

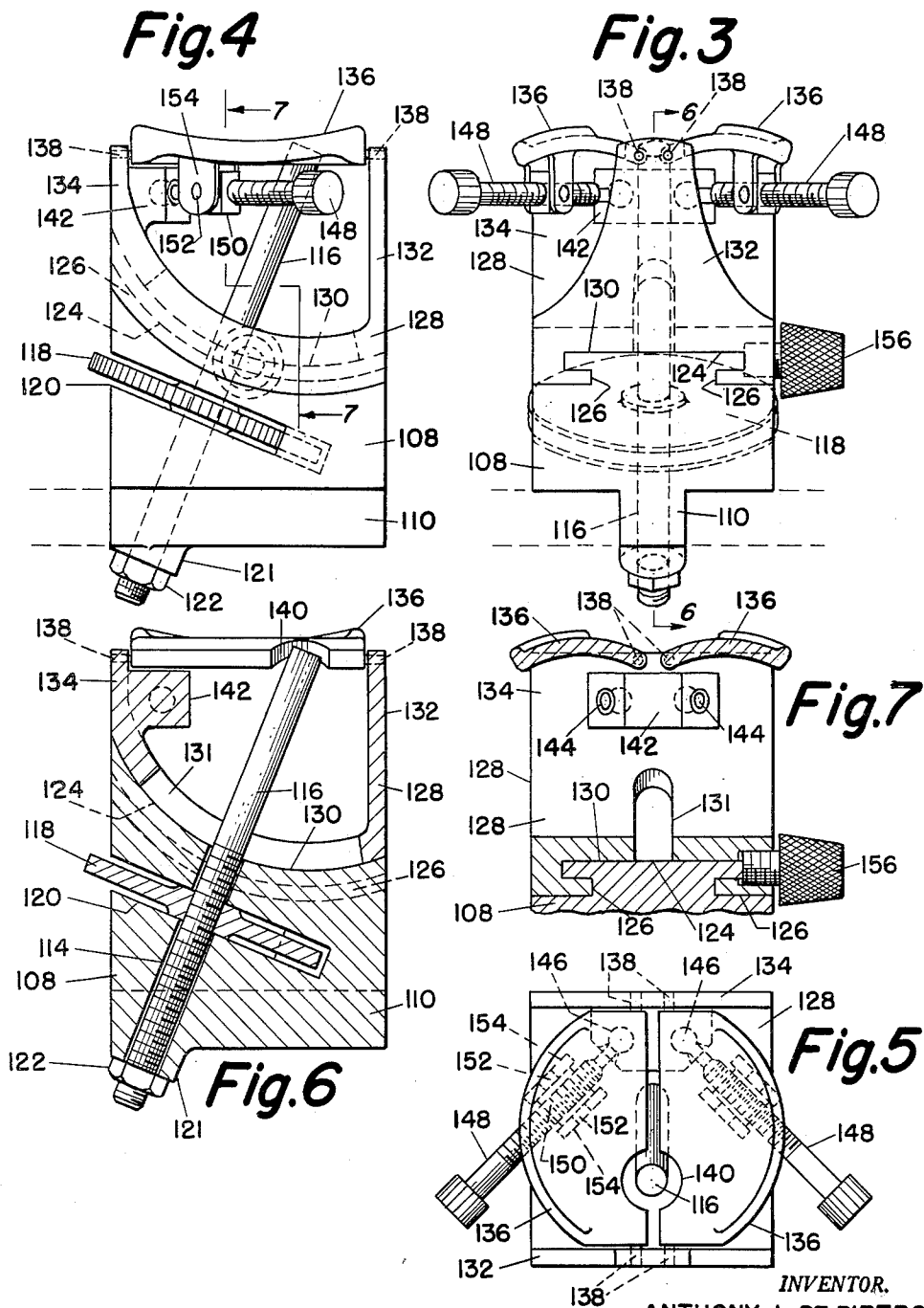
Feb. 6, 1962

A. J. DE PIETRO
DENTAL ARTICULATOR

3,019,530

Filed Dec. 1, 1959

4 Sheets-Sheet 2



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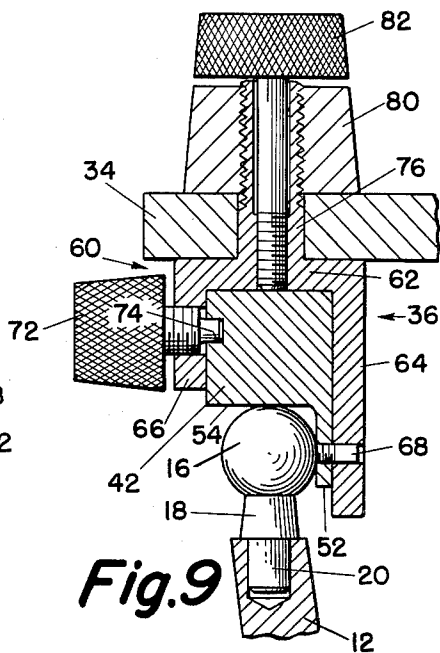
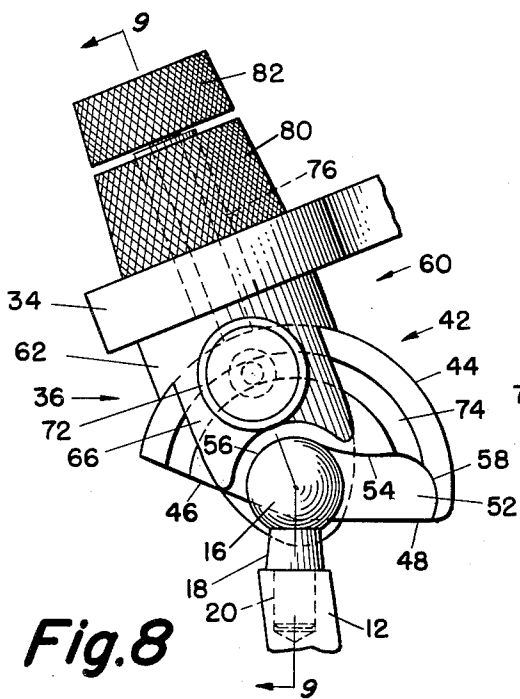
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4 Sheets-Sheet 3



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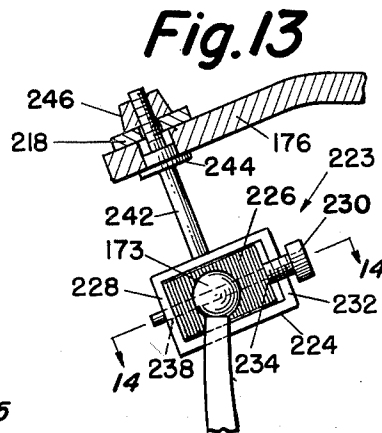
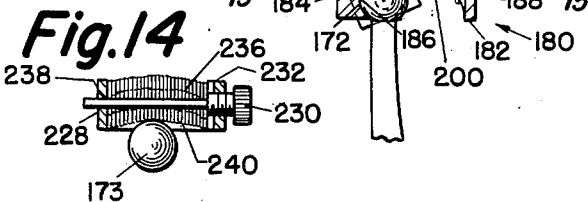
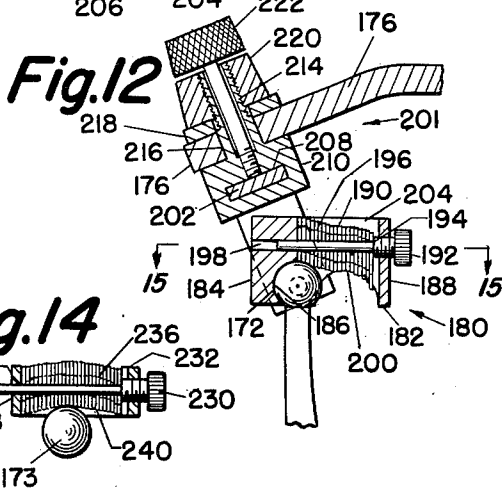
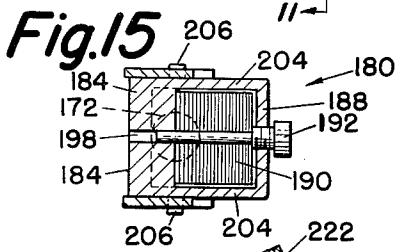
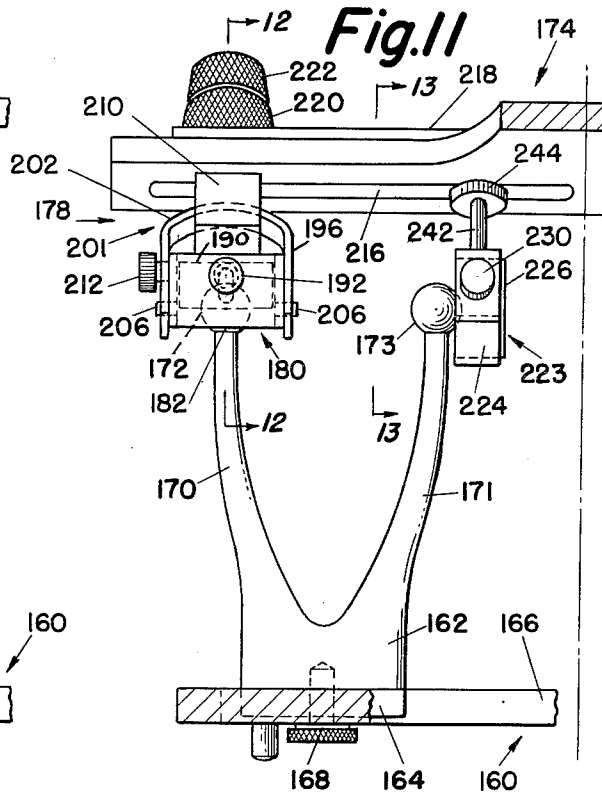
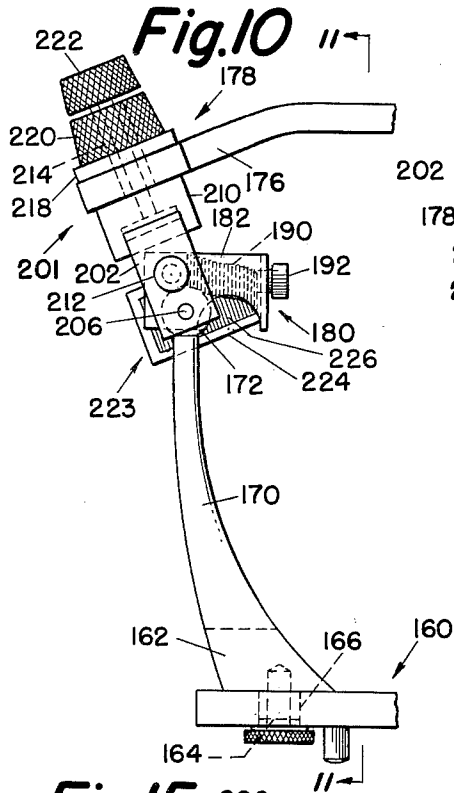
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4 Sheets-Sheet 4



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3,019,530

DENTAL ARTICULATOR

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9 Claims. (Cl. 32—32)

This invention relates to a device for use in dental prosthesis and more particularly to a device for use in the making of artificial dentures.

In the masticating mechanism of the human being the more or less rounded formations respectively formed on the two upstanding branches of the mandible, the condyles, articulate respectively in sockets formed in the skull at the rear ends of the cheek bones, the glenoid fossae. Each glenoid fossa has a surface forming the condyle path, which path slopes more or less downwardly toward the incisors. The slope is practically rectilinear within the range of movement normally employed during mastication, changing somewhat in the most protrusive and in the most retrusive positions.

The condyles may move slightly substantially in all directions respectively within the glenoid fossae, always in contact respectively with the condyle paths. Consequently, relative to the maxilla, the mandible is capable of swinging movement downwardly and rearwardly about the axis through the two condyles, the condyle axis, of longitudinal movements forwardly from the centric position, and of lateral movements to either side.

From any possible closed position of the mandible relative to the maxilla, the closed mandible may be rocked to fully open position and back again. Since the condyles never leave the condyle paths, the mandible rocks about the condyle axis, which axis, throughout the range of rocking movement, remains positionally fixed relative to the maxilla.

The type of articulator to which this invention pertains has an upper bow member and a lower bow member hinged to one another at the rear of the articulator by two laterally spaced joints, and separated from one another at the front of the articulator by an incisal pin resting upon an incisal guide. Models of the upper and lower jaws are mounted respectively in the upper and lower bow members and are subjected to movements simulating the movements that occur during natural mastication.

An object of the present invention is to provide such an articulator in which models of the jaws may be mounted and subjected to movements that are more truly representative of the human jaw.

Another object of the present invention is to provide an articulator with bow members which, from any possible closed position thereof, may be opened and reclosed without the pivotal axis shifting relative to either bow member.

And another object of the present invention is to provide each articulator hinge joint with spherical means, representative of the condyle, and with means formed with a surface, representative of the condyle path, seated upon the top of the spherical means, and with a surface, abutting the innermost side of the spherical means.

Still another object of the present invention is to provide an articulator with hinge joints each of which may be adjusted independently of the other to slope the condyle path or condylar guide surface and/or tilt the same laterally as may be required.

And still another object of the present invention is to provide an articulator with hinge joints which may be adjusted in the manner aforesaid, and which may be additionally adjusted independently of one another to provide for relative lateral movements of the upper and lower bow members.

Another object of the present invention is to provide

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an articulator with hinge joints which may be adjusted in the manner aforesaid, and which may be additionally adjusted independently of one another to selectively vary the contour of the surfaces engaging the spherical means.

Still another object of the present invention is to provide an articulator with hinge joints which may be shifted laterally relative to one another as may be required.

And still another object of the present invention is to provide an articulator with bow members that are separable by a simple lifting movement applied to the upper bow member, without the handling of releasing means.

Another object of the present invention is to provide an articulator which may be adjusted to simulate the protrusive and lateral movements of the jaws without disturbing previously made overjet-overbite adjustments.

Other objects of the invention will become apparent when the following description is read with reference to the drawings, in which:

FIGURE 1 is a side view of an articulator constructed in accordance with the invention;

FIGURE 2 is a plan view of the articulator shown in FIGURE 1;

FIGURE 3 is a front view of the incisal guide;

FIGURE 4 is a side view of the incisal guide;

FIGURE 5 is a plan view of the incisal guide;

FIGURE 6 is a section on line 6—6 of FIGURE 3;

FIGURE 7 is a section on line 7—7 of FIGURE 4;

FIGURE 8 is a fragmentary side view of the articulator, showing a hinge joint;

FIGURE 9 is a section on line 9—9 of FIGURE 8;

FIGURE 10 is a fragmentary side view of a modified form of the articulator constructed in accordance with the invention;

FIGURE 11 is a section on line 11—11 of FIGURE 10;

FIGURE 12 is a section on line 12—12 of FIGURE 11;

FIGURE 13 is a section on line 13—13 of FIGURE 11;

FIGURE 14 is a section on line 14—14 of FIGURE 13; and

FIGURE 15 is a section on line 15—15 of FIGURE 12.

Referring particularly to FIGURES 1-9, the articulator constructed in accordance with the invention comprises a lower bow member including a main body portion 10 terminating at the rear thereof in a pair of laterally spaced upright posts 12. Each post 12 mounts a condylar head or hinge part in the form of a spherical element 16 formed integral with a neck 18 terminating in a pin 20 through the medium of which the element 16 is removably affixed to the post 12. The lower bow member is mounted upon three legs in the form of pins 22 respectively underlying the posts 12 and a fore end area of the body 10. Carried by the body 10 are a pair of guide pins 24 and a lock screw 26 adapted for securing to the lower bow member the mounting plate (not shown) for a lower jaw model.

Overlying the lower bow member is an upper bow member including a main body portion 30 terminating at the rear thereof in a pair of wings 34 extending laterally outwardly in opposite directions. Each wing 34 mounts a hinge part in the form of an assembly generally indicated 36. Carried by the body 30 are a pair of guide pins 38 and a lock screw 40 adapted for securing to the upper bow member the mounting plate (not shown) for an upper jaw model.

Each assembly 36 comprises a condylar guide in the form of the major part of a flat circular disc 42 disposed in an upright position with its principal axis passing hori-

zontally through the center of the underlying spherical element 16 and having an arcuate outer edge 44 and a pair of straight, angularly related edges 46 and 48, as shown. The guide 42 is suitably recessed to afford an abutment 52 and a slightly curvilinear base or condylar guide surface 54 having an arcuate posterior portion 56 and an arcuate anterior portion 58. Each abutment 52 is adapted to slidably engage the associated spherical element 16.

Each assembly 36 includes a condylar guide mount in the form of a bifurcated member 60 having a base portion 62 joining a pair of arms 64 and 66. These arms depend from the base in laterally spaced relation to one another and conjointly with the base embrace a marginal area of the guide 42. At the center of the guide 42 and affixed to the abutment 52, is a pin 68 having one end portion journaled in the arm 64. Threaded into the arm 66 is a screw 72 having a terminal portion received in an arcuate groove 74 formed in the guide 42.

Extending from the base 62 is a stem in the form of a tubular element 76 projected freely through the associated wing 34, the axis of the element 76 passing through the center of the underlying spherical element 16. Threaded over the stem 76 is a nut 80, and threaded into the stem 76 is a screw 82, the terminal portion of which screw is adapted to engage the guide 42.

The fore end of the upper bow member is in the form of a tongue 86 received in a groove formed in a headpiece 90. The latter is affixed to the tongue 86 by a screw 92 and is provided with an arcuate groove that slidably receives a tongue 96 formed upon a member 98. Freely projected through an elongated opening 100 formed in the member 98 is a screw 102 threaded into the headpiece 90. Affixed to the lower end of the member 98 and depending therefrom is an incisal pin 104.

Underlying the incisal pin 104 is an incisal guide mounted upon the fore end portion of the lower bow member. This incisal guide comprises a base 108 having at the bottom thereof a tongue 110 slidably received in a slot formed in the body 10. The base 108 is adjustably affixed to the body 10 by any suitable means (not shown). Extending upwardly and forwardly through the base 108 at an angle of approximately 22 degrees from the vertical is a bore 114, and projected freely through the latter is a post 116 threaded through a nut 118 lodged in a slot 120. The tongue 110 is provided with a protuberance 121 and abutting the latter is a lock nut 122 on the end of the post 116. The upper surface 124 of the base 108 is arcuate in form, and concentric with this surface are a pair of grooves 126 respectively formed in the sides of the base 108.

Carried by the base 108 is a cradle 128 having an undersurface channeled, as at 130, the base 108 and the cradle 128 being slidably interlocked, as shown. The post 116 extends freely through an elongated opening 131 formed in the cradle 128. At the fore end of the latter is an upstanding wall 132, and at the rear end is an upstanding wall 134. A pair of leaves 136 are carried by these walls, each leaf being journaled in the walls 132 and 134 respectively by coaxially aligned pins 138. Marginal areas of the leaves 136 are cut out thereby to conjointly form an opening 140 adapted to freely receive the upper terminal of the post 116. The rear wall 134 has formed thereon a boss 142 having formed therein a pair of sockets 144. Each of these sockets has fitted therein a spherical terminal portion 146 of a screw 148. The latter is threaded through a block 150 pivoted by a pair of trunnions 152 respectively in a pair of brackets 154. Threaded into one side of the cradle 128 is a screw 156 having a terminal portion engaging the side of the base 108 to maintain the cradle stationary on the base 108.

Initially the instrument may be arranged as shown in FIGURE 1, wherein the spherical elements 16 nest in the arcuate rear portions 56 of the condylar guide surfaces,

post 116 and incisal pin 104 conjointly support the fore end of the upper bow member so that the upper bow member is disposed generally horizontally and the leaves 136 of the incisal guide slope downwardly and forwardly.

After arranging the instrument in the manner aforesaid, the lower jaw model is secured to the lower bow member by lock screw 26. The positions of the spherical elements 16 relative to the lower jaw model closely approximate those of the condyles relative to the lower jaw in the human being. Now the upper jaw model is secured to the upper bow member by lock screw 40, in proper centric relation to the lower jaw model.

Then the upper bow member is moved rearwardly a distance equal to the overjet to bring the incisal edges of the upper and lower anterior teeth into registry with one another. When the upper bow is moved rearwardly, the spherical elements 16 move forwardly along the condylar guide surfaces and the incisal pin 104 moves onto the leaves 136. The screw 156 is loosened, and the cradle 128 is rocked to a position wherein the vertical component of the incisal pin movement is equal to the overbite, and the horizontal component of the incisal pin movement is equal to the overjet. The screw 156 is then retightened.

A protrusive bite record is fitted to the lower jaw model and the upper jaw model is made to register therewith by moving the upper bow member rearwardly still farther as may be required and manipulating the hinge assemblies 36. This manipulation is effected by loosening the screws 72 and 82 to release the guides 42, whereupon the latter are turned about the axes of the pins 68 to effect proper registry. The screws 72 and 82 are then retightened.

A lateral bite record is now fitted to the lower jaw model and the upper jaw model made to register therewith by further manipulation of the hinge assembly 36. This further manipulation is effected by loosening one of the nuts 80 to release the associated guide mount 60, whereupon the latter is turned about the axis of its stem 76 to permit the required lateral movement for proper registry. Then the nut 80 is retightened to secure the adjusted guide mount 60 in position. A similar procedure is followed using the other lateral bite record. When the adjustments for lateral movement have been effected, planes respectively containing the surfaces of the abutments 52 adapted to engage the opposed sides respectively of the spherical elements 16 diverge forwardly.

The upper bow may now be moved in substantially all directions, with the condylar guide surfaces 54 always in contact respectively with the spherical elements 16. The upper bow is capable of swinging movement upwardly and rearwardly about the axis of the spherical elements 16, of longitudinal movements rearwardly from the centric position, and of lateral movements to either side.

Referring particularly to FIGURES 10-15, which illustrate a modified form of the hinge joint, the lower bow member, designated 160, mounts a pair of laterally spaced posts 162 each of which is provided with a tongue 164 slidably fitted in an elongated slot 166 extending across the rear of the bow member 160. The posts 162 are adjustably fixed to the bow member 160 by screws 168. The upper end of each post 162 is bifurcated and these furcations 170 and 171 terminate respectively in outer and inner spherical elements 172 and 173. In any adjusted position of the posts 162, the several elements 172 and 173 are aligned on a horizontal axis extending across the rear of the instrument. The upper bow member, designated 174, is provided with an area 176 extending across the rear thereof and mounting at opposite ends thereof hinge parts in the form of assemblies, designated 178, respectively overlying the posts 162.

Each assembly 178 comprises a subassembly 180 including a rectangular frame member 182 having an open top and an open bottom. The rear wall of the frame, designated 184, is undercut to form an arcuate surface 186

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of a radius corresponding to that of the underlying spherical element 172. Between the front wall of the frame, designated 188, and the wall 184 are a stack of very thin rectangular leaves 190 pressed against the wall 184 by a screw 192. The latter is threaded into the wall 188 and is provided with a shoulder 194 which abuts the endmost leaf 190. The opposite end portion of the screw 192 extends freely through elongated apertures 196 formed in the leaves 190 and is guided in a bore 198 in the wall 184. The surface 186 and the lower terminal narrow edges of the several leaves 190 conjointly form a condylar guide surface 200.

Each assembly 178 also comprises a second subassembly 201 including a yoke member in the form of an arcuately shaped strap 202 overlying the frame 182 and extending downwardly on both sides thereof for connection to the sides of the frame, designated 204, through the medium of a pair of coaxially aligned pins 206. The axis of pins 206 passes horizontally through the center of the associated spherical element 172. The strap 202 is slidably received in an opening 208 formed in a member 210, the center of curvature of the opening and of the strap received thereby being the center of the underlying spherical element 172. Threaded through the strap 202 is a screw 212 having a terminal portion abutting the side of the frame 182.

Extending from the member 210 is a stem in the form of a tubular element 214 projected freely through an elongated slot 216 formed in the area 176 at the rear of the upper bow member, and projected freely through one end portion of a strap 218 overlying the area 176. Threaded over the stem 214 is a nut 220, and threaded into the stem 214 is a screw 222, the terminal portion of which screw is adapted to engage the yoke 202.

Each assembly 178 still further comprises a third subassembly 223 including a rectangular frame member 224 housing a stack of very thin rectangular leaves 226 pressed against the rear wall of the frame, designated 228, by a screw 230. The latter is threaded into the front wall of the frame, designated 232, and is provided with a shoulder 234 which abuts the endmost leaf 226. The opposite end portion of the screw 230 extends freely through elongated apertures 236 formed in the leaves 226 and is guided in a bore 238 in the wall 228. Corresponding narrow side edges of the several leaves 226 conjointly form a surface 240 which engages the innermost side of the associated spherical element 173. The frame 224 is carried by a rod 242 the lower end portion of which is affixed to the frame and the upper end portion of which is projected freely through the slot 216 and through the strap 218. Formed on the rod 242 is a flange 244 underlying the area 176 of the upper bow member, and threaded upon the rod 242 is a nut 246 coacting with the flange 244 to clamp the rod 242 in position.

Initially the upper bow member 174 is disposed generally horizontally, with the spherical elements 172 nesting in the arcuate rear portions 186 of the condylar guide surfaces 200, as shown in FIGURE 10. Then the lower and upper jaw models are positioned in the instrument, and the overbite-overjet adjustment is effected. Now the hinge assemblies 178 are manipulated to effect registry of the upper jaw model with the protrusive bite record. This manipulation may be effected by slightly loosening the screws 212, turning the frames 182 about the pins 206 to the desired positions thereof relative to the yokes 202 and then retightening the screws 212. This adjustment may be made more effective by manipulating the leaves 190 to vary the contours of the condylar guide surfaces 200 as may be required.

Now the hinge assemblies 178 are manipulated to effect registry of the upper jaw model with one of the lateral bite records. This manipulation may be effected by loosening one of the nuts 246 to release the associated frame 224, whereupon the latter is turned about the axis of its rod 242 to permit the required lateral movement for reg-

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istry. Then the nut 246 is retightened. Now the other nut 246 is loosened and a similar procedure followed to effect registry of the upper jaw model with the other lateral bite record. These adjustments may be made more effective by manipulating the leaves 226 to vary the contours of the surfaces 240 as may be required. These adjustments may be made still more effective by adjusting the subassemblies 201, which is done by loosening the screws 222, adjusting the yokes 202 to obtain the desired lateral tilt of the subassemblies 180 and then retightening the screws 222.

Since the distance between the condyles varies from patient to patient, the distance between the posts 162 may be varied to vary the distance between the spherical elements 172 to suit the individual patient. To effect this adjustment, the screws 168 are loosened, the posts 162 shifted to the desired positions thereof and then the screws are retightened. When the distance between the spherical elements 172 is changed, the distance between the assemblies 178 must be changed to correspond. This latter adjustment may be effected by loosening the nuts 220 and 246, shifting the assemblies bodily relative to one another to the desired positions thereof and then retightening the nuts.

The upper bow may now be moved in substantially all directions, with the condylar guide surfaces 200 always in contact respectively with the spherical elements 172. The upper bow is capable of swinging movement upwardly and rearwardly about the axis of the spherical elements 172 and 173, of longitudinal movements rearwardly from the centric position, and of lateral movements to either side.

With regard to either embodiment of the invention, in any selected position of the upper bow member fore and aft relative to the lower bow member, the upper bow member may be rocked upwardly and rearwardly and back again. In the absence of lateral movement of the upper bow member relative to the lower bow member, corresponding portions of the condylar guide surfaces engage with the tops of the underlying spherical elements throughout the range of rocking movement. The rocking movement is about the axis through the spherical elements, which axis remains positionally fixed not only relative to the lower bow member but also relative to the upper bow member.

Even when the upper bow member is offset laterally relative to the lower bow member, in any selected position of the upper bow member fore and aft relative to the lower bow member, the upper bow member may be rocked upwardly and rearwardly and back again. In this case, with regard to the embodiment of FIGURES 1-9, the abutment 52 of one of the guides 42 engages the side of the associated sphere 16, while the abutment 52 of the other guide 42 is spaced somewhat from its associated spherical element 16, and with regard to the embodiment of FIGURES 10-15, the leaves 226 of one of the subassemblies 223 engages the side of the associated sphere 173, while the leaves 226 of the other subassembly are spaced somewhat from their associated spherical element 173. In either case, the same portions of the condylar guide surfaces engage the tops of the underlying spherical elements throughout the range of rocking movement, but these portions are not corresponding portions. The axis through the spherical elements is not parallel to any of the positions thereof when there is an absence of lateral movement. Nevertheless, as in the case where there is an absence of lateral movement, the upper bow member may be rocked about the axis through the spherical elements, without the axis shifting in position relative to the lower bow member or to the upper bow member.

Referring to the embodiment of FIGURES 10-15, it will be obvious that the subassemblies 223 and the coacting spherical elements 173 and the members 171 upon which the latter are mounted may be omitted, and that

in lieu thereof the innermost side walls 204 of the frames 182 may be arranged to engage respectively the spherical elements 172, just as the abutments 52 are arranged to engage respectively the spherical elements 16 in the embodiment of FIGURES 1-9. When, in addition to the foregoing suggested modification, provision for laterally tilting the subassemblies 180 is omitted, the modified device is essentially the same as the embodiment of FIGURES 1-9, except that the contour of the condylar guide surface may be varied.

Again referring to the embodiment of FIGURES 10-15, it will be obvious that the spherical elements 173 and the members 171 upon which the latter are mounted may be omitted, and that each subassembly 223 may be combined with the associated subassembly 180 to form a unitary structure, with the subassembly 223 coacting with the spherical element 172 instead of with the spherical element 173.

It will be understood, of course, that the present invention is susceptible of other changes and modifications which may be made from time to time without departing from the real spirit or general principles of the present invention, and accordingly it is intended to claim the same broadly as well as specifically, as indicated in the appended claims.

What is claimed is:

1. In a dental articulator, a lower bow member, an upper bow member, and means mounting said members in mutually overlying relation including a pair of laterally spaced hinge-type joints at the rear of said articulator, each of said hinge joints including a part in the form of a spherical element mounted in fixed relation to said lower bow member, and a part in the form of a disc-like element mounted in adjustable fixed relation to said upper bow member and disposed in upright position, a marginal area of said disc-like element being recessed to provide a downwardly facing undersurface simulating the condyle path in the natural skull and bearing upon the top of the underlying spherical element, and to provide an abutment for engaging the side of said spherical element facing the other one of said spherical elements.

2. In a dental articulator, a lower bow member, an upper bow member, and means mounting said members in mutually overlying relation including a pair of laterally spaced hinge-type joints at the rear of said articulator, each of said hinge joints including a part in the form of inner and outer laterally spaced relatively fixed spherical elements mounted upon said lower bow member for shifting movement as a unit laterally of the instrument, a part in the form of means providing an undersurface simulating the condyle path in the natural skull and engaging the top of said outer spherical element, means providing an abutment for engaging with said inner spherical element on the side thereof facing the other hinge joint, and means mounting said condyle path and abutment means for shifting movement as a unit laterally of the instrument.

3. In a dental articulator, a lower bow member, an upper bow member, and means mounting said members in mutually overlying relation including hinge means at the rear of said articulator, an incisal pin depending from the fore end of said upper bow, and an incisal guide mounted upon the fore end of said lower bow member including a stationary base member, a rockable member cradled in said base member and providing incisal pin guide surfaces, and an axially shiftable post member mounted upon said base member, the point of said incisal pin being engaged with the upper terminal of said post member, said post member being disposed with its longitudinal axis tangent to the arc traced by the point of said incisal pin upon opening and closing of said articulator.

4. In a dental articulator, a lower bow member, an upper bow member, and means mounting said members in mutually overlying relation including hinge means at

the rear of said articulator, an incisal pin depending from the fore end of said upper bow, and an incisal guide mounted upon the fore end of said lower bow member including a stationary base member, a rockable member cradled in said base member and providing incisal pin guide surfaces, and a post member carried by said base member and underlying said incisal pin, the point of said incisal pin being engaged with the upper terminal of said post member.

5. In a dental articulator, a lower bow member, an upper bow member, and means mounting said members in mutually overlying relation including a pair of laterally spaced hinge-type joints at the rear of said articulator, each of said hinge joints including a first part in the form of a rounded element mounted in fixed relation to said lower bow member, and a second part mounted in adjustable fixed relation to said upper bow member and having an undersurface simulating the condyle path in the natural skull and bearing upon the top of the underlying rounded element, and means providing an abutment depending from said second hinge part and extending below, and along one side of, the condyle simulating undersurface of said second hinge part in engagement with the rounded element on the side thereof facing the other rounded element.

6. In a dental articulator, a lower bow member, an upper bow member, and means mounting said members in mutually overlying relation including a pair of laterally spaced hinge-type joints at the rear of said articulator, each of said hinge joints including a part in the form of a spherical element mounted in fixed relation to said lower bow member, and a part in the form of a disc-like element mounted in adjustable fixed relation to said upper bow member and disposed in upright position, said disc-like element being provided with a recess extending into one side thereof and providing a downwardly facing surface simulating the condyle path in the natural skull and bearing upon the top of the underlying spherical element, and providing on the opposite side of said disc-like element an abutment depending below and extending along the condyle simulating undersurface of said disc-like element in engagement with the spherical element on the side thereof facing the other spherical element.

7. In a dental articulator, a lower bow member, an upper bow member, and means mounting said members in mutually overlying relation including a pair of laterally spaced hinge-type joints at the rear of said articulator each of said hinge joints including a part mounted in fixed relation to said lower bow member and having rounded surface areas respectively facing upwardly and toward the other hinge joint, and a part mounted in fixed relation to said upper bow member including an assembly of thin plates placed side by side with corresponding narrow edges conjointly providing an undersurface simulating the condyle path in the natural skull and engaging said upwardly facing rounded surface area, said plates being shiftable relative to one another for selectively varying the shape of said condyle path, and means providing an abutment for engaging the other of said rounded areas.

8. In a dental articulator, a lower bow member, an upper bow member, and means mounting said members in mutually overlying relation including a pair of laterally spaced hinge-type joints at the rear of said articulator, each of said hinge joints including a part mounted in fixed relation to said lower bow member and having rounded surface areas respectively facing upwardly and toward the other hinge joint, and a part mounted in fixed relation to said upper bow member including means providing an undersurface simulating the condyle path in the natural skull and engaging said upwardly facing rounded surface area, and abutment means in the form of an assembly of thin plates placed side by side with corresponding narrow edges conjointly providing an abutment surface engaging the other of said rounded

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surface areas, said plates being shiftable relative to one another for selectively varying the shape of said abutment surface.

9. In a dental articulator, a lower bow member, an upper bow member, and means mounting said members in mutually overlying relation including a pair of laterally spaced hinge-type joints at the rear of said articulator, each of said hinge joints including a part in the form of inner and outer laterally spaced spherical elements mounted in fixed relation to said lower bow member, and a part mounted in fixed relation to said upper bow member including an assembly of thin plates placed side by side with corresponding edges conjointly providing an under-surface simulating the condyle path in the natural skull and engaging the top of said outer spherical element, said

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plates being shiftable relative to one another for selectively varying the shape of said condyle path, and abutment means in the form of an assembly of thin plates placed side by side with corresponding narrow edges conjointly providing an abutment surface engaging said inner spherical element on the side thereof facing the other hinge joint, said abutment plates being shiftable relative to one another for selectively varying the shape of said abutment surface.

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