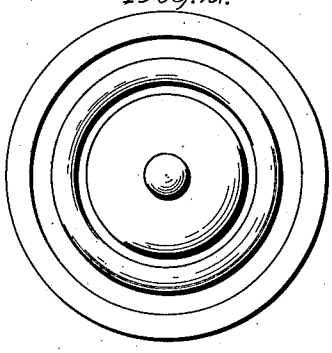
June 10, 1924. 1,497,514

K. W. KNAPP

METHOD OF PREPARING DENTAL INLAYS

Filed July 29, 1920

Fig.2.



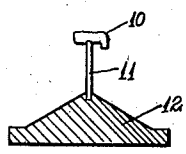


Fig.3.

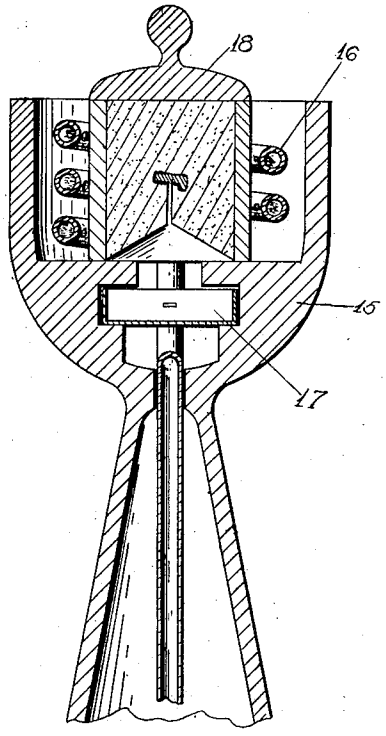


Fig.1.

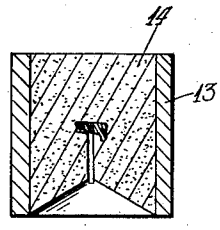


Fig.4.

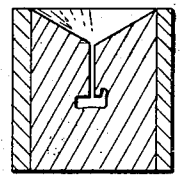


Fig.5.

INVENTOR

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by Owen & Hagel ATTORNEYS

Patented June 10, 1924. 1,497,514

UNITED STATES PATENT OFFICE.

KARL W. KNAPP, OF DES MOINES, IOWA, ASSIGNOR TO M. F. PATTERSON DENTAL SUPPLY CO., OF ST. PAUL, MINNESOTA, A CORPORATION OF ILLINOIS.

METHOD OF PREPARING DENTAL INLAYS.

Application filed July 29, 1920. Serial No. 399,688.

To all whom it may concern:

Be it known that I, KARL W. KNAPP, a citizen of the United States, and resident of Des Moines, in the county of Polk and State of Iowa, have invented a certain new and useful Method of Preparing Dental Inlays, of which the following is a specification.

The method of preparing gold inlays now in common use by dentists, comprises the making of a pattern by pressing a wax-like substance into the tooth cavity, then mounting this wax-like mold pattern on a mold supporting pin, then covering the entire pattern with a plaster-like material or investment, and then subjecting the investment to such high temperatures as will result in absorbing the wax-like mold pattern into the material of the investment, or vaporizing it so that it may escape through the opening in the investment formed by the mold supporting pin.

It has been found that by the use of this mold it frequently occurs that the finished inlay does not accurately fit the tooth cavity for which it was prepared, owing mainly to two causes:

First. It frequently happens with said mold that the wax-like pattern is not wholly absorbed within the investment material, or vaporized, hence small flakes or particles of ashes or dross from the wax-like mold remain in the cavity and prevent accuracy in molding the inlay; and

Second. The intense heat required in this method subjects the investment material itself to such great degree of contraction as to crack or distort the walls of the mold cavity, and also it effects certain chemical changes in the investment material itself, tending to disintegrate it so that it will not firmly withstand the action of pouring in the melted gold and the centrifugal action to which these investments are ordinarily subjected instantly after the pouring in of the gold and before it sets.

My objects are to provide an improved method of removing the wax pattern from the mold by first subjecting it to such temperatures as will cause the wax to melt, and then forcing the melted wax out through the passageway leading to the mold cavity by the action of water and steam being driven into the mold cavity by heat applied to the exterior of the investment, said steam being formed from the water mixed with the plaster of the investment material, to thereby provide for the complete and thorough removal of every vestige of the wax pattern without absorbing any of the wax into the investment material or leaving any deposits in the form of dross or ashes.

My object is further to provide an improved method of forming the metal inlay in a more exact replica of the original wax pattern than has been possible with the methods heretofore in use, and also to greatly lessen the time required for completing the metal inlay after the wax pattern has been made, by subjecting the investment material to such temperatures only as will remove so much of the free water or moisture as may be necessary to prevent it from injuriously affecting the metal inlay, and without subjecting it to such high temperatures as will cause the water of crystallization that has chemically united with the investment material, to be removed or decomposed in such a manner as to cause the investment material to unduly contract, or crack or disintegrate; and my object is further, in this connection, to pour the metal inlay into the mold cavity at the time when the investment material is being subjected to a uniform and relatively high temperature throughout, and the investment has been somewhat expanded so that the mold cavity is larger than the original wax pattern, and whereby when the metal inlay has been cast in said mold cavity and later contracted, upon cooling, it will contract substantially to the same extent as the investment was expanded at the time the casting was made, with the result that the metal inlay, after cooling, will be substantially an exact replica of the original wax pattern.

My invention consists in the various steps of the process, by which the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which:

Figure 1 shows a vertical, central, sec-

tional view of a heating device and investment case, and an investment therein, with a wax pattern within the investment ready to be subjected to heat for melting and forcing out the wax pattern.

Figure 2 shows a top or plan view of the same.

Figure 3 shows a detail sectional view of a wax pattern placed on a suitable base and supporting pin.

Figure 4 shows a view of the wax pattern contained in an investment and surrounded by the metallic investment casing; and

Figure 5 shows a similar view after the wax pattern has been removed ready to receive the metal for forming the inlay.

Referring to the accompanying drawings, I have used the reference numeral 10 to indicate a wax pattern of the kind now ordinarily made by dentists. This wax pattern is preferably supported upon a pin 11 detachably mounted in a base 12. The investment casing is preferably made of a metal cylinder, indicated by the numeral 13, and the investment material proper is indicated by the numeral 14. This investment material is placed around the wax pattern in the ordinary way, that is to say, by first mixing the cement material with water in suitable proportions, and then placing the casing around the pattern and finally filling the space within the casing and surrounding the pattern. Then the base 12 and its pin 11 are withdrawn, thus leaving the wax pattern in the center of the investment material with a passageway leading from the wax pattern to the exterior of the investment material.

For heating the investment I have provided a heater frame 15, provided with perforated gas coils 16, and below the investment casing support I preferably provide a removable tray 17, to receive the wax after it has been melted and forced out of the investment. On top of the investment casing in a disc-shaped weight 18, for purposes hereinafter made clear.

In practicing my improved method, and after the wax pattern has been placed in the investment material as before described, I place the casing containing the investment material in an inverted position in the heater, as shown in Figure 1, and preferably provide a weighted cover 18 for the top of the investment material. I then apply heat to the exterior of the investment casing, by means of the heat coils, or in any other suitable manner, and apply this heat at such high temperature that within a period of two or three minutes after the investment material has been placed in the heater, the wax will be melted and the water contained within the investment material will commence to be turned into steam, first, of course, near the exterior of the investment material. This steam will penetrate through the investment material toward the cavity in the center thereof, and will force ahead of it the water that has not been turned into steam and this water, under pressure from the steam, will flow into the mold cavity and carry with it the melted wax out through the passageway that extends downwardly from the mold cavity. Obviously as the heat further penetrates the investment material, it will drive out free moisture.

Before all of the free moisture is driven out of the investment material, I discontinue the application of heat to the exterior of the investment casing, and when this has been done for a period of about two minutes, approximately all of the free moisture has been driven from the investment material by the latent heat, leaving in that portion of the investment material adjacent to the pattern cavity the water of crystallization, and as soon as this free moisture has been thus removed, the device is in condition for casting.

I determine when the free moisture has been driven from the investment material, to the proper extent, at least, by placing adjacent to the passageway from the mold cavity, a small dental mirror, and noting whether or not moisture in visible quantities collects thereon, and just as soon as the mirror fails to show moisture in visible quantities the investment is ready for casting.

One of the marked advantages of my improved process is that at the instant when the free moisture has been driven from the investment, the investment material is all heated to a relatively high temperature and has all been expanded and expanded uniformly, because the excessive heat from the exterior has penetrated evenly through the entire mass. Under these conditions the mold cavity is slightly larger than was the original wax pattern. Then, when the metal inlay has been poured into the expanded mold cavity, it will at first be slightly larger than the wax pattern but, when it has cooled, the metal inlay itself will contract and, as the contraction of the metal inlay substantially corresponds with the expansion of the mold cavity, the finished metal inlay, when cooled, is substantially an exact replica of the wax pattern, so that much more accurate fittings of the inlays in the tooth cavities can be made than with the process now in common use.

The weighted cover 18 tends to prevent the escape of steam or water upwardly through the top of the investment material, and compels all of the steam and water to force its way down into the mold cavity and out through the passageway. This helps to force all of the melted wax out through

the mold cavity, although I have obtained excellent results without the use of this weighted cover.

One of the important advantages of my improved method is the time element. With my improved method it is possible to complete the metal inlay within a comparatively few minutes after the heat is first applied to the investment casing, and this is of particular advantage in dentistry because the inlay may be completed and placed in the patient's tooth while the patient still remains in the dentist's chair.

Another advantage of this time element is that after the invesment material has been fully relieved of all free moisture and then is permitted to stand for a long period, certain changes take place in the investment material proper which tend to alter its shape or cause it to contract or expand, and this contraction and expansion is not equal and uniform; whereas, with my improved method, the casting is made prior to any sort of detrimental action on the investment material itself after drying, and greater accuracy may be thus attained.

It will be observed that in carrying out my method heat is applied externally to the casing 13, which is of a non-absorbent heat conducting material; heat is transmitted through the casing to the moist investment material; this heat raises the temperature of the fluid element of the investment material so that the heated free fluid is moved progressively from the casing towards the embedded pattern which is melted by the heat thus imparted and discharged from its cavity through the discharge opening provided for the purpose by the heated fluid received from the body of the investment material; that some of the free moisture remaining after the free liquid has been removed is eliminated by continued heat transmitted through the investment material, and remaining free moisture then eliminated by the latent heat of the investment material and thereafter the metal for the inlay is supplied to the cavity. As a result of this method the wax-like substance of which the pattern is formed is not absorbed by the investment material but is washed or flushed from its cavity by the heated free water or fluid moving inward from the non-absorbent heat conducting casing and the free moisture is then eliminated without affecting the integrity of the investment material adjacent to the pattern cavity as water of crystallization is retained at that point.

I claim as my invention:

1. The method of making dental inlays, consisting in forming a pattern of wax-like substance, placing the pattern in a non-absorbent heat-conducting casing, surrounding the pattern with a wet investment material formed with a passage-way leading from the pattern, then heating the non-absorbent heat-conducting casing to bring the moisture in the investment material to a temperature sufficient to drive the moisture through the investment material towards the pattern and melt the pattern and discharge the melted wax-like substance and free liquid out through the passage-way.

2. The method of making dental inlays, consisting in forming a pattern of wax-like substance, surrounding the pattern with a wet investment material formed with a passage-way leading from the pattern, then applying heat to the exterior of the investment sufficient in temperature to drive the moisture through the body of the investment towards the pattern and melt the pattern and discharge the melted wax-like substance and free liquid out through the passage-way.

3. The method of making dental inlays, consisting in forming a pattern of a wax-like substance, surrounding the pattern with a wet investment material formed with a passage-way leading from the pattern, then applying heat to the exterior of the investment material sufficient to bring the temperature of the investment above the melting point of the pattern and drive the moisture towards the pattern and melt the pattern and discharge the melted wax-like substance and free liquid through the passage-way, then continuing the application of heat until moisture is substantially eliminated from the investment material, and then supplying molten inlay metal to the pattern cavity while the investment material is in a heated, expanded condition.

4. The method of preparing dental inlays, consisting in forming a pattern of a wax-like substance, then placing the pattern in a metal casing, then filling the casing and surrounding the pattern with wet investment material formed with a passage-way leading from the pattern, then positioning the investment material with the passage-way extending downwardly, then applying heat to the exterior of the casing to bring the free liquid in the investment to a temperature above that of the pattern and move the liquid under pressure to the pattern to melt the wax-like substance of the pattern and discharge it and the free liquid through the passage-way, then continuing the applied heat until the free moisture is substantially eliminated from the investment, then discontinuing the applied heat and permitting the latent heat within the investment to eliminate remaining free moisture, and then supplying molten metal to the pattern cavity through the passage-way while the cavity is heat expanded.

5. The method of making dental inlays, consisting in forming a pattern of wax-like substance, surrounding the pattern with wet

investment material formed with a passage-way leading from the pattern, then applying heat to the exterior of the investment to bring the free liquid in the investment to a temperature above that of the pattern and move the liquid under pressure to the pattern to melt the wax-like substance of the pattern and discharge it and the free liquid through the passage-way, then continuing the application of applied and latent heat until the investment is free from moisture, and then supplying molten inlay material to the cavity before the investment has cooled and contracted and while there is water of crystallization in the investment adjacent to the pattern cavity.

Des Moines, Iowa, July 21, 1920.

KARL W. KNAPP.