PATENT SUPPORTING DEVICE FOR RADIOGRAPHIC EXAMINATION

Paul Louis Marie Koster, St. Oedenrode, Netherlands, assignor, by mesne assignments, to U.S. Philips Corporation, New York, N.Y., a corporation of Delaware
Filed July 12, 1967, Ser. No. 652,805

Abstract

A device having a movable carriage on which a patient is supported in various positions during radiographic examination, the carriage movement controlled by two members of a sub-assembly that have their lower ends slidably translatable at different rates along a base, and have their upper ends engaged in a sliding-pivot joint, whereby the carriage is moved in a circular path about a point at a fixed distance from said base.

This invention relates to a device including a seat or other suitable carrier for supporting a patient during radiographic examinations with which device tilting movements of the seat or carrier about a horizontal axis can be effected in a simple manner. Such a device is used in cooperation with, for example, an X-ray apparatus or other radiation source with directed beam of rays, the central ray of which is directed to a point of the axis of rotation and the point of intersection is situated within the object to be examined. The object to be examined must not or substantially not change its position as a result of the tilting movement of the seat or carrier.

By means of the tilting movement gaseous and liquid contrast means used in radiographic examinations are moved with the aid of gravity in the patient in and around the object to be examined (myelography) and cavities in the head can be filled with air as a contrast means for taking X-ray pictures (pneumatic encephalography).

Such devices for a sitting patient with which the isocentric rotation of the patient around his skull or another part of his body is possible must be constructed very rigidly. In a known device of this kind the support for the patient is secured to an annular supporting stand with which the seat or carrier can be lifted through 360°. The annular construction required for that purpose is very bulky and in addition the radiographic examination is hampered in that the annular supporting stand wholly encircles the support for the patient so that certain adjustments of the radiation source are not possible.

An object of the present invention is to avoid these disadvantages. According to the invention, for performing the tilting movements of the seat or carrier for supporting the patient about a horizontal axis passing through a point in space, which point is situated in an object to be examined, the seat or carrier is secured to a movable carriage which is guided along a movable supporting column, and a stand, which is also slideable, is rotatably connected to a sliding member which is moveable along the column, the column and the stand having supporting points which are jointly slideable on a base plate along a path perpendicularly crossing the axis of rotation, the supporting points assuming positions independently of the movement in which the longitudinal axis of the column is directed towards the point in the object to be examined which coincides with the axis of rotation, the movement causing the sliding member and the carriage to move jointly along the supporting column at a distance which varies between the sliding member and the carriage without the distance between the carriage and the point coinciding with the axis of rotation varying.

As there are no bulky and intricate components which are difficult to manufacture, the device according to the invention is of a comparatively simple construction. In addition it is easy to operate because the space around and more particularly above the patient remains entirely free. Hence the examination to be carried out by the operating personnel becomes simpler. The patient can be approached from all sides without any hindrance of parts of the device and a correct adjustment can always be achieved of the X-ray apparatus. Such apparatus is often especially designed for this purpose and includes an X-ray tube and an X-ray detector which are jointly pivotable about two mutually perpendicular axes with a common point of intersection which must be laid in the object to be examined during the adjustment of the central axis of the X-ray cone. Adjustment of the object with respect to the axis through this point of intersection can be achieved by varying the height of the seat or carrier for support, which in a manner suitable for that purpose may be connected to a supporting arm for securing to the carriage and the supporting column. The variation in height also allows for differences in lengths of patients.

Due to the distance between carriage and centre of rotation remaining constant, the tilting movement thus achieved satisfies the condition that the angle of incidence of the beam can be varied without essentially changing the position of the object and the direction of gravity of the contrast means is adjustable relative to the object.

The patient's support is preferably secured to the supporting arm of the carriage by means of a rotatable connection the axis of which coincides with the body axis of the patient and for which the position of the skull preferably passes through the common point.

In order that the invention may be readily carried into effect it will now be explained in detail, by way of example, with reference to the accompanying diagrammatic drawing, the figure of which shows an embodiment of such a device.

The central point in the figure is the centre 1 of the skull 2. The seat for the patient consists of the body adapted frame 3 which is covered with some kind of foamed material 4. A stand 5 and a supporting column 6 are mutually connected by a pivot 7 which is secured to a sliding member 8 which is moveable within the column 6. The stand 5 and the base of the column 6 are supported by a base plate 9 and can be moved on the base plate along a horizontal path. The column 6 is rotatably journalled by the shaft 10 in the side 11. Rollers 12 provide for easy movability.

To complete the triangular shape, of which the stand 5 forms the rectangular side and the column 6 the hypotenuse, there is a coupling between the stand 5 and the slide 11 of the column 6. This coupling is obtained in that the base plate 9 includes a mechanism having a drive consisting of an electric motor, the shaft of which is connected to two pulleys 14 and 15 of different diameters. The pulleys carry chains, belts, or cords 16 and 17 which are led back by a second set of pulleys 18 and 19.

In order to achieve that in any position of the stand 5 the supporting column 6 is directed towards the centre 1, a certain ratio between the pulleys of the two systems must be ensured. This ratio is equal to the ratio of the distance between the centre 1 and the horizontal plane through the pivot 7 of the stand 5 and the supporting column 6, and between the centre 1 and the upper surface of the base plate 9.

The stand 5 is connected to the chain or belt 16 carried by the small pulleys 14 and 18 and the slide 11 of the column 6 is connected to the chain or belt 17 which is carried by the large pulleys 15 and 19.

A movement of the device causes the sliding member 8 to move along the supporting column 6. The movement...
of the sliding member 8 is transmitted by a chain or belt 26 to two pulleys 21 and 22 which transmit this movement on to two sets of larger pulleys 23 and 24. A chain or belt 25 carried by the latter pulleys is connected to a carriage 26 which is movable along the column 6. A supporting arm 27 which constitutes the support for the seat 3 is secured to the carriage 26.

When the stand 5 and the column 6 are moved, the carriage 26 is moving along the column 6 so that the distance between the centre 1 and the carriage remains the same. The carriage 26 describes in that case a part of a circle about the centre 1 and the seat will successively take up the positions shown by the broken lines, in which position the object to be examined does not change. To that end the diameters of the pulleys 21, 22 and 23, 24 are different and of a size so that the ratio of the diameters corresponds to the ratio which exists between the height of the pivot 7 over the supporting surface of the base plate 9 and the height of the centre 1 relative to the base. The seat 3 is preferably rotatably secured to the supporting arm 27 so that the seat can be rotated about an axis 28 which substantially coincides with the body axis 29. When these axes pass through the centre 1 an increase in the number of adjusting possibilities is obtained and the operation is further simplified because one has a greater freedom of movement on either side of the head in arranging of the X-ray tube and the X-ray detector.

What is claimed is:

1. A device including a seat or other suitable carrier for supporting a patient during radiographic examinations with which device tilting movements of the seat or carrier can be effected about a horizontal axis passing through a point in space which point is situated in an object of the supported patient to be examined, characterized in that the seat or carrier is secured to a movable carriage which is guided along a movable supporting column, and a stand, which is also slidably, is rotatably connected to a sliding member which is movable along the column, the column and the stand having supporting points which are jointly slideable on a base plate along a path perpendicularly crossing the axis of rotation, the supporting points assuming positions independently of the movement in which the longitudinal axis of the column is directed toward the point in the object to be examined which coincides with the axis of rotation, the movement causing the sliding member and the carriage to move jointly along the supporting column at a distance which varies between the sliding member and the carriage without the distance between the carriage and the point coinciding with the axis of rotation varying.

2. A device as claimed in claim 1, characterized in that the stand and the supporting column are coupled by a mechanism for the simultaneous movement of the stand and the column, and the movement of the column is longer than the movement of the stand, the transmission ratio of the coupling mechanism being equal to the ratio of the distance between the axis of rotation and the horizontal plane through the pivot of the stand, and between the said axis and the base plate.

3. A device as claimed in claim 2, characterized in that the sliding member and the carriage which are movable along the column are connected together by a mechanism the transmission ratio of which is equal to the ratio between the heights of the pivot and the axis of rotation relative to the base plate.

4. A device including a base with a support surface and a carrier for supporting a patient during radiographic examination, the carrier being movable about a horizontal axis passing through a fixed point in space, which point is at a fixed distance from the base, the device comprising: (a) a first member having (i) a first end slidably engaging the base surface, and (ii) a remote part with a pivot point thereon, this member being translatable with a fixed orientation relative to the base, (b) a second member having a first end slidably engaging the base surface, and a remote end, and a longitudinal axis extending through its ends, this second member being both translatable and pivotable, with said longitudinal axis thereof always extending through said fixed point, (c) a third member (i) being connected to said second member for moving slidably along the longitudinal axis, and (ii) being pivotably engaged to said pivot point of said first member, (d) means carried by the base for translating the first ends of the first and second members at different velocities along said base surface, said carrier being coupled to said third member, whereby said translation of said first and second members cause the carrier to pivot about said fixed point in a circular path.

5. A device as defined in claim 4 wherein the supporting surface is substantially planar.

6. A device as defined in claim 5 wherein a first height is defined by a first line normal to the base and extending from the base to said fixed point, and a second height is defined by the first height less the length of a second line normal to the base and extending from the base to said pivot point, the ratio of velocities in translation of said ends of the first and second members being equal to the ratio of said heights.

7. A device as defined in claim 5 wherein said means for translating said first ends comprises a pulley system including a pair of spaced shafts with first and second pulleys of different diameters fixed on each shaft, first and second belts engaging the first and second pulleys and members respectively.

8. A device as defined in claim 6 further comprising a fourth member slidably engaging the second member, and transmission means (i) carried by the second member, (ii) actuated at a first rate by the third member, and (iii) engaged to the fourth member to drive same at a second rate different from the first rate, the carriage being secured to the fourth member.

9. A device as defined in claim 8 wherein a ratio of velocities of third and fourth members is equal to said ratio of said first height and said second line.

10. A device as defined in claim 8 wherein said transmission means comprises an auxiliary pulley system including two spaced shafts with a large and a small pulley on each shaft, belts connecting the large pulleys with the fourth member and the small pulleys with the third member.

11. A device as defined in claim 5 wherein said carriage is rotatable about an axis normal to said axis of rotation.

12. A device as defined in claim 5 wherein said carriage is adjustable in height along an axis intersecting said fixed point.

References Cited

UNITED STATES PATENTS

3,141,972 7/1964 Oller 250—55

RALPH G. NILSON, Primary Examiner
A. L. BIRCH, Assistant Examiner

U.S. Cl. X.R.

269—323
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,506,826 Dated April 14, 1970

Inventor(s) PAUL LOUIS KOSTERS

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, after "Filed July 12, 1967, Ser. No. 652,805"
the next line should read as follows:

--Claims priority application Netherlands July 14, 1966
6609882--

Column 1, line 46, "lifted" should be --tilted--
Column 2, line 48, "side" should be --slide--
Column 3, line 22, "rototed" should be --rotated--

Signed and sealed this 25th day of August 1970.

(SEAL)
Attest:
Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHULTZ, JR.
Commissioner of Patents