May 7, 1929. I. KULIK 1,711,952

METHOD OF AND APPARATUS FOR FILLING TEETH

Filed Feb. 11, 1924 2 Sheets-Sheet 1

Fig 1

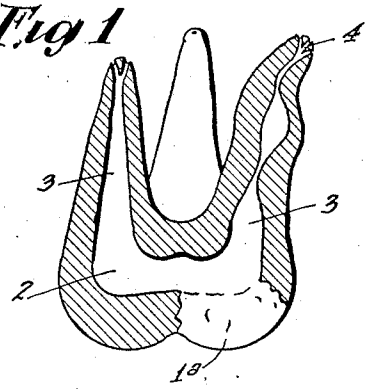


Fig. 2

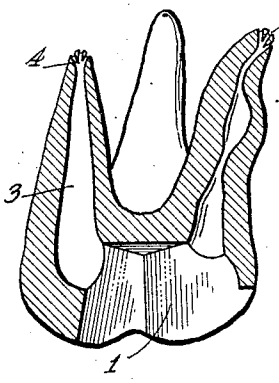


Fig. 3





Fig 4

Fig.5

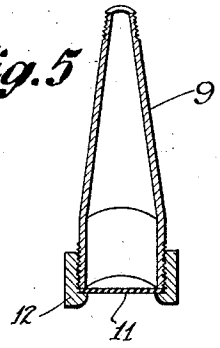


Fig. 6

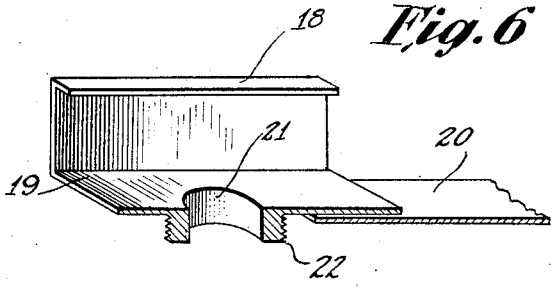
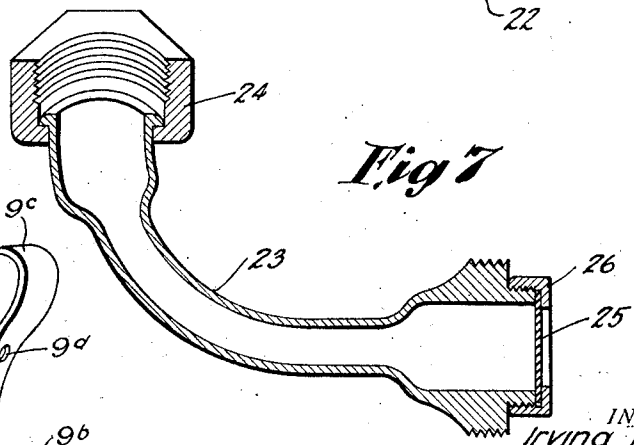


Fig 7



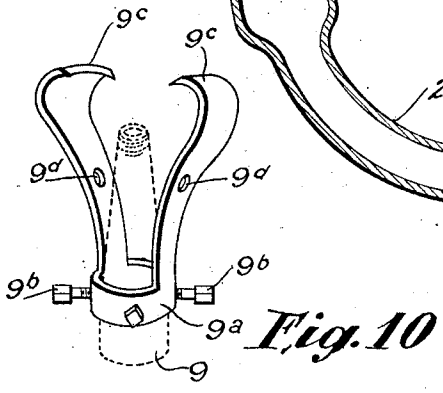


Fig. 10

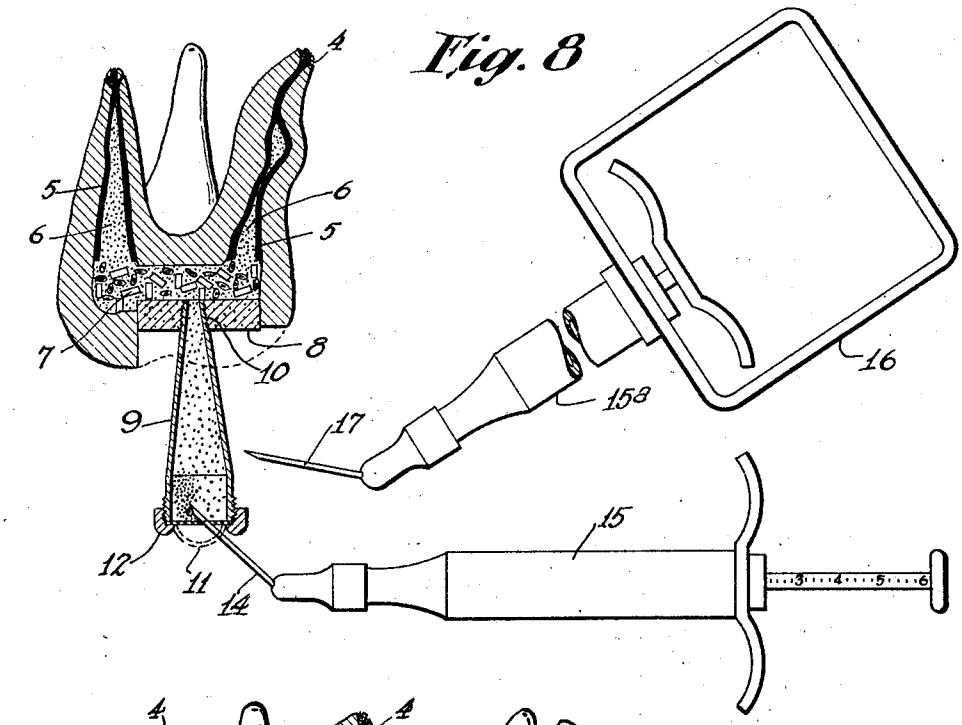
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Fig. 8



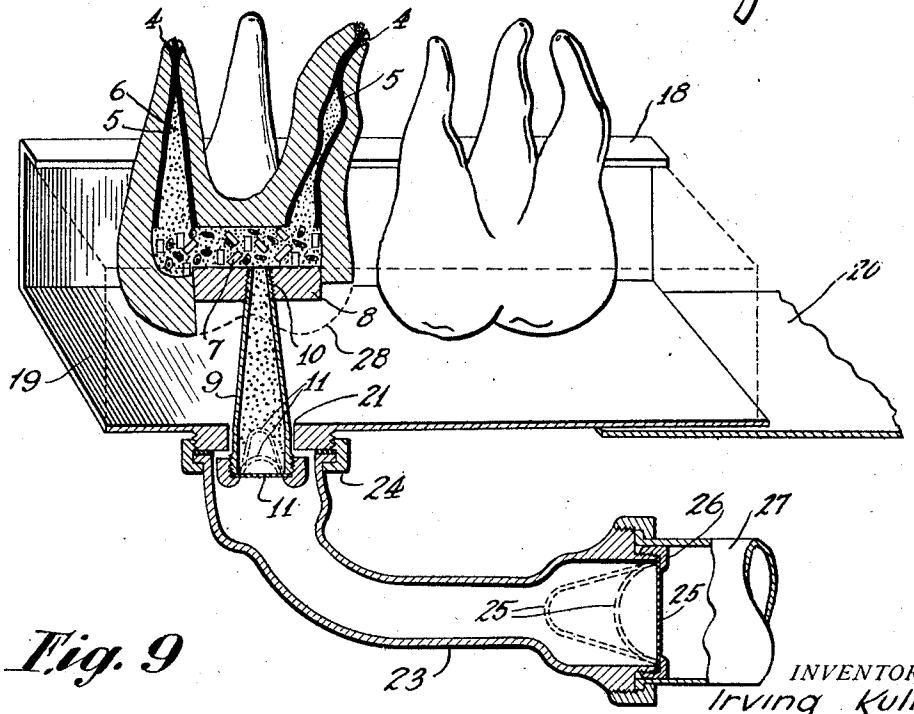


Fig. 9

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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR FILLING TEETH.

Application filed February 11, 1924. Serial No. 691,899.

This invention relates to the art of dentistry and while generally directed to the filling of teeth is especially adapted to the efficient filling of root canals.

As is well understood by the dental profession, the human tooth is provided interiorly with a chamber from which extends one or more channels leading to the tips of the several roots of the tooth. The chamber referred to is known as the pulp chamber and the canals are technically termed the root canals. The pulp in a normally healthy condition fills the pulp chamber and extends through the root canals and is generally known to the layman as the nerves of the tooth. When a tooth breaks or wears away at its grinding surface sufficiently to expose or form an opening into the pulp chamber, filling of the tooth is required to properly preserve the tooth against further decay and it is essential to the proper filling of the tooth that all of the pulp contained in the pulp chamber and root canals be removed and the filling material, whatever it may be, must, to insure proper results, be introduced so as to completely fill the chamber and especially every portion of the root canals.

It is very common in teeth for the root canals to each have several small branches which are generally adjacent the tips of the roots and it is absolutely essential that these minute branches, as well as the main root canals be absolutely filled with a filling substances. If the pulp is not entirely removed or the root canals and their branches completely filled, breaking down of the organic matter present within the canals or later seeping thereinto will result in putrefaction, the production of gas and consequent abscesses and fistulas with resulting pain, discomfort and danger to the health.

Under prior practice, it has been usual in the preparing of a tooth for filling to grind away that portion of the tooth which is broken, so as to produce a cavity extending into the pulp chamber and suitable to receive the filling and the pulp is removed from the pulp chamber by means of suitable scrapers and from the root canals through the employment of appropriate broaches.

After the cleaning has been accomplished, to the satisfaction of the dentist, it has been the practice to force various agents into the root canals to sterilize and fill the canals. The most approved agents for sterilizing the canals and filling the fine openings are ammoniacal silver nitrate and formalin, while the most approved agents for filling all of the remaining area of the root canals and pulp chamber are gutta percha and chloroform.

After the pulp has been removed from the pulp chamber and root canals, ammoniacal silver nitrate is introduced into the canals and is followed by the introduction of formalin, the function of which is to sterilize the passages and to precipitate out the metallic silver from the ammoniacal silver nitrate. The precipitated silver is supposed to fill the fine root canal branches. The root canals are then filled with chloropercha (gutta percha dissolved in chloroform), this being of creamy consistency and usually poked into the canals through the employment of a probe. After the dentist has poked sufficient chloropercha into the roots to convince him that the roots are fairly full, a tapering solid gutta percha point in the form of a wedge is forced into the canal, presumably to the end of the root of the tooth. This completes the filling of the root canals and is presumed to produce a satisfactory filling. The filling of the pulp chamber and the prepared cavity is next proceeded with by stuffing chloropercha into this cavity after which the tooth is capped or crowned.

My long experience in root canal work and a thorough study of the subject have convinced me that it is practically impossible to properly fill root canals in the manner common to prior practice as above specified and this statement is borne out by the many abscesses which occur after the filling of teeth by some of the most skilled practitioners. A very careful study of the subject has convinced me that the cause of the abscesses which too frequently occur after filling are the direct result of inability to entirely fill the root canals and the branches thereof in the manner described and I have concluded after most exhaustive experimentation that in following the practice outlined, it is practically impossible to effect a complete filling of such canals. The reason for this is apparent when it is borne in mind that the chloropercha when introduced in a pasty form rapidly solidifies when brought in contact with organic matter and it will thus be apparent that as soon as the chloropercha is introduced it begins to solidify and partakes of a stringy semi-solid condition which renders it impossible to force it to the roots of the tooth by a probe or otherwise. Moreover, when the

gutta percha is introduced into the root, it is brought into direct engagement with said chloropercha and is immediately softened thereby, so that the point of the wedge rolls up and does not penetrate the root to its base. As a result, a considerable portion of the root canal of the tooth as well as the root canal branches remain unfilled and decomposition takes place in this unfilled area with consequent deleterious results.

The present invention is intended to overcome the foregoing disadvantages in production of a method and apparatus for the complete filling of root canals and their branches in a simple, economical and efficient manner and in such a way that the root canals and their branches will be completely filled in a positive manner in contradistinction to the hit or miss practice heretofore common.

My theory which underlies the present invention is based on the proposition that the gutta percha or other material employed as the body of the filling for the cavity and root canals should be introduced in a substantially solid form, so that it may be tightly packed within the spaces to be filled by withstanding the pressure of a tool sufficiently to force its entry into the most minute and distant portions of the cavity or canal. After the tooth is thus preliminarily filled with the gutta percha, the liquid constituents which enter into the proper filling are introduced in proper sequence and under sufficient pressure to insure their entry into the most remote interstices. In practice, ammoniacal silver nitrate is forced through the packed gutta percha which no matter how tightly packed will have interstices between the parts thereof which will permit the thorough impregnation of such filling material with the silver nitrate. The formalin is next introduced and combining with the silver nitrate precipitates metallic silver from the nitrate into the most remote and smallest root cavities or branches. The surplus silver nitrate and formalin are preferably then exhausted and chloroform is forced into the packed mass of gutta percha. This chloroform immediately acts as a solvent for the gutta percha thereby softening the same and at the same time producing a swelling of the gutta percha as it takes up the chloroform. As a result of this action, the swelling of the gutta percha within the pulp chamber, root channel and branches generates a relatively high internal autogenous pressure which forces the homogeneous mass thus formed into every remote channel and fissure wherein it hardens in the form of a complete filling for every space within the tooth. Absolutely no cavities are left or no spaces remain. The filling is complete and deterioration of the unhealthy and dangerous condition due to the breaking down of cellular tissue cannot take place as heretofore.

Aside from the broad general method of introducing the body of the filling in a substantially dry state and thereafter introducing the liquid constituents, the invention is directed to certain novel and highly efficient forms of material and apparatus whereby this method may be carried out to advantage and these features also form a part of the invention. Others which I have not referred to specifically will be apparent from the following detailed description and appended claims, when read in conjunction with the accompanying drawings.

The accompanying drawings illustrate one practical embodiment of the invention, but the construction therein shown, is to be understood as illustrative, only, and not as defining the limits of the invention.

Figure 1 shows a tooth broken away to form a cavity such as is commonly found.

Figure 2 shows the same tooth with a cavity prepared for filling.

Figure 3 shows a hollow gutta percha point or wedge which I use and which forms part of the present invention.

Figure 4 shows a piece of gutta percha in hollow cylindrical or tubular form, a large number of which are used in the filling of teeth in accordance with this invention.

Figure 5 illustrates a filling tube used in the introduction of the liquid constituents entering into the filling and constituting a part of the present invention.

Figure 6 illustrates a dental impression tray also constituting a part of the present invention.

Figure 7 shows a pneumatic percussion device of novel construction adapted to cooperate with the impression tray to allow the application of external pressure to the filling, and which also forms part of this invention.

Figure 8 shows one step in the practising of the method;

Figure 9 shows a subsequent step of the method; and,

Figure 10 shows a clamp for holding the filling tube in position while the cement is hardening.

In proceeding in accordance with the method of this invention with a tooth such as shown in Figure 1, the dentist first prepares a cavity for filling. The cavity shown in this figure is designated by the reference character 1^a and is shown as extending through the pulp chamber 2. From the pulp chamber 2, the root canals 3 lead to the apex of the respective tooth roots and near the apex of such roots divide into a number of branches 4. A molar tooth is shown having three roots with a corresponding number of root canals. The preparation of the cavity is accomplished in the usual manner and at the conclusion of such preparation the tooth appears as shown in Figure 2 wherein the cavity is designated 1.

Prior to the preparation of the cavity, it may be necessary to devitalize the pulp or nerve of the tooth through the carrying out of any approved treatment, but we will assume that the pulp has been devitalized and that the cavity is prepared as shown in Figure 2. The next step of the method is to completely remove the pulp from the pulp chamber 2, the root canals 3 and the branches 4 and this operation should be carried on with great care so that all passages or openings in the tooth will be completely devoid of pulp content. After this has been accomplished, the tooth is ready for filling and is proceeded with as follows.

I first take a sufficient number of gutta percha points such as shown in Figure 3, which are novel and differ from those of prior practice in that they are hollow or tubular for the greater portion of their length. These points are designated generally by the reference character 5 and have a hollow interior 6. I force as many of these gutta percha points as possible into the root canals of the tooth while the points are in a dry or substantially dry condition and have sufficient inherent resistance to withstand the pressure of an instrument against their blunt ends. By virtue of this fact, the points may be forced to the very ends of the root canals and into probably some of the canal branches. Attention is paid to force as many of the points as possible into position in order to fill the root canals as far as possible while dry and at such time that pressure on the gutta percha points may be efficiently applied to force the points into the most remote portions of the tooth.

After as many of the points as can be forced into position have been inserted, the pulp chamber is packed as tightly as possible with a large number of relatively small pieces of gutta percha which in practice are preferably of hollow cylindrical form although they may be of other form if desired. The reason for making them hollow is to furnish maximum superficial surface to be subsequently acted upon by a solvent so that they may be properly dissolved or softened to a sufficient extent to unite with one another in a substantially homogeneous mass.

It may be here stated that this is the purpose of making the gutta percha points 5 hollow with the exception that there is an additional purpose in the latter instance, namely, to permit the solvent to penetrate as far as possible into the root canals.

After the pulp chamber has been thoroughly packed with the gutta percha cylinders designated 7, as shown in detail in Figure 4, I cover the compacted mass with a cement partition such as shown in Figure 8, wherein it is designated by the reference character 8 and so position a filling tube 9 that it will extend through this partition or abutment. This may be accomplished by investing the smaller end of the tube 9 with a suitable cement and packing this cement around the tube and into the cavity sufficiently to close or partition off the pulp chamber in which the gutta percha packing is positioned.

The cement abutment 8 should be carefully placed in position and should make a proper bond with the tooth so as to form an air tight joint therewith and with the tube 9. It should also be of sufficient strength to withstand internal pressure with the tooth.

If a slow setting cement is used in making the abutment 8, the dentist may find it inconvenient to hold the tube 9 in position until the cement has hardened sufficiently to hold it in place and in such instances the device shown in Figure 10 will be of advantage. This device is a holder or retainer and embodies a ring 9^a of sufficient diameter to allow it to embrace the tube 9, to which it is adapted to be secured by set screws 9^b. Spring jaws 9^c extend from the ring and are adapted to grip the tooth and hold the tube 9 in position until the cement abutment hardens. The retainer may thereupon be removed from the tooth and tube. Perforations 9^d in the spring jaws are for the reception of spurs on the forceps and facilitate the positioning on or removal of the retainer from the tooth.

The filling tube 9 is in practice preferably of metal of some non-corrosive type well able to withstand the action of such acids as may contact therewith. The tube 9 is tapered and at its smaller end is preferably threaded as shown at 10 so that it will retain its position within the cement abutment 8 until such time as it is desired to positively remove the tube therefrom. The larger end of the tube is exteriorly threaded and the open end is closed by a diaphragm 11 preferably of rubber and held in place by a threaded cap 12 cooperating with the threads on the exterior of the tube.

As soon as the cement abutment 8 is sufficiently hardened to insure its permanency, the needle 14 of a hypodermic syringe 15 containing ammoniacal silver nitrate is thrust through the diaphragm 11 as shown in Figure 8. Inasmuch as the syringe is graduated, the operator can tell how much ammoniacal silver nitrate contained therein. By operating the syringe the nitrate of silver is forced into the tube, fills the latter and is thereupon forced through the smaller end of the tube into the pulp chamber. As the piston of the syringe is forced inwardly, an appreciable pressure is generated within the tube 9 and this pressure is maintained in a more or less balanced condition by the diaphragm 11 which bulges out slightly under the pressure and forces the silver nitrate under a substantially uniform pressure to intermingle with the gutta percha cylinders

packed within the pulp chamber. No matter how tightly these cylinders are packed, there will be found interstices between them and through these interstices and channels the silver nitrate will penetrate to the root canals and will be forced longitudinally of the canals through and around the points 5 therein, penetrating to the extreme ends of the root canals and their branches.

After a sufficient period has been allowed for the complete penetration of the silver nitrate, the syringe 15 is removed and a second syringe 15ª of the suction type, shown in Figure 8, is employed. This syringe differs from the syringe 15 mainly in that it is provided with a yoke 16 to enable its operation as a suction syringe. Its barrel is graduated and while its needle 17 is forced through the perforatable diaphragm, the piston of such syringe may be retracted to withdraw from the tube and tooth surplus silver nitrate. The quantity withdrawn can be measured by virtue of the scale on the piston of the syringe so that an accurate account may be kept of the requirements of the particular filling which will guide a dentist in his future work.

After the surplus silver nitrate has been withdrawn, formalin is introduced in the same manner as shown by the syringe 15 in Figure 8. Just enough formalin should be injected as is necessary to perform the chemical reaction of precipitating the metallic silver from the ammoniacal silver nitrate. The next step in the process consists in withdrawing the surplus formalin if there be any through the employment of a suction syringe. Chloroform is now injected by means of a pressure syringe. During this operation sufficient pressure is again applied to insure that the chloroform enters the most remote parts of the tooth in order that the contact of the chloroform with the gutta percha will be positively assured. At this point, an important action takes place. Chloroform is a solvent for gutta percha and serves to soften the gutta percha and at the same time cause a pronounced swelling or expansion thereof and through this action, autogenous pressure which results causes the gutta percha to completely fill every space in the tooth as well as the interstices between adjacent parts of the gutta percha so as to form all of the gutta percha within the tooth into a homogeneous mass under fully sufficient pressure to insure complete filling of the tooth.

Thus the gutta percha and the metallic silver collectively constitute a permanent filling leaving no parts of the pulp chamber, roots or root branches unfilled. After this action has been permitted to proceed sufficiently surplus chloroform is drawn off through the employment of a suction syringe of the type shown at 15ª.

My experience has convinced me that a tooth subjected to the method described will be positively fully filled so far as its pulp cavity, roots and branch root channels are concerned by the time the last mentioned step of the process has been completed and the dentist may here cease and simply provide a suitable filling for the cavity exteriorly of the portion 8 providing a suitable cap or crown after this cavity filling is complete. To finish the filling in this manner, the tube 9 of course is removed and the opening in the partition left by the removal of the tube is filled. However, in order to insure against the slightest possibility of inadequate filling, further steps may be taken intended more particularly to ram the filling tightly into place. If these further steps are to be carried on, the tube 9 is temporarily left in place and a dental impression tray and pneumatic percussion device brought into use. The impression tray which I employ is preferably provided at its sides with an inturned edge shown at 18 in Figure 6. In this figure as in the other figures of the drawings, the impression tray is designated by the reference character 19. It has a suitable handle 20 and its base is perforated at 21. The perforation is surrounded on the under side of the tray with a boss or flange exteriorly threaded at 22. The perforation 21 is slightly greater in diameter than the diameter of the tube 9 and permits the impression tray to be filled with plaster and passed over the tube as shown in Figure 9, so as to completely embed the end of the tooth which is being operated upon and also preferably an adjacent tooth in order that the impression tray may be firmly in position and efficiently held to its work.

After the tray is in position and the plaster hardened therein, a percussion device designated 23 is secured by means of a coupling 24 to the threaded post 22 of the tray. The device 23 is in the form of a tube preferably bent and its free end is provided with a diaphragm 25 preferably of rubber and held in place on the tube by means of a threaded cap 26. Associated with the same end of the tube is a hose 27 adapted to be coupled to the air pressure supply at the dental switchboard common in offices of practitioners. Inasmuch as the filler tube 9 is provided at its end with a diaphragm 11 and the distant end of the percussion instrument 23 is also provided with a diaphragm 25, a dead air space results between these diaphragms, so that if one diaphragm is bulged under the action of compressed air, the other diaphragm will also be bulged in the same direction by virtue of the intermediate air being placed under compression.

When the parts are assembled, as shown in Figure 9, the valve at the switch-board is intermittently opened and closed to place the diaphragm 25 under a pulsating pressure and this pulsating pressure is communicated to

the diaphragm 11 which communicates it to the air in the tube 9. As a result, the filling within the tooth is subjected to a pulsating pneumatic pressure which may be graphically referred to as an air mallet and this pressure is found to be highly efficient in ramming the filling to any degree desired so that there will be absolutely no possibility of the filling failing to properly fill out every portion of the space within the tooth.

At the conclusion of the ramming operation, the percussion instrument is removed and is followed by the dental tray. A slight turn of the tube 9 is next accomplished through the employment of pliers or the like and the tube readily breaks away from the partition or abutment 8 and is withdrawn. The hole in the abutment which is left by the tube is packed with suitable cement or composition and that portion of the tooth exteriorly of the partition is built out of such cement or composition to the dotted line position shown at 28 in Figure 9 at which time the tooth is ready to be capped or crowned as may be desired.

Although the method of the present invention in its preferred complete form embodies a number of steps, it is found in practice that the filling of a tooth in the manner described is much simpler and less tedious than when filling a tooth under prior well recognized practice for the reason that the results are assured and the uncertainty incident to present day methods is absent.

In carrying out the present invention in its preferred form, I employ apparatus shown in the drawings but I wish it understood that other forms of apparatus may be employed without departing from the invention. However, the apparatus disclosed and the conformation of the substances constitute an important part of this invention as they embody considerable novelty and a marked departure from prior constructions. The present invention is to be understood as not restricted to the specific showing of the drawings but is to be construed as broadly novel as is commensurate with the appended claims.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:

1. The method of filling teeth which consists in introducing into the space to be filled gutta percha in a dry state and in the absence of a solvent, and thereafter subjecting said gutta percha to the action of a solvent to effect a swelling or expansion of the gutta percha.

2. The method of filling teeth which consists in packing gutta percha in solid form into the space to be filled and in the absence of a solvent and thereafter subjecting the gutta percha to the action of a solvent for the purpose of expanding the gutta percha within the space to be filled.

3. The method of filling teeth which consists in introducing into the space to be filled a filling material in solid form and in the absence of a solvent therefor, and thereafter impregnating said material with a solvent.

4. The method of filling teeth which consists in introducing into the space to be filled gutta percha in solid form and in the absence of a solvent, and thereafter impregnating the gutta percha with a solvent for the purpose of setting up autogenous pressure and thereby forcing the gutta percha to entirely fill the space to be filled.

5. The method of filling teeth which consists in packing the space to be filled with a number of pieces of gutta percha in the absence of a solvent and thereafter subjecting the gutta percha to the action of chloroform for the purpose of generating autogenous pressure to expand the gutta percha so as to entirely fill the space to be filled thereby and simultaneously form the pieces of gutta percha in a homogeneous mass.

6. The method of filling teeth which consists in forcing hollow gutta percha points in a dry condition into the root canals of the tooth, thereafter packing hollow gutta percha pieces in the root canals and pulp chamber, then placing a closure over the open face of the chamber and thereafter forcing a solvent through the closure and causing it to permeate the packing of gutta percha.

7. The method of filling teeth which consists in packing the space to be filled with divided gutta percha, thereafter sealing such space, and thereafter impregnating the packing of gutta percha with a solvent.

8. The method of filling teeth which consists in packing the space to be filled with a number of pieces of gutta percha in solid state and in the absence of a solvent, and thereafter impregnating said pieces of gutta percha with a solvent to cause the same to form a homogeneous mass.

9. The method of filling teeth which consists in introducing gutta percha into the space to be filled in the absence of a solvent, and thereafter introducing into contact with the gutta percha ammoniacal silver nitrate, formalin and chloroform.

10. The method of filling teeth which consists in positioning a filling material in the root cavities and pulp chamber in the absence of a solvent, then sealing the pulp chamber, then introducing ammoniacal silver nitrate under pressure, then introducing formalin under pressure to precipitate metallic silver in the most remote cavities, and thereafter introducing a solvent under pressure to act upon the filling material and cause it to form a homogeneous mass, which, under the resulting autogeneous pressure, is caused to completely conform to and fill the space to be filled.

11. The method of filling teeth which con-

sists in forcing a filling material into the root cavity and thereafter packing the pulp chamber with filling material, then sealing the pulp chamber, and then introducing in succession ammoniacal silver nitrate, formalin and a solvent for the filling material.

12. The method of filling teeth which consists in forcing gutta percha points into the root cavities, thereafter packing the pulp chamber with divided gutta percha, thereafter sealing the pulp chamber and subsequently introducing in succession ammoniacal silver nitrate, formalin and chloroform.

13. The method of filling teeth which consists in forcing gutta percha points into the root cavities, thereafter packing the pulp chamber with divided gutta percha, thereafter sealing the pulp chamber and subsequently introducing in succession ammoniacal silver nitrate, formalin and chloroform, and thereafter ramming the filling.

14. The method of filling teeth which consists in forcing gutta percha points into the root cavities, thereafter packing the pulp chamber with divided gutta percha, thereafter sealing the pulp chamber and subsequently introducing in succession ammoniacal silver nitrate, formalin and chloroform, and thereafter subjecting the filling to pulsating air pressure.

15. The method of filling orifices and the tubuli ramifying from the root canals of a tooth which consists in introducing liquids under pressure and in sequential order so as to cause the liquids to infiltrate said orifices and tubuli and to precipitate out materials to at least partially fill the orifices and tubuli.

16. The method of filling teeth which consists in introducing expandible materials in non-expanded form into the root canal of a tooth and thereafter causing a liquid to infiltrate the root canal for the purpose of expanding the material therein.

17. In the art of filling the root canal of a tooth the method which consists in inserting a gutta percha point into the root canal while the canal is free from artificial foreign substances and the absence of a solvent, and thereafter introducing the solvent.

In testimony whereof I have signed the foregoing specification.

IRVING KULIK.