US005546013A

United States Patent [19]

Ichioka et al.

[11] **Patent Number:** **5,546,013**

[45] **Date of Patent:** **Aug. 13, 1996**

[54] **ARRAY TESTER FOR DETERMINING CONTACT QUALITY AND LINE INTEGRITY IN A TFT/LCD**

[75] Inventors: **Yoshikazu Ichioka**, Fujisawa, Japan; **Leslie C. Jenkins**, Holmes, N.Y.; **Shinichi Kimura**, Sagamihara, Japan; **Robert J. Polastre**, Ossining, N.Y.; **Ronald R. Troutman**, Ridgefield, Conn.; **Robert L. Wisnieff**, Yorktown, N.Y.

[73] Assignee: **International Business Machines Corporation**, Armonk, N.Y.

[21] Appl. No.: **26,897**

[22] Filed: **Mar. 5, 1993**

[51] Int. Cl.^{6} **G06F 7/02**

[52] U.S. Cl. **324/770**; 324/158.1

[58] Field of Search 324/770, 73.1, 324/765, 158.1; 250/310; 365/98, 100, 87; 359/55, 57, 59; 371/25.1, 15.1, 22.1; 364/481

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,175,253	11/1979	Pitegoff	324/754
4,290,013	9/1981	Thiel	324/158.1
4,342,959	8/1982	Skilling	324/158.1
4,801,869	1/1989	Sprogis	324/765
4,819,038	4/1989	Alt	324/765
4,843,312	6/1989	Hartman et al.	250/310
4,894,605	1/1990	Ringleb et al.	324/537
4,940,934	7/1990	Kawaguchi et al.	324/770
5,057,775	10/1991	Hall	324/770
5,072,175	12/1991	Marek	324/537
5,113,134	5/1992	Plus et al.	324/73.1
5,179,345	1/1993	Jenkins et al.	324/658
5,377,030	12/1994	Suzuki et al.	324/770

FOREIGN PATENT DOCUMENTS

1130132	5/1989	Japan .
246726	10/1989	Japan .
9209900	6/1992	WIPO .

OTHER PUBLICATIONS

L. C. Jenkins et al., "Functional testing of TFT/LCD arrays" IBM Journal of Research and Development vol. 36, No. 1, Jan. 1992 pp. 59–68.

Primary Examiner—Vinh P. Nguyen
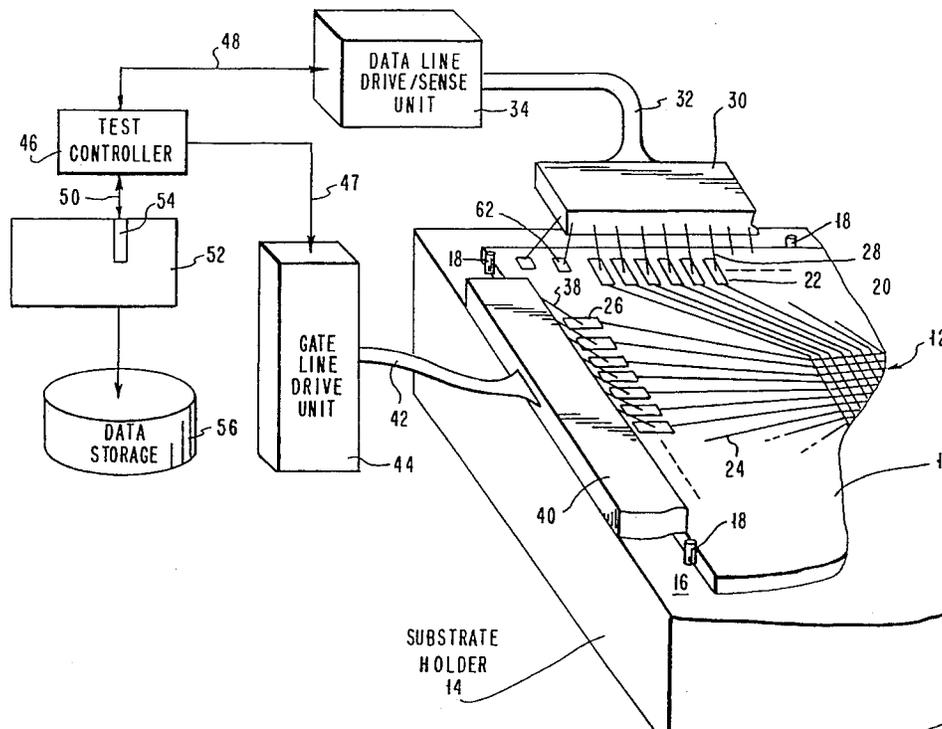*Attorney, Agent, or Firm*—David Aker

[57] **ABSTRACT**

An apparatus for testing for and classifying defects in a TFT/LCD array having gate lines and data lines. Devices are provided for activating cells of the array by applying gate pulses to the gate lines and pulses to the data lines. Devices are also provided for acquiring waveforms from data lines of the array. Additional devices sample the waveforms at selected points in time. A computer may be used to classify the waveforms to indicate whether defects are present and if present, the nature of the defects by comparing voltages of the waveform at the selected points in time.
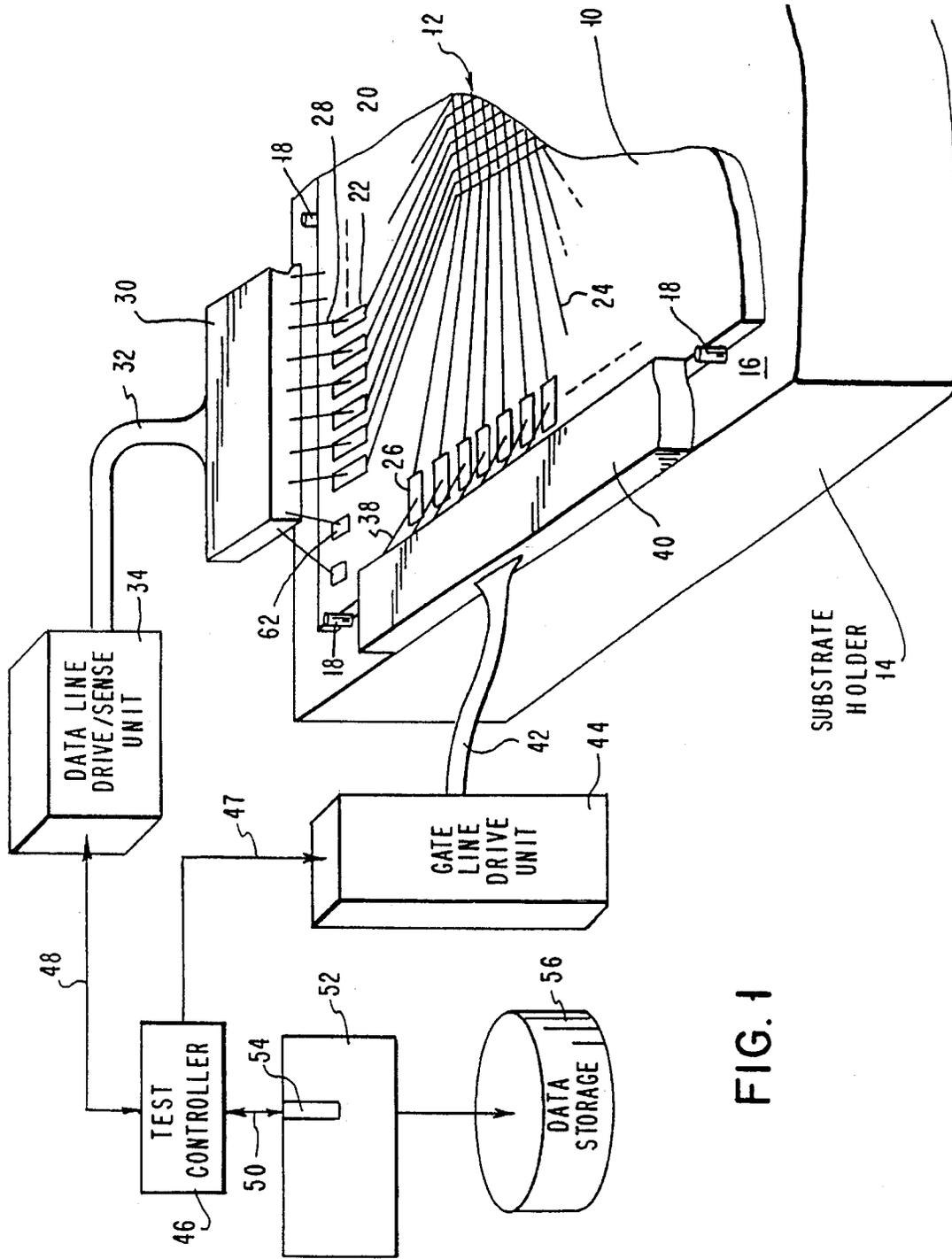
4 Claims, 10 Drawing Sheets

FIG. 1

SUBSTRATE HOLDER 14

DATA LINE DRIVE/SENSE UNIT

GATE LINE DRIVE UNIT

TEST CONTROLLER

DATA STORAGE

FIG. 2

FIG. 3

LOCATE POSITION OF OPEN ALONG DATA LINE

24

TO MULTIPLEX SWITCH AND
20   SENSE AMPLIFIERS

G/L #1

#2

#3

. . .

#4

#5

#6

GATE/LINE
DRIVERS

TO MULTIPLEX SWITCH AND
SENSE AMPLIFIERS

D/L #1 2 3 4 5 6 · · ·

FIG. 4

LOCATE POSITION OF OPEN ALONG GATE LINE

24

TO MULTIPLEX SWITCH AND
20   SENSE AMPLIFIERS

G/L #1

#2

#3

#4

#5

GATE/LINE
DRIVERS

TO MULTIPLEX SWITCH AND
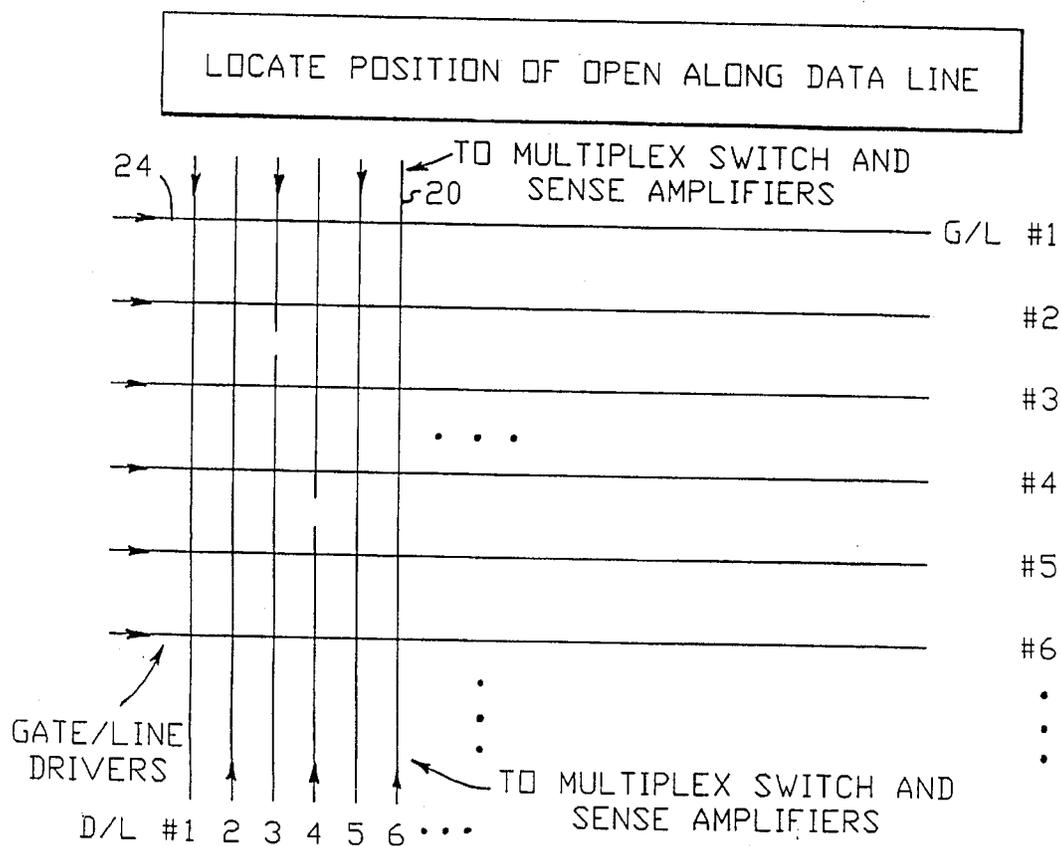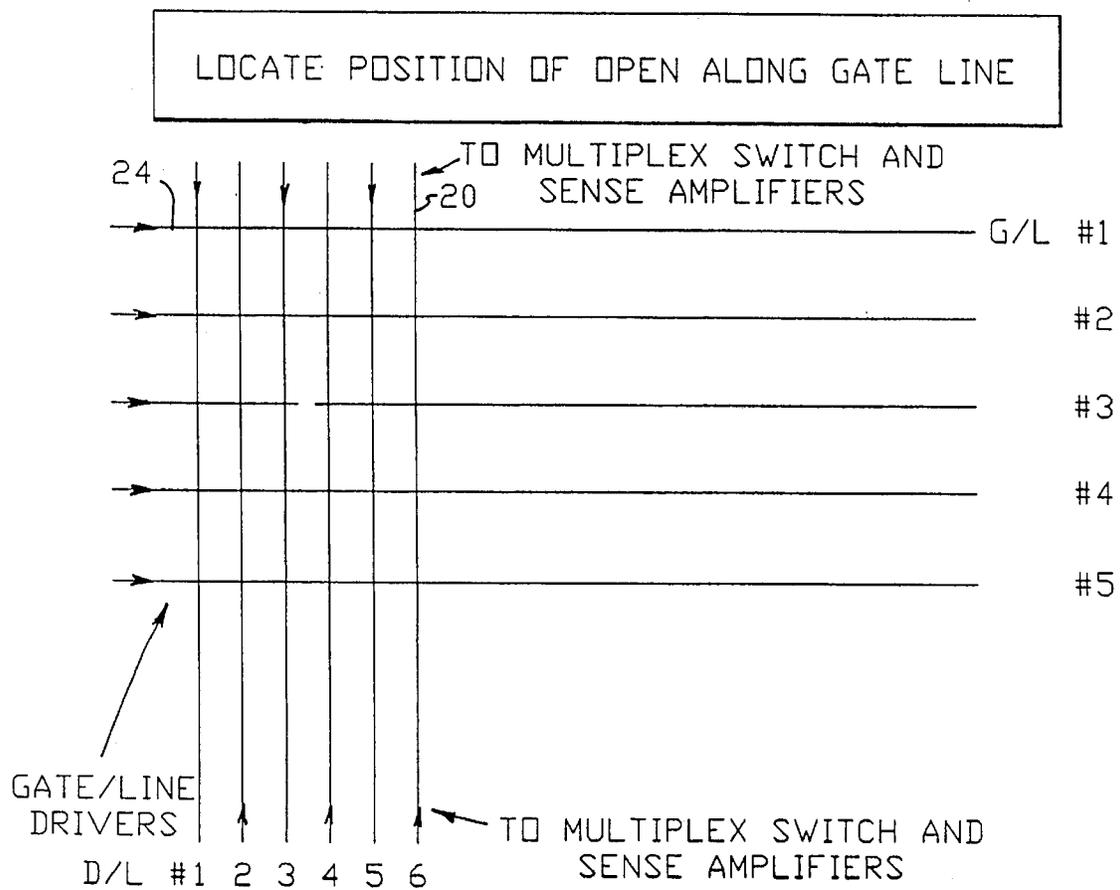SENSE AMPLIFIERS

D/L #1 2 3 4 5 6

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.

fastcase®
Smarter legal research.