

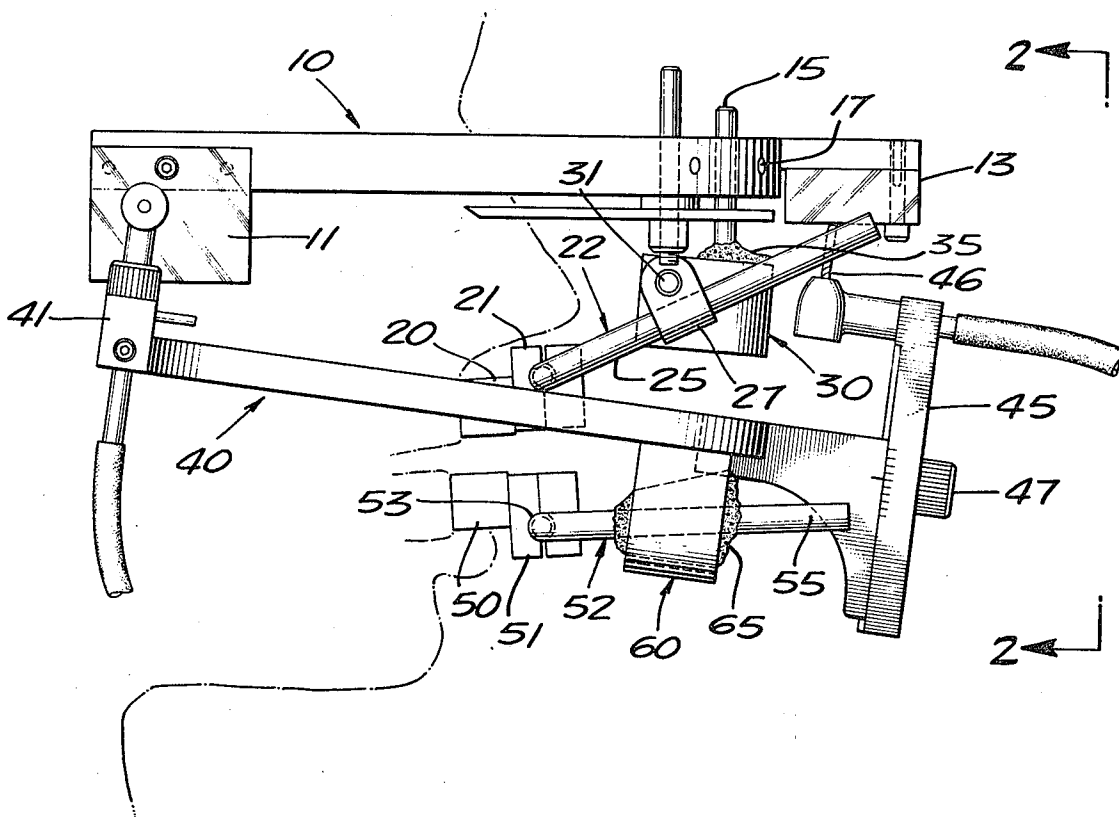
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 [21] Appl. No. **736,613**
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 [45] Patented **May 4, 1971**
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[56] **References Cited**
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[54] **FACE BOW WITH THREE-DIMENSIONALLY**
ADJUSTABLE SUPPORT MEANS
 15 Claims, 9 Drawing Figs.

[52] U.S. Cl..... 32/19
 [51] Int. Cl..... A61c 9/00
 [50] Field of Search..... 32/19, 20,
 21

ABSTRACT: Jaw movement recording apparatus including an upper face bow supported from an upper clutch, and a lower face bow supported from a lower clutch. Each clutch carries a vise grip, and a U-shaped bolt or rod has its base or middle portion supported from the vise grip. The legs of each U-shaped bolt or rod project in a generally forward direction for supporting the associated face bow. Four adjustment members are used which are hollow, one being associated with each of these legs. After precise adjustment of the position of the face bow in three dimensions has been achieved, each of the hollow adjustment members is filled with quick-setting plaster to capture the then existing position of an associated rod end which projects into the cavity of the member.



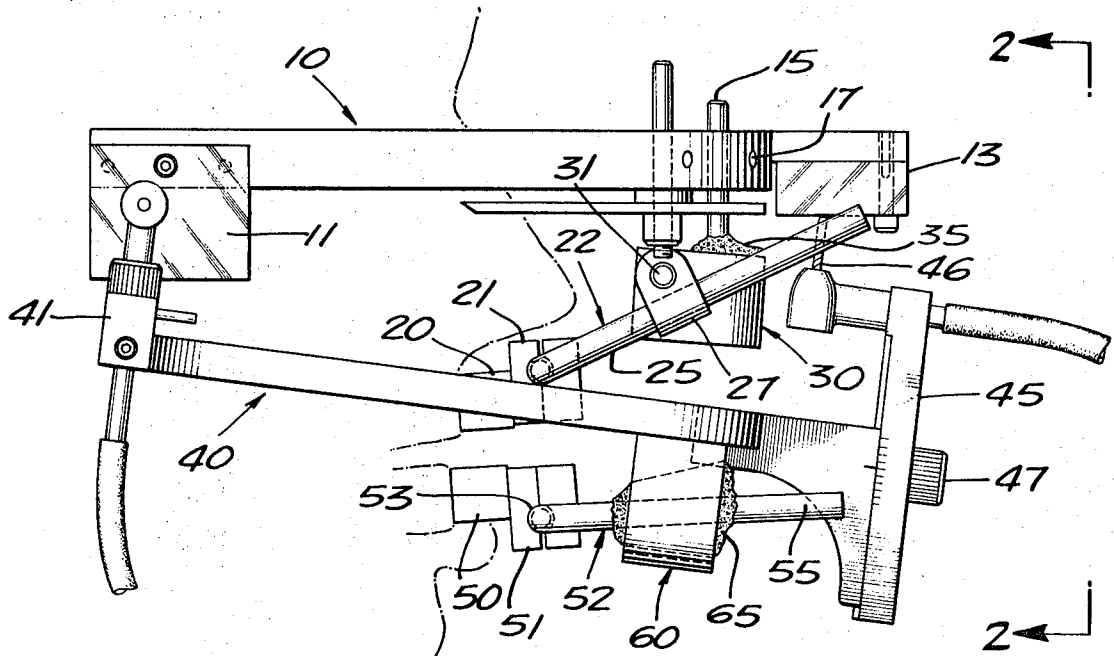


FIG. 1.

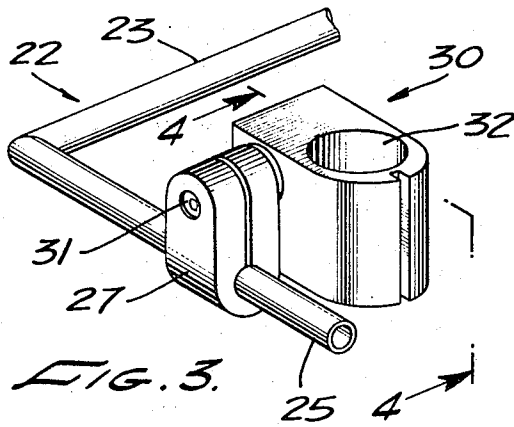


FIG. 3.

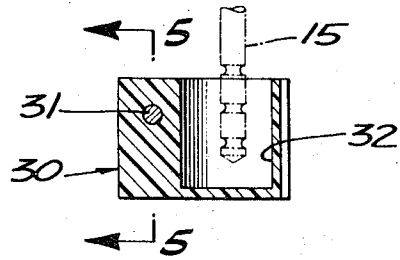


FIG. 4.

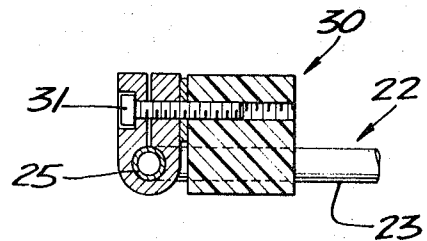


FIG. 5.

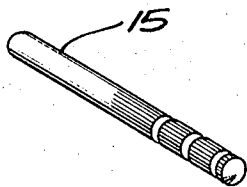


FIG. 6.

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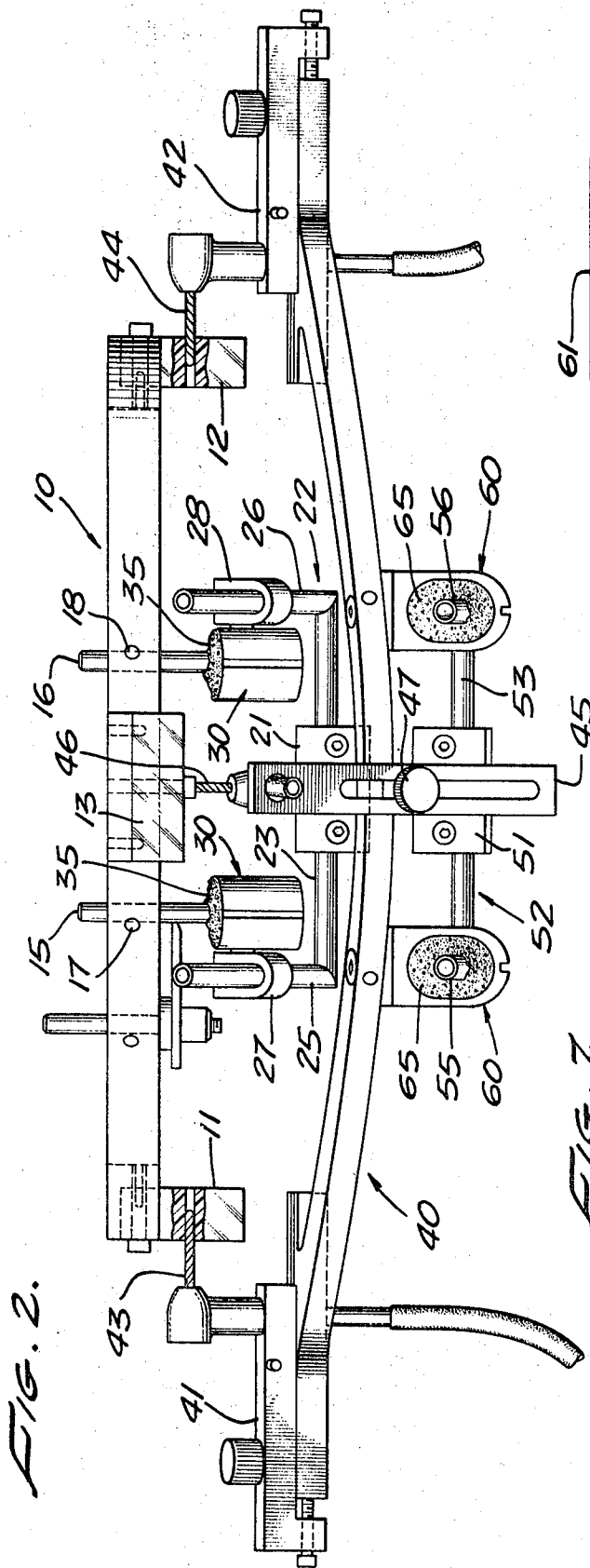


FIG. 2.

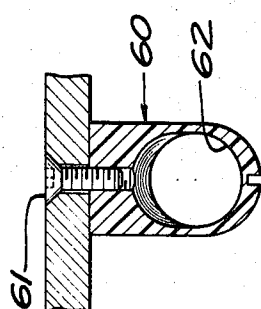


FIG. 9.

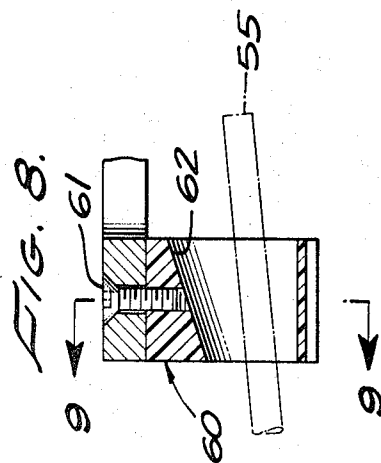


FIG. 8.

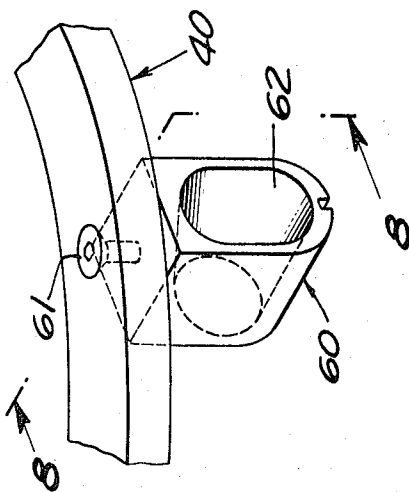


FIG. 7.

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FACE BOW WITH THREE-DIMENSIONALLY ADJUSTABLE SUPPORT MEANS

RELATED APPLICATIONS

The present application discloses improvements over the jaw movement recording apparatus disclosed and claimed in my copending prior patent application Ser. No. 569,472 filed Aug. 1, 1966 entitled "GNATHOLOGICAL METHOD AND APPARATUS," now Pat. No. 3,452,439 issued July 1, 1969.

BACKGROUND OF THE INVENTION

In recording jaw movements it is well known to utilize upper and lower face bows which move with the upper and lower jaws, respectively. My referenced patent discloses apparatus in which the upper face bow as an integral unit (together with associated transducer portions), and the lower face bow as an integral unit (including associated transducer portions), are both precisely aligned with the hinge axis. Such precise alignment involves positioning each face bow with regard to six parameters, i.e., a position and an angle along each of three reference axes.

Except for my above-referenced patent, other prior art jaw movement recording apparatus insofar as known to me has included face bows that are not precisely positioned. An approximately correct position for the face bow is established, and then movable members carrying the various jaw movement recording transducers are adjusted in their positions relative to the face bow. So far as I am aware my prior patent disclosed the first face bow which is precisely positioned in the first instance. However, the adjustable mounting means disclosed in my referenced patent is cumbersome in operation, and expensive to manufacture. More specifically, the tightening or locking of the devices 35, 36, 75, and 76 shown in FIG. 5 of that patent has tended to destroy the precise position of the corresponding face bow which was achieved prior to the tightening or locking.

SUMMARY OF THE INVENTION

According to the present invention a precise position adjustment is achieved by utilizing a hollow member in conjunction with a rod, the end of the rod being very loosely fitted inside the cavity of the member. One of the rod-and-member pair is used to support the face bow while the other is in turn supported from the clutch. When the desired three-dimensional positional and angular relationship has been achieved, the cavity is filled with quick-setting plaster, and after the plaster has hardened a rigid support is obtained.

THE DRAWINGS

FIG. 1 is a side elevational view of the complete jaw movement recording apparatus of the present invention, after it has been aligned on a patient;

FIG. 2 is a front elevational view of the apparatus, taken on the line 2-2 of FIG. 1;

FIG. 3 is a perspective view of part of one of the upper support devices;

FIG. 4 is a cross-sectional elevational view taken on the line 4-4 of FIG. 3;

FIG. 5 is a cross-sectional elevational view taken on the line 5-5 of FIG. 4;

FIG. 6 is a perspective view of one of the upper position adjustment rods;

FIG. 7 is a perspective view of part of one of the lower support devices;

FIG. 8 is a cross-sectional elevational view taken on the line 8-8 of FIG. 7; and

FIG. 9 is a cross-sectional elevational view taken on the line 9-9 of FIG. 8.

PREFERRED EMBODIMENT

The upper face bow 10 is a single flat horseshoe-shaped piece of aluminum, the extremities of which are recessed on

their under and outer corners to receive the plastic lateral recording blocks 11 and 12, and having a frontal extension beneath which the frontal recording blocks 13 is secured. Face bow 10 is generally similar to face bow 80 or face bow 340 shown in my referenced patent. A pair of upper position adjustment rods 15, 16 are vertically disposed on respective sides of the frontal recording block 13, each of these adjustment rods being slidably received in a corresponding hole in the upper face bow 10. The rods 15, 16 are secured in a selected vertical position by means of the associated setscrews 17, 18 (FIG. 2). As shown in FIG. 6 the lower end of each of these rods has a serrated or otherwise irregular surface, for the purpose of better retaining the plaster.

The upper clutch 20 has a vise grip 21 attached to its forward extremity, and a U-shaped bolt or rod 22 has its central or base part horizontally disposed within the vise grip. Upper clutch 20 is similar to clutch 71, 73 shown in my reference patent. The base or central part of the U-bolt is identified as 23 while the legs are identified as 25, 26. These legs extend forwardly and are also inclined upwardly at an angle of about 30°. Small U-shaped fastening straps 27, 28 are attached to the rod legs 25, 26, respectively.

In supporting the upper face bow 10 the most significant part of the mechanism are two upper position adjustment members 30, which are identical. Each of the members 30 has an upwardly opening cavity 32 formed therein, the cavity having a diameter of about a half inch and a depth of about three-quarters inch. The lower ends of upper position adjustment rods 15, 16 are received in the cavities of the respective ones of the members 30. A retaining bolt 31 is provided for each of the members 30 (see FIGS. 3, 4, and 5), and the bolt 31 besides passing through both ears of the U-shaped strap 27 or 28 also extends into and is securely received by a threaded opening in the member 30. As best seen in FIG. 4, the threaded opening in member 30 is located beside the cavity 32, and hence the longitudinal axis of the cavity 32 is perpendicular to the longitudinal axis of the bolt 31.

In positioning the upper face bow 10, the face bow itself is placed precisely in the desired position by means of techniques described in my referenced patent. The coarse adjustments of the supporting mechanism are made by tilting the U-shaped member 22 up or down as desired before securing the vise grip 21; by sliding the straps 27 forward or backward (up or down) on the legs 25, 26; and by rotating each of the position adjustment members 30 relative to the longitudinal axis of its associated retaining bolt 31 prior to tightening the bolt. A further coarse adjustment is made by dropping the rods 15, 16 to the approximate desired elevations. Any of these adjustments may then be varied slightly to achieve the final position desired, and in addition, if it were necessary the U-shaped bolt 22 may also be shifted to one side or the other before retightening the vise grip 21. In the final alignment position as shown in FIG. 4 each of the rods 15, 16 will fit loosely in its associated cavity 32, or preferably one of the rods will be adjusted so that its lower end is in contact with the bottom of the cavity. Then the quick-setting plaster 35 is poured into each of the members 30 and permitted to harden. Pouring of the plaster does not disturb the alignment of the mechanism.

The position of the upper face bow 10 is established by reference to the orbital-axis plane, and three tattoo marks on the face of the patient which indicate the location of that plane, all as described in my referenced patent. The position of the lower face bow 40, however, is established subsequently, and by reference to the position of the upper face bow 10. More specifically, each of the lateral recording blocks 11, 12 shown in the present drawings is not a block actually used for recording, but rather it is an alignment block (otherwise identical to the corresponding recording block) having a transverse alignment opening formed therein. The method of alignment will be described after first describing the lower face bow 40 and its associated apparatus.

The lower face bow **40** is also an integral flat piece of aluminum, of generally horseshoe-shaped configuration. Its lateral extremities are provided with drill carriages **41**, **42**, which are slidable inwardly and outwardly relative to each other and along a common axis of movement. The drill carriages carry air-driven drills **43**, **44**, whose longitudinal axes are at all times aligned with each other, in the manner described in my referenced patent, and which have hemispherical cutting ends. At the front and center of lower face bow **40** there is provided a front drill carriage **45**, which is slidable in a vertical direction, the carriage **45** serving to support a similar air-driven drill **46** which is disposed perpendicular to the mutually aligned longitudinal axes of the drills **43**, **44**.

In aligning the lower face bow **40** with the upper face bow **10** it is necessary that the axis of the mandible (represented by the longitudinal axes of drills **43** and **44**) be aligned with the maxillary axis (represented by the alignment holes in the blocks **11**, **12**), all as described in my referenced patent. This is the position of the apparatus as shown in FIGS. **1** and **2**, in which the tip of the hemispherical end of frontal drill **46** is also in engagement with the undersurface of frontal recording block **13**. The setscrew **47** for front carriage **45** may be loosened to permit lower face bow **40** to be moved up or down relative to upper face bow **10**, in order to obtain the optimum working position, and then the setscrew **47** is tightened. The alignment of the lower face bow **40** has then been completed relative to the upper face bow **10** and also to the maxilla or upper jaw.

The lower clutch **50** has a vise grip **51** at its forward extremity, and a U-shaped bolt or rod **52** (identical to **22**) has its central portion **53** received in that vise grip. The legs **55**, **56** of member **52** extend forward in a horizontal direction from the vise grip **51**.

The lower support apparatus also includes a pair of lower position adjustment members **60**, which are generally similar to the upper position adjustment members **30**. Each of the members **60** has a cavity **62** formed therein which extends horizontally with both ends open, the cavity **62** having an average diameter of about one-half inch but being wider at its forward end than at the rearward end. (FIGS. **7**, **8**). The upper end of member **60** has a flat surface in which a threaded opening is formed, and an associated retaining bolt **61** passes downwardly through a corresponding opening in the lower face bow **40** and is received by this threaded opening. The member **60** may therefore be rotated in a horizontal plane, about the axis of the retaining bolt **61**, before the bolt is tightened.

After the lower face bow **40** is aligned relative to the upper face bow, as previously explained, the jaw of the patient is then manipulated so that the centric relation is achieved. Quantities of quick-setting plaster **65** are then poured into the cavity **62** and allowed to harden. Thereafter when the drills **43**, **44** are released from the alignment blocks **11**, **12** and allowed to move with the mandible, they will at all times represent the axis of the mandible, as distinguished from the maxillary axis.

In theory it would suffice to utilize a single hollow adjustment member, and a single associated adjustment rod, to support each of the face bows. However, from the standpoint of practical mechanics it is advantageous to use a rod-and-member pair on each side of each face bow, thus achieving a greater mechanical stability of support.

It will be seen that the rod ends **55**, **56** project throughout the length of the cavities **62**, and hence throughout the length of the associated members **60**, while the upper position adjustment members **30** are somewhat cup-shaped and have bottoms for their cavities **32**. This distinction between the upper and lower position adjustment members, again, is practical rather than theoretical. Due to the horizontal position of the lower adjustment rods **55**, **56** there is an advantage in having cavities **62** open at both ends, while the vertical sliding relationship of the upper position adjustment rods **15**, **16** results in

an advantage in having the lower ends of cavities **32** closed. But it is possible to use a closed cavity in conjunction with the lower face bow, or an open cavity in conjunction with upper face bow.

In member **60** the cavity **62** has substantially a truncated conical configuration. A cylindrical configuration would work almost as well, but the configuration shown does have a practical advantage in view of the arc through which the rods **55**, **56** swing when the member **52** is rotated in its vise grip **51**.

The invention has been described in considerable detail in order to comply with the patent laws by providing a full public disclosure of at least one of its forms. However, such detailed description is not intended in any way to limit the broad features or principles of the invention, or the scope of patent monopoly to be granted.

I claim:

1. In jaw movement recording apparatus, the combination comprising:
 - a clutch adapted to be fastened to the tooth structure of one jaw of a patient;
 - a face bow adapted to fit around the patient's jaw;
 - an elongated position adjustment rod having first and second ends;
 - means fixedly supporting one end of said rod from one of said clutch and face bow;
 - a hollow position adjustment member having a cavity adapted to receive the other end of said rod in a loose-fitting relationship permitting relative three-dimensional movement therebetween; and
 - means fixedly supporting said hollow member from the other of said clutch and face bow;
 whereby when a desired positional and angular relationship of said face bow relative to said clutch is achieved, said cavity may be filled with plaster or the like for fixedly securing said face bow in said desired position.
2. Apparatus as claimed in claim **1**, which includes two such adjustment rods and two such adjustment members, one on each side of the lateral center of said face bow, each adjustment rod-and-member pair having separate support means associated therewith.
3. Apparatus as claimed in claim **1** wherein the lower end of said rod projects downwardly into said cavity.
4. Apparatus as claimed in claim **1** wherein said cavity is elongated and open at both its ends, said rod extending throughout the length of said cavity.
5. Apparatus as claimed in claim **4** wherein said cavity has substantially a truncated conical configuration.
6. Apparatus as claimed in claim **2** wherein said clutch is an upper clutch and said face bow is an upper face bow, the lower end of each of said rods projecting downwardly into the associated one of said cavities.
7. Apparatus as claimed in claim **6** which further includes a vise grip secured to the forward extremity of said upper clutch, a U-bolt having its base part horizontally disposed in said vise grip and its legs projecting forwardly and somewhat upwardly, and a separate U-strap secured to each of said U-bolt legs for supporting an associated one of said adjustment members.
8. Apparatus as claimed in claim **2** wherein said clutch is a lower clutch and said face bow is a lower face bow, each of said cavities being elongated and open at both its ends, each said rod extending throughout the length of the associated cavity, each said cavity having substantially a truncated conical configuration with its smaller diameter end being toward said lower clutch.
9. Apparatus as claimed in claim **8** which further includes a vise grip secured to the forward extremity of said lower clutch, a U-bolt having its base part horizontally disposed in said vise grip and its legs projecting horizontally forwardly to provide said position adjustment rods, each said adjustment member being so disposed that the longitudinal axis of its associated cavity is substantially horizontal.

10. The combination claimed in claim 1 wherein said rod end is disposed within said cavity and which further includes a quantity of quick-setting plaster filling the remainder of said cavity.

11. For positioning a dental face bow, a mounting member integrally formed from rigid material, having a roughly cubical configuration with a thickness in two directions of about 1 inch and in the third direction of about 1½ inches, the side surfaces perpendicular to one of the short axes being flat and parallel to each other, one end surface being flat and perpendicular to the long axis, the side surfaces perpendicular to the other short axis being also flat and parallel to each other adjacent said one end surface but being curved towards each other to form an essentially semicylindrical end surface at the other end of the long axis, a generally cylindrical cavity formed in one of said first-named side surfaces with its longitudinal axis perpendicular to said side surface and having a diameter of about a half inch and being located adjacent said semicylindrical end surface, and a hole formed in said mounting member in one of said flat surfaces in a direction perpendicular to the longitudinal axis of said cavity for attaching said mounting member to a supporting device in a position relative

thereto which is adjustably rotatable about the longitudinal axis of said hole; said cavity being adapted to receive a rod end in a selected three-dimensional position relative to said member and to then be filled with quick-setting plaster for maintaining said selected position.

12. The device claimed in claim 11 wherein said cavity is open at both its ends, and said hole extends from said one end surface in a direction perpendicular thereto into said cavity.

13. The device claimed in claim 12 wherein said cavity is of larger diameter at one end than at the other.

14. The device claimed in claim 11 wherein said hole is threaded.

15. The method of supporting a dental face bow from a clutch, comprising attaching a position adjustment rod to one of said face bow and clutch and a hollow position adjustment member to the other, establishing a precise position of the face bow relative to the clutch and at the same time establishing rigid positions of the adjustment rod and hollow member in which the end of the adjustment rod is positioned within the hollow member, and then filling the hollow member with plaster to fix the position of the rod.

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