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CHARGING SURFACES FOR XEROGRAPHY

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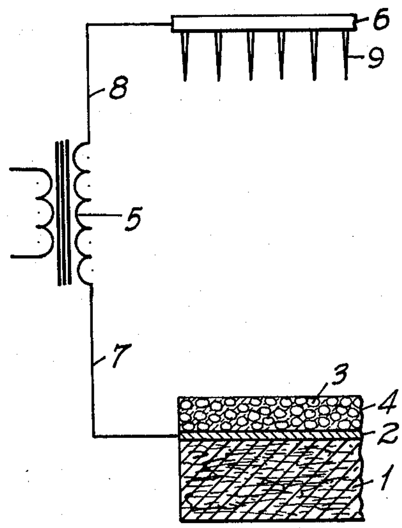

FIG. 1

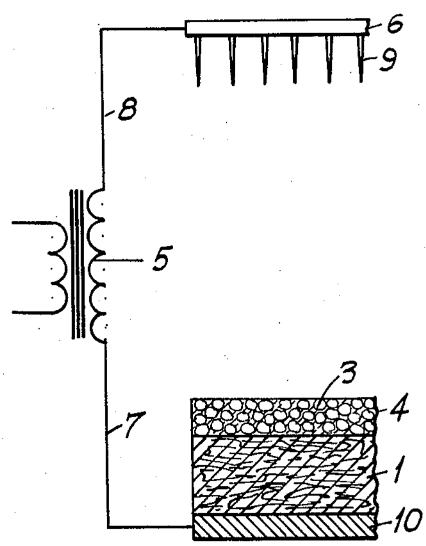

FIG. 2

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CHARGING SURFACES FOR XEROGRAPHY

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This invention relates to an improved method of charging photoconductor surfaces.

In xerography it is customary to carry a photoconductor substance in a film base supported on a suitable backing either with or without a conductor therebetween and this material is used by first charging the photoconductor substances in the dark and then bleeding away the charge by the application of light to such areas where a pattern is to be formed.

The method of charging usually consists in subjecting the surface to a corona discharge of the required polarity, it being found that a variation in the charging occurs according to whether a positive or negative polarity is used, this being dependent also of course on the particular type of photoconductor materials used and particularly the polarity of the charges on the photoconductor particles prior to charging.

Certain difficulties occur when using direct current for charging photoconductor surfaces, such as unequal charging and the presence of electrical flaws or inequalities on the final developed image due to charging irregularities and paper grain and the like.

We have now found that improved charging results where A.C. is used to charge the photoconductor surface. From tests it is obvious that the photoconductor surface itself is capable of acting as a rectifier provided conditions are right and will only charge one way even though the corona discharge used is of an alternating nature. Further, charging is, as stated, more uniform.

The basis of our invention therefore is to use alternating current and to use an effective conductor for the charge by applying the photoconductor surface to the conductor with a minimum of electrical resistivity, particular care being taken to ensure that there is no oxide film between the conductor and the film base which could form a barrier to electrical flow.

To understand the charging it can be assumed that when the photoconductor substances are embedded in an insulating base such as an alkyd resin, the photoconductor particles will have an inherent surface charge which exists on all particles suspended in an insulating medium.

The polarity of the charges varies with different materials, but when using a material such as zinc oxide, the surface charge will be of a definite and fixed polarity.

When such a particle is then subjected to an electrical field which changes in polarity, there will be a tendency to reject charge of one polarity but to accept the charge of the opposite polarity.

If therefore the flow of the alternating current is not materially restricted, and can readily be conducted away by the conductor beneath the photoconductor film, it is found that the photoconductor particles will automatically reject the unwanted polarity but will be charged from the required polarity.

From the experiments conducted using alternating current charging for zinc oxide photoconductor films, it is obvious that a very uniform and effective charge is possible provided the lack of a barrier for electrical flow between the film base and the conductor is assured.

It was found that if the conductor was applied to a backing such as paper or glass or the like by vacuum coating, and if a condition was maintained which discouraged the formation of an oxide coating on the conductor prior to the application of the film base, a very satisfactory photoconductor medium was given which could be charged by means of alternating current and could then be processed in the normal manner, similarly to the methods used with photoconductor surfaces charged by means of direct current.

It has also been found that the process can be used with materials where the backing has the photoconductor film applied directly to it without an intermediate conductor layer, provided during processing the backing is impregnated with a conductive liquid so that there is intimate contact between the conducting liquid and the photoconductor film.

It seems clear from all of the experiments carried out, that the critical factor is the avoidance of an electrical barrier between the photoconductor surface and the conductor which bleeds away the unwanted sign charge, and it obviously also follows that when exposing such a charged surface to a light image, it is again advantageous to have the intimate contact between the film base and the conductor to ensure that no undue barrier is formed for the bleeding away of the charges of the photoconductor material.

To enable the invention to be fully appreciated, an embodiment thereof will now be described with reference to the accompanying drawings in which:

FIG. 1 is a schematic view showing how the invention may be applied, using a photoconductor layer on a paper or like backing with a conductive substrate, and

FIG. 2 is a similar view but showing the photoconductor layer formed directly on a paper or like backing and placed on to a conducting plate, in this case the electrical continuity between the photoconductor layer and the conducting plate being ensured by treating the backing with a conductive liquid or the like.

Referring first to FIG. 1. A backing **1** of paper or similar material has vacuum deposited on it a conductive substrate **2**, such as a metal, and this in turn carries a layer of photoconductive particles **3**, such as zinc oxide, embedded in an insulating matrix **4**, such as a resin. A high voltage transformer **5** is connected between the conductive substrate **2** and discharge means **6** by leads **7** and **8** respectively. The discharge means **6** include a series of points **9**.

The points **9** are spaced some distance from the photoconductor layer **3–4**, in actual practice a distance of perhaps half an inch for a discharge voltage of 8,000 volts.

When alternating current is applied to the transformer **4**, a corona discharge takes place between the points **9** of the discharge means **6** and the conductive substrate **2**, but it is found that the photoconductor particles **3** take a charge of only one polarity, consistent with their own inherent surface charge, and in this way a very uniform and effective potential is built up on the photoconductor layer. As the backing **1** is below the conductive substrate, mottling of the surface does not take place as where the charge must leak away through the backing, and a much cleaner picture results. To allow electrical contact with the conductive substrate, this may remain uncovered along an edge by stopping the deposition of the photoconductor material short of such edge during manufacture.

In the embodiment shown in FIG. 2 the arrangement is somewhat similar to that shown in FIG. 1 and similar reference numerals are used for corresponding members, but in this case the conductive substrate **2** is omitted and the photoconductor layer comprising the particles **3** and the insulating matrix **4** are put down directly on to the paper or like backing **1**.

A metal plate **10** replaces the substrate **2**, and the lead **7** is connected to this plate **10**.

The paper or like backing 1 is soaked in a conductive liquid, such as a saline solution, prior to charging, and a good electrically conductive path thus exists between the photoconductor layer and the metal plate 10, which again ensures that electrical flow between the discharge means 5 and the metal plate can take freely, with the resultant rectification effect and uni-polar charging of the photoconductor layer as previously described herein.

As the paper or like backing is rendered conductive, mottling due to paper grain effects, or lack of uniformity in the backing, is again avoided.

Any suitable paper is coated with a paint of the following composition which forms the photoconductor layer:

Example 1

Rhodene Resin L9/50 Trade Mark for a short oil linseed oil modified alkyd resin, acid No. 25–35 marketed by Polymer Corporation Pty. Ltd.,—10 lbs., Durham Microx Trade Mark for an indirect process lead free zinc oxide, particle size 0.2–0.5μ manufactured by Durham Chemical Ltd., zinc oxide—30 lbs., toluene—1½ gallons; are blended and mixed in a ball mill for sixteen hours; after milling add:

Rhodene Resin L9/50—10 lbs., lead napthenate 15%—2 oz., cobalt naphthenate 3%—1 oz. The paint should be stored at this concentration but thinned prior to application to the paper. Thorough drying is permitted to take place, and the paper is ready for use. When charging, an alternating potential of between 1000 to 8000 is applied, the distance between the points 8 of the discharge means 5 and the conductive substrate 2 on the metal plate 10 being such as to give a field strength of about 8000 volts per inch.

Example 2

For zinc oxide substitute amorphous selenium powder.

Example 3

For zinc oxide substitute lead monoxide.

Example 4

For zinc oxide substitute cadmium oxide.

I claim:

1. In a xerographic process in which a layer of photoconductor material is charged in the absence of illumination and subsequently exposed to produce a charge pattern on the photoconductor, the charging method comprising: applying a layer of photoconductor material, comprising a photoconductor selective to a given charge polarity, on a base comprising an electrical insulator; establishing said layer of photoconductor material in electrical contact, at one surface thereof, with an electrically conductive backing; disposing the photoconductor layer in spaced relation to a corona discharge means with the discharge means facing the surface of the photoconductor layer opposite the conductive backing; and applying a balanced high-voltage alternating current between the discharge means and the conductive backing to afford a balanced A.C. corona discharge therebetween and charge the photoconductor layer to said given charge polarity, charges of opposite polarity being discharged through said conductive backing.

2. The charging method of claim 1 in which the conductive backing is directly physically engaged with the photoconductor layer in the form of a conductive substrate interposed between the photoconductor layer and the base.

3. The charging method of claim 1 in which the conductive backing is in the form of a conductive plate, the conductive plate is disposed in contact with the base, and the base is treated with a conductive medium to establish electrical continuity between the photoconductor layer and the conductive plate.

4. The charging method of claim 1 in which the electrically conductive backing is afforded by a conductive metal substrate on the base, said substrate being applied to the base by vacuum deposition before the photoconductor layer is applied to the base.

5. The charging method of claim 3 in which the treatment employed to establish electrical continuity between the photoconductor layer and the conductive plate comprises wetting the base with a conductive fluid.

6. A charging system for xerography in which a layer of photoconductor material is charged in the absence of illumination and subsequently exposed to produce a charge pattern on the photoconductor, comprising: a photoconductive member comprising a layer of photoconductor material, selective to a given charge polarity, mounted on an insulator base; an electrically conductive backing in electrical contact with the surface of said photoconductor layer facing said base; corona discharge means, disposed in spaced relation to the other surface of said photoconductor; and means for applying a balanced high-voltage alternating current between said discharge means and said conductive backing to charge said photoconductor layer to said given charge polarity, charges of opposite polarity being discharged through said conductive backing.

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