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T. E. MOORE

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METHOD OF MAKING DENTAL CASTINGS AND COMPOSITION EMPLOYED IN SAID METHOD

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Fig. 1

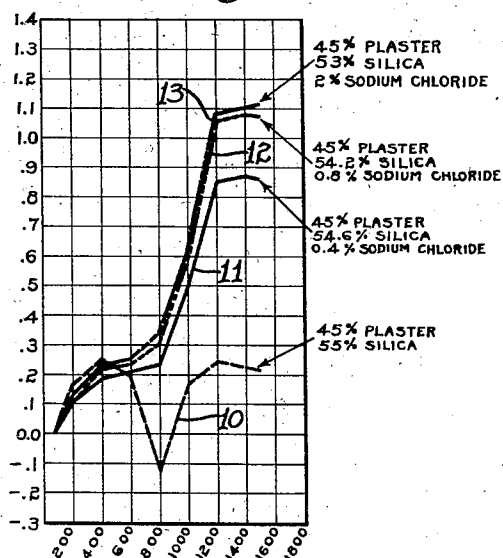


Fig. 2

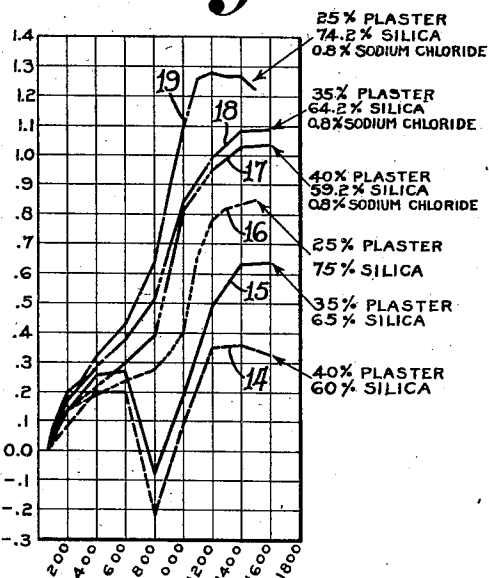


Fig. 3

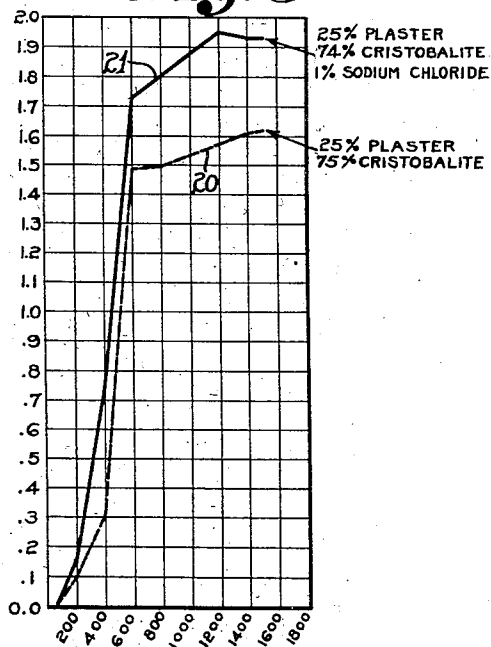
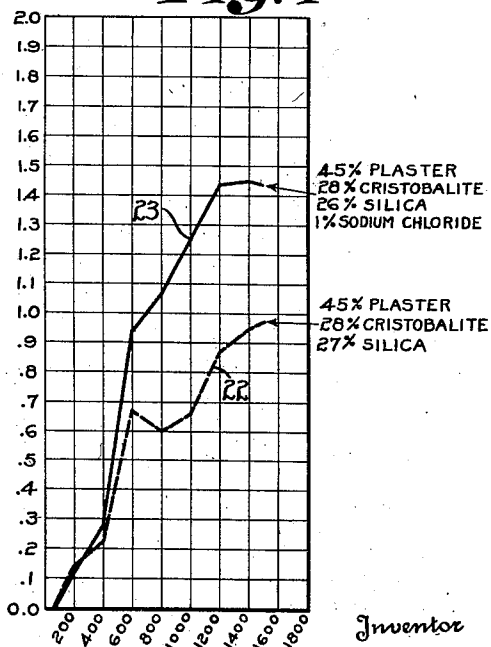


Fig. 4



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METHOD OF MAKING DENTAL CASTINGS
AND COMPOSITION EMPLOYED IN SAID
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9 Claims. (Cl. 22—188)

This invention relates to a method of making dental castings and to a composition for molds employed in the method.

One of the objects of the invention is to produce castings of accurately predetermined size. Another object is to provide a composition that will produce molds having exactly the desired degree of expansion when heated preparatory to forming a casting. Other objects and details of the invention will appear as the description proceeds.

In making dental castings, it is customary to first form a model of the desired casting, then employ a plaster setting investment material to shape a mold having a cavity therein corresponding to the model, allow the mold to set, heat the set mold, pour an alloy into the heated mold, and allow the casting thus formed to cool to normal temperature.

The main ingredients of the investment compound most extensively used for making dental casting, are silica and plaster of Paris. Customarily, the molds are heated to a temperature around 1200° F. to 1500° F. before the casting is formed. During this heating the material of the mold usually expands slightly, thus enlarging the casting cavity. The composition of the investment material may be modified in various ways to vary the degree of this expansion, but I have discovered a new and improved method of modifying the composition so as to obtain the exact degree of expansion desired, and thereby obtain castings having exactly the desired size relative to the original model.

Ordinarily, I prefer to employ a material that has an expansion during heating substantially equal to the shrinkage of the casting during cooling from solidification temperature to the normal temperature at which it is employed, since this results in producing castings of the exact size of the cavity formed in the mold at normal temperature; but a number of factors, such as the exact composition of the casting, the use to which it is to be put, the manner and material by means of which the pattern is formed, etc., modify the amount of expansion desirable, and therefore I vary my investment composition to suit the use for which it is intended.

The behavior of various compositions during heating, and the manipulation by which correct behavior is obtained, will be discussed in connection with the accompanying drawing, which forms a part of this specification.

Fig. 1 is a series of graphs showing the expansion upon heating of a mixture of 45% plas-

ter of Paris with approximately 55% of silica and different amounts of sodium chloride.

Fig. 2 is a series of graphs showing the expansion upon heating of compositions containing different proportions of plaster of Paris and silica, with and without sodium chloride.

Fig. 3 is a pair of graphs showing the expansion when heating of a mixture of 25% plaster of Paris and approximately 75% cristobalite, with and without sodium chloride.

Fig. 4 is a pair of graphs showing the expansion upon heating of a mixture of 45% plaster of Paris, 28% cristobalite and approximately 27% ordinary silica, with and without the addition of sodium chloride.

A fairly common investment material is one containing 45% of plaster of Paris and 55% silica, having an expansion such as indicated in graph 10 of Fig. 1. It will be understood that various elements in the treatment of the material modify the expansion to some extent, but the graph shown indicates the exact expansion found in one mixture of the kind indicated, and is typical of a mixture of that character. It will be seen that the expansion at a casting temperature between 1200° F. and 1500° F. is between .2% and .3%. This is materially less than the contraction of the cooling casting. An expansion of over 1% is usually desired. The substitution of .4% sodium chloride for that amount of silica in the mixture, results in an increase of over .6% in the expansion, or a total of over .8% expansion, as shown in graph 11 on Fig. 1. Doubling the sodium chloride, so as to use .8% thereof, further increases the expansion to nearly 1.1%, as shown in graph 12, but the increase in sodium chloride does not increase the expansion in proportion to the amount of the sodium chloride. A further increase to 2% sodium chloride increases the expansion to slightly over 1.1%, as shown in graph 13. Further addition of sodium chloride is not shown by the graphs, but it may be stated that such further additions have little effect upon the expansion.

The percentage of expansion is affected by the proportion of silica used. In Fig. 2, graphs 14, 15 and 16 show the expansion curves of mixtures containing respectively 40%, 35% and 25% plaster of Paris with the remainder silica. It will be seen from these graphs that increasing proportions of silica result in some increased expansion, graph 13 showing an expansion of between .3% and .4%, graph 14 showing an expansion of between .6% and .7%, and graph 15 showing a maximum expansion of over .8%. Graphs 17, 18 and 19 show

the expansion curves of the same mixtures as graphs 14, 15 and 16 respectively, with .8% sodium chloride used in place of that much silica. It will be seen that in each instance the addition of sodium chloride increases the expansion.

In this connection, it may be stated that for many purposes an expansion of around 1.25% is desirable, as it approximates the shrinkage of the castings during cooling. Therefore, graph 19 shows one of my preferred compositions, as it is capable of quite general use with a high degree of satisfactory results.

Cristobalite is a form of silica that has a greater expansion than ordinary silica, and can be used to increase the expansion where desired. In Fig. 3, graph 20 shows the expansion curve of a mixture of 25% plaster of Paris and 75% cristobalite. It will be seen that the maximum expansion is about 1.6%, which is amply high for all ordinary purposes, but even this can be increased by the addition of sodium chloride, as shown in graph 21. In Fig. 4, graph 22 is the expansion curve of a mixture of 25% plaster of Paris, 28% cristobalite and 27% silica. This shows a maximum expansion of nearly 1%. Graph 23 is the expansion curve of a similar mixture containing 1% sodium chloride, and shows the increase of expansion to over 1.4%.

As will be seen from graphs 20 and 22, cristobalite expands sharply between 400° F. and 600° F., and heating must be conducted slowly to avoid cracking because of this sudden expansion. Where sufficient expansion is obtainable by the use of ordinary silica and sodium chloride, it is preferable to omit cristobalite, because of this danger of cracking, also because cristobalite is an expensive material, and for the additional reason that cristobalite continues to expand between 1200° F. and 1500° F. more than does ordinary silica, as appears from the graphs. This continued expansion between 1200° F. and 1500° F. adds to the care required in accurately determining the temperature of the mold when the casting is made in order to accurately determine the size of the casting. As will be seen from graphs 21 and 23, the addition of sodium chloride mitigates this difficulty.

Where sufficient expansion can be obtained by a material such as illustrated by graph 18, this is preferred; and if a higher expansion is desired, it can be obtained by the use of sodium chloride and some cristobalite to advantage over the use of the material without the sodium chloride, as the salt reduces both the amount of cristobalite necessary to obtain a given expansion and the difficulties resulting from its use.

Throughout the description the use of sodium chloride has been discussed. Chlorides of potassium and lithium have a similar effect, but not as great. Since the chlorides of lithium and potassium are less effective and more expensive than sodium chloride, there is no practical advantage in their use, but if the use of sodium chloride was not possible, some of the advantage of its use could be obtained by the use of the chlorides of lithium or potassium, and therefore in its broadest aspect my invention contemplates the use of any of the three chlorides mentioned.

Small quantities of materials for modifying the speed of setting or other qualities may be added to my compound, as to other investment materials containing plaster of Paris and silica, and the presence or absence of such materials does not alter the application of my invention.

To summarize, by the addition of sodium chlo-

ride to a compound consisting essentially of plaster of Paris and silica, the expansion reached at 1200° F. is increased, the expansion up to that point is rendered more even and continuous, so as to facilitate rapid heating, the change in volume between 1200° F. and 1500° F. is little affected where it is otherwise small and is reduced where it is otherwise large, the full expansion desired can be obtained ordinarily with the use of common silica, and where exceptional requirement calls for greater expansion, it can be obtained with the addition of comparatively small amounts of cristobalite. By properly selecting the common ingredients and adding the proper amount of sodium chloride, the expansion can be accurately regulated so as to result in a casting having the desired predetermined relation to the cavity formed at normal temperatures.

Various modifications may be made within the scope of the appended claims.

What I claim is:—

1. The process of forming dental castings consisting in forming a model of the shape of the desired casting, applying to said model a plastic setting composition consisting essentially of plaster of Paris and silica and having its heat expansion increased by the addition of a material of the group consisting of the chlorides of sodium, potassium and lithium, removing the composition from the model, allowing the composition to harden, heating the hardened composition thus formed into a mold, pouring an alloy into the heated mold, and allowing the casting to cool.
2. The process of forming dental castings consisting in forming a model of the shape of the desired casting, applying to said model a plastic setting composition consisting essentially of plaster of Paris and silica and having its heat expansion increased by the addition of a material of the group consisting of the chlorides of sodium, potassium and lithium, the amount of said material being such as to give a heat expansion during the subsequent heating of the mold substantially equal to the contraction during cooling of the casting to be made therein, removing the composition from the model, allowing the composition to harden, heating the hardened composition thus formed into a mold, pouring an alloy into the heated mold, and allowing the casting to cool.
3. The process of forming dental castings consisting in forming a model of the shape of the desired casting, applying to said model a plastic setting composition consisting essentially of plaster of Paris and silica and having its heat expansion increased by the addition of sodium chloride, removing the composition from the model, allowing the composition to harden, heating the hardened composition thus formed into a mold, pouring an alloy into the heated mold, and allowing the casting to cool.
4. The process of forming dental castings consisting in forming a model of the shape of the desired casting, applying to said model a plastic setting composition consisting essentially of plaster of Paris and silica and having its heat expansion increased by the addition of sodium chloride so that its expansion during the heating of the mold formed therefrom is substantially equal to the contraction during cooling of the casting to be formed in the mold, removing the composition from the model, allowing the composition to harden, heating the hardened composi-

tion thus formed into a mold, pouring an alloy into the heated mold, and allowing the casting to cool.

5 5. A composition for forming dental molds consisting essentially of plaster of Paris and silica and having its heat expansion increased by the addition of a material of the group consisting of the chlorides of sodium, potassium and lithium.

10 6. A composition for forming dental molds consisting essentially of plaster of Paris and silica and having its heat expansion increased by the addition of sodium chloride.

15 7. A composition for forming dental molds consisting mainly of plaster of Paris and silica, at least some of the silica being in the form of

cristobalite, and the composition having its heat expansion increased by the addition of a material of the group consisting of the chlorides of sodium, potassium and lithium.

8. A composition for forming dental molds consisting mainly of plaster of Paris and silica, at least some of the silica being in the form of cristobalite, and the composition having its heat expansion increased by the addition of sodium chloride.

9. A composition for forming dental molds, consisting substantially of 25 parts plaster of Paris, 74 parts silica and .8 parts sodium chloride.

THOMAS E. MOORE.

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