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United States Patent [19]

Sanderford et al.

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[45] **Date of Patent: Feb. 10, 1998**

[54] **ENHANCED POSITION CALCULATION**

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[73] Assignee: **Sanconix Inc.**, New Orleans, La.

[21] Appl. No.: **487,522**

[22] Filed: **Jun. 7, 1995**

[51] **Int. Cl.**[6] **G01S 3/02**

[52] **U.S. Cl.** **342/457**; 342/363

[58] **Field of Search** 342/363, 457; 364/443, 449, 449.1

[56] **References Cited**

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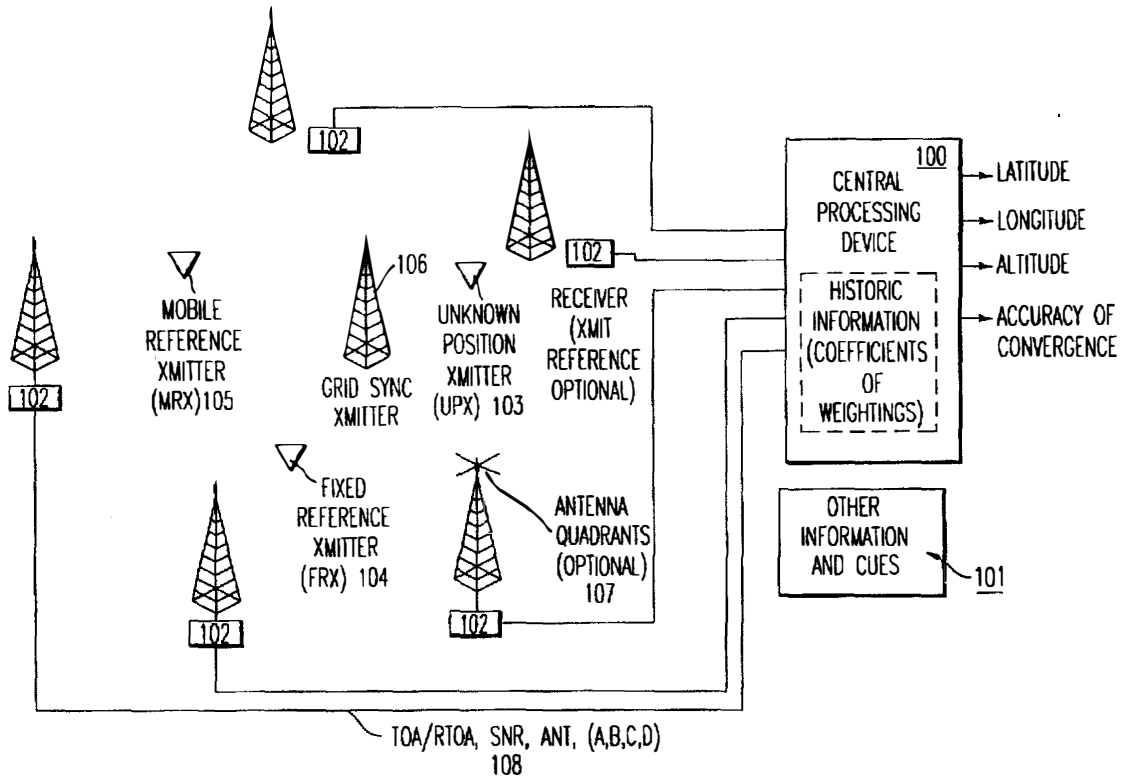
Primary Examiner—Theodore M. Blum
Attorney, Agent, or Firm—Oblon, Spivak, McClelland, Maier & Neustadt, P.C.

[57] **ABSTRACT**

The invention discloses several computation and control techniques which use historic information as well as other cues in order to enhance the accuracy of a radio position fix. These computational techniques include neural networks, mapped grid coefficients as input to a set of simultaneous or differential equations, and table lookup of correction coefficients for known low accuracy positions. The invention further discloses techniques for receiver array synchronization so that all system elements in a particular coverage area obtain a time reference appropriate for time of flight radio location measurements. The invention further teaches techniques to enhance the accuracy of a position fix by use of both fixed references, which are located in a coverage area, as well as a mobile reference carried by a search team. The invention also discloses techniques to provide information appropriate to guide a search team to an unknown positioned transmitter that is located within a building or structure. The invention discloses techniques to train a central computing unit, by using actuarial data, so that multi-path errors resulting from fixed or mobile obstacles may be reduced.

47 Claims, 11 Drawing Sheets



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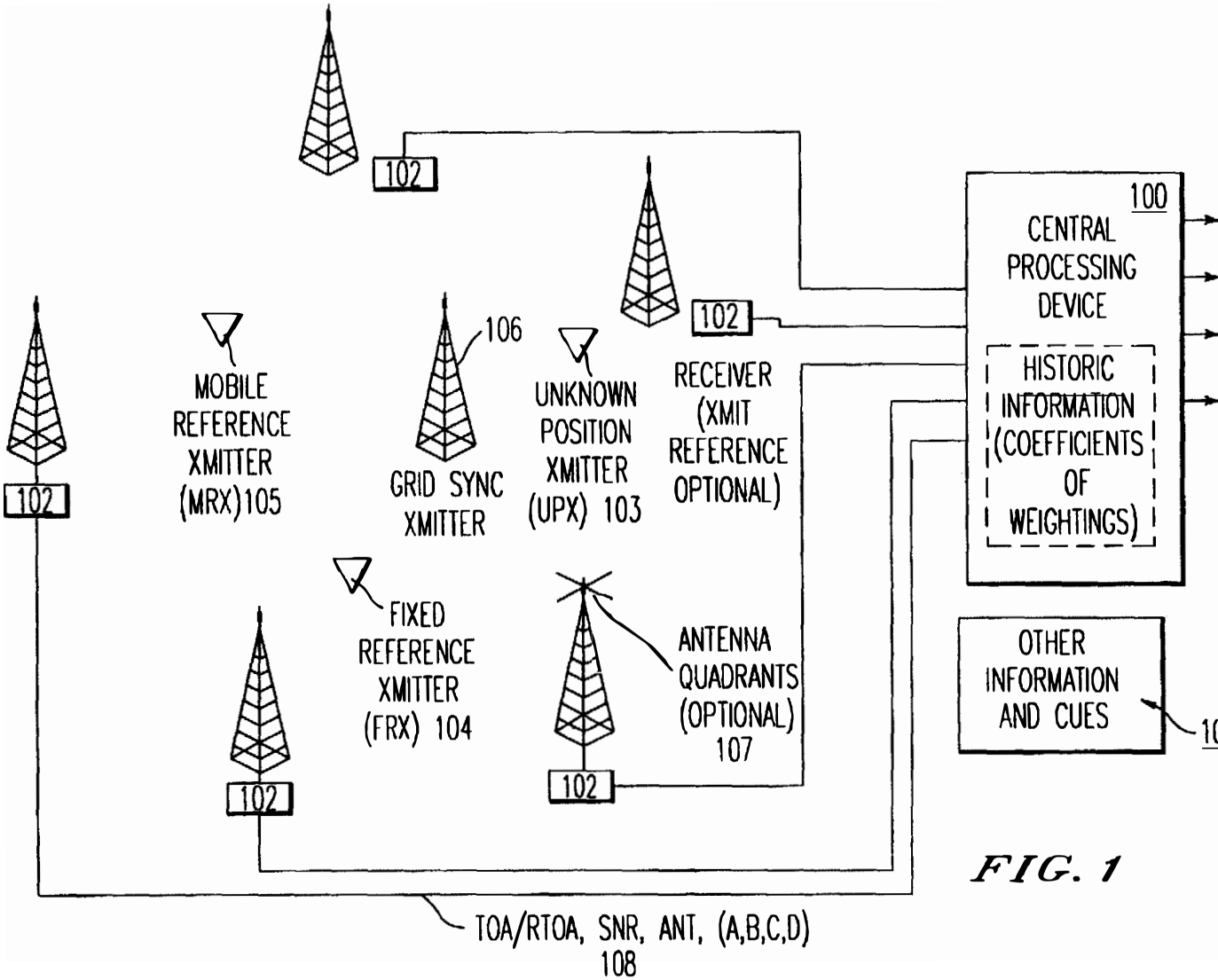

FIG. 1

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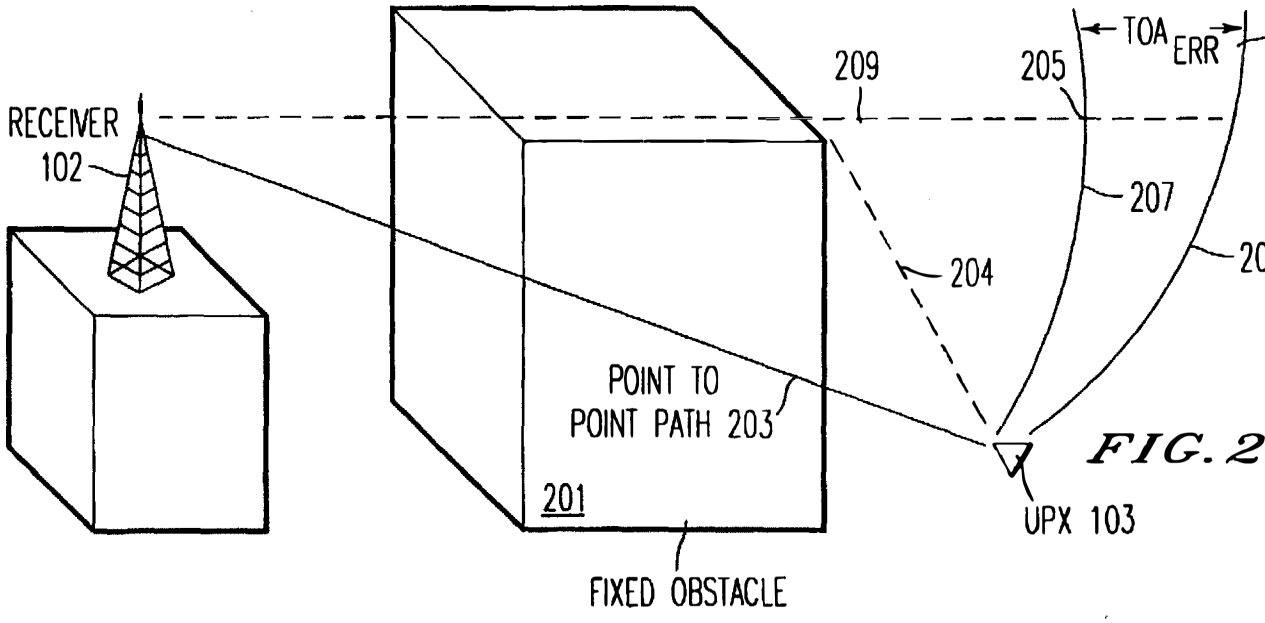

FIG. 2

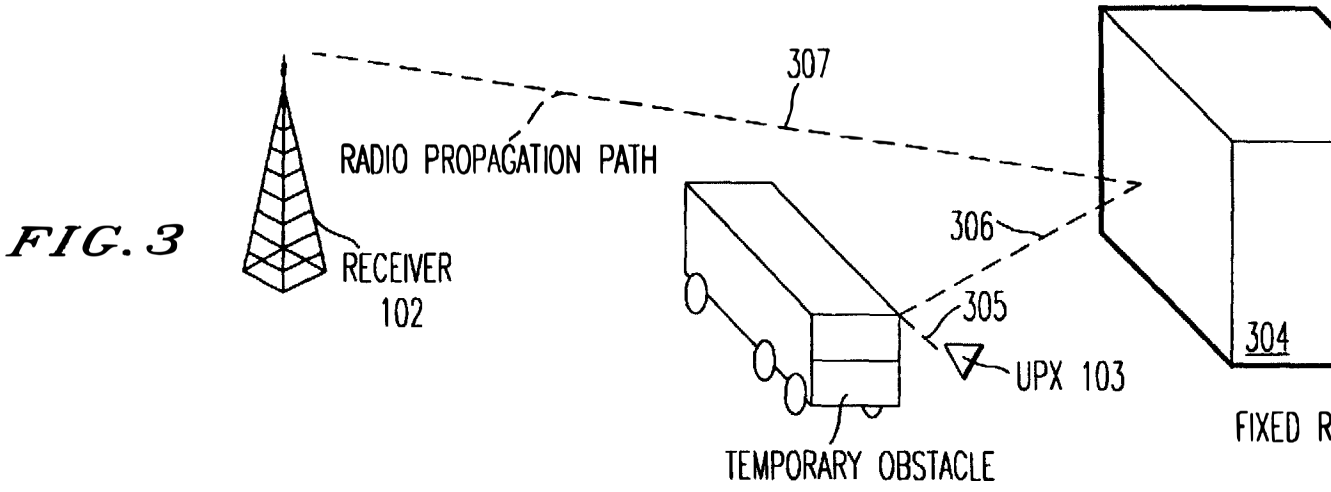

FIG. 3

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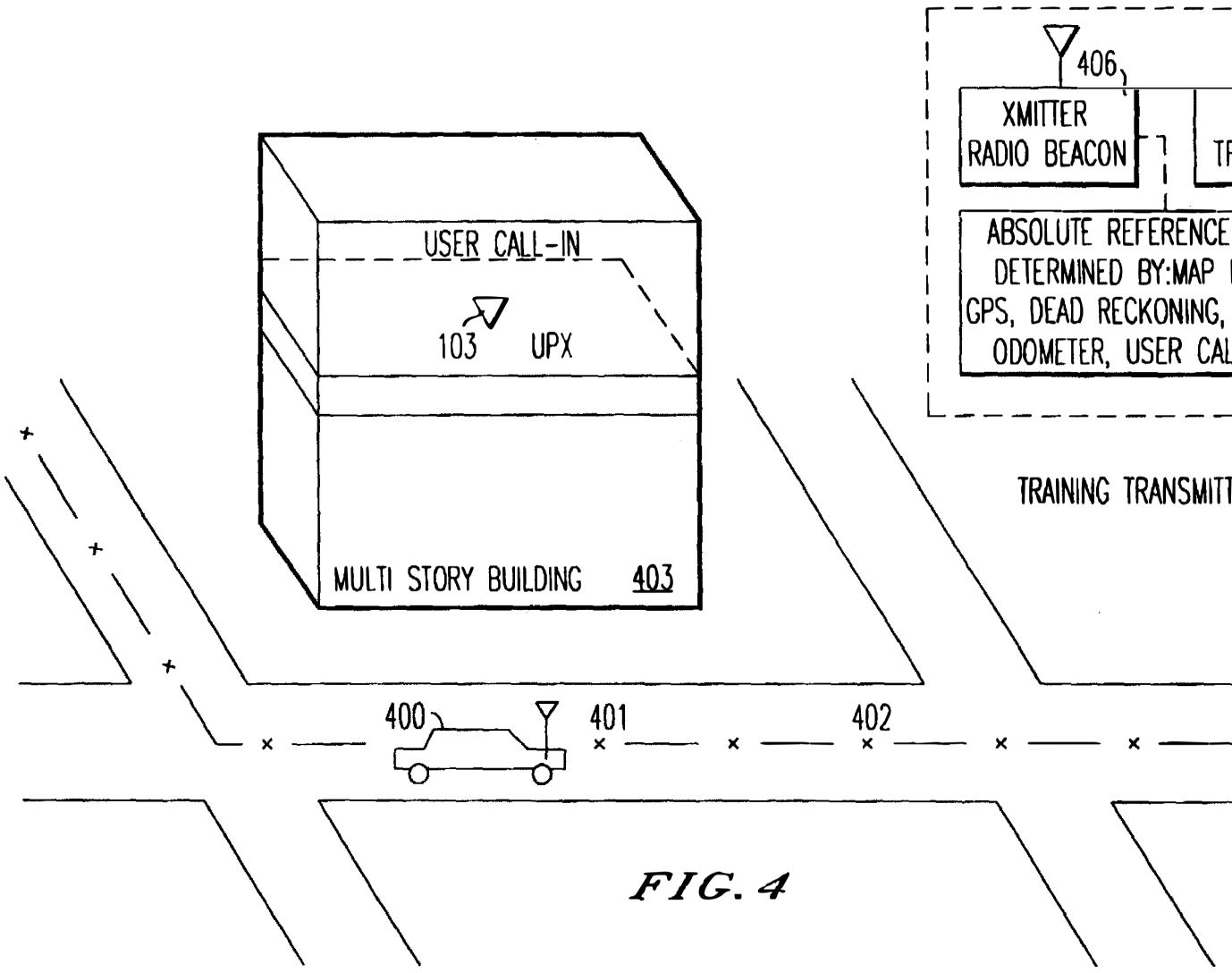

FIG. 4

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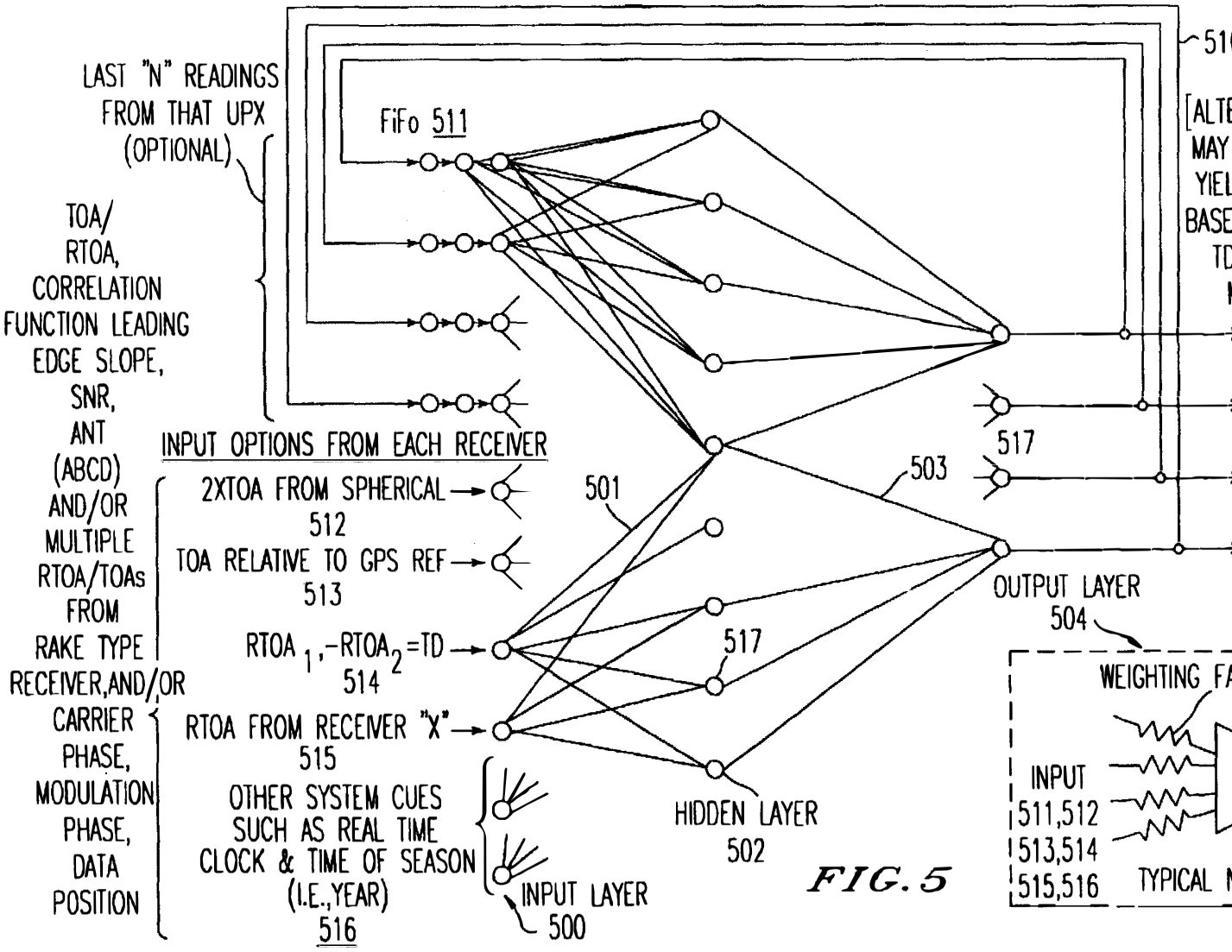

FIG. 5

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