June 26, 1962 R. M. BLAKNEY ET AL 3,041,167

XEROGRAPHIC PROCESS

Filed Aug. 19, 1959 2 Sheets-Sheet 1

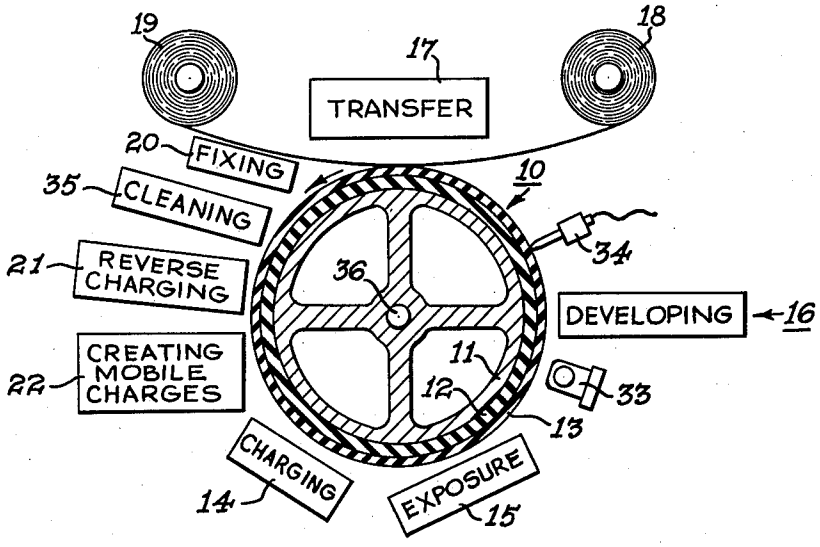


Fig. 1

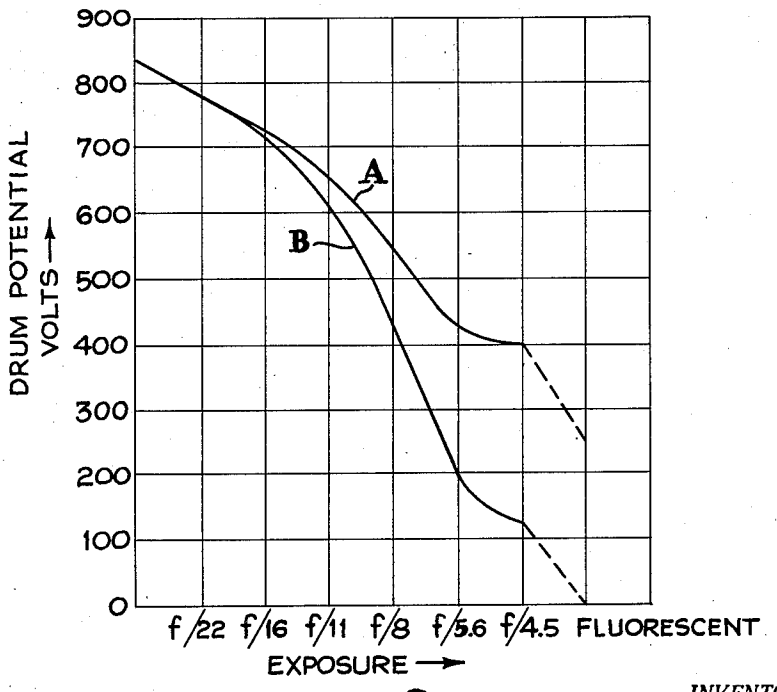


Fig. 2

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XEROGRAPHIC PROCESS

Filed Aug. 19, 1959 2 Sheets-Sheet 2

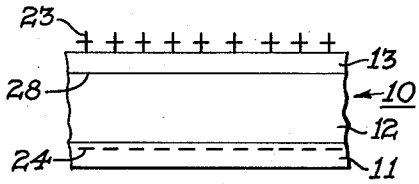


Fig. 3

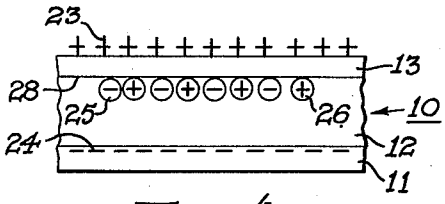


Fig. 4

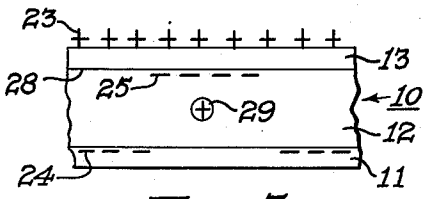


Fig. 5

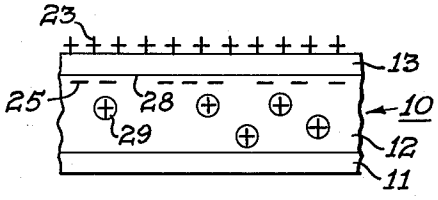


Fig. 6

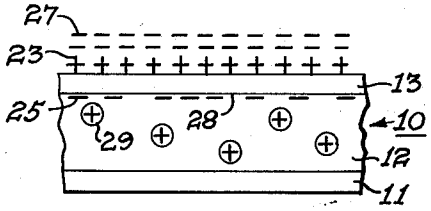


Fig. 7

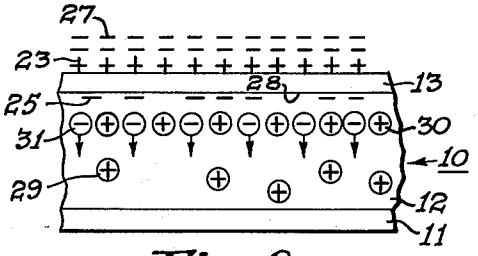


Fig. 8

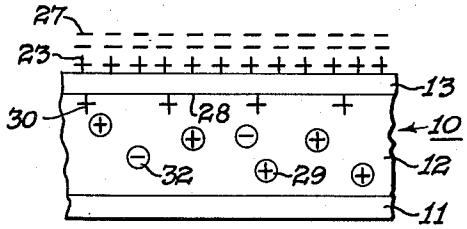


Fig. 9

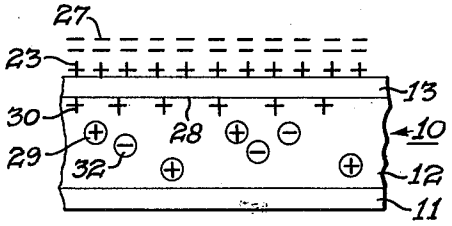


Fig. 10

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3,041,167

XEROGRAPHIC PROCESS

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Filed Aug. 19, 1959, Ser. No. 835,170
9 Claims. (Cl. 96—1)

This invention relates to xerography and has for its object to improve the xerographic processes as heretofore known or practiced.

A practical purpose of the invention is to improve the functioning and efficiency of overcoated xerographic plates, particularly when used for repeated operation. To these and other ends, the invention consists in the procedure that will appear clearly from the following description, the novel features being pointed out in the claims following the specification.

In xerography, it is usual to form an electrostatic latent image on a surface. One method of doing this is to charge a photoconductive insulating surface and then dissipate the charge selectively by exposure to a pattern of activating radiation. Other means of forming electrostatic latent images are set forth in U.S. 2,647,464 to James P. Ebert. Whether formed by these means or any other, the resulting electrostatic charge pattern is conventionally utilized by the deposition of an electroscopic material thereon through electrostatic attraction whereby there is formed a visible image of electroscopic particles corresponding to the configuration of the electrostatic latent image. Alternatively, the electrostatic charge pattern may be transferred to an insulating film and thereafter the electroscopic particles deposited thereon to form the visible image. In any case, to form a xerographic print this visible image may be transferred to a second surface or may be fixed directly to the aforementioned first surface whereon the image is developed.

The member bearing the photoconductive insulating surface in this process is called a xerographic plate and indeed its unique properties make the process possible. A xerographic plate comprises a photoconductive insulating layer on a conductive backing. The chief property of the photoconductive insulator is that in the absence of light or other activating radiation it be a sufficiently good insulator to support an electrostatic potential for a period of time and that it be significantly conductive in the presence of light or other activating radiation. The requirements of the insulating character of the photoconductive insulating materials are very stringent as can be seen from the fact that if the layer is to retain 37% of an applied potential after a lapse of 5 seconds it must have a resistivity of about 10^{13} ohms-cm. Much slower rates of charge or potential decay than this are generally desired in xerography. The photoconductive insulating material, accordingly, may have a resistivity of 10^{14} or 10^{15} ohms-cm. or even higher which puts it outside the range of materials normally considered semi-conductors. By comparison a regular insulator such as asbestos has a resistivity varying from 10^{9} to 10^{12} ohms-cm., nylon has a resistivity of 10^{11} to 10^{13} ohms-cm., plate glass has a resistivity of 2×10^{13} ohms-cm., and cellulose nitrate has a resistivity of 10^{11} ohms-cm. Since the photoconductive insulating material is seen to be necessarily a better electrical insulator than many materials specified for that property it is inappropriate to refer to it as a photoconductive or semi-conductive layer and, hence, the term "photoconductive insulator" has come into use to describe its unique properties. Suitable photoconductive insulators include vitreous materials such as anthracene, sulphur, vitreous selenium or a finely-divided photoconductive pigment such as an oxide, sulfide or selenide of zinc or cadmium dispersed in an insulating resinous binder. Suitable conductive backings include aluminum, brass, conductive glass, paper, etc. Xerographic plates are described in more detail in U.S. applications Serial No. 311,546, filed September 25, 1952, by A. E. Middleton et al., now abandoned, and Serial No. 526,781, filed August 5, 1955, by William E. Bixby, now Patent No. 2,970,906.

For use in the xerographic process an electrostatic charge is placed on the photoconductive insulating surface as by frictional rubbing as described in U.S. 2,297,691 to C. F. Carlson or by other methods as by passing the xerographic plate under a corona discharge emanating from a row of needles of a grid of fine wires as described, for example, in co-pending application Serial No. 154,295, filed April 6, 1950 by Lewis E. Walkup, now Patent No. 2,777,957. When the sensitized xerographic plate is exposed to a light image, the resistance of the areas receiving the incident radiation drop at least several orders of magnitude. This significant photoconductivity is generally accounted for by physical theory postulating that the incident light creates or liberates hole-electron pairs (hole being the term applied to a positive charge carrier). Under the influence of the electrostatic field between the surface of the photoconductive insulating layer and the relatively conductive backing member the hole-electron pair acts to modify the heretofore uniform electrostatic charge.

It has been found that selenium, commercially the most widely used photoconductive insulating material, conducts both electrons and holes but the latter preferentially. It has, therefore, become common practice to charge xerographic plates to a positive potential so that under illumination the plate may dissipate or lose its charge principally through the conduction of holes through the photoconductive layer where they are created by light. The electrons remain at the surface to neutralize the charge at that point. The invention will, accordingly, be described principally in terms of positive charging without intent to be limited thereto.

In this manner a normal xerographic image is created on the surface of the photoconductive insulating material. After utilization of the electrostatic image, as set forth above, the remaining charges are removed by exposing the plate to uniform illumination and the plate is ready for another cycle of operation. In the case of hand-operated xerographic machines there is a significant delay between each cycle of operation. It is desirable, where the plates are subjected to particularly heavy use, to use more than one plate and to alternate the use of the plates. The reason for this is that while selenium presents a substantial range of mobility to holes, some holes nevertheless do become trapped within the selenium layer. By assuring a few minutes between cycles these trapped charges free themselves and the plate is ready for the new cycle. When used in this manner xerographic plates give efficient service for some thousands of cycles.

In the case of a continuous operation machine wherein a photoconductive insulating surface is coated on a cylindrical drum and the drum rotated into the various stations performing the xerographic process, in any drum of practicable size the sequence of operation is so fast that adequate relaxation time cannot be provided. Under these circumstances trapped charges do not have an opportunity to free themselves and build-up in the selenium layer so as to create an appreciable charge in the selenium which is not amenable to discharge on exposure to uniform illumination. This results in a considerable

and significant decrease in the contrast obtainable upon exposure of the sensitized photoconductive surface.

This problem and the solution thereto are shown in U.S. 2,741,959 to John J. Rheinfrank et al. As there-shown, adding the step of charging the photoconductive insulating layer with a charge of polarity opposite to that used to sensitize the photoconductive insulating surface in effect neutralizes the unwanted charges trapped in the selenium thereby restoring the electrostatic contrast virtually to its original value.

It has become essential to increase the life of xerographic drums both because of the high cost of the drums and to decrease down time of any apparatus incorporating a xerographic drum which, in the case of a complex computer machine or the like, can be so significant a cost item as to prevent the use of xerographic apparatus therein. Accordingly, it has been found that applying a suitable insulating or barrier layer on the upper or outer side of the photoconductive insulating layer will achieve the desired result.

This outer layer, or overcoating as it is termed, must be transparent so as not to interfere with the projection of the light image onto the photoconductive insulating layer, must be a good insulator so as not to cause blurring of the electrostatic image due to lateral conductivity and must be very thin in relation to the photoconductive insulating layer so that most of the electric field present across the structure composed of the overcoating and the photoconductive insulating layer by virtue of the charge on the surface of the overcoating will appear across the photoconductive insulating layer. In practice, the overcoating is sufficiently thin so that most materials are adequately transparent. A particularly preferred overcoating material is a polyvinyl acetal. Similar materials such as other vinyl resins, silicones, cellulose esters and ethers etc, may also be used.

For a better understanding of this invention, reference is now had to the following description taken in connection with the accompanying drawings wherein:

FIGURE 1 is a diagrammatic representation of a continuous xerographic copying apparatus;

FIGURE 2 is a graph showing residual potential of the xerographic plate as a function of exposure to light; and

FIGURES 3 through 10 are diagrammatic representations of a section of a xerographic plate showing charge behaviour during the xerographic process illustrating the instant invention.

FIG. 1 illustrates apparatus for continuous xerographic copying. This apparatus comprises, essentially, a cylindrical drum **10** made up of a conductive backing **11** having coated thereon a photoconductive insulating layer **12** which in turn is desirably protected by an overcoating layer **13**. The drum is rotatably mounted on its longitudinal axis **36** to revolve in the direction shown in the drawing. In the normal xerographic process the surface of the drum, constituting a xerographic plate, is first charged at a charging station **14** (as described in the Walkup application referred to above), exposed to an image of light and shadow by a conventional projection optical system **15**, made visible by the deposition thereon of electroscopic powder particles in conformity with the electrostatic image at a developing station **16** (as shown, for example, in U.S. 2,573,881 to Walkup et al, and U.S. 2,357,809 to C. F. Carlson) transferred at a transfer station **17** (as shown, for example, in U.S. 2,576,047 to R. M. Schaffert) to a suitable recording medium such as paper, plastic, metal or the like which desirably is provided by feed roll **18**, stored on take up roll **19** immediately after fixing of the powder image to the surface of the recording medium at fixing station **20** (as shown, for example, in U.S. 2,701,765 to Codichini et al.) and has the residual image removed from surface **13** at cleaning station **35** (as shown, for example, in U.S. 2,751,616 to Turner et al.).

In electrical terms what this involves can be seen with reference to FIGS. 3–6 which show a section of the xerographic drum **10**. When such a plate is charged at the charging station **14** a layer of positive electric charges **23** is deposited on overcoating layer **13** thereby inducing a layer of negative charges **24** at the interface between conductive backing **11** and photoconductive layer **12**. On exposure to incident radiation, the radiation as shown in FIG. 4 creates hole-electron pairs **26—25** near the upper surface of the photoconductive layer **12** where the majority of the light is absorbed. These hole-electron pairs are acted on by the electrostatic field extending between **23** and **24** whereby the positive charges **26** are repelled by the positive charge layer **23** and the negative charges **25** are attracted thereto. Accordingly, the negative charges **25** are retained at the interface **28** between **12** and **13** while the positive charges **26** migrate through the photoconductive layer **12** to the conductive backing **11**, probably resulting at the end of the first cycle in a picture qualitatively somewhat like that shown in FIG. 5.

As there shown, in the area where incident light struck the plate, negative charges **25** remain at the interface **28** while the remainder of the positive charges **26** have come through the photoconductive layer **12** to neutralize the negative charges **24** in that portion of the conductive layer **11** immediately under where the incident radiation struck the plate. Not all of the positive charges **26** make the complete trip, some being trapped en route in trap sites as shown by remaining charge **29** in FIG. 5 within the body of the photoconductive layer **12**.

As the plate is subjected to repeated cycles there is reached a state shown in FIG. 6 wherein an appreciable body of positive charges **29** become trapped within the body of the photoconductor **12**. Similarly, it is surmised that a number of negative charges **25** build up at the interface **28**. Even the application of intense illumination under such conditions is completely unable to free the negative charges from their position at the interface **28** due to strong attraction of the positive charges **23** on top of the overcoating layer **13**. Similarly, the application of negative charging as suggested in U.S. 2,741,-959 to John J. Rheinfrank et al. also does not help as the presence of the overcoating layer **13** prevents the negative charges applied thereto from migrating through the photoconductive layer **12** and neutralizing the positive charges **29** trapped in the body of the photoconductive layer **12**.

Now applicants have discovered that if enough additional negative charges are added to the overcoating to create a net negative field (i.e., a field in the opposite direction from that produced in the normal charging operation) through the plate together with the additional step of creating mobile positive charges in the photoconductor in sufficient quantity to form a layer of net positive charge at the photoconductor-overcoating interface under the influence of the negative field, it is possible not merely to obviate the effects of both the trapped charges **29** and the interfacial charges **25**, but to obtain considerably enhanced contrast and realizable photographic speed even over what is obtainable with an unovercoated plate. These additional advantages are indeed highly surprising and unexpected.

Strictly speaking, an insulator is a material which does not permit the passage of any electricity at all. More definitively, an insulator is a material that has substantially no current carriers in conductive energy levels. A photoconductive insulator is such a material which in its normal state is an insulator and thus will not permit the flow of the electricity. Thus, for an electrostatic charge to pass through a photoconductive insulator, it is essential to inject charge carriers from some extrinsic source. This may be done by either of two means; first, by the absorption of activating radiation; and, second, by the injection of charge carriers from an electrode.

The phenomenon which causes the photoconductivity is the fact that within the body are structures in which certain electrons can be activated by photon energy to conductivity energy levels thus constituting charge carriers. In the case of the photoconductive insulator, it should be remembered that the term "current carrier" is deliberately used in place of the term "electron" since the current carrier might be an electron or might be a positive carrier or "hole" left in the atomic structure by the activation of the electron, as is well known to those skilled in the art. Thus, illuminating the layer of vitreous selenium with activating radiation creates mobile charge carriers, that is, a hole-electron pair in the bulk of the photoconductor.

The essential steps in the instant process are to create a negative electric field through the plate and under the influence of this field to form a layer of positive charge bound at the interface between the selenium and the insulating overcoating. It is believed that the positive charges are retained in traps and/or states analogous to surface states. For regular selenium plates such a layer of positive charge is formed by illuminating the plate while the negative field is maintained, the illumination creating electron-hole pairs in the photoconductor near the interface. The electrons so formed will be driven towards the metal backing by the negative electric field while the positive holes will be attracted towards the photoconductor-insulating interface and there form the desired positive charge layer.

The other means of creating charge carriers in the bulk of the photoconductive insulator from a source extrinsic thereto is to contact the photoconductor with an electrode having a highly rectifying energy barrier therewith. The insulating overcoating covering the free surface of the photoconductor protects that surface from injection. Thus, it is evident that the requisite electrode-photoconductor junction must be formed with the backing material, that is, the rectifying junction is formed by layers **11** and **12**.

In the regular xerographic process injection of charge carriers into the photoconductor from the backing material interferes with the basic image forming process of xerography, significantly decreasing the available electrostatic contrast and the ability of the plate to retain the electrostatic charge image in the dark prior to development. Accordingly, it is the practice to prevent such unwanted injection from the backing electrode by interposing a "barrier layer" between the metal backing and the photoconductive insulating layer. This layer, its formation and its function are described in Ser. No. 342,856, filed March 17, 1953, by Dessauer and Clark, now U.S. 2,901,348. In general, it is desirable to prevent the injection of both polarities of charge carriers so as to permit the utilization of the xerographic plate with either polarity of sensitization (if the photoconductor has a sufficent range for both polarities of charge carriers). Barrier layers having a rectifying action ranging anywhere from a slight polarity differential to highly rectifying characteristics may also be used.

In a repetitive xerographic machine of the type to which the present invention relates, the time between successive stages of the xerographic process is a matter of seconds. Accordingly, the injection of charge carriers across a slightly rectifying barrier, such as aluminum oxide, when a reverse field (i.e., a field opposite in polarity to that applied during the image-forming exposure step) is applied, is not sufficiently rapid to supply the amount of charge carriers necessary for the creation of the charge layer at the interface between the photoconductor and the overcoating. However, the use of a highly rectifying barrier layer does supply an adequate amount of charge carriers so as to permit the formation of the desired charge layer. The rectifying nature of the barrier is a function both of the material of the barrier layer and of the photoconductor. Thus, the selection of a proper material for the barrier layer is dependent on the nature of the photoconductor.

Examples of materials which have proven satisfactory for the formation of such highly rectifying barrier layers with vitreous selenium are metallic selenium and cuprous oxide. Vitreous selenium normally has a significantly longer range for holes than for electrons. Thus, it is desirable to use positive sensitization of the selenium for the sensitizing step so that the image forming process requires the movement only of holes through the selenium. Both metallic selenium and cuprous oxide have been found highly effective in preventing the injection of electrons into vitreous selenium under an applied positive field. Thus, a selenium xerographic plate with such an interlayer when positively charged has excellent dark decay and image forming properties. However, these materials offer a very low energy barrier for positive charge carriers when a negative, i.e., reverse polarity, field is applied, that is, the junction is highly rectifying. Thus, selenium xerographic plates having an interlayer of cuprous oxide or metallic selenium have excellent dark decay rates when positively charged but very high dark decay rates when negatively charged. Thus, the use of such materials for the barrier layer causes injection of holes into the photoconductor from the conductive backing without the necessity for uniform illumination when the reverse field is applied in the instant process. The selection of such materials for a highly rectifying barrier layer does not constitute part of the instant invention and any such materials known to those skilled in the art may be used.

In electrical terms what happens can best be seen by referring to FIGS. 7–10. As shown in FIG. 7, a layer of negative charges **27** is placed on the overcoating layer **13** to form a net negative field through the plate. Now, when the mobile holes are created in the photoconductive layer **12**, as shown in FIG. 8, as by exposure to incident radiation **22**, since charges **27** have a greater density than charges **23** thereby giving a net negative field, the effect of the combined electrostatic charges **23** and **27** is to repel negative charges **31** and retain positive charges **30** at the interface **28**. As positive holes have a much greater range in a photoconductor such as selenium than do negative charges, a larger percentage of such negative charges **31** are trapped in the selenium thereby building up an appreciable space charge in effect in the body of the photoconductor. At the same time an appreciable layer of positive charges **30** are retained at the interface **28** so that there is built up at interface **28** a layer having a net positive charge. There is thus built into the xerographic plate an appreciable and highly significant electrostatic charge which is bound in a definite layer-like formation.

The contrast sensitivity and also the effective photographic speed of the xerographic plate may be considered a function, among other things, of the available potential. For a given charging voltage it is evident that there is now available a far greater potential in the xerographic plate than was ever available before. What this means in terms of practical operability can be seen by the graphs FIG. 2. Curves A and B were obtained using the apparatus shown in FIG. 1. Charging station **14** was set for an initial charge of (+)825 volts and reverse charging station **21** for the equivalent charge of a negative polarity. With these voltages at **14** and **21**, a uniform fluorescent light at **22**, a uniform electric light behind a diaphragm in the projection optical system at **15**, and electrometer probe **34** activated and positions **16** and **17** deactivated, drum **10** was rotated through several cycles (generally about 50) until the electrometer indicated a steady state had been reached. The steady state voltage was determined for each *f* number and finally for exposure by activating fluorescent light **33** with projection optical system **15** turned off. Two sets of curves were obtained in this way, A for a drum **10** having no overcoating and B for a drum **10** having an overcoating **13**. When run in this manner, with the projection optical system **15** set at an aperture of *f*/4.5 there re-

mained a residual potential of 400 volts on the unovercoated drum. In contrast to this, at the same *f* number the overcoated drum had a residual potential of only 125 volts. When exposed to a uniform fluorescent light, it was impossible to completely discharge the unovercoated plate, there remaining a potential of about 255 volts on the plate. On the other hand, the overcoated plate was completely discharged by the fluorescent light.

By further increases in the negative potential applied at station **21**, it is possible to even further improve the performance of the overcoated plate. Thus, one can completely discharge the overcoated plate with an exposure at *f*/4.5 while having it assume a negative potential upon exposure to a fluorescent light. In terms of results this means that at equivalent exposures of say 4.5, the overcoated drum has available 275 volts more potential contrast between image areas and non-image areas than does the non-overcoated drum. Hence, it is possible to obtain a higher image density and clearer images throughout using an overcoated drum and the process of the instant invention than with an unovercoated drum. Conversely, one may obtain the same degree of contrast with an overcoated drum as with an unovercoated drum while substantially decreasing the exposure, thus, making the system much less critical in terms of light requirements and considerably increasing the latitude possible.

The instant invention produces a controlled double charge layer (as distinguished from the space charge-type of distribution resulting from charges randomly trapped within the bulk of the photoconductor) at the surface of the xerographic plate. The critical feature of this double charge layer is its controlled nature—controlled in polarity and controlled in density—which makes possible not merely the operation of xerographic plates with longer use lifetimes, but also results in increased contrast, etc. The double charge layer unique in the instant invention maintains a different potential across the photoconductor than the external potential applied to the plate would indicate. Nevertheless, the field across the photoconductor remains sensitive to incident radiation and any change in the photoconductor potential is effective outside of the overcoating to produce a developable result.

While the invention has been described principally in terms of vitreous selenium, it is not intended to be limited thereto. Thus, in the case of a photoconductive insulating material which normally is sensitized by placing thereon a negative charge (such as a mixture of 5% arsenic and 95% vitreous selenium), the process of the instant invention will be practiced as with selenium except that the polarity of the charges used at each step of the process will be the opposite of that normally used with unalloyed vitreous selenium. If such a photoconductor is used as the photoconductive layer **12** in FIG. 1, the xerographic plate is sensitized by placing on the insulating layer **13** negative charges from charging station **14**. Reverse charging station **21** flows positive charges to insulating layer **13** to create a net positive field through the xerographic plate. Free negative charges are created at station **22** as by illumination or injection from conductive backing **11**. Under the net positive field, the layer created at interface **23** will have a net negative charge.

Whatever type of photoconductor is used, if illumination is used to create mobile charges in the photoconductor, the illuminating means may be combined at a single station with the reverse charging means so that creating mobile charges in the photoconductor proceeds concurrently with establishment of the electrostatic field of the desired polarity on the insulating layer. Alternatively, these steps may be carried out serially at separate stations as shown.

This application is a continuation-in-part of our application Serial No. 613,123, filed October 1, 1956, now abandoned.

We claim:

1. In a repetitive xerographic process which comprises the steps of sensitizing an insulating layer coated on a photoconductive insulating layer on a conductive backing by charging it with an electrostatic charge of a first polarity, exposing said photoconductive layer to a light image to provide a latent electrostatic image, utilizing said electrostatic image in a copying cycle and repeating the entire series of operations, the added steps before the sensitizing step comprising charging said insulating layer with an electrostatic charge opposite in polarity to said first polarity to produce a field thereon whose net charge is opposite in polarity to said first polarity and applying an electrical potential to said conductive backing thereby injecting mobile charges of said first polarity from said conductive backing into said photoconductive insulating layer to form a layer of charges of said first polarity, said charge layer being held at the interface between said insulating layer and said photoconductive insulating layer.

2. A process according to claim 1 wherein said photoconductive insulating layer is vitreous selenium.

3. In a repetitive xerographic process which comprises the steps of sensitizing an insulating layer coated on a photoconductive insulating layer on a conductive backing by charging it with an electrostatic charge of a first polarity, exposing said photoconductive layer to a light image to provide a latent electrostatic image, utilizing said electrostatic image in a copying cycle and repeating the entire series of operations, the added steps before the sensitizing step comprising charging said insulating layer with an electrostatic charge opposite in polarity to said first polarity to produce a field thereon whose net charge is opposite in polarity to said first polarity and uniformly illuminating said photoconductive insulating layer with activating radiation while said field is maintained thus creating at the interface between said photoconductive insulating layer and said insulating layer a layer of charges of said first polarity.

4. A process according to claim 3 wherein said photoconductive insulating layer is vitreous selenium.

5. In a repetitive xerographic process which comprises the steps of sensitizing an insulating layer coated on a photoconductive insulating layer on a conductive backing by charging said insulating layer with an electrostatic charge of a first polarity, exposing said photoconductive layer to a light image to provide a latent electrostatic image, making visible said electrostatic image by depositing thereon a finely-divided electroscopic material, transferring the visible image, cleaning said insulating layer and repeating the above cycle of operations, the added steps before the sensitizing step comprising charging said insulating layer with an electrostatic charge opposite in polarity to said first polarity to produce a field thereon whose net charge is opposite in polarity to said first polarity and applying an electrical potential to said conductive backing thereby injecting mobile charges of said first polarity from said conductive backing into said photoconductive insulating layer to form a layer of charges of said first polarity, said charge layer being held at the interface between said insulating layer and said photoconductive insulating layer.

6. A process according to claim 5 wherein said photoconductive insulating material is selenium.

7. The method of reproducing light images which comprises charging an insulating layer coated on a photoconductive insulating layer on a conductive backing with an electrostatic charge of a first polarity, exposing said photoconductive insulating layer to a light image, depositing a finely-divided electroscopic material in accordance with the resulting electrostatic charge pattern, transferring said deposited electroscopic material in accordance with said charge pattern, cleaning said insulating layer, charging said insulating layer with an electrostatic charge opposite in sign to said first polarity to create thereon an electrostatic field whose net charge is opposite in polarity to said first polarity, injecting mobile charges of said first polarity from said conductive backing into said photoconductive insulating layer by apply-

ing an electrical potential to said conductive backing while said electrostatic field is maintained to form a layer of charges of said first polarity at the interface between said insulating layer and said photoconductive insulating layer, then recharging said insulating layer with an electrostatic charge of said first polarity prior to a second exposure to a light image.

8. The method of reproducing light images which comprises charging an insulating layer coated on a photoconductive insulating layer on a conductive backing with an electrostatic charge of a first polarity, exposing said photoconductive insulating layer to a light image, depositing a finely-divided electroscopic material in accordance with the resulting electrostatic charge pattern, transferring said deposited electroscopic material in accordance with said charge pattern, cleaning said insulating layer, charging said insulating layer with an electrostatic charge opposite in sign to said first polarity to create thereon an electrostatic field whose net charge is opposite in polarity to said first polarity, uniformly illuminating said photoconductive insulating layer with activating

radiation while said field is maintained thus creating at the interface between said photoconductive insulating layer and said insulating layer a layer of charges of said first polarity, then recharging said insulating layer with an electrostatic charge of said first polarity prior to a second exposure to a light image.

9. A process according to claim 8 wherein said photoconductive insulating layer is vitreous selenium.

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