T. B. McCLINTOCK.

ROENTGENOSCOPE.

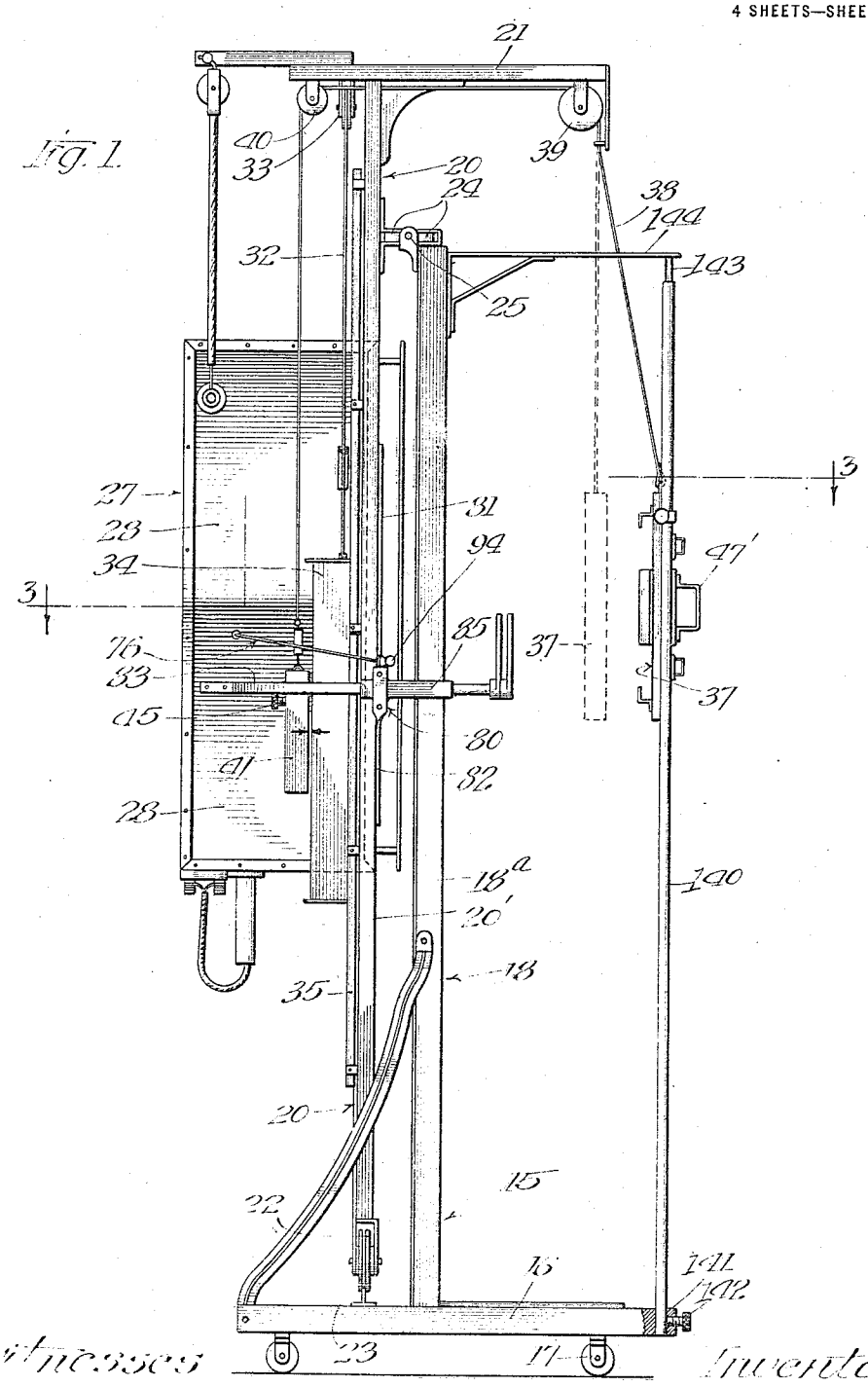
APPLICATION FILED JAN. 25, 1916.

1,285,283.

Patented Nov. 19, 1918.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

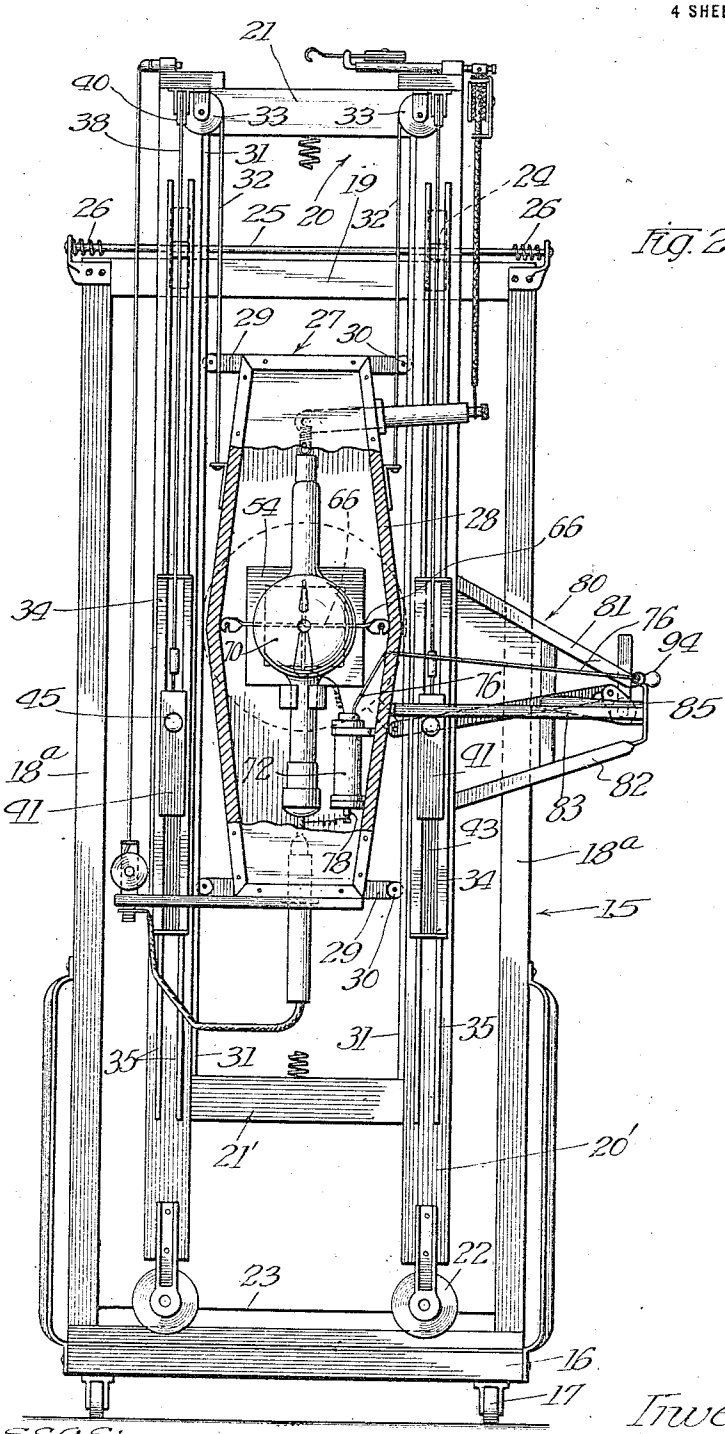


Fig. 2.

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4 SHEETS—SHEET 3.

Fig. 3.

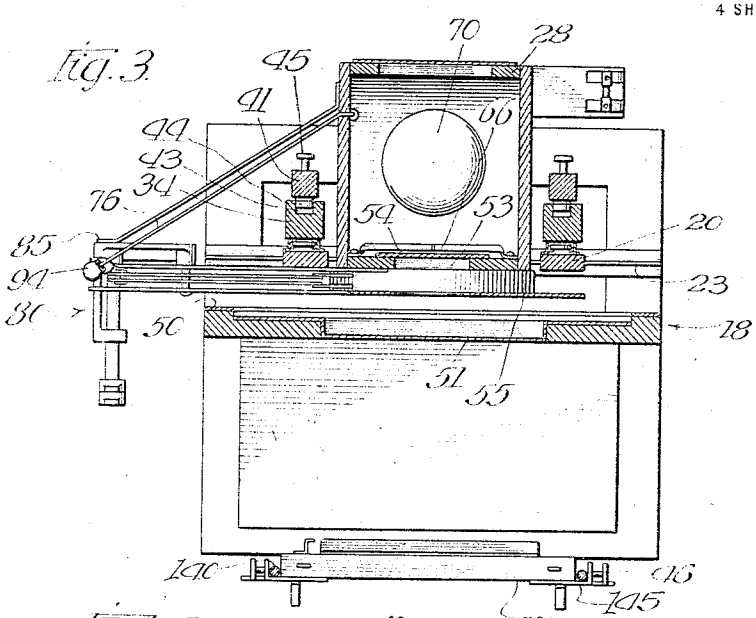


Fig. 5.

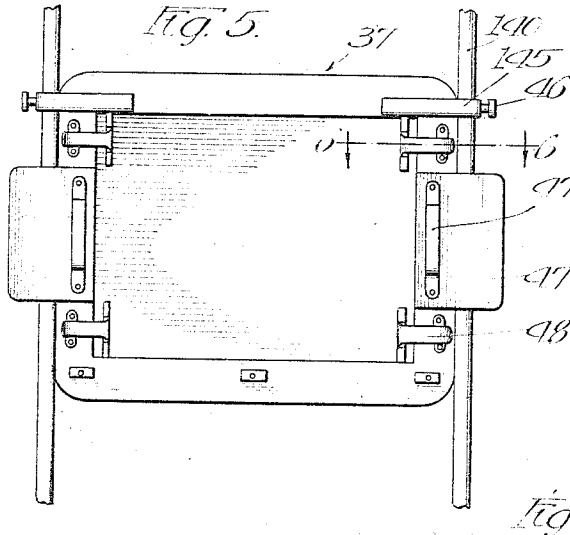


Fig. 6.

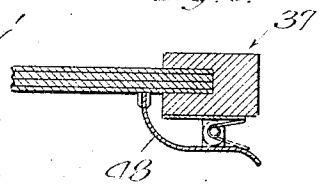
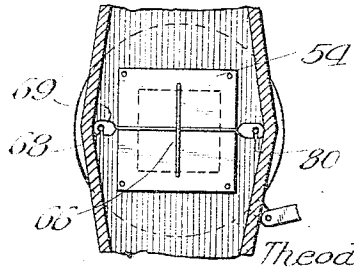


Fig. 4.



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4 SHEETS—SHEET 4.

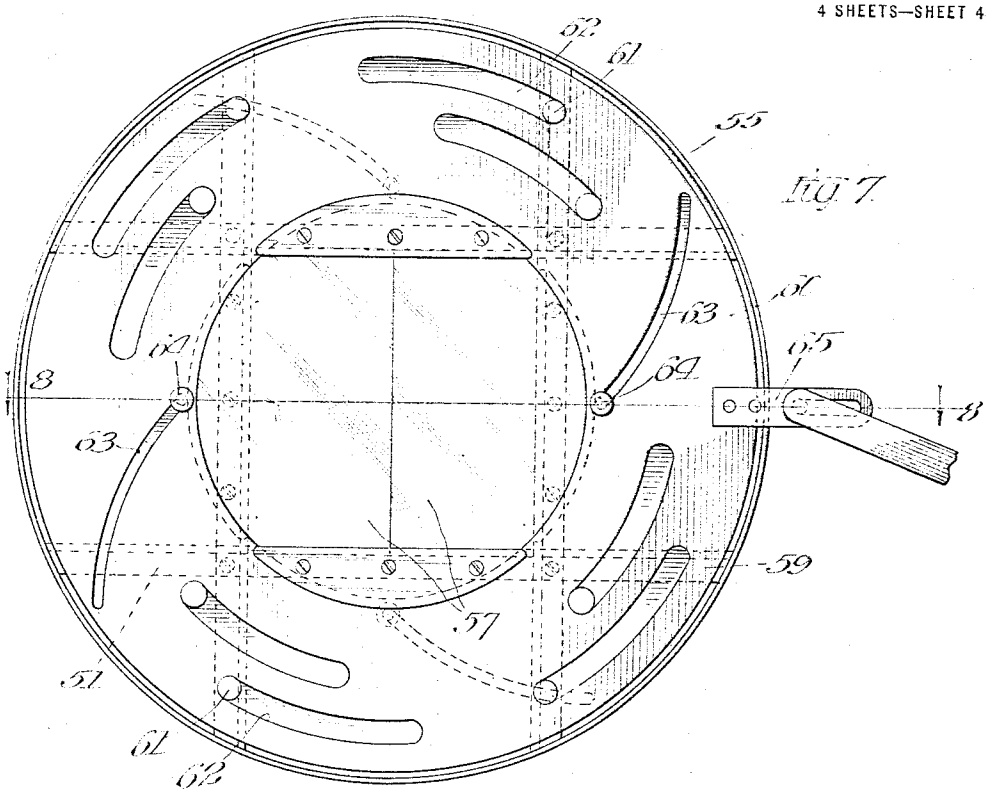


Fig. 7.

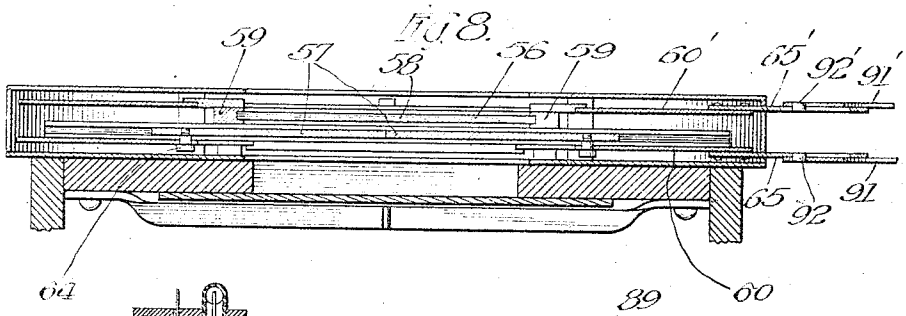


Fig. 8.

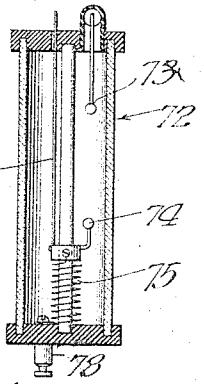


Fig. 10.

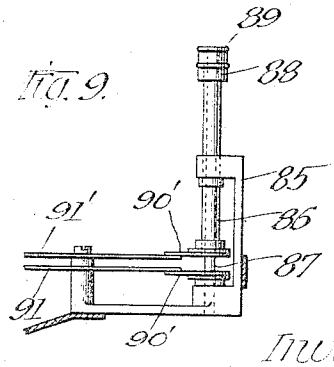


Fig. 9.

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UNITED STATES PATENT OFFICE.

THEODORE B. McCLINTOCK, OF CHICAGO, ILLINOIS.

ROENTGENOSCOPE.

1,285,283. Specification of Letters Patent. Patented Nov. 19, 1918.

Application filed January 25, 1916. Serial No. 74,099.

To all whom it may concern:

Be it known that I, THEODORE B. McCLINTOCK, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Roentgenoscopes, of which the following is a specification.

My invention relates to improvements in roentgenoscopes and more particularly to apparatus for facilitating fluoroscopic examination of the human body.

One of the objects of my invention is to provide an apparatus susceptible of manipulation and control from a single point, so that the operator—working, as usually he must, in a dark room—may readily adjust the apparatus in all needed particulars, working with one hand only at the control point to effect all necessary adjustment while himself standing in proper position for observation.

A further object of my invention is to provide apparatus which is efficient, simple, rugged and not liable to get out of order.

Another object of my invention is to provide an apparatus particularly adapted and arranged for orthodiagraphic work, such as accurately determining the outline of the heart or other organ.

Other objects of my invention are to improve in general and in detail the construction and arrangement of apparatus of the character described and further objects will be apparent to those skilled in the art from the following description taken in conjunction with the accompanying drawings in which—

Figure 1 is a side elevation of a roentgenoscope embodying my invention;

Fig. 2 is a rear elevation thereof with parts broken away;

Fig. 3 is a horizontal section on line 3—3 of Fig. 1.

Fig. 4 is a detail of a finder for orthodiagraphic work.

Fig. 5 is an elevation in detail of a fluoroscopic screen mounting.

Fig. 6 is a detailed section on line 6—6 of Fig. 5.

Fig. 7 is a view showing a convenient diaphragm construction;

Fig. 8 is a horizontal sectional view thereof on line 8—8 of Fig. 7.

Fig. 9 is a detail of the control arm construction;

Fig. 10 is a detail of the spark gap adjuster typifying a suitable tube-regulator.

The main frame 15 provides a platform 16 mounted on rollers 17 and carrying an upright back frame 18, composed of suitably braced side pieces 18^a connected at the top by cross bar 19. This back frame, on which the movable parts of the apparatus are mounted, is appropriately constructed as to size and strength for stability to carry all of the operating apparatus and is of height and width somewhat greater than the reasonable height and breadth of a person, so that the patient may comfortably stand (or be seated) on the platform in front of the back frame.

A second frame or slide frame 20, narrower than the main frame, is mounted to slide transversely on the latter. Such second frame may be an upright open panel, arranged just in rear of the upright back frame 18, with side members 20′ extending above the back frame and united by a horizontal head frame 21 and bottom brace 21′. This second frame as an entirety is supported and guided for lateral adjustment by mounting it on rollers 22 at its foot that engage a guide rail 23 on the main frame platform, and providing near its top horizontal guide rollers 24 that engage a rod 25 mounted at the top of the main frame and surrounded, at the supported ends of the said rod, with bumper springs 26.

The second frame carries, for vertical adjustment, the tube carriage 27, and as the container 28 for the X-ray tube itself is sturdy and rugged, it may be used as the principal member of the carriage.

The tube casing or container 28 is a receptacle of suitable size and shape, made of material impervious to X-rays, and mounted adjacent its upper and lower ends, on cross frame strips 29, that carry at their extremities grooved rollers 30 which run on vertical guide rails 31 secured to the side members of the second frame 20. Two cords 32 suitably attached to the sides of the tube-casing run over pulleys 33 carried by the head frame 21 and down to the counter-

weights 34 that slide vertically on guides 35 mounted on the guide members of the second frame. The counterweights balance the tube-container so that the latter may be moved vertically to any suitable height and will remain in adjusted position owing to the counterbalancing effect of the weights 34.

A fluoroscopic screen structure 37 is adjustably suspended from the front of the head 21, its carrying cords 38 running over pulley pairs 39 and 40 and down to counterweights 41 that are suitably guided for vertical movement with respect to, or for connection with, the counter-weights 34 of the tube container. Alinement of the arrows on the counter-weight 34 and the counterweight 41 indicate when the tube casing 27 and the screen 37 are in proper positions for most efficient operation. Specifically I prefer that counter-weights 41 be slidably mounted on the counter-weight 34 by providing in the counter-weight 34 the slots 43 and on the counter-weight 41 the rollers 44 engaging in said slots, the two counterweights on each side of the machine being adapted to be locked positively together by a screw 45. When the screen and tube casing have their counter-weights thus locked together they may be moved in unison up or down without changing their relative position, but either may be adjusted, individually, when the screw 45 has been released. Normally the fluoroscopic screen 37 may hang pendant, as shown in dotted lines in Fig. 1, so that the screen may be moved toward and from the patient's body, or laterally by the patient under the operator's directions, or by the operator, and may interfere as little as possible with the comfort of the patient or the actions of the operator. For certain purposes, as in orthodiagraphic work, it is important, however, that the location of the fluoroscopic screen be definitely fixed, and, therefore, I provide on the main frame vertical guide rods 140, removably positioned as by engagement at their lower ends in the sockets 141 of the base, 16, to be locked by set screw 142, and by engagement of the tubular upper end of each guide telescopically on a stud 143 carried by a suitable bracket 144, projecting from the back frame 18. The screen, as best shown in Figs. 3 and 5, is provided with guides to engage the rods 140, such guides comprising angles 145 and clamp screws 46 by which they may be secured to the vertical rods 140 in any desired position of adjustment. Metal plates 47 secured to the screen frame may serve as additional guides to rest against the rods 140 and maintain the vertical position of the screen, as well as acting as bases for the handles 47', and protection against needless exposure of the operator's hands in adjusting the screen. In order that a paper sheet may be laid upon the fluoroscopic screen for the purpose of making permanent record, spring clamps 48 are provided at the four corners of the screen to clip a suitable paper sheet against the exterior surface of the screen.

For protection of the operator and the patient from needless exposure to the X-rays, the main frame is substantially covered on its rear face with a metallic plate 50, of steel or other impervious material, except for an area 51 which is preferably overlain by a ray filter plate of aluminum. At its front the tube casing is provided with a diaphragm, adjustable as to area of opening, to regulate to a nicety the desired extent of exposure. As specifically shown the tube casing has an orifice 53, covered on the inside of the casing with a leather shield 54, and overlain exteriorly by the diaphragm casing 55.

The diaphragm structure shown, contained within the disk shaped casing 55 that has the central orifice 56, comprises two pairs of slide plates, 57—57 and 58—58, mounted to reciprocate at right angles to each other so as to control respectively the horizontal and the vertical extent of opening of the diaphragm, these pairs of plates being mounted respectively to slide in appropriately disposed guide ways 59, being actuated to effect their opening and closing movements by two annular cam plates 60—60', disposed between the opposite sides of the guide structure and the contiguous casing walls, guided in circular movement by suitable studs or pins 61 engaging arcuate slots 62 therein, and provided with camslots 63—63 engaging pins 64—64 carried by the respective slidable diaphragm members of the pair controlled by the respective cam plates. Thus, referring to Fig. 7, it will be apparent that as plate 60 is rocked back and forth within the range of movement allowed by the slot 62, the cam slot 63 and pins 64 will cause the two diaphragm shutters 57 to recede from or approach each other, like provision being made for the movement of the other pair of diaphragm members by kindred disposition of the operating parts. The two cam plates 60 and 60' have lever arms 65 and 65' extending therefrom through peripheral slots in the casing 55, and the adjustment controlling devices hereafter described are connected with these arms.

Also I prefer that there be detachably associated with the diaphragm structure a centering finder, in the form of a cross 66 made of flat impervious metal strips turned edgewise to the orifice 53, such cross being mounted so that its center corresponds with the center of the diaphragm opening. For suitably mounting the finder cross, as shown in Fig. 4, screws or pins 68 are secured in the front wall of the tube casing, the transverse

limb of the cross has its ends deflected to form a vertical flat piece 69, and these are notched to engage the pins. When the X-ray tube 70 is properly positioned in the casing, the center of the cross should accurately aline with the focus of the tube, and consequently, for orthodiagraphic work, such as indicating exactly the size of the heart or other internal organ, it is only necessary to secure the fluoroscopic screen in stationary position, disconnect its counterweights from the tube casing, and to shift the tube casing vertically in the second frame, or laterally with the second frame, until the black spot of shadow thrown by the center of the cross upon the screen has followed the outlines of the heart or other organ. An adequate series of points may thus be plotted by connecting which the outline of the heart may accurately be drawn, for this movement of the tube to make the black shadow spot of the cross register always with the margin of the heart outline insures that the diagram has been procured by the projection of parallel, rather than divergent, rays.

In the employment of the X-ray tube 70, it is usually desirable to utilize some regulating means, generally within the tube casing. Various expedients for tube regulation, involving the operation of a mechanically moving part, are well known, that herein shown being selected merely as one type of several that may be employed, and comprising a spark gap regulator 72 having a fixed terminal 73 and a sliding terminal 74, controlled by a retractile spring 75 and an operating cord 76, the terminals, of course, being connected in suitable fashion with the X-ray tube.

I provide means whereby all of the adjustment of the apparatus normally requisite while the tube is in operation, may be effected by the operator from a single control point, while the operator is standing in a position protected from the influence of the X-ray, and if desired, is working with one hand only.

To these ends I mount upon the tube casing, to move therewith, a control stand 80. This control stand is shown as a tripod frame, the limbs 81, 82 and 83 of which are connected with the tube casing 28, such frame carrying suitable handles or levers by which the frame and consequently the tube casing may be bodily moved to any position of adjustment, and by which the diaphragm opening may be regulated as to either dimension. Specifically 85 indicates a bracket carried by the tripod and suitably secured thereto affording adequate bearing for the concentric shafts 86 and 87 that respectively carry the handle or levers 88 and 89 in convenient position to one side of and in front of the back frame, so that such handles or their shafts may be conveniently grasped by the operator to move the tube casing in desired adjusted position. The two shafts 86 and 87 are suitably connected as by cranks 90—90′ and pivoted levers 91—91′ bearing pins 92—92′, with appropriate slots made in the arms 65—65′ of the diaphragm slide controlling annuli, the connections being preferably such that as both shafts are similarly rocked by movement of both handles 88 and 89 in unison, the two pairs of diaphragm shutters move accordantly toward open or closed position. Also the control stand is preferably provided with a pull knob 94 connected with the control cord 76 for the tube regulator.

It will be apparent that the operator standing beside the platform 16 may, with his left hand, control all of the instrumentalities necessary for varying the adjustment of the diaphragm or the position of the tube frame, or the condition of the tube, without exposing himself to the action of the rays, and leaving his right hand free to work on the patient or make an orthodiagraphic tracing or otherwise.

While I have herein described in some detail a particular embodiment of my invention it will be apparent to those skilled in the art that numerous changes might be made without departure from the spirit of my invention and within the scope of the appended claims.

Having described my invention, what I claim is:

1. In a roentgenoscope, the combination with the main frame, providing a vertical, impenetrable screen with a penetrable midportion, and a tube carrying casing mounted on said frame for vertical and lateral adjustment and provided with an adjustable diaphragm, of a control stand carried by said casing and moving therewith, said stand projecting laterally beyond the main frame, and a diaphragm controlling lever carried by said control stand and projecting forwardly beyond the main frame.

2. In a roentgenoscope, the combination with the main frame, providing a platform and a vertical impenetrable shield having a central penetrable area, a transversely sliding second frame having a head above the main frame, a vertically adjustable tube containing casing carried by said second frame and provided with an adjustable diaphragm, and a fluoroscopic screen suspended from the head frame and vertically movable with respect thereto; of a control stand carried by and movable with the tube casing, extending laterally beyond the main frame, a diaphragm controlling rock shaft carried by the extremity of said control stand and extending forwardly beyond the main frame, and an operating lever carried by said rock shaft, said lever being accessible to an oper-

ator in front of the main frame and being bodily movable to permit adjustment of the tube containing casing and pivotally movable for adjustment of the diaphragm opening.

3. In a roentgenoscope, the combination of a main frame, a second frame transversely movable thereon, a tube casing and a fluoroscopic screen both carried by the second frame and vertically adjustable thereon, counterweights for said casing and fluoroscope independently slidable on the second frame, and means for interconnecting said counterweights for movement in unison.

4. In a roentgenoscope, the combination of a main frame, a second frame transversely movable thereon, a tube casing vertically movable in the second frame, a fluoroscopic screen, and means flexibly suspending said fluoroscopic screen and connecting it with the tube casing for vertical and transverse movement harmoniously with the tube casing.

5. In a roentgenoscope, the combination of a main frame, a second frame transversely movable thereon, a tube casing vertically movable in the second frame, a fluoroscopic screen, means for connecting said screen for movement in unison with the tube casing, and means for anchoring said screen against movement.

6. In a roentgenoscope, the combination of a main frame, a second frame transversely movable thereon, a tube casing and a fluoroscopic screen both carried by the second frame and vertically adjustable thereon, and counter-weights for said casing and fluoroscopic screen independently slidable on the second frame.

7. In a roentgenoscope, the combination of a main frame, a second frame transversely movable thereon, a tube casing and a fluoroscopic screen both carried by the second frame and vertically adjustable thereon, a counter-weight for the fluoroscopic screen, a counter-weight for the casing, one of said counter-weights being slidably guided on the second frame and the other counter-weight being slidably guided on the first counter-weight and means for interconnecting said counter-weights for movement in unison.

8. In a roentgenoscope, the combination of a main frame, a second frame transversely movable thereon, a tube casing movable in the second frame at right angles to the direction of second frame movement, a fluoroscopic screen, and means flexibly suspending said fluoroscopic screen and connecting it with the tube casing for universal movement harmoniously with the movement of the tube casing.

9. In a roentgenoscope, the combination with a frame; a counter-balanced movable tube casing; a counter-balanced movable screen supported on said frame; said casing and screen movable independently of each other; and indicating means to show when the casing and screen are locked in correct positions.

10. In a roentgenoscope, a main frame; a second frame movably supported thereon; a tube casing mounted on said second frame; a diaphragm on said tube casing containing a plurality of independently operable shutter elements; means for counterbalancing said tube casing; a guide-way; a fluorescent screen mounted on said guide-way and adjustable thereon; means for counterbalancing said screen; a control stand carried by said tube casing and means on said control stand for operating said shutter elements.

11. In a roentgenoscope, a main frame; a second frame movably supported thereon; a tube casing mounted on said second frame; a diaphragm on said tube casing containing a plurality of independently operable shutter elements; means for counterbalancing said tube casing; a guide-way; a fluorescent screen mounted on said guide-way and adjustable thereon; means for counterbalancing said screen; a control stand carried by said tube casing and arranged to serve as means for moving said tube casing and means on said control stand for independently operating said shutter elements.

12. In a roentgenoscope, a main frame; a second frame movably supported thereon; a tube casing mounted on said second frame; a diaphragm on said tube casing containing a plurality of independently operable shutter elements; means for counterbalancing said tube casing; a guide-way; a fluorescent screen mounted on said guide-way and adjustable thereon; means for counterbalancing said screen; a control stand carried by said tube casing and arranged to serve as means for moving said tube casing independently of said screen and means on said control stand for independently operating said shutter elements.

In testimony whereof I hereunto set my hand in the presence of two subscribing witnesses.

THEODORE B. McCLINTOCK.

In the presence of—
STANLEY W. COOK,
MARY F. ALLEN.