



US007656561B2

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

(10) **Patent No.:** **US 7,656,561 B2**
(45) **Date of Patent:** **Feb. 2, 2010**

(54) **IMAGE COMPRESSION FOR RAPID HIGH-QUALITY IMAGING**

(75) Inventors: **Claus Mølgaard**, Nærum (DK);
Thomas Alexander Rogon, Virum (DK); **Thomas Andersen**, Glumso (DK)

(73) Assignee: **Phase One A/S**, Frederiksberg (DK)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 685 days.

(21) Appl. No.: **10/865,748**

(22) Filed: **Jun. 14, 2004**

(65) **Prior Publication Data**

US 2005/0276496 A1 Dec. 15, 2005

(30) **Foreign Application Priority Data**

May 31, 2004 (DK) 2004 00846

(51) **Int. Cl.**
H04N 1/41 (2006.01)

(52) **U.S. Cl.** **358/426.01**; 358/426.13;
382/232; 382/244

(58) **Field of Classification Search** 382/162,
382/166, 232, 233, 238, 239, 244, 245, 246,
382/248, 250; 358/426.01, 426.13, 426.14,
358/539

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,958,235 A * 9/1990 Sims et al. 358/402
5,553,200 A * 9/1996 Accad 358/1.9
6,097,838 A 8/2000 Klassen et al.
6,614,483 B1 9/2003 Lee et al.
6,694,061 B1 * 2/2004 Acharya 382/251
6,744,929 B1 6/2004 Okada

2002/0041761 A1 4/2002 Glotzbach et al.
2002/0044778 A1 4/2002 Suzuki
2003/0222996 A1 12/2003 Patej
2004/0008896 A1 1/2004 Suzuki

FOREIGN PATENT DOCUMENTS

DE 102 54 192 A1 9/2003

(Continued)

OTHER PUBLICATIONS

S. Battiato et al.; Coding Techniques for CFA Data Images; Proceedings of the 12th International Conf. on Image Analysis and Processing; 2003; IEEE.

Toi et al.; A Subband Coding Techniqui for Image Compression in Single CCDE Cameras With Bayer Color Filter Arrays; IEEE Transactions on Consumer Electr; vol. 45, Feb. 1999.

(Continued)

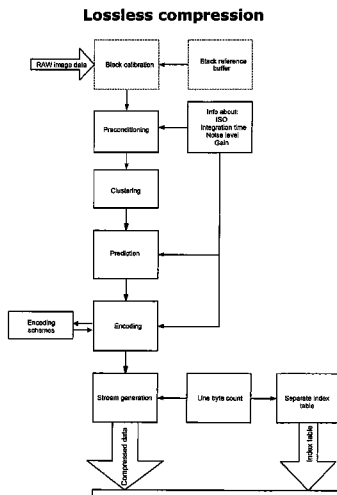
Primary Examiner—Thomas D Lee

(74) Attorney, Agent, or Firm—Volentine & Whitt, P.L.L.C.

(57) **ABSTRACT**

Lossless, near-lossless, and lossy compression and decompression of digital image data, whereby the image data can be compressed and decompressed on-the-fly with no need for external RAM resources for temporary data storage while compressing/decompressing image data. Implementing the algorithm only requires a very limited amount of silicon and yields very high performance in relation to very low power consumption. The described implementation is optimized for raw image data from a sensor with a Bayer filter pattern but can be used on data from image sensors with ay color filter. The compression algorithm contains a line indexing formation which enables very fast subsampling of an already compressed image and the possibility to decompress only parts of an image—this improves performance and reduces the need for temporary RAM storage greatly when zooming and in postprocessing.

10 Claims, 7 Drawing Sheets



FOREIGN PATENT DOCUMENTS

EP	0 469836 A2	7/1991
EP	1 173 005 A2	12/2000
JP	2000244935	11/1999
WO	WO 00/75859 A1	12/2000

OTHER PUBLICATIONS

Koh et al.; New Efficient Methods of Image Compression in Digital Cameras With Color Filter Array; IEEE Transactions on Consumer Electronics, vol. 49, No. 4, Nov. 2003.

* cited by examiner

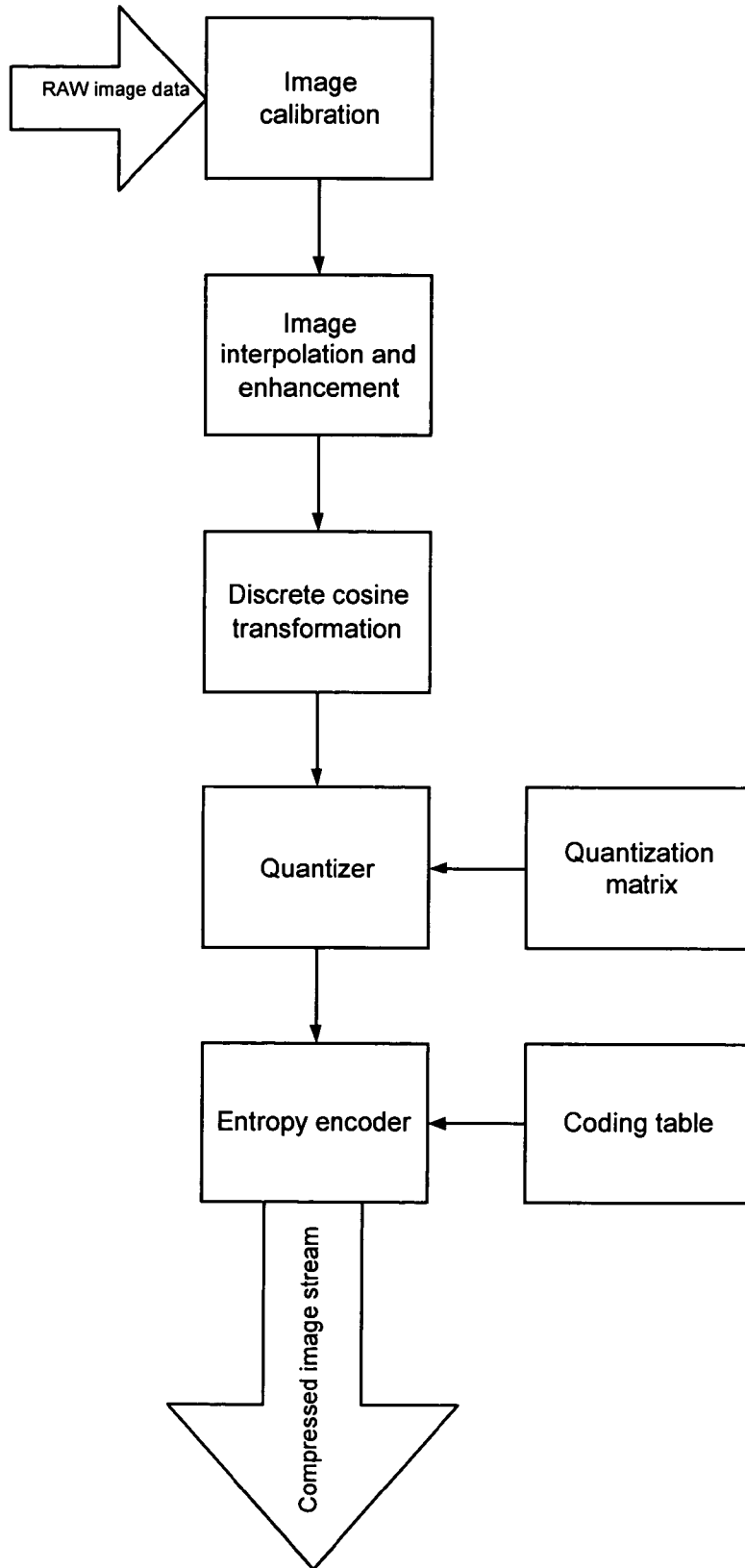


Fig. 1 (PRIOR ART)

Lossless compression

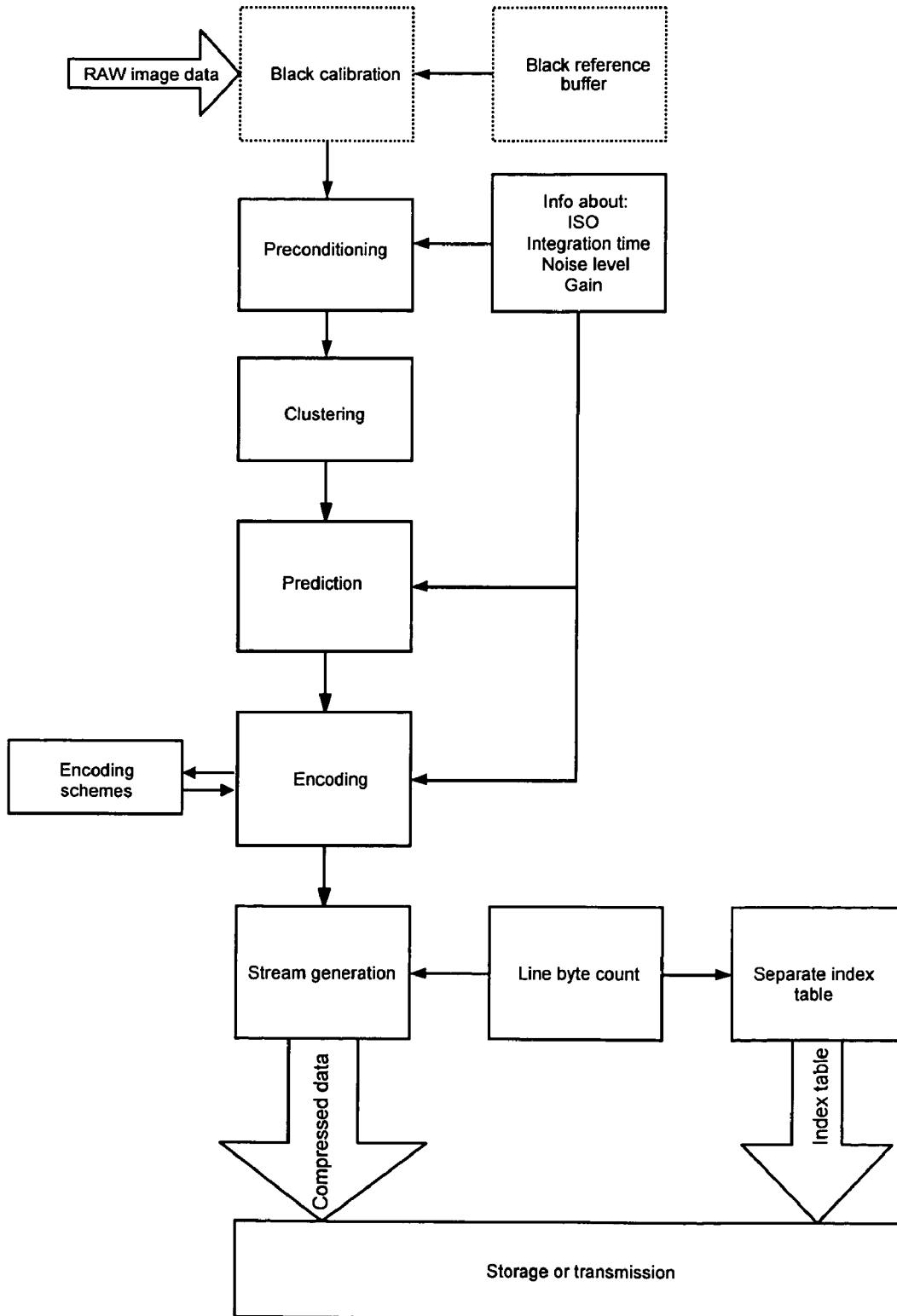


FIG. 2A

Near-lossless compression

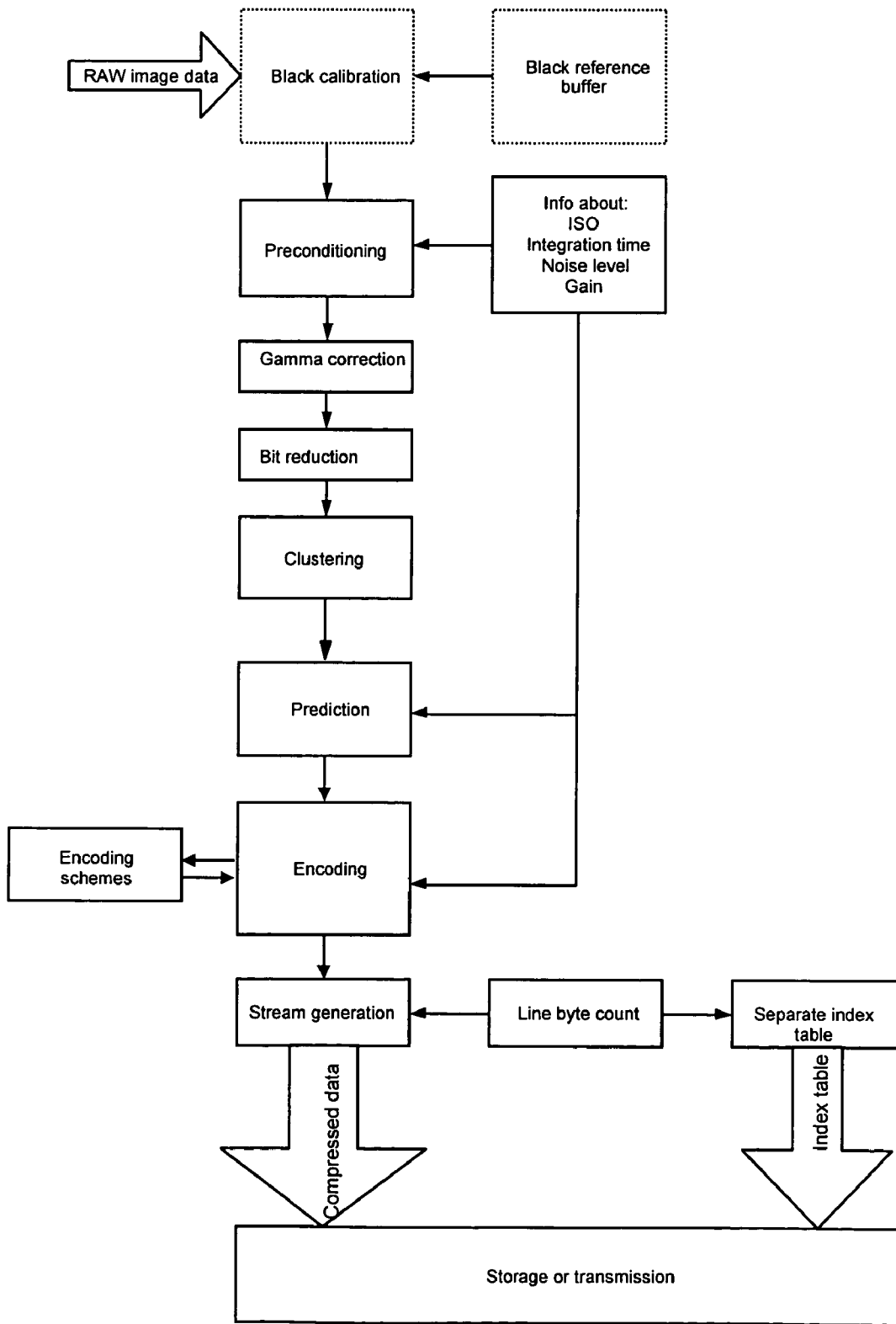


Fig. 2B

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.