



US005841409A

United States Patent [19]

[11] Patent Number: **5,841,409**

Ishibashi et al.

[45] Date of Patent: ***Nov. 24, 1998**

[54] **IMAGE DISPLAY APPARATUS** 4,722,601 2/1988 Mcfarlane 345/8
 5,343,313 8/1994 Fergason 348/8
 [75] Inventors: **Kenji Ishibashi, Izumi; Yasushi Tanijiri, Sakai; Yasumasa Sugihara,** 5,388,990 2/1995 Beckman 345/8
 Hashimoto, all of Japan 5,491,510 2/1996 Gove 345/8

FOREIGN PATENT DOCUMENTS

5-78013 12/1983 Japan .
 62-115989 5/1987 Japan .
 5-52116 5/1991 Japan .
 3-289797 (A) 12/1991 Japan .

[73] Assignee: **Minolta Co., Ltd.,** Osaka, Japan
 [*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Primary Examiner—Matthew Luu
Attorney, Agent, or Firm—Burns, Doane, Swecker & Mathis, LLP

[21] Appl. No.: **633,167**
 [22] Filed: **Apr. 16, 1996**

[57] ABSTRACT

[30] **Foreign Application Priority Data**
 Apr. 18, 1995 [JP] Japan 7-092747
 Jun. 12, 1995 [JP] Japan 7-144488
 Jun. 12, 1995 [JP] Japan 7-144490

An HMD is provided with two piezoelectric vibrating gyros, and a horizontal sensor which detects a vertical angle. While the user's head rotates, shooting direction of a three-dimensional camera is varied in accordance with the angles obtained by integration of the detected angular velocities. While the head is stationary, the obtained vertical angle and the output of the gyro is corrected based on the angle detected by the horizontal sensor. The shooting direction of the camera can be manually set irrespective of the direction of the head, and information on the viewing direction is displayed together with a taken image.

[51] **Int. Cl.⁶** **G09G 5/00**
 [52] **U.S. Cl.** **345/8; 345/7**
 [58] **Field of Search** 345/7, 8, 9; 348/53; 359/13, 630; 350/142, 143, 148, 149

[56] **References Cited**
U.S. PATENT DOCUMENTS
 2,956,156 10/1960 Heilig .

19 Claims, 16 Drawing Sheets

