

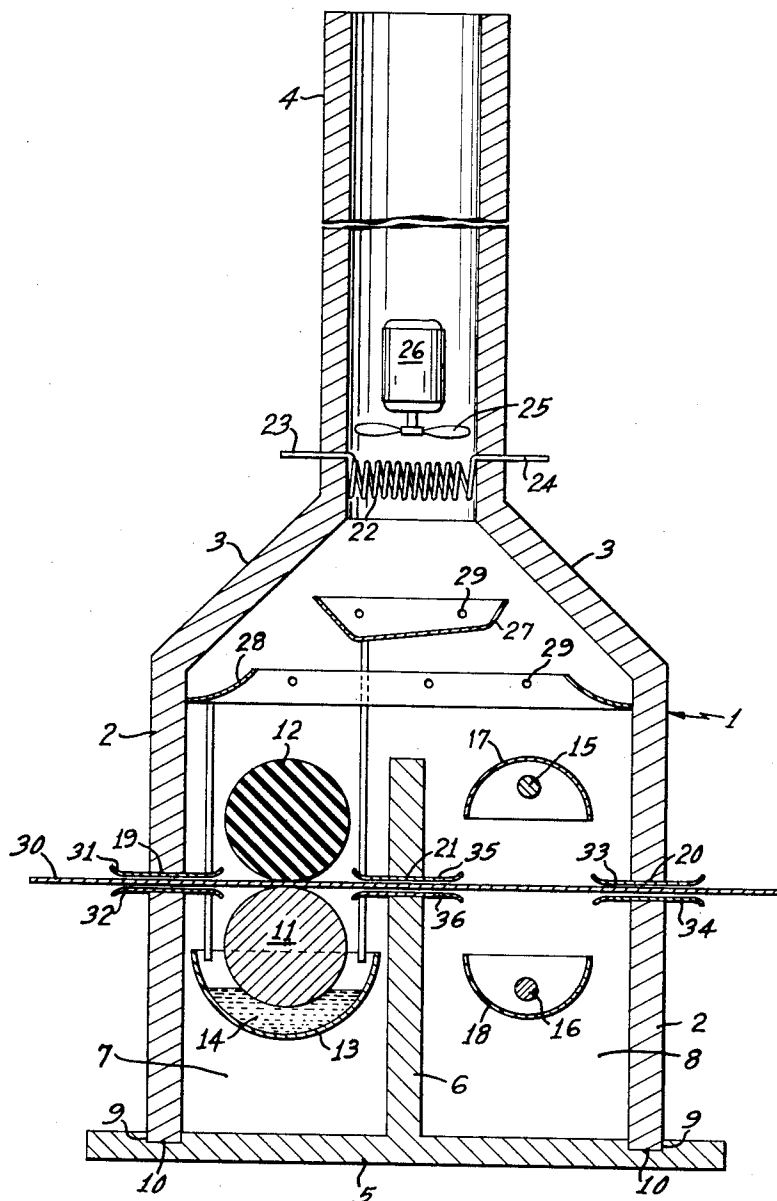
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APPARATUS FOR DEVELOPING AN ELECTROSTATIC LATENT IMAGE

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1

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APPARATUS FOR DEVELOPING AN ELECTROSTATIC LATENT IMAGE

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2 Claims. (Cl. 118—637)

The invention deals with an apparatus for developing an electrostatic latent image and more particularly with an apparatus for developing an electrostatic latent image with a liquid developer.

In the art of electrophotography, an electrostatic latent image is obtained upon a photoconductive insulation material supported on a conductive backing. For example, the photoconductive insulating layer may be given a uniform electrostatic charge over its surface and then exposed to a light image through a transparent master to discharge the portions of the layer exposed to light while leaving the electrostatic charges in the areas not struck by sufficient light to discharge them. The charged areas are then developed by depositing finely-divided material thereon.

The electrographic reproduction material employed in the practice of this invention is prepared by applying to an electrically conductive base sheet, e.g. a sheet of metal foil, an insulating layer of photoconductive material.

Various methods are known for preparing photoconductive insulating layers, e.g. by using selenium, sulphur, zinc oxide, or organic substances, e.g. anthracene or anthraquinone, and dissolving or dispersing the photoconductive substances in organic solvents in association with a soluble binding agent and subsequently applying them to the base sheet. It is further known to prepare the photoconductive insulating layers by dispersing the photoconductive substances and the layer-forming binding agents in water, applying the aqueous dispersions to the electrically conductive bases, e.g. metal foils, and drying them.

According to one method of developing the electrostatic latent image, a developer is used which comprises a finely-divided powder dispersed in a liquid of high dielectric strength. Development is accomplished by submerging the electrostatically imaged electrophotographic material beneath the developing liquid, or by pouring the liquid on the imaged surface of the material, or by spreading the developer on the imaged surface with a roller or other applicator.

Suitable liquid developers, among others, are those comprising a mixture of finely-divided electrostatically attractable material and polyethylene dispersed in a liquid hydrocarbon vehicle, and those comprising a mixture of finely-divided pigment and an alkyd resin dispersed in a liquid to form a developer of high resistivity. Liquid developers of these types are described in U.S. Patents No. 2,891,911 and No. 2,907,674.

Usually, the solvents or vehicles suitable for use in liquid development are either inflammable, toxic, or odoriferous. For this reason liquid developers cannot be used safely in small rooms that are not well ventilated, and even then, the possibility of static sparks cannot be overlooked.

The present invention employs electrographic materials, e.g. plates, and liquid developers of the types described above. The plate, after having been provided with an electrostatic latent image according to known practice, or other contemplated suitable practice, is developed in an apparatus employing a liquid developer. The process and apparatus of the invention comprises developing and fixing the electrostatically produced image in a housing containing conveying, developing and fixing

2

means operating under the influence of directed gas currents, whereby the inflammable, toxic or odoriferous gases or fumes produced in the developing and fixing operations are safely removed from the housing.

It is an object of the present invention to provide a process and apparatus for developing and fixing an electrostatically formed latent image on an electrophotographic material with a liquid developer and confining the developing and fixing operations within a housing.

It is another object of the invention to provide a process and apparatus for applying a liquid developer to an imaged electrophotographic material and fixing the developed image within a confined space and rapidly evaporating and removing the vehicle or solvent employed in the developer in a safe manner under the influence of directed gas currents.

Other objects and advantages of the invention will become apparent from the description hereinafter following and the drawing forming a part hereof, which illustrates a partly schematic and partly cross-sectional view of the apparatus according to the invention.

The apparatus for developing an electrostatic latent image in accordance with the invention comprises a housing 1 of substantially rectangular form having four walls 2 which converge from their upper portions, as at 3, and continue as, or are connected to, a flue 4 and forming, e.g. a hood, which is mounted on a base 5 forming an effective enclosure. A partition 6 extends upwardly from the base 5 into the housing 1 and terminates substantially below the flue 4 to provide separate compartments 7 and 8. The base 5 is provided with a groove 9 conforming in configuration with the bottom edges 10 of walls 2 with the edges 10 seated in the grooves. A pair of elongated parallel applicator rolls 11 and 12 are suitably mounted in compartment 7 one above the other and positioned longitudinally of the compartment 7. The rolls are spaced from the wall 2 and partition 6 and are urged toward each other in a relationship permitting one roll to drive the other. The rolls are also spaced from the housing walls normal to their axes. Roll 11 is composed of an electrically conductive material, e.g. stainless steel, and is grounded in any suitable manner to housing 1, or is provided with a positive or negative potential. The purpose of maintaining the conductive roll under grounded conditions or under a positive or negative potential is to prevent the discharging of the electrostatically imaged surface through the roll during the developing process. Roll 12 is composed of either a conductive or non-conductive material, e.g. rubber. An elongated substantially semicylindrical tray 13, composed of an electrically conductive material and maintained at the same potential as roll 11, is suitably mounted in the compartment 7 with the roll 11 partly positioned therein to a depth sufficient to engage the liquid developer 14 contained by the tray.

The compartment 8 contains at least one and preferably a pair of elongated heating elements 15 and 16, e.g. electrical resistance heating elements suitably mounted one above the other in parallel spaced relationship. Each heating element is provided with a reflector 17 and 18, respectively, positioned to direct infrared radiation toward each other and to heat the space therebetween. When one heating element is employed, its cooperating reflector is positioned to direct infrared radiation downwardly of the compartment 8. The reflectors 17 and 18 are of substantially semi-cylindrical shape positioned longitudinally of the heating elements 15 and 16. The heating units are mounted longitudinally of compartment 8 and spaced both from the housing walls normal to their axes and the wall and partition forming compartment 8. The primary purpose of the partition 6 is for shielding the developing means contained in compartment 7 from the heat produced by the heating elements 15 and 16.

Slots 19 and 20 are formed through opposite walls 2 of housing 1 and slot 21 is formed through partition 6, the slots being preferably in horizontal alignment, parallel with base 5, or in lateral alignment, and positioned for the direction of electrographic plates or sheets between rolls 11 and 12 and heating elements 15 and 16.

A cooling or condensing tubular coil 22 is positioned inside housing 1, preferably in the flue portion 4 of the housing, or at the upper portion of the converging housing walls 3. Ends 23 and 24 of coil 22 pass through opposite walls of the housing whereby a coolant liquid or gas is passed through the coil. An exhaust fan 25 and its motor 26 are suitably mounted in the flue portion 4 above the condensing coil 22. A first drip pan 27 is appropriately mounted in the housing 1 below the condenser coil 22. A second larger drip pan 28 is appropriately mounted in the housing 1 below the smaller drip pan 26. While the larger drip pan is illustrated in contact with opposite sides 2 of housing 1, it is spaced from the other two opposite sides of the housing to permit the passage of gases from lower portions of the housing upwardly through the flue portion 4. Apertures 29 may be provided through the sides of drip pans 27 and 28.

In operation, the heating elements 15 and 16 are electrically energized and fan 25 and roll 11 are electrically motivated with the roll 11 rotating in the liquid developer 14. A coolant is passed through coil 22. An electrographic sheet 30 of the type described above, after having been provided with an electrostatic image, is passed between a pair of upper and lower spaced dielectric guide plates 31 and 32 mounted in slot 19. Similar guide plates 33, 34 and 35, 36 are mounted in slots 20 and 21, respectively. The sheet then passes into compartment 7 and between rolls 11 and 12, where the rotating roll 11, which is wet with developing solution from tray 13, applies the developing solution to the imaged surface of sheet 30 under the influence of the hold-down roll 12. Since the rolls 11 and 12 rotate in opposite directions, as illustrated, the sheet is thereby conveyed forwardly between dielectric plates 35 and 36, mounted in the slot formed through partition 6, and into the drying and fixing compartment 8. As the sheet passes through the compartment 8 between the heating elements 15 and 16, it is effectively heated, dried and fixed by the heat developed by the heating elements, and the dried and fixed sheet passes between dielectric plates 33 and 34 outwardly of the housing 1. While the sheet is being heated, dried and fixed in compartment 8, vapor from the developer

solvent or vehicle is evolved. However, the fan 25 in flue 4 provides a positive gas flow, e.g. air flow, through slots 19 and 20 and directs the air currents upwardly through the flue 4. In this manner the otherwise obnoxious gas or vapor fumes are entrained in the gas flow and safely directed outwardly of the housing. As the vapor passes over the cooling coil 22, it is effectively condensed and the condensate drips into pans 27 and 28 where it is collected or wherefrom it is otherwise directed into the developer tray 13, e.g. by means of conduits 27' and 28' connected between their respective pans and tray 13 so that the condensate is automatically directed into tray 13. The conduits are positioned against the inner wall of the housing so as not to interfere with the passage of the sheet 30 through the housing.

Various modifications of the invention are contemplated within the scope of the appended claims.

What is claimed is:

1. Apparatus for developing an electrostatic latent image comprising a housing, flue means communicating with a plurality of compartments within the housing, fluid developer applying means mounted in one of the compartments, the applicator means comprising a pair of rolls one superposed on the other and a developer tray, one of the rolls being at least partly positioned in the tray and composed of electrically conductive material, infrared heating means mounted in another of the compartments, and sheet passage means formed through the walls of the housing in a path passing between the applicator rolls and through the heating compartment.
2. Apparatus for developing an electrostatic latent image according to claim 1, comprising vapor condensing means mounted in the housing above the compartments, and gas motivating means mounted in the housing above the vapor condensing means.

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