrangements of staples and like anchors for reinforcing teeth—particularly thin broad teeth, and for securing the same to backings at so many and so widely distributed points that breakage is rendered very unlikely.

One advantage of the method of forming teeth herein described is, that the tooth bodies, without facings, and, if desired, without anchors, may be furnished to the dentist, who may himself apply the anchors according to the demand of the particular situation in which the tooth is to be used, and then himself apply the facing, coloring it as occasion may require. In Fig. 39 I show a form of tooth body which is particularly adapted for use in this manner, as it is provided with a large number of anchor holes into some or all of which the dentist may insert anchors of various constructions, the type of anchors employed and their location in the tooth depending upon circumstances, and may then apply the enamel facing to cover the backs of such pins and may himself bake the enamel on. In such case, the enamel will fill those holes in the tooth body which are not occupied by anchor pins.

In the drawings I have shown many different forms of teeth and different constructions of anchors, for the reason that the requirements of plate and bridge work call for a large number of different forms of teeth and different methods of anchoring them to their backings. Owing to the grinding of the teeth after baking and before the application of the anchors, teeth of no matter what form may be ground true to gage during manufacture and will be of the same form when used, and require no further dressing at the back to fit them to backings themselves formed to similar gages. This method of constructing and applying teeth therefore avoids bad joints between teeth and backings, such as are frequently encountered when using teeth formed in other ways.

What I claim is:—

1. The herein described method of making artificial teeth, which comprises applying to the front surface of a previously baked tooth body, provided with one or more anchor holes extending from the front surface of such tooth backward, a coating of enamel of a materially lower melting temperature than the melting temperature of the material of said tooth body, and fusing the said enamel on said tooth body, thereby closing, on the front side of the tooth, the said anchor hole or holes.

2. The herein described method of making artificial teeth, which consists in forming a baked tooth body provided with one or more anchor holes extending from the front of the tooth body backward, truing that surface of such tooth body which is to fit against a backing, inserting an anchor or anchors in said hole or holes, and applying to the front surface of said tooth body an enamel which covers the said anchor or anchors, and baking said enamel on said tooth body at a temperature materially lower than the melting temperature of the material of the tooth body.

3. The herein described method of making artificial teeth, which consists in forming a tooth body provided with one or more anchor holes extending from the front of the tooth body backward, inserting into said hole or holes one or more anchors extending beyond said anchor holes at both ends, applying to the front surface of said tooth body enamel which covers said anchor or anchors and in which same are embedded, and baking said enamel on said tooth body

at a temperature materially lower than the melting temperature of the material of the tooth body.

4. The herein described method of making artificial teeth, which comprises forming a tooth body provided with one or more anchor holes extending from the front of the tooth body backward clear through said body, and applying to the front surface of said tooth body an enamel which covers the front end or ends of said anchor hole or holes, and baking said enamel on said tooth body at a temperature materially lower than the melting temperature of the material of the tooth body.

5. A tooth body having a plurality of anchor holes extending therethrough from front to rear, said holes connected, at their front ends, by a recess adapted to receive the back of a staple the legs of which are located in said holes.

6. An artificial tooth comprising a tooth body having one or more anchor holes extending therethrough from front to rear, anchor means in said hole or holes, and a facing covering the front of said tooth body and the front end or ends of said anchor means and closing said hole or holes.

7. An artificial tooth comprising a tooth body having one or more anchor holes extending therethrough from front to rear, said hole or holes enlarged at the front end, anchor means in said hole or holes, and a facing covering the front of said tooth body and the front end or ends of said anchor means.

8. An artificial tooth comprising a tooth body having a plurality of anchor holes extending therethrough from front to rear, said holes connected, at their front ends, by a recess adapted to receive the back of a staple, a staple anchor, the legs of which are located in said holes and the back of which is located in said recess, and a facing covering the front of said tooth body, and the front end or ends of said anchor means.

9. An artificial tooth comprising a tooth body, a facing, and one or more anchor means penetrating the tooth body from front to rear, the front portion of said anchor means of a noble metal, the rear portion of base metal, the said facing completely covering the front of said anchor means.

10. An artificial tooth comprising a tooth body, a facing, and one or more anchor means penetrating the tooth body from front to rear and extending into the facing and thereby interlocking with the facing.

11. An artificial tooth comprising a tooth body, a facing, and an anchor of loop form, embedded in said tooth, and extending completely through the tooth body from front to rear.

HENRY P. OSBORN.

Witnesses:
H. M. Surridge,
F. F. Goeller.