Sept. 26, 1939. J. EGGERT ET AL Re. 21,216

INTENSIFYING AND FLUORESCENT SCREEN

Original Filed March 8, 1934

*Fig. 1*

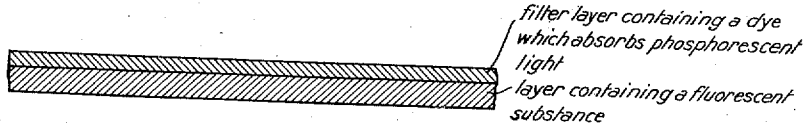
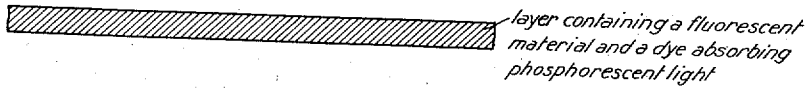



*Fig. 2*




Inventors:
John Eggert,
Fritz Loft,
Philip S. Hopkins,

By Attorney

Reissued Sept. 26, 1939

Re. 21,216

# UNITED STATES PATENT OFFICE

21,216

## INTENSIFYING AND FLUORESCENT SCREEN

John Eggert and Fritz Luft, Leipzig, Germany, assignors, by mesne assignments, to Agfa Ansco Corporation, Binghamton, N. Y., a corporation of Delaware

Original No. 2,076,984, dated April 13, 1937, Serial No. 714,729, March 8, 1934. Application for reissue October 9, 1937, Serial No. 168,198. In Germany March 15, 1933

10 Claims. (Cl. 250—80)

Our present invention relates to an intensifying or fluorescent screen for X-ray work.

One of its objects is an improved screen of this kind. Further objects will be seen from the detailed specification following hereafter.

Many intensifying and fluorescent screens for use in X-ray work have the drawback to show phosphorescence, that is to say, the screens not only emit the desired fluorescent radiation during the diagnostic exposure, but also produce after exposure a phosphorescent light, at the places previously struck by the X-rays so that on the screens the successively produced phosphorescent and fluorescent pictures become mixed, a fact which may render difficult the interpretation of the inspected or photographed picture. As known, it is very difficult to free the luminescent substances used in the manufacture of intensifying screens and fluorescent screens for X-ray work from substances that phosphoresce when struck by X-rays.

This phosphorescent light frequently has a color different from that of the fluorescent light. By the invention the detrimental effect caused by the phosphorescent substances contained in the fluorescent layer may be eliminated by coating the intensifying screen or the fluorescent screen with a filter layer which transmits the fluorescent light completely or in greater part, but absorbs the phosphorescent rays. By this expedient the manufacture of intensifying and fluorescent screens for X-ray work is considerably cheapened and improved, because on the one hand the complicated process of removing the phosphorescent admixtures from the fluorescent substances is rendered unnecessary and on the other hand there is a wide choice of fluorescent substances since those which give fluorescent and also phosphorescent substances can be used. If required, the filter dyestuff may be added directly to the binding agent carrying the fluorescent substance instead of being incorporated in a special filter layer.

Furthermore, substances are known, such as zinc sulfide and sulfides of the alkaline earths, which fluoresce and phosphoresce when struck by X-rays or by daylight. If such substances are used for the manufacture of intensifying screens, these screens must, of course, always be protected from daylight, thus causing much trouble in X-ray work.

Now, according to Stoke's law, these luminescent rays always have a greater wave length than the exciting primary rays. By providing fluorescent screens with a filter (in the way above referred to, i. e., applying a filter layer by casting or dyeing the layer throughout its thickness) which absorbs only the exciting light, and transmits the luminescent rays completely or in greater part, the risk that such a screen be excited in daylight is greatly diminished, without the excitability by X-rays being reduced or the emission of the fluorescent rays being materially hindered. With a screen protected in this manner, therefore, the X-ray work may be done almost irrespective of any previous exposure to daylight.

In the following table there are given some materials which are used for manufacturing intensifying or fluorescent screens and materials which they may contain as impurity. There is further indicated the fluorescent and phosphorescent light emanated by these materials and the filter dye to be used for absorbing the phosphorescent light.

| Main constituent | Impurity | Color of fluorescence | Color of phosphorescence | Filter dye |
|---|---|---|---|---|
| ZnS activated with Ag. | Mn | Dark blue | Orange | Toluidine blue (cf. Schultz Farbstofftabellen 7th edition No. 1041) or Crystal Violet (hexamethylpararosaniline). |
| ZnS activated with Ag. | Cu | do | Green | Rose bengale (cf. Schultz Farbstofftabellen 7th edition No. 889). |
| ZnS activated with Cd. | Mn | Orange yellow. | do | Orange 2 (cf. Schultz Farbstofftabellen 7th edition No. 189). |
| $CaWO_4$ | ZnS activated with Mn. | Blue | do | Rose bengale (cf. Schultz Farbstofftabellen 7th edition No. 889). |

The following examples illustrate the invention:

*Example 1.*—An intensifying screen for X-ray work consists of a support, for instance stiff

paper, and a fluorescent layer, containing as a fluorescent substance, zinc sulfide activated with silver. This layer is coated with another layer containing as a filter dyestuff hexamethylpararosaniline in gelatin as a binding agent. If the zinc sulfide activated with silver and fluorescing in a blue color, contains as usual traces of copper, the screen will phosphoresce in a green light, which is absorbed by the filter layer containing hexamethylpararosaniline. The blue fluorescent light penetrates the filter layer unweakened.

*Example 2.*—An intensifying screen containing as an active substance zinc sulfide activated with copper is coated with a green filter layer of gelatin dyed with Tartrazine (cf. Schultz Farbstofftabellen, 7th edition, No. 737), and Patent Blue (cf. Schultz Farbstofftabellen, 7th edition, No. 826). This filter layer prevents the screen from being excited by daylight by absorbing the blue rays exciting phosphorescence. On the contrary, X-rays which are not absorbed by such a filter excite a fluorescent radiation. The yellowish-green fluorescent light produced is transmitted by the filter layer.

Our invention is illustrated in the accompanying drawing in which Fig. 1 shows a modification in which the layer containing the fluorescent material is provided with a filter layer for absorbing phosphorescent light and Fig. 2 shows a modification in which the layer containing the fluorescent material is colored throughout by a dye absorbing phosphorescent light.

What we claim is:

1. An intensifying or fluorescent screen for X-ray work which comprises a layer containing a fluorescent material and a filter layer containing a dye permeable to the fluorescent light produced on excitation of said fluorescent material and absorbing the phosphorescent light.

2. An intensifying or fluorescent screen for X-ray work which comprises in its active layers a fluorescent material and a dye permeable to fluorescent light produced on excitation of said fluorescent material and absorbing the phosphorescent light.

3. An intensifying or fluorescent screen for X-ray work which comprises uniformly distributed in a binding agent a fluorescent material and a dye permeable to fluorescent light produced on excitation of said fluorescent material and absorbing the phosphorescent light.

4. An intensifying or fluorescent screen for X-ray work which comprises a layer containing zinc sulfide activated with silver and coated on this layer with a layer of gelatin dyed with hexamethylpararosaniline.

5. An intensifying screen, comprising active fluorescent material and an associated medium having color value adapted to transmit fluorescent light produced on excitation of said fluorescent material and to absorb a substantial part of the afterglow of said material.

6. In an intensifying screen for use in X-ray examination and including an active luminescent material, a light filter of spectral composition adapted to transmit fluorescent light produced on excitation of said luminescent material and to absorb a substantial part of the afterglow of said material.

7. The method of suppressing the phosphorescence of luminescent material, comprising the steps of determining the spectral distribution of the said phosphorescence, selecting a medium substantially opaque to light of said spectral distribution and substantially transparent to light of a color falling within the remainder of the spectrum, and associating such selected medium with the said luminescent material in a position relative thereto in order to absorb the phosphorescent luminescence of said material.

8. The method of suppressing the phosphorescence of luminescent material, comprising the steps of determining the spectral distribution of said phosphorescence; selecting a dye having a color value capable of substantially absorbing the light of said spectral distribution, and transmitting substantially unhindered the fluorescent light of the said luminescent material; and associating such selected dye with the said luminescent material in a position relative thereto in order to absorb the phosphorescent luminescence of said material.

9. Intensifying means for use in radiography comprising a layer containing a fluorescent material, and a material associated with said layer capable of absorbing phosphorescent light from said material while being permeable to fluorescent light from said material.

10. Intensifying means for use in radiography comprising a layer containing a fluorescent material, and a dye associated with said layer capable of absorbing phosphorescent light from said material while being permeable to fluorescent light from said material.

JOHN EGGERT.
FRITZ LUFT.