April 26, 1966 D. M. ZABIAK 3,247,794

TRANSFER PROCESS

Filed April 25, 1963

FIG. 1

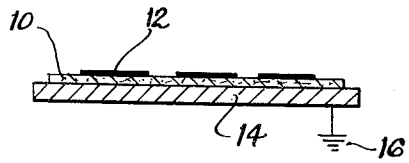


FIG. 2

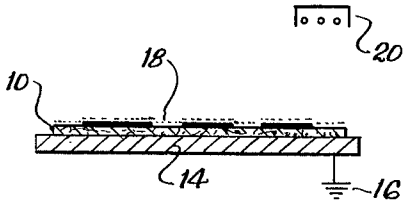


FIG. 3

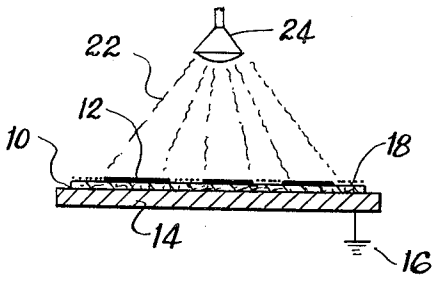


FIG. 4

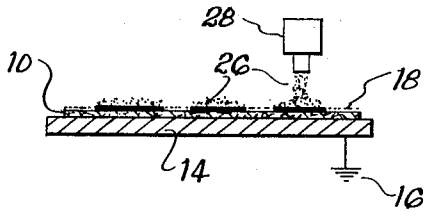


FIG. 5

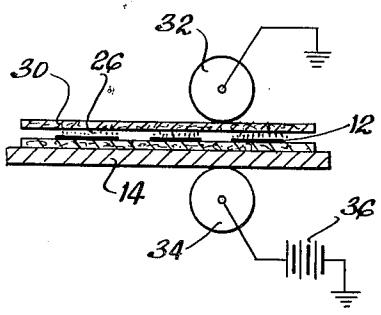
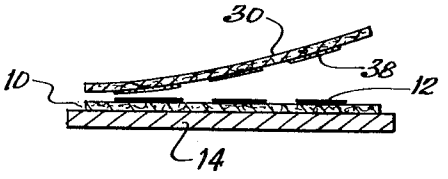


FIG. 6



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TRANSFER PROCESS

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The present invention relates to a process wherein a first medium displaying certain information can be treated and can thereafter be used to transfer the information to a different medium whereby one or more copies of the information can be provided.

There are numerous situations where the transfer of information displayed on a first medium is desired whereby one or more copies of the information can be produced. It is, accordingly, a general object of this invention to provide a simple and economical manner for the transfer of information from one medium to another.

It is one more specific object of this invention to provide a transfer process which is adapted to produce a correct image on a second medium corresponding to a reverse image on a first medium or which is adapted to provide a reverse image on a second medium through transfer from a correct image on a first medium.

It is a more particular object of this invention to provide for the transfer or copying of reverse images wherein said images comprise heat generating portions disposed on a dielectric medium and wherein said process involves the use of electrostatic techniques.

These and other objects of this invention will appear hereinafter, and for purposes of illustration but not of limitation, a specific embodiment of this invention is shown in the accompanying drawing wherein:

FIGURE 1 comprises a diagrammatic cross sectional view of a first medium having heat generating image portions thereon and a ground plate therefor;

FIGURE 2 illustrates the assembly shown in FIGURE 1 after application of a corona charge;

FIGURE 3 is a schematic illustration of the preceding assembly during exposure to infra-red radiation;

FIGURE 4 is a schematic illustration of the assembly shown in the preceding figures during application of a developer material thereto;

FIGURE 5 is a schematic view illustrating the application of a transfer material to the assembly having developer on the image areas; and,

FIGURE 6 illustrates the transfer material after provision of the image thereon.

The concepts of this invention generally provide for the transfer of information which is disposed on a first dielectric medium, and which is adapted to generate heat during the transfer procedure. In an initial phase of the operation, an electrostatic charge is provided over the sheet holding the image areas, and heat is then generated in these image areas whereby the electrical resistance in these areas will be lowered. By providing a ground for the system, the charge in these image areas will dissipate while the charge in the non-image areas will remain intact. When developer material is applied to the dielectric medium, the heavily charged non-image areas will repel the developer to prevent deposit of developer in these areas. On the other hand, the image areas which are at a lower potential will preferentially attract the developer material and, accordingly, the developer material will collect in these image areas.

With the developer material located in the image areas, a copy sheet is then brought into contact with the imaged surface of the dielectric medium. The dielectric medium is then electrically charged whereby the developer material will be repelled by the dielectric medium and will deposit on the copy sheet held adjacent the dielectric medium. The developer material is then subjected to a conventional fixing operation to thereby provide a record of the information.

FIGURE 1 illustrates a sheet **10** comprising a dielectric medium such as paper. Heat generating image portions **12** are formed on this sheet and these portions **12** may be provided on this sheet by means of various conventional techniques. Thus, the instant invention contemplates the use of sheets having image portions capable of generating heat, for example when exposed to infra-red radiation. In addition, the sheets employed in the procedure of this invention must be adapted to retain an electrical charge, for example, a charge as applied by means of a corona discharge.

In one specific application of the instant invention, the sheet **10** comprises a dielectric medium which has been provided with the image **12** by means of electrostatic printing techniques. For example, an electrostatic printing system of the type described in copending application of Joseph James Stone, Jr., Serial No. 227,500, filed October 1, 1962, and entitled "Electrostatic Printing System and Method," assigned to the A. B. Dick Company, may be employed whereby a latent image is formed on the sheet **10** by means of an electrostatic printing tube, and the image is then subjected to a deveolping medium whereby a fixed image **12** can be formed thereon.

Electrostatic printing systems of the type referred to in the copending application have been employed in combination with various recording systems which are fed data to provide a rapid and reliable means for producing copy. In such systems, a reverse image of the data can be produced by reversing the polarity of elements in the electrostatic printing tube. Since the instant invention is adapted to provide a correct image from a medium having a reverse image disposed thereon, the invention is particularly important for use on copy produced in electrostatic printing systems where the electrostatic printing systems are being operated to produce reverse image copies.

As shown in FIGURE 1, the dielectric medium **10** is disposed on a conductive plate **14** which is grounded as indicated at **16**. In carrying out the process of this invention, a blanket electrical charge **18** is formed over the imaged surface of the medium **10** by means of a corona device **20** or by other suitable means. Reference is made to known systems employed in xerographic copy operations for teachings regarding application of blanket charges. After provision of the blanket charge, the assembly is subjected to infra-red radiation **22** delivered by means of lamp **24**. The radiation provides for the generation of heat in the image area **12** whereby the electrical resistance of these image areas decreases. Since the plate **14** is grounded, the charge in the image areas of the plate will be drained off due to this lowering of electrical resistance. The non-image areas of the plate will retain their electrical charge.

FIGURE 4 illustrates the next step of the process wherein a developing medium **26** is applied to the assembly as by means of a dispenser **28**. The developing medium is selected whereby the toner therein will be repelled by the charged, non-imaged areas of the medium **10**. Since the charge has been dissipated in the image areas, the toner particles will not be repelled from these areas, and, therefore, the toner particles will preferentially cover the image areas. It will be understood that a dry developing medium may be employed wherein the developing medium will be contacted with the plate, as by a cascading technique, in a manner such that removal of the toner particles in the non-image areas is insured. A liquid developing medium, for example as described in copending application of Metropoulos and Relph, Serial No. 205,690, filed June 27, 1962, and entitled "Com-

position and Method for Developing Electrostatic Images," and assigned to the A. B. Dick Company, can also be employed and in this instance, the medium **10** will be passed through a developing bath and the image areas will preferentially hold the developing medium.

The next step of the process, illustrated in FIGURE 5, provides for contacting of the assembly of FIGURE 4 with a copy sheet **30**. The copy sheet is adapted to be pressed against the developing material, and a potential drop is effected between the sheet **30** and the plate **14** whereby electrostatic transfer of the developing material can be effected. In the illustrated embodiment, a charged roller **32** is contacted with the back side of the copy sheet **30** and the plate **14** is contacted by roller **34**. The rollers act to produce the necessary pressure in the assembly and a source of EMF **36** provides for build-up of the necessary electrostatic forces whereby the transfer can be effected. Again, reference is made to known xerographic techniques where a similar transfer of developer is effected.

The copy sheet **30** having the transferred developing medium **38** disposed thereon is then separated from the medium **10** as shown in FIGURE 6, and the developing medium will then be fixed to the copy sheet **30**. In the case of a dry developer, the fixing can be carried out by heat, fusion through application of infra-red radiation, by vapor fusing techniques, or in any other conventional fashion. Where liquid developers are employed, the copy sheet can be passed through a dryer to accelerate production of the permanent copy.

The concepts of this invention were successfully utilized in the preparation of copy from reverse imaged paper formed in an electrostatic printing system which was utilized for the production of labels to be attached to magazines. The label paper was charged with a negative corona of approximately 5000 to 6000 volts. The paper was then exposed to infra-red radiation to provide for reduction in the electrical resistance of the image areas on the paper. By reason of contact of the paper with a grounded metal plate, the charge was dissipated in the image areas.

A reversal powder developer (a developer containing toner particles repelled by negative charges) was then applied to the paper and the toner deposited in substantial quantities only over the imaged areas. The paper was then placed in contact with impression paper which lay on a grounded metal plate. A negative charge was induced upon the back side of the label paper by a corona at 5000 to 6000 volts. By reason of the electrostatic forces developed, the toner was directed to the impression paper, and a substantial deposit of the toner was left on the impression paper when the assembly was separated. The toner was fixed to the impression paper by means of exposure to infra-red radiation.

It will be appreciated that the description of the invention and the example provided illustrates concepts wherein images on electrographic paper can be transferred to other mediums. The invention is particularly suited for use where a reverse image is on the electrographic paper, and it will be understood that the image can be developed by any electroscopic developer employed in dry, liquid or powder cloud techniques. The original image can be of any nature provided it is capable of generating heat, for example when subjected to infra-red radiation. The medium upon which the image is disposed must be capable of assuming an electrostatic charge whereby the image areas can be discharged upon exposure to infra-red radiation.

A negative corona may be used to provide the blanket charge over the dielectric medium, and, in this case, a negatively charged, positive-seeking toner will be included in the developer material whereby the toner will be repelled by the non-image areas and attracted to the non-charged image areas even though the potential of the developer may be substantially lower than the surrounding areas. The concepts of this invention are equally suitable for use in a system where a positive corona provides the blanket charge and a positively charged toner is included in the developer material.

The medium to which the image is to be transferred may comprise a sheet of ordinary impression paper, board stock, plastic film, glass, metal, or other materials. As previously indicated, where a dry powder developer is employed, fixing of the developer can be achieved by heat, infra-red fusing or vapor fusing. The liquid developer assumes a permanent state after being subjected to drying conditions.

It will be appreciated that the transfer system of this invention is characterized by certain advantages. Thus, it must be noted that the master, which comprises the reverse imaged medium in the example given, will not be in any way affected by the transfer procedure as would be the case where solvent or heat transfer systems are employed. Once the master has been prepared in accordance with this invention, it can be utilized repeatedly with no loss in copy quality. Several different transfer techniques can be employed on the same master without destroying the capability for producing further copy. The production of halftone transfers in accordance with the described techniques is also contemplated.

It will be understood that various changes and modifications can be made in the transfer process above described which provide the characteristics of this invention without departing from the spirit thereof particularly as defined in the following claims.

That which is claimed is:

1. A process for the production of copy comprising the steps of providing an electro-photographic sheet having a conductive base and a dielectric coating adapted to lower its electrical resistance when exposed to heat with a latent electrostatic image on the surface of the dielectric coating, developing the latent electrostatic image with an infrared ray absorbing developing composition, fixing the developed image on the dielectric surface, exposing the imaged sheet to corona discharge to provide an overall electrostatic charge on the imaged surface of the sheet, radiating the sheet with radiations rich in infrared to generate a heat pattern corresponding to the imaged portion whereby electrostatic charge is dissipated from the imaged areas, developing the sheet with a developing material having the same polarity as the overall electrostatic charge whereby the developing material will deposit on the imaged areas, contacting the developed surface of the sheet with a copy sheet whereby the developing material transfers from the imaged sheet to the copy sheet and then fixing the transferred developing material on said copy sheet to produce copy.

2. A process in accordance with claim **1** wherein said developer material is transferred to said impression medium by applying ground potential to said impression medium and by applying a charge to said sheet whereby said developer material is attracted to said impression medium by electrostatic force.

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DAVID KLEIN, *Primary Examiner.*