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# United States Patent [19]

[11] Patent Number: **6,141,701**

Whitney

[45] Date of Patent: **Oct. 31, 2000**

[54] **SYSTEM FOR, AND METHOD OF, OFF-LOADING NETWORK TRANSACTIONS FROM A MAINFRAME TO AN INTELLIGENT INPUT/OUTPUT DEVICE, INCLUDING OFF-LOADING MESSAGE QUEUING FACILITIES**

5,659,794	8/1997	Caldarale .....	710/1
5,742,761	4/1998	Olnowich et al. ....	709/250
5,764,922	6/1998	Peacock et al. ....	710/6
5,822,766	10/1998	Purdham et al. ....	711/148
5,828,881	10/1998	Wang .....	709/300
5,925,099	7/1999	Futral et al. ....	709/204
5,931,918	8/1999	Row et al. ....	709/300
5,931,920	8/1999	Ghaffari et al. ....	710/5
5,983,292	11/1999	Nordstrom et al. ....	710/54

[76] Inventor: **Mark M. Whitney**, 3874 Wintergreen Ct., Marietta, Ga. 30062-6825

*Primary Examiner*—Thomas C. Lee  
*Assistant Examiner*—Katharina Schuster  
*Attorney, Agent, or Firm*—Hale and Dorr LLP

[21] Appl. No.: **09/038,603**

[22] Filed: **Mar. 11, 1998**

### [57] ABSTRACT

#### Related U.S. Application Data

[60] Provisional application No. 60/040,555, Mar. 13, 1997.

[51] **Int. Cl.**<sup>7</sup> ..... **G06F 13/14**; G06F 13/12; G06F 13/10; G06F 3/06; G06F 12/10

[52] **U.S. Cl.** ..... **710/5**; 710/6; 710/52; 710/54; 710/36; 710/39; 709/215; 709/250; 709/300

[58] **Field of Search** ..... 710/6, 36, 1, 5, 710/54; 709/204, 300, 250, 215; 711/152, 148; 714/38

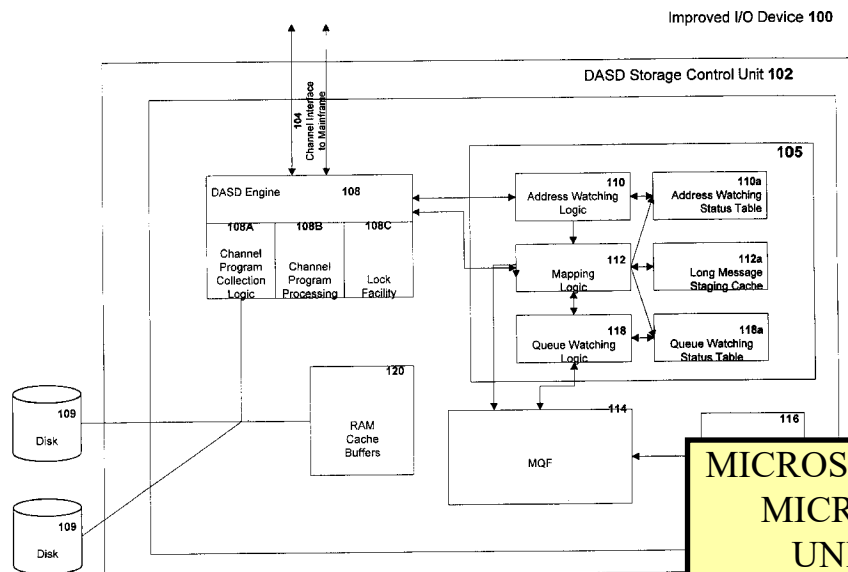
A system for, and method of, off-loading network transactions from a mainframe to an intelligent input/output device, including off-loading message queuing facilities. A storage controller has a processor and a memory, in which the controller receives I/O commands having corresponding addresses. In the controller memory, a communication stack is provided for receiving and transmitting information on a network. In addition, a message queue facilities (MQF) is provided that cooperates with the communication stack and that is responsive to a message queue verb. The MQF causes the communication stack to provide information to a queue in the MQF or causes a queue in the MQF to provide information to the communication stack. Moreover, interface logic is provided in the controller memory and is responsive to the I/O commands, to determine whether an I/O command is within a first set of predetermined I/O commands. If so, the interface logic maps the I/O command to a corresponding message queue verb and queue to invoke the MQF. In this fashion, the MQF may cooperate with the communication stack to send and receive information corresponding to the verb, while off-loading the processing from a computer client (e.g., a mainframe) of the storage controller.

#### [56] References Cited

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4,534,013	8/1985	Sheth .....	710/5
4,901,232	2/1990	Harrington et al. ....	710/6
5,263,161	11/1993	Barth et al. ....	711/152
5,293,385	3/1994	Hary .....	714/38
5,333,269	7/1994	Calvignac et al. ....	709/215
5,388,219	2/1995	Chan et al. ....	710/5
5,452,430	9/1995	Dievendorff et al. ....	395/183.13
5,463,772	10/1995	Thompson et al. ....	395/600
5,465,328	11/1995	Dievendorff et al. ....	395/182.13
5,499,384	3/1996	Lentz et al. ....	710/1
5,577,211	11/1996	Annapareddy et al. ....	395/200.13
5,603,059	2/1997	Churchill et al. ....	710/36

**22 Claims, 25 Drawing Sheets**



**MICROSOFT - EXHIBIT 1041**  
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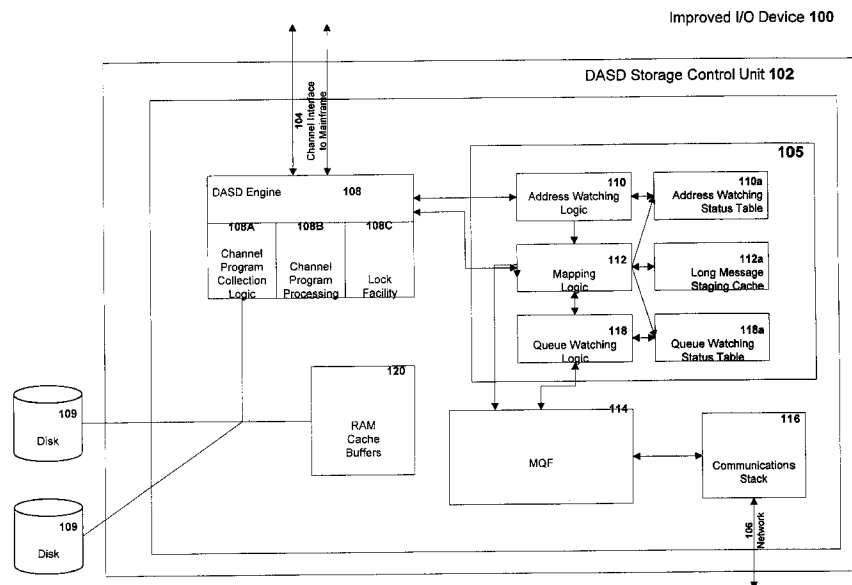
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**22 Claims, 25 Drawing Sheets**



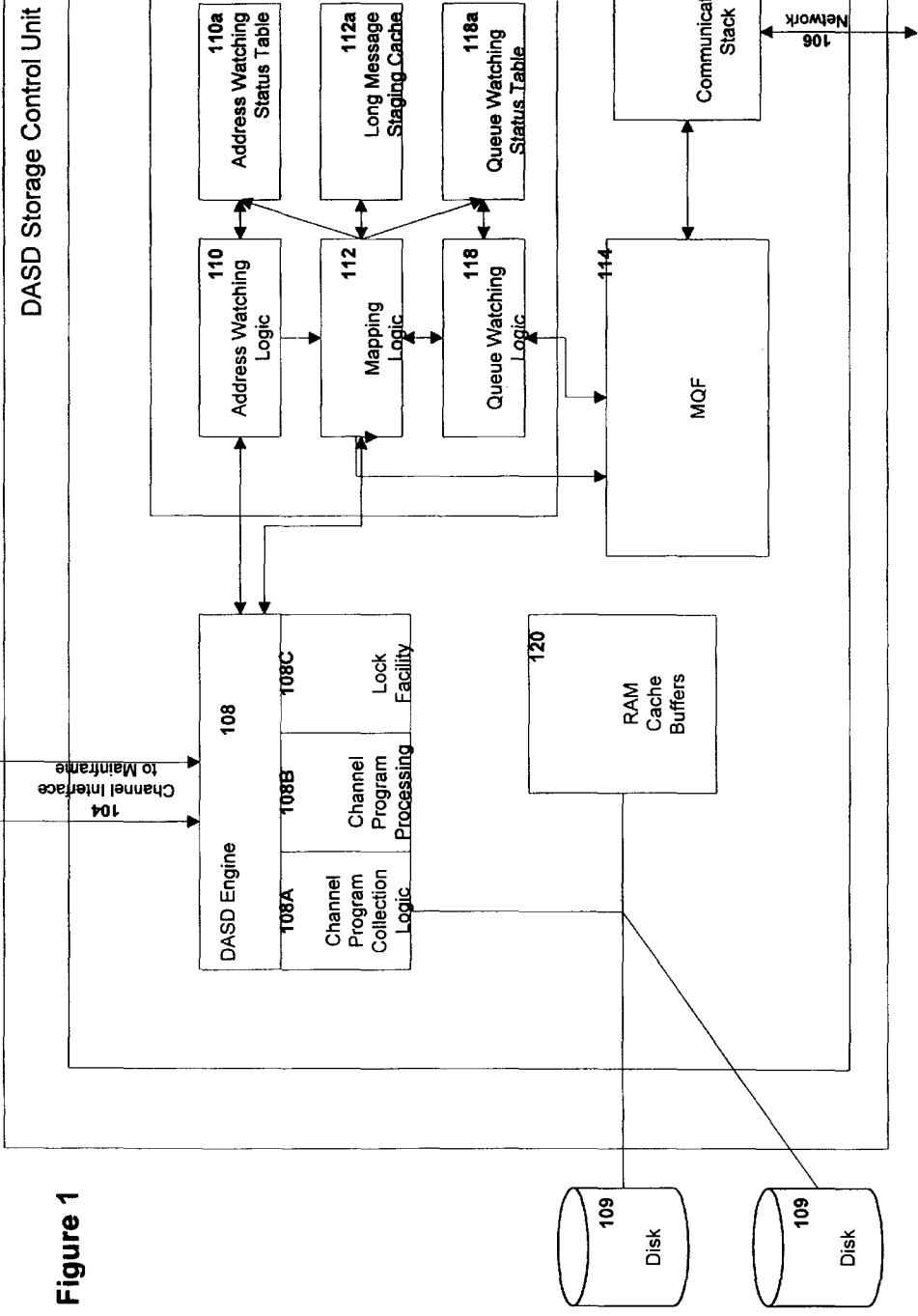


Figure 1

Figure 2

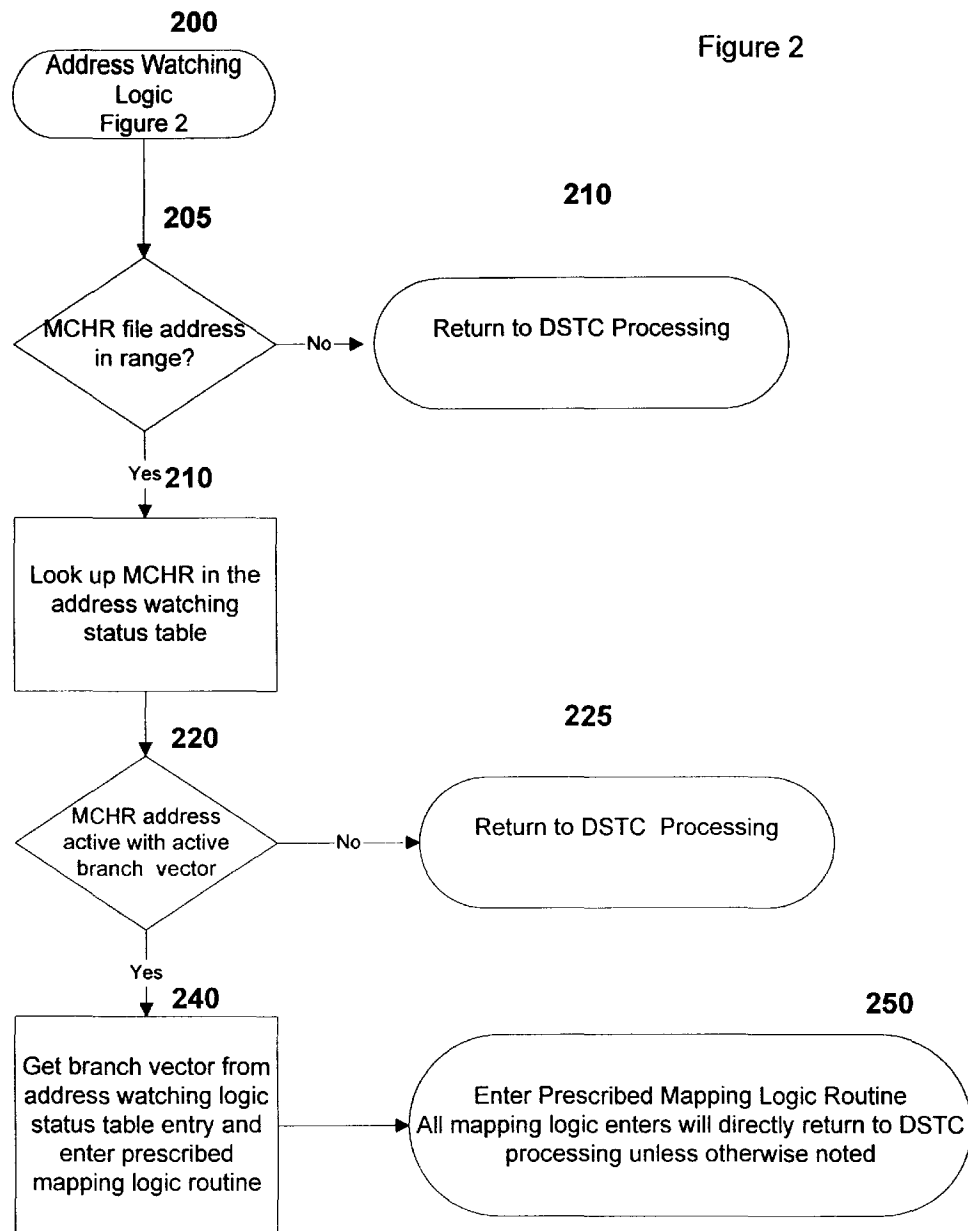
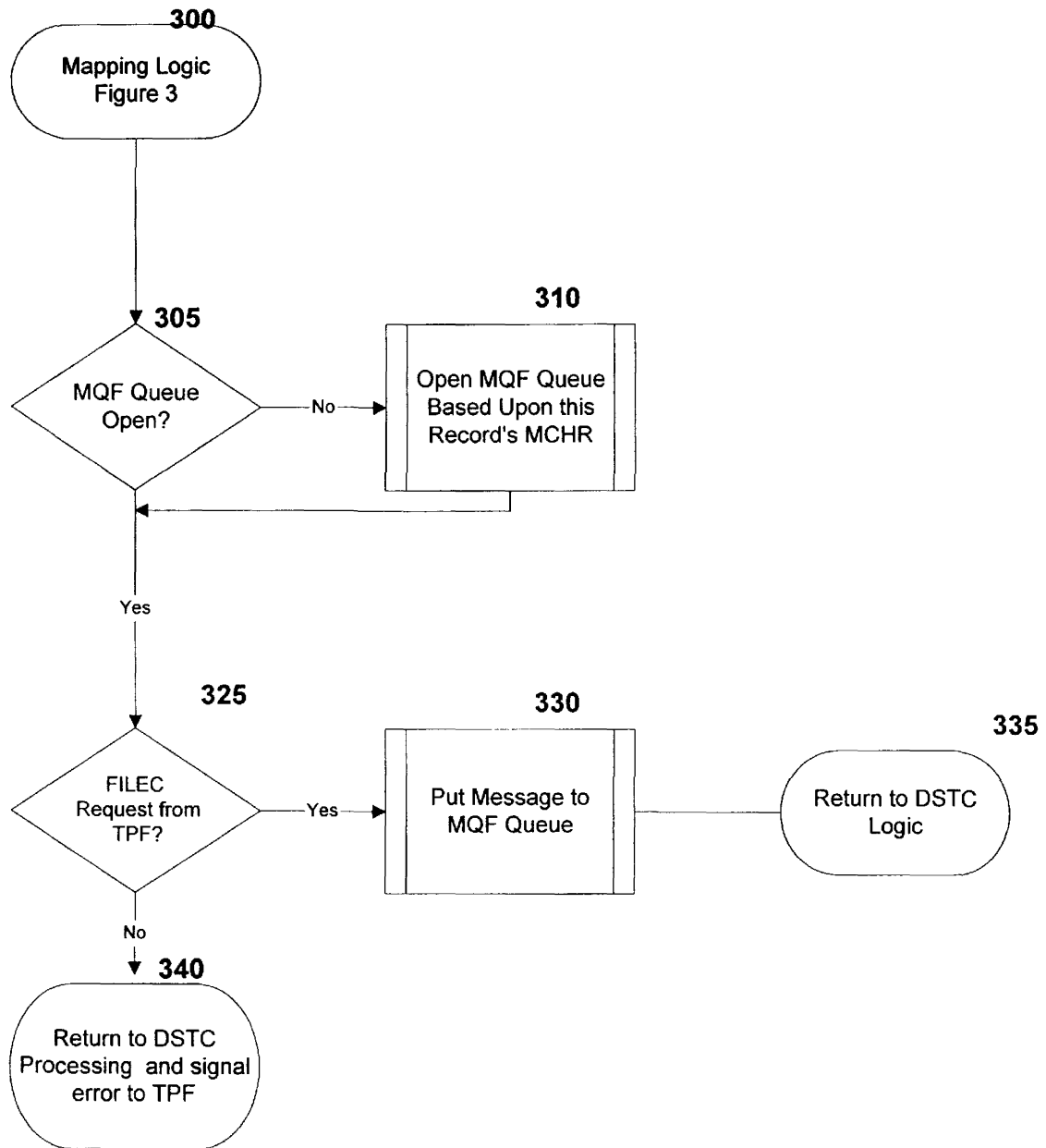


Figure 3



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