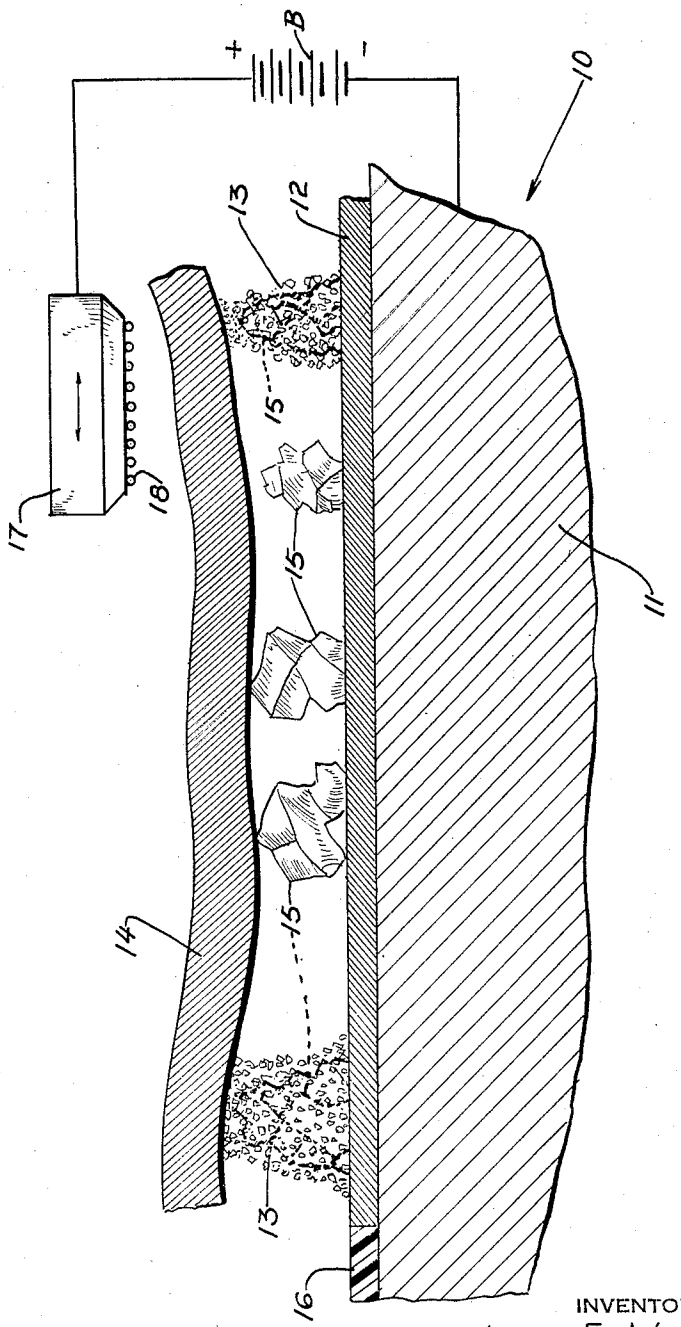
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XEROGRAPHIC TRANSFER PROCESS

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INVENTOR
LEWIS E. WALKUP
BY
Frank A. Steinhilper
ATTORNEY

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XEROGRAPHIC TRANSFER PROCESS

Lewis E. Walkup, Columbus, Ohio, assignor, by mesne assignments, to Haloid Xerox Inc., Rochester, N.Y., a corporation of New York

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This invention relates to xerographic processes and in particular to the transfer of electroscopic powder images after development especially under conditions of high relative humidity.

In the art of xerography as disclosed in Carlson Patent No. 2,297,691, it is usual to place an electrostatic charge on a xerographic member which is generally composed of a photoconductive layer overlying a conductive backing. This charged member is then exposed to copy to be reproduced and the electrostatic charge on the photoconductive insulated layer is selectively discharged, thereby leaving an electrostatic latent image on the photoconductive surface. This latent image may then be developed by depositing thereon electroscopic particles carrying charges opposite to those composing the electrostatic latent image. These charged particles adhere to areas of charge on the insulating layer, thereby developing an electrostatic image pattern. This image pattern may be utilized as it exists on the surface of the insulating layer, or and preferably, it may be transferred to other material.

One of the usual methods of transfer is to cause particles of electroscopic material forming the developed image pattern to move from the insulating surface to another surface, for example, paper by the use of electrostatic forces. This transfer technique is not particularly difficult in ordinary circumstances. In the past, however, a number of difficulties have been encountered in employing the electrostatic transfer process of xerography at high relative humidities. Such difficulties are to be expected, because xerography depends upon minute charges of static electricity which can be drained away over the smallest leakage paths. The practical importance of the effect on transfer of humidity has become greater in recent years because of the increasing quality expected of xerographic products and because users are becoming more critical as the novelty of using the process wears off. It is common now to compare xerography with other commercial processes in terms of the results produced and it is expected to work almost perfectly under all times and under all conditions.

It has been found that for practical purposes using commonly known transfer procedure it is difficult if not impossible to transfer satisfactorily to paper or to offset duplicating mats when either is in equilibrium with air at high relative humidities. Objects and features of this invention are to provide improved techniques of transfer of developed xerographic images to paper or to offset duplicating mats that yield effective and satisfactory results irrespective of the relative humidity conditions in existence at the time transfer is effected.

In its most common form electrostatic transfer comprises laying a sheet of paper over the developed toner image on the xerographic plate, delivering an electrostatic charge to the paper, usually by means of a corona discharge, and peeling the paper from the plate. This operation transfers to the paper approximately one-half of the image toner powder present on the plate. This procedure is satisfactory for most applications when

humidity is low. However, this transfer fails when the paper is made slightly electrically conductive as by the absorption of too much moisture, for example, under conditions of high relative humidity. The reason for this failure with moist paper is that the electrical charge on the paper drains away so rapidly that the potential cannot build up to the usual 300 to 600 volts necessary for adequate transfer of the powder image to the paper. While one way to improve transfer in such procedure would be to reduce the lateral electrical conductivity of the paper this cannot be done as a practical matter except by keeping it dry until actually used. However, this is difficult from a packaging and storage standpoint and involves other objectionable features as well as added expense which make it preferable to provide other simple and inexpensive techniques for effecting the transfer irrespective of humidity conditions or of moisture content of the transfer paper or material.

While lateral conductivity in the moist paper is the principal cause of transfer failure at high relative humidities this lateral conductivity would have no deleterious effect on electrostatic transfer if there were no paths over which the electrical charge could leak from the paper to the ground. The elimination or else the material reduction of such leakage is proposed as a mode or technique for overcoming the difficulties of transfer to damp or moist paper under conditions of high relative humidity. In the present invention elimination or material reduction of leakage is effected by insulating the moist transfer sheet or paper from the xerographic plate or element during transfer. This invention contemplates effecting such insulation by the use of small insulating particles sprinkled on the plate or element before making a transfer. These insulating particles are small enough to permit the transfer sheet or mat of paper or the like to make contact with the powder image on the plate or element but not with the plate or element itself.

Objects and features of this invention are the provision of an effective method of providing insulation between the transfer mat and the plate or element which will enable adequate transfer to moist transfer paper or other material during conditions of high relative humidity to be effected.

Other objects and features of the invention are the provision of a method for effecting transfer under such conditions that is simple, efficient and inexpensive.

Further objects and features of the invention will become apparent from the following specification and from the accompanying drawing which is a diagrammatic illustration on an exaggerated scale of the arrangement for practicing the invention.

Referring to the drawing the reference character **10** denotes generally a xerographic plate or element comprising in usual way a backing **11** of conductive material such as aluminum, provided on one surface with a photoconductive coating **12**, for example, of amorphous selenium. As is known, a photoconductive insulating coating as described, for example, in the aforesaid Carlson patent, may be charged electrostatically and its surface **12** may be exposed to copy thereby producing a latent electrostatic image. This image can then be developed by blowing, passing or cascading electroscopic developing powder over the surface of the coating **12**. The powder particles adhere to the surface of coating **12** by electrostatic attraction in conformity with the residual charges of the latent image pattern in said coating, producing a visible developed powder or toner image **13** on the surface of coating **12** made up of particles of the developer powder. This image now is ready for transfer preferably to other material such as a paper sheet or a mat of offset material.

In effecting the transfer to a transfer member of sheet

paper or to a mat of offset material, the usual practice hereinabove described has been utilized. While effective as long as the transfer member is dry, this practice is not satisfactory when attempted under conditions of high relaive humidity at which time the transfer member is either wet or excessively moist and hence conductive.

In order to effect adequate and entirely satisfactory transfer to a transfer member **14** of the materials mentioned under conditions of relatively high humidity the practice in accord with the present invention is to provide insulative supporting means for the transfer member in non-image areas of the xerographic plate coating **12** to prevent any direct contact anywhere between the transfer member and the coating **12** or its backing plate **11**. Preferred insulative supporting means for practicing this invention are small insulating particles **15** of, for example, a plastic insulation such as polystyrene flour. Flours of other insulating natural or synthetic materials are also contemplated as substitutes for the polystyrene flour. In practice, the most effective technique is found to be the application of a thin deposit of the flour to the surface of coating **12** before its sensitization (charging), exposure and development. The application of the flour is made, for example, by cascading or spraying the flour across the photoconductive coating **12** of xerographic element **10** to provide a surface deposit of said flour on said coating a few microns thick. Thereafter, the element **10** is sensitized (charged), exposed and developed in the usual way. It is found that the polystyrene flour deposit on coating **12** is too thin to interfere in any way with the xerographic charging, exposing and developing steps. The flour deposit clings to coating **12** during all these steps being overcoated in image areas of the developed element by the development powder of image **13**. In the non-image bearing portions of photoconductive coating **12** however, only the flour particles **15** are present.

Transfer member **14** is now laid over the image bearing coating **12**. The surface of member **14** then is in direct contact with powder constituting the image **13** on coating **12** but is maintained out of contact with said coating **12** in non-image bearing portions of the coating by the insulative polystyrene powder particles **15** which are present on coating **12** in such non-image bearing areas. A plastic mask **16** is also applied to the base border of the backing plate **11** to prevent any direct contact between transfer member **14** and backing plate **11** during transfer.

Electrostatic transfer is now effected in any of the usual ways by establishing required transfer potential differences between the conductive backing plate **11** and the transfer member **14**. Electrical charging mechanism of known kinds as exemplified in Mayo et al. Patent No. 2,626,865 may be utilized. Such mechanisms comprise a corona discharge electrode **17** made of a plurality of corona wires **18**. This electrode is charged to required polarity and potential from a high voltage source B and moved across the surface of the transfer member **14** to spray an electrostatic charge onto said sheet of sufficient potential to cause usual electrostatic transfer of the powder of image **13** from the plate or element **10** to the transfer member **14**. The insulative properties of the flour particles **15** in the non-image bearing portions of the coating **12** and the plastic mask **16** prevent any actual contact between the transfer member **14** and the coating **12** or any base portions of backing plate **11**. In consequence, there are no leakage paths available for dissipation of the charge sprayed onto transfer member **14** and all of said charge is available for effecting electrostatic transfer of the image powder **13** to said transfer member **14** notwithstanding the lateral conductivity of said member due to its moisture content.

After electrostatic transfer has been completed the transfer sheet is lifted from its position over plate or element **10** and may be treated in usual manner to fix the transferred powder image it bears thereon as by heat or vapor fusion or by other known procedures.

In some instances some of the insulative flour particles **15** may be transferred to the transfer sheet **14** during the electrostatic transfer procedure just described and produce objectionable background on mats whose transferred images have been fixed by heat fusion because of simultaneous heat fusion of some of the flour particles to the transfer mat. Thus, mats to which flour particles also have fused create objectionable background on prints prepared therefrom. This difficulty can be avoided by utilizing a non-fusible flour of insulative material to provide the insulative particles **15** instead of polystyrene flour. Suiable material of this kind might, for example, be flours of mica, glass, asbestos or of plastic insulating materials having a melting point above the heat fusion fixing temperature of the electroscopic powder of the image **13**. Thus, after heat fusion of the image powder the unfused insulating flour can be wiped off the member **14** before preparing prints therefrom.

It is to be noted that the distribution or deposit of the insulative flour particles on the surface of coating **12** preferably should be effected prior to sensitization (charging), exposure and development of the xerographic plate or element **10**. Experimentation shows that if the deposit is effected after sensitization, or after exposure, or after development too much of the particles of the flour becomes deposited in some areas of coating **12** and insufficient deposition occurs in other areas. The presently preferable course therefore is to effect flour deposition in advance of plate sensitization, exposure and development. It is possible, however, that procedure may be developed for effecting uniform flour deposition in all areas of coating **12** at any stage prior to electrostatic transfer. Accordingly, deposition of the insulative flour at any time prior to effecting electrostatic transfer to transfer member **14** is contemplated as within the scope of this invention.

With the procedure described, effective transfer has been practiced with the apparatus and transfer member in equilibrium with air at 85° F. and 85 percent relative humidity.

While specific features and procedural steps have been described and shown herein, variations within the scope of the appended claims are possible and are contemplated. There is no intention, therefore, of limitation to the exact details herein shown and described.

What is claimed is:

1. In the process of xerography wherein a xerographic plate is electrostatically charged and is exposed to a light image to form an electrostatic latent image on the plate corresponding to the light image, and wherein the plate is developed with oppositely charged particles of developing material to form a xerographic powder image on the plate surface corresponding to the light image, and wherein the xerographic powder image is transferred to a transfer material by superposing the transfer material on the powder image on the plate surface and electrostatically charging the transfer material to a polarity opposite to that on the powder image, whereby the powder image is electrostatically attracted and bonded to the transfer material surface, and wherein the transfer material is then separated from the xerographic plate, the improvement which comprises conditioning said xerographic plate for effecting powder image transfer under conditions of high relative humidity comprising scattering a plurality of insulating particles other than said developing material on the surface of the plate prior to image transfer and independently of image development, said particles having a grain size and density to prevent contact between the xerographic plate and the transfer material during the transfer step, and distributing said insulating particles substantially uniformly over the entire surface of the plate.

2. The method defined in claim 1 wherein said insulating particles are formed of resinous polystyrene.

3. The method defined in claim 1 wherein said insulating particles are formed of material selected from the group consisting of resinous polystyrene, mica, glass, and asbestos.

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