

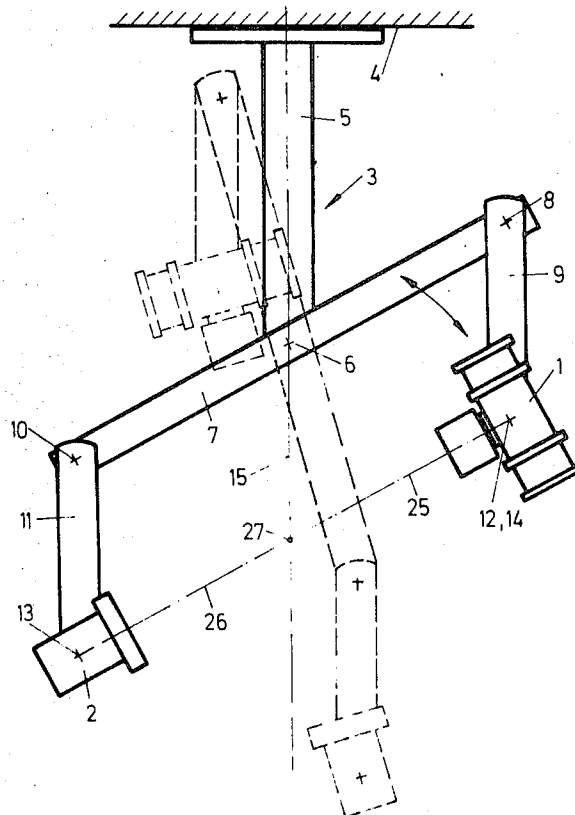
- [54] **X-RAY DEVICE WITH A STAND**
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[57] **ABSTRACT**
 An X-ray device has a stand and an X-ray tube mounted upon a bracket which is supported rotatably about a support axis extending perpendicularly to its longitudinal axis. The invention is particularly characterized in that a carrying arm is rotatably mounted upon the free end of the bracket and that the X-ray tube is mounted upon the free end of this arm for rotation about further axes extending parallel to the support axis of the bracket. Driving means are provided which keep constant in space and independently from the swinging location of the bracket the position of the carrying arm relative to the X-ray tube, whereby the central ray of the X-ray tube is always maintained parallel to the longitudinal axis of the bracket.

- [56] **References Cited**
- UNITED STATES PATENTS**
- 2,818,510 12/1951 Verse..... 250/91
- 2,097,095 10/1937 Goldfield et al..... 250/92

2 Claims, 2 Drawing Figures



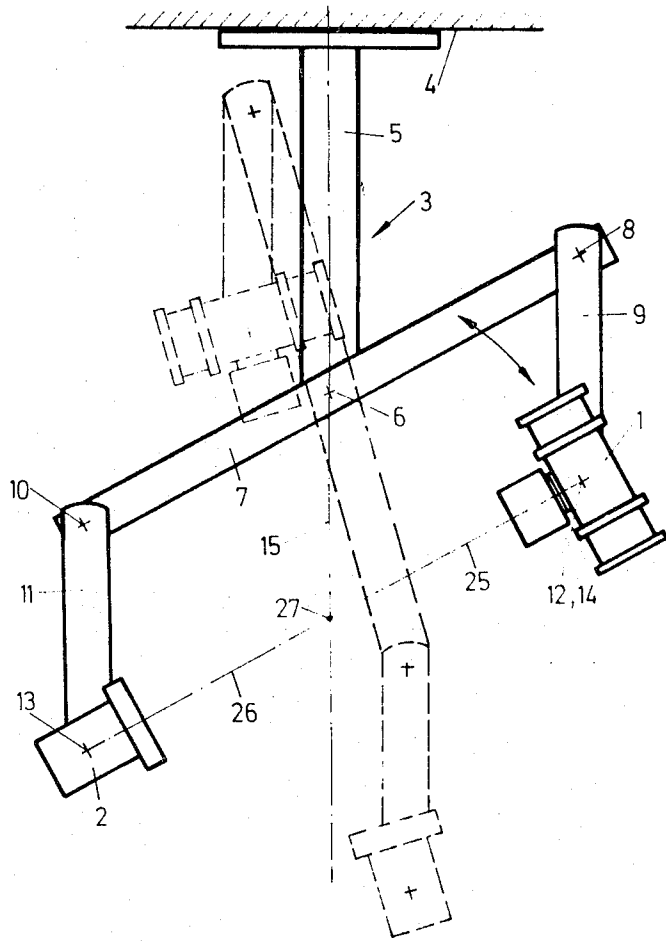


Fig. 1

X-RAY DEVICE WITH A STAND

This invention relates to an X-ray device having a stand and an X-ray tube mounted upon a bracket which is supported rotatably about a support axis extending perpendicularly to its longitudinal axis.

In X-ray diagnosis as well as in X-ray therapy it is sometimes necessary to be able to move the ray source as freely as possible around the patient. In the X-ray diagnosis and also in surgery the doctor should be given the greatest possible freedom in the selection of the direction of illumination. In ray therapy in order to diminish skin strain there is the tendency to move the ray source at the same location from the sick area over the greatest possible sections of the outer surface of the patient. In both cases the stand should be so constructed that the patient is not squeezed by the supporting arms or swinging brackets or that he should even collide with them. At the same time the patient should be made as accessible as possible.

An X-ray examining apparatus is known which is used in surgery and wherein an X-ray tube and an X-ray image amplifier centered relatively to the X-ray tube are mounted on opposite ends of a semi-circular supporting arm and are adjusted relatively to each other. This supporting arm is guided along its circumference and is swingably mounted upon an axle extending through the center of the semi-circle. The drawbacks of this X-ray examining apparatus consist in that the swinging of the X-ray tube is limited to less than one half of a circle and that it is difficult to reach the patient due to the provision of the semi-circular carrier and its support.

An object of the present invention is to eliminate the drawbacks of existing constructions.

Another object is the provision of an X-ray device having a stand which is equally suitable for use in X-ray therapy and X-ray diagnosis.

Other objects of the present invention will become apparent in the course of the following specification.

In the accomplishment of the objectives of the present invention it was found desirable to provide an X-ray examining device of the described type with a supporting area rotatably mounted upon the free end of the bracket. The X-ray tube is mounted upon the free end of this arm for rotation about further axes extending parallel to the support arm of the bracket. Driving means are provided which keep constant in space and independently from the swinging location of the bracket the position of the supporting arm relatively to the X-ray tube, whereby the central ray of the X-ray tube is always maintained parallel to the longitudinal axis of the bracket.

This construction of the present invention provides for the first time an X-ray device wherein the X-ray tube can be swung about a circle of 360° around the patient, without it being necessary for the extension of the swinging axis to touch the patient. This makes it possible to freely and conveniently place the patient.

An embodiment of the present invention which is particularly suitable for an X-ray examining apparatus is provided when the bracket is shaped as a two arm lever and its end opposed to arm carrying the X-ray tube carries swingably a discharging arm located at the same distance as the tube carrying arm. At the free end of the discharging arm an X-ray image amplifier is mounted so as to be swingable about axes extending parallel to the supporting axis of the bracket. Driving

means are provided which hold the arm carrying the X-ray image amplifier independently from the swinging position of the bracket parallel to the arm carrying the X-ray tube and which direct the optical axis of the X-ray image amplifier to the central ray of the X-ray tube. In that case the X-ray image amplifier always remains centered to the central ray of the X-ray tube when the bracket is swung or the illumination direction is changed. The central ray and the optical axis coincide and form the fourth side of a parallelogram drive.

According to a further advantageous embodiment of the present invention the stand can be rotatably mounted about an axle extending at right angles to the bearing axle and passing through the common intersection point of the central rays of the X-ray tube during all swinging positions of the bracket. This makes it possible to move the X-ray tube as if it were on a conical surface around the object being examined.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawings showing by way of example only, a preferred embodiment of the inventive idea.

In the drawings:

FIG. 1 is a front view of an X-ray examining device with a stand and constructed in accordance with the present invention.

FIG. 2 is a side view, partly in section of the stand shown in FIG. 1.

FIG. 1 shows an X-ray tube 1 and an X-ray image amplifier 2 which are hung by a stand 3 from the ceiling 4. The stand consists of a column 5, a bracket 7 swingable upon the column about a horizontal axle 6, a carrying arm 9 for the X-ray tube 1, the arm being mounted upon one end of the bracket and being swingable about a horizontal axle 8 extending parallel to the axle 6, and a carrying arm 11 for the X-ray image amplifier 2 which is located at the other end of the bracket 7 and is swingable about a horizontal axle 10 also extending parallel to the axle 6. The X-ray tube and the X-ray image amplifier are swingable about horizontal axes 12 and 13, respectively, which are also parallel to the axle 6. The stand 3 is attached to the ceiling 4 so as to be rotatable about a vertical axis 15.

FIG. 2 shows the inner structure of the stand 3. A chain wheel 16 is mounted upon the stand axle 6 upon which the bracket 7 is mounted so as to be swingable relatively to the column 5. The chain wheel 16 is clamped to the column; it is connected by an endless chain 17 with a second chain wheel 18 which is coupled by a hollow shaft 19 with the arm 9 carrying the X-ray tube 1 and swingable about the axle 8 carried by the bracket 7. Inside the hollow shaft 19 there is an axial pivot 20 which is soldered to the bracket 7 and upon which is fixed a third chain wheel 16. The chain wheel 16 is connected by a further endless chain 22 with a fourth chain wheel 23 mounted upon the horizontal axle 12 and coupled with a flange 24 of the X-ray tube. The carrying arm 11 (FIG. 1) for the X-ray image amplifier and the X-ray image amplifier itself are mounted upon the bracket 7 in the same manner as the carrying arm 9 for the X-ray tube 1 and the X-ray tube itself and are coupled with each other by chain drives in the same manner.

When the bracket 7 is swung about the horizontal supporting pivot 6 of the column, the carrying arm 9 for the X-ray tube 1 will be swung by chain wheels 16

and 18 and the chain drive 17 relatively to the bracket in such manner that it retains its location in space. In the embodiment shown in the drawings this is a vertical downwardly directed position. The same applies in a corresponding manner to the carrying arm 11 of the X-ray image amplifier 2. At the same time the X-ray tube is taken along by bracket 7 through the axial pivot 20, the chain wheels 21 and 23 and the chain drive 22 in such manner that its central ray always extends parallel to the longitudinal axis of the bracket 7. Since the same applies in a corresponding manner to the X-ray image amplifier 2, and provided the carrying arms are the same length, during the swinging of the bracket 7 the central ray 25 of the X-ray tube and the optical axis 26 of the X-ray image amplifier 2 will be always directed upon each other. The central ray of the X-ray tube and the optical axis of the X-ray image amplifier extend through the same point 27 in space throughout all swingings of the bracket 7. Should the vertical axle 15 about which the stand 3 at the ceiling 4 is rotatably mounted, be so arranged that it also extends through the same point 27, then the X-ray tube and the X-ray image amplifier can be moved about a spherical surface around this point 27. They always remain adjusted to each other and to this point 27. The object to be examined can be placed in this point. A further advantage of this construction is that the approach to the patient is not interfered with either by the bracket 7, nor by its axle 6 or the column 5 and that it is easily possible by extending the bracket to further increase the distance between the patient, the X-ray image amplifier and the X-ray tube.

Within the scope of the present invention it is also possible to make the bracket 7 rotatable about a vertical axis and to make the axes of the two carrying arms 9 and 10 as well as those of the X-ray tube and the X-ray image amplifier, parallel to this vertical axis. When constructing an embodiment of the present invention in this manner it is particularly advantageous to arrange the bracket at the end of a column so that it is rotatable about two axes at right angles to each other and to cause the horizontal axis to pass through the intersection of the central rays of the X-ray tube in all swinging positions of the bracket.

The described chain drives can be replaced by toothed drives, belt drives and electrical setting means. The X-ray image amplifier 2 can be replaced by any other image carrier adapted to receive slides, roll films and/or a screen and fixed to the carrying arm 11.

I claim:

1. An X-ray device, comprising a bracket, a stand, an axle carried by said stand and rotatably supporting said bracket, a carrying arm, an axle extending parallel to

the first-mentioned axle and supporting one end of said arm upon one end of said bracket, a third axle carried by the other end of said arm and extending parallel to the first- and second-mentioned axles, an X-ray tube carried by said third axle, driving means connected with said axles for maintaining constant the location of said arm and always directing the central ray of the X-ray tube parallel to the longitudinal direction of said bracket, an axle rotatably supporting said stand and extending perpendicularly to the first-mentioned axle, the axis of the last-mentioned axle extending through the common intersection point of the central rays of the X-ray tube in all positions of said bracket, said third axle having an axis extending through the focal point of said X-ray tube, wherein said means comprise two chain wheels and an endless chain enclosing said chain wheels, said chain wheels being mounted upon the second and third-mentioned axles on opposite ends of said arm, one of said chain wheels being coupled with said bracket, the other one of said chain wheels being coupled with said X-ray tube, whereby the longitudinal axis of said bracket is maintained parallel to the central ray of X-ray tube, the first-mentioned axle extending horizontally, said means maintaining said arm in a vertical position.

2. An X-ray device according to claim 1, wherein said bracket is a two-arm lever, the device further comprising a second carrying arm, a fourth axle extending parallel to the first-mentioned axle and supporting one end of the second arm upon the opposite end of said bracket, the two axles being equally spaced, a fifth axle carried by the other end of the second arm and extending parallel to said axles, an X-ray image amplifier carried by said fifth axle, said means being connected with said fourth and fifth axles and maintaining said second arm independently of the location of said bracket parallel to the first-mentioned arm and always directing the optical axis of said X-ray image amplifier to the central ray of the X-ray tube, wherein said means comprise two chain wheels and an endless chain enclosing said chain wheels, one of said chain wheels being coupled with said stand, the other one of said chain wheels being coupled with said arm, whereby the location of said arm relatively to the first-mentioned and second-mentioned axles is maintained constant, said chain wheels being mounted upon the fourth-and fifth-mentioned axles on opposite ends of said second arm, one of said chain wheels being coupled with said X-ray image amplifier, whereby said bracket is maintained parallel to the optical axis of said X-ray image amplifier.

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