April 28, 1964 F. MacKAY 3,130,494

DENTAL EQUIPMENT

Filed July 12, 1957 4 Sheets-Sheet 1

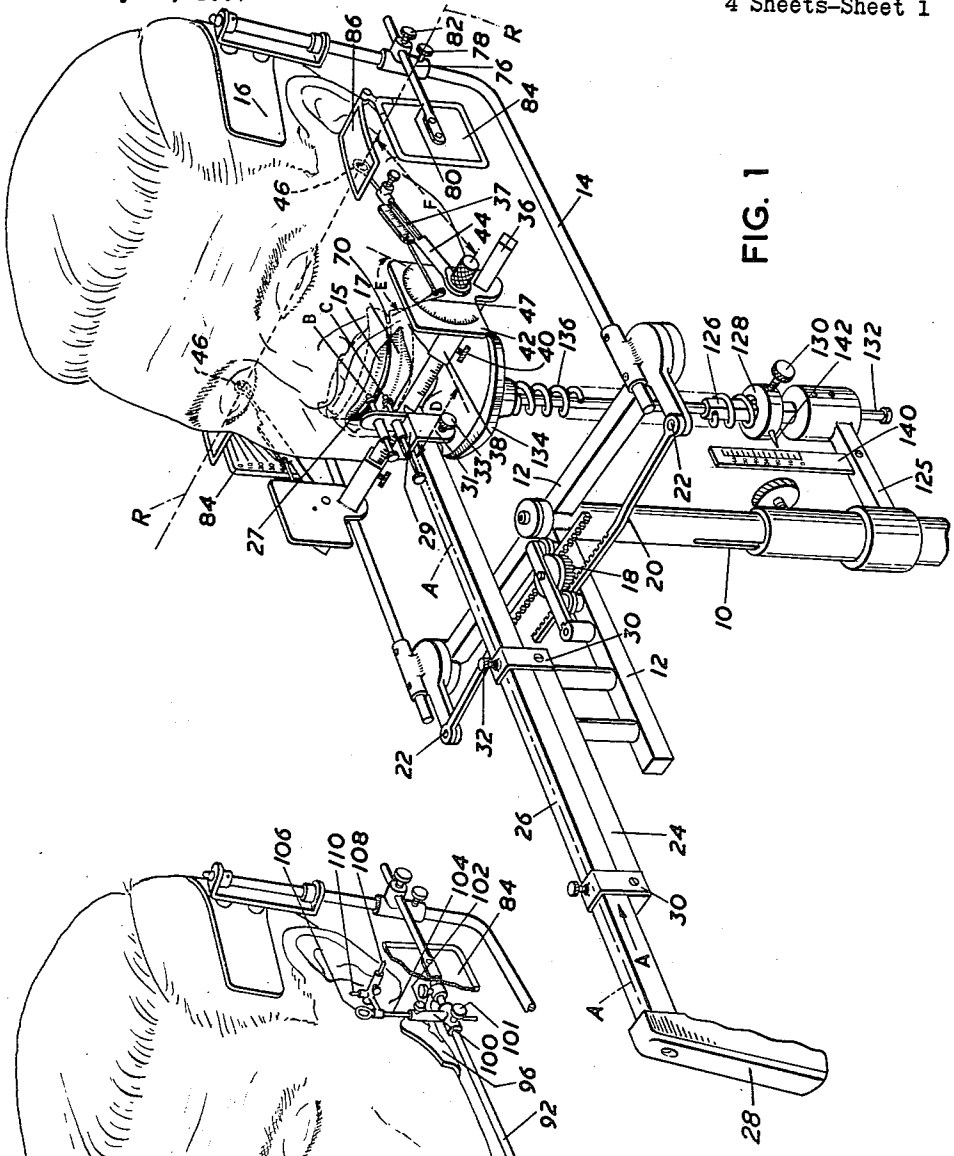


FIG. 1

FIG. 2

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DENTAL EQUIPMENT

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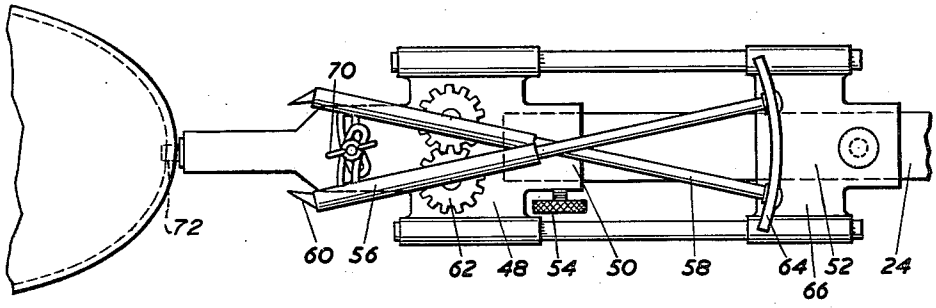


FIG. 3

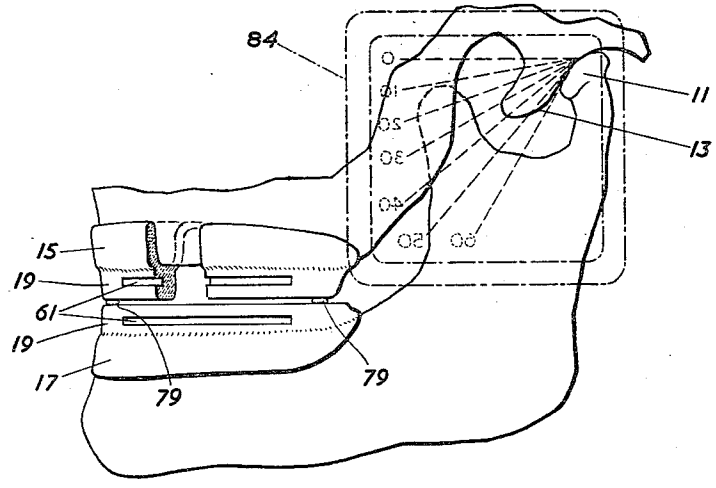


FIG. 4

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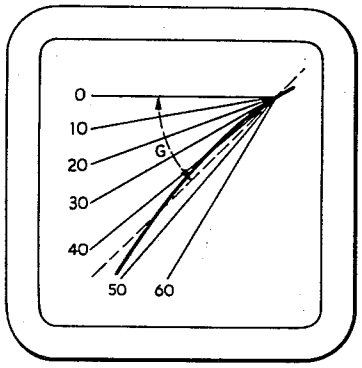


FIG. 5

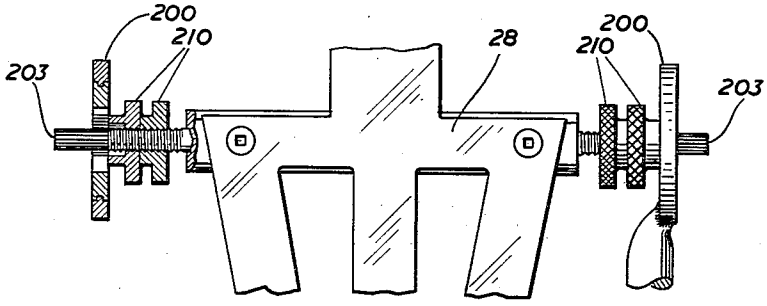


FIG. 7

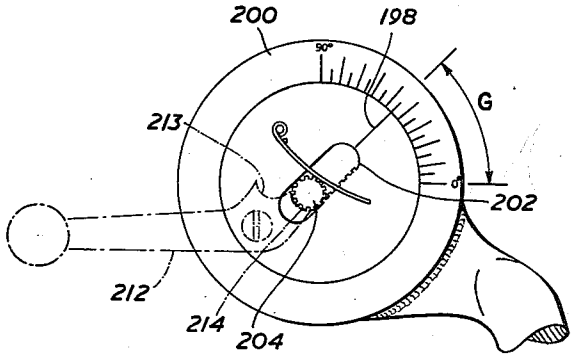


FIG. 8

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DENTAL EQUIPMENT

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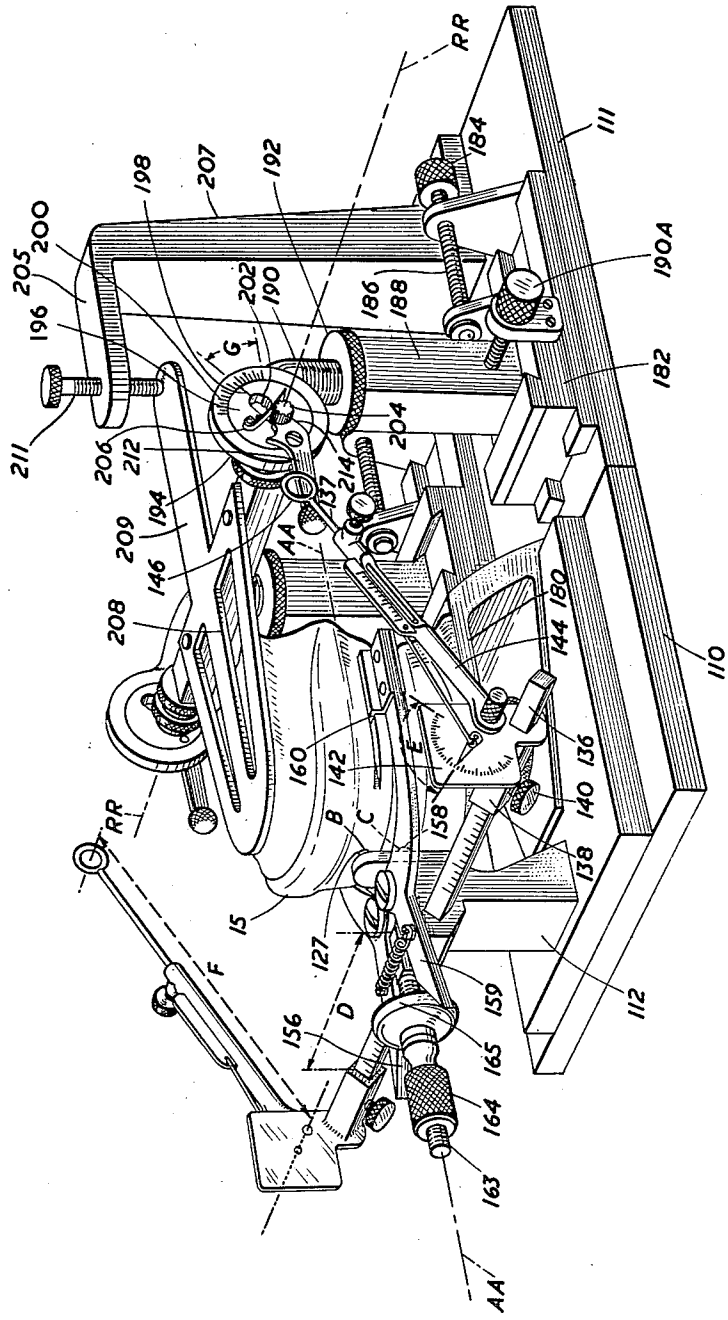


FIG. 6

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United States Patent Office

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DENTAL EQUIPMENT

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Filed July 12, 1957, Ser. No. 671,554
6 Claims. (Cl. 32—20)

This invention relates to an apparatus for assisting in the proper fitting of dentures.

In fitting dentures, models are first constructed which represent the shaping of that part of the plate which is to contact the gums. These models are inserted in the patient's mouth while further measurements are made to ascertain the characteristics of his jaw construction and movement. In order to obtain the necessary spacing between the models corresponding to the space which will be taken by the upper and lower plates, rims are provided on the upper and lower models extending below and above respectively the gum contacting portion, and these rims represent the necessary space taken up by the false teeth when they are fitted in place in the plate. These rims are known as occlusal rims.

In the fitting of plates, in addition to the gum fitting and gum spacing discussed above, other characteristics of the formation of the patient's jaw are material to the provision of a properly fitting set of dentures. The relative movement of the patient's upper and lower jaws in the opening and closing thereof, depends to a large extent upon the location of the condyle surfaces which are the surfaces where the lower jaws slides on the upper jaw during relative movement thereof. Also important is the path of travel of the condyles during such sliding. Since the movement between the jaws is a sliding and not a pivotal one, it is important also that the path of travel of the condyles be accurately determined. The determination of condyle position and of condyle travel must, of course, be determined relative to the position and orientation of the models, since it is the wax models which form the datum to which these observations may be applied in the laboratory during the construction of the plates.

Other devices have been directed towards assisting in the determination of these characteristics. However, the apparatus provided either has not sufficiently provided for inter-relating the various measurements taken so that they may be accurately reproduced in the dental laboratory; or has not provided for the reproduction of some of these characteristics at all.

There is herein provided an apparatus whereby the above characteristics may be measured and inter-related in the form of data which may be applied to the apparatus for the assembly of dental plates in the dental laboratory, whereby these characteristics may be reproduced, the result being that a better fitting and operating set of dental plates is produced. The invention generally provides a means for measuring various oral characteristics relative to the models fitted in the patient's mouth including: a measuring apparatus supporting framework, said framework defining an axis, means for locating the patient's head in a predetermined relation to said framework, first means for marking a point of reference with respect to said framework on each of said occlusal rims, means for marking on each side of each occlusal rim grooves parallel or bearing a definite angular relation to said axis, and means for locating the patient's condyles relative to said first reference point and to said axis.

The invention also provides means for tabulating in graph form the path of travel of the condyles during the opening and closing of the jaws.

The accompanying laboratory apparatus is designed to suspend in proper relation, the same models which were in the patient's mouth. A pivotal connection is provided

in the laboratory which is adapted to incorporate the measurements of condyle location and angle made in the dentist's office so that the pivotal connection can be connected to the models and the models when attached by the connection, will move in the same relation to one another as they would in the patient's mouth. Thus the teeth may be set in the models thus connected by the dental technician to take into account the individual characteristics of each patient.

The invention also comprises the method of locating a patient's condyles relative to the models of his upper and lower plates comprising placing the models properly in his mouth, making data marks thereon and geometrically locating his condyles in relation to said data marks.

The invention further comprises the steps of locating the patient's condyles relative to the models as above set out, removing said models, placing them in juxtaposition as they would be in a patient's mouth with his jaws closed, locating a mechanical pivotal connection in the same relative position to said data marks as was assumed by the patient's condyles when the models were in his mouth, and connecting said upper and lower jaws by said pivotal connection so located.

In drawings which illustrate embodiments of the invention:

FIGURE 1 illustrates the framework used with the invention and the means for measuring some of the data;

FIGURE 2 illustrates the condyle travel tracing means;

FIGURE 3 illustrates the occlusal groove marking means;

FIGURE 4 illustrates the wax models;

FIGURE 5 illustrates the path of travel of the condyles;

FIGURE 6 illustrates the laboratory apparatus for reproducing the patient's jaw movement;

FIGURE 7 illustrates part of the laboratory apparatus;

FIGURE 8 is an enlargement of the slot.

It may be of assistance to first refer to FIGURES 4 and 5. FIGURE 4 illustrates a condyle 11 which projects from a patient's lower jaw to contact surface 13 on the patient's upper jaw. When the patient opens his mouth the lower jaw drops away from the upper and condyle 11 rides along surface 13. The slope of surface 13 therefore determines the travel of the lower jaw and the slope of surface 13 therefore must be taken into account in the construction of a properly fitting set of dentures.

In FIGURE 4 are illustrated the wax models 15 and 17 which make the molds of the upper and lower jaws. To simulate the spacing required for the teeth to be provided, each model is provided with an occlusal rim 19.

Referring to FIGURE 1, a standard 10 supports the framework, but the standard 10 may be replaced by any suitable mounting, fixed or retractable, which may be based upon the floor or upon the wall or upon some other base, to be brought close to the patient's head during the measuring operation. A cross-bar of a T-shaped framework 12 defining an axis A, pivotally mounts arms 14 at each end which extend on each side of the patient's head and are bent to extend upwardly adjacent the patient's ears to form, by means of clamps 16, a means for holding the patient's head in position during the measurements. A gear wheel 18 is pivotally mounted on the framework 12 adjacent the standard and cooperates with a pair of racks 20 each pivotally connected at 22 to the head holding arms. Both racks 20 mesh with the gear wheel 18 and it will be seen by this arrangement that the patient's head is always maintained symmetrical with respect to the axis A of the framework 12 since movement of one clamp means 16 brings about an equal movement of the other clamp. A guide rod

24 extends rigidly from the framework 12, away from the patient's head.

The guide rod 24 forms a mounting for the means for marking datum positions on the wax models which means are attachable thereto for the marking operation.

Adjustably and slidably mounted on rod 24 is a rod 26 provided with a control handle 28 at one end and with its other end extending toward the patient's head. The slidable mounting is achieved by brackets 30 rigidly attached to rod 24, the brackets providing apertures through which may pass the rod 26. Set screws 32 in the bracket are provided to fix the rod in position. Slidably mounted on the rod 26 in the vicinity of the intended head position, are a pair of marking points 27. The points are mounted on a bracket 29 which has two downwardly extending ears 31 which slide on each side of the bar 26 to guide the travel of the bracket 29 thereon. A screw 33 connects the ears 31 beneath the bar 31 for retention of the bracket thereon.

The marking points 27 are respectively adapted to contact the center of the occlusal rim of the upper and lower wax model, making datum points B and C which are the basis for the application of the measurements applied to the laboratory apparatus.

For accuracy in locating the condyles, the bracket 29 must bear a definite relation to a bar 36 (to be mentioned hereafter) and it is suggested that bracket 29 be located as far forward on the rod 26 as possible, that is, actually bearing on such bar 36.

At the end of the rod 26 adjacent the patient's head is provided a cross-bar 36 extending to each side of said head, the cross-bar slidably mounting condyle locating gauges 37 which will now be described. Each gauge is provided with a sleeve 38 for non-rotating slidable receipt of the cross-bar 36, and a set screw 40 is adapted, when tightened, to prevent relative movement between gauge and cross-bar.

The sleeve 38 is rigidly connected to a vertical plate 42 which has marked thereon an angle indicating dial. The dial indicates the angle E, being the angle of the condyles to the horizontal, projected on a vertical plane parallel to axis A. The outer member of a telescopic arm 44 is pivotally mounted at the radial center of said dial, the outer member of said telescopic arm extending to an eye 46.

The cross-bar 36 adjacent the locus of sleeve 38 is calibrated to indicate the position of sleeve 38 thereon when eye 46 is laid over the condyle of the patient. This calibration indicates the distance, measured transverse to the cross-bar A, from the condyles to datum points B and C. It will be seen that the pivotally mounted arm 44 is rigidly attached to a pointer 47 adapted to provide an indication on the dial.

In this way each of the patient's right and left hand condyles may be accurately located relative to the centric points B and C and to the grooves 61. The right and left hand condyles will not necessarily be equally spaced from points B and C and hence the line R joining the two condyles, and representing the axis of pivot of the upper and lower jaw relative to one another, will not from one patient to another bear any definite angular relationship to axis A.

The apparatus for marking the occlusal grooves will now be described. It should be noted that when this latter apparatus is in use, the marking points 27 and bracket 29 are either removed after the removal of screw 33, or the bracket 29 is slid to its rearmost position adjacent bracket 30.

The pointer 47 is adapted to provide an indication on dial 42 of the angle of the arm 44 and that the inner member of the telescopic arm is slotted so that the position of the inner end of the outer member thereof may be observed. The borders of the slot are calibrated so that the inner end of the outer member indicates the extension of the arm and therefore the position of the condyle when eye 46 is located thereon. Dimension F therefore represents the distance, measured transversely of the cross bar 36 of the condyle from a datum.

The operation of the invention so far described is as follows:

It will be noted especially with reference to FIGURE 4 of the drawing that the thickness of the wax models 15 should be different for each patient's mouth, since a pair of wax models which were too thick in the vertical direction would, when transformed into plates provide a set of teeth which tended to unduly distend the patient's jaws. On the other hand it should be noted that the gums which rest in the sockets in the wax models are composed of bone and tissue and hence are compressible. Thus the measurements obtained and in particular, the position of the occlusal groove 61 and the centric points C relative to the patient's jaws will be affected by the clamping pressure which the patient exerts on the wax models while the measurements are being taken.

In order to cause the exertion of a constant pressure by the patient and in order to avoid effects from the use of wax models which are too thick or too thin in the vertical direction, there has been provided a pressure means operable on the lower jaw of the patient to exert a constant upward pressure and soft wax is provided to yieldingly space the upper and lower wax models. The soft wax illustrated at 79 in FIGURES 1 and 4 acts as a spacer between the upper and lower wax models 16 and 17 and thus allows these models to be made so that at the proper jaw setting there is still a spacing between their adjacent extremities. Between these extremities the soft wax flows under the perloading pressure until the desired spacing is reached.

The preloader illustrated in FIGURE 1 is mounted on an arm 125 which is rigidly mounted on the standard 10. Rigidly extending upward from the arm 125 parallel to the standard 10, is a hollow tube 126. A collar 128 is slidable on the exterior of the tube 126 and the collar may be adjusted vertically and held in any desired position by a set screw 130. Slidable in the tube 126 is a spindle 132 rigidly mounting a chin rest 134 adapted to bear upwardly on the patient's chin. The chin rest is biased upwardly by a compression spring 136 which bears at one end on the chin rest 134 and at its other end on the collar 128. Thus the desired preloading pressure for the patient's chin may be set by adjusting the height of the collar 128 which in turn adjusts the pressure exerted by the spring 136. A calibrated scale 140 projecting upwardly from the arm 125 adjacent the tube 126 and a pointer 142 projecting from the collar 128 act to indicate the location of the collar 128 for the proper preloading pressure.

Wax models 15 are fitted in the patient's mouth and his head releasably but firmly held by the movable clamps 16 which effectively locate said head centrally relative to the measuring framework. With the head so held, the slidable rod 24 is then moved toward the patient and the marking points 27 are applied to the occlusal rims 11, and the patient's head is at the same time moved, so that points 27 mark the center horizontally and vertically of, respectively, the upper and lower occlusal rims.

With the marking points 27 remaining or relocatable in position to indicate a constant position of the patient's head, the telescopic arms 44 are rotated and extended until the eye 46 overlies the condyle. The location of sleeves 38 on crossbars 36 (dimension D), the angle of telescopic arms 44 (angle E) and the extension thereof (dimension F) are then recorded for future use.

The occulsal groove marking apparatus comprises: a base 48 provided with mounting means 50 similar to bracket 29 and ears 31 so that the groove marker may be mounted on bar 24 and a set screw 54 is provided in one of the ears so that the base may be clamped in position on the bar.

A pair of horizontal sleeves 56 are pivotally mounted

on the base 48 and are each adapted to slidably receive the shank 58 of a stylus point 60. The pivotal mountings of the sleeves 56 are provided with intermeshing gear wheels 62 which are so meshed and arranged that in any angle of a sleeve 56 to the bar 24 the other sleeve is kept by the meshed gears at an equal opposite angle.

A pair of arcuate slotted members project inwardly from the sleeves 56 with the slots intersecting. The slots are arcuately centered at the pivotal axis of the sleeve 56 from which they extend and the slots therefore intersect on the line of symmetry of base 48 and bar 24. A winged bolt 70 extends through the intersecting slots into the base 48 and is provided to clamp the sleeves 56 in any given orientation.

A second base 66 is mounted, in a similar manner to and on the remote side of the base 48, on the bar 24. The base 66 is not rigidly fixable on the bar 24 but is intended to slide relative to the base 48. A pair of guide rods 68 extend in the direction remote from the patient's head through sleeves in base 66 to guide the relative sliding movement between the two bases 48 and 66.

Mounted on base 66 is a slotted arcuate plate 64, adapted to receive the remote ends of the stylus shanks which are grooved to provide shoulders which prevent axial movement of the shanks relative to plate 64 while allowing relative arcuate movement.

The stylus points 60 are inwardly directed to mark the grooves 61 on the occlusal rims, on axial sliding of the shanks 58.

The base 48 is provided with a pair of projections 72 bearing the same relative vertical location to the bar 24 as do the marking points 27.

The method of using the above apparatus to mark datum grooves is a follows:

With the marking points 27 out of the way, the bases 48 and 66 are placed on the bar 24 and the base 48 is then moved toward the patient's head.

The bolt 70 is loosened and the sleeves 56 are adjusted to an angular divergence slightly less than the angular divergence of the occlusal rims so that a groove 61 will be cut by each of the stylus points 60 therein.

The base 48 is then moved and the patient's head adjusted until the projections 72 contact the centre marks made by the marking points 27 in the occlusal rims.

The base 66 is then moved toward the base 48 whereby the arcuate plate 64 moves the stylus shanks and points toward the patient's head so that the stylus points 60 contact and make a groove 61 upon each side of the occlusal rims 19 of each of the upper and lower wax models.

The apparatus for measurement of the path of condyle travel is used when the groove marking apparatus mounted on bases 48 and 66 has been removed. The apparatus includes sleeve 76 attached to the vertical extent of each arm 14 adjacent the patient's ears and fixed in position by set screws 78. From each sleeve 76 adjustably extends an arm 80 to a position adjacent the condyle 11 and the arm is made adjustable relative to the sleeve 76 by a set screw 82. The arm 80 holds a marking screen 84 erected in a vertical plane opposite each condyle 11. Attached to this screen 84 at the upper edge may be a horizontal screen 86 extending between the upper edge of the vertical screen 84 and the patient's head. A similar construction is, of course, provided on the framework on the other side of the patient's head.

To operate in conjunction with these marking screens there is provided a framework of three linked arms 88, 90 and 92, the central arm 90 having a dished plate 94 adapted to fit about the point of the patient's chin and each of the connected arms 88 and 92 have a recessed plate 96 to contact the rearward upwardly curving lower surface of the patient's lower jaw.

The ends of arms 88 and 92 adjacent the arm 90 are pivotally joined by bolts 98 which when tightened clamp the arms rigidly relative to one another in any desired

position. Thus with plate 94 under the patient's chin, plates 96 behind the patient's jaw and the arms clamped in this position, the three arms may be clamped as a framework on the patient's lower jaw. In this connection it will be noted that the rear clamps are movable to various positions along bars 88 and 92 to fit various jaw sizes and may be fixed in the properly fitting position.

A telescopic sleeve 100 is slidably and rotatably mounted on bars 88 and 92 and is fixable in any desired location by a set-screw 101.

Slidable in sleeve 100 is a shank 104, terminating at its upper extremity in an eye 106 adapted to overlie the patient's condyle. The shank 104 may be fixed at any given height by means of the set screw 102.

Attached to each shank 104 adjacent eye 106 are an outwardly and an upwardly extending pair of marking points 108 and 110 respectively, adapted to indicate the path of condyle travel on screens 84 and 86 respectively. The screens 84 and 86 therefore indicate condyle travel in their respective planes.

In operation therefore with the framework 88, 90 and 92 clamped together and attached to the patient's face, and the eye 106 adjusted to overlie the patient's condyle, the marking points are placed in contact with their respective screens. The patient is then told to move his lower jaw in a normal chewing motion and the points trace out vertical horizontal projections of the consequent movements of the patient's condyles on screens 84 and 86 respectively.

As will be seen from FIGURE 4, the screen 84 should be calibrated in angles indicating varying condyle paths. The superimposed trace of marking point 108 upon the calibration allows the mean condyle path to be read therefrom. The mean angle "G" is sufficient for the construction of a workable set of plates since the present condyle curve provided in the dental laboratory for the measured angle, will simulate the patient's jaw formation for all practical purposes.

The mean angle G is the projection of the condyle angle to the horizontal on a vertical plane parallel to the axis A.

The trace made on the screens 86 may also, for extreme accuracy, be used in the dental laboratory to reproduce the patient's lateral jaw movement. It is found, however, that good results may be obtained without the use of this measurement. In the latter case, the marking point 110 and the screen 86 may be dispensed with.

There has been described therefore for use in the dentist's office:

(1) Means for marking the central forward points on each of the wax models to supply datum points thereon.

(2) Means for marking grooves on the occlusal rims of the wax models for alignment purposes in the laboratory.

(3) Means for measuring the condyle location relative to said central points.

(4) Means for measuring the path of travel of the condyle surfaces.

While the path of condyle travel projected on a vertical plane parallel to the axis "A" is essential for the arcuate fitting of the dentures, the path of condyle travel projected on a horizontal plane is not considered so important, hence the horizontal screen is considered as optional equipment.

Before discussing the apparatus used in the dental laboratory a brief review will be made of the data assembled so far. It will be recalled that datum-grooves 61 directed parallel to axis A have been marked on each side of both the upper and the lower models 15 and 17. Moreover datum holes B and C have been cut in the front central portion of the upper and lower wax models 15 and 17 respectively. Grooves 61 and apertures B and C form the datum for the condyle location measurements made.

The measurements taken with the apparatus illustrated

in FIGURES 1 and 5 included the distance D representing the horizontal distance at right angles to the axis A of the condyle from either of points B or C. The distance F was measured representing the distance in a vertical plane parallel to axis A of the condyle from the points B and C while the angle E represents the angle between the direction of measurement of the distance F and the direction of axis A, whereby the dimensions D, E, F effectively locate the condyle with reference to the points B, C. The angle G represents the angle of the condyle surfaces to a horizontal plane containing the axis A.

The laboratory equipment shown in FIGURES 6 and 7 comprises: a base means for temporarily supporting on the base the models in the relationship to one another which they will have in the patient's mouth with his jaws closed; a member connected to said base through a pivotal connection, means for locating said pivotal connection relative to the models in accord with measurements D, E, F so that the pivotal axis bears the same relation to the models temporarily suspended as did the line R joining the patient's condyles, means for supporting one of said models from said pivotal member once their proper relative locations are established and means for supporting the other of said models from said base.

The equipment includes a base supporting: firstly, a pair of studs adapted to rest in the centric holes B and C and, secondly, a pair of jaw members each provided with upper and lower teeth, each tooth being shaped to rest in a groove **61** on each side of a wax model so that each wax model is supported by a pair of teeth, one on each side thereof and by a stud. The teeth and the studs are arranged as are the marking points **27** and knives **60**. Hence the teeth and studs define an axis AA bearing the same symmetrical relation to them as the axis A does to the elements **27** and **60**.

The above described means will temporarily support the wax models **15**, **17** in the laboratory or a base in a predetermined relation, that is the relationship they would bear to one another if in the patient's mouth with his jaws closed. The models have also a predetermined orientation. An arm is provided with means for attachment to one of said models, said arm being pivotally connected to said base, the pivotal connection being adjustable to assume the same position relative to data marks B, C and **61** as did the patient's condyles in the dentist's office (see FIGURE 1). Means are provided for so adjusting the pivotal connection location. The means for adjusting the pivotal connection location incorporates the measurements D, E and F which fixes this location with respect to the points B and C.

In a preferred embodiment of the invention, the pivotal axis of the arm above described is allowed to slide against the spring bias along an axis set by the angle G representing the condyle angle measured on the plate **84**, to reproduce the retrusion of the lower jaw relative to the upper.

The preferred embodiment of the laboratory apparatus is as follows: a base **110** is provided at one end with an upright **112**, the upright being provided at a convenient height with a pair of studs **127** projecting horizontally therefrom, the studs **127** being adapted to rest in the centric holes B and C of the wax models **15** and **17**.

Referring back to FIGURE 1 it will be understood that the studs **127** bear the same relation to an axis AA as the studs **27** bore to the axis A. Referring to FIGURE 3 it will be seen that stylus points **60** were to cut two pairs of grooves **61**, one pair symmetrically located on each side of axis A and each groove being at the same height as a corresponding groove on the opposite side and the height being so adjusted that a groove **61** is cut on each side of each of the wax models. There are provided a pair of jaws **158** vertically pivotally mounted on the upright **112** and diverging about the centric pins, the jaws **158** being symmetrical with respect to the axis AA and being movable toward and away from one another along a horizontal plane and the jaws **158** are each provided with a pair of teeth at the divergent ends thereof adapted to rest in the pair of grooves **61** on one side of an upper and lower wax model. The jaws **158** are provided with means to control their divergence and when brought into contact with the wax model it will be seen that the upper and lower wax models **15**, **17** are each suspended by the converging teeth **160** and the studs **127**.

The relative location and orientation between the studs **127**, teeth **160** and the axis AA is the same as the relative location and orientation between the studs **27**, the stylus points **60** and the axis A. A convenient means for controlling the convergence of the teeth **160** comprises the construction of each jaw with arms **159** which each extend away from groove-contacting teeth **160** and are symmetrically disposed on each side of the axis AA to end in chamfered surfaces **156** diverging from such axis. A stud **163** rigidly mounted on the upright **112** projects between such chamfered faces and threaded to the stud **163** is a control knob **164** provided with a truncated-cone disc **165** adapted to contact such chamfered faces **156** and to bias them outwardly. The jaws **158** form bell crank with their respective arms **159** so that outward movement of the arms causes inward movement of the jaws and movement of teeth **160** toward the grooves **61**. For certainty of operation, the bell-crank arms **159** may be lightly biased against the operation of the control knob **164** by spring **170** joining the arms **159**.

The means for temporarily suspending the wax models has just been described. The means for giving permanent support to such models while the teeth are being fitted will now be described.

It will be noted that the base **110** is provided with a V-shaped cut-out in plan view and that in this groove is received the V-shaped projection of a base **111**. The complementary V-shaped elements allow alignment of the parts as will be hereinafter described.

A support plate or grid **180** rigidly attachable to a base **111** is adapted to underlie the model **17** when it is suspended by stud **127** and two teeth **160**. Soft plaster may be used to attach the wax model to the grid and, if necessary, key means may be made in grid and model to ensure attachment. Thus once the plaster is applied the withdrawal of stud and teeth would leave the lower model **17** supported by the grid **180**.

The means for permanently mounting the upper wax model **15** will now be discussed. On the opposite end of the base **111** from upright **112**, and disposed, on opposite sides of said base, are a pair of base plates **182**, slidable relative to the base **110** parallel to the axis AA and each movable relative to the base **110** by a control knob **184** having a shank **186** which is threaded to an upward extension of the base and rotatably slidable in the base plate **182**.

An upright **188** is slidable relative to each base plate **182** along a horizontal axis at right angles to the axis AA and is controlled by a knob and shank **190A**, rotatable with respect to the base plate **182** and threaded in the upright **188** to adjust it in said relative direction.

Each upright **188** forms the outer sleeve of a telescopic arm, the inner member being a shank **190** slidably projecting from the upper end of the upright. The projecting portion of the shank **190** is provided with threading and a ring **192** threaded thereon controls the amount of upward extension of the shank **190**. Each shank **190** mounts an annular ring **194** defining a vertical plane parallel to the axis AA and suitably mounted in such annular ring **194** is a circular plate **196** rotatable with respect to the ring **194** and having a pointer **198** which cooperates with a degree scale **200** on ring **194** to indicate the relative orientation of plate and ring. On this degree scale the pointer **198** is set to the condyle angle G measured as shown in FIGURE 5. The circular plate **196** is provided with a slot **202** extending across the cen-

ter thereof and the scale 200 is adapted to indicate the angle of such slot 202 to the horizontal. Such slotted plate, of course, appears on each side of the apparatus and extending therebetween is a shank 203 having two ends 204 adapted to rest in the slot. A spring 206 is mounted on the circular plate and is adapted to bias the ends 204 toward the bottom of the slot 202. A support plate 208 of generally triangular shape and projecting to overlie the upper wax model is provided slidably mounted on the shank but keyed thereto against relative rotatable movement. A portion of the shank 203 is threaded on each side of the support plate 208 and a pair of lock nuts 210 are provided on each side whereby the support plate 210 may be locked in any position relative to the axis AA. A lever 212 pivotally mounted on circular plate 196 beyond tthe lower extremity of the slot 202 is provided with a pair of radially outward concave surfaces 213, 214 respectively adapted by rotation to face and receive the shank ends 204. One of said surfaces 213 is adapted to hold a shank end 204, a short distance upward from its lowermost position and the second surface is adapted to allow the end 204 to assume its lowermost position. Similar provision is made for the other shank end 204.

The lower edge of slot 202 is smooth to allow for sliding movement of the shank end 204 between the two positions allowed by concavities 213, 214 but along the remainder of its length is splined in a similar manner to a gear rack and the shank ends 204 are correspondingly splined.

The shank end-slot connection is meant to simulate the condyle orientation and movement and the method of locating the shank ends 204 relative to holes B and C and to grooves 61, will therefore now be discussed.

To maintain the support plate in its desired position the plate is provided with a rearwardly extending arm 209 while the base 111 at its rearward end is provided with a vertical standard 207. The standard 207 integrally extends into the forwardly extending arm 205 whose extremity overlies the rearward extremity of the arm 209. A screw 211 threaded in the arm 205 projects downwardly to bear on the arm 209 and to form a detent for the arm and for the plate 208 against downward movement of the latter. The arm 209 is kept in contact with the screw 211 by the weight of the plate 208 forward of the axis RR.

Attached to the upright 112 on the side of the studs 127 remote from the wax models is a crossbar 136 bearing the same relation to studs 127 and axis AA as bar 36 does to axis A in FIGURE 1. The bar 135 is similarly calibrated to bar 36 and a pair of sleeves 138 are slidable on each end thereof, and controllable in their locations by set screws 140 mounted on such sleeves. The setting of sleeve 138 on arm 136 therefore incorporates the measurement B as illustrated in FIGURE 1. Mounted on the sleeve 138 is plate 142 having an angle indicating dial and at the center of such dial is pivotally mounted a telescopic arm 144 similar to arm 44 and provided with a pointer 147 which indicates the angular orientation of arm 144 and therefore allows the setting of the angle E shown on FIGURE 1.

The telescopic arm 144 is apertured and calibrated in a similar manner to arm 44 of FIGURE 1 whereby the calibration allows the setting on the arm of the dimension F as shown in FIGURE 1, and arm 144 terminates at its upper extremity in an eye 146.

In operation the wax models 15, 17 are each caused to be suspended by a centric and by teeth 160 in grooves 61. On the left hand ring 200 the proper angle, G, is set corresponding to that of the patient's left condyle. The lever 212 is set so that shank 204 is in the upper of its two positions at the lower end of the slot. The position corresponding to the patient's left condyle is found by:

(1) Setting sleeve 138 on crossbar 136 in accord with measurement D.

(2) Setting the angle of telescopic arm 144 as indicated on scale 142 in accord with angle E.

(3) Setting the extension of arm 144 as indicated by measurement F.

The position of the left "eye" 146 relative to studs 127 then corresponds to the position of the patient's left condyle relative to pins 27 in FIGURE 1.

The right eye 146 is similarly located.

The left hand knobs 184, 190A and ring 194 are then adjusted until left hand shank end 204 is located opposite left hand eye 145 and the right hand shank end 204 is then similarly located opposite right hand eye 146, so that pivotal axis RR corresponds to pivotal axis R.

With the shank ends correctly positioned the support plate 208 is then attached to the upper wax model 15 by soft plaster and the bolt 211 is adjusted downwardly to bear on tthe arm 209 to maintain the support plate 208 in this position.

Studs 127 and teeth 160 are then withdrawn, by sliding the base 110 away from the base 111. With the base 110 removed, the technician in the laboratory is now in a position to fit the teeth with knowledge that the movement of the upper model relative to the lower model correctly reproduces the patient's jaw movement. To simulate the normal amount of protrusion or retrusion of the lower jaw relative to the upper the lever 212 may be rotated (counterclockwise in FIGURE 6) to allow the shank end 204 to slide to the lower end of the slot, causing the upper jaw to protrude relative to the lower.

What I claim as my invention is:

1. Means for obtaining data for use in the fitting of dentures, said means being designed for use in association with wax models of at least one of the upper and lower plates when said models are fitted in the patient's mouth, each such model including an occlusal rim, comprising: a framework having means for holding the patient's head in a position, said framework being provided with means to contact and mark each such rim and means to contact each of the condyles of the patient while said patient's head is held in position, and means for indicating the position of said condyles relative to the mark on each said occlusal rim, in combination with means mounted on said framework for measuring the condyle angle when said head is held in position and for indicating said angle relative to the positions of said condyles and said marks.

2. Means for obtaining data for use in the fitting of dentures, said means being designed for use in association with wax models of at least one of the upper and lower plates when said models are fitted in the patient's mouth, each such model including an occlusal rim, comprising: a framework having means for holding the patient's head in a position, said framework being provided with means to contact and mark each such rim and means to contact each of the condyles of the patient while said patient's head is held in position, and means for indicating the position of said condyles relative to the mark on each said occlusal rim; wherein said framework defines an axis running generally horizontally and forwardly and rearwardly relative to the patient's head and wherein said occlusal rim marking means are slidably mounted on said framework and movable when said framework in holding said head in position to mark said occulsal rims and to indicate the position of said marks relative to said framework; in combination with means, mounted on said framework for marking grooves on each side of each occlusal rim in such manner that said grooves bear a definite angular relation to said axis.

3. Means as claimed in claim 2 wherein said head locating means is adapted to locate said head symmetrically relative to said axis.

4. Meains as claimed in claim 2 wherein said groove

marking means provides that the said grooves on each side will be balanced with respect to said axis.

5. The method of providing for the simulating, in relation to a model of at least a patient's upper and lower dental plates, the relative upper and lower jaw movements of the patient, comprising: placing the models properly in said patient's mouth, making data marks thereon, physically determining the position of the patient's condyles in relation to said data marks, removing said models, placing them in juxtaposition as they would be in a patient's mouth with his jaws closed, locating a mechanical pivotal connection in the same relative position to said data marks as was assumed by the patient's condyles when the models were in his mouth, and connecting said upper and lower models by said pivotal connection so located.

6. A method of assisting in the preparation of dental plates comprising: fitting wax models of upper and lower dental plates in the patient's mouth; mounting apparatus on the patient's head independently of the patient's condyle, making with said apparatus location and orientation marks

on said wax models, said orientation being adapted to act as support abutments, measuring the position of the patient's condyles relative to said marks, removing said marked models from the patients' mouth, supporting said wax models by said support abutments and adjusting said support abutments so that said support abutments assume positions corresponding to the position of location and orientation marks relative to the condyles while said wax models are so supported.

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