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(54) Tamperproof authority document

(57) A method for producing an authority document containing a tamperproof right-reading image comprising:

a) imagewise-heating a dye-donor element in face-to-face contact with an intermediate dye-receiving element and transferring an image in reverse order to that of an original image, the intermediate dye-receiving element comprising a transparent dye-receiving layer weakly-bonded to a substrate;
b) applying heat and/or pressure to laminate a heat-activatable adhesive layer contained on a peelable support to a final receiving element support;
c) removing the peelable support to leave the heat-activatable adhesive layer on the final receiving element support;
d) placing the intermediate dye-receiving element with the dye-receiving layer containing the image in reverse order, in face-to-face contact with the heat-activatable adhesive layer on the final receiving element support to form an assemblage;
e) applying heat and/or pressure to the assemblage sufficient to activate the adhesive; and
f) removing the weakly-bonded support of the intermediate dye-receiving element to obtain the authority document having a right-reading image adhesively-bonded to the final receiving element support.

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Description

This invention relates to a new method of producing high image quality, tamperproof authority documents, such as passports, driver's licenses, insurance, security, and other identification documents or cards.

In recent years, thermal transfer systems have been developed to obtain prints from pictures which have been generated electronically from a color video camera. According to one way of obtaining such prints, an electronic picture is first subjected to color separation by color filters. The respective color-separated images are then converted into electrical signals. These signals are then operated on to produce cyan, magenta and yellow electrical signals. These signals are then transmitted to a thermal printer. To obtain the print, a cyan, magenta or yellow dye-donor element is placed face-to-face with a dye-receiving element. The two are then inserted between a thermal printing head and a platen roller. A line-type thermal printing head is used to apply heat from the back of the dye-donor sheet. The thermal printing head has many heating elements and is heated up sequentially in response to one of the cyan, magenta or yellow signals, and the process is then repeated for the other two colors. A color hard copy is thus obtained which corresponds to the original picture viewed on a screen. Further details of this process and an apparatus for carrying it out are contained in U.S. Patent 4,621,271.

Authority documents are widely used for identification purposes such as passports, driver's licenses, and other image-bearing documents which provide access to restricted locations, bank accounts, or licensed activities, etc. Security is important for such documents, and an important security feature of such documents is the use of a continuous tone color photograph printed in the same layer along with other personal, variable data. These types of documents have been subject to tampering for illegal purposes, and attempts to alter the authorizing data and/or images contained in them are quite common.

U.S. Patent 5,211,424 relates to a process for obtaining a passport document using a mounting folder. Heat-activatable adhesives are used to mount a photograph within the mounting folder as part of the passport.

U.S. Patent 5,589,435 relates to a method for transferring a thermal image layer from an image transfer sheet to a substrate. The image-receiving layer is placed in face-to-face relation with the substrate and a release base sheet is peeled from the image transfer sheet.

There is a problem with the above processes, however, in that the resultant image is either mounted into a thick laminate as part of the passport or could still be subject to peeling or other ways of removing and altering the image.

It is an object of this invention to provide a method for producing an image which is not readily removable from its substrate and which provides an image in an extremely thin layer configuration securely laminated to a suitable receiver.

These and other objects are achieved in accordance with this invention which relates to a method for producing an authority document containing a tamperproof right-reading image comprising:

a) imagewise-heating a dye-donor element in face-to-face contact with an intermediate dye-receiving element and transferring an image in reverse order to that of an original image, the intermediate dye-receiving element comprising a transparent dye-receiving layer weakly-bonded to a substrate;
b) applying heat and/or pressure to laminate a heat-activatable adhesive layer contained on a peelable support to a final receiving element support;
c) removing the peelable support to leave the heat-activatable adhesive layer on the final receiving element support;
d) placing the intermediate dye-receiving element with the dye-receiving layer containing the image in reverse order, in face-to-face contact with the heat-activatable adhesive layer on the final receiving element support to form an assemblage;
e) applying heat and/or pressure to the assemblage sufficient to activate the adhesive; and
f) removing the weakly-bonded support of the intermediate dye-receiving element to obtain the authority document having a right-reading image adhesively-bonded to the final receiving element support.

In a preferred embodiment of the invention, a thin protective layer may also be applied over the surface of the right-reading image after step f).

In another preferred embodiment of the invention, a security pattern of fine lines, images, etc. may also be printed as part of the dye image-receiving layer or protective overcoat layer. The protective layer may also incorporate security devices such as holographic images.

By use of the invention, an extremely thin (1-10 μm) transparent dye-receiving layer carrying a mirror or reversed image of a subject is reversed during processing to become a right-reading image on the final receiver. Heat-activatable adhesives are used for securing the imaged receiver layer to the final support.

The transparent dye-receiving layer polymers which may be employed for the intermediate receiver include polycarbonates, polyurethanes, polyesters, poly(vinyl chlorides), poly(styrene-co-acrylonitrile), polycaprolactone or any other receiver polymer or mixtures thereof. In a preferred embodiment, the dye image-receiving layer comprises a polycarbonate. Preferred polycarbonates include bisphenol-A polycarbonates having a number average molecular weight of at least about 25,000. Examples of such polycar-

bonates include General Electric LEXAN® Polycarbonate Resin, Bayer AG MACROLON 5700®, and the polycarbonates disclosed in U.S. Patent 4,927,803.

The dye image-receiving layer employed in the intermediate receiver may be present in any amount which is effective for its intended purposes. In general, good results have been obtained at a receiver layer dry laydown of from 1 to 10 g/m^2, preferably from 2 to 5 g/m^2. Such a layer would have a thickness of from 1 to 10 μm.

The support for the intermediate receiver may be, for example, transparent or reflective, and may comprise a polymeric, a synthetic paper, or a cellulosic paper support, or laminates thereof. Examples of transparent supports include films of poly(ether sulfone)s, poly(ethylene naphthalate), polyimides, cellulose esters such as cellulose acetate, poly(vinyl alcohol-co-acetal)s, and poly(ethylene terephthalate). The support may be employed at any desired thickness, usually from 10 μm to 1000 μm.

The final receiving element is generally a synthetic paper, or a cellulosic paper support, or laminates thereof.

In the process of the invention, an intermediate receiver is employed wherein the dye image-receiving layer is weakly adhered to the support. The receiving layer needs to have enough adhesion to go through the printing process steps, yet have the ability to be delaminated easily at the final step of the process. This can be accomplished, for example, by using a subbing layer material such as an incompletely hydrolyzed silane coupling agent, or other materials which provide a weak bond.

A broad selection of polymeric resins can be utilized as heat-activatable adhesives in the invention, such as polyesters, polyester copolymers, polyamides, polyurethanes, polyolefins including ethylene vinyl acetate copolymers and ethylene acrylic acid polymers, hot melt materials, etc. Useful heat-activatable adhesives are also shown in U.S. Patents 4,713,365 and RE 35,211.

The heat-activatable adhesive is coated on a peelable support and can be easily released therefrom, such as by using a release liner, such as a waxy material, polyolefin coating, etc. Such materials are available commercially as HG Stablerite II by Avery Dennison Co., Painesville Ohio; 42# Easy Release Liner or 42# Tight Release Liner by Dunsirn Industries, Neenah, Wisconsin.

Dye-donor elements that are used in the process of the invention to prepare an authority document conventionally comprise a support having thereon a dye-containing layer. Any dye can be used in the dye-donor element provided it is transferable to the dye-receiving layer by the action of heat. Especially good results have been obtained with sublimable dyes. Dye-donor elements applicable for use in the present invention are described, e.g., in U.S. Patents 4,916,112; 4,927,803 and 5,023,228.

As noted above, dye-donor elements are used to form a dye transfer image. Such a process comprises imagewise-heating a dye-donor element and transferring a dye image to a dye-receiving layer using the process as described above to form the dye transfer image.

The dye-donor element employed in the process of the invention may be used in sheet form or in a continuous roll or ribbon.

In a preferred embodiment of the invention, a dye-donor element is employed which comprises a poly(ethylene terephthalate) support coated with sequential repeating areas of cyan, magenta and yellow dye, and the above process steps are sequentially performed for each color to obtain a three-color dye transfer image. In another preferred embodiment, a clear protective layer is applied after the three colors noted above, as described in U.S. Patent 5,387,573.

Thermal printing heads which can be used to transfer dye from dye-donor elements to the ID card receiving elements of the invention are available commercially. Alternatively, other known sources of energy for thermal dye transfer may be used, such as lasers as described in, for example, GB No. 2,083,726A.

After the final process step, a transparent protective layer can be formed on the surface of the image-receiving layer if desired. A clear, protective layer can be applied to the element using a laminator with heat and pressure. Protective layer materials employed are clear thermoplastic polymers whose exact composition is dictated by the ability to adhere to the dye image-receiver layer and to provide the desired, specific protective properties. The protective layer must not degrade the image nor affect image stability to heat and light. Such layer may also incorporate other materials, such as ultraviolet light absorbers.

The following example is provided to further illustrate the invention.

Example

Preparation of Thermal Dye Transfer Receiving Elements with an Incompletely Hydrolyzed Subbing Layer

The thermal dye transfer receiving elements in this example are composed of the following functional layers:

(1) microvoided receiver support
(2) an incompletely hydrolyzed subbing layer
(3) dye-receiving layer
(4) receiver overcoat/topcoat

The detailed solution preparation and coating procedure of dye-receiving elements are as follow:

The microvoided receiver support samples were prepared in the following manner. Commercially availa-

ble packaging films (OPPalyte 350 K18® and BICOR 70 MLT® made by Mobil Chemical Co.) were laminated to the paper stock described below. OPPalyte 350 K18® is a composite film (36 μm thick) (d=0.62) consisting of a microvoided and orientated polypropylene core (approximately 73% of the total film thickness), with a titanium dioxide pigmented non-microvoided orientated polypropylene layer on each side; the void-initiating material is poly(butylene terephthalate). BICOR 70 MLT® is an orientated polypropylene film (18 μm thick). Reference is made to U.S. Patent 5,244,861 where details for the production of this laminate are described.

Packaging films may be laminated in a variety of ways (by extrusion, pressure, or other means) to a paper support. In the present context, they were extrusion laminated as described below with pigmented polyolefin on the frontside and clear polyolefin on the backside of the paper stock support. The OPPalyte 350 K18® film was laminated on the frontside and the 70 MLT film was laminated on the backside. The pigmented polyolefin (12 g/m2) contained anatase titanium dioxide (12.5% by weight) and a benzoxazole optical brightener (0.05% by weight). The clear polyolefin was high density polyethylene (12 g/m2).

The paper stock was 137 μm thick and made from a 1:1 blend of Pontiac Maple 51 (a bleached maple hardwood kraft of 0.5 μm length weighted average fiber length) available from Consolidated Pontiac, Inc., and Alpha Hardwood Sulfite (a bleached red-alder hardwood sulfite of 0.69 μm average fiber length), available from Weyerhauser Paper Co.

A subbing layer coating solution was prepared by mixing Prosil 221® 3-aminopropyl triethoxysilane (PCR Inc.) with Prosil 2210®, a hydrophobic epoxy-terminated organo-oxysilane (PCR Inc.) at a 1:1 weight ratio in an ethanol-methanol solvent mixture. The resultant test solutions contained approximately 1% of silane component and 99% of anhydrous 3A alcohol. The test solution was not kept for more than six hours before it was coated onto the above receiver support. Prior to coating, the support was subjected to a corona discharge treatment of approximately 450 joules/m^2.

The subbing layer test sample was overcoated with a dye-receiving layer containing Makrolon KL3-1013® polyether-modified bisphenol-A polycarbonate block copolymer (Bayer AG) (1.742 g/m^2), Lexan 141-112® bisphenol-A polycarbonate (General Electric Co.) (1.426 g/m^2), Fluorad FC-431® perfluorinated alkyl sulfonamidoalkyl ester surfactant (3M Co.) (0.011 g/m^2), and Drapex 429® polyester plasticizer (Witco Corp.) (0.264 g/m^2), and diphenyl phthalate (0.528 g/m^2) coated from methylene chloride.

The dye-receiving layer was then overcoated with a solvent mixture of methylene chloride and trichloroethylene; a polycarbonate random terpolymer of bisphenol-A (50 mole-%), diethylene glycol (49 mole-%), and polydimethylsiloxane (1 mole-%) (2,500 MW) block units (0.550 g/m^2); a bisphenol A polycarbonate modified with 50 mole-% diethylene glycol (2,000 MW) (0.11 g/m^2); Fluorad FC-431® surfactant (0.022 g/m^2); and DC-510® surfactant (Dow Corning Corp.) (0.003 g/m^2).

Preparation of Reversed (or Mirror) Thermal Dye Transfer Image Print for Authority Document

The above prepared multilayer dye-receiver element was then subjected to thermal dye transfer printing. A digitally reversed individual image including personal data matching regular passport size was printed in a Kodak XLS 8650® Thermal Printer using a commercially available Kodak EKTATHERM® XLS Extralife donor ribbon. This ribbon had repeating patches of yellow, magenta and cyan dye layers and a clear protective layer. The reversed image was formed and contained within the above dye-receiving layer and receiver overcoat/topcoat.

Preparation of Heat-Activatable Film Adhesive with Release Liner

A heat-activatable film adhesive was prepared by first dissolving a crystalline polyester Bostik 7962® (Bostik Co.), in methylene chloride. The solution which contained approximately 9.1% by weight Bostik 7962® was then coated on a release liner, HG Stablerite II by Avery Dennison Co., Painesville Ohio, by a doctor blade. The final dry laydown of the film adhesive was approximately 1.65 g/m^2.

Assembly Procedure

Step 1: A sample passport paper stock was placed against the above heat-activatable film adhesive with a release liner having the adhesive side facing the passport paper stock. This assemblage was then placed inside a butterfly paper-based carrier with its release coating side directly contacting the assemblage. The carrier with said assemblage was then fed at a linear speed of 8.9 cm/s through a Datacode Systems Laminator® (Model-Pouch 4") at a set temperature of 163°C. The assemblage was then removed from the carrier. The heat-activatable adhesive layer stuck firmly to this sample passport paper stock after running the material through the laminator at the stated temperature and speed. The release paper support was easily separated from the adhesive layer.

Step 2: The sample passport paper stock with the heat-activatable film adhesive prepared in Step 1 was placed against the reversed thermal dye transfer image print with the film adhesive facing the reversed image side. This assemblage was then placed inside a butterfly paper-based carrier with its release coating side directly contacting the assemblage. The carrier with the assemblage was then fed at a linear speed of 8.9 cm/sec through a Data-

code Systems Laminator® (Model-Pouch 4") at a set temperature of 163°C. The assemblage was then removed from the carrier. After the laminator treatment, the reversed thermal dye transfer image adhered firmly to the film adhesive. The microvoided receiver support was then easily separated from the image-containing layer, i.e., the dye-receiving layer and receiver overcoat/topcoat, due to the weakly bonded subbing layer. After removing the microvoided receiver support, a tamperproof, thin, right-reading thermal dye transfer passport image was obtained.

Step 3: An optional transparent protective film with a security pattern was laminated onto the image side of the sample passport page prepared in Step 2 to provide further protection and tamperproofing.

Claims

1. A method for producing an authority document containing a tamperproof right-reading image comprising:

   a) imagewise-heating a dye-donor element in face-to-face contact with an intermediate dye-receiving element and transferring an image in reverse order to that of an original image, said intermediate dye-receiving element comprising a transparent dye-receiving layer weakly-bonded to a substrate;
   b) applying heat and/or pressure to laminate a heat-activatable adhesive layer contained on a peelable support to a final receiving element support;
   c) removing said peelable support to leave said heat-activatable adhesive layer on said final receiving element support;
   d) placing said intermediate dye-receiving element with said dye-receiving layer containing said image in reverse order, in face-to-face contact with said heat-activatable adhesive layer on said final receiving element support to form an assemblage;
   e) applying heat and/or pressure to said assemblage sufficient to activate said adhesive; and
   f) removing said weakly-bonded support of said intermediate dye-receiving element to obtain said authority document having a right-reading image adhesively-bonded to said final receiving element support.

2. The process of Claim 1 wherein a thin protective overcoat layer is applied over the surface of said right-reading image after step f).

3. The process of Claim 1 wherein a security pattern is part of said dye image-receiving layer.

4. The process of Claim 2 wherein a security pattern is part of said protective overcoat layer.

5. The process of Claim 1 wherein said dye-receiving layer containing said right-reading image is less than 10 μm.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 20 0715

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	EP 0 529 537 A (EASTMAN KODAK CO) 3 March 1993 * claim 1 * ---	1	B41M3/14
Y	WO 95 06564 A (REXHAM GRAPHICS INC) 9 March 1995 * claim 1 * * examples 1-3 * * page 11 * ---	1	
A	DE 43 27 995 A (KURZ LEONHARD FA) 23 February 1995 * the whole document * -----	1-5	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B41M
B42D
B44C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 June 1998	Martins Lopes, L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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