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INVESTMENT

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This invention relates to investment compositions, that is, to compositions of matter for making refractory moulds, into which desired metals and alloys thereof may be cast in molten condition to form dental inlays, partial dentures and various other types of dentures, as well as other kinds of articles in this and other arts, where it is desired to make by casting, an article with suitable control over the dimensions, shape and details of the cast article.

This invention is of general application in the industrial arts, but for purposes of illustration and not as a limitation of the invention, it will hereinafter be described particularly with respect to the casting of dental inlays. In reconstructing a tooth which has been partly decayed or otherwise damaged, the dentist makes a cavity in the tooth of the size and shape which he considers good dental practice. He then makes or procures a casting of the metal or alloy he desires, with the expectation that the casting fit as exactly as possible into the tooth cavity.

The conventional method followed is to force warm wax into the tooth cavity to fill it, shape the open surface by having the patient bite down on it, and/or perhaps by trimming with a suitable tool; and then to heat a small metal rod or sprue, insert it into the wax, and then, after cooling, remove the wax pattern by pulling on the sprue to which the pattern adheres after cooling. A mould is then formed by carefully placing a cementitious mass about the pattern and the sprue, and this mass known as the "investment" is allowed to harden. This investment is a mould containing the wax pattern therein, and, after removal of the sprue, the wax is burned out by heating the assembly which at the same time is brought to a suitable temperature for casting.

The investment materials most commonly used generally contain a binder such as plaster of Paris, and silica, and frequently accelerators, retarders or other modifying agents, as well as inert filler materials are used in the composition.

I have discovered that tridymite, which is a distinct form of silica, may be used with advantage in making investments of the type referred to above. Metals or alloys, on solidifying from the molten to the solid state undergo a shrinkage in volume, and there is generally an additional shrinkage due to drop in temperature, even when there is no change in the physical state; and I have discovered that investments containing tridymite compensate to a substantial degree by their expansion on being heated the shrinkage of the cast metal above referred to.

For example, an investment mould made ready for receiving the molten metal by the treatment above described if made of quartz silica, flint silica or chalcedony silica, all known as "silex" in the dental art, will not produce a casting as closely approximating the exact dimensions as would be produced in an investment wherein tridymite is used in place of at least a very substantial proportion of the ordinary type silica.

I have found that the tridymite, in combination with a binder, thus furnishes an investment preferable to one made of ordinary silica and a like binder. I prefer plaster of Paris as the binder but others may be used, for example, Keene's cement, Portland cement, sodium silicate cements, phosphoric acid cements, magnesium oxide cement, and various oxide salt cements generally, as well as others. Accelerators, retarders or other modifying agents may be added in the usual small quantities; these being used as heretofore in proportions of somewhere around 1% of the whole, or a fraction of 1%, or otherwise as known in the art, and ingredients which have the effect of toughening, hardening or otherwise modifying the mass may likewise be used. Any or all such ingredients in combination with the cementitious ingredient or ingredients, really form what may be termed the binder, so that the binder ingredient may consist of cementitious material alone or cementitious material in combination with some modifying material, and these terms are so used in the appended claims. Inert fillers may likewise be used as heretofore, but generally the effect thereof is to decrease the expansive effect of the tridymite and/or the strength of the whole composition, so that it is frequently preferred not to use them.

Ordinarily when using tridymite with a plaster of Paris binder I prefer to have at least one half the composition by weight consist of tridymite and at least 20% of the composition consist of plaster of Paris. Less plaster of Paris results in an investment which may not have sufficient mechanical strength, and less tridymite than the amount mentioned decreases substantially the tridymite effect. These proportions are quite variable, both within and beyond the limits stated, but I prefer them for practical dental laboratory purposes. As one specific example of a suitable composition I may refer

to one consisting of 25% of the plaster of Paris binder and 65% of tridymite.

It is understood, of course, that the materials used are of about the same degree of fineness as those heretofore used and are, of course, well intermixed; and it is to be further understood that materials, the major part of which consists of tridymite, may be used in place of the tridymite itself.

It is to be understood that various details mentioned may be changed without departing from the spirit of the invention, the scope of which is defined in the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. An investment composition containing tridymite and a binder.

2. An investment composition containing tridymite and plaster of Paris.

3. An investment composition containing a binder and at least 50% by weight of tridymite.

4. An investment composition containing plaster of Paris and at least 50% by weight of tridymite.

5. An investment composition containing tridymite and at least 20% by weight of binder.

6. An investment composition containing tridymite and at least 20% by weight of plaster of Paris.

7. An investment composition containing at least 50% by weight of tridymite and at least 20% by weight of a binder.

8. An investment composition containing at least 50% by weight of tridymite and at least 20% by weight of plaster of Paris.

9. An investment composition containing about 75% by weight of tridymite and about 25% by weight of a binder.

10. An investment composition containing about 75% by weight of tridymite and about 25% by weight of plaster of Paris.

11. An investment composition containing tridymite and a binder, the amount of tridymite being sufficient to make the investment sufficiently larger than the pattern, when the investment is at a predetermined temperature above room temperature and less than that of the molten metal, to correspond to the shrinkage of the casting from the molten to the cooled state.

12. An investment composition containing tridymite and plaster of Paris, the amount of tridymite being sufficient to make the investment sufficiently larger than the pattern, when the investment is at a predetermined temperature above room temperature and less than that of the molten metal, to correspond to the shrinkage of the casting from the molten to the cooled state.

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