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(54) **SYSTEM AND METHOD OF CONTROLLING AN HVAC SYSTEM**

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

3,181,791 A *	5/1965	Axelrod .....	236/44 C
4,075,699 A	2/1978	Schneider et al.	
4,174,517 A	11/1979	Mandel	
4,217,646 A	8/1980	Caltagirone et al.	
4,218,737 A	8/1980	Buscher et al.	
4,245,319 A	1/1981	Hedges	
4,291,375 A	9/1981	Wolf	
4,324,987 A	4/1982	Sullivan, II et al.	
4,336,462 A	6/1982	Hedges et al.	
4,338,791 A	7/1982	Stamp, Jr. et al.	

(Continued)

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FOREIGN PATENT DOCUMENTS

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**Related U.S. Application Data**

OTHER PUBLICATIONS

(63) Continuation of application No. 10/402,370, filed on Mar. 28, 2003, now abandoned.

"50 Successful DSM Programs", The Results Center, lists Mar. 1994.

(60) Provisional application No. 60/383,027, filed on May 24, 2002, provisional application No. 60/368,963, filed on Mar. 28, 2002.

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(52) **U.S. Cl.** ..... 700/276; 700/299; 700/300; 705/412; 702/60; 702/130; 702/188

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See application file for complete search history.

(57) **ABSTRACT**

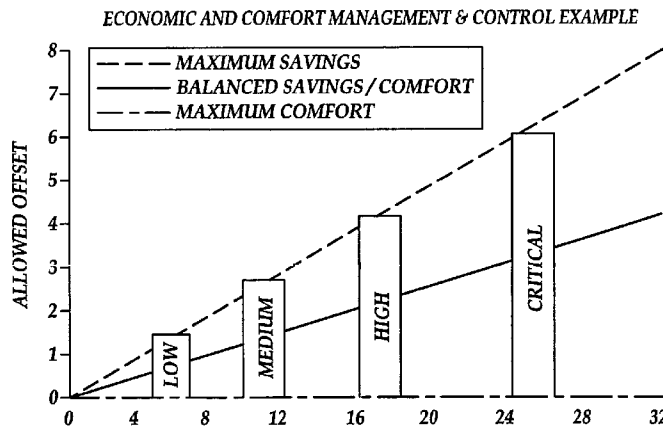
A system and method manage delivery of energy from a distribution network to one or more sites. Each site has at least one device coupled to the distribution network. The at least one device controllably consumes energy. The system includes a node and a control system. The node is coupled to the at least one device for sensing and controlling energy delivered to the device. A control system is coupled to the node and distribution network for delivery to the node at least one characteristic of the distribution network. The node controls the supply of energy to the device as a function of the at least one characteristic.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,547,242 A 7/1925 Strieby

**29 Claims, 18 Drawing Sheets**



U.S. PATENT DOCUMENTS

4,367,414 A 1/1983 Miller et al.  
 4,382,544 A 5/1983 Stewart  
 4,466,074 A 8/1984 Jindrick et al.  
 4,475,193 A 10/1984 Brown  
 4,503,288 A 3/1985 Kessler  
 4,511,979 A 4/1985 Amirante  
 4,513,189 A 4/1985 Ueda et al.  
 4,514,594 A 4/1985 Brown et al.  
 4,520,576 A 6/1985 Vander Molen  
 4,521,645 A 6/1985 Carroll  
 4,523,307 A 6/1985 Brown et al.  
 4,539,562 A 9/1985 Sanders  
 4,549,274 A 10/1985 Lerner et al.  
 4,567,557 A 1/1986 Burns  
 4,630,218 A 12/1986 Hurley  
 4,663,775 A 5/1987 Olek  
 4,665,544 A 5/1987 Honda et al.  
 4,697,182 A 9/1987 Swanson  
 4,701,698 A 10/1987 Karlsson et al.  
 4,728,949 A 3/1988 Platte et al.  
 4,771,185 A 9/1988 Feron et al.  
 4,772,870 A 9/1988 Reyes  
 4,819,180 A 4/1989 Hedman et al.  
 4,847,554 A 7/1989 Goodwin  
 4,847,780 A 7/1989 Gilker et al.  
 4,847,781 A 7/1989 Brown, III et al.  
 4,847,782 A 7/1989 Brown, Jr. et al.  
 4,855,922 A 8/1989 Huddleston et al.  
 4,884,021 A 11/1989 Hammond et al.  
 4,888,495 A 12/1989 Feron et al.  
 4,899,129 A 2/1990 MacFadyen et al.  
 4,899,217 A 2/1990 MacFadyen et al.  
 4,971,136 A 11/1990 Mathur et al.  
 4,977,515 A 12/1990 Rudden et al.  
 4,987,513 A 1/1991 Shelley  
 4,998,097 A 3/1991 Noth et al.  
 5,033,112 A 7/1991 Bowling et al.  
 5,045,823 A 9/1991 Nichols, III  
 5,086,385 A 2/1992 Launey et al.  
 5,090,024 A 2/1992 Vander Mey et al.  
 5,101,191 A 3/1992 MacFadyen et al.  
 5,109,222 A 4/1992 Welty  
 5,126,934 A 6/1992 MacFadyen  
 5,134,356 A 7/1992 El-Sharkawi  
 5,168,170 A 12/1992 Hartig  
 5,170,360 A 12/1992 Porter et al.  
 5,196,982 A 3/1993 Landsberg et al.  
 5,218,552 A 6/1993 Stirk et al.  
 5,220,311 A 6/1993 Schweitzer, Jr.  
 5,263,046 A 11/1993 Vander Mey  
 5,274,571 A 12/1993 Hesse et al.  
 5,278,862 A 1/1994 Vander Mey  
 5,289,362 A 2/1994 Liebl et al.  
 5,301,122 A 4/1994 Halpern  
 5,315,499 A 5/1994 Bilas et al.  
 5,323,307 A 6/1994 Wolf et al.  
 5,347,167 A 9/1994 Singh  
 5,414,640 A 5/1995 Seem  
 5,436,510 A 7/1995 Gilbert  
 5,462,225 A 10/1995 Massara et al.  
 5,469,365 A 11/1995 Diekena et al.  
 5,475,371 A 12/1995 Dunk et al.  
 5,501,267 A 3/1996 Iritani et al.  
 5,572,438 A 11/1996 Ehlers et al.  
 5,598,349 A 1/1997 Elliason et al.  
 5,675,503 A \* 10/1997 Moe et al. .... 700/296  
 5,684,710 A 11/1997 Ehlers et al.  
 5,696,695 A 12/1997 Ehlers et al.  
 5,924,486 A 7/1999 Ehlers et al.

6,311,105 B1 10/2001 Budike, Jr.  
 6,816,757 B1 \* 11/2004 De La Ree et al. .... 700/286  
 2001/0010032 A1 7/2001 Ehlers et al.  
 2002/0019712 A1 2/2002 Petite et al.  
 2003/0036810 A1 2/2003 Petite  
 2003/0036822 A1 2/2003 Davis et al.

FOREIGN PATENT DOCUMENTS

DE 27 43 212 3/1979  
 EP 0 163 572 A1 12/1985  
 EP 0 288 413 A1 10/1988  
 EP 0 534 839 A1 3/1993  
 EP 0 577 532 A1 1/1994  
 EP 0 580 217 A1 1/1994  
 EP 0 688 085 A1 12/1995  
 FR 2 645 968 10/1990  
 FR 2 660 511 10/1991  
 WO WO 93/08653 4/1993  
 WO WO 94/00824 1/1994  
 WO WO 94/03989 2/1994  
 WO WO 94/09572 4/1994

OTHER PUBLICATIONS

"A-14—DMS 350A Programming Reference", Jul. 1998, 1 page.  
 "Bell of Pennsylvannia's automatic meter reading coult mean greater security and privacy for customers", PR Newswire, Feb. 28, 1990.  
 "Boosting Your Home's IQ: Manufacturers agree on standards for creating the smart house", Technology, p. 70 (not dated).  
 "Cebus (R) power line carrier technologies from Intellon Corp. support home automation application", PR Newswire, Mar. 1, 1994.  
 "Commonwealth Edison installs Metricom's communication network" Business Wire, Mar. 4, 1993.  
 "Demonstrating smarts; bright home; a demonstration home that utilizes consumer electronics . . ." Popular Science, Jul. 1991.  
 "DMS and Operator Interface Guide Specification", Dec. 1991, pp. 1-33.  
 "DMS Facilities Management System FMS2-35SX", Robertshaw Control Division, Nov. 1991, 4 pages.  
 "Energy announces a major development in its residential customer-controlled load manage . . ." PR Newswire Assoc., Jan. 19, 1994.  
 "Energy moves into fiber optics to control residential consumption", Energy Report, Dec. 4, 1992, vol. 20, No. 49 (sr abst).  
 "Entergy Enterprises" CC2000 test joined by Sprint Honeywell . . . PR Newswire Assoc., Aug. 26, 1993.  
 "First Pacific Networks, Central and South West Corp. to conduct energy management project in Laredo, TX", Business Wire, Mar. 24, 1994.  
 "Home automation: what's in it for utilities?", EPRI, Apr. 1990.  
 "Honeywell, Oracle Corp. unveil joint technology and marketing alliance", Electric Utility Week's Demand-Side Report, Mar. 3, 1994.  
 "Is DSM having an impact on electric-utility credit ratings?" , Electrical World, Aug. 1993.  
 "Itron signs \$27M contract with Baltimore Gas and Electric", PR Newswire, Apr. 4, 1994.  
 Johnson Controls makes entry into home energy automation market . . . , PR Newswire, Mar. 29, 1994.  
 "Leading companies demonstrate home automation based on Echelon's technology", Business Wire, Apr. 14, 1994.  
 "Lon Works—the choice in home automation", Motorola, Mar. 1994.  
 "MicroSmart Control Network (Features and Benefits)", Siebe Environmental Controls, 1993, 10 Pages.  
 "MicroSmart Control Network System Overview", Siebe Environmental Controls, Nov. 1993, pp. 1-12.  
 "MicroSmart MSC-NC/NCM (Network Communications Module) Installation Guidelines", Siebe Environmental Controls, Jun. 1993, pp. 1-9.

- "PLC features & specifications", Regency Electronics, Inc. date unknown.
- "Re-engineering electric utility metering and communications", Transmission & Distribution, Apr. 1994.
- "Schlumberger launches new venture for building automation systems in Europe using Echelon Technology", Bus. Wire, Jul. 13, 1992.
- "Scientific-Atlanta, Bell Atlantic to Offer Cost-Effective Information", PR Newswire, Sep. 23, 1991 (Mary Nagelhout).
- "Section 2 Standard Program Functions (DMS 350A Programming Reference)", Sep. 1987, pp. 2-1 to 2-18.
- "Section 6: User Defined Programming (DMS 350A Programming Reference)", Apr. 1989, pp. 6-11 to 6-12 (double-sided).
- "Using the line sharing switch in power utility load study application", Teltone Telesolutions, 1993.
- "Variable electric rates", Transtext.
- Cain, Charles J., "Metering gets real", Fortnightly, Apr. 1, 1994, pp. 39-40.
- Coleman, Andrew et al., "Competitive edge-Power View: A DSM-focused technology", Fortnightly.
- Dawson, Fred, "Energy saver can support voice and data", Multichannel News, Oct. 21, 1991.
- Eaton Corporation, Cutler-Hammer—Westinghouse Products, Power Distribution Components Division, "IMPACC System Communications", IL 17384, May 1995, Revision 2.1, Appendix E (title page, contents listing and pp. E-1 through E-4). Home Automation Laboratories, Fall 1994 Catalog.
- Jones, David A., "Cutting edge; three houses that break the rules and break new ground . . .", Builder Info Access, Nov. 1993.
- Jones, David A., "Smart Money? Home automation systems", Builder Jun. 1993, pp. 162-166.
- Kaplan, Daniel, "DSM Monitoring a key issue for utility industry industry E-source", The Engery Daily, Oct. 5, 1993.
- Karve, Anita, "Brainy Buildings", LAN Magazine, Aug. 1994.
- McLeister, Dan, "Dramatic changes lie ahead for home automation", Professional Builder & Remodeler, Feb. 1994.
- Millar, Heather, "Smart houses: getting switched on", Business Week, Jun. 28, 1993.
- Niggli, Michael R., PowerView: Two-Way Customer Communications: (no ref or date).
- Phillips, Tim, "Welcome to the computerized home", The Guardian, Mar. 10, 1994.
- Piepmeyer, James M. et al., "The tools of competition:" differentiation, segmentation . . . , The Electricity Journal, Nov. 1993.
- Rupinski, Patrick, "New device automatically alerts company of power interruption", (no ref or date).
- Saladyga, John S., "New home automation systems integrate security, energy and entertainment", Newsday, Inc., Oct. 15, 1992.
- Salpukas, Agis, "Big hopes put on electric wires", The New York Times, Jul. 6, 1994.
- Sanders, Michele, "Interfacing with the home of the future", Information Access, Apr. 1993.
- Schrock, Clifford B., "conservation and safety for the 90's using cable TV networks", Cable Bus Systems Corp., (no ref or date).
- Stevenson, Jr. William, "Elements of Power System Analysis", 4th Edition (1982), pp. 13-18 PCT International Search Report.
- Teletimer Energy Savings Service: Low-cost—high value building automation.
- Vizard, Frank, "Building the information superhighway", Popular Mechanics, Jan. 1994.

\* cited by examiner

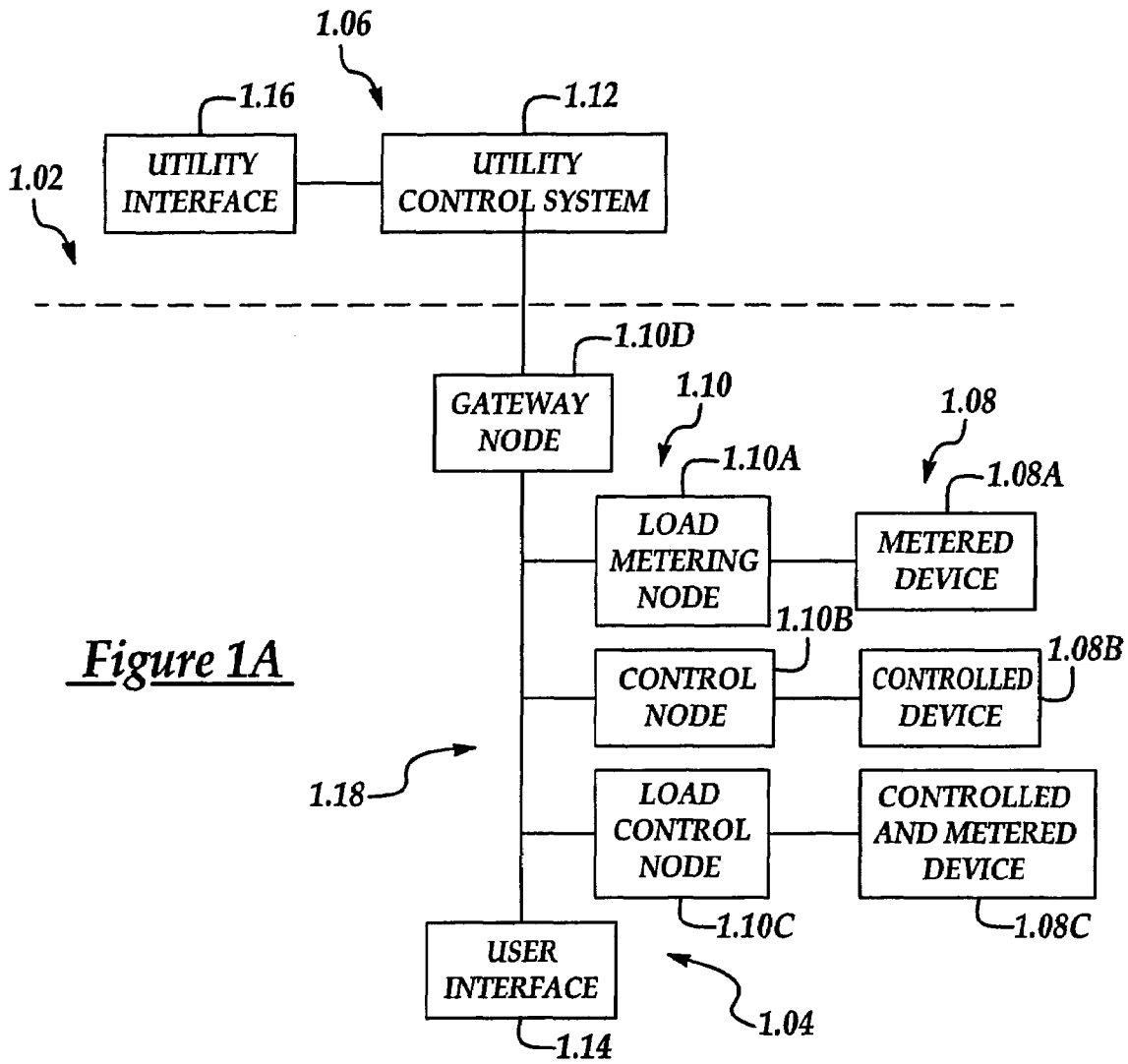


Figure 1A

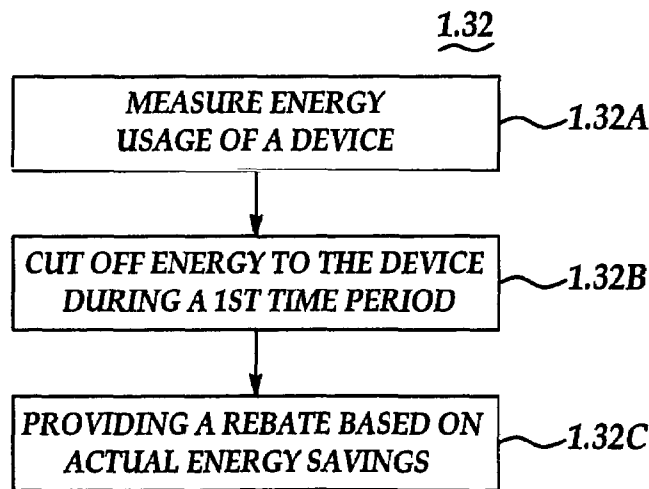


Figure 1C

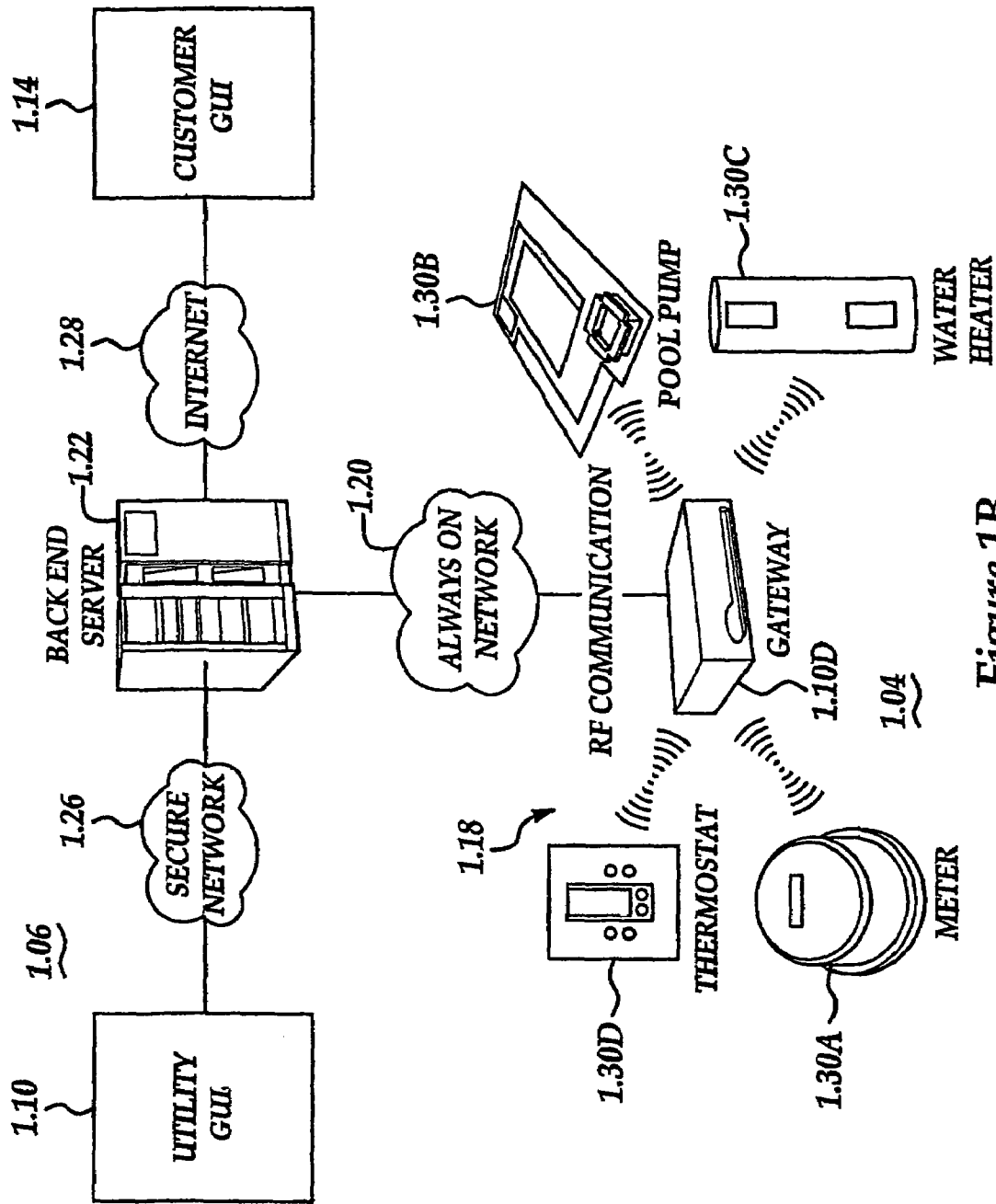


Figure 1B

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