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PRESSURE TRANSFER OF XEROGRAPHIC IMAGES

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FIG. 1

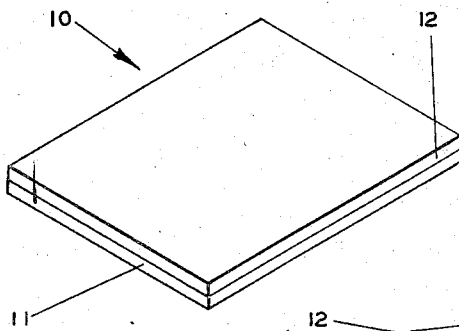


FIG. 2

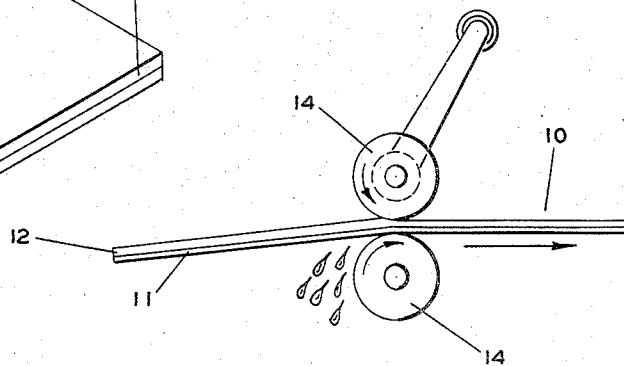
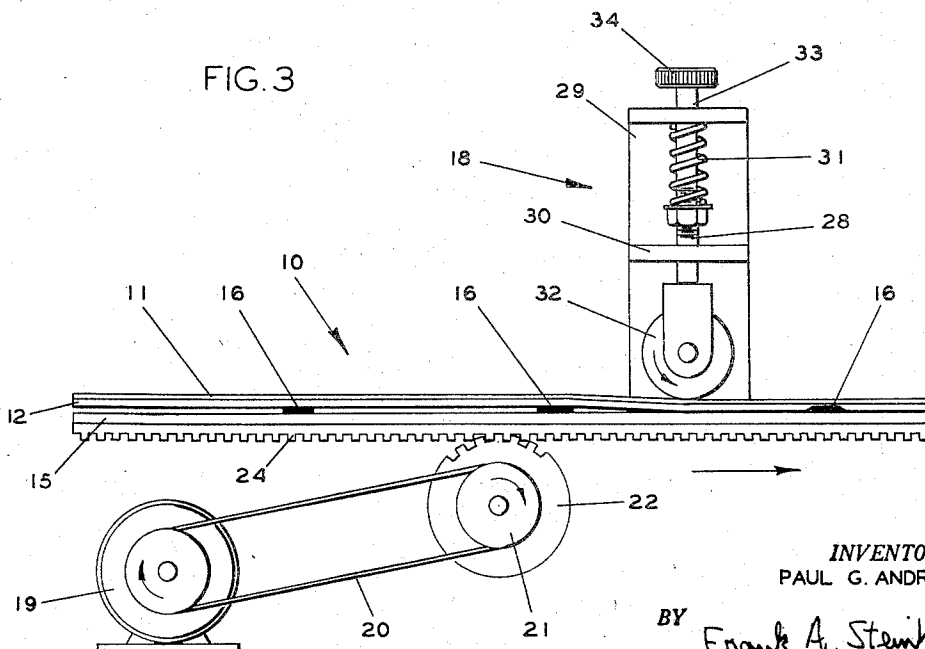


FIG. 3



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PRESSURE TRANSFER OF XEROGRAPHIC IMAGES

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2 Claims. (Cl. 117—17.5)

This invention relates to xerography and in particular to the transfer of electroscopic particles used in the developing process.

In the art of xerography as disclosed in Carlson 2,297,691, it is usual to place an electrostatic charge on a xerographic member which is generally composed of a photoconductive insulating layer overlying a conductive member. This charged member is then exposed to copy to be reproduced and the electrostatic charge on the photoconductive insulating layer is selectively discharged thereby leaving an electrostatic latent image on the surface. This latent image then may be developed by depositing thereon electroscopic particles carrying charges opposite to those making up the electrostatic latent image. These charged particles adhere to areas of charge on the insulating layer thereby developing an electrostatic image pattern. The image pattern may be utilized as it exists on the surface of the insulating member or it may be transferred to other materials. This invention deals with methods of transfer which improve on past processes of transfer.

One of the usual methods of transfer is to cause the particles to move to another surface through the use of electrostatic forces. This invention is concerned with new techniques of transfer. More specifically, this invention deals with new methods for transfer through the use of pressure.

One of the many advantages of these new methods is the ability to bring about a better transfer and so as an end result a finer xerographic reproduction than if the usual electrostatic type of transfer were used. For example, more of the developer particles are removed from the insulating member to the transfer surface when the techniques of this invention are used as compared with usual electrostatic transfer techniques, and this ability to transfer more of the developer particles is of particular value in many important instances where the image is not excessively dense. It is, therefore, another object of this invention to supply methods to produce finer and more accurate xerographic transfers.

It is also pointed out that previously known techniques of transfer do not produce images with as high a resolution as is desired in some applications of xerography and it is, therefore, a further object of this invention to produce methods of transfer which are highly effective for producing images of high resolution through xerography.

For a better understanding of this invention, together with other and further objects thereof, reference is now had to the following description taken in connection with the following drawings in which:

Fig. 1 shows an isometric view of the transfer member.

Fig. 2 is a diagrammatic view of means and apparatus for the removal of excess water from the transfer member.

Fig. 3 is a diagrammatic view showing an embodiment for the transfer of the developed image pattern.

Referring to the drawings—

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In Fig. 1, a transfer member, generally designated as 10 is shown. The transfer member 10 is generally composed of a hydrophilic layer or coating 12 on a base material 11. Generically the coating is a hydrophilic layer that swells and softens, but does not dissolve, upon moistening or soaking with water. Included in this class are cellulose and non-cellulosic materials such as gelatin, hydrophilic or water swellable plastics and the like. Although the invention is not limited to a specific hydrophilic layer, it will be described hereinafter in terms of a gelatin layer as one preferred embodiment without necessary limitation thereto. The gelatin layer or coating 12 may be prepared in a number of ways. One preferred method of preparation is to add to a 5% gel solution saponin to act as a spreading agent, and formaldehyde which acts as a hardening agent. One commercially produced material which has been found to work successfully as a transfer member 10 is Kodak Dye Transfer Paper Type F Glossy. This commercial product carries the same emulsion as double-weight glossy photographic paper, except that the silver salts are omitted and as indicated such a coating on the proper material will produce a valuable transfer member 10.

Any material capable of being coated with a gel solution is a suitable base material. This includes but is in no way limited to paper, film, glass, cloth, synthetic materials, and the like. In some instances before the gel solution can be applied, the base material 11 must be prepared to take the layer; however, generally no such preparatory steps must be taken.

The transfer member 10 is prepared for the transfer step by immersion in water at room temperature for from 10 seconds to many minutes, and when Kodak Dye Transfer Paper Type F is used, it has been found that soaking in water for about 30 seconds gives optimum results.

After the transfer member 10 is removed from its bath, excess water is removed so that the gelatin layer 12 is characterized by being impressionable and soft in an impressionable sense but not tacky. This may be accomplished in many ways as for example blotting the transfer member 10 under pressure. A preferred means for the removal of excess water is shown in Fig. 2 wherein the transfer member 10 is squeezed through wringers 14. The pressure applied by the wringers 14 or other means used to remove excess water will depend on many factors such as the coating applied to the base material 11, the base material used, the time the transfer member was immersed in water, the humidity, and the like. The proper amount of water left remaining in the transfer member is that water which is, in effect, molecularly a part of the transfer member 10. That is, that water which is soaked into the base material 11 and into layer 12 and is not removed when the transfer member 10 is run through wringers 14 such as ordinary washing machine wringers. The gelatin at this point is not sticky or soft as is glue, but is in a swelled condition and is soft in the sense that it is susceptible to pressure, and will accept within it foreign bodies or materials. The transfer member 10 is now ready for the transfer of the xerographic developed image pattern.

A developed xerographic image is composed of many small particles which remain in position due to electrostatic forces. Often they are placed originally on the xerographic plate member; however, they may be on another surface as, for example, a surface they have been transferred to through the use of electrostatics. While on a surface where they are held in place due to electrostatic forces, they may be transferred to a gelatin coated transfer member 10 after the preparatory steps discussed above have been taken.

To effect a transfer, the transfer material or member

10 is placed with the gelatin coated surface 12 against the developed xerographic image 16 carried on an image bearing surface 15 as is shown in Fig. 3. These members, the surface 15 and the transfer member 10, while in contact are firmly pressed together to cause the image body to be thoroughly imbedded in the swelled coating. The amount of pressure used will depend on many factors as, for example, the height of the raised image 16, the water content of the coating 12 and of the base material 11, the thickness of the gelatin coating 12, the base material 11 used, and the like. It has been found that where Kodak Dye Transfer Paper Type F Glossy is used as the transfer member 10, and has been soaked in water at room temperature for 30 seconds that a force of from 5 to 10 pounds per linear inch will produce optimum transfer.

One means of exerting this force is shown in Fig. 3. The assembly of member 10 overlying surface 15 carrying the xerographic image 16 may be made to move under the force exerting assembly generally designated 18 through the operation of motor 19 driving belt 20 which drives a rack and pinion assembly comprising a gear wheel 22 operated by pulley 21 engaging a gear rack 24 or the assembly may be driven by other means. The pressure exerting element 18 housed within casing 29 is composed of a regulating screw member 28 which screws into shaft 33 and is controlled by turning control head 34 at the end of shaft 33 so that the desired amount of force may be exerted by roller 32 onto the assembly of member 10 resting on surface 15 with the xerographic image thereon. Part of shaft 33 is surrounded by compression spring 31 and shaft 33 extends into roller 32 through screw member 28. The roller 32 may be composed of many substances and hard rubber has been found to work particularly well.

Pressure may also be applied by rolling manually a rubber roller across the assembly; however, great care must be exercised to exert even pressure in such a case, since uneven pressures may bring about uneven transfers of the xerographic image pattern 16 which could produce poor reproductions of the original image. In general, in a mechanized operation, the device should produce a regulated uniform pressure so that transfers and copies are reproducible.

After pressure has been applied, the transfer member 10 is removed out of contact with surface 15 and will carry within and on layer 12 of transfer member 10 image pattern 16. At this point the transfer has been accomplished and on allowing the gelatin layer to dry and harden a transferred reproduction is obtained.

It is pointed out that although in many respects this invention resembles an adhesive type of transfer, in actuality it differs therefrom since the surface is substantially nontacky. To complete an adhesive transfer, a material with an adhesive coating is brought into contact with the electrostatic image pattern. Particles in this pattern adhere to the adhesive coating. In the operation of this invention, however, electroscopic particles are lodged within and onto a coated material. Rather than the particle sticking onto a surface it finds its place within the surface and in a sense substantially becomes a part thereof. Particles which are not lodged within the surface, that is, those remaining above the surface are held there by other than normal adhesive means. In this sense, a new method for the transfer of the electrostatic image pattern is accomplished by this invention.

It is also pointed out that where adhesive type transfer is used often the adhesive coating will adhere to the foreign surface instead of to its backing member and thus breaks or holes will appear in the final product, while in using the techniques of this invention similar problems do not exist. Conversely, when a strongly adhesive member is employed for adhesive type of transfer there is a decided tendency toward flaking off the photoconductive layers of certain types of xerographic plates.

In particular, this invention has been found to have real

value when practiced on a xerographic image on a xerographic plate comprising a photoconductive insulating layer and particularly a selenium layer adhering to a conductive backing member. The selenium layer which is readily released from the backing member to normally adhesive materials is in no way affected when pressed against the soft, impressionable, and nontacky gelatin layer of the transfer member of this invention and a high quality transfer of the image results.

This invention has been found valuable where high quality reproductions are required, for example, in continuous tone xerography. The presently preferred developed continuous tone image often may be of a low density and the transfer of such an image must be substantially complete. That is, to produce a valuable final product in the case of continuous tone images, substantially all of the developed image must be transferred, and the particles making up the image must remain in their proper positions on the transfer material. This invention has accomplished transfers for continuous tone images with resolutions as high as 40 and sometimes 60 lines per millimeter.

The image formed according to this invention is a permanent image. However, the formed image may be given a coating to protect it against damage due to excessive handling. Such a coating may at the same time serve to put a particular finish on the reproduction. For example a solvent spray of lacquer will, when dry, protect the image and the transfer member, and will put a glossy finish on the reproduction, or appropriate transparent or patterned films may be affixed over the image bearing surface.

While the invention has been described in specific embodiments, it is intended to cover the invention broadly within the scope and spirit of the appended claims.

This is a continuation-in-part of patent application Serial Number 397,917, filed December 14, 1953, now abandoned, and entitled "Pressure Transfer of Xerographic Images."

What is claimed is:

1. The method of transferring a dry electrostatically-bound loose powder particle image to a transfer member comprising a gelatin layer upon a support base to form a quality transferred xerographic print, said method comprising immersing the transfer member in water at room temperature for more than 10 seconds, removing by squeezing excess water from the transfer member to a point whereat the gelatin layer is characterized by being soft impressionable and substantially nontacky, transferring a loose powder particle image held electrostatically in position on the surface of a xerographic plate comprising a photoconductive insulating layer adhering to a conductive backing member, the photoconductive insulating layer being releasable from the backing member to a conventionally adhesive material, by pressing the gelatin layer of the transfer member against the photoconductive insulating image-bearing surface using sufficient force to thoroughly imbed the powder image in the gelatin layer while the gelatin layer is in the soft condition reached by removing excess water, removing the gelatin layer and the powder image out of contact with the photoconductive insulating layer, and hardening the gelatin layer carrying the powder image by drying.

2. The method of transferring a dry electrostatically-bound loose powder particle image to a transfer member comprising a gelatin layer upon a support base to form a quality transferred xerographic print, said method comprising immersing the transfer member in water at room temperature for more than 10 seconds, removing by squeezing excess water from the transfer member to a point whereat the gelatin layer is characterized by being soft impressionable and nontacky, transferring a loose powder particle image held electrostatically in position on the surface of a xerographic plate comprising a selenium layer adhering to a conductive backing member,

the selenium layer being releasable from the backing member to a conventionally adhesive material, by pressing the gelatin layer of the transfer member against the selenium image-bearing surface using sufficient force to thoroughly imbed the powder image in the gelatin layer while the gelatin layer is in the soft condition reached by removing excess water, removing the gelatin layer and the powder image out of contact with the selenium layer, and hardening the gelatin layer carrying the powder image by drying.

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