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(54) Title: INK INLCUDING AN INORGANIC NEAR INFRARED SCATTERING PIGMENT

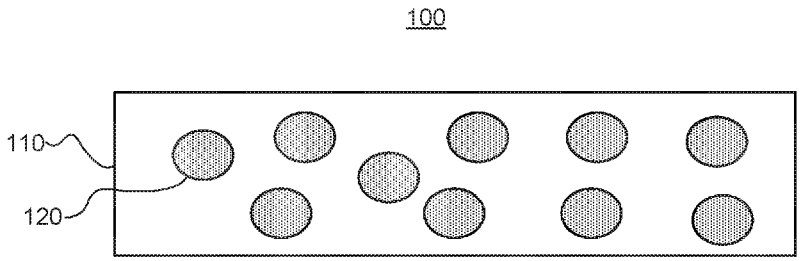

FIG. 1

(57) Abstract: According to an example, an ink composition may include a carrier and an inorganic near infrared scattering pigment, in which the ink composition is a neutral white color.

WO 2018/199969 A1

INK INLCUDING AN INORGANIC NEAR INFRARED SCATTERING PIGMENT

BACKGROUND

[0001] Users are increasingly demanding functionalities beyond merely recognizing a touch to the surface of a touch-sensitive device. Such other functionalities include handwriting recognition and direct note taking (using, for example, a stylus). Such functionalities are generally provided in so-called digitizing systems. Digitizing systems may have position-dependent indicia detected by an image sensor in a stylus, such as an electro-optical pen or other image reader, where the position-dependent indicia include an ink.

BRIEF DESCRIPTION OF THE DRAWING

[0002] Features of the present disclosure are illustrated by way of example and not limited in the following figure(s), in which like numerals indicate like elements, in which:

[0003] FIG. 1 is a diagram of an example ink composition;

[0004] FIG. 2 is a diagram of an example display;

[0005] FIG. 3 is a flow chart of an example of a method of making a printed substrate; and

[0006] FIG. 4 is a line graph illustrating backscatter reflectance for example ink compositions.

DETAILED DESCRIPTION

[0007] For simplicity and illustrative purposes, the present disclosure is described by referring mainly to an example thereof. In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present disclosure. It will be readily apparent however, that

the present disclosure may be practiced without limitation to these specific details. In other instances, some methods and structures have not been described in detail so as not to unnecessarily obscure the present disclosure. As used herein, the terms “a” and “an” are intended to denote at least one of a particular element, the term “includes” means includes but not limited to, the term “including” means including but not limited to, and the term “based on” means based at least in part on.

[0008] With reference to FIG. 1, there is shown a diagram of an example ink composition 100. The ink composition 100 may include an inorganic near infrared scattering pigment 120, 230 and a carrier 110. The inorganic near infrared scattering pigment 120, 230 may scatter near infrared irradiance back to an electro-optical reader, such as a pen. As shown in FIG. 2, the ink composition 100 may be applied to a clear surface 210, such as a display or printed medium 200, for example, a plastic film, in a pattern of indicia 220 so that the pattern may be invisible to the human eye. In instances in which the pattern is not totally invisible to the human eye, the ink composition 100 may have a color neutral hue, such as a neutral white color to enhance or augment the non-visible detection of the pattern by the human eye when a display image is rendered below the pattern.

[0009] The inorganic near infrared scattering pigment 120, 230 may be present in the ink composition 100 in an amount ranging from about 0.5 wt.% to about 45 wt.% relative to the total weight of the ink composition 100. In an aspect, the inorganic near infrared scattering pigment 120, 230 may be present in the ink composition 100 in an amount ranging from about 1 wt. % to about 35 wt. %, for example, from about 3 wt. % to about 25 wt. %, relative to the total weight of the ink composition 100.

[0010] The inorganic near infrared scattering pigment 120, 230 may be any pigment that is visibly white-colored. Non-limiting examples of a inorganic near infrared scattering pigment 120 for use in the ink composition 100 include titanium oxides, zinc oxide, zinc sulphides, zirconium oxide, silicon dioxide, aluminum oxides, white lead, basic lead sulfate, barium sulfate, calcium carbonate

(precipitated, ground, and treated), calcium silicate, kaolin clay, talc, silica, or combinations thereof. In an aspect, the inorganic near infrared scattering pigment 120 may include sodium aluminosilicate particles, aluminum-doped zinc oxide, zinc dioxide, titanium dioxide, polytetrafluoroethylene, or combinations thereof.

[0011] The ink composition 100 may include a carrier 110, such as a clear carrier 110 or clear resin. By way of non-limiting examples, the carrier 110 may be polyvinyl alcohol, polyvinyl acetate polyvinylpyrrolidone, poly(ethoxyethylene), poly(methoxyethylene), poly(acrylic) acid, poly(acrylamide), poly(oxyethylene), poly(maleic anhydride), hydroxyethyl cellulose, cellulose acetate, poly(sacchrides) such as gum arabic and pectin, poly(acetals) such as polyvinylbutyral, poly(vinyl halides) such as polyvinyl chloride and polyvinylene chloride, poly(dienes) such as polybutadiene, poly(alkenes) such as polyethylene, poly(acrylates) such as polymethyl acrylate, poly(methacrylates) such as poly methylmethacrylate, poly(carbonates) such as poly(oxycarbonyl oxyhexamethylene, poly(esters) such as polyethylene terephthalate, poly(urethanes), poly(siloxanes), poly(sulphides), poly(sulphones), poly(vinylnitriles), poly(acrylonitriles), poly(styrene), poly(phenylenes) such as poly(2,5 dihydroxy-1,4-phenyleneethylene), poly(amides), natural rubbers, formaldahyde resins, other polymers and mixtures of polymers and polymers with solvents.

[0012] The inorganic near infrared scattering pigment 120, 230 may be present in the carrier 110 in any loading amount so long as the pigment may randomly orient within the carrier 110. In an aspect, the ink composition 100 may include from about 0.1% by volume to about 90%, for example, from about 5% to about 85%, and as a further example, from about 10% to about 80%, by volume of the inorganic near infrared scattering pigment 120, 230 in the ink composition 100.

[0013] With reference to FIG. 2, a printed medium 200 may include a surface 210 including a pattern of indicia 220 in which the pattern of indicia 220 includes an ink composition 100 including an inorganic near infrared scattering

pigment 120, 230 and a carrier 110 as discussed herein. In an aspect, the surface 210 may be a clear surface, such as a display, for example, a plastic film. The pattern of indicia 220 may be a dot array applied to the surface 210 with the ink composition 100. Because the ink composition 100 includes an inorganic near infrared scattering pigment 120, 230 the individual dots in the dot array may be created using a smaller diameter dot thereby reducing the percent of the display area occupied by the pattern. In an aspect, the dot array may include a dot having a diameter ranging from about 60 microns to about 140 microns, for example, from about 70 microns to about 130 microns, and as a further example, from about 80 microns to about 120 microns. A reduced pattern feature size may enable the pattern of indicia 220 to be less visible to a human eye. In an aspect, a percent area of the surface 210 covered by the pattern of indicia 220, e.g., dot array, may range from about 1.5 % to about 22.3%, for example, from about 5.6% to about 19.2%, and as a further example, from about 7.3% to about 16.4%.

[0014] With reference now to FIG. 3, there is shown a flow diagram of an example method 300 of making a printed medium. In the method 300, at block 310, an ink composition 100 including a carrier 110 and an inorganic near infrared scattering pigment 120, 230 may be made. In addition, at block 320, a pattern of indicia 220 may be applied onto a clear surface 210 using the ink composition 100. Moreover, at block 330, the applied pattern may be cured.

[0015] The ink composition 100 may be cured using ultraviolet light, visible light, infrared, electron beam, or the like. Curing may proceed in an inert or ambient atmosphere. In an aspect, the curing may utilize an ultraviolet light source having a wavelength of about 395 nm. The ultraviolet light source may be applied to the ink 100 at a dose ranging from about 200 mJ to about 1000 mJ, for example ranging from about 250 mJ to about 900 mJ, and as a further example from about 300 mJ to about 850 mJ. In an aspect, the ink 100 may be cured in a short period of time, for example substantially instantaneously, in order to decrease the possibility of the inorganic near infrared scattering pigment 120, 230 reorienting in the carrier 110 in a flat orientation due to the effect of gravity, which would provide for a less scattered irradiance when subjected to an electronic reader..

[0016] The cured ink 100 may be tuned to a neutral white-color hue using a colorimeter.

[0017] EXAMPLE 1 – An ink 100 having zinc oxide pigments was prepared and applied to a substrate. Using a Cary 5000 Reflectometer Instrument the backscatter reflectance for the ink was determined. The incidence of near infrared light (850 nm) onto a film was varied from 0° to 70° by incrementing the sample angle theta. The detector angle was held constant at 10°. At this position the backscatter reflectance at an angle that was 10° past the source radiance was measured. Inks 100 with other materials were also tested. The backscatter reflectance data is presented in FIG. 4. The legend on the graph identifies inks 100 having the following inorganic near infrared scattering pigment: zinc oxide (60 nm) with an average 5% by weight loading (NanoArc® zinc oxide nanopowder - 100% crystalline, non-porous, non-agglomerated, available from NanoArc); zinc oxide (60 nm) with an average 3% by weight loading (NanoArc® zinc oxide nanopowder - 100% crystalline, non-porous, non-agglomerated, available from NanoArc); nanoparticle of polytetrafluoroethylene with 3% by weight loading of polytetrafluoroethylene (nanoFLON® P39B powder is agglomerated to 10-15 microns, commercially available from Shamrock Technologies; Fluoro-A 3% by weight loading of polytetrafluoroethylene (Fluoro A is a polytetrafluoroethylene powder, commercially available from Shamrock Technologies); titanium dioxide with 50% by weight loading (printed on full area); azo with 1% by weight loading (aluminum doped zinc oxide (aluminum nanopower 15 nm-2wt% and zinc oxide nanopowder 15 nm – 98wt%)); and azo with 5% by weight loading (aluminum doped zinc oxide (aluminum nanopower 15 nm-2wt% and zinc oxide nanopowder 15 nm – 98wt%)).

[0018] Although described specifically throughout the entirety of the instant disclosure, representative examples of the present disclosure have utility over a wide range of applications, and the above discussion is not intended and should not be construed to be limiting, but is offered as an illustrative discussion of aspects of the disclosure.

[0019] What has been described and illustrated herein is an example of the

disclosure along with some of its variations. The terms, descriptions and figures used herein are set forth by way of illustration only and are not meant as limitations. Many variations are possible within the spirit and scope of the disclosure, which is intended to be defined by the following claims -- and their equivalents -- in which all terms are meant in their broadest reasonable sense unless otherwise indicated.

What is claimed is:

1. An ink composition, comprising:

an inorganic near infrared scattering pigment; and

a carrier,

wherein the ink composition is a neutral white color.

2. The ink composition of claim 1, wherein the inorganic near infrared scattering pigment is present in the ink composition in an amount ranging from about 0.5 wt.% to about 45% wt.% relative to the total weight of the ink.

3. The ink composition of claim 1, wherein the inorganic near infrared scattering pigment includes titanium oxides, zinc oxide, zinc sulphides, zirconium oxide, silicon dioxide, aluminum oxides, white lead, basic lead sulfate, barium sulfate, calcium carbonate, calcium silicate, kaolin clay, talc, silica, polytetrafluoroethylene or combinations thereof.

4. The ink composition of claim 1, wherein the inorganic near infrared scattering pigment includes sodium aluminosilicate particles, aluminum-doped zinc oxide, zinc dioxide, titanium dioxide, polytetrafluoroethylene, or combinations thereof.

5. The ink composition of claim 1, wherein the ink composition includes from about 0.1% by volume to about 90% by volume of the inorganic near infrared scattering pigment.

6. A printed medium, comprising:

a clear surface including a pattern of indicia, wherein the pattern of indicia includes an ink composition including an inorganic near infrared scattering pigment and a carrier, wherein the ink is a neutral white color.

7. The printed medium of claim 6, wherein the pattern of indicia includes a dot array.

8. The printed medium of claim 7, wherein the dot array includes dots having diameters ranging from about 60 microns to about 140 microns.

9. The printed medium of claim 6, wherein the inorganic near infrared scattering pigment includes titanium oxides, zinc oxide, zinc sulphides, zirconium oxide, silicon dioxide, aluminum oxides, white lead, basic lead sulfate, barium sulfate, calcium carbonate, calcium silicate, kaolin clay, talc, silica, polytetrafluoroethylene, or combinations thereof.

10. A method of making a printed medium, comprising:

applying to a clear substrate an ink composition including a carrier and an inorganic near infrared scattering pigment, wherein the ink composition is a neutral white color.

11. The method of claim 10, further comprising curing the ink composition.

12. The method of claim 10, wherein the ink composition is applied in a pattern of indicia.

13. The method of claim 12, wherein the pattern of indicia is a dot array.

14 The method of claim 13, wherein the dot array includes dots having diameters ranging from about 60 microns to about 140 microns.

15. The method of claim 13, wherein a percent area of the clear substrate covered by the dot array ranges from about 1.5% to about 22.3%.

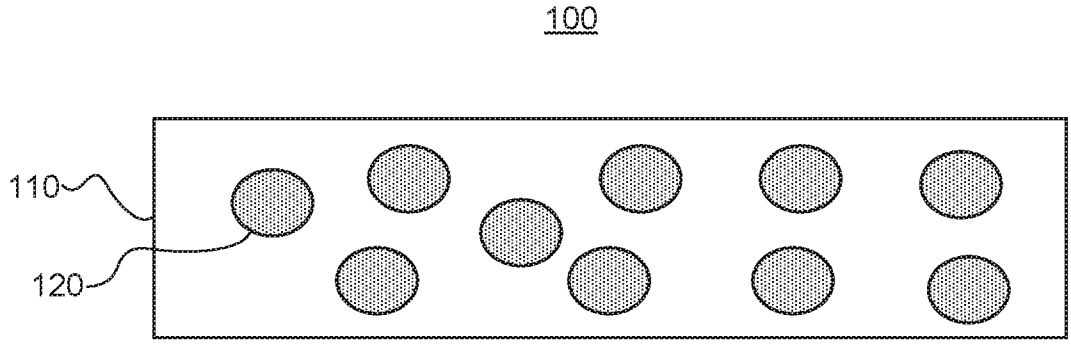

FIG. 1

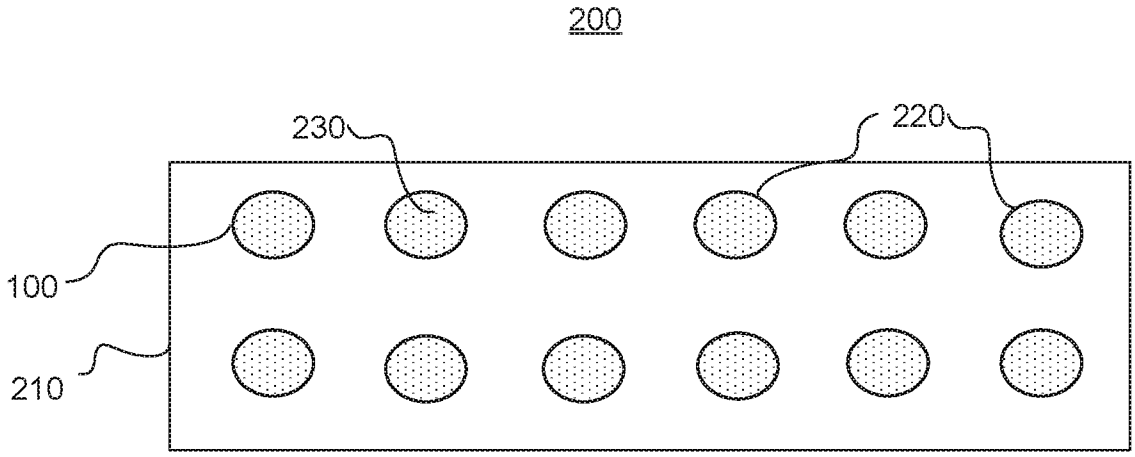

FIG. 2

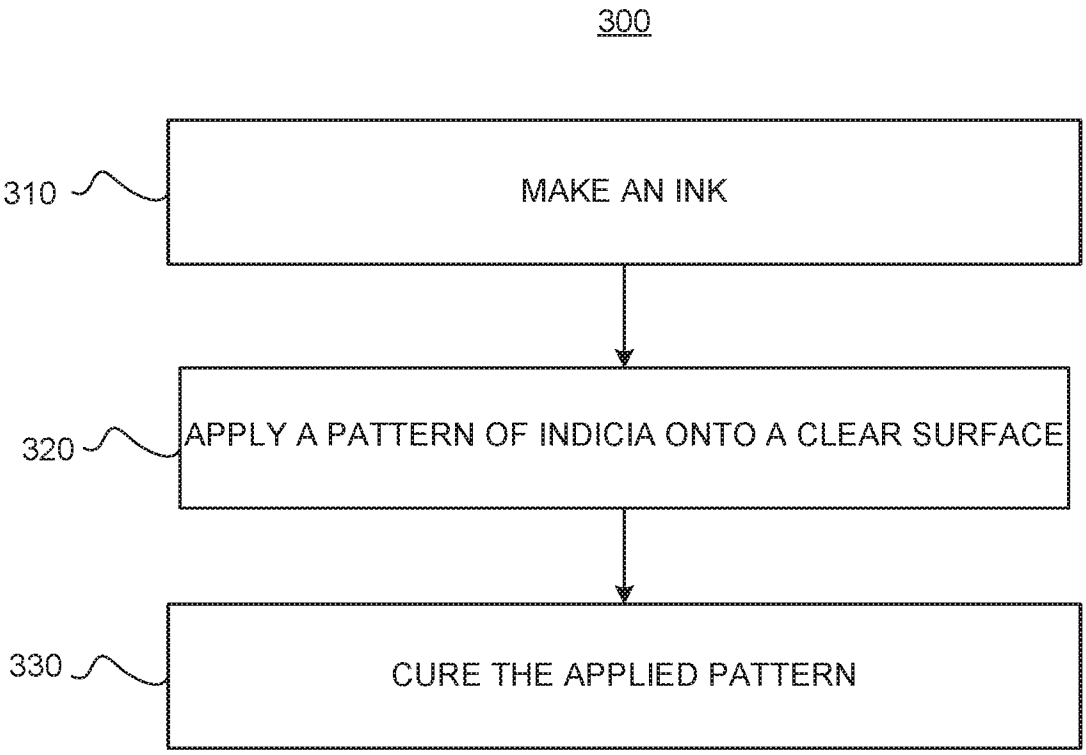
300
310
MAKE AN INK
320
APPLY A PATTERN OF INDICIA ONTO A CLEAR SURFACE
330
CURE THE APPLIED PATTERN

FIG. 3

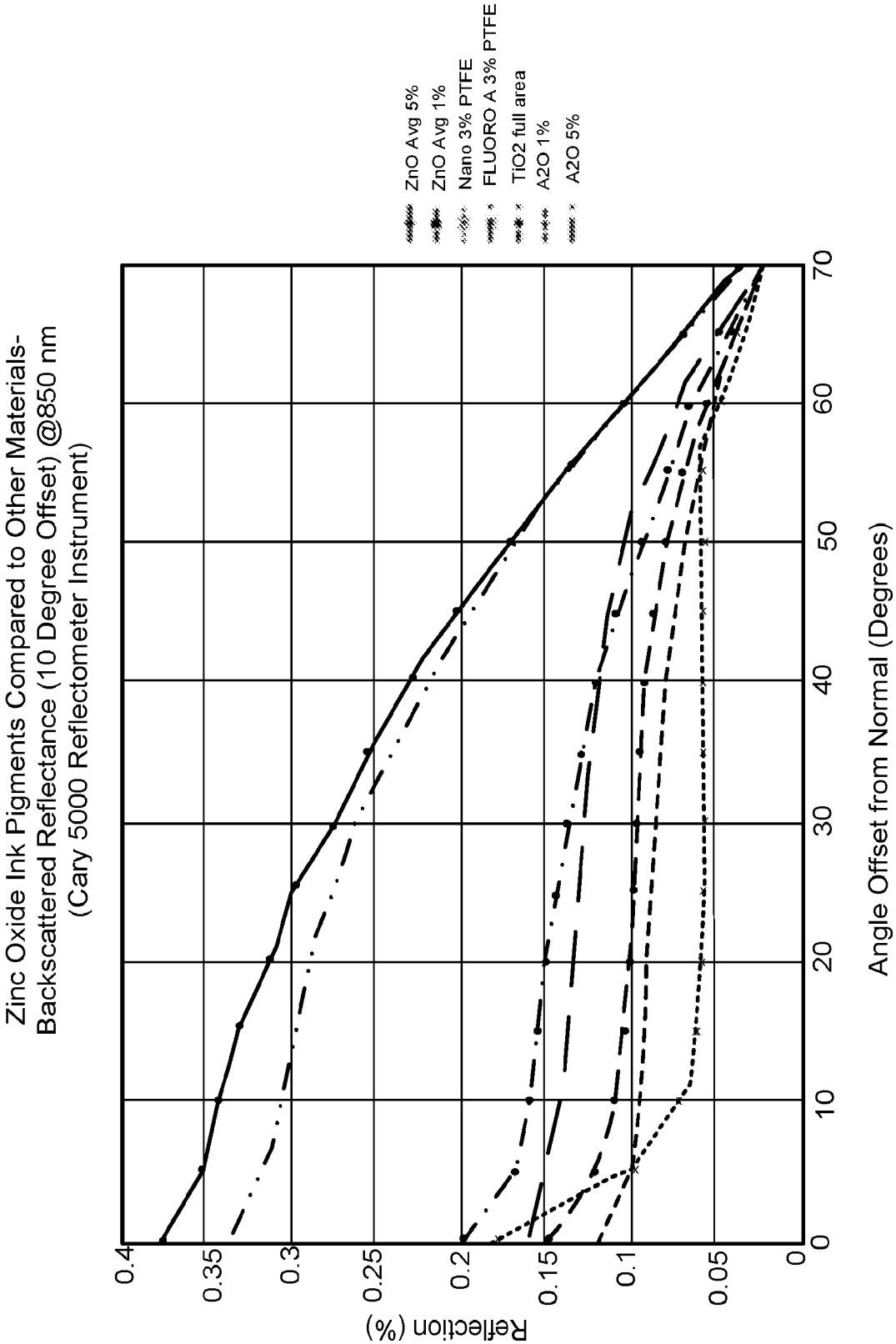
Zinc Oxide Ink Pigments Compared to Other Materials-
Backscattered Reflectance (10 Degree Offset) @850 nm
(Cary 5000 Reflectometer Instrument)
ZnO Avg 5%
ZnO Avg 1%
Nano 3% PTFE
FLUORO A 3% PTFE
TiO2 full area
A2O 1%
A2O 5%
Reflection (%)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Angle Offset from Normal (Degrees)
0
10
20
30
40
50
60
70

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 2017/029966

A. CLASSIFICATION OF SUBJECT MATTER

C09D 11/322 *(2014.01)*
C09D 11/037 *(2014.01)*
C09D 11/102 *(2014.01)*
C09D 11/106 *(2014.01)*
B41J 2/01 *(2006.01)*
C08K 3/22 *(2006.01)*

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C09D 11/00, 11/03-11/037, 11/10-11/102, 11/6-11/17, 11/30-11/322, 11/106, C08K 3/00, 3/18-3/22, B41J 2/01

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatSearch (RUPTO internal), DWPI, Esp@cenet, RUPAT, SIPO, PATENTSCOPE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2009/136141 A1 (TIOXIDE EUROPE LIMITED) 12.11.2009, claims 1, 6, 9, p. 4, line 24, p. 13, lines 12-14	1-5 6-15
Y	US 2012/0040155 A1 (SEIKO EPSON CORPORATION) 16.02.2012, abstract, paragraphs [0010], [0017]-[0018], [0041]-[0098], [0156]-[0161]	6-15
A	US 2016/0333202 A1 (DAINICHISEIKA COLOR & CHEMICALS MFG. CO., LTD) 17.11.2016	1-15

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 December 2017 (22.12.2017)	28 February 2018 (28.02.2018)

Name and mailing address of the ISA/RU:	Authorized officer
Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37	V. Kochetkova Telephone No. (8-499) 240-25-91