



US006542629B1

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

(10) **Patent No.:** **US 6,542,629 B1**
(45) **Date of Patent:** **Apr. 1, 2003**

(54) **DIGITAL IMAGING METHOD AND APPARATUS FOR DETECTION OF DOCUMENT SECURITY MARKS**

EP 0 664 642 7/1995
EP 0 675 631 10/1995
EP 0 751 475 1/1997
EP 0 789 270 8/1997

(75) Inventors: **John W. Wu**, Rancho Palos Verdes, CA (US); **Mike C. Chen**, Cerritos, CA (US); **Zhigang Fan**, Webster, NY (US); **Kien A. Phong**, Cerritos, CA (US)

OTHER PUBLICATIONS

U.S. application patent Ser. No. 09/328,481, Zhigang Fan, filed Jun. 9, 1999.

(73) Assignee: **Xerox Corporation**, Stamford, CT (US)

* cited by examiner

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

Primary Examiner—Bhavesh Mehta
Assistant Examiner—Barry Choobin

(57) **ABSTRACT**

(21) Appl. No.: **09/360,348**

(22) Filed: **Jul. 22, 1999**

(51) **Int. Cl.**⁷ **G06K 9/00**

(52) **U.S. Cl.** **382/135; 356/71; 902/7**

(58) **Field of Search** 382/135, 100; 209/534; 235/379; 356/71; 902/7

A method and apparatus for preventing or inhibiting effective reproduction of documents such as currency, checks, stock certificates, and any other printed document including a pre-defined security mark printed therein. The subject method and apparatus operate to effect a multi-step review of all digital image data acquired from a printed document to be reproduced for purposes of locating any potential security marks and further examining same for purposes of positively identifying a potential security mark as an actual security mark. If a mark is located and verified to be an authentic security mark, effective reproduction of the printed document will not be permitted and/or other security measures will be taken. A pretest of a mark consists of deleting the fine line patterns that may be printed on top of the mark by smoothing the data in an averaging process, and then determining the difference between the density of the darkest and lightest pixels in the area. A difference smaller than a predetermined value means that the mark is not valid.

(56) **References Cited**

U.S. PATENT DOCUMENTS

- 5,533,144 A * 7/1996 Fan 382/135
- 5,565,962 A * 10/1996 Yoshimoto 355/201
- 5,982,940 A * 11/1999 Sawada 382/260
- 6,052,484 A * 4/2000 Kobayashi 382/195
- 6,078,682 A * 6/2000 Tanioka et al. 382/135

FOREIGN PATENT DOCUMENTS

EP 0 608 118 7/1994

3 Claims, 11 Drawing Sheets

