

# UNITED STATES PATENT OFFICE.

BARNABAS WOOD, OF ALBANY, NEW YORK.

## IMPROVED FUSIBLE METAL FOR FILLING TEETH.

Specification forming part of Letters Patent No. 44,362, dated September 20, 1864; antedated September 4, 1864.

*To all whom it may concern:*

Be it known that I, BARNABAS WOOD, of Albany, in the county of Albany, in the State of New York, have invented a new and useful improvement on fusible metal or metallic composition or alloy as applied to the purpose of filling, stopping, or repairing defective teeth, being an improvement for said purpose on the form of fusible alloy embraced in Letters Patent No. 27,590, granted to me (then a citizen of Nashville, Tennessee,) March 20, A. D. 1860, and consisting of cadmium, bismuth, tin, and lead in the proportions therein set forth; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying sample of the ingredients and of the composition.

This invention consists in so changing and adjusting the proportions of said fusible alloy as to produce a metal which, in addition to the requisite fusibility, hardness, and tenacity, possesses a degree of plasticity or semi-fluidity during a certain range of temperature, so as to be easy of manipulation and to admit of successful application to a dental cavity or defective part of a tooth, and which, on congealing in the cavity or place to which it is applied, will not shrink to admit the fluids of the mouth, nor, upon the other hand, expand, so as to injure the shell of a tooth.

This improved or plastic form of metal I prepare by combining the constituents in proportions substantially as follows: cadmium, from one to two parts; bismuth, three to four parts; tin, two to three parts; lead, one to two parts. To these mercury may be added, to lower the melting-point; but the result is less desirable for the purpose of a filling for teeth. The proportions may be varied to some extent without materially modifying the result; or they may be somewhat varied to increase or to diminish the qualities of hardness, pliability, &c. When the less proportion of lead is used, the alloy is harder and more rigid. When the greater, it is softer and more pliable. The proportions of tin or of cadmium may be somewhat increased or diminished, or those of the one increased and of the other diminished, without very sensible alteration in the character of the compound; also, an analogous result may be produced by using a smaller pro-

portion of cadmium or tin, or of both, and supplying the deficit by addition of other metal or metals—as zinc, antimony, silver, &c., or, what amounts to the same thing, by making such addition to the formula of the original fusible alloy—but the above-named proportions are those which I use, and which I believe to be the best for the purpose specified, as securing the requisite plasticity at the lowest fusing temperature, and the least practical shrinkage or expansion on congealing, in connection with other requisite qualities. The metal so prepared remains soft and plastic between 155° and 180° Fahrenheit, or thereabout, giving a range of some 20° or 30°, during which it can be manipulated. This affords time for conveyance without hurry to the desired place, and enables it to be molded securely to the cavity of a tooth. This quality of plasticity is essential in order to facility and perfection in the execution of the work. A metal which passes immediately or quite suddenly from a fluid to a solid state, and vice versa, is attended with serious difficulty. Its tendency, while fluid, to assume a spherical form causes it, when fused into the cavity of a tooth, to roll up or recede from the walls and margins of the cavity, thereby leaving imperfections, and at the point of congealing it becomes too quickly solid and unimpressible for successful introduction, whereas if plastic during a sufficient range of temperature it can be molded to every part, and, if applied by sections, each piece congealing as introduced, the temperature of the mass in a tooth need hardly exceed that at which the metal congeals. This plastic condition, moreover, affords a criterion and safe-guard as to the temperature, which a fluid condition does not afford, being but fluid at whatever degree of heat.

Practical freedom from shrinkage and expansion is essential for the ultimate success of the operation, for if the filling, on congealing, shrinks from the walls of the cavity, so as to admit the fluids of the mouth, decay may go on and the object of the work be defeated. On the other hand, if it expands, so as to exert undue pressure against the walls, it may induce fracture. It is also desirable that the metal be sufficiently hard to endure the wear of mastication.

For a better understanding of the working



qualities of the metal, I will briefly state my manner of applying it. I apply it by means of instruments constructed for the purpose, having variously-shaped points—flat, round, or square—with a bulb near the point, the better to retain the heat. The metal is cut up into small blocks or pieces suited to the cavity. The proper instrument being heated sufficient to soften the metal by holding the bulb a few moments over the flame of a spirit-lamp, the point is pressed upon one of the blocks, which, on softening, clings to it, and is thus carried to the cavity or defective part of the tooth and molded to the place. Successive blocks are taken up and applied the same way until the work is complete. The surface may then be smoothed with the heated instrument, or trimmed down with a file or scraper and finished off the same as plugs of gold or tin.

There is nothing peculiar in my manner of compounding the ingredients. They are melted together and incorporated in the usual way. For therapeutical considerations I prefer having them as pure as practicable.

I am aware that fusible metals have hitherto been employed for filling teeth. An alloy consisting, substantially, of three parts tin, five parts lead, and eight parts bismuth, or thereabout, fusible at about 200° Fahrenheit, and congealing but little under the point of fluidity—say two or three degrees—was some years ago in quite general use for the purpose, and is yet used to some extent; but the minimum heat required for its fusion is regarded too high for general safety, and as the metal passes so suddenly from a fluid to a solid state it is liable to the objections above stated, and is indeed inapplicable for many cases, being confined chiefly to cavities in the coronal surfaces of lower teeth. It moreover expands on congealing to an extent that renders it liable to crack the frail shell of a tooth. It is rendered more fusible by the addition of mercury, and, thus modified, has been used for filling teeth; but this renders the compound comparatively fragile, more susceptible to oxidation and otherwise objectionable. In either case this metal is much softer and less durable than that which I prepare, as herein described. The manner of applying it was different, being usually dropped in a fluid state into the tooth-cavity, or applied in bits and melted in with a hot instrument.

The new fusible alloy embraced in Letters Patent granted to me the date aforesaid, composed of cadmium, from one to two parts; tin, two parts; lead, four parts, and bismuth from seven to eight parts, melts at a temperature low enough (without addition of mercury) for general use in filling teeth; but it passes so suddenly from a fluid to a solid state that it is unmanageable, and, for most cases, inapplicable, for reasons above referred to. It also, upon congealing, expands in dimensions to an extent that renders it liable to injure the shell of a tooth. The specification of the original

patent provides, indeed, for variation from the formula, but the modifications therein specified or indicated do not indicate the particular composition of the herein-described improvement. Said specification claims, in effect, the production of certain fusible alloys, and the production of fusibility in alloys by the use of cadmium in the ratio therein described in combination with the metals specified in the proportions thereof substantially as set forth; but it does not claim the production of a form of alloy plastic during a certain range of temperature, specially adapted to the purpose of filling teeth or other purpose, nor specify the quality of plasticity, or any improvement in respect to shrinkage and expansion. In my improved form of the alloy the ratio of bismuth is materially less, and the ratio of cadmium materially greater, than in the original in any of its modifications. This adjustment of proportions diminishes the expansion, increases the hardness, and improves the color of the result, while at the same time conferring or contributing to the requisite plasticity.

I do not claim the production of fusibility, nor the use of cadmium for its production in combination with the other constituents named; but I base my claim to improvement upon the production of plasticity in connection with practical freedom from shrinkage and expansion upon congelation in this class of fusible alloys in order to a result for a specific purpose. I do not speak absolutely in regard to shrinkage and expansion, but only so far as to meet the requirements in practice. (The shell of a tooth will bear with impunity some expansion of the filling, and the slight expansion and contraction which plugs of gold, tin, &c., undergo from transitions of temperature induced by hot and cold food or drinks appear to do no harm.)

I do not claim that the quality of plasticity in alloys during a wide range of temperature has never before been produced and made applicable to certain uses; but I am not aware that it has hitherto been produced in fusible alloys to render them applicable to the purpose of filling teeth, or that the herein-specified proportions of the ingredients mentioned have heretofore been used in the formation of alloys for any purpose.

What I claim as my invention, and desire to secure by Letters Patent, is—

The herein-described metallic composition for filling or repairing teeth, consisting of the ingredients specified in the proportions thereof, substantially as set forth, or proportions equivalent thereto, as indicated, so as to produce a metal, as described, for said purpose.

In testimony whereof I hereunto set my name and seal this 18th day of February, A. D. 1864.

BARNABAS WOOD. [L. S.]

Witnesses:

D. DE GRAFF,  
GEO. W. HOGEBOM.