Dec. 25, 1956 K. WEIGEL ET AL 2,775,709

X-RAY DIAGNOSTIC APPARATUS

Filed Oct. 23, 1952 2 Sheets-Sheet 1

FIG. 1

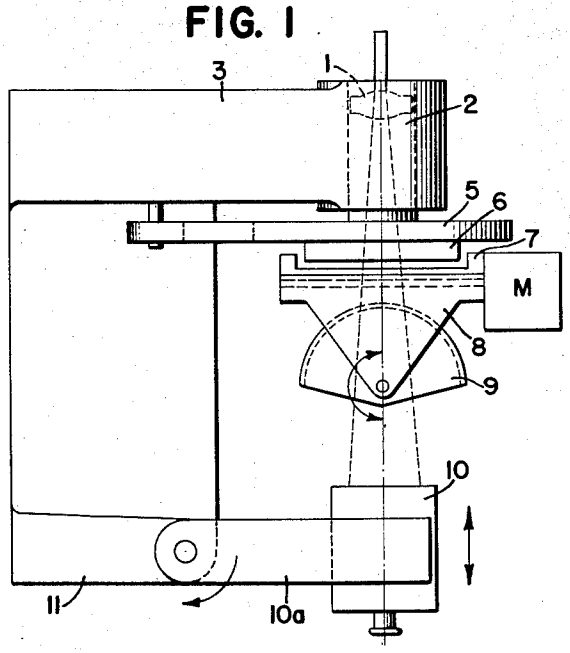


FIG. 3

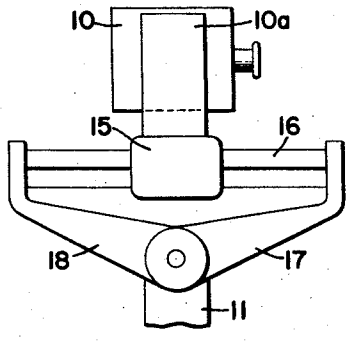
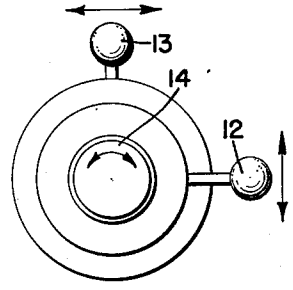


FIG. 4



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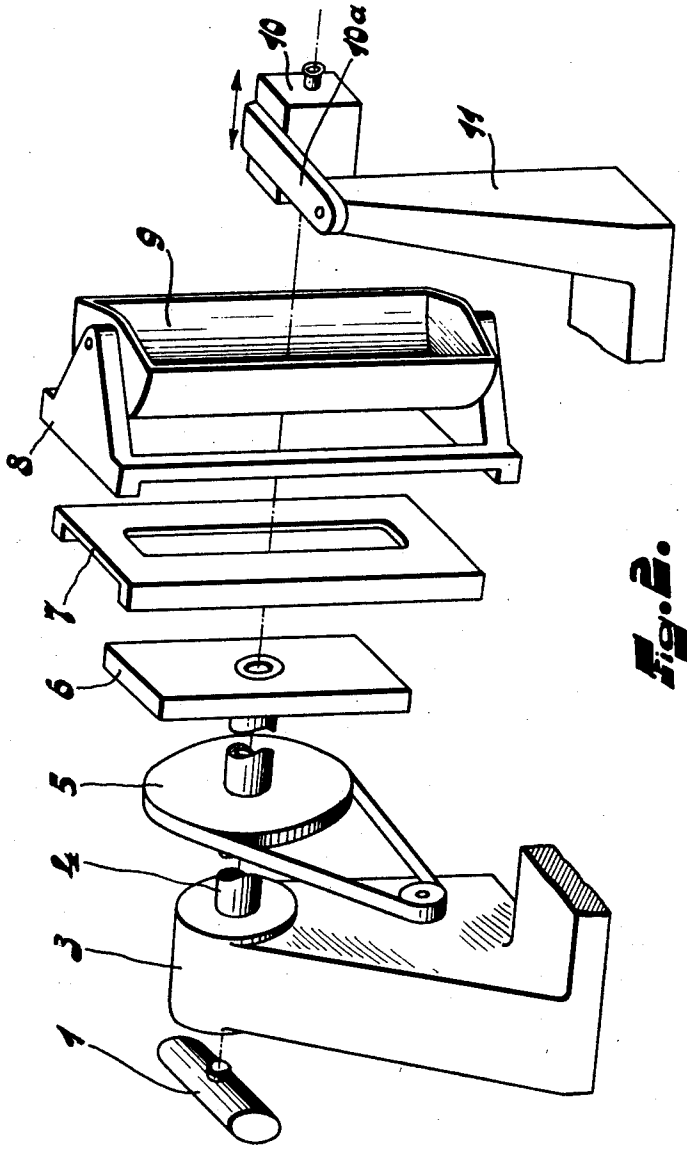


Fig. 2.

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United States Patent Office 2,775,709 Patented Dec. 25, 1956

2,775,709

X-RAY DIAGNOSTIC APPARATUS

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Application October 23, 1952, Serial No. 316,372

Claims priority, application Germany November 28, 1951

7 Claims. (Cl. 250—55)

In order to examine the object medically at all areas by X-rays, the observer must move the image collector, since the projection screen has a restricted surface. For various reasons the X-ray tube must mostly move with the movements of the image collector. Most apparatus are constructed in a manner such that this does not require great efforts. In some cases however, it is tiring for the observer to follow the movements of the image collector.

This is particularly the case, if a luminoscope is used as an image collector. In this case the magnified image is observed through an ocular. With respect to this ocular the eye is little movable, since otherwise the image disappears from eyesight. Especially when the image collector is arranged over the body of a lying patient, the observer has difficulties in keeping the eye constantly over the ocular of the moving image amplifier.

The invention provides a means to obviate the said disadvantage and is furthermore of importance for X-ray examination, since it permits the physician to arrange the patient to be examined in a manner such that the results of the examination are superior to those obtainable by means of known apparatus.

With the apparatus for medical X-ray examination according to the invention, not the image collector, but the patient is moved relative to the former, so that the observer can keep his head at rest and is thus more capable of following the variations in the image. According to the invention, a bed for the patient is secured to a cross support and thus movable in two directions at right angles to one another in a plane at right angles to the cone of rays (projection plane).

This cross support may be secured to a rotatable, hollow spindle, the axis of which is at right angles to the projection plane and through which passes the cone of rays. This spindle will preferably be arranged horizontally, the axis being at the level of the observer's eye.

The drawing shows diagrammatically one embodiment of the apparatus according to the invention.

Fig. 1 shows the apparatus, viewed from above.

For the sake of clearness Fig. 2 shows the various parts of the apparatus side by side in a perspective view.

Fig. 3 illustrates the manner in which a luminoscope is secured so as to be movable.

Fig. 4 shows a few control-handles, which are integral with one another.

Corresponding parts are designated in the various figures by the same reference numerals.

The apparatus comprises a hollow spindle 4, which is supported in a bearing 3 and is rotatable by means of a belt pulley or a chain pulley 5. The X-ray tube 1 is arranged in a manner such that the cone of rays initiating from this tube passes through the hollow spindle.

On the spindle is seated a cross support comprising a guide path 6, a slide 7 and a slide 8. To the latter is secured the bed 9 for the patient. The slide 7 is adapted

to slide over the guide path 6 in the direction of length of the bed and will therefore be termed longitudinal slide. It constitutes a guide path for the slide 8, which is adapted to slide over it in a direction transverse to the bed and which will therefore be termed transverse slide. In order to permit the X-rays to pass uninterrupted the slide 7 has an elongated window. For the same reason the slide 8 has a window of the same length and a larger width in the transverse direction in accordance with the extent of the displacement. The bed is shaped in the form of a trough and is pivotable about a shaft extending in the direction of length of the bed, so that the body of the patient secured to the bed can be turned.

The apparatus finally comprises the image collector. In the embodiment shown this is a luminoscope 10, which reproduces the projected image in a magnified manner. It is secured by means of an arm 10*a* to the supporting column 11. The arm is pivotable, so that the image amplifier can be tilted away, when the patient lies down on the bed or gets up therefrom.

It may be useful to have the image collector displaceable in the direction of the rays, since then the size of the collected image may be varied. An arrangement which permits of doing so is shown in Fig. 3. The supporting arm 10*a* of the luminoscope is secured in this case to a sleeve 15, which is adapted to slide over a square rod 16, secured between the arms 17 and 18 of a fork. In order to permit of tilting the image amplifier away, this fork is secured to the supporting column so as to be pivotable. The observer need not move his head parallel to the projection plane during the examination carried out by means of the apparatus shown.

As an alternative, by displacing the X-ray tube in the direction of the rays, the size of the image may be varied. An arrangement permitting of performing this displacement is readily obtained by arranging the X-ray tube inside the hollow spindle, which then must have a larger inner diameter than is required in the arrangement shown in the drawing.

As in known apparatus for X-ray examination, the various movements in the apparatus according to the invention may be performed mechanically. An electric motor may be used to turn the cross support about the cone of rays, and even the displacement of the two slides may be performed by electric motors. It is advisable to unite the handles for connecting and disconnecting these motors at the due instant and to arrange them in a manner such that each displacement of the mechanically moved parts is obtained by a movement of the hand logically associated with this displacement. A concentrical arrangement of these handles is most suitable for the said purpose.

The apparatus may thus be provided with a rotary knob 14, shown in Fig. 4, which serves to actuate the spindle. The axis of this knob coincides with the axis of rotation of two cranks 12 and 13, by means of which the moving mechanism for the two slides is actuated. The crank 12 is provided for the longitudinal slide and, if the latter has a vertical position it takes up a horizontal position in the rest position. The crank 13 serves for the transverse slide and if the latter is in the horizontal position it is vertical in the rest position. Consequently, the cranks are at rights angles to the path of the associated slides. In order to move the longitudinal slide, the cranks taking up the positions shown in Fig. 4, the crank 12 must be tilted upwards or downwards, according as it is desired to move the longitudinal slide upwards or downwards. For moving the transverse slide to the left or to the right, the crank 13 must be tilted to the left and to the right respectively. The movement

of the control-handles is thus in logical accordance with the displacement aimed at.

In a further embodiment of the invention, in order to maintain the aforesaid accordance, when the bed **9**, initially taking up a vertical position, is moved into another position by turning the knob **14**, the set of control cranks is movable as a unit about the shaft of the knob **14** and coupled in some way or other with the moving mechanism so that it moves with the hollow spindle and the cranks maintain their initial positions relative to the slides. Consequently, the rest position of the cranks **12** and **13** is varied in accordance with the inclination of the slides, so that it is always immediately evident what manipulations are required to obtain the desired change of the patient's position.

Means for mechanical movement of spindles and slides, and those for the establishment of a correlation of control-handles and moving parts in the sense referred to above are generally known in engineering, so that a further description may be dispensed with.

Even the tilting of the bed **9** relative to the transverse slide **8** may be carried out by means of an electric motor. The switch for actuating this motor may at best be provided at a separate area, for example, on the supporting column **11**.

What we claim is:

1. An apparatus for medical X-ray examination of a patient comprising a base member, an X-ray source mounted on said base member for producing an X-ray beam having a central axis, an image collector mounted on said base member in a position intercepting said X-ray beam, a support for said patient between the X-ray source and the image collector, intermediate support members secured to said patient support and rotatably mounted on said base member, means for moving the intermediate support members and thereby said patient support in two directions at right angles to one another in a plane at right angles to said X-ray beam, and means for rotating said intermediate support members around the central axis of the X-ray beam.

2. An apparatus for medical X-ray examination of a patient comprising a base member, an X-ray source mounted on said base member for producing an X-ray beam having a central axis, an image collector mounted on said base member in a position intercepting said X-ray beam, a patient support between the X-ray source and the image collector, said patient support having a longitudinal axis, intermediate cross-support members between said patient support and said base member, one of said cross support members pivotally mounting said patient support for rotating the latter around the longitudinal axis thereof, another cross-support member rotatably mounted on said base member, means interconnecting said cross-support members and for moving the same relative to one another and thereby moving said patient support in two directions at right angles to one another in a plane at right angles to said X-ray beam, and means for rotating said intermediate cross-support members around the central axis of the X-ray beam.

3. An apparatus for medical X-ray examination of a patient, comprising a base member including a hollow rotatable spindle having a central axis, an X-ray tube mounted on one side of said spindle for producing a cone of X-rays in the direction of the axis of and through said spindle, an image collector mounted on the other side of said spindle and having a viewing position located on the axis of said spindle, a support for said patient disposed between the collector and the spindle, a cross-support

secured to said patient support and mounted on said spindle, means for moving said cross-support and thereby said patient support in two directions at right angles to one another in a plane at right angles to the cone of the X-rays and to the spindle axis, and means for rotating said spindle, whereby during the examination, the patient is moved relative to the stationary collector and tube.

4. An apparatus as claimed in claim 3 in which the X-ray tube is disposed within the hollow spindle and is axially displaceable therewithin.

5. An apparatus for medical X-ray examination of a patient, comprising a base member including a hollow rotatable spindle having a central axis, an X-ray tube adapted to be stationary during the examination and mounted on one side of said spindle for producing a cone of X-rays in the direction of the axis of and through said spindle, an image collector adapted to be stationary during examination pivotably mounted on the base on the other side of said spindle and having a viewing position located on the axis of said spindle, a trough-like support for said patient disposed between the collector and the spindle and at right angles to the spindle axis, a first member rotatably secured to said patient support and having a slide-receiving channel extending in a first given direction at right angles to the spindle axis, a second member having a slide portion in engagement with the channel of said first member and a slide-receiving channel extending in a second given direction at right angles to said first direction and also at right angles to said spindle axis, a third member mounted on said spindle and rotatable therewith and having a slide portion in engagement with the channel of said second member, motor means associated with said first and second members and with said spindle, and control means for actuating said motor means to effect rotation of said patient and displacement thereof in said first and second directions in a plane at right angles to the spindle axis, said control means being arranged relative to the patient support at which a movement of the control means in one direction causes a corresponding movement of the patient in the same direction.

6. An apparatus as claimed in claim 5 in which the control means comprises a rotatable knob associated with the motor means for rotating the spindle and a pair of crank handles associated with the motor means for the first and second members and integrally united with said knob, one of said handles extending at right angles to said first given direction and being displaceable in said first direction, the other of said handles extending at right angles to said second given direction and being displaceable in said second direction.

7. An apparatus as claimed in claim 6 in which rotation of said knob of said control means causes a corresponding rotation of said crank handles whereby the handles maintain their relative positions to the first and second members.

References Cited in the file of this patent

UNITED STATES PATENTS

1,573,571	Pohl	Feb. 16, 1926
1,985,715	Bucky	Dec. 25, 1934
1,988,993	Bouwers	Jan. 22, 1935
2,293,324	Vladeff	Aug. 18, 1942
2,412,662	Watson	Dec. 17, 1946
2,523,132	Mason et al.	Sept. 19, 1950
2,532,967	Thompson	Dec. 5, 1950
2,571,011	Chapman	Oct. 9, 1951
2,646,514	Noschis	July 21, 1953