



# United States Patent [19]

[11] Patent Number: **5,455,590**

Collins et al.

[45] Date of Patent: **Oct. 3, 1995**

- [54] **REAL-TIME HOLOGRAPHIC SURVEILLANCE SYSTEM**
- [75] Inventors: **H. Dale Collins; Douglas L. McMakin**, both of Richland; **Thomas E. Hall**, Kennewick; **R. Parks Gribble**, Richland, all of Wash.
- [73] Assignee: **Battelle Memorial Institute**, Richland, Wash.
- [21] Appl. No.: **212,432**
- [22] Filed: **Mar. 14, 1994**

### Related U.S. Application Data

- [63] Continuation-in-part of Ser. No. 963,204, Nov. 23, 1992, abandoned, which is a continuation-in-part of Ser. No. 752,750, Aug. 30, 1991, abandoned.
- [51] Int. Cl.<sup>6</sup> ..... **G01S 13/89; G03H 5/00**
- [52] U.S. Cl. .... **342/179; 367/8**
- [58] Field of Search ..... **342/179; 367/8**

### References Cited

#### U.S. PATENT DOCUMENTS

- 5,073,782 12/1991 Hugenin et al. .... 342/179
- 5,142,255 8/1992 Chang et al. .... 343/767
- 5,170,170 12/1992 Soumekh ..... 342/179

#### FOREIGN PATENT DOCUMENTS

- 2034554 6/1980 United Kingdom .

#### OTHER PUBLICATIONS

Ynguesson et al, "Endfire Tapered Slot Antennas on Dielectric Substrates" IEEE Trans on Antennas and Propagation, vol. Ap. 33, No. 12, Dec. 1985.

A. L. Boyer, et al., Reconstruction of Ultrasonic Images by Backward Propagation, Ch. 18, 7/70, pp. 333-349.

H. D. Collins, Error Analysis in Scanned Holography, 1970, Thesis, Oregon State University.

B. P. Hildebrand, et al, An Introduction to Acoustical Holography, 1974, pp. vii, 20-21.

Aoki et al, Diagnosis of Under-Snow Radar Images by Three Dimensional Displaying Technique in Holographic Imaging Radar, Proc. of IGARSS '87 Symposium, May 18-21, 1987, pp. 571-576.

Primary Examiner—Ian J. Lobo  
Attorney, Agent, or Firm—Paul W. Zimmerman

### [57] ABSTRACT

A holographic surveillance system including means for generating electromagnetic waves; means for transmitting the electromagnetic waves toward a target at a plurality of predetermined positions in space; means for receiving and converting electromagnetic waves reflected from the target to electrical signals at a plurality of predetermined positions in space; means for processing the electrical signals to obtain signals corresponding to a holographic reconstruction of the target; and means for displaying the processed information to determine nature of the target.

The means for processing the electrical signals includes means for converting analog signals to digital signals followed by a computer means to apply a backward wave algorithm.

**18 Claims, 10 Drawing Sheets**

