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(54) Curable resin transparentizing system for vellum papers

(57) A method for coating paper with an ultraviolet curable resin in order to achieve transparency as a vellum paper and thereby avoid the use of traditional mobile or solid transparentizing resins which are coated using organic solvents whose traces often contaminate xerographic machines. Alternatively, existing vellum paper is coated with an ultraviolet curable resin so as to seal its surface and completely trap the transparentizing resin that it now includes, thus ensuring that the transparentizing resin will not escape and contaminate components of a machine.

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Description

This invention relates to printing machines, and more particularly, to contamination resulting from use of vellum papers in such machines.

In the art of xerography or other similar image reproducing arts, a latent electrostatic image is formed on a charge-retentive surface such as a photoconductor which generally comprises a photoconductive insulating material adhered to a conductive backing. This photoconductor is first provided with a uniform charge after which it is exposed to a light image of an original document to be reproduced. The latent electrostatic images, thus formed, are rendered visible by applying any one of numerous pigmented resins specifically designed for this purpose. In the case of a reusable photoconductive surface, the pigmented resin, more commonly referred to as toner which forms the visible images is transferred to plain paper.

It should be understood that for the purpose of the present invention, the latent electrostatic image may be generated from information electronically stored or generated, and the digital information may be converted to alphanumeric images by image generation electronics and optics. However, such image generation electronic and optic devices form no part of the present invention.

Rather serious problems have been encountered with copier/printers when handling large numbers of transparencies of vellum paper consecutively. It appears that the paper is filled with waxes, oils or resins to make it more transparent. These oils, waxes or resins are boiled out by the image fusing process, causing serious contamination, such as, gummy deposits on the corona charging wires; fuser; pressure rolls; exhaust vents and drive/transport belts; rollers and sometime even in the cleaning apparatus and on the photoreceptor of the imaging apparatus. This is especially true for wide body machines that feed large engineering drawing copy sheets (e.g. 27.9x43.2cm, 30.5x45.8cm, 45.8x61cm, 61x91.5cm, 91.5x122cm).

It is therefore an object of this invention to provide a method and article of manufacture that can be used in wide body copier/printers without contaminating the copier/printers.

Accordingly, in accordance with the present invention, a solution to the above-mentioned machine contamination problem is provided and includes a vellum paper with the vellum paper being impregnated with an ultraviolet curable resin or vellum paper that is coated with an ultraviolet curable resin in order to seal its surface and completely trap a transparentizing resin which is a part of the vellum paper thereby ensuring that the transparentizing resin will not escape during machine operation to contaminate components of the machine. Additionally, a paper substrate composed of wood pulp, cotton, linen or a combination of these fibers can be coated with an ultraviolet curable resin to achieve transparency, thereby avoiding the use of transparentizing resin.

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate an embodiment of a copier/printer that may be used with the vellum papers of the present invention and, together with the description, serve to explain the principles of the invention.

FIG. 1 is a perspective view of an exemplary copier/printer apparatus in which the vellum paper of the present invention is used.

FIG. 2 partial schematic side view of the machine of Figure 1 showing roll fed vellum paper being fed for imaging.

Reference will now be made in detail to the present preferred embodiment of the improved vellum papers of the present invention which is adapted for use in the machine illustrated in the accompanying drawings.

Referring to **FIGS. 1** and **2** of the drawings there is shown, by way of example, an automatic xerographic reproduction or printing machine, designated generally by the numeral **10** incorporating an embodiment of the vellum paper of the present invention.

Referring now to the drawings in detail wherein like numbers represent like elements, in **FIG. 1** a wide format copier/printer **10** including a control panel **12** is shown which is especially adapted to copy large documents. Documents to be copied are fed in from the front of the machine, pass through an exposure zone and exit out of the back of the machine. **FIG. 2** shows a side internal view of the copier/printer machine **10**. Machine **10** includes an electrostatic drum **20** with xerographic stations arranged around its periphery, which carry out the operational steps of the copying process. These stations include charging station **22**, exposure station **24**, developing station **26**, transfer station **28** and fusing station **30**. Documents fed along the platen **19** in the direction of arrow **8** are imaged onto the surface of drum **20**, at exposure station **24**. The operations of the stations are conventional and are described, for example, in U. S. Patents 4,821,974; 4,996,556; and 5,040,777.

Vellum paper, is cut from the selected media roll assembly **14A, 14B** or **14C** and is fed by a respective feed roller pair **32A, 32B** or **32C**. The sheet to be cut is guided along a vertical path between baffle pairs into the sheet cutting bar assembly **16** which includes a stationary blade **42** and a rotating cutting bar **44** that includes a helical cutting blade. Cutter bar **44** is shown in the home position which is about 30° of rotation away from the cutting position and is driven by motor **60**. Cutter assembly **16** is of the type described, for example, in U.S. Patent 4,058,037. Initiated by a cutter operation signal, bar **44** rotates in the direction of the arrow with its blade moving against blade **42** to sheer a sheet **50** from the roll media with a straight cut. The cut sheet is transported after registration by roller pair **51** into baffle **52** and then into transfer station **28** where a developed image is transferred onto the sheet. The cut sheet is then forwarded over post transfer corrugator **29**, through fuser

31 at fuser station **30** and out of the machine. It is between the feeding station and sheet exit point where the problem of machine component contamination is experienced. Current technology incorporates hard resin systems in a vellum paper making process which require organic solvents as a vehicle in the coating process which contaminate or act as carriers for machine contaminants. Mobile resin systems, such as used in Xerox Zero Solvent vellum paper made by, for example, Fletcher Paper Company, Alpena, MI, can be used also, however, these are incompatible with silicone oils that are used in the machines, e.g., as a coating for fuser rolls. Therefore, the preferred solution in accordance with the present invention includes overcoating a conventional, commercially available vellum paper with an ultraviolet curable resin in order to seal the surface of the vellum paper such that the mobile resin, which is incompatible with silicone oils, will not contact machine components. Alternatively, the ultraviolet curable resin could be used to "tie-up" or cross link the mobile resin, thus eliminating the ability of the resin to be pressed out of the sheet, such as, in roll fusing, and in addition raise the boiling point to eliminate emissions during fusing. Although many ultraviolet curable resins are employable with the present invention, a suitable ultraviolet curable resin in a feasible price range is a polyester backboned resin manufactured by DSM Desotech of Elgin, Illinois, especially a polyester with unsaturated sites particularly in the backbone.

Examples of polyesters, it is believed, that may be selected include those in U. S. Patent 3,590,000 and the precursor polyesters in U. S. Patent 5,376,494. An alternative method of preparing non-contaminating vellum like paper includes coating a paper comprised of wood, pulp, cotton, linen or a combination of these fibers with an ultraviolet curable resin, such as, a polyester backboned ultraviolet resin manufactured by DSM Desotech, Elgin, Ill in order to achieve transparency as a vellum paper and thereby avoid the use of transparentizing resins which are coated, using organic solvents whose traces often contaminate different components of xerographic machines. Replacing currently used transparentizing resins that require organic solvents as a vehicle in the coating process or mobile resins which are incompatible with silicone oils and leach out in the xerographic process with a coating process that employs ultraviolet curable resins will result in a vellum paper with less machine contamination potential because of the large immobile polymer chain created from resin crosslinking achieved due to the non-solvent method of processing used (i.e., ultraviolet radiation). Organic solvents, which are a major contributor and carrier of contaminants are eliminated with this process, and the resulting crosslinked resin product has a higher boiling point than resins presently used which reduce or eliminate resin emission during the fusing phase in a machine.

It is also contemplated that rather than supplying transparentized paper produced off-site as described above to the machine 10, the paper could be produced within the machine on demand, i.e., in situ production of vellum paper. This would be accomplished by applying a fluid monomer coating to transparentize the paper in machine **10** and then cure the monomer to a non-volatile solid by passing the now coated paper through a curing station (ultraviolet light, heat, etc.). This coating could be done before or after imaging. If done after imaging, the curable coating would serve to fix the image to the paper and could possibly eliminate the fusing step. Curable liquids that are particularly well suited for this application are the vinyl ethers and epoxies whose polymerization are acid initiated. The acid initiator can be generated by an ultraviolet sensitive iodoium or sulfonium salt that decomposes to form an acid on exposure to ultraviolet light. The advantage of this polymerization process is that the process will continue in the ambient. Most of the usual ultraviolet initiated polymerizations are by free radical formation and these reactions must be done anaerobically. U. S Patent 5,232,812 (Morrison et al.) discloses curable liquids that could be used to coat vellum or paper in accordance with the present invention.

In operation of the printer apparatus of **FIGS 1** and **2**, control and monitoring of media, which in this instance is a vellum roll, are maintained from initialization to the registration roll pair by three reflective media sensors **33A, 33B,** and **33C** that are employed in the paper path leading to registration roll pair **51**. The sensors are configured to provide a dual function. The first function of the sensors is to initialize the media to a predetermined nominal position, for example, if a new roll **14C** of media is loaded into machine **10**, the media lead edge is indexed into a nominal feed start position once the operator loads the media feed edge into pinch roll pair **32C**. That is, after the machine doors are closed, sensor **33C** is adapted to sense the lead edge of the media. If the lead edge is not detected, the media is automatically fed forward toward media sensor **33C** by pinch roll pair **32C** until the lead edge is detected by sensor **33C**, pinch roll pair **32C** is reversed by a conventional media rewind drive (not shown) for a preset time interval with the media lead edge being placed in a predetermined nominal position as shown. If media sensor **33C** initially detects the lead edge of the media after the operator loads the media into the machine, pinch roll pair **32C** reverses until the media lead edge uncovers the sensor and continues to rewind to the nominal position between pinch roll **32C** and sensor **33C**. The media initialization procedure is the same when loading media rolls **32B** and **32A**.

A second function of sensors **33A, 33B** and **33C** is to monitor progress of media through the machine's predetermined paper path during each feed cycle. The sensors **33A, 33B** and **33C** monitor the lead edge of the media as it is fed vertically up the media path until the lead edge of each cut sheet reaches registration sensor **35**. For example, when an operator selects media roll

14C on control panel **12** and a copying cycle is initiated by the machine's conventional microprocessor controller, pinch roll pair **32C** is energized and the media begins to feed toward sensor **33C**. The media lead edge will be detected by sensor **33C** within a predetermined window. Each of the three sensors **33A, 33B** and **33C** have a predetermined time window within which the media lead edge should be detected as it progresses toward registration sensor **35**. If any of the three media sensors do not detect the media lead edge within the predetermined time interval, a jam is indicated and the machine is stopped automatically for operator interaction.

It should now be understood that a low cost, and easy to implement process for producing vellum paper that resist outgassing contaminating components of a machine in which it is used, comprising the steps of overcoating the vellum paper with an ultraviolet curable resin and exposing that resin to ultraviolet light for curing purposes The curable resin will seal the surface of the vellum paper and thereby prevent mobile resin from migrating to parts of the machine. Alternatively, conventional paper, such as, a substrate composed of wood pulp, cotton, linen or a combination of these fibers is converted into transparentized vellum by impregnating the paper with an ultraviolet curable resin which when polymerized becomes translucent which avoids the use of vellum which contains contaminating oils.

Claims

1. A process for transparentizing vellum paper comprising the steps of:

   (a) providing paper to be transparentized;
   (b) coating said paper with an ultraviolet curable resin; and then
   (c) curing said coated paper with an ultraviolet light source.

2. The process of claim 1, including the step of including a polyester backboned resin as said ultraviolet curable resin.

3. The process of claim 2, including the step of providing said vellum paper with 100% cotton content.

4. An article of manufacture, comprising: a vellum paper, said vellum paper being impregnated with an ultraviolet curable resin.

5. An article of manufacture, comprising: a vellum paper, said vellum paper being overcoated with an ultraviolet curable resin.

6. The article of manufacture of claims 4 or 5, wherein said ultraviolet curable resin is a polyester backboned resin.

7. The article of manufacture of any of claims 4-6, wherein said paper substrate is taken from a group of fibers consisting of wood pulp, cotton, linen or a combination of these fibers.

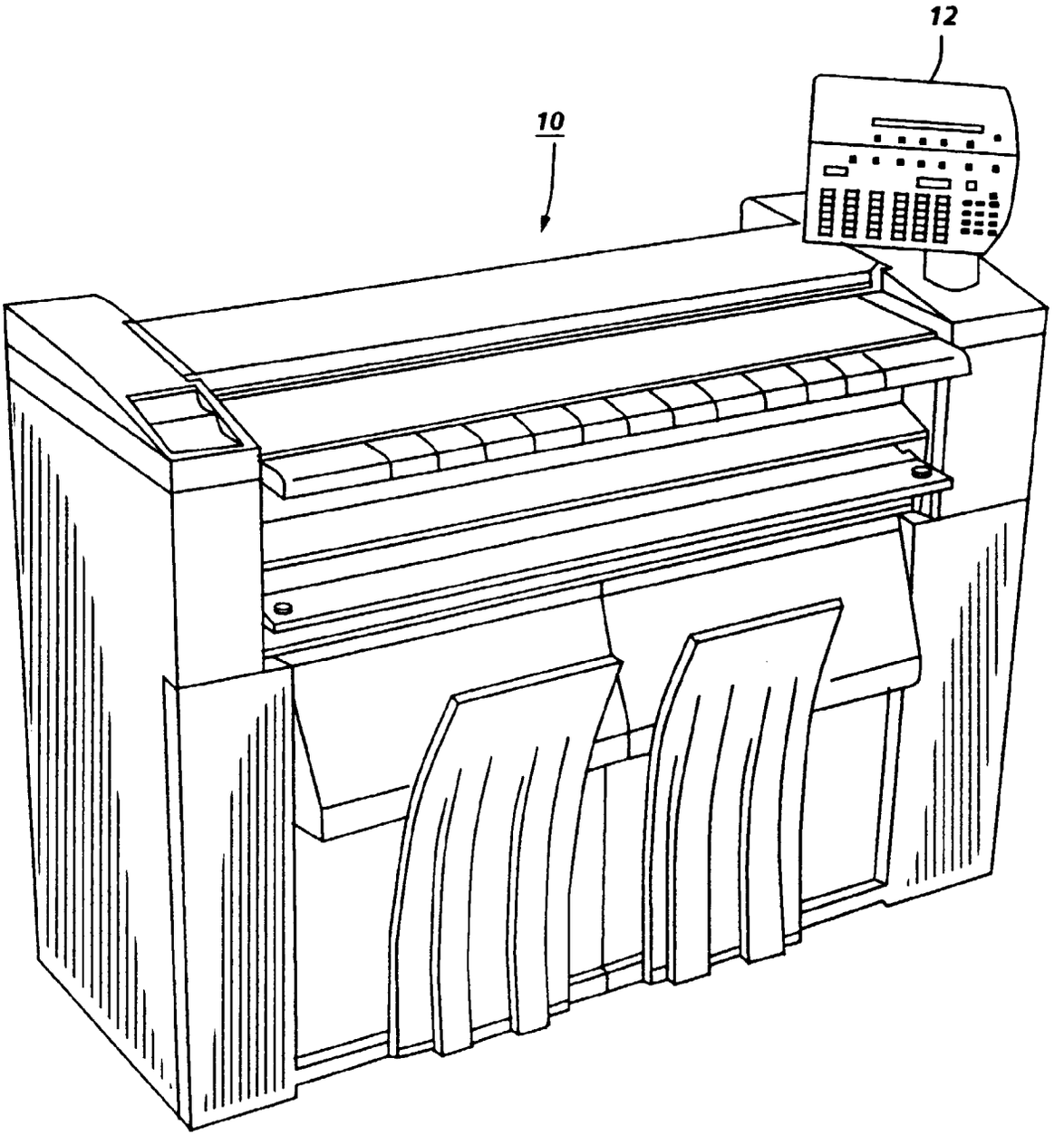

FIG. 1

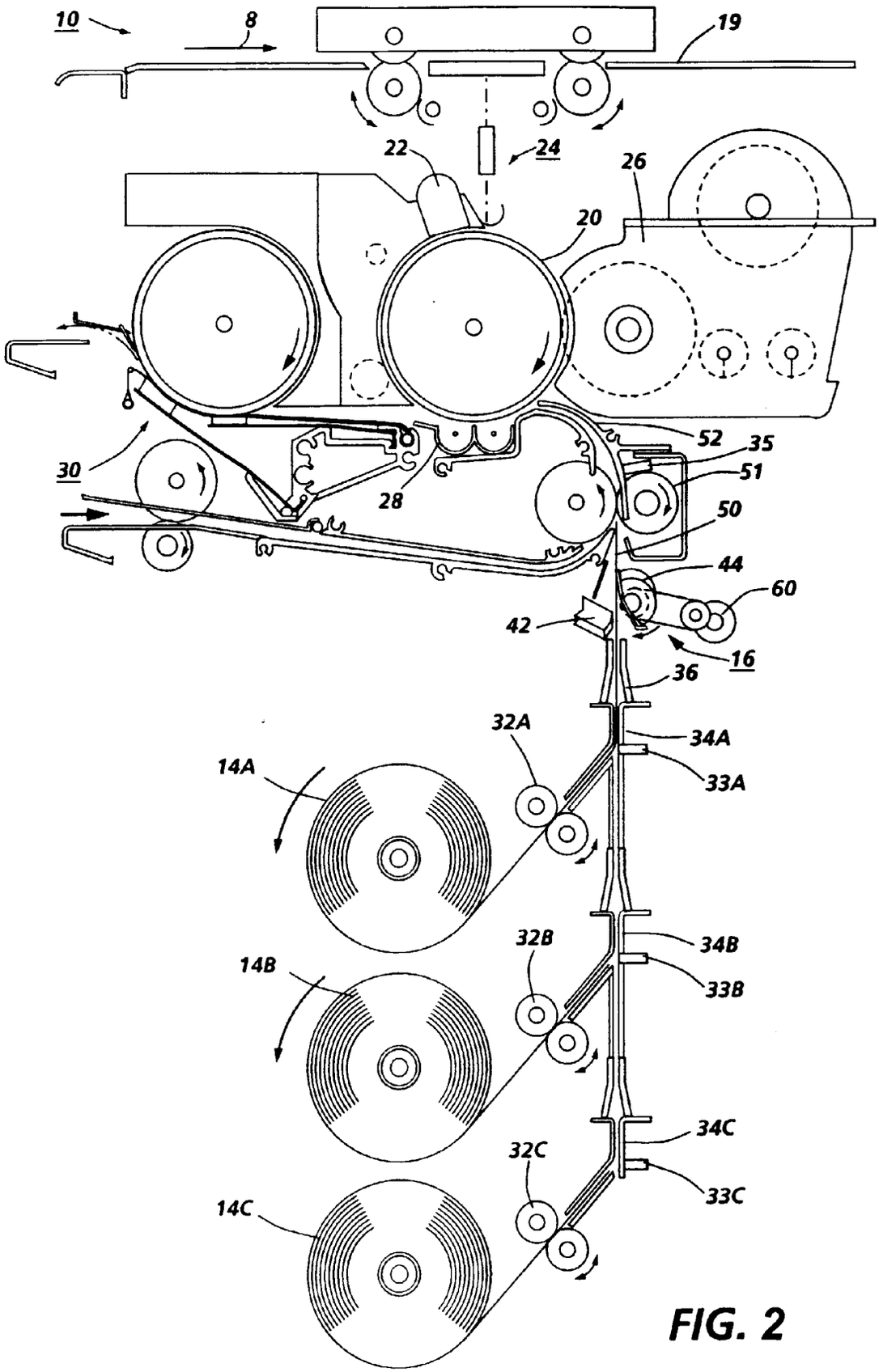
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FIG. 2