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INTRA-ORAL TRACER HAVING A SCRIBER FOR INDICATING
VERTICAL POSITION OF DENTURES
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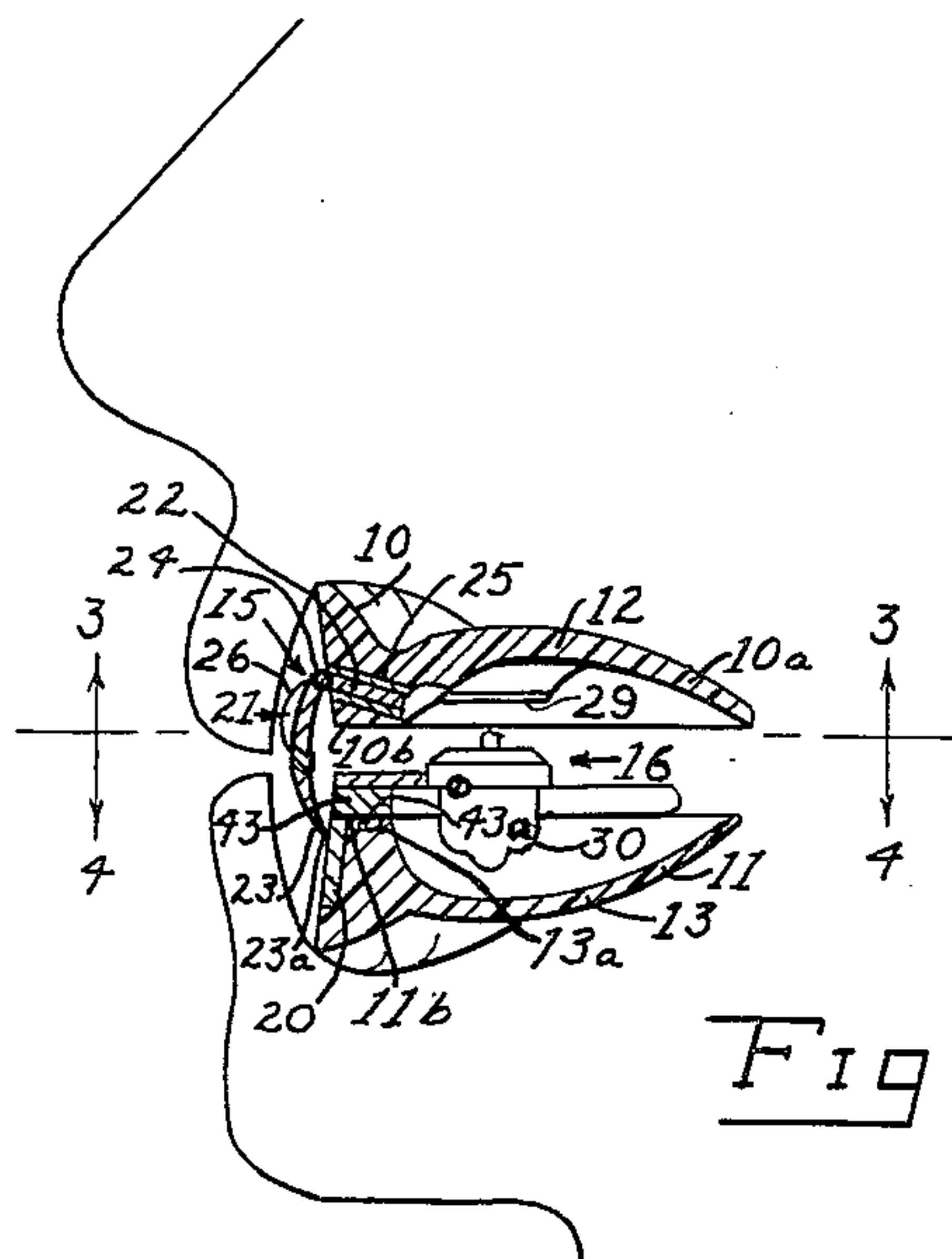


Fig 1

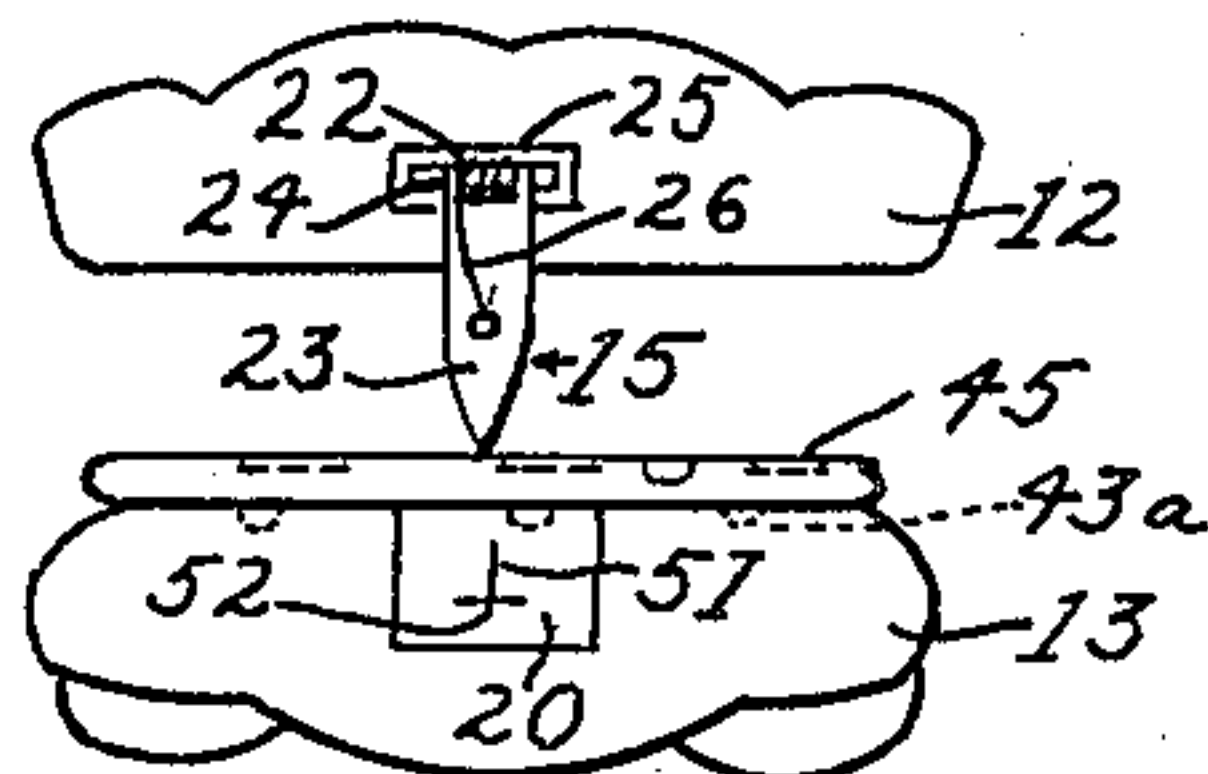


Fig 2

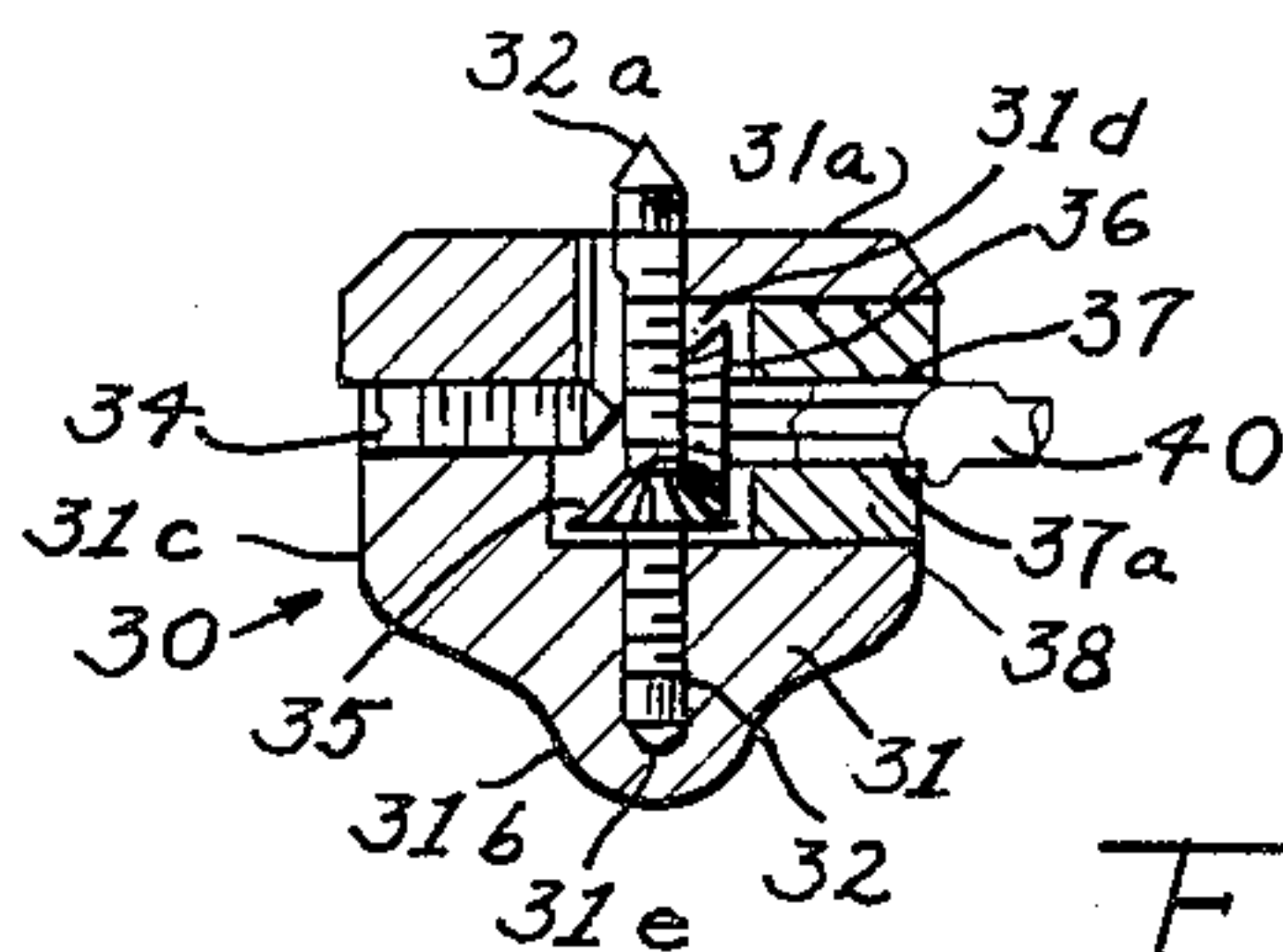


Fig 3

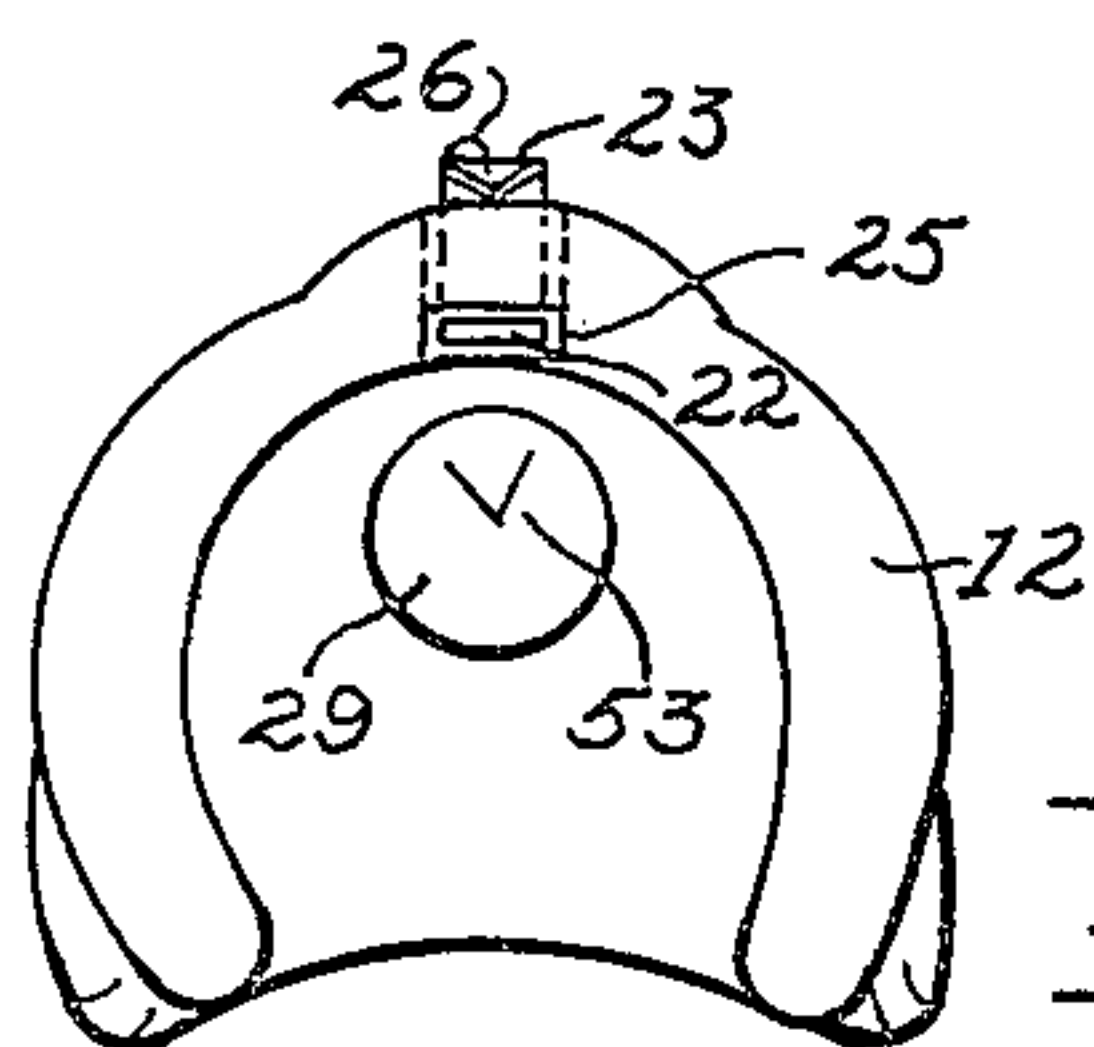


Fig 4

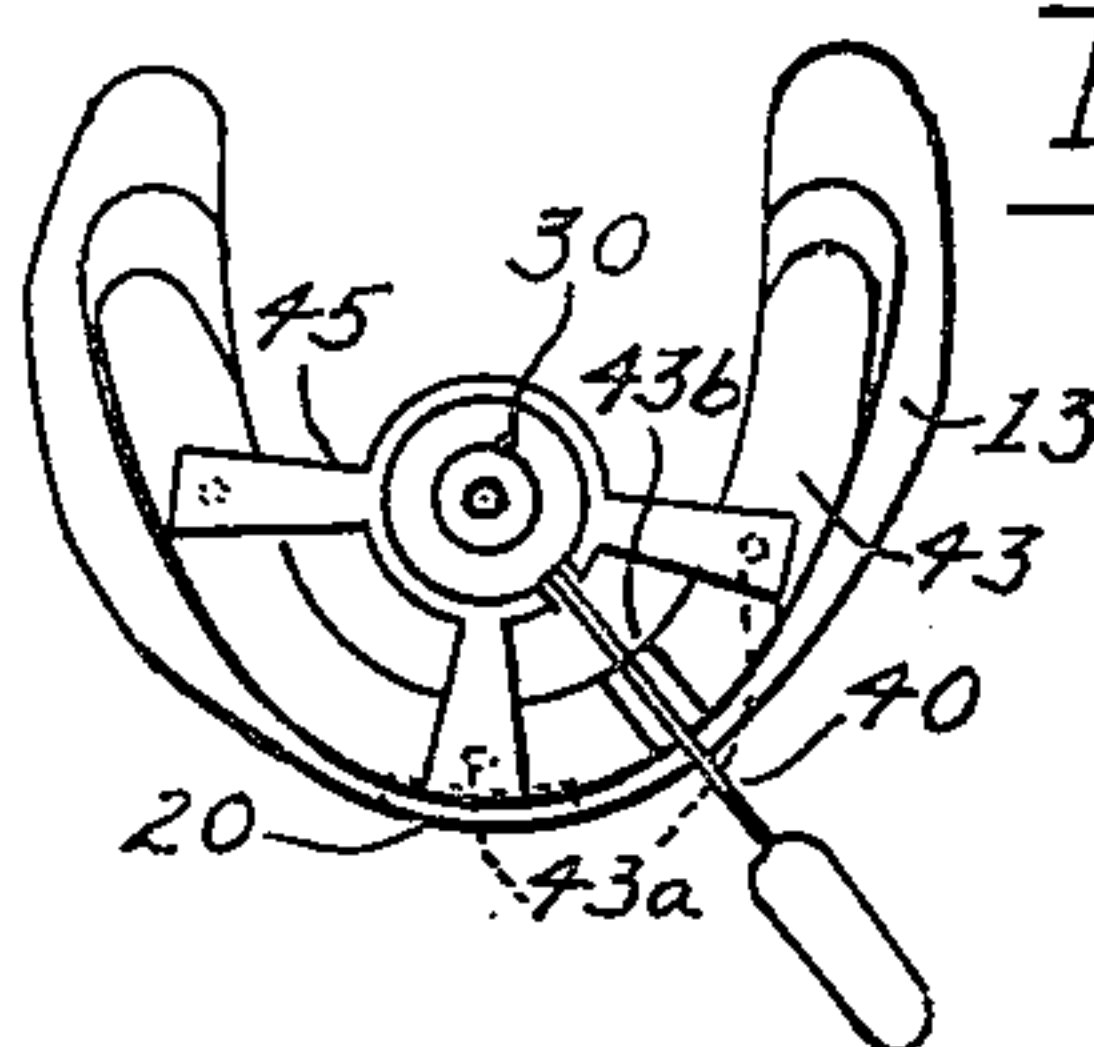


Fig 5

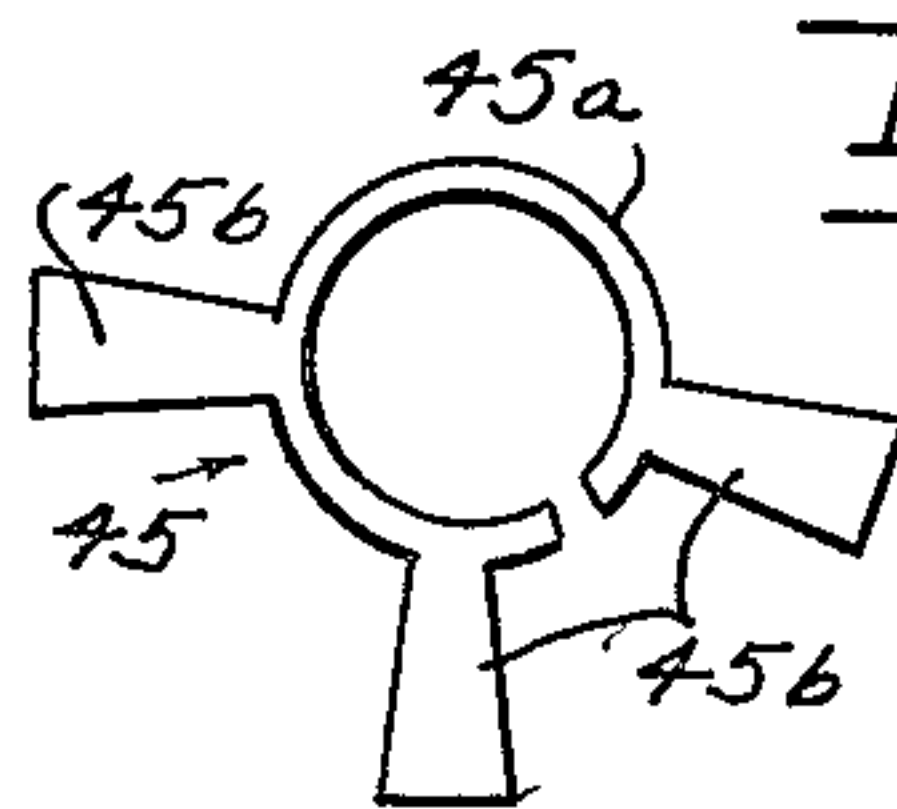


Fig 6

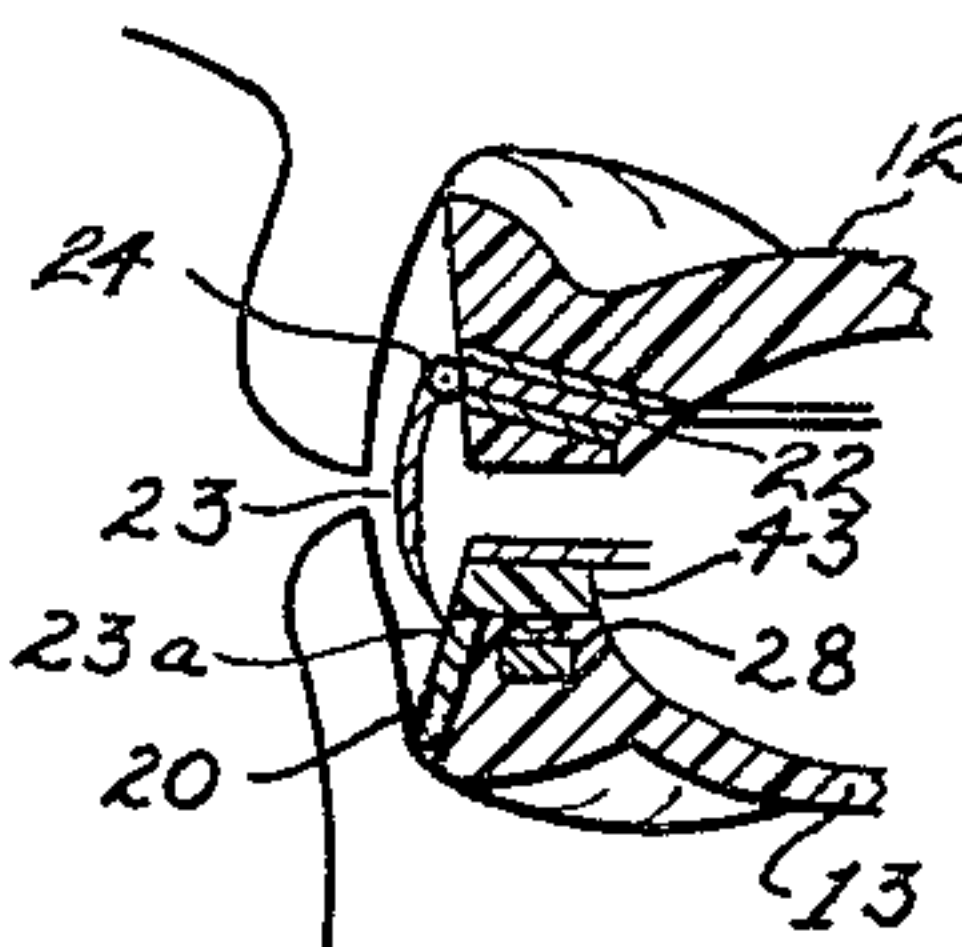


Fig 7

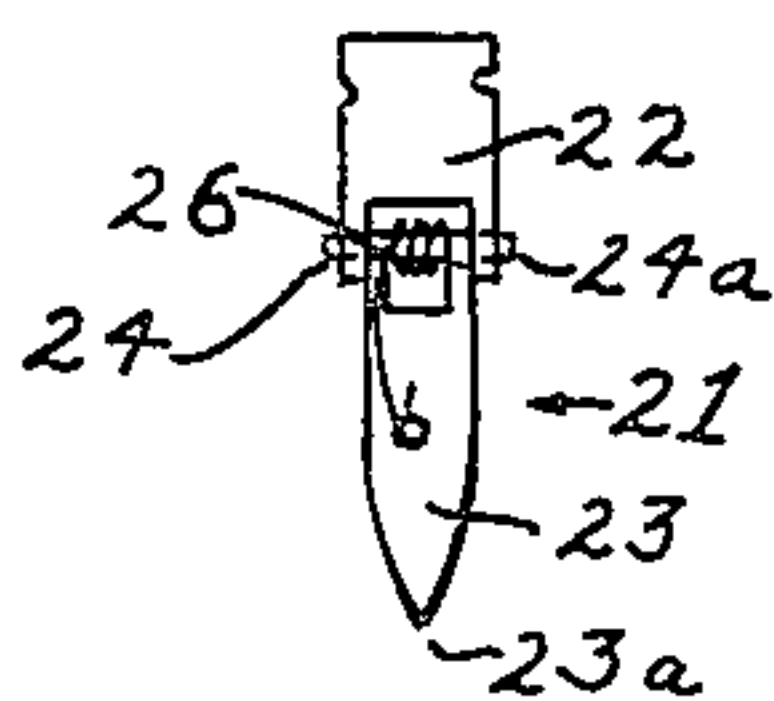


Fig 8

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INTRA-ORAL TRACER HAVING A SCRIBER FOR INDICATING VERTICAL POSITION OF DENTURES

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11 Claims. (Cl. 32—19)

This invention relates to improvements in the manufacture of dental plates and more particularly to what is known as an intra-oral tracer. The purpose of this tracer is to assist the dentist and laboratory technician in so shaping and forming the plates as to insure proper vertical spacing between the jaws and thus not only secure a correct bite but also preserve or produce the most desirable contour of the lips, cheeks and other soft tissues.

One of the objects of the present invention is to provide a device for determining graphically the "working bite" of the human patient with the "working bite" determining the space between the jaws.

A further object of the present invention is to provide an intra-oral tracer for determining the working bite and gothic arch by the normal movement of the mandible or lower jaw.

A further object of the present invention is to provide a method of determining the working bite position of the jaws of a human patient by inducing the patient to swallow and then recording the closest approach between said jaws during swallowing.

A further object of the present invention is to provide a simple apparatus for recording graphically the working bite obtained by the method set forth in the previous paragraph.

A further object of the present invention is to provide an intra-oral tracer for determining the working bite and gothic arch respectively by inducing the patient to swallow and to move his jaws from side to side to generate a gothic arch wherein said tracer has at least one of the elements of the gothic arch generating components removably secured therein to permit removal from the mouth during determination of the working bite so that said element does not interfere with the normal swallowing by the patient.

A further object of the present invention is to provide an intra-oral tracer characterized by its structural simplicity, ease of assembly of its parts, and simplicity of operation or usage.

Other features of this invention reside in the arrangement and design of the parts for carrying out their appropriate functions.

Other objects and advantages of this invention will be apparent from the accompanying drawings and description and the essential features will be set forth in the appended claims.

In the drawings,

FIG. 1 is a side elevational view of the face of a human patient with the intra-oral tracer mounted therein and shown in vertical sagittal section through the median plane of the human masticatory mechanism with this view including both the upper and lower members carried by the respective jaws, a verti-scriber unit for determining the working bite and a verti-tracer unit for generating the gothic arch;

FIG. 2 is a front view of the members and the verti-scriber removed from the mouth of the patient and having the "working bite" recorded thereon;

FIG. 3 is a bottom view taken in the occlusal plane along line 3—3 of FIG. 1 of the upper member having the tracer of the verti-scriber unit and the markable surface element of the verti-tracer unit;

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FIG. 4 is a top plan view taken along line 4—4 of FIG. 1 of the lower member having the markable surface of the verti-scriber unit, and having the tracer element and the operating wrench therefor of the verti-tracer unit;

FIG. 5 is a longitudinal sectional view through the tracer element of the verti-tracer unit;

FIG. 6 is a top plan view of a portion of the connecting means between the tracer element of the verti-tracer unit and the lower member;

FIG. 7 is an enlarged sectional view of the left-hand portion of FIG. 1 disclosing a modified form of biasing construction for the tracer of the verti-scriber unit; while

FIG. 8 is an enlarged view of the verti-scriber tracer with its sections flattened into coplanar relationship.

Before the intra-oral tracer here illustrated and the method here disclosed are specifically described in detail, it is to be understood that the invention here involved is not limited to the structural details, arrangement of parts, etc. here set forth in detail since mechanisms and methods embodying the present invention may take various forms. It also is to be understood that the phraseology or terminology herein employed is for purposes of description and not of limitation since the scope of the present invention is denoted by the appended claims.

The intra-oral tracer and the method forming the subject matter of the present invention can best be explained by a description of the technique of which they form a part. It may be assumed, as an example, that a dental technician in his laboratory, possibly remote from the office of the dentist, is assisting in the preparation and fabrication of dental plates in accordance with measurements and other instructions obtained and supplied to him by the dentist as a result of his examination of the patient's mouth. The cooperative procedure of the dentist and his technician is as follows:

First, the dentist prepares a pair of upper and lower jaw impressions in plaster or any other suitable material by standard procedure requiring neither illustration nor detailed description.

Second, he prepares the usual mush or biscuit wax plate form (not shown) to simulate the true bite relation of the two jaws and to establish an arbitrary vertical spacing relation between them.

Now the two impressions and the mush or biscuit bite form are sent to the technician who proceeds as follows:

First, he fabricates two models (not shown) from the two impressions, one for each jaw. The models are complementary to the upper and lower jaw impressions furnished by the dentist and simulate the upper jaw and palate and the lower jaw respectively of the patient. These models are mounted on the hinged arms of the usual articulator (not shown) by means of which they may be relatively moved to simulate ordinary bite action. Base plate members are then made to conform with the models. The upper base plate member 10 comprises an impression, similar to the impression made by the dentist, and includes an integral central portion 10a across the palate. The lower base plate member 11 comprises an impression adapted to fit the lower jaw of the patient. These base plate members may be made of any suitable material for the purpose, such as hardening plaster or a synthetic plastic material. Each is a thin-walled, concavo-convex member accurately conformed to fit the corresponding jaw model member on its concave base and curved smoothly on its convex base. The technician attaches the two models to the articulator and adjusts the articulator arm to close the base members 10 and 11 mounted thereon together upon the mush bite form to thus bring them into exactly the same bite relationship existing when the mush bite form was produced. Then, the closing stop on the articulator is set to establish this

relation, which, of course, is the arbitrary vertical jaw spacing before referred to.

Then, the technician applies wax, such as at 10b and 11b, to the stabilized base plate members 10 and 11 to build them up to form respectively bite block members 12 and 13. These members 12 and 13 are attached to the upper and lower jaws of the patient in the manner shown in FIG. 1.

At the same time, the technician imbeds in or secures to these members 12 and 13 means operatively connecting the members for recording the working bite distance between the jaws in response to swallowing by the patient, with this means hereinafter called verti-scriber unit 15, and means operatively connecting these members for recording as a gothic arch the loci of the relative movement between the jaws in the occlusal plane during grinding of the teeth while maintaining the working bite distance between the jaws, this means being hereinafter called verti-tracer unit 16.

Verti-scriber unit 15 includes a plate 20 with a markable surface thereon carried by member 13 and a tracer 21 carried by member 12. Plate 20 has an external surface, remote from member 13, capable of being marked upon and extending generally normal to the occlusal plane, which plane extends generally horizontally along the section line 3—3 or 4—4 of FIG. 1. Plate 20 is inset into a recess in the lower bite rim of member 13 and is luted in place. Tracer 21 comprises two sections 22 and 23 pivotally secured together by a hinge 24 having its pivot axis extending generally parallel to the occlusal plane. The enlarged view in FIG. 8 of the flattened tracer 21 reveals that hinge 24 permits pivotal movement about the axis of hinge pin 24a but prevents axial relative movement along the axis between sections 22 and 23 because the pair of arms on section 22 straddles the pair of arms on section 23.

Means is provided for detachably securing one section 22 to member 12 and takes the form of a sleeve 25, C-shape in cross section, secured in member 12 within which section 22 is telescopically and frictionally detachably secured. The other section 23 is located between members 12, 13 and the lips of the patient in about the same position as the teeth will be set so as not to interfere with the patient's lips. Marking or stylus point 23a, on the distal end of section or stylus arm 23, bears against the markable surface on plate 20 for recording the "working bite" position, as will be brought out in more detail hereinafter.

Means is provided for biasing marking point 23a into marking contact with the surface of plate 20. This biasing means may take any one of several forms. In FIGS. 1, 2, 3 and 8, a spring 26 is fixed respectively at its opposite ends to sections 22 and 23 with the helix thereof wrapped around the pivot pin 24a of hinge 24 between the arms of sections 22 and 23 so as to bias section 23 in a counterclockwise direction in FIG. 1 to urge point 23a against the surface of plate 20. In a second embodiment (not shown), an elastic band may be secured respectively at opposite ends to member 12 and section 23 at points remote from hinge 24. A third form is shown in FIG. 7 wherein section 23 is made of magnetic material, such as steel, and a permanent magnet 28 is imbedded in member 13 during its manufacture on the opposite side of plate 20 from section 23 so as to bias by magnetic force marking point 23a into marking contact with the external surface of plate 20.

Verti-tracer unit 16 includes a markable surface element 29 and a tracer element 30. Element 29 is a thin, flat steel plate attached to the upper member 12, as high in the palate as possible, and adapted to receive the tracer marks forming the gothic arch placed thereon by tracer element 30 in a manner to be described in more detail hereinafter. The surface of plate 29 is oriented similar to the occlusal plane. Tracer element 30 is carried by member 13 and is built as small and as compact as pos-

sible because it goes into the oral cavity and must not interfere with comfortable closing of the jaws. It includes a body portion 31 of generally cylindrical form having a flat transverse face 31a at one end and a reduced shank 31b at the other end with stepped cylindrical surface 31c located therebetween. The body 31 is hollowed out to provide an inner cavity or chamber 31d within which is mounted a tracer member 32, the upper end of which protrudes through face 31a and is pointed at 32a. The lower end of tracer member 32 lies within a reduced extension 31e of chamber 31d.

Suitable operating means is provided for adjusting the tracer member 32 longitudinally or endwise in chamber 31d in such manner as to vary the position of its pointed end 32a. Tracer member 32 moves in a straight line along its axis, which is approximately normal to the occlusal plane, roughly indicated by the section line 3—3 of FIG. 1. Tracer member 32 is a threaded screw, longitudinally slotted along one side to receive the inner end of a headless set screw 34, which prevents rotation of the tracer member 32 but permits its endwise adjustment. On the screw threads of tracer member 32 is mounted an internally threaded nut or actuating member in the form of a bevel gear 35 meshing with a similar bevel gear 36 secured to the inner end of a shaft 37 rotatably mounted on a horizontal axis in a plug 38 secured into an opening in the tracer body 31. Shaft 37 has a non-circular, such as a square or rectangular, recess 37a in its outer exposed end to receive the similarly shaped inner end of a key shaft 40 by means of which the gearing may be turned in either direction.

Verti-tracer unit 16 includes a connecting means for detachably connecting tracer element 30 to lower member 13. This includes a U-shaped support base 43, located in assembled position in FIG. 1 between the horizontal U-shaped sections of members 12 and 13 in the occlusal plane, and a support bracket 45 secured thereto for supporting tracer element 30. Base 43 is formed of molded material and is detachably connected to member 13 by a plurality of projections 43a, here shown as three in number, on base 43 projecting downwardly therefrom and adapted to fit into corresponding detents 13a in the surface of member 13. Bracket 45 has a C-shaped portion 45a to telescopically and frictionally retain the cylindrical periphery 31c of tracer body 31 and has a plurality of spokes 45b, here shown as three in number, integrally secured thereto with the outer ends firmly imbedded in the plastic material of base 43. A U-shaped cut-out 43b is formed in the upper surface of base 43 to receive the shaft 40 of the operating key in the manner shown in FIG. 4. Hence, tracer element 30 will be held in assembled position in the C-shaped portion 45a and base 43 will be held in assembled position on member 13 by gravity so that the component parts will be prevented in this assembled position from shifting in the horizontal or occlusal plane but may be readily lifted out or disassembled to remove one or all of them from member 13.

The markable surfaces of both plates 20 and 29 are now painted with tracing stains, and all parts so prepared are now sent to the dentist for further adjustment in the mouth of the patient.

First, the "working bite" is recorded. After moving tracer element 30 and base 43 from member 13, the dentist places members 12 and 13 in the mouth of the patient in proper association with the jaws. The patient is asked to bend forwardly from the hips, tilt his head forwardly and then swallow. The "working bite" is then automatically recorded by the stylus point 23a making a vertical mark 51 on the surface of plate 20 because the "working bite" is the closest approach attained between the jaws during swallowing. It should be noted that there is no interference with the normal swallowing action during this recording of the "working bite" because tracer element 30 and base 43 have been removed

from the unit in FIG. 1 so that the patient's tongue may move in its normal manner.

This graphical determination or recording of the "working bite" by the act of swallowing may also be described more technically. The mandible (lower jaw) during the act of deglutition (swallowing) travels upwardly from its vertical "rest position" to a centric position wherein its articulating condyles are in centric relation with the glenoid fossae and at this most superior position the agonistic and antagonistic muscle fibers of suprahyoid and infrahyoid musculature acting on the mandible cause it to be suspended in a position called the "working bite." Any moderately severe tactile interference acting on the mandible during this travel tends to stimulate proprioceptive neural reflex mechanisms associated with the musculature to exert muscular forces causing the mandible to assume a physiologically unnatural relationship. This tracer graphically records the uninhibited sagittal position of the mandible in its normal physiologic relationship so that registrations may then be made in this desired position. As deglutition occurs, the mandible moves upwardly in uninhibited physiologic freedom and causes an inscription of its distance of travel on the inked plate 20.

This "working bite" determines the particular vertical spacing between members 12 and 13 which provides or produces the desired, or the most pleasing, appearance or external contour of the soft tissue, such as the lips.

Now, the dentist removes the members 12 and 13 from the patient's mouth, and then draws a horizontal line 52 in FIG. 2 at the bottom of the vertical line 51 scribed by scriber point 23a during the swallowing process. Tracer element 30 and support base 43 are reassembled on member 13, and then both members 12 and 13 are placed back on the articulator. Key shaft 40 is inserted into the socket 37a and turned until tracer member 32 has, by bearing against plate 29, separated members 12 and 13 to the point wherein stylus point 23a is in horizontal alignment with horizontal line 52. Members 12 and 13 are returned to the mouth and the vertical relationship between stylus point 23a and line 52 is checked with any needed adjustment being made by inserting and turning wrench 40. Now, the verti-scriber-tracer 21 may be removed from its socket-type securing sleeve 25.

The patient is now requested to move his jaws from side to side, as though to grind his teeth, so as to record as a gothic arch 53 on the markable surface of plate 29 the loci of the relative movement between the jaws in the occlusal plane during grinding of the teeth while maintaining the "working bite" distance between the jaws. It should be noted that tracer element 30 has been heretofore firmly seated by gravity and friction in the bore of C-shaped portion 45a and that the three projections 43a on the support base 43 have been similarly firmly seated in the detents 13a of member 13. Now, they are more firmly pressed together by the pressure between tracer member 32 and plate 29. This construction and these forces prevent horizontal shift between these components in the occlusal plane so that the gothic arch will be accurately recorded. However, this tracer element 30 and base 43 are removably mounted so that they may be removed during the determination of the working bite and will not at that time cause any interference with the natural swallowing action. This construction permits the dentist to obtain both the working bite and gothic arch with minimum work and alteration of the tracer components.

When tracing of the gothic arch is completed, the dentist removes members 12 and 13 from the mouth, and the tracing is further defined by drawing bisecting lines on plate 29 at the apex of the arch 53. Then, a plastic disk, having a small hole therein, is placed over the markable surface of plate 29 with this hole located

at the bisecting point of these lines, and the disk is sealed securely with wax to plate 29.

The dentist then returns members 12 and 13 to the mouth of the patient, and the patient is instructed to close his mouth until tracer member point 32a comes in contact with this disk and then to slowly move the jaw right and left until the point 32a drops into the hole in the disk. Plaster is now injected completely around buccal and labial from left to right or vice versa. While the plaster is soft, the lips are allowed to form their own labial contour and also the normal lip line so that the plaster index actually takes an accurate impression of the patient's lips on the tissue side. After the plaster has set, a center line is marked on its surface and the finished case is now ready to be removed from the patient's mouth and sent to the laboratory for setting of the teeth.

At the laboratory of the dental technician, members 12 and 13 are mounted on the models carried by the articulator. The lower member is now remounted to a new centric and the articulator is locked into position with the plaster so that the vertical relationship cannot be changed. Anterior teeth are set to conform with the angulation of the plaster on the bite block members 12 and 13. A "tryin" is sent to the dentist. After the dentist has processed the tryin cases, they are returned to the articulator for final milling in by the dental technician. Then, the finished cases are returned to the doctor for the patient.

Various changes in details and arrangement of parts can be made by one skilled in the art without departing from either the spirit of this invention or the scope of the appended claims.

What I claim is:

1. A method of determining the working bite position of the jaws of a human patient, comprising the steps of attaching a pair of members to the jaws with one carried by the upper and the other by the lower jaw, inducing the patient to swallow with his head tilted forwardly, and recording the closest approach between said jaws during swallowing by marking on one of said members by means carried by the other of said members.

2. A method of determining the working bite position and the gothic arch of the jaws of a human patient, comprising the steps of attaching a pair of members to the jaws with one carried by the upper and the other by the lower jaw, inducing the patient to swallow with his head tilted forwardly, recording the closest approach between said jaws during swallowing by marking on one of said members by means carried by the other of said members, and recording by one member on the other member as a gothic arch the loci of the relative movement between the jaws in the occlusal plane during grinding of the teeth while maintaining said marked and recorded closest approach between said jaws.

3. In an intra-oral tracer for determining the working bite, a pair of members adapted to be carried respectively one by each jaw of a patient, and means operatively connecting said members for recording the working bite distance between said jaws in response to swallowing by the patient, said last mentioned means including a markable surface carried by one of said members and including a tracer carried by the other of said members, whereby said tracer will record on said surface the working bite distance between said jaws when the patient swallows.

4. In an intra-oral tracer for determining the working bite, a pair of members adapted to be carried respectively one by each jaw of a patient, and means operatively connecting said members for recording the working bite distance between said jaws in response to swallowing by the patient, said last mentioned means including a markable surface carried by one of said members and extending generally normal to the occlusal plane and including a tracer carried by the other of said members located between said members and the lips of said patient

and including means biasing said tracer into marking contact against said surface, whereby said tracer will record on said surface the working bite distance between said jaws when the patient swallows.

5 5. In an intra-oral tracer for determining the working bite and gothic arch, a pair of members adapted to be carried respectively one by each jaw of a patient, means operatively connecting said members for recording the working bite distance between said jaws in response to swallowing by the patient, said last mentioned means including a markable surface carried by one of said members and including a tracer and including means detachably securing said tracer to the other of said members so that said tracer can be removed from said other member while the patient grinds his teeth to record the gothic arch, and means operatively connecting said members for recording as a gothic arch the loci of the relative movement between the jaws in the occlusal plane during grinding of the teeth while maintaining said working bite distance between said jaws.

10 6. In an intra-oral tracer for determining the working bite, a pair of members adapted to be carried respectively one by each jaw of a patient, and means operatively connecting said members for recording the working bite distance between said jaws in response to swallowing by the patient, said last mentioned means including a markable surface carried by one of said members and extending generally normal to the occlusal plane and including a tracer comprising two sections with one section carried by the other of said members and including means biasing the other of said tracer sections into marking contact against said surface, said tracer including a hinge connecting said sections with the pivot axis of said hinge extending generally parallel to said occlusal plane, whereby said tracer will record on said surface the working bite distance between said jaws when the patient swallows.

15 7. The combination of claim 6 with said biasing means including a spring operatively connecting said sections together.

20 8. The combination of claim 6 with said biasing means including the other of said sections being made of magnetic material and including a magnet carried by the other of said members on the opposite side of said surface from said other section to bias said other section into marking contact against said surface.

25 9. In an intra-oral tracer for determining the working bite and gothic arch, a pair of members adapted to be carried respectively one by each jaw of a patient, means operatively connecting said members for recording by a mark of one of said members the working bite distance between said jaws in response to swallowing by the patient, and means operatively connecting said members for recording as a gothic arch the loci of the relative movement between the jaws in the occlusal plane during grinding of the teeth while maintaining said working bite distance between said jaws, said last mentioned means including a tracer element carried by one of said members and including a markable surface element oriented similarly to the occlusal plane and carried by the other of said members and including connecting

means detachably connecting one of said elements to its associated member to permit removal of said one element so that said one element does not interfere with the swallowing during recording of the working bite.

10 10. In an intra-oral tracer for determining the working bite and gothic arch, first and second members adapted to be carried respectively by the lower and upper jaws of a patient with the adjacent surfaces of said members being generally U-shaped in the occlusal plane, means operatively connecting said members for recording the working bite distance between said jaws in response to swallowing by the patient, said last mentioned means including a markable surface carried by said first member and extending generally normal to the occlusal plane and including a tracer comprising two sections and including means detachably securing one of said tracer sections to said second member with the other of said tracer sections being located between said members and the lips of said patient and bearing against said surface and including means biasing said other tracer section into marking contact against said surface, said tracer including a hinge connecting said sections with the pivot axis of said hinge extending generally parallel to said occlusal plane, said detachable securing means permitting said tracer to be removed from said second member while the patient grinds his teeth to record the gothic arch, whereby said tracer will record on said surface the working bite distance between said jaws when the patient swallows, and means operatively connecting said members for recording as a gothic arch the loci of the relative movement between the jaws in the occlusal plane during grinding of the teeth while maintaining said working bite distance between said jaws, said last mentioned means including a tracer element carried by said first member and including a markable surface element carried by said second member and including connecting means detachably connecting said tracer element to said first member in assembled position by gravity to prevent shift therebetween in said occlusal plane so that said gothic arch will be accurately recorded but to permit lifting out and removal of said tracer element so that said tracer element does not interfere with the swallowing during recording of the working bite, the portion of said connecting means carried by said tracer element being generally U-shape and located in assembled position between the U-shapes of said members.

11. In an intra-oral tracer for determining the working bite, a pair of members adapted to be carried respectively one by each jaw of a patient, and means on one of said members for establishing a mark on the other of said members in a plane generally normal to the occlusal plane responsive to relative movement of said members in response to swallowing by the patient to record the working bite distance between said jaws.

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