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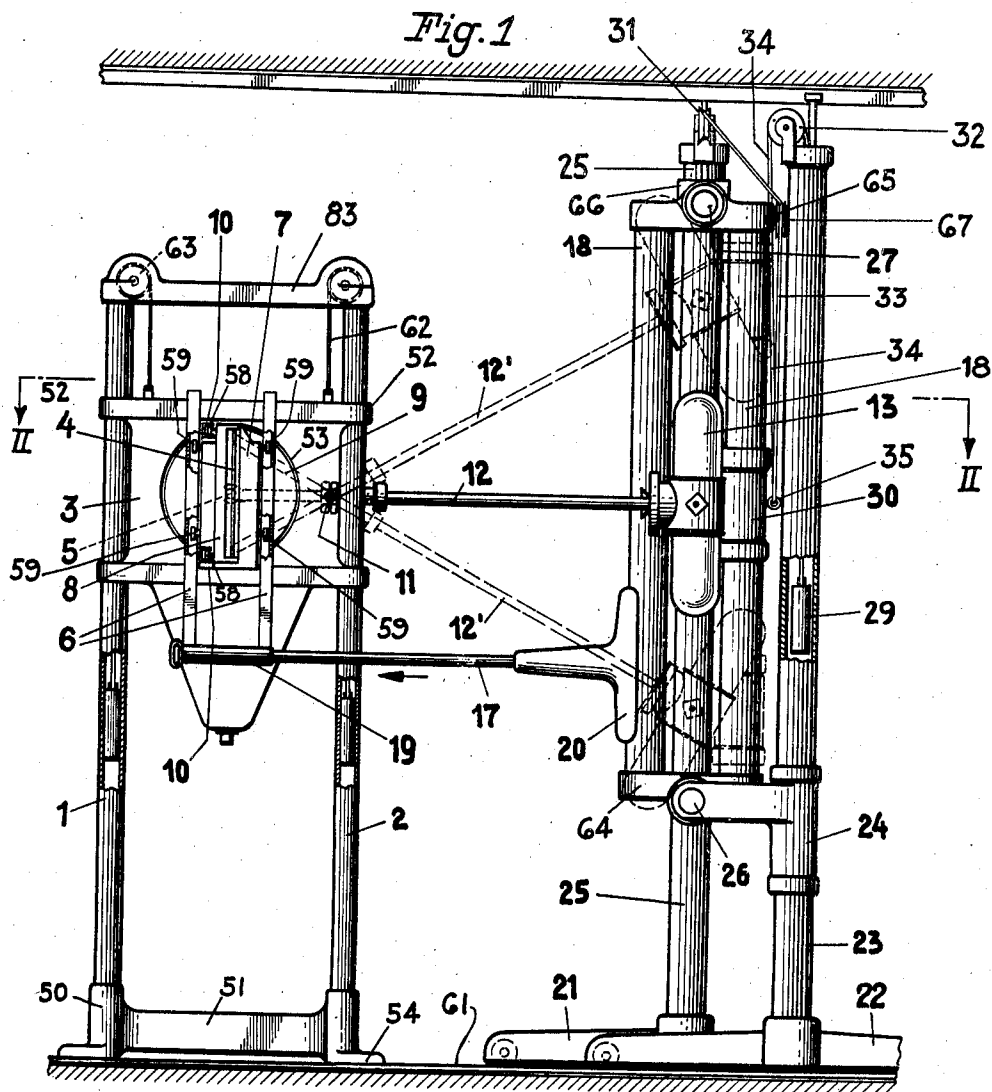
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2,190,458

SUPPORT FOR X-RAY WORK

Filed May 2, 1938

6 Sheets-Sheet 1



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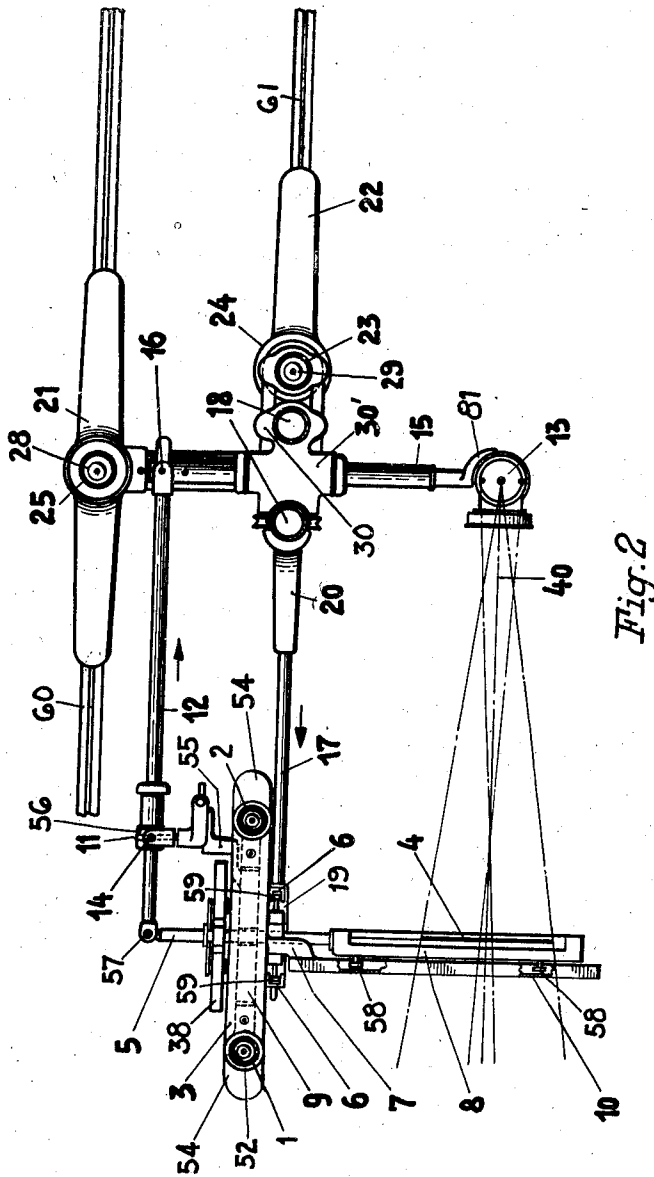


Fig. 2

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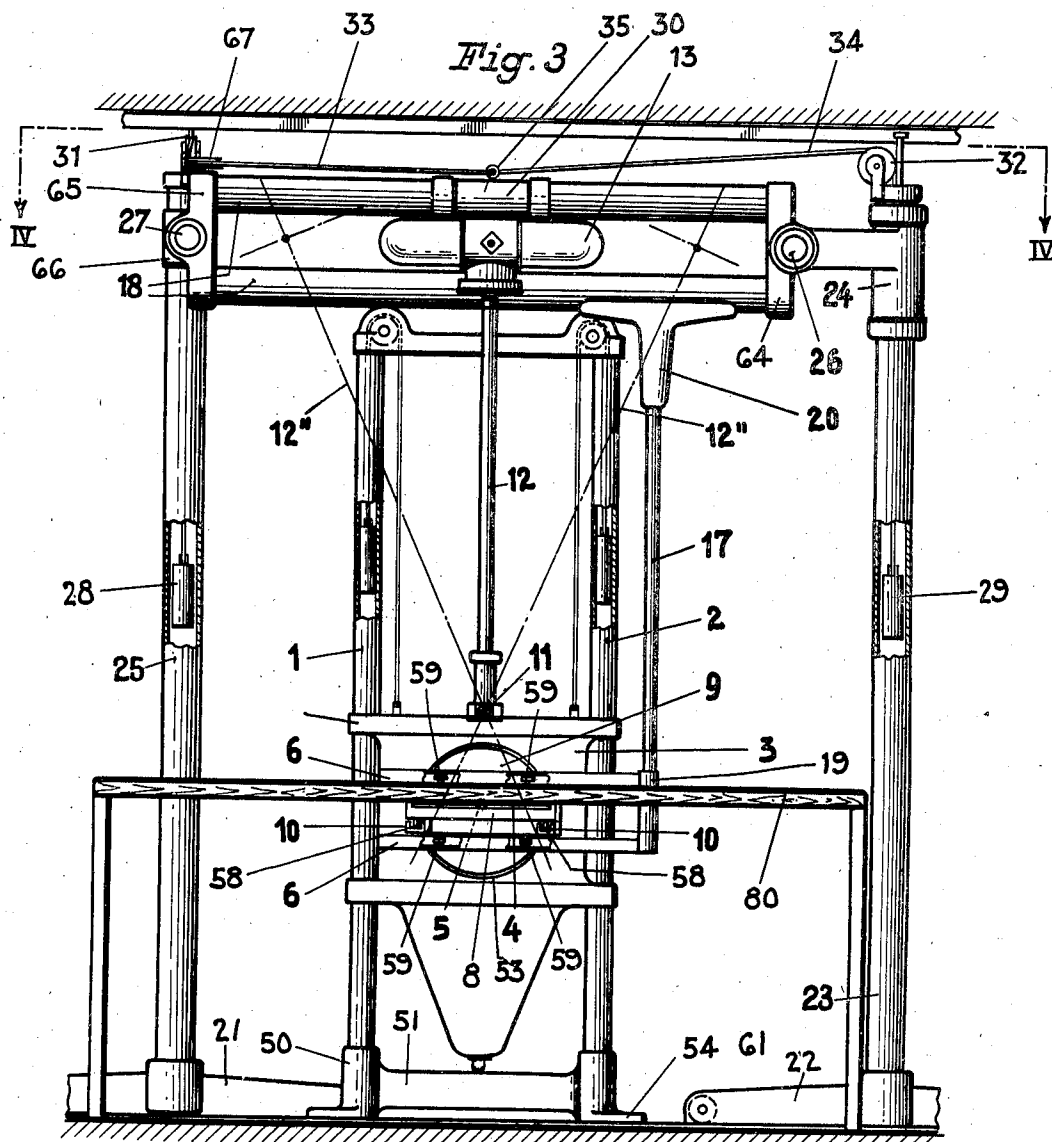
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SUPPORT FOR X-RAY WORK

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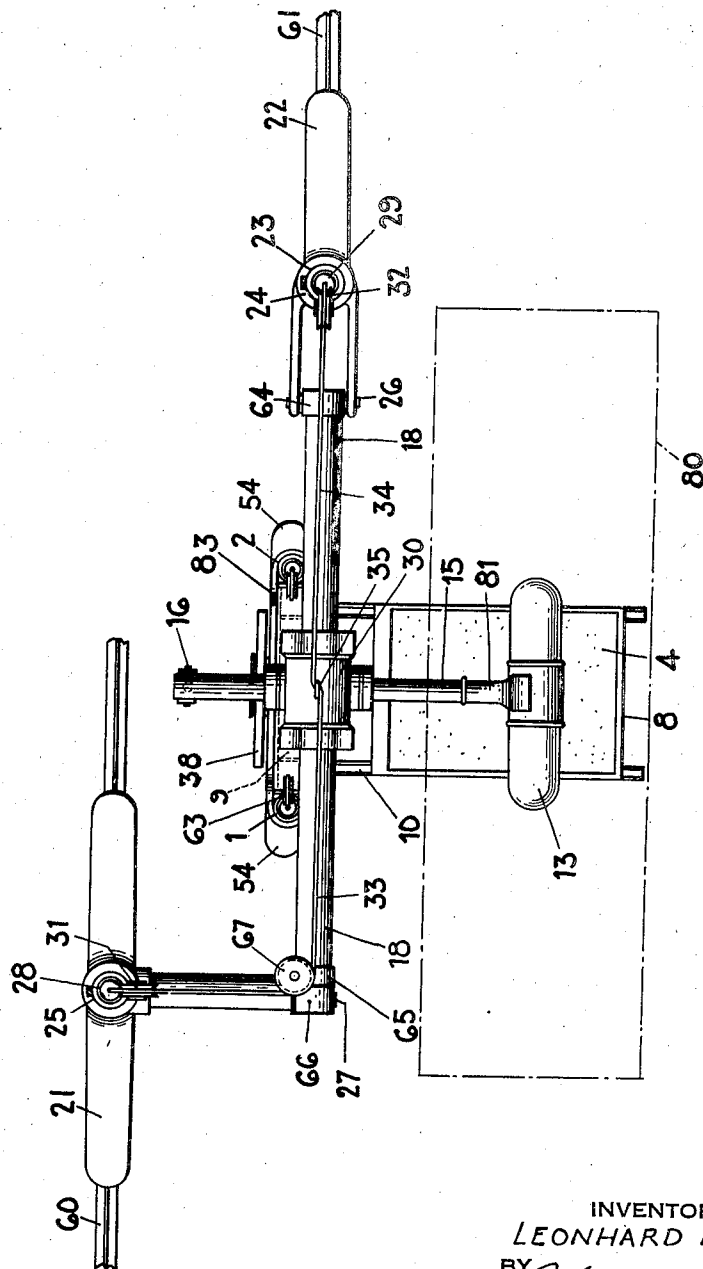
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Fig. 4.



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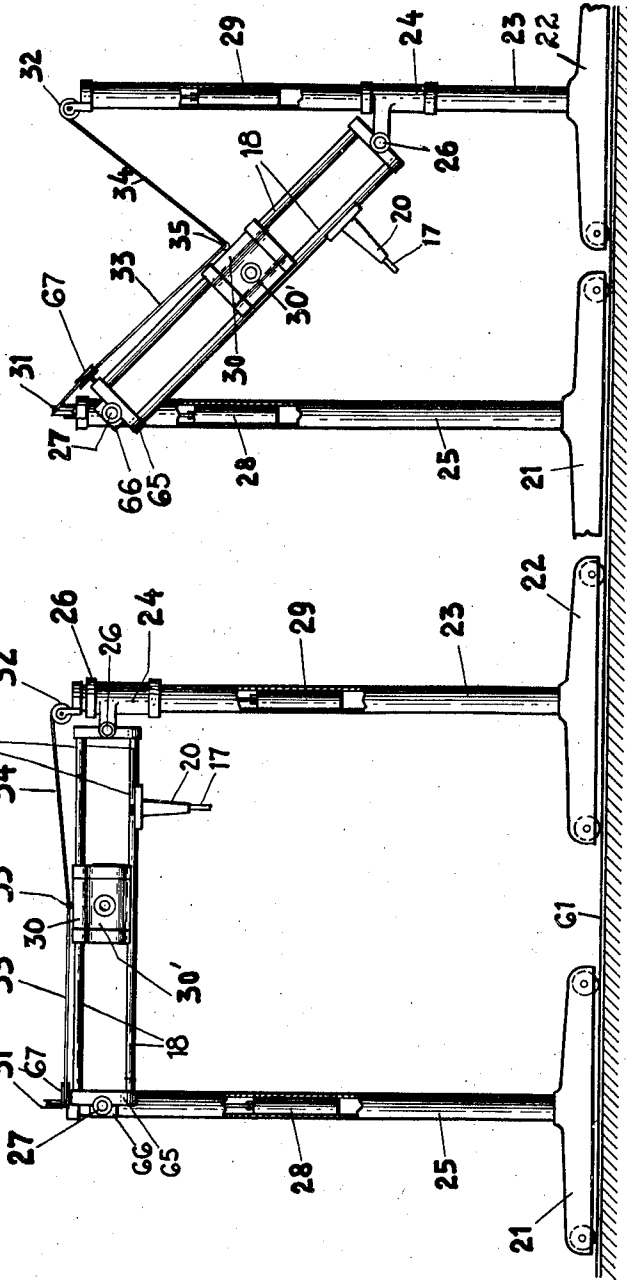
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Fig. 6



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SUPPORT FOR X-RAY WORK

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Fig. 8

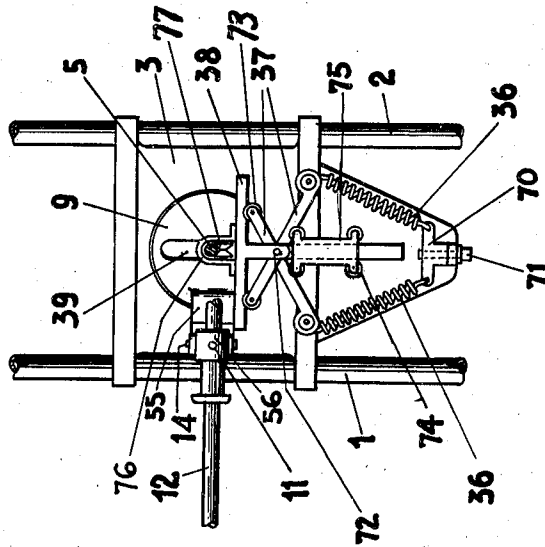
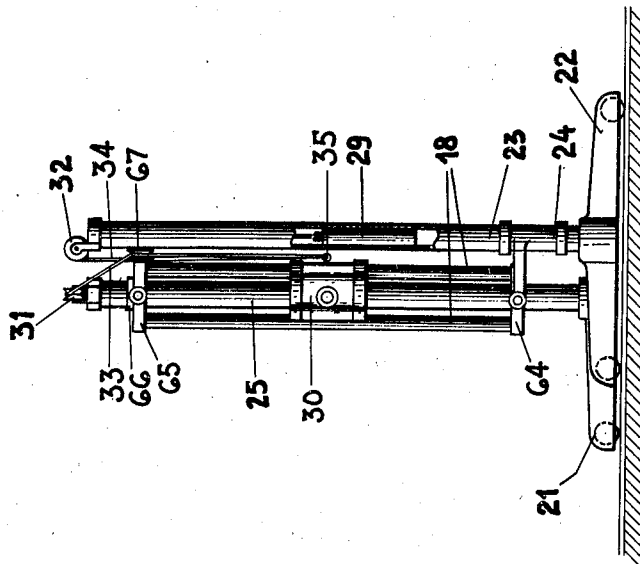


Fig. 7



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SUPPORT FOR X-RAY WORK

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13 Claims. (Cl. 250—57)

This invention relates to a support for X-ray work, and refers more particularly to an implement for producing images or photographs of different layers or organs of a body by means of X-rays.

In prior art, various devices and implements were constructed which movably supported the source of the X-rays, constituted by the focal point of an X-ray tube, and the surface of the image, represented by a screen or a box containing a photographic plate. The construction of these devices is such that although the X-ray source and the image surface are made movable, each X-ray leaving its source is caused to strike the same point of the image surface.

However, heretofore separate devices or implements of this type were required for the reproduction of layers or organs of the human body, which extend horizontally, vertically or obliquely, so that separate devices were necessary for examining a patient in a standing or in a reclining position.

An object of the present invention is to improve constructions of this type by the provision of a single device through the use of which a patient and his organs may be conveniently and easily photographed or illuminated in all possible positions, such as the standing, reclining, or inclined positions.

A drawback of prior art constructions was the difficulty of quickly and readily adjusting the tube-supporting device. It is, therefore, another object of the present invention to provide a device or implement all the movable parts of which can be easily shifted to any desired positions, the weights of these parts being comparatively easily balanced in all such positions.

A further object is the provision of a device of the described type, the construction of which renders it extremely stable and thus affords great convenience in operation.

A still further object is the provision of a device of the described type which is so constructed that the patient can be easily and conveniently handled while he is being examined.

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

The objects of the present invention may be realized through the use of a construction comprising at least two holding and supporting devices, which may be coupled one with the other and which may be shifted relatively to each other. One of these devices includes a guiding surface, or rails, for the casing containing the

image surface, while the other one of these devices comprises rails or guides for the X-ray source, the two guiding means being pivotally disposed in such manner that they may be swung from a horizontal to a vertical position.

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

In the drawings:

Figure 1 shows in side elevation a device constructed in accordance with the principles of the present invention, the support of the X-ray source being shown in a position in which the X-rays are directed substantially horizontally for the purpose of illuminating vertical bodies or layers;

Figure 2 is a plan view of the device shown in Figure 1, along the line II—II of Figure 1.

Figure 3 is a side view of the device in a position in which the X-rays are directed vertically for the purpose of illuminating horizontal layers or bodies;

Figure 4 is a plan view of the device shown in Figure 3, along the line IV—IV of Figure 3.

Figures 5, 6, and 7 are diagrams showing separately in side elevation and in three different positions the carriage for the X-ray tube, the columns supporting the same and the weight-balancing device; and

Figure 8 is a diagrammatic rear view of the carriage for the image surface.

The apparatus shown in the drawings comprises two interconnected supporting devices, one of which is used as a carrier for the image surface 4 while the other one carries the X-ray tube 13.

As already mentioned, the image surface 4 may be constituted by a screen, a photographic plate or the like.

As shown in Figures 1 and 3, the device which is used as a support for the image surface 4, has the form of a gate and comprises two columns 1 and 2, the lower ends of which fit into the sleeves 50 of a carrier or bracket 51, the legs 54 of which are situated upon the floor or the ground surface. A carriage 3 is provided with sleeves 52 which embrace the columns 1 and 2 so that the carriage 3 may be shifted in vertical planes upon the columns. The carriage 3 is connected by cables 62 to pulleys 63 which are rotatably mounted in an upper bracket 83 carried by the columns 1 and 2.

A vertical disc 9 is rotatably mounted in a suitably shaped opening 53 provided in the carriage 55

3. The disc 9 is connected with an arm 55 (Figures 2 and 8) which carries a horizontal pivot 11. A member 56 mounted upon the pivot 11 carries a vertical pivot 14. A rod 12 is mounted intermediate its ends upon the pivot 14. Due to this arrangement the rod 12 which serves as a connection with the X-ray tube support may swing both vertically and horizontally.

The disc 9 is provided with a longitudinal slot 39 (Figure 8) through which a connecting rod or axle 5 extends. One end of the axle 5 is connected by means of the pivot 57 with one end of the rod 12 (Figure 2) while the opposite end of the axle 5 carries a casing 8, which contains the image surface 4. The axle 5 is movable within the slot 39.

The casing 8 is provided with wheels 58 which are guided along a pair of horizontal rails 10, so that the image surface 4 can be shifted in the direction of the axle 5. The rails 10 are firmly connected with a carriage 7, which is provided with wheels 59. The wheels 59 of the carriage 7 are guided along another pair of rails 6, which are carried by a tube 19 (Figure 1).

Since the carriage 7 rides upon the rails 6, the image surface 4 may be shifted in the direction of its plane. At the same time, the image surface 4 may be rotated about the central axis of the axle 5, due to the fact that the arm 55 (Figure 2) which pivotally supports the rod 12, is rotatable along with disc 9, so that the casing 8 of the image surface rotates along with the disc. The casing 8 may be shifted in directions parallel to the image surface 4 in each position of the disc 9.

The weight of the casing 8 for the image surface 4 is balanced by means of a spring arrangement, which is shown more clearly in Figure 8 of the drawings and which comprises two springs 36 having adjacent ends which are attached to a plate 70 which is connected by a bolt 71 with the carriage 3. Two levers 37 are pivotally mounted at 72 upon the carriage 3. The opposite end of the levers 37 are connected with the rollers 73 which form a support for the horizontal arm of the guiding rod 38 which has the form of a T. The vertical arm of the guiding rod 38 is positioned within the rollers 74 of the member 75. The member 75 is firmly connected to the carriage 3. On the upper surface of the horizontal arm of the guiding rod 38 a U-shaped member 76 is fastened. A wheel 77 is pivotally positioned within the member 76 and forms a support for the axle 5. Due to this arrangement the axle 5 is free to move horizontally over the wheel 76. The weight of the casing 8 which is connected to one end of the axle 5 is directed downwardly at the point of support of the wheel 76 causing the horizontal arm of the guiding rod 38 to spread the levers 37. Due to the pivotal arrangement of the levers 37 any downward thrust of the upper ends is met with a counterbalancing action of the lower ends which are connected with the springs 36. In this manner a smooth cushion-like balance and support is always maintained for the axle 5.

The rod 12 is connected by a joint 16 with a shaft 15 (Figure 2) which is connected at 81 with the X-ray tube 13.

A rod 17 which may be a telescoping one, has one end which is situated within the sleeve 19 and is movable within that sleeve, while its opposite end is connected with the member 20 of the X-ray supporting device.

Thus the rods 12 and 17 serve as connections

between the X-ray tube supporting device and the image supporting device and assure that the guide surfaces for the X-ray tube and the image surface are always guided or shifted parallel to each other.

The supporting device for the X-ray tube 13 comprises two carriages 21 and 22 which are movable relatively to the columns 1 and 2 upon the rails 60 and 61, respectively (Figures 2 and 4).

The carriage 21 supports a column 25, while the carriage 22 carries a similar column 23. As shown in Figures 1 and 3, the two columns 25 and 23 may extend up to the ceiling of the room in which the device is located.

Two guides 18 are used for the purpose of guiding the X-ray tube. The lower ends of the guides 18 are interconnected by a member 64, which is connected by a pivot 26 with a sleeve 24 mounted upon the column 23.

The upper ends of the guides 18 may be interconnected by a member 65 carrying a pivot 27 by means of which the upper ends of the guides 18 are connected to a sleeve 66 mounted upon the column 25.

Due to this arrangement, the guides 18 may be shifted vertically along the columns 23 and 25 by means of the sleeves 24 and 66.

As already mentioned, the joint 16 (Figure 2) connects the rod 12 with the tube-carrier 15 which passes through the carriage 30'. The carriage 30' has a sleeve 30 which encloses one of the guides 18, while another portion of the carriage engages the other one of the guides 18. Due to this arrangement, the X-ray tube 13, which is attached at 81 to the shaft or carrier 15, is shiftable along the guides 18.

The connecting member 20 which carries one end of the rod 17 is in engagement with one of the guides 18.

As shown more clearly in Figures 5, 6, and 7, the guides 18 and the carriage 30' are balanced by two counterweights 28 and 29 which are connected to two ends of a cable 34, and which extend within the columns 25 and 23, respectively. The cable 34 passes over a pulley 31 which is rotatably mounted on top of the column 25 and then passes over another pulley 67. The cable 34 is connected to the carriage 30' at the point 35. The opposite end of the cable which is connected to the weight 29 passes over a pulley 32 which is rotatably mounted at the upper end of the column 23.

The arrangement used for illuminating standing bodies is illustrated in Figures 1 and 2 of the drawings. In that position the movable columns 23 and 25 are situated at a distance from the columns 1 and 2 and substantially close to each other. The rods 12 and 17 extend horizontally while the rails 6 extend vertically. The guides 18 also extend vertically with the result that both the image surface 4 and the X-ray tube 13 are situated in parallel vertical planes.

As shown in Figure 1, the connecting rod 12 may swing easily around the pivot 11. The two extreme positions which the rod 12 can assume are indicated by broken lines in Figure 1 and designated by the numeral 12'. In these positions, it is possible to illuminate or photograph a body or organ extending in an oblique or inclined position. Furthermore, the rod 12 can swing about the pivot 14, thereby shifting the X-ray tube 13 in the direction of its supporting shaft 15.

It is comparatively easy to swing the X-ray

tube from the position in which the main direction of the X-rays is a horizontal one and which is shown in Figures 1, 2 and 7, to a position in which the main direction of the X-rays is a vertical one (Figures 3, 4, and 5), and vice versa. In order to shift the device from the position shown in Figure 1, for the purpose of illuminating a reclining body, the carriage 21 is moved away from the carriage 22, so that the two columns 25 and 23 are separated. The sleeve 24 is shifted upward upon the column 23 until gradually the guides 18 are moved from the vertical position shown in Figure 1 to the horizontal position shown in Figure 3. The X-ray tube 13 is also moved upwardly, since the tube is connected by the shaft 15 with the carriage 30', the sleeve 30 of which encloses one of the guides 18. At the same time, the connecting rod 12 is also shifted upwardly thereby rotating the disc 9. The connecting rod 17 is also shifted to a vertical position while the rails 6 are caused to extend horizontally.

As shown in Figure 3, a table 80 for the patient, may be placed directly above the image surface 4 and below the X-ray tube 13.

The connecting rod 12 may swing around the pivot 11 and assume extreme positions which are shown by broken lines and indicated by the numeral 12' in Figure 3.

It is particularly advantageous that the plane of the columns 1 and 2, which is parallel to the plane of the disc 9, is also parallel to the main direction of the X-rays, which is indicated by the numeral 40 in Figure 2. Due to this arrangement, it is possible to hold the image surface on one side only, and in such manner that the operator can easily reach the patient from all sides and that the patient can be easily placed into any position which is desired for examination purposes.

By means of the described construction, a guided centering of the X-ray source and the image surface is achieved, and the weight of all the swinging and movable parts is balanced in all positions, while the distance between the X-ray tube and the image surface may be changed at will.

It is apparent that the specific illustration shown above has been given by way of illustration and not by way of limitation, and that the structures above described are subject to wide variation and modification without departing from the scope or intent of the invention, all of which variations and modifications are to be included within the scope of the present invention.

What is claimed is:

1. A support for X-ray work, comprising at least two separate supporting devices which are movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, and means swingably supporting said guiding means to enable said guiding means to swing from a horizontal position to a vertical position and vice versa; the other one of said supporting devices comprising other guiding means, means slidably supporting the image surface upon said other guiding means, and means swingably supporting said other guiding means to enable said other guiding means to swing from a horizontal position to a vertical position and vice versa; and means interconnecting the two guiding means to cause a proportional movement of the

two guiding means in opposite directions when one of the two guiding means is moved.

2. A support for X-ray work, comprising at least two separate supporting devices which are movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, and means swingably supporting said guiding means to enable said guiding means to swing from a horizontal position to a vertical position and vice versa; the other one of said supporting devices comprising other guiding means, means slidably supporting the image surface upon said other guiding means, and means swingably supporting said other guiding means to enable said other guiding means to swing from a horizontal position to a vertical position and vice versa; and means coupling the two guiding means for maintaining said X-ray tube at a predetermined distance from said image surface in the course of the movements of the two coupled guiding means.

3. A support for X-ray work, comprising at least two separate supporting devices which are movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, and means swingably supporting said guiding means to enable said guiding means to swing from a horizontal position to a vertical position and vice versa; the other one of said supporting devices comprising other guiding means, means slidably supporting the image surface upon said other guiding means, and means swingably supporting said other guiding means to enable said other guiding means to swing from a horizontal position to a vertical position and vice versa; means interconnecting the two guiding means to cause a proportional movement of the two guiding means in opposite directions when one of the two guiding means is moved, and weight-balancing means connected with the two guiding means.

4. A support for X-ray work, comprising at least two separate supporting devices which are movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, and means swingably supporting said guiding means to enable said guiding means to swing from a horizontal position to a vertical position and vice versa; the other one of said supporting devices comprising other guiding means, means slidably supporting the image surface upon said other guiding means, and means swingably supporting said other guiding means to enable said other guiding means to swing from a horizontal position to a vertical position and vice versa; and adjustable means interconnecting the two guiding means for maintaining said X-ray tube at an adjustable distance from said image surface.

5. A support for X-ray work, comprising at least two separate supporting devices which are movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, and means swingably supporting said guiding means to enable said guiding means to swing from a horizontal position to a vertical position and vice versa, to enable a shifting of the direction of

the X-rays of said X-ray tube from a horizontal one to a vertical one and vice versa; the other one of said supporting devices comprising horizontal guiding means, means slidably supporting the image surface upon said horizontal guiding means to enable the image surface to slide horizontally in a direction parallel to the image surface along these horizontal guiding means, means swingably supporting these horizontal guiding means to enable them to swing from a horizontal position to a vertical position and vice versa, and a carriage movable in a vertical direction and carrying the supporting means of the other one of said supporting devices; and means interconnecting the two guiding means to cause a proportional movement of the two guiding means in opposite directions when one of the two guiding means is moved.

6. A support for X-ray work, comprising at least two separate supporting devices which are movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, and means swingably supporting said guiding means to enable said guiding means to swing from a horizontal position to a vertical position and vice versa; the other one of said supporting devices comprising other guiding means, means slidably supporting the image surface upon said other guiding means, and means swingably supporting said other guiding means to enable said other guiding means to swing from a horizontal position to a vertical position and vice versa; and a telescoping rod coupling the two guiding means for maintaining said X-ray tube at a predetermined distance from said image surface in the course of the movements of the two coupled guiding means.

7. A support for X-ray work, comprising at least two separate supporting devices which are movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, means swingably supporting said guiding means to enable said guiding means to swing from a horizontal position to a vertical position and vice versa, and a movable column carrying these supporting means; the other one of said supporting devices comprising other guiding means, means slidably supporting the image surface upon said other guiding means, means swingably supporting said other guiding means to enable said other guiding means to swing from a horizontal position to a vertical position and vice versa, and a support for the image-surface supporting means; and means interconnecting the two guiding means to cause a proportional movement of the two guiding means in opposite directions when one of the two guiding means is moved.

8. A support for X-ray work, comprising at least two separate supporting devices which are movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, means swingably supporting said guiding means to enable said guiding means to swing from a horizontal position to a vertical position and vice versa, and two columns, the supporting means being connected with said columns and being movable relatively to at least one of said columns; the other one of said supporting devices

comprising other guiding means, means slidably supporting the image surface upon said other guiding means, and means swingably supporting said other guiding means to enable said other guiding means to swing from a horizontal position to a vertical position and vice versa; and means interconnecting the two guiding means to cause a proportional movement of the two guiding means in opposite directions when one of the two guiding means is moved.

9. A support for X-ray work, comprising at least two separate supporting devices which are movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, means swingably supporting said guiding means to enable said guiding means to swing from a horizontal position to a vertical position and vice versa, two columns, the supporting means being connected with these columns, two counterweights, means connecting these counterweights with the supporting means; the other one of said supporting devices comprising other guiding means, means slidably supporting the image surface upon said other guiding means, and means swingably supporting said other guiding means to enable said other guiding means to swing from a horizontal position to a vertical position and vice versa; and means interconnecting the two guiding means to cause a proportional movement of the two guiding means in opposite directions when one of the two guiding means is moved.

10. A support for X-ray work, comprising at least two separate supporting devices which are movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, and means swingably supporting said guiding means to enable said guiding means to swing from a horizontal position to a vertical position and vice versa; the other one of said supporting devices comprising other guiding means, means slidably supporting the image surface upon said other guiding means, a carriage swingably supporting said other guiding means to enable said other guiding means to swing from a horizontal position to a vertical position and vice versa, and resilient weight-balancing means carried by said carriage and connected with said other guiding means; and means coupling the guiding means of the two devices for maintaining said X-ray tube at a predetermined distance from said image surface in the course of the movement of the two coupled guiding means.

11. A support for X-ray work, comprising at least two separate supporting devices which are movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, and means swingably supporting said guiding means to enable said guiding means to swing from a horizontal position to a vertical position and vice versa; the other one of said supporting devices comprising a rotatable disc, means carried by said rotatable disc and supporting said image surface to enable it to move in a direction parallel to the image surface, a carriage swingably supporting said rotatable disc to enable it to swing from a horizontal position to a vertical position and vice versa, and a gate-like support carrying said carriage, to enable it to move

vertically upon said gate-like support; and means connecting the guiding means of the first supporting device with the supporting means of the other supporting device.

5 12. A support for X-ray work, comprising at least two separate supporting devices which are movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, 10 and means swingably supporting said guiding means to enable said guiding means to swing from a horizontal position to a vertical position, the other one of said supporting devices comprising a carriage, means movably supporting said carriage, a rotatable disc within said carriage, said disc having a slot formed therein, means supporting said image surface and extending through said slot; and means connecting the guiding 15 means of the first supporting device with the means supporting said image surface.

20 13. A support for X-ray work, comprising at least two separate supporting devices which are

movable relatively to each other; an X-ray tube, an image surface, one of said supporting devices comprising guiding means, means slidably supporting the X-ray tube upon said guiding means, and means swingably supporting said guiding 5 means to enable said guiding means to swing from a horizontal position to a vertical position and vice versa; the other one of said supporting devices comprising other guiding means, means slidably supporting the image surface upon said 10 other guiding means, means swingably supporting said other guiding means to enable said other guiding means to swing from a horizontal position to a vertical position and vice versa, and a support carrying these supporting means and 15 extending in a plane parallel to the main direction of the X-rays; and means interconnecting the two guiding means to cause a proportional movement of the two guiding means in opposite directions when one of the two guiding means is 20 moved.

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