# United States Patent [19]

## Lin

[54] **FACE RECOGNITION APPARATUS, METHOD, SYSTEM AND COMPUTER READABLE MEDIUM THEREOF**

[75] Inventor: **Shang-Hung Lin**, San Jose, Calif.

[73] Assignee: **Seiko Epson Corporation**, Tokyo, Japan

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### Related U.S. Application Data

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[51] **Int. Cl.$^7$** ....................................................... **G06K 9/00**
[52] **U.S. Cl.** ............................................ **382/118**; 382/217
[58] **Field of Search** ..................................... 382/117, 118, 382/157, 291, 116, 155, 156, 158, 159, 190, 209, 199, 217, 218; 340/825.34; 348/77, 78; 380/23

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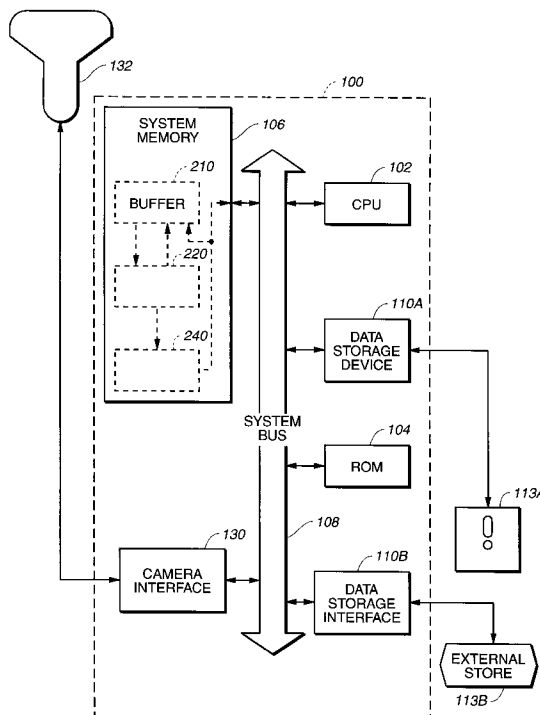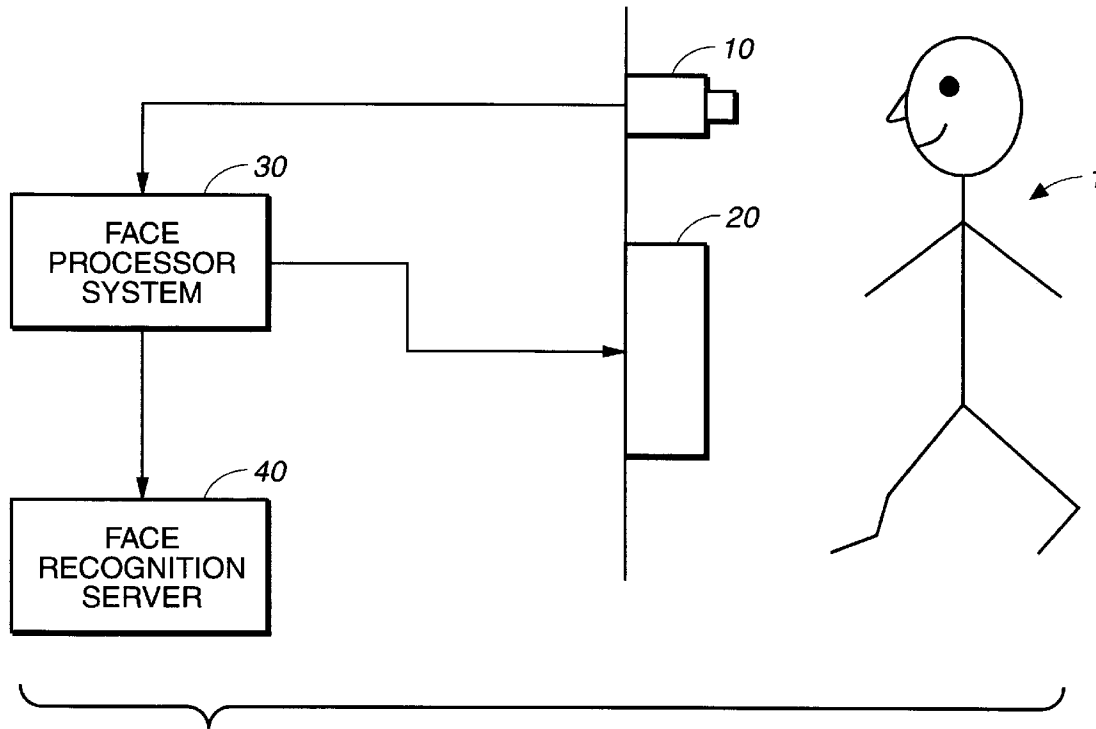#### U.S. PATENT DOCUMENTS

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*Primary Examiner*—Jon Chang
*Assistant Examiner*—Vikkram Bali
*Attorney, Agent, or Firm*—Eric B. Janofsky
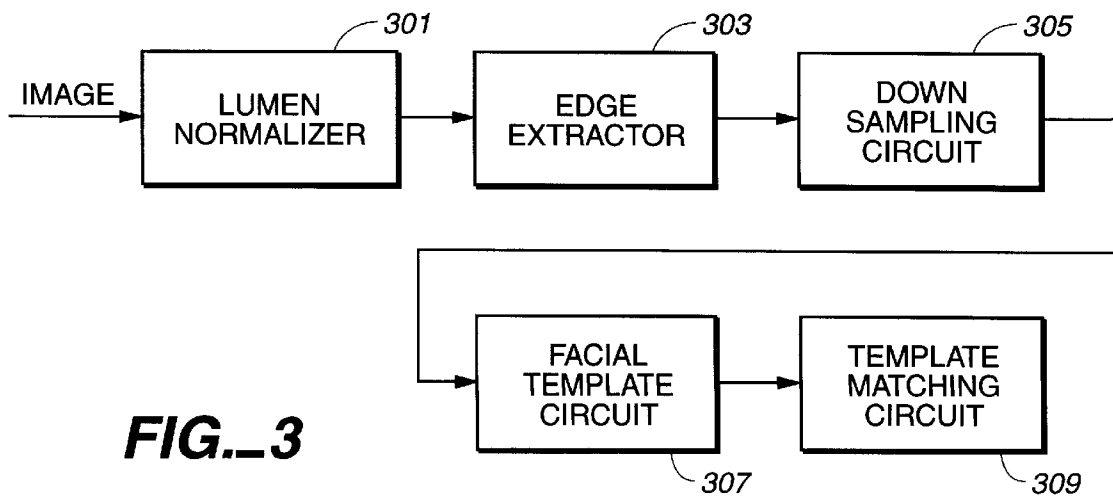
[57] **ABSTRACT**

A face recognition system is provided comprising an input process or circuit, such as a video camera for generating an image of a person. A face detector process or circuit determines if a face is present in a image. A face position registration process or circuit determines a position of the face in the image if the face detector process or circuit determines that the face is present. A feature extractor process or circuit is provided for extracting at least two facial features from the face. A voting process or circuit compares the extractor facial features with a database of extracted facial features to identify the face.
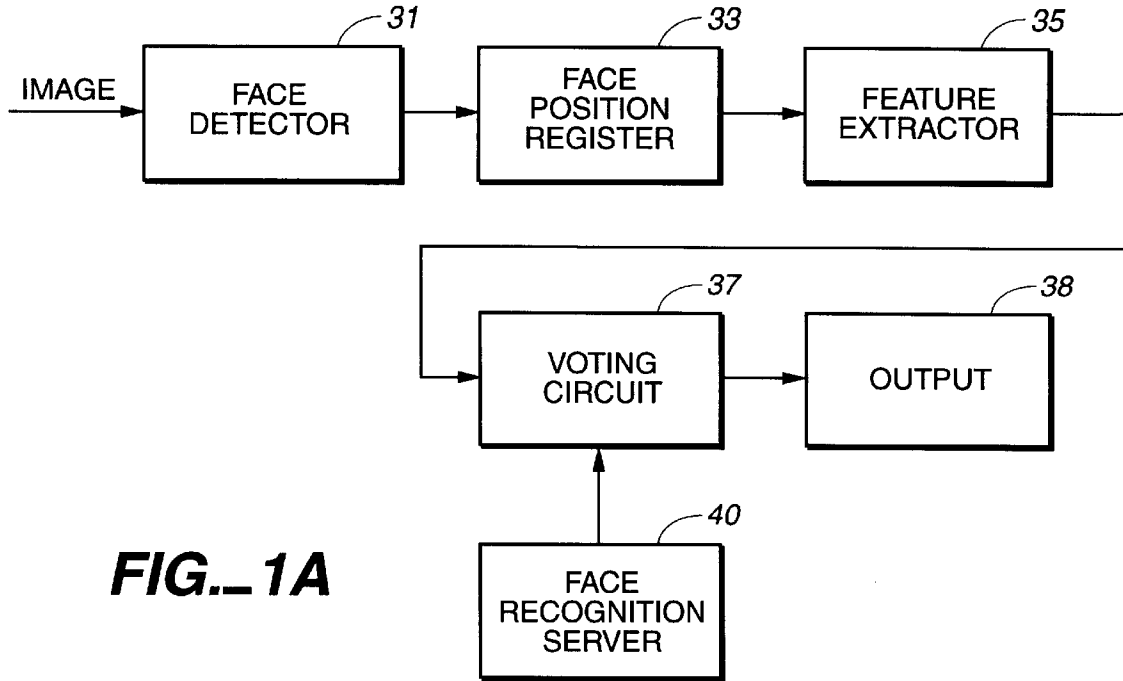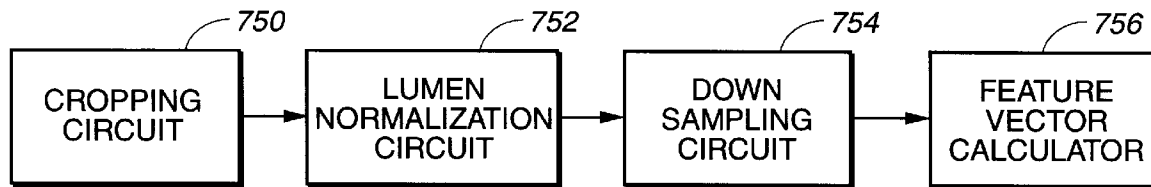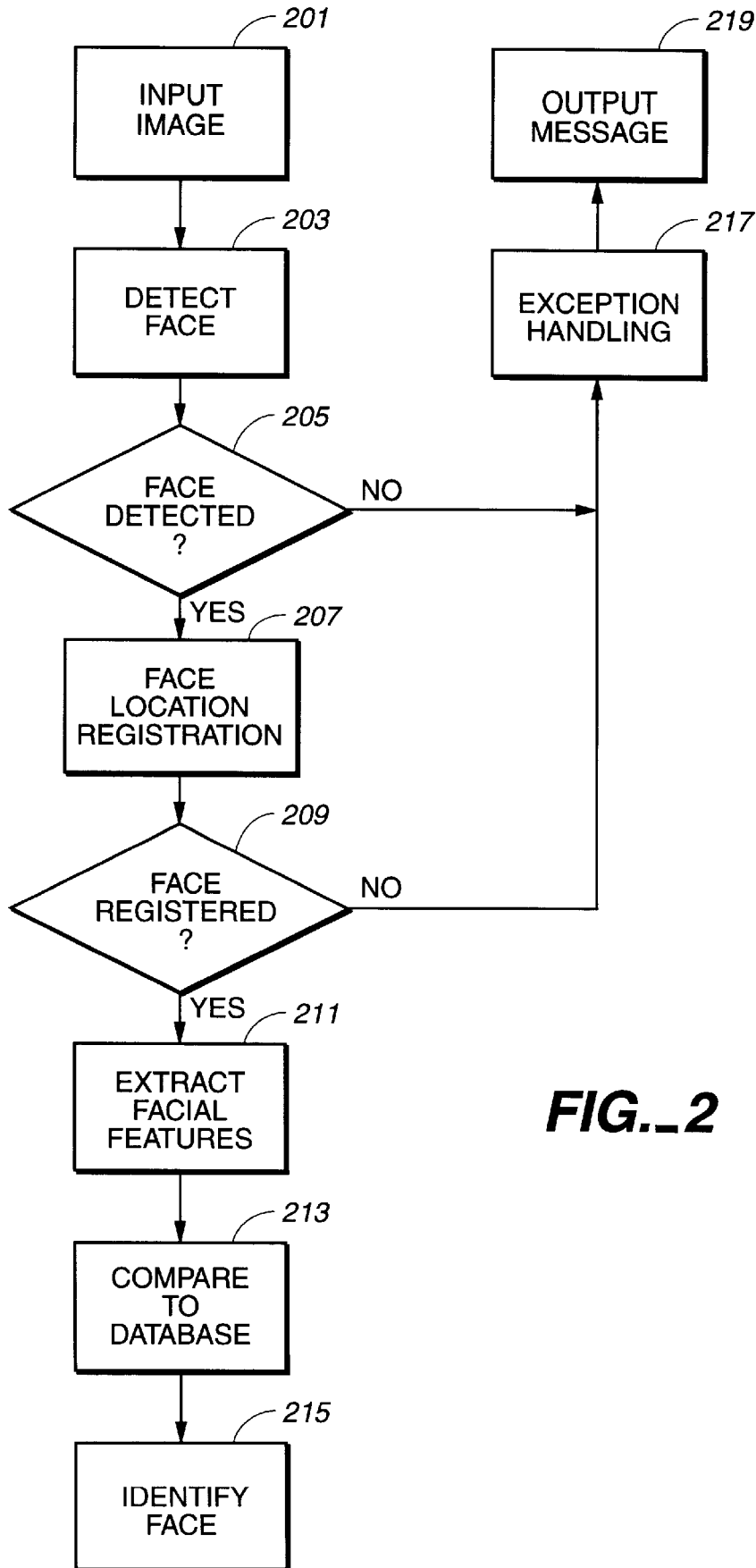
**90 Claims, 12 Drawing Sheets**
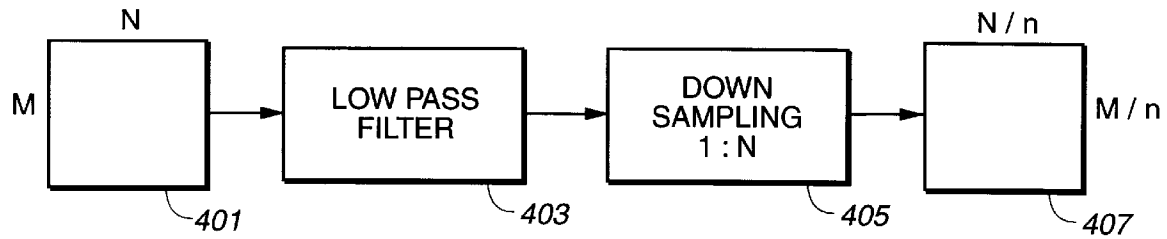
*FIG._1*



*FIG._3*

IMAGE → FACE DETECTOR *31* → FACE POSITION REGISTER *33* → FEATURE EXTRACTOR *35*

→ VOTING CIRCUIT *37* → OUTPUT *38*

FACE RECOGNITION SERVER *40*

*FIG._1A*

CROPPING CIRCUIT *750* → LUMEN NORMALIZATION CIRCUIT *752* → DOWN SAMPLING CIRCUIT *754* → FEATURE VECTOR CALCULATOR *756*

*FIG._7A*

*FIG._2*

N

M

401

→

LOW PASS
FILTER

403

→

DOWN
SAMPLING
1 : N

405

→

N / n

M / n

407

## *FIG._4*

IMAGE →

501

LUMEN
NORMALIZER

→

503

EDGE
EXTRACTOR

→

505

DOWN
SAMPLING
CIRCUIT

EYE
TEMPLATE
CIRCUIT

507

→

TEMPLATE
MATCHING
CIRCUIT

509

→

FACE
ALIGNER

511

## *FIG._5*

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