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[Continued on next page]

(54) Title: CAMERA SYSTEM WITH MINIMAL AREA MONOLITHIC CMOS IMAGE SENSOR

(57) Abstract: The disclosure extends to methods, systems, and computer program products for digitally imaging with area limited image sensors, such as within a lumen of an endoscope.

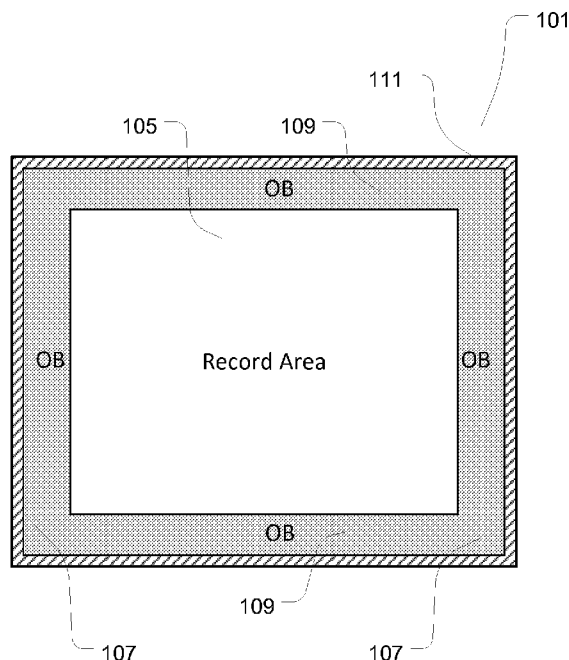


FIG. 1A



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))*

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 13/52423

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - A61B 1/04 (2014.01) USPC - 348/68 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) USPC: 348/68				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched USPC: 348/65, 68, 272, 274 (keyword limited--see terms below)				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) Patbase; Google Patents; Google Scholar; Google web Search Terms Used: Endoscope, imaging, black, clamp, long, register, registry, exposure, timing, lens, handhold, hand, hold, handle, lens, pixel, tip, electromagnet, digitizer, ADC, analog, digital, light, illumination, lumen				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
Y	US 2008/0021271 A1 (PASERO et al.) 24 January 2008 (24.01.2008), para [0044], [0048], [0050], [0054], [0068], Fig. 1	1-7, 48		
Y	US 2006/0250513 A1 (YAMAMOTO et al.) 09 November 2006 (09.11.2006), Abstract, para [0021]-[0022], [0058]	1-7, 48		
Y	US 5,339,275 A (HYATT) 16 August 1994 (16.08.1994), col 10, ln 52-58, col 55, ln 60- col 56, ln 22, col 85, ln 28-57	2		
Y	US 6,469,739 B1 (BECHTEL et al.) 22 October 2002 (22.10.2002), col 8, ln 37-55, col 18, ln 25- col 19, ln 20, col 23, ln 15-22	3-7		
☐ Further documents are listed in the continuation of Box C. ☐				
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; border: none;"> * 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 </td> <td style="width: 50%; vertical-align: top; border: none;"> "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 </td> </tr> </table>			* 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
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Date of the actual completion of the international search 13 May 2014 (13.05.2014)	Date of mailing of the international search report 03 JUN 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: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774			

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 13/52423

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.:
1-7, 48

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

International application No.

PCT/US 13/52423

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

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 fees must be paid.

Group I: Claims 1, 48, 2-7 drawn to a long registry

Group II: Claims 1, 48, 8-9, 14-25, 35-43, 49-51, 53-56, 59, 69 drawn to a pixel array comprises active pixels and optical black pixels, further including a black clamp circuit and a charge pump.

Group III: Claims 1, 48, 10-11, 71-72 drawn to digitizers.

Group IV: Claims 1, 48, 12-13, 70 drawn to transfer ports.

Group V: Claims 1, 48, 26-27 drawn to imaging sensor corrections.

Group VI: Claims 1, 48, 28-34, 60-61 drawn to control registers, latches, and shift registers.

Group VII: Claims 1, 48, 44-47 drawn to two dimensional frame data.

Group VIII: Claims 1, 48, 52 drawn to programmable gate array.

Group IX: Claims 1, 48, 57 drawn to a memory for accumulating a set of measured uncorrected line offsets.

Group X: Claims 1, 48, 58 drawn to digital to analog conversion.

Group XI: Claims 1, 48, 62-68 drawn to a hand piece having optical fiber and a light emitter.

NOTE

Claims 1 and 48 are considered generic.

The inventions listed as Groups I through XI 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 for the following reasons:

Special technical features

The invention of Group I includes the special technical feature of a long registry wherein the long registry comprises control parameter entries, not required by Groups II-XI.

The invention of Group II includes the special technical feature of a pixel array comprises active pixels and optical black pixels, further including a black clamp circuit and a charge pump, not required by Groups I and III-XI.

The invention of Group III includes the special technical feature of digitizers, not required by Groups I-II and IV-XI.

The invention of Group IV includes the special technical feature of transfer ports, not required by Groups I-III and V-XI.

The invention of Group V includes the special technical feature of imaging sensor corrections, not required by Groups I-IV and VI-XI.

The invention of Group VI includes the special technical feature of control registers, latches, and shift registers, not required by Groups I-V and VII-XI.

The invention of Group VII includes the special technical feature of two dimensional frame data, not required by Groups I-VI and VIII-XI.

The invention of Group VIII includes the special technical feature of programmable gate array, not required by Groups I-VII and IX-XI.

The invention of Group IX includes the special technical feature of a memory for accumulating a set of measured uncorrected line offsets, not required by Groups I-VIII and X-XI.

The invention of Group X includes the special technical feature of digital to analog conversion, not required by Groups I-IX and XI.

The invention of Group XI includes the special technical feature of a hand piece having optical fiber and a light emitter, not required by Groups I-X.

Common technical features:

The only features shared by Groups I through XI that would otherwise unify the groups are the features of claims 1 and 48. However, claims 1 and 48 are considered generic, and are made obvious over US 2008/0021271 A1 to Pasero et al. (hereinafter, 'Pasero') in view of US 2006/0250513 A1 to Yamamoto et al. (hereinafter, 'Yamamoto').

As per claim 1, Pasero discloses an endoscopic device (Fig.1) for use in a closed light environment comprising: an endoscope body (para [0044]- disclosing endoscope 1) comprising: a hand holding structure (para [0044]- hand part 4); a lumen attached by a lumen base at a first end of the body (para [0044], [0068]); a tip portion of the lumen opposite of the lumen base of the body (para [0044], [0068]); a lens disposed at the distal most portion of the tip portion (para [0044]- disclosing lens 5 fixed to the head part 3); an imaging sensor disposed near the tip portion of the lumen (para [0044]- imaging sensor 6), wherein the imaging sensor comprises: an array of pixels for sensing electromagnetic radiation (para [0044], [0048]); a transfer port for transmitting data generated by the pixel array (para [0044]- disclosing a USB transfer port); a digitizer to convert analog pixel data into digital data (para [0048]); electrical connections providing electrical communication between the imaging sensor and image signal processing circuitry disposed remotely from the imaging sensor (para [0044], [0048], [0050], [0054]). However, Pasero does not disclose a black clamp circuit for providing offset control for the data generated by the pixel array. However, Yamamoto does disclose a black clamp circuit for providing offset control for the data generated by the pixel array (Abstract, para [0021]-[0022], [0058]- disclosing black clamp circuit for controlling offset values). It would have been obvious to one of ordinary skill in the art to combine the device taught by Pasero with the black clamp circuit taught by Yamamoto, since such would allow for correcting or adjusting the black levels of an image.

As per claim 48, Pasero discloses a system for digital imaging in an ambient light deficient environment comprising: an imaging sensor for sensing electromagnetic radiation (para [0044]- imaging sensor 6); wherein said imaging sensor comprises: an array of pixels for sensing electromagnetic radiation (para [0044], [0048]); a transfer port for transmitting data generated by the pixel array (para [0044]- disclosing a USB transfer port); a digitizer to convert analog pixel samples to digital numbers (para [0048]); an endoscope for accessing the ambient light deficient environment (para [0044]); a hand piece attached to said endoscope wherein said endoscope may be maneuvered by manipulation of the hand piece (para [0044]- hand part 4); a control unit comprising a processor wherein said control unit may be in electrical communication with the imaging sensor para [0055]-[0059]; and a connection cable electrically connecting the hand piece and the control unit (para [0054]). However, Pasero does not disclose a black clamp circuit for providing offset control for the data generated by the pixel array. However, Yamamoto does disclose a black clamp circuit for providing offset control for the data generated by the pixel array (Abstract, para [0021]-[0022], [0058]- disclosing black clamp circuit for controlling offset values). It would have been obvious to one of ordinary skill in the art to combine the system taught by Pasero with the black clamp circuit taught by Yamamoto, since such would allow for correcting or adjusting the black levels of an image.

Therefore, Groups I through XI lack unity under PCT Rule 13.