June 15, 1943. C. L. A. WYND ET AL 2,322,082

PHOTOGRAPHIC PROCESS

Original Filed Sept. 23, 1941

Fig. 1

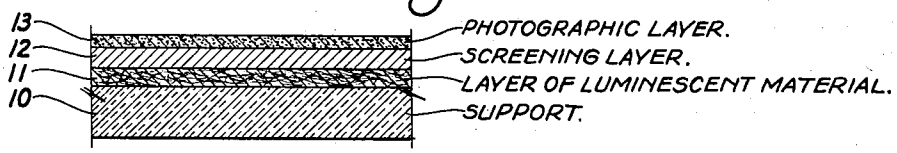


Fig. 2

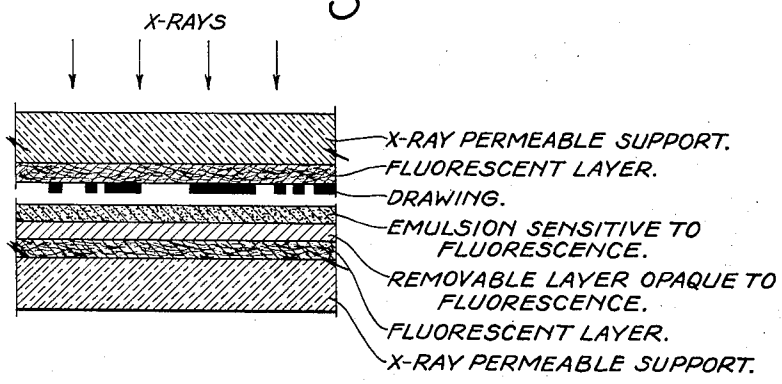
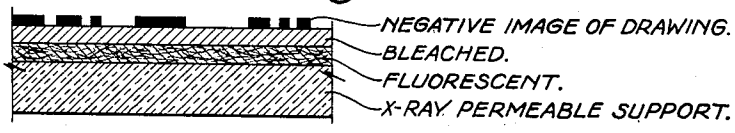


Fig. 3



Clarence L. A. Wynd
Gerould T. Lane
INVENTORS

BY Newton M Pennie

ATTORNEY

Patented June 15, 1943

2,322,082

UNITED STATES PATENT OFFICE

2,322,082

PHOTOGRAPHIC PROCESS

Clarence L. A. Wynd and Gerould T. Lane, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y., a corporation of New Jersey

Original application September 23, 1941, Serial No. 411,968. Divided and this application May 1, 1942, Serial No. 441,280

5 Claims. (Cl. 250—65)

This invention relates to the reproduction of engineering drawings and the like, and particularly to the photographic reproduction of such drawings when using opaque materials throughout. This is a division of our application Serial No. 411,968 filed September 23, 1941.

In the making of metal templates or patterns for industrial production it has been customary to prepare the original drawings which were then redrawn to scale on the work material by hand. This time-consuming and laborious method of preparing the templates or patterns (usually metal) was subject to errors and recently has been replaced to some extent by photographic copying and reproduction. One such process, disclosed in Patent No. 2,303,942 granted December 1, 1942, to the present inventors, makes use of a drawing delineated by fluorescent material and contact printed on a photographic layer carried by that work material. The resulting print of the drawing is, of course, a mirror image of the original and for convenience will be referred to herein as a negative. When the print is not a mirror image but is a duplicate it will be referred to as a positive without regard to whether it is black on white or white on black.

For obvious reasons it is highly desirable to be able to produce on the metal work sheets several positive duplicates of the original drawings or selected portions of it. This is made possible by the present invention which provides a complete process of making photographic reproductions via the negative, positive method and using opaque material throughout.

According to the preferred embodiment of the invention, the original drawing is made on a layer of fluorescent material carried by an X-ray permeable, rigid support, such as aluminum or plywood. This drawing is made with a lacquer or pencil which is opaque to the luminescent light from the layer. It may also be made by scriving or engraving in a fluorescent layer, by drawing with a fluorescent lacquer or pencil upon a non-fluorescent layer, or by any other means forming an image which when activated by light, X-rays or other radiant energy is rendered differentially luminous. The luminescent material may be of a suitable phosphor such as calcium tungstate as proposed in our Patent 2,303,942 or barium fluorochloride as described in the patent of Herbert J. Dietz, No. 2,303,917, granted December 1, 1942. The light from this is in the violet and ultraviolet region to which ordinary photographic emulsions are highly sensitive. This drawing is placed in contact with a photographic layer carried by an X-ray permeable support and exposed by activating the fluorescent layer with X-rays which may be directed through either support. Now, in order that the resulting negative print may be similarly printed to provide a positive, a fluorescent layer is provided under its photographic layer and a removable screening layer is preferably provided between the two so that, when the photographic layer is exposed and developed and the screening layer removed, there results a negative equivalent of the original drawing. This negative may be printed on a photographic layer by activating the fluorescent layer of the negative with X-rays in the same general way the negative was made from the original.

In addition to making a negative on a fluorescent layer, the original may also be employed to print negative template material. Thus, by having both a positive and a negative from which contact prints can be made, it is simplicity itself to provide the exactly symmetrical templates so often required in the type of manufacturing for which such templates are best adapted. For example, if the original drawing represents the right front door of an automobile, the negative fluorescent print will represent the left front door, and the templates for the right and left doors will be made by contact printing the fluorescent negative and the fluorescent original, respectively.

Instead of using fluorescent material any suitable luminescent material may be employed. This material may then be activated with the proper radiation, such as ultra-violet light, cathode rays, X-rays, etc. It will be understood that when the activating radiation is not transmitted by the support, the exposure will be made by phosphorescent light. Also, the sensitive photographic layer carried by the element of my invention may be exposed as desired, whether by means of a luminescent drawing or by means of ordinary light when the drawing to be printed thereon is carried by a transparent support, such as plate glass.

The luminescent drawing may be exposed to X-rays or other activating rays while separated from the sensitive plate and at once moved into contact with it, the exposure of the sensitive plate being then caused entirely by the after-glow or phosphorescence.

In the drawing:

Fig. 1 is a cross-sectional view of a light-sensitive element made in accordance with the invention;

Fig. 2 is a sectional view showing this element being given an epipolized printing exposure; and

Fig. 3 is a sectional view showing a photographic record made in accordance with the invention.

In Fig. 1 an opaque support 10 is provided with a plurality of layers, the first of which is a layer 11 of luminescent material, the next layer 12 is a screening layer adapted to shield the outer light-sensitive layer 13 from the luminescence of the layer 11. The luminescent material of layer 11 may be calcium tungstate incorporated in a water-resistant medium, such as a cellulose ester solution. The screening layer 12 should be capable of being made transparent and preferably is one which may be decolorized either by action of a photographic processing bath or a separate bleaching bath. A satisfactory screening layer 12 may be made of manganese dioxide or a non-wandering dye suspended in a water-permeable medium, such as gelatin, far hydrolyzed cellulose esters, or resinous materials of like properties, in order that this layer 12 may be decolorized by the aqueous processing or bleaching baths.

A photographic layer 13 is preferably of the process type and may be either a gelatino silver halide emulsion or one prepared from suitably prepared cellulose esters or resins. These may be adapted to be spread or brushed onto the base material and, of course, suitable subbing layers of known types should be used to secure satisfactory adhesion between the various layers.

In view of the fact that, in the industrial art for which the present invention is particularly suitable, the sheets upon which the drawings are made and reproduced range in size up to six feet wide and twenty feet long, it is not a simple matter to apply the photographic layer 13, and for this reason we prefer to make use of the transfer film described and claimed in an application, Serial No. 397,093, filed June 7, 1941, by G. T. Lane, one of the present inventors by which an unexposed sensitized layer is applied to the large metal plate.

Although at the present time it is preferred to practice the invention as above described, the invention has been practiced in other ways to obtain the same desirable results. For instance, the fluorescent layer upon which the drawing is made can be prepared so that it transmits a relatively small proportion of the X-rays employed to activate it. Thus, the screening layer of the photographic element may be omitted because its underlying fluorescent layer will not be sufficiently activated to produce an intolerable fogging exposure. A similar result can be obtained by carefully choosing the X-ray exposure, both as to hardness and time, best adapted for the fluorescent material employed and the sensitivity of the emulsion to be exposed.

There may also be used a sensitive material which is insensitive to the light given off by the luminescent layer carried on the same support.

When the process of the present invention is practiced using phosphorescent light for copying the original drawing, a screening layer between the sensitive layer 13 and the underlying luminescent layer 11 is unnecessary, and the print may be made on a photographic layer directly overlying the luminescent layer.

It will be evident from the above description that the present invention makes it possible and practical to make a photographic copy on a rigid opaque support, which copy may be printed onto another photographic layer carried by an opaque support. It will be understood that the usefulness of the element of the present invention is not limited to processs in which it is printed from a drawing or printed onto a photographic layer carried by an opaque support.

What we claim and desire to secure by Letters Patent of the United States is:

1. The method of preparing a negative in terms of luminescent and non-luminescent areas of an original drawing defined by luminescent and non-luminescent areas which comprises exciting the luminescent areas of the original to make them luminesce, exposing to the resulting luminescing image a light-sensitive emulsion overlying a layer of luminescent material carried by an opaque support and developing the exposed layer.

2. The process of making photographic reproductions which comprises making on a first element an image having luminescent areas, exposing said image to radiant energy exciting said areas, holding said element while thus excited in contact with a second element having a photographically sensitive layer, and also a luminescent layer, whereby a latent image from the rays emitted by the first element is formed in said photographic layer, developing a light obstructing image in said photographic layer, submitting said second element to radiant energy capable of exciting said luminescent layer carried thereby and holding said second element while thus excited in contact with a third element carrying a photographic layer whereby a latent image is formed in said photographic layer on the third element.

3. The process of making photographic reproductions which comprises making on a first element an image comprising areas which become luminescent when excited by X-rays and non-luminescent areas, holding said element in contact with a second element carrying a photographic layer and also a layer which when excited by X-rays becomes luminescent, exposing said elements while in contact to X-rays whereby said luminescent areas are activated and emit rays which impress said photographic layer, developing a photographic image in said photographic layer, holding said second element in contact with a third element carrying a photographic layer and exposing said element while in contact to X-rays whereby the luminescent layer is excited and emits rays which impress a latent image in the photographic layer carried by the third element except where such rays are intercepted by the image in the second element.

4. The process of making photographic reproductions which comprises making on a first element an image comprising areas which are rendered luminescent when excited by X-rays, holding said element in contact with a second element carrying a photographically sensitive layer and a layer which is rendered luminescent when excited by X-rays, the photographic layer being substantially unaffected by the luminescent light from the second element, exposing said elements while in contact to X-rays whereby the luminescent areas on the first element are excited and impress an image in the photographic layer, holding said second element in contact with a third element carrying a photographic layer and exposing said elements while in contact to X-rays, whereby the luminescent layer is excited and impresses an image in said photographic layer carried on the third element except where the rays are intercepted by said image.

5. The process of making photographic repro-

ductions which comprises making on a first element an image comprising areas which become luminescent layer opaque to rays emitted by said element in contact with a second element carrying a photographic layer, a layer which becomes luminescent when excited by X-rays and a screening layer between said photographic layer and said luminscent layer opaque to rays emitted by said luminescent layer, and exposing said elements while in contact to X-rays whereby the luminescent areas on the first element are excited and impress said photographic layer, developing an image in said photographic layer and rendering said screening layer transmissive of the luminescent rays, holding said second element in contact with a third element carrying a photographic layer and exposing said elements while in contact to X-rays whereby the luminescent layer is excited and emits rays which impress a latent image in the photographic layer on the third element except when the rays are intercepted by the developed image.

CLARENCE L. A. WYND.
GEROULD T. LANE.

CERTIFICATE OF CORRECTION.

Patent No. 2,322,082. June 15, 1943.

CLARENCE L. A. WYND, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 3, claim 5, strike out the words "layer opaque to rays emitted by" and insert instead --when excited by x-rays holding--; 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 29th day of February, A. D. 1944.

Leslie Frazer

(Seal) Acting Commissioner of Patents.