United States Patent [19]

Barrett et al.

[11] Patent Number: 5,584,033

[45] Date of Patent: Dec. 10, 1996

[54] **APPARATUS AND METHOD FOR BURST DATA TRANSFER EMPLOYING A PAUSE AT FIXED DATA INTERVALS**

[75] Inventors: **Wayne M. Barrett**, Rochester; **Bruce L. Beukema**, Hayfield; **William E. Hammer; Daniel F. Moertl**, both of Rochester, all of Minn.

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

[21] Appl. No.: **335,228**

[22] Filed: **Nov. 7, 1994**

Related U.S. Application Data

[63] Continuation of Ser. No. 760,426, Sep. 16, 1991, abandoned.

[51] **Int. Cl.⁶** **G06F 13/28**

[52] **U.S. Cl.** **395/800**; 364/260; 364/271.5; 364/260.1; 364/DIG. 1; 395/868

[58] **Field of Search** 395/800, 868

[56] **References Cited**

U.S. PATENT DOCUMENTS

Re.34,282	6/1993	Suzuki	395/425
4,275,440	6/1981	Adams	395/868
4,558,429	12/1985	Barlow	395/425
4,644,463	2/1987	Hotchkin	395/250
4,703,478	10/1987	Haselton	370/94
4,712,176	12/1987	Fredericks et al.	364/200
4,799,199	1/1989	Scales, III et al.	365/230
4,807,109	2/1989	Farrell et al.	364/200
4,816,947	3/1989	Scales	395/325
5,029,124	7/1991	Leahy et al.	370/85
5,073,969	12/1991	Shoemaker	395/307
5,140,680	8/1992	Best	395/325
5,159,672	10/1992	Salmon	395/325
5,276,818	1/1994	Okazawa	395/325

OTHER PUBLICATIONS

IBM Technical Disclosure Bulletin vol. 30 No. 4 Sep. 1987 pp. 1432–1434 "Swinging Buffer With Programmable Size".

Primary Examiner—Eric Coleman
Attorney, Agent, or Firm—Roy W. Truelson; Owen J. Gamon; Karuna Ojanen

[57] **ABSTRACT**

A plurality of devices attached to a communications bus observe a burst transfer protocol which allows pausing only at pre-determined, fixed intervals of n data words, where a word is the width of the bus. In accordance with this protocol, once burst transfer is initialized the sending device transmits an uninterrupted stream of n data words over the communications bus, after which either the sender or receiver may cause transmission to pause. The sender may need to wait for more data, or the receiver may need to finish processing the data just received. The pause lasts as long as needed until both devices are ready to proceed. This cycle is repeated until the data transmission is complete. The sending and receiving devices do not relinquish control of the bus during a pause, and therefore are not required to re-initialize communications. In the preferred embodiment, after n data words have been transmitted, the sender and receiver toggle interlocking signals that accomplish a handshaking between the two devices. The sender de-activates its signal when it is ready to send more, and the receiver de-activates its signal when it is ready to receive more. Both devices are equipped with buffers large enough to hold n data words, but the buffers need not be as large as the longest possible burst communication.
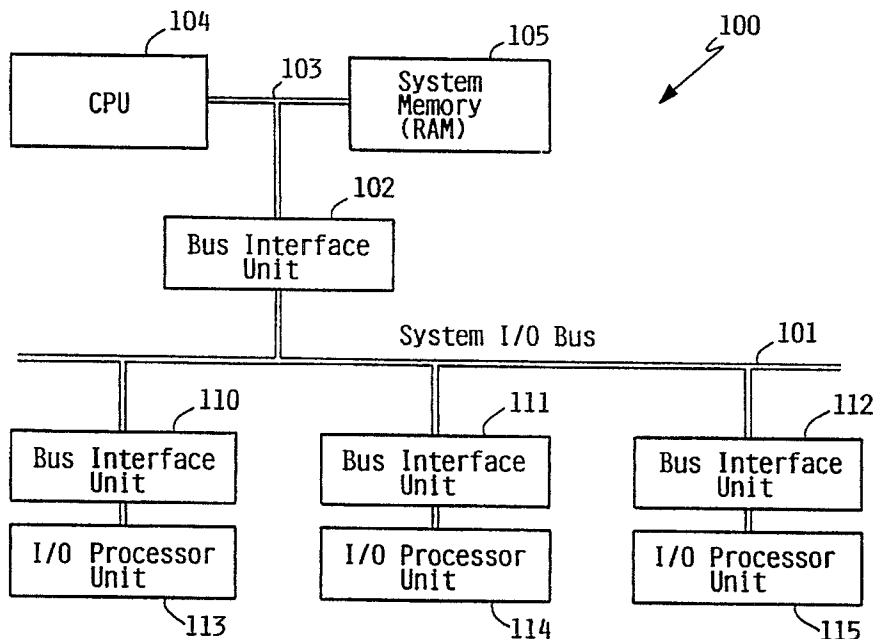
30 Claims, 5 Drawing Sheets

FIG. 1

FIG. 2

FIG. 3

START

```
                                      401
┌─────────────────────────────────┐
│ Master Bus Unit arbitrates for  │
│ the bus, takes control of bus   │
└─────────────────────────────────┘
                                      402
┌─────────────────────────────────┐
│ Master Bus Unit selects Slave   │
│ Unit, issues command            │
└─────────────────────────────────┘
                                      403
┌─────────────────────────────────┐
│ Initial status cycle, slave     │
│ sends status, pause allowed     │
│ by Sender or Rcvr.              │
└─────────────────────────────────┘
```

INITIALIZATION

- -

```
                                      404
┌─────────────────────────────────┐
│ Burst Data Transfer: 31 cycles  │
│ uninterrupted data transfer     │
└─────────────────────────────────┘
                                      405
┌─────────────────────────────────┐
│ 32nd cycle: Rcvr acknowledges,  │
│ Slave sends status, pause       │
│ allowed by Sender or Rcvr.      │
└─────────────────────────────────┘

        NO        ◇ Done? ◇
                     │
                    YES
```

DATA TRANSFER PHASE

- -

```
                                      407
┌─────────────────────────────────┐
│ Master releases control of bus  │
└─────────────────────────────────┘

                 END
```

CONCLUDE

FIG. 4

DOCKET ALARM
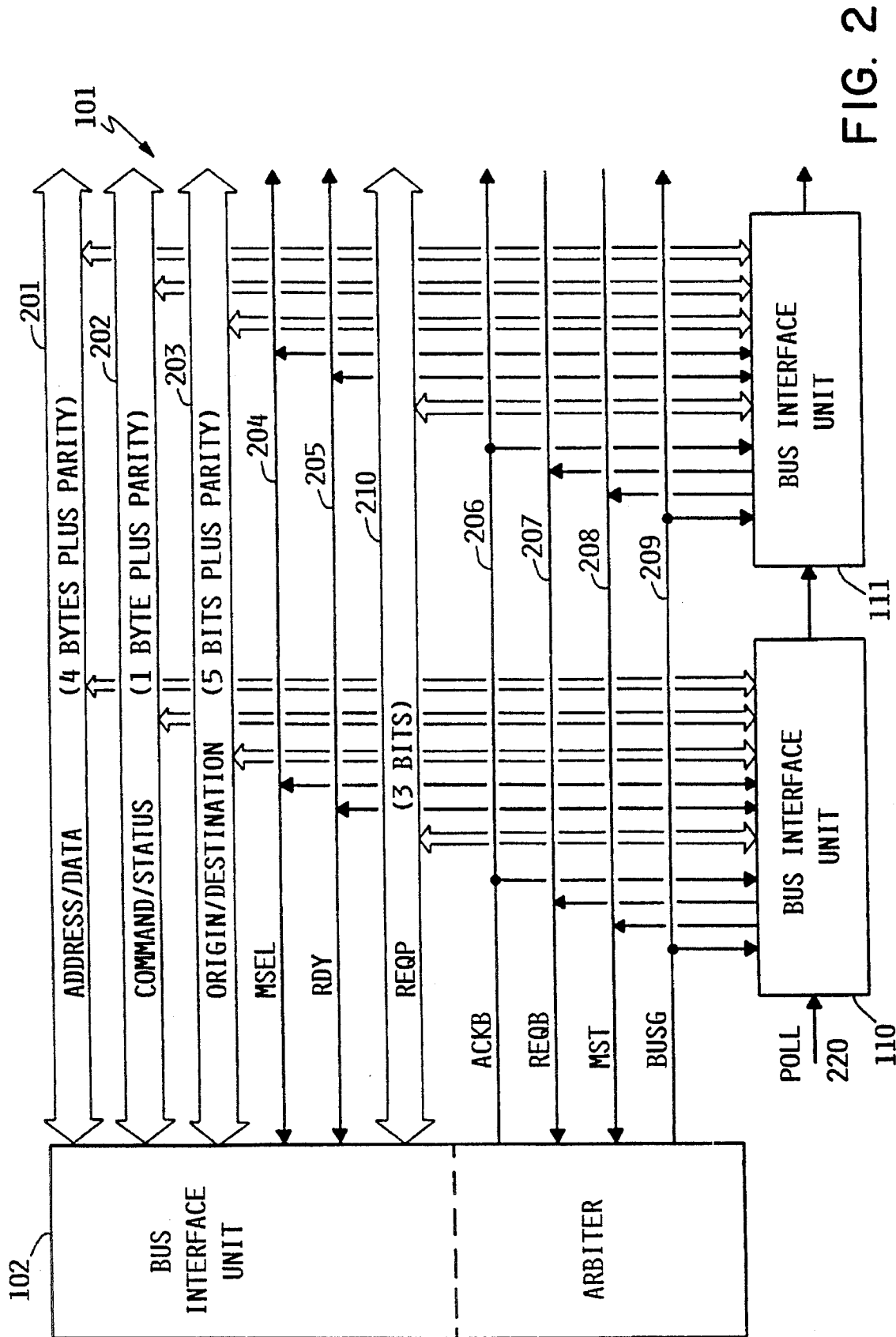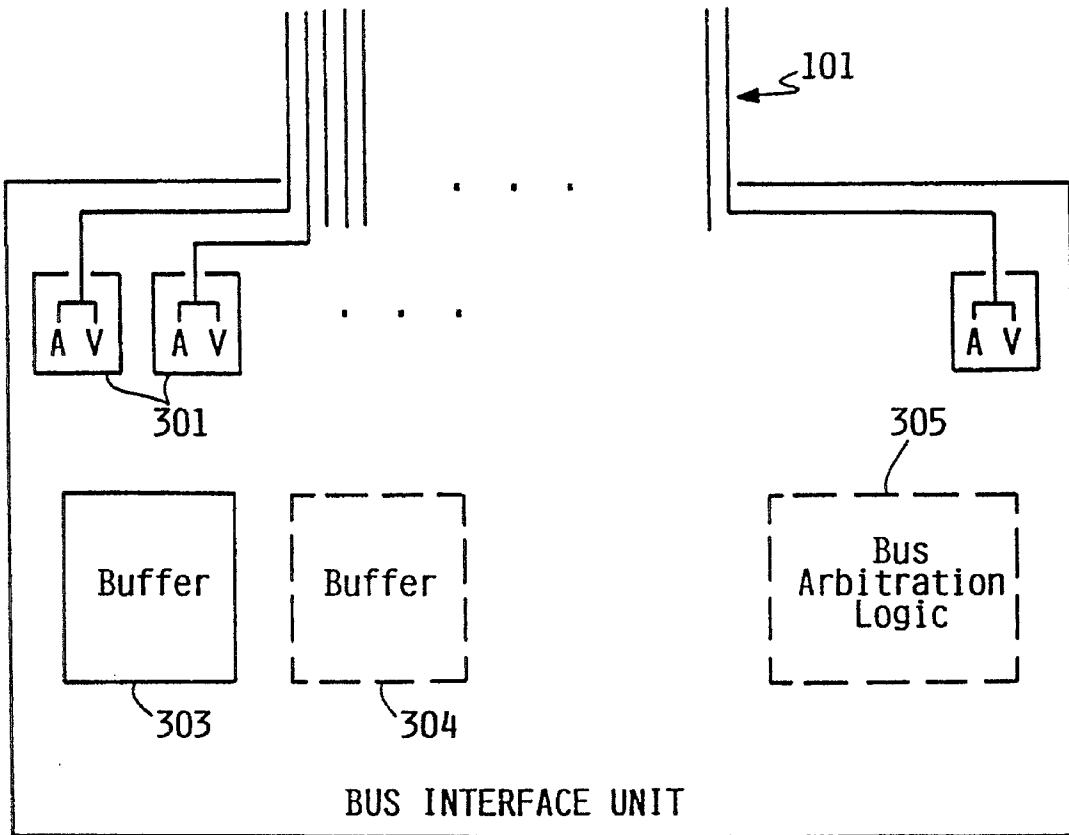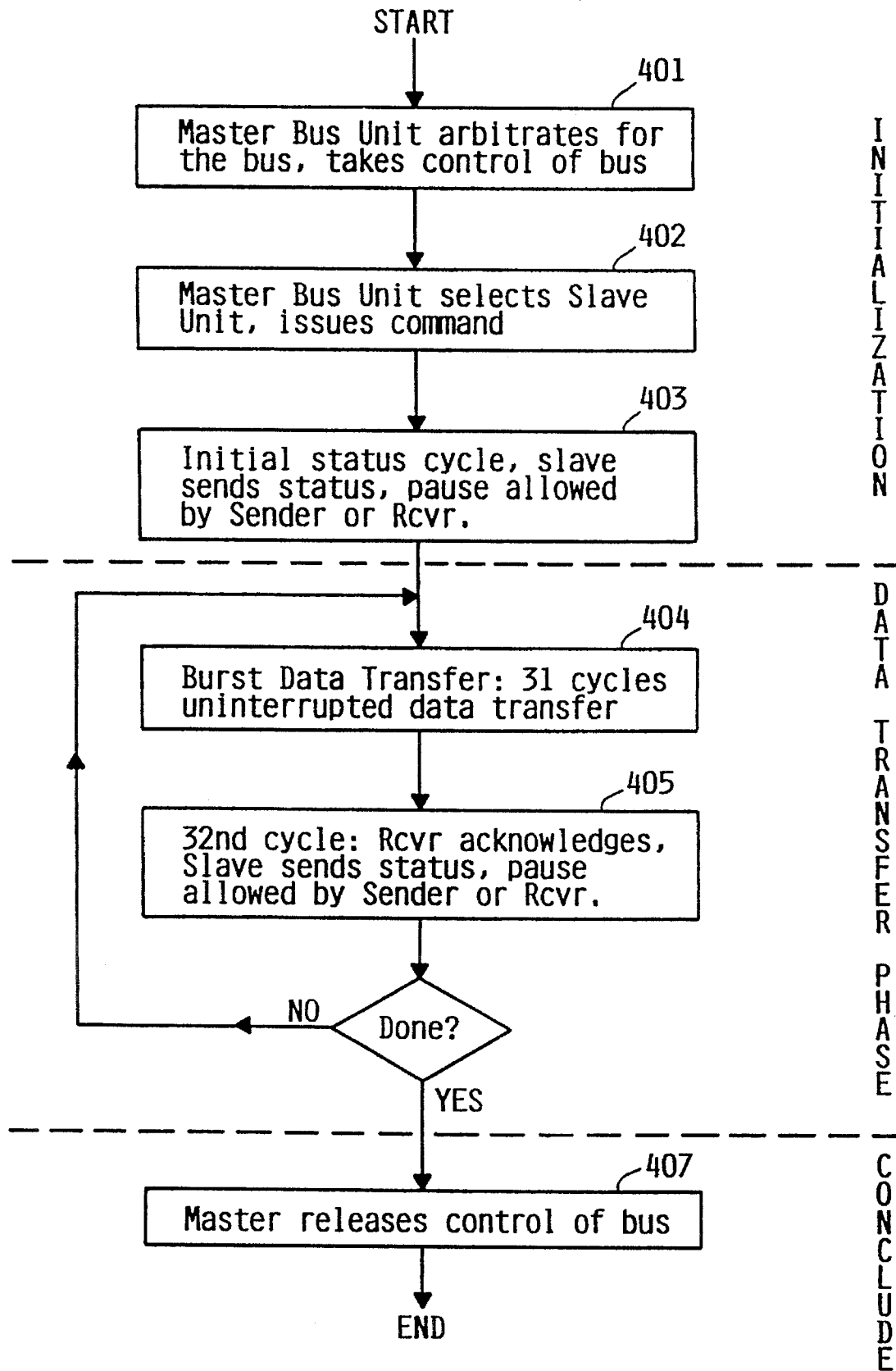
Explore Litigation Insights

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.