

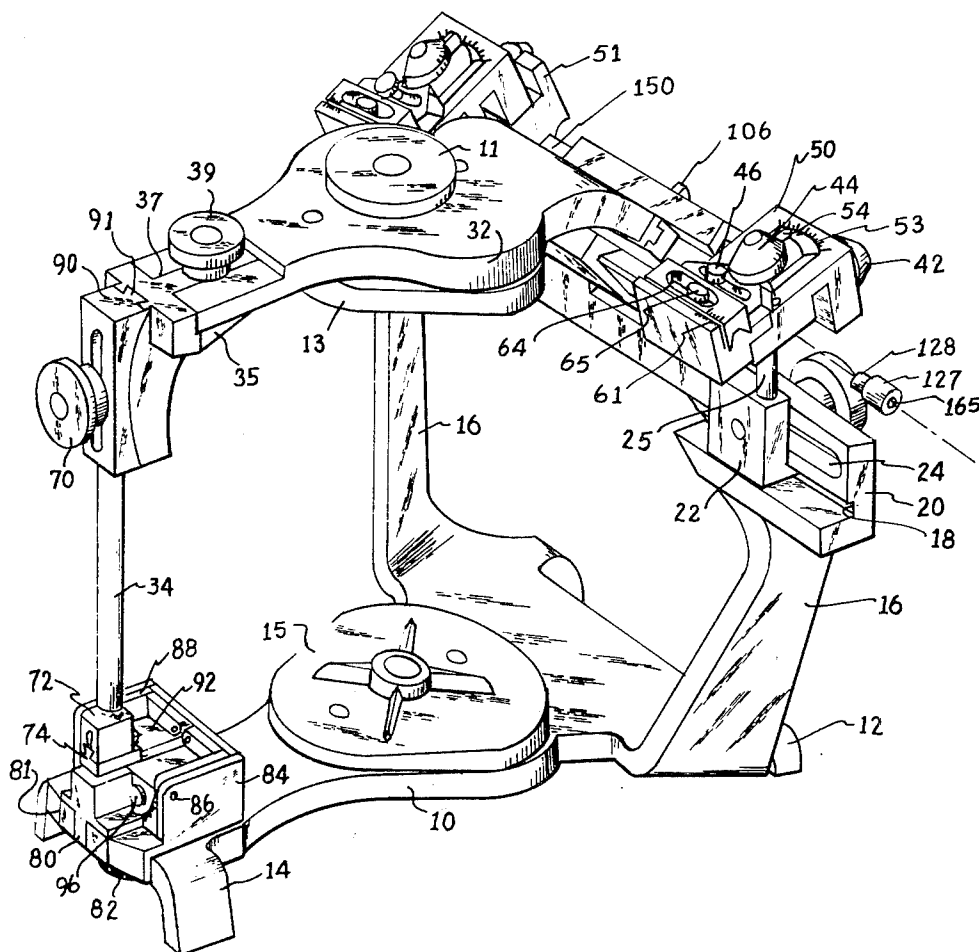
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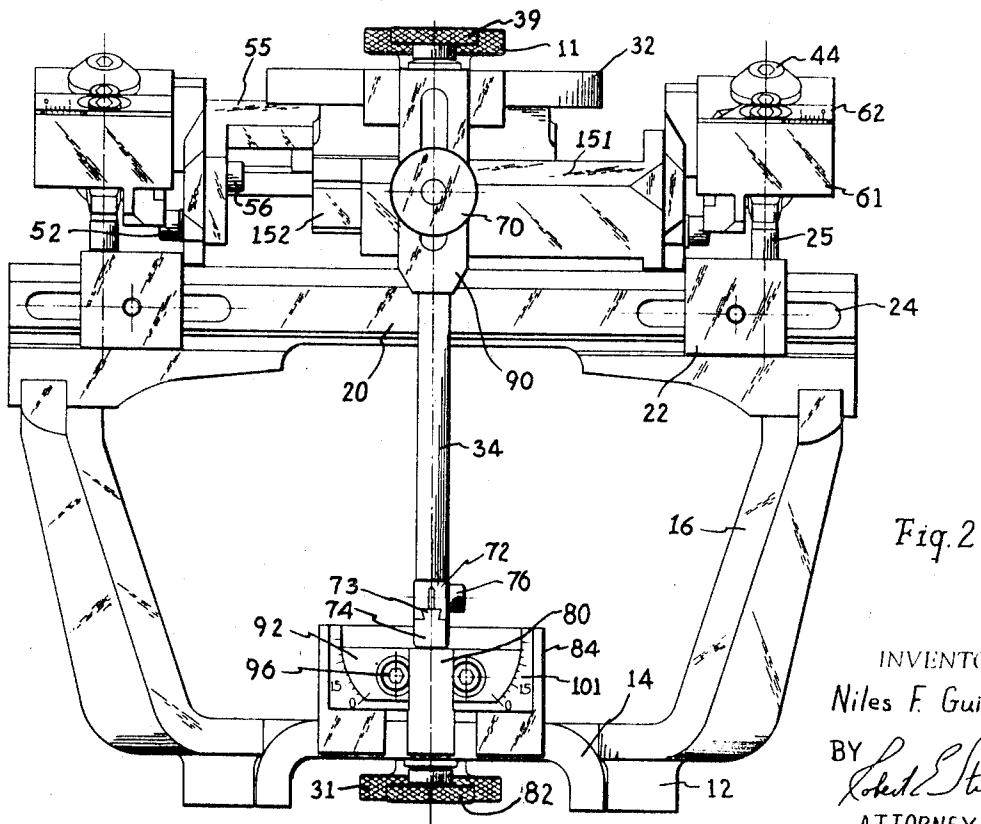
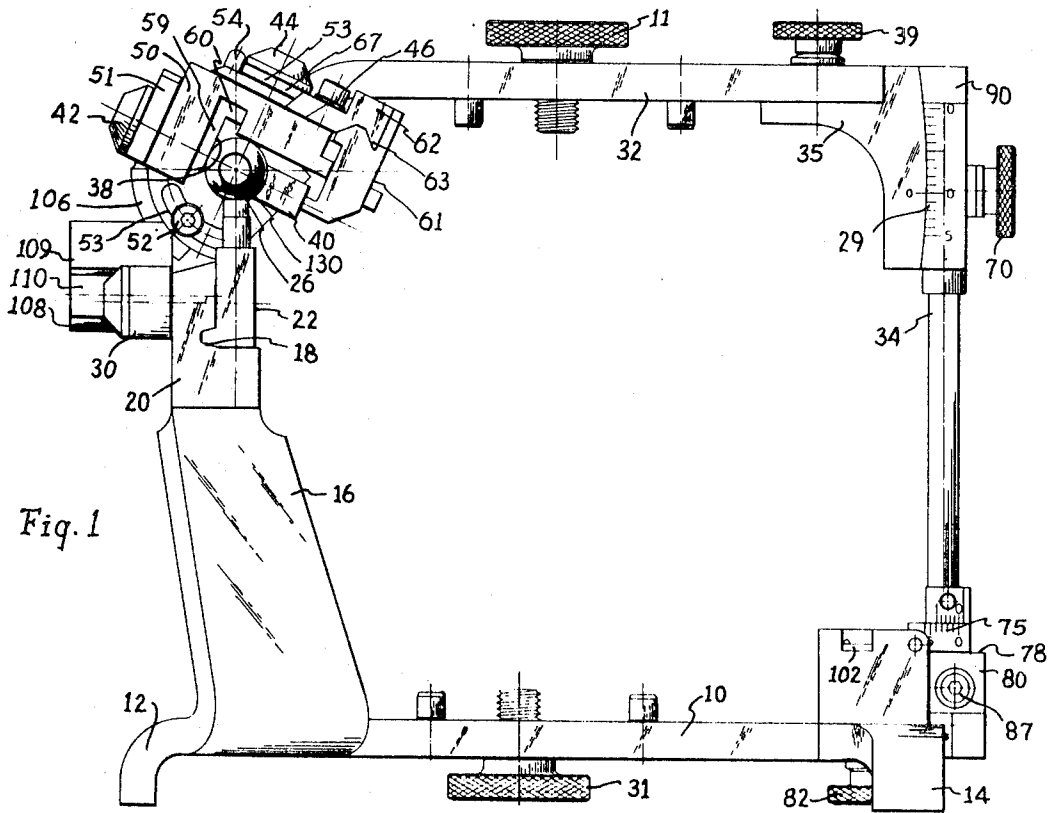
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Primary Examiner—Robert Peshock
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[54] **DENTAL ARTICULATOR**
 17 Claims, 11 Drawing Figs.

[52] U.S. Cl..... 32/32
 [51] Int. Cl..... A61c 11/00
 [50] Field of Search..... 32/32

ABSTRACT: An arcon-type articulator is described with fossa guide means which permit lateral, vertical and posterior-anterior translation of rotating condyles during lateral rotation of the members. The articulator has improved incisal table means with a permanent reference rest for the incisal pin and adjustable means to permit a limited degree of relative movement of the anterior ends of the members without vertical separation.





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Fig. 4

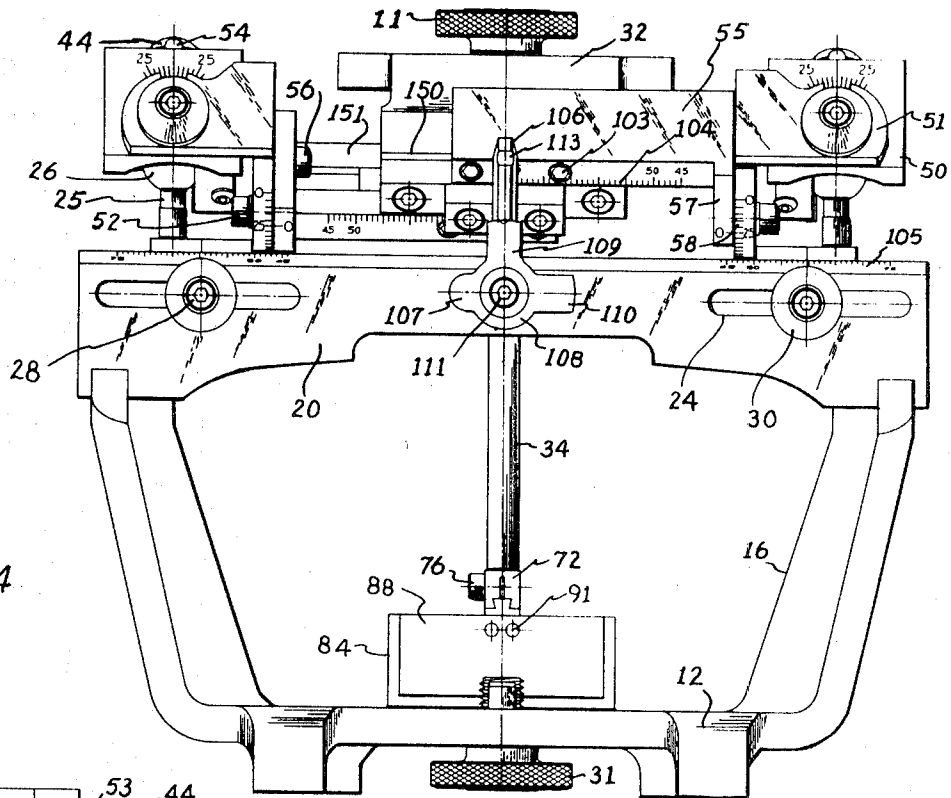
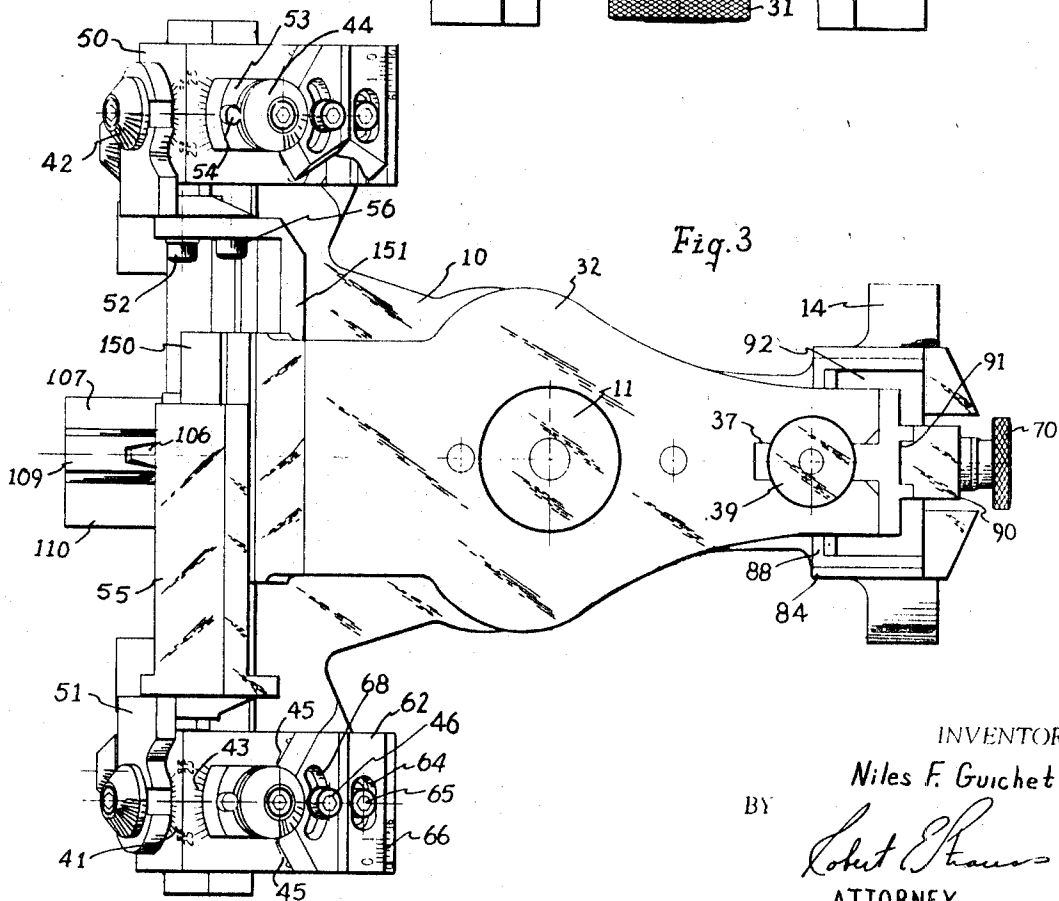


Fig. 3

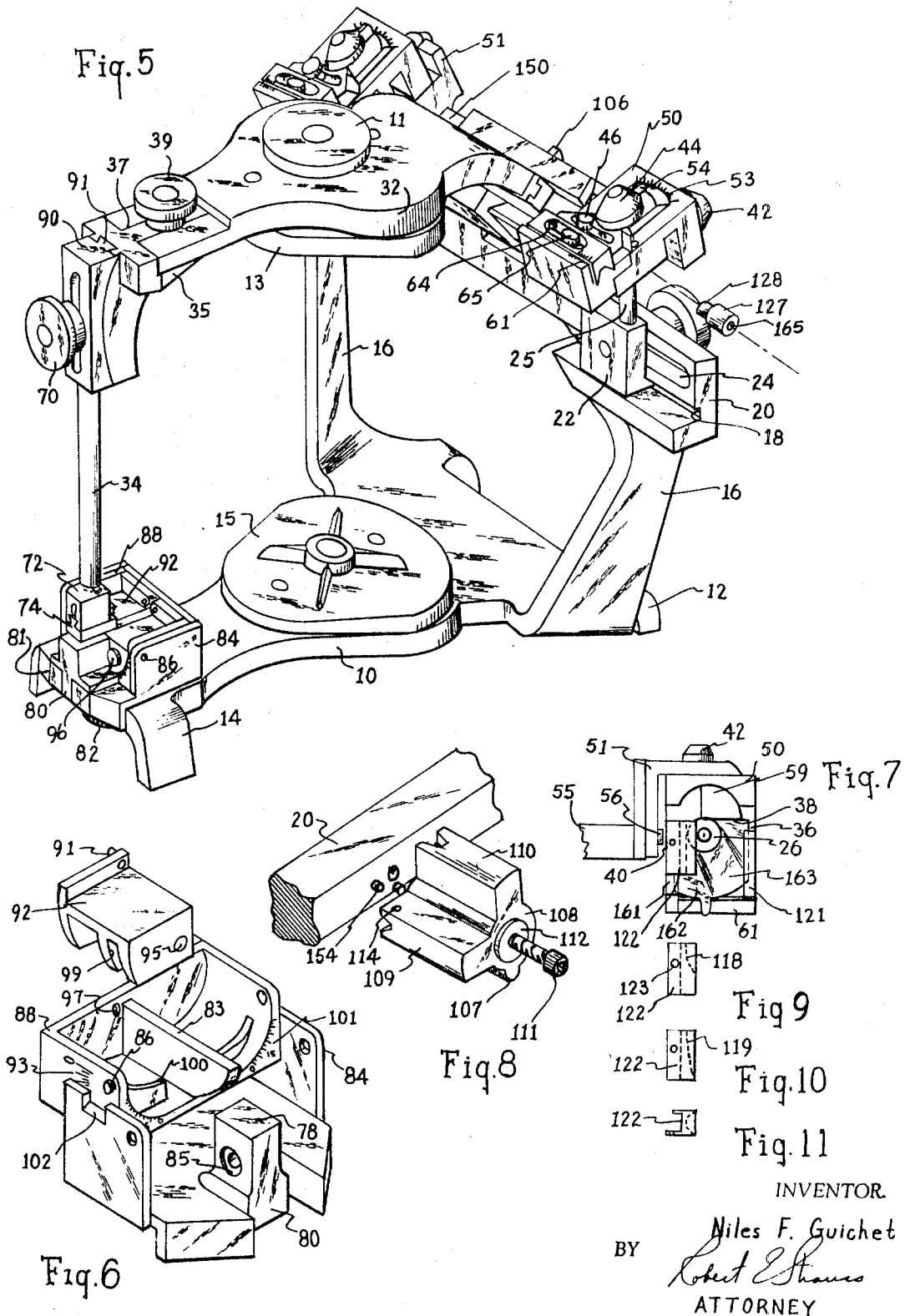


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DENTAL ARTICULATOR

This application is a continuation-in-part of my copending application, Ser. No. 670,138, filed Sept. 23, 1967, now abandoned.

The invention relates to dental articulators and comprises an articulator having means to provide lateral, vertical and posterior-anterior translation of rotating condyles during lateral rotation of the members. The articulator also has improved incisal table means having a permanent reference rest for the incisal pin and means permitting a limited degree of shifting of the anterior of the instrument without vertical separation of the dental casts. The invention also includes means to provide an immediate and programmed or precontoured early and distributed side shifting of the frame members. In a specific adoption, the invention relates to an arcon-type articulator.

Arcon-type articulators have the condyle balls carried by the lower of mandibular frame and are the closest approach to an instrument that duplicates anatomic counterparts. The adjustments of the mandible excursions are made on fossa guides carried by the upper or maxillary member. Heretofore, these instruments have not faithfully duplicated all the movements of the mandible without time consuming and expensive custom grinding of guides from metal or plastic. An immediate side shifting of the articulator members without relative rotation of the frames about either condyle is an example of one movement that has not previously been provided on articulators. Other examples of inadequacies of prior articulators include the absence of means permitting vertical and/or anterior-posterior translation of the condyle rotational centers as well as inadequate means for shifting of the anterior of the instrument without encountering vertical separation of the dental casts. These shortcomings of the conventional articulators have limited their efficient use to teaching and prevented their use to accurately establish specific tolerances in dental restorations.

I have now provided means on a dental articulator, preferably of the arcon type, that permit the faithful and exact tracing of mandibular movements and/or permit the building of tolerances in dental work. The means comprise adjustable fossa guides carried by the upper frame of the articulator which register and permit a controlled degree of vertical and/or lateral and/or anterior-posterior displacement of either condyle as the articulator frames are rotated about the condyle. This adjustment provides a movement that has been overlooked in the prior design of articulators since the posterior and superior guides of the fossa are frequently not anatomically normal or perpendicular to the sagittal plane but are often inclined to this plane. Since upon rotation about either of the condyles, a lateral side shift of the mandible often occurs, the condyle rotational center therefore, shifts, i.e., translates in a vertical, lateral and/or anterior-posterior direction as determined by the angle of inclination of the superior, medial and posterior walls of the fossa and by the magnitude of the lateral shifting. The articulator of my invention has adjustable means for faithfully duplicating these movements or, if desired, of providing a tolerance in the dental restoration to compensate for such movements.

The articulator of my invention also has means on the fossa guide assembly permitting an immediate side shift of the frame members and a centric latch to lock the frame members along their longitudinal centerline. The fossa guides can also be provided with means permitting the insertion of precontoured superior and medial wall guides to impart a controlled shifting of the frames of the articulator.

The articulator of my invention also has an adjustable means between the incisal table guide means and the incisal pin at the anterior of the instrument that permits an immediate and entirely lateral side shifting at the anterior of the frames without encountering vertical separation of the dental casts.

My invention will now be described by reference to the FIGURES, of which:

FIG. 1 is a side view of an articulator having the improvements of my invention;

FIG. 2 is a view of the front of the articulator;

FIG. 3 is a view of the top of the articulator;

FIG. 4 is a view of the rear of the articulator;

FIG. 5 is an isometric view of the articulator;

FIG. 6 is an exploded view of the incisal table;

FIG. 7 is a bottom view of a fossa guide assembly;

FIG. 8 is a view of the centric latch; and

FIGS. 9 through 11 illustrate the replaceable fossa guides.

Referring now to FIG. 1, the articulator is shown having a lower frame 10 supported by rear feet 12 and front feet 14. The lower frame is triangular in shape with the apex at the anterior and with two upright posts 16 at opposite sides of the instrument. The frame is cut from sheet metal stock and the rear posts are integral wings which are bent upright to form the posts 16. Similarly, feet 12 and 14 are wings of the pattern which are bent downwardly.

The upper ends of posts 16 are secured to means that support the condyles 26 in a laterally expandible relationship. This comprises crossbar 20 which has a flat anterior surface bearing a keyway 18 on its front face into which are inserted sliding condyle supports 33. Opposite ends of crossbar 20 are slotted at 24; see FIG. 4. The condyle supports are bored and threaded to receive the threaded end of shaft 28 which extends through slot 24 and keyway 18. A handwheel 30 is splined onto shaft 28 so that rotation of the wheel will lock the sliding condyle support in the keyway. The condyles 26 are carried by the upper end of the shafts 25 at opposite sides of the instruments. These condyles provide the rear bearing surfaces for the upper frame 32 of the articulator. The upper frame rests on the condyles to provide a hinged connection between the upper and the lower frames at their posterior ends.

The upper frame 32 is an elongated plate with its anterior end supported by the incisal pin 34. Projecting from each side of the posterior end of frame 32 are the left and right fossa guide assemblies which rest on their respective condyles.

Centrally positioned on each of the upper and lower frames are dental cast-mounting screws 11 and 31 which removably secure dental cast mounts 13 and 15; see FIG. 5; that are of conventional construction to permit the attachment of dental casts to the frames.

The anterior of the frame 32 terminates with a longitudinal slot 37 and block 35 fits into this slot and is locked to frame 32 by thumbscrew 39. The anterior face of block 35 is convex as shown in FIGS. 1 and 5 and has a slot 91 which engages a mating arcuate key of block 90. The incisal pin 34 is press fitted into a bore in block 90. The block 90 and the anterior end of block 35 mate in an arcuate fit so that the angular relationship between the pin and frame 32 can be varied and observed on scale 29. Screw 70 interlocks the block 90 to block 35 at any angular position along groove 91.

The lower end of pin 34 carries guide 72 which has a dovetail groove 73 that fits a matching dovetail on shoe 74. Shoe 74 is engaged in dovetail guide 72 in a sliding fit that is locked by screw 76 in the guide. A scale 75 is provided on the shoe with a vernier calibration on the guide.

The shoe in the centric position lies on pin support 78 which is the top surface of block 80 that is carried by the rear of the incisal table. Block 80 is removably secured to the lower frame by thumbscrew 82. The anterior end of frame 10 is slotted at 81 and block 80 has a mating key along its lower edge that fits into the slotted frame 10 and screw 82 is then turned to lock block 80 to frame 10. Block 80 will have a fixed vertical relationship to frame 10 regardless of any adjustments that may be made in the incisal table assembly as hereinafter described. Block 80 therefore is a removable rest for the incisal pin that has a fixed vertical position in the articulator.

The incisal table guide means is shown in detail in the exploded view of FIG. 6 as a U-shaped bracket formed by walls 84 having their sides bored in the anterior upper corners to receive pins 86 which pivotable support housing 88 so that the

housing can be tilted along an axis passing through pins 86, thereby providing any desired inclination of the table assembly for protrusive movements. Housing 88 has a central longitudinal wall 83 terminating in an anterior tail that projects into a groove in block 80 which is bored and tapped at 85 to receive screw 87 which can be tightened to lock any angular position of the table assembly in housing 84.

Housing 88 carries incisal guide wings 92 which are bored at 95 to receive screws 96. Wings 92 are pivotably mounted on pins 91 which extend into bores 97 located in the upper corners of the rear wall of housing 88, adjacent wall 83. The outside surfaces of wings 92 are arcuate and mate with a similar arcuate cut in the sides of housing 88, with the radius of curvature of these surfaces being about a centerline passing through the pivot center, pins 91. Screws 96 project through bores 95 of wings 92 and into tapped bores behind slot 99 so that the screws 96 can be tightened to bind the sides of slot 99 against ribs 100 on housing 88 and thereby lock wings 92 at any angular setting. Preferably compression springs, not shown, are embedded in the assembly to bias housing 88 upwardly in a tilted position and to bias wings 92 upwardly in a tilted position. Calibration marks 101 on the face of the housing 88 register the angle of inclination of wings 92 while calibration marks 93 on the side of housing 88 in cooperation with knife edge 102 register the angle of inclination of housing 88.

The fossa guide assemblies at the posterior of the instrument are provided with multiple adjustable surfaces to permit duplication of the condyle guide surfaces found in the fossa of humans. These fossa guide assemblies include a superior guide member 36, a rear wall or posterior guide member 38 and a lateral guide member 40. The lateral guide member functions to guide the frames through movements having a lateral directional component and is shown as an inside or medial guide member. All of these fossa guide members pivot about a common center of rotation at the center of condyle 26. The angular setting of posterior guide member 38 is locked by screw 44 while that of superior guide member 36 is locked by screws 42 and 52; see FIG. 4; and that of medial wall guide member 40 by screw 46. The angular settings of the guide surfaces of the members are registered on scales on the assemblies which are shown in FIG. 3 as scale 41 for the superior guide setting, (mediolaterally), scale 43 for the posterior guide setting (anterior-posteriorly), and scales 45 for the medial wall setting. The lateral scales are partly obscured by plate 62 in the zero position as shown, but either of the scales are uncovered when the angular setting of the medial wall guide is moved from its zero position.

The fossa assemblies are mounted on main angle blocks such as 50 which are pivotably mounted on the telescoping lateral arm 55 carried by upper frame 32. Wing 51 pivots on the hinge axis on the centerline passing through condyles 26 and a screw 56 on the centerline projects through flange 57 and pivotably secures wing 51 to arm 55. Screw 52 in an arcuate slot 53 in flange 57 is threaded into a tapped bore of arm 55 to lock the angular setting of wing 51. The degree of angular inclination of wing 51 is registered on scale 58. Similar mounting means are provided for the other fossa assembly.

The angle block 50 has an arcuate inside rear wall cut on a radius about the condyle center against which is fitted a matching angle block 59 that supports posterior guide member 38. The shape and fitting of these members is best illustrated in FIG. 7 which is a view of the underside of the fossa guide assembly. The upper plate 60 of block 59 projects into a slot in block 50 and has a boss which extends through the center bore in block 50. A flange 53 is secured to the boss above block 50 and knob 54 is provided to move the posterior guide member. The boss is bored for screw 44 that passes through the bore and into a tapped bore in plate 60 beneath block 50 to permit locking of plate 60 in block 50.

The medial guide member 40 is attached to the inside rear edge of plate 61. Plate 61 is grooved at 63 and secured in sliding engagement with a mating groove in the lower face of plate 62. A slot 64 is cut in plate 62 and screw 65 extends through

the slot into a tapped bore in plate 61. A scale 66 with vernier calibrations is provided to register the degree of sliding displacement of plate 61 relative to plate 62. The anterior portion of 62 has a reduced thickness with a finger projection 67; see FIG. 1; that extends over the condyle 26 and that is bored to receive screw 44. An arcuate slot 68 on a radius about screw 44 is cut in plate 62 and screw 46 projects through the slot into a tapped bore in block 50 for securing the angular setting of plate 62 on fossa block 50.

The fossa guides of the instrument can be set to accommodate every possible movement of a human jaw. The The guide member 38 can be tilted on the hinge axis and the angle of its inclination registers on scale 58. The superior guide can also be tilted on an axis perpendicular to the hinge axis and the degree of its inclination on this perpendicular axis registers on scale 41. The posterior guide member 38 can be rotated about an axis that is perpendicular to both of the aforementioned axes and its angular setting is registered on scale 43. This independent adjustment of the posterior guide member permits a condyle to translate in a forwardly or rearwardly direction when serving as a center of rotation for the frames as the articulator is moved in right or left lateral excursions. The lateral guide member 40 serves to guide the traveling fossa during such lateral excursions and the angle of its setting about an axis perpendicular to the hinge axis registers on scale 45. To permit an immediate side shifting of the instrument in the centric position, member 40 is linked to the assembly with sliding block 62 which can be moved in an entirely lateral displacement and the degree of the displacement registers on scale 66.

Referring now to FIGS. 3 and 4, the upper frame assembly will be described. The longitudinal member 32 terminates with an upwardly oriented transverse dovetail 250 and a similarly and downwardly oriented dovetail 151; see FIG. 2. Arms 55 and 152 have mating dovetailed grooves and extend from member 32 in a laterally telescoping fit. The arms are bored and tapped transversely through one side of the dovetailed grooves and screws 103 extend into these taps so that the screws can be tightened against the dovetail to lock the arms at any desired lateral extension. Scales 104 are provided to register the lateral displacement of the arms and these scales are calibrated with the scales 105 on crossbar 20 which register the lateral displacement of the condyle mounting blocks 22.

Projecting from the rear of the mount and on the centerline of the instrument is a semicircular flange 106 which has a chamfered rear edge. This flange engages with a centric latch that is supported on crossbar 20 at the rear of the instrument. FIG. 8 illustrates this device in greater detail as comprising a sleeve 108 with ears 109 and 110 which have arcuate grooves that mate with the chamfered edge of flange 106. Knob 107 is dependent from sleeve 108 and has a bore which projects into alignment with pins 154 in crossbar 20 so that ears 109 and 110 can be vertically aligned on the crossbar.

Screw 111 extends through sleeve 108 and is threaded into a tapped bore in crossbar 20 and a compression spring is placed in the sleeve, bearing against washer 112 and a web in cylinder 108 to bias the latch forward into engagement between flange 106 and either of its ears 109 or 110. The opposing faces of the groove in ear 110 provide only limited contact with flange 106 so that the groove in 110 serves as a centering means for frame 32 without preventing rotation of frame 32 about the hinge axis of the articulator. The groove in 109, however, has a pin 114 that mates with 187 groove 113 in flange 106; see FIG. 4; so that the pin 114 in ear 110 serves to lock member 32 at an open position. Either ear can be engaged with flange 106 by retracting the latch against the spring bias, then rotating the ear opposite the flange 106 and releasing the latch to permit the spring to seat the ear into engagement with the flange. The latch can be entirely disengaged by rotating the latch so that ears 109 and 110 are removed from flange 106.

In a preferred embodiment, the medial wall guide 40 has retaining means that extend beneath the condyles 26 to

restrain the frame members from vertical separation. These retaining means permit locking the two members together for transporting or handling of the articulator. Preferably member 40 has a concave groove that cups under the condyle 26. A similar groove is shown in the end view of plastic cover 122 of FIG. 11 which can be used as a precontoured guide as described in the following paragraph.

In another preferred embodiment, the medial wall and the superior wall are replaceable plastic inserts that have a precontoured surface. This construction is shown in the FIG. 7 wherein the superior member 38 is provided with lips 121 and 161 along its opposite lower edges. These lips are grooved to accept an insertable bearing guide 162 that is preferably a plastic plate having a precontoured surface shown at 163. The lateral wall guide member 40 can also be provided with means to removably secure a plastic guide 122 which is shown in end view in FIG. 11 and which slips over member 40. This plastic cover for member 40 has a recess 123 to mate with a pin in member 40 and thereby index the cover to the member 40. The plastic guides 122 have concave grooves that mate with the condyles 26 and these grooves can be precontoured to provide an early lateral side shifting of the articulator frames. The guide 122 in FIG. 7 has a straight or uncountoured guide and lateral shifting with this guide is immediate, the degree of which is controlled by settings of plate 61. FIGS. 9 and 10 show other plastic guides that can be used to provide an early side shift; FIG. 9; or a distributed side shift; FIG. 10. FIG. 11 is an end view of the guides shown in FIG. 10. These guides are provided to be effective over approximately one-third of the protrusive movement or for a distance of approximately 12 millimeters.

Another accessory for the articulator is shown in FIG. 5 to the right of the articulator on an extension of the hinge axis. This accessory is a condyle mount in the form of a cylindrical plug 127 with a convex inner face for mating with the condyle 26 and a shank 128 that fits into a bore on the outside face of the condyle on the hinge axis; see 130 in FIG. 1. This mount is approximately 10—12 millimeters in length so that the outside end projects this distance from the condyle when mounted in the bore 130. This distance is an approximate anatomical thickness of the tissue over the condyle. The outside face of 127 bears a recess 165 on its centerline which permits hinge axis centering pins of a pantograph to be locked onto the articulator at an approximate anatomical position.

The articulator as described has the following features:

An arcon-type instrument with laterally adjustable fossa and condyles which are on telescoping mounts rigid against rotation;

provision for adjustment to an immediate lateral side shift and/or to precontoured early and distributed side shifts;

provision for independent adjustment of the posterior fossa guides;

provision for independent adjustment of superior wall guide member for longitudinal inclination of this guide member for protrusive movement and also for lateral inclination during lateral excursions of the instrument;

a sliding shoe adjustment on the incisal pin to permit limited protrusive or a lateral movement without separation of the dental models;

an incisal table with a pin rest that is at a fixed vertical relationship to the lower articulator member regardless of the adjustments in the incisal table inclinations;

provision for the use of superior and medial wall plastic and precontoured guide inserts;

an interlock to retain the assembly of the instrument in the centric position;

centric latch-centering means permitting freedom of movement of the upper frame about the hinge axis and exchangeable means locking the upper frame at any angle of opening; and

provision for independent adjustment of inclination of the medial wall member in a progressive side shift.

I claim:

1. In a dental articulator comprising first and second frame members with means to support dental casts in opposed relationship wherein one of the members supports a condyle at each of its opposite sides of its posterior end and the other member supports fossa guides in engagement with the condyles and wherein one of the members, at its anterior end, supports an incisal table with means permitting varied angular settings of the incisal table and the other member supports an incisal pin bearing a shoe member in engagement with the table, the improvement comprising adjustable means securing said shoe to the incisal pin permitting a limited withdrawal of the bearing point of said shoe member from the incisal table guide to permit relative movement of the frame members without vertical separation of the anterior ends of the members, scale means carried by one of the members to register the degree of such displacement and an incisal pin rest to support the incisal when the frames are in centric position secured to the one frame member with means maintaining a fixed position of the rest independently of variation in the angular setting of the incisal table and the degree of withdrawal of said bearing point.

2. The articulator of claim 1 wherein the incisal table extends posteriorly of said incisal pin and is secured to the first frame member with means permitting pivoting of the table about an axis along its anterior edge and parallel to the axis passing through the condyles.

3. The articulator of claim 1 wherein the incisal table has right and left guide wings pivotably mounted on axes perpendicular to the axis passing through the condyles.

4. The articulator of claim 1 wherein the adjustable means comprises a shoe mounted on the end of the incisal pin in a sliding engagement along the longitudinal axis of the articulator.

5. In a dental articulator comprising first and second frame members having means to support removable dental casts in opposed relationship wherein the first frame member supports a condyle at each of its opposite sides of its posterior end and supports an incisal table guide means and pin support means at its anterior end and wherein the second frame member bears at opposite sides of its posterior end a fossa guide assembly comprising a continuous superior fossa guide member and a posterior fossa guide member in engagement with their respective condyle supported by the first member and at its anterior end an upright incisal pin engageable with the incisal table guide means and pin support means, the improvement comprising: attachment means securing said posterior and said continuous superior fossa guide members to the fossa guide assembly and permitting angular setting of each of said members about said condyle independently of the angular setting of the remaining member, means to lock the position of each of the guide members in the assembly and first and second scale means carried by the fossa assembly to register the angular setting of the guide members.

6. The articulator of claim 5 including a lateral fossa guide member carried by the fossa guide assembly wherein the lateral guide member has attachment means securing it to the assembly and permitting angular adjustment of the lateral member independently of the setting of the superior and posterior guide members, means to lock the position of the lateral guide member and a scale carried by the assembly to register the setting of the lateral guide member.

7. The articulator to claim 6 wherein the lateral guide member is attached to its respective fossa assembly with adjustment means permitting an immediate and entirely lateral shifting of the first and second frame members and wherein said assembly has scale means to register the degree of the lateral shifting.

8. The articulator of claim 6 wherein the lateral guide members have retaining means extending beneath their respective condyles to engage the under surface of said condyles and thereby permit locking the posterior of the members against vertical separation.

9. The articulator of claim 5 wherein said assembly comprises an extendible arm secured to said second frame member, a flange on the outboard end of said arm, a wing bracket secured to said flange and pivotable about an axis passing through said condyle, said continuous superior fossa guide member secured to said wing bracket and pivotable about a second axis passing through said condyle, and said posterior fossa guide member secured to said continuous superior fossa guide member and pivotable about a third axis passing through said condyle.

10. The articulator of claim 6 wherein said assembly comprises a plate supported on the anterior portion of said superior fossa guide member and pivotable about said third axis through said condyle and extending anteriorly of said superior fossa guide member, a lateral guide support member projecting below said superior fossa guide member and attached to the anterior edge of said plate by means permitting relative sliding displacement between said member and said plate with said lateral displacement guide member being secured to said support member and projecting posteriorly beneath said superior fossa guide member and into lateral engagement with said condyle.

11. The articulator of claim 6 wherein latch means are provided on one of the frame members operative to engage a centric indexing means on the other of the frame members whereby the frames can be indexed into alignment along a common longitudinal axis.

12. The articulator of claim 11 wherein the latch means

bears an arcuate keyway and the centric indexing member is an arcuate key that engages the keyway.

13. The articulator of claim 12 wherein the arcuate key is freely slidable in the arcuate keyway to provide a hinged interconnection of the first and second frame members along an axis passing through the condyles.

14. The articulator of claim 13 wherein said keyway carries a pin operative with a groove on said key to interlock said members at a predetermined open position.

15. The articulator of claim 5 wherein said condyles are carried by upright legs that are mounted on said first frame member with means permitting lateral movement of the condyles and wherein the fossa guide assemblies are secured to the second frame member with a telescoping relationship that permits lateral extension of the assemblies and means to prevent rotation of said assemblies.

16. The articulator of claim 5 wherein the condyles are bored on their outside faces on a common centerline in combination with removable plugs in said bores which extend about 10 to 12 millimeters along said centerline with means on the outside ends of said plugs for engagement with hinge axis centering pins of a pantograph.

17. The articulator of claim 5 wherein the fossa guides include a superior guide member with attachment means operative to secure any of several prefabricated guide surfaces of varied contours thereto.

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