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[15] **3,655,967**

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[54] X-RAY DIAGNOSTIC DEVICE HAVING A PATIENT CHAIR AND AN X-RAY SOURCE WHOSE RELATIVE ORIENTATION IS CONSTANT

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[63] Continuation-in-part of Ser. No. 666,285, Sept. 8, 1967, abandoned.

[52] **U.S. Cl.** .....**250/50,** 250/65 R, 250/91

[51] **Int. Cl.** **G03b 41/16**

[58] **Field of Search** 250/50, 65, 91, 92

[56] **References Cited**

UNITED STATES PATENTS

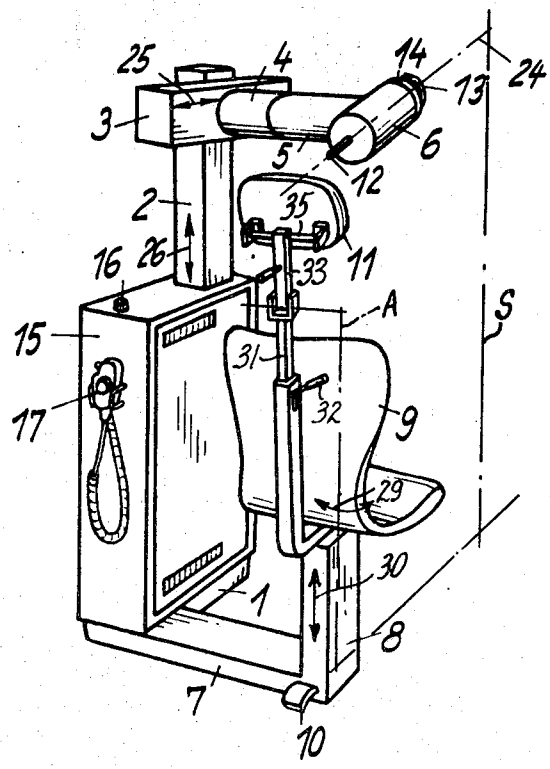
2,798,958 7/1957 Hudson.....250/61.5

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[57] **ABSTRACT**

X-ray diagnostic apparatus including a chair for the patient having a vertical plane of symmetry in which lies the central X-ray beam. The chair has a headrest which may be adjusted into a fixed position for the head of the patient and is supported on an arm extending from the base and in the plane of the base and is spaced a fixed distance from a column supporting the X-ray emitter. A horizontal boom arm extends from the column and is carried by a carrier member extending parallel to the vertical plane of symmetry of the chair. The boom arm is adjustable along said carrier member toward and from the chair. The horizontal boom arm is adjustable about its longitudinal axis. The X-ray emitter is carried in a protective casing extending perpendicular to the boom and is positioned to lie in the vertical plane of symmetry of the chair. The boom and chair are vertically adjustable and the chair is pivotally movable about a vertical axis extending along the vertical plane of symmetry of the chair.

9 Claims, 2 Drawing Figures



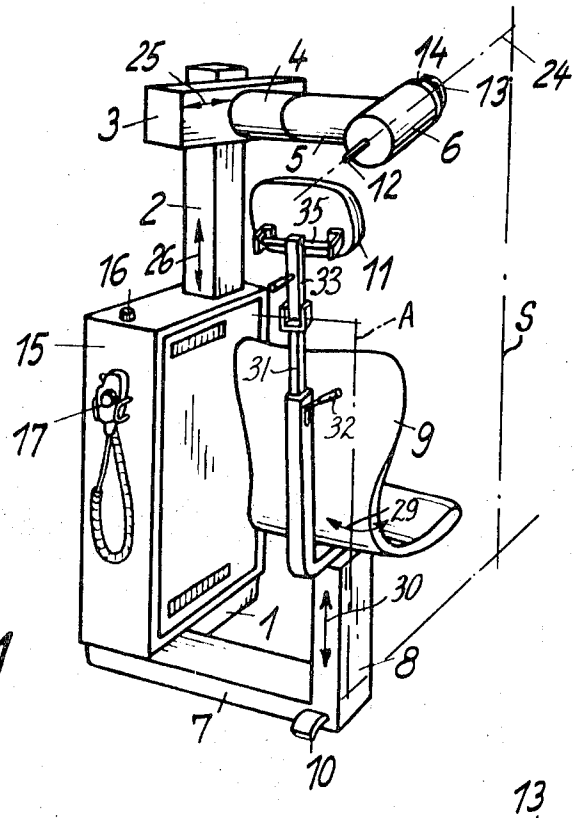


Fig. 1

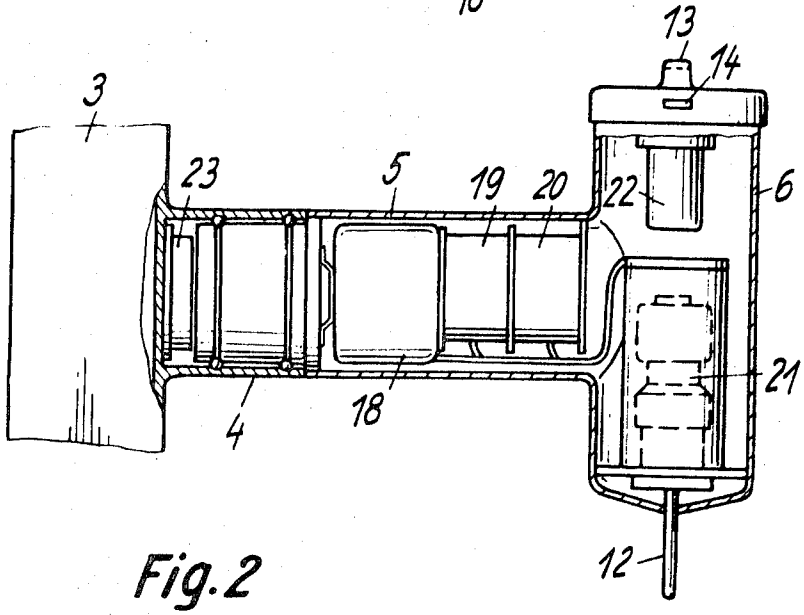


Fig. 2

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X-RAY DIAGNOSTIC DEVICE HAVING A PATIENT CHAIR AND AN X-RAY SOURCE WHOSE RELATIVE ORIENTATION IS CONSTANT

This application is a continuation-in-part of our application Ser. No. 666,285, filed Sept. 8, 1967 now abandoned.

BACKGROUND AND OBJECTS OF THE INVENTION

In X-raying the mouth, it is common practice to introduce small X-ray film in the mouth and to arrange the X-ray tube in such a way that the X-rays pass through the teeth to be radiographed, and reproduce the teeth on the X-ray film. With such methods, the exposure of the whole set of teeth must be carried successively in individual sections. This is both time consuming and subjects the patient to an unnecessarily high radiation burden, and because the film is situated in the mouth between the palate and cheek, the film is not visible, with the result that the X-raying can only be imprecisely carried out.

U.S. Pat. Nos. 2,798,958 and 3,045,118 disclose apparatus for producing full-mouth dental diographs in which the X-ray tube and the X-ray film are supported on a common rotatable carrying arm, so they can be moved about the patient situated in the beam path. The disadvantages of such apparatus are that they require a complicated and bulky apparatus and it is difficult to retain the patient in position to attain an accurate radiograph of the teeth. Moreover, because of the great mass of the apparatus, considerable physical strength of power aids are required for adjusting the apparatus, and there is always the liability of movement of the X-ray tube and film with respect to the patient caused by vibrations, which lead to fuzziness of the picture.

The present invention remedies the disadvantages heretofore present in X-ray apparatus for X-raying the teeth, by providing two laterally spaced columns extending upwardly of a base in parallel relation with respect to each other, placing a chair for the patient along the vertical axis of one column, placing a support column for the X-ray emitter on the other column and extending parallel to the axis of the chair, with a boom extending from the support column and carrying an X-ray emitter on its end, the axis of which is perpendicular to the axis of the boom and emits X-rays in the vertical plane of symmetry of the chair.

A principal object of the present invention, therefore, is to remedy the deficiencies heretofore present in apparatus for X-raying the mouth, accommodating the patient to rest in a chair and to be positioned at a position fixable by the head support extending from the chair, in which the X-ray tube and film laid around the mouth of the patient are at rest, to avoid the fuzziness of the image heretofore caused by vibration and movement of the head of the patient.

A further object of the invention is to provide a unitary form of X-ray apparatus and chair of an efficient, simple and compact construction and easy to transport from place to place.

A further object of the invention is to provide a novel and simple form of X-ray apparatus minimizing the amount of adjustment between the patient and the X-ray emitter, by so arranging the emitter that the X-rays are emitted in a vertical plane of symmetry of the chair.

Still another object of the invention is to provide a novel and improved X-ray apparatus reducing the amount of adjustment heretofore required with such apparatus, and enabling full-mouth dental diographs to be obtained, with a material reduction in radiation burden on the patient over previous mouth X-ray apparatus.

Still another object of the invention is to improve upon the X-ray apparatus heretofore in use by reducing adjustable movement of the X-ray tube to a minimum, by arranging the high-voltage generator along the axis of adjustment of the boom supporting the X-ray emitter and arranging the X-ray emitter along the plane of symmetry of the chair.

A still further object of the invention is to provide a simplified form of X-ray emitter for full dental X-raying of the teeth, in which horizontal swinging movement of the X-ray emitter is eliminated, by arranging the emitter to emit X-rays along the vertical plane of symmetry of the chair for the patient and thereby enabling adjustment to be carried out with one hand.

It is still another object of the invention to provide an X-ray apparatus so constructed and arranged as to make it possible for the operator to quickly bring the X-ray tube into the exact position desired relative to the object to be X-rayed, by the use of one hand.

Still another object of the invention is to simplify the adjustment required for full-mouth X-raying of the teeth, by simplifying the support and adjustment mechanism for the X-ray emitter, to enable adjustment to be attained by the use of one hand and improving the positioning between the tube and the object to be X-rayed, thereby enabling the total X-ray dosage and scattering to be reduced and minimizing the shielding required.

Other objects, features and advantages of the invention will be readily apparent from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of the X-ray diagnostic device of the present invention; and

FIG. 2 is a horizontal sectional view taken through the X-ray tube housing and support member therefor.

DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

In FIG. 1 of the drawings, I have diagrammatically shown a base **1** having a vertical column **2** extending upwardly therefrom. The column **2** is vertically adjustable by suitable adjusting means, designated generally by reference numeral **26**. The column and base are suitably counterbalanced by counterbalancing means of a known construction (not shown) enclosed in a protective housing **15**, which also encloses the low-voltage components of the X-ray generators. A knob **16** is provided on top of the housing to manually adjust the current in a conventional manner. A timer **17**, electrically coupled with the X-ray generator is also shown as detachably supported on an end wall of the housing.

Adjacent the top of the column **2** is a horizontally extending carrier **3** suitably mounted on said column for vertical adjustment therewith and for adjustable movement with respect thereto along an axis perpendicular to the vertical axis of the column. Horizontal adjustment of the carrier **3** is achieved by a conventional adjustment means **25**, which may be of any well-known form, so need not herein be shown or described further. Rigidly mounted on the carrier **3** and extending at right angles with respect thereto is a boom **4**, which carries a housing for the unitary X-ray generator structure. The housing for the unitary generator structure is of a generally T-shape configuration and includes a leg portion **5** forming an extension of the boom **4** and rotatably mounted on said boom on suitable bearings for adjustment about the longitudinal axis thereof. A magnetic brake **23** of a conventional form is provided to hold the housing in position about the axis of the boom **4**. The leg portion **5** of the housing carries a transversely extending foot or cross portion **6** at its outer end, and extending generally perpendicular thereto and mounted for adjustable movement in a vertical plane about the axis of the boom **4**, and in the plane of symmetry of a chair **9**.

The cross portion **6** of the housing carries an X-ray tube **21** adjacent one end thereof, and an oil reservoir **22** adjacent the opposite end thereof (FIG. **2**). An anode **12** extends from the tube **21** in axial alignment with the longitudinal axis of the cross portion **6** and along the vertical plane of symmetry of the chair **9**, as indicated by reference character "S" in FIG. **1**. A handle **13** is at the opposite end of the cross portion **6** from the anode, to enable manual adjustment of said housing and the

anode 12 about the axis of the boom 4 by the use of one hand. A push button 14 is provided at the top of the cross portion 6, in close proximity to the handle 13, to enable actuation of the push button by the hand grasping the handle 13. Actuation of the push button 14 will actuate an electrical switch (not shown) operative to release the magnetic brake means 23 normally operative to retain the housing 6 and anode 12 in any selected position of adjustment. The operator, therefore, may simultaneously actuate the switch 14 to release the brake means and utilize the handle to manually effect adjustment of the anode 12. When the anode 12 is in the proper position of adjustment about the axis of the boom 4, the push button 14 is released. This will actuate the brake means 23 to rigidly lock the housing 6 and anode 12 in position about the longitudinal axis of the boom 4.

The T-shaped housing formed by the housing portions 5 and 6 also carries the X-ray generator, which comprises a high-voltage transformer 18, a heater transformer 19 and a supplemental transformer 20 contained within the leg portion 5 of the housing.

Extending laterally of the base member 1, at right angles with respect thereto, and rigidly secured thereto, is a base arm 7 forming a mounting at its outer end for a vertically extending support structure 8 for the chair 9. The chair 9 may be of a well-known construction and may be pivotally mounted on a column or support structure 8 for adjustment about a vertical axis, intersecting the plane of symmetry of the chair 9 and indicated by dot-dash lines in FIG. 1 and designated by reference character A. The pivotal adjustment support for the chair is designated generally by a double-headed arrow 29 on opposite ends of an arcuate lead line. The chair may also be vertically adjusted by adjustment means 30 of a conventional construction, which may be under the control of a foot pedal 10. The chair is also provided with an adjustable headrest on the top of a post 31 which may be vertically adjusted under the control of a lever 32. A support 33 for the headrest is transversely pivoted to the post 31 and extends upwardly therefrom. The support 33 is adjustable about its transverse axis of pivotal connection to the post and is suitably held in a fixed position for adjustment. The headrest 11 may further be adjustable bout the axis of a transverse rod 35 forming a mounting therefor on the support 33.

It may be seen from the foregoing that a simplified form of X-ray apparatus has been achieved, in which the X-ray tube and anode have only a single adjustment which can readily be attained by the use of one hand with the assurance that the tube and anode are in the plane of symmetry of the chair 7 as the anode is adjusted into its required positions.

It may further be seen that with the arrangement of the unitary generator structure illustrated in FIG. 2, the high-voltage generator 18 is on the pivotal axis of the X-ray generator housing which is adjustable about the axis of the boom 4 and is concentric with this axis, so that the moment of inertia of the entire structure, and the resultant force necessary to adjust the anode along the plane of symmetry of the chair, is very small and the position of the anode 12 can readily be adjusted by the hand, by grasping the handle 13 and releasing the magnetic brake 23 by depression of the push button 14, by the same hand grasping the handle.

It should further be understood that the anode 12 is so positioned as to be introduced into the mouth by the simple operation of turning the housing portion or cross 6 about the axis of the boom 4 and since the anode is adjustable along the plane of symmetry of the chair, no adjustment of the anode toward and from the carrier 3 is required, materially reducing the adjustments and requiring a minimum amount of skill to operate the X-ray apparatus.

It may further be seen that when the housing 6 and anode 12 is vertically adjusted relative to the chair, by the adjusting mechanism 26 or is adjustably moved to and from the chair by the adjusting mechanism 25, that the anode 12 is always in the plane of symmetry of the chair, assuring the proper position of the housing and anode 12 and the placing of the anode 12 into the mouth of the patient on the chair with little, if any, maneuvering of the position of the patient, and with a minimum amount of adjustment of the position of the anode.

We claim as our invention:

1. An X-ray diagnostic device adapted for positioning a patient in a predetermined position relative to the X-ray emitter, for X-raying a patient by insertion of an X-ray anode into a body cavity comprising,

a base having a top surface portion lying in a horizontal plane,

a chair for the patient having a vertical plane of symmetry extending perpendicularly to said base and having a fixedly attached headrest for the head of a patient, positioning the heat of the patient along the vertical plane of symmetry of the chair,

a vertical column extending upwardly from said base in parallel spaced relation relative to said chair,

an upper horizontal boom fixedly attached to said column and extending from said column in parallel relation with respect to the horizontal plane of said base,

a housing on the end of said boom mounted for adjustable movement about an axis coaxial with the axis of said boom and perpendicular to the plane of symmetry of the chair,

an X-ray emitter including a high-voltage source, carried by said housing, and

said housing including a protective casing extending at right angles to said boom and said X-ray emitter being carried in said protective casing having an anode extending from said casing having a longitudinal axis lying in the vertical plane of symmetry of said chair, and

means for altering the distance between said anode and said chair without altering the location of said anode from said vertical plane of symmetry of said chair.

2. An X-ray diagnostic device in accordance with claim 1,

wherein the means for altering the distance between the anode and the chair includes a horizontal carrier mounted on said column and extending parallel to the vertical plane of symmetry of said chair and being horizontally adjustably movable along a plane parallel to the plane of symmetry of the chair and having said boom fixedly attached thereto and extending perpendicularly thereto for movement therewith toward and from the chair.

3. An X-ray diagnostic device in accordance with claim 2,

wherein the means for altering the distance between the anode and the chair also includes means for adjusting the height of said vertical column, means mounting said anode for movement about the axis of said boom, and means holding said anode in a selected position of adjustment.

4. An X-ray diagnostic device in accordance with claim 1,

wherein the protective casing containing the X-ray emitter has a portion containing the high-voltage source and forming an axially aligned extension of said boom, and another portion extending in the plane of symmetry of the chair and containing the anode and positioning the anode in the plane of symmetry of the chair.

5. An X-ray diagnostic device in accordance with claim 2,

wherein the means for altering the distance between the anode and the chair includes a horizontal carrier disposed on said column adjacent the top thereof and extending parallel to said vertical plane of symmetry of the chair, and adjustably movable with respect to said column in a horizontal direction parallel to said plane of symmetry of said chair and toward and from said chair,

wherein said boom is rigidly connected to said carrier and extends at right angles thereto,

wherein the housing is a T-shaped casing having a leg portion carried by said boom for adjustable movement about the longitudinal axis of said boom, and

having a cross portion extending perpendicular to said leg portion having said anode extending from one end

thereof and means at the opposite end thereof for adjustably moving said anode about the longitudinal axis of said boom.

6. An X-ray diagnostic device in accordance with claim 2,

wherein the housing is of T-shaped configuration and includes a leg portion forming an extension of the boom and rotatable about the axis of the boom and a cross portion extending perpendicularly to said leg portion and having an axis extending along the plane of symmetry of the chair,

wherein a high-voltage transformer is carried in said leg portion, and

wherein an X-ray tube and anode are carried in said cross portion.

7. An X-ray diagnostic device in accordance with claim 6,

wherein the anode extends from one end of said cross portion along the plane of symmetry of the chair,

wherein a handle is at the opposite end of said cross portion, and manual release means are mounted on said cross portion in access to a hand placed on the handle, to release said housing for adjustment about the axis of said boom, and to hold said housing in position.

8. The X-ray diagnostic device of claim 7,

wherein a magnetic brake is provided to hold said housing and anode in a selected position of adjustment, and

wherein the manual release means includes a push button in close proximity to said handle.

9. The X-ray diagnostic device in accordance with claim 8,

wherein a casing is mounted on said base and extends upwardly along said vertical column, and wherein a counterbalance device and controls for controlling low-voltage and current supplied to said transformer are contained in said casing.

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