Aug. 18, 1959 C. C. SMITH 2,899,712

METHOD OF CONSTRUCTING DENTURES

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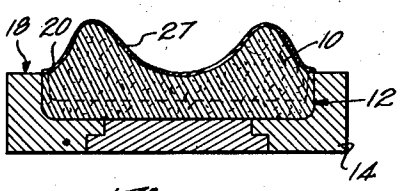


Fig. 1.

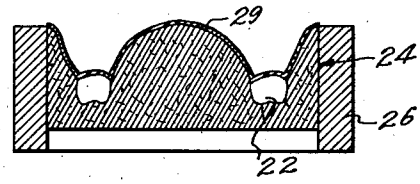
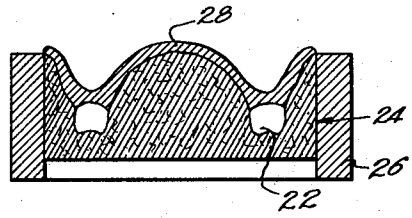


Fig. 2.

Fig. 3.



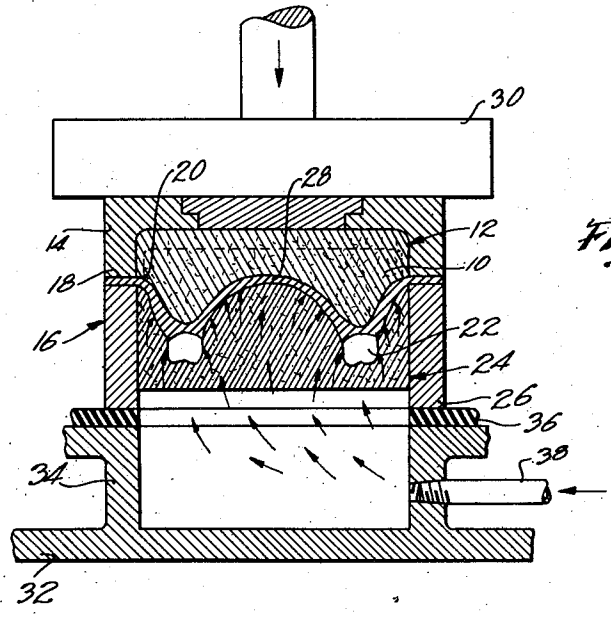


Fig. 4.

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METHOD OF CONSTRUCTING DENTURES

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5 Claims. (Cl. 18—55.1)

This invention relates to prosthetic dentistry and more particularly to the manufacture of partial or complete dentures, the primary object being to alleviate problems incident to volumetric shrinkage resulting especially from employment of modern-day denture materials and making it virtually impossible to produce a well fitting appliance by commonly employed methods.

To a large extent, the dough from which dentures are universally made, consists wholly or in part of acrylic resin and during the curing of the dentures, such dough undergoes an appreciable volumetric shrinkage. Manifestly, such shrinkage occurs during polymerization and following the condensation thereof into a relatively hard solid structure.

By virtue of such shrinkage therefore, it is virtually impossible to expect that the finished appliance will conform in any accurate sense to the shape and configuration of the cast from which it is made and, therefore, cannot possibly fit the mouth of the user with any degree of accuracy. Such shrinkage occurs in virtually all directions, i.e., in thickness, length and breadth. Usually the denture is too narrow from ridge to ridge across the posterior and there is a notable linear shrinkage from the anterior to the posterior. However, the most notable error consists of a space between the denture and the cast, not only in the palate of the denture, but at the crest of the ridge due not only to the pulling away of the denture plate material from the cast, but from warpage by virtue of the fact that the volumetric shrinkage is permitted to take place uninhibited through conventional techniques.

It is the most important object of the present invention, therefore, to provide a method of manufacturing artificial dentures which contemplates the control of such volumetric shrinkage so as to reduce, if not eliminate, the extent of variance in the shape and dimensions of the denture plate material with respect to the cast or positive dental model from which the denture is made.

Another important object of the instant invention is to provide a method of manufacturing artificial dentures that includes as one of the essential steps, the maintenance of pressure upon the denture plate material while the same is cured so as to hold it firmly against the positive pattern and thereby cause the same to accurately take on the shape and configuration of such pattern.

Another object of this invention is to provide in a method of manufacturing artificial dentures, a novel step which contemplates differential pressures on opposite sides of the denture plate material during curing thereof so that the same is caused to assume the shape and configuration of the cast and to maintain such shape and configuration throughout the time the same condenses into a hard solid denture with the result that the latter accurately fits the mouth of the user and engages the tissues uniformly throughout the palate, gum area and the ridge crest.

A further object of the present invention is to provide a method of the aforementioned character that takes

advantage of the inherent porosity of investing materials used in the molding flask for passage of fluid pressure to the denture plate material during polymerization, whereby such pressure controls the direction of volumetric shrinkage as and for the purposes aforementioned.

A still further object of the instant invention is to provide a method of making artificial dentures having for its primary object the improvement of proper fit by sealing one of the mold sections within the flask from the other mold section with material impermeable to the passage of the fluid pressure medium so that there is a pressure differential within the flask which will continue until the denture plate material is firmly set and ready for removal from the positive cast.

Other objects include more detailed procedure in carrying out the aforementioned primary objects and which include the utilization of the denture base material itself as a sealing medium between the flask sections and the mold sections; the way in which there is presented a space between land areas formed on the mold sections and between proximal edges of the flask sections into which the denture base material may flash; the manner of providing such spaces through a waxing procedure constituting one of the steps of the method; the way in which the mold sections and the flask sections are held against separation during curing of the acrylic resin or the like by pressure imparted thereto that is greater than the fluid pressure that is directed to the denture; and many other important steps in the method which will be made clear as the following specification progresses.

In the drawing:

Figure 1 is a cross-sectional view through a flask section and a mold section showing a separating medium applied as contemplated by the first step of the method.

Fig. 2 is a cross-sectional view through another flask section and mold section showing the separating medium applied according to said first step. Fig. 3 is a cross section similar to Fig. 2 showing the denture material packed in place pursuant to the second step of the method; and Fig. 4 is a cross-sectional view showing the step of compression of the flask sections as well as the steps of applying and maintaining fluid pressure.

Those skilled in this art are familiar with the initial steps commonly employed in the manufacture of artificial dental appliances, and while the method of the instant invention will be hereinafter outlined in accordance with the procedures to be employed for the manufacture of complete dentures, it is understood that the principles thereof apply equally well to the production of partial dentures and other types of artificial restoration.

Accordingly, in the usual manner, a negative impression of the user's mouth will be taken from which is produced a positive model, pattern or cast and which cast is designated by the numeral **10** in Figs. 1 and 4 of the drawing.

Any suitable material such as wax may be used in the shaping of a base plate (not shown) over the cast **10** whereupon artificial teeth are mounted on such base plate in the usual manner. Normally, the dentist will then adjust the teeth within the base plate by a trial fit within the mouth of the user and thereupon the permanent denture can be produced according to the steps about to be outlined.

The said base plate is then attached to the cast **10** in the usual manner through use of a removable substance such as wax and the cast **10** is invested within a suitable casting material presenting a mold section **12** within one section **14** of a flask broadly designated by the numeral **16**. If desired, the last mentioned casting

step may precede the waxing of the base plate to the cast **10**.

After the investment forming the molding section **12** has hardened, edge **18** of flask section **14**, as well as land area **20** of investment **12** adjacent the edge **18** and adjacent the base plate, are covered with a removable substance such as wax. The base plate, together with artificial teeth **22**, are then invested within a casting material presenting a second mold section **24** within flask section **26**.

Following the hardening of the investment forming the mold section **24**, the two sections **14** and **26** of flask **16**, as well as the two mold sections **12** and **24**, are separated and all of the wax forming the base plate, as well as the wax that was placed along land area **20** and edge **18**, are removed, leaving cast **10** in its initial condition and leaving the teeth **22** firmly embedded within the mold section **24**.

It is advisable to thereupon coat the mold sections **12** and **24** with a conventional separating medium to facilitate removal of the completed denture, such coatings being shown in Figs. 1 and 2 and designated by the numerals **27** and **29** respectively. Thereupon, as shown in Fig. 3, the mold section **24** is packed with a polymeric denture base material **28** completely covering the teeth **22** partially embedded within the investment forming the mold section **24**, following which the flask sections **14** and **26** and the mold sections **12** and **24**, are reassembled in the manner illustrated in Fig. 4 and compressed tightly together in any suitable manner so as to cause the denture base material to not only distribute evenly over the cast **10**, but to flash outwardly between the mold sections **12** and **24** and between the edges of the flask sections **14** and **26**. For clearness, coatings **27** and **29** have been omitted from Figs. 3 and 4.

In the apparatus chosen for illustration in Figure 4, head **30** of a conventional press, rests directly upon the flask section **14** and the flask section **26** is retained by a stationary plate **32** having an upstanding tubular portion **34**.

It is to be noted that one end of the flask section **26** registers directly with the tubular portion **34** and is sealed with respect thereto through use of a gasket **36**. The fact that the denture base material flashes outwardly from the cast **10** therearound and between the mold sections **12** and **24**, as well as between the flask sections **14** and **26**, presents a seal and inasmuch as such material is impermeable to the flow of most fluids, it is possible to produce a pressure differential on opposite sides of the denture **28**. Any suitable fluid medium such as air, water or nitrogen by way of example only, may be directed into the tubular portion **34** by way of supply pipe **38** coupled therewith.

It is to be pointed out that most casting materials commonly employed for investment purposes, are sufficiently porous in nature when hard, to permit passage of the fluid medium therethrough so that it impinges directly upon the teeth **22**, as well as the denture material **28** in the manner illustrated by arrows in Fig. 4 of the drawing. Manifestly, the pressure exerted upon the flask **16** by the head **30**, must be greater than the pressure of the fluid medium chosen to carry out the principles of the method to positively prevent any separation of the flask sections **14** and **26** and the mold sections **12** and **24**. Thus, as the pressure differential is produced, the denture base material **28** will be forced firmly against the cast **10** into conformity with the shape and configuration thereof, and such pressure should be maintained throughout the polymerization or curing of the material from which the denture **28** is made. Such maintenance of pressure upon the denture **28** controls the direction of volumetric shrinkage so that at the completion of the curing step (which incidentally may or may not be carried out in the presence of heat, depending upon the nature of the plastic material employed in producing the denture **28**) denture **28** will have remained in firm engagement with the cast **10** throughout its entire effective area. It is to be particularly noted that when the permanent completed denture is removed, it may be again placed upon the cast **10** and unlike dentures made in accordance with the conventional methods, it will fit the cast **10** perfectly and particularly there will be no gap or space along the palate thereof.

From the foregoing it is evident that no attempt is made to prevent volumetric shrinkage because such shrinkage must take place in order for the dough to condense into a hard solid. Instead, the direction of volumetric shrinkage is controlled and as the same takes place, the denture base material is not permitted to pull away from the cast **10** at any point, forcing the same to harden or cure precisely according to the shape and configuration of the cast upon which it is polymerized.

It is now evident that the nature of the material from which the cast **10** is made and the material used to invest such cast is of no consequence to the method as above described. Such materials may well be solid and impermeable to flow of fluids therethrough for the fluid pressure acting on the denture material **28** will normally hold the latter firmly against the cast during polymerization. However, it is preferred that the same be porous since there will be no tendency for bubbles forming between the denture and the cast, preventing the denture from bearing accurately and flatly against the cast. Fluids forming the bubbles will be readily forced through the porous materials forming the cast and the investment in which it is mounted.

Furthermore, if such materials are sufficiently porous to permit passage of fluids, the denture may be held firmly against the cast by reducing the pressure within flask section **14** rather than raising the pressure in flask section **26**. Still further, good results can be attained by exerting pressure within section **26** while simultaneously reducing the pressure or applying a vacuum in section **14**. The porosity of the materials lends the same to attainment of the pressure differentials above referred to and is therefore, to be preferred to use of solid materials.

It may be said that the denture material, together with the boundary therearound which flashes to a point where it is even forced slightly between the flask sections, presents an impermeable membrane or diaphragm which can be termed a separator or divider for making it possible to carry out the principal object of the invention, i.e., control of volumetric shrinkage as aforesaid.

In this respect therefore, it is unnecessary that such divider be made entirely from the denture material. Instead, prior to packing with the polymeric resin, the area between the mold sections may be coated with a shellac or other material capable of blocking flow of material. Thereupon, packing may be carried out in a conventional manner by successive steps of trial and removal until the correct amount of denture material has filled the space previously occupied by the base plate.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. A process for producing artificial dentures comprising the steps of placing a divider between a pair of mold sections, said divider being substantially impermeable to flow of fluid therethrough, one of said sections including an internal first denture cast and the other section having an internal second denture cast of porous substance, at least a portion of said divider being of uncured synthetic resin denture material and disposed between normally opposed segments of said casts; compressing the mold sections together under sufficient pressure to force said segments of the casts into firm engagement with said material; effecting a fluid pressure through the substance defining said second cast of not greater force than said compression pressure; and maintaining said compression and fluid pressures during polymeriza-

tion and curing of the synthetic resin material to control the direction of volumetric shrinkage thereof and force the same into conformity with the configuration of said segment of the first cast.

2. A process for producing artificial dentures comprising the steps of placing a divider of uncured synthetic resin denture material between a pair of mold sections, said divider being substantially impermeable to flow of fluids therethrough, one of said sections including an internal first denture cast and the other section having an internal second denture cast of porous substance, at least a portion of said divider being disposed between normally opposed segments of said casts; compressing the mold sections together under sufficient pressure to force said segments of the casts into firm engagement with said material; effecting a fluid pressure through the substance defining said second cast of not greater force than said compression pressure; and maintaining said compression and fluid pressures during polymerization and curing of the synthetic resin material to control the direction of volumetric shrinkage thereof and force the same into conformity with the configuration of said segment of the first cast.

3. A process for producing artificial dentures comprising the steps of packing a quantity of uncured synthetic resin denture material between a pair of mold sections one of said sections including a peripheral edge surrounding an internal first denture cast and the other section having a peripheral edge surrounding an internal second denture cast of porous substance, at least a portion of said material being disposed between normally opposed segments of said cast; compressing the mold sections together under sufficient pressure to squeeze a portion of the material into the space between opposed peripheral edges of the sections and force said segments into firm engagement with said material, the latter presenting a divider between the sections, substantially impermeable to flow of fluid therethrough; effecting a fluid pressure through the substance defining said second cast of not greater force than said compression pressure; and maintaining said compression and fluid pressure during polymerization and curing of the synthetic resin material to control the direction of volumetric shrinkage thereof and force the same into conformity with the configuration of said segment of the first cast.

4. A process as set forth in claim 3 wherein said segments of the first and second denture casts and said peripheral edges of the mold sections are coated with a separating medium prior to packing of the material into said sections.

5. A process as set forth in claim 3 wherein said material is an acrylic resin.

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