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# United States Patent [19]

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[54] **COMPLIED OBJECTIVE REFERENTIAL CONSTRAINTS IN A RELATIONAL DATABASE HAVING DUAL CHAIN RELATIONSHIP DESCRIPTORS LINKED IN DATA RECORD TABLES**

[75] Inventors: **Richard A. Crus**, San Jose; **Michael J. Dockter**, Hollister; **Robert W. Engles**, San Jose; **Donald J. Haderle**, Los Gatos, all of Calif.

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

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### Related U.S. Application Data

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[51] Int. Cl.<sup>5</sup> ..... **G06F 7/00; G06F 15/40**

[52] U.S. Cl. .... **395/600; 364/DIG. 1; 364/282.1; 364/283.4; 364/974; 364/974.4; 364/974.5**

[58] Field of Search ... **364/200 MS File, 900 MS File**

### [56] References Cited

#### U.S. PATENT DOCUMENTS

4,498,145	2/1985	Baker et al.	364/900
4,631,673	12/1986	Haas et al.	364/200
4,870,397	9/1989	Soto et al.	340/747
4,918,593	4/1990	Haber	364/200
4,933,848	6/1990	Haderle et al.	364/300
4,947,320	8/1990	Crus et al.	364/200
5,043,872	8/1991	Cheng et al.	364/200

#### OTHER PUBLICATIONS

Stonebraker, et al., "Object Management in POSTGRES Using Procedures", University of California, Berkeley, Jun., 1986.

Lindsay, et al., "A Data Management Extension Archi-

ecture", Proceedings of ACM-SIGMOD Conference on Management of Data, May, 1987, pp. 220-226.

Simon, et al., "Efficient Algorithms for Integrity Control in a Database Machine", Proceedings IEEE Trends and Applications, 1984, pp. 53-59.

Simon, et al., "Design and Implementation of an Extendible Integrity Subsystem", Proceedings ACM-SIGMOD 1984, pp. 9-17.

Dogac, et al., "The Design and Implementation of an Integrity Subsystem for the Relational DBMS RAP", IEEE Fourth International Conference on Entity-Relationship Approach 1985, pp. 295-302.

*Primary Examiner*—Thomas C. Lee

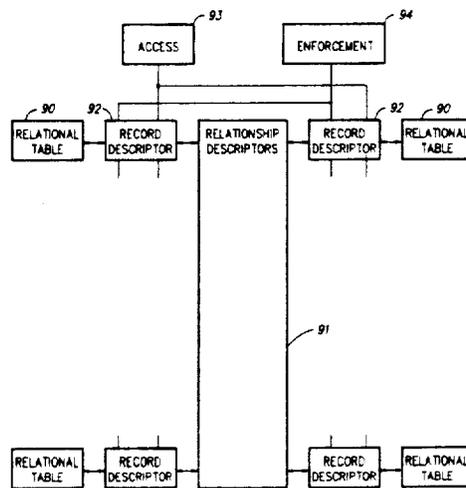
*Assistant Examiner*—Krisna Lim

*Attorney, Agent, or Firm*—Pryor A. Garnett

### [57] ABSTRACT

An implementation of referential integrity in which descriptions of referential constraints are compiled into meta-data descriptions of the constraint rules and specifications. The meta-data descriptions of the constraints are stored in the form of objects called relationship descriptors. Each relationship descriptor contains a complete description of a referential constraint, either directly or by means of pointers to other objects such as record and index descriptors which contain information comprised in the constraint's specification. The relationship descriptors are linked into two types of chains by symbolic pointers. One type of relationship descriptor chain connects all relationship descriptors which have a common parent table. The other type of relationship descriptor chain connects relationship descriptors with common dependent tables. Both types of chains are anchored in respective fields in the tables' record descriptors. The use of meta-data descriptors facilitates both ready modification of the constraints, and speedy enforcement of the constraints by a single, shared procedure which may be embedded in the data base manager.

**12 Claims, 5 Drawing Sheets**



RELATIONAL DATA BASE MANAGEMENT SYSTEM