



(51) International Patent Classification:

A61B 1/00 (2006.01) A61B 1/04 (2006.01)
A61B 1/06 (2006.01)

(21) International Application Number:

PCT/US2013/052406

(22) International Filing Date:

26 July 2013 (26.07.2013)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/676,289 26 July 2012 (26.07.2012) US
61/790,487 15 March 2013 (15.03.2013) US

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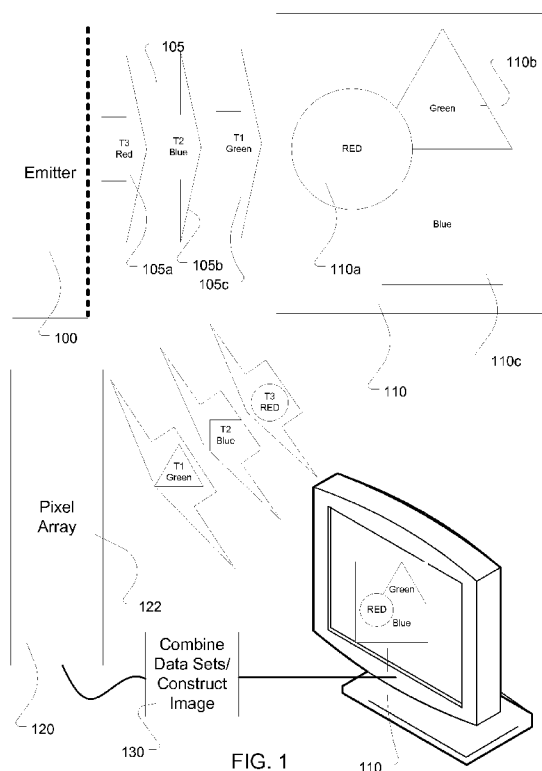
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(81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,

[Continued on next page]

(54) Title: CONTINUOUS VIDEO IN A LIGHT DEFICIENT ENVIRONMENT



(57) **Abstract:** The present disclosure extends to methods, systems, and computer program products for producing an image in light deficient environments and associated structures, methods and features is disclosed and described. The features of the system may include controlling a light source through duration, intensity or both; pulsing a component controlled light source during the blanking period; maximizing the blanking period to allow optimum light; and maintaining color balance.



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))*

Published:

— *with international search report (Art. 21(3))*

(88) Date of publication of the international search report:

5 June 2014

INTERNATIONAL SEARCH REPORT

PCT/US13/52406

International application No.

PCT/US13/52406

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61B 1/00, 1/06, 1/04 (2014.01)

USPC - 348/77; 600/184

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)

IPC(8) Classification(s): A61B 1/00, 1/06, 1/04, H04N 7/18 (2014.01)

USPC Classification(s): 348/77; 600/184, 185, 188

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)

MicroPatent (US Granted, US Applications, EP-A, EP-B, WO, JP, DE-G, DE-A, DE-T, DE-U, GB-A, FR-A); ProQuest (Derwent, INSPEC, NTIS, PASCAL, Current Contents Search, Dissertation Abstracts Online, Inside Conferences); IP.com; IEEE.com; Google Scholar, Endoscope imaging sensor hand piece processor emitter coordinator digital video blanking, camera ccd cmos, handle

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2011/0028790 A1 (FARR, A. et al.) February 3, 2011; Abstract, figures 1-4D, paragraphs [0008]-[0009], [0016]-[0019], [0032]-[0049], [0057]-[0065].	1-6, 9-14, 16-18, 20, 22-25 --- 7-8, 15, 19, 21, 52, 58-61, 65, 71-74, 77
X --- Y	US 2007/0279486 A1 (BAYER, L. et al.) December 6, 2007; Abstract, figures 1-5, paragraphs [0007] [0013]-[0017], [0028], [0039]-[0046], [0050]-[0063].	43-44, 62, 64, 66, 70, 75, 78 --- 45-61, 63, 65, 67-69, 71-74, 76-77
Y	US 6,023,315 A (HARROLD, J et al.) February 08, 2000; figures 13-22, and 36, column 1, lines 5-13; column 2, line 16-21; column 7, line 2-15	7-8, 52-57, 76
Y	US 2011/0208004 A1 (FEINGOLD, B. et al.) August 25, 2011; Figures 1 and 2, paragraphs [0003]-[0008].	15, 19, 63, 67
Y	WO 2009/120228 A1 (UNGER, C. et al.) October 1, 2009; Figures 2 and 4, paragraphs [0027]-[00039], [00055].	21, 68, 69
Y	US 7,071,979 B1 (OHTANI, A. et al.) July 4, 2006; Figures 13 and 17, column 8, lines 27-49; column 9, lines 4-42.	45-47, 49-51
Y	US 7,151,568 B2 (KAWACHI, M. et al.) December 19, 2006; Abstract, figure 3, column 2, line 5- column 9, line 31.	48-50

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified).

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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

19 March 2014 (19.03.2014)

Date of mailing of the international search report

09 APR 2014

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

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PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US13/52406

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
See Extra Sheet.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-25, 43-78

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

PCT/US13/52406

International application No.

PCT/US13/52406

-***-Continued from Box III -***-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fee must be paid.

Group I: Claims 1-25 and 43-78 are directed toward a system for digital imaging in an ambient light deficient environment comprising an imaging sensor, an array of pixels, electromagnetic radiation, an endoscope, ambient light deficient environment, a hand piece, a control unit, a processor, an emitter, a pulse of electromagnetic radiation, and a digital video stream.

Group II: Claims 26-42 are directed toward a digital imaging method for use with an endoscope in ambient light deficient environments comprising an emitter, a pulse of a wavelength of electromagnetic radiation, illumination, light deficient environment, a first wavelength range, a first portion of electromagnetic spectrum, a predetermined interval, reflected electromagnetic radiation, a pixel array, a sensing interval, a predetermined blanking interval, a stream of images, and a frame.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features. Group I has at least a hand piece that Group II does not have. Group II has at least a predetermined blanking interval that Group I does not have.

The common technical features of Groups I-II are at least a system for digital imaging in an ambient light deficient environment comprising an array of pixels, electromagnetic radiation, an endoscope, ambient light deficient environment, an emitter, a pulse of electromagnetic radiation, and a video stream. This common feature is disclosed by US 2011/0028790 A1 to Farr et al. (Hereinafter Farr). Farr discloses a system for digital imaging in an ambient light deficient environment (disposable opto-electronic modules for illumination and imaging for endoscopy or borescopy, abstract) comprising: an array of pixels and electromagnetic radiation (image capture device 206 can be a CCD or CMOS sensor (an imaging sensor comprising an array of pixels for sensing electromagnetic radiation), figures 2A, 2B and 3A, paragraphs [0016]-[0019], [0032]-[0037], [0041]-[0047]); an endoscope and the ambient light deficient environment (disposable opto-electronic modules for illumination and imaging for endoscopy or borescopy, abstract, figures 2A, 2B and 3A, paragraphs [0016]-[0019], [0032]-[0047]); a emitter and a pulse of electromagnetic radiation (LED sources in illumination module 202 can provide illumination and can be individually pulsed by control unit 210, figures 2A, 2B and 3A, paragraphs [0016]-[0019], [0032]-[0047]); a digital video stream (image processing electronics that can convert the signals from image sensors 206 into various digital video formats, figures 2A, 2B and 3A, paragraphs [0016]-[0019], [0032]-[0047]).

Since the common technical feature is previously disclosed by the Farr reference, these common features are not special and so Groups I and II lack unity.