

(12) **United States Patent**  
Westby

(10) **Patent No.:** US 6,279,057 B1  
(45) **Date of Patent:** Aug. 21, 2001

(54) **COMMUNICATIONS SYSTEM HAVING DEDICATED FRAME BUFFERS LOCATED IN A CHANNEL NODE CONNECTED TO TWO PORTS OF THE CHANNEL NODE FOR RECEIVING FRAMES**

(75) Inventor: **Judy Lynn Westby**, Bloomington, MN (US)

(73) Assignee: **Seagate Technology, Inc.**, Scotts Valley, CA (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/193,681**

(22) Filed: **Nov. 17, 1998**

**Related U.S. Application Data**

(60) Provisional application No. 60/065,920, filed on Nov. 17, 1997, provisional application No. 60/065,926, filed on Nov. 17, 1997, provisional application No. 60/065,919, filed on Nov. 17, 1997, and provisional application No. 60/067,211, filed on Dec. 1, 1997.

(51) **Int. Cl.<sup>7</sup>** ..... **G06F 13/14**

(52) **U.S. Cl.** ..... **710/52; 710/7**

(58) **Field of Search** ..... **710/7, 52, 36-38; 709/236, 251; 370/400**

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,486,739 12/1984 Franaszek et al. .... 340/347  
4,819,229 4/1989 Pritty et al. .... 370/89

(List continued on next page.)

**OTHER PUBLICATIONS**

“Fibre Channel, Arbitrated Loop (FC-AL), REV 4.5”, American National Standard for Information Technology draft proposed, ANSI X3.272-199 X, (Jun. 1, 1995).

“Fibre Channel, Arbitrated Loop (FC-AL-2), REV 6.3”, American National Standard for Information Technology draft proposed, ANSI X3.xxx-199x, (May 29, 1998).

“Fibre Channel, Physical and Signaling Interface (FC-PH), REV 4.3”, American National Standard for Informations Systems working draft, ANSI X3.230-199x, (Jun. 1, 1994).

“Information Systems—dpANS Fibre Channel Protocol for SCSI”, American National Standard—draft proposed, X3.269-199x revision 12, (Dec. 4, 1995).

Georgiou, C. J., et al., “Scalable Protocol Engine for High-Bandwidth Communications”, *IEEE*, pp. 1121-1126, (1997).

*Primary Examiner*—Thomas Lee

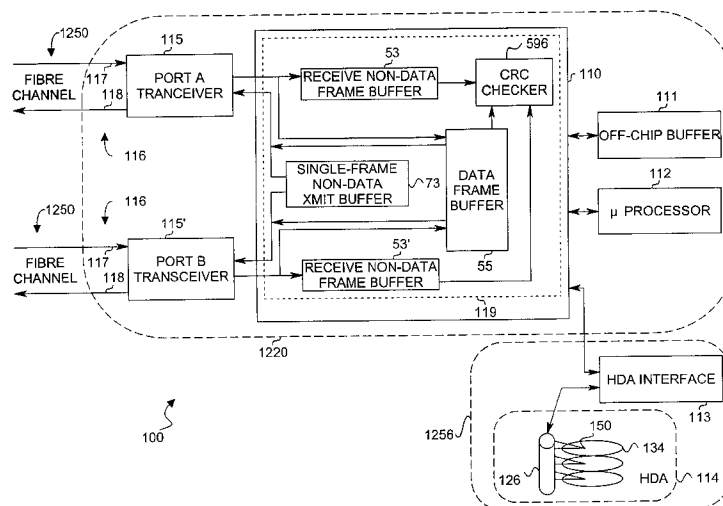
*Assistant Examiner*—Thuan Du

(74) *Attorney, Agent, or Firm*—Schwegman, Lundberg, Woessner & Kluth P.A.

(57) **ABSTRACT**

Dedicated receive buffers for receiving non-data frames are provided for each port of a two-port node in a fibre-channel arbitrated-loop serial communications channel design. The improved communications channel system and method includes a channel node having dual ports each supporting a communications channel, both ports interfaced from a single interface chip, and a dedicated on-chip frame buffer located on the chip for receiving frames. The dedicated on-chip frame buffer includes two inbound non-data buffers, one coupled to each of two ports, wherein inbound non-data frames from each port are received into the respective inbound non-data buffer. The system further includes an off-chip buffer, wherein received non-data frames are received into one of the non-data-frame buffers and transferred from the non-data-frame buffer to the off-chip buffer. A data-frame buffer is operatively coupled to both ports to receive data frames from the ports, and move the data frames to the off-chip buffer. In addition, a method for receiving frames using the dedicated buffer is described.

**22 Claims, 15 Drawing Sheets**



U.S. PATENT DOCUMENTS					
5,168,568	12/1992	Thayer et al. .... 395/725	5,781,801	7/1998	Flanagan et al. .... 395/876
5,260,933	11/1993	Rouse ..... 370/14	5,787,242	7/1998	DeKoning et al. .... 395/182.03
5,535,035	7/1996	DeFoster et al. .... 359/161	5,787,450	7/1998	Diedrich et al. .... 707/513
5,598,541	1/1997	Malladi ..... 395/286	5,790,773	8/1998	DeKoning et al. .... 395/182.04
5,617,425	4/1997	Anderson ..... 371/10.2	5,790,792	8/1998	Dudgeon et al. .... 395/200.42
5,619,497	4/1997	Gallagher et al. .... 370/394	5,802,080	9/1998	Westby ..... 371/53
5,619,647	4/1997	Jardine ..... 395/200.7	5,805,788	9/1998	Johnson ..... 395/182.04
5,638,518	6/1997	Malladi ..... 395/200.21	5,805,920	9/1998	Sprenkle et al. .... 395/821
5,663,724	9/1997	Westby ..... 341/59	5,807,261	9/1998	Benaron et al. .... 600/473
5,694,615	12/1997	Thapar et al. .... 395/822	5,809,328	9/1998	Nogales et al. .... 395/825
5,758,081	5/1998	Aytac ..... 395/200.41	5,812,564	9/1998	Bonke et al. .... 371/40.1
5,761,534	6/1998	Lundberg et al. .... 395/870	5,812,754	9/1998	Lui et al. .... 395/182.04
5,761,705	6/1998	DeKoning et al. .... 711/113	5,815,662	9/1998	Ong ..... 395/200.47
5,764,931	6/1998	Schmahl et al. .... 395/287	5,819,054	10/1998	Ninomiya et al. .... 395/308
5,764,972	6/1998	Crouse et al. .... 395/601	5,819,111	10/1998	Davies et al. .... 395/849
5,768,530	6/1998	Sandorfi ..... 395/200.63	5,822,143	10/1998	Cloke et al. .... 360/65
5,768,623	6/1998	Judd et al. .... 395/857	5,822,782	10/1998	Humlicek et al. .... 711/170
5,778,426	7/1998	DeKoning et al. .... 711/122	6,012,128	1/2000	Birns et al. .... 711/163

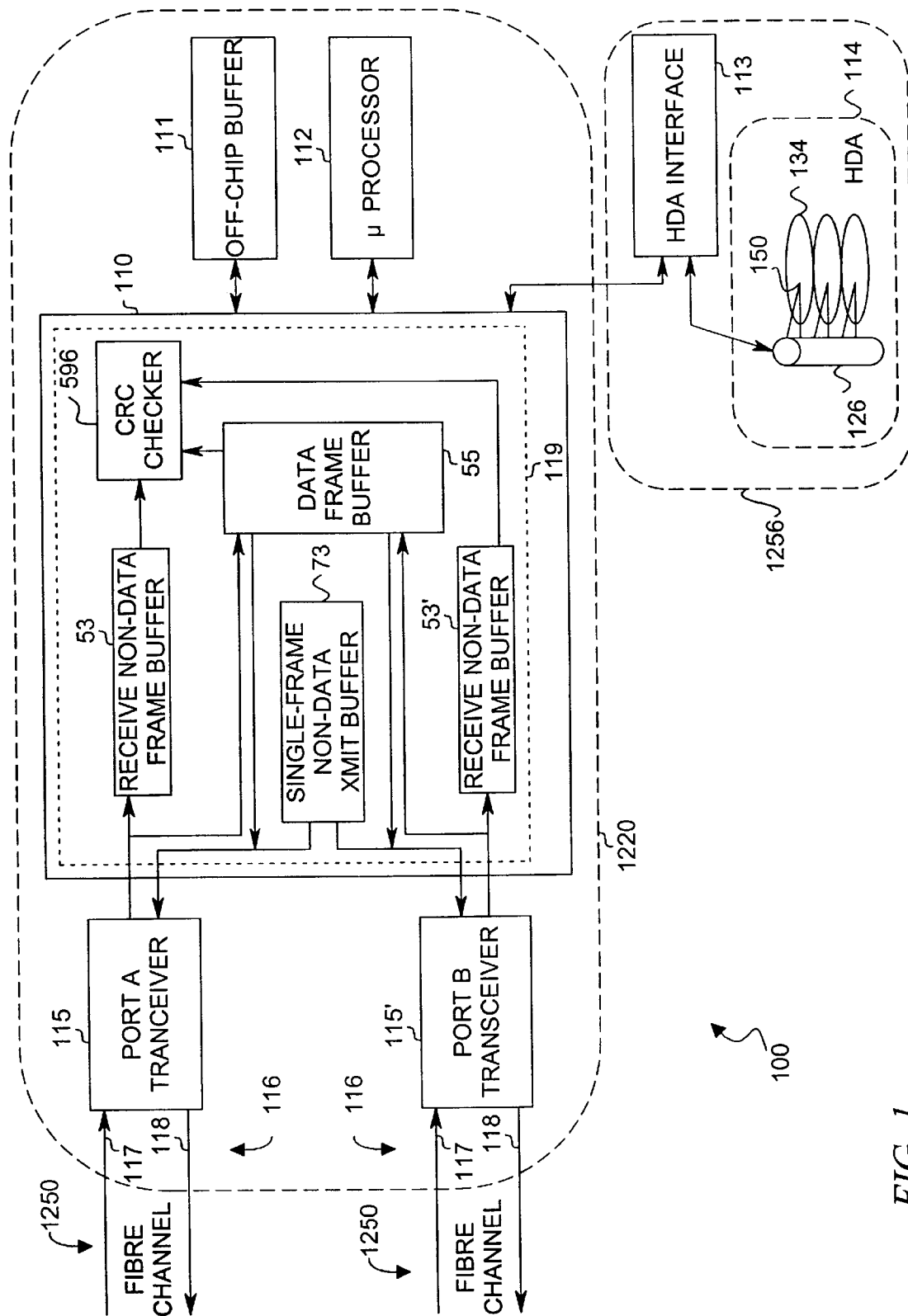


FIG. 1

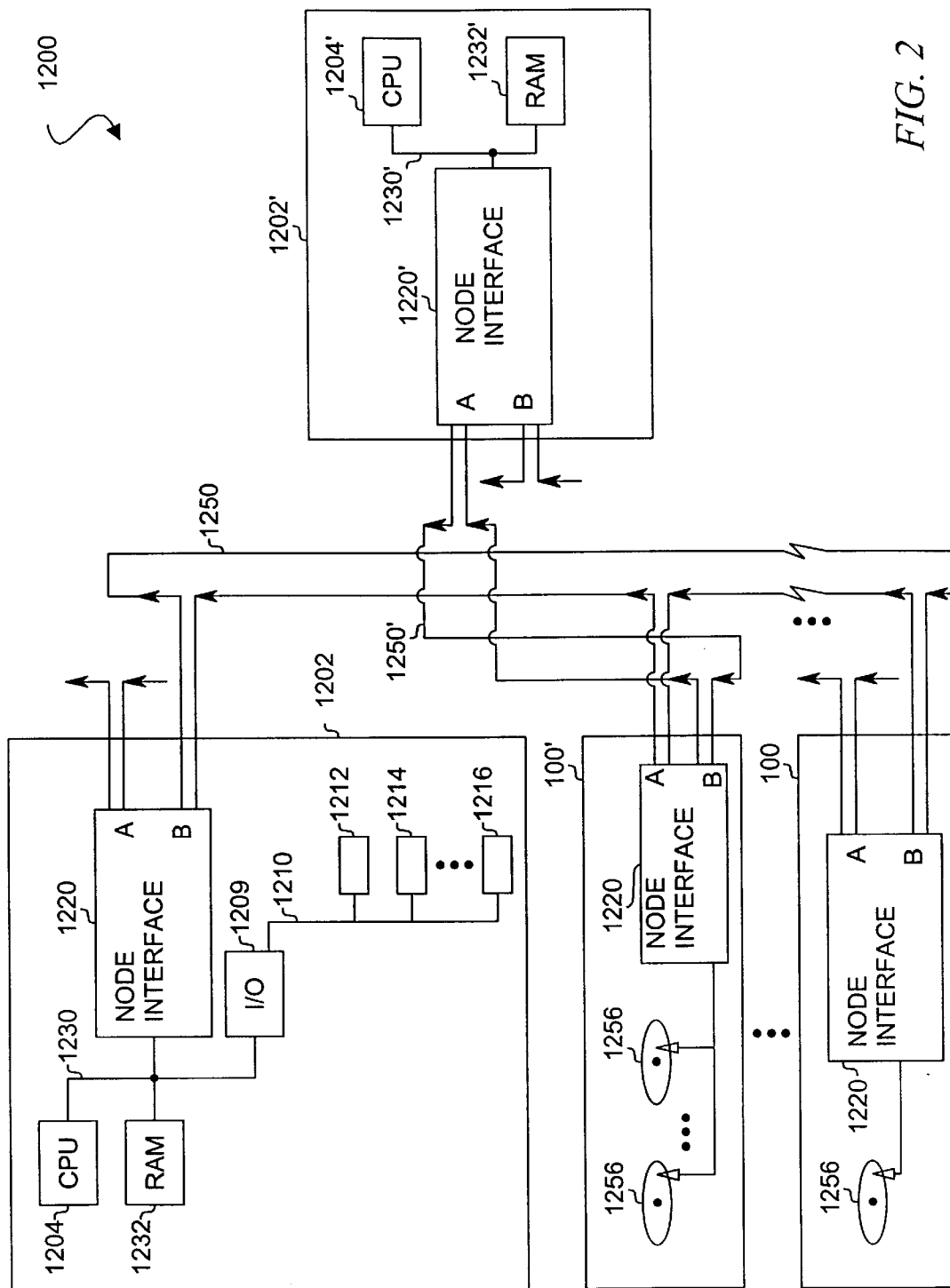


FIG. 2

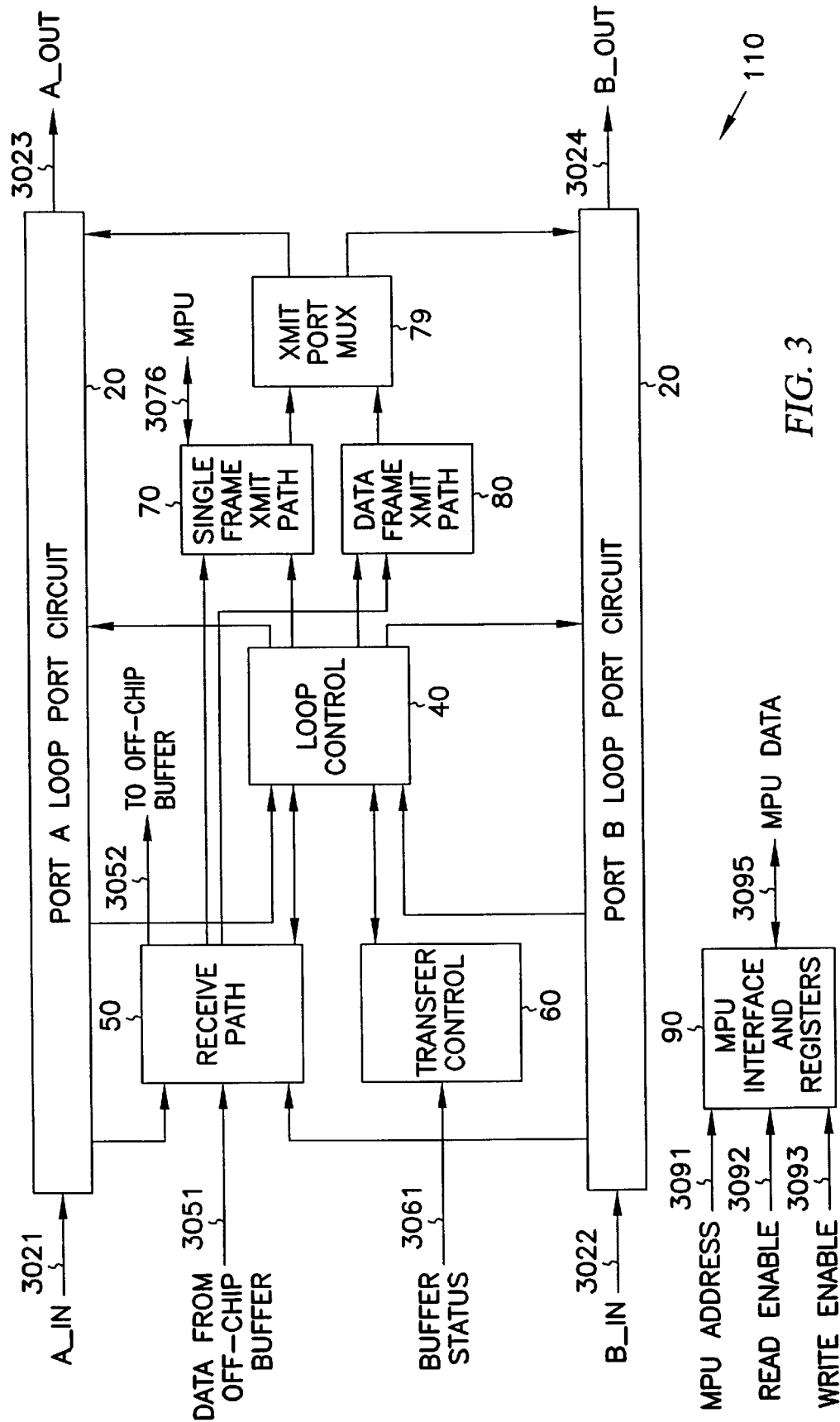


FIG. 3

# 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.