The Detailed Technique for Making Dental Restorations on Artificial Stone Models.

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It is essential to a clear understanding of what is to follow, that you have distinctly in mind certain facts regarding the behavior of gold and all metals when cooling, which facts very largely modify our results, though not usually understood.

The facts are, first: That when pure gold is melted and allowed to cool, either rapidly or slowly, without pressure, it will contract 22.5 thousandths of its diameter in all directions, which is two and two-tenths per cent. The alloys of gold that we use contract nearly the same extent.

Second: This contraction is most rapid near the melting or freezing point.

Third: For considerable distance in temperature below the freezing point the metals and their alloys (varying according to the formulae) yield to pressure.

Fourth: The total contraction of a definite part of a cooling mass of any metal or alloy can be materially and definitely lessened by the application of pressure to another part of the same cooling mass. This causes most of the contraction to occur in one place where not objectionable. As the contraction takes place the mass is moved by

the pressure at a certain point to replace the shrinkage taking place elsewhere, but this can only occur so long as the pressure is greater than the resisting strength of the mass, which for available pressure for our use is only a few hundred degrees. By this means we can, with one-fiftieth of an ounce actual pressure, reduce the total contraction in part of a mass of pure gold from 22.5 thousandths to 20.5 thousandths, and with one-tenth ounce reduce it to 18 thousandths. With three pounds we may reduce it to 14 thousandths, and with five and a half pounds to 13 thousandths. Remember that the actual pressure is not represented by the surface pressure per square inch of a gas pressing upon it. For a further discussion of the technical and physical phase of the subject, see articles in the May and June numbers of the ITEMS OF INTEREST, by the writer.

Correction of Contraction of Gold.

This is nearly the limit of correction we can hope to make by this particular method, and though it is a great deal, it is only about one-third of the total. Neither the shrinkage of 14 thousandths nor the total of 22.5 thousandths will be very noticeable to the ordinary observer if the restoration is to fill a small inside dimension with a nearly round plug, as an occlusal inlay, but if it is to fit an outside dimension, as around a root or tooth, and is a strong metal that will not stretch, it will be very noticeable, for it will not go on without enlarging. All who have cast bases for porcelain teeth and cap abutments for roots know this, and it is because pure gold will stretch easily that they prefer it for that purpose.

The other methods for correcting this contraction are by modifying the alloy to have a minimum contraction (in which little has yet been done, but no doubt will be), and by either enlarging the mold so that the cast will be the correct size when contracted, or by holding the metal, compelling it to stretch when cooling, or both. The former can be accomplished by expanding a mold into which the cast will be made, and the latter only where the metal can be confined over a very strong form, as a ring around a very hard core.

The expansion of the mold has been accomplished to a certain, but not a sufficient extent, by heating an investment material, forming a mold and casting into it when hot. The best of these (see articles referred to) only allow of an expansion by this method of six or eight thousandths and most investment materials very much less, if not an actual contraction, on heating, and this class of material on heating, being chiefly silica and plaster has so little resistance or strength that it is easily distorted by high pressure, absolutely limiting the use of the first-named method for preventing the contraction, viz., by making

high pressure on another part of the cooling mass, for they yield, producing beads and distortions on the surfaces, which, if on the cavity surfaces of the inlay, spoil it. The ideal conditions demand, then, that into the mold into which we cast, all surfaces that are to make contact with cavity walls and margins be so hard and strong that they will allow of high pressure without yielding, and should expand either when heated or upon setting, or both to increase its dimensions uniformly about 15 thousandths, which is one and one-half per cent. When casting upon this with an actual pressure of about two and one-half pounds we will have a cast within about one thousandth of the dimensions of the original.

A centrifugal casting machine, revolving five times per second in a circle of a diameter of ten inches, and with one-half ounce of molten gold, produces an actual pressure of almost one-half pound in the mold, one-eighth inch cross section situated at end of gate. At ten times per second, 2.14 pounds, and at twenty times per second, 8.56 pounds. An air or gas pressure casting machine, with sixteen pounds pressure per square inch on the sprue, produces something less than one-quarter of a pound pressure in a mold one-eighth inch cross section, situated at the end of the sprue or gate; at thirty-two pounds air pressure, about one-half pound, and at sixty-four pounds pressure, about one pound, not allowing for leakage of pressure past metal.

Effects of Contraction.

The percentage of contraction it will be of advantage to correct depends upon the size of the piece and where it is to go. A simple occlusal cavity with tapering walls and rounded margins over which a blunt knife edge of gold extends, can have the inlay cast with its full 22 thousandths contraction or much more and do no harm, for by grinding the seat a little it only goes in the cavity enough farther to make an apparently perfect adaptation. If, however, the restoration is a mesial and distal filling, united into one piece through the occlusal surface, the contraction will prevent its going to place and to force it means simply to spread it out at the gingival margins, like spreading a horseshoe. It can not be corrected by grinding, for that would require grinding not only the surfaces making contact with the pulpal walls, but all the margins of both the mesial and distal cavities. These laws of contraction are constant and so are their effects: no matter what methods we use they must be compensated for, and unless our ideals are high, we will not always see them in inlay work. In bridge work, because of the length of the piece, the cooling contraction not only makes the piece too short to reach the abutments, thereby throwing one of them out of register, but, if the attachment encloses the foundation as a

ferule for a root, its decreased diameter will not allow it to go over. The bridge will also be too short at the surface making contact with the gum tissue. For this reason it has been necessary to assemble bridges in sections.

Another and very desirable quality in the material on which we construct our work is a strength and density that will permit us to assemble and finish our work as though it were in place in the mouth, but without the inconvenience of the surrounding parts in our way. I believe all of these advantages are provided in this artificial stone model material and method, as we will demonstrate.

Price's Artificial Stone.

Being a silicate cement it is manipulated precisely as they all are. It should be mixed with a large stiff spatula, as large as a dinner knife, made preferably of German silver, and the powder worked very thoroughly into the phosphoric acid in small portions at a time. It sets in a short time, but can be hardened quickly by heating. It is made in different qualities for different purposes. That for record or display models, white and very hard and with a minimum of expansion or contraction. For inlay models, hard and strong enough to polish upon, but can be broken up to remove the inlays. This is made with different degrees of setting expansion (as strange as this may seem for a silicate cement) for different uses, as will be demonstrated and explained later, and a grade with a slight contraction for modifying the others. After setting, they should each be baked to a dull red to harden. It has been a great gratification to be able to develop a fixed expansion in a cold model after being baked to a temperature of 2000 degrees of eight and ten and even twenty thousandths. When red-hot this expansion is about twenty-seven thousandths. This is especially important since the silicate cements on the market all have a large contraction, generally from twenty-five to forty-five thousandths, on setting before being heated, and much more after heating. The most extreme heat of a gas and air blowpipe does not injure the artificial stone, which fact makes it available for fusing gold and platinum alloys and porcelain upon it. Experience has shown that with careful and skilful handling it can be placed into very complex impressions without requiring the hydraulic press previously suggested.

It is applicable for the construction and finishing of gold inlays, for gold and platinum inlays, combination gold and platinum and porcelain inlays, porcelain inlays, all porcelain crowns, gold base porcelain crowns, bridge abutments, bridges, removable bridges, gold plates, swaged or cast aluminum plates, orthodontia appliances and retainers and in rubber work.

Cavity Preparation for Inlays.

We will observe in some detail its use in gold inlay work. Space will not permit of a detailed discussion of the proper technique for forming cavities, except to emphasize that the same rules that are recognized for malleted fillings, relative to anchorage, must be observed. There must be locking dovetails or anchoring seats sufficient to hold the inlay in place even without cement under any load which it may receive, and the cement is simply the key that locks it. No more cutting or separation is needed for this method than any other inlay method, and an impression can be taken of practically any cavity into which a finished filling can be inserted.

For preparing cavities, the square end and slightly tapering spiral crosscut fissure burs are especially serviceable; also the rapid cutting stones of various shapes, particularly the assortment put up by the Chicago Wheel and Mfg. Co., Chicago, Ill. As for all methods of inlay work, every part of the cavity must draw. If there are undercuts they must be filled with temporary stopping or other suitable material.

There are a few good impression materials, but such compositions as Perfection Impression Compound and Magnifique are not suitable on account of the mineral earths they contain. We require something that will burn off clean as well as take a smooth detail impression. I expect a good material and probably the best so far available will be put on the market with the stone; however, good results will be obtained with White's crown sticky wax, the dark orange color.

The special tray to use for each particular case will depend upon the cavity and will be discussed later, and is very important.

Technique of Making the Stone Model.

The stone model is made in the impression by packing little bits of the mixed stone in the deeper parts of the impression with a small pointed spatula and working it along to positively drive out every bit of air. If necessary, it can be placed at once, or in a few minutes, over a slow heat to hasten the setting and melt off the wax impression, after which it is heated to a dull red heat to harden. As soon as cool enough to handle it is ready to build the inlay in. It is sometimes desirable to take an extra impression and make an extra model of each case for the convenience and advantage in polishing, to show the exact position and shape of the margins. This is an advantage you cannot have when finishing any kind of a filling in the mouth.

A print of the opposing tooth or teeth is taken by having the patient bite into a piece of warmed tough base plate beeswax. The

occlusion is either determined from this by the eye, or by making a stone model in the side opposite the cavity and using this to articulate with the cavity model as will be shown later.

The majority of inlays will be cast directly into the model, but small occlusal or buccal cavities having all walls present can be made more quickly by packing with gold and platinum foil, taking care that it laps on all margins and then flowing pure gold into it. The gold settles into gold like water into a sponge. The filling is then polished on the model as though it were in the tooth.

The other method of procedure is to build into the cavity in the stone model, a filling of wax. Use any good beeswax base plate, transparent preferred. A warm spatula is used and the wax, colorless preferred, is melted and carved to suit. You cannot appreciate, until you have tried both, the difference in making by melting in a dry model outside the mouth a wax filling that is to remain in the model; and making, in a wet cavity, in the mouth a wax filling, which must be removed without distortion. There is simply no comparison in the ease, simplicity and exactness. A headless pin or piece of small wire is heated and inserted into the wax filling, preferably at a point where there is not a contact to be preserved, and this pin placed in the hole in the taper form making the sprue gate and attached with a very little sticky wax, and the whole, model and all, invested in any silica and plaster preparation in a suitable size cup, which preferably is a tube with a removable bottom. After drying out, which forces the wax out by the steam generated behind it, for the wax does not settle into the stone model, nor can it flake off, the whole is heated to expand the mold. Do not be afraid that expansion will make the cavity or mold smaller; it works just the same as heating an iron wagon tire which the blacksmith heats to expand it to place on the wheel, where he allows it to cool and contract to tighten.

The casting of the gold, or gold and platinum, or other alloy desired, can be done by any desired method and with the advantage that it is impossible to distort the cavity surfaces or margins of the inlay by any pressure you can use, and these surfaces will be glossy, smooth as they come from the stone model. If the silica and plaster investment yields at any point it does not change the fit of the piece, for any beads, etc., in that surface are removed in the polishing, which after cutting off the sprue gate you are ready to do. It is always very important to use a high and continued pressure in casting to reduce the shrinkage, provided you have a cavity surface in your mold dense enough to permit it, which the stone does, but which unfortunately the

silica and plaster and similar compounds do not permit. The continued pressure is essential so long as the gold is yielding, but after the gold is cooled too stiff to yield to the pressure used, it will have, no matter who does it, nor what method he use, precisely the contraction that it or any other piece of the same metal will on being heated from normal temperature up to that point, which is approximately one thousandth for every hundred degrees; except only when the gold forms a ring around a solid core or similar confined shape which stretches it.

Advantages of Stone Models.

The advantages in polishing the piece on the stone model reproduction of the tooth cannot possibly be fully appreciated until you have experienced them for yourself. You cannot distort the margins, which you cannot entirely help doing when holding the inlay in your fingers. You cannot, if thoughtful, polish off too much *without knowing it,* for the stone tooth and articulating model show precisely the ideal and essential shape and contours, even better than in the mouth, where, for example, the adjoining tooth and cheek and gums, etc., cannot be removed to give access to the gingival and other margins. This finishing cannot give discomfort by getting hot, as neither you nor the patient is touching it, and the stone model is a poor conductor of heat. It cannot fly from the polishing disk or stone, as when polishing when holding it in your fingers. It is seldom that so high ideals of form could be secured if polished in the mouth, and yet the patient is saved all that discomfort.

The removing of the inlay from the stone model is simple, but requires judgment. Take a pair of wedge cutters or wire cutters, with knife jaws set at about forty-five degrees to the handles, and fracture the tooth, carrying the inlay, from the model after fracturing off the adjoining teeth. Then, without touching the inlay, cross fracture the stone tooth in a direction where it can separate without being locked by the filling. A sharp excavator will fracture and loosen any clinging pieces, and it will remove as clean and bright and smooth as if coming from a metal surface, and bear every scratch or line of the model. If the inlay has been fused in the cavity by the blow pipe method, the contraction being the full extent, the inlay will usually drop out; also if cast with a very low or brief pressure; but if cast with a high sustained pressure it cannot be removed without fracturing the model.

After removal, it is essential or desirable that cross anchorage, grooves or undercuts be ground in the cavity surface in such positions as to allow the cement to lock it into its seat, but, as before stated, the

form of the cavity should be such as not to depend upon the cement for anchorage.

Cementation. In cementing it is not necessary to apply the rubber, which, incidentally, is also seldom necessary for the preparation of the cavity, except such cavities as the sensitiveness requires, the application of cocaine by cataphoresis where high pressure anesthesia of the dentine is not convenient or painful. The writer has found indispensable for setting inlays or bridges in the lower arch a simple instrument that holds both the cheek and tongue away, and a saliva ejector at the same time if desired, giving the effect of two of the Nyman instruments in one.

The setting of inlays in the upper arch can be accomplished in almost any case with a small roll or pad of bibulous paper between the teeth and cheek or lip and the saliva ejector. Have the cement mixed thin or the inlay cannot be inserted entirely to place and proceed at once while the cement is soft, but still dry, to go all around the inlay and burnish all the margins tightly to the tooth, including the gingival, while holding the inlay firmly in place. There is no reason why these margins, if pure gold, cannot be burnished as closely, if the cavity is properly formed, as a malleted filling, and an inlay that shows a cement line at any point is not up to a high ideal easily attained by this method.

I confidently believe, from careful observation and experience, that very much more perfect margins can be secured by this method than by any heretofore suggested. For burnishing the occlusal surface margins a very smooth round steel burnishing bur, rotating in the engine handpiece, is excellent; also exceedingly fine grit stones that will not scratch, followed by oval headed or other hand steel burnishers. The burnisher will harden the surface, which should be done with all gold fillings, malleted or otherwise. A mat surface can be given for a finish, with a fine cuttle-fish disc if desired after the burnisher.

Impression Trays. There are some special trays and special methods desirable for the various cavities. The best trays for simple occlusal cavities having all walls are the fingers or thumb. Take a piece of the hard impression wax suggested, not a beeswax or paraffin wax, large enough to fill the cavity and also cover the entire surfaces of the crown; warm to a yielding stage and shape like a cone or wedge; wipe or blow the excess of moisture from the cavity, and after softening the tip press into the cavity, and after placing the saliva ejector in the mouth throw a stream of cold water on to the impression and chill and remove. This spray should be connected to the cold water supply, and the saliva ejector should have a large capacity, large enough to take water away faster than the

spray supplies it. If the cavity is far back, or on a buccal or gingival surface, the impression cone is more easily handled by warming its base slightly and sticking it to the ball of the finger to carry it to place. Impressions of exceeding exactness can be quickly taken by this simple method.

For cavities on the distal surfaces of third molars and some buccal and gingival cavities very close to, or under, the gingival tissue, the

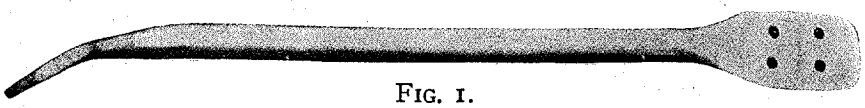

FIG. 1.

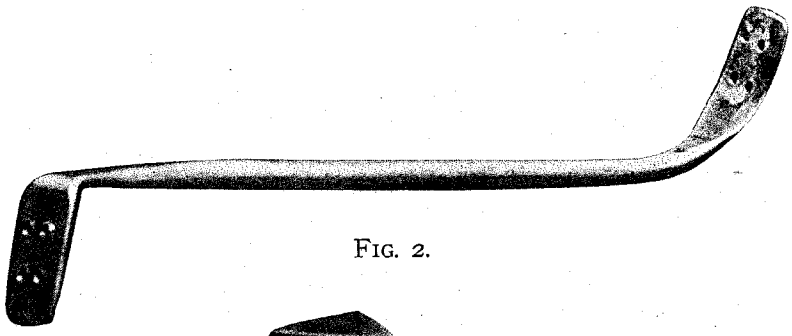

FIG. 2.

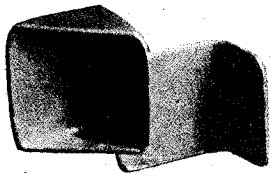

FIG. 3.

wax cone, or wedge, or ball, is attached to a suitably bent bar for a handle with a flattened or spoon shaped end to support the impression material. Figs. Nos. 1 and 2 show a variety of shapes. I have here a number of practical cases to illustrate these various cavities, taken during the last week or ten days. They show generally an impression in the tray, if one was used, a stone model of the case and a finished filling in another stone model of the same case, and the occluding model if one was needed. These will all be inserted at the early visits of the patients on my return, probably all within a week. You will see by the cards that many of them are for children.

Whether these inlays should be cast or fused into the stone models made from these impressions will depend upon the size of the cavity and difficulty of obtaining the contours.

For approximal cavities involving the occlusal surface, but without

a contact with any adjoining tooth, as the disto-occlusal of third molars, or where approximal tooth is absent, the impression material is supported by a tray shaped like the letter L, with or without one or both sides closed. Both are shown in Fig. 3.

For approximal cavities, either one or two adjoining, the technique is slightly more difficult, but no less exact in results. We will first consider one approximal cavity with a normal contact with the adjoining

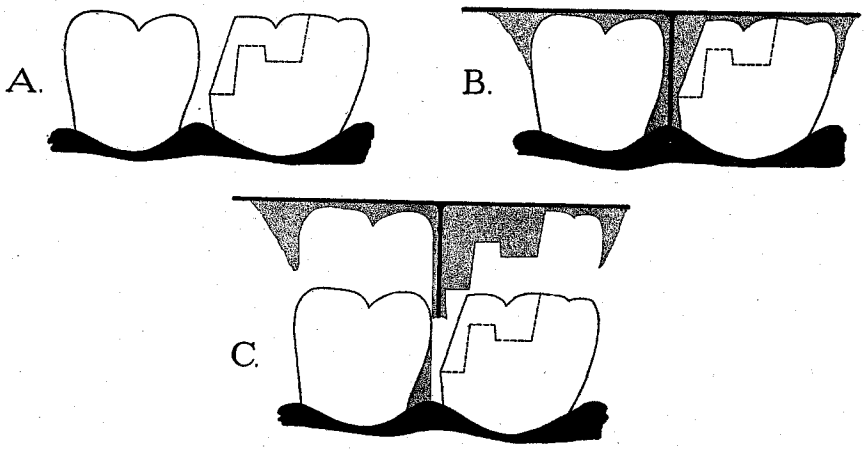

FIG. 4.

tooth. An impression can not be taken of the cavity and the adjoining tooth surfaces without distorting the impression on removal if made by simply pressing the material into this space (see A, Fig. 4), because of the undercut under the contact point of the adjoining tooth. This is overcome by placing a septum on the tray to pass between the teeth (B, Fig. 4), and support the impression material and prevent any distortion on the cavity side of it on withdrawal, while the wax in the undercut below the contact point is drawn off on the removal of the impression without any disadvantage to the impression. (See Fig. C, No. 4; the trays are made with one or both sides enclosed, Figs. 5 and 6.)

After the stone model is made, which reproduces the cavity and the adjoining tooth and its contact point with exactness, the contact point is polished slightly before the gold is cast against it, in order that there may be a little excess gold at that point for polishing, and that there may be a firm pressure at this point when the finished inlay is inserted in the mouth. The wax filling is built into the cavity and the gold cast into it usually before this tooth is removed from

the model, which is done to allow of polishing that surface and the gingival margins, which thereby become easily accessible.

A record of the occlusion having been taken by the bite in a suitable base plate wax, the antagonizing or occluding model made of the stone gives accurately the exact occlusion. A very great advantage of this material for all occluding antagonizing models is the fact that its hardness allows of hard pressure being used or a grinding motion

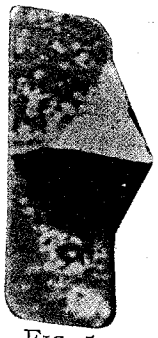

FIG. 5.

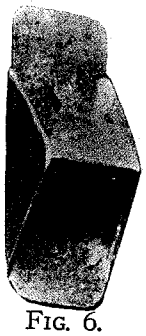

FIG. 6.

applied without danger or possibility of defacing the cusps or surfaces, unlike any material we have heretofore had, except by casting the opposing teeth in metal. This will be a boon to all prosthetic workers, for with it porcelain teeth can, when grinding, be forced to their place in crown, bridge or plate work.

Where there are two approximal cavities the technique for the impression is the same, and in all cases we endeavor to secure exact information of only the surfaces desired, in order not to allow the impression material to extend into undercuts in or between other teeth, its removal from which may distort the cavity impression. In case of two approximal cavities the model is separated by fracturing between the teeth before the wax fillings are built in them, for the purpose of giving free access to the gingival margins for contouring and forming and finishing them in the wax, and to allow of a slight excess being added to the contact points, both for polishing material and for a slight pressure at this point when the fillings are inserted. Our former method was to depend on the placing of the fractured surfaces of the model together to determine when the correct excess of wax had been added to the contact points, but usually too much was added, when only a few thousandths of an inch were needed. I have designed a very simple but efficient and exact instrument for this, which allows the amount of this addition to be determined and gauged with accuracy. (See Fig. 7.) The stone model when made is placed in between the

short, square supporting walls, bounding the flat surface or seat of the instrument and allowed to set. After setting and baking it is fractured through between the teeth that have the approximating cavities and replaced in the instrument. These end walls are now separated a definite distance by means of a micrometer screw. This keeps the teeth in exact relation, except for being separated a few thousandths of an inch, and even after the fillings are cast and polished the stone models with

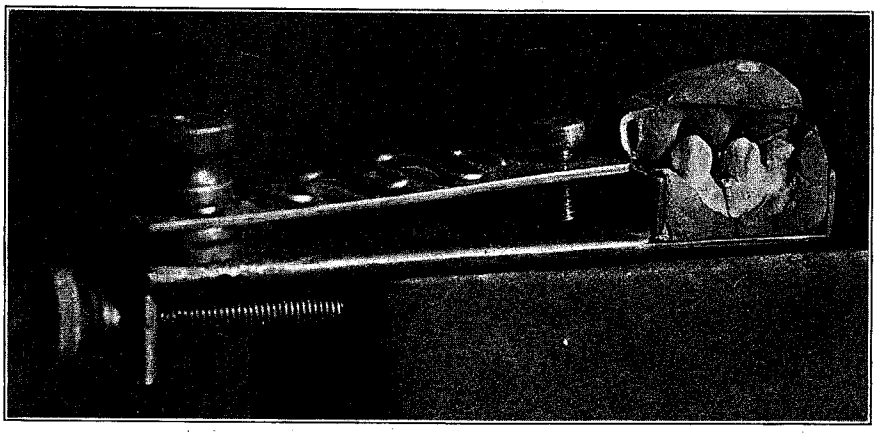

FIG. 7.

the fillings can be placed in it and the exact additional pressure at the contact point measured. This instrument is also arranged to mount the occluding model as an articulator and with all the motions of mastication. One of these instruments, as I show it to you, has the completed fillings for approximal cavities in upper right bicuspids, shown in Fig. 7, and another has the foundation and occlusion models of a lower left third molar badly broken down, but prepared for a large gold inlay. With this instrument, with the articulator attachment, it is possible to get exceedingly accurate contact surfaces of the inlays direct, without grinding in the mouth. On the bottom of this micrometer gauge articulator is a Vernier scale reading directly in thousandths, which always gives to that accuracy the expansion or contraction of the stone model material. I have in this way made the fillings for several adjoining teeth, involving all of the mesial and distal surfaces of the first and second molars, and the distal of the second bicuspid, the mesial and distal fillings united into one filling in each of the molars, and the contact points and occlusion were so perfect on first trial as to need exceedingly little relieving. The restorations for contour occlusion and contact were more perfect than I have ever seen in malleted

fillings, and I believe much more desirable. These cases require great care in the preparation of the cavities to allow all to be taken in one impression, and it is only possible where the teeth stand in quite normal position, and of course where very extensive decay has taken place. The stone model is divided between each of the teeth, so they can be handled as single teeth. I will pass the models, showing a case, before and after, of a nervous girl, age about thirteen years, who has never

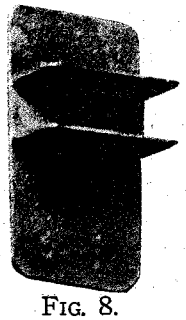

FIG. 8.

FIG. 9.

FIG. 10.

been able to have gold fillings malleted, yet had all these cavities prepared at one sitting, and the impression taken and the inlays all inserted at the next sitting, and she was probably in the office less than one hour for each sitting, and it would have taken several hours by the best operators to have malleted all of them in, to say nothing of the time and discomfort of finishing and polishing them.

We frequently see bicuspids with only the lingual and buccal walls, and, while these are strong, there is danger from malleting against them. These cases are very satisfactorily restored with gold inlays that protect and strengthen these walls and yet are not unsightly. This permits of postponing for a long time the porcelain crown, which requires the destruction also of the pulp. For taking an impression of these cases a tray with two septa is used, which preserves the exactness of the impression of that tooth and gives the contact points accurately. This tray is shown in Fig. 8. One of these septa is also made adjustable (Fig. 9).

Difficult Cases.

Because of the added strength of cemented inlays to frail walls, as compared with malleted fillings, this method is exceedingly well adapted to restoring the incisal angles and edges of the anterior teeth. The tray

I use for taking these is very simple, being a V-shaped piece like a short trough, which supports the impression splendidly. The advantages in contouring and finishing are apparent to any one by inspecting these models with and without the finished inlays. Fig. 10 shows one of the trays. For these restorations I generally use from two to five per cent. of platinum in the gold for greater density and wear. Of course where the gold will be conspicuous or unsightly this method must be modified, which is done by making one of the most satisfactory and esthetic operations I have ever seen, which is to cast the gold and platinum inlay with a cavity in the labial surface which shows, and after polishing the filling on the model, bake into this cavity in the gold and platinum a porcelain inlay to match the shade of the tooth. A very thin wall of gold is left at the edge of the margin of the cavity and undercuts are made in the gold to lock the porcelain. These inlays are very desirable and serviceable; they have all the strength of an all-gold angle, with all the good appearance of an all-porcelain restoration. You can appreciate this from the practical cases being passed. In some cases, where I do not want the gold line to show, I cement the gold inlay with its unfilled cavity in place and take an impression of the cavity and make a porcelain inlay to go into the gold inlay.

I believe these operations will solve the problem of the incisal angles of the anterior teeth, and buccal cusps of bicuspids.

Stone Model in Porcelain Inlay Work.

In some cases where there is no strain on anterior teeth and where the restoration involves a large part of the labial surfaces, as where the enamel is deficient from sickness in early childhood, an all-porcelain restoration may be indicated. The stone model fills a long-felt want for these difficult restorations, which are chiefly troublesome because of the difficulty in securing exact contours and angles.

By adapting over the tooth a sheet of exceedingly thin, soft platinum foil that will adapt with very close accuracy one five-thousandth or less, and placing the impression wax over it and pressing into the cavity, and at the same time taking the adjoining teeth, a model is secured with the platinum in place on which the porcelain is built and molded, baked and ground, and rebaked, with the advantage that all the time, as in the cases of either the gold tip or the combination gold platinum and porcelain tips or angles, the operator has the adjoining teeth in place to show the size, length and contour, etc., and the platinum can not become distorted. The operator has only to refer to the mouth for the shade. These joints are exceedingly close, and the contours the best I have ever been able to make. You will see the advantages from the cases being passed.

Approximal Cavities.

The cavities in the mesial and distal surfaces of cuspids and all the incisors are especially difficult to take impressions of where, as is usually the case, the incisal angle is not gone. These cavities are usually prepared from the lingual surface. The impressions can be taken in platinum foil, first adapted and removed and annealed, and then placed again in the cavity with a hard wax, like sticky wax,

FIG. 11.

FIG. 12.

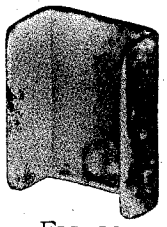

FIG. 13.

in them to support and strengthen. These are chilled and removed and mounted on the stone, and the filling fused or cast into them and polished on the model. Another excellent and, I think, new method, is as follows: A special tray with a thin septum is used and with the impression wax pressed to place the septum protruding through. This gives the lingual and approximal surfaces and the cavity form, but not the labial surfaces, which are secured by replacing the impression and taking a labial impression over the moist protruding septum. After this is chilled the impression removes in two sections, and as you will see from this case with all the steps, the result is very satisfactory. The tray is shown in Fig 11. Figs. 12 and 13 show trays for taking impressions of compound buccal or lingual with occlusal cavities.

Before discussing crowns and bridges I wish to show you some rings, cast from wax rings, made to just pass over this taper column, which has a slope to represent twenty thousandths to the inch. A pure gold ring, fused to this size as accurately as possible, without pressure, lacks more than one inch of passing down to the base. Rings cast in plaster and silica molds and in the best investments on the market, even when heated, will only go to within about three-quarters of an inch of the base, and a ring cast at the same time, in the same cup, but on another branch of the same sprue, with the same size gate, but with the artificial stone placed in it for a hard core to prevent the

contraction by stretching the cooling metal, which the plaster and silica preparations are not strong enough to do, passes to the base of the taper column. They are left attached to the sprue to show that they were cast at the same time, and hence, under precisely the same conditions, except the stone core. I have made them over a stone core with sufficient expansion to allow them to drop freely off the base of the column. The contracting strength of gold is enormous.

Bridge Work.

Those who have done crown and bridge work know how the teeth will not go into the sockets cast for them without grinding the tooth or stretching the socket, which latter was only possible with pure gold, and the band would not go over the root. By placing this artificial stone of an expanding quality in these chambers when casting, the metal is held or stretched on cooling, preserving the dimensions. This is shown by the gold and platinum base porcelain bicuspid crown being passed. The gold base is made by taking the adapted crown, with thin platinum foil over its base to prevent the wax from sticking to it, and with the iridio-platinum post in position in the crown pressing with the warm wax over the pin and base of the crown into place on the root.

After chilling and removing and trimming the tooth is removed and the stone placed in both the tooth seat and the root seat, and after it is hard the wax is polished and invested and cast. These crowns go with exactness to place, as no others have ever done for the essayist.

The entire construction of gold-base porcelain crowns can be accomplished by taking the impression with the two septum trays shown in Figs. 6 and 7, with the post in position in the root when the impression is taken. This, with the occluding model, gives with exactness all the relations for completing the crown, and gives very exact results.