United States Patent [19]

Moose

[54] **ECHO CANCELLATION IN MULTI-FREQUENCY DIFFERENTIALLY ENCODED DIGITAL COMMUNICATIONS**

[75] Inventor: **Paul H. Moose**, Carmel, Calif.

[73] Assignee: **Mercury Digital Communications, Inc.**, Monterey, Calif.

[21] Appl. No.: **566,290**

[22] Filed: **Aug. 10, 1990**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 490,769, Mar. 6, 1990, Pat. No. 5,063,574.

[51] Int. Cl.^{5} **H04L 5/14; H04M 9/08**
[52] U.S. Cl. **370/32.1**; 379/410
[58] Field of Search 370/32.1, 32; 379/410, 379/411

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,799,214 1/1989 Kaku 370/32.1
4,868,874 9/1989 Takatori et al. 370/32.1

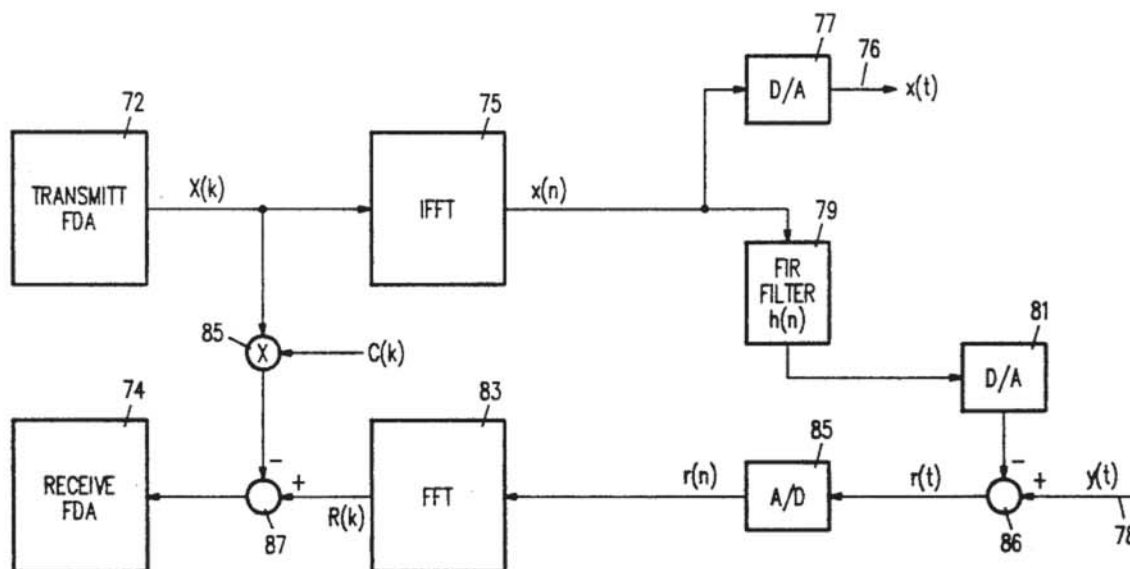*Primary Examiner*—Douglas W. Olms
Assistant Examiner—Wellington Chin
Attorney, Agent, or Firm—Davis & Schroeder

[57] **ABSTRACT**

A differentially encoded digital signal waveform is generated as a discrete time representation of a desired analog signal utilizing multi-frequency modulation techniques. The computational capability of present day, industry-standard microcomputers equipped with a floating point array processor or digital signal processor chip is utilized to perform digital frequency encoding and compute both discrete Fourier transforms and inverse discrete Fourier transforms to provide a transmitter and receiver system utilizing suitably programmed microcomputers coupled by a communications channel.
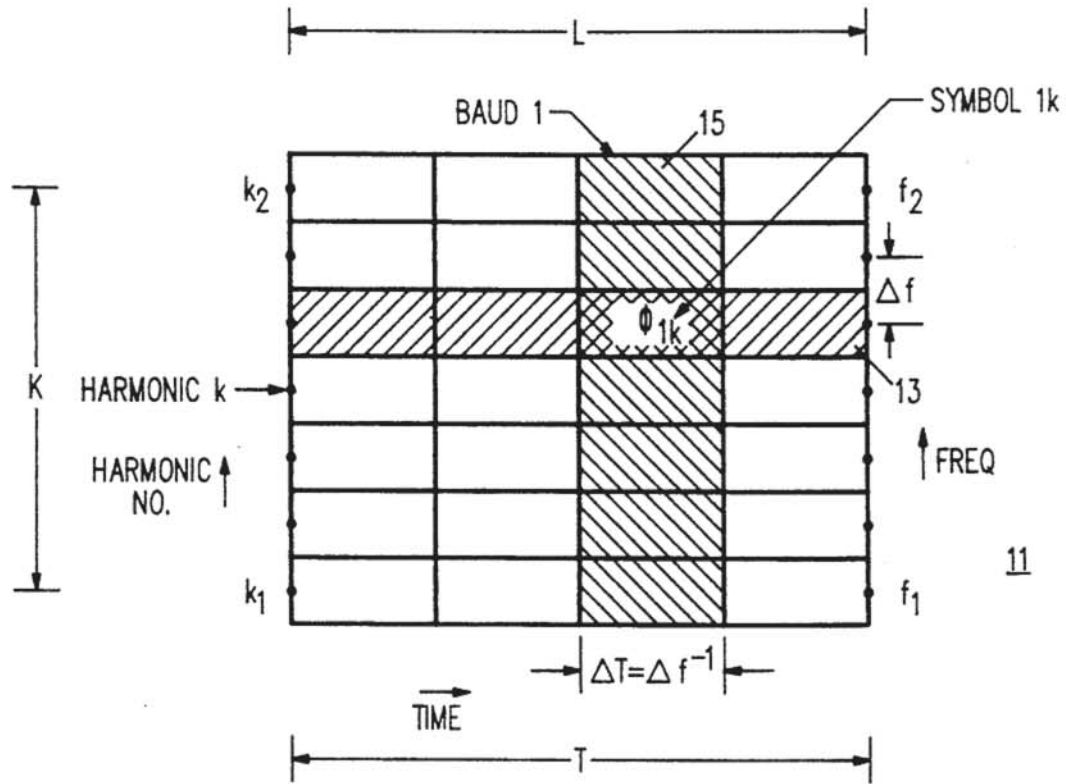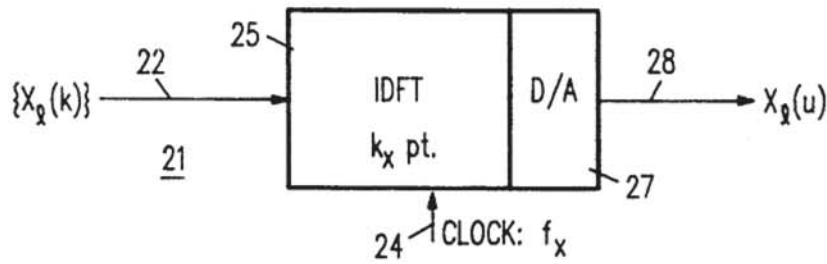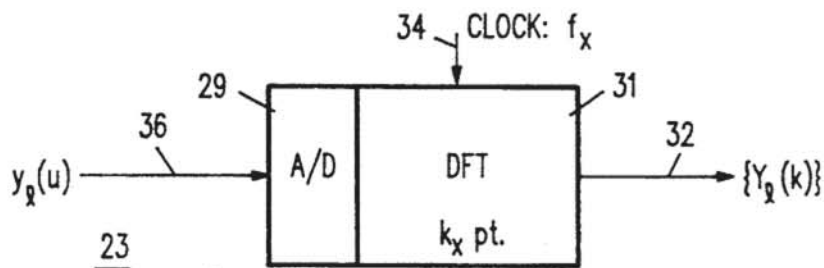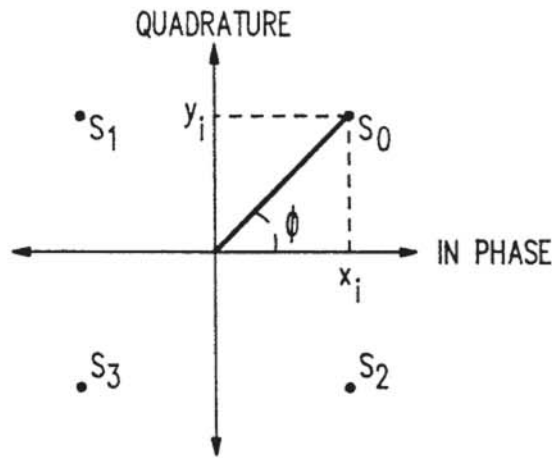
5 Claims, 11 Drawing Sheets

FIG. 1

FIG. 2a

QUADRATURE

IN PHASE

FIG. 3

PREVIOUS STATE S_0

FIG. 4a

PREVIOUS STATE S_1

FIG. 4b

PREVIOUS STATE S_2

PREVIOUS STATE S_3

FIG. 5
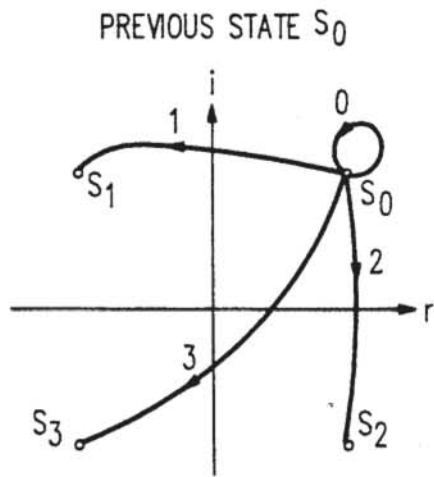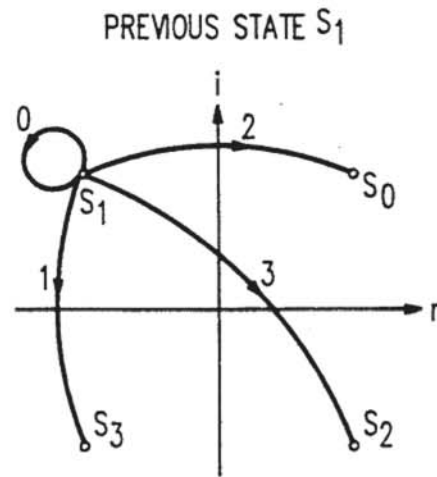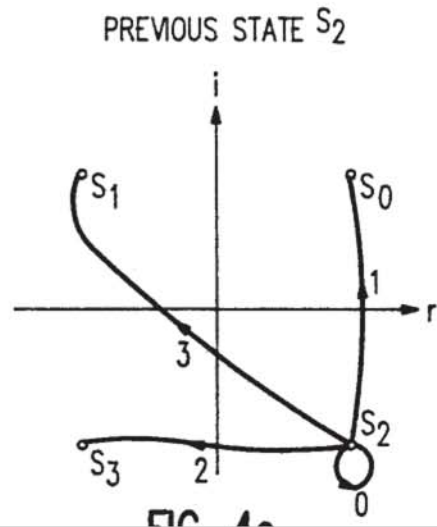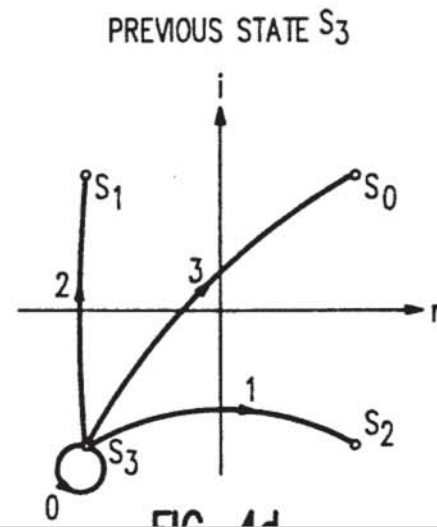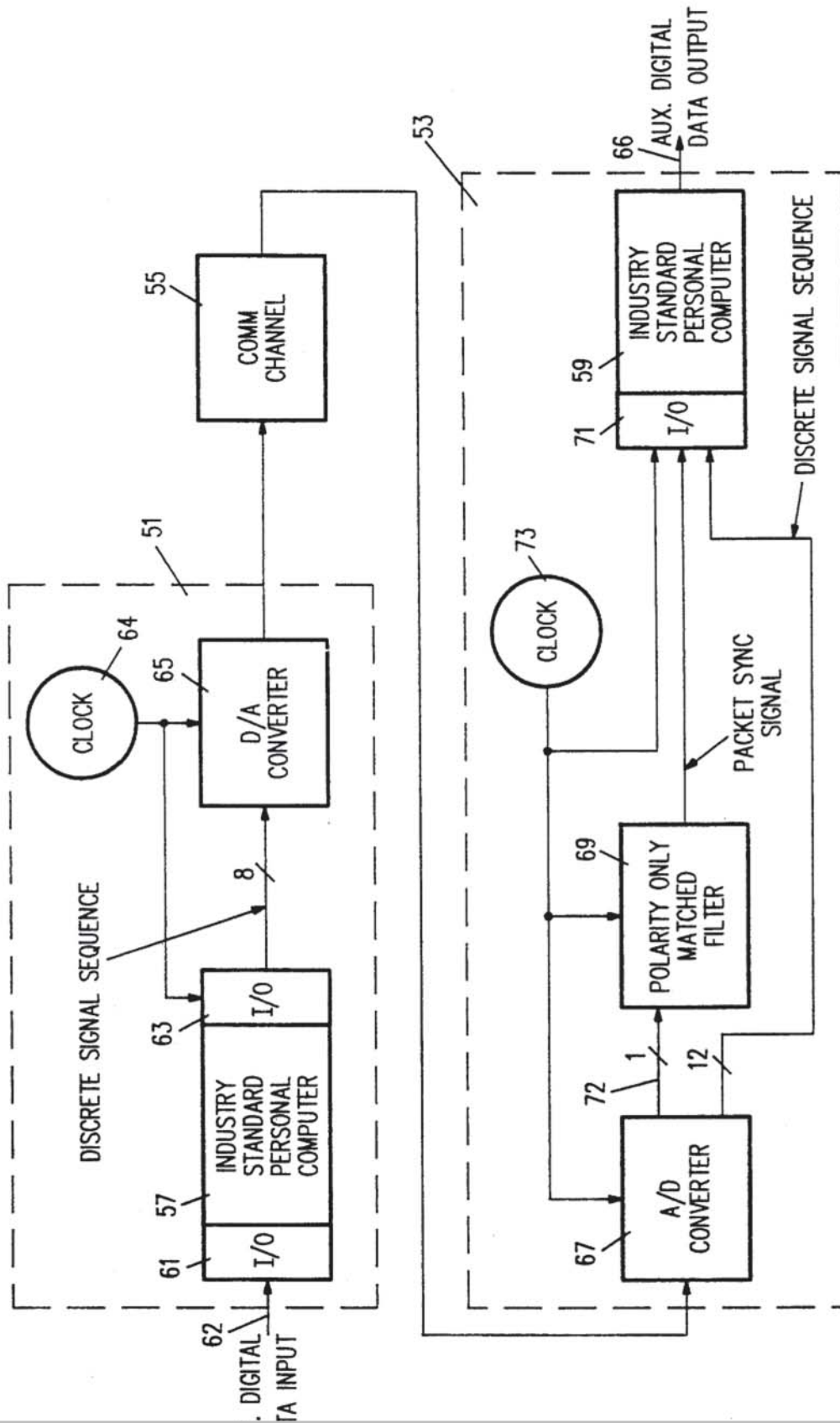
FIG. 6

FIG. 7

FIG. 8

DOCKET ALARM

Explore Litigation Insights

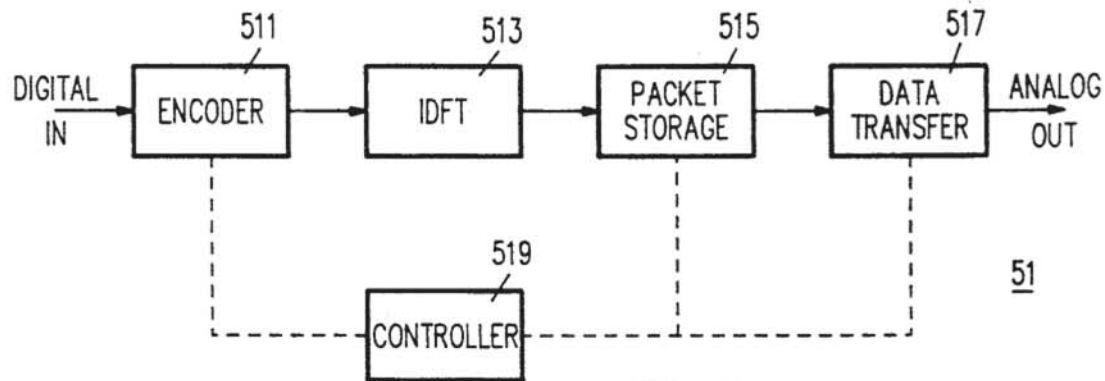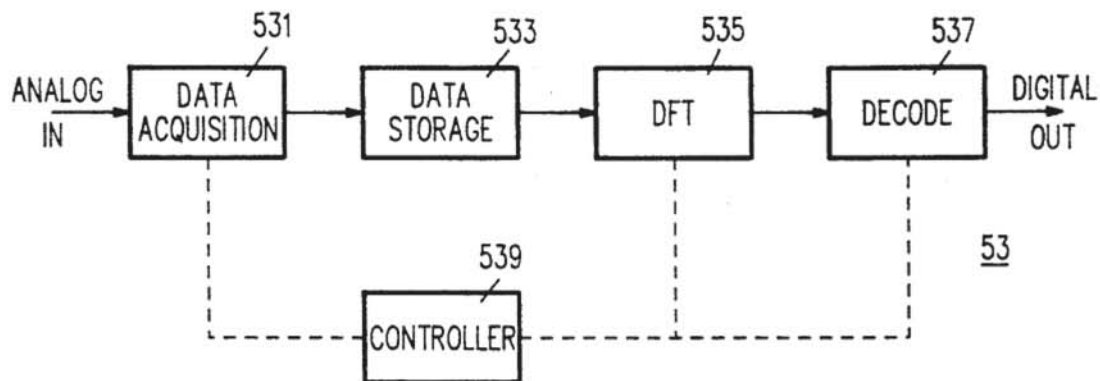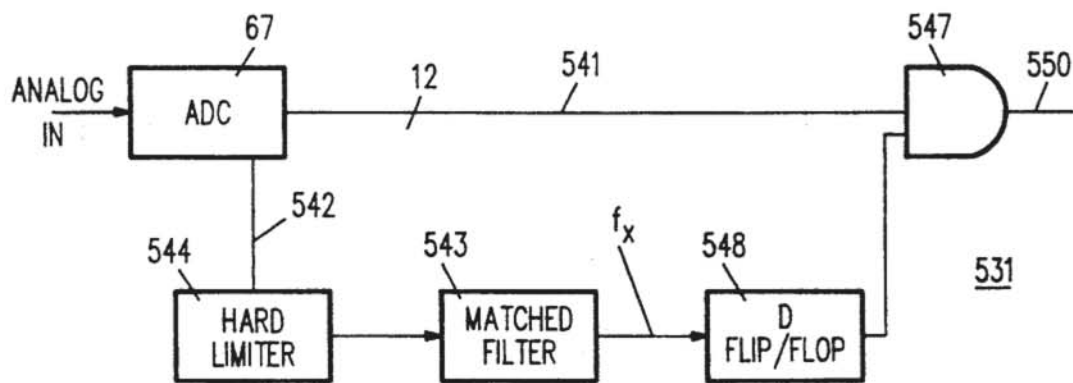Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.