

Patented Nov. 6, 1923.

1,473,482

UNITED STATES PATENT OFFICE.

PAUL W. KRUGER, OF ATTALA COUNTY, MISSISSIPPI.

COMPOSITION OF MATTER FOR FILLING ROOT CANALS IN TEETH.

No Drawing.

Application filed July 25, 1921. Serial No. 487,416.

To all whom it may concern:

Be it known that I, PAUL W. KRUGER, a citizen of the United States, residing in Attala County, in the State of Mississippi, have invented certain new and useful Improvements in Compositions of Matter for Filling Root Canals in Teeth, of which the following is a specification.

My invention relates to a germicidal composition of matter for filling root-canals in teeth and is composed of finely divided metal coated with a fluid, or a liquid germicide or semi-liquid or viscid combination of germicides in such proportions that when the composition is compressed by tamping or pressure, the resilience of the composition under pressure is reduced on account of the adhesiveness of the viscid germicidal coating so that cohesion of the metal particles more readily takes place assisted by the adhesive germicide to form a firm compact filler as it is tamped and compressed into the tooth root, the interstices among the metal surfaces not brought into actual contact through the compression, remaining confined and filled with the germicidal agent as a permanent, confined, bactericidal ingredient.

My invention is a new composition of matter for insertion into the root-canals of teeth to form a bacterially impervious and dense root-canal filling of germicidally compacted metal, permanently germicidal and rigid in the root-canals, though removable without very much difficulty; a root-canal filler conveniently assuring the essential, impervious closure of the root-canal and thorough filling to the apex, upon which is dependent so much the prevention of subsequent, focal infection.

The object of my invention is to provide a reliable filling material for root-canals as a permanent filler to fill into the canals without tedious technique and to avoid the use of methods which according to dental authorities and general experience of dentists have been found wanting,—a filling material designed to overcome the deficiencies of such methods as the use of insoluble germicidal powders with intervening spaces, the use of medicated pastes or organic filling material impregnated with germicides such as saturated cotton and to provide a material free from the objections to cements and shrinkage of gutta percha points which in time occurs leaving crevices penetrable to

bacteria along the root-canal walls on account of the gradual dissipation of the lubricating solvent employed in filling with gutta percha.

Any metal or particularly one of malleability which is adaptable in finely divided form and suitable to be in contact with human tissue or suitable to be confined in the root-canal, may be used for the purpose of my invention, but silver is the preferred metal. Silver is readily reduced to appropriate, finely divided form and is a malleable metal adapted to adjustment of finely divided particles into intimate contact. It is an antiseptic metal in contact with tissues of the human body and is permanently tolerated so that it is adapted to root-canal filling to penetrate into the foramina and through the foramina of a root without detriment when that may occur.

I prefer to use in my invention pure precipitated or reduced silver, a finely divided silver produced in a wet way as a coarse form of precipitated silver or molecular silver which more readily clutches together and which more easily coheres than a colloidal form which would be likely to be dissipated at the root tip. This silver may be obtained in the various ways known to the science of chemistry or a laminated or a comminuted silver, or a rolled leaf-form or other loose form of silver as produced by mechanical means may also be used. By a loose form of metal, as the word "loose" appears in this specification, when the word "loose" is not otherwise limited, is meant "loose" as embracing laminations in layers or overlying layers of metal in metal leaf-form existing in the composition in a loose form. The dry silver powder I coat with a fluid, a germicidal fluid or solvent of germicides which must not be oleaginous or a lubricant or which must be restricted in quantity so as not to act as a lubricant. A fluid acting as a lubricant defeats the packing tendency and coherent action and clutching effect of the silver particles under tamping. A very limited amount only of adherent coating is desired on the silver particles to assist the coherence while tamping the composition into the root-canals so that the resilience of the multitude of loose silver particles may be diminished in being packed to bring the silver particles into most intimate coherent contact to form a compact mass.

With the liquid coating used to coat the

metal or silver, I incorporate solid germicides, soluble in the coating-liquid, to thicken the coating-fluid to lessen any tendency to lubricant action and increase the surface-viscidness and at the same time giving to the composition a more varied and effective germicidal quality.

An excessive coating such as would be sufficient to surround the silver particles in addition to filling the interstices or intervening spaces among them would either act as a lubricant or as an obstruction to prevent the satisfactory cohesion of the particles of silver and would hold them apart or permit ready slipping upon each other and prevent packing readily into as solid a mass or into so compact a mass as desired. The amount of coating comprising the germicidal ingredient of the composition should be of such limited quantity only as would less than fill the interstices of the silver powder under light pressure. Such an amount permits the silver to be compressed into intimacy of direct contact which is essential to compactness and rigidity, the intention being to form a mass of silver particles in actual intimate surface contact with no more fluid coating-material intervening than may be forced into and fill the smaller interstices of the finely compressed mass and remain there confined. The limiting amount required may be found by actual absorption-power of silver-powder to take up a liquid; or may be deducted from the relative specific gravities of silver solid and silver powder; or may be found approximately by relative volume of interstitial spaces in a volume of spherical substances in contact. Experimentally for best workability and for compactness of the filling the amount of coating desirable is found to be considerably less than the limiting amount or total volume of the interstitial spaces in the silver powder.

To uniformly coat the silver with this limited amount of germicidal material I dissolve the germicidal substances in a solvent which may be evaporated and leave the silver-powder particles coated with a thin film adherent. For the purpose I use ether as it is a solvent for the particular germicides I prefer to use. The silver powder is mixed with the solvent containing the liquid and the germicides. The solvent then being allowed to evaporate, a coating of uniform distribution is deposited adherent to the silver particles. The composition then has the appearance and form of a powder. Any suitable fluid or preferably any germicidal liquid suitable to use in root-canals either by itself or thickened with solid insoluble ingredients or germicidal substances soluble in the liquid may be used as adapted to the purpose of forming a part of the filling material to assist the coherence of the silver into a firm root-canal filling and as a bacteri-

cidal ingredient. However metallic silver is antiseptic, not in itself but through contact with tissues or may become a germicidal agent by prolonged contact with human tissues or products of decay or proximity to bacteria. Silver becomes germicidal through the formation of its salts which are antiseptic and germicidal at the surface of the silver in minute quantity. It is believed that metallic silver in the human body acquires its antiseptic action in one way through the formation of a lactate. Silver is slightly soluble in alkaline chlorides and as chloride salts are a constant constituent of the human tissue, the silver salt may form or this may be changed into soluble combinations with ammonia or other salts present or resulting through bacterial agency from which may be formed the particularly germicidal oxide. To prevent germicidal activity of silver by introducing germicides which precipitate its soluble salts or which readily reduce silver in its salts to the metallic form would prevent the germicidal efficiency of the presence of silver. It is preferable to use such germicides as are not incompatible with the soluble silver salts and are more likely to avoid precipitation or to avoid reversion to the metallic silver so that the antiseptic possibilities of the silver may not be disturbed.

The liquid I use is guaiacol methylglycolate, a compound of guaiacol which is devoid of its irritant quality and not incompatible with soluble silver compounds. In this I dissolve a suitable proportion of insoluble or nearly insoluble germicides such as helein of marked germicidal power even in its very minute solubility, and iodo-chloroxy-quinoline, a particularly lasting germicide in its elementary constituent, both nearly tasteless and odorless compounds suitable for dental work and all three soluble in ether so that the silver can be uniformly coated by means of the ether-solution on evaporation of the ether.

As the germicidal compounds as well as the liquid which I use are compounds insoluble or nearly insoluble in water and the fluid has been thickened by the solid germicides in its solution or incorporated with it, the coating then contains a minimum of fluid material to be bound up with the solid germicides and finally retained within the interstices of the compacted silver as the composition is tamped in a tooth root-canal. The composition of the silver powder so coated appears or feels like a dry powder and cannot so easily be handled or inserted into the tooth root as if it were in the form of a paste. For ease of working I make the composition in paste form or suspension by incorporating just sufficient water with it. This is not detrimental to cohesion and packing of the composition but is found to be an assistance.

The germicides are such as are considered insoluble substances as ordinarily understood but, to be more exact, are only of very limited or slight solubility sufficient to give to the incorporated water a germicidal property. The small amount of water does not detrimentally affect the adherence of the coating adherent to the silver particles. When the composition of matter in this paste form is brought under pressure by tamping the silver is packed together and clutches together firmly into a compact mass as the water is squeezed out or comes to the surface while being compressed. By using fine, bevelled tampers or smooth broaches in filling the composition into the root-canals and alternating these with the use of blunt, fine canal pluggers as tampers the water is readily squeezed out to the surface and formation of water strata is avoided.

My composition as a filling in a root-canal makes a very compact filler not readily removable. It may be removed without great difficulty with double-tapered chisel-pointed wires or probes twirled to tear asunder the coherent particles little by little. Being essentially a metallic filler of indestructible metal, it is a filler remaining durable as a compact and rigid filler of confined bactericidal property and bactericidally not inert.

I claim as my invention:

1. A composition of matter for filling root canals in teeth, containing metal, suitable for dental fillings, in loose form, and a germicide with which the metal remains in loose form.

2. A composition of matter for filling root canals in teeth, consisting of metal, suitable for dental fillings, in finely divided form coated with a germicidal substance without binding the particles into a mass.

3. A composition of matter for filling root canals in teeth, consisting of metal, suitable for dental fillings, in finely divided form, and a germicidal fluid with which the particles of metal remain in loose form.

4. A composition of matter for filling root canals in teeth, consisting of metal, suitable for dental fillings, in finely divided form coated with a germicidal fluid without binding the particles into a mass.

5. A composition of matter for filling root canals in teeth, consisting of metal, suitable for dental fillings, in finely divided loose form coated with a substance suitable for

dental fillings, and mixed with water in which the particles remain in finely divided loose form.

6. A composition of matter for filling root canals in teeth, consisting of metal, suitable for dental fillings, in finely divided loose form coated with a germicidal substance without binding the particles into a mass, and water in which the particles remain in loose form.

7. A composition of matter for filling root canals in teeth, consisting of metal, suitable for dental fillings, in finely divided form coated with a liquid having incorporated with it a germicidal substance without binding the particles into a mass.

8. A composition of matter for filling root canals in teeth, consisting of metal, suitable for dental fillings, in finely divided form coated with a germicidal liquid having dissolved in it a solid germicidal substance without binding the particles into a mass.

9. A composition of matter for filling root canals in teeth, containing silver in finely divided form and a germicidal substance without binding the particles into a mass.

10. A composition of matter for filling root canals in teeth, comprising silver in finely divided form, guaiacol methylglycolate, iodo-chloroxy-quinoline and helenin.

11. A composition of matter for filling root canals in teeth, consisting of metal suitable for dental fillings, a germicide and water without binding the ingredients into a mass.

12. A composition of matter for filling root canals in teeth, consisting of metal, suitable for dental fillings, in finely divided form mixed with water having a germicidal property by solution of a germicide in the water.

13. A composition of matter for filling root canals in teeth, containing silver in loose form and a germicide with which the silver remains in loose form.

14. A composition of matter for filling root canals in teeth, containing silver, a germicide and water in which the ingredients remain in loose form.

In testimony whereof I affix my signature in presence of two witnesses.

PAUL W. KRUGER.

Witnesses:

JACK SANDERSON,
OSCAR BOYETT.