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James

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[54] **DEVICE FOR EXAMINING A PATIENT, IN PARTICULAR BY MEANS OF X-RAYS**

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Related U.S. Application Data

[63] Continuation of Ser. No. 162,564, July 14, 1971, abandoned.

[52] **U.S. Cl.** **250/446,** 250/523

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

[58] **Field of Search** 250/54, 55, 56, 57, 58, 250/91, 92

[56] **References Cited**

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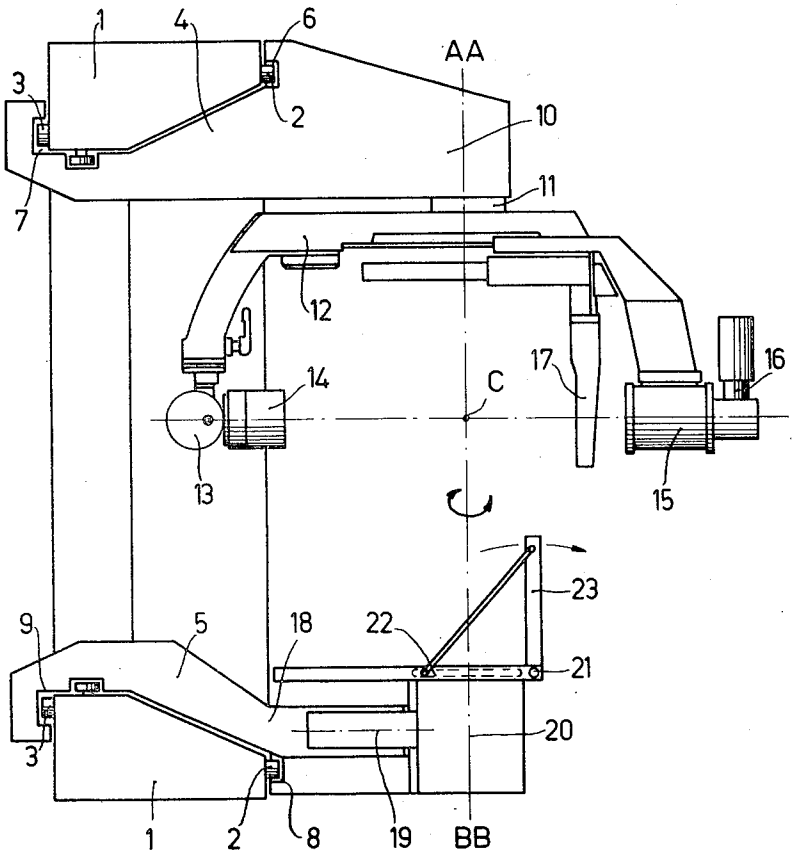
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[57] **ABSTRACT**

An x-ray examination device including on the frame two guides defining circular paths about a single horizontal axis, with a first and a second carriage movable along said paths, the first carriage supports a radiation section, and the second carriage accommodates a patient support. The radiation section and patient support are also pivotable about a common vertical axis extending between them.

3 Claims, 2 Drawing Figures



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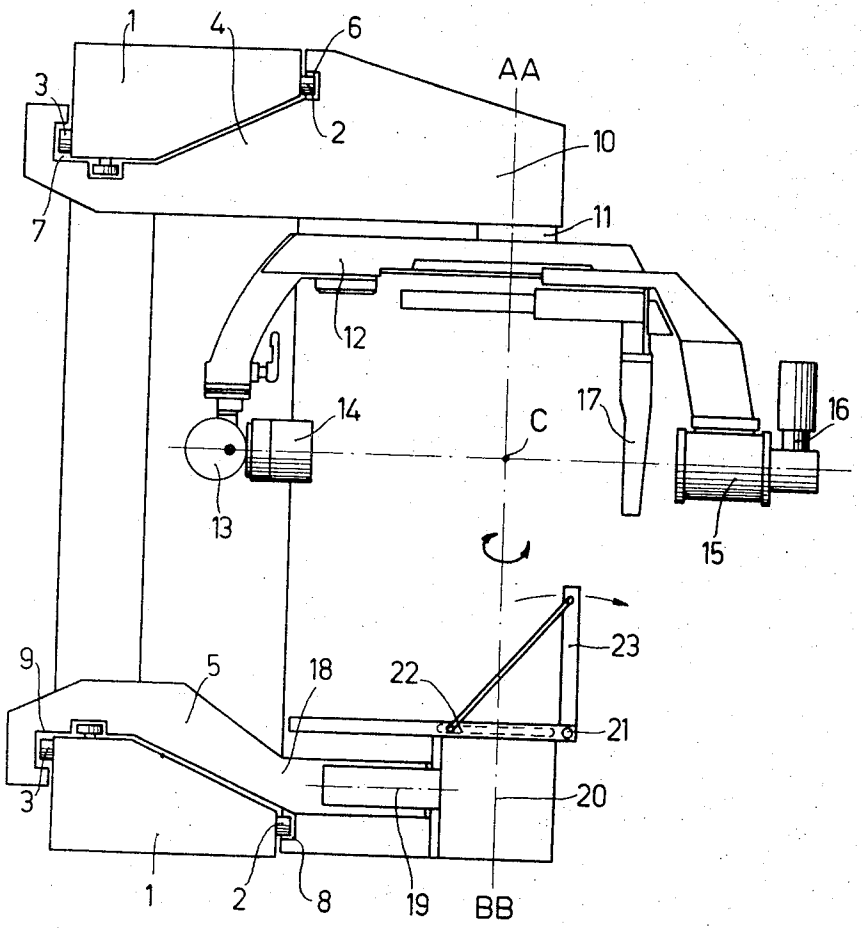


Fig.1

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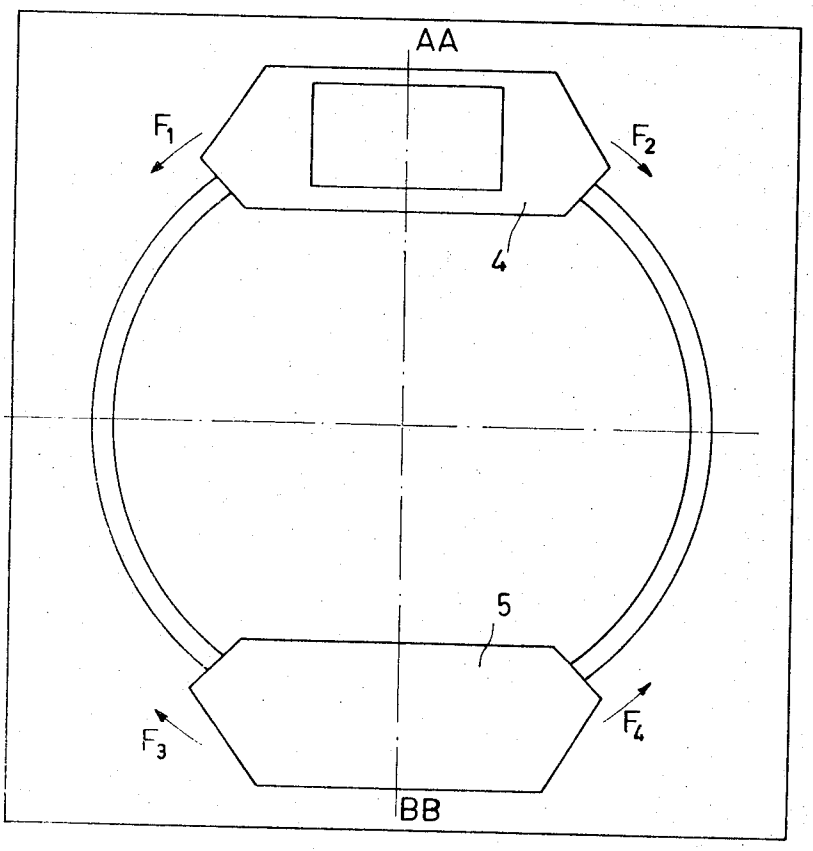


Fig.2

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DEVICE FOR EXAMINING A PATIENT, IN PARTICULAR BY MEANS OF X-RAYS

This is a continuation, of application Ser. No. 162,564, filed July 14, 1971, now abandoned.

This invention relates to a device for examining a patient, in particular by means of X-rays, in which a part of the body to be examined is always situated within the main ray of the beam of rays emitted by the source of radiation in the various spatial positions to be successively occupied by the patient for examination and in the various spatial positions of a source of radiation or radiation receiver incorporated in the device. During the movements of the patient between various positions a possibly injected contrast medium such as, for example, air is displaced in or around the part of the body to be examined so that the X-ray images received by the radiation receiver are comparatively rich in contrast. The radiation receiver may be an image intensifier as well as a film which is sensitive to X-rays. Devices of the kind set forth are particularly suitable for examining parts of the head.

In order to obtain a device enabling examinations to be performed at an as large as possible number of angles of incidence of the beam of rays, it is necessary that the various possible movements of the patient can be combined in many ways with the various movements of the source of radiation or radiation receiver.

A known device of the kind set forth comprises a vertically arranged stand to which a guide, situated in a vertical plane, is rigidly secured. This guide extends over such a portion of a circle circumference that a carriage which is movable along the guide can be displaced over one quarter of the circle circumference. Via a shaft which is rotatable with respect to the carriage, a mainly C-shaped carrier arm is suspended from the carriage. From one end of the C-shaped carrier arm the source of radiation is suspended while the other end of the carrier arm supports the radiation receiver. By placing, for example, the head of a patient in the intersection of the main ray of the X-ray beam and the said rotatable shaft and by moving the carriage along the circular guide, the shaft secured to the carriage also being rotated, the patient's head can in principle be exposed at a number of spatial angles corresponding to half a sphere. One drawback is that in practice a considerable part of the in principle possible angles of exposure cannot be utilized because parts of the body which are not to be subjected to exposure or parts of the patient support are situated within the beam of rays. Consequently, the device of the kind set forth is frequently used in combination with a special patient chair by means of which a sitting patient can be made to assume different spatial positions. One drawback of the described combination is that the patient can only be exposed in the sitting posture and not, for example, in the often desired lying posture. A further drawback is that the patient chair which is to be movable for various purposes, each time has to be accurately positioned with respect to the source of radiation.

The invention has for its object to provide a device enabling exposure at a great plurality of different angles of incidence, while it is also possible to place the patient in various postures.

To this end the invention is characterized in that the device comprises an annular stand which is arranged in a vertical plane and which is provided with at least one

circular guide along which a first and a second carriage are movable, a mainly C-shaped carrier arm being secured to said first carriage through the intermediation of a rotary shaft, the centre line of which is situated in a vertical plane, a source of radiation being provided near one end of the C-shaped carrier arm, the center line of which coincides, on the one hand with the center line of a radiation receiver provided near the other end of the carrier arm and, on the other hand, with the center line of the circular guide, the second carriage being provided with a patient support which is adjustable with respect to the second carriage at least to a degree such that a part of the body to be supported can be moved into the intersection of the center line of the source of radiation and the center line of said rotary shaft.

In order that the invention may be readily carried into effect, one emodiment thereof will now be described in detail, by way of example, with reference to the accompanying diagrammatic drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagrammatic cross-sectional view through a symmetry plane of an embodiment of a device according to the invention.

FIG. **2** is a front view of the device shown in FIG. **1.**

DESCRIPTION OF THE PREFERRED EMBODIMENT

The embodiment of a device according to the invention shown in FIG. **1** comprises an annular stand **1** which is permanently arranged in a vertical plane, and which has a central, horizontal axis, and which is provided with two annular guide profiles **2** and **3** situated in mutually parallel planes and symmetrically about said central axis. The guide profile **2** is situated at the front of the stand **1,** the guide profile **3** being situated at the rear of the stand. A first carriage **4** and a second carriage **5** are arranged along the guide profiles **2** and **3** so as to be movable. The first carriage **4** has two recesses **6** and **7** gripping around the guide profiles **2** and **3,** respectively, the second carriage **5** having two recesses **8** and **9** which also grip around the guide profiles **2** and **3.** The stand **1** accommodates the usual means (not shown for clarity) for moving, braking and locking the carriages **4** and **5.** In the portion of the carriage **4** which is denoted by the reference numeral **10,** a rotary shaft **11** is located to which a mainly C-shaped supporting shaft **12** is secured. The center line or first pivot axis AA of the rotary shaft **11** is situated in a vertical plane parallel with the plane of the annular stand **1.** Secured to one end of the carrier arm **12** is an X-ray tube which is shielded by an envelope **13** and which has a diaphragm **14,** the other end of the carrier arm **12** supporting in a slidable manner with respect to the X-ray tube, an image intensifier **15,** an observation or recording device **16,** and a storage **17** for X-ray films. The observation device or recording device **16** is shown only schematically but may comprise, as usual, a display screen, a film camera, a TV pick-up tube and a TV display tube. The carrier arm **12** is proportioned such that in any position of the carriage **4** the direction of the main ray of the beam of rays or radiation axis coincides with the rotation-symmetry or central horizontal axis of the annular stand **1** if the carrier arm **12** is in the position shown in FIG. **1.**

Located in a portion **18** of the carriage **5** is rotary shaft **19** along a second horizontal axis to which a support **20** is secured supporting a patient table **21.** The patient table **21** comprises a portion **22** in respect of which a portion **23,** serving as a back support, can be hinged through an angle of **90°** about an axis which is parallel with portion **22** of the patient table. Also present in the support **20** is a shaft of the usual construction which is not shown in FIG. **1** and which is rotatable and slidable such as, for example, a rotatable telescopic shaft on which the patient table **21** is secured. The center line or second pivot axis BB of said shaft coincides with the center line BB of the rotary shaft **11** in the position of the carriages **4** and **5** shown in FIG. **1,** namely with carriages **4** and **5** respectively and bottom center positions in their respective guides. The motor drives of the shafts **10** and **19,** situated in the carriages **4** and **5,** respectively, are of a known kind. For the sake of clarity the drives are not shown in FIG. **1.** The patient table **21** may, of course, also consist of parts which are slidable with respect to each other in order to enlarge the resting area. By adjusting the height of the patient table **21,** for example, the head of a patient sitting on the patient table can be simply brought to the intersection C of the main ray and the centre lines AA and BB, in the positions of the carriages **4** and **5** and the rotary shaft **19** which are shown in FIG. **1.** The patient's posture thus obtained is usually used as a starting point for the movements necessary for an examination of the brain. The distance between patient table **21** and support **20** is then maintained.

For the examination the following movements, for example, can be performed (see also FIG. **2**):

- a movement of the carriage **4** in the directions F_1 and F_2,
- a movement of the carriage **5** in the directions F_3 and F_4,
- a rotation about the axis AA through an angle of 360° of the carrier arm **12,**
- a rotation about the axis BB through an angle of 360° of the patient table **21,**
- a comparatively small angle variation of the shaft **19.**

By means of a device according to the invention a very large number of angles of exposure can be realized, while the positioning of the patient requires only a small number of simple manipulations.

The embodiment described in the foregoing is the most universal one. Utilizing the invention, however, the shaft **19** can be rigidly secured to the carriage **5** for less extensive examinations. The rotary movement of the patient table **21** with respect to the support **20** is not always necessary either.

What is claimed is:

1. In an apparatus for X-ray examination of a patient, a frame including a guide that defines upper and lower circular paths in generally vertical planes about a central horizontal axis, a first carriage engaged to said guide for movement between positions along the upper circular path, including a top-center position, a second carriage engaged to said guide for movement between positions along the lower circular path, including a bottom center position, each of said carriages being movable independently of the other, a radiation support that is C-shaped with two arms and is secured to said first carriage and pivotal about a first pivot axis that is vertical only when the first carriage and support are in said top-center position on said circular path, an X-ray source secured to one of said arms and a radiation receiver secured to the other arm, the source and receiver aligned co-axially along a second horizontal or radiation axis that intersects said first pivot axis and can coincide with said central horizontal axis, a patient support secured to said second carriage and pivotal about a second pivot axis which extends through said patient support and which will be vertical only when said support and second carriage are in said bottom center position, said second and first carriages being movable independently of each other about said second and first pivot axes respectively so that a patient on said second carriage can be situated so his head is at the intersection of said first pivot and central horizontal axes and said radiation axis, and said carriages are movable to permit irradiation of the patient's head from a multitude of angles, said apparatus further comprising connection means between said patient support and said second carriage permitting said support to pivot about a third horizontal axis (a) that intersects said second pivot axis, and (b) that lies in the plane of said first pivot and central horizontal axes when said second carriage is in its bottom center position.

2. Apparatus according to claim **1** wherein said upper path and lower path are in the same vertical plane.

3. Apparatus according to claim **1** wherein said guide and said first carriage have closely adjacent guide surfaces, one of said surfaces including a groove and the other including projection means extending into said groove, and said second carriage and guide are similarly constructed.

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