



US010444395B1

(12) **United States Patent**
Vinegar

(10) **Patent No.:** **US 10,444,395 B1**
(45) **Date of Patent:** **Oct. 15, 2019**

(54) **TUNNEL DETECTION USING A PIPELINE PIG**

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324/219

(71) Applicant: **Vinegar Technologies, LLC**, Bellaire, TX (US)

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(72) Inventor: **Harold Vinegar**, Bellaire, TX (US)

(73) Assignee: **Vinegar Technologies, LLC**, Bellaire, TX (US)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **16/118,187**

(22) Filed: **Aug. 30, 2018**

Primary Examiner — Reena Aurora

(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(51) **Int. Cl.**
G01V 3/165 (2006.01)
G01V 3/02 (2006.01)
G01V 3/40 (2006.01)
G01V 3/08 (2006.01)

(52) **U.S. Cl.**
CPC **G01V 3/165** (2013.01); **G01V 3/02** (2013.01); **G01V 3/081** (2013.01); **G01V 3/40** (2013.01)

(58) **Field of Classification Search**
CPC G01V 3/165; G01V 3/02; G01V 3/081
USPC 324/345
See application file for complete search history.

(57) **ABSTRACT**

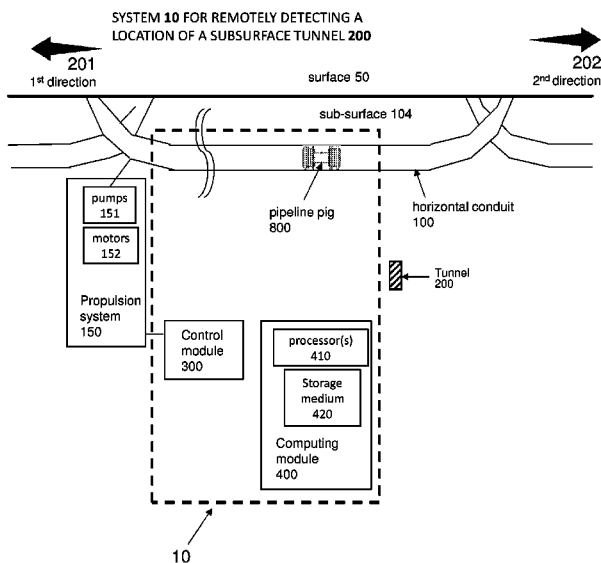
A method and system for detecting a subsurface tunnel includes propelling an instrumented pipeline pig through a horizontal detection conduit, acquiring and analyzing magnetometer measurements and VLF EM resistivity measurements to detect distortions and/or anomalies in the Earth's magnetic field and/or VLF electromagnetic field, respectively, and correlating the data with position data of the pipeline pig to compute a parameter of a tunnel such as, for example, location, size and depth.

(56) **References Cited**

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16 Claims, 7 Drawing Sheets





US010416078B2

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

(10) **Patent No.:** **US 10,416,078 B2**

(45) **Date of Patent:** ***Sep. 17, 2019**

(54) **APPARATUS AND METHOD FOR CUSTOMIZED HAIR-COLORING**

(71) Applicant: **COLORIGHT LTD.**, Rehovot (IL)

(72) Inventors: **Efraim Miklatzky**, Neve Ilan (IL);
Elena Ishkov, Givataim (IL); **Daniel Mandelik**, Rehovot (IL); **Gilad Davara**, Rehovot (IL)

(73) Assignee: **COLORIGHT LTD.**, Rehovot (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **16/023,139**

(22) Filed: **Jun. 29, 2018**

(65) **Prior Publication Data**
US 2018/0321146 A1 Nov. 8, 2018

Related U.S. Application Data
(63) Continuation of application No. 15/303,726, filed as application No. PCT/IB2015/053065 on Apr. 27, 2015, now Pat. No. 10,012,588.
(Continued)

(51) **Int. Cl.**
G01N 21/47 (2006.01)
G01J 3/46 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC **G01N 21/47** (2013.01); **A45D 44/005** (2013.01); **G01J 3/0264** (2013.01); **G01J 3/463** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC G01J 3/463; G01J 3/0264; G01J 3/504; G01J 2003/466; G01J 3/0272; G01J 3/42;
(Continued)

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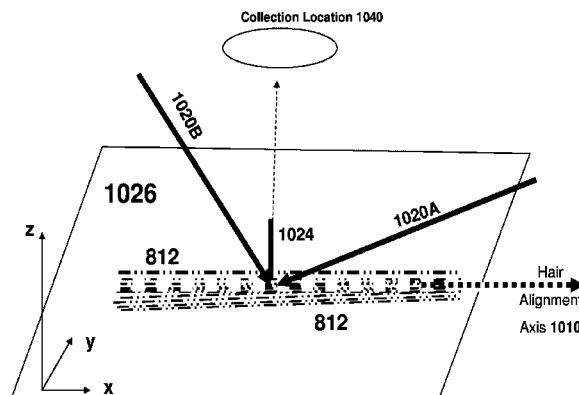
(Continued)

Primary Examiner — Michael P Stafira
(74) *Attorney, Agent, or Firm* — Oblon, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**

An apparatus and method for customized hair-coloring is disclosed. In some embodiments the method comprises: a. performing a plurality of light-scattering measurements upon a sample of hair such that for each light-scattering measurement, the sample of hair is illuminated from a different respective direction; b. comparing the results of the light-scattering measurements; c. in accordance with results of the comparing, computing an initial damage-state of the sample by comparing the results of the light-scattering measurements; d. obtaining an initial color-state of the hair of the sample; and e. computing a hair-coloring composition that is predicted to transform the hair sample from the initial color-state to a target color-state such that in response to a determining of a greater (lesser) extent of initial damage, a concentration of artificial-colorant(s) within the computed coloring composition is reduced (increased).

20 Claims, 17 Drawing Sheets



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

(10) **Patent No.:** **US 8,781,158 B1**
(45) **Date of Patent:** **Jul. 15, 2014**

(54) **UVB-VISIBLE CHANNEL APPARATUS AND METHOD FOR VIEWING A SCENE COMPRISING TERRESTRIAL CORONA RADIATION**

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(71) Applicant: **Ofil, Ltd.**, Nes Ziona (IL)

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(72) Inventors: **Eran Frisch**, Neve Daniel (IL); **Odelya Koslovsky**, Jerusalem (IL); **Reuel Haavrahami**, Beit Shemesh (IL)

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(73) Assignee: **Ofil, Ltd.**, Nes Ziona (IL)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

Lindner, M.; Elstein, S.; Lindner, P.; Topaz, J. M.; Phillips, A.J., "Daylight corona discharge imager," High Voltage Engineering, 1999. Eleventh International Symposium on (Conf. Publ. No. 467), vol. 4, no., pp. 349,352 vol. 4, 1999.*

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(21) Appl. No.: **14/151,885**

(22) Filed: **Jan. 10, 2014**

Primary Examiner — Utpal Shah

(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(51) **Int. Cl.**

G06K 9/00 (2006.01)
G06K 9/62 (2006.01)
G06K 9/36 (2006.01)
G01J 3/50 (2006.01)
G06K 7/10 (2006.01)
G02B 5/22 (2006.01)
G02B 27/28 (2006.01)

(57) **ABSTRACT**

A UVB-visible hybrid system and method for visualizing a scene comprising one of more terrestrial corona discharge(s) and one or more objects is disclosed. On the UVB channel, an object-devoid UVB image of at least a portion of the scene is generated using UVB light which passes through a corona-peak tuned optical filter configured to filter out sufficient non-terrestrial-corona light so that the generated UVB image is object-devoid. The object-devoid UVB image is analyzed to classify pixels thereof as corona-discharge pixels or non-corona-discharge pixels. When a derivative of the object-devoid UVB image superposed with a visible-band image of the scene is displayed on a display device, the pixels classified as corona-discharge are displayed at increased visibility, while the pixels classified as non-corona-discharge are displayed at decreased visibility. In some embodiments, the optical filter has an average optical density over the [290 nm, 700 nm] spectrum of at least 4.

(52) **U.S. Cl.**

CPC **G02B 27/28** (2013.01)
USPC **382/100; 382/224; 382/284; 250/226; 359/350; 359/885**

(58) **Field of Classification Search**

USPC 382/100, 224, 284; 250/226; 359/350, 359/885

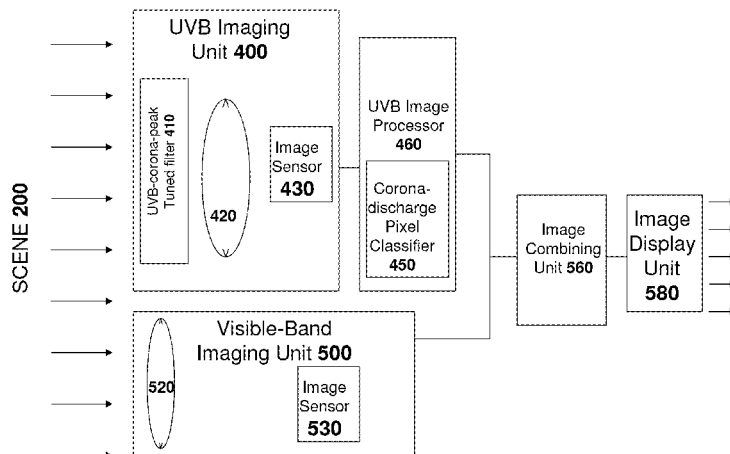
See application file for complete search history.

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15 Claims, 16 Drawing Sheets





US010434764B1

(12) **United States Patent
Tal**

(10) **Patent No.:** US 10,434,764 B1
(45) **Date of Patent:** Oct. 8, 2019

- (54) **YAW MEASUREMENT BY SPECTRAL ANALYSIS**
- (71) Applicant: **LANDA CORPORATION LTD.,**
Rehovot (IL)
- (72) Inventor: **David Tal,** Rehovot (IL)
- (73) Assignee: **LANDA CORPORATION LTD.,**
Rehovot (IL)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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- (21) Appl. No.: **16/122,943**
- (22) Filed: **Sep. 6, 2018**

Related U.S. Application Data

- (60) Provisional application No. 62/554,596, filed on Sep. 6, 2017.
- (51) **Int. Cl.**
B41J 2/045 (2006.01)
- (52) **U.S. Cl.**
CPC **B41J 2/04505** (2013.01); **B41J 2/04586** (2013.01)
- (58) **Field of Classification Search**
CPC B41J 2/04505; B41J 2/04586
See application file for complete search history.

(56) **References Cited**

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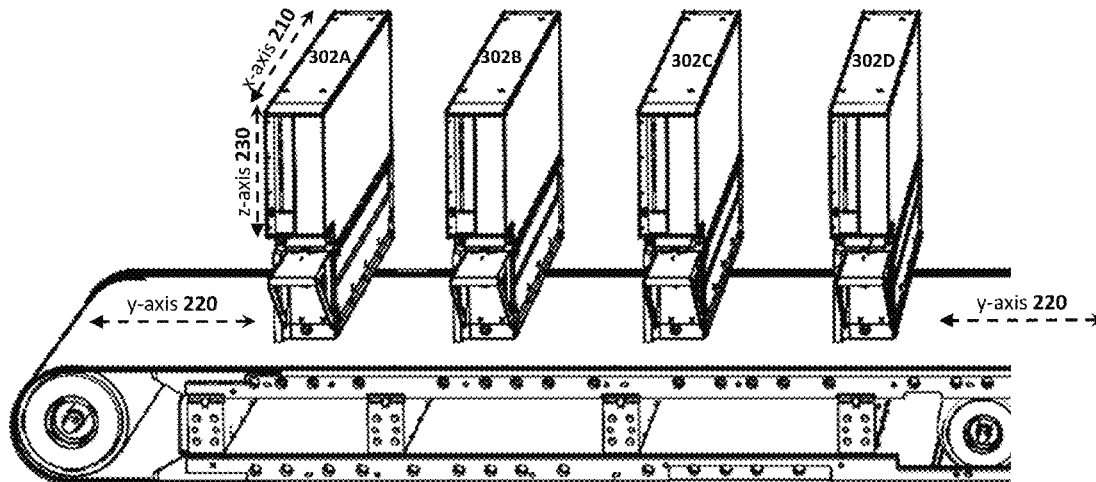
Co-pending U.S. Appl. No. 16/244,145, filed Jan. 10, 2019.
(Continued)

Primary Examiner — Sharon A. Polk
(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(57) **ABSTRACT**

Some embodiments relate to a method of measuring a magnitude of a yaw angle of print head(s) or of a supporting print-bar thereof relative to cross-print direction. In some embodiments, a 1D-representation (1D-rep) of an ink-calibration image is transformed into the frequency domain (e.g. by FFT) characterized by peak profile. The yaw angle magnitude may be computed from relative energies of a primary and secondary peak of the peak profile of the frequency domain.

20 Claims, 21 Drawing Sheets





US010806234B2

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

(10) **Patent No.:** **US 10,806,234 B2**
(45) **Date of Patent:** **Oct. 20, 2020**

(54) **APPARATUS AND METHOD FOR ANALYZING HAIR AND/OR PREDICTING AN OUTCOME OF A HAIR-COLORING TREATMENT**
(71) Applicant: **COLORIGHT LTD.**, Rehovot (IL)
(72) Inventors: **Efraim Miklatzky**, Neve Ilan (IL); **Daniel Mandelik**, Rehovot (IL); **Gilad Davara**, Rehovot (IL); **Eliyahu Benny**, Rishon-LeZion (IL); **Oded Livneh**, Holon (IL); **Tal Marcu**, Mevaseret Zion (IL); **Thierry Wasserman**, Tel Aviv (IL)
(73) Assignee: **COLORIGHT LTD.**, Rehovot (IL)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 906 days.

(51) **Int. Cl.**
A45D 44/00 (2006.01)
G01J 3/50 (2006.01)
(Continued)
(52) **U.S. Cl.**
CPC *A45D 44/005* (2013.01); *A61B 5/1032* (2013.01); *A61B 5/448* (2013.01);
(Continued)
(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**
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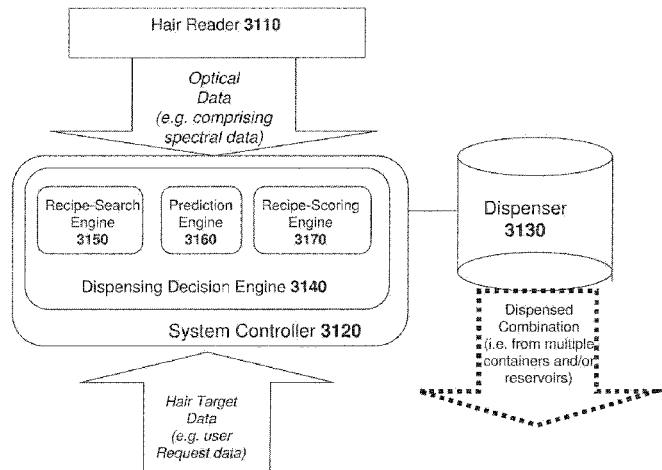
European Office Action dated Mar. 5, 2018 in Patent Application No. 15 729 219.4, 5 pages.
(Continued)

Primary Examiner — Shawn Decenzo
(74) *Attorney, Agent, or Firm* — Oblon, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**

The present disclosure relates to devices and methods for analyzing hair and/or predicting an outcome of hair-coloring treatment. disclosed is method of predicting a result of a hair-color-modifying treatment on a sample of hair, the method comprising: a. for each given region of a plurality of distinct regions, respectively measuring a region-specific spectrum of respective material of the hair-sample respec-
(Continued)

(21) Appl. No.: **15/303,727**
(22) PCT Filed: **Mar. 25, 2015**
(86) PCT No.: **PCT/IB2015/000724**
§ 371 (c)(1),
(2) Date: **Oct. 12, 2016**
(87) PCT Pub. No.: **WO2015/166340**
PCT Pub. Date: **Nov. 5, 2015**
(65) **Prior Publication Data**
US 2017/0156476 A1 Jun. 8, 2017
Related U.S. Application Data
(63) Continuation-in-part of application No. PCT/IL2014/050850, filed on Sep. 28, 2014.
(Continued)
(30) **Foreign Application Priority Data**
Sep. 24, 2014 (WO) PCT/IB2014/064809



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

(10) **Patent No.:** **US 9,605,524 B2**
(45) **Date of Patent:** **Mar. 28, 2017**

(54) **HEATER PATTERN FOR IN SITU THERMAL PROCESSING OF A SUBSURFACE HYDROCARBON CONTAINING FORMATION**

(52) **U.S. Cl.**
CPC *E21B 43/243* (2013.01); *E21B 36/04* (2013.01); *E21B 43/2401* (2013.01); *E21B 43/30* (2013.01)

(71) Applicants: **Harold Vinegar**, Bellaire, TX (US);
Scott Nguyen, Houston, TX (US)

(58) **Field of Classification Search**
CPC *E21B 43/2401*; *E21B 36/04*; *E21B 43/30*
See application file for complete search history.

(72) Inventors: **Harold Vinegar**, Bellaire, TX (US);
Scott Nguyen, Houston, TX (US)

(56) **References Cited**

(73) Assignee: **GENIE IP B.V.**, Amsterdam (NL)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **14/373,884**

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(22) PCT Filed: **Oct. 24, 2012**

WO WO 02086029 A2 * 10/2002 *E21B 43/243*

(86) PCT No.: **PCT/IB2012/055860**

Primary Examiner — Zakiya W Bates

§ 371 (c)(1),
(2) Date: **Jul. 22, 2014**

(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(87) PCT Pub. No.: **WO2013/110980**

PCT Pub. Date: **Aug. 1, 2013**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2015/0027694 A1 Jan. 29, 2015

Embodiments of the present invention relate to heater patterns and related methods of producing hydrocarbon fluids from a subsurface hydrocarbon-containing formation (for example, an oil shale formation) where a heater cell may be divided into nested inner and outer zones. Production wells may be located within one or both zones. In the smaller inner zone, heaters may be arranged at a relatively high spatial density while in the larger surrounding outer zone, a heater spatial density may be significantly lower. Due to the higher heater density, a rate of temperature increase in the smaller inner zone of the subsurface exceeds that of the larger outer zone, and a rate of hydrocarbon fluid production ramps up faster in the inner zone than in the outer zone. In some embodiments, a ratio between a half-maximum sustained production time and a half-maximum rise time of a hydrocarbon fluid production function is relatively large.

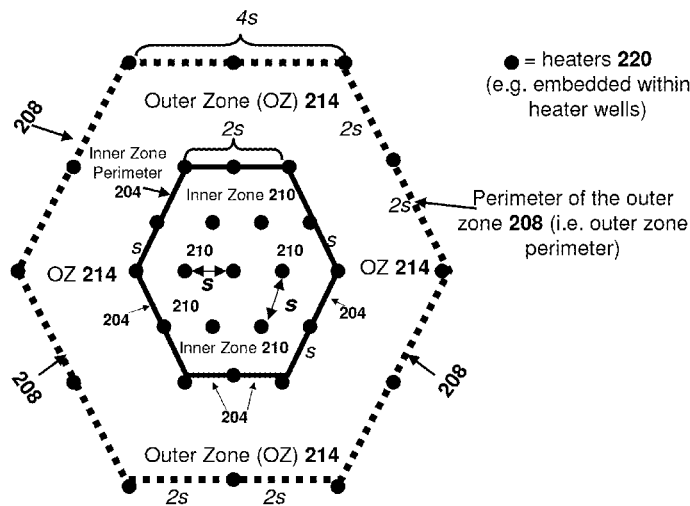
Related U.S. Application Data

(63) Continuation-in-part of application No. PCT/US2012/022282, filed on Jan. 23, 2012.
(Continued)

(51) **Int. Cl.**
E21B 43/30 (2006.01)
E21B 36/04 (2006.01)

(Continued)

19 Claims, 102 Drawing Sheets





US008931475B2

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

(10) **Patent No.:** **US 8,931,475 B2**
(45) **Date of Patent:** **Jan. 13, 2015**

(54) **SYSTEMS AND METHODS FOR CONTROL OF A SOLAR POWER TOWER USING INFRARED THERMOGRAPHY**

USPC 431/600, 603, 680, 681, 696, 701, 714;
126/572, 601, 584, 604, 605, 600, 603,
126/680, 681, 696, 701, 714

See application file for complete search history.

(75) Inventors: **Yoel Gilon**, Jerusalem (IL); **Ophir Chernin**, Ramat Beit Shemesh (IL); **Gideon Goldwine**, Jerusalem (IL); **Gil Kroyzer**, Jerusalem (IL); **Rotem Hayut**, Jerusalem (IL); **Dan Franck**, Modi'in (IL); **Israel Kroizer**, Jerusalem (IL); **Ziv Aumann**, Jerusalem (IL)

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Primary Examiner — Avinash Savani

(74) *Attorney, Agent, or Firm* — Miles & Stockbridge P.C.; Mark A. Catan

(57) **ABSTRACT**

Systems and methods for directly monitoring energy flux of a solar receiver in a solar energy-based power generation system include measuring infrared radiation emanating from the solar receiver. Such measurement can be achieved using one or more infrared thermography detectors, such as an IR camera. Resulting thermal data obtained by the imaging can be used to determine energy flux distribution on the receiver. A user or a system controller can use the determined flux distribution to adjust heliostat aiming to achieve a desired operation condition. For example, heliostats can be adjusted to achieve a uniform energy flux distribution across the external surface of the receiver and/or to maximize heat transfer to a fluid flowing through the receiver within system operating limits.

27 Claims, 6 Drawing Sheets

(73) Assignee: **Brightsource Industries (Israel) Ltd.**, Jerusalem (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1228 days.

(21) Appl. No.: **12/500,101**

(22) Filed: **Jul. 9, 2009**

(65) **Prior Publication Data**

US 2010/0006087 A1 Jan. 14, 2010

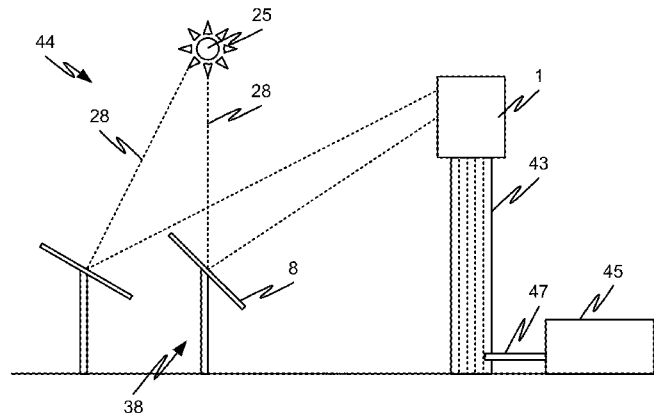
Related U.S. Application Data

(60) Provisional application No. 61/079,441, filed on Jul. 10, 2008.

(51) **Int. Cl.**
F24J 2/07 (2006.01)
F24J 2/10 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC **F24J 2/07** (2013.01); **F24J 2/10** (2013.01);
F24J 2/402 (2013.01); **F24J 2/38** (2013.01);
Y02E 10/41 (2013.01); **Y02E 10/47** (2013.01)
USPC **126/572**; 126/600; 126/603; 126/680;
126/601; 126/701

(58) **Field of Classification Search**
CPC F24J 2/402; F24J 2/07; F24J 2/10;
F24J 2/38; Y02E 10/41



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

(10) **Patent No.:** **US 10,302,495 B2**
(45) **Date of Patent:** **May 28, 2019**

(54) **HAIR READER, DISPENSER DEVICE AND RELATED SYSTEMS AND METHODS**

(71) Applicant: **COLORIGHT LTD.**, Rehovot (IL)

(72) Inventors: **Efraim Miklatzky**, Neve Ilan (IL); **Daniel Mandelik**, Rehovot (IL); **Gilad Davara**, Rehovot (IL); **Eliyahu Benny**, Rishon-LeZion (IL); **Oded Livneh**, Holon (IL); **Elena Ishkov**, Givataim (IL); **Uri Zadok**, Herzliya (IL); **Lior Shahar**, Kiryat-Ono (IL)

(73) Assignee: **ColorRight Ltd.**, Rehovot (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/023,398**

(22) PCT Filed: **Sep. 28, 2014**

(86) PCT No.: **PCT/IL2014/050850**
§ 371 (c)(1),
(2) Date: **Mar. 20, 2016**

(87) PCT Pub. No.: **WO2015/044944**
PCT Pub. Date: **Apr. 2, 2015**

(65) **Prior Publication Data**
US 2016/0209272 A1 Jul. 21, 2016

Related U.S. Application Data

(60) Provisional application No. 61/883,263, filed on Sep. 27, 2013, provisional application No. 61/926,909, (Continued)

(30) **Foreign Application Priority Data**

Sep. 26, 2013 (CA) 2828363
Sep. 24, 2014 (WO) PCT/IB2014/064809

(51) **Int. Cl.**
G01J 3/46 (2006.01)
G01N 21/25 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC **G01J 3/462** (2013.01); **A45D 44/005** (2013.01); **B01F 13/1055** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC G01J 3/462; G01J 3/463; G01J 3/50; G01J 3/0272; A45D 44/005; B01F 13/1055;
(Continued)

(56) **References Cited**

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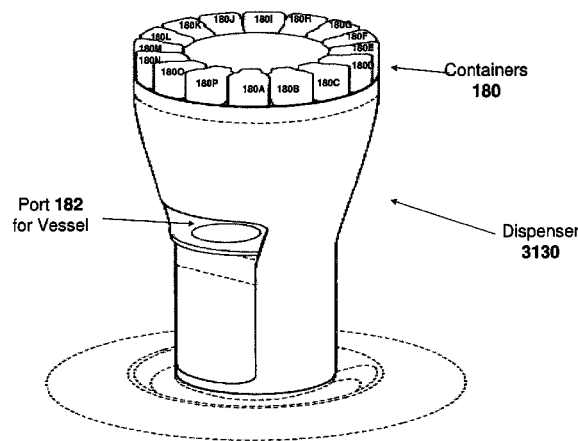
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Primary Examiner — Michael Collins
(74) *Attorney, Agent, or Firm* — Oblon, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**

The present disclosure relates to hair readers, dispenser devices, and related systems and methods. For example the present application relates to a method of optically acquiring data from keratinous fibers, the method comprising: a.
(Continued)



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

(10) **Patent No.:** **US 10,292,482 B2**
(45) **Date of Patent:** **May 21, 2019**

(54) **HAIR-HOLDER, HAIR-READER COMPRISING THE SAME, AND METHODS FOR OPTICALLY ACQUIRING DATA FROM HAIR**

FOREIGN PATENT DOCUMENTS

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(Continued)

(71) Applicant: **COLORIGHT LTD.**, Rehovot (IL)

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(72) Inventors: **Efraim Miklatzky**, Nevellan (IL); **Tal Marcu**, Mevaseret Zion (IL)

International Search Report and Written Opinion dated May 23, 2018 in PCT/IB2018/000040, citing documents AA, AB, AC, AD, AO, AP and AQ therein, 15 pages.

(73) Assignee: **COLORIGHT LTD.**, Rehovot (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 161 days.

Primary Examiner — Michael Collins

(21) Appl. No.: **15/399,796**

(74) *Attorney, Agent, or Firm* — Oblon, McClelland, Maier & Neustadt, L.L.P.

(22) Filed: **Jan. 6, 2017**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2018/0192764 A1 Jul. 12, 2018

(51) **Int. Cl.**
A45D 44/00 (2006.01)
A45D 8/00 (2006.01)
(Continued)

A system for optically acquiring data from hair comprises a hair-holder including: upper and lower plate assemblies respectively having downward-facing and upward-facing opposing surfaces defining a gap therebetween, the lower plate assembly having a window-void therein, the upper plate assembly further comprising a sideward-facing sample-thickness-regulating surface above the gap; and an alignment-wall mechanically coupled to both plate assemblies and having a side-facing alignment surface within gap or sideward-facing into the gap, the alignment surface being straight along a longitudinal direction parallel to both of the opposing surfaces, the hair-holder being configured so that: when an externally-tensioned sample of hair is loaded onto the hair-holder by laterally moving the sample towards the alignment surface, a presence of the sideward-facing sample-thickness-regulating surface regulates an amount of hair permitted to enter the gap, thereby regulating a thickness of hair above the window-void to at least 0.5 mm and at most 2 mm, and after the loading and after release of the external tension, static friction applied by the side-facing alignment surface upon shafts of the hair sample maintain alignment of hair above the window-void.

(52) **U.S. Cl.**
CPC **A45D 44/005** (2013.01); **A45D 8/00** (2013.01); **G01N 21/25** (2013.01); **G01N 21/84** (2013.01);
(Continued)

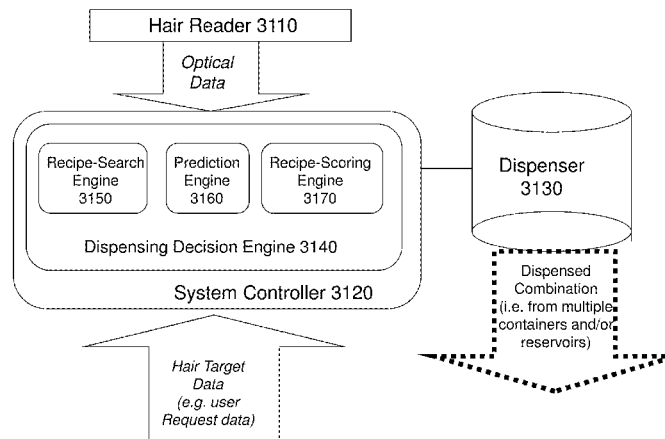
(58) **Field of Classification Search**
CPC .. A45D 44/005; A45D 8/00; A45D 2044/007; G01N 21/25; G01N 33/4833; G01N 21/84
(Continued)

(56) **References Cited**

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9,844,687 B2* 12/2017 Landa A45D 19/02
(Continued)

17 Claims, 25 Drawing Sheets



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

(10) **Patent No.:** **US 10,047,594 B2**
(45) **Date of Patent:** ***Aug. 14, 2018**

(54) **HEATER PATTERN FOR IN SITU THERMAL PROCESSING OF A SUBSURFACE HYDROCARBON CONTAINING FORMATION**

(58) **Field of Classification Search**
CPC E21B 43/24; E21B 43/2401; E21B 43/243
See application file for complete search history.

(75) Inventors: **Harold Vinegar**, Bellaire, TX (US);
Scott Nguyen, Hoston, TX (US)

(56) **References Cited**

(73) Assignee: **GENIE IP B.V.**, Amsterdam (NL)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 604 days.

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This patent is subject to a terminal disclaimer.

(Continued)

Primary Examiner — Brad Harcourt

(21) Appl. No.: **14/373,880**

(74) *Attorney, Agent, or Firm* —

(22) PCT Filed: **Jan. 23, 2012**

Marc Van Dyke

(86) PCT No.: **PCT/US2012/022282**

§ 371 (c)(1),
(2), (4) Date: **Feb. 18, 2015**

(57) **ABSTRACT**

(87) PCT Pub. No.: **WO2013/112133**

PCT Pub. Date: **Aug. 1, 2013**

Embodiments of the present invention relate to heater patterns and related methods of producing hydrocarbon fluids from a subsurface hydrocarbon-containing formation (for example, an oil shale formation) where a heater cell may be divided into nested inner and outer zones. Production wells may be located within one or both zones. In the smaller inner zone, heaters may be arranged at a relatively high spatial density while in the larger surrounding outer zone, a heater spatial density may be significantly lower. Due to the higher heater density, a rate of temperature increase in the smaller inner zone of the subsurface exceeds that of the larger outer zone, and a rate of hydrocarbon fluid production ramps up faster in the inner zone than in the outer zone. In some embodiments, a ratio between a half-maximum sustained production time and a half-maximum rise time of a hydrocarbon fluid production function is relatively large.

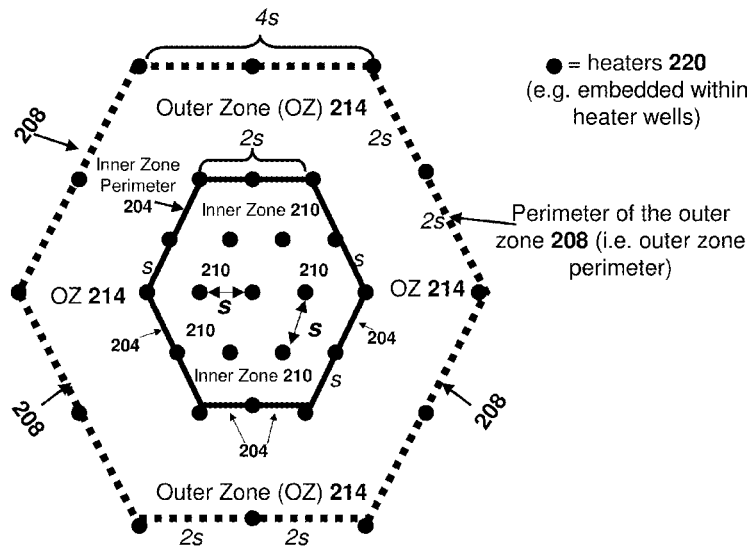
(65) **Prior Publication Data**

US 2015/0176380 A1 Jun. 25, 2015

(51) **Int. Cl.**
E21B 43/24 (2006.01)
E21B 43/243 (2006.01)

(52) **U.S. Cl.**
CPC **E21B 43/24** (2013.01); **E21B 43/2401** (2013.01); **E21B 43/243** (2013.01)

15 Claims, 100 Drawing Sheets





US010046183B2

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

(10) **Patent No.:** **US 10,046,183 B2**

(45) **Date of Patent:** ***Aug. 14, 2018**

(54) **SYSTEMS FOR CUSTOM COLORATION**

(71) Applicant: **COLORIGHT LTD.**, Rehovot (IL)

(72) Inventors: **Benzion Landa**, Nes Ziona (IL); **Efraim Miklatzky**, Neve Ilan (IL); **Sagi Abramovich**, Raanana (IL); **Yacov Mazuz**, Rishon-LeZion (IL); **Anton Krassilnikov**, Holon (IL); **Eliyahu Benny**, Rishon-LeZion (IL); **Gilad Davara**, Rehovot (IL); **Chen Ofek**, Rehovot (IL); **Elena Ishkov**, Givataim (IL); **Lior Shahar**, Kiryat Ono (IL); **Daniel Mandelik**, Rehovot (IL); **Uri Zadok**, Herzliya (IL)

(73) Assignee: **COLORIGHT LTD.**, Rehovot (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.
This patent is subject to a terminal disclaimer.

(21) Appl. No.: **15/131,074**

(22) Filed: **Apr. 18, 2016**

(65) **Prior Publication Data**
US 2016/0339274 A1 Nov. 24, 2016

Related U.S. Application Data
(63) Continuation of application No. 14/501,010, filed on Sep. 29, 2014, now Pat. No. 9,316,580, and a (Continued)

(51) **Int. Cl.**
G01J 3/00 (2006.01)
A61Q 5/10 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC **A61Q 5/10** (2013.01); **A61K 8/0216** (2013.01); **B65D 1/0223** (2013.01); **B65D 83/04** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC G01J 3/00; G01J 3/02; G01J 3/10; G01J 3/18; G01J 3/28; G01J 3/42
See application file for complete search history.

(56) **References Cited**
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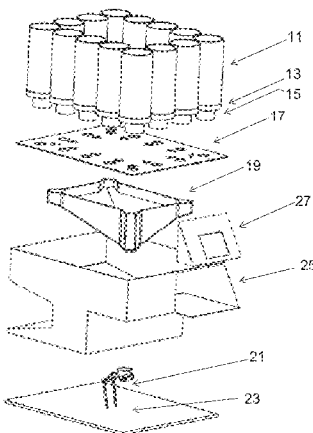
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Bolduc, Chantal, and Jerry Shapiro. "Hair care products: waving, straightening, conditioning, and coloring." Clinics in dermatology 19.4 (2001): 431-436.
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Primary Examiner — Abdullahi Nur
(74) *Attorney, Agent, or Firm* — Oblon, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**
Novel systems and methods for performing treatment (e.g., coloration) of keratinous fibers are disclosed. The methods and systems utilize one or more of a dispensing device which is configured to provide customized composition for treating keratinous fibers (e.g., a coloring composition), optionally formed from tablets; an optical reader, for obtaining sufficient characteristics of the keratinous fibers to make a realistic prediction of the outcome of a treatment (e.g., coloring treatment); a computational units for predicting an outcome of a treatment, optionally being interfaced with the dispensing device and for selecting a customized treatment; and tablet formulations which are useful in preparing customized composition for treating keratinous fibers. Further
(Continued)





US010012588B2

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

(10) **Patent No.:** **US 10,012,588 B2**

(45) **Date of Patent:** **Jul. 3, 2018**

(54) **APPARATUS AND METHOD FOR CUSTOMIZED HAIR-COLORING**

(58) **Field of Classification Search**

CPC G01J 3/463; G01J 3/50; G01J 3/524; G01J 2003/466; G01J 3/02; G01J 3/462;
(Continued)

(71) Applicant: **COLORIGHT LTD.**, Rehovot (IL)

(56) **References Cited**

U.S. PATENT DOCUMENTS

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5,205,837 A 4/1993 Andrian et al.
(Continued)

(72) Inventors: **Efraim Miklatzky**, Neve Ilan (IL); **Elena Ishkov**, Givataim (IL); **Daniel Mandelik**, Rehovot (IL); **Gilad Davara**, Rehovot (IL)

(73) Assignee: **COLORIGHT LTD.**, Rehovot (IL)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/303,726**

(22) PCT Filed: **Apr. 27, 2015**

OTHER PUBLICATIONS

(86) PCT No.: **PCT/IB2015/053065**

§ 371 (c)(1),

(2) Date: **Oct. 12, 2016**

Birngruber C et al: The color(s) of human hair-Forensic hair analysis with SpectraCube; vol. 185, No. 1-3, Mar. 10, 2009, pp. e19-e23; Forensic Science International, Elsevier Scientific Publishers Ireland LTD, IE; available online Jan. 24, 2009.
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(87) PCT Pub. No.: **WO2015/166403**

PCT Pub. Date: **Nov. 5, 2015**

Primary Examiner — Michael P Stafira

(65) **Prior Publication Data**

US 2017/0038297 A1 Feb. 9, 2017

(74) *Attorney, Agent, or Firm* — Oblon, McClelland, Maier & Neustadt, L.L.P.

Related U.S. Application Data

(57) **ABSTRACT**

(60) Provisional application No. 61/984,796, filed on Apr. 27, 2014.

An apparatus and method for customized hair-coloring is disclosed. In some embodiments the method comprises: a. performing a plurality of light-scattering measurements upon a sample of hair such that for each light-scattering measurement, the sample of hair is illuminated from a different respective direction; b. comparing the results of the light-scattering measurements; c. in accordance with results of the comparing, computing an initial damage-state of hair of the sample by comparing the results of the light-scattering measurements; d. obtaining an initial color-state of the hair of the sample; and e. computing a hair-coloring composition that is predicted to transform the hair sample from the initial

(51) **Int. Cl.**

G01J 1/10 (2006.01)

G01N 21/47 (2006.01)

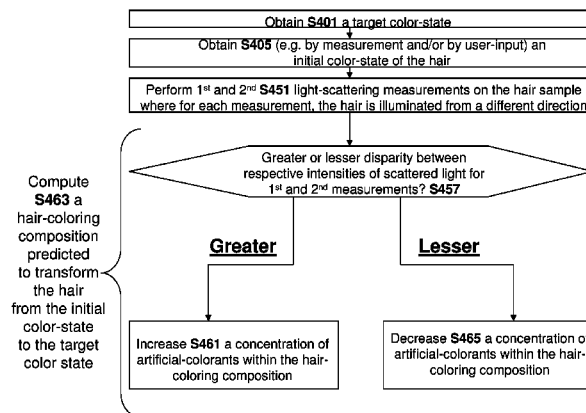
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(52) **U.S. Cl.**

CPC **G01N 21/47** (2013.01); **A45D 44/005** (2013.01); **G01J 3/463** (2013.01); **G01N 21/25** (2013.01);

(Continued)

(Continued)





US009844687B2

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

(10) **Patent No.:** **US 9,844,687 B2**

(45) **Date of Patent:** ***Dec. 19, 2017**

(54) **SYSTEMS FOR CUSTOM COLORATION**

(71) Applicant: **COLORIGHT LTD.**, Rehovot (IL)

(72) Inventors: **Benzion Landa**, Nes Ziona (IL); **Efraim Miklatzky**, Neve Ilan (IL); **Sagi Abramovich**, Raanana (IL); **Yacov Mazuz**, Rishon-LeZion (IL); **Anton Krassilnikov**, Holon (IL); **Eliyahu Benny**, Rishon-LeZion (IL); **Gilad Davara**, Rehovot (IL); **Chen Ofek**, Rehovot (IL); **Elena Ishkov**, Givataim (IL); **Lior Shahar**, Kiryat Ono (IL); **Daniel Mandelik**, Rehovot (IL)

(73) Assignee: **COLORIGHT LTD.**, Rehovot (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/948,430**

(22) Filed: **Nov. 23, 2015**

(65) **Prior Publication Data**

US 2016/0175620 A1 Jun. 23, 2016

Related U.S. Application Data

(63) Continuation of application No. 14/005,828, filed as application No. PCT/IB2012/051351 on Mar. 21, 2012, now Pat. No. 9,205,283.

(Continued)

(51) **Int. Cl.**
G01J 3/00 (2006.01)
A61Q 5/10 (2006.01)

(Continued)

(52) **U.S. Cl.**
CPC **A61Q 5/10** (2013.01); **A45D 19/02** (2013.01); **A45D 44/005** (2013.01); **A45D 44/02** (2013.01);

(Continued)

(58) **Field of Classification Search**

CPC G01J 3/00; G01J 3/02; G01J 3/10; G01J 3/18; G01J 3/28; G01J 3/42

See application file for complete search history.

(56) **References Cited**

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DE 42 05 112 8/1993

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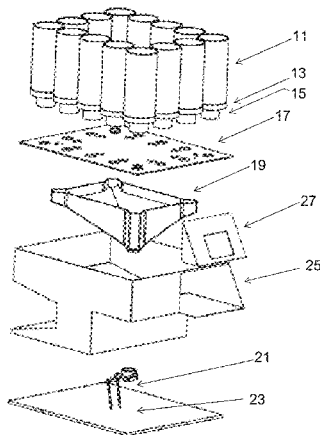
Primary Examiner — Abdullahi Nur

(74) *Attorney, Agent, or Firm* — Oblon, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**

Novel systems and methods for performing treatment (e.g., coloration) of keratinous fibers are disclosed. The methods and systems utilize one or more of a dispensing device which is configured to provide customized composition for treating keratinous fibers (e.g., a coloring composition), optionally formed from tablets; an optical reader, for obtaining sufficient characteristics of the keratinous fibers to make a realistic prediction of the outcome of a treatment (e.g., coloring treatment); a computational units for predicting an outcome of a treatment, optionally being interfaced with the dispensing device and for selecting a customized treatment; and tablet formulations which are useful in preparing customized composition for treating keratinous fibers. Further

(Continued)





US009784882B2

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

(10) **Patent No.:** **US 9,784,882 B2**

(45) **Date of Patent:** **Oct. 10, 2017**

(54) **MAPPING HYDROCARBON LIQUID PROPERTIES OF A KEROGENCONTAINING SOURCE ROCK**

(71) Applicants: **GENIE IP B.V.**, Amsterdam (NL); **Harold Vinegar**, Bellaire, TX (US); **Scott Nguyen**, Houston, TX (US); **Eva Vinegar**, Bellaire, TX (US)

(72) Inventors: **Eva Vinegar**, Bellaire, TX (US); **Scott Nguyen**, Austin, TX (US); **Harold Vinegar**, Bellaire, TX (US)

(73) Assignee: **GENIE IP B.V.**, Amsterdam (NL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 432 days.

(21) Appl. No.: **14/412,702**

(22) PCT Filed: **Jul. 4, 2013**

(86) PCT No.: **PCT/IB2013/055492**

§ 371 (c)(1),

(2) Date: **Jan. 5, 2015**

(87) PCT Pub. No.: **WO2014/006592**

PCT Pub. Date: **Jan. 9, 2014**

(65) **Prior Publication Data**

US 2015/0168588 A1 Jun. 18, 2015

Related U.S. Application Data

(63) Continuation-in-part of application No. PCT/IB2013/054090, filed on May 18, 2013.

(Continued)

(51) **Int. Cl.**

G01V 3/18 (2006.01)

G01V 3/38 (2006.01)

(Continued)

(52) **U.S. Cl.**

CPC **G01V 3/38** (2013.01); **G01V 3/02** (2013.01); **G01V 3/06** (2013.01); **G01V 3/24** (2013.01)

(58) **Field of Classification Search**

CPC ... **G01V 3/00**; **G01V 3/02**; **G01V 3/04**; **G01V 3/06**; **G01V 3/08**; **G01V 3/24**; **G01V 13/38**

See application file for complete search history.

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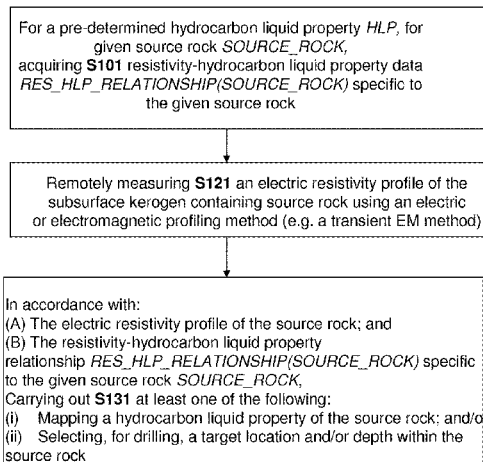
Primary Examiner — Huan Tran

(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(57) **ABSTRACT**

A method is disclosed for generating an areal map of a pre-determined hydrocarbon liquid property of a subsurface kerogen-containing source rock from an electromagnetic resistivity profile. Preferably, the profile is generated by a transient EM method such as a long-offset transient electromagnetic (LOTEM) method. In some embodiments, the areal map is generated by employing resistivity-hydrocarbon liquid-quality relationship data describing a relationship between (i) a property of hydrocarbon liquid generated within the source rock pore space to (ii) an electrical resistivity of the source rock. In some embodiments, it is possible to acquire such data even in the absence of source rock samples where the hydrocarbon liquids within the samples has been preserved. The areal map is useful for determining a target location and/or depth in the source rock to drill for oil. The presently-disclosed techniques are particularly relevant to tight oil formations.

20 Claims, 26 Drawing Sheets





US009533169B2

(12) **United States Patent**
Zachar

(10) **Patent No.:** **US 9,533,169 B2**
(45) **Date of Patent:** **Jan. 3, 2017**

(54) **APPARATUS AND METHOD FOR IRRADIATING BIOLOGICAL TISSUE**

(71) Applicant: **Oron Zachar**, Tel Aviv (IL)

(72) Inventor: **Oron Zachar**, Tel Aviv (IL)

(73) Assignee: **PRODOLUX SP Z O O**, Warsaw (PL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/447,630**

(22) Filed: **Jul. 31, 2014**

(65) **Prior Publication Data**

US 2015/0057736 A1 Feb. 26, 2015

Related U.S. Application Data

(63) Continuation-in-part of application No. PCT/IB2012/050453, filed on Jan. 31, 2012.

(51) **Int. Cl.**

A61B 18/18 (2006.01)
A61N 5/04 (2006.01)
A61N 2/00 (2006.01)
A61N 2/02 (2006.01)
A61B 18/00 (2006.01)

(52) **U.S. Cl.**

CPC **A61N 5/04** (2013.01); **A61N 2/006** (2013.01); **A61B 18/1815** (2013.01); **A61B 2018/00321** (2013.01); **A61N 2/02** (2013.01)

(58) **Field of Classification Search**

CPC **A61N 5/04**; **A61N 2/02**; **A61N 2/006**; **A61B 18/1815**; **A61B 2018/00321**

USPC **607/88**; **600/9**, **13**
See application file for complete search history.

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Primary Examiner — Carl H Layno

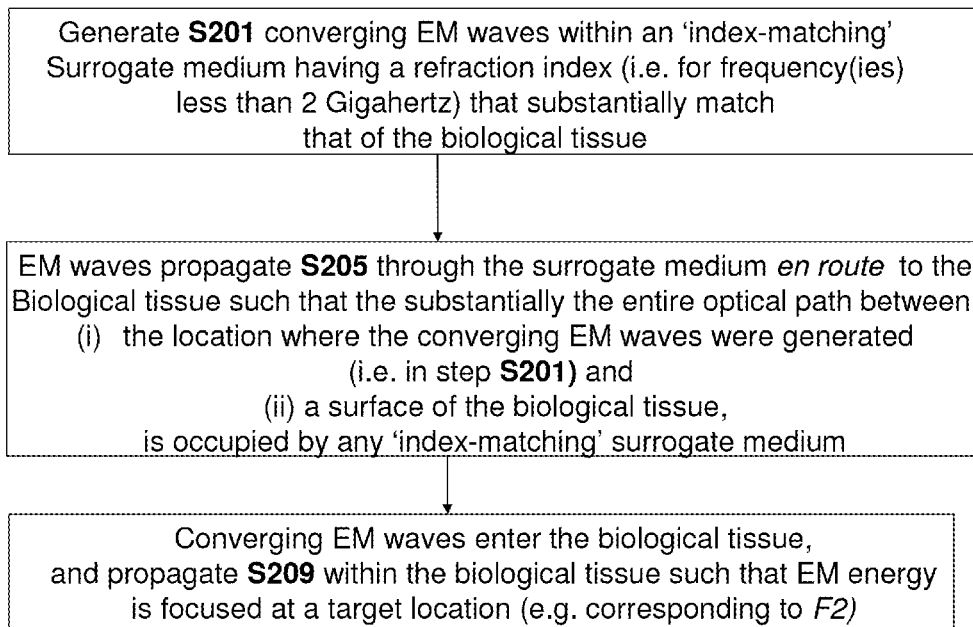
Assistant Examiner — Jon Eric C Morales

(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(57) **ABSTRACT**

Methods and apparatus for irradiating biological tissue by EM radiation having radiation frequency(ies) of at most 10 Gigahertz are disclosed herein. In some embodiments, the tissue is irradiated by passing converging EM waves (e.g. generated using an ellipsoidal mirror **110**) through a surrogate medium having a specially shaped ENTRY_SURFACE via which the converging EM waves enter the surrogate medium. In some embodiments, a refractive index at a sub-10 Gigahertz of the surrogate medium is at least 2 or at least 3 or at least 5 and/or substantially matches a refractive index of an irradiated biological tissue. In some embodiments, converging EM waves are formed within the surrogate medium. Some embodiments relate to methods and apparatus for irradiating neuron(s), for example, to non-invasively stimulating or otherwise modify a behavior of neuron(s) using focused or non-focused EM radiation.

1 Claim, 38 Drawing Sheets





US009316580B2

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

(10) **Patent No.:** **US 9,316,580 B2**
(45) **Date of Patent:** **Apr. 19, 2016**

(54) **SYSTEMS FOR CUSTOM COLORATION**

G01J 3/02 (2006.01)

(71) Applicant: **COLORIGHT LTD.**, Rehovot (IL)

G01J 3/18 (2006.01)

G01J 3/42 (2006.01)

(72) Inventors: **Benzion Landa**, Nes Ziona (IL); **Efraim Miklatzky**, Neve Ilan (IL); **Sagi Abramovich**, Raanana (IL); **Yacov Mazuz**, Rishon-LeZion (IL); **Anton Krassilnikov**, Holon (IL); **Eliyahu Benny**, Rishon-LeZion (IL); **Elena Ishkov**, Givataim (IL); **Lior Shahar**, Kiryat Ono (IL); **Daniel Mandelik**, Rehovot (IL)

(52) **U.S. Cl.**

CPC **G01N 21/27** (2013.01); **B65D 1/0223** (2013.01); **B65D 83/04** (2013.01); **G01N 21/21** (2013.01); *G01J 3/02* (2013.01); *G01J 3/18* (2013.01); *G01J 3/42* (2013.01); *G01N 2201/062* (2013.01); *G01N 2201/105* (2013.01)

(58) **Field of Classification Search**

CPC *G01J 3/00*; *G01J 3/02*; *G01J 3/10*; *G01J 3/18*; *G01J 3/28*; *G01J 3/42*

USPC 356/300-445
See application file for complete search history.

(73) Assignee: **COLORIGHT LTD.**, Rehovot (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(56)

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424/70.2

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Primary Examiner — Abdullahi Nur

(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(21) Appl. No.: **14/501,010**

(22) Filed: **Sep. 29, 2014**

(65) **Prior Publication Data**

US 2015/0089751 A1 Apr. 2, 2015

Related U.S. Application Data

(63) Continuation-in-part of application No. 14/005,828, filed as application No. PCT/IB2012/051351 on Mar. 21, 2012.

(60) Provisional application No. 61/883,263, filed on Sep. 27, 2013, provisional application No. 61/585,701, filed on Jan. 12, 2012, provisional application No. 61/543,392, filed on Oct. 5, 2011, provisional application No. 61/454,764, filed on Mar. 21, 2011.

(51) **Int. Cl.**

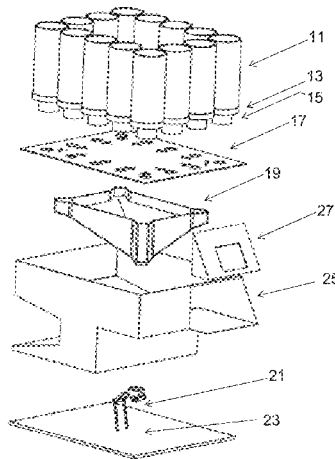
G01J 3/00 (2006.01)
G01N 21/27 (2006.01)
B65D 83/04 (2006.01)
G01N 21/21 (2006.01)
B65D 1/02 (2006.01)

(57)

ABSTRACT

Novel systems and methods for performing treatment (e.g., coloration) of keratinous fibers are disclosed. The methods and systems utilize one or more of a dispensing device which is configured to provide customized composition for treating keratinous fibers (e.g., a coloring composition), optionally formed from tablets; an optical reader, for obtaining sufficient characteristics of the keratinous fibers to make a realistic prediction of the outcome of a treatment (e.g., coloring treatment); a computational units for predicting an outcome of a treatment, optionally being interfaced with the dispensing device and for selecting a customized treatment; and tablet formulations which are useful in preparing customized composition for treating keratinous fibers. Further disclosed are rapidly disintegrating tablets for use in the preparation of compositions for treating keratinous fibers.

6 Claims, 74 Drawing Sheets





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

(10) **Patent No.:** **US 10,863,816 B2**
(45) **Date of Patent:** **Dec. 15, 2020**

(54) **METHOD AND SYSTEM FOR CUSTOMIZED HAIR-COLORING**

(71) Applicant: **COLORIGHT LTD.**, Rehovot (IL)

(72) Inventors: **Efraim Miklatzky**, Neve Ilan (IL); **Sagiv Lustig**, Ramat Hasharon (IL); **Elena Ishkov**, Rehovot (IL); **Eliyahu Benny**, Rehovot (IL); **Hila Sela**, Ramle (IL); **Roy Frenkel**, Kfar Menachem (IL)

(73) Assignee: **COLORIGHT LTD.**, Rehovot (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 361 days.

(21) Appl. No.: **15/770,549**

(22) PCT Filed: **Nov. 4, 2016**

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(65) **Prior Publication Data**
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(51) **Int. Cl.**
A45D 44/00 (2006.01)
A45D 19/00 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC **A45D 44/005** (2013.01); **A45D 19/0008** (2013.01); **G01J 3/50** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC **A45D 44/005**; **A45D 19/0008**; **A45D 2019/0066**; **A45D 2044/007**;
(Continued)

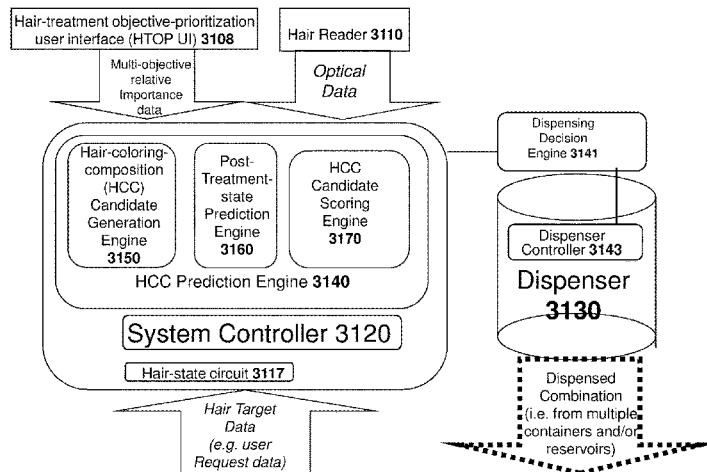
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Primary Examiner — Michael Collins
(74) *Attorney, Agent, or Firm* — Oblon, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**
Systems and methods for computing a hair-coloring composition (HCC) or for dispensing ingredients for the HCC are disclosed herein. In some embodiments, the system comprises a hair-treatment objective-prioritization user interface (HTOP UI) for receiving multi-objective relative-importance data describing a relative importance of different hair-treatment objectives (e.g. immediate post-treatment accuracy versus auxiliary goals, or one auxiliary goal versus another) for a potential hair-coloring treatment. In some embodiments, a hair-coloring-composition (HCC) prediction-engine is responsive to input received via the HTOP UI to compute, from the initial hair-state data and from the target color-state, a customized hair-coloring composition
(Continued)





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

(10) **Patent No.:** **US 9,205,283 B2**

(45) **Date of Patent:** **Dec. 8, 2015**

(54) **SYSTEMS FOR CUSTOM COLORATION**

(75) Inventors: **Efraim Miklatzky**, Neve Ilan (IL);
Eliyahu Benny, Rishon-LeZion (IL);
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Mandelik, Rehovot (IL)

(73) Assignee: **COLORIGHT LTD.**, Rehovot

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/005,828**

(22) PCT Filed: **Mar. 21, 2012**

(86) PCT No.: **PCT/IB2012/051351**

§ 371 (c)(1),
(2), (4) Date: **Jun. 19, 2014**

(87) PCT Pub. No.: **WO2012/127429**

PCT Pub. Date: **Sep. 27, 2012**

(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 61/454,764, filed on Mar. 21, 2011, provisional application No. 61/543,392, filed on Oct. 5, 2011, provisional application No. 61/585,701, filed on Jan. 12, 2012.

(51) **Int. Cl.**

G01J 3/00 (2006.01)

A61Q 5/10 (2006.01)

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(52) **U.S. Cl.**

CPC **A61Q 5/10** (2013.01); **A45D 19/02** (2013.01);
A45D 44/005 (2013.01); **A45D 44/02**
(2013.01);

(Continued)

(58) **Field of Classification Search**

CPC G01J 3/00; G01J 3/02; G01J 3/10;
G01J 3/18; G01J 3/28; G01J 3/42

USPC 356/300-445
See application file for complete search history.

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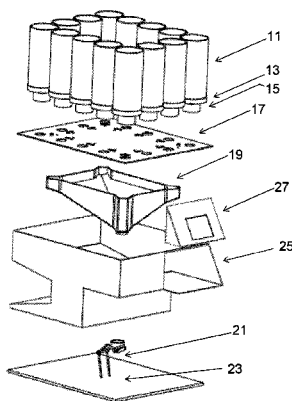
Primary Examiner — Abdullahi Nur

(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(57) **ABSTRACT**

Novel systems and methods for performing treatment (e.g., coloration) of keratinous fibers are disclosed. The methods and systems utilize one or more of a dispensing device which is configured to provide customized composition for treating keratinous fibers (e.g., a coloring composition), optionally formed from tablets; an optical reader, for obtaining sufficient characteristics of the keratinous fibers to make a realistic prediction of the outcome of a treatment (e.g., coloring treatment); a computational units for predicting an outcome of a treatment, optionally being interfaced with the dispensing device and for selecting a customized treatment; and tablet formulations which are useful in preparing customized composition for treating keratinous fibers. Further disclosed are rapidly disintegrating tablets for use in the preparation of compositions for treating keratinous fibers.

5 Claims, 53 Drawing Sheets



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

(10) **Patent No.:** **US 8,723,144 B2**
(45) **Date of Patent:** **May 13, 2014**

(54) **APPARATUS FOR SAMPLE FORMATION AND MICROANALYSIS IN A VACUUM CHAMBER**

(75) Inventors: **Eitan Kidron**, Hod Hasharon (IL); **Dror Shemesh**, Hod Hasharon (IL)

(73) Assignee: **Applied Materials Israel, Ltd.**, Rehovot (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1266 days.

(21) Appl. No.: **11/119,230**

(22) Filed: **Apr. 28, 2005**

(65) **Prior Publication Data**
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Related U.S. Application Data

(60) Provisional application No. 60/588,272, filed on Jul. 14, 2004.

(51) **Int. Cl.**
H01J 37/08 (2006.01)

(52) **U.S. Cl.**
USPC **250/492.21**; 250/306; 250/307; 250/310; 250/311; 250/492.1; 250/492.22; 250/492.23; 250/492.3; 118/723 FI

(58) **Field of Classification Search**
USPC 250/492.22, 306, 307, 309, 310, 311, 250/440.11, 442.11, 492.1, 492.2, 492.21, 250/492.23, 492.3; 118/723 FI
See application file for complete search history.

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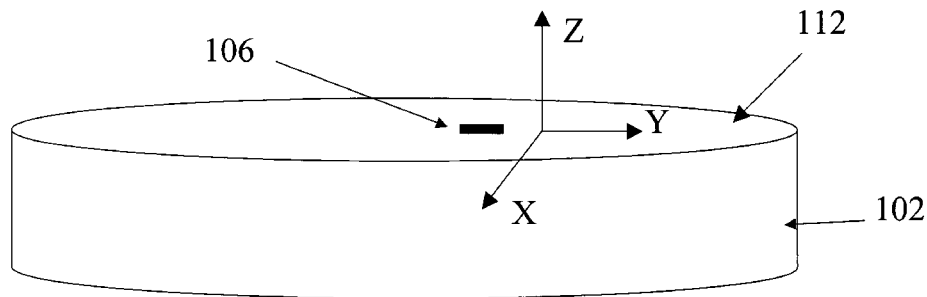
Primary Examiner — Michael Maskell

(74) *Attorney, Agent, or Firm* — Kilpatrick Townsend & Stockton LLP

(57) **ABSTRACT**

An apparatus is disclosed for forming a sample of an object, extracting the sample from the object, and subjecting this sample to microanalysis including surface analysis and electron transparency analysis in a vacuum chamber. In some embodiments, a means is provided for imaging an object cross section surface of an extracted sample. Optionally, the sample is iteratively thinned and imaged within the vacuum chamber. In some embodiments, the sample is situated on a sample support including an optional aperture. Optionally, the sample is situated on a surface of the sample support such that the object cross section surface is substantially parallel to the surface of the sample support. Once mounted on the sample support, the sample is either subjected to microanalysis in the vacuum chamber, or loaded onto a loading station. In some embodiments, the sample is imaged with an electron beam substantially normally incident to the object cross section surface.

11 Claims, 38 Drawing Sheets





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

(10) **Patent No.:** **US 7,297,965 B2**
(45) **Date of Patent:** **Nov. 20, 2007**

(54) **METHOD AND APPARATUS FOR SAMPLE FORMATION AND MICROANALYSIS IN A VACUUM CHAMBER**

(75) Inventors: **Eitan Kidron**, Hod Hasharon (IL);
Dror Shemesh, Hod Hasharon (IL)

(73) Assignee: **Applied Materials, Israel, Ltd.**,
Rehovot (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 91 days.

(21) Appl. No.: **11/119,207**

(22) Filed: **Apr. 28, 2005**

(65) **Prior Publication Data**
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Related U.S. Application Data

(60) Provisional application No. 60/588,272, filed on Jul. 14, 2004.

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G21K 5/10 (2006.01)

(52) **U.S. Cl.** **250/492.2; 250/307; 250/311; 250/306; 250/492.1; 250/492.21**

(58) **Field of Classification Search** None
See application file for complete search history.

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(74) *Attorney, Agent, or Firm*—Tarek N. Fahmi

(57) **ABSTRACT**

Methods and apparatus are disclosed for forming a sample of an object, extracting the sample from the object, and subjecting this sample to microanalysis including surface analysis and electron transparency analysis in a vacuum chamber. In some embodiments, a method is provided for imaging an object cross section surface of an extracted sample. Optionally, the sample is iteratively thinned and imaged within the vacuum chamber. In some embodiments, the sample is situated on a sample support including an optional aperture. Optionally, the sample is situated on a surface of the sample support such that the object cross section surface is substantially parallel to the surface of the sample support. Once mounted on the sample support, the sample is either subjected to microanalysis in the vacuum chamber, or loaded onto a loading station. In some embodiments, the sample is imaged with an electron beam substantially normally incident to the object cross section surface.

14 Claims, 38 Drawing Sheets

