

[54] **METHOD AND MEANS FOR MAKING DENTAL IMPRESSIONS**

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[52] U.S. Cl. **32/17**

[51] Int. Cl. **A61c 9/00**

[58] Field of Search **32/17; 222/413, 326, 327**

[56] **References Cited**

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[57] **ABSTRACT**

A method of impression making for use in dentistry wherein a clear plastic impression tray is stabilized in position in the mouth without any impingement of hard or soft tissue, the impression tray being stabilized and held in the mouth by the patient while the impression material is injected into the stabilized tray by a special injector gun, in such a manner as to produce an impression with neither displacement of the soft tissue, nor entrapment of any air or saliva.

17 Claims, 18 Drawing Figures

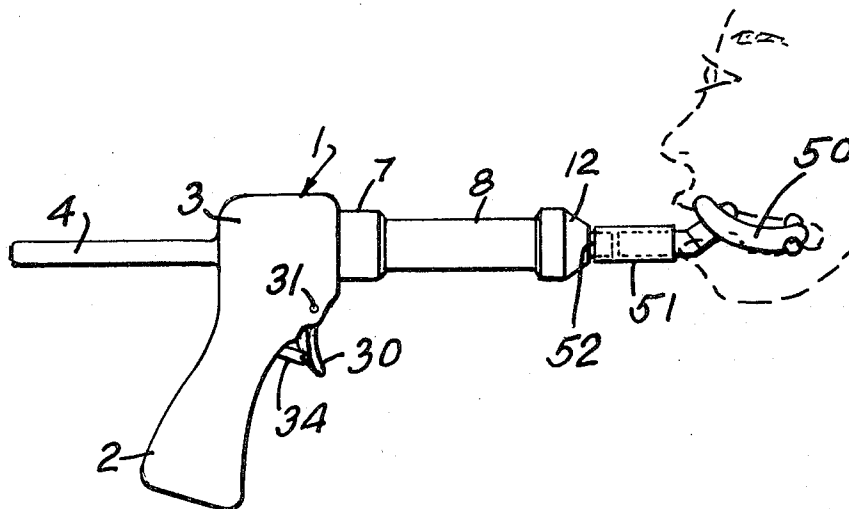


FIG. 1.

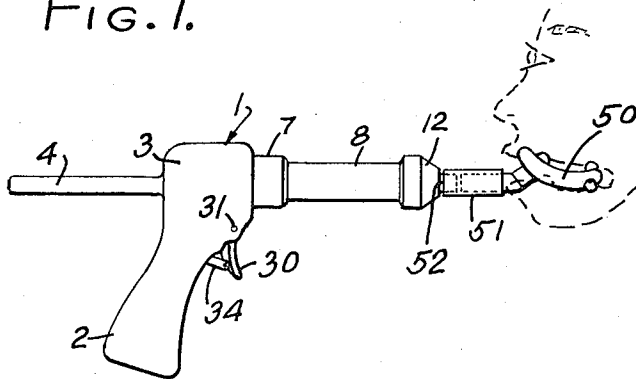


FIG. 2.

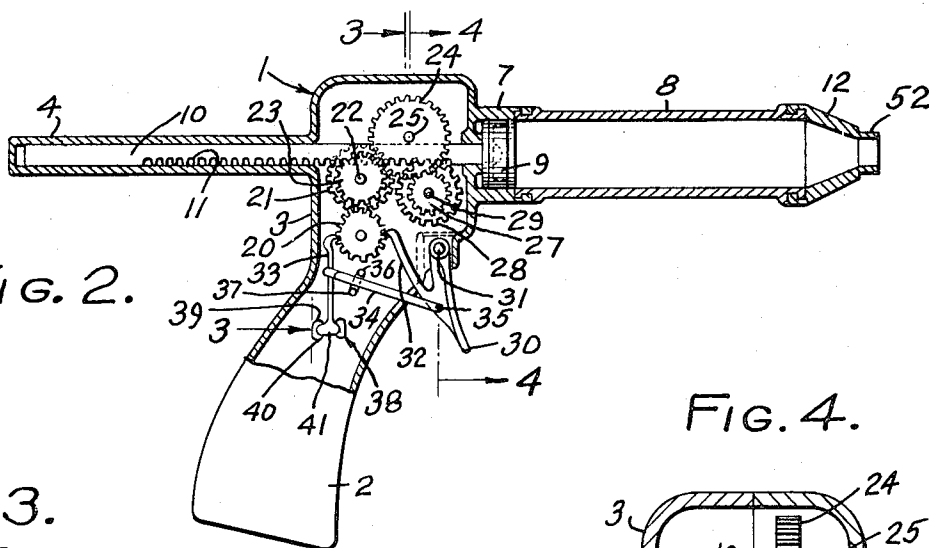


FIG. 3.

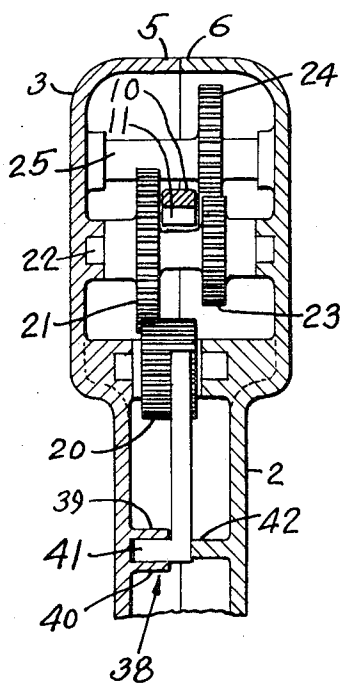


FIG. 4.

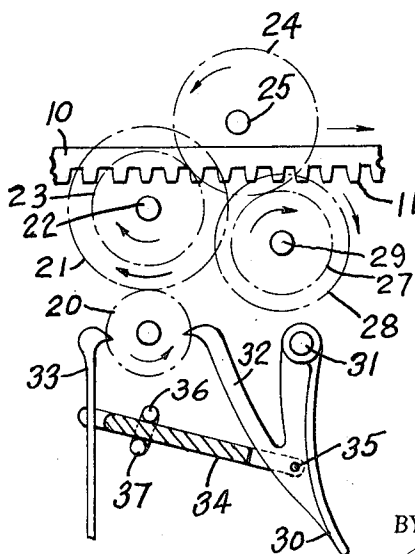
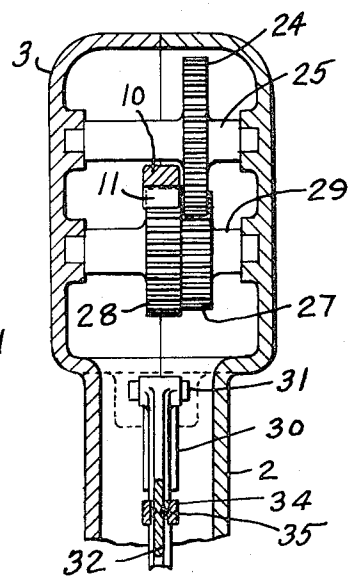


FIG. 5.

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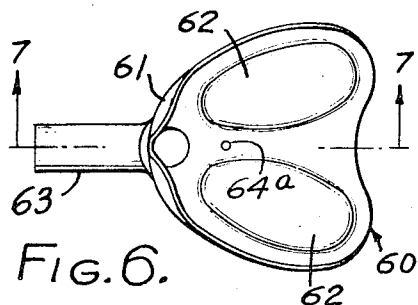


FIG. 6.

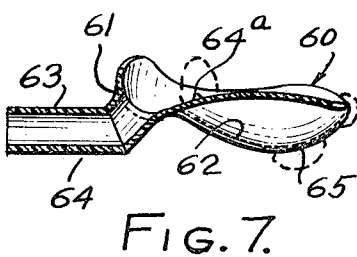


FIG. 7.

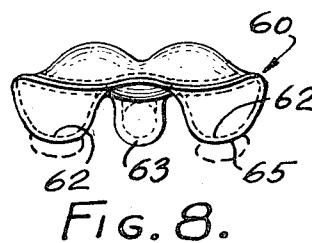


FIG. 8.

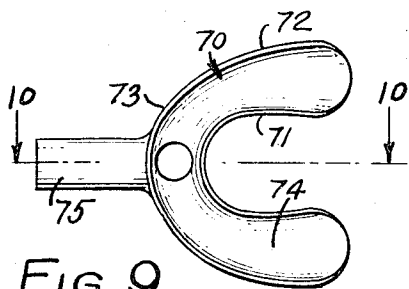


FIG. 9.

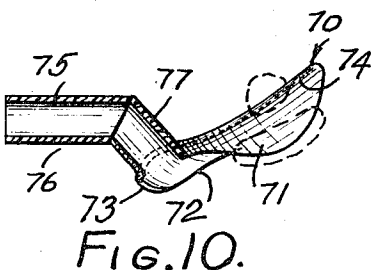


FIG. 10.

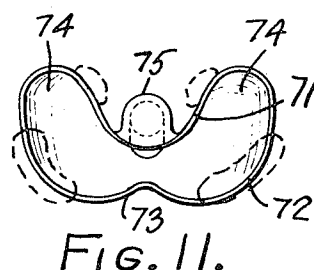


FIG. 11.

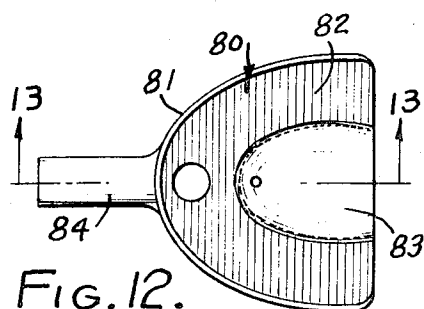


FIG. 12.

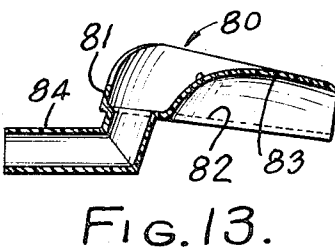


FIG. 13.

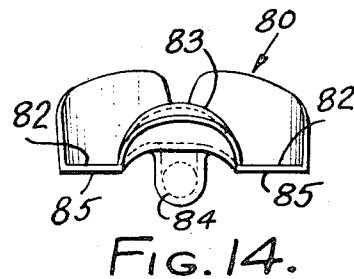


FIG. 14.

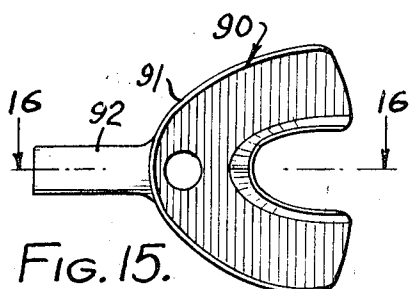


FIG. 15.

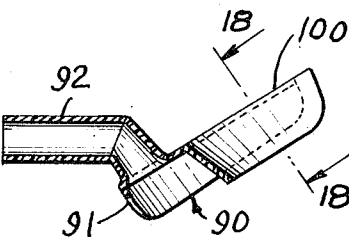


FIG. 16.

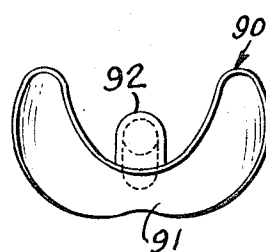


FIG. 17.

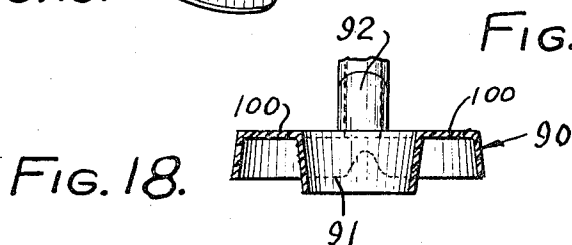


FIG. 18.

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METHOD AND MEANS FOR MAKING DENTAL IMPRESSIONS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention has application to the entire scope of impression making in dentistry. Any time that an accurate cast replica of hard or soft tissues of the mouth is desired, this invention is applicable. The areas involved are those of the science of the materials as well as the scope or field of application of the technique.

2. Description of the Prior Art

The art of impression making as it exists today in dentistry can be described as a procedure that utilizes a device (tray) to carry to the mouth some type of material that has either a chemical or thermal set. The tray is filled with the material, introduced into the mouth, and the desired imprint obtained. There are certain short-comings or difficulties in the usual impression procedures that necessitate many involved steps to try to help prevent the short-comings or errors from occurring. For example: if the desire is to obtain an accurate imprint or impression of the existing teeth to accurately determine the state of the occlusion of examining it outside of the mouth, it becomes necessary to use some method of registering the depths of the crevices of the teeth without trapping air or saliva; otherwise a void will occur in the impression, with a corresponding plus area in the poured study cast.

The two most frequently used techniques for eliminating these defect areas are to either finger wipe the impression material onto the surfaces of the teeth before inserting the filled tray and/or removing the plus areas with a sharp instrument from the hardened poured cast. A preferred, but less used method, is to use a small syringe that has a narrow opening, approximately $\frac{1}{2}$ - 1 mm., and inject the impression material slowly around the teeth and then seat the larger tray filled with a bulk of impression material. The first two techniques are fraught with error and the third is laborious and difficult.

Many other impression procedures frequently used in dentistry today involve a two-visit or two-step procedure. A preliminary impression is obtained first, a cast poured, a custom tray fabricated on the original cast, the custom tray refined in the mouth, and then a final impression obtained in the custom tray. A problem of the custom tray type impression is that it frequently renders an impression that can look perfect but because of the great pressures that may be produced within its closely adapted fit, it can frequently cause distortion of soft tissues when the final impression is registered.

Other attempts have been made to overcome some of these impression problems. Seeger in 1890, U.S. Pat. No. 432,909; Wentzel in 1951, U.S. Pat. No. 2,594,832; Wagner in 1954, U.S. Pat. No. 2,722,744; Brant in 1957, U.S. Pat. No. 2,860,414, and Zandberg in 1961, developed adjustable trays that would more accurately conform to the anatomy of the mouth, thus hoping to eliminate the necessity of a preliminary impression followed by the construction of a custom impression tray for registering the final impression. None of these attempts became popular, as they fell short of their goal.

The technique of Coffey in U.S. Pat. No. 2,458,145 which was issued in 1949, attempted to reduce or eliminate some other impression problems. By injection molding the impression material he hoped to eliminate distortion of the gums. The theory was correct, the devices described, made it fall short of this goal. The shape of the impression trays and the site of attachment of the nipple or injector tube on Coffey's tray, distorted the oral structures. There was no way of being certain that the under surface of the tray, when placed in the mouth was not impinging upon nor displacing soft tissues. Lastly, there was no way of controlling the injecting pressure in Coffey's injecting gun, making it possible to cause not only displacement of soft tissues, but movement of the tray.

SUMMARY

This is a system of impression making for dentistry that, for edentulous mouths combines the advantages of mucostatics with the advantages of fully border molded impressions by recording both peripheral height and thickness as well as an undistorted registration of the bearing area. The same principles apply to dentulous mouths with the added advantages of having a controlled amount of impression material surrounding all teeth; thus eliminating distortion from too thin areas. Both types of impressions yield virtually bubble free reproductions of all tooth and soft tissue anatomic detail.

In order to achieve these results, an empty clear plastic impression tray is stabilized in position and any impingement of hard or soft tissue visualized and eliminated. The impression material is then injected into the stabilized tray by using a special injector gun. This technique and armamentarium gives a superior final impression without the necessity of a preliminary impression and a special custom tray.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation, partly in fragment of a tray of the invention within a patient's mouth and a gun for injecting impression material within the tray;

FIG. 2 is a fragmentary, sectional view on an enlarged scale of the gun shown in FIG. 1;

FIG. 3 is a fragmentary sectional view, on an enlarged scale, taken on the line 3—3 of FIG. 2;

FIG. 4 is a fragmentary, sectional view, on an enlarged scale, taken on the line 4—4 of FIG. 2;

FIG. 5 is a fragmentary enlarged view of mechanism used in moving the piston of the gun shown in FIG. 2;

FIG. 6 is a top plan view of a maxillary tray used in the practice of the invention;

FIG. 7 is a sectional view of the line 7—7 of FIG. 6;

FIG. 8 is a posterior end elevation of the tray shown in FIG. 6;

FIG. 9 is a top plan view of a mandibular tray;

FIG. 10 is a cross sectional view on the line 10—10 of FIG. 9;

FIG. 11 is a posterior end view of the tray of FIG. 9;

FIG. 12 is a top plan view of a maxillary tray;

FIG. 13 is a sectional view on the line 13—13 of FIG. 12;

FIG. 14 is a posterior end view of the tray shown in FIG. 12;

FIG. 15 is a top plan view of a mandibular tray;

FIG. 16 is a sectional view on the line 16—16 of FIG. 15;

FIG. 17 is a posterior end view of the tray shown in FIG. 15; and,

FIG. 18 is a sectional view on the line 18—18 of FIG. 16.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The gun for injecting impression material within a tray will be described first.

The gun 1 shown as an entirety in FIGS. 1 and 2, includes a hand grip, stock, or handle 2 communicating with a casing or housing 3 and a rear casing extension 4 joining with the casing or housing 3. In the present instance the stock, housing or casing is longitudinally split, as shown in FIGS. 3 and 4 to provide two cooperating parts joined together, as shown at 5 and 6. A tubular extension 7 is secured to the housing or casing 3 and this extension receives one end of a tubular barrel or cylinder 8. A plunger or piston 9 is provided with a stem 10 receivable within the extension 4 thus the piston and stem is capable of movement throughout the length of the barrel or cylinder 8 when the stem which is provided with a rack 11 is actuated by a train of gears within the housing or casing 3. The outer end of the cylinder 8 is provided with a conical head 12. The barrel or cylinder 8 is adapted to receive impression material which is to be ejected through the conical head when the piston 9 is moved in one direction. To move the piston and the stem, we provide within the housing or casing 3 suitable gears mounted on axles. Thus referring to FIG. 3, a ratchet 20 meshes with a gear 21 mounted on shaft 22 which also mounts a gear 23. Gear 23 meshes with gear 24 mounted on shaft 25. Gears 27 and 28 are mounted on shaft 29, gear 27 being in mesh with gear 24 while gear 28 meshes with the teeth of the rack 11. With reference to FIG. 3, it will be noted that the rack type stem passes between the spaced gears 21 and 23. The ratched wheel 20 is moved by a trigger as shown best in FIG. 5 wherein the trigger 30 is pivoted at 31 within the housing or casing and the trigger is provided with a hook type pawl 32, the hook end of which engages a tooth of the ratchet wheel 20. A second hook type pawl 33 diametrically engages a tooth of the ratchet wheel 20 and the trigger and the pawl arm 33 are connected by means of a link 34, the link being pivoted at 35 to the trigger and extends between two guide members 36 and 37, the pawl 33 extending freely through an end of the link. Pawl arm 33 is supported within the handle or stock in the manner shown in FIGS. 2 and 3 at 38 which comprises two spaced apart lugs 39 and 40, the end of the pawl arm being bent at 41 for reception between said lugs, there also being a lug at 42 bearing against the pawl arm so as to maintain the portion 41 between the lugs 39 and 40. When the trigger is moved inwardly toward the stock or handle, pawl 32 turns the ratchet wheel a slight amount while the pawl arm 33 is moved from engagement with the teeth of the ratchet wheel by the link 34. In this manner the piston is moved within the barrel progressively, that is to say, it is first moved and then as the trigger is released, there is a pause in the movement of the piston whereupon the piston is again moved when the trigger is moved. This provides what may be

designated as interrupted movement and after the piston has made an excursion within the cylinder, it may be moved from the outer end of the cylinder inwardly to the position shown in FIG. 2 by movement of the trigger toward the stock which releases both pawls from engagement with the ratchet wheel 20. the piston is then returned to the position of FIG. 2 manually. If there is back pressure exerted against the piston greater than 1½ PSI, movement of the trigger will not move the piston but the trigger in its movement will cause the pawls 32 and 33 to release their engagement with the ratchet wheel so that the piston remains stationary.

The trays for which the gun is employed are shown in FIGS. 6 to 18 inclusive and a specimen tray is shown at 50 positioned within the mouth of a patient. This tray, like all of the trays shown in the remaining Figures, is provided with an external tube communicating with the channel portion of the tray and with a tube 51, which tube connects with the outlet end 52 of the conical head for the cylinder or barrel. The barrel 8 holds impression material which is progressively or interruptedly fed from the barrel into the tray as the trigger is moved in one direction followed by relaxation or stoppage of movement as the trigger assumes its forward position, as shown in FIGS. 1 and 2. To recapitulate, the manually driven ratchet wheel 20 meshes with and drives gear 21. Gear 21 is on the same shaft 22 with gear 23 and gear 23 in turn drives gear 24 mounted on shaft 25. As shown in FIG. 5, gear 24 drives gear 27 which is mounted on the same shaft 29 as gear 28 and gear 28 in turn meshes with the teeth of the rack. The gear ratio is such that the plunger moves forwardly approximately 1/16 inch in the barrel with each reciprocation of the trigger.

Reference is now made to sheet 2 and FIGS. 6 to 18 inclusive, which illustrate the tray construction. All of the trays are formed from a crystal clear material and which may be formed from an acrylic resin or from a styrene. FIGS. 6 and 8 inclusive are maxillary and FIGS. 9 to 11 mandibular trays for edentulous jaws. While the trays shown in FIGS. 12 to 18 are maxillary and mandibular for dentulous mouths. The maxillary edentulous tray shown in FIGS. 6, 7 and 8, is designated as 60, the labial flange 61 inclines toward the lingual so as to fit the anterior residual ridge. The flange thusly conforms to the labial vestibule rather than distorting the lip. The tray has large areas 62 over the ridge crest to allow for a non-pressure flow of impression material. The injector tube 63 is attached to the tray over the crest of the anterior residual ridge and is angled in such a way that it does not interfere with the normal relaxed position of the upper lip thus allowing the injector tube 63 to exit from the mouth between the upper and lower lips with no displacement of either lip. The angle of the injector tube 63 is such that when the tray is positioned correctly in the mouth of the patient, the tube is substantially horizontal, as shown at 64 in FIG. 7. As previously pointed out, the injector tube is adapted to be connected to the conical head outlet 52 of the injector gun.

The edentulous mandibular tray shown in FIGS. 9 to 11 inclusive is designated as 70 and as in the case of the tray 60 has an anatomic shape and is provided with a lingual flange 71, a buccal flange 72 and a labial flange 73. Between the flanges aforesaid and connecting the

flanges is an occlusal wall 74. The injector tube 75 is similar in detail to injector tube 63 in that it has substantially a horizontal portion 76 and an angular portion 77 leading to the interior of the tray. It will be observed that the flanges are of relatively long length in the posterior lingual area.

The dentulous maxillary tray of FIGS. 12, 13 and 14, is designated as 80. It will be noted that the inclined labial flange 81 of tray 80 closely follows the normal inclined angle of natural anterior teeth to prevent the incisal edges of the anterior teeth from striking the labial wall of the tray. This tray is formed to have a widened space 82 for the tooth-row provided by the narrower palatal portion 83 of the tray. The injector tube 84 is attached over the anterior teeth section of the tray whereby it does not interfere with the normal relaxed position of the upper lip, thus allowing it to exit from the mouth between the upper and lower lips with no displacement of either lip. This tray, like tray 60, provides platforms 85 for the addition of external stabilizing wax as hereinafter described in the statement of operation.

The mandibular dentulous tray shown in FIGS. 15, 16, 17 and 18 is designated as 90. This tray follows generally the construction of tray 80 in the provision of an inclined labial flange 91 and the method of attachment of the injector tube 92 to the tray. Tray 90 provides a wider buccal-lingual dimension and long length flanges in the posterior lingual area. As shown in FIG. 18 the lingual flange is of greater depth than the buccal flange. Platforms 100 are provided for the addition of external stabilizing wax as hereinafter set forth.

The impression material is characterized in that it has low viscosity and may be a modified alginate, a polysulfide, a silicone rubber or an agar hydrochloride, to name a few. As stated, it should be of low viscosity and the impression material is placed within the gun cylinder or barrel with the piston retracted as shown in FIG. 2. After the tray has been correctly positioned within the mouth of the patient as hereinafter set forth in discussion of the maxillary impression and mandibular impression for both dentulous and edentulous mouths, the trigger of the gun is actuated to cause the piston to move the impression material from the gun into the tray. The gun is designed so that if a back pressure in excess of 1½ PSI is encountered in injecting the impression material from the gun into the tray, the piston will not advance due to slippage of the pawls in the contact with the ratchet wheel 20. There will also be a slippage of the pawls so that the piston does not advance if the trigger of the gun is operated too rapidly to provide a rapid injection of the impression material or if too viscous impression material is used. Thus minimum pressure and interrupted advancement of the piston prevents any pressure from being transmitted to the soft tissues in the mouth and thus an impression can be recorded without displacing any soft tissues. The clear plastic trays enable the dentist to correctly position the trays within the mouth prior to the gun injecting the impression material into the tray. All of the trays described provide ample tissue room for the flow of impression material as well as conforming closely to the anatomic details of the mouth. Furthermore, the interrupted movement of the piston of the gun is effective in removing air from the impression material and

results in an accurate impression which is free from the defects which frequently occur in most impressions.

The technique of operation is as follows:

First a correct size anatomic injector tray is selected for the patient's mandible or maxilla.

The Maxillary Impression:

The maxillary tray is stabilized in position by placing a "pea" sized mound of stabilizing wax over the "stop nub" 64a on the tray in the rugae area. A strip of stabilizing wax is also placed along the distal border of the tray just distal to the vibrating line of the soft palate. A visual check is made intra-orally and any areas of impingement are checked for and eliminated. Palatal impingement is eliminated by either adding a larger amount of stabilizing wax in the rugae area or by selecting a different size tray. Peripheral flange placement should be within three-sixteenths of an inch of the depth of the vestibular fold. This distance must not be observed by pulling the cheeks laterally, but checked without displacing the cheeks. Impingement or over-extension in the peripheral areas is corrected by grinding away the plastic tray. Under-extended areas are modified by the addition of small amounts of stabilizing wax, being certain not to over-extend with the wax.

Enough stabilizing wax is next added to the external surface of the tray that will allow the patient to close into it and stabilize the tray in position in the mouth. This wax is added in the posterior area where the stabilizing wax platforms 65 are located, as the occlusal pressure of the patient must be confined to the posterior strip of wax across the vibrating line, that will then be the only area of soft tissue distorted from rest, when the impression is recorded. The tray is inserted and removed several times, this familiarizes the operator with the tray's exact placement and stabilization position; thus insuring a final placement that is free from impingement when the impression is actually recorded. The tray is removed from the mouth and air dried. An alginate impression adhesive is applied to the inside and peripheral edges of the tray. A special alginate impression material (roughly half again as much water) is mixed and inserted into the injector gun. Any elastic impression material that will have sufficient body to not run out of the tray, once it is filled in the mouth and yet of a viscosity that is low enough so that any back pressure created in the gun can be kept below 1½ pounds PSI, will work in this procedure. The tray is again stabilized in the mouth. The injection rate must be fast enough to get the material into the mouth before gelation begins, but slowly enough to enable the operator to visualize (at the transparent injector tube attached to the tray) a relaxation of impression material flow between each advancement of the piston of the injector gun. The ratchet mechanism of the injector gun, if advanced slowly enough, will cause this very necessary interrupted flow of impression material into the mouth. As mentioned above, this interrupted injection rate can be observed through the clear plastic injector tube of the tray. Three minutes after initial set, the impression is removed from the mouth and poured immediately with an accelerated mix of dental stone.

The Mandibular Impression:

The technique is carried out as described above except that stabilizing wax is placed on both buccal shelf areas only. The external stabilizing wax for the oppos-

ing occlusal stabilization is placed over the same areas where the underlying stabilizing wax has been placed, at the sites of the stabilizing wax platforms.

We claim:

1. Means for making dental impressions including an impression tray adapted for insertion into the mouth of the patient, a low viscosity impression material for application to said impression tray, a gun for holding said impression material detachably engaged with said impression tray, said gun including means for feeding said impression material into said impression tray, and pressure-responsive means carried by said gun in operative engagement with said means for feeding said impression material from said gun to said tray for preventing the flow of impression material into said impression tray upon build-up of a predetermined back pressure against said means for feeding the impression material into the impression tray.

2. The means of claim 1, wherein said impression tray includes a channel portion and a tube at the front of the tray in communication with said channel portion, and said tube includes two portions angularly disposed with respect to each other, one of said portions being angularly connected to said tray, and the other angular portion being engaged by said means for injecting the impression material into the tray, the angular relationships of the angular portions with respect to each other and to the tray being such that when the tray is in position in the mouth, said other angular portion extends from the mouth in a substantially horizontal plane.

3. The means of claim 1 with the addition of means for intra-orally visualizing a space between said tray and the mouth structure to accurately position the tray and avoid impingement of hard or soft mouth tissue.

4. The means of claim 3 wherein said means for intra-orally visualizing the space between the tray and the mouth structure comprises the construction of the tray with a clear translucent material.

5. The means of claim 1 with the addition of wax-like stabilizing means attached to said tray for accurately positioning and maintaining the tray in the mouth.

6. The means of claim 1, wherein the front of the impression tray is at an acute angle with the floor of the tray to give the tray the same contour as the space between the lip and the jaw and not to touch or distort the soft tissue covering the jaw or lip, nor to touch the front teeth.

7. The means of claim 1 wherein the peripheral edge of the tray is contoured to follow the shape of the human mouth without touching the soft tissue.

8. The means of claim 1, wherein said tray has a labial flange that forms an acute angle with the occlusal surface of the tray.

9. The means of claim 1, with the addition of nubs and platforms on said tray, and stabilizing wax attached to said nubs and platforms for accurately positioning and maintaining the tray in the mouth.

10. The means of claim 1, wherein said gun includes a housing, a hand grip connected to said housing, a cylindrical member for holding said impression material, one end of said cylindrical member being connected to said housing and the opposite end thereof being provided with an outlet opening for communication with the tube of said impression tray, a piston movable

through said cylindrical member for moving the impression material towards the outlet opening, a trigger operatively mounted in said hand grip, and actuating means connecting said trigger and piston for advancing the latter in said cylindrical member in response to the operation of the former.

11. The means of claim 10, wherein said actuating means include a rack connected to, and movable with, said piston, a train of gears operatively engaged with said rack, and pawl means operatively engaged with said gear train and trigger for actuating the former upon operation of the latter.

12. The means of claim 11, wherein said pawl means slips upon exertion of a predetermined back pressure on said impression material to prevent the forcing of impression material into said tray under increased pressure of a sufficient degree to cause tissue displacement.

13. Means for making dental impressions including an impression tray, said tray having a channel portion and a tube at the front of the tray in communication with said channel portion, said tray being constructed of a clear, translucent material for intra-orally visualizing a space between said tray and the mouth structure to accurately position the tray and avoid impingement of hard or soft mouth tissue, wax-like stabilizing means positioned on said tray for maintaining the tray in position in the mouth, a low viscosity impression material for application to said impression tray, a gun for holding said impression material detachably engaged with said impression material into said impression tray, and pressure-responsive means carried by said gun in operative engagement with said means for feeding said impression material from said gun to said tray for preventing the flow of impression material into said impression tray upon build-up of a predetermined back pressure against said means for feeding the impression material into the impression tray.

14. The means of claim 13 wherein said gun includes a housing, a hand grip connected to said housing, a cylindrical member for holding said impression material, on end of said cylindrical member being connected to said housing and the opposite end thereof being provided with an outlet opening for communication with the tube of said impression tray, a piston movable through said cylindrical member for moving the impression material towards the outlet opening, a trigger operatively mounted in said hand grip, and actuating means connecting said trigger and piston for advancing the latter in said cylindrical member in response to the operation of the former.

15. The means of claim 14, wherein said actuating means include a rack connected to, and movable with, said piston, a train of gears operatively engaged with said rack, and pawl means operatively engaged with said gear train and trigger for actuating the former upon operation of the latter.

16. The means of claim 15, wherein said pawl means slips upon exertion of a predetermined back pressure on said impression material to prevent the forcing of impression material into said tray under increased pressure of a sufficient degree to cause tissue displacement.

17. The means of claim 15 wherein said pawl means slips if there is back pressure created against said piston in excess of 1½ psi.

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