EXHIBIT D

US008228979B2

(12) **United States Patent**
Washino

(10) **Patent No.: US 8,228,979 B2**
(45) **Date of Patent: Jul. 24, 2012**

(54) **WIDE-BAND MULTI-FORMAT AUDIO/VIDEO PRODUCTION SYSTEM WITH FRAME-RATE CONVERSION**

(75) Inventor: **Kinya Washino**, Little Ferry, NJ (US)

(73) Assignee: **Multi-Format, Inc.**, Little Ferry, NJ (US)

(*) 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.: **12/348,804**

(22) Filed: **Jan. 5, 2009**

(65) **Prior Publication Data**

US 2009/0174813 A1 Jul. 9, 2009

Related U.S. Application Data

(63) Continuation of application No. 10/117,496, filed on Apr. 5, 2002, now Pat. No. 7,474,696, which is a continuation of application No. 09/305,953, filed on May 6, 1999, now Pat. No. 6,370,198, which is a continuation-in-part of application No. 08/834,912, filed on Apr. 7, 1997, now Pat. No. 5,999,220.

(60) Provisional application No. 60/084,522, filed on May 7, 1998.

(51) **Int. Cl.**
H04B 1/66 (2006.01)
H04N 7/01 (2006.01)

(52) **U.S. Cl.** **375/240.01**; 348/446

(58) **Field of Classification Search** 348/555, 348/556, 722, 441, 445, 448, 426, 432, 454, 348/558, 568, 446; 375/240.26, 240.29, 375/240.01, 240.16, 240.24
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,633,293 A 12/1986 Powers
(Continued)

FOREIGN PATENT DOCUMENTS

EP 314873 5/1989
(Continued)

OTHER PUBLICATIONS

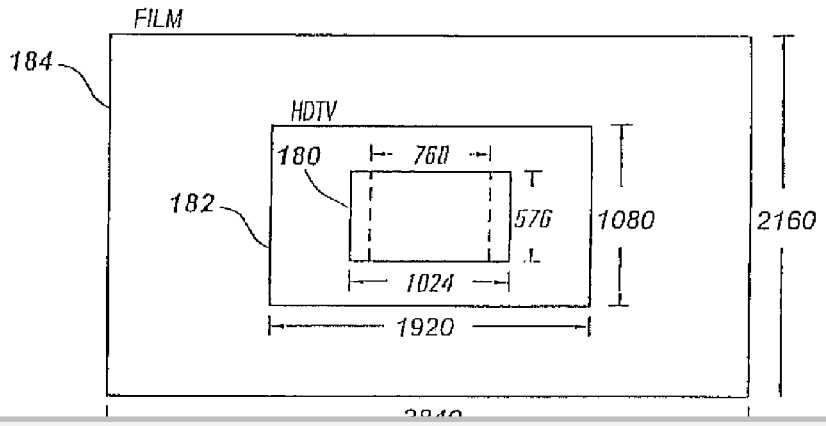
G Demos, "An Example of Hierarchy of Formats for HDTV," SMPTE Journal, Sep. 1992, pp. 609-617.
(Continued)

Primary Examiner — Behrooz Senfi
(74) *Attorney, Agent, or Firm* — Gifford, Krass, Sprinkle, Anderson & Citkowski, P.C.

(57) **ABSTRACT**

A multi-format digital video production system enables a user to process an input video program to produce an output version of the program in a final format which may have a different frame rate, pixel dimensions, or both. An internal production format of 24 fps is preferably chosen to provide the greatest compatibility with existing and planned formats associated with HDTV standard 4:3 or widescreen 16:9 high-definition television, and film. Images are re-sized horizontally and vertically by pixel interpolation, thereby producing larger or smaller image dimensions so as to fill the particular needs of individual applications. Frame rates are adapted by inter-frame interpolation or by traditional schemes, including "3:2 pull-down" for 24-to-30 fps conversions. Simple speed-up (for 24-to-25 conversions) or slow-down (for 25-to-24 conversions) for playback, or by manipulating the frame rate itself using a program storage facility with asynchronous reading and writing capabilities. The step of converting the signal to a HDTV format is preferably performed using a modified upconversion process for wideband signals (utilizing a higher sampling clock frequency) and a resizing to HDTV format frame dimensions in pixels.

14 Claims, 14 Drawing Sheets



U.S. PATENT DOCUMENTS

5,045,932	A	9/1991	Sharman et al.	
5,243,433	A	9/1993	Hailey et al.	
5,327,235	A	7/1994	Richards et al.	
5,329,309	A *	7/1994	Dorricott et al.	348/97
5,331,346	A	7/1994	Shields et al.	
5,335,013	A *	8/1994	Faber	348/104
5,384,598	A	1/1995	Rodriguez et al.	
5,444,491	A *	8/1995	Lim	348/441
5,444,492	A *	8/1995	Kihara	348/445
5,519,438	A	5/1996	Elliott et al.	
5,532,749	A	7/1996	Hong et al.	
5,537,157	A	7/1996	Washino et al.	
5,600,377	A	2/1997	David et al.	
5,608,464	A	3/1997	Woodham et al.	
5,617,218	A	4/1997	Rhodes	
5,701,383	A	12/1997	Russo et al.	
5,706,290	A	1/1998	Shaw et al.	
5,724,101	A	3/1998	Haskin	
5,754,248	A *	5/1998	Faroudja	348/474
5,771,073	A	6/1998	Lim	
5,812,204	A	9/1998	Baker et al.	
5,832,085	A	11/1998	Inoue et al.	
5,835,150	A	11/1998	Choi et al.	
5,838,381	A	11/1998	Kasahara et al.	
5,999,220	A *	12/1999	Washino	348/441
6,356,945	B1	3/2002	Shaw et al.	
6,370,198	B1 *	4/2002	Washino	375/240.26
6,542,198	B1	4/2003	Hung et al.	
6,549,240	B1 *	4/2003	Reitmeier	348/459
6,656,945	B2	12/2003	Campbell et al.	
6,906,687	B2 *	6/2005	Werner	345/8
7,864,865	B2 *	1/2011	Hatti et al.	375/240.25
2002/0118296	A1 *	8/2002	Schwab et al.	348/441

FOREIGN PATENT DOCUMENTS

EP	514012	11/1992
WO	WO-9315586	8/1993

OTHER PUBLICATIONS

J.S. Lim, "A Proposal for an HDTV/ATV Standard with Multiple Transmission Formats," SMPTE Journal, Aug. 1993, pp. 699-702.

W.E. Bretl, "3SNTSC-A 'Leapfrog' Production Standard for HDTV," SMPTE Journal, Mar. 1989, pp. 173-178.

B. Hunt, G. Kennel, L. DeMarsh, S. Kristy, "High-Resolution Electronic Intermediate System for Motion-Picture Film," SMPTE Journal, Mar. 1991, pp. 156-161.

A. Kaiser, H. Mahler, R., McMann, "Resolution Requirements for HDTV Based Upon the Performance of 35mm Motion-Picture Films for Theatrical Viewing," SMPTE Journal, Jun. 1985, pp. 654-659.

Y. Ide, M. Sasuga, N. Harada, T. Nishizawa, "A Three-CCD HDTV Color Camera," SMPTE Journal, Jul. 1990, pp. 532-537.

G. Reitmeier, C. Carlson, E. Geiger, D. Westerkamp, "The Digital Hierarchy—A Blueprint for Television in the 21st Century," SMPTE Journal, Jul. 1992, pp. 466-470.

L. Thorpe, T. Hanabusa, "If Progressive Scanning is So Good, How Bad is Interlace?", SMPTE Journal, Dec. 1990, p. 972-86.

* cited by examiner

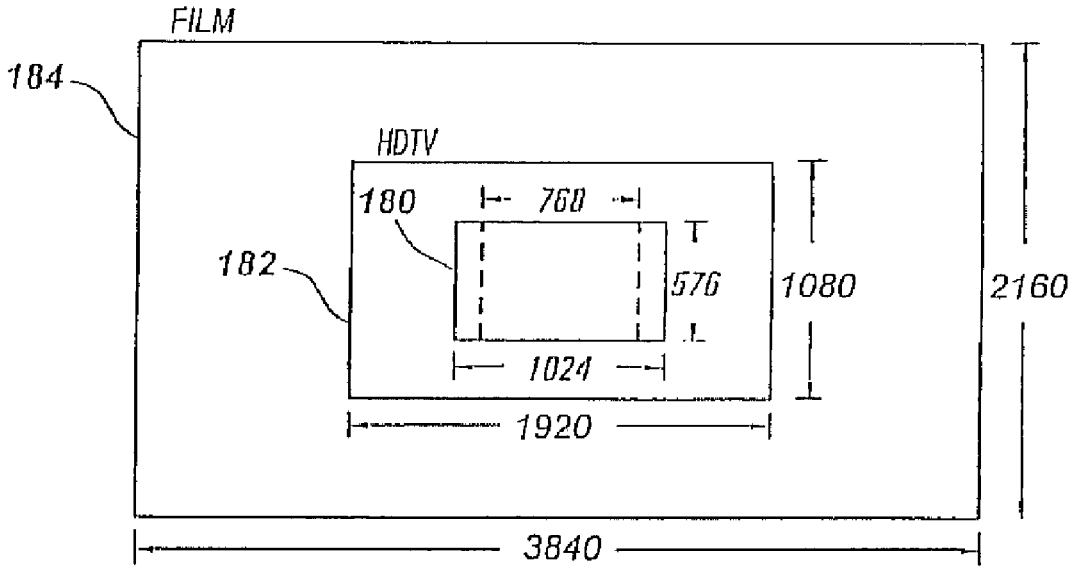


Figure 1a

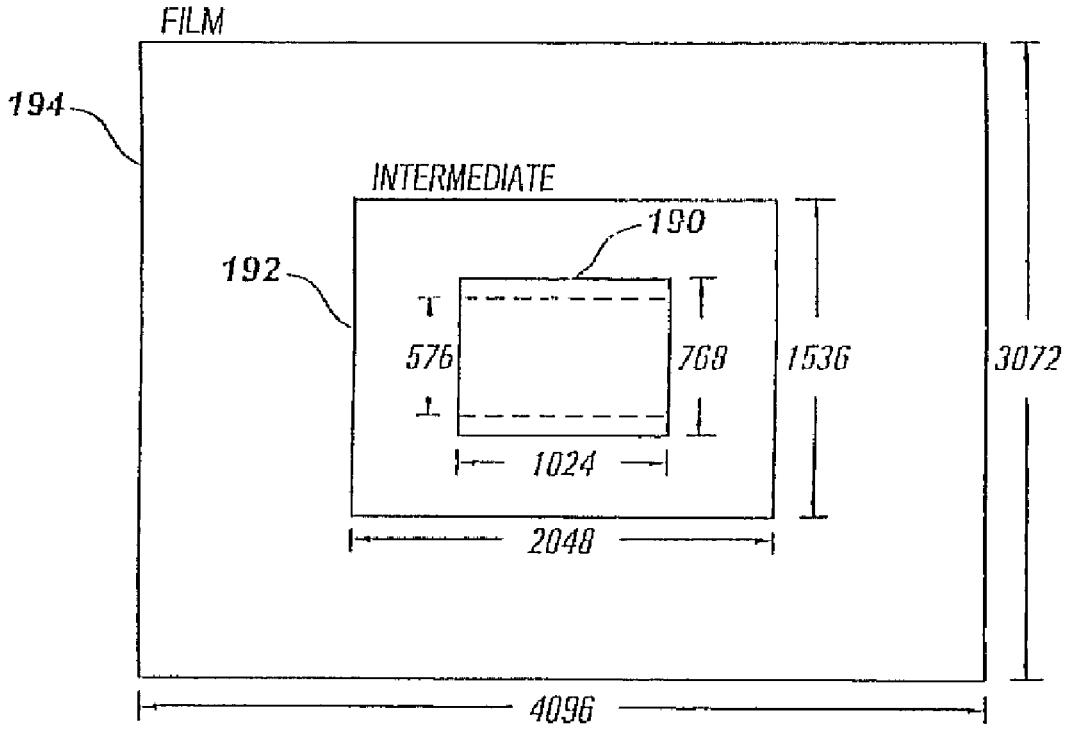


Figure 1b

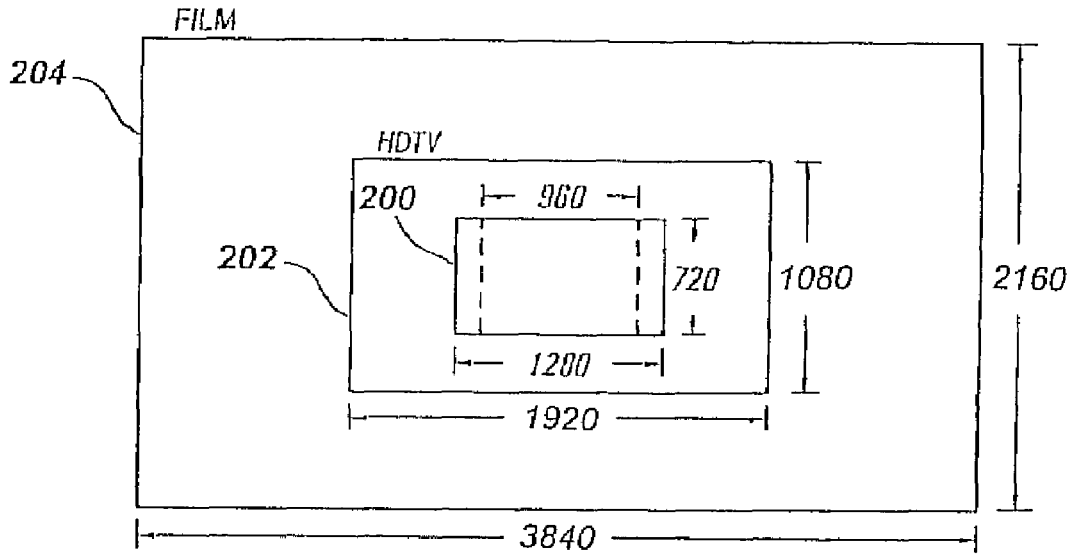


Figure 1c

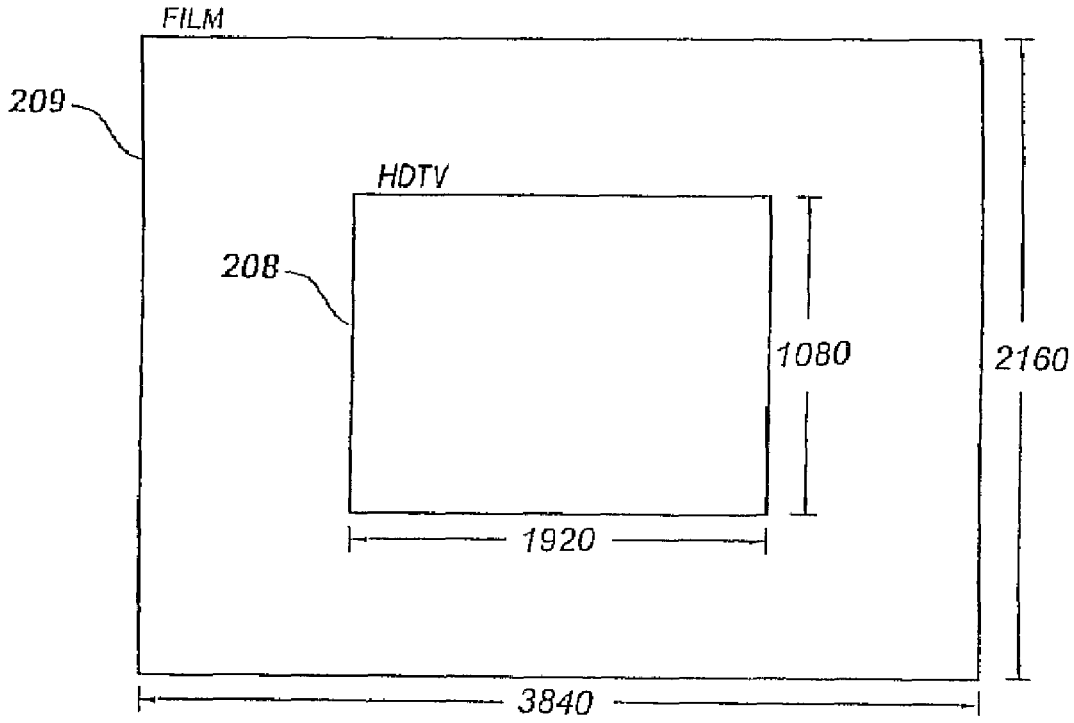


Figure 1d

DOCKET ALARM

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.