United States Patent [19]

Bolle et al.

[54] **PRODUCE RECOGNITION SYSTEM**

[75] Inventors: **Rudolf M. Bolle**, Bedford Hills;
Jonathan H. Connell, Cortlandt-Manor;
Norman Haas, Mount Kisco, all of
N.Y.; **Rakesh Mohan**, Stamford, Conn.;
Gabriel Taubin, Hartsdale, N.Y.

[73] Assignee: **International Business Machines Corporation**, Armonk, N.Y.

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[57] **ABSTRACT**

The present system and apparatus uses image processing to recognize objects within a scene. The system includes an illumination source for illuminating the scene. By controlling the illumination source, an image processing system can take a first digitize image of the scene with the object illuminated a higher level and a second digitized image with the object illuminated at a lower level. Using an algorithm, the object(s) image is segmented from a background image of the scene by a comparison of the two digitized images taken. A processed image (that can be used to characterize features) of the object(s) is then compared to stored reference images. The object is recognized when a match occurs. The system can recognize objects independent of size and number and can be trained to recognize objects that is was not originally programmed to recognize.
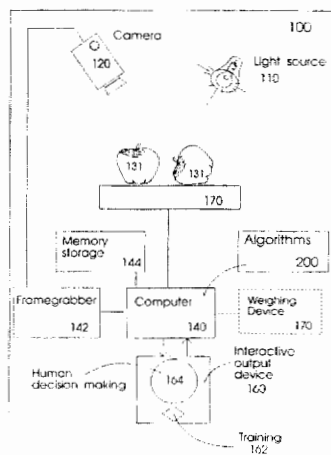
32 Claims, 16 Drawing Sheets

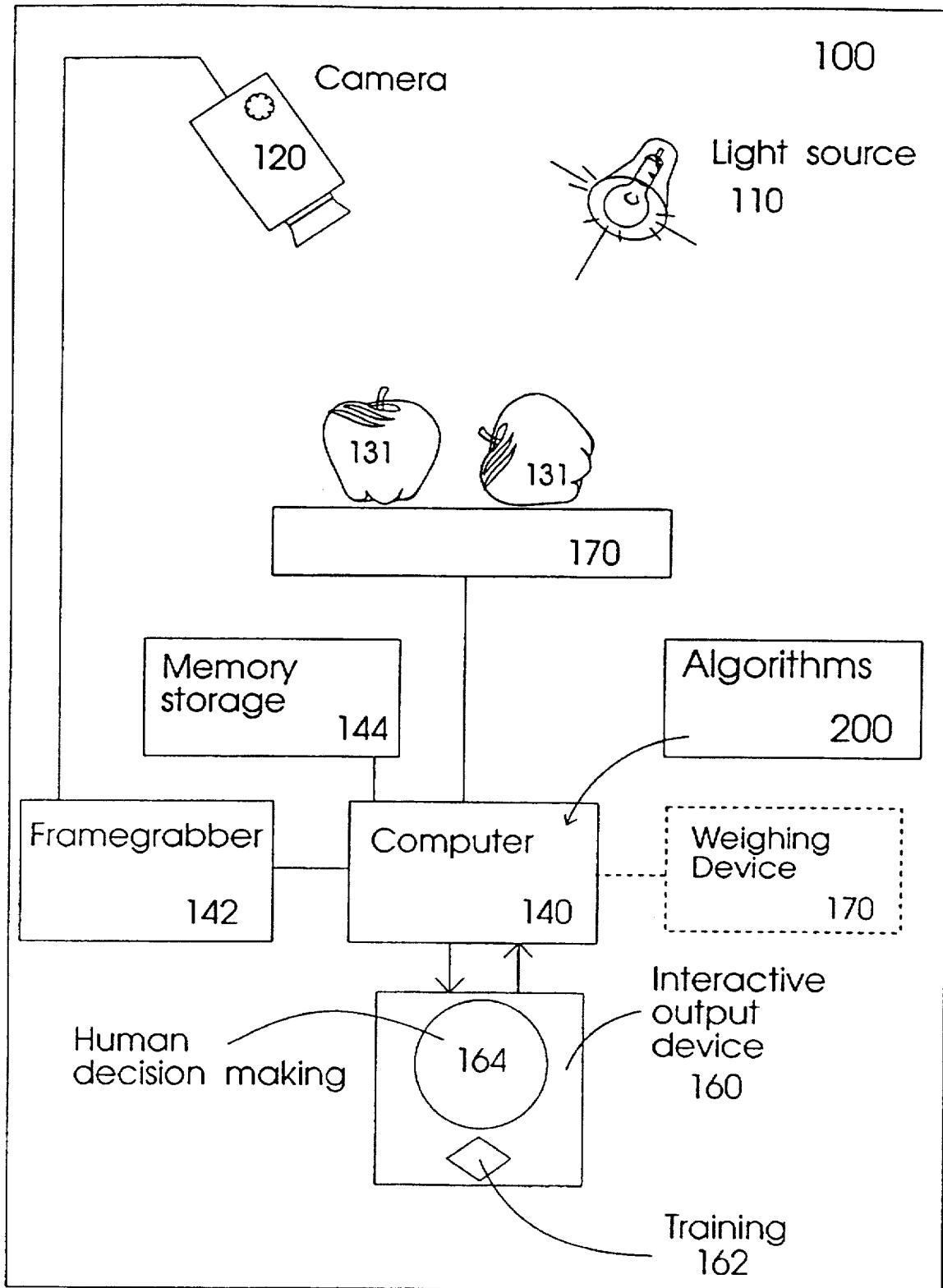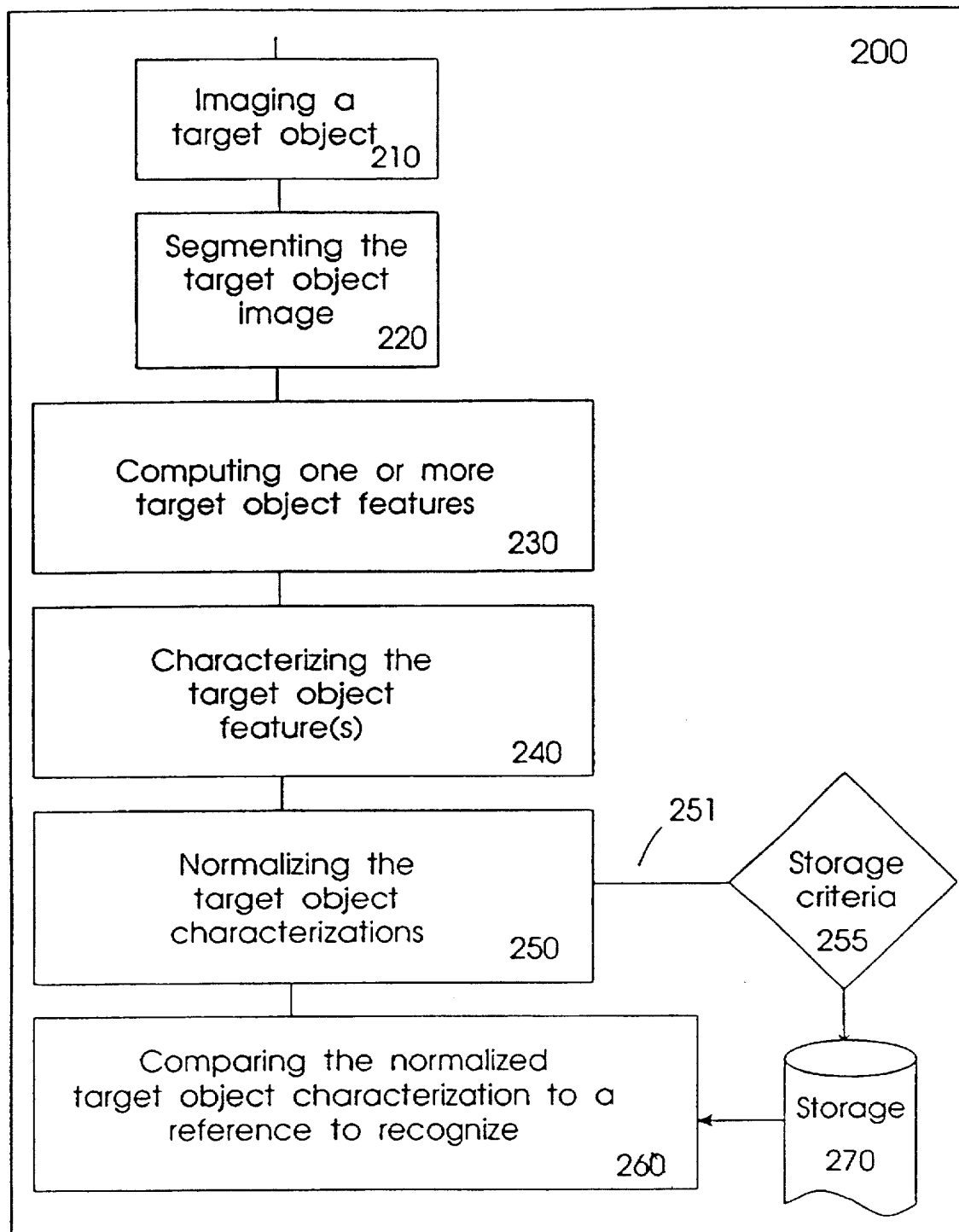# FIG. 1

FIG. 2

Imaging a target object 210

Segmenting the target object image 220

Computing one or more target object features 230

Characterizing the target object feature(s) 240

Normalizing the target object characterizations 250

251

Storage criteria 255

Comparing the normalized target object characterization to a reference to recognize 260

Storage 270

200

FIG. 3a

First image

Second image

FIG. 3b

First image

Second image

FIG. 4

Background	312

131

405

403

407

420

410

Camera

120

110
Light

401

Control

450

Frame
grabber

142
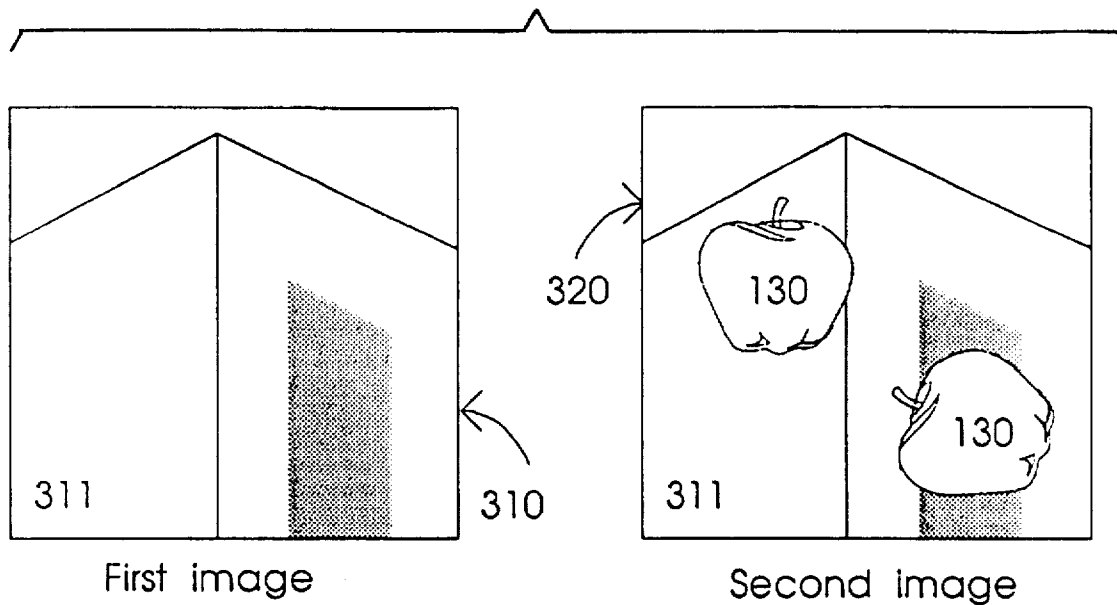
Computer
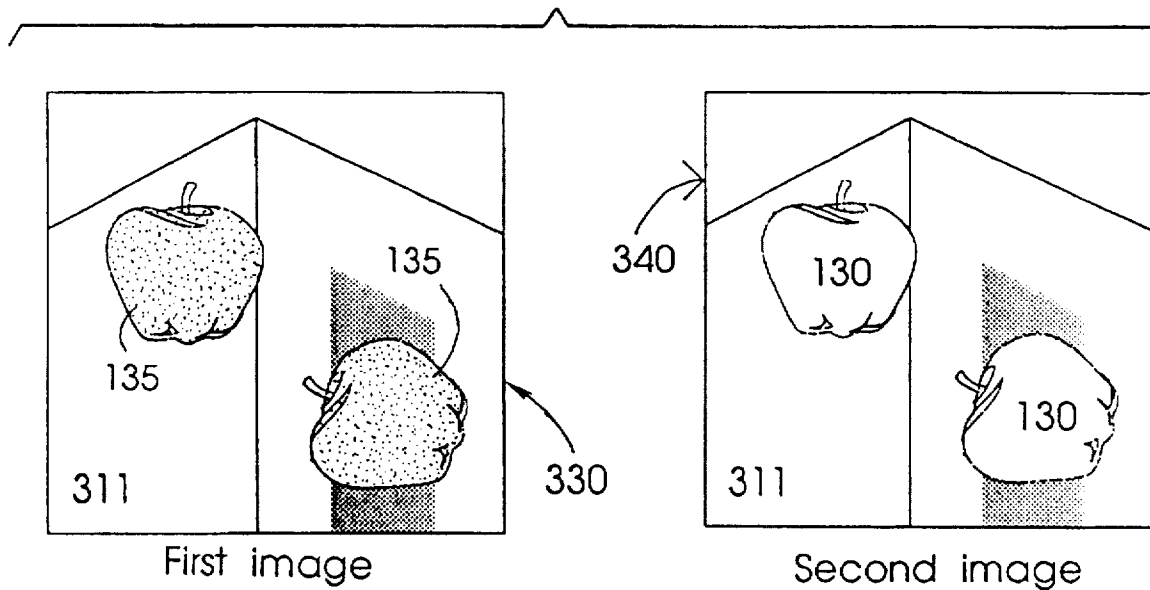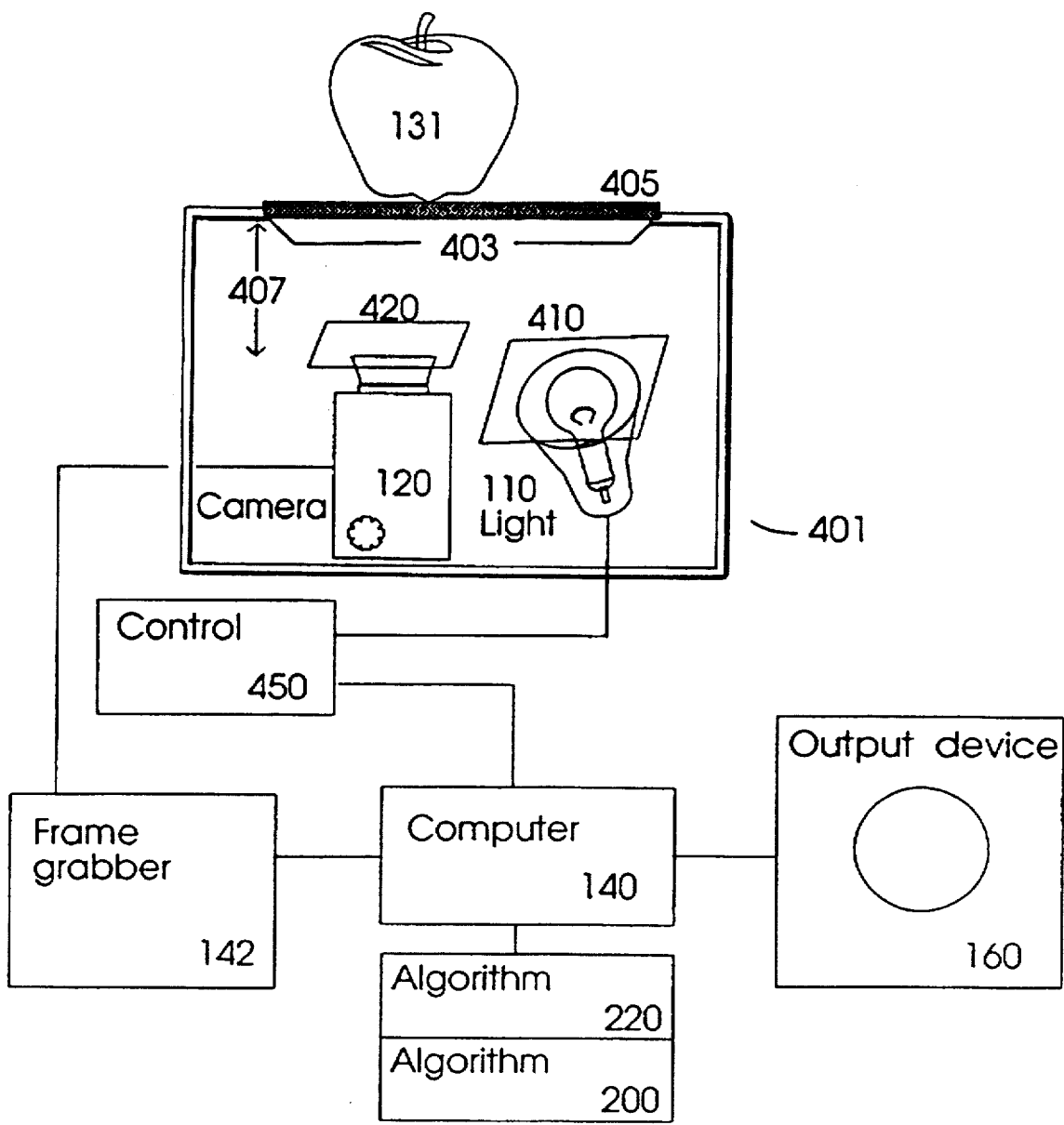
140

Output device

160

Algorithm

220

Algorithm

200

400

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