Patented May 12, 1936 2,040,179

UNITED STATES PATENT OFFICE

2,040,179

PROCESS OF PRODUCING COHESIVE GOLD FOR DENTAL FILLINGS

Stanley Livingstone, Sydney, New South Wales, Australia, assignor to Baker & Company, Inc., Newark, N. J., a corporation of New Jersey

No Drawing. Application October 21, 1933, Serial No. 694,642. In Australia February 12, 1931

6 Claims. (Cl. 148—21)

This invention relates to gold fillings for natural teeth or artificial teeth, and this application is a continuation in part of my copending application Serial No. 674,961 filed June 8, 1933, which is a continuation in part of my application Serial No. 590,516 filed February 2, 1932.

In the known practice gold fillings in natural teeth are inlaid into undercut cavities in the teeth by inserting rolled up thin shreds or strips of gold into them and compacting these rolled shreds or strips by hammering. In this operation it is necessary to keep the cavity in dry condition by protecting the tooth with a sheet rubber dam. This device is objectionable because of the discomfort suffered by the patient in the fitting of it. The operation is also a long and painful one, frequently extending over an hour or more, and much care and deftness is required of the operator to ensure that the inlay of solid gold pieces is satisfactorily expanded into the undercut and solidified, thus to lock it in position. Various forms of spongy gold have been used by dentists with more or less satisfactory results. These various forms of gold are made either by ignition of gold salts or by electrodeposition, but the gold sponge either is hard, or assumes a rather large crystalline structure, so that the gold does not condense into a solid unitary mass as is desirable, and it is difficult to make a satisfactory filling even when great force (hammering) is used in the filling process, to the grief of the patient.

The present invention contemplates the preparation of gold to be used for dental fillings in a fine spongy, cohesive and somewhat plastic condition in which it can be compacted and caused to condense readily and rapidly in undercut cavities in teeth under pressure without hammering action, applied by an appropriately shaped instrument, so that the gold will become effectually locked in such cavities. Furthermore, the invention provides a spongy gold which can be conveniently broken into small particles having dimensions suitable for filling cavities, and which permits moistening of the instrument with a dilute antiseptic solution (phenol, etc.) for sterilizing while filling a cavity and to facilitate picking up the particles of gold with the instrument and conveying them to the cavity. When condensed into the cavity under pressure by the instrument in the usual way, the gold becomes a solid, compact mass the exposed surface of which is finished by rubbing and burnishing flush with the tooth surface immediately after emplacement of the filling in the cavity. By the use of the gold of this invention, another practical advantage is obtained in that the necessity for a rubber dam is eliminated because it is not necessary to preserve the tooth cavity in dry condition during the filling, condensing and burnishing operations since the presence of saliva, blood or grease in the cavity does not affect the integrity of the filling nor cause any inconvenience to the operator, and due to the fact that the gold is not materially affected by moisture, it is permissible to moisten the instrument to facilitate picking up the pieces, as described, and expedite the filling operation. The operation is a short one, its cost is substantially reduced and the patient is not unduly discomforted.

The cohesive spongy gold of this invention may be produced in the following way: A gold chloride solution containing preferably approximately 1 to 2 ounces of gold per liter (different concentrations may be used as is understood by those versed in the chemistry of gold) is neutralized by addition of an alkali, for example sodium or potassium hydroxide or carbonate, the solution is heated to about 80 degrees C. and then the gold is precipitated by the gradual addition of one of the usual gold precipitants, for example oxalic acid, sodium nitrite, etc. Generally an excess of the precipitant is preferable; for example in the case of oxalic acid two ounces of the acid should be used to one ounce of gold. The precipitated gold and solution are then boiled until the supernatant liquid becomes colorless. Small quantities of gold may be still in solution however. This gold may be fully recovered by the gradual addition of oxalic acid if sodium nitrite was used as precipitant, or by the gradual addition of sodium oxalate or an alkali if oxalic acid was used as a precipitant. The pH at the completion of this operation preferably should be between 6 and 7, although a higher or lower pH may be employed, it being understood that the crystalline structure of a precipitated gold may be widely varied, by varying the acidity or alkalinity of the solution from which it is precipitated.

After precipitation of the gold in the manner described above, the liquid is decanted off, and the precipitate may be washed in water to remove the salt solution.

Thereafter I heat the gold in a high boiling liquid at a temperature of from 150° to 250° C., preferably not less than 150° C. The liquid may be, for example, concentrated phosphoric acid or concentrated sulphuric acid. Commercial sulphuric acid that is, unpurified sulphuric acid including the usual impurities, arsenic, iron and lead sulphate, sold for industrial purposes, as

distinguished from purified sulphuric acid, has been found to be satisfactory. One-half hour is usually sufficient to raise the temperature to about 200° C. although heating for a longer period is not detrimental. During the heat treatment the sponge gold becomes more compact and plastic. The sponge gold is then washed free of acid, and it is necessary to remove all traces of salts and acid by repeated boiling and washing with distilled water until the wash water is free of acid, as otherwise the sponge will not be suitable for fillings.

I have discovered that if the salt solution is simply decanted off without washing of the precipitate before the heat treatment in sulphuric acid, the sponge gold is somewhat harder after the heat treatment than when the precipitate is washed before the heating thereof in the sulphuric acid.

Thereafter the sponge gold is dried at a temperature preferably not exceeding 100° C. as higher temperatures will cause undue hardening, after which the sponge is broken up into small pellets having dimensions suitable for filling, for example of about $\frac{1}{16}$'' to $\frac{1}{8}$'' in diameter. Smaller particles are screened off and the gold is then ready for use. These pellets are applied to a tooth cavity by moistening the end of an instrument known as a plugger with an antiseptic lubricating solution, such as a solution of phenol or the like, and lightly pressing the moistened end of the instrument into contact with a desired piece of spongy gold so that said piece will adhere to the instrument, and then pressing the piece of gold into the cavity to condense the gold therein. The gold thus becomes a compact, solidly condensed mass, the exposed surface of which may be burnished over the edges of the cavity and takes a high polish which appears as pure gold. The spongy gold produced according to the invention can be worked into the cavities in the presence of moisture and is preferably worked in the presence of the antiseptic lubricant that also sterilizes the filling and tooth, as described, which is a radical departure from and highly advantageous over known practice where a perfectly dry cavity and dry gold are required; and at the same time the invention enables the production of more satisfactory fillings than those resulting from known processes.

The invention provides a sponge gold which appears to be superior in all respects to known sponge gold for use in dental fillings.

Having thus described my invention, what I claim is:

1. The process of producing cohesive sponge gold for dental fillings which consists in precipitating sponge gold from a gold solution and then subjecting the precipitated sponge gold to a heat treatment in liquid at a temperature of about 150 degrees C.

2. The step in the process of producing cohesive gold for dental fillings consisting in heat treating sponge gold in a liquid at a temperature of from 150 degrees C. to 250 degrees C.

3. The step in the process of producing cohesive gold for dental fillings consisting in heating sponge gold in concentrated sulphuric acid at a temperature of from 150 degrees C. to 250 degrees C.

4. The step in the process of producing cohesive gold for dental fillings consisting in heating sponge gold in concentrated phosphoric acid at a temperature of from 150 degrees C. to 250 degrees C.

5. The step in the process of producing cohesive sponge gold for dental fillings consisting in boiling chemically precipitated gold in commercial sulphuric acid.

6. The process of producing sponge gold for dental fillings consisting in making a gold chloride solution containing from one to two ounces of gold per liter, approximately neutralizing the solution, heating the solution to approximately 80 degrees C., precipitating the gold by adding an excess of a gold precipitant to provide an acidity of about pH_6 at the end of the precipitation, boiling the solution and precipitate until the supernatant liquid becomes clear, decanting off the liquid, heating the precipitate in liquid at a temperature of from 150 degrees C. to 250 degrees C., washing and drying the precipitate.

STANLEY LIVINGSTONE.