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METHOD OF MOLDING DENTURES

Filed Jan. 30, 1963

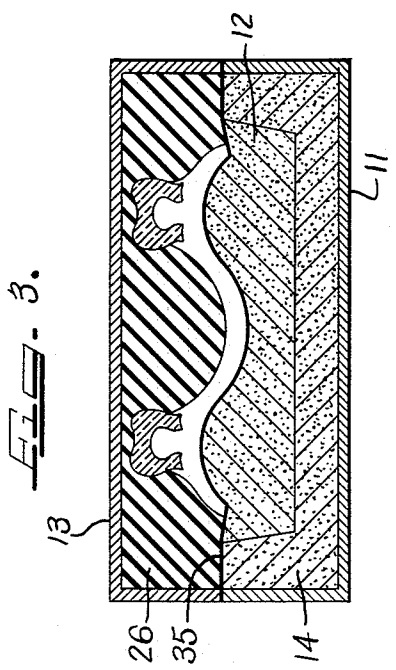


Fig. 3.

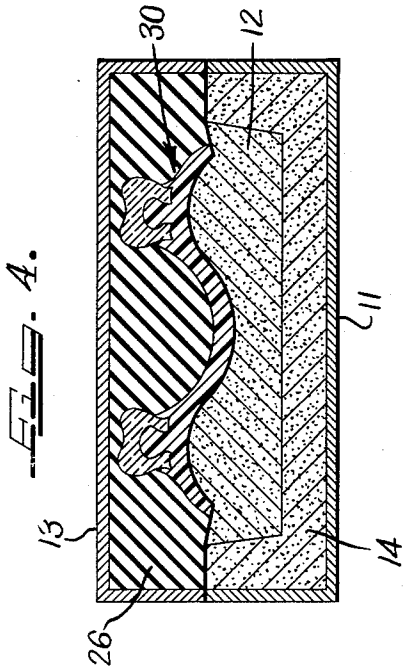


Fig. 4.

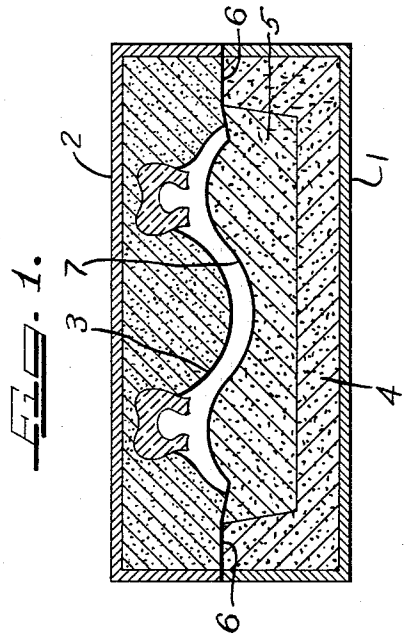


Fig. 1.

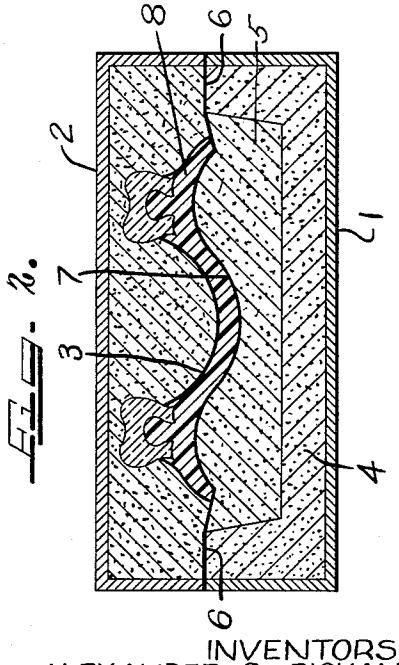


Fig. 2.

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METHOD OF MOLDING DENTURES

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This invention relates to improved methods for fabricating dentures, commonly known as "false teeth."

Dentures are very intricate structures to fabricate. Since slight deviations in a denture's configration can result in severe discomfort to the patient, a denture must be made to very close tolerances. Therefore the molds in which they are made and the processes by which they are made must be very accurate and extremely reliable.

Many steps take place in fabricating a denture, and to understand more readily the improvements of this invention a brief summary of a conventional procedure for fabricating a denture follows.

First an impression of the desired portion of the patient's mouth using any standard impression material is taken. After the impression material has set and has been cleaned, the impression is packed with dental stone. When the stone hardens and cures it provides a duplicate of the portion of the patient's mouth of which the impression was taken. That duplicate or positive is known as a master cast and forms the base upon which the desired denture is constructed.

The master cast is then covered with a thin layer of dental wax of the same thickness that the final denture is to be. That wax is molded to conform precisely to the master cast and once so molded is known as the trial baseplate. Since a trial baseplate is frequently removed from the master cast and fitted in the patient's mouth, a release agent such as talc is generally provided between the master cast and the trial baseplate.

The trial baseplate having been prepared, both the master cast and the baseplate are positiond on an instrument known as an articulator, an adjustable device which simultes the movement and relative positions of a patient's jaws. The articulator is adjusted to simulate a given patient's jaw movement by utilizing wax impressions, known as registrations or records, taken in a patient's mouth by the dentist to enable such adjustment to be made in the laboratory. It is when the cast and baseplate are positioned upon this instrument that the individual teeth are fitted to the trial baseplate in accordance with well known techniques. When all of the teeth have been fitted to the trial baseplate, a trial denture results. And, when the dentist and the technician have become satisfied that the trial denture has been properly constructed and aligned for fit and bite, the trial denture is sealed to the master cast with additional wax in a step commonly known as waxing-up.

The master cast is then invested in the lower half of a metal flask, a frame designed for that purpose, by placing the master cast in the flask and filling the flask with plaster of Paris unitl the entire lower portion of the master cast becomes surrounded with and embedded in the plaster. The trial denture and additional wax remain free of the investing medium.

When the plaster has set, the wax portion of the trial denture and the plaster of Paris itself is tinfoiled, that is covered with a very thin layer of tinfoil or a well known substitute therefor. At least one of the purposes of tinfoiling is to form a mold lining and to prevent the molding material to be described from contacting and sticking to the trial denture and the plaster of Paris. Thus prepared, the lower half of the flask is covered with its mating upper half and the flask is filled with a molding material

such as dental stone or plaster of Paris. When that material has hardened, the flask is immersed in boiling water and the wax of the trial denture and that wax used in the waxing-up step melts while the teeth of the trial denture remain embedded in the hardened molding material now to be referred to as the upper mold. The flask is then opened and the molten wax removed. To insure complete removal of all wax and impurities, the upper mold and the master cast are cleaned with boiling water and detergent. With the wax gone, a space between the master cast (lower mold) and the newly formed upper mold exists. That space will define the shape of the final denture.

The previous tinfoiling step generally provides a lining for the upper mold. Tinfoil or a tinfoil substitute is then conformed to the lower mold. Thus prepared, and having had waste gates or escape grooves provided in the land area of the plaster of Paris investing medium, the mold is ready to be filled with denture resin. Most frequently a heat curable acrylic resin formulation having the consistency of a dough is used. The dough is manually packed into the space between the upper and lower portions of the mold and it is usually the case that at least three trial packings alternated with trail pressings on a denture press are necessary before the mold is finally properly packed. With the trial packings complete the resin is allowed to cure thereby forming the final denture. It is then deflasked, cleaned, polished and made ready for the patient's mouth. Both during curing and during the subsequent removal of the denture from the mold, deflasking, great care must be exercised to avoid excessive pressures or unusual stresses on the mold and its contents.

By following the teachings of this invention generally more accurate, more comfortable dentures are obtained and practitioners are enabled to fabricate dentures more rapidly.

Therefore, it is the principal object of this invention to provide novel methods by which, and novel molds in which, dentures may be fabricated.

It is a further object of this invention to simplify the procedure by which dentures are made and to provide a more accurate method for making them.

It is yet another object of this invention to provide a novel tinfoiling technique.

Still further objects and advantages of this invention will become apparent from the following description and drawings in which:

FIGURE 1 is a cross-sectional view of a mold after boil-out and in which a denture is fabricated according to a method of this invention;

FIGURE 2 is a view of the mold shown in FIGURE 1, and which has been filled with a denture resin;

FIGURE 3 is a cross-sectional view of a mold after boil-out, and in which a denture is to be fabricated according to another method of this invention, and

FIGURE 4 is a view of the mold shown at FIGURE 3, and which has been filled with a denture resin.

Applicants have discovered that silicone rubber can be made to form a very thin film on a denture mold, which film strongly adheres to, but is also readily removable from, when necessary, denture mold surfaces. That film which may be as thin as several mils is vastly superior to known tinfoil substitutes and to tinfoil itself.

The silicone rubber tinfoil substitute formed on the mold surface in accordance with this invention has many necessary and desirable attributes. It forms a continuous film. It is both insoluble in water and water repellent. That is very important because the water absorbed by denture resins in processes using other tinfoiling media has caused the finally formed dentures to warp and craze. That does not occur in accordance with this invention. The film of this invention is totally insoluble in both the

liquid resins and the paste resins commonly used to form the dentures themselves. For that reason it successfully separates the denture resins from the mold surfaces and does not react with those resins to alter the properties of the finally formed denture. Further, the silicone rubber tinfoil substitute tends to produce a denture having a better surface texture. And because it is so easy to apply to a denture mold, the silicone rubber film cuts down dramatically the time necessary to prepare the tinfoil substitute layer. It also enables those of lesser skill to provide a more effective separating medium or tinfoil substitute than is presently possible, all without sacrificing accuracy.

Those combined properties of applicants' improved mold utilizing the silicone rubber tinfoil substitute enable the preparation of dentures with previously unheard of rapidity and with previously unavailable certainty of results.

A method illustrative of this invention is shown at FIGURES 1 and 2 and will be described in connection with the tinfoiling of a lower mold **1** after the boil out. It is after the boil out that tinfoil or a conventional tinfoil substitute in a very thin precise layer is applied to the lower mold surface. It is usually the case that the tinfoil substitute **3** earlier applied to the trial denture remains in contact with the upper mold surface so that it is only the lower mold surface that requires tinfoiling. The purpose of the tinfoil or substitute is to make certain that the denture resin to be introduced into the mold in a later denture forming step is kept separate and apart from the plaster of Paris **4** and dental stone which comprises the master cast **5** and investing medium of the lower mold. The reasons why this is necessary have been alluded to.

In accordance with this invention the master cast **5** and land areas **6** of the lower mold **1** are covered with a very thin uniform layer **7** of a fluid polysiloxane. This may be accomplished by brushing a thin uniform layer of methyl polysiloxane, having a sufficiently low viscosity to facilitate brushing, directly upon the surfaces of the lower mold. Following the application of the methyl polysiloxane, a curing agent comprising a finely divided dispersion of stannous octoate is sprayed against the methyl polysiloxane layer and the methyl polysiloxane allowed to stand for a period of time sufficient to cause it to cure. A suitable curing time is six minutes, although it will be appreciated that the curing time depends upon the thickness of the methyl polysiloxane layer **7** and amount of curing agent used.

While we do not intend to be limited to any particular fluid polysiloxane or catalyst, it might be mentioned that a methyl polysiloxane useful in accordance with this invention is one having a viscosity of about 50,000 centipoises and a specific gravity of 1.13 at 77° F., which has been diluted with silicone oils, toluene and the like to thin it to a proper consistency for brushing. The undiluted methyl polysiloxane and a complementary stannous octoate catalyst are available from Dow Corning Corporation under the designation of "RTV 502." The stannous octoate may be applied by an aerosol spray if desired.

Following the curing period, the lower mold was found to have a thin, as thin as only one to four mils in thickness, water impervious inert film closely conforming to the contour of the lower mold surface. The mold was then ready for use in the preparation of a denture.

The lower mold **1** is then placed in juxtaposition with the upper mold **2** and filled with a denture resin formulation as shown at FIG. 2. A suitable denture resin formulation is an acrylic denture resin consisting of a mixture of finely divided spherical methyl methacrylate polymer of a molecular weight of about 600,000 and a methyl methacrylate monomer solution of a specific gravity of approximately 0.95. The monomer solution contains small amounts of additional materials and curing agents including ethylene dimethyl acrylate and dimethyl paratoluidene, each in an amount equal to about four-tenths volume percent. Three parts of the methyl methacrylate polymer by volume are added to 1 part by volume of the monomer solution and thoroughly mixed.

This fluid self-curing mixture is then poured into the mold and the excess squeezed out by exerting pressure against the two halves of the flask in a flask press. The completely closed flask is then held in the flask press under pressure for approximately two hours during which time the acrylic resin fully cures and the teeth formerly held by the upper mold portion become embedded in the acrylic resin **8**. The denture is recovered by carefully prying open the two halves of the flask at which time the cured denture slips easily out of the mold. The dentures fabricated in a flask in which the silicone rubber film was utilized instead of a conventional tinfoil substitute were found to be of superior texture and of improved accuracy.

In the U.S. patent to R. L. Tencate, No. 3,217,067, issued November 9, 1965, entitled "Process for Forming Dentures," an improved method for forming dentures is described and claimed. Particularly described is a novel denture mold in which a silicone rubber mold element is present. The means whereby that mold element is prepared and the manner in which it is to be used in fabricating a denture described in that application are here incorporated by reference. FIGS. 3 and 4 of this application correspond with FIGS. 3 and 4 of the patent to Tencate 3,217,067, described above. With the exception of the numeral **34** of the Tencate patent, the numerals of that patent are used herein to describe corresponding elements of this invention. The element **34**, of the patent to Tencate 3,217,067, denoted a "tinfoil layer." In the present method, a thin silicone rubber film **35**, to be described below, is used in lieu of the tinfoil layer **34** of that patent. Suffice it to say, at this point, that the silicone rubber mold element **26** is finally formed immediately before the boil out, for it is the waxed-up trial denture configuration that the silicone rubber mold element is intended to reproduce.

To prepare an all-silicone denture mold in accordance with this invention, an upper mold **13** is first made in accordance with U.S. patent to R. L. Tencate No. 3,217,067, issued November 9, 1965, entitled "Process for Forming Dentures." After that has been prepared, and after the boil out, the silicone rubber film tinfoil substitute **35** of this invention is applied to the master cast **12** and lower mold **11** instead of tinfoil itself or a conventional tinfoil substitute. Applicants' novel silicone rubber tinfoil substitute is then applied by brushing a thin uniform layer of methyl polysiloxane over the master cast and land areas of the lower mold. Then a finely divided layer of stannous octoate is sprayed against the methyl polysiloxane layer and the methyl polysiloxane allowed to stand for a period of time sufficient to cure the methyl polysiloxane. Enough stannous octoate is used to complete curing in about six minutes. However by varying the amount of catalyst used and thickness of the methyl polysiloxane layer the cure time may be varied.

When the methyl polysiloxane has been allowed to cure, the lower mold will have a thin silicone rubber film **35** which serves as a superior tinfoil substitute.

Therefore in accordance with another embodiment of this invention, an all silicone rubber denture mold may be formed, the upper mold portion **13** being fabricated in accordance with the procedures described in the above-described patent to Tencate and the lower mold portion **11** being provided with a silicone rubber tinfoil substitute layer **35** in accordance with the methods described herein. Such a mold facilitates the fabrication of a denture **30** having superior texture and improved accuracy.

While we have described only several embodiments of our invention, it will become apparent to those of ordinary skill in the art from the foregoing description that minor changes may be made without departing from the spirit or scope of the invention. As such we intend to be limited only insofar as the appended claims may make it necessary.

We claim:

1. The method of fabricating a denture in a mold comprising the steps of preparing a master cast, forming a trial denture on said master cast, said trial denture including gingival and palate portions and one or more teeth, removably adhering said trial denture to said master cast, and investing said master cast to form a first mold portion, forming a second mold portion over said trial denture and cooperatively with said first mold portion, separating said second mold portion from said first mold portion and removing all of said gingival and palate portions of said trial denture from each mold portion, applying a thin film of a curable methyl polysiloxane to at least one of said first and second mold portions, applying a curing agent to said thin film to cure said methyl polysiloxane, assembling said first and second mold portions, filling said mold with a denture resin and curing said denture resin therein.

2. The method of fabricating a denture in a mold comprising the steps of preparing a master cast, forming a trial denture on said master cast, said trial denture including gingival and palate portions and one or more teeth, removably adhering said trial denture to said master cast and investing said master cast to form a first mold portion, tin-foiling the exposed surfaces of said gingival and palate portions, forming a second mold portion over said trial denture and cooperatively with said first mold portion, separating said second mold portion from said first mold portion and removing all of said gingival and palate portions of said trial denture from each mold portion, applying a thin film of a curable methyl polysiloxane to said first mold portion, applying a curing agent to said thin film to cure said methyl polysiloxane, assembling said first and said second mold portions, filling said mold with denture resin therein.

3. The method of fabricating a denture in a mold comprising the steps of preparing a master cast, forming a trial denture on said master cast, said trial denture including said gingival and palate portions and one or more teeth, removably adhering said trial denture to said master cast to form a first mold portion, casting a silicone rubber second mold portion over said trial denture and cooperatively with said first mold portion, separating said second mold portion from said first mold portion and removing all of said gingival and palate portions of said trial denture from each mold portion, applying a thin film of a curable methyl polysiloxane to said first mold portion, applying a curing agent to said thin film to cure said methyl polysiloxane, assembling said first and second mold portions, filling said mold with a denture resin and curing said denture resin therein.

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