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Carey

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[54] VARIABLE APERTURE X-RAY SHIELD

[76] Inventor: **Carlton F. Carey**, 221 Jackson, Anderson, Ind. 46011

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Primary Examiner—William F. Lindquist
Attorney, Agent, or Firm—Woodard, Weikart, Emhardt & Naughton

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[51] Int. Cl. **G21f 5/04, H01j 35/16**

[58] Field of Search **250/320, 503, 505, 511, 250/512, 513; 350/272, 273; 355/74, 126**

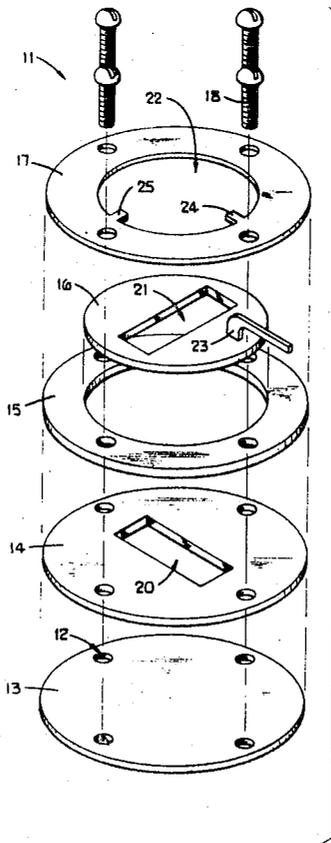
[57] **ABSTRACT**

An X-ray shield of two layers of lead or other X-ray opaque material presenting a variable aperture to incident X-rays. A rectangular hole in one layer is rotated with respect to a rectangular hole in the second layer, thereby providing two alternative rectangular configurations of X-rays beyond the shield. A handle and setting indicators are provided to achieve proper rotation for desired apertures.

[56] **References Cited**
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17 Claims, 4 Drawing Figures



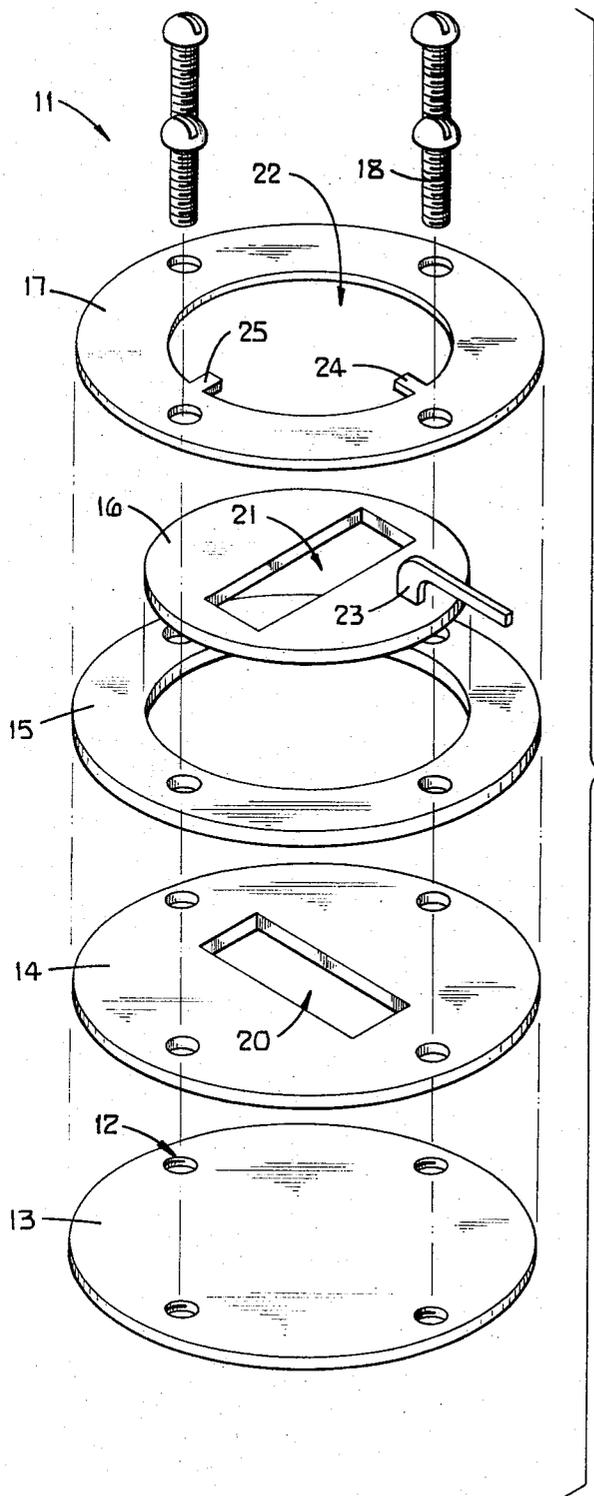


Fig. 1

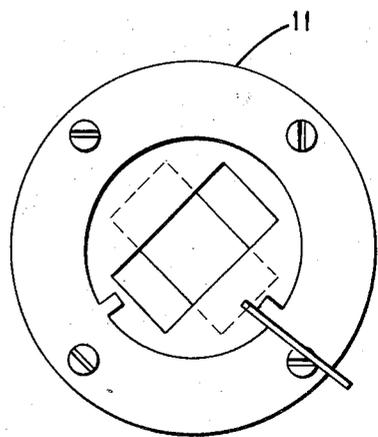


Fig. 2a

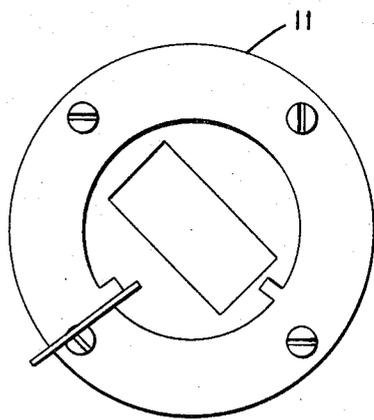


Fig. 2b

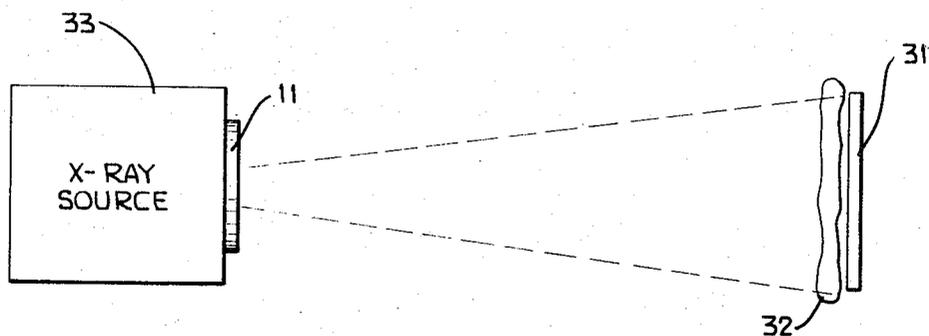


Fig.3

VARIABLE APERTURE X-RAY SHIELD

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is in the field of radiant energy, X-ray apertured shielding devices.

2. Description of the Prior Art

Many X-ray sources are available which are not equipped with a shutter mechanism for varying the size or shape of the emitted X-ray beam. Such shutters are expensive, and they are relatively difficult to operate because they provide continuous adjustment ranges.

With a typical X-ray source, not equipped with a shutter mechanism, there is available only one size and shape X-ray beam. Such a beam may radiate over a larger area than is necessary for a given subject and for the size of film used to record the X-rays. Such excess radiation may be dangerous to the subject, such as a human being, that is being X-rayed.

There is a need for an inexpensive variable aperture X-ray shield capable of quickly and accurately producing two alternative beam configurations from an X-ray source. Such configurations could be appropriate for two common sizes of X-ray film, allowing quick and accurate transitions from the use of one size film to another.

SUMMARY OF THE INVENTION

An embodiment of this invention is a variable aperture X-ray shield which includes two layers of X-ray opaque material, each containing a rectangular hole. Said embodiment utilizes rotational movement of the layers relative to one another to produce discrete rectangular "windows" of different sizes through which X-rays may travel. The layers are positioned in parallel planes and aligned so that a beam of X-rays may pass through the hole in each layer.

It is an object of the present invention to accurately and inexpensively produce two alternative beam configurations from an X-ray source.

It is a further object of the present invention to produce said configurations to be used with two sizes of X-ray sensitive film, thereby providing only the necessary X-ray beam to properly expose the desired film.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded view of an embodiment of the invention.

FIG. 2A is a top view of the embodiment of FIG. 1.

FIG. 2B is a top view of the embodiment of FIG. 1 in the alternative mode.

FIG. 3 is an illustration of apparatus incorporating the embodiment of FIG. 1 with an X-ray source and a receiving element.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiment illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of

the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Referring in particular to FIG. 1 there are illustrated four layers of materials fastened together by bolts in appropriately threaded holes. Beginning at the bottom of FIG. 1 there is an aluminum backplate 13. Disc 14 may be lead or other material opaque to X-rays. Disc 14 has a centrally located rectangular hole 20. The next layer consists of an outside ring 15, which may be any mechanically appropriate rigid material, and disc 16, which may be lead or other material opaque to X-rays. Disc 16 has a centrally located rectangular hole 21. A handle 23, is attached to one side of the disc 16 so that disc 16 may be easily rotated relative to disc 14. Front plate 17 is aluminum and has a center hole 22, which is larger in diameter than the longer diagonal of rectangular holes 20 and 21. Center hole 22 is smaller in diameter than disc 16, thereby holding disc 16 in place except for its rotation relative to disc 14. Front plate 17 also has two stops 24 and 25 which limit the rotation of disc 16 to one quarter-turn by restraining the movement of handle 23. The stops 24 and 25, also indicate the two positions for disc 16 which allow useful configurations of X-rays to pass through the X-ray shield 11. Bolts such as 18 pass through holes in front plate 17, outside ring 15, disc 14 and backplate 13, fastening the layers together through appropriately threaded holes such as 12 in backplate 13.

In operation, rotation of disc 16, by moving handle 23 into contact with the stops 24 or 25 rotates rectangular hole 21 so that it either crosses or aligns with rectangular hole 20 in disc 14. Since discs 14 and 16 are opaque to X-rays, the two positions of rectangular hole 21 relative to rectangular hole 20 allow two different configurations of X-ray to pass through the X-ray shield 11.

FIGS. 2A and 2B show the x-ray shield 11 in the two positions of rotation of disc 16.

FIG. 3 shows the x-ray shield 11 positioned in front of an X-ray source 33 allowing a selected configuration of X-rays to pass on to an X-ray sensitive element 31. Element 31 may be X-ray sensitive film or other X-ray sensitive material. The sizes of the rectangular holes 20 and 21 in the present invention 11 may be chosen so that, upon rotation of hole 21 to the positions in which handle 23 contacts stops 24 or 25, the configurations of the x-ray beam passed by the X-ray shield 11 are appropriate to the sizes of X-ray sensitive film which may be used as element 31. Thereby an X-ray source 33 may be used to expose two different sizes of film without subjecting a subject 32 to unnecessary exposure to X-ray radiation when a smaller sized film is used.

The components used in the X-ray aperture shield 11 are to be considered opaque to X-rays if they are of such thickness and material as to absorb more than 95 percent of incident X-ray radiation. The components used in the X-ray aperture shield 11 are to be considered transparent to X-rays if they are of such thickness and material as to absorb less than 10 percent of incident X-ray radiation.

While there have been described above the principles of this invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of the invention.

What is claimed is:

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1. A device for providing a variable aperture for X-rays comprising:
 - a. a first layer of material opaque to X-rays having a rectangular opening therein;
 - b. a second layer of material opaque to X-rays and having a rectangular opening therein; and
 - c. positioning means for maintaining said layers in parallel planes and for permitting said layers to rotate relative to one another, said positioning means including aligning means enabling positioning of the opening of said first layer of material such that a line perpendicular to said second layer and passing through said rectangular opening of said second layer also passes through said rectangular opening of said first layer.
2. The device of claim 1 wherein said first layer includes a handle whereby rotation relative to said second layer can be readily effected.
3. The device of claim 2 wherein said first layer is a disc having a rectangular opening therein.
4. The device of claim 3 wherein said first layer is lead.
5. The device of claim 4 wherein said second layer is a disc having a rectangular opening therein.
6. The device of claim 5 wherein said second layer is lead.
7. The device of claim 6 wherein said positioning means and said aligning means include stops to insure rapid and accurate positioning of said first layer disc relative to said second layer disc.
8. The device of claim 7 wherein said positioning means and said aligning means consist of:
 - a. a back plate of aluminum material,
 - b. a ring of the thickness of said first layer disc and fitting around it,
 - c. a front plate with an interior circular opening having a diameter larger than the longer diagonal of the rectangular openings in the said first and second layer discs but smaller than the diameter of said first layer disc,
 - d. and an attaching means to rigidly connect said plates, said ring and said second layer disc, leaving

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- said first layer disc free to rotate between said second layer disc and said front plate.
9. An apparatus consisting of:
 - a. a source of X-ray radiation,
 - b. an X-ray-sensitive element positioned near said source to receive X-ray radiation from said source, and
 - c. the device of claim 1 interposed between said source and said receiving element.
 10. The device of claim 9 wherein said X-ray-sensitive element is X-ray-sensitive film.
 11. The device of claim 10 wherein said first layer includes a handle whereby rotation relative to said second layer can be readily effected.
 12. The device of claim 11 wherein said first layer is a disc having a rectangular opening therein.
 13. The device of claim 12 wherein said first layer is lead.
 14. The device of claim 13 wherein said second layer is a disc having a rectangular opening therein.
 15. The device of claim 14 wherein said second layer is lead.
 16. The device of claim 15 wherein said positioning means and said aligning means includes stops to insure rapid and accurate positioning of said first layer disc relative to said second layer disc.
 17. The device of claim 16 wherein said positioning means and said aligning means consist of:
 - a. a back plate of aluminum material,
 - b. a ring of the thickness of said first layer disc and fitting around it,
 - c. a front plate with an interior circular opening having a diameter larger than the longer diagonal of the rectangular openings in the said first and second layer discs but smaller than the diameter of said first layer disc,
 - d. and an attaching means to rigidly connect said plates, said ring and said second layer disc, leaving said first layer disc free to rotate between said second layer disc and said front plate.

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