March 19, 1929. C. O. McBEAN 1,706,179

MEANS FOR DETERMINING THE NORMAL OCCLUSAL PLANE

Filed May 23, 1927 3 Sheets-Sheet 1

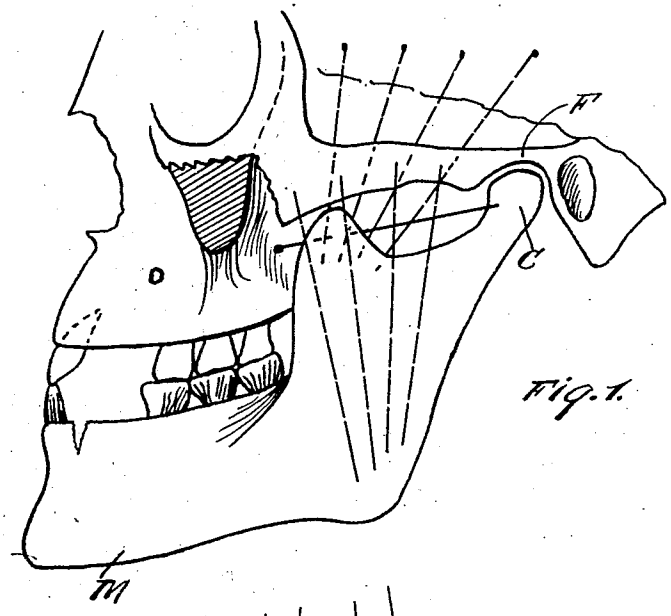


Fig. 1.

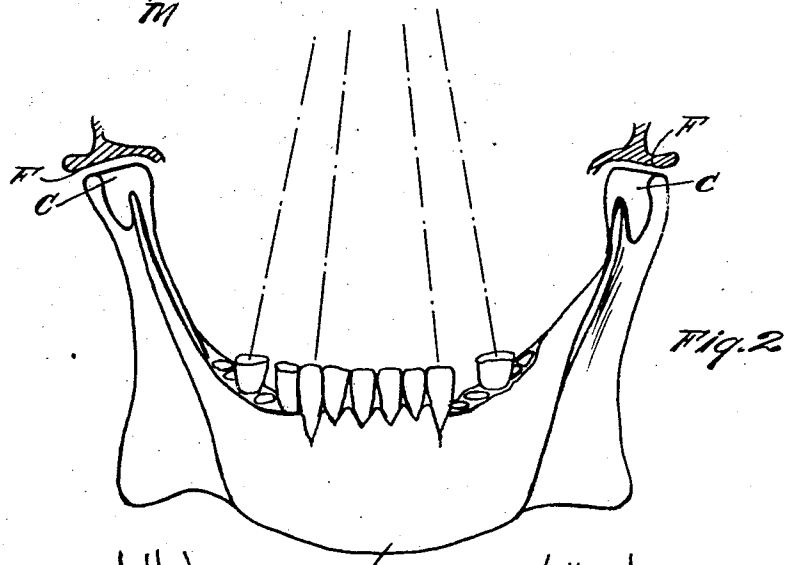


Fig. 2

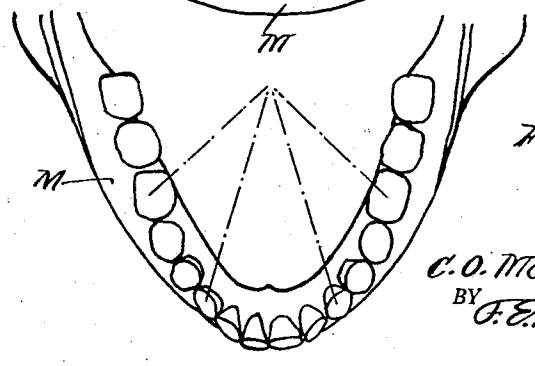


Fig. 3.

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Filed May 23, 1927 3 Sheets-Sheet 2

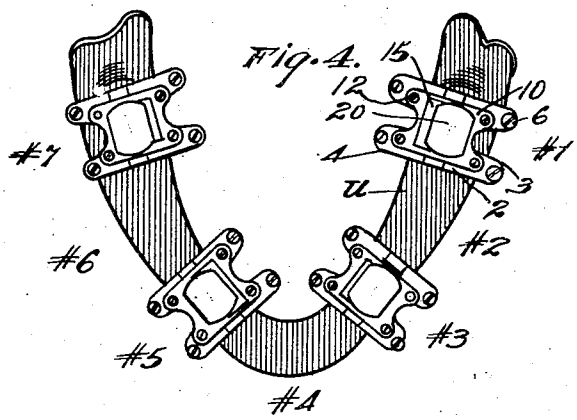


Fig. 4.



Fig. 31.

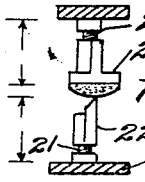


Fig. 32.

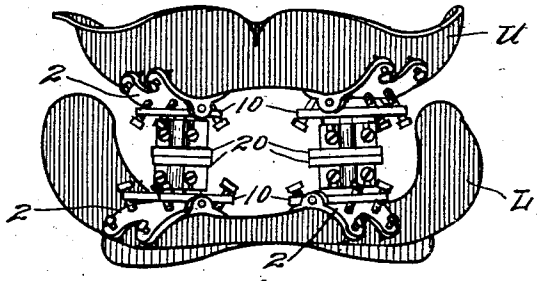


Fig. 5.

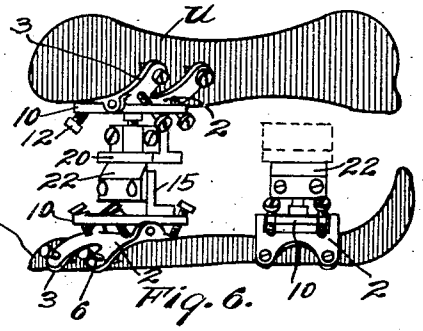


Fig. 6.

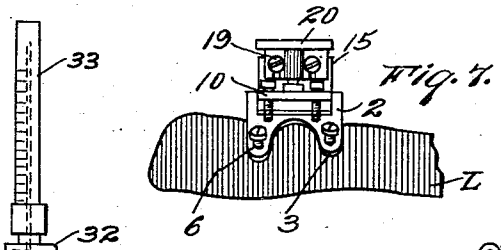


Fig. 7.

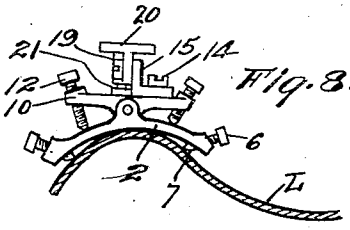


Fig. 8.

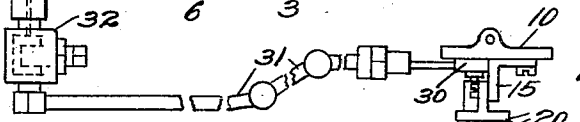


Fig. 9.

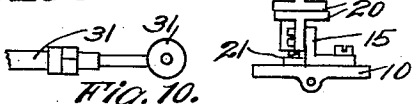


Fig. 10.

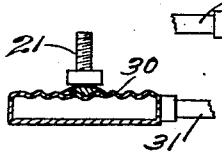


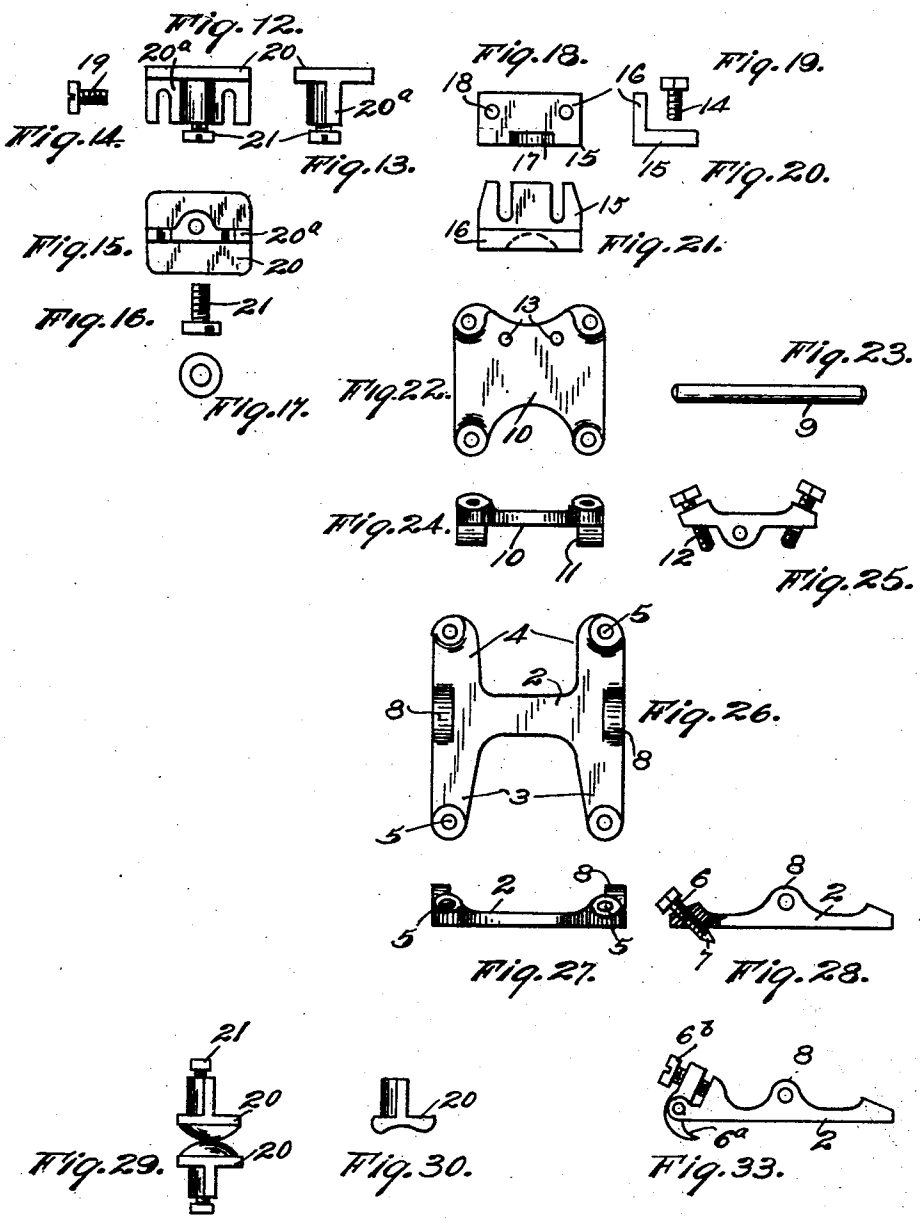
Fig. 11.

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MEANS FOR DETERMINING THE NORMAL OCCLUSAL PLANE

Filed May 23, 1927 3 Sheets-Sheet 3



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Patented Mar. 19, 1929. 1,706,179

UNITED STATES PATENT OFFICE.

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MEANS FOR DETERMINING THE NORMAL OCCLUSAL PLANE.

Application filed May 23, 1927. Serial No. 193,539.

This invention relates to the science of producing partial or complete occlusive masticatory elements.

The old system of preparing dentures is to first make a cast of upper, or maxillary ridge, and then, lower or mandibular ridge, then building of base plates to the casts and then bite blocks are built upon the base plates.

A try for esthetic plane is made by arbitrary guess according to the lip plane and facial expression.

Thus no regard is given to the actual masticatory plane on which maximum muscular forces are registered.

It is the interpretation of practitioners that they can determine the proper plane by the mandibular condyle path. Thus working from an unsound basis to doubtful registration.

With the base plates and their bite blocks seated in the mouth the condyle path, in a given case, is determined by taking three bite plates of plastic wax, one for a right lateral, one for a left lateral and one for a protrusive.

After the "bites" have been taken the mounted bite blocks are brought into centric occlusion and sealed together.

Now a face bow tongue is fastened rigidly to the sealed blocks after which the face bow lugs are adjusted to the head of the condyles of the patient. Having located the head of the condyle, then the stem of the tongue is set as to the face bow. The face bow and set bite blocks are now removed from patient and the lugs of the face bow are mounted upon the condyles of the articulator. The casts or models are now seated in their respective base plates which are held by the bow, then the casts are sealed to the bows of the articulator.

Following this the face bow and its tongue are removed from the bite blocks and the articulator. Then the condyle paths are established on the articulator by registering the casts with the previously taken bites and from and by this mechanically determined and delimited means the arbitrary occlusive plane of the teeth is produced as tooth after tooth is placed in position on the base plates following the removal of the bite blocks.

The occlusive plane so produced is usually so erroneous that either spot grinding by the prosthetist is resorted to or the teeth are gradually abraded into the correct occlusive plane by chewing on carborundum-filled gum.

Many deleterious effects are common as a result of the use of dentures manufactured by the above apparatus. Such for instance; as pathologic changes in the condular articulation; aggravated and uneven absorption of the bony processes, together with a deficiency of function of the dentures, all caused by an utter disregard for the muscular forces involved in mastication.

The apparent error in the old system is that the mechanical articulation is not founded upon such a basis as will result in the true coordination of all of the occlusive surfaces in coordination with the muscular forces involved in a given case.

The ideal is the reconstruction of the masticatory mechanism in such a manner that the entire masticatory apparatus is functioning in perfect harmony with the muscle forces applied.

This, therefore, involves the coordination of action of the condular articulation, and the coaction of the occlusive surfaces of the masticatory mechanism upon the plane of maximum force functioning in harmony with the muscle forces applied.

Failure of coaction of the upper and lower articular surfaces, throughout, results in traumatic occlusion which is likely to produce pathologic changes in the tissues of the condular articulation, or pathologic changes in either the soft or hard tissues of either, or both, the mandible or maxilla. This condition will result in a partial or complete loss of efficiency of the masticatory mechanism.

It is recognized that it is of the utmost importance to provide an edentulous patient with a set of dentures which will effect a restoration of the natural appearance, will be successful in their intended function and give general satisfaction in a comfortable application on the gums. In the attempt to produce a reasonable approach to the normal condition of the case the practitioners are divided in two general principles: one is that the condyles constitute the controlling media of masticatory processes and the other is that occlusion controls the condyles, this latter being known as the spherical principle.

I submit that these principles are quite secondary and that the fundamental basis of masticatory balance and efficiency is in

the coordination of the heavy muscles, especially the masseter, the temporal, the buccinator, the pterygoids, and other lesser members. These determine the floating movement of the condyles and equally determine the occlusion plane normal to the teeth.

There is no doubt that there is an ideal occlusion plane for every individual masticatory system and it is undeniable that there is a masticatory plane normal only to each individual and for this reason of the positive difference in the conditions in every case that it is impossible to use a mechanical articulator with delimited lines of condular movement to accurately adapt artificial teeth whose occlusial surfaces are the product of the limited action of an articulator.

The condyles of the mandible are known to have a practically universal floating action under the mastoid process and there is little or no limit to the gyratory motion of the condyle in any definite plane such as is assumed by the use of the usual articulator. The mandible is under the control of a complex system of muscles which in the action of mastication cause the condyles to work in a loose floating manner while supported on the mastoid process, the points of support of the condyles varying constantly during the movement of the condyles at least until maximum crush effort of the coordinated muscles brings the condyles to that indefinite and variable seat as will be determined largely by the bolus of food or other object or matter which may be under the compressive action of the working muscles.

Knowing that the mandible will have its condyles adjusted as determined by the reaction of the bolus and the tension of the masticatory muscles, it is the cardinal object of my present invention to provide means adapted to be adjusted in the oral cavity while said means are in situ on a supporting means which has been previously carefully adapted to the upper and lower gum ridges of the maxilla and the mandible with the object in view of utilizing the fitted supports which are to ultimately carry the false teeth combined with means to accurately determine the true normal occlusion plane in each individual case where partial or complete dentures are to be installed. In other words it is an object of my present invention to provide a system including means adjustable in the oral cavity to nicely determine the plane of occlusion in a case, while carrying out the desired line of esthetics, which in the general present practices of the profession of prosthesis is the arbitrary line assumed for the building up of dentures, with the object of bringing the face into an apparently normal state of rest and at the same time supposedly to result in a fair adjustment of the occlusion through the mechanical instrumentality of the conventional articulator. In attempting to produce dentures from the arbitrary line of esthetics in conjunction with the use of "bites", no consideration whatever has been given to the highly important factor of muscular actions and it is a purpose of my invention to directly consider the actions of the muscles on the mandible in erecting either partial or full dentures with the purpose in view of giving to the individual dentition means which have been produced with consideration of the factors of esthetics, of condyle action, of a normal occlusion plane and of the combined actions of the principal muscles of the masticatory system.

A further obpect of the invention is to provide a system of devices which are capable of being adjustably attached to denture plates as may be necessitated according to the undulations and angularities of the gum ridges or gum ridge as the case may be. An object is to provide a small and practicable means capable of being easily attached to a fitted ridge element, such as a plate or partial plate and which includes means adaptable for angular adjustment so that the ideal and normal masticatory plane for the proposed teeth or tooth may be accurately ascertained directly from data established by the refined adjustment of the plane finder in the oral cavity.

Numerous additional objects, advantages and features will be made manifest in the ensuing specification of an embodiment as herewith illustrated; it being understood that modifications, variations and adaptations may be resorted to within the scope, spirit and principle of the invention as more particularly hereinafter claimed.

Figure 1 is a side elevation of a portion of a human skull to indicate diagrammatically the normal plane of contact of teeth in the mandible and in the maxilla and showing the spacing of the condyle from the superadjacent fulcrum or the condylar foramen of the condyle and indicating in a general way the lines of forces of several of the heavier muscles just above mentioned.

Figure 2 is a front elevation of the mandible with its condyles spaced below the condylar foramen; and indicating by converging lines the desired balance of force on each side of the mandible with respect to certain predetermined teeth.

Figure 3 is a plan of the mandible with full dentition.

Figure 4 is a plan of a lower ridge fitted denture plate illustrating the attachment, in balanced relation, of a set of the novel occlusion plane finders.

Figure 5 is a front elevation of upper and

lower plates showing a pair of right and left balanced plane finders applied.

Figure 6 is a side elevation of upper and lower plates showing applied plane finders.

Figure 7 is a front elevation of an individual plane finder as attached.

Figure 8 is a side elevation of an individual plane finder.

Figure 9 is a detail view showing the method of obtaining a record of pressure developed under muscular action in bringing opposed plane finder platens into occlusion.

Figure 10 is a plan of a pressure receiving pan.

Figure 11 is an enlarged sectional view of the pan.

Figure 12 is a front elevation of a detached platen with its jack screws.

Figure 13 is an end view of the plate.

Figure 14 is an elevation of the platen clamp screws.

Figure 15 is a bottom plan of the platen.

Figure 16 is an elevation of the detached platen jack screw.

Figure 17 is a plan of the jack screw.

Figure 18 is a front elevation of a platen carrying bracket.

Figure 19 is an elevation of a bracket clamp screw.

Figure 20 is an end view of the bracket.

Figure 21 is a top plan of the bracket.

Figure 22 is a top plan of the bracket cradle.

Figure 23 is an elevation of the cradle rock-shaft.

Figure 24 is a front end view of the cradle.

Figure 25 is a side view of the cradle including its adjusting screws.

Figure 26 is a top plan of the main clamping device or bed of the finder.

Figure 27 is a front end view of the bed.

Figure 28 is a side elevation and partial section of the bed showing one of its clinching screws.

Figure 29 is a side elevation of an opposed pair of platens having rounded occlusion surfaces.

Figure 30 is an end view of a platen having a concaved occlusion surface.

Figure 31 is a perspective of an occlusion surface cutting knife.

Figure 32 is a detail showing an occlusion knife in effective position against a prepared and protected upper occlusion platen faced with a modelling compound on which the ultimate impression for occlusion is impressed.

Figure 33 illustrates a pivoted impaling hook.

Figures 1, 2 and 3 are introduced to show very closely the actual relation of the condyles C to the superadjacent bony structure forming the fulcra F in a case taken directly from a dry skull in which there was an unusually complete and perfect set of upper and lower teeth. Figure 1 illustrates the actual position of the condyles when the teeth of the skull were in what appeared to be the normal plane of occlusion when all of the teeth were brought into the ideal and normal register. This example clearly demonstrates that in human cases having an ideal masticatory plane the condyles take positions which are determined by the lines of occlusion of the teeth. It is obvious that the surfaces of the teeth will be worn to planes which are determined mainly directly from the final coordination of the heavier muscles utilized in the process of mastication and which muscles are illustrated in Fig. 1, in a more or less general manner by the heavy dotted lines.

My present system for determining a normal occlusion plane to each individual case is based on the fundamental principle that aside from habits and possible abnormalities the planes of occlusion especially to be determined for full dentures will best be arrived at by a means capable of being adapted in each case to the peculiar conditions resultant from the main muscles of mastication in each given case. While it is highly desirable to follow the principle involving the line of esthetics and while it is also desirable to give due consideration to the so-called spherical principle and to the theory that occlusion is primary as a factor I believe that a most satisfactory result including the comfort of the patient depends upon the development of the given case almost wholly by a means which will give the patient a line of occlusion in direct conformity to the lines of forces generated and concentrated by the concurrent and true coordination of the masticatory muscles, in the given case.

In a given edentulous case the dentures should be developed by means working from equalization of forces on the mandible M, Figs. 1 and 2, as for instance, by determining that position of the mandible when it is under the contracting force of muscles which would set the lower cuspids and the first molars in esthetic balance at the moment and position when the muscles are exerting their maximum effort.

With the object of most easily and accurately obtaining the ideal and normal occlusion plane for a given case it is assumed that upper and lower denture plates U, L have been obtained in the usual manner. To these plates it is possible to attach means by which the true planes of occlusion can be arrived at and my invention consists in means which are not only attachable to the prepared plates or partial plates but such means further includes parts adjustable laterally, angularly and vertically so that

the mandible can be carefully brought to that desired position of closed occlusion surfaces at which all of the factors involved in mastication are so truly coordinated that the patient may have the comfort given originally by his normal teeth.

The mechanism of the invention includes a main carrier, frame or bed part 2 made of any suitable material and of various sizes and which includes forwardly or outwardly extending side arms 3 and rearwardly extending arms 4 which arms are severally provided with screw holes 5 all pitching obliquely inwardly as clearly shown in Fig. 28 to receive substantial clamping screws 6, which form one means by which the bed 2 may be applied firmly to the ridge fitting plate or partial plate U or L as the case may be and which screws are shown as having sharp penetrating tips 7 to readily bite into the denture plate. The top of the bed is shown as provided with spaced bearing ears 8 to receive a rock-shaft 9, Fig. 23, fastening through bearing ears 11 of a cradle 10 adapted to be tiltably connected to the bed 2 by means of the rock-shaft 9.

The cradle 10 is provided with a set of adjusting screws 12 shown as obliquely disposed and designed to bear upon the contiguous portions of the arms 3—4 of the bed; these screws providing means for locking the cradle on the bed. The cradle 10 has screw holes 13 into which turn clamp screws 14, Fig. 19, and these pass through a slotted base of a bracket 15 having an upstanding wall 16, the lower portion of which is concaved at 17 for a purpose later shown. Therefore, the bracket 15 is capable of being adjusted laterally as to the cradle 10 in any position of the cradle on its bed 2.

The bracket wall 16 has screw holes 18 to receive clamp screws 19, Fig. 14, passing into slots in what is here termed the platen 20, which includes a top or shelf portion and a perpendicular medial flange portion 20^a which is provided with a threaded bore to receive a stout screw 21 forming a jack for solidly supporting and for adjusting the platen 20 with respect to its bracket 15; the head of the jack screw 21 turning free in the recess 17 of the bracket.

The arms 3 and 4 are designed to permit of being bent so that the bed 2 can be set hard down on the ridge of the denture part or plate and then clamped by the clamp means here shown as the screws 6, this being desirable because of the irregularity of the denture part as determined by the ridge of the gums of the patient being fitted.

In the technique of the system a pair of upper and lower posterior finders is set at approximate relation to lateral and height positions at which time the lateral position is corrected by adjustment of the occlusion platens which are brought into flat or coordinate contact with the mandible in centric occlusion; the planes of the platens being in temporary height adjustment. The platens are now set at low points or a closed bite relation and a pressure record is made by suitable means which is here shown as including a small, compressible, hollow disc or pan 30 attached to the end of a flexible conduit 31, of any suitable type or construction and material, and which extends to a fixedly mounted reservoir 32 which is provided with an indexed or scale tube 33 in which is visible the movement of a liquid contained in the pressure pan 30 and its conduit and reservoir. For the purpose of making a pressure test the pan 30 is introduced between the base of the upper jack screw Fig. 9, and its cradle 10 while the occlusion platens of the upper and lower plates are in occlusion. The pressure exerted by the bite of the patient is determined from the pressure pan 30 by the expulsion of liquid therefrom and a consequent change of level of the indicating liquid in the index gage 33, which is calibrated with a range of index readings predetermined as being the average between a very low pressure to a very high pressure under muscle action.

Following the first test or extreme posterior position the platens of this set are adjusted at an open bite relation and pressure is taken and recorded and subsequently readjustment of the platens is made and bites and pressure readings are completed until the plane of maximum pressure for the trial sets of platens is ascertained. In other words the first sets of platens for upper and lower plates are set arbitrarily as close as practicable to the line of esthetics and thereafter the upper and lower platens are equally adjusted for closed bite relation and record of pressure and then equal adjustments of both upper and lower are continued until the maximum pressure recorded in the different steps will determine that occlusion plane normal to the case.

In Fig. 4, a set of four of the plane finders is applied in balanced relation to a lower plate and after the tests for pressure have been completed with the set of four finders on upper and lower then there is applied to the upper and lower plates additional finder sets to complete the occlusive line entirely around the plates.

After the proper occlusion plane has been ascertained at which maximum muscular energy is effected, both as to gum reaction and as to condular articulation, then the platens 20 are removed from the lower finders and there is applied to the lower brackets 20 a suitable cutting knife or blade 22, Fig. 32, the effective cutting edge of which is adjusted to a line above its cradle 10 as

determined by the previously ascertained height of the top of platen from the cradle. There is then applied to the articular surface of the upper platen 10 a modelling compound. Knives having been adjusted to each of the lower cradle brackets while the upper platens remain in place, then the patient is instructed to proceed to chew in the normal manner. When the blades 22 have cut through the modelling compound to the articular surface of the upper platen 20 the ideal and normal occlusion plane has been established in the given case.

After this the prosthetist carefully replaces the occlusion finding means on the lower plate by false teeth in the following manner. The patient is instructed to close the jaws in centric relation and the lower knives are sealed to the now cut occlusal plane as determined by the carvings, after which a face bow transfer is made of the sealed upper and lower base plates to an articulator which is capable of the scope of movement recorded upon the compound on the upper platens.

With position No. 1, Fig. 4, as a starting point in a plate in the articulator a series of porcelain teeth is selected, due regard to type and size, and these are each preground on their occlusal surfaces to articulate closely with the established occlusion planes on the articular surfaces of the opposing upper platens and are then set on the lower plate ridge and attached by wax. The ground teeth are set progressively around the arch, each being carefully brought into proper angular position. Then the top or upper plate is completed by a similar progressive mounting of the teeth from one end around to the other on the upper; and the attachment of the teeth to the base plates is reproduced in permanent form, giving a masticatory plane in harmony with the forces of mastication.

Figure 33 shows a form of pivoted claw or hook 6^a having a jamb screw 6^b on one arm whereby to obtain a secure impaling grip on the plate face.

What is claimed is:

1. The combination with a denture plate, of an adjustable bed, and means on the bed adjustable to locate the normal masticatory plane.

2. Means for obtaining the masticatory plane including a bed adjustably attachable to a ridge fitting member, and means on the bed adapted for adjustment to the relative plane of occlusion.

3. Means for determining the occlusion plane normal to a case, including a bed attachable to a ridge fitting support, and a a device adjustably mounted on the bed and having a plane finder.

4. Apparatus for combination with ridge fitted denture parts, including means to clamp onto the said parts, a tiltable member mounted on said means, a laterally adjustable element on said member, and a platen adjustable on the said element.

5. An occlusal plane finder including a base means, means to attach the base to a ridge fitting denture part, a cradle tiltably mounted on the base and means to set the cradle in adjustment, a laterally adjustable bracket on the cradle and means to set it in adjusted position, and a platen adjustable on the bracket and means to positively set the platen when it has been adjusted.

6. Apparatus for finding the normal occlusal plane in a given case, including upper and lower means adjustably attached to respective ridge fitted parts, one of said means being adapted to form a base for a modelling compound and the other having a knife operative to cut a masticatory plane on the opposed compound.

7. The method of locating the normal masticatory plane which consists of fitting gum plates, ascertaining the occlusion plane by effecting positive angle position of the mandible at different bites, obtaining pressure readings at different positions of the mandible, and setting the teeth on the plates in accordance with the ascertained plane of maximum pressure.

8. In combination with upper and lower ridge fitting plates, a base adjustably mounted on one of said plates for a modelling compound, and cutting means adjustably mounted on the opposed plate to cut a masticatory plane on the compound.

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