March 3, 1953 T. VLADEFF 2,630,536

SCREEN FOR CONTROL OF ROENTGENOGRAPHIC EXPOSURES

Filed Nov. 16, 1949 2 SHEETS—SHEET 1

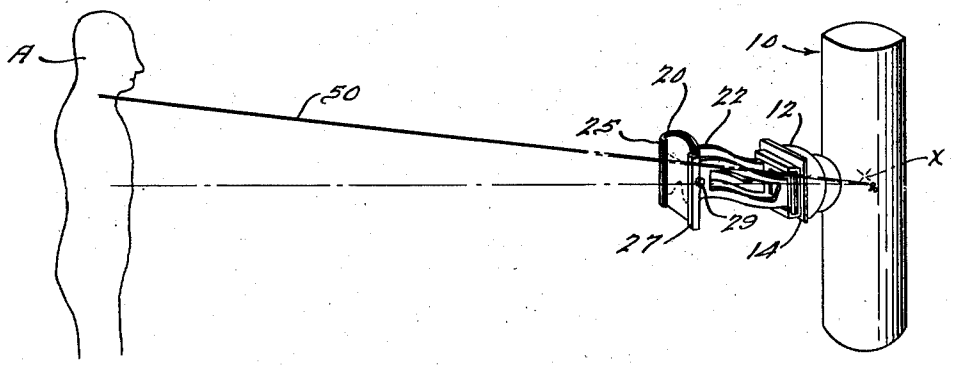


FIG. 1.

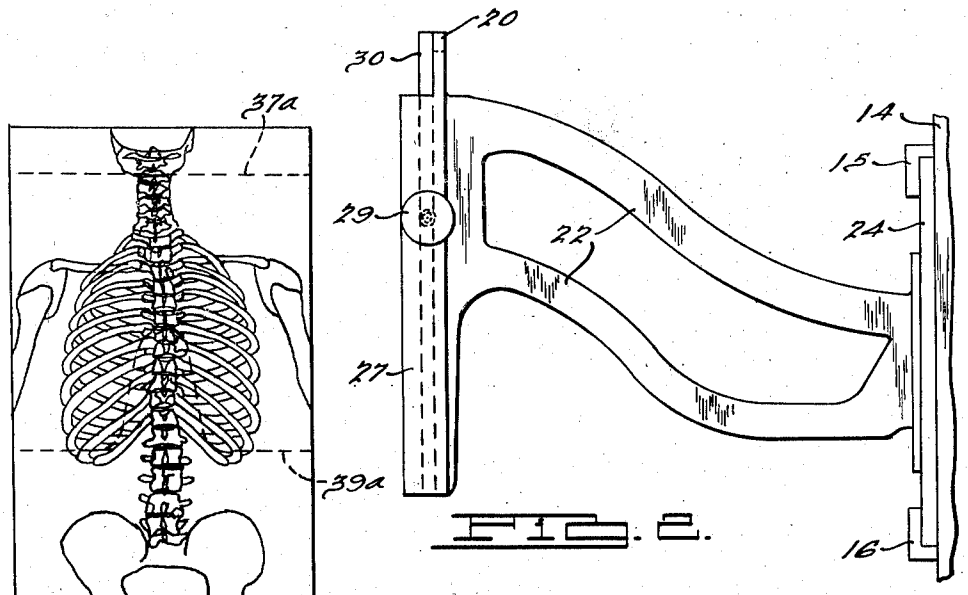


FIG. 2.

FIG. 3.

INVENTOR.
Theodore Vladeff.
BY
Harness, Dickey & Pierce.
ATTORNEYS.

March 3, 1953 T. VLADEFF 2,630,536

SCREEN FOR CONTROL OF ROENTGENOGRAPHIC EXPOSURES

Filed Nov. 16, 1949 2 SHEETS—SHEET 2

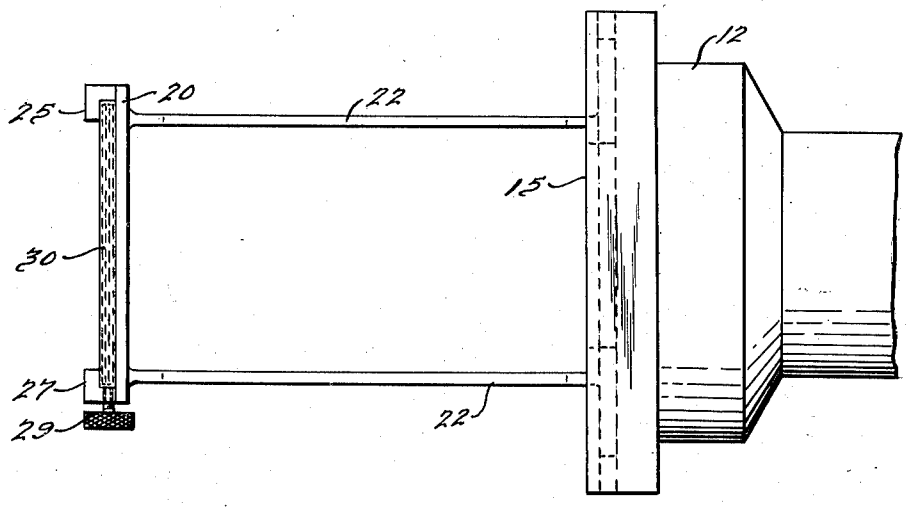


Fig. 3.

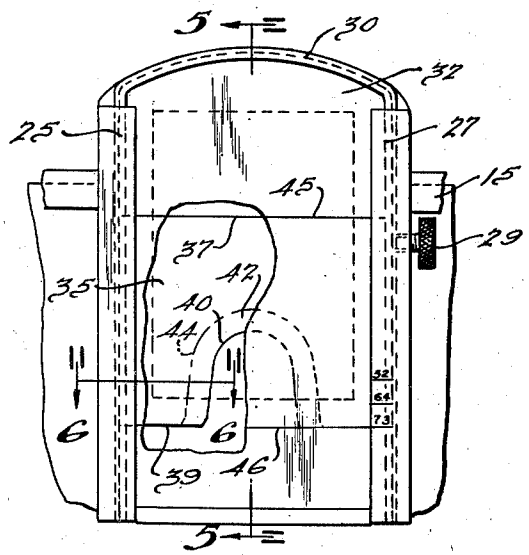


Fig. 4.

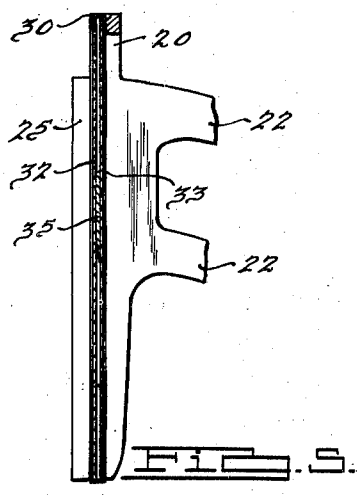
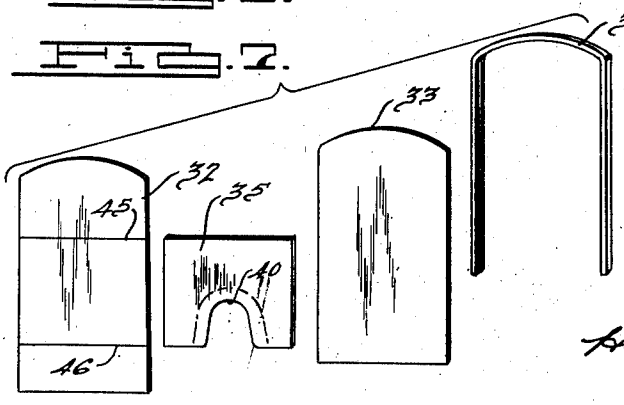


Fig. 5.

Fig. 7.



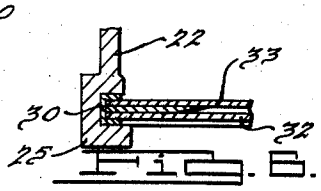


Fig. 6.

INVENTOR.
Theodore Vladeff.
BY
Harness, Dickey & Pierce.
ATTORNEYS.

Patented Mar. 3, 1953

2,630,536

UNITED STATES PATENT OFFICE

2,630,536

SCREEN FOR CONTROL OF ROENTGENOGRAPHIC EXPOSURES

Theodore Vladeff, Detroit, Mich.

Application November 16, 1949, Serial No. 127,575

2 Claims. (Cl. 250—86)

1

This invention relates to methods and devices for controlling roentgenographic exposures, having as its primary object the provision of improved means whereby radiographs of parts varying widely in penetrability to X-rays may be taken upon a single plate or film and with a single exposure, without over-exposure or under-exposure of parts of varying penetrability.

Another object is to provide such a method and means for controlling roentgenographic exposures which is especially suitable for use in making radiographs of the human body and which is effective to prevent both under-exposure and over-exposure in the making of radiographs of patients who may vary widely in size, no complicated adjustments being required in order to adapt my improved screening means to patients of varying size.

Still another object is to provide an improved screening device and method which is readily adaptable to and usable with existing X-ray equipment without requiring structural changes or modification of such equipment, and which permits wide variation of the distance between the X-ray tube and the patient without diminishing the effectiveness of its selective screening action.

Further objects include the provision of a screening device which is adapted to be readily installed upon and removed from X-ray machines of standardized construction and which permits easy substitution of screens of various types.

Other objects and advantages of the invention will become apparent upon consideration of the present disclosure in its entirety.

In the drawing:

Figure 1 is a somewhat diagrammatic view, partly in perspective, showing screening mechanism constructed in accordance with the present invention associated with X-ray generating means;

Fig. 2 is a side elevational view of my improved screening device;

Fig. 3 is a plan view thereof;

Fig. 4 is a front elevational view partly broken away;

Fig. 5 is a vertical sectional view taken substantially on the line 5—5 of Fig. 4 and looking in the direction of the arrows;

Fig. 6 is a horizontal sectional view taken substantially on the line 6—6 of Fig. 4 and looking in the direction of the arrows;

Fig. 7 is an exploded perspective view showing important components of the screen and holder assembly; and

Fig. 8 is a diagrammatic projected outline of a portion of a human skeleton showing the boundaries between the portions thereof which would correspond to shielded and unshielded

2

areas during the making of a roentgenographic exposure with the aid of my improved screening means.

Referring now to the drawings, reference character 10 designates generally a casing intended to represent the head of an X-ray machine, comprising the portion which contains the X-ray tube (not shown). The radiation from the tube is directed outwardly toward the patient at A through an orificed or tubular boss 12 formed upon the side of the casing 10. Fixed to the outer end of the boss 12 is a supporting frame 14 provided with fixed horizontal guides 15, 16 arranged above and below the opening in the boss through which the radiation is projected. Such guides are commonly provided upon such X-ray projection head casings to support screening devices of currently used types, which are ordinarily in the form of flat plates which are simply slid into the guides.

In the taking of X-ray photographs of the full length of the spine, it is common to have the patient stand in front of a vertical film carrier (not shown), with the projection head of the X-ray machine positioned from four to six feet distant. Such X-ray pictures of the entire trunk portion of the body are difficult to take without over-exposure and/or under-exposure of parts of the subject, because the upper and outer portions of the trunk of the body, including the areas of the lungs and ribs, are much more easily penetrable by X-rays than the lower areas where the bone structures are much heavier. Thus, if a single uniform exposure is made, the lower parts will be under-exposed, and/or the upper parts over-exposed. Attempts have been made to utilize screening devices such as pieces of cut-out aluminum placed in the guides 15, 16, but due to the relatively great distance between the tube and subject, accurate alignment between the lines defined by the contours of the screen and the parts of the body of the subject are difficult to maintain, and standardized screens cannot be used, because even if proper registry is obtained for one patient, it will not be satisfactory for another patient. Such screens of the types mounted in guides as 15, 16 on the head are not adjustable vertically, so that differences in the height of patients would throw such screens far out of position even if they could be made to conform to different patients in other respects, which cannot as a practical matter be done, as previously noted.

My improved screening means comprises a supplemental screen carrier in the form of a flat frame 20, supported by extension arms 22 in a position substantially outspaced from the head 10 and in substantially coaxial alignment with the frame 14, the common axis being considered as the central axis of the pencil of rays from the

tube, and such axis being indicated at 23. The arms 22 are positioned to lie outside the rays projected from the tube and are rigidly attached to a supporting frame 24 proportioned to slide easily into and be supported by the guides 15, 16. The frame 20 is provided at its side edges with vertical overhanging guide portions 25, 27.

Interchangeable screen assemblies are adapted to be supported in the frame 20 and are adjustably movable in all directions, due to the fact that the screen may be slid laterally by moving the supporting frame 24 in the ways 15, 16, and may be moved vertically by sliding the screen assembly up and down in the guides 25, 27. A thumb screw 29 is provided to releasably clamp the screen assembly against displacement, extending through the side of the guide portion 27.

The screen assembly consists of a panel-retaining frame 30 of inverted U-section and of inwardly opening channeled cross section, as best shown in Fig. 7, and which holds a pair of panels 32, 33 formed of relatively stiff thin plastic or other suitable material which is easily penetrable by X-rays. Held by and between the panels 32, 33 is a screening layer 35 which may comprise relatively thin but dense material resistant to X-rays, such as a putty-like plastic loaded with barium or the like.

Sheet metal may be used rather than a plastic screening layer, but I prefer an easily moldable, soft plastic of synthetic character such as a resin of the poly-sulfide type because it can conveniently be shaped and tapered in thickness to vary its penetrability.

In the preferred screen construction shown, the screening layer is formed with a straight transverse top edge 37. The lower edge portion 39 is also straight and transverse, but is partially cut away in a central region, or greatly reduced in thickness in such region, which is designated 40 in Fig. 4, the relieved area extending upwardly and being joined to the remainder of the screening material by a tapered section 42 of graduated thickness, such graduated or tapered section being of inverted U-shape and bounding the cut-out area 40. The outer margin of the tapered area is denoted by the broken line 44, and the remainder of the screening layer outside the line 44 is of full and uniform thickness. The thickness of the layer, however, is not such as to form a complete barrier, but merely to reduce the radiation sufficiently to prevent over-exposure in the regions shadowed by the screening material.

On the outer face of the front panel 32 which covers the screening layer, upper and lower lines 45, 46 are inscribed which coincide with and serve to denote to the operator the upper and lower margins of the concealed screening layer.

When the thumbscrew 29 is loosened, the entire screen assembly can be raised and lowered to locate the shadow effect of the screen in a desired position with respect to the subject. My improved screen is so proportioned that when a patient is placed at the normal distance for full spine X-ray photography, which may be at a distance of 54" to 72" from the tube, the partial shading effect of the screening layer falls upon substantially all of the area of the lungs and ribs, but shadows only the upper portion of the spine, extending from approximately the third cervical vertebra down to the sixth or seventh dorsal vertebra. In other words, the distance between the top line 37 of the screening layer and the upper extremity of the cut-out portion 40 is such as to partially shadow the indicated portion of the spine, while the parts of the screening layer which extend downwardly on either side of the cut-out area provide the shading effect for the more easily permeable portions of the body structure lying upon either side of the portions of the spine but below the level of the sixth or seventh dorsal vertebra. In Fig. 8, which is a conventionalized diagram of the portion of the human skeleton which might appear upon an X-ray photograph taken in accordance with the present invention, the upper limit of the screening effect, corresponding to the shadow margin created by the top edge 37, is indicated in broken lines at 37*a*, while the lower boundary of the shaded region is denoted by the broken line 39*a*.

Screens wherein the screening layer differs in the vertical distance between top and bottom edges may be provided to compensate for differences in the sizes of the patients and for differences in the distance between the tube and patient, but I have found that a total of four screens is adequate to cover this entire range, in view of the fact that the screen is quickly and accurately adjustable in the vertical guides 25, 27 to compensate for differences in the height of the patients.

In order to so position the screen as to insure accurate shading of the subject in the manner and in the regions indicated, a cord 50 is attached to the side of the X-ray tube casing 10 at a position in horizontal and vertical alignment with the location of the source of radiation, generally indicated at X. The cord is long enough to reach to the patient. The position of the patient is indicated at A in Fig. 1. The cord is so located that it extends alongside of, but close to, the screen holder 20. With the patient and camera at desired positions and at the desired distance from one another, the location of the shadow cast by the screen can be predetermined with great accuracy by extending the cord 50 in a straight line to the body of the patient. While holding the cord at a position corresponding to the desired upper limit of the shadowing effect, as for example, at the position of patient's third cervical vertebra, the screen assembly is positioned so that the stretched cord is in horizontal alignment with the upper line 45 on the screen cover plate 32. If it is desired to similarly check the lower boundary of the shadowed area, this may also be done with the cord, although this is not ordinarily necessary since the screens may be so proportioned that it is only necessary to position the upper line in the manner indicated to insure that the lower boundaries of the shaded zone will fall in the desired area.

While it will be apparent that the preferred embodiment of the invention herein disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. Apparatus for controlling roentgenographic exposures comprising a screen element incorporating screening material restrictedly penetrable by X-rays, said screening material being a substantially flat layer having a transverse top margin and a lower margin spaced from the top margin, and a cover for said layer opaque to light but penetrable by X-rays and having markings thereon corresponding in location to the positions of said top and lower margins.

2. Apparatus for controlling roentgenographic exposures comprising a screen element incorporating screening material restrictedly penetrable by X-rays, said screening material being a substantially flat layer having a transverse top margin and a lower margin spaced from the top margin, a central lower portion of said layer and said lower margin being relieved to define a re-entrant area of increased penetrability, the screening layer being formed of shaped plastic material of varying thickness and varying penetrability to X-rays and the relieved portion of the screening layer being of substantially inverted U-form, said relieved portion being joined to the remainder of said screening material by portions of tapered thickness, and an opaque cover sheet over said screening layer and provided with indicia showing the positioning of said layer.

THEODORE VLADEFF.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,535,359	Tousey	Apr. 28, 1925
1,967,980	Talty	July 24, 1934
2,216,326	Smith	Oct. 1, 1940
2,405,444	Moreau et al.	Aug. 6, 1946

OTHER REFERENCES

The American Journal of Roentgenology and Radium Therapy, vol. XXII Aug. 1929. Pages 171, 172.