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[54] VIRTUAL MANIPULATING APPARATUS AND METHOD

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **345/156**; 395/355

[58] **Field of Search** 325/156, 157, 325/158, 145, 146; 395/161, 355, 326

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,414,537	11/1983	Grimer .	
4,988,981	1/1991	Zimmerman et al.	345/157
5,293,529	3/1994	Yoshimura et al.	345/158
5,381,158	1/1995	Takahara et al.	345/156

FOREIGN PATENT DOCUMENTS

4-18626	1/1992	Japan .
2013617	8/1979	United Kingdom .

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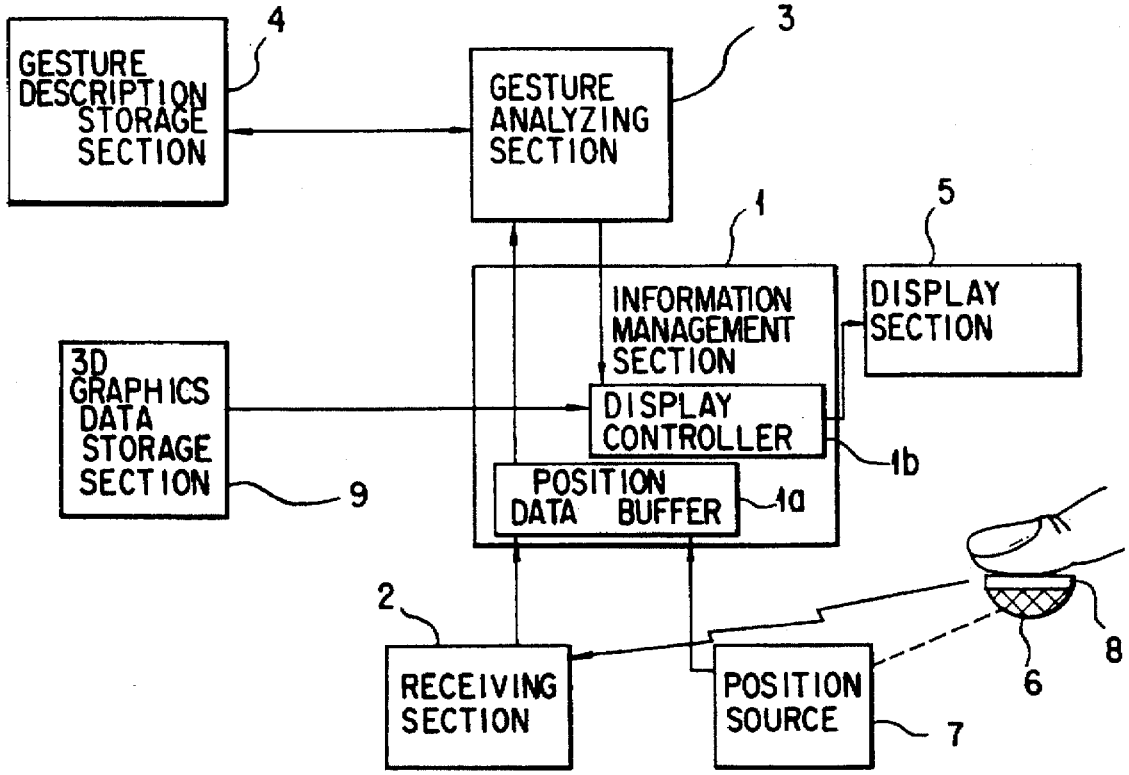
[57] **ABSTRACT**

A manipulation target such as a lever or button is displayed in a three-dimensional virtual space using three-dimensional computer graphics. The positions of a thumb and an index finger are detected. A manipulation instruction is interpreted, using interpretation rules described on the basis of a relationship between the detected positions and the thumb and the index finger and the three-dimensional coordinates of a display device.

12 Claims, 23 Drawing Sheets