Feb. 28, 1939. G. A. LINDSTEDT ET AL 2,148,631

DEVICE FOR SCREENING OFF SECONDARY X-RAYS

Filed April 24, 1937

Fig. 1

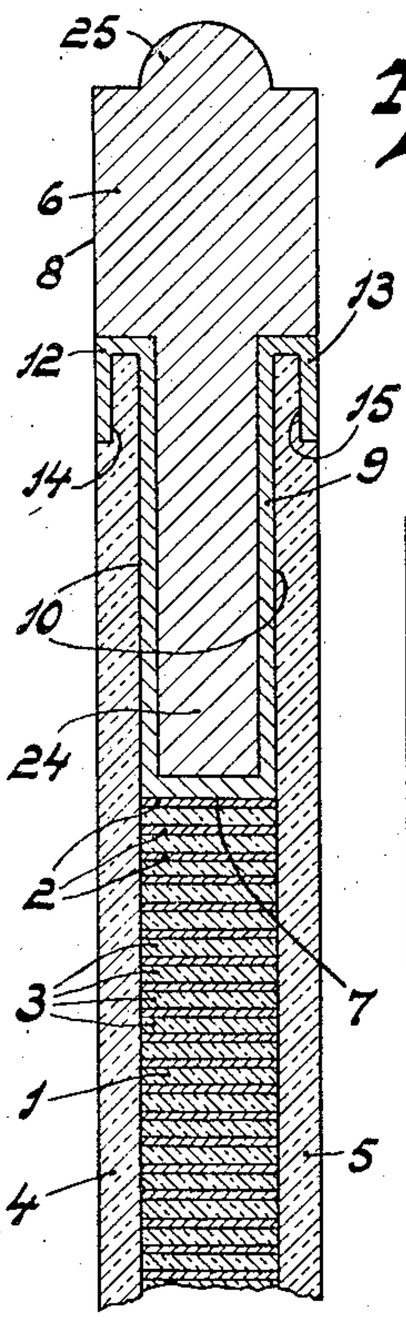


Fig. 2

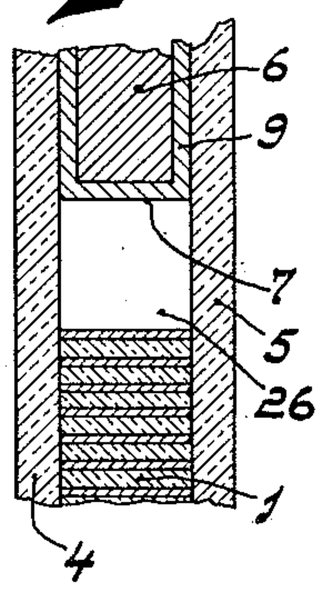


Fig. 3

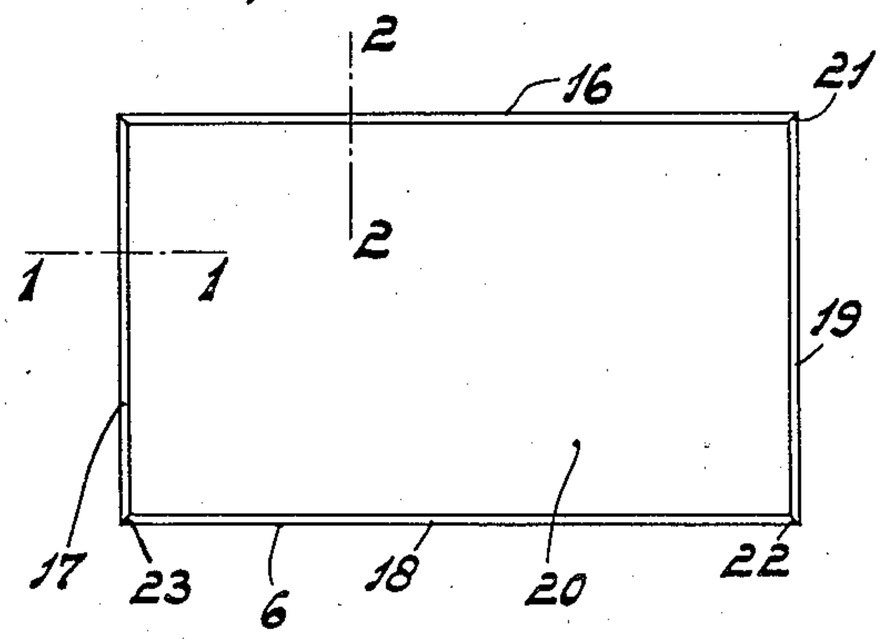


Fig. 4

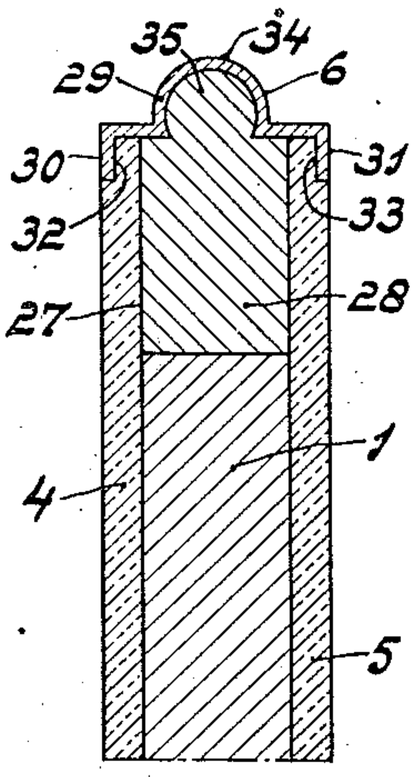


Fig. 5

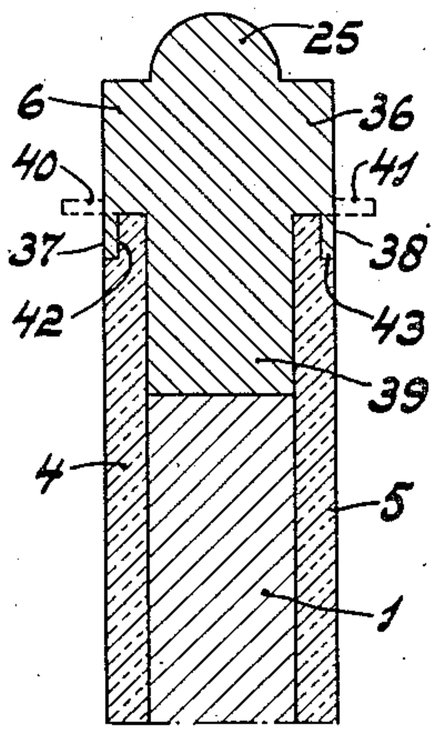
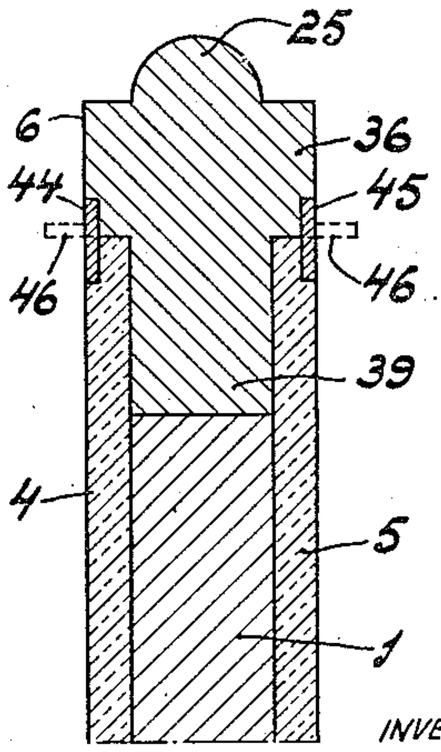


Fig. 6



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2,148,631

DEVICE FOR SCREENING OFF SECONDARY X-RAYS

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In Sweden April 28, 1936

9 Claims. (Cl. 250—63)

In radiography devices are frequently used for screening-off scattered X-rays, that otherwise would give rise to blurring of the image on the photographic film. Such devices consist of a grid built up from a large number of laminations, made from an X-ray-absorbent material. The laminations are arranged side by side with small interspaces. The useful X-rays which are almost parallel pass through the interspaces, but most of the secondary X-rays are intercepted by the laminations.

It is an object of our invention to make devices of the kind specified which are so constructed that they do not throw annoying shadows on the picture-receiving surface.

Another object of our invention is to provide reinforcing elements to make the screening grid secure against mechanical loads.

A further object of our invention is to provide means that repels moisture from the air which might have an injurious action on the grid body.

A still further object is to facilitate the mounting of a frame and of other mechanical protective means provided in connection with a device of the above kind.

Other objects of our invention will appear from the following description in which our invention will be more fully explained with reference to the accompanying drawing.

In this drawing Fig. 1 is a sectional view of a portion of a device according to our invention.

Fig. 2 is a modification of the device shown in Fig. 1.

Fig. 3 is a plan view of a device according to our invention.

Figs. 4–6 represent various other embodiments of our invention. Referring to Fig. 1 we denote by 1 a diaphragm or grid consisting of strips 2 of a material absorbing X-rays. These strips, which preferably are lead, are separated by layers 3 of a material pervious to X-rays consisting for example of paper or a similar fibrous material. The strips and intermediate layers are pasted together by means of a suitable agglutinant, so that they form a flat plate.

When the strips have a considerable thickness, it is necessary in order to avoid the shadows of the impervious strips interfering with the image to be made, that the grid is shifted during the exposure. This requires however the provision of a separate mechanism, for example an electric motor, guiding elements and means for transmitting the rotative motion of the motor into a translative motion for the screen.

By using strips having a very small thickness, e. g. a thickness of 0.1 mm. or even less, the shadow of the grid is rendered practically invisible. In addition we use laminations having a relatively small width, such as a few millimeters or 1.5 mm. and provide for interspaces of a thickness not much greater than that of the absorbing laminations. The leaves 3 may have a thickness of a few tenths of a millimeter.

It will be understood from the foregoing that a plate having a thickness of a few millimeters at the most, made of thin leaves of lead alternating with thin leaves of paper glued together, will not present sufficient rigidity to withstand the forces exerted thereon when used in radiography. In order to ensure that the device will satisfy practical requirements set by the practical use, especially to make it secure, the grid 1 is sandwiched between protective sheets 4 and 5 of a comparatively stiff material transparent to X-rays such as Celluloid. These protective sheets considerably increase the solidity of the device and protect the grid against the action of the moisture from the air. This is important because the interleaves 3 are generally made from hygroscopic material. If moisture were absorbed by this material and the adhesive used for uniting the laminations 2 and the leaves 3, this might cause detachment of the said elements or curvature of the grid. By the plates 4 and 5 the entrance of moisture is counteracted.

It is difficult to make a suitable connection between the plates 4 and 5 and the grid 1. For this purpose an adhesive may be used, but the danger exists that during the use the plates loosen from the grid. This drawback especially might arise when the screening device has a large surface area, for example 30 by 50 cm. Such a screen is still rather slack and the plates 4 and 5 cannot be made very thick, because then they would absorb a considerable quantity of X-rays and would make the device too heavy. The danger of detachment though decreased is not completely eliminated by using inflexible plates.

In order to do away with these difficulties we surround the grid with a metal frame 6, as is also shown in Fig. 3. The frame is made of any suitable material, such as copper or aluminium. Fig. 1 shows the section of the frame taken over the line I—I. In this form of construction, the frame aperture of the screen is bounded by the bottom part 7 of the frame 6. The latter consists of a main portion 8 and an additional portion 9. The additional portion 9 is of U-shaped section. It may be made from sheet metal. The protecting sheets 4 and 5 extend along the upright walls 10

of the U-shaped portion 9, which at their ends have two right-angle bends so as to engage the edges of the plates 4 and 5.

The bent-over edges 12 and 13 are received in recesses 14 and 15 of the plates 4 and 5. By those means there are provided rabbets engaging the edges of the protecting sheets, which considerably facilitates the mounting of the frame, as the latter fits easily around the grid. After the sides of the frame have been mounted, the corners may be united by suitable means, for example by soldering. It is possible to make one piece consisting, for example of the sides 16, 17 and 18 and to secure, after this piece being slipped over the plate 20 consisting of grid 1 and plates 4 and 5, side 19 to sides 16 and 18 at corners 21 and 22. It may however be preferred to first unite side 16 with side 17 and side 18 with side 19, assemble the two pieces so formed and plate 20 and then make the connection at corners 21 and 23.

The bent-over edges 12 and 13 are located in one plane with the external lateral sides of the sheets 4 and 5. The surfaces of the solid portion 8 may also be located in the same plane or slightly project beyond the external lateral sides of sheets 4 and 5 (this latter modification is not shown in the drawing). In both cases the bent-over edges of the portion 9 are protected against pushing and grazing.

The portion 8 is provided with a projection 24 extending between the upright sides 10 of portion 9. The form of portion 9 may be such that the sides 10 exert a slight compression on the projection 24, so that the portion 9 is clamped on the portion 8.

It appears from the drawing that the projection 24 with the upright parts 10 of U-shaped portion 9 serve as a spacer between the plates 4 and 5 and maintain them at the correct relative spacing. This prevents the edge portions of plates 4 and 5 being mechanically loaded by clamping means. On the other hand the plates cannot budge from the grid as they are caught by the rabbets at the frame.

At the top the frame 6 is provided with a guide edge 25, the shape of which corresponds to a guide groove in a cassette (not shown) to be used with the screen. This guide edge may be provided on all the four sides of the frame but generally it will be sufficient if it is provided on two opposite sides only.

It may be of advantage to provide for a space between the grid 1 and the bottom part 7 of the frame 6 as shown at 26 in Fig. 2. In this case the grid is permitted to expand under the influence of temperature variations or of humidity and to move between the plates 4 and 5.

In Figs. 4 to 6 elements corresponding with elements present in the structure shown in Fig. 1 are denoted with the same numbers. These figures show various modifications of a frame in a device according to our invention, taken over the line 2—2 of Figure 3, thus showing one of the laminations 2 in longitudinal section.

In the form of construction shown in Fig. 4 a solid stiffening frame 27 is arranged directly between the protecting sheets 4 and 5, thus bounding the frame aperture for the grid 1. The frame consists of a solid main portion 28 and a locking-portion 29 of strap-shaped section. The portion 29 has bent-over edges 30 and 31 and the locations for the edges of plates 4 and 5 are formed between the bent-over portions 30 and 31 and the sides of portion 28. As in the construction shown in Fig. 1 plates 4 and 5 are provided with recesses 32 and 33 in which rabbet-edges 30 and 31 are sunk. The frame is given a suitable profile for being guided in a cassette. A guide edge 34 is formed at the portion 29 closely fitting around a corresponding projection 35 of portion 28. The profile of portion 29 is preferably such that the sides of edge 34 engage the said projection with tension, so that portion 29 is clamped around the projection 35 of portion 28.

In the modification shown in Fig. 5 the frame 36 itself is provided with rabbet-edges 37 and 38 and the internal part 39 of the frame serves as a spacer between the sheets 4 and 5. It is possible to mount the frame with the edges bent upwards as shown by dotted lines at 40 and 41 and forcing same into recesses 42 and 43 at the edges of the protecting sheets 4 and 5 after the grid 1 is put into the frame 36. In this case the four sides of the frame may be united so as to make a complete frame before assembling it with the grid.

The modification shown in Fig. 6 differs from that shown in Fig. 5 in that the rabbet-edges 44 and 45 are not made in one piece with the frame, but consist of separate strips. They are secured to frame 36 along the lateral sides thereof for example by spot-welding or soldering. It is again possible to use strips having an L shaped profile as shown by dotted lines at 46 and to flatten them after the grid and the plates have been mounted in the frame.

What we claim is:—

1. A device for screening-off secondary X-rays comprising a grid having laminations of X-ray opaque material alternating with layers of a material transparent to X-rays, said grid being clamped between two protecting plates, and a frame surrounding said grid, said frame being provided with rabbets engaging the edges of the protecting plates.

2. A device for screening-off secondary X-rays comprising a grid having laminations of X-ray opaque material alternating with layers of a material transparent to X-rays, said grid being enclosed between two protecting plates, and a frame surrounding said grid, said frame being provided with a portion extending between the edges of said protecting plates so as to keep same spaced and with rabbet-edges engaging the edges of said plates externally.

3. A device for screening-off secondary X-rays comprising a grid having laminations of X-ray opaque material alternating with layers of a material transparent to X-rays, said grid being enclosed between two protecting plates and a frame surrounding said grid, said frame comprising a solid main portion and an additional portion, said latter portion being U-shaped and having bent-over edges, the edges of said protecting plates fitting between the sides of said U-shaped portion and said bent-over edges.

4. A device for screening-off secondary X-rays comprising a grid having laminations of X-ray opaque material alternating with layers of a material transparent to X-rays, said grid being enclosed between two protecting plates, and a frame surrounding said grid, said frame having rabbet-edges, the edges of the protecting plates being engaged by said rabbet-edges and having recesses, wherein said rabbet-edges are sunk.

5. A device for screening-off secondary X-rays comprising a grid having laminations of X-ray opaque material alternating with layers

of a material transparent to X-rays, said grid being enclosed between two protecting plates, and a frame surrounding said grid, the edges of said protecting plates having recesses at the side turned away from the grid and said frame having three inwardly projecting portions, two of which are located in said recesses, the center projecting portion being located between the edges of said protecting plates.

6. A device for screening-off secondary X-rays comprising a grid having laminations of X-ray opaque material alternating with layers of a material transparent to X-rays, said grid being enclosed between two protecting plates, and a frame surrounding said grid, the edges of said protecting plates having recesses at the side turned away from the grid and said frame having inwardly projecting edges which are located in said recesses, the external lateral sides of said inwardly projecting edges being in one plane with the external lateral sides of the protecting plates.

7. A device for screening-off secondary X-rays comprising a grid having laminations of X-ray opaque material alternating with layers of a material transparent to X-rays, said grid being enclosed between two protecting plates, and a frame surrounding said grid, said frame comprising a solid main portion and an additional portion of substantially strap-shaped section, said latter portion being clamped around said main portion.

8. A device for screening-off secondary X-rays comprising a grid having laminations of X-ray opaque material alternating with layers of a material transparent to X-rays, said grid being enclosed between two protecting plates, and a frame surrounding said grid, said frame comprising a solid main portion and an additional portion of U-shaped section, said main portion forming the outermost part of the frame and having an inwardly projecting portion fitting between the upright sides of said U-shaped portion, the edges of the protecting plates bearing in the external surface of said upright sides, said upright sides having turned-down ends to enclose the edges of the plates.

9. A device for screening-off secondary X-rays comprising a grid having laminations of X-ray opaque material alternating with layers of a material transparent to X-rays, said grid being enclosed between two protecting plates, and a frame surrounding said grid, said frame having at least along two opposite sides a guide edge adapted to be received in a corresponding groove in a cassette for use with the screening device.

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CERTIFICATE OF CORRECTION.

Patent No. 2,148,631. February 28, 1939.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 16, strike out the words "set by the practical use"; line 17, after "secure" and before the comma, insert against mechanical loads; 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 11th day of April, A. D. 1939.

Henry Van Arsdale

(Seal)

Acting Commissioner of Patents.