

US007313534B2

### (12) United States Patent

### Scheer

### (54) SYSTEM AND METHOD FOR PREDICTIVE MAINTENANCE AND SERVICE PARTS FULFILLMENT IN A SUPPLY CHAIN

- (75) Inventor: Robert H. Scheer, Chicago, IL (US)
- (73) Assignee: W.W. Grainger, Inc., Lake Forest, IL (US)
- (\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1138 days.

This patent is subject to a terminal disclaimer.

- (21) Appl. No.: 09/867,068
- (22) Filed: May 29, 2001

#### (65) Prior Publication Data

US 2002/0143598 A1 Oct. 3, 2002

#### **Related U.S. Application Data**

- (60) Provisional application No. 60/263,317, filed on Jan. 22, 2001.
- (51) Int. Cl.

### **G06F 9/46** (2006.01)

 (52)
 U.S. Cl.
 705/9
 705/9

 (58)
 Field of Classification Search
 705/8, 705/9, 10

See application file for complete search history.

#### (56) **References Cited**

#### U.S. PATENT DOCUMENTS

4,383,298	A	5/1983	Huff et al.	
4,459,663	A *	7/1984	Dye	705/29
4,827,423	A	5/1989	Beasley et al.	
5,040,123	A	8/1991	Barber et al.	
5,089,970	A	2/1992	Lee et al.	
5,216,612	Α	6/1993	Cornett et al.	
5,287,267	А	2/1994	Jayaraman et al.	

## (10) Patent No.: US 7,313,534 B2 (45) Date of Patent: \*Dec. 25, 2007

### (45) Date of Patent: "Dec. 25, 2007

### (Continued)

#### FOREIGN PATENT DOCUMENTS

0467257 A2 \* 1/1992

### (Continued)

### OTHER PUBLICATIONS

Andel, Tom, Maintenance Keeps Supply Chains Stong Transportation & Distribution, Aug. 1998, vol. 37, No. 8, pp. 84-86.\*

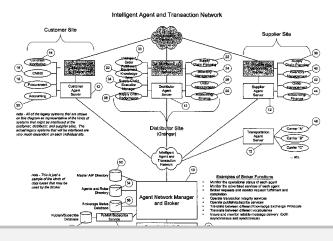
(Continued)

Primary Examiner—Tariq R. Hafiz Assistant Examiner—Scott L. Jarrett (74) Attorney, Agent, or Firm—Greenberg Traurig, LLP

#### (57) ABSTRACT

A supply chain transaction network. The network includes a customer agent server hosting a collection of intelligent customer agents for interfacing with and extracting information from one or more of a condition monitoring system, a computer maintenance management system and a procurement system and a distributor agent server hosting a collection of intelligent distributor agents for interfacing and communicating with one or more of a supply chain planning system, an inventory management system, a logistic management system, an order management system, an intelligent order fulfillment system, and an equipment knowledge base. An agent network manager and broker routes messages between the distributor agent server and the customer agent server to effect a movement of items within the supply chain.

### 11 Claims, 14 Drawing Sheets



### (74) Attorne

EP

#### U.S. PATENT DOCUMENTS

5,331,579	A *	7/1994	Maguire et al 703/2
5,367,452	Α	11/1994	Gallery et al.
5,377,098	Α	12/1994	Sakai
5,528,489	A *	6/1996	Asahara et al 705/9
5,596,507	A *	1/1997	Jones et al 700/276
5,611,051	Α	3/1997	Pirelli
5,682,728	Α	11/1997	DeBusk et al.
5,710,723	A *	1/1998	Hoth et al 702/181
5,732,401	Α	3/1998	Conway
5,764,543	Α	6/1998	Kennedy
5,787,283		7/1998	Chin et al.
5,819,232	Α	10/1998	Shipman
5,845,272	A *	12/1998	Morjaria et al 706/50
5,877,961	Α	3/1999	Moore
5,884,300	Α	3/1999	Brockman
5,946,662	A *	8/1999	Ettl et al 705/8
5,953,707	A *	9/1999	Huang et al 705/10
5,960,414	Α	9/1999	Rand et al.
5,974,395	Α	10/1999	Bellini et al.
5,995,945	Α	11/1999	Notani et al.
6,006,171	A *	12/1999	Vines et al 702/184
6,006,192	Α	12/1999	Cheng et al.
6,006,196	A *	12/1999	Feigin et al 705/10
6,032,125	А	2/2000	Ando
6,041,267	Α	3/2000	Dangat et al.
6,044,357	Α	3/2000	Garg
6,049,742	Α	4/2000	Milne et al.
6,061,691	Α	5/2000	Fox
6,078,900	A *	6/2000	Ettl et al 705/28
6,088,626	Α	7/2000	Lilly et al.
6,094,603	А	7/2000	Ishii
6,097,995	Α	8/2000	Tipton et al.
6,119,102	Α	9/2000	Rush et al.
6,154,728		11/2000	Sattar et al.
6,167,380	Α	12/2000	Kennedy et al.
6,167,385		12/2000	Hartley-Urquhart
6,182,053		1/2001	Rauber et al.
6,188,991	B1	2/2001	Rosenweig et al.
6,192,325		2/2001	Piety et al 702/184
6,324,522		11/2001	Peterson et al 705/28
6,614,882		9/2003	Beamon et al 379/27.01
6,742,000		5/2004	Fantasia et al 707/104.1
6,810,406		10/2004	Schlabach et al 707/201
6,832,205		12/2004	Aragones et al 705/10
6,959,235		10/2005	Abdel-Malek et al 701/33
7,016,774		3/2006	Barber et al 701/30
2001/0034673	A1*	10/2001	Yang et al 705/28
2002/0035495	A1*	3/2002	Spira et al 705/7
2002/0065698		5/2002	Schick et al 705/8
2002/0073012	A1*	6/2002	Lowell et al 705/37
2002/0103690		8/2002	Lyon et al 705/9
2003/0055666	A1*	3/2003	Roddy et al 705/1

#### FOREIGN PATENT DOCUMENTS

WO WO 98/24042 \* 11/1997

#### OTHER PUBLICATIONS

Songini, Marc L, Navy embarks on supply-chain mission Computerword, Jan. 15, 2001, vol. 35, No. 3.<sup>3</sup>

Weiss, Gerhard, Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence The MIT Press, Jul. 31, 2000, ISBN: 0262731312.3

Dilger, Karen Abramic, To Protect and Serve Manufacturing Systems, Jun. 1997, vol. 15, No. 6., pp. 22-28.\*

MRO.com Delivers Buy-Side Online Procurement Solution for Purchasing MRO Materials and Services PR NewsWire, Jun. 24, 1999.\*

Avery, Susan, Electronic Tools help distributors meet service demands Purchasing, May 4, 2000.\*

McColm, Neal et al., Simulation Model for Multi-Level Distribution System Planning IEEE 1982.\*

Graves, Stephen, A Multiple-Item Inventory Model with Job Completion Criteria Management Science, vol. 28, No. 11, 1982, pp. 1334-1337.3

Gullinan, Gregory F., Tracking work orders with a microcomputer Plant Engineering, vol. 38, Apr. 12, 1984.\*

Mamer, John W. et al., Job Completion Based Inventory Systems: Optimal Policies for Repair Kits and Spare Machines Management Science, vol. 31, No. 6, Jun. 1985, pp. 703-718.\*

Katzel, Jeanine, Maintenance Management Software Plant Engineering, vol. 41, Jun. 18, 1987.\*

Cohen, Morris et al., Optimizer: IBM's Multi-Echelon Inventory System for Managing Service Logistics Interfaces, Vo. 20, No. 1, Jan.-Feb. 1990, pp. 65-82.\*

Cohen, Morris A. et al., Out of Touch With Customer Needs? Space Parts and After Sales Service Sloan Management Review, Winter 1990, vol. 31, No. 2, pp. 55-66.\*

Lahiri, Santi B., A Decision-Support Modeling System for Minimization of Logistic Support Cost Production and Inventory Management Journal, Fourth Quarter 1992, vol. 33, No. 4, pp. 75-80.\* Langan, George, Maintenance Automation: Out of the broom closet and into the boardroom IIE Solutions, vol. 27, No. 7, Jul. 1995, pp. 14-17.\*

Agrawal, Vipul, Planning Models for Multi-Level Distribution Systems University of Pennsylvania, AAT 9615007, 1995, Abstract.\*

Ashayeri, J. et al., Inventory Management of Repairable Service Parts for Personal Computers: A Case Study International Journal of Operations & Production Management, vol. 16, No. 12, 1996.\*

Cohen, Morris A. et al., Service Parts Logistics: A Benchmark Analysis IIE Transactions, Vo..29, No. 8, Aug. 1997.\*

Teachey, Daniel, What Is A CMMS, And Why Should You Care? EC&M, Mar. 1, 1998.\*

Lamedola, Mark, Beyond Work Orders: Get More from you CMMS EC&M, Oct. 1, 1999.\*

Dilger, Karen A., Asset Management Exchange Bound Manufacturing Systems, Jun. 2000, vol. 18, No. 6, pp. 43-48.\*

Botter, Rene et al., Stock Strategy For Service Parts: A Case Study International Journal of Operations & Production Management, vol. 20, No. 6, 2000.\*

Cohen, Morris A. et al., Saturn's Supply-Chain Innovation: High Value in After Sales Service Sloan Management REview, Summer 2000, vol 41, No. 4, pp. 93-101.\*

Kalakota, Ravi et al., Readings in Electronic Commerce Addison Wesley Longman, Inc., Oct. 1995, ISBN 0-201-88060-1.\*

Patton, Joseph et al., Service Management Principles and Practice Instrument Society of America, Third Edition, 1994, ISBN: 1-55617-491-8.\*

Orsburn, Douglas K., Spares Management Handbook McGrawHill, 1991, ISBN: 0-8306-7626-0.\*

Luxhoj, James T. et al., Probalistic Spares Provisioning for Repairable Population Models Journal of Business Logistics, vol. 9, No. 1, 1988.\*

Cohen Morris A., et al., Identifying Opportunities for Improving Teradyne's Service-Parts Logistics System Interfaces, vol. 29, No. 4, Jul./Aug. 1999, pp. 1-18.\*

Wang, Yunzeng, Service Parts Logistics: Modeling, Analysis and Application University of Pennsylvania, 1998.\*

Patton, Joseph Jr. et al., Service Parts Handbood The Solomon Press Publishers, '99, ISBN 0-934623-73-2.\*

Michael Bittner, E-Business Requires Supply Chain Event Management, The Report on Supply Chain Management, Nov. 2000, pp. 1-25, AMR Research, Inc.

Robert Ferrari, Demand Planning and Management Will Leverage the Web, The Report on Supply Chain Management, Dec. 2000, pp. 3-25, AMR Research, Inc.

Bob Parker, Buildign a Collaboration Strategy, The Report on

Charles C. Poirier and Stephen E. Reiter, Supply Chain Optimization, 1996, pp. 224-259, Berrett-Koehler Publishers, Inc.

Charles C. Poirier, Advanced Supply Chain Management, 1999, pgs. Exhibit 6.2, 105-106, 174, Berrett-Koehler Publishers, Inc.

Aimo Hinkkanen, Ravi Kalakota, Porama Saengcharoenrat, Jan Stallaert, and Andrew B. Whinston, Distributed Decision Support Systems for Real-Time Sypply Chain Management Using Agent Technologies, 1997, pp. 275-291, Addison Wesley Longman, Inc. Supply-Chain Operations Reference-Model, Version 4.0, 2000, pp. 1-20, Supply Chain Council, Inc.

David Berger, A Look into the Future of Asset Optimization, Asset Magazine, vol. 1, Issue 1, pp. 1-19.

Maincor Maintenance Management Software, Brochure, 6 pgs.

Eryn Brown, 9 Ways to Win on the Web, Fortune, May 24, 1999, 2 pgs.

Christopher Carlson, Pitney Bowes Gets the Message, Electronic Commerce World, Apr. 1999, 5 pgs. A Management Briefing on VendorSite, Prepared for W.W.

Grainger, Inc., Feb. 1, 2000, pp. 1-16.

Your Window Into Your Supply Chain, Eventra, 1998, 4 pgs. VendorSite, A Focus on ROI, Eventra, 4 pgs.

Larry Lapide, Focus Group on Supply Chain Collaboration, The Report on Supply Chain Management, Apr. 1999, pp. 17-22, AMR Research, Inc.

Scott Lundstrom, Business Community Integration-The Next Wave, The Report on Enabling Technologies, Aug. 1999, pp. 3-17, AMR Research, Inc.

Bob Parker, Should Internet Procurement Be a Priority for The Enterprise?, The Report on Enabling Technologies, Oct. 1998, pp. 3-24, AMR Research, Inc.

Susan Avery, Distribution Redefines Itself, Purchasing online, May 7, 1998, pp. 1-17.

Demand Activated Manufacturing Architecture, DAMA Project, DAMA Model for Collaboration, Oct. 2000, pp. 1-20, Sandia Corporation.

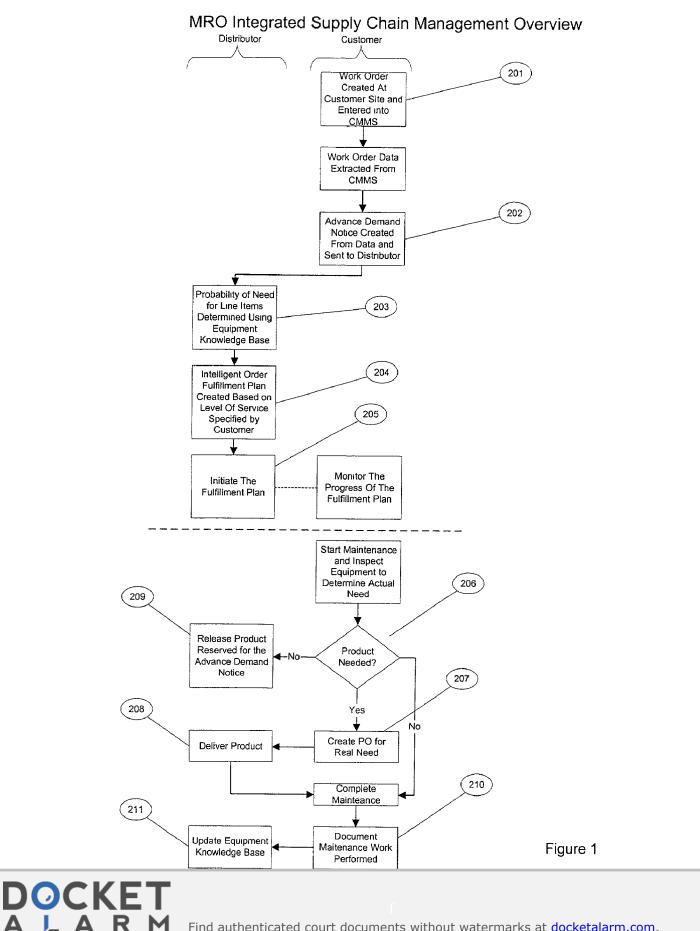
Chris Newton, Warehousing Isn't Just About Storage Anymore, The Report on Supply Chain Management, Oct. 1999, pp. 1-28, AMR Research. Inc.

Mark Bittenbender, AlliedSignal balances Inventory and service levels across its supply chain to increase customer satisfaction and internal cash flow, 6 pgs., AlliedSignal.

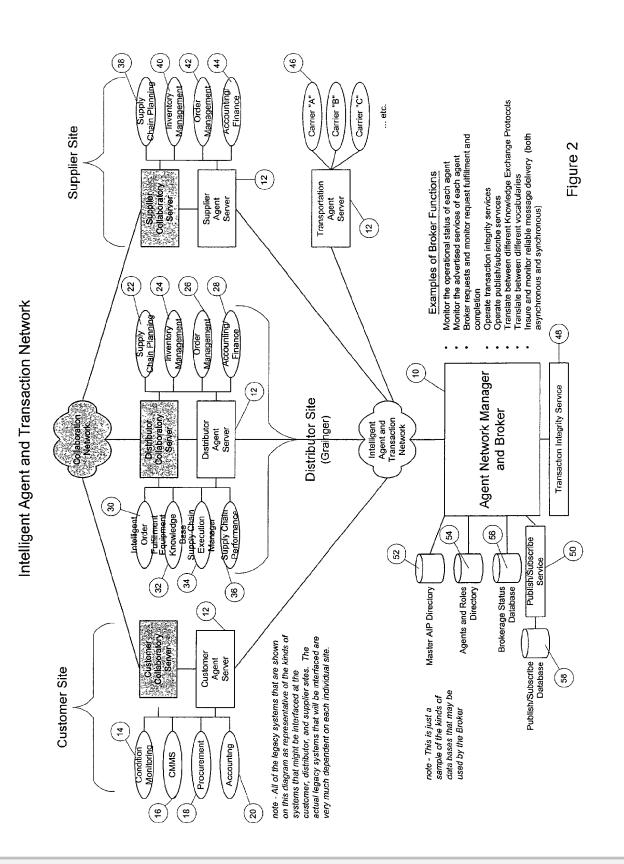
LPA Vision, Supply Chain Management Software, 26 pgs., LPA Software, Inc.

\* cited by examiner

Δ



Find authenticated court documents without watermarks at docketalarm.com.



### DOCKET A L A R M Find authenticated court

Find authenticated court documents without watermarks at <u>docketalarm.com</u>.

# DOCKET A L A R M



# 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.