



# United States Patent [19]

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**Bolle et al.**

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[54] **PRODUCE RECOGNITION SYSTEM**

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[21] Appl. No.: **235,834**

[22] Filed: **Apr. 29, 1994**

[51] Int. Cl.<sup>6</sup> ..... **G06K 9/46; G06K 9/66**

[52] U.S. Cl. .... **382/190; 382/110; 382/164;**  
**382/165; 382/170; 382/173**

[58] **Field of Search** ..... **382/110, 164,**  
**382/165, 170, 173, 190, 199, 181**

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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**

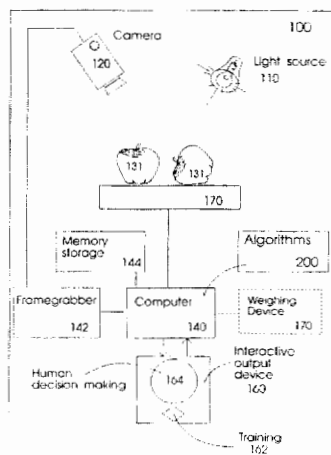


FIG. 1

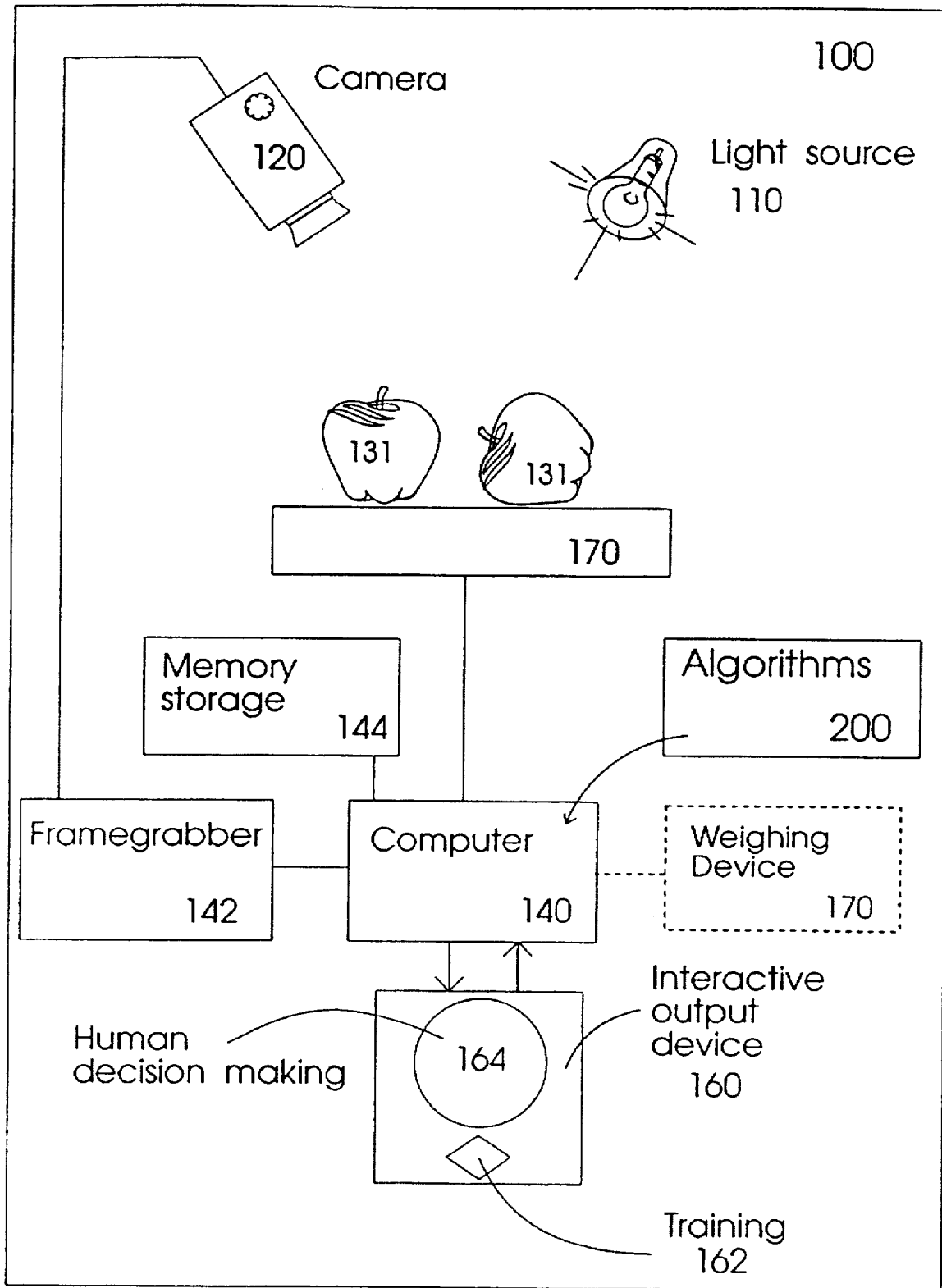


FIG. 2

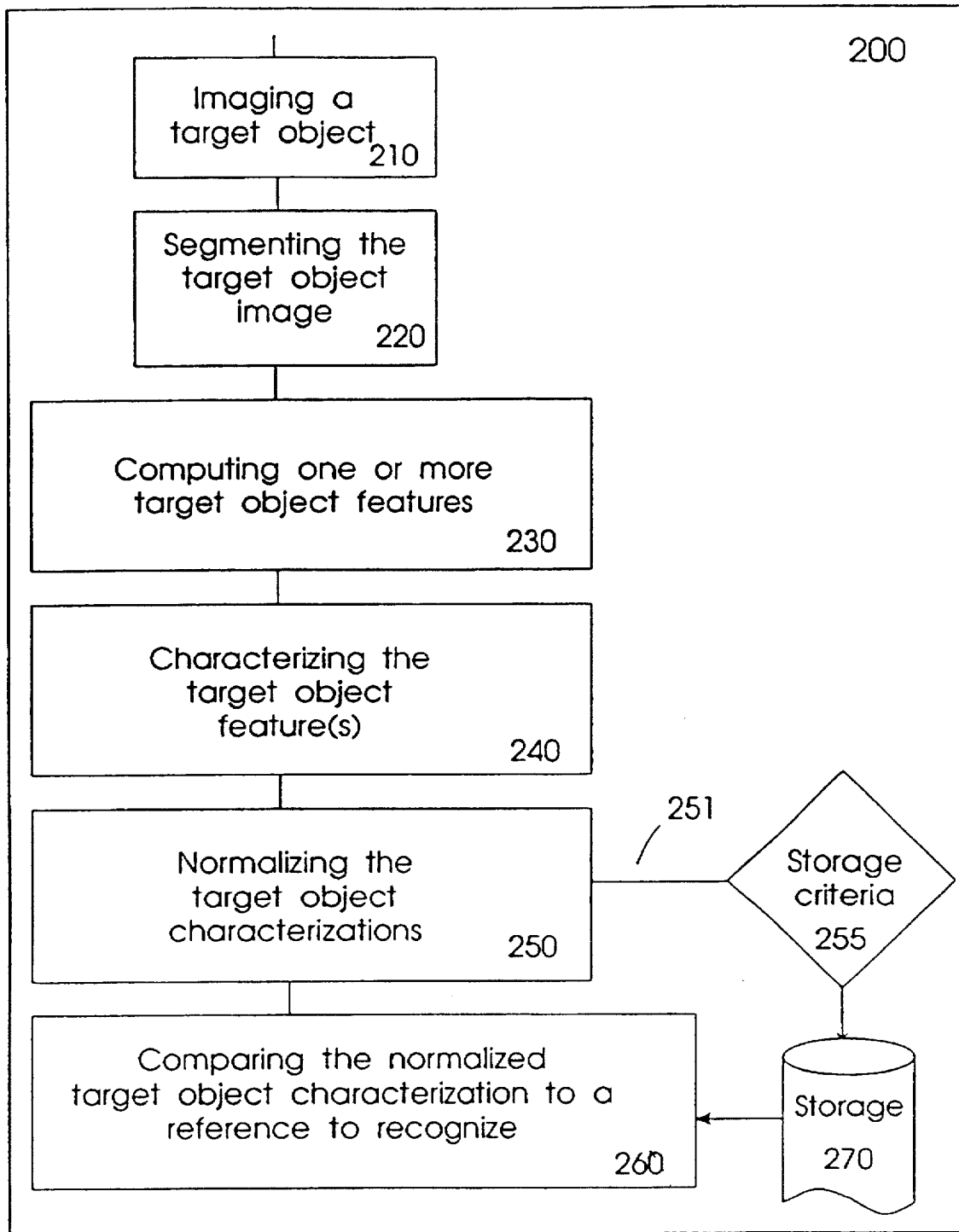


FIG. 3a

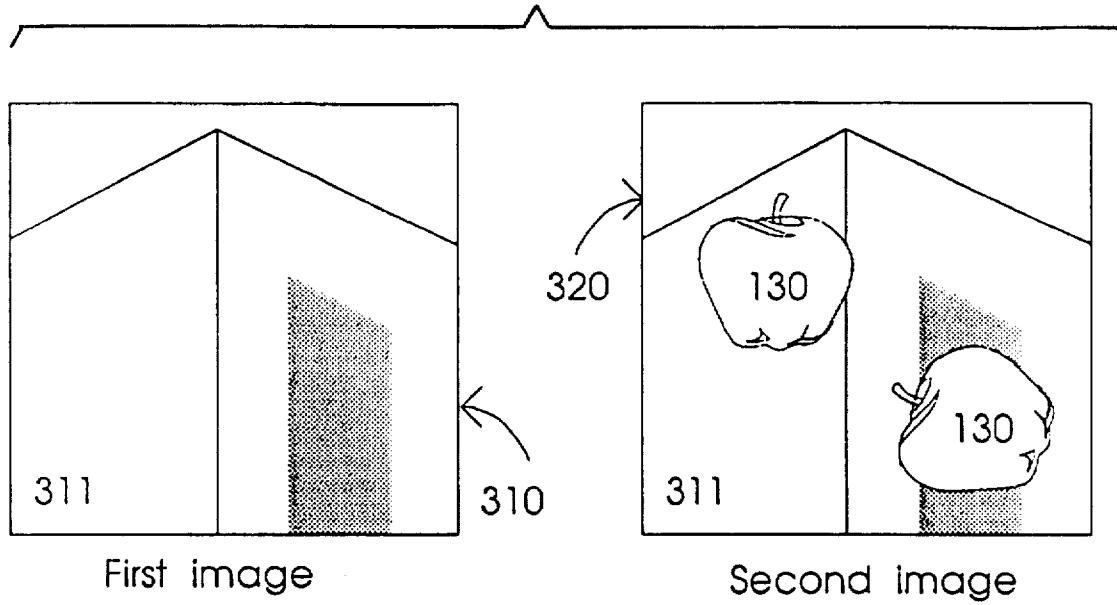


FIG. 3b

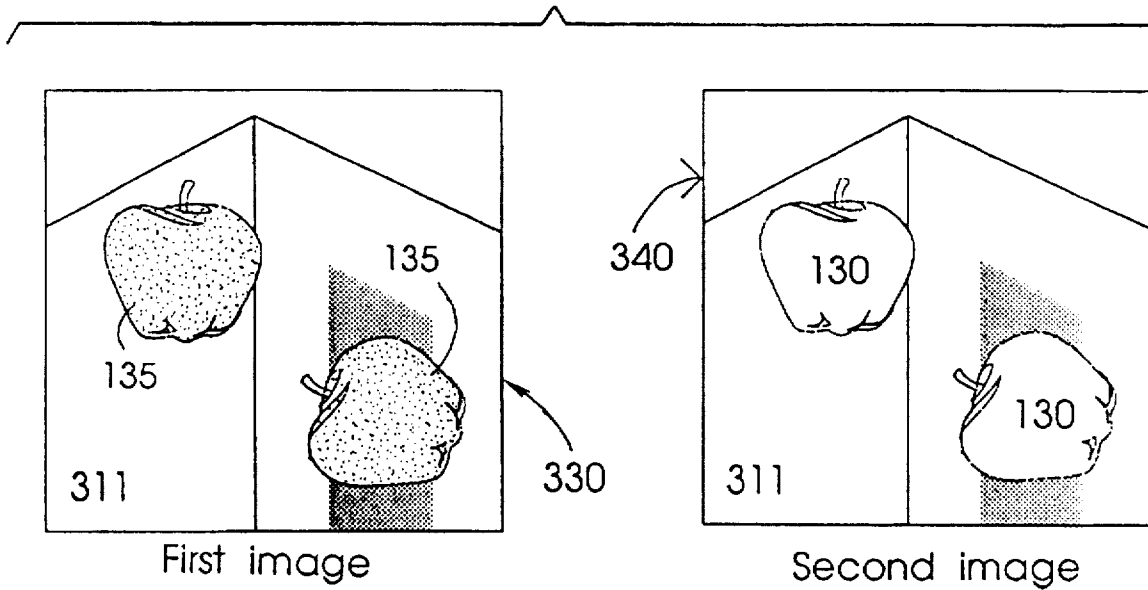
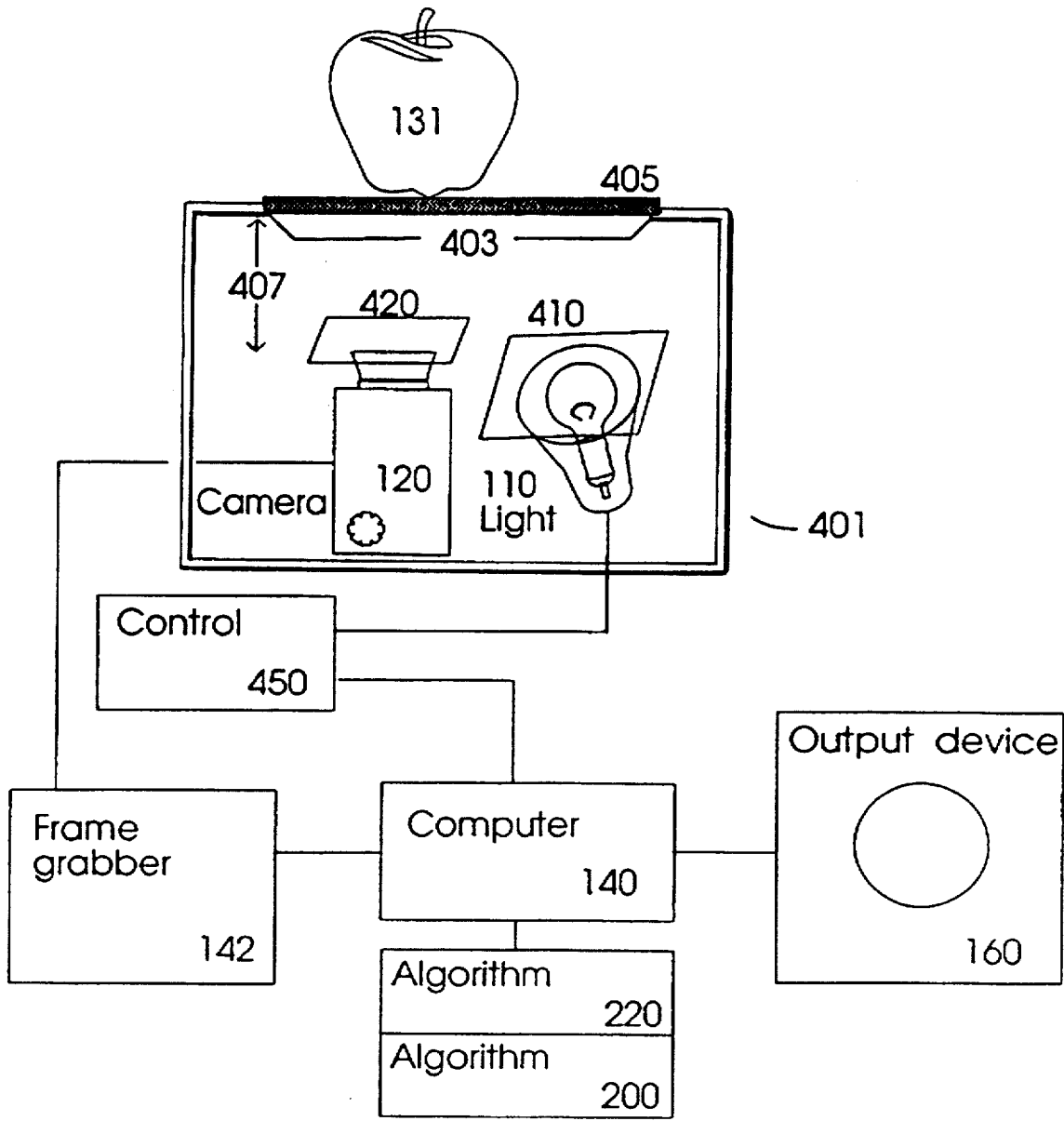


FIG. 4

Background 312



400

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