Sept. 4, 1951 J. J. CANTOR 2,566,596

METHOD OF PREPARING DENTAL INVESTMENTS AND THE LIKE

Filed Jan. 15, 1948

FIG. 1.

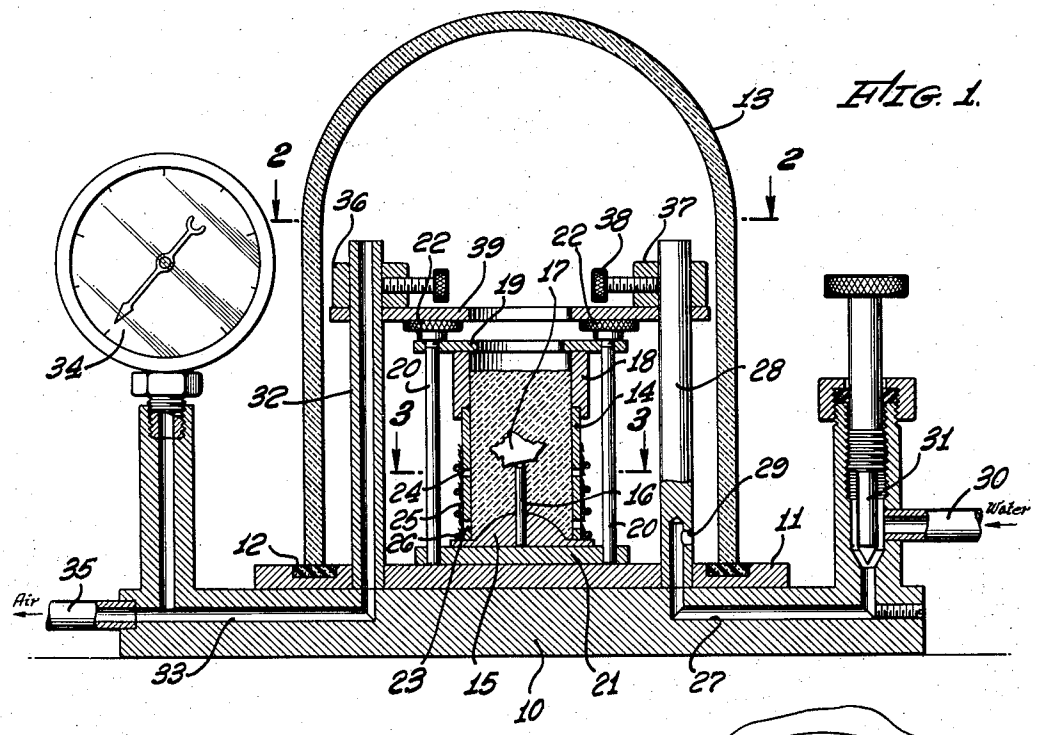
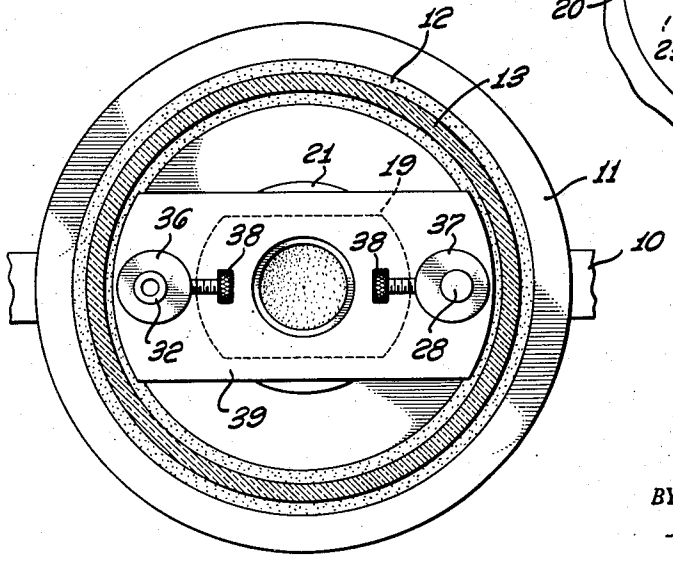


FIG. 2.



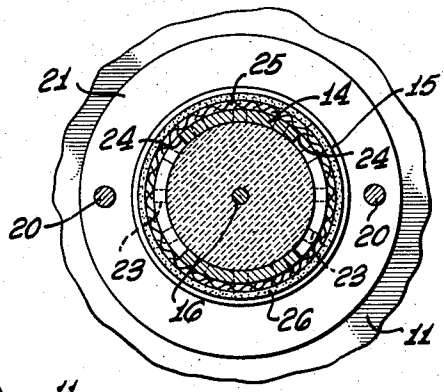


FIG. 3.

JACOB J. CANTOR,
INVENTOR.

BY Hazard & Miller
ATTORNEYS.

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METHOD OF PREPARING DENTAL INVESTMENTS AND THE LIKE

Jacob J. Cantor, Los Angeles, Calif.

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6 Claims. (Cl. 18—55.1)

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This invention relates to a method for preparing dental investments and similar molds.

It has long been recognized in the preparation of dental investments that air bubbles in the investment mix interfere with the production of castings which are in exact conformity with the pattern and attempts heretofore have been made to eliminate these air bubbles so that more precise castings can be obtained.

Generally speaking, techniques endeavoring to eliminate such bubbles may be divided into two classes. In the first class, the plaster or similar self-hardening material used to form the investment or mold was mixed with its liquid such as water and then subjected to vacuum with the intention of extracting from the mix all of the gases existing therein including air and water vapor. When the mix was thus prepared it was then poured in the flask about the pattern and allowed to set. An objection to this method resided in the fact that in the course of pouring the mix after it had been evacuated around the pattern the mix usually had adequate opportunity to pick up or absorb new air which became entrained therein and prevented or greatly retarded the ability of securing highly precise castings. The second method consisted of first mixing the plaster and subjecting it to vacuum, pouring it into the flask around the pattern and then subjecting the poured plaster to a second vacuum designed to extract the air from the poured material. A general review of these procedures is to be found in the article entitled "Principles of Vacuum Investing" by K. W. Ray appearing in the Dental Laboratory Review for September 1946, page 27.

Both of the above outlined procedures are still subject to a number of objections. One such objection exists in the fact that when the plaster and water have been mixed to form a paste or slurry the ability of the vacuum to draw out the air bubbles from the paste or slurry is highly restricted in that the high viscosity of the mix retards the passage of the air bubbles therethrough. Furthermore, if the pattern is quite intricate it may form pockets in which the air bubbles may be disposed and these are held from escape through the plaster by the pattern itself. Another and more serious objection resides in the fact that after the water and dry plaster have been mixed together the plaster immediately begins to set. Consequently, the creation of the vacuum intended to withdraw the air must take place with high rapidity. For this reason, both the single and double vacuum processes

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heretofore employed have been largely restricted in their use to castings of small size.

An object of the present invention is to provide a method proceeding upon a different theory from those heretofore developed wherein the dry plaster is placed in a suitable flask around the pattern and then is subjected to vacuum to remove the air therefrom. As the plaster is dry or substantially so, the extraction of the air therethrough is accomplished in a much easier manner than endeavoring to extract air bubbles through a moist paste or slurry. When the air has been thus extracted from the dry plaster and preferably while it is still subject to vacuum, water or other liquid, which may or may not be but which is preferably free of air or oxygen, is admitted to the vacuum chamber and allowed to wet the plaster causing it to commence to set. As soon as the plaster has been thoroughly wet ambient air pressure is allowed to enter the vacuum chamber and if there are any remaining air bubbles or vapor bubbles within the investment these are immediately compressed or collapsed by the air pressure. The result obtained is an investment which is remarkably free of pockets produced by air and vapor bubbles so that highly precise castings are obtainable with great uniformity. The process is further highly advantageous in that the admission of the water to the vacuum chamber for purposes of setting the plaster can take place at any time and there consequently is no race against the time of setting of the plaster within which to create the vacuum as in the prior processes above referred to. Consequently, the present process is in no way restricted to small castings but is equally applicable to castings of any reasonable size.

With the foregoing and other objects in view, which will be made manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the accompanying drawings for an illustrative embodiment of the invention, wherein:

Fig. 1 is a vertical section through the apparatus designed and used in accordance with the present invention;

Fig. 2 is a horizontal section taken substantially upon the line 2—2 upon Fig. 1; and

Fig. 3 is a partial view in horizontal section taken substantially upon the line 3—3 upon Fig. 1.

Referring to the accompanying drawings wherein similar reference characters designate similar parts throughout, the apparatus illustrated consists of a base generally in the form

of a transverse bar 10 on which is mounted a circular plate 11. A suitable gasket such as rubber or rubber-like material indicated at 12 is recessed in the plate 11 to form an air-tight seal with the bottom edge of a bell jar 13. A flask 14 is adapted to be positioned on the base beneath the bell jar and this flask has at the bottom thereof the conventional crater forming member 15 and the gate or sprue forming member 16 on which the pattern 17 is positioned in the usual manner. In accordance with conventional dental practice the pattern is formed of wax. On top of the flask 14 there is positioned a ring 18 which is held down against the flask by means of an apertured plate 19. Studs 20 extend upwardly from the base 21 that supports the flask and thumb nuts 22 are threaded thereon enabling the plate 19 to be tightened downwardly against the top of the flask so that the base, crater forming member, flask, ring, and plate 19 may be held together as a unit when these parts have been assembled. The flask 14 has openings in the side walls thereof some of which may be merely in the form of perforations 23 and others of which indicated at 24 may be in the form of horizontal slots. These openings are covered externally by means of gauze or equivalent material indicated at 25 which is retained in place in any suitable manner such as, for example, by rubber bands or split rings indicated at 26. The bar 10 has a water passage 27 formed therein that leads to the base of an upstanding stud 28 that is mounted on the plate 11. This stud provides an outlet 29 for water that can be admitted through a supply pipe 30 past a needle valve 31. Within the bell jar there is also disposed an upwardly extending tubular stud 32 the top of which is open to the interior of the bell jar and the bottom of which communicates with a passage 33 that is adapted to be connected to a vacuum gauge 34 and to a conduit 35 that leads to a vacuum producing or creating means. The vacuum creating means may be any conventional apparatus for this purpose such as a vacuum pump or a water aspirator and when operated serves to create a high degree of vacuum within the bell jar 13. Collars 36 and 37 are adjustably mounted on the two studs 28 and 32 such as by thumb screws 38. These collars may be tightened down against an apertured plate 39 which is positioned against the tops of the thumb nuts 22 to hold the entire flask assembly in place.

The method performed utilizing the above described apparatus is substantially as follows. The pattern 17 is mounted on the sprue providing member 16 in the conventional manner and the flask 14 with its applied gauze 25 and retaining elements 26 is positioned on the crater forming member 15. The ring 18 which may be regarded as an excess plaster retaining ring is then mounted on the flask and the entire assembly clamped together by means of the thumb nuts 22. This assembly can then be positioned on the plate 11 and clamped thereon by means of the collars 36 and 37. Dry plaster or other cementitious material which becomes self-hardening when mixed with a liquid such as water is then poured into the flask. As materials of this type usually contract on being moistened, an excess of the dry plaster is poured into the flask so as to partially fill the ring 18 and thus compensate for shrinkage. The bell jar 13 is then applied to its gasket 12 and the vacuum creating means connected to the conduit 35 is then operated. During the creation of the vacuum within the bell jar the valve 31 is maintained in closed position. As the plaster or equivalent material within the flask is dry the air contained therein can readily pass out through the interstices between the dry particles and the vacuum can be retained in the bell jar 13 for an indefinite period of time to assure complete extraction of the air. When it is desired to form the investment or mold the needle valve 31 is opened allowing water to enter from the conduit 30, pass the needle valve and go through the passage 27. This water enters the bell jar through the inlet 29 and is allowed to fill the bell jar up to a level where it may wet the plaster within the flask through the perforations 23 and/or 24. In many instances the plaster will wet itself throughout by capillary action but if desired the vacuum chamber may be flooded with water so that the investment is completely submerged. In the preferred method the water or liquid used is characterized by the fact that it is free or substantially free of all dissolved air or oxygen and other objectionable gases. Such water may be water that has been retained under a vacuum over a prolonged period of time or may be water that has been thoroughly boiled to drive out air and other gases. In some instances the water may be from a supply containing dissolved air or oxygen and as this water is admitted to the vacuum chamber within the bell jar 13 very slowly it will have the dissolved air removed therefrom on admittance. Where the water or liquid is rendered gas free prior to admittance the particular manner in which it is thus prepared is immaterial in so far as the present invention is concerned. It is merely desirable that the water that wets the plaster be substantially free of air or gases so that it will not reintroduce air or gases into the dry plaster that has just been evacuated. In this way the dry-air-free plaster is wetted in situ around the pattern and while the vacuum within the bell jar is maintained. When the plaster has been thoroughly wet the conduit 35 is quickly opened allowing air to enter the bell jar and the water therein can be either drained off through the conduit 30 such as by siphoning or the bell jar may be lifted from the gasket 12 allowing the water within the bell jar to flow off of the plate 11. The entrance of ambient air pressure into the chamber causes any water vapor bubbles or any remaining expanded air bubbles to be compressed into very small volume so that these do not interfere with the obtaining of a highly precise mold from the pattern. The flask can then be treated in any conventional manner to remove the wax pattern 17 leaving a clean dry mold cavity.

In the course of removing the air from the dry plaster within the flask it may be advisable to vibrate or successively jar the entire apparatus so as to disturb the plaster and thus facilitate egress of air therefrom while the plaster is in its dry condition. In most instances, however, the air will readily escape from the powdered plaster without such vibration or jarring primarily because egress of air therethrough is not hindered by the liquid. When the water is admitted to wet the dried air-free powder, the plaster usually contracts and in so doing the level of the plaster within the flask 14 and the ring 18 may settle to a level approximately even with the top of the flask 14.

In the above described manner a mold or investment can be produced having high fidelity to the shape of the pattern and which when the

casting is made in the mold will produce an exact reproduction of the pattern. The improved method and apparatus is highly advantageous in that the extraction of the air from both the plaster and the liquid can take place in advance of the mixture of these two substances as contrasted with endeavoring to remove the air from the plaster and water after they have been mixed together as in prior processes. Consequently, where prior processes presented limitations that were dependent on how fast a high vacuum could be created immediately after the plaster and water had been mixed together and the plaster started setting, no such limitations are presented herein. For this reason, much larger patterns may be employed if desired or necessary than those capable of being used with prior processes above referred to.

Various changes may be made in the details of construction without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. The method of preparing a dental investment or similar mold which comprises placing dry plaster in a flask about a pattern and evacuating air from the same while dried and while evacuated wetting the plaster causing it to commence to set.

2. The method of preparing a dental investment or similar mold which comprises placing dry plaster in a flask about a pattern and evacuating air from the same while dried and while evacuated wetting the plaster causing it to commence to set and then subjecting the wetted plaster to at least atmospheric pressure.

3. The method of preparing a dental investment or similar mold which includes bringing into contact around a pattern dry plaster and water from which the air has been removed and after the plaster has been thus wetted allowing the plaster to set.

4. The method of preparing dental investments or similar molds which includes bringing into mutual contact dry plaster and water around a pattern while under a vacuum.

5. The method of preparing a dental investment or similar mold which includes bringing into mutual contact around a pattern plaster and gas-free water while under a vacuum.

6. The method of preparing a dental investment or similar mold which includes as a step thereof placing dry plaster in a flask about a pattern and evacuating the air from the same while the plaster is in a dry state.

JACOB J. CANTOR.

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