

## Respuesta a Requerimientos

### 1 Datos del Solicitante / Titular

|                                                                                                                                                                                                                                                                                             |                                                               |                                        |                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------|-----------------------------------------------------|
| <b>Nombre:</b>                                                                                                                                                                                                                                                                              | TROY GROUP, INC                                               | <b>Dirección Electrónica:</b>          | notificacionesbm.bogota@bakermckenzie.com.com       |
| <b>Dirección:</b>                                                                                                                                                                                                                                                                           | 940 SOUTH COAST DRIVE, SUITE 200 COSTA MESA, CALIFORNIA 92626 | <b>Domicilio/País de constitución:</b> | ESTADOS UNIDOS DE AMÉRICA - CALIFORNIA - COSTA MESA |
| <b>Identificación:</b><br><br><input type="checkbox"/> CEDULA DE CIUDADANIA<br><input type="checkbox"/> CEDULA DE EXTRANJERIA<br><input checked="" type="checkbox"/> EMPRESA EXTRANJERA<br><input type="checkbox"/> NIT<br><input type="checkbox"/> PASAPORTE<br><br><b>Número:</b> 803532- |                                                               |                                        |                                                     |

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### Dato de la Creación

| Identificación de la Creación | No. de Certificado | Vigencia | No. de Expediente | Tipo Trámite |
|-------------------------------|--------------------|----------|-------------------|--------------|
|-------------------------------|--------------------|----------|-------------------|--------------|

|                                                                                               |                          |                                                                                                                      |  |          |                                           |
|-----------------------------------------------------------------------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------|--|----------|-------------------------------------------|
| COMPOSICIÓN DE RECUBRIMIENTO QUE INCLUYE MATERIAL FLUORESCENTE PARA PRODUCIR IMÁGENES SEGURAS |                          | 000000                                                                                                               |  | 12051593 | PCT-PATENTE DE INVENCION CAPITULOS I Y II |
| 3                                                                                             | Texto de la Comunicación | RESPUESTA AL AUTO NOTIFICADO POR FIJACIÓN EN LISTA NO. 30 DEL 28 DE JULIO DE 2015, OFICIO NO. 8461 (EXAMEN DE FONDO) |  |          |                                           |
| 4                                                                                             | Anexos                   |                                                                                                                      |  |          |                                           |
| <input checked="" type="checkbox"/> Anexos                                                    |                          |                                                                                                                      |  |          |                                           |

Doctor

José Luis Salazar

Director de División de Nuevas Creaciones (C)

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

E. \_\_\_\_\_ S. \_\_\_\_\_ D. \_\_\_\_\_

Referencia: Expediente No. 12.051.593

Solicitud de Patente de Invención titulada: "Sistema que comprende una composición de recubrimiento que incluye material fluorescente para producir imágenes seguras".

Solicitante: Troy Group, Inc.

**RESPUESTA AL AUTO NOTIFICADO POR FIJACIÓN EN LISTA NO. 30**  
**DEL 28 DE JULIO DE 2015, OFICIO NO. 8461 (EXAMEN DE FONDO)**

ÁLVARO CORREA ORDÓÑEZ, mayor de edad y vecino de Bogotá D.C., identificado tal como aparece al pie de mi firma, en mi carácter de apoderado de la sociedad en referencia, doy respuesta al auto emanado por ese Despacho dentro del término de prórroga solicitado en mi memorial 12-051593-00013-0000 de fecha 21 de octubre de 2015:

**1. Respuesta a las objeciones del Examinador**

**1.1 Reivindicaciones relativas a un uso o a un segundo uso**

El examinador establece que las reivindicaciones 1 y 14 no son patentables pues se menciona el uso.

Al respecto, aclaramos al examinador que las reivindicaciones 1 y 14 no hacen referencia a un uso sino a un sistema, materia claramente patentable de acuerdo con el artículo 14 de la Decisión 486.

## 1.2 Título

El examinador afirma que el título no permite distinguir el objeto a proteger, por lo tanto es necesario cambiarlo.

Con el fin de atender a la anterior observación mi representada esta de acuerdo con la modificación sugerida por el examinador.

Por lo tanto, el título se modifica a: *"Sistema que comprende una composición de recubrimiento que incluye material fluorescente para producir imágenes seguras"*.

De esta forma se da por superada esta observación.

## 1.3 Reivindicaciones

El Examinador menciona que las reivindicaciones 1, 13 y 14 no son claras porque presentan efectos: *"la imagen formada con el tinte sobre la primera superficie del sustrato que temple el primer recubrimiento luego de contacto con el primer recubrimiento originando una imagen inversa negativa de esa parte de la imagen sobre la....."*, *"material que produce fluorescencia blanca, amarilla...."*, *"para mejorar la migración del tinte....para producir una imagen negativa inversa de la imagen impresa sobre la primera superficie que entra en contacto"*,

Así mismo, el examinador establece que las reivindicaciones 1 y 3 referidas a un producto en particular un sistema, incluyen características funcionales *"dicho tóner imprime una imagen sobre la primera superficie del sustrato"*, *"que mejora la migración del tinte al sustrato aplicado a la superficie de sustrato mediante impresión offset"*, *"la resina que genera alta viscosidad y propiedades de baja nebulización"*, y que dichas características no le pueden dar novedad ni nivel inventivo a la invención.

El examinador establece que las reivindicaciones 1 y 10 referidas a un sistema incluyen características de proceso *"aplicado a la superficie del sustrato mediante impresión offset"*, *"el segundo promotor de la migración es aplicado a la superficie del sustrato mediante impresión offset"*.

Por último se menciona que *"la reivindicación 14 tiene por objeto un método, sin embargo aunque muestra la secuencia de etapas técnicas por medio de las cuales se transforme una materia en un producto....no se enseña las etapas técnicas con sus condiciones técnicas por lo que no es clara...."*.

#### 1.3.1 Modificación a una solicitud en trámite

Con el objeto de atender a las observaciones del examinador y de conformidad con artículo 34 de la Decisión 486, me permito presentar un nuevo pliego reivindicatorio como sustituto del anteriormente presentado el cual se encuentra totalmente sustentado en la memoria descriptiva originalmente presentada.

El examinador podrá notar que las reivindicaciones 1 y 13 son las únicas reivindicaciones independientes las cuales se modificaron sustancialmente.

Con las modificaciones efectuadas se supera las observaciones de claridad establecidas por su Despacho.

Las reivindicaciones originales 2, 11-12 y 16-20 fueron canceladas. Las reivindicaciones 10-12 y 16 fueron canceladas anteriormente. El examinador podrá notar que el nuevo pliego reivindicatorio se dirige solamente a un sistema para producir un documento seguro.

La reivindicación 1 y las reivindicaciones dependientes de esta, es decir, las reivindicaciones 3,4,5,6,7,8,9 y 10 se dirigen a un sistema para producir un documento seguro que incluye un sistema de creación de imágenes con base en tóner. El sistema requiere un sustrato de papel, un tóner el cual contiene un colorante y un tinte empleado por un sistema de creación de imágenes con base en tóner para aplicar una imagen a la primera superficie del sustrato de papel.

El punto crucial de la invención es el recubrimiento del papel en áreas seleccionadas con un recubrimiento que comprende material fluorescente, un aceite, una resina, un agente antinebulización y un agente anticompensación en la primera o segunda superficie. La interacción del recubrimiento y el tóner es como se menciona en la reivindicación en la parte "donde".

La reivindicación 10 reclama un sistema para producir un documento seguro que utiliza un sistema de creación de imágenes con base en tóner, un sustrato de papel, un tóner que contiene un color, y un tinte, empleado por el sistema de creación de imágenes con base en tóner para aplicar una imagen al sustrato de papel. Un primer recubrimiento que contiene material fluorescente está en la primera o segunda superficie del sustrato de papel en áreas seleccionadas. Un segundo recubrimiento contiene un aceite con viscosidad alta con baja tensión superficial y un agente anti-nebulización está sobre la primera o segunda superficie del sustrato de papel en áreas seleccionadas. La interacción del recubrimiento y el tóner es como se menciona en la reivindicación en la parte "donde".

La diferencia entre las reivindicaciones 1 y 10, es que la reivindicación 10 utiliza dos recubrimientos sobre el sustrato de papel mientras que la reivindicación 1 utiliza solamente un recubrimiento. Los contenidos de los recubrimientos son importantes para obtener el resultado deseado.

Teniendo en cuenta las modificaciones efectuadas al pliego reivindicatorio así como las explicaciones dadas anteriormente, se tiene que la presente solicitud cumple a cabalidad con el requisito de claridad establecido en el artículo 30 de la Decisión 486.

#### 1.4 Novedad

Su Despacho reconoce la novedad de la presente solicitud de patente. Por lo tanto, el requisito a sustentar es el nivel inventivo.

#### 1.5 Nivel Inventivo

Sobre el requisito del nivel inventivo, el Examinador establece que el documento **D2**<sup>1</sup> (US 2007/0231725) afecta el nivel inventivo de las reivindicaciones 1 a 5, 8, 10, 13, 14 and 15 de la solicitud en estudio, y que el documento **D1**<sup>2</sup> (US 7,220,524) afectan el nivel inventivo de las reivindicaciones 1,4,6,7,9,11,12,14 y 15 de la solicitud en estudio.

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<sup>1</sup> "Secure imaging toner and methods of forming and using the same"

<sup>2</sup> "System and method for producing secure toner-based images"

En forma resumida se argumenta:

*".....Los documentos D1 y D2 se consideran el estado de la técnica cercano a la invención definida en la reivindicación 1 porque divulgan sistemas para producir documentos seguros.*

*La diferencia entre la invención definida en la reivindicación 1 y el sistema de D2 consiste en que este último no menciona que el material fluorescente entre otros aditivos se encuentre en un primer recubrimiento y no en el tóner.*

*La diferencia entre la invención definida en la reivindicación 1 y el sistema de D1 consiste en que este último no menciona un material fluorescente.*

*No se evidencia un efecto técnico inesperado o sorprendente el hecho de que el material fluorescente entre otros aditivos se encuentren en un primer recubrimiento y no el tóner, por cuanto el documento D2 divulga en la Fig. 2 (a) y Fig. 2 (b) ilustran un cheque impreso en una primera superficie (204) de la verificación y una imagen (206) que se forma como resultado de la migración de colorante.....(..).Sin embargo, la utilización de un recubrimiento que comprende un material fluorescente (puede ser un material (por ejemplo, tinte o pigmento) visible bajo luz ambiente o puede hacerse visible bajo otra radiación, por ejemplo, radiación ultravioleta ...(..) para disponer de otra alternativa para producir imágenes seguras, ya está divulgada en el documento D1 que se refiere a un sistema para producir un documento seguro usando imágenes con base en tóner (reivindicación 1), donde, un sustrato que incluye un agente de migración de mejora se forma mediante recubrimiento de una base con un agente mejorador de migración de sustancias...(..)..*

*En consecuencia, la persona del oficio normalmente versada en la materia, estaría motivada a incluir el material fluorescente en el recubrimiento y no en el tóner de D1 en el sistema de D2 para llegar así al objeto de la reivindicación 1 de la solicitud. Por lo cual se considera obvia.....".*

Con relación a la reivindicación 14 se establece lo siguiente:

*".....Los documentos D1 y D2 se consideran el estado de la técnica cercano a la invención definida en la reivindicación 14 porque divulgan métodos para producir documentos seguros.*

*La diferencia entre la invención definida en la reivindicación 14 y el método de D2 consiste en que este último no menciona que en el recubrimiento se incluye el material fluorescente entre otros aditivos y que se imprima mediante impresión offset sobre el sustrato.*

*La diferencia entre la invención definida en la reivindicación 14 y el método de D1 consiste en que este último no menciona un material fluorescente. No se evidencia un efecto técnico inesperado o sorprendente el hecho de que el material fluorescente entre otros aditivos se incluyan en el recubrimiento y no en el tóner y se imprima mediante impresión offset sobre el sustrato, por cuanto el documento D2 divulga que en la figura 2 (a) y Fig. (b) ilustran un cheque (200) formada usando el sistema (100). En particular, Fig. 2 (a) ilustra una imagen (202) impreso en una primera superficie (204) de la ventilación y una imagen (206), que se forma como resultado de la migración de colorante, formado en o visible desde una superficie opuesta (208) del cheque (Párr.28), que con relación al sistema propuesto, el efecto sería el mismo, es decir formación de una imagen inversa negativa para producir un documento seguro.*

*Sin embargo, la utilización de un recubrimiento que comprende un material fluorescente (puede ser un material (por ejemplo, tinte o pigmento) visible bajo luz ambiente o puede hacerse visible bajo otra radiación, por ejemplo, radiación ultravioleta...(.) para disponer de otra alternativa para producir imágenes seguras, ya está divulgada en el documento D1 que se refiere a un método para formar un documento seguro que comprende un sustrato que tiene una primera y segunda superficie ...(.).*

*En consecuencia, la persona del oficio normalmente versada en la materia, estaría motivada a incluir el material fluorescente en el recubrimiento y no en el tóner, además de imprimir el recubrimiento que contiene material fluorescente mediante impresión offset sobre el sustrato de D1 en el método de D2 para llegar así al objeto de la reivindicación 14 de la solicitud. Por lo cual se considera obvia.*

#### 1.5.1 Argumentos en favor del nivel inventivo

El nivel inventivo de una solicitud se encuentra definido en el Artículo 18 de la Decisión 486 y se establece cuando *“si para una persona del oficio normalmente versada en la materia técnica correspondiente, esa invención no hubiese resultado obvia ni se hubiese derivado de manera evidente del estado de la técnica”*.

Contrario a lo que plantea el Examinador, los documentos del arte previo citado no afectan el nivel inventivo de la presente solicitud por cuanto no es posible derivar la presente invención a partir de las enseñanzas presentadas en los documentos D1 o D2, debido a los siguientes argumentos:

La presente invención como se establece en las reivindicaciones 1 y 10 del nuevo pliego reivindicatorio se distingue de los documentos D1 y D2 por el hecho que de acuerdo con la presente invención, el recubrimiento aplicado al sustrato de papel se aplica separadamente y selectivamente con el fin de depositar con exactitud el recubrimiento sobre solamente áreas seleccionadas del sustrato de papel. La característica de seguridad, por lo tanto, se crea, solamente en estas áreas preseleccionadas sobre el papel. El documento D1 no enseña ni sugiere impresión de un recubrimiento que contiene material fluorescente y que mejora la migración sobre un sustrato y dicho documento no enseña ni sugiere específicamente el material de recubrimiento tal como se reclama en la presente invención.

El documento D2 no contempla impresión de un recubrimiento que contiene materiales fluorescentes y que mejoran la migración sobre una superficie del papel. Este documento ni siquiera contempla aplicar un recubrimiento. El documento D2 por el contrario se preocupa por un recubrimiento que mejora la migración incorporado en el papel, a través de la superficie entera del sustrato de papel.

En este orden de ideas, tenemos que la invención propuesta por el solicitante no solamente es novedosa como ya lo ha reconocido su Despacho sino que también cumple con el requisito de nivel inventivo y de esta manera es susceptible de ostentar el título de patente de invención.

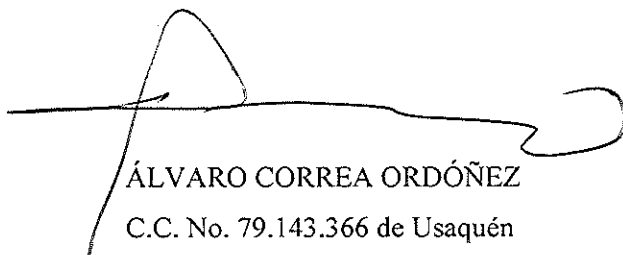
**2. Solicitudes concedidas en otros países para esta misma invención.**

A manera informativa, pongo en conocimiento del Examinador que la patente US 8,747,997 equivalente a la presente solicitud colombiana ha sido otorgada. El examinador podrá notar las reivindicaciones otorgadas en dicha patente son similares a las que ahora se presenta con este escrito, siendo las otorgadas por la Oficina de Patente Estadounidense con un alcance mayor.

Aún cuando entiendo que estas decisiones de ninguna manera obligan al Despacho para decidir de igual forma, considero que por tratarse de una pregunta fáctica la determinación de la existencia de novedad, nivel inventivo y aplicación industrial, las decisiones de otras oficinas de patentes constituyen un antecedente persuasivo en la materia.

En virtud de lo anterior, solicito que se acepten las razones expuestas en el presente documento y en consecuencia, se otorgue el privilegio de patente de invención para el invento que se tramita en este expediente.

Atentamente,



ÁLVARO CORREA ORDÓÑEZ  
C.C. No. 79.143.366 de Usaquén  
T.P. 20.281

Anexos: Capítulo reivindicatorio modificado conformado por 12 reivindicaciones  
Copia de la carátula de la Patente US 8,747,997 junto con las reivindicaciones.

3197925-v1\BOGDMS

**REIVINDICACIONES MODIFICADAS SOLICITUD DE PATENTE No. 12.051.593 -**

**RESPUESTA A FONDO DICIEMBRE 2015**

1. Un sistema para producir un documento seguro que comprende:

un sistema de creación de imágenes con base en tóner;

un sustrato de papel que tiene una primera superficie y una segunda superficie;

un tóner que contiene un colorante y un tinte, el tóner empleado en el sistema de creación de imágenes con base en tóner para aplicar una imagen a la primera superficie del sustrato de papel; y

un recubrimiento que comprende material fluorescente, un aceite, una resina, un agente antinebulización y un agente anticompensación sobre la primera y segunda superficie del sustrato de papel a las porciones seleccionadas del sustrato de papel,

donde el tinte del tóner temple una porción del material fluorescente en el recubrimiento para producir una imagen inversa negativa de la imagen aplicada a la primera superficie del sustrato de papel por el tóner, cuando se expone a la radiación ultravioleta.

2. El sistema de la reivindicación 1, en donde el aceite es de un solo componente ó una combinación de uno ó más aceites, plastificadores y polímeros líquidos.

3. El sistema de la reivindicación 1, en donde la resina es una resina que genera alta viscosidad, y propiedades de baja nebulización.
4. El sistema de la reivindicación 1, en donde el agente anti-nebulización comprende un compuesto seleccionado del grupo que consiste de sílice, arcilla de bentonita, caolín, dióxido de titanio, y cualquier combinación de estos.
5. El sistema de la reivindicación 1, en donde el agente anticompensación comprende un compuesto que tiene un tamaño de partícula entre 0,2 micrones a 25 micrones.
6. El sistema de la reivindicación 1, en donde el agente anticompensación comprende un compuesto seleccionado del grupo que consiste de sílice, almidón de guisante, almidón de trigo, y cualquier combinación de los anteriores.
7. El sistema de la reivindicación 1, en donde el agente anticompensación comprende una cera sintética, una cera natural, ó una combinación de estas.
8. El sistema de la reivindicación 7, en donde la cera sintética comprende un polietileno, una cera de fluorocarbono, polipropileno, ó cualquier combinación de estas.

9. El sistema de la reivindicación 1, en donde el primer recubrimiento comprende material fluorescente que comprende de 0,5% a 4% de material fluorescente.

10. Un sistema para producir un documento seguro que comprende:

un sistema de creación de imágenes con base en tóner;

un sustrato de papel que tiene una primera superficie y una segunda superficie;

un tóner que contiene un colorante y un tinte, el tóner empleado en el sistema de creación de imágenes con base en tóner para aplicar una imagen a la primera superficie del sustrato de papel;

un primer recubrimiento que comprende material fluorescente aplicado a la primera o segunda superficie del sustrato de papel en áreas seleccionadas; y

un segundo recubrimiento que contiene un aceite de viscosidad alta con baja tensión superficial y un agente anti-nebulización sobre la primera o segunda superficie del sustrato de papel en áreas seleccionadas;

donde el tinte del tóner temple una porción del recubrimiento que comprende material fluorescente para producir una imagen inversa negativa de la imagen aplicada a la primera superficie del sustrato de papel por el tóner, cuando se expone a la radiación ultravioleta.

11. El sistema de la reivindicación 10, donde el agente anti-nebulización se selecciona del grupo que consiste de sílice, arcilla de bentonita, caolín, dióxido de titanio, y cualquier combinación de estos.

12. El sistema de la reivindicación 10, donde el segundo recubrimiento comprende una combinación de aceites de silicona que tienen diferentes viscosidades, donde la viscosidad final de la composición es adecuada para la impresión litográfica offset.

BM\_MGT/BOGDMS-#3197057-V1-P2012\_000011-REIVINDICACIONES\_MODIFICADAS\_PARA\_RESPUESTA\_A\_FONDO.DOCX



US008747997B2

(12) **United States Patent**  
**Heilman et al.**

(10) **Patent No.:** **US 8,747,997 B2**  
(45) **Date of Patent:** **Jun. 10, 2014**

(54) **COATING COMPOSITION INCLUDING  
FLUORESCENT MATERIAL FOR  
PRODUCING SECURE IMAGES**

(75) Inventors: **Kevin L. Heilman**, Wheeling, WV (US);  
**Eugene Hoefs**, Riverside, CA (US);  
**Michael R. Riley**, Steubenville, OH  
(US)

(73) Assignee: **Troy Group, Inc.**, Costa Mesa, CA (US)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 110 days.

(21) Appl. No.: **13/395,408**

(22) PCT Filed: **Oct. 18, 2010**

(86) PCT No.: **PCT/US2010/053068**

§ 371 (c)(1),

(2), (4) Date: **Mar. 9, 2012**

(87) PCT Pub. No.: **WO2011/049876**

PCT Pub. Date: **Apr. 28, 2011**

(65) **Prior Publication Data**

US 2012/0171603 A1 Jul. 5, 2012

**Related U.S. Application Data**

(60) Provisional application No. 61/253,471, filed on Oct.  
20, 2009.

(51) **Int. Cl.**  
**B41M 5/00** (2006.01)

**B41M 5/52** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **B41M 5/52** (2013.01); **B41M 5/5254**  
(2013.01); **B41M 5/5218** (2013.01)

USPC ..... **428/195.1**

(58) **Field of Classification Search**

CPC ..... B41M 5/52; B41M 5/5254; B41M 5/5218

USPC ..... 428/195.1

See application file for complete search history.

(56) **References Cited**

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|              |      |         |                 |            |
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| 2003/0175609 | A1 * | 9/2003  | Combes et al.   | 430/108.22 |
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Application No. PCT/US2010/053068, filed Oct. 18, 2010 (11 pages)  
Search completed Jan. 21, 2011.

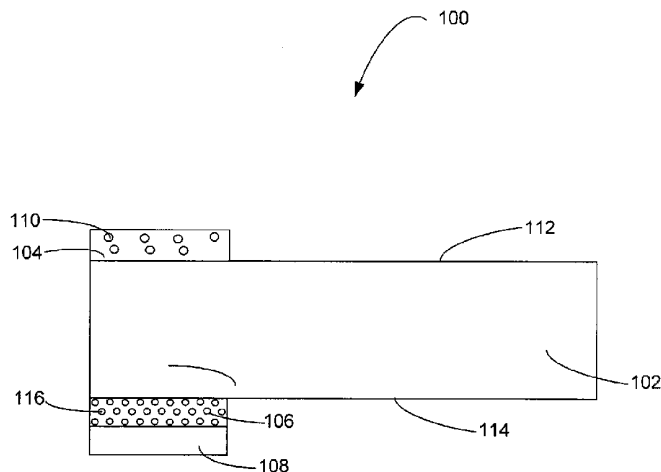
\* cited by examiner

*Primary Examiner* — Betelhem Shewareged

(57) **ABSTRACT**

A coating composition, system, and method for printing documents that are difficult to chemically or physically forge and that are easy to visually verify are disclosed. The system includes a substrate, a toner, including a colorant and a dye, a coating including fluorescent material, e.g., a primary migration-enhancing coating, applied using an offset printing process and optionally a secondary migration-enhancing coating applied using an offset printing process. An image formed using the toner of the invention is readily verified by comparing a colorant-formed image and a dye-formed image and/or to a reverse negative image formed by the dye quenching the fluorescent material. In addition, if a solvent is used in an attempt to alter the printed image on the substrate, the dye migrates or diffuses to indicate tampering with the document.

**12 Claims, 4 Drawing Sheets**



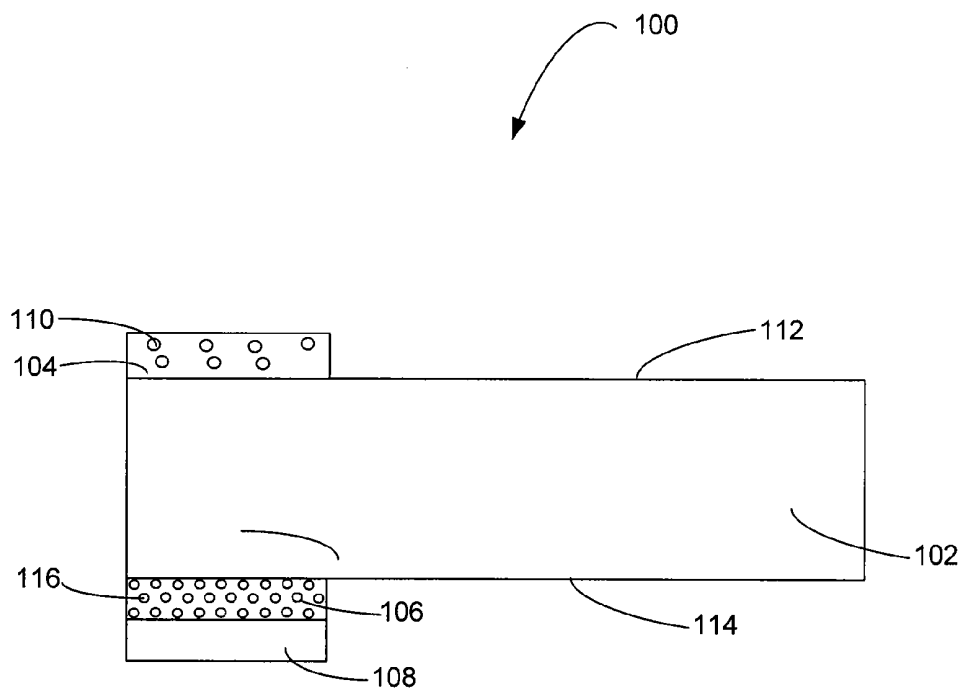


FIG. 1

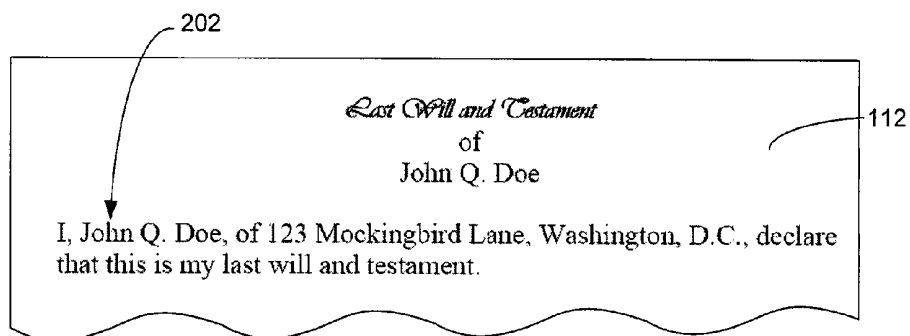


Fig. 2A

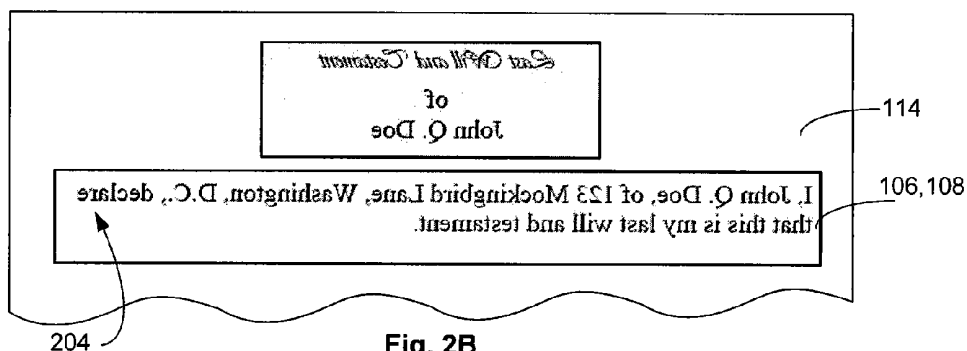


Fig. 2B

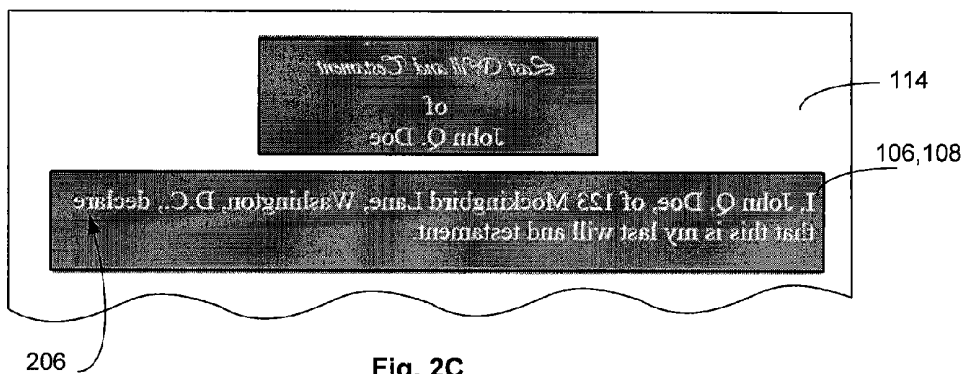


Fig. 2C

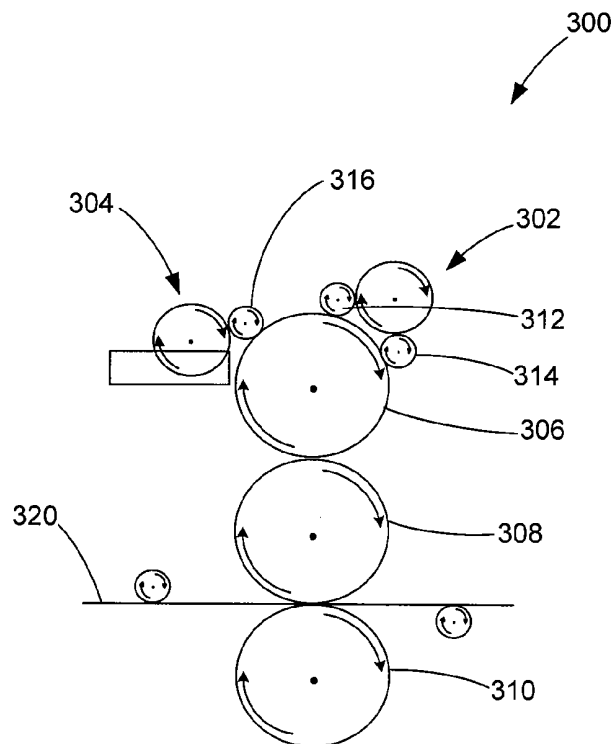


Fig. 3

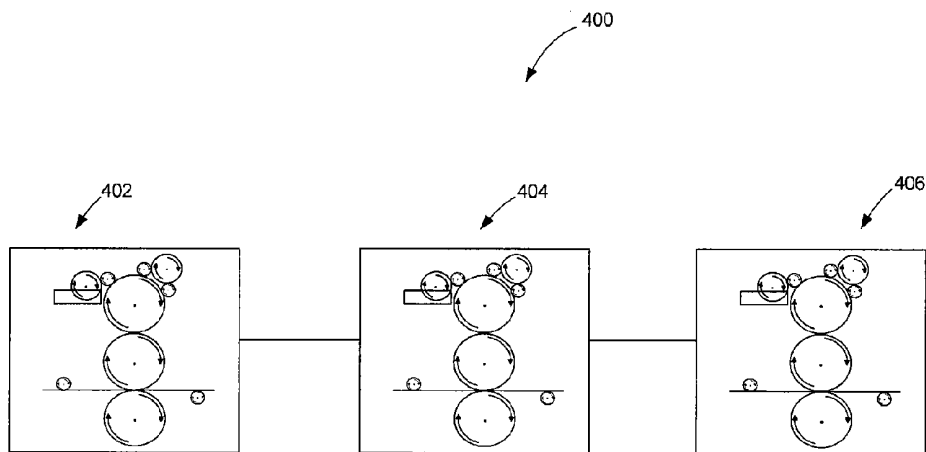


Fig. 4

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## COATING COMPOSITION INCLUDING FLUORESCENT MATERIAL FOR PRODUCING SECURE IMAGES

### CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 12/543,438, entitled, COATING COMPOSITION, SYSTEM INCLUDING THE COATING COMPOSITION, AND METHOD FOR PRODUCING SECURE IMAGES, filed Aug. 18, 2009, which claims the benefit of Provisional Application No. 61/139,510, entitled A SYSTEM AND METHOD FOR PRODUCING A SECURE DOCUMENT USING TONER-BASED IMAGING, filed Dec. 19, 2008; this application also claims the benefit of Provisional Application No. 61/253,471, entitled METHOD AND APPARATUS FOR PRODUCING OVERT AND COVERT SECURITY IMAGES ON PAPER, filed Oct. 20, 2009; the entire disclosures of which are hereby incorporated herein by reference.

### FIELD OF INVENTION

The present invention relates to compositions, systems, and methods for printing documents. More particularly, the invention relates to an improved coating composition for printing documents in a secure manner, such that the documents are difficult to forge and original versions of the documents are readily verifiable, and to a system including the coating composition and to methods of using and making the coating composition.

### BACKGROUND OF THE INVENTION

Toner-based imaging, which generally involves forming an electrostatic or magnetic image on a charged or magnetized photoconductive plate or drum, brushing the plate or drum with charged or magnetized toner, transferring the image onto a substrate such as paper, and fusing the toner onto the substrate using heat, pressure, and/or a solvent, can be used to form relatively inexpensive images on a surface of a substrate.

Because toner-based imaging, such as printing, is a relatively quick and inexpensive technique for producing copies of images, the technique is often employed to produce documents that were traditionally formed using other forms of printing or imaging—e.g., impact printing or ink-jet printing. For example, in recent years, toner-based imaging has been employed to produce financial documents, such as personal checks, stocks, and bank notes; legal documents such as wills and deeds; medical documents such as drug prescriptions and doctors' orders; and the like. Unfortunately, because the image is formed on the surface of the substrate, documents produced using toner-based imaging techniques may be relatively easy to manipulate, forge and/or duplicate.

Various techniques for printing or forming secure documents have been developed over the years. For example, U.S. Pat. No. 5,124,217, issued to Gruber et al. on Jun. 23, 1992, discloses a secure printing toner for electrophotographic processing. This toner, when exposed to a solvent such as toluene, often used in document forgery, produces a color stain indicative of the attempted forgery. This toner is only useful to disclose an attempted forgery when a particular solvent is used to remove a portion of a printed image. Thus, the toner cannot be used to mitigate copying of the document or forgery resulting from adding material to the document.

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U.S. Pat. No. 5,714,291, issued to Marinello et al. on Feb. 3, 1998, discloses another toner that includes submicron ultraviolet sensitive particles. A document printed with the toner can be authenticated using ultraviolet light.

Other techniques for producing secure images include modifying the paper onto which the image is printed. Such modified papers may include paper having a low-ink-absorption coating and paper including crushable micro capsules that contain leuco ink and a color acceptor. Although techniques including these forms of paper work relatively well for impact-type printing or copying, the techniques would not work well in connection with toner-based or similar printing methods.

Other techniques for producing secure images include providing special paper coatings to increase smudge resistance of an image created by an electrostatic process. However, the coatings generally do not affect an ability to add material to the document or authenticate the originality of the document.

For the foregoing reasons, improved compositions, methods and apparatus for forming secure documents using toner-based processing, which are relatively easy and inexpensive, are desired.

### SUMMARY OF THE INVENTION

The present invention provides an improved coating composition, system and method for producing secure documents. Various ways in which the present invention addresses the drawbacks of the prior art are addressed below. In general, however, the coating composition, system, and method of the present invention produce images that are difficult to alter and that are relatively easy to assess whether an alteration to a printed image has been attempted or made.

In accordance with various embodiments of the invention, a system includes a substrate, a toner that includes a colorant and a dye applied to a surface of the substrate, and a coating including fluorescent material. In accordance with exemplary aspects of these embodiments, the coating including fluorescent material is a primary migration-enhancing coating. As set forth in more detail below, the primary migration-enhancing coating may be configured to facilitate migration of the dye through the substrate to form an image visible from a second surface of the substrate. In accordance with additional and/or alternative aspects of these embodiments, the system further includes a secondary migration-enhancing coating, which may additionally and/or alternatively include fluorescent material. The secondary coating may be configured as a barrier between the first coating and other substrates and/or to minimize effects of different substrates. In accordance with further aspects of these embodiments, the toner is applied using a laser printer. And, in accordance with yet additional aspects, the coating comprising fluorescent material, the primary migration-enhancing coating and/or secondary migration-enhancing coating is applied using an offset printing process. As discussed in more detail below, using an offset printing process to apply the coating comprising fluorescent material, the primary migration-enhancing coating and/or secondary migration-enhancing coating allows for application of the coating(s) to select areas of the substrate—within the registration of the printer.

In accordance with additional embodiments of the invention, a coating composition, e.g., a composition for application of a primary migration-enhancing coating, used for producing secure images, includes an oil, a resin, an anti-misting agent, an anti-offsetting agent, and fluorescent material. In

accordance with various exemplary aspects, the primary coating composition is configured for application to a substrate using offset printing.

In accordance with yet additional embodiments of the invention, a coating composition, e.g., a composition for application of a secondary migration-enhancing coating, includes a high viscosity oil with low surface tension, an anti-misting agent, and optionally fluorescent material. In accordance with various aspects of these embodiments, the secondary migration-enhancing coating composition includes a plurality of oils. In accordance with further exemplary aspects, the secondary coating composition is configured for application to a substrate using offset printing.

In accordance with yet further embodiments of the invention, a method of forming a secure document includes the steps of providing a substrate, applying a colorant and a dye to the substrate, and applying a coating including fluorescent material (e.g., a primary migration-enhancing coating, which includes fluorescent material) to the substrate using, for example, an offset printing (e.g., offset lithography) process. In accordance with various aspects of these embodiments, the process further includes the step of applying a secondary migration-enhancing coating, which may optionally include fluorescent material. In accordance with further aspects, the secondary migration-enhancing coating is applied using offset printing techniques. As set forth in more detail below, the colorant and dye, the coating including fluorescent material, the primary migration-enhancing coating, and the secondary migration-enhancing coating may be applied to the same surface of the substrate, or the colorant and dye may be applied to a first surface of the substrate and the coating including fluorescent material, the primary migration-enhancing coating, and/or the secondary migration-enhancing coatings may be applied to a second surface of the substrate.

In accordance with additional embodiments of the invention, a method of forming a secure document includes the steps of providing a substrate, applying a colorant and dye to the substrate, applying a primary migration-enhancing coating to the substrate, and applying a secondary migration-enhancing coating overlying the primary migration-enhancing coating. In accordance with various aspects of these embodiments, the primary migration-enhancing coating includes fluorescent material and is applied using, for example, offset printing techniques. In accordance with further aspects, the secondary migration-enhancing coating is applied using offset printing techniques.

#### BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present invention may be derived by referring to the detailed description and claims, considered in connection with the figures, wherein like reference numbers refer to similar elements throughout the figures, and:

FIG. 1 illustrates a secure document system in accordance with various embodiments of the invention;

FIGS. 2A-2C illustrate a first surface and a second surface of a secure document in accordance with exemplary embodiments of the invention;

FIG. 3 illustrates an offset printing station for use with various embodiments of the invention; and

FIG. 4 illustrates an offset printing apparatus, including multiple stations, for use with various embodiments of the invention.

Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of

some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of embodiments of the present invention.

#### DETAILED DESCRIPTION

The following description is provided to enable a person skilled in the art to make and use the invention and sets forth the best mode contemplated by the inventors of carrying out their invention. Various modifications to the description, however, will remain readily apparent to those skilled in the art, since the general principles of a coating composition, system, and method for forming secure images on a document have been defined herein.

The present invention may be used in connection with a variety of printing processes, and is particularly well suited for electrophotography and offset printing applications. The following description describes a coating composition, system, and method to produce secure documents using electrophotography and lithographic offset processes. However, the invention is not limited to such composition, system, or process.

Exemplary coatings and systems in accordance with various embodiments of the invention may be used for a variety of purposes, such as to produce financial documents, such as personal checks, stocks, and bank notes; legal documents such as birth certificates, drivers' licenses, wills, and deeds; medical documents such as drug prescriptions, transcripts, and doctors' orders; educational documents, such as transcripts and records, and the like.

FIGS. 1 and 2A-2C illustrate a system 100, which includes a substrate 102, a toner 104, a first or primary migration-enhancing coating 106, including fluorescent material 116 (the coating containing fluorescent material in this illustrative example), a second or secondary migration-enhancing coating 108, and a dye 110. Although system 100 is illustrated with multiple coatings, as discussed in greater detail below, systems in accordance with alternative embodiments may include fewer coatings or layers, wherein, for example, a single coating may include the attributes of one or both coatings 106 and 108. Furthermore, although coatings 106, 108 are illustrated as being directly opposite toner 104 on a second surface 114 of substrate 102, coatings 106 and/or 108 could alternatively be disposed on the same surface as and underlying toner 104, and in either case, need not be directly corresponding to a location of toner 104. Furthermore, while illustrated with coating 106 including fluorescent material, coating 108 or another layer may additionally and/or alternatively include fluorescent material; when coating 108 or another layer includes fluorescent material, coating 108 or the other layer is referred to as the coating including fluorescent material.

Toner 104 and dye 110 function together with coatings 106 and 108 to provide a first image 202 using toner 104 on a first surface 112 of substrate 102 and a latent image 204 with dye 110 that may be visible from first surface 112 and/or a second surface 114. In accordance with specific examples of the invention, dye 110 and fluorescent material 116 function together to produce a reverse negative image 206 within an area coated with the fluorescent coating (e.g., coating 106). When viewed under a fluorescing light, e.g., ultraviolet light, a reverse negative image may be formed by, for example, dye 110 quenching fluorescent material 116.

In accordance with various embodiments of the invention, the secure image systems (e.g., system 100) are difficult to forge and copies of the secure images are easily detected, because any mismatch between the printed image (e.g., image

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202) and the latent image (e.g., image 204) and/or reverse negative image (e.g., image 206) indicates an alteration or attempted alteration and a missing latent image and/or reverse negative image is indicative of a copy of the document.

System 100 may be formed by applying a toner and a dye 5 onto substrate 102 using, for example, an electrostatic or electrophotographic process, such as a laser printing process and applying coating 106 and/or coating 108 using rod, gravure, spray, or wet or dry offset printing process (e.g., a lithographic process). Using an offset printing process to 10 apply coatings 106 and/or 108 is advantageous because it allows the coating to be applied relatively inexpensively and, if desired, allows for precise application of the coatings only to desired areas of the substrate—within the precision of the register of the lithographic printer. In accordance with one 15 embodiment of the invention, toner 104, including dye 110, is printed onto a first surface of a substrate and one or more coatings 106, 108 are applied onto a second surface of the substrate. In accordance with alternative embodiments, coatings 106, 108 may be applied onto a first surface of the 20 substrate and subsequently a toner-based image may be printed on top of the coating(s).

FIG. 3 illustrates a station and FIG. 4 illustrates an apparatus including multiple stations for application of coating 106 and/or 108 using offset printing, in accordance with 25 various embodiments of the invention. Exemplary station 300 includes an ink or composition transfer system 302, a damping station 304, a plate cylinder 306, an offset cylinder 308, and an impression cylinder 310.

In accordance with various embodiments of the invention, 30 during operation of station 300, a coating (e.g., coating 106) is applied to a substrate 320, such as paper, by first applying water from system 304, and then a coating composition from system 302, onto cylinder 306, using roller 316 and rollers 312-314, respectively. The coating composition and the water 35 are immiscible, such that the water repels the coating composition from the non-image areas of cylinder 306 and the coating composition is applied to image areas of cylinder 306. The coating composition from cylinder 306 is then transferred to offset cylinder 308, which in turn, is used to transfer 40 the coating composition to substrate 320. Coating 108 may be applied in the same manner. As noted above, applying coating compositions in this manner allows for very precise application of the coating compositions, which may be desirable to, for example, reduce an amount of coating material used to form system 100 and to mitigate unwanted diffusion of dye 110.

Apparatus 400 may be used to provide multiple images and/or coatings to a substrate using offset techniques. Apparatus 400 includes multiple stations 402, 404, and 406, each 50 station generally including an ink or coating composition transfer system 302 to transfer an image or coating composition onto a substrate. By way of example, an image can be transferred to a substrate (e.g., substrate 102) using station 402. Station 404 is then used to apply layer or coating 106 onto substrate 102. Coating 106 may be applied substantially in register with and on an opposite surface with toner 104, as illustrated, or underlying toner 104. Similarly, if used, coating 108 can be applied overlying coating 106.

Referring back to FIG. 1, in accordance with various 60 embodiments of the invention, substrate 102 may include any suitable material onto which an image can be transferred. Exemplary substrate 102 materials include paper (e.g., 20 lb. MOCR bond paper), and other substrates suitable for offset lithographic printing.

Toner 104 may include any suitable composition capable of printing an image on a surface of substrate 102. In accor-

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dance with various embodiments of the invention, toner 104 includes a thermoplastic binder resin, a colorant, a charge-controlling agent, and a migrating dye 110. Each of the thermoplastic binder resin, the colorant, release agent, and the charge-controlling agent may be the same as those used in typical toners. The toner may be a one-component toner or a multiple-component toner (e.g., toner and developer).

The thermoplastic binder resin helps fuse the toner to the substrate. In accordance with one embodiment of the invention, the binder resin has a melt index of between about 1 g/10 min. and 50 g/10 min. at 125° C. and has a glass transition temperature between about 50° C. and about 65° C. Exemplary materials suitable for the thermoplastic binder resin include polyester resins, styrene copolymers and/or homopolymers—e.g., styrene acrylates, methacrylates, styrene-butadiene-epoxy resins, latex-based resins, and the like. By way of particular example, the thermoplastic binder resin is a styrene butadiene copolymer sold by Eliokem as Pliolite S5A resin.

The colorant for use with toner 102 can be any colorant used for electrophotographic image processing, such as iron oxide, other magnetite materials, carbon black, manganese dioxide, copper oxide, and aniline black. In accordance with one particular example, the colorant is iron oxide sold by 25 Rockwood Pigments as Mapico Black.

The charge-control agent helps maintain a desired charge within the toner to facilitate transfer of the image from, for example, an electrostatic drum, to the substrate. In accordance with one embodiment of the invention, the charge control agent includes negatively-charged control compounds that are metal-loaded or metal-free complex salts, such as copper phthalocyanine pigments, aluminum complex salts, quaternary fluoro-ammonium salts, chromium complex salt type axo dyes, chromic complex salt, and calix arene compounds.

The toner may also include a releasing agent such as a wax. The releasing agent may include low molecular weight polyolefins or derivatives thereof, such as polypropylene wax or polyethylene wax or a copolymer of polypropylene wax and polyethylene wax.

Preferred dyes in accordance with the present invention exhibit a strong color absorbance through a substrate (e.g., substrate 102), good solubility in a migration fluid, good stability, do not adversely affect photographic development properties of the toner, are compatible with the toner resin, do not separate or bloom, are non toxic, and dissolve and/or migrate in polar and/or non-polar solvents used to attempt document forgery—e.g., by attempting to remove an image from the top surface of the substrate. Exemplary polar solvents used in such attempted forgery include acetone, methanol, methyl ethyl ketone, and ethyl acetate; exemplary non-polar solvents include toluene, mineral spirits, gasoline, chloroform, heptane, and diethyl ether. In addition, the dyes are preferably indelible.

Exemplary soluble dyes, suitable for use as dye 110, include phenazine, stilbene, nitroso, triarylmethane, diarylmethane, cyanine, perylene, tartrazine, xanthene, azo, disazo, triphenylmethane, fluorane, anthraquinone, pyrazolone quinoline, and phthalocyanine, or derivatives thereof. In accordance with one embodiment of the invention, the dye is red in color and is formed of xanthene, sold by BASF under the trade name Baso Red 546. In accordance with another embodiment of the invention, the dye is red in color and is formed of disazo, and sold under the name Bright Red 65 LX-5988 from Pylam Products Company, Inc. In accordance with yet another embodiment of the invention, the dye is blue in color and is formed of anthraquinone, sold under the name

Bright Blue LX-9224 by Pylam Products Company, Inc. Other color dyes of similar chemical structure are also suitable for use with this invention.

The following example illustrates a composition that may be used to form a toner e.g., toner **104**. The example set forth below is merely illustrative, and it is not intended that the invention be limited to this illustrative example.

#### Example 1

| Material                                          | Amount |
|---------------------------------------------------|--------|
| Mixture of styrene acrylic and polyester polymers | 51     |
| mixture of iron oxides                            | 40     |
| polyethylene wax                                  | 5      |
| chromium complex                                  | 2      |
| Pylam Bright Red LX-5988                          | 2      |

A toner of example 1 was prepared by melt mixing the components on a two-roll mill, jet milling the composition, and classifying the mixture to about 11 microns and blending the mixture with about 1% mixture of silicas. The toner was tested using a Hewlett-Packard 4050 laser printer and exhibited the desired properties.

In accordance with various embodiments of the invention, coating **106** includes a migration-enhancing agent configured to assist dye **110** to migrate through at least a portion of substrate **102**. Coating **106** may be applied in neat form, without additional diluents, or may include additional diluents. In accordance with various aspects of these embodiments, coating **106** includes an oil as a migration-enhancing agent, a resin, and an anti-misting agent, such as silica, bentonite clay, kaolin, titanium dioxide, or any combination thereof. The anti-misting agent mitigates unwanted spray of coating material. The oil may be a single-component oil or include multiple components, such as oils, plasticizers, liquid polymers, and combinations thereof. The migration fluid may alternatively and/or additionally be adsorbed onto a carrier, such as silica. The migration fluid may also additionally and/or alternatively be encapsulated by a shell that can rupture—e.g., during a printer fusing process. The migration fluid may also be used with additional coating components. For example, the migration fluid may be sealed with the paper sheet by a coating material, such as a polymer, or the like. The additional coating component may be included with the migration fluid or may be added during another coating step. By way of example, the oil may include one or more of the following compounds: benzyl butyl phthalate, bis(2-ethylhexyl) adipate, trioctyl trimellitate, and 2,2,4-trimethyl-1,3-pentanediol diisobutyrate. The resin may be a phenolic modified rosin ester or other resin or compound, yielding high viscosity (e.g., greater than about 70,000 cp) and low tack and low misting properties, such as Sylvaprint 87-85 available from Arizona Chemical.

In accordance with further aspects of these embodiments, coating **106** includes an anti-offsetting agent, such as silica, pea starch, wheat starch, silicone oil, a wax, or any combination thereof. The wax may be a synthetic wax, such as fluorocarbon wax, polyethylene, polypropylene, combinations thereof, or a natural wax, such as carnauba wax, or a combination of natural and synthetic waxes. In accordance with further aspects, a particle size of the anti-offsetting agent may range from about 0.2 microns to about 25 microns or about 10 to about 25 microns.

As noted above, an exemplary coating **106** may also include fluorescent material. The fluorescent material may be material (e.g., dye or pigment) visible under ambient light and/or may become visible under other radiation, e.g., ultraviolet radiation. The fluorescent material may fluoresce any suitable color, such as fluorescent white, fluorescent yellow, fluorescent yellow green, fluorescent green, fluorescent blue, fluorescent orange, fluorescent red, or fluorescent pink. In accordance with various examples of the invention, the fluorescent material also becomes quenched (i.e., does not fluoresce) by dye **110**, when dye **110** contacts fluorescent material **116**.

In accordance with further embodiments of the invention, a composition for application of coating **106** (e.g., a composition of a solution for station **302**) includes about 25% to about 90%, about 35% to about 80%, or about 50% to about 75% oil; about 10% to about 60%, or about 20% to about 50%, or about 30% to about 40% resin; and about 0.1% to about 10%, or about 0.02% to about 5%, or about 0.5% to about 4% anti-misting agent. In accordance with various aspects of these embodiments, the composition includes about 0.1% to about 10%, or about 0.2% to about 5%, or about 0.5% to about 4% anti-offsetting agent and various combinations of these compounds. When coating **106** includes fluorescent material, the composition includes about 0.1% to about 10%, or about 0.3% to about 6%, or about 0.5% to about 4% fluorescent material. All percents set forth herein are in weight percent unless otherwise noted.

The following non-limiting examples illustrate various combinations of materials and processes useful in forming a coating composition in accordance with various embodiments of the invention.

#### Example 2

| Material   | Amount |
|------------|--------|
| Oil        | 64%    |
| Resin      | 33%    |
| Silica     | 1%     |
| Pea Starch | 1%     |

A composition for coating **106** was prepared by first heating a stirred mixture of the oil and the silica (e.g., Syloid Rad 2105 available from Grace Davidson) until a temperature of about 250° F. was reached. While continuing to increase the temperature of the mixture, the resin was slowly added to the mixture. After all the resin has been added and the temperature had reached about 320° F. and had not exceeded about 360° F., the mixture is held at about 360° F. until all of the resin is dissolved. The mixture was then allowed to cool to a temperature below about 135° F., and then the pea starch was added. The mixture was mixed until the pea starch (e.g., pea starch available from Nutri-Pea Limited) was fully dispersed.

After the mixture had cooled to about 70° F., the viscosity of the mixture was measured with a falling rod viscometer. The viscosity of the composition at about 70° F. was between about 40,090 cps and 95,000 cps. The coating was applied to the paper with an offset press (e.g., using station **302**). The

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amount of coating applied was in the range of about 0.3 mg/sq. inch to about 4 mg/sq. inch.

## Example 3

| Material | Amount |
|----------|--------|
| Oil      | 64%    |
| Resin    | 33%    |
| Silica   | 1%     |
| Wax      | 1%     |

Another composition for application of coating **106** was prepared by first heating a stirred mixture of the oil, the wax, and the silica until a temperature of about 250° F. was reached. While continuing to increase the temperature of the mixture, the resin was slowly added to the mixture. After all the resin had been added and the temperature had reached about 320° F. but had not exceeded 360° F., the mixture was held at about 360° F. until all of the resin was dissolved. The mixture was mixed until the pea starch was fully dispersed.

After the mixture had cooled to about 70° F., the viscosity of the mixture was measured with a falling rod viscometer. An exemplary viscosity was between about 40,000 cps and 95,000 cps at about 70° F. The coating was applied to the paper with an offset press. The amount of coating applied was in the range of about 0.3 mg/sq. inch to about 4 mg/sq. inch.

## Example 4

| Material | Amount |
|----------|--------|
| Oil      | 64%    |
| Resin    | 33%    |
| Silica   | 1%     |
| Wax      | 1%     |

Yet another composition for application of coating **106** was prepared by first heating a stirred mixture of the oil, the wax and the silica until a temperature of about 250° F. was reached. The silica was a large particle size silica (e.g., about 9.0 microns) such as Sylysia 380, available from Fuji Sylysia Chemical Ltd. While continuing to increase the temperature of the mixture, the resin was slowly added to the mixture.

After all the resin had been added and the temperature had reached about 320° F. but not exceeded 360° F., the mixture was held at about 360° F. until all of the resin dissolved. The mixture was allowed to mix until the pea starch was fully dispersed.

After the mixture had cooled to about 70° F., the viscosity of the mixture was measured with a falling rod viscometer. An exemplary viscosity is between about 40,000 cps and 95,000 cps at about 70° F. The coating was applied to the paper with

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an offset press. The amount of coating applied was in the range of about 0.3 mg/sq. inch to about 4 mg/sq. inch.

## Example 5

| Material        | Amount |
|-----------------|--------|
| Oil             | 62%    |
| Resin           | 35%    |
| Silica          | 1%     |
| Pea Starch      | 1%     |
| Fluorescent Dye | 1%     |

The substrate coating of Example 5 was prepared by heating a stirred mixture of the oils and the silica until a temperature of about 250° F. was reached. While continuing to increase the temperature of the mixture, the resin is slowly added to the mixture. After all of the resin has been added and the temperature has reached about 320° F. but not exceed about 360° F., the mixture is held at about 360° F. until all of the resin has dissolved. The mixture is then allowed to cool and at a temperature below 135° F., the pea starch and D043 fluorescent dye from DayGlo Color Corp. is added. The mixture is stirred until the pea starch is fully dispersed.

After the mixture has cooled to about 70° F., the viscosity is measured with a falling rod viscometer. Once the viscosity falls into a range of about 40,000 cp to about 95,000 cp at about 70° F., the coating was applied to the paper with an offset press. The amount of coating applied was in the range of about 0.3 mg/sq. inch to about 4 mg/sq. inch.

As noted above, systems in accordance with various embodiments of the invention include a secondary migration-enhancing coating **108**, which may be applied overlying coating **106**. In accordance with various aspects, the composition for forming coating **108** includes a high viscosity oil (e.g., viscosity about or greater than about 100,000 cp) having a low surface tension and an anti-misting agent. The oil may be a single oil (e.g., a high-viscosity silicone oil) or a combination of oils (e.g., silicone oils) having different viscosities, such that the final viscosity of the composition is suitable for offset printing. The anti-misting agent may include any of the anti-misting agents noted above.

In accordance with further embodiments of the invention, a composition for application of coating **108** (e.g., a composition of a solution for station **302**) includes about 70% to about 99.9%, about 85% to about 99.5%, or about 95% to about 99% of a first silicone fluid; and about 0.1 to about 30%, or about 0.2% to about 15%, or about 0.5% to about 2% silica. In accordance with various aspects of these embodiments, the composition includes about 0% to about 50%, or about 10% to about 30%, or about 15% to about 25% of a second silicone fluid. Exemplary first silicone fluids include moderately-high (10,000±5000 cp) to high viscosity (about 100,000 cp) dimethyl silicones fluids, and exemplary second silicone fluids include extremely high (about 1 million cp) viscosity dimethyl silicones fluids. In accordance with further exemplary embodiments of the invention, a composition for application of coating **108** includes fluorescent material. The composition may include about 0.1% to about 10%, or about 0.3% to about 6%, or about 0.5% to about 4% fluorescent material.

The following examples illustrate compositions that may be used to form a secondary migration-enhancing coating—e.g., coating 108.

#### Example 6

| Material        | Amount |
|-----------------|--------|
| Silicone Fluid  | 98%    |
| Silica          | 1%     |
| Fluorescent Dye | 1%     |

A secondary migration-enhancing coating according to this example was made by weighing a desired amount of high viscosity silicone oil such as a di-methyl silicone (e.g., DM Fluid 100,000, sold by Shin-Etsu Chemical) and a five micron silica powder into a vessel equipped with a stirrer. The solution was stirred until a uniform dispersion was obtained. The mixture can be heated to facilitate the mixing. After the mixture was well dispersed and cooled, the viscosity was measured. An exemplary viscosity range for the composition is between about 54,000 cps and about 100,000 cps at a temperature of about 70° F. The coating was applied via an offset printing press utilizing a station subsequent to the station used to apply coating 106. The amount of coating applied was in the range of about 0.2 mg/sq. inch to about 6 mg/sq. inch.

#### Example 7

| Material                                 | Amount |
|------------------------------------------|--------|
| Extremely High Viscosity Silicone Fluid  | 25%    |
| Moderately High Viscosity Silicone Fluid | 74%    |
| Silica                                   | 1%     |

A secondary migration-enhancing coating according to this example was made by weighing a desired amount of extremely high viscosity silicone oil such as a di-methyl silicone (e.g., oil having a viscosity of about 1 million cp or more, such as DM Fluid 1,000,000, sold by Shin-Etsu Chemical), moderately high viscosity silicone oil, such as a lower molecular weight di-methyl silicone (e.g., oil having a viscosity of about 10,000±5000 cp, such as DM Fluid 10,000, sold by Shin-Etsu Chemical), and a five micron silica powder into a vessel equipped with a stirrer. The solution was stirred until a uniform dispersion was obtained. The mixture can be heated to facilitate the mixing. After the mixture was well dispersed and cooled, the viscosity was measured. An exemplary viscosity range for the composition was between about 54,000 cps and about 100,000 cps at about 70° F. The coating was applied via an offset printing press utilizing a station subsequent to the station used to apply coating 106. The amount of coating applied was in the range of about 0.2 mg/sq. inch to about 6 mg/sq. inch.

Documents were printed in accordance with examples 1-4 and 6-7 described above using a Hewlett Packard Laserjet 4250 printer. Initially, the resulting image had high optical density, high resolution with no noticeable background, and no migration of the visible red dye was apparent. Within 24 hours, areas of printed toner were removed from the surface of the paper and it was observed that red residual images had started to work into the paper. Within 72 hours of printing, an

indelible image became visible on the non-printed side of the paper. This measurement can be qualified by measuring the reflective optical density difference between the image on the second surface of the substrate and the non-image area on the second surface of the substrate. In accordance with various exemplary embodiments of the invention, an optical density difference of at least 0.07 optical density units measured 72 hours after the first side of the substrate has been printed with a laser printer is observed.

Documents were also printed with the coatings of examples 1, 5 and 6, using a Hewlett Packard Laserjet 4015 printer to print an image on a first surface of a substrate and using offset printing techniques to apply coating 106, 108 to the second surface of the substrate. Initially, the resulting image had high optical density, high resolution with no noticeable background, and no migration of the visible red dye was apparent. After printing an image on a first surface of a substrate, the coating including fluorescent material (e.g., coating 106) is visible from the other side of the document. After about twenty-four hours have elapsed since applying the toner, the toner image is visible on the first surface, and a red indelible image of the printed image is visible from the second surface. The fluorescent material is visible under fluorescent light. However, in areas where the indelible image has migrated to the fluorescent material, the fluorescent material is quenched, causing an inverse negative indelible image under ultraviolet light.

Although the present invention is set forth herein in the context of the appended drawing figures, it should be appreciated that the invention is not limited to the specific form shown. For example, while the invention is conveniently described in connection with electrostatic printing and offset printing, the invention is not so limited; the toner of the present invention may be used in connection with other forms of printing—such as ionographic, magnetographic, rod, gravure, spray, and similar techniques. Various other modifications, variations, and enhancements in the design and arrangement of the composition, method, and system set forth herein may be made without departing from the spirit and scope of the present invention as set forth in the appended claims.

We claim:

1. A system for producing a secure document using toner-based imaging, the system comprising:
  - a substrate having a first surface and a second surface;
  - a toner comprising a colorant and a dye, the toner applied to the first surface of the substrate; and
  - a coating comprising fluorescent material, an oil, a resin, an anti-misting agent and an anti-offsetting agent applied to the first or second surface using offset printing, wherein the dye quenches a portion of the coating comprising fluorescent material to produce a reverse negative image of an image printed with the toner, when exposed to ultraviolet radiation.
2. The system of claim 1, wherein the oil is a single component or a combination of one or more oils, plasticizers, and liquid polymers.
3. The system of claim 1, wherein the resin is a resin yielding high viscosity, and low misting properties.
4. The system of claim 1, wherein the anti-misting agent comprises a compound selected from the group consisting of bentonite clay, silica, kaolin, titanium dioxide, and any combination thereof.
5. The system of claim 1, wherein the anti-offsetting agent comprises a compound having a size between about 0.2 microns and about 25 microns.

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6. The system of claim 1, wherein the anti-offsetting agent comprises a compound selected from the group consisting of silica, pea starch, wheat starch, and any combination thereof.

7. The system of claim 1, wherein the anti-offsetting agent comprises a synthetic wax, a natural wax, or a combination thereof. 5

8. The system of claim 7, wherein the synthetic wax comprises a polyethylene, fluorocarbon wax, polypropylene, or any combination thereof.

9. The system of claim 1, wherein a composition for coating comprising fluorescent comprises about 0.5% to about 4% fluorescent material. 10

10. A system for producing a secure document using toner-based imaging, the system comprising:

a substrate having a first surface and a second surface; 15  
a toner comprising a colorant and a dye, the toner applied to the first surface of the substrate;

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a coating comprising fluorescent material applied to the first or second surface using offset printing; and

a secondary migration-enhancing coating containing a high viscosity oil with a low surface tension and an anti-misting agent,

wherein the dye quenches a portion of the coating comprising fluorescent material to produce a reverse negative image of an image printed with the toner, when exposed to ultraviolet radiation.

11. The system of claim 10, wherein the anti-misting agent is selected from the group consisting of bentonite clay, silica, kaolin, titanium dioxide, and any combination thereof.

12. The system of claim 10, wherein the secondary migration-enhancing coating comprises a combination of silicone oils having different viscosities, wherein the final viscosity of the composition is suitable for lithographic offset printing. 15

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