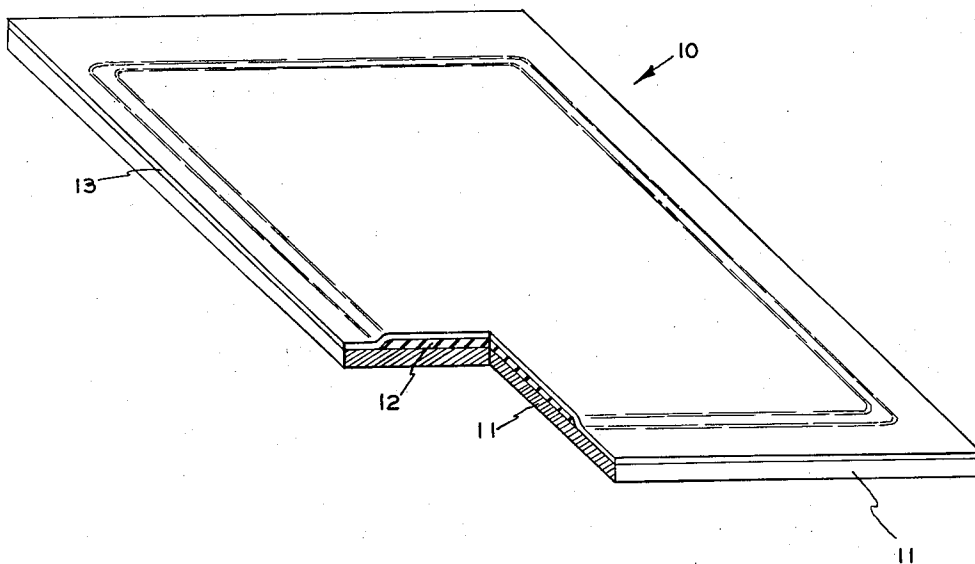


Nov. 11, 1958

R. L. DEUBNER  
XEROGRAPHIC PLATE  
Filed June 13, 1955

2,860,048



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## XEROGRAPHIC PLATE

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Application June 13, 1955, Serial No. 515,013

3 Claims. (Cl. 96—1)

This invention relates in general to xerography and, in particular, to a new xerographic member.

An electrophotographically sensitive member such as a xerographic plate comprises basically a conductive backing member with a photoconductive insulating layer or coating on at least one surface thereof. In its use in xerography, this member or plate is provided with a surface charge of a suitable means such as, for example, by exposure to an ion source after which it is exposed to a light image and then developed, for example, with an electroscopic powder. These steps and additional or optional steps, such as cleaning, cause various hazards, and normal handling frequently results in mechanical damage or destruction to the plate with consequent loss of an otherwise still usable plate. With careful usage the electrical life of the plate will easily include several thousand photographic or printing cycles and the plate may well be virtually infinitely re-usable in terms of electrical deterioration. For this reason, it is obviously desirable to hold mechanical wear and damage to an absolute minimum.

One line of attempt in the effort to preserve the plate against mechanical damage has been the protection of its delicate photoconductive insulating layer by means of a superficial coating of a protective film. This line of effort, however, has resulted in substantial impairment of the product. The electrical properties and characteristics of the xerographic plate are highly critical. Several materials were found which satisfy the critical electrical characteristics imposed by plate use but failed to significantly protect the plates from excessive mechanical wear and damage.

Now, in accordance with the present invention, a xerographic member of improved properties is prepared by placing a photoconductive insulating coating on a conductive backing and further placing on a photoconductive insulating surface a thin coating of a protective film of polyvinyl acetal. The product is, therefore, a structure comprising a conductive backing member, such as, for example, a metallic plate, a photoconductive insulating layer thereon, such as a vitreous selenium coating on the plate, and a protective coating or layer on the selenium. A member prepared according to the instant invention satisfies the critical electrical requirements imposed by the xerographic art and is truly outstanding in resistance to mechanical wear and damage.

Not only does the improved plate have increased abrasion resistance but, in addition, it operates more satisfactorily in the xerographic process under conditions of high humidity. Thus, it is frequently observed that conditions of high humidity lead to the formation of indistinct or weak images on a xerographic plate, apparently, partly because of a film that forms on the plate during such operations. It has been found, surprisingly, that improved, high humidity operations are achieved by the protected plate according to this invention.

In further description of the invention, reference is made to the drawing in which the figure is an oblique

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view, partially in section, of a xerographic member according to one embodiment of the invention.

In this figure there is illustrated a xerographic member 10 having a backing member 11, a photoconductive insulating coating or layer 12 thereon, and a protective coating or layer 13 covering and protecting at least the photoconductive insulating layer. The backing member is a suitable conductive material such as, for example, a metallic member, plate or the like as of brass, aluminum, zinc, etc. or, optionally, a non-conductive member of desired structural properties, such as glass, having a conductive coating as of tin oxide, or a fibrous material, such as paper, having therein conductive material, such as water, particles of carbon, metal, or the like, to render the back conductive. On this backing member is a photoconductive insulating layer 12 which is one of suitable materials including vitreous selenium, sulphur, anthracene, mixtures of selenium and sulphur, various photoconductive phosphors, such as zinc oxide, cadmium sulfide and the like, either as a continuous layer or as discrete particles in a resinous binder. According to one specific embodiment of the invention, the combination of layer 12 and backing member 11 may be a xerographic plate having a coating of vitreous selenium on a backing plate of aluminum.

The protective coating or layer 13 which overlies at least the photoconductive insulating layer 12 must be critically selected with respect to its electrical characteristics. Criteria imposed by the basic xerography process require that the layer must be a sufficiently good insulator so as to prevent dissipation of the charge on the surface of the sensitized photoconductive layer nor must it permit surface leakage of the charge (which would result in smearing or blurring the electrostatic latent image by permitting the charge to migrate from a high potential area to an adjacent low potential area of the electrostatic latent image). At the same time, the electrical charge with which the plate is charged or sensitized may not be generated within the plate but instead, as in the case of charging by an adjacent ion source, may be deposited on the plate from an external source in which case the protective layer 13 must permit this charge to operate through and effectively reach the photoconductive layer. In addition to these basic requirements of electrical properties are various other important characteristics such as: absence of tackiness so as not to cause adhesion of an electroscopic or other powder in uncharged areas; abrasion resistance and durability; smoothness; water and solvent resistance; and the like. Polyvinyl acetal resins have been found to meet all of these exacting requirements and, in addition, to be truly outstanding compared to other coating compositions in the ability to protect the delicate, photo-conductive insulating surface from mechanical damage.

According to a preferred method of preparation, a plate or member is first prepared of a photoconductive insulating coating on a conductive backing such as, for example, by vacuum evaporation, spraying or otherwise placing the coating or layer thereon. This intermediate member is then further processed by placing a thin film thereover of the protective material. Thus, the polyvinyl acetal may suitably be made into a dilute solution in an organic and the solution lightly sprayed, flowed or rubbed across the photoconductive surface and allowed to dry. Suitably, the polyvinyl acetal may be placed in aqueous emulsion and similarly spread on the surface.

Polyvinyl acetals are readily available commercially, and their preparation is well understood by those skilled in the art. Generally, they are prepared by first hydrolyzing a polyvinyl ester, such as polyvinyl acetate, to produce thereon free hydroxy groups. These groups are then acetalized by reaction with an appropriate aldehyde,

such as formaldehyde, acetaldehyde, etc. Particularly preferred are those polyvinyl acetals produced by the hydrolyzation of polyvinyl acetate followed by acetalization with formaldehyde or acetaldehyde or mixtures thereof. Polyvinyl acetal resins wherein formaldehyde is used to form the acetal are readily available from Shawinigan Products Corporation under the trade name "Formvar." Similarly, polyvinyl acetal resins wherein acetaldehyde is used as the reactive aldehyde are available from the same company under the trade name "Alvar." These two resins are particularly preferred for the instant invention. The exact compositions of these proprietary materials are not known. An excellent description of these resins and their method of preparation is given in "Vinyl and Related Polymers," by Schildknecht, published by Wiley in 1952.

The following examples are presented in illustration but not in limitation of the invention:

#### Examples

A series of xerographic plates consisting of a coating of vitreous selenium on an aluminum backing were overcoated as follows: A tank was filled with an organic solution of the particular resin to be used for the overcoating and the tank heated to 85° F. to prevent moisture condensation on the overcoating. The plate to be overcoated was then lowered into the tank to a depth such that all but ¼ inch of the plate was immersed, allowed to come to thermal equilibrium and then withdrawn at a constant velocity, the time of withdrawal being of the order of a few seconds. The thickness of the coating is governed by the rate of withdrawal, the concentration of the solution, and its viscosity. The thickness of the overcoating was determined by means of the interference fringes at the beginning of the overcoating. All overcoatings were applied to obtain a thickness of one micron on top of the xerographic plate. The following resins were overcoated on the xerographic plates: cellulose acetate, Formvar, cellulose acetate butyrate, ethyl cellulose, polystyrene, and an acrylic resin obtained from Rohm and Haas bearing the trade name Acryloid B 72 and Devron Chemfast 500 from Devoe-Reynolds and Company, consisting of 90% phenolic ether resin and 10% chlorinated resins.

Plates so overcoated were allowed to dry and then used in the conventional xerographic process. In this process the plate is first sensitized as by placing an electrical charge on the photoconductive insulating layer, then exposed to a pattern of light and shadow to be recorded. The plates were then developed in a powder cloud generator such as shown in Fig. 3 of U. S. 2,666,144 to Schaffert et al. After development, the plates were first examined and then cleaned by means

of a rapidly rotating, rabbit's fur brush. As the process was repeated, a film gradually built up on top of the plate that could not be removed by the brush and which eventually resulted in obscuring the image developed on the plate. When this point was reached, the plate was rejected. In comparing the number of times that a plate could be used in this manner, it was found that the plates having an overcoating of Formvar were usable for three times as many cycles as were the best of the comparative resins (which were the cellulose esters, namely, the cellulose acetate and cellulose acetate butyrate). Compared to a non-overcoated plate, the plates overcoated with Formvar were usable up to eight times as many development cycles.

I claim:

1. A xerographic member of improved characteristics comprising a conductive backing member, a photoconductive insulating layer thereon, and a thin, protective coating about 1 micron thick over the photoconductive insulating layer composed of a resinous polyvinyl acetal selected from the group consisting of polyvinyl formal and polyvinyl acetal, the member being capable of receiving an electrical charge on a photoconductive insulating layer and selectively dissipating said charge on exposure to a light image.

2. A xerographic member according to claim 1 wherein the resinous acetal is polyvinyl formal.

3. A xerographic member according to claim 1 wherein the resinous acetal is polyvinyl acetal.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |             |               |
|-----------|-------------|---------------|
| 2,277,013 | Carlson     | Mar. 17, 1942 |
| 2,297,691 | Carlson     | Oct. 6, 1942  |
| 2,489,662 | Murray      | Nov. 29, 1949 |
| 2,588,569 | Picard      | Mar. 11, 1952 |
| 2,624,857 | Mager       | Jan. 6, 1953  |
| 2,663,636 | Middleton   | Dec. 22, 1953 |
| 2,693,416 | Butterfield | Nov. 2, 1954  |
| 2,734,825 | Morgan      | Feb. 14, 1956 |
| 2,808,328 | Jacob       | Oct. 1, 1957  |

##### OTHER REFERENCES

Mees: "The Theory of the Photographic Process" (1942), pages 176 and 177; pub. by The MacMillan Co., N. Y., N. Y.

Schildknecht: Vinyl and Related Polymers, Wiley (1952), pages 358-365.

"Phosphor—Type Photoconductive Coatings for Continuous Tone Electrostatic Electrophotography," 1952, Photographic Engineering; vol. 3, No. 1, pages 12-22; page 20 particularly relied upon.