

[54]	XERORADIOGRAPHIC PLATE	3,647,427	3/1972	Hanada et al.	252/501 X
[75]	Inventor: Helmut Baum, Nurnberg, Germany	3,655,377	10/1972	Sechak	96/1.5
[73]	Assignee: International Standard Electric Corporation, New York, N.Y.	3,709,683	1/1973	Ciuffini et al.	96/1.5 X
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[22] Filed: Jan. 23, 1974

[21] Appl. No.: 436,019

[30] Foreign Application Priority Data

Feb. 3, 1973 Germany..... 2305407

[52] U.S. Cl. 96/1.5; 250/315; 250/315 A; 252/501; 252/512; 117/225; 252/500

[51] Int. Cl. G03g 5/04

[58] Field of Search 96/1.5; 250/315, 315 A; 252/500, 501, 512; 117/225

[56] References Cited

UNITED STATES PATENTS

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FOREIGN PATENTS OR APPLICATIONS

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ABSTRACT

A xeroradiographic plate or foil has a non-conducting selenium layer. The X-ray absorption of the selenium layer is improved by additions of elements of high atomic number or chemical compounds of such elements especially lead, thallium and elements of the rare earth group. In a preferred example, the selenium consists of three layers, one layer of pure selenium, a second layer with additions of high atomic number elements and a third layer with an addition of arsenic.

2 Claims, 2 Drawing Figures

Fig.1

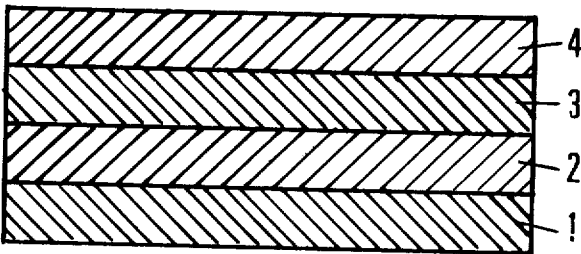
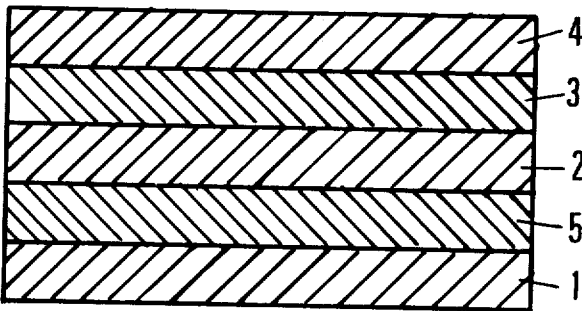


Fig.2



XERORADIOGRAPHIC PLATE

BACKGROUND OF THE INVENTION

This invention relates to a xeroradiographic element in which a selenium layer is arranged on a conducting substrate.

It is known from U.S. Pat. No. 2,666,144, entitled "Electroradiography" that xeroradiographic elements, such as xeroradiographic plates and foils, provided with a semiconducting coat of selenium, can also be used in making X-ray photographs.

Relative thereto, it is important to make the xeroradiographic element particularly sensitive to X-rays, in order to keep the X-ray stress application at a low level when taking X-ray photographs of the human body. In particular, elements with a high atomic weight have been used for increasing the sensitivity of selenium plates used in xeroradiography. Thus, for example, it is known from U.S. Pat. No. 2,859,350, entitled "Xeroradiography Device" to apply an amplification screen to the layer of selenium during exposure, said screen containing at least one layer of an element having a high atomic weight.

Further, it is known from U.S. Pat. No. 2,809,294, entitled "Xeroradiographic Plates or Elements" to embed a layer of an element with a high atomic weight into the conducting substrate for the selenium layer. The selenium layer support consists of two layers of aluminum between which there is positioned a layer of lead. The top aluminum layer carries a non-conducting layer of aluminum oxide on which the selenium layer is deposited.

All of these conventional means, however, have been incapable of providing a noteworthy improvement in the sensitivity of the selenium layer with respect to X-rays. This is attributed to the fact that the X-ray energy absorbed by the layer consisting of an element with a high atomic weight adds little towards the discharge of the charged selenium layer.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a xeroradiographic element by using an element with a high atomic weight in which a large quantity of the X-ray energy, as absorbed by this layer, is activated for discharging the selenium layer and consequently, for forming the image.

According to a broad aspect of the invention, there is provided a xeroradiographic element comprising a conducting substrate, and a selenium layer on said substrate, said selenium layer containing at least one element having a high atomic weight as an additive.

The above and other objects of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of a first embodiment of a xeroradiographic element; and

FIG. 2 is a sectional view of a second embodiment of a xeroradiographic element.

DESCRIPTION OF THE PREFERRED EMBODIMENT

By embedding elements with a high atomic weight in

the selenium layer, the absorbed energy is utilized for discharging the charged selenium layer and, consequently, for forming the image. When taking X-ray pictures of the human body by using a xeroradiographic element according to the invention, therefore, the X-ray stress application will be far less than was the case with conventional types of xeroradiographic elements.

Lead can be used as a suitable element for the intermediate layer. It is also possible, however, to use other elements with a high atomic weight, such as thallium and elements of the rare earth group.

The share of selenium layer in the addition depends on the electrical conductivity of the added substance. The share of selenium layer in elements may amount up to 10 per cent by weight, while non-conducting chemical compounds may amount up to 50 per cent by weight of the selenium layer.

It is particularly advantageous to build up the selenium layer of several partial layers. The selenium layer with an addition of elements with a high atomic weight or of chemical compounds of such elements, will then form an intermediate selenium layer. The thickness of this layer is between 1 and 50 microns, preferably 30 microns.

It is particularly advantageous to arrange the intermediate selenium layer between two selenium layers, one of which consists of pure selenium and the other of selenium containing additions for preventing crystallization. By the term pure selenium, it is understood that selenium having a purity of about 99.99 per cent is meant. As an addition for preventing crystallization, arsenic is used.

Preferably, the layer arrangement is made in such a way that a layer of pure selenium is arranged on a conducting substrate, followed by a selenium layer with additions of high atomic weight elements or chemical compounds of such elements, and on this there is deposited a selenium layer with an addition of a crystallization retarding agent. In so doing, it is particularly favorable for the pure selenium layer to be thinner than the selenium layer containing the addition of a crystallization-retarding agent.

A plate or foil of aluminum or steel is used as the substrate. In some cases, it may be of particular advantage to use foils as the substrate, i.e. aluminum or steel foils having a thickness of about 0.1 mm. In the case of such foil-type substrates, an intermediate layer is required between the lowest selenium layer and the conducting substrate for improving adherence of the selenium layer to the substrate. For this purpose, there is preferably used an intermediate layer of polyvinylacetal containing an addition of lampblack and/or graphite for increasing the conductivity.

The individual selenium layers are deposited onto the substrate preferably by way of evaporation under vacuum.

FIGS. 1 and 2 of the accompanying drawing schematically show two preferred examples of embodiment relating to xeroradiographic elements according to the invention, in sectional views.

The element according to FIG. 1 consists of a conducting substrate 1 of aluminum or steel having a thickness ranging between 50 and 200 microns. On this conducting substrate 1 there is arranged a layer 2 of pure selenium having a purity degree of 99.99 per cent and a thickness ranging from 5 to 50 microns. On this pure

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selenium layer there is arranged the selenium layer 3 containing an addition of a high atomic weight element, preferably lead or a lead compound, with the thickness thereof ranging between 1 and 50 microns. On top of this layer 3 there is arranged the selenium layer 4 containing an addition of crystallization-retarding agents. Preferably, arsenic is used as such an addition. This layer may have a thickness of between 1 and 50 microns. The content of arsenic preferably amounts to 0.5 per cent by weight.

A modified type of embodiment relating to a xeroradiographic element is shown in FIG. 2. In this case, the conducting substrate 1 consists of a foil of aluminum or steel having a thickness of about 0.1 mm. On this conducting substrate, there is deposited a layer 5 consisting of a conductive lacquer of polyvinylacetal comprising additions of lampblack and/or graphite, and which is preferably deposited by way of spraying. The layer 5 preferably has a thickness of between 0.5 and 2 microns. The layer 5 carries a selenium layer 2 of pure selenium with a thickness of 1 to 20 microns. This is followed by the selenium layer 3 containing a high atomic weight element, preferably lead, with a thickness of up to 30 microns. The last layer 4 consists of selenium containing a crystallization-retarding agent, preferably arsenic, and may have a thickness ranging between 2 and 30 microns.

It is to be understood that the foregoing description of specific examples of this invention is made by way of example only and is not to be considered as a limitation on its scope.

I claim:

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1. A xeroradiographic element comprising:
 - an aluminum foil substrate having a thickness of 0.1 mm;
 - a layer of conductive lacquer of polyvinylacetal containing an addition of graphite on said foil substrate, said layer of conductive lacquer having a thickness of 0.5 to 2 microns;
 - a layer of pure selenium having a thickness of 1 to 20 microns on said layer of conductive lacquer;
 - an intermediate layer of selenium having a lead additive, said intermediate layer disposed on said pure selenium layer and having a thickness of up to 30 microns; and
 - a top layer of selenium containing an additive of 0.5 percent by weight arsenic as a crystallization-retarding agent, said top layer having a thickness of 2 to 30 microns.
2. A xeroradiographic element comprising:
 - an aluminum substrate having a thickness of 50 to 200 microns;
 - a layer of pure selenium on said substrate having a thickness of 5 to 50 microns;
 - an intermediate layer of selenium having a lead additive, said intermediate layer disposed on said pure selenium layer and having a thickness of 1 to 50 microns; and
 - a top layer of selenium containing an additive of 0.5 percent by weight arsenic as a crystallization-retarding agent, said top layer having a thickness of 1 to 50 microns.

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,901,703

DATED : Aug. 26, 1975

INVENTOR(S) : Helmut Raum

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

[75] Correct spelling of inventor's name as follows:

Helmut Raum

Signed and Sealed this

Tenth Day of August 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks