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[54] **OBJECT ORIENTED DATA STORE INTEGRATION ENVIRONMENT FOR INTEGRATION OF OBJECT ORIENTED DATABASES AND NON-OBJECT ORIENTED DATA FACILITIES**

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[58] **Field of Search** 395/600, 650, 395/700

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,525,780	6/1985	Bratt et al.	364/200
4,853,843	8/1989	Ecklund	364/200
4,864,497	9/1989	Lowry et al.	364/300
4,943,933	7/1990	Miyamoto et al.	364/513
4,953,080	8/1990	Dysart et al.	364/200
4,989,132	1/1991	Mellender et al.	364/200
5,008,853	4/1991	Bly et al.	364/900
5,079,695	1/1992	Dysart et al.	395/700
5,093,914	3/1992	Coplien et al.	395/700
5,113,522	5/1992	Dinwiddie, Jr. et al.	395/700
5,125,091	6/1992	Staas, Jr. et al.	395/650
5,129,083	7/1992	Cutler et al.	395/600
5,129,084	7/1992	Kelly, Jr. et al.	395/650
5,136,712	8/1992	Perazzoli, Jr. et al.	395/700
5,142,674	8/1992	Barker et al.	395/600
5,157,777	10/1992	Lai et al.	395/425
5,161,223	11/1992	Abraham	395/600
5,161,225	11/1992	Abraham et al.	395/600
5,170,466	12/1992	Rogan et al.	395/145
5,175,848	12/1992	Dysart et al.	395/600
5,185,885	2/1993	Dysart et al.	395/600
5,187,786	2/1993	Densmore et al.	395/600
5,187,787	2/1993	Skeen et al.	395/600
5,187,790	2/1993	East et al.	395/725
5,193,180	3/1993	Hastings	395/575
5,206,951	4/1993	Khoyi et al.	395/650
5,265,206	11/1993	Shackelford et al.	395/200
5,291,583	3/1994	Bapat	395/500
5,291,593	3/1994	Abraham et al.	395/600
5,327,559	7/1994	Priven et al.	395/700
5,386,564	1/1995	Shearer et al.	395/650
5,388,264	2/1995	Tobias, II et al.	395/650

OTHER PUBLICATIONS

P. Butterworth et al. "The Gemstone Object Database Management System" Comm. ACM, V. 34, N. 10, pp. 65–77, Oct. 1991.

J. Joseph et al. "Object–Oriented Databases: Design and Implementation" Proc. IEEE, V. 79, N. 1, pp. 42–64, Jan. 1991.

D. Fishman et al. "IRIS: An Object–Oriented Database Management System" ACM Trans Ofc Info Sys, V. 5, N. 1, pp. 48–69, Jan. 1987.

(List continued on next page.)

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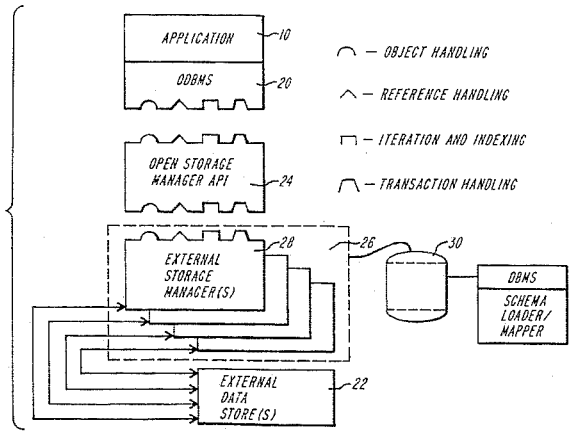
[57] **ABSTRACT**

A method and apparatus for accessing and effectively integrating non-object oriented data stores with object applications. An integrating environment is implemented wherein an application using a distributed object database and object database management system (ODBMS) is provided with an interface to external data stores in a manner so as to effect location transparency. The application, accessing data via the ODBMS, can manipulate data in foreign data stores which include external data that is mapped and converted into objects for use by object applications. A storage management application program interface ("SM API"), effects a functional interface for handling objects, referencing objects, implementing iteration and indexing of objects, and implementing object transaction and cache handling. The SM API is part of a modular architecture that includes an external storage manager which implements classes that provide the foundation for engaging external data stores, and which maps and converts external data into objects that can be manipulated by an application using the ODBMS.

10 Claims, 7 Drawing Sheets