Dec. 14, 1948. B. F. WEHMER 2,456,096

X-RAY EQUIPMENT

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Fig. 1

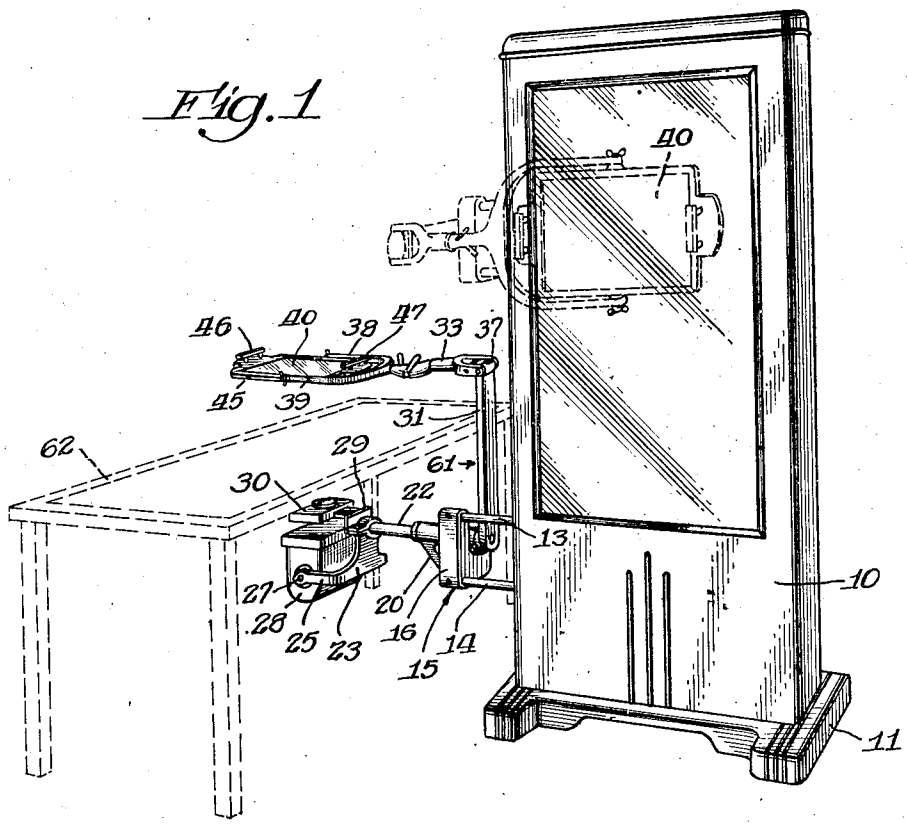
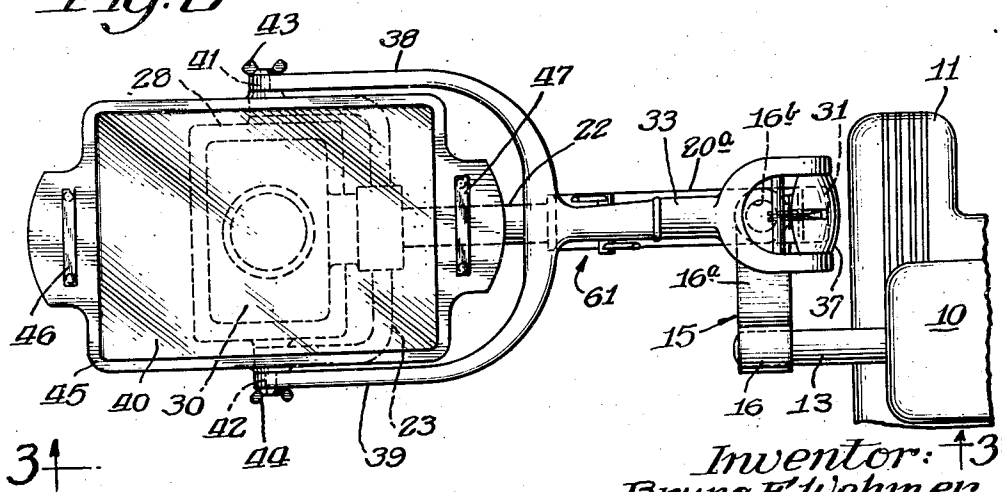


Fig. 2



Inventor:
Bruno F. Wehmer
By Albert G. McCabe
Atty.

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X-RAY EQUIPMENT

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Fig. 3

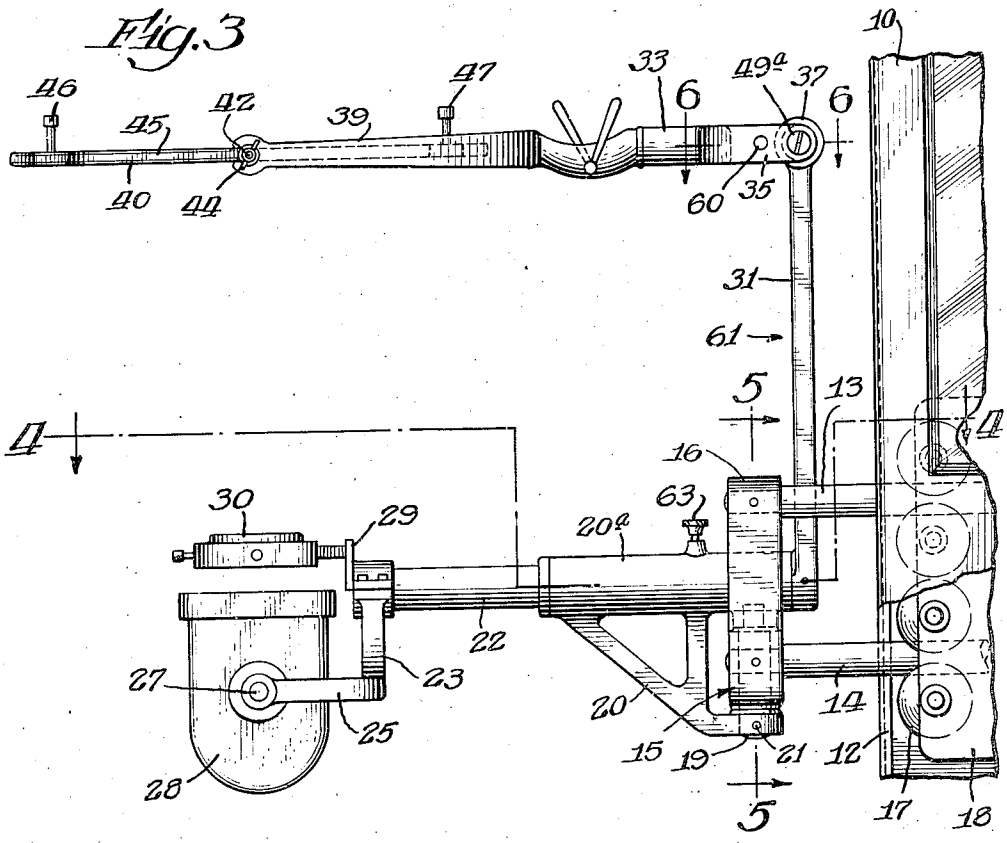


Fig. 4

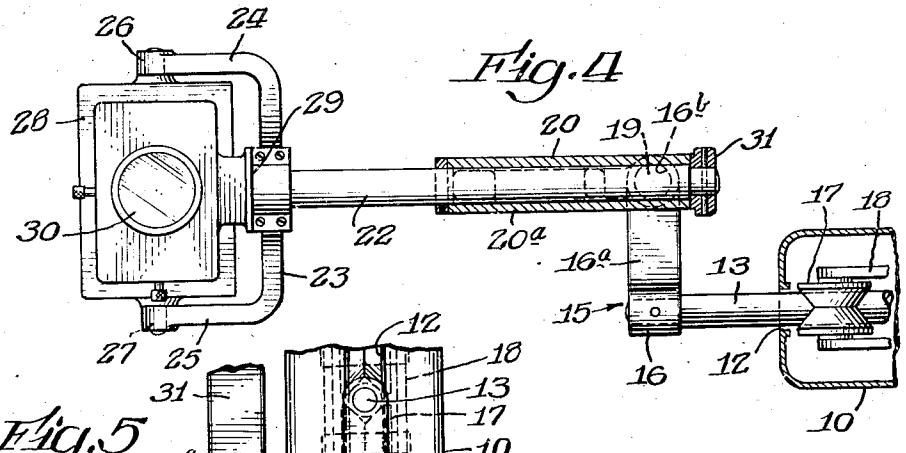
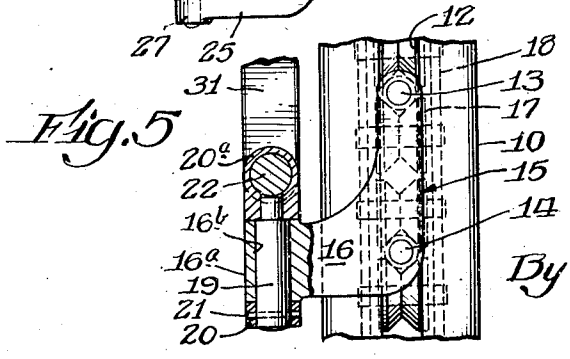


Fig. 5



Inventor:
Bruno F. Wehmer
By Albert H. McCaleb
Atty.

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X-RAY EQUIPMENT

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Fig. 6

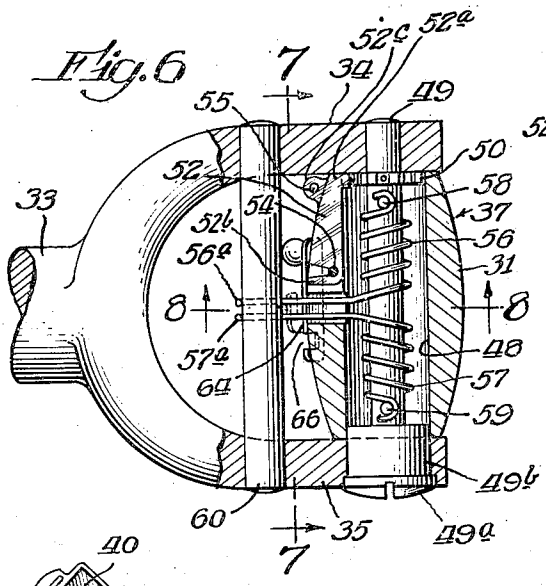


Fig. 7

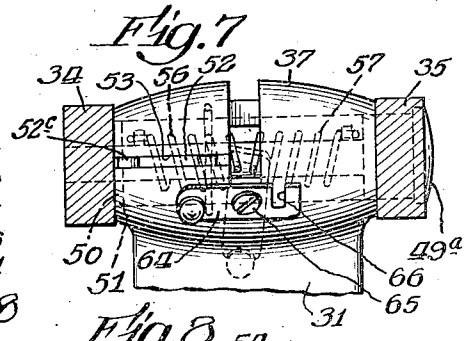


Fig. 8

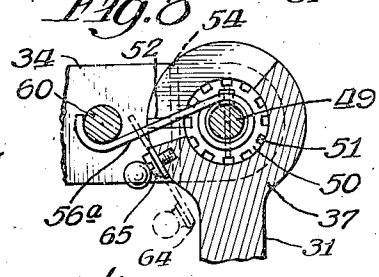


Fig. 11

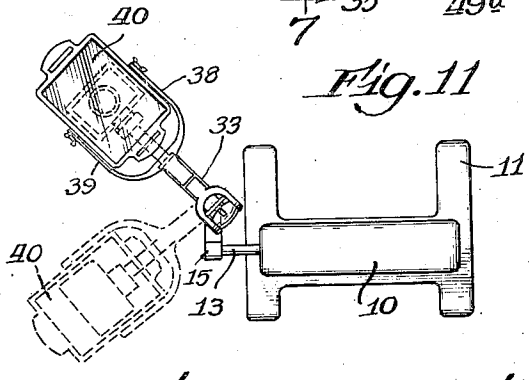


Fig. 9

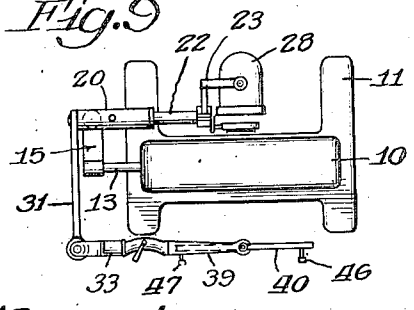


Fig. 12

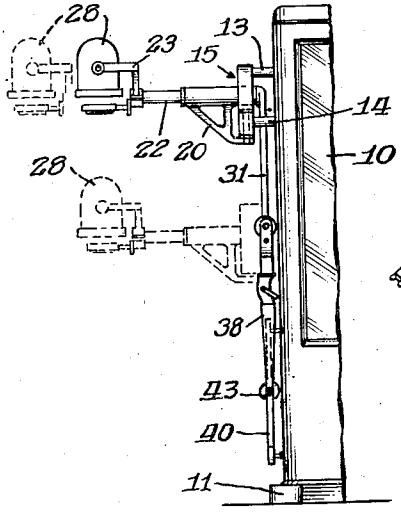


Fig. 13

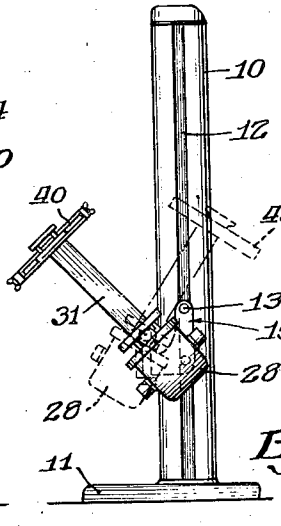
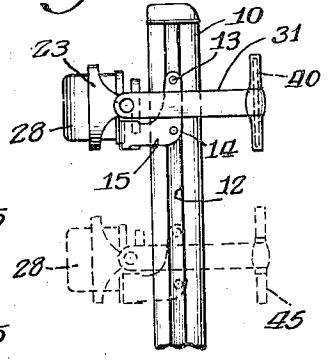


Fig. 10



Inventor:
Bruno F. Wehmer
By Albert D. McCosh
Atty.

Patented Dec. 14, 1948 2,456,096

UNITED STATES PATENT OFFICE

2,456,096

X-RAY EQUIPMENT

Bruno F. Wehmer, Melrose Park, Ill., assignor to The Wm. Meyer Company, Chicago, Ill., a corporation of Illinois

Application September 26, 1946, Serial No. 699,533

4 Claims. (Cl. 250—58)

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This invention relates to X-ray equipment and, more particularly, equipment adapted for both radiographic work and the making of fluoroscopic examinations, especially of human subjects.

Among the objects of my invention is to provide in a single unit, which, in general, includes an X-ray tube, facilities which enable a physician or X-ray technician quickly to adapt the unit for the making of fluoroscopic examinations while the patient is either sitting, standing, or lying down on a table, as the case may be, and which also enables the unit quickly and easily to be adapted for the making of radiographs, with the patient prone or supine, the underlying purpose being to economize on operating time and also on equipment cost by providing a relatively inexpensive single unit which will meet all the ordinary variant requirements of an office or laboratory where the volume of business is not so large as to demand separate equipment for each individual type of work.

Another object is to expedite fluoroscopic examinations of patients by making it unnecessary for the operator to separately re-position the X-ray tube each time the placement of the fluoroscopic screen is varied.

Other objects will be pointed out as the detailed description progresses.

The present invention provides a unit comprising an X-ray tube and a fluoroscopic screen, together with supporting structure for the tube and screen which is operative in such manner that the tube and screen move in unison, so that whenever the screen is moved by the operator in scanning the subject, either in the vertical plane or the horizontal plane, the tube follows, and is, consequently, at all times in alignment with the screen, requiring no separate positional adjustment. Thus, in making fluoroscopic examinations, the operator has only to move the fluorescent screen vertically or horizontally, as the case may be, in scanning the patient's body, and is not required to make separate positional adjustments of the tube each time the screen is moved to another area.

Another feature believed to be broadly novel consists in the provision of a supporting structure for the tube and screen which not only keeps those two elements in alignment, as above indicated, but is adjustable in such manner as to enable the tube and screen to be co-related for the fluoroscopic examination of sitting or standing patients and, alternatively, for the fluoroscopic examination of patients lying prone or supine on a table, and which, in the one case,

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enables up and down movements of the screen and tube in unison, while, in the alternative case, enabling unified movements of those elements in the horizontal plane.

In the drawings which accompany this specification:

Fig. 1 is a perspective view of a complete unit adjusted for fluoroscopic examination of a patient lying on a table;

Fig. 2 is an enlarged fragmentary plan view showing the fluoroscopic screen and X-ray tube housing in the same positional adjustment as in Fig. 1;

Fig. 3 is an elevational view taken at 3—3 of Fig. 2 and shows the X-ray tube and fluoroscopic screen in position for making a fluoroscopic examination of a patient lying on a table;

Fig. 4 is a view, partly in section, taken along line 4—4 of Fig. 3;

Fig. 5 is a detail view, partially in section, taken at line 5—5 of Fig. 3;

Fig. 6 is a detail of the hinge interconnecting the screen arm with the radius rod;

Fig. 7 is a sectional view taken at 7—7 of Fig. 6;

Fig. 8 is a sectional view taken at 8—8 of Fig. 6;

Fig. 9 is a plan view of the entire unit, showing the X-ray tube and fluoroscopic screen in position for examining a sitting or standing patient;

Fig. 10 is a side elevation of the unit with the X-ray tube and screen positioned as in Fig. 9 and illustrating the unified vertical movement of those elements;

Fig. 11 is a plan view of the unit with the X-ray tube and screen in the same setting as depicted in Figs. 1 to 4, inclusive, and illustrating how those two elements can be swung in unison through an arc about a vertical axis;

Fig. 12 is an elevational view showing how the X-ray tube can be inverted for making radiographs without interference from the fluorescent screen; and

Fig. 13 is an edgewise elevation showing how the X-ray tube and screen can be tilted in unison when adjusted for making fluoroscopic examinations of a patient.

Referring first to Fig. 1, the unit there shown in perspective includes a pedestal 10 having a base 11, and is adapted to stand on a floor in upright posture, as depicted. Said pedestal is built up of appropriate structural steel shapes and preferably has a sheet metal covering of attractive design which serves to conceal certain

mechanism which is housed within the pedestal.

Along one edge of pedestal 10 is a vertical slot 12 (see Figs. 3 and 4) leading to the interior of the pedestal, and through said slot there extends a pair of parallel horizontal bars 13 and 14 constituting component parts of a carriage 15, which carriage includes a bracket 16 serving to hold one end of the bars 13 and 14 fixedly in spaced parallel relation, as shown.

Bars 13 and 14 are supported interiorly of the pedestal on rollers 17 (see Figs. 3 and 4) by virtue of which fact carriage 15 is bodily movable horizontally, rollers 17 serving as guiding carriers for said bars. Rollers 17, of which there are a total of eight (four only being shown in Fig. 3) are rotatably mounted on a carrier 18 disposed inside the pedestal, said carrier being movable up and down under control of the operator and balanced by a suitable counterweight, not shown, which retains the carrier, together with carriage 15, at any vertical position to which it may be set.

Because the mechanism inside the pedestal is well known in the art, it is not thought necessary to illustrate that part of the unit in greater detail.

As depicted most clearly in Figs. 3 to 5, inclusive, bracket 16 is a casting having a horizontally projecting leg 16*a* (Fig. 5) extending perpendicularly to bars 13 and 14. The bracket 16 has a vertical bore 16*b* in which is rotatably journaled a pin 19, the upper and lower ends of which engage a casting 20, the lower end of said pin being secured to said casting by a smaller pin 21.

The upper portion 20*a* of casting 20 is bored horizontally to provide a bearing in which is journaled a horizontal shaft 22.

To the outer end of shaft 22 is secured a casting 23 having a pair of arms 24, 25 between which is suspended on trunnions at 26 and 27 a housing 28 in which is mounted an X-ray tube, together with a high voltage transformer. Neither the transformer nor the X-ray tube is shown, but, as viewed in Figs. 1 and 3, the tube is so oriented that the X-ray beam is projected upwardly.

Attached to casting 23 is a bracket 29 which supports a shutter 30 having an aperture of variable size for confining the projected X-ray beam to a desired area.

Fixedly connected to shaft 22 at the end thereof remote from housing 28 is an elongated member 31 which is herein defined as a radius rod and which extends perpendicularly to shaft 22.

An arm 33, bifurcated at one end to form a pair of complementary legs 34, 35 (see Fig. 6) is pivotally connected at 37 to the free end of radius rod 31, and is also bifurcated at the other end to form an additional pair of complementary legs 38, 39, between which is pivotally suspended a fluoroscopic screen 40, mounted on trunnions 41, 42 which are threaded to receive wing nuts 43, 44 by which the screen may be locked in any adjusted rotational position.

Screen 40 comprises a glass plate coated with a phosphor which fluoresces in response to X-rays and is mounted in a frame 45 which is provided with handles 46, 47 by which the operator swings the screen, as desired, about its trunnions 41, 42 and performs other screen manipulations as hereinafter described.

The pivotal connection 37 joining radius rod 31 and legs 34, 35 of arm 33 is shown in detail in Figs. 6 to 8, inclusive. The free end of said radius rod is provided with a bore 48 through which passes a pintle 49 having a running fit in each of legs 34 and 35 and provided with a screw-slotted head 49*a* which has a reduced diameter at 49*b* having a running fit in the end of bore 48.

A disc 50 is keyed to pintle 49 and is provided with a series of equally spaced rectangular peripheral notches 51. The outside diameter of said disc has a running fit in bore 48.

A detent 52 consisting of a flat strip of spring steel is fitted in a slot 53 (Fig. 7) and pivotally anchored on a screw 54 in radius rod 37. Said detent has a tooth 52*a* (Fig. 6) designed to engage any one of notches 51 with which it happens to register and serves, when so engaged, to restrain disc 50 and pintle 49 against rotation. The end of detent 52 adjacent pin 54 is slotted to form a resilient tail piece 52*b* (Fig. 6) which bears against the surface defining one end of slot 53, thus yieldably but firmly holding detent 52 in locking engagement with disc 50. Said detent is also provided with a lug 52*c* having an eye 55 for engagement by a hooked tool by which the detent can be forced out of engagement with disc 50, thus enabling said disc and pintle 49 to be rotated by a screw driver.

A pair of coil springs 56 and 57 embrace pintle 49 within bore 48 and are each anchored at one end by pins 58 and 59. The unanchored end of each spring is bent to form an arm 56*a*, 57*a* which extends laterally of the pintle through a slot cut in radius rod 37 to engage a cross pin 60 interconnecting legs 34 and 35. The function of springs 56, 57 is to counterbalance the weight of arm 33 and the fluoroscopic screen carried thereby when the unit is adjusted as shown in Figs. 1 and 3. In order to achieve an accurate balance, it is necessary to suitably tension springs 56 and 57. This is accomplished by withdrawing detent 52 from locking engagement with disc 50 and then turning pintle 49 with a screw driver. When the correct tension is obtained, the detent is released, whereupon the pintle is locked against further rotation.

Shaft 22, together with radius rod 31 and arm 33, form, conjointly, what is herein termed a yoke, identified as a whole by reference numeral 61, and said assemblage is so designated because it serves to maintain a fixed relationship between the X-ray tube and the fluoroscopic screen, except as modified by rotation of arm 33 about the pivotal joint 37.

As exhibited in Figs. 1 and 3, the X-ray tube and screen are positioned for making a fluoroscopic examination of a patient lying on a table 62; and it will be apparent that in the course of such an examination the tube and screen can be moved in unison in a horizontal arc by rotating yoke 61 together with casting 20 about pin 19 as a center. And it also will be apparent that yoke 61 can be rotated bodily in bearing 20*a* about the axial center of shaft 22, thus tilting the X-ray tube with its housing 28, and at the same time revolving screen 40 so as to maintain said screen in operative alignment with the X-ray beam.

By rotating yoke 61 about the center of shaft 22 through an angle of 180 degrees from the position in which it is shown in Fig. 3, the X-ray tube may be inverted, as shown in Fig. 12, and arm 33 may be turned down about its pivotal center, as shown in that figure, thus positioning the X-ray tube for radiographing a patient lying on the table. It is not necessary for this purpose that the screen be turned down, as shown in Fig. 12, unless it is desired to raise the X-ray tube to such an elevation that the screen would

interfere with the table. In making radiographs of a patient lying on the table, the tube can be swung through an arcuate horizontal path, as illustrated in Fig. 11.

When it is intended to make fluoroscopic examinations of a patient in standing or sitting posture, the patient is placed immediately in front of pedestal 10, with the X-ray tube positioned at the rear of the pedestal and the fluoroscopic screen in front of the patient and on the side of the pedestal opposite the tube, as depicted in Figs. 9 and 10. Transition of the tube and screen from the positions thereof illustrated in Fig. 3 to those of Figs. 9 and 10 is accomplished by first raising carriage 15 to its uppermost level, together with the yoke, tube and screen, then rotating the yoke clockwise, as viewed in Fig. 2, through an angle of 180 degrees about its vertical axis (pin 19), and thereafter rotating the yoke about the axis of shaft 22 in the clockwise direction, as viewed in Fig. 10.

Yoke 61 can be locked against rotation about the axis of shaft 22 in any of several positions by an index pin 63 which is operative to engage any one of several appropriately positioned index holes in shaft 22.

With the tube and screen positioned as shown in Figs. 9 and 10, the operator can move the screen both vertically and horizontally for the purpose of examining different areas of the patient's body; and in doing so he simultaneously moves carriage 15 and yoke 61 and thus effects a corresponding movement of the X-ray tube, so that the latter remains at all times in operative alignment with the screen. Handles 46 and 47 are gripped by the operator when thus manipulating the screen.

Springs 56 and 57 are useful for counterbalancing arm 33 only when the yoke is positioned as per Fig. 3. When, on the other hand, the unit is adjusted as per Figs. 9 and 10, said springs serve no purpose and must be restrained against acting on arm 33, because they would operate to swing said arm into alignment with radius rod 31 which obviously is not desirable. For the purpose of restraining said springs, while at the same time leaving arm 33 free for rotation by the operator about the pivotal center 37, there is provided a manually operable latch 64, pivotally secured by a screw 65 to radius rod 37 and having a notch 66 which is adapted to engage the two spring arms 56*a* and 57*a* and hold them in retracted position.

While I have shown, for purposes of illustration, what I now regard as the preferred embodiment of my invention, it is to be understood that the scope of the invention is not limited otherwise than as defined by the terms of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. X-ray equipment comprising an upright pedestal, a carriage, means forming a part of said pedestal for supporting said carriage, said means enabling up and down bodily movements of said carriage under control of the operator, said carriage being also bodily movable horizontally relative to said pedestal under control of the operator, a bearing supported by said carriage exteriorly of said pedestal and pivoted for rotation in a horizontal plane, said bearing having a horizontal bore, a yoke including a shaft journaled in said bore and a radius rod connected at one end to said shaft and extending perpendicularly thereto, an arm connected to the other end of said radius rod for swinging movement in a plane passing through the radius rod, an X-ray tube carried by said shaft and rotatable therewith, and a fluoroscopic screen carried by said arm, said yoke being effective to hold said screen and tube in cooperative alignment, the rotatability of said yoke permitting said screen and tube to be positioned in alignment at opposite sides of said pedestal and, alternatively, to be positioned in alignment at one side of said pedestal.

2. X-ray equipment comprising an upright pedestal, a carriage, means forming a part of said pedestal for supporting said carriage, said means enabling up and down bodily movements of said carriage under control of the operator, a bracket forming a part of said carriage and located exteriorly of said pedestal, a bearing block pivotally mounted on said bracket for rotation in a horizontal plane, said bearing block having a horizontal bearing bore therein, a yoke including a shaft journaled in said bearing bore, said yoke also including a radius rod connected at one end to said shaft and extending perpendicularly thereto and an arm having one end connected to said radius rod remotely from said shaft, an X-ray tube connected to one extremity of said yoke and carried thereby, and a fluoroscopic screen connected to the other extremity of said yoke and carried thereby, said yoke being bodily rotatable in a vertical plane in said bearing bore and bodily rotatable with said bearing block in a horizontal plane.

3. X-ray equipment comprising an upright pedestal, a carriage comprising a pair of parallel laterally spaced bars and a bracket attached to said bars and carried thereby exteriorly of said pedestal, a carrier supporting said carriage and supported by said pedestal, said carrier being movable vertically to raise and lower said carriage, said carriage being movable horizontally on said carrier, a bearing pivotally mounted on said bracket for rotation in a horizontal plane, said bearing having a horizontal bore, a yoke including a shaft journaled in said bore, said yoke also including a radius rod connected at one end to said shaft and extending perpendicularly thereto, and an arm having one end connected at one end to said radius rod remotely from said shaft and for swinging movement in a plane passing through the radius rod, an X-ray tube connected to one extremity of said yoke and carried thereby, and a fluoroscopic screen connected to the other extremity of said yoke and carried thereby, said yoke being bodily rotatable in a vertical plane in said bearing and bodily rotatable with said bearing in a horizontal plane.

4. X-ray equipment comprising an upright pedestal, a carriage, means forming a part of said pedestal for supporting said carriage, said means enabling up and down movements of said carriage under control of the operator, a bearing block supported by said carriage exteriorly of said pedestal and pivoted for rotation in a horizontal plane relative to said carriage, said bearing block having a horizontal bearing bore therein, a yoke including a shaft journaled in said bearing bore and a radius rod connected at one end to said shaft and extending perpendicularly thereto, index means for locking said shaft in a plurality of rotational positions, selectively and individually, an arm connected to the other end of said radius rod for swinging movement in a plane passing through the radius rod, said arm

being rotatable in a vertical plane when an X-ray tube carried by said shaft and rotatable therewith, a fluoroscopic screen carried by said arm, said yoke being effective to hold said screen and tube in cooperative alignment in a direction passing through the screen and tube, the rotatability of said yoke permitting said screen and tube to be positioned in alignment at opposite sides of said pedestal and, alternatively, to be positioned in alignment at one side of said pedestal, the pivotal connection between said arm and radius rod including a pintle, a coil spring embracing said pintle and anchored thereto at one end, the other end of said spring engaging said arm, said spring being effective to counterbalance the weight of said arm when said radius rod is vertical, said pintle being rotatable for varying the torsion of said spring, means for releasably locking said pintle against rotation, and a manually operable latch for restraining the action of said spring

on said arm whereby to inhibit such action when said radius rod is horizontal.

BRUNO F. WEHMER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,594,171	Grobe	July 27, 1926
2,151,877	Walker	Mar. 28, 1939
2,232,014	Simon	Feb. 18, 1941
2,259,036	Goldfield et al.	Oct. 14, 1941
2,311,581	Simmon	Feb. 16, 1943

FOREIGN PATENTS

Number	Country	Date
473,824	Great Britain	Oct. 20, 1937

Certificate of Correction

Patent No. 2,456,096. December 14, 1948.

BRUNO F. WEHMER

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 6, line 75, and column 7, line 1, claim 4, strike out the words "said arm being rotatable in a vertical plane when";

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of April, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.