

Dec. 17, 1940.

M. D. MacGOUN

2,225,274

GNATHOSTAT

Filed April 26, 1938

2 Sheets-Sheet 1

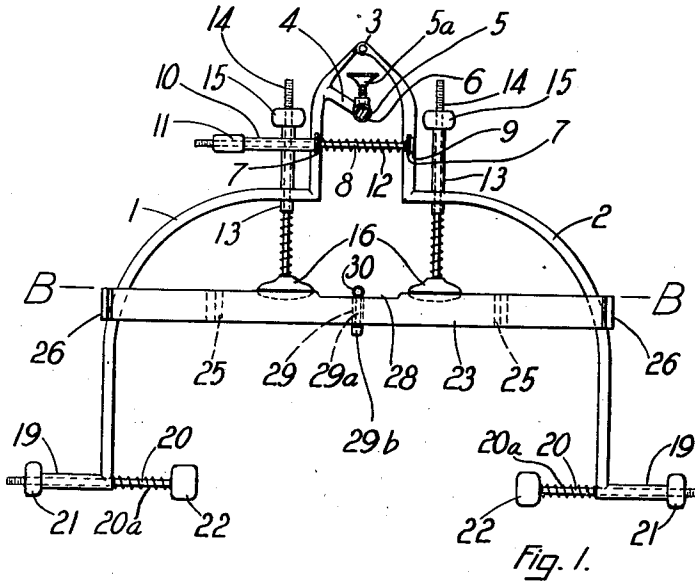


Fig. 1.

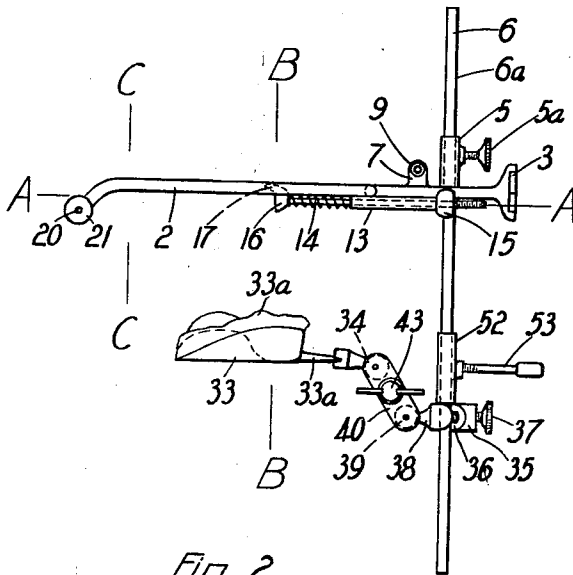


Fig. 2.

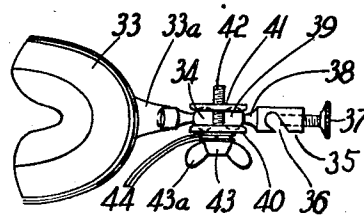


Fig. 3.

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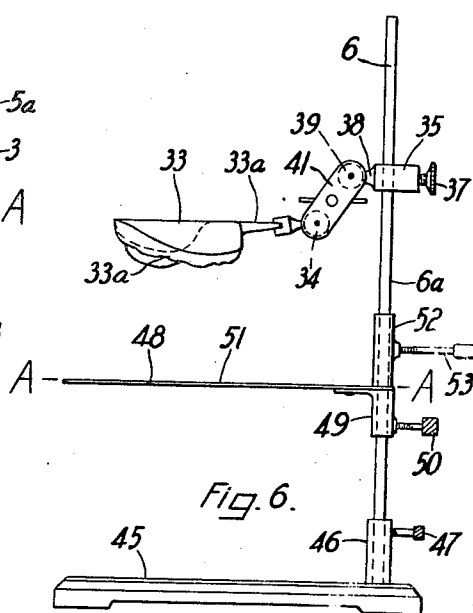
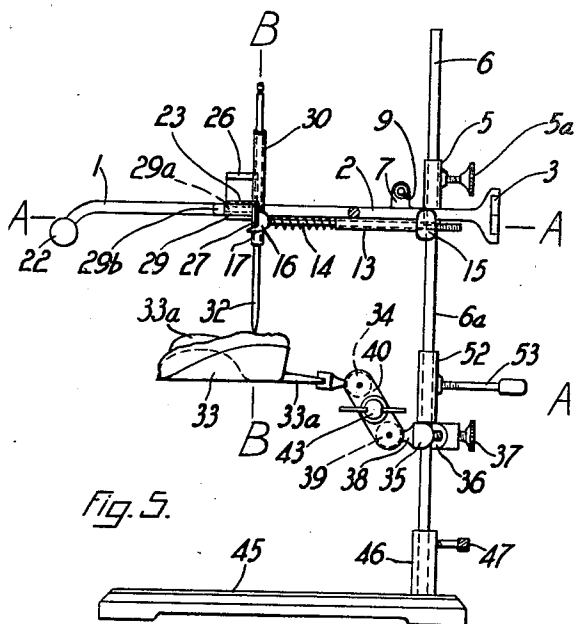
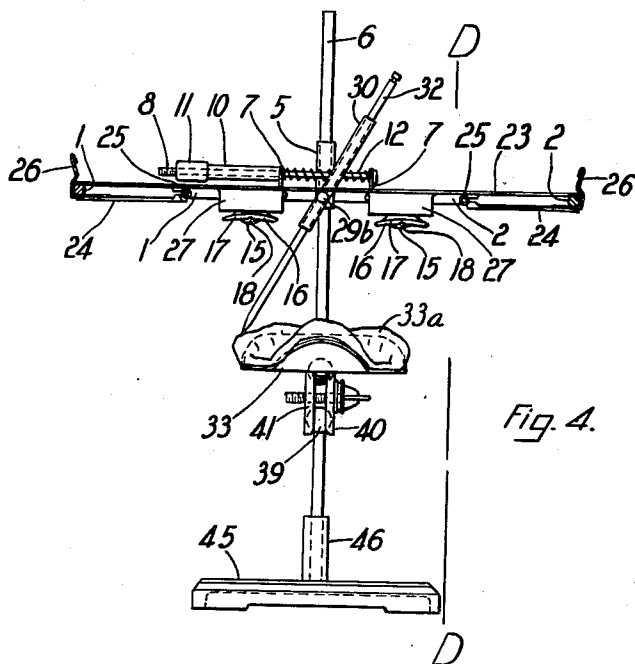
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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GNATHOSTAT

Maxwell Duncan MacGoun, Wellington,
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In New Zealand May 27, 1937

7 Claims. (Cl. 32-19)

In a publication entitled "Fundamental Principles of a Systematic Diagnosis of Dental Anomalies" by Dr. Paul W. Simon, translated by Dr. B. E. Lischer, and published in 1926 by the Stratford Company of Boston, Massachusetts, the particular art to which this present invention relates is referred to as "Gnathostatics" and in such work the author describes in detail a gnathostat with ancillary apparatus which he had devised for use in the art in question.

The present invention has been devised with the object of providing improvements in or relating to a gnathostat of the type above referred to, namely in the taking of measurements bearing on orthodontic treatment and consists in an improved orthodontic measuring device and modelling guide. By the present invention certain disadvantages entailed in the use of such gnathostat are overcome while also the scope of the operation of a gnathostat has been widened.

With the gnathostat above referred to it was necessary for the operator to support the gnathostat in position on the patient's head; thus not only considerably restricting his movements, but adding to the difficulties of obtaining accurate adjustments of the requisite casts.

Furthermore such earlier apparatus was so constructed as to be extremely heavy with the result that in use it was irksome and cumbersome to the patient.

Amongst other defects in construction may be mentioned the fact that it was difficult in the earlier apparatus to ensure that the stylus marks on the impression indicated the locality of the "frontal" plane in its correct position, firstly because the operator had to use the stylus from the orbital beam from below so that he could not readily observe the marking on the impression while secondly with the apparatus in question it was difficult to ensure that the impression and its tray were aligned from the supporting pillar in correct position.

Further in the earlier apparatus the construction was such that the tray was not capable of vertical movement up and down on the pillar with the result that the casts were made by raising the table towards the impression whereas in the present invention more positive means are employed by forcing the poured impression down the pillar onto the plaster mass onto the plane table.

The most important aspect of the present invention is, however, the provision for its more extensive application. In the earlier apparatus it was not possible to retain the measurements

of the "Porion" axis, that is the axis between the two Porion points, the Porion point being the upper edge of the external auditory canal, as, to remove the instrument from the patient's head, at least one of the pivoted ends of the plane bow required adjusting movements, and the result was that on the removal of the instrument from the patient's head the length of the "Porion" axis was lost.

Particularly in the case of certain malformations of the head in children—caused by malbreathing—it is important for the specialist consulted to have a chart of the "Porion" axis so that he may be aware at each consultation as to whether the condition in question is responding to treatment or otherwise.

According, therefore, to the present invention I have devised a gnathostat which not only is of light construction, capable of ready and accurate adjustment and is self-supporting on the patient's head, but on removal of the gnathostat from the patient's head the length of the "Porion" axis is not lost, thus enabling an accurate chart to be plotted during the course of treatment.

These and other features more particularly pointed out in the claims constitute the present invention which will now in one constructional embodiment be described with reference to the accompanying drawings in which

Figure 1 is a plan of the semi-circular plane-bow with the orbital beam in position, the "frontal" or "orbital" plane being represented by B—B;

Figure 2 is a side elevation of the assembled plane-bow, pillar, locating collar and impression tray in typical positions they may occupy on the patient's head; the "Frankfort" or "eye-ear" plane and the "frontal" or "orbital" plane being represented by A—A and B—B respectively,

Figure 3 is a plan of the impression tray, universal joint and adaptor,

Figure 4 is a front elevation of the plane-bow, orbital beam, pillar and impression tray assembly mounted on the base, with a stylus inserted in the sheath of the orbital beam preparatory to marking the impression where the "frontal" or "orbital" plane intersects the dentition, the plane-bow being shown as though cut through on the line C—C, Figure 2,

Figure 5 is a section on the line D—D, Figure 4, the "Frankfort" or "eye-ear" plane and the "frontal" or "orbital" plane being represented by A—A and B—B respectively, and,

Figure 6 is a side elevation of the impression tray assembly and pillar inverted on the base

with the plane-table in such a position on the pillar that its upper surface corresponds with the "Frankfort" or "eye-ear" plane A—A.

In the construction shown the semi-circular plane-bow comprises two preferably tubular curved arms 1 and 2 hinged together at 3, one of the arms 1 being connected by the connection 4 to a bow-collar 5 adapted to be held to a pillar 6 by a set-screw 5a.

The arms 1 and 2 are provided with upwardly projecting lugs 7 each having a hole therethrough to receive a threaded rod 8 which is provided with a head 9 at one end and a sleeve 10 and adjusting knob 11 at the threaded end, a spring 12 being disposed between the lugs.

The curved arms 1 and 2 have horizontal sleeves 13 secured thereunder at either side of the pillar 6, and a spring-loaded threaded rod 14 is slidable through each sleeve and is provided with an adjusting knob 15. The other end of each rod 14 is provided with a frontal-plane recording member 16 having a flange 17 so that the plane-bow will be supported by, and the members 16 substantially correctly located relatively to, the intra-orbital ridges. The flanges 17 are provided with notches 18.

At the outer end of each of the curved arms 1 and 2 there is provided a transverse sleeve 19 in which a spring-loaded threaded rod 20 is slidable, such threaded rod 20 having an adjusting knob 21 on its threaded end and an ear-hole engaging member 22 which is preferably about $\frac{1}{2}$ " in diameter, at the other end.

The curved arms 1 and 2 are bent downwardly at the ends farthest from the hinge 3 so that the axes of the rods 14 are as nearly as possible in the same plane as the tops of the ear-hole engaging members 22, this plane coinciding substantially, on the patient's head, with the "Frankfort" or "eye-ear" plane.

I provide an orbital beam comprising a flat strip 23 having spring clips at each end so that it may be clipped rigidly to the curved arms 1 and 2.

The spring clips comprise short strips 24 hinged at 25 to the strip 23 and having preferably phosphor-bronze strips 26 projecting upwardly at their outer ends, such spring strips 26 being so formed that by bringing the strips 24 upwardly the spring strips 26 will clip over the ends of the strips 23 which will be thus securely held to the arms 1 and 2.

The strip 23 is provided with two downwardly-projecting plates or flanges 27 which, when the frontal-plane recording members 16 are inverted as shown in Figures 4 and 5 can be brought into engagement with the vertical faces of such members 16 so that, as the "frontal" plane is in line with such vertical faces, the outer surfaces of the plates 27 are thus brought into the "frontal" plane.

A recess 28 is cut in one edge of the strip 23 at the centre thereof. A sleeve 29 is secured to the underside of such strip 23. A pin 29a passes through the sleeve 29 and has a collar 29b secured to one end and a sheath 30 secured to its other end at right angles to the axis of such pin. The sheath 30 is partly accommodated in the recess 28.

I provide a stylus 32 adapted to be inserted in the sheath 30 so as to mark the intersection of the dentition by the "frontal" or "orbital" plane.

The pillar 6 is provided with a flat side 6a adapted to be engaged by the set-screws of the various components so that such components will

be correctly located about such pillar by tightening the appropriate set-screws.

I provide an impression tray 33 connected by a universal joint to an adaptor 35 having a slot 36 and a set-screw 37 so that the impression tray 33 may be readily removed from, or attached to, the pillar 6.

The universal joint is constructed in the following manner:

The impression tray 33 is provided with a projection 33a having a ball 34 at its outer end, and the adaptor 35 has an extension 38 which is ball-shaped at its outer end 39.

Two clamping plates 40 and 41 are provided, and have spherical hollows engaging the balls 34 and 39, to which such plates are held by means of a threaded bolt 42 engaging threads in the plate 41, the head 43 of such bolt having wings 43a to facilitate tightening such bolt, and washers 44 being provided.

I provide a heavy base 45 having a collar 46 in which the pillar 6 may be secured by the set-screw 47.

I also provide a plane-table 48, Figure 6, having a collar 49 and set-screw 50, such table being oblong and in use being placed on the pillar 6 in place of the plane-bow and with its surface 51 coinciding with the "Frankfort" plane A—A so that in the cephalometric cast, which is built up on such table, the "Frankfort" plane is represented by a flat surface.

I provide a locating collar 52 having a set-screw 53, such collar being employed to locate the impression tray assembly, plane-bow assembly and plane-table on the pillar 6 in the various stages of operation.

The operation of the invention is preferably as follows:

The plane-bow is adjusted to fit the patient's head, with the ear-hole engaging members 22 in the ear-holes and the frontal-plane recording members 16 engaging the intra-orbital ridges.

This adjustment to fit the patient's head is performed by adjusting the knobs 15 according to the distance between the ear-holes and the "frontal" or "orbital" plane, and adjusting the knobs 11 and 21 according to the distance between the ear-holes and according to the pupillar width which is recorded by the spacing of the notches 18.

It will be understood that, by adjusting the knob 11, both the distance between the ear-hole engaging members 22 and the distance between the notches 18 will be adjusted, while adjustment of the knobs 21 will affect the relative spacings of the ear-hole engaging members 22 and the notches 18.

I do not consider it essential to record exactly the pupillar width, and, because it is essential that the adjustment of the knobs 21 is always such that the members 22 only press lightly in the ear-holes and may be moved sufficiently against the pressure of the springs 20a (Figure 1) to release such members 22 from the ear-holes, it may be necessary in some cases to laterally displace the notches 18 relatively to the pupils by adjusting the knob 11.

When the adjustment is correct, the plane-bow is supported by the flanges 17 of the frontal-plane recording members 16 resting on the tops of the infra-orbital ridges.

The plane-bow is now removed from the head and the pillar 6 is then placed in the bow-collar 5 and the set-screw 5a is tightened.

The locating collar 52 is moved up the pillar 75.

preferably so as to contact with the lower end of the bow-collar 5.

The assembly is then placed aside for later application.

5 The upper impression 33a is taken, and while the impression tray 33 is in position in the mouth, the operator makes sure that the universal joint is free and that the set-screw 37 is withdrawn sufficiently to allow free access of the pillar 6
10 into the slot 36.

When the impression compound 33a is well set, the patient is asked to bring the lower teeth into contact with the tray 33 to assist in retaining it in position.

15 The plane-bow assembly is then replaced on the patient's head, with the ear-hole engaging members 22 and frontal-plane recording members 16 in correct position, the tray-adaptor 35 is placed on the pillar 6 and the set-screw 37 is
20 tightened.

As the plane-bow and impression tray 33 will now be in their correct relative positions, the impression tray 33 is secured by tightening the universal-joint bolt 42.

25 The locating collar 52 is then loosened and moved down so as to contact with the tray-adaptor 35 and is tightened in this position on the pillar 6.

The various members of the assembly may then have the relative positions shown in Figure 2.

30 The set-screw 37 is then loosened sufficiently to permit sideways removal of the pillar 6 from the adaptor 35 and the plane-bow, pillar 6 and locating collar 52 are then readily removable from the patient's head and from the impression
35 tray assembly by withdrawing the ear-hole engaging members 22 from the ear-holes by traction on the adjusting knobs 21.

40 The pillar 6 is then fixed in the base collar 46 and the set-screw 47 is tightened, the impression tray assembly being then replaced in its former position on the pillar.

45 The orbital beam is placed in position across the plane-bow and is secured in position in the manner hereinbefore described after bringing the plates or flanges 27 into contact with the vertical faces of the frontal-plane recording members 16.

50 The stylus 32 is then inserted in the sheath 30, as shown in Figures 4 and 5, and marks are carefully scratched on the impression compound 33a sufficiently to show up on the cast. These marks indicate the intersection of the dentition by the "frontal" or "orbital" plane, and may
55 take the form of a line or a series of pin-pricks by swinging movement of the stylus across the line of intersection on the impression.

60 The locating collar 52 is then loosened and moved to contact with the bow collar 5, the set-screw 5a is loosened and the plane-bow is then removed from the pillar 6.

The plane table 48 is placed on the pillar in place of the plane-bow and with its surface 51 towards the impression 33a.

65 The whole assembly is then inverted in the stand as shown in Figure 6, the locating collar 52 is moved upwardly on the pillar so as to contact with the adaptor 35 and the impression tray assembly is removed.

70 A quantity of mixed plaster of Paris is now poured into the impression and a soft plaster mass is placed on the plane table which is preferably coated with Vaseline or the like, and the impression tray assembly is placed on the pillar
75 6 and forced down onto the plaster mass until

the adaptor 35 again engages the locating collar 52.

After the plaster has set the cast thus obtained of the upper dentition is separated from the impression and may be finished and marked in a similar manner to that disclosed in the work
5 entitled "Fundamental Principles of a Systematic Diagnosis of Dental Anomalies" hereinbefore referred to, the lower cast being made in the usual manner.
10

The distance between the ear-hole engaging members 22, the distance between the notches 18 and the distance between the ear-hole engaging members 22 and the "frontal" plane, may be recorded on a card or the like such as by constructing a quadrilateral figure illustrating these measurements, a record being thus kept of the cranial dimensions at each stage of development or treatment.
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It will be realised that the comparison of these charts with the cephalometric casts made at corresponding stages will yield valuable data.

I claim:

1. A gnathostat of the type referred to including a pillar, a plane-bow comprising two arms
25 hinged together and in the same plane, a collar extending from one of such arms and having its axis perpendicular to the plane thereof, means for detachably securing the plane-bow to the pillar in any desired selected position longitudinally thereof, means to adjust the relative
30 positions of the arms about the hinge, transversely adjustable ear-hole engaging members associated with each arm, springs to hold such members in the ear-holes, and substantially longitudinally adjustable "frontal" plane locating
35 members associated with such arms and adapted to engage the infra-orbital ridges in such a manner as to assist in supporting the plane-bow on the head of the patient or subject.

2. A gnathostat of the type referred to including a pillar, a plane-bow comprising two arms
40 hinged together and in the same plane, a collar extending from one of such arms, and having its axis perpendicular to the plane of such arms, means for detachably securing the plane-bow to the pillar in any desired selected position longitudinally thereof, means to adjust the relative
45 position of the arms about the hinge, transversely adjustable means associated with each arm at a distance from the hinge for engaging the ear-holes and longitudinally adjustable means associated with such arms for engaging the infra-orbital ridges.
50

3. A gnathostat as claimed in claim 2 wherein the free extremities of the plane-bow arms are curved away from the plane of the major portion of the plane-bow and the ear-hole engaging members are carried by these extremities of the plane-bow so that they are disposed slightly below the level of the plane-bow.
55

4. A gnathostat of the type referred to comprising a supporting pillar, a base in which either end of said pillar may be mounted for holding it in upright position, a plane-bow and an impression tray independently detachably securable to and adjustable longitudinally of the pillar, an orbital beam for mounting on the plane-bow and a stylus carried by the orbital beam for marking its path on an impression in the tray, said pillar being reversible on its base so that the stylus may be operable to trace its path on the impression from above.
65

5. A gnathostat as claimed in claim 4 wherein the side of the pillar against which the secur-
75

ing means of all the detachable parts of the apparatus work, is flat, whereby they may be individually removed and replaced in the same relative adjusted relationship.

- 5 6. An improved orthodontic measuring device including a plane-bow comprising two arms hinged together in the same plane, two ear-hole engaging members carried by said arms adjacent to the free ends thereof and movable inwardly and outwardly with respect to each other, springs
10 for holding said members in ear-hole engaging positions, adjustable means for securing said members against further inward movement with respect to said positions, and two "frontal" plane
15 recording members adapted to engage the infra-orbital ridges in such a manner as to support the plane-bow on the head of the patient or subject.

7. An improved orthodontic measuring device including a plane-bow comprising two arms

hinged together in the same plane, two ear-hole engaging members carried by said arms adjacent to the free ends thereof and movable inwardly and outwardly with respect to each other, springs for holding said members in ear-hole engaging
5 positions, adjustable means for securing said members against further inward movement with respect to said positions, two "frontal" plane recording members adapted to engage the infra-orbital ridges in such a manner as to support the
10 plane-bow on the head of the patient or subject, and means for adjusting said plane-bow arms on their hinges with respect to each other whereby the relation of the "frontal" plane recording
15 members may be adjusted laterally and substantially correctly located relative to the infra-orbital ridges of the patient or subject.

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