



US006101602A

United States Patent [19]

[11] **Patent Number:** **6,101,602**

Fridrich

[45] **Date of Patent:** **Aug. 8, 2000**

[54] **DIGITAL WATERMARKING BY ADDING RANDOM, SMOOTH PATTERNS**

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[21] Appl. No.: **08/986,695**

[22] Filed: **Dec. 8, 1997**

[51] **Int. Cl.⁷** **H04L 9/00**

[52] **U.S. Cl.** **713/176**

[58] **Field of Search** 380/4, 5, 28, 51, 380/54, 43, 48, 200, 201, 263; 713/176, 168

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Primary Examiner—Tod B. Swann

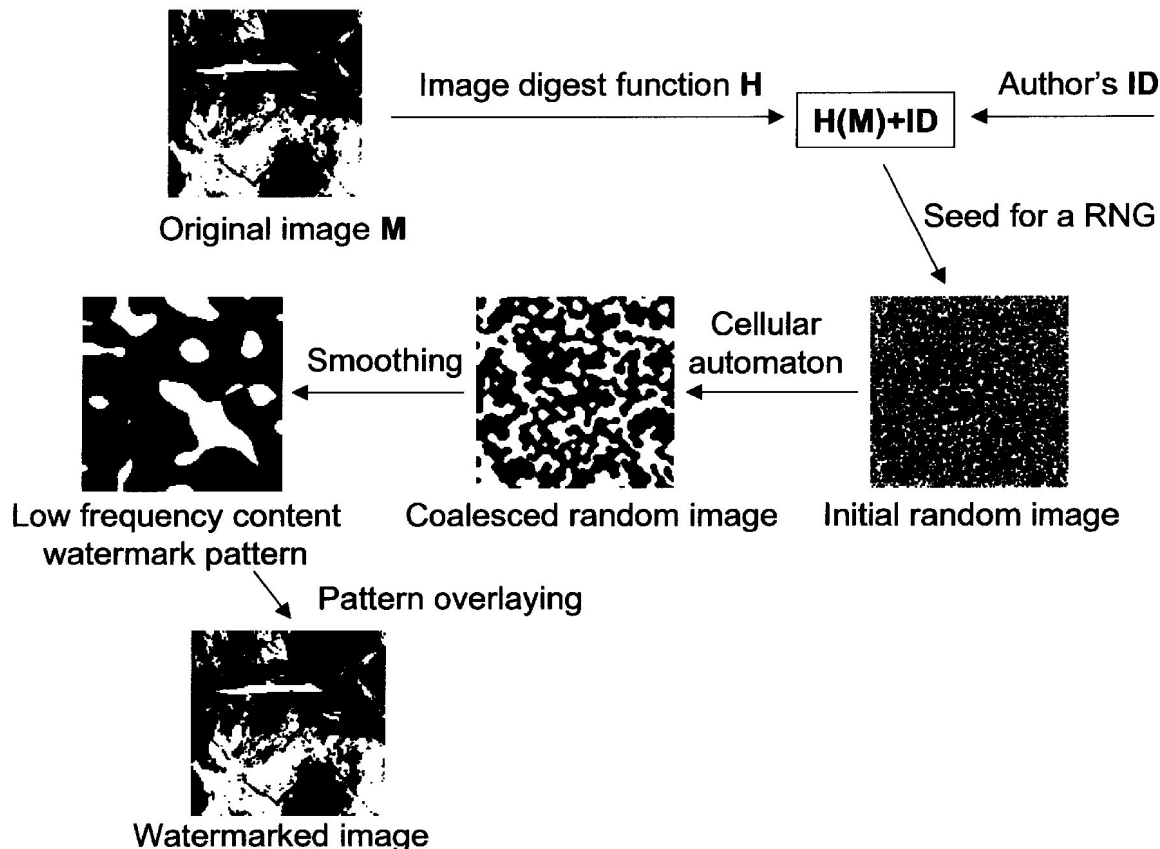
Assistant Examiner—Matthew Smithers

Attorney, Agent, or Firm—Harold L. Burstyn

[57] **ABSTRACT**

A digital image is "watermarked", that is, authenticated by an embedded pattern. The pattern is created by hashing the image and adding a signature element. Manipulating this result by the seed for a random number generator leads to an initial two dimensional random black-and-white pattern. This pattern is manipulated by a cellular automaton and smoothed before being added to the original image. To determine whether the image is authentic, one retrieves the watermark by subtracting the watermarked image from the original to obtain the difference. The value of the correlation between the difference thus obtained and the smoothed pattern determines the presence or absence of the watermark.

22 Claims, 4 Drawing Sheets



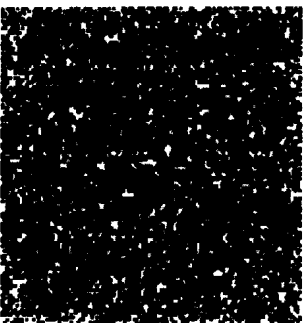


Figure 1(a)

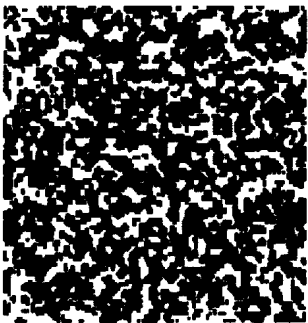


Figure 1(b)

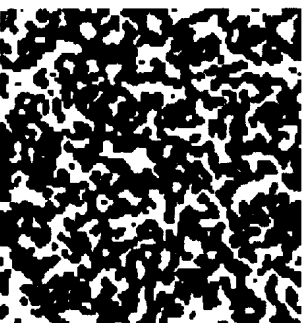


Figure 1(c)

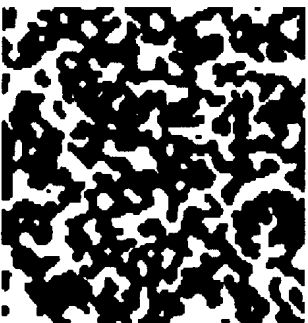


Figure 1(d)

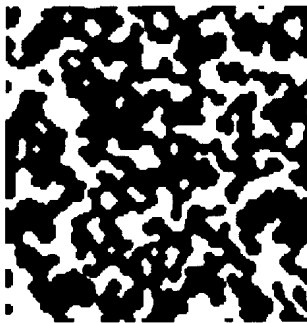


Figure 1(e)

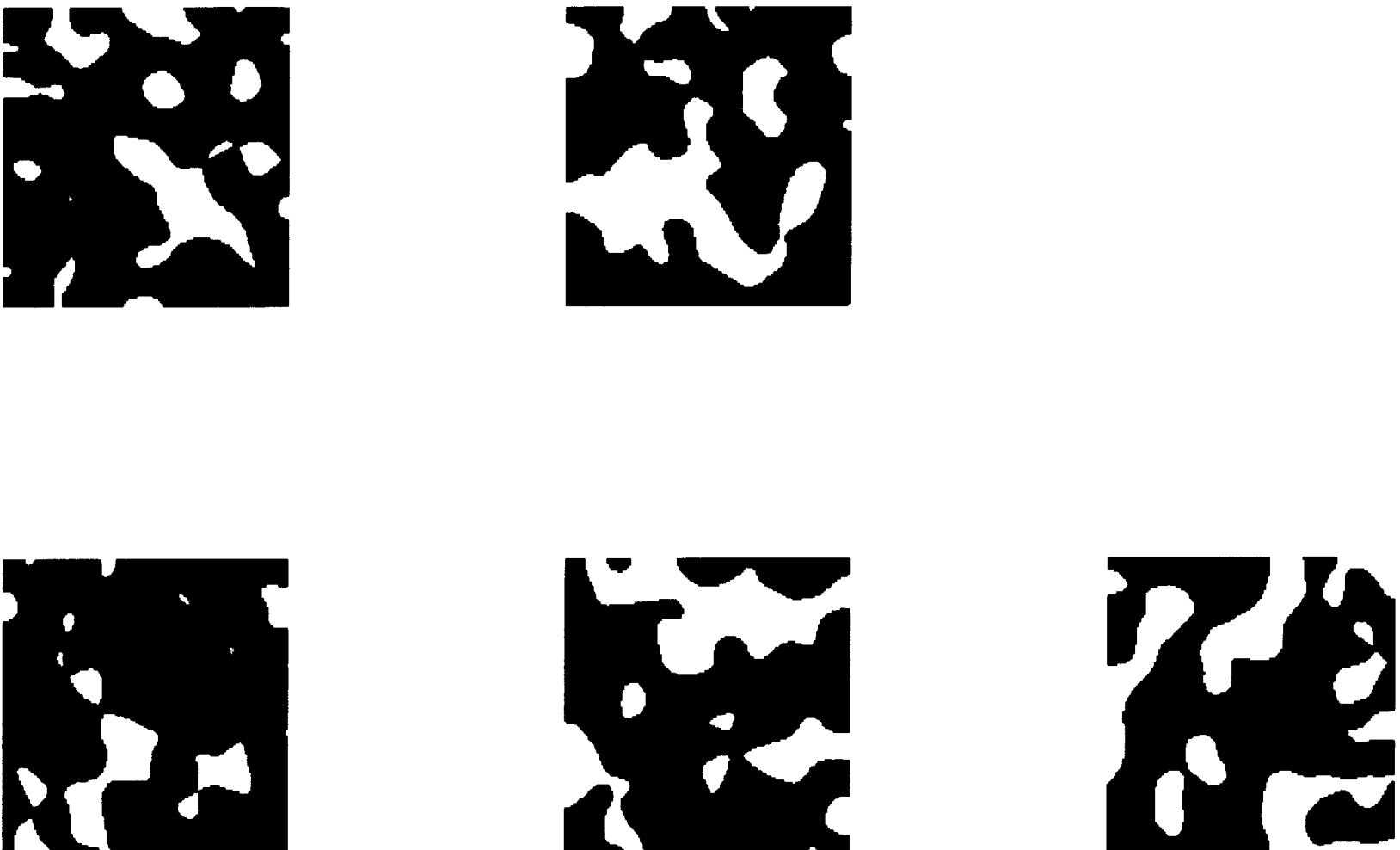


Figure 2

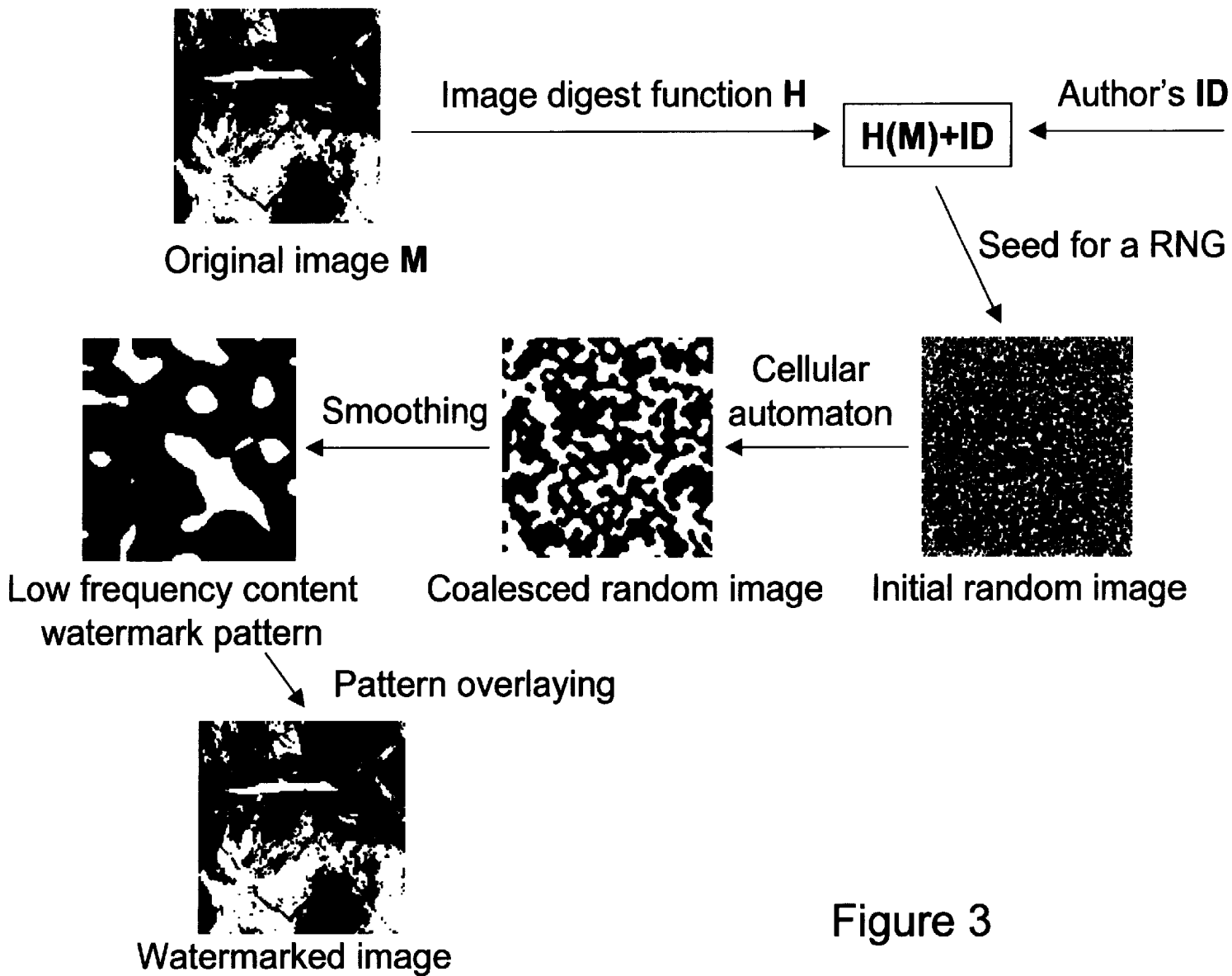


Figure 3

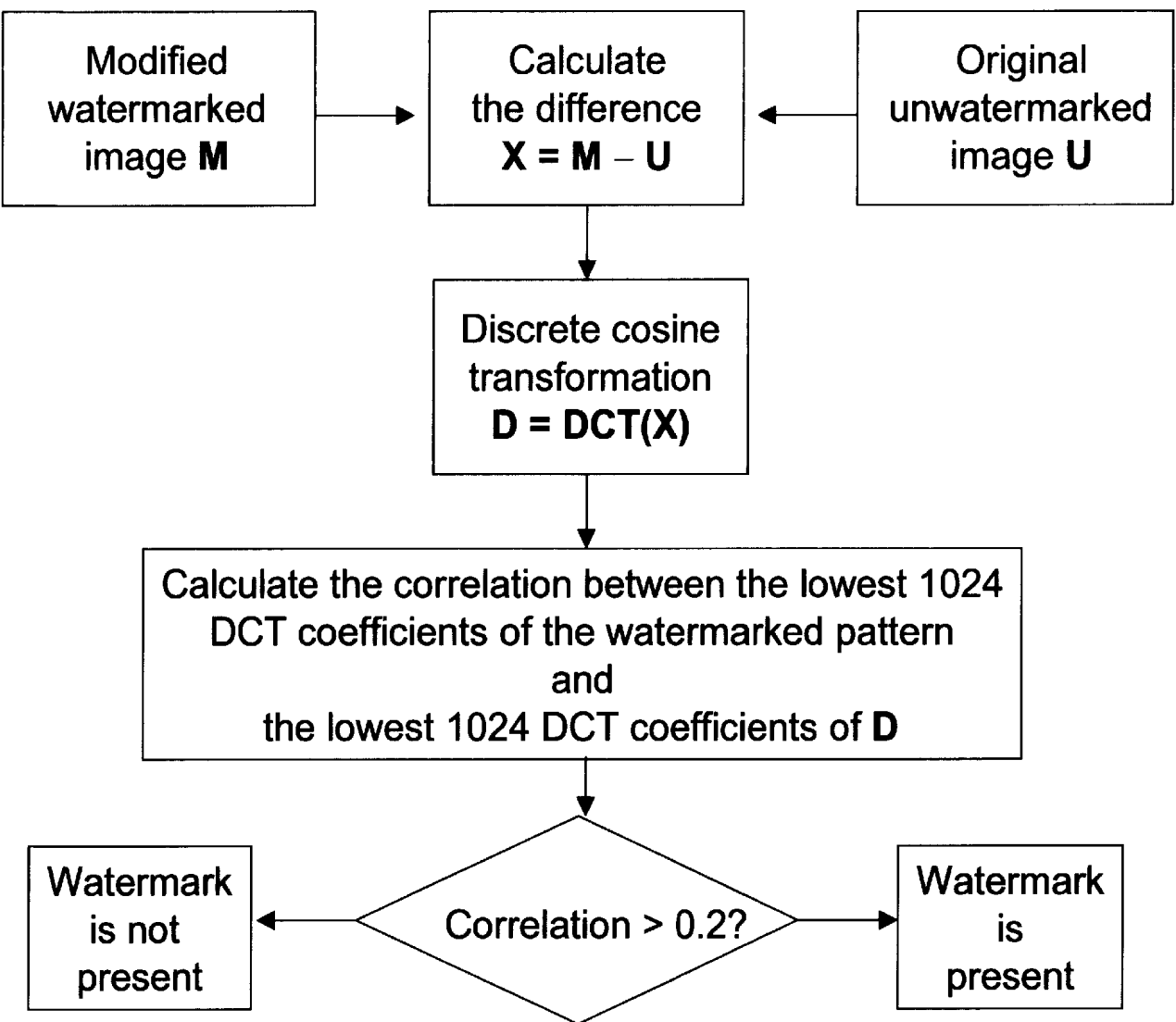


Figure 4

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