An articulator for use in constructing artificial teeth is provided with means (10) for use in measuring the condylar movements of the artificial temporomandibular joints in the articulator, the measuring means (10) comprising boss means (11) adapted to be secured coaxially at the end of the shaft member (24) forming the pivot for a movable base plate (22) with respect to a fixed baseplate (21), axial scale bearing means (12) adapted to extend over the adjacent support (26) and generally parallel to the axis of the shaft member (24), point means (13) extending generally parallel to the axial scale bearing means (12), and slide means (14) for the pointer means (13) to enable its point (16) to be brought into contact with a scale (51) affixed to a face area of the support (26).
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ARTICULATORS FOR USE IN CONSTRUCTING ARTIFICIAL TEETH

This invention relates to articulators for use in constructing artificial teeth and which are of the type incorporating a lower, stationary or fixed base plate and an upper, movable base plate, these base plates being connected with one another by supports.

US-PS 3772788 describes and claims such an articulator in which the supports are independently adjustable in length by up to 1.2 mm as indicated by vernier scales. It also describes the top portion of each support as being provided with a transverse bore in which is rotatably mounted a disc, and screw means to prevent axial displacement of the disc and to selectively secure the disc within a range of rotational positions as indicated by an arcuate scale, each disc also being provided with a radially extending elongated aperture in which rests a guide portion on one end of a shaft member forming a pivot for the movable base plate, and each guide portion having the form of two truncated cones which abut one another at their smaller base surfaces, as is also described in US-PS 2909837, thereby forming a waist. A movable locking element is provided on each support for optionally clamping the waist of the guide portion in engagement with the lower edge of the elongated aperture, as described and claimed in US-PS 2909837. When the locking element is not in use, tension springs between the guide portions and their respective supports urge the waists of the guide portions into centralising engagement with the lower edges of the elongated apertures.
The articulator described in US-Pat 3 772 788 is known as the "Vario" as the relative positions of the base plates (and therefore of dentures or part dentures secured thereto) can be altered to reproduce the most complex movements of the human jaws.

A version without the length adjustment and vernier scales for each support is known as the "Individual", while another version that is also without the rotatable discs (but includes the radially extending elongated apertures in the supports) is known as the "Simplex".

The radially extending elongated apertures, cooperating guide portions on the shaft member, and tension springs are, therefore, common to all three versions of articulator and enable the condylar movements of the artificial temporomandibular joints to be observed. Hereafter, all these versions of articulator will be referred to as "of the type described".

The object of the present invention is to provide means whereby the aforesaid condylar movements can be measured.

According to the present invention, means for use in measuring the condylar movements of artificial temporomandibular joints in an articulator of the type described comprises boss means adapted to be secured coaxially at the end of the shaft member forming the pivot for the movable base plate, axial scale bearing means adapted to extend over the adjacent support and generally parallel to the axis of the shaft member, pointer means extending generally
parallel to the axial scale bearing means, and slide means for
the pointer means to enable its point to be brought into
contact with a face area of the support when the boss means
has been secured coaxially with the shaft member.

Thus, when measuring means in accordance with the
invention has been secured at one end of the shaft member, the
top edge of the respective support can serve as the index for
the axial scale, or an index mark can be provided on that
edge, and a scale can be affixed on a face area of the support
for traversing by the point of the pointer means as the
respective guide portion on the shaft member moves radially in
its aperture in the support, the pointer means being pushed
along the slide means one way or the other as the shaft member
moves axially, to effect contact of the point with the scale
affixed to the support.

It will be evident that an articulator of the type
described will be provided with measuring means in accordance
with the invention at each end of the shaft member,
particularly to enable radial movements of both guide portions
to be measured, the two measuring means being mirror images of
each other.

The measuring means may be formed from wire e.g., of
stainless steel with round and/or flattened section, bent
intermediately into an arcuate boss portion from one end of
which extends a first arm to an end portion which is bent
perpendicularly to form the axial scale bearing means, while
from the other end of the boss portion extends a second arm
with a coiled end forming the slide means for the pointer
means, which may consist of a hardened steel pin with a knob on its end remote from the point. The boss portion may alternatively be formed by a complete turn of the wire, and a suitably profiled plastics washer may be provided to accommodate the overlapping portions of wire. Again, the measuring means may be manufactured in metal, e.g. stainless steel, or rigid plastics, with an annular boss and a cylindrical slide means, but being in all other respects similar to the measuring means described above.

The invention also includes an articulator having, on each end of the shaft member that forms a pivot for the movable base plate, means for measuring the condylar movements of artificial temporomandibular joints and comprising an axial scale extending over the adjacent support and generally parallel to the axis of the shaft member, pointer means extending generally parallel to the axial scale, slide means for the pointer means to enable its point to be brought into contact with a face area of the support, and a scale on that face area for traversing by the point of the pointer means as that end of the shaft member moves in simulation of the said condylar movements. Each measuring means may be formed or manufactured in any of the ways described above, and may have its boss means secured to the shaft member by the same screw that usually secures the guide portion to the shaft member, conveniently with the boss means secured between the head of the screw and the guide portion, so that the scale to be traversed by the pointer means is secured to the outside face of the respective support.
A number of embodiments of the invention will now be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of one form of construction of measuring means in accordance with the invention for use with an articulator, e.g., as shown in Figures 6 to 8;

Figure 2 is a side elevation of the measuring means of Figure 1;

Figures 3 and 4 correspond to Figures 1 and 2 but shown another form of construction of measuring means in accordance with the invention;

Figure 5 corresponds to Figures 1 and 3 but show a further form of construction of measuring means in accordance with the invention;

Figure 6 is a perspective view of an articulator as in US-PS 3 772 788 which is shown fitted with measuring means as in Figure 5;

Figure 7 is a fragmentary elevation of the other side of the articulator of Figure 6;

Figure 8 is a plan view corresponding to Figure 7; and

Figure 9 corresponds to Figure 7 but with a number of parts removed to reveal relevant details.

The measuring means 10 shown in the drawings comprises boss means 11, axial scale bearing means 12, pointer means 13, and slide means 14 for the pointer means 13, and slide means 14 for the pointer means, the purpose of which will be
described after a description of the articulator shown in Figure 6 and with reference to Figures 7 to 9.

The articulator will be seen to embody a fixed base plate 21 and a movable base plate 22. The fixed base plate 21 and the movable base plate 22 are equipped with suitable means 23 for attaching hereto suitable impressions or reproduction of the bite of the patient. To the movable base plate 22 there is secured a shaft member 24 equipped at both ends with a respective guide portion 25. Each of those guide portions 25 possesses the configuration of a geometric body of rotation, and specifically that of two truncated cones which abut one another at their smaller base surfaces. Furthermore, the transition location between both outer surfaces or jackets of the truncated cones is advantageously slightly rounded.

Continuing, it will be recognized that the fixed base plate 21 is provided at both sides with a respective support 25 which is fixedly connected therewith. The top portion or marginal region of each support 26 is provided with a transverse bore 25a and both of these bores 26a of both supports 26 are disposed along a common horizontal axis. A disc 27 is rotatably mounted in each such bore 26a. Near the region of the transverse bore 26a there is formed a small opening 28 in the associated support 26. In each such opening 28 there is mounted a screw (not shown) and upon the shaft of such screw there is threaded an adjusting nut 29 which simultaneously serves to prevent axial displacement of the discs 27 and to selectively secure the discs 27 against
rotation.

Each of the discs 27 is provided with a radially extending elongated aperture or hole 30, the boundary wall of which is a blunt knife edge in cross-section over its entire length and therefore forms a support or bearing portion for the corresponding guide portion or piece 25 which is displaceable within each such associated elongated hole 30. The periphery of the elongated hole 30 is formed from two circular arcs 30a and 30b and two tangent lines 30c which connect these circular arcs with one another. One of the circular arcs, such as arc 30a, is concentrically arranged with regard to the center of rotation of the disc 27 and possess a radius which is approximately 1.5 times greater than the smallest radius of the guide portions 25 at its transition location. The radius of the other circular arc 30b is the same size as the smallest radius of such guide portion 25.

From this relationship it will be understood that when the movable base plate 22 together with both of its guide portions or pieces 25 is supported at the lowest location of each of both support or bearing portions and thereafter the discs 27 are rotated for the purpose of changing the inclination of the lower linear section of the elongated holes 30 the guide portions or pieces 25 do not change their position because the support or bearing portion then defines a circular arc which is concentric to the axis of rotation of the discs 27.

Each of the aforementioned supports 26 consists of two components which can be displaced relative to one another, of
which the respective first component 31 carries the disc 27. This disc 27 cooperates with one of the associated guide portions 25 of the movable base plate 22. The second relatively displaceable component 32 of each support 26 is directly fixedly connected in a suitable manner with the fixed base plate 21.

Now in Figure 9 there is again illustrated the first component 31 of each support 26 which, as shown, is constructed in the form of an elongated plate member. This plate member 31 will be seen to be provided at its lower region or terminal portion with two oppositely situated elongated holes 33 and 34. These elongated holes or apertures 33 and 34 cooperate with screws 35 and 36, which can be connected, for instance by establishing a threadable connection with the second component 32 of the support 26.

The elongated holes 33 and 34 are covered by a bracket or strap 37 which is also provided with two holes or apertures 38 and 39 which in this case however are circular. These two last-mentioned holes 38 and 39 possess a diameter which corresponds to the diameter of the screws 35 and 36 so that the bracket 37 is maintained fixed in position by these screws.

As already mentioned the screws 35 and 36 extend through the elongated holes 33 and 34 in the plate-shaped component 31 of the support 36. The large dimension of each of these elongated holes 33 and 34 is oriented in the lengthwise direction of the associated support 26. The plate-shaped component 31 of each support 26 can therefore be
displaced with respect to the lower component 32 of such support 26 after releasing nuts 40 and 41 operatively associated with the screws 35 and 36. The path through which both components 31 and 32 of any given support 26 can be displaced relative to one another corresponds to the size of the lengthwise dimension of the elongated holes 33 and 34. It has been found desirable to permit a lengthwise adjustment of the supports 26 in a range of approximately zero to 1.2 millimeters.

Now the adjustment of the length of the supports 26 can take place either only at one support or at each support separately by an amount which corresponds to the examination determination or diagnosis, for instance established by X-rays. It is possible to fix the adjusted lengths of each support 26 which has been appropriately regulated by merely tightening the associated nut members 40 and 41.

In order to be able to readily carry out the desired adjustment of the length of each of these supports in accordance with the examination results or diagnosis and specifically with the necessary accuracy, both the bracket 37 as well as the portion of each plate member 31 situated beside such bracket 37 are provided with an appropriate scale or marking, these scales collectively forming a vernier scale arrangement indicated by reference character 50. After adjusting the desired length of the support or supports 26, on the basis of the vernier scale 50 and after tightening the nut members 40 and 41 it is then possible to carry out the required adjustment work at both halves of the artificial
Now in Figure 9 there has additionally been depicted two further elongated holes or apertures 42 and 43, serving for appropriately guiding a suitable fixation or locking element 44 in the form of a toothed element. Each of these locking elements 44 can engage by means of a non-illustrated hook-shaped projection with the guide portion and so can maintain such guide portion 25 in engagement with the lower supporting or contact surface of the associated elongated hole 30. A screw 45 extends through the uppermost opening 42 and serves to secure the locking element 44 in desired position and in the next lower situated opening 43 there is mounted a guide pin 46 connected with such locking element 44.

When the locking elements 44 are not engaged with the guide portions 25, each of the latter is urged towards the lower supporting or contact surface of the associated elongated hole 30 by a tension spring 47 between the shaft member 24 and the projecting end of the screw 36. However, the tension springs 47 allow the shaft member 24 to move axially and also transversely with respect to its axis, independent movement of each guide portion 25 in its associated elongated hole 30 being possible, to simulate comprehensively the condylar movements of temporomandibular joints.

The measuring means 10 previously referred to are adapted for use in measuring the aforesaid condylar movements, as will now be described with reference to Figures 6 to 8. The boss means 11 is adapted to be secured coaxially at the
end of the shaft member 24 forming the pivot for the movable base plate 22, by means of the same screw 48 that secures the guide portion 25 to the shaft member 24, whereby the axial scale bearing means 12 extends over the adjacent support 26 and generally parallel to the axis of the shaft member 24. An index mark 49 for the axial scale 15 is provided on the top edge of the respective support 26. The pointer means 13 extends parallel to the axial scale bearing means 12, and the slide means 14 for the point means 13 enables its point 16 to be brought into contact with a grid-like scale 51 affixed to a face area of the support 26, by being mounted on a clip 52 gripping over an edge 53 of the plate component 31 of the support 26. The scale 51 may be provided on material which can be indented by the point 16 of the pointer means 13, so as to be able to retain impressions of the pointer made before and after movement of the respective guide portion 25 radially in its aperture 30 in the support 26. The material on which the scale 51 is provided may be self-adhesive, so as to be replaceable by a fresh scale (i.e., not indented) for each patient model.

In Figures 1 and 2, the measuring means 10 is shown formed from wire, e.g., of stainless steel with round section, bent intermediately into an arcuate boss portion 11 from one end of which extends a first arm 17 to an end portion which is bent perpendicularly and flattened to form the axial scale bearing means 12, while from the other end of the boss portion 11 extends a second arm 18 with a coiled end forming the slide means 14 for the pointer means 13, which may consist of a
hardened steel pin with a knob 19 on its end remote from the point 16.

In Figures 3 and 4 a wire construction as in Figures 1 and 2 differs only in that the boss means 11 is formed by a complete turn of the wire, and a suitably profiled plastics washer 54 (Figure 4 only) is provided to accommodate the overlapping portions of wire.

In Figures 5 to 8 the (or each) measuring means 10 is manufactured in metal, e.g., stainless steel, or rigid plastics, with an annular boss 11 and a cylindrical slide means 14, but being in all other respects similar to the measuring means of Figures 1 and 2 or Figures 3 and 4.

A friction washer (not shown) may be interposed between the (or each) boss means 11 and the associated guide portion 25 on the shaft member 24, to secure the measuring means 10 against rotation relative to that guide portion and the shaft member.
CLAIMS

1. Means for use in measuring the condylar movements of artificial temporomandibular joints in an articulator of the type described comprising boss means adapted to be secured coaxially at the end of the shaft member forming the pivot for the movable base plate, axial scale bearing means adapted to extend over the adjacent support and generally parallel to the axis of the shaft member, pointer means extending generally parallel to the axial scale bearing means, and slide means for the pointer means to enable its point to be brought into contact with a face area of the support when the boss means has been secured coaxially with the shaft member.

2. Measuring means as in Claim 1, formed from wire bent intermediately into an arcuate boss portion from one end of which extends a first arm to an end portion which is bent perpendicularly to form the axial scale bearing means, while from the other end of the boss portion extends a second arm with a coiled end forming the slide means for the pointer means,

3. Measuring means as in Claim 2, wherein the boss portion is formed by a complete turn of wire.

4. Measuring means as in Claim 1 manufactured in metal or rigid plastics, with an annular boss portion and a cylindrical slide means.

5. Measuring means as in any one of Claims 1 to 4, wherein the point means consists of a hardened steel pin with a knob on its end remote from the point.

6. An articulator of the type described having, on
each end of the shaft member that forms a pivot for the movable base plate, means for measuring the condylar movements of artificial temporomandibular joints and comprising an axial scale extending over the adjacent support and generally parallel to the axis of the shaft member, pointer means extending generally parallel to the axial scale, slide means for the pointer means to enable its point to be brought into contact with a face area of the support, and a scale on that face area for traversing by the point of the pointer means as that end of the shaft member moves in simulation of the said condylar movements.

7. An articulator as in Claim 6, wherein each measuring means is formed or manufactured as in any one of Claims 2 to 5.

8. An articulator as in Claim 6 or Claim 7, wherein the boss means of each measuring means is secured to the shaft member by the same screw that usually secures the guide portion to the shaft member.

9. An articulator as in Claim 8, wherein the boss means is secured between the head of the screw and the guide portion.

10. An articulator as in Claim 8, wherein a friction washer is interposed between each boss means and the associated guide portion on the shaft member.

11. An articulator as in any one of Claims 6 to 10, wherein an index mark for the axial scale is provided on the top edge of the respective support.

12. An articulator as in any one of Claims 6 to 11,
wherein a grid-like scale is affixed to a face area of the respective support.

13. An articulator as in Claim 12, wherein the grid-like scale is mounted on a clip gripping over an edge of the support.

14. An articulator as in Claim 12 or Claim 13, wherein the grid-like scale is provided on material able to retain impressions of the point of the pointer means.

15. An articulator as in any one of Claims 12 to 14, wherein the grid-like scale is provided on self-adhesive material, so as to be replaceable by a fresh scale for each patient model.

16. Means for use in measuring the condylar movements of artificial temporomandibular joints in an articulator of the type described substantially as hereinbefore described with reference to Figures 1 and 2 or 3 and 4 or 5 to 8 of the accompanying drawings.

17. An articulator substantially as hereinbefore described with reference to Figures 5 to 9 of the accompanying drawings.
INTERNATIONAL SEARCH REPORT

PCT/GB 89/01359

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC: A 61 C 11/00

II. FIELDS SEARCHED

Classification System

Classification Symbols

IPC: A 61 C

Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in the Fields Searched

III. DOCUMENTS CONSIDERED TO BE RELEVANT

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* Special categories of cited documents: 10
A*: document defining the general state of the art which is not considered to be of particular relevance
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L*: document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
O*: document referring to an oral disclosure, use, exhibition or other means
P*: document published prior to the international filing date but later than the priority date claimed
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Y*: document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step
Z*: document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
A*: document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search: 6th March 1990
Date of Mailing of this International Search Report: 19. 04. 90

International Searching Authority: EUROPEAN PATENT OFFICE

Signature of Authorized Officer: T.K. WILLIS

Form PCT/ISA/210 (second sheet) (January 1985)
This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 30/03/90. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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