

June 19, 1973

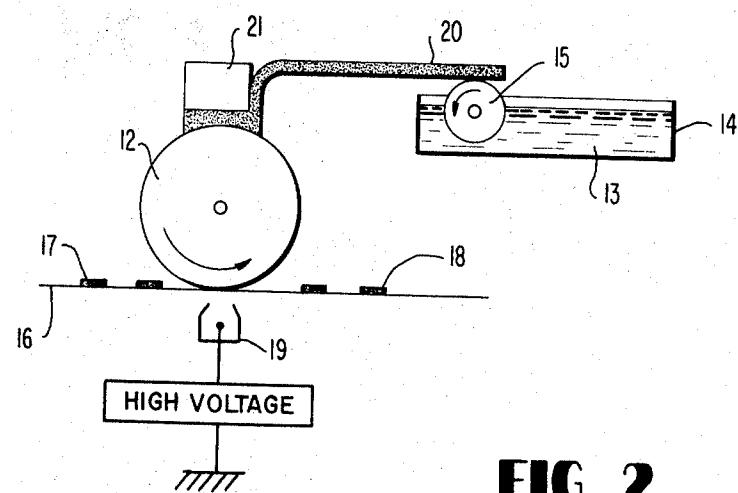
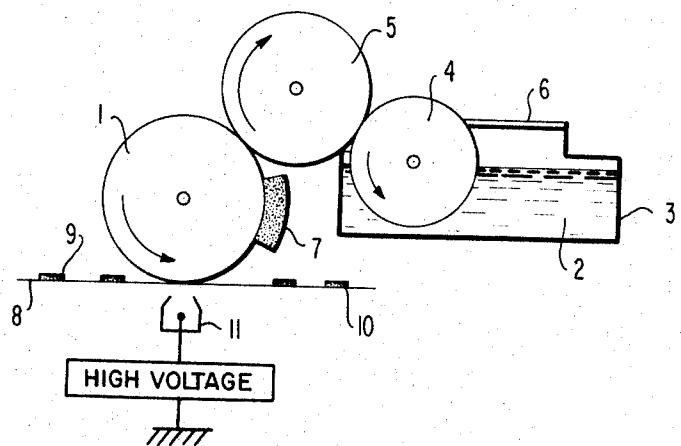
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SOLVENT FIXING PROCESS

Filed Oct. 1, 1971

**FIG. 1**



**FIG. 2**

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**SOLVENT FIXING PROCESS**

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Filed Oct. 1, 1971, Ser. No. 185,619  
Claims priority, application Japan, Oct. 1, 1970,  
45/86,240  
Int. Cl. G03g 13/20

U.S. Cl. 117—21

6 Claims

**ABSTRACT OF THE DISCLOSURE**

A process for fixing toner images with a solvent which comprises contacting a film of a solvent formed on the surface of a grounded conductive roller with the front surface of a support having thereon toner images while applying to the back side of the support a corona discharge of a polarity opposite to the charge of the toner images to thereby fix the toner images on the support, said solvent being capable of fixing said toner image and being a non-conductive and non-polar liquid.

**FIELD OF THE INVENTION**

The present invention relates to a novel process of fixing a toner image onto the surface of a support and more particularly, the invention relates to a process of fixing a toner image formed loosely on a xerographic plate, an electrostatic recording paper or on a transfer sheet electrostatically by using a solvent.

**BACKGROUND OF THE INVENTION**

Hitherto, a toner image formed on a support was fixed in electrophotography by one of the following two methods. One method is the use of heat and the second method is the use of solvent.

The first method is unacceptable because of faults such that the power consumed in the fixing by heating is great and there is a danger of fire and the practice of the continuous heating gives harmful influences on the photoconductive layer. In spite of such faults, the fixing method by heating has generally been adopted more favorably than the fixing method by solvent because the solvent fixing method has many faults such that in the so-called solvent-vapor fixing method of condensing the vapor of solvent on the surface bearing thereon a toner image, there is the necessity of a long period of time in the condensation of the solvent vapor, which makes it difficult to speed up the fixing and makes the control and maintenance of vapor difficult. The solvent fixing method has also faults, such that in the method of conducting the solvent fixing by contacting a back surface of the toner image-bearing sheet directly to a metallic roller rotated in a solvent bath with a controlled speed the whole sheet is impregnated with the solvent from the back side thereof, which requires a large quantity of solvent and the sheet is withdrawn from the fixing system in a wet state, which requires an additional drying step.

Therefore, an object of this invention is to provide a novel process of fixing a toner image formed on a support with a solvent with a considerable reduction in consumption and release of solvent as compared with conventional solvent fixing methods. In the specification of this invention, the term "support" means a photosensitive paper or a web sheet of electrostatic recording paper each having a toner image thereon or a web sheet to which a toner image formed on a photosensitive plate has been transferred.

**2****BRIEF DESCRIPTION OF THE DRAWINGS**

Now, the principle of this invention will be explained by referring to the drawings, in which:

FIG. 1 is a cross-sectional view showing the typical mechanism of the process of this invention; and

FIG. 2 is a cross-sectional view showing a modification of the process of this invention.

**DETAILED DESCRIPTION OF THE INVENTION**

In FIG. 1, a conductive roller 1 which has been grounded, is rotated by means of a motor (not shown). A solvent 2 placed in a solvent tank 3 is a solvent capable of directly fusing a toner image, a solvent containing a binder, or a solvent containing a plasticizer. That is to say, a liquid used in a conventional fixing method of toner images by solvent, may be used in this invention. The solvent is restricted in electric conductivity to some extent by the reasons shown below. A roller 4 is immersed partially in the solvent and supplies the solvent onto a roller 5 in an amount controlled by a control blade 6. The roller 5 transfers the solvent thus supplied onto the surface of the conductive roller 1 to form a thin film of the solvent on the conductive roller 1. Adjacent to the roller 1 is disposed a cleaner 7 for cleaning away the toner offset on the roller 1. A support having formed thereon toner image 9, is supplied to the solvent fixing system and withdrawn therefrom with fixed toner images 10 by solvent. Under the roller 1 is disposed a corona discharging device 11.

By the mechanism mentioned above, a solvent is supplied from the solvent tank 3 in a suitably controlled amount and the film of the solvent is formed on the surface of the roller 1. The conductive roller 1 is contacted with the surface of the sheet 8 bearing the toner images via corona discharging. The polarity of the corona discharging is so selected that it is opposite to the charge of the toner images 9 formed electrophotographically on the support. By this process, the toner images are brought into contact with the solvent film. Accordingly, the toner images are fixed with a smaller amount of solvent than that in the conventional method and because the amount of the solvent required for the fixing of toner images is less, the support having the fixed toner image withdrawn from the roller 1 is in an almost dry state and hence, requires almost no drying step.

Also by utilizing corona discharging, the sheet 8 is closely brought into contact with the solvent film on the conductive roller 1 to provide uniform fixing and additionally, because the polarity of the corona discharging is opposite to the charge of the toner image, the toner images are attracted strongly to the support by the electrostatic attraction forces to reduce the offset of the toner onto the roller 1 and also thereby reduces the disturbance of the toner images by solvent. As will be understood from the aforesaid mechanism, the evaporation of the solvent at the stoppage of the above fixing system is prevented by stopping the rotation of the roller 4 and closing the solvent tank 3.

Another embodiment of this invention is shown in FIG. 2. By this embodiment, the solvent is supplied to the conductive roller 12 by means of a solvent supplying material 20, such as felt in place of the roller 5 in FIG. 1. That is to say, the solvent supplied to the solvent supply material 20 by means of a rotary roller 15 from a solvent tank, is carried onto the conductive roller 12 by a capillary phenomena to form a thin film of the solvent on the surface of the conductive roller 12.

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In this case, a load 21 is used for forming a uniform film on the roller. Also, the load acts as a cleaner for the conductive roller 12 together with the solvent supply member. The fixing of the toner images 17 on the support 16 is conducted by the same manner as mentioned in relation with the embodiment shown in FIG. 1. 13 is, of course, the solvent in the solvent tank 14, 18 is the fixed toner image, and 19 is the corona discharging device.

As another embodiment of this invention it is possible to pass the support having toner images between the conductive roller and a roller to which an opposite bias has been applied in place of applying opposite corona discharging to the charge of the toner images by means of the corona discharging device in the embodiments shown in FIG. 1 and FIG. 2. In this case, the offsetting of toner on the conductive roller may be prevented but a solvent is accumulated between the two rollers and when the support is passed between the rollers, the top portions of the sheet are supplied with an excessive amount of solvent to disturb the toner images. For preventing such difficulty a mechanism of narrowing the space between the two rollers only during the passage of the sheet is used.

As mentioned above, the solvent used in this invention must not have a property of losing the charge of the toner images. Accordingly, a liquid having a high electric conductivity or having a polarity cannot be used. As the solvents satisfying the above conditions, liquids usually used as dispersing mediums for liquid developers in electrophotography are desirably used.

## EXAMPLE 1

The fixing system shown in FIG. 1 was used. As the conductive roller 1, an aluminum roller having a diameter of 38 mm. was used. The diameter of the roller 4 was 28 mm., and the diameter of the roller 5 was 18 mm. The solvent used was 1,1,1-trichloroethane. A wire of 0.1 mm., in diameter was placed as an experimental corona discharging device with a distance of 14 mm. from the surface of the roller 1 and an electric potential of 6 kv. was applied to the wire.

The rollers, 1, 4 and 5 were rotated in the direction of the arrow at a line speed of 70 mm./sec. and when a paper sheet having unfixed toner images formed by toners charged negatively was passed through the fixing system, good fixed toner images were obtained. The paper sheet having the fixed toner images was also obtained in an almost dry state and no offset of toner was observed on the roller.

Also, when trichloroethylene was used as the solvent for fixing in the same fixing system as above, almost the same good fixing was achieved. Moreover, when a sheet having toner images positively charged was used and an

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electric potential of -6 kv. was applied to the corona discharging device, almost similar good fixing was achieved.

## EXAMPLE 2

5 The fixing system as shown in FIG. 2 was used. As the conductor roller 12 an aluminum roller having a diameter of .38 mm. was used and the diameter of the roller 15 was 21 mm. Also, a felt of 4 mm. in thickness was used as the solvent supply material 20. By conducting the same fixing procedure as in Example 1 using the same corona discharging device and 1,1,1-trichloroethylene or trichloroethylene as the solvent, a good fixing was obtained. For the toner images positively charged, an electric potential of -6 kv. was applied and for the toner images 10 negatively charged, an electric potential of +6 kv. was applied to the corona discharging device. The line speed of the roller 1 was 70 mm./sec.

What is claimed is:

1. A process for fixing toner images with a solvent 20 which comprises contacting a film of a solvent formed on the surface of a grounded conductive roller with the front surface of a support having thereon toner images while applying to the back side of the support a corona discharge of a polarity opposite to the charge of the toner images to thereby fix the toner images on the support, said solvent being capable of fixing said toner images and being a non-conductive and non-polar liquid.
2. The process as set forth in claim 1 wherein the solvent is supplied onto the surface of said conductive roller by means of solvent supply rollers.
3. The process as set forth in claim 1 wherein said solvent is supplied to said conductive roller by a solvent supply fibrous material.
4. The process as set forth in claim 3 wherein said fibrous material comprises felt.
5. The process as set forth in claim 1 wherein said solvent is trichloroethane or trichloroethylene.
6. The process as set forth in claim 1 wherein said solvent comprises an electrophotographic liquid developer dispersing medium.

## References Cited

## UNITED STATES PATENTS

45 2,684,301 7/1954 Mayo ----- 117-21

## FOREIGN PATENTS

267,804 7/1964 Australia ----- 117-17.5

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U.S. Cl. X.R.

55 117-17.5; 96-1 R