United States Patent [19]

Murphy et al.

[54] **ATOMIC CLOCK AUGMENTED GLOBAL POSITIONING SYSTEM RECEIVERS AND GLOBAL POSITIONING SYSTEM INCORPORATING SAME**

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[52] **U.S. Cl.** **342/357**

[58] **Field of Search** 342/357; 364/449.7

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,155,490	10/1992	Spradley, Jr. et al.	342/357
5,192,921	3/1993	Chantry et al.	331/3
5,319,374	6/1994	Desai et al.	342/387
5,364,093	11/1994	Huston et al.	
5,600,329	2/1997	Brenner	342/357

OTHER PUBLICATIONS

Proceedings of the Rural Electric Power Conference, New Orleans, May 3–5, 1992, No. 3, May, 1992, Institute of Electrical and Electronics Engineers, pp. D2.01–D2.10, XP000300323; M.N. Zeiler Integrated GIS and GPS For Mapping and Analysis of Electric Distribution Circvuits, see p. D2–4, line 29—p. D2–5, line 21.

Electronics and Communication Engineering Journal, vol. 7, No. 1, 1 Feb. 1995, pp. 11–22, XP000500767; Morgan–Owen G J et al: "Differential GPS Positioning", see p. 11, col. 2, line 20–p. 14, col. 1, line 36.

M.A. Sturza, *GPS Navigation Plane*, published by the Department of Transportation and the Department of Defense, DOT–VNTSC–RSPA–92–2/DOD–4650.5 (1992).
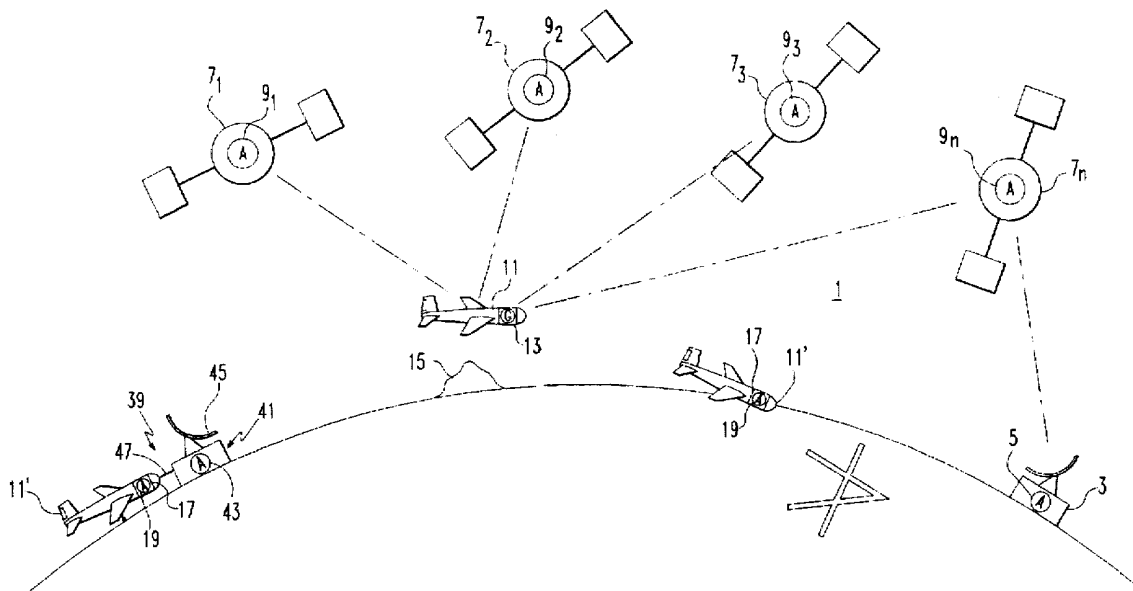
P. Misra and M. Pratt, *Role of the Clock in a GPS Navigation Receiver*, ATC Project Memorandum No. 42PM–SAT-NAV–0008, Massachusetts Institute of Technology, Lincoln Laboratory (May 1994).

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[57] **ABSTRACT**

A GPS radio navigation system utilizes an atomic clock in each user's GPS receiver station and a ground reference station located at a fixed, precisely known position which determines GPS time from satellite information and transmits an absolute time signal together with time-of-flight information over a communications path of precisely known length to the user stations, each at a fixed position. Once the atomic clock in a GPS receiver has been set to the precise GPS time, the user station is free to maneuver for an extended period of time during which its position is calculated from pseudorange and time information received from as few as three satellites and the time maintained by its atomic clock.
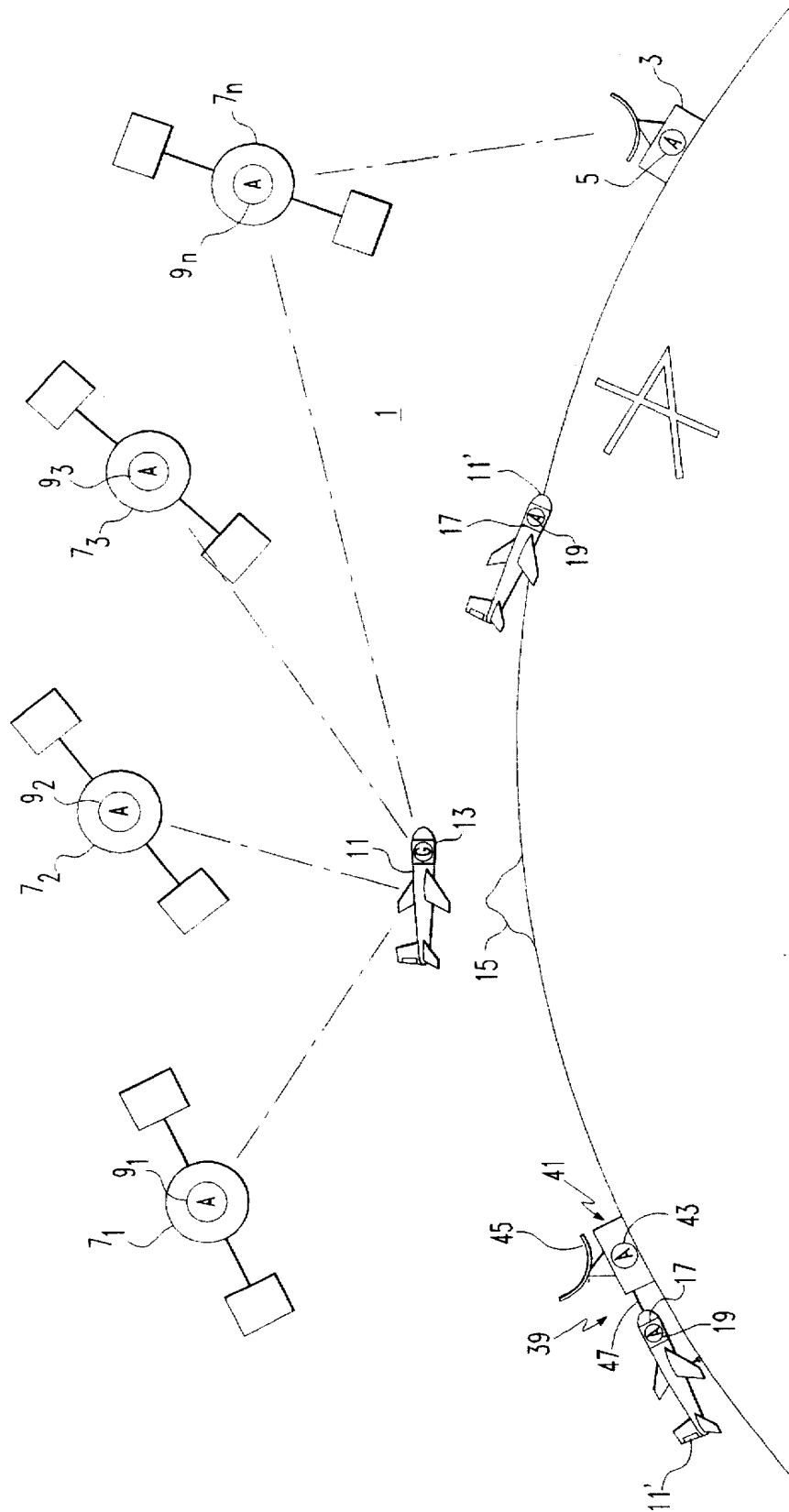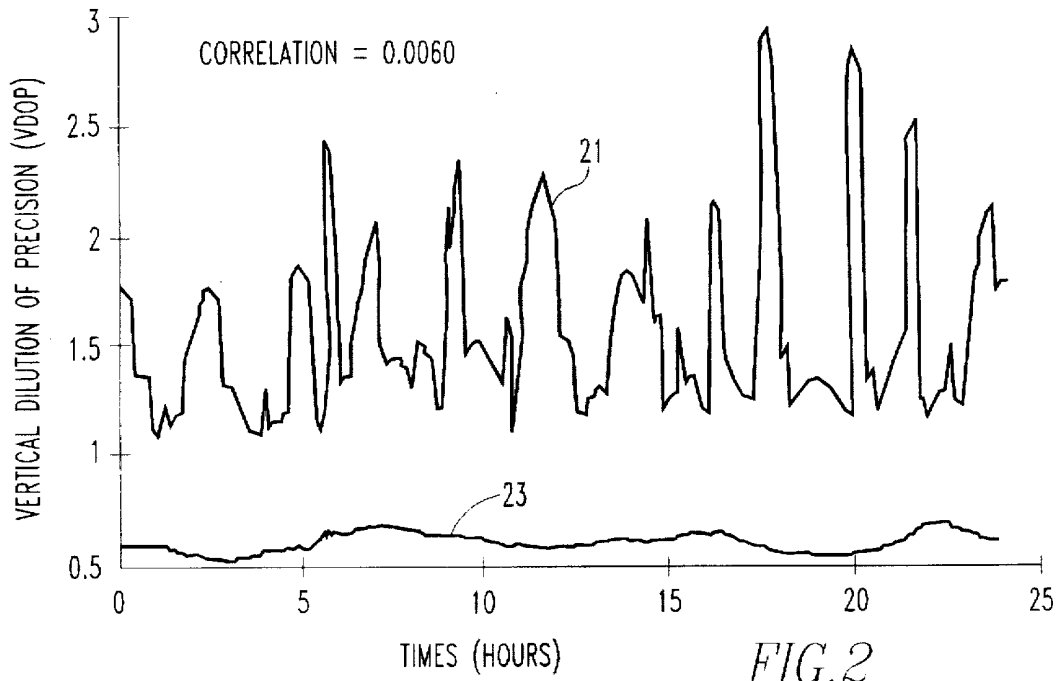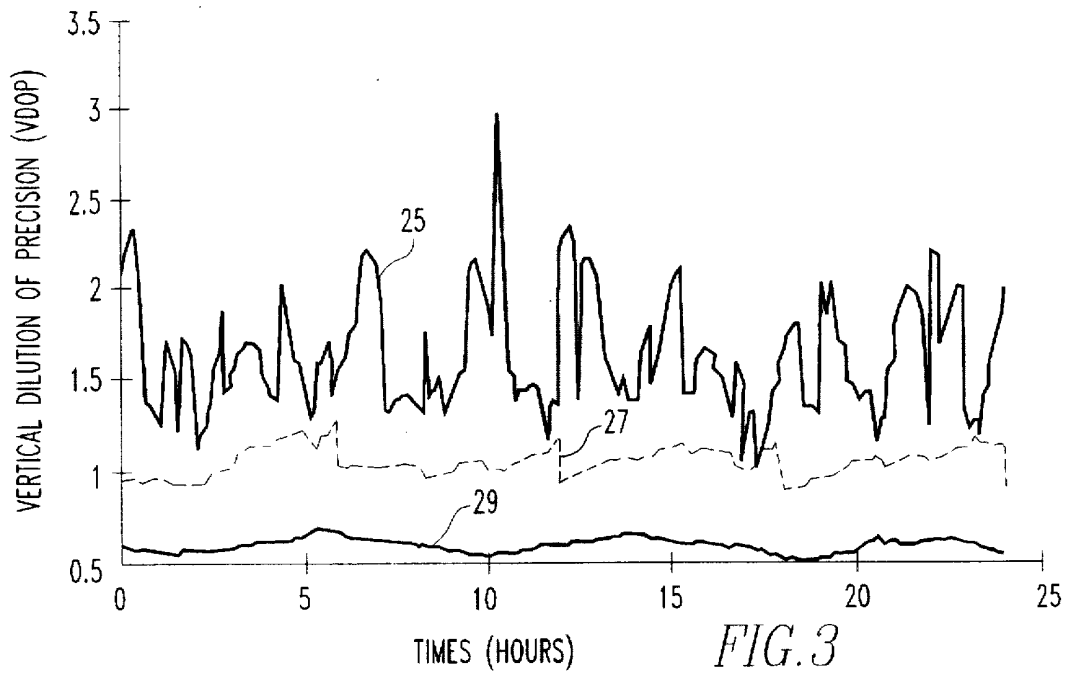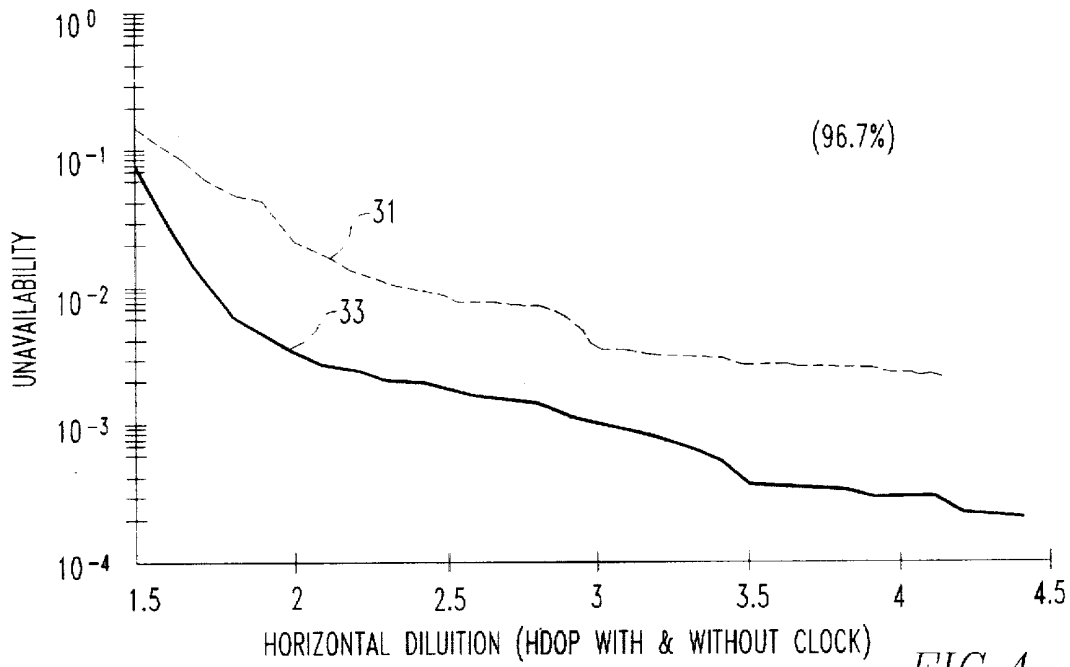
14 Claims, 4 Drawing Sheets

FIG. 1

FIG.2

FIG.3

FIG.4

FIG.5

FIG.6

DOCKET ALARM
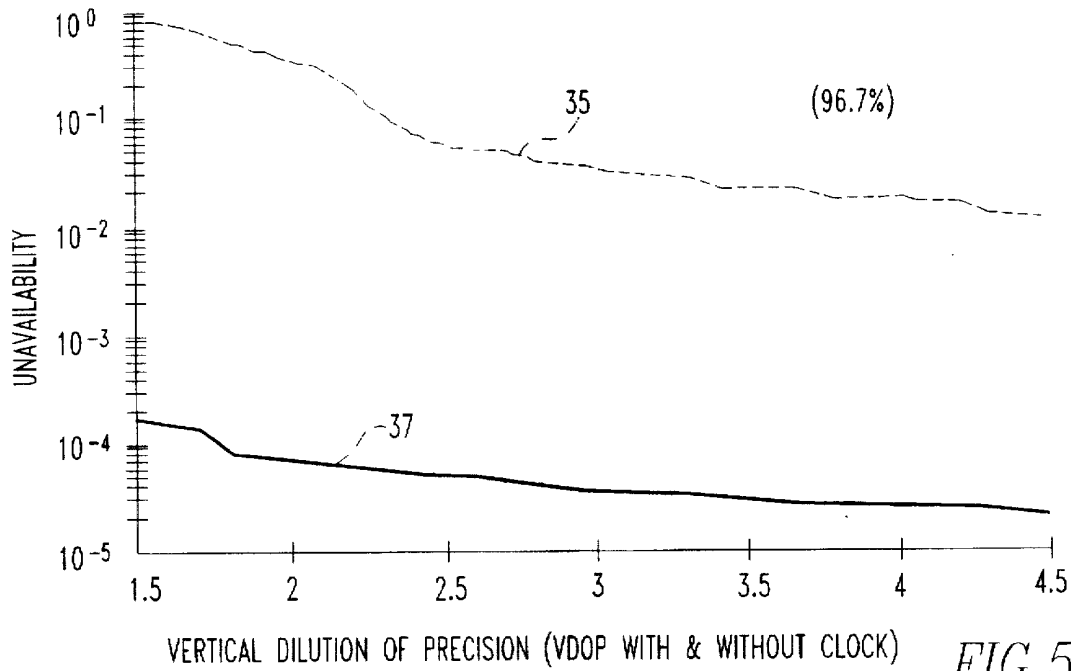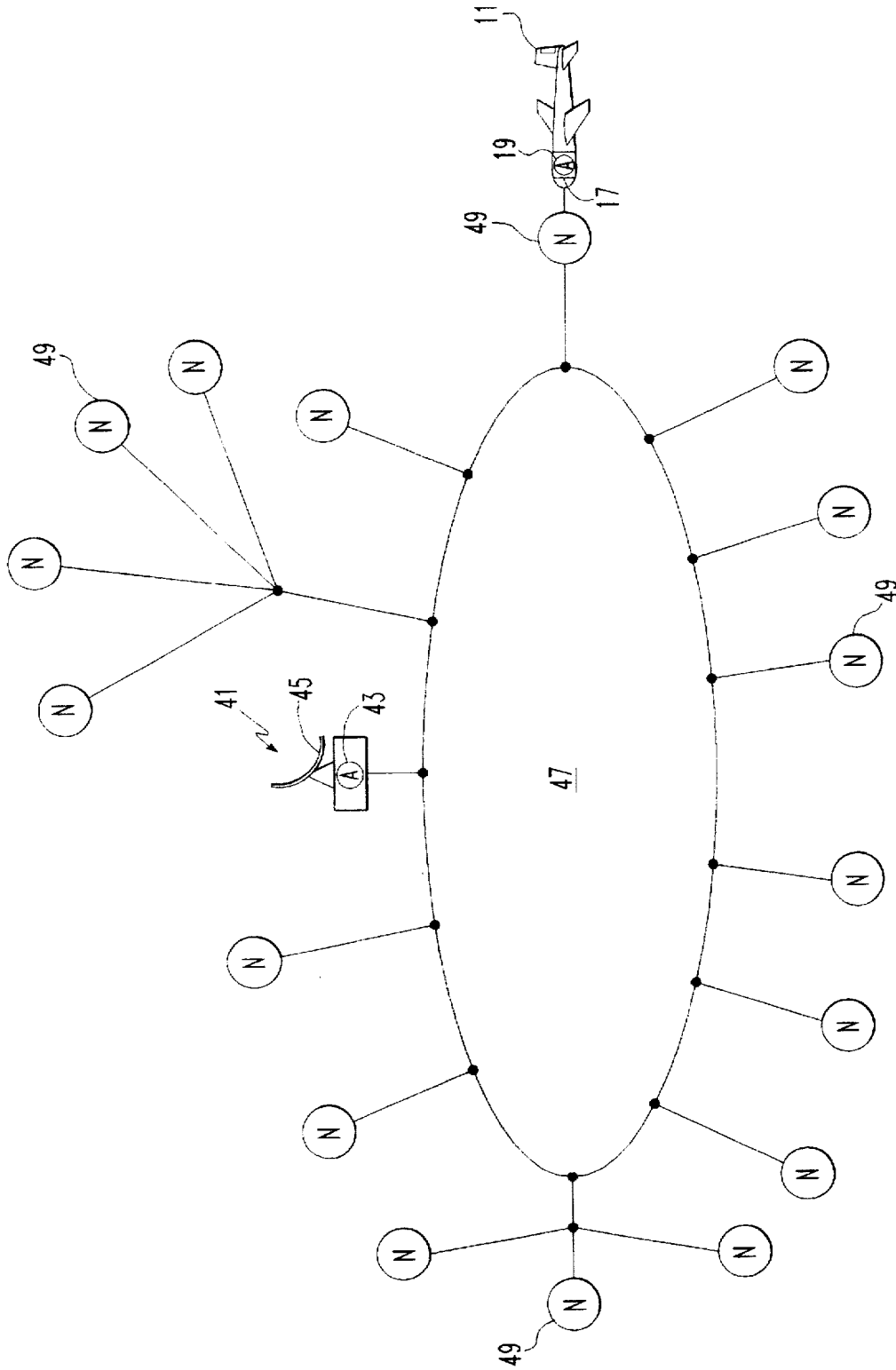
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