R. H. W. STRANG.

INSTRUMENT FOR RECORDING CHANGES IN TOOTH REGULATING APPLIANCES.

APPLICATION FILED MAY 9, 1913.

1,082,052.

Patented Dec. 23, 1913.

3 SHEETS—SHEET 1.

Fig. 1

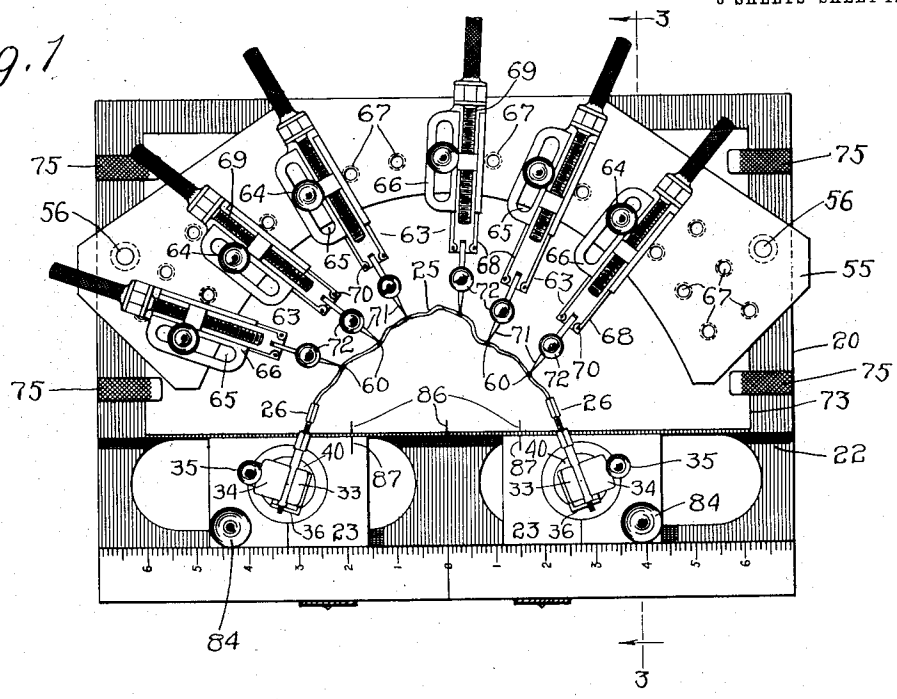


Fig. 2

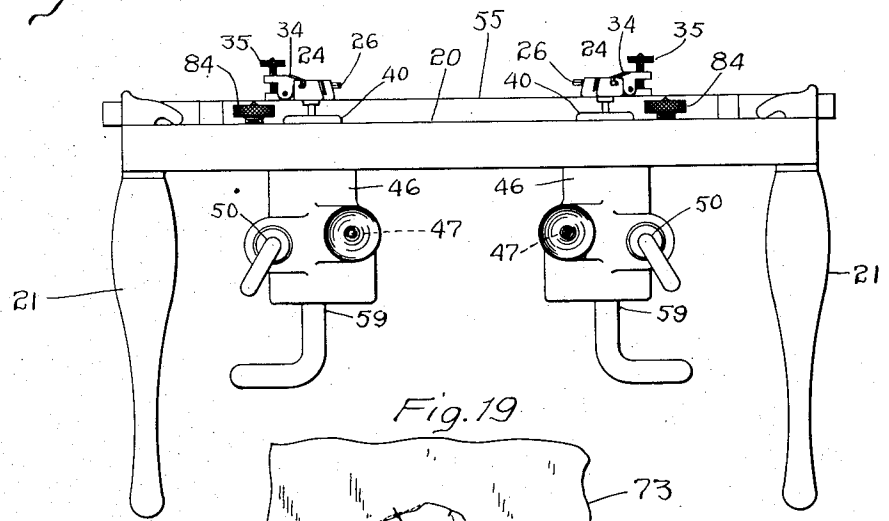
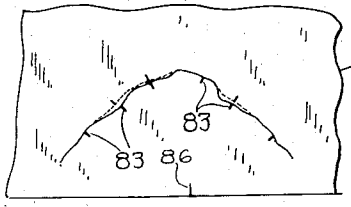


Fig. 19



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Fig. 3

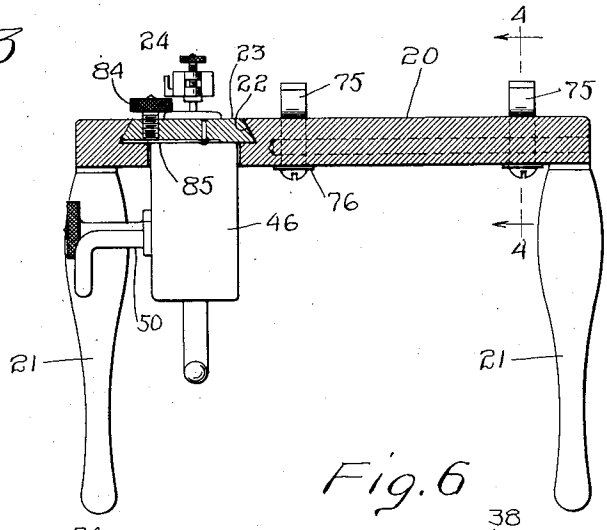


Fig. 4

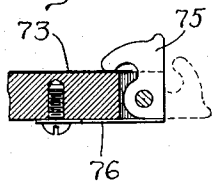


Fig. 6

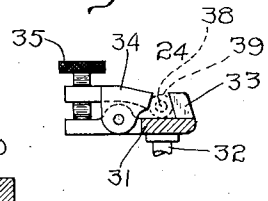


Fig. 5

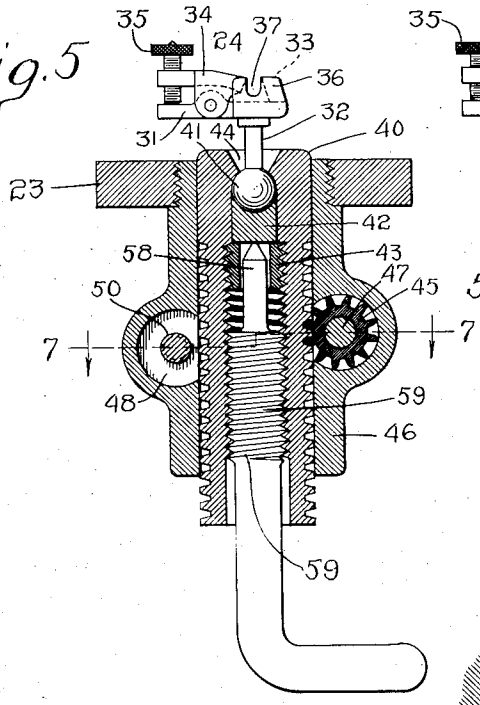


Fig. 7

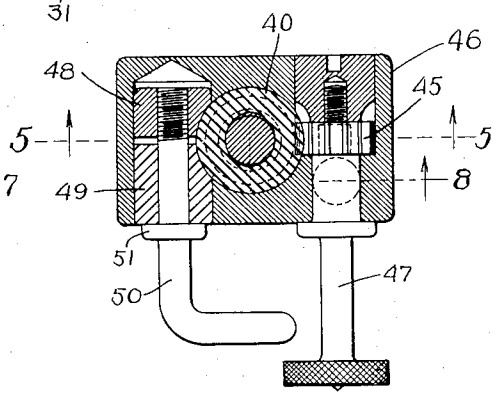
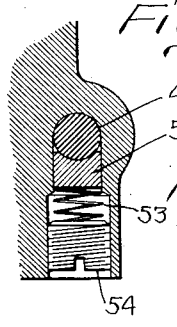


Fig. 8



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3 SHEETS—SHEET 3.

Fig. 9

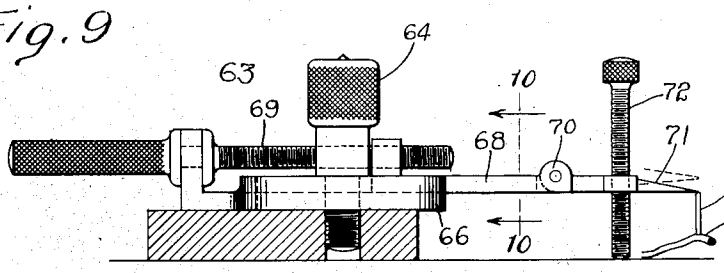


Fig. 10

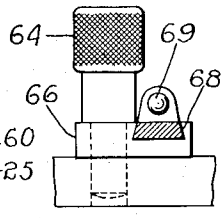


Fig. 11

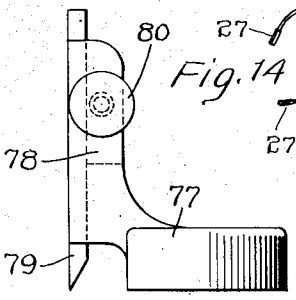


Fig. 13

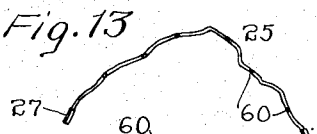


Fig. 14

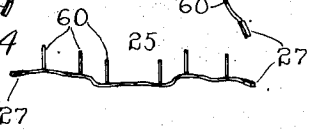


Fig. 15

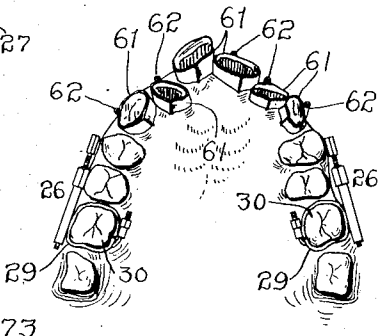


Fig. 12

Fig. 16

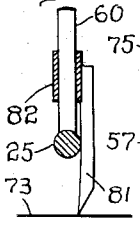
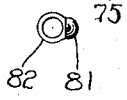
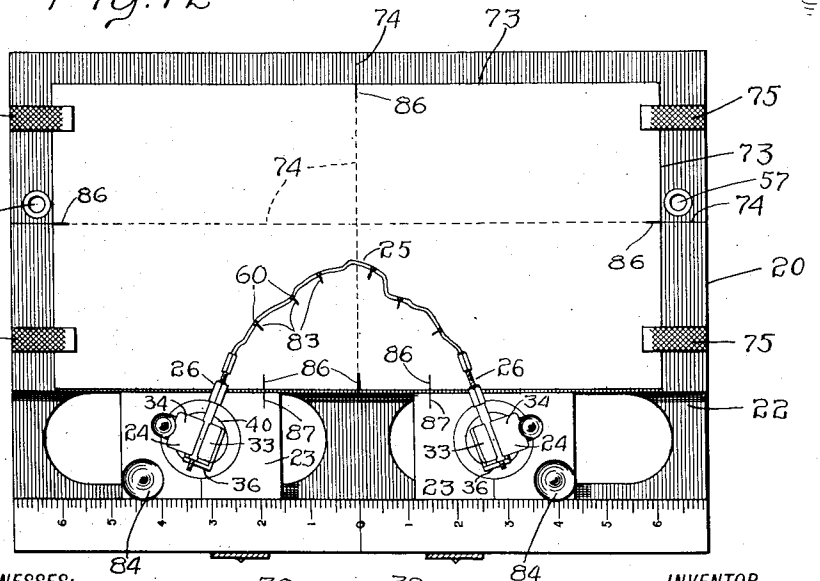


Fig. 17





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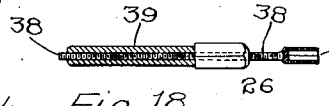


Fig. 18

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INSTRUMENT FOR RECORDING CHANGES IN TOOTH-REGULATING APPLIANCES.

1,082,052. Specification of Letters Patent. Patented Dec. 23, 1913.

Application filed May 9, 1913. Serial No. 766,578.

To all whom it may concern:

Be it known that I, ROBERT H. W. STRANG, a citizen of the United States, residing at Bridgeport, county of Fairfield, State of Connecticut, have invented an Improvement in Instruments for Recording Changes in Tooth-Regulating Appliances, of which the following is a specification.

This invention relates to the treatment of malocclusion by appliances of the arch bar type, and has for its object to provide an instrument which I call an "archograph," that will determine and enable the user to record accurately changes in the shape of the arch in the vertical and horizontal planes, will indicate the direction of force that may be produced by changing the shape of the arch or by bending the pins of the arch and will enable the operator to estimate the amount of force applied to individual teeth by the changes in the shape of the arch, as shown by the record sheet.

With these and other objects in view I have devised the novel recording instrument which I will now describe, referring to the accompanying drawings forming a part of this specification, and using reference characters to indicate the several parts.

Figure 1 is a plan view of the instrument complete as in use; Fig. 2 a front elevation, the gages being removed; Fig. 3 a section on the line 3—3 in Fig. 1, looking in the direction of the arrows, the table being removed; Fig. 4 a section on the line 4—4 in Fig. 3, looking in the direction of the arrows; Fig. 5 a detail sectional view on an enlarged scale of the chuck holding and locking mechanism detached, the section being on the line 5—5 in Fig. 7, looking in the direction of the arrows; Fig. 6 a detail view party in section illustrating the operation of a chuck; Fig. 7 a section on the line 7—7 in Fig. 5, looking in the direction of the arrows; Fig. 8 a section indicated by the line 8 in Fig. 7, looking in the direction of the arrow; Fig. 9 a cross section of the table on an enlarged scale showing one of the gages in elevation; Fig. 10 a section on the line 10—10, in Fig. 9, looking in the direction of the arrows; Fig. 11 an elevation on the same scale of a special form of tracing pencil adapted for use with my novel instrument; Fig. 12 a plan view of the bed with a record sheet and an arch in place; Fig. 13 a plan view illustrating the operative portion of a sectional arch, so called; Fig. 14 an elevation corresponding therewith; Fig. 15 an inverted plan view showing an irregular set of upper teeth with bands attached and showing the attaching members of a sectional arch attached to anchor teeth; Fig. 16 a greatly enlarged view illustrating an attachment for indicating the position of the pins in the horizontal plane; Fig. 17 an inverted plan view corresponding with Fig. 16; Fig. 18 an enlarged view partly in section illustrating one of the attaching members of a sectional arch, and Fig. 19 (Sheet 1) is a plan view of a portion of a record sheet showing tracings thereon indicating changes in the shape of the arch.

20 denotes the bed of the instrument shown as supported by legs 21, and 22 a longitudinal groove in the bed in which are slides 23 which carry the chucks 24 by which the arch is held when making a record. The slides are locked in position after adjustment by means of screws 84 which pass through the slides and bear upon springs 85 (see Fig. 3) which are secured to the slides and the ends of which bear upon the bottoms of the grooves to lock the slides in position.

25 denotes the operative portion and 26 the attaching members of a sectional arch, so called. It should be understood, however, that my novel instrument is equally operative in connection with an ordinary one-piece arch. It is sufficient for the purposes of this specification to state that the ends of the operative portion of a sectional arch are made angular as at 27 and detachably engage adjustable sockets 28 forming part of the attaching members. The operative portion of the arch has rigidly secured thereto pins 60 corresponding with the teeth to be moved. Each tooth to be moved has a band 61 placed about it and each band is provided with a socket 62 which is adapted to receive one of the pins on the arch (see Figs. 13, 14 and 15). Other means of connecting the teeth with the arch may be used if preferred; for example, the bands and pins may be dispensed with and the teeth connected to the arch by means of wires or ligatures encircling the teeth and twisted about the arch.

In use, two attaching members are secured to bands 29 themselves secured to anchor teeth indicated by 30, see Fig. 15. The operative portion of the arch is readily attach-

able to and detachable from the attaching members. For the purpose of adjustment and for making records by the use of my novel instrument, the operative portion of the arch (or the entire arch if a one-piece arch is used) is removed from the patient's mouth and placed in a duplicate set of attaching members which are held by the chucks of the instrument, (see Figs. 1 and 12). The chucks (see especially Figs. 1, 5 and 6) each comprise a base 31 having a stem 32, a fixed jaw 33 integral with or secured to the base, a pivoted jaw 34 operated by means of a screw 35 bearing against the base and a flange 36 secured to the base and having a slot 37 which just receives the screw 38 of the attaching member, the flange being engaged by the body 39 of the attaching member and holding the end of the member against backward movement. The attaching members are simply laid between the jaws of the chuck, the screws lying in the slots and the bodies of the members against the flanges, in which position they are locked by turning screws 35 inward, thereby clamping the pivoted jaws against the members. The chucks require to be universally adjustable. This is effected by connecting the chucks by ball and socket joints to chuck carriers 40 vertically movable in holders 46 which are detachably secured to the slides and move freely in openings in the bed. At the lower end of each stem is a ball 41 which lies in a socket formed partly in the carrier and partly in a block 42 lying in a longitudinal recess in the carrier. Below the block the longitudinal recess is threaded and the block is loosely retained in place by a threaded stop piece 43. The stem passes through an outwardly flaring hole 44 leading into the socket which permits free movement of the stem. Each chuck carrier is raised independently to the desired position by means of a pinion 45 carried by a shaft 47 mounted to rotate in the holder and engaging rack teeth on the carrier. Each carrier is locked at any required vertical adjustment in any suitable manner, as by means of locking blocks 48 and 49 lying in a recess in the holder. A screw 50 having a collar 51 bearing on the outer block passes freely through the outer block and has threaded engagement with the inner block. Turning the screw in one direction will therefore cause the blocks to engage the chuck carrier and lock it in place and turning in the opposite direction will cause the blocks to release the carrier. As a means for retaining the carrier and chuck in the raised position without locking it, as in making an adjustment, I provide a friction block 52, in a recess in the holder, which is forced against shaft 47 by means of a spring 53 retained in position by a screw plug 54. After effecting the adjustments just described each chuck is locked against any movement by means of a rod 58 (shown as pointed) which extends through the stop piece and is carried by a screw 59 threaded to engage the threaded longitudinal recess in the carrier. By turning the screw and rod in one direction, block 42 is raised and clamps the ball in its socket, thus securely retaining the stem and chuck against movement. Slight turning of the screw in the opposite direction will cause the block to release the ball and permit the stem and chuck to be removed freely.

55 denotes a table which is removably secured to the bed by means of dowel pins 56 engaging holes 57 (shown as bushed) in the bed.

63 denotes gages, one corresponding with each pin upon the arch, which are detachably secured to the table by means of screws 64 passing through slots 65 in the bodies 66 of the gages and engaging holes 67 in the table. Each gage comprises a slide 68 which is moved longitudinally in ways in the body by means of a screw 69 which rotates freely in the body but is held against longitudinal movement and has threaded engagement with the slide, so that rotation of the screw will move the slide inward or outward as may be required. At the forward end of each slide and hinged thereto as at 70, so as to swing in the vertical plane, is a marker 71 which is adapted to operate in connection with pins 60, as will presently be explained, to indicate changes in the height and position of the pins in adjusting the arch (see Fig. 9). The marker may be moved upward and downward and is caused to remain in any position to which it is adjusted by means of a screw 72, in the marker, the tip of which engages the bed, (see Figs. 1 and 9).

73 denotes the record sheet which is laid upon the bed and the table placed over it. The bed is provided with central cross lines, indicated by 74 and corresponding marks are placed upon the record sheet to insure its being placed upon the bed with absolute accuracy each time a record is made. The record sheet is shown as held in place by pivoted clamps 75 which are retained in the operative and the inoperative positions by means of a spring 76 secured to the underside of the bed (see Fig. 4). When the record sheet has been accurately placed the clamps are swung to the retaining position, as in full lines in Fig. 4, and retain it securely in position.

In Fig. 11 I have illustrated a special pencil for use in making tracings of the arch upon a record sheet after making the adjustments. This pencil comprises a body 77 having a split arm 78 and a groove to receive the lead 79. The lead is locked in the groove after adjustment by means of a screw

80 which clamps the sides of the split arm upon the lead. It will be noted that the point is at the front edge of the lead and that it is sharpened by beveling it backward. This is in order to insure that the lead will always bear upon the arch at the same angle of inclination and thus produce perfectly accurate tracing after all of the adjustments.

In practice after making tracings with the pencil, I trace them over in different colored inks so that each record of the adjustment of the arch may be distinguished from previous records made upon the same sheet. After tracing an arch on the record sheet after an adjustment I also indicate on the sheet by a mark 83 (see Fig. 19) the position of each pin relatively to the arch. These indications of the positions of the pins require to be made with the greatest possible accuracy. In order to insure this accuracy, in indicating the positions of pins, in portions of the arch that are sprung upward from the normal horizontal plane of the arch, I provide special indicating pins 81 (see Fig. 16). Each indicating pin is provided with a sleeve 82 which is adapted to slip over a pin 60 on the arch, as clearly shown, permitting the point of the indicating pin to rest upon the record sheet practically in alinement with the pin 60. As the points of the indicating pins are at their forward edges and they are beveled backward from the points, this construction enables me to secure the desired result. In practice, the indicating pins are made of half round wire, (see Fig. 17) the flat side of the indicating pin engaging the arch and preventing lateral movement of the pin. It will be understood that in Figs. 16 and 17 the parts are all greatly exaggerated in size.

The operation is as follows: The arch is first adjusted to the mouth of the patient and allowed to remain in position passively for the usual period to allow the patient to become accustomed to the appliance. The table is removed from the bed and a record sheet secured in place thereon, after which the record is made as follows: Duplicate end sections are placed in the chucks as described, and then the operative portion of the arch is removed from the end sections in the anchor teeth and engaged with the end sections in the chucks, the correct lateral separation being of course given to slides 23 which carry the chucks to correspond with the width of the arch, after which the slides are locked in position by screws 84. The chuck carriers are now raised or lowered as may be required by turning pinions 45 on shafts 47 until they are in a position to permit the arch to lie in its normal horizontal plane; that is, a position in which so much of the arch as possible will lie in contact with the record sheet. Having determined the proper height of the chucks in this manner they are locked in position by means of screws 50 and locking blocks 48 and 49. The chucks themselves are then securely locked in place by means of screws 59 and rods 58 which cause blocks 42 to clamp the balls on the chuck stems in their sockets. The attaching members in the chucks of the instrument are now in the same position relatively to each other as are the other set of attaching members upon the anchor teeth. The adjustment may now be tested by removing first one end of the operative portion of the arch and then the other, allowing each in turn to rest upon the corresponding attaching member in the chuck, over which it should lie in perfect alinement. The operative portion of the arch is then again placed in the attaching members in the chucks and a tracing is made on the record sheet by means of the pencil. After tracing the shape of the arch the position of each pin is indicated on the record sheet by marks, as 83. For accurately indicating the position of the pins upon portions of the arch sprung above the plane of the record sheet, I use indicating pins 81 as already described. The table is then placed upon the bed and a gage 63 secured thereon corresponding with each pin. The markers on the gages are now adjusted to accurately indicate the height of the pins and also the position of the pins independently of the record sheet. We now have fixed indices of the essential points of the arch, *i. e.*, the anchor ends and the points of attachment for each tooth to be moved, while the arch as a whole is accurately outlined on the record sheet. The markers are now turned backward, the table removed and then the arch is removed from the attaching members and bends are made therein at the points necessary to accomplish the desired tooth movement. These bends or changes in the shape of the arch are preferably made one at a time. After making a bend the end of the arch farthest away from the point of bending is replaced in the corresponding attaching member. This end of the arch is the one selected to place in position in order that as many unchanged points as possible may be placed in contact with the previously adjusted markers. The table is now placed in position again and the markers turned to operative position. The markers will then indicate the character and amount of variation in the shape of the arch at the point of bending together with its effect upon the anchorage point of the unattached side of the arch and all portions of the arch between the point of bending and the unattached end of the arch. If the change in the arch is too great, or is in the wrong direction, or has produced a faulty inclination of the pin it is now detected and the arch is readjusted to proper form to correct the disturbed re-

lationship. If the position of more than one tooth is to be changed, the arch is then adjusted in the same manner for each tooth that is to be moved. Having completed the adjustment of the arch, the markers are turned back out of the way, the table removed and a tracing of the adjusted arch is made upon the record sheet, the new positions of the pins being also indicated in the record sheet. These records made by the pencil can be retraced to advantage in different colored inks and the dates recorded on the sheets in the corresponding color. In this manner four or more changes in the shape of the arch may be recorded on one record sheet. Before the sheet is removed from the instrument, indicating points are marked upon it as at 86 to correspond with cross line 74 on the bed and marks 87 on slides 23. This enables the operator to replace the record sheet in the exact position at which former records were made and to place the arch in the exact position at which the last tracing was made. The table is then placed in position and the markers turned into engagement with the pins, after which a new adjustment of the arch may be made as before.

The use of this instrument in the manner described enables the operator to avoid displacement of the anchor teeth and to plan with absolute accuracy for such operations as lingual and labial movements of teeth, rotation, elongation and the tipping of the roots of teeth in any direction. Where a one-piece arch is used, records of the changes may be made upon the instrument in the same manner as when a sectional arch is used.

Having thus described my invention I claim:

1. An instrument of the character described, comprising arch holding chucks and means for adjusting said chucks independently in the vertical plane.

2. An instrument of the character described, comprising arch holding chucks and means for imparting universal adjustment to each chuck independently.

3. An instrument of the character described, comprising arch holding chucks each having a stem and ball, carriers having sockets to receive the balls and means for locking the balls in the sockets.

4. An instrument of the character described, comprising arch holding chucks each having a stem and ball, carriers having sockets to receive the balls, means for locking the balls in the sockets and means for imparting vertical movement to the carriers.

5. An instrument of the character described, comprising arch holding chucks each having a stem and ball, carriers having sockets to receive the balls, means for imparting vertical movement to the carriers, means for holding the carriers against movement without locking, means for locking the carriers and means for locking the balls in the sockets.

6. An instrument of the character described, comprising arch holding chucks each having a stem and ball, carriers having sockets to receive the balls, slides to which the carriers are secured, means for imparting vertical movement to the carriers, means for locking the slides and for locking the balls in the sockets.

7. An instrument of the character described, comprising arch holding chucks each having a stem and ball, carriers having sockets to receive the balls, and external rack teeth, pinions engaging the rack teeth to raise and lower the carriers, means for locking the carriers after adjustment and means for locking the balls in the sockets.

8. An instrument of the character described comprising arch holding chucks each having a stem and ball, carriers having sockets to receive the balls, means for raising and lowering the carriers, locking blocks adapted to engage the carriers, a screw for operating the locking blocks and means for locking the balls in the sockets.

9. An instrument of the character described, comprising arch holding chucks each having a stem and ball, carriers each having a longitudinal recess, a block therein, an outwardly flaring hole leading into the recess and a socket for the ball formed partly in the carrier and partly in the block, and means for causing the block to clamp the ball, whereby the chuck is locked at any adjustment.

10. An instrument of the character described, comprising arch holding chucks each having a stem and ball, carriers each having a longitudinal recess, a block therein, a stop piece for loosely retaining the block in place, an outwardly flaring hole leading into the recess, a socket for the balls formed partly in the carrier and partly in the block, and a screw carrying a rod passing through the stop piece and engaging the block, whereby the chuck is locked at any adjustment.

11. An instrument of the character described, comprising arch holding chucks, each consisting of a base having a fixed jaw, a pivoted jaw, a screw for operating the pivoted jaw and a stem secured to the jaw and carrying a ball, and vertically movable carriers having sockets in which the balls are universally adjustable.

12. An instrument of the character described, comprising arch holding chucks, carriers therefor in which the chucks are universally adjustable, and holders in which the carriers are vertically adjustable.

13. An instrument of the character described, comprising arch holding chucks, carriers therefor in which the chucks are

universally adjustable, holders for the chucks, means for raising and lowering the carriers in the holders, and slides to which the holders are secured.

14. An instrument of the character described, comprising arch holding chucks consisting of fixed and pivoted jaws and stems carrying balls, carriers having sockets in which the balls are universally adjustable, and holders in which the carriers are vertically adjustable.

15. An instrument of the character described, comprising arch holding chucks consisting of fixed and pivoted jaws, operating means for the pivoted jaw and stems carrying balls, carriers having sockets in which the balls are universally adjustable, holders in which the carriers are vertically adjustable, and means for locking the parts in place after adjustment.

16. An instrument of the character described, comprising arch holding chucks consisting of fixed and pivoted jaws and stems carrying balls, carriers having sockets in which the balls are universally adjustable, holders in which the carriers are vertically adjustable and slides to which the holders are secured.

17. An instrument of the character described, comprising arch holding chucks, carriers therefor in which the chucks are universally adjustable, holders for the chucks, means for raising and lowering the carriers in the holders, slides to which the holders are secured and means for independently locking the chucks, the carriers and the slides after adjustment.

18. In an instrument of the character described, the combination with universally adjustable arch holding chucks, of a table and a gage secured to the table and comprising a slide and a marker hinged thereto and provided with a screw for adjusting the marker to the height of an arch pin.

19. In an instrument of the character described, the combination with universally adjustable arch holding chucks, of a table, a gage secured to the table and comprising a slide, means for imparting longitudinal movement to the slide, a marker hinged to the slide and adapted to swing in the vertical plane and means for adjusting the height of the marker.

20. In an instrument of the character described, the combination with universally adjustable arch holding chucks, of a marker hinged to swing in the vertical plane and means for adjusting the height of the marker.

21. In an instrument of the character described, the combination with universally adjustable arch holding chucks, of a removable table having a plurality of holes, a gage having a slot, a pin passing through the slot and engaging a hole in the table to secure the gage in position, an adjustable slide carried by the gage, a marker hinged to the slide to swing in the vertical plane and means for adjusting the height of the marker, for the purpose set forth.

22. In an instrument of the character described, the combination with universally adjustable arch holding chucks, of a table, a gage adjustably secured thereto, an adjustable slide in the gage, a marker hinged to the slide and means for adjusting the height of the marker.

23. In an instrument of the character described, the combination with universally adjustable arch holding chucks, of a table, a gage adjustably secured thereto, a slide in the gage, a screw for adjusting the slide, a marker hinged to the slide and a screw for adjusting the height of the marker.

24. In an instrument of the character described, the combination with universally adjustable arch holding chucks, of a bed, and means for attaching a record sheet thereto in a fixed position relative to the chucks and at the side thereof, so that tracings may be made upon the record sheet of changes in the shape of an arch held by the chucks.

25. In an instrument of the character described, the combination with a bed, universally adjustable arch holding chucks, and slides by which the chucks are carried, of clamps upon the bed for holding a record sheet in a fixed position relative to the slides and at the side thereof, for the purpose set forth.

26. In an instrument of the character described, the combination with a bed, arch holding chucks, carriers on which the chucks are universally adjustable in the horizontal plane, slides on which the carriers are vertically adjustable and means for locking the chucks, the carriers and the slides, of means upon the bed for holding a record sheet in a fixed position relative to the slides and at the side thereof, substantially as described, for the purpose specified.

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT H. W. STRANG.

Witnesses:

EDWARD B. GRIFFITH,

WELLFORD V. LYON.