

Aug. 8, 1967

C. SNELLING

3,335,003

REFLEX XEROGRAPHIC PROCESS

Filed Oct. 9, 1963



FIG. 1

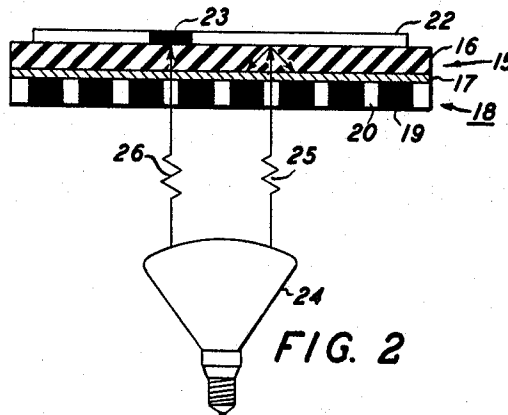


FIG. 2

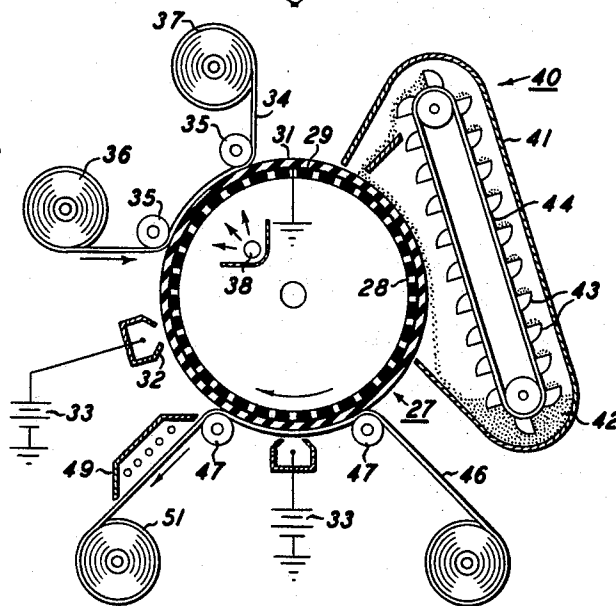


FIG. 3

INVENTOR.
CHRISTOPHER SNELLING

BY *Stanley Z. Cole*
ATTORNEY

1

3,335,003

REFLEX XEROGRAPHIC PROCESS

Christopher Snelling, Penfield, N.Y., assignor to Xerox Corporation, Rochester, N.Y., a corporation of New York

Filed Oct. 9, 1963, Ser. No. 315,046

3 Claims. (Cl. 96—1)

This invention relates in general to xerography and in particular to an improved xerographic plate.

Xerography as originally described in U.S. Patent 2,297,691 to Carlson and later related patents generally comprises charging a photoconductive insulating member to sensitize it and then subjecting it to a light image or other pattern of activating electromagnetic radiation which serves to dissipate charge in radiation struck areas, thus leaving a charge pattern or latent electrostatic image on the photoconductor conforming to the electromagnetic radiation pattern. In most instances, these exposures are made with projectors of various types which employ relatively expensive lens systems. Following exposure, the image is developed by the deposition of electroscopic or electrostatically attractable, finely divided, colored material, referred to in the art as toner, on the exposed photoconductor, which by virtue of its latent electrostatic image, forms a corresponding toner image on its surface. The toner image thus formed may then optionally be viewed in situ on the photoconductive insulator or transferred to a copy sheet and fixed thereon.

The photoconductive insulating member along with its supporting substrate is known in the art as a xerographic plate regardless of its shape or flexibility. The xerographic plate has undergone continuous improvement and development since the time of the original Carlson patent noted above as is attested to by the following exemplary U.S. Patents: 2,599,542 to Carlson, 2,803,541 to Paris, 2,863,768 to Schaffert, 2,901,348 to Dessauer, 2,970,906 to Bixby and 2,917,385 to Byrne. The aforementioned Bixby patent describing the amorphous selenium xerographic plate marks a large step forward in the art of xerography because of its truly unique properties. First of all, because of the homogeneous nature of this amorphous elemental selenium plate and because of the smoothness with which its surface may be fabricated, the plate has been found to be capable of producing exceptionally high resolution latent electrostatic images. In addition, it has the highest photographic sensitivity of any commercially utilized xerographic plate while at the same time being the only known type of xerographic plate which is easily cleanable and capable of rapid reuse. The combination of all these capabilities has gone to make the amorphous selenium xerographic plate pre-eminent in the field by a wide margin and in fact the only plate available commercially for use in reusable plate xerography.

Although amorphous selenium plates are capable of producing exceptionally good line copy reproductions with relatively simple xerographic apparatus, they share some of the defects common to all xerographic plates. For example, special techniques such as half-tone exposure as described in U.S. Patent 2,598,732 to Walkup or more complex apparatus such as development electrodes as described in U.S. Patent 2,777,418 to Gundlach have, in many instances, been required to produce really exceptional continuous rendition and the complete copying of very large solid dark areas from the original. In addition, selenium plates as ordinarily produced are not fully panchromatic.

In addition, no simple, easy-to-manufacture, reflex type, amorphous selenium xerographic plate which is practical for use in inexpensive office copying machines has yet been devised. Reflex exposure systems which have many advantages over other techniques of exposure are widely

2

used in the photographic field. Since reflex exposure is made through the photosensitive medium and reflects off the image to be reproduced which rests on the upper surface of the photosensitive medium, no lenses are necessary with this technique. This elimination of the lens or lens systems which are employed in other exposure techniques results in large savings in both money and space because not only is the lens eliminated, but its optical path is also eliminated. It is to be noted, however, that reflex type systems are difficult of achievement in xerography. This is so because when the photoconductive insulating layer is thick enough to form a relatively good xerographic plate, it becomes quite opaque and thus any illumination of sufficient intensity to penetrate the photoconductive insulating layer is sufficient of itself to discharge the plate irrespective of any additional radiation reflected back to the photoconductive insulating surface from the image above the plate as would be the case with a reflex exposure technique. When ordinary amorphous selenium is put down in a continuous film over a discontinuous opaque pattern for use with reflex exposure in a xerographic system, difficulties arise because only red light is transmitted through the selenium layer and since the selenium is not very sensitive at the red end of the visible spectrum, the reflected red light is highly inefficient in exposing those areas of the selenium which had not been exposed by the light on its original passage through the selenium layer. If the selenium layer is made thicker to increase its sensitivity, the light passing through the selenium on its original path is cut down making for little, if any, increase in over all system sensitivity. At any event, it has generally been found that a selenium plate should be at least 10 microns thick to give prints of commercially acceptable quality with improved solid dark area reproducing capabilities.

In an attempt to overcome these problems, a vitreous selenium, reflex type xerographic plate was developed by Byrne as described in U.S. Patent 2,917,385. This plate employs a transparent or translucent conductive support for a pattern of opaque conductive material in which each opaque pattern portion is itself covered with a layer of photoconductive insulating material such as selenium. Although the construction described in the Byrne patent does overcome the problem of transmitting light through the plate from its underside by only depositing the relatively opaque selenium and its conductive opaque interface in discrete areas on the plate surface so that light may pass through the noncoated areas of the plate, this plate is relatively complex in structure and difficult to manufacture. Difficulties are encountered in laying down the selenium and conductive interface layers in very small discrete areas on the plate surface so that the image produced by the plate appears uniform and continuous to the viewer. Furthermore, unless the protuberances formed by the small layers of interface material and selenium are back filled with a transparent material, the plates cannot be used with great efficiency in reusable plate xerography because of the difficulty in removing residual toner particles from the development process which tend to become lodged in the depressions between adjacent protuberances on the plate surface.

Accordingly, it is an object of this invention to provide an improved xerographic plate with extended spectral sensitivity.

A further object of this invention is to provide a reflex-type xerographic plate which is of simple construction and easy to fabricate, and a method for its production.

An additional object of this invention is to provide a novel xerographic plate capable of copying subjects with large solid dark areas as well as continuous tone and line copy subjects.

The above and still further objects, features, and advantages of the present invention will become apparent

upon consideration of the following detailed disclosure of the invention, especially when taken in conjunction with accompanying drawings wherein:

FIGURE 1 is a side-sectional view of the electrical portions of the xerographic plate according to this invention;

FIGURE 2 is a side-sectional view of a reflex-type xerographic plate according to this invention including an original to be reproduced on the plate surface and an exposure light source;

FIGURE 3 is a side-sectional view of a complete xerographic system employing a reflex xerographic plate of the type described in FIGURE 2 in the form of a cylindrical drum for continuous operation.

Referring now to FIG. 1, there is illustrated a xerographic plate generally designated 10 embodying the concept of this invention. In this sectional view of the xerographic plate, there is shown a supporting substrate 11 overcoated with a uniform thin layer of gold 12 and an upper layer of amorphous selenium 13. Since amorphous selenium films are not generally durable, self-supporting films for use in xerographic apparatus, and since it is desirable to keep the gold base layer 12 as thin as possible to minimize the amount of this costly material utilized in the plate structure, the plate substrate 11 is employed to provide mechanical support for the remaining plate elements, thus making the whole plate suitable for use in xerographic copying machines. It should be noted, however, that if cost and transparency are not considerations, the gold layer may be made thicker to provide mechanical support for the plate and the supporting substrate may be eliminated from the plate structure. In the great majority of cases where the supporting substrate 11 is employed, it may be either flexible or rigid, insulating or conductive and transparent or opaque depending upon the end use of the plate. Thus in some instances where the plate is utilized in xerographic copying machines, the supporting substrate may consist of a rigid member such as a plastic or metallic plate or cylinder or if it is desired that the plate be flexible the substrate may consist of a web, foil or similar flexible member. While this substrate may generally be fabricated of some opaque material such as for example aluminum, in certain instances where it is desired to expose the selenium through the plate substrate, the substrate must be fabricated of some transparent material such as Lucite (a trade name for clear polymethylmethacrylate), glass or the like. In those instances, it is also necessary that the gold layer 12 be sufficiently thin to transmit at least some of the light impinging on it through to the selenium layer. This generally requires that the gold layer be a few hundred angstrom units or less in thickness. As a general rule, the thinner the gold layer is made, the more light it will transmit from the plate substrate to the selenium layer. Thus, for example, a gold layer of about 225 angstrom units in thickness will transmit only about 15% of impinging light whereas a film of about 100 angstrom units will transmit about 50% and a film of about 50 angstrom units will transmit about 70%. Although gold films even thinner than 50 angstrom units have been employed it becomes increasingly difficult to get uniform gold coverage as the gold film thickness is lowered and at this point, the savings in the cost of the gold employed becomes negligible.

In most prior art amorphous selenium xerographic plates employing a conductive backing either aluminum, copper or brass has been employed as this layer. Although these prior base materials have made for the formation of xerographic plates of high quality, they generally include a thin insulating barrier layer between the conductive layer and the amorphous selenium layer. As described more fully in the above referenced patent to Dessauer, this intervening barrier layer is generally formed by oxidizing the upper surface of the conductive layer or by interposing a very thin layer of an additional

insulating material such as polystyrene between the conductive layer and the selenium. Obviously, the necessity for this additional barrier layer means that an additional manufacturing step is required for the production of the plate when the prior art conductive bases are employed. In contrast to this requirement, it has been found that when gold is employed as the conductive base layer, no intervening barrier layer is required to make a high quality xerographic plate and that this omission can be made without reduction in the charge holding capability or sensitivity of the plate produced. In fact, not only does the sensitivity of the gold base plate remain unimpaired as compared with aluminum, copper or brass base plates, but in fact it has been found that the use of gold as a conductive base increases the sensitivity and very significantly extends the spectral response of the amorphous selenium plate. By way of example, the aluminum based amorphous selenium xerographic plate with an aluminum oxide interface has a maximum sensitivity in the ultraviolet with light having a wave length of about 2750 angstrom units. This sensitivity falls off gradually as wave length is increased until it reaches substantially zero at about 5600 to 5700 angstrom units. The use of gold as a conductive base has produced an amorphous selenium xerographic plate whose sensitivity is at least as high as the prior art xerographic plates at the wave lengths where the prior art plates showed sensitivity and which in addition, shows a very significant response at longer wave lengths ranging into the red. Thus although the gold base selenium plate falls off in sensitivity at about 5600 angstrom units, its sensitivity does not come nearly as close to zero at this wave length as do the prior art plates, and in addition its response curve runs up above 6000 angstrom units with a peak at about 7000 angstrom units. The selenium coating is accomplished by evaporation from an inert boat in a vacuum evaporation coating apparatus so as to deposit the selenium in its amorphous form. The selenium employed may either be in its substantially pure elemental form or alloyed with small amounts of other elements such as arsenic for greater heat resistance, as more fully described in U.S. Patent 2,803,542 to Ullrich. This enhanced response at the red end of the spectrum makes the plate sensitive to any monochromatic light and increases its sensitivity to polychromatic light.

In FIG. 2, there is illustrated a reflex type xerographic plate generally designated 15. This plate is composed of a selenium layer 16 and a gold layer 17 both transparent and similar to the selenium and gold layers of the plate described above in connection with FIG. 1. These two layers are superimposed on a supporting substrate 18. Substrate 18 is an optical screen made up of a number of small alternating opaque sections 19 and transparent sections 20. A copy sheet with white areas 22 and dark areas 23 is shown on the upper surface of the selenium so as to illustrate the mode of operation of the plate. Owing to the fact that exposure is made from underneath the optical screen 18 and must pass through the selenium, a light source 24 which is rich in red light is preferably employed since selenium transmits red light best. After the selenium surface of the plate has been charged so as to sensitize it, the copy sheet to be reproduced is laid down in contact with the upper surface of the selenium and the exposure light 24 is turned on for an appropriate length of time. Since the selenium is quite sensitive to the red light because of the gold base, all those portions of the selenium directly above the transparent areas 20 of the screen 18 are immediately discharged by the light on its first pass through the selenium from the light source. Two light rays 25 and 26 are shown emanating from the light source 24 for purposes of illustration; however, the back of the optical screen 18 is flooded with light rays in actual practice. As each of these light rays pass through the optical screen and the selenium, they discharge the selenium directly above

the transparent portions 20 of the optical screen 18 through which they pass; however, since light ray 26 strikes the darkened portion 23 of the copy sheet, it is absorbed after its first pass through the selenium while light ray 25 which strikes a white portion of the copy sheet is diffusely reflected back through closely adjacent portions of the selenium thereby discharging portions of the selenium directly above those opaque areas of the optical screen 18 immediately adjacent to the transparent area 20 of the optical screen through which the light beam 25 initially passed. It is thus seen that the initial passage of light through the transparent sections 20 of the optical screen 18 serves to render the charge pattern on the selenium discontinuous in the microscopic sense while leaving it uniformly charged in the macroscopic sense. Of course it is to be realized that this "uniform" charge over the surface of the selenium is interrupted by very small areas which have been at least partially discharged by the initial exposure. Because of this microscopic discontinuity in the charge pattern, charged areas on the selenium are immediately adjacent to areas which are at least partially discharged resulting in a relatively high potential gradient at the junction points of these two types of areas. Because of these high potential gradients, strong electrostatic fringing fields of force are set up at the junctions which have large vertical components extending above the surface of the selenium plate. It has been found that these vertical electrostatic field components are very favorable for development with the commonly used xerographic developing materials and thus when a completely black copy sheet is placed on the upper surface of the selenium plate illustrated in FIGURE 2 and all of the light from light source 24 is absorbed by this black sheet with no reflection of light back into the selenium, development of the plate after exposure results in complete and uniform coverage of the plate (in the macroscopic sense) with black xerographic developing material (or toner as it is known in the art). In contrast to this result, it has been found that when an ordinary xerographic plate or a plate constructed in this manner described above in connection with FIG. 1 is exposed to an image containing large solid dark areas, the result is the formation of a large uniformly charged area on the plate after exposure. This type of charged area is extremely difficult to develop with uniformity because such uniformly charged areas have virtually no vertical electrostatic field components extending above the surface of the plate at their centers (because of the lack of fringing fields) with which to attract ordinary xerographic toners.

Returning now to the FIG. 2 illustration, it is seen that the microscopically discontinuous charge pattern formed by the initial passage of the light through the selenium is completely eliminated in those portions of the selenium directly below white or other light colored portions of the original by reflected light from those portions of the original as shown by the reflected light rays in this figure. The optical screen 18 may be a conventional dot or line screen of the type commonly used in the graphic arts. Actually the pattern of the optical screen may be of almost any shape including round dots, elliptical dots, lines, random shapes and the like. The spacings of the pattern may also vary so that the pattern is regular, irregular or random and the pattern may also be varied in size from line to line or dot to dot. While it is not absolutely essential, it is preferable that the optical screen 18 be of the type in which the adjacent transparent and opaque areas are sharply defined so as to provide for very high potential gradients on the plate with the first pass of the exposure light through the selenium. This type of screen is referred to in the graphic art as a "hard" pattern screen. The screen and its close proximity to the selenium layer (because of the thinness of the gold layer) allows the use of a non-point source of illumination for exposure while still providing very

sharp boundaries between sections of the selenium which are exposed and those which are not exposed on the initial pass of the light through the screen thus giving rise to the beneficial fringing fields described above. The number of lines or dots per inch on the screen may vary widely depending upon the final effects desired in the copies. Generally speaking, the number of lines or dots per inch on the screen selected is a compromise between cost and quality since although the rougher and less expensive screens containing about 40 to 60 lines or dots per inch produce images in which the dot pattern is visible to the naked eye, the finer screen ranging up from 300 to 500 dots or lines per inch which consequently do not produce an easily visible dot or line pattern in the final image are quite expensive. Screens of about 133 or 150 lines per inch generally make a good compromise choice. A more important parameter in the selection of the screen is its percentage light transmission. In testing xerographic plates of this type, it has been found that optical screens with transmissions ranging from about 5 to about 40% provide the best results, since below about 5% insufficient light gets through the screen to expose adjacent areas of the selenium by reflection while screens with above about 40% light transmission allow excessive light to pass through the screen initially, resulting in generally inadequate density of the final images produced because of insufficient charge remaining in unexposed areas of the plate corresponding to black portions of the original. Another plate parameter of considerable importance is the thickness of the selenium layer employed. If this selenium layer is too thin, the maximum voltage of the charge which may be placed on the selenium layer is not high enough to produce developed xerographic images of sufficient density to be acceptable as truly high quality images. On the other hand, as selenium thicknesses are increased in this reflex plate, the opacity of the selenium layer increases so that even the amount of red light which is transmitted through the selenium upon initial exposure from light source 24 is significantly reduced. It has generally been found that about 10 microns of selenium will make a fairly good print because it will hold sufficient voltage without breakdown but that if the selenium thickness is decreased much below this level, print quality becomes inadequate. On the other hand, if the selenium thickness is increased much above 25 microns, image quality falls off because of decreased light transmission through the selenium and also decreased resolution because the spacing between the red sensitive interface and the subject is greater. Twenty microns of selenium has been found to produce about the optimum results in final print quality when used with an optical screen having about 10% transmission.

A test plate of the type described above was made starting with a 133 line per inch hard dot pattern on a photographic film which is sold under the trade name of Byrum Screen Tint and which is available from the Byrum Company of Columbus, Ohio. This screen is substantially opaque having a 10% light transmission rate and is a connected screen having small discrete transparent dots over its whole area. The screen was first protectively dip coated with a withdrawal rate of about 60" per minute in a 2 to 1 mixture by volume of an ordinary lacquer catalogue No. M-5972 and a thinner catalogue No. EM-998 available from the Bee Chemical Company and then air dried. The lacquer coated tint was then placed in a vacuum evaporator above an electrically heated molybdenum boat containing 1 1/4" to 16 gauge gold wire. A temperature of about 1300 to 1400° C. in the boat caused substantially complete evaporation of the gold in about one minute thus forming a uniformly transparent gold film on a 5" x 7" area of the screen tint. The tint was then removed from the evaporator and overcoated with a layer of about 20 microns of amorphous selenium in a second vacuum evaporator with the gold coated tint being held at about

60° C. during this second evaporation. Since the completed plate was flexible, it was taped to a clear Lucite plate for easy handling and tested in the xerographic mode of operation described above in connection with FIGURE 2 and found to produce high quality prints faithfully reproducing line copy, large solid dark area and continuous tone original subjects. This amount of gold produced a conductive film with a resistivity of 10^4 ohm/square and $\frac{1}{4}$ as much gold on the same area yielded a resistivity of 5×10^6 ohm/square.

In FIGURE 3, there is illustrated an automatic continuous type xerographic copier utilizing a cylindrical plate 27 hereinafter referred to as a xerographic drum, constructed according to this invention. This plate may also be constructed in the form of a flexible endless belt if desired. The drum is made up of a rigid optical screen 28 overcoated with a very thin layer of gold 29, the thickness of which is not illustrated in this figure. Over this gold layer which is connected to ground, is the amorphous selenium layer 31 which is the uppermost coating on the drum. It is to be noted that the optical screen 28 may either be one integral member or it may be composed of two or more elements. Thus, for example, the optical screen may be a flexible, photographic film type optical screen firmly attached to a rigid Lucite or glass drum. In effect, then, drum 27 in FIGURE 3 is the cylindrical counterpart of the plate 15 illustrated in connection with FIGURE 2. In operation, the cylindrical drum 27 is rotated at a constant angular velocity in the direction indicated by the arrow. The process begins with the charging step which sensitizes the drum by applying a uniform charge over its surface. This charging is accomplished by a charging unit 32, spaced from the outer surface of the drum and connected to a source of high positive potential 33. The charging unit contains one or more wire filaments which are connected to the potential source and operate on the corona discharge technique as described more fully in U.S. Patents 2,588,699 to Carlson and 2,777,957 to Walkup. Essentially, this technique consists of spacing a filament slightly from the surface of the selenium xerographic plate having its conductive base grounded and applying a high potential to the filament so that a corona discharge occurs between the filament and the plate thus serving to deposit charged particles on the plate surface to raise its level of electrostatic charge with respect to ground potential. After sections of the drum periphery pass the charging unit 32, the charged drum comes in contact with paper 34 bearing the original image to be reproduced. This original is moved at the same speed of the drum and is held in contact with the drum surface by two small rollers 35. As illustrated in this figure, the original comes from a feed roll 36 and after exposure is rewound on a take-up roll 37. During the time which the original 34 is in contact with the surface of the xerographic drum 27, the drum is exposed by a projector 38 included within the periphery of the drum 27. This projector operates on the same principle described above in connection with FIGURE 2. It is to be noted that the original copy need not necessarily be in the form of a continuous web but may instead be composed of a number of ordinary letter size sheets which are sequentially fed into contact with the drum surface for exposure. Subsequent to charging and exposure, the drum surface moves past a developing unit generally designated 40. This developing unit is of the cascade type which includes an outer container or cover 41 with a trough at its bottom containing a supply of developing material 42. The developing material is picked up from the bottom of the container 41 and dumped or cascaded over the drum surface by a number of buckets 43 on an endless driven conveyor belt 44. This development technique, which is more fully described in U.S. Patents 2,618,552 to Wise and 2,618,551 to Walkup, utilizes a two-element development mixture including finely divided, colored, marking particles (toner) and grossly larger carrier beads. The

carrier beads serve both to deagglomerate the toner and to charge it by virtue of the relative positions of the toner particles and the carrier beads in the triboelectric series. When the carrier beads with toner particles clinging to them are cascaded over the drum surface, the electrostatic fields from the charge pattern on the drum pulls toner particles off the carrier beads serving to develop the image. The carrier beads along with any toner particles not used to develop the image then fall back into the bottom of the container 41 and the developed image moves around until it comes into contact with a copy web 46 which is pressed up against the drum by two idle rollers 47 so that the web moves at the same speed as the periphery of the drum. A transfer unit 48 is placed behind the web and spaced slightly from it between the rollers 47. This unit is similar in nature to the plate charging mechanism 32, 33 and also operates on the corona discharge principle. The transfer device is also connected to a source of high potential of the same polarity as that employed in the charging device so that it deposits a charge on the back of web 46 which is of the same polarity as the charge on the drum and is also opposite in polarity to the charge on the toner particles utilized in developing the drum. This transfer unit pulls the toner particles away from the drum and onto web 46. The drum may then be cleaned as with a rotary brush or cloth web in contact with its surface and then recycled through the copying process described above. It should be noted at this point that many other transfer techniques known in the art may be utilized with the invention. For example, a roller connected to a high potential source opposite in polarity to the toner particles may be placed immediately behind the copy web or the copy web may itself be adhesive to the toner particles. After transfer of the toner image to the web 46, the web moves beneath a fixing unit 49 which serves to fuse and permanently fix the toner image to the web. In this case, a resistance heating type fixer is illustrated, however, other techniques known in the xerographic art may also be utilized to fix the image including the subjection of the toner particles to a solvent vapor or spraying of the toner image on the copy sheet with an overcoating. After fixing, the web is rewound on a roll 51 for later use as desired.

It is also to be noted that this copy sheet need not necessarily be in the form of a continuous web, but that instead a number of the cut sheets of the size ordinarily used in offices may be fed into contact with the developed xerographic drum in synchronism therewith so that each of the individual images produced from the original may be transferred to an individual cut sheet of copy paper.

While the specific embodiments shown and described in this specification and drawings are admirably adapted to fulfill the stated objects of the invention, it should be understood that it is not intended to confine the invention to these disclosed embodiments since it is susceptible of embodiment in many various forms all coming within the scope of the following claims.

What is claimed is:

1. A method of xerography comprising charging the photoconductive insulating layer of a xerographic plate comprising an optical screen made up of small finely interspersed, transparent and opaque areas, a uniform layer of gold in a thickness up to about 300 angstrom units on at least a portion of one surface of said optical screen, said gold layer being thin enough to transmit at least a portion of the visible light impinging on its surface, and a uniform, adherent, smooth surfaced, photoconductive insulating layer consisting essentially of amorphous selenium having a thickness up to about 25 microns over said gold layer; placing an original to be reproduced in face to face contact with the charged photoconductive insulating surface of said plate, exposing said plate through its optical screen with a light source containing red light, removing the original from contact with said photoconductive insulator, and then developing the latent

electrostatic image formed by said exposure with colored, finely divided, electroscopic marking particles.

2. A method of xerography comprising charging the photoconductive insulating layer of a xerographic plate comprising an optical screen made up of small, alternating, transparent and opaque areas with from about 1 to about 40% of the area of said optical screen being transparent, a uniform gold film on at least a portion of one surface of said optical screen, said gold film ranging in thickness from about 25 to about 300 angstrom units, and an inherent, smooth surfaced layer of photoconductive insulator ranging in thickness from about 10 to about 25 microns on said gold film, said photoconductive insulator consisting essentially of amorphous selenium; placing an original to be reproduced in face to face contact with the charged photoconductive insulating surface of said plate, exposing said plate through its optical screen with a light source which emanates at least partially in the red portion of the visible light spectrum, removing the original from contact with said photoconductive insulator, and then developing the latent electrostatic image formed by said exposure with colored, finely divided, electroscopic marking particles.

3. The method of reproducing an image containing image elements in a red portion of the visible spectrum comprising charging a xerographic plate comprising an optical screen made up of small, alternating transparent and opaque areas, a uniform layer of gold in a thickness

up to about 300 angstrom units on at least a portion of one surface of said optical screen, and a thin layer of amorphous selenium in a thickness up to about 25 microns over said gold layer; placing an original to be reproduced in face to face contact with the charged photoconductive insulating surface of said plate, exposing said plate through its optical screen with a panchromatic light source emanating at least partially in the red portion of the visible light spectrum to form a latent charge pattern corresponding to said image, and developing said charge pattern with finely divided, colored, electroscopic marking particles to render it visible.

References Cited

UNITED STATES PATENTS

2,598,732	6/1952	Walkup	96—1.4
2,808,328	10/1957	Jacob	96—1
2,892,709	6/1959	Mayer	96—1
2,955,938	10/1960	Steinhilper	96—1
2,965,481	12/1960	Gundlach	96—1
3,041,166	6/1962	Bardeen	96—1.5
3,102,026	8/1963	Metcalfe et al.	96—1.5
3,234,020	2/1966	Stockdale	96—1.5

NORMAN G. TORCHIN, *Primary Examiner*.

J. T. BROWN, C. E. VAN HORN, *Assistant Examiners*.