March 13, 1962 R. K. TRAVIS ETAL 3,025,397

SKULL RADIOGRAPHY APPARATUS

Filed June 11, 1959 3 Sheets-Sheet 1

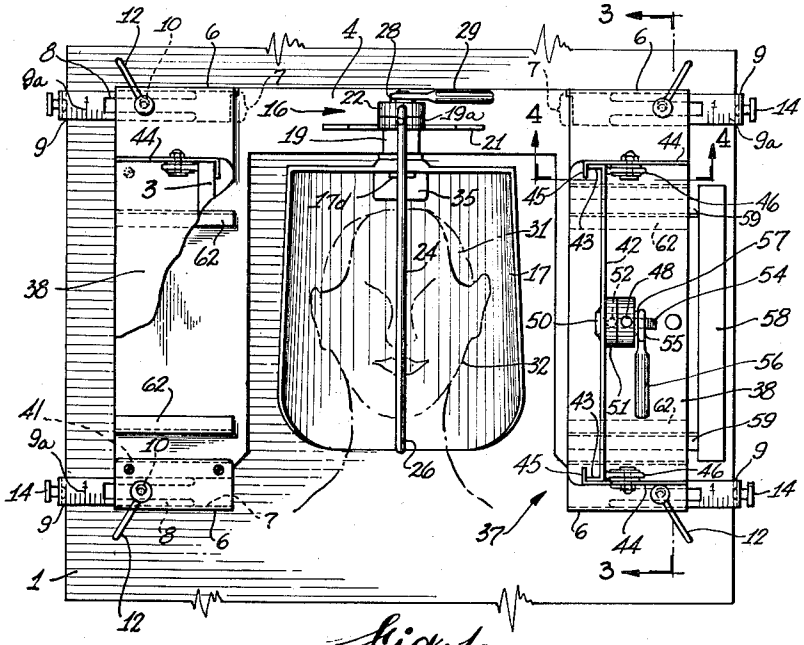

Fig. 1.

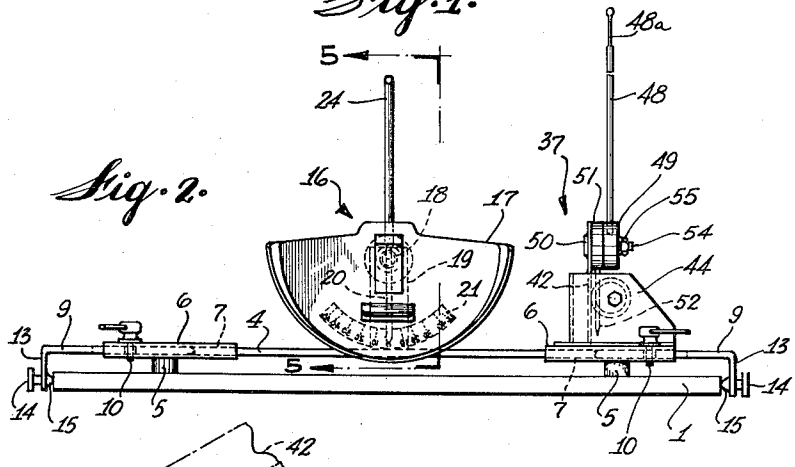

Fig. 2.

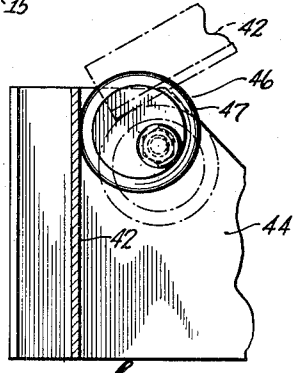

Fig. 4.

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SKULL RADIOGRAPHY APPARATUS

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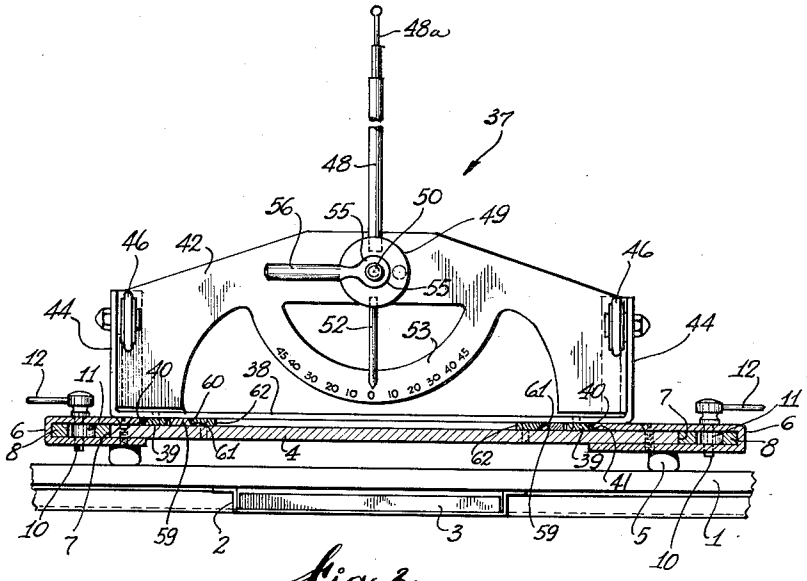

Fig. 3.

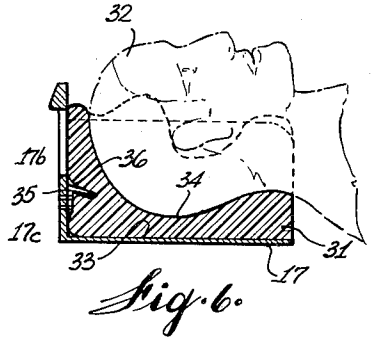

Fig. 6.

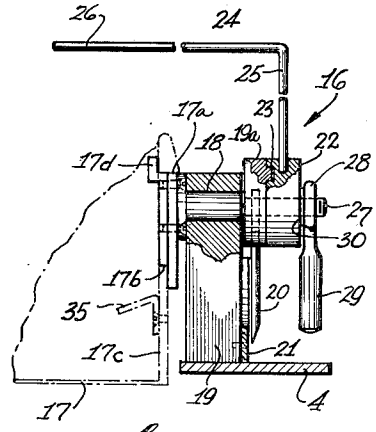

Fig. 5.

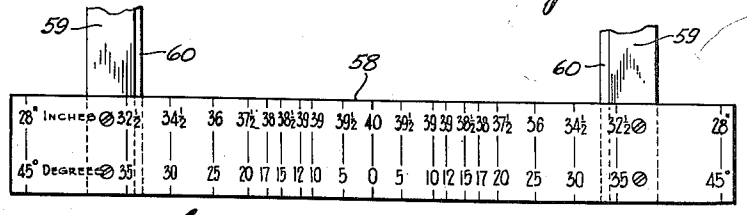

Fig. 7.

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SKULL RADIOGRAPHY APPARATUS

Filed June 11, 1959

3 Sheets-Sheet 3

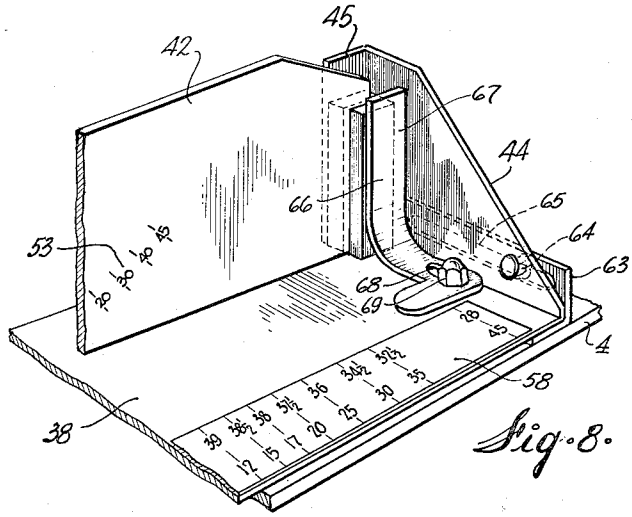

Fig. 8.

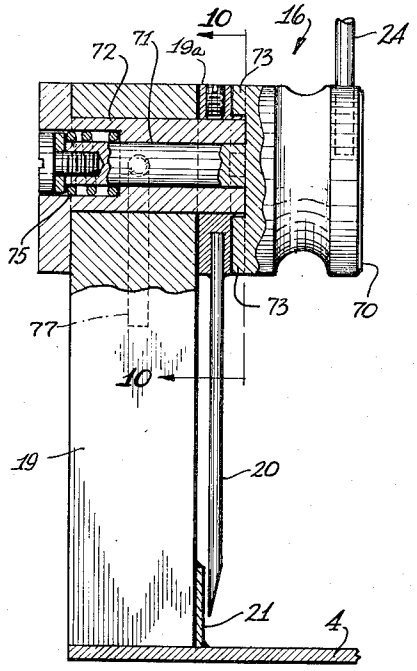

Fig. 9.

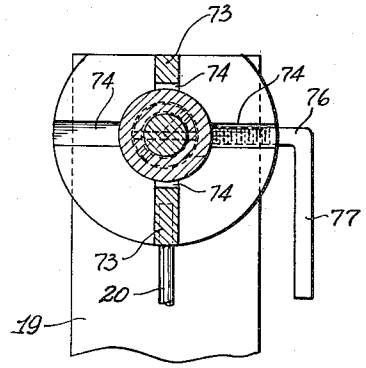

Fig. 10.

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SKULL RADIOGRAPHY APPARATUS

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8 Claims. (Cl. 250—50)

This invention relates to skull radiography apparatus.

With the conventional X-ray machines used in most hospitals, skull radiography presents a problem to the average technician who is often forced to retake projections in order to produce the correct angle and quality of X-ray as required by the radiologist for good diagnosis. For such diagnosis it is obviously essential that the radiologist be supplied with good X-ray projections at the particular standard angles (lateral, oblique and longitudinal) that he may request.

To achieve this, the technician must accurately align the patient's skull along the center line of the radiographic table, set it at the required angle, laterally and longitudinally, and hope that the patient will maintain this position for the period of the exposure. For stereoscopic pairs the position must be maintained while two identical X-rays are taken. For best results in X-rays, it is generally considered that the central ray from the X-ray tube should pass through the sella turcica, this point being relatively centrally located within the skull.

To achieve immobility of the patient's skull it is obviously highly desirable that the patient be completely relaxed and comfortable and that the skull be physically held in the desired position. The use of clamping means for the skull is unsatisfactory because it causes discomfort to the patient and it may obscure the projection. Use of available aligning means is inconvenient and inaccurate.

Immobilization is usually achieved by use of radio opaque sandbags placed at various areas of the skull. Nurses and other attendants assist by manually holding the patients, thus exposing themselves unnecessarily to the hazards of excessive radiation.

Checking of the axial alignment of the skull with respect to the center of the supporting table is usually done visually, which is not positively accurate. Moreover, no means or procedure are provided for checking the longitudinal position of the cassette in the Potter-Bucky diaphragm in relation to the required angles.

It is an object of the present invention to provide a skull positioning device which is of inexpensive and convenient manufacture, which may be utilized to position the skull in an effective and positive manner in relation to any desired radiographic procedure, and which may be operated by technicians with a minimum degree of skill in a rapid, convenient, and accurate manner.

The invention will be described with reference to the accompanying drawings, in which

FIGURE 1 is a plan view of an apparatus in accordance with the invention,

FIGURE 2 is an end elevation of the apparatus,

FIGURE 3 is a side elevation of the apparatus,

FIGURE 4 is an enlarged partial side elevation, partly in section, of a cassette and aligner holder.

FIGURE 5 is an enlarged side elevation, partly in section, of a mounting means for a crown sella aligner,

FIGURE 6 is an enlarged partial side elevation, partly in section, of a skull positioning means,

FIGURE 7 is an enlarged plan view of a scale,

FIGURE 8 is a perspective view of an alternative form of side sella aligner,

FIGURE 9 is an enlarged side elevation, partly in section, of an alternative form of mounting means for a crown sella aligner, and

FIGURE 10 is a sectional view on line 10—10 of FIGURE 9.

In the drawing, 1 indicates a conventional supporting table, and 2 a cassette holder mounted thereon for supporting a cassette 3 in horizontal position, such holder being movable in the usual manner for desired positioning of the cassette.

The apparatus in accordance with the invention comprises a main base plate 4 having rubber or like feet 5 for engagement with the surface of the table 1. Means for clamping the base plate in desired position on the table comprises a U-shaped bracket 6 fixed to each corner of the plate 4 and providing a passage 7 for sliding reception of a bifurcated portion 8 of a bar 9. A pin 10 threadedly mounted in each bracket is arranged to extend between the arms of the bifurcated portion 8. The pin carries a cam 11 which on rotation of the pin frictionally clamps the bar 9 against the wall of the bracket passage 7. A lever 12 on the pin permits ease of manual rotation thereof. The bar 9 has an angular end portion 13 in which is mounted a screw 14 having a head 15 for clamping engagement with an edge of the table. It will be apparent that the bifurcated portion 8 is of sufficient length to provide for a desired degree of lateral adjustment of the base plate 4 which respect to the table. To facilitate positioning of the base plate 4 on the table, a graduated scale 9*a* may be applied to each bracket 6.

A crown sella aligner is generally indicated at 16 and comprises, as shown, a semi-cylindrical skull support tray 17 pivotally mounted about a horizontal longitudinal axis (relatively to the table) by means of a pin 18 journalled in a post 19 fixed to the plate 4. The tray 17 is preferably removably mounted on the post 19 as by means of a bracket 17*a* fixed to the post and adapted to extend through an opening 17*b* in the end wall 17*c* of the tray. The bracket has a hook portion 17*d* to retain the tray in fixed position with respect to the post. Fixed to the pin is a collar 19*a* having a depending pointer 20 for cooperation with an arcuate scale 21 mounted on the post. The scale 21 is provided with angle markings to indicate the degree of pivotal movement of the tray 17 in either direction. Also mounted on the pin is a collar 22 which is keyed to collar 19*a* at 23. The collar 22 carries an aligning rod 24 having a portion 25 extending perpendicularly from the collar and a portion 26 extending right angularly therefrom and thus overlying the skull support 17. The rod portion 26 is parallel and perpendicularly opposite the longitudinal axis of the support 17.

Means for clamping the collar 22 to collar 19*a* to fix the support 17 and aligning rod 24 in desired position with respect to post 19 and base plate 4 and to release such elements for adjustment of their pivotal position comprises, a screw-threaded portion 27 on the end of pin 18, a screw-threaded disc 28 on portion 27, a lever 29 fixed to the disc to impart rotation thereto, and an interposed washer 30. It is desirable that, after desired positioning of the tray 17 by means of the aligner rod 24, the rod 24 may be swung out of overlying relation with the skull of the patient whereby it will not appear on the X-ray projection. This is readily effected by releasing the clamping means whereby the collars 19*a* and 22 may be unkeyed to permit such swing movement.

Removably mounted in skull support 17 is a head mold 31. The mold 31 preferably comprises a unitary mass of a radiolucent, soft, resilient material for comfortable reception of the patient's head as indicated at 32. Since the material is resilient, it will adjust itself to varying skull sizes. Preferably, a set of molds will be provided corresponding to various desired skull positions. The mold 31 has an under surface 33 of fixed contour complementary to the contour of the surface of skull support

17 whereby the mold will have an unvarying position relative to the support. The mold 31 also has an upper surface 34 of a contour complementary to a portion of the skull of the patient. Positioning means for the mold in the support may comprise a lug 35 on the support arranged to enter a complementary recess 36 in the mold. The mold 31 is thus positively located in the support 17 such that the saggital plane is coincident with the center line on the table 1. Moreover, the mold 31 is such that, when the patient's head is positioned therein, the sella turcica point is opposite the pivotal axis of the aligner rod 24.

Preferably, the mold 31 is formed of one of that class of compositions known commercially as a foam-in-place plastic. Suitable products for the present purpose are those known in the trade as "Stafoam," "Isofoam," "Polyrubber."

Slidably mounted on base plate 4 on one or both sides of the crown sella aligner 16 is a side sella aligner 37.

A supporting base plate 38 is provided for each aligner 37, such base plate 38 having strips 39 secured to the bottom surface thereof. Each strip 39 has an outer edge surface 40, which may be bevelled, for sliding engagement with a complementary edge surface 41 on base plate 4. Conveniently, the edge surface 41 may be formed on an edge of bracket 6. The aligner 37 proper is removably mounted in base plate 38 and comprises a plate 42 having flanged edge portions 43 for engagement with upright end walls 44 on the plate 38. Each end wall 44 has a flange 45 also for engagement with an edge portion 43. Means for clamping the plate 42 against the flanges 45 comprises an eccentric 46 pivoted in each wall 44 and having a periphery 47 of high surface friction material such as rubber. The peripheries 47 engage the edge portions 43 of the plate 42 to clamp it securely against the flanges 45 while permitting ease of mounting in and removal from the base plate 38.

Each plate 42 has an aligning rod 48 pivotally mounted therein. As shown, each rod 48 may be carried by a collar 49 fixed to a pin 50 pivoted in plate 42. A second collar 51 is keyed to collar 49 and has a depending pointer 52 for association with an arcuate scale 53 mounted on the plate 42. Thus, the rod 48 and pointer 52 are swingable about the pivot 50. Means for clamping the rod and pointer in any desired position comprises a screw-threaded portion 54 on the pin, a screw-threaded disc 55 thereon, a lever 56 fixed to the disc, and an interposed washed 57.

The rod 48 may be of telescopic form as shown to render its length adjustable. The pivotal axis of the rod and pointer is approximately opposite the sella turcica point of the skull in the head mold 31 when located in the support 17. It will be apparent that each aligner 37 may be moved towards and away from the crown sella aligner 16.

Each scale 53 is marked with degrees to indicate the angular position of the aligner rod 48.

A cassette positioner scale 58 is mounted on one or each side of the base plate 4 in parallel relation to the longitudinal axis of the apparatus. Each scale 58 is preferably slidably mounted in the base plate 4 for movement outwardly or inwardly thereof. For this purpose, the scale may be provided with a pair of bars 59 fixed thereto and having bevelled edge surfaces 60 engageable with complementary edge surfaces 61 on strips 62 fixed to the base plate 4. The scale contains the range of degrees of the angles at which the X-ray tube may be positioned and opposite such range the corresponding range of distances from such tube of the sella turcica. Thus, at 0° such distance is 40 inches, at 5°, 39½ inches and so on.

It will be apparent that many variations are possible in the mechanical details of the structure described. FIGURE 8 is illustrative of one such variation wherein means for slidably mounting the base plate 38 of the aligner 37 on the main base plate 4 comprises a pair of angle guides 63 fixed to plate 4 and on which the plate 38 is positioned for sliding movement. A pin 64 on each end wall 44 of the plate 38 extends through a slot 65 in the guide 63. Instead of the eccentrics 46, means for removably supporting the plate 42 of the aligner 37 comprises a pair of strips 66 fixed to the base plate 38 and each having an upright portion 67 in opposed relation to a flange 45 to receive therebetween the flanged end portions 43 of plate 42. Strip 66 may be adjustably mounted on plate 38 as by means of a slot 68 in the strip and an adjusting screw 69 extending therethrough.

Instead of mounting the cassette positioner scale 58 on separate slides, it may be fixed directly to the slidable base plate 38 as shown in FIGURE 8.

FIGURES 9 and 10 illustrate an alternative means for mounting the aligner rod 24. As shown, the rod 24 is mounted in a knob 70 having a shank 71 reciprocally mounted in a sleeve 72 in the post 19. The knob 70 has a pair of projections 73 on its inner face for selective seating in one of two pairs of grooves 74 in the opposing face of the collar 19*a* of the pointer 20. A spring 75 urges the shank 71 and knob 70 into seating engagement. It will be apparent that by exerting a pull on the knob, it may be disengaged from seating relation in one of the pairs of grooves 74 and rotated to seat it in the other pair of grooves. It will also be apparent that the one pair of grooves constitutes an operative seating position for the aligner rod whereas the other pair constitutes an inoperative positioning thereof and disposition of the rod in non-interfering relation with the X-ray projection. Means for clamping the rod and pointer in any desired angular position comprises a set screw 76 in collar 19*a* and having a handle portion 77.

In operation, the patient's head is positioned in the mold in tray 17, a mold being employed which will assist in positioning the head at the correct tangential angle. The aligner rod 24 is now employed to obtain correct axial alignment of the forehead, nose and chin of the patient with the center line of the table. Since the aligner rod 24 has a pivotal axis opposite the sella turcica, the true angle of the view required for skull radiography will be indicated by the pointer 20 on the scale 21.

The side sella aligner 37, positioned on either side of the patient as desired by the technician, is now utilized to place the aligning rod 48 at the desired angle for the view required by means of the pointer 52 and scale 53. Since the pivotal axis of the rod 48 is opposite the sella turcica, accurate identification of the required angle is determined. The X-ray tube may now be accurately positioned at the desired angle as indicated by the rod 48 and pointer 52. The rod 48 may be extended to indicate the distance of the tube from the skull. For this purpose, the extensible section 48*a* of the rod may be marked with graduations to indicate such distance.

The cassette 3 is properly positioned in the table 1 having regard to the angle of projection required. For this purpose, the cassette positioner scale 58 is withdrawn to a position overlying the cassette as it is being inserted in its supporting holder 2. The center line of the cassette is lined up with the line on the scale indicating the angle of projection and the cassette is then moved along this line to its proper position in the table. The scale also indicates the corresponding distance of the X-ray tube from the skull for the desired projection. This may be compared with the length of the extended rod 48 for checking purposes to ensure accurate operation.

The radiograph may now be proceeded with after movement of the aligner rod 24 out of interfering position as previously described.

Should a lateral radiograph be required, one of the side aligner supporting plates 38 is utilized as a holder for the cassette as indicated at the left hand side of FIGURE 1, the cassette thus being supported in vertical position by means of the eccentrics 46 or strips 66.

There has thus been provided a device ensuring the accurate production of any desired radiographs with a minimum of skill on the part of the operating technician. Because there is substantially no possibility of unacceptable radiographs, a significant saving in film costs is effected. Moreover, since the patient may be much more rapidly positioned and since no retakes are necessary, the patient is not exposed unnecessarily to radiation. The time required by the operating technician as well as the time required for radiologist interpretation is greatly shortened. Moreover, because of the accurate radiographs produced, easier and more positive and rapid diagnosis is permitted. Use of the mold and supporting tray ensures more positive immobilization of the skull for stereoscopic studies. Furthermore, the mold and tray described greatly promotes comfort of the patient during examination. Most important, however, is the promotion and acceleration of treatment of the patients involved as a result of the drastic improvement in the standard and quality of skull radiography resulting from the use of the device.

We claim:

1. Skull radiography apparatus comprising a base plate having a longitudinal axis, a skull-receiving tray pivotally mounted on said base plate about an axis parallel to said longitudinal axis, a unitary mold of resilient material seated in fixed position in and with respect to said tray for pivotal movement therewith, said mold having a skull-receiving depression therein, said depression having a length and width of approximately skull equivalent extent and a single surface of undulating skull-conforming contour, an aligner rod overlying said tray and connected thereto for swinging movement therewith about said tray axis, said aligner rod having a longitudinal axis parallel to said tray axis, means on said base plate indicating the angular position of said rod with respect to said base plate, a second aligner rod pivotally mounted on said base plate about an axis normal to said tray axis, said second aligner rod axis extending transversely of said tray, and means on said base plate indicating the angular position of said second aligner rod with respect to said base plate.

2. Skull radiography apparatus as defined in claim 1, said resilient material comprising a foam-in-place plastic composition.

3. Skull radiography apparatus as defined in claim 1, including means releasably retaining each of said aligner rods in any pivotal position thereof.

4. Skull radiography apparatus as defined in claim 1,

including a cassette positioner scale in parallel relation to said longitudinal axis of said base plate and slidably mounted thereon for movement outwardly beyond said base plate.

5. Skull radiography apparatus comprising a base plate having a longitudinal axis, a skull-receiving tray pivotally mounted on said base plate about an axis parallel to said longitudinal axis, a unitary mold of resilient material seated in fixed position in and with respect to said tray for pivotal movement therewith, said mold having a skull-receiving depression therein, said depression having a length and width of approximately skull equivalent extent and a single surface of undulating skull-conforming contour, an aligner rod overlying said tray and connected thereto for swinging movement therewith about said tray axis, said aligner rod having a longitudinal axis parallel to said tray axis, means for releasably retaining said aligner rod and tray in any pivotal position thereof, an indicator on said base plate for indicating the angular position of said aligner rod and tray, an aligner rod support mounted on said base plate laterally of said tray, an aligner rod holder removably mounted in said support, a second aligner rod pivotally mounted in said holder about an axis normal to said tray axis, said second aligner rod axis extending transversely of said tray, means releasably retaining said second aligner rod in any pivotal position thereof, and an indicator on said holder for indicating the angular position of said second aligner rod.

6. Skull radiography apparatus as defined in claim 5, including table-mounting clamps fixed to said base plate.

7. Skull radiography apparatus as defined in claim 5, including a set of slides on said base plate on each side of said tray, said aligner rod support being slidably supported in one of said set of slides.

8. Skull radiography apparatus as defined in claim 5, said first aligner rod having a releasable key connection with said tray permitting selective pivotal movement of said first aligner rod out of said overlying relation with said tray.

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