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(12) **United States Patent**  
Akanuma et al.

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(54) **OBJECTIVE LENS DRIVING APPARATUS FOR DRIVING AN OBJECTIVE LENS OF AN OPTICAL DISK DRIVE**

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*Primary Examiner*—Muhammad Edun

(74) *Attorney, Agent, or Firm*—Dickstein Shapiro Morin & Oshinsky LLP

(75) **Inventors:** Goichi Akanuma, Tokyo; Hiroshi Koide, Kanagawa, both of (JP)

(73) **Assignee:** Ricoh Company, Ltd., Tokyo (JP)

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

(57) **ABSTRACT**

An objective lens driving apparatus having a focusing coil and a tracking coil arranged in a parallel relationship with a thin, flat shape so that both the focusing coil and the tracking coil can be moved by a single flat magnet. An objective lens supporting member supports the objective lens, and is movably supported on a stationary member. A drive motor is provided at least one side of the objective lens supporting member. A yoke is fixed to the stationary member, and a drive magnet is mounted to the yoke. The drive magnet has a flat surface parallel to both the focusing direction and the tracking direction, the flat surface having four single-pole areas each of which is magnetized in a direction perpendicular to the flat surface. A drive coil assembly including the focusing coil and the tracking coil is mounted on the objective lens supporting member. The drive magnet assembly has a flat shape so that the drive coil assembly faces the flat surface of the drive magnet in parallel relationship with a small air gap therebetween.

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(22) **Filed:** Aug. 25, 1999

(30) **Foreign Application Priority Data**

Aug. 28, 1998 (JP) ..... 10-243873  
Nov. 9, 1998 (JP) ..... 10-317517  
Dec. 22, 1998 (JP) ..... 10-364609  
May 21, 1999 (JP) ..... 11-142300

(51) **Int. Cl.**<sup>7</sup> ..... G11B 7/12

(52) **U.S. Cl.** ..... 369/44.14; 369/44.11; 359/814

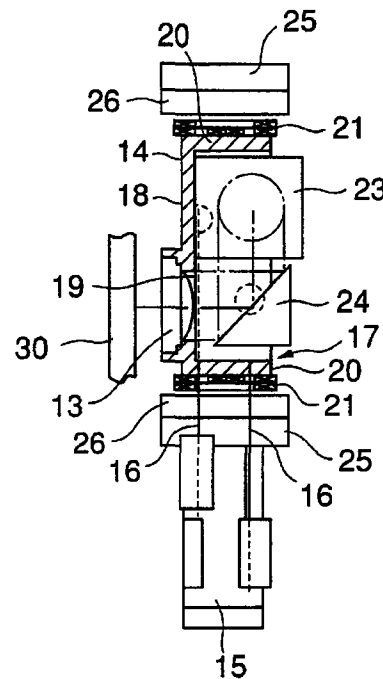
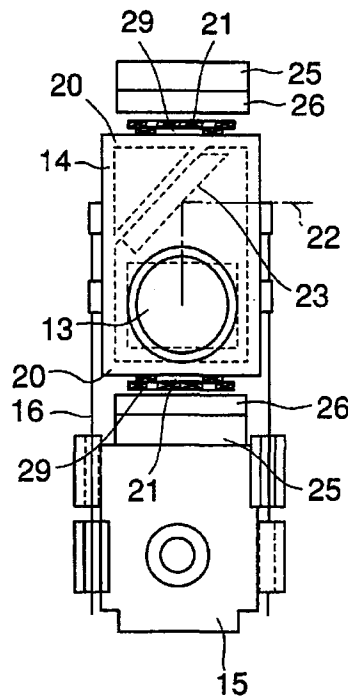
(58) **Field of Search** ..... 369/44.11, 44.12, 369/44.14, 44.15, 44.22, 44.28, 47.1, 53.1, 112.01; 59/814, 824

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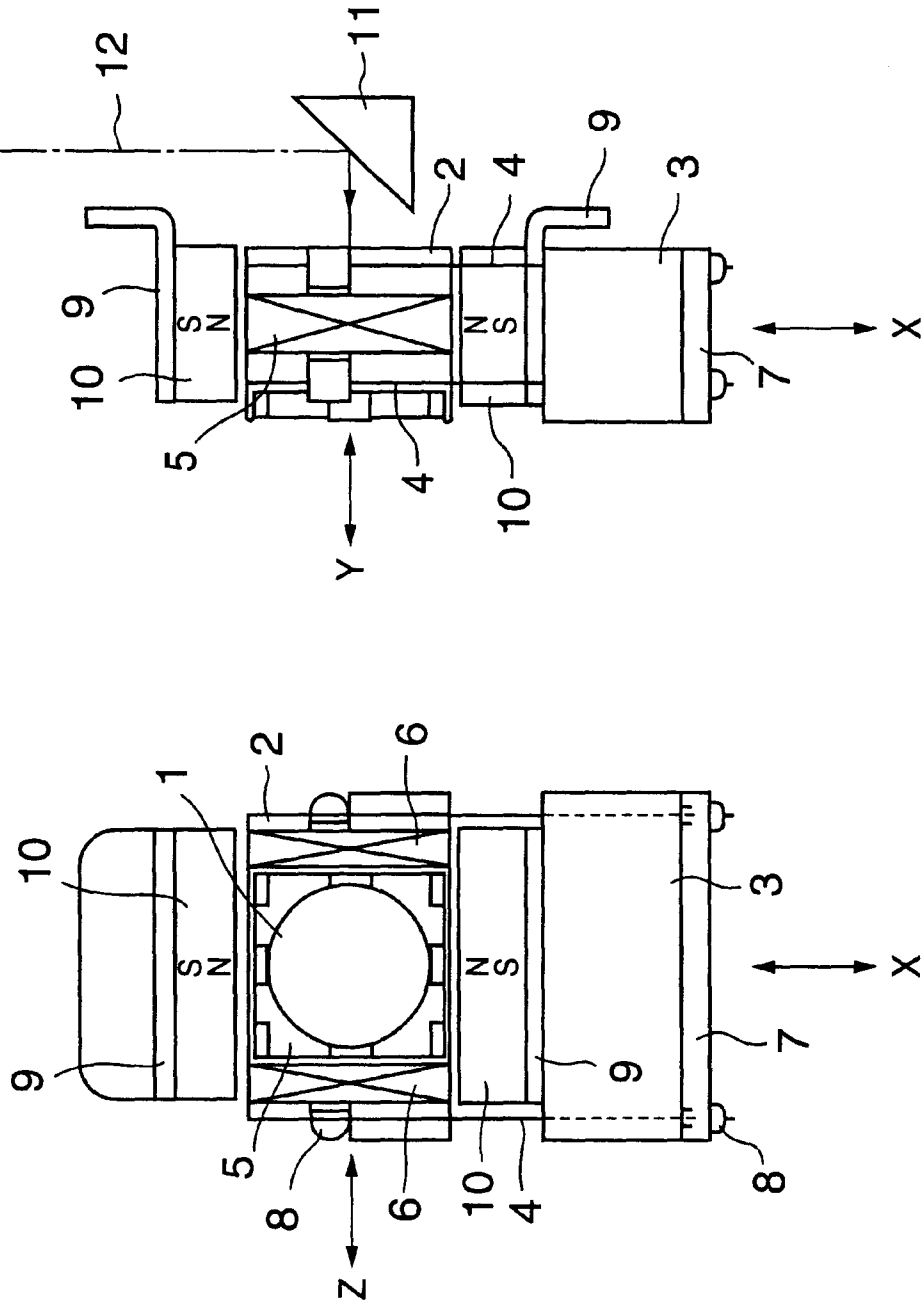
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**15 Claims, 20 Drawing Sheets**

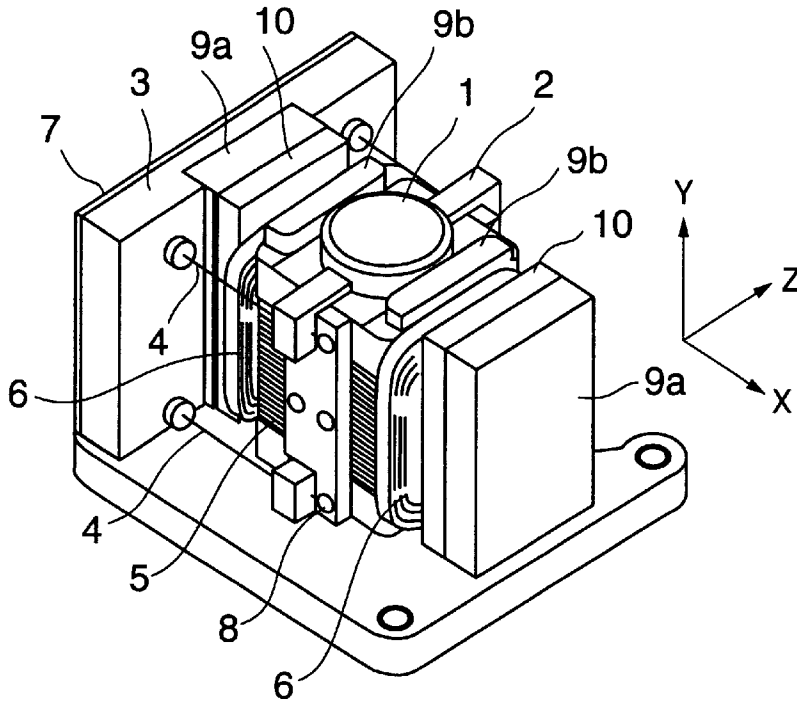


LG Electronics, Inc. et al.  
**EXHIBIT 1002**

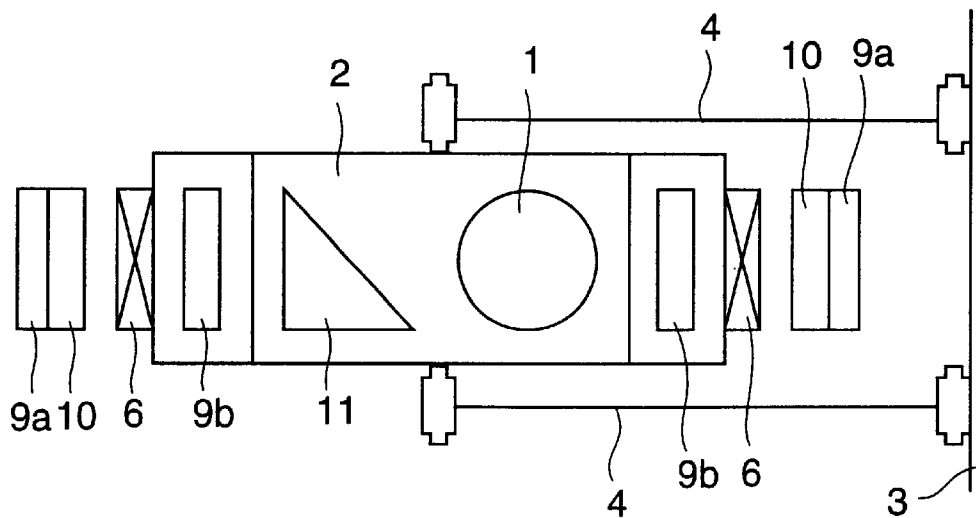
FIG.1A PRIOR ART FIG.1B PRIOR ART



### FIG.2 PRIOR ART



### FIG.3 PRIOR ART



# FIG.4 PRIOR ART

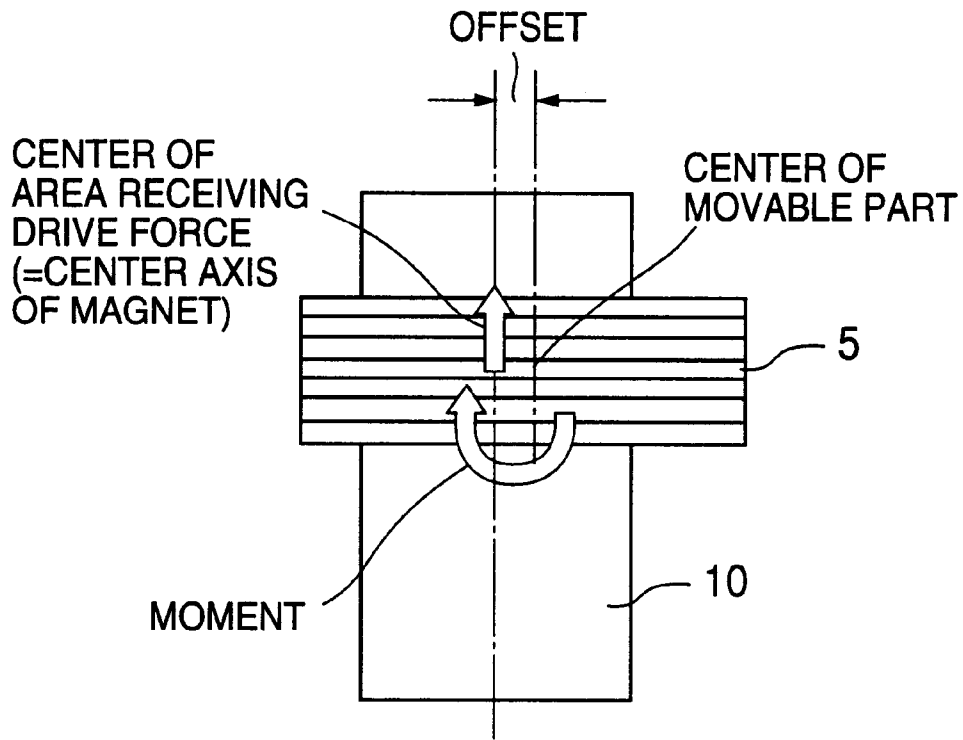


FIG.5A

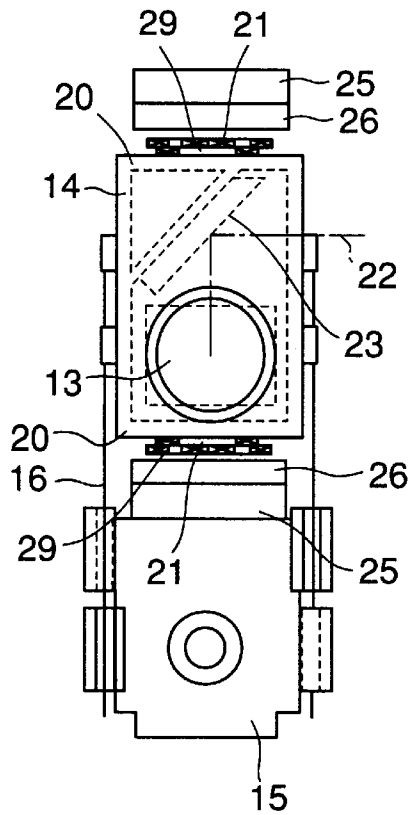


FIG.5B

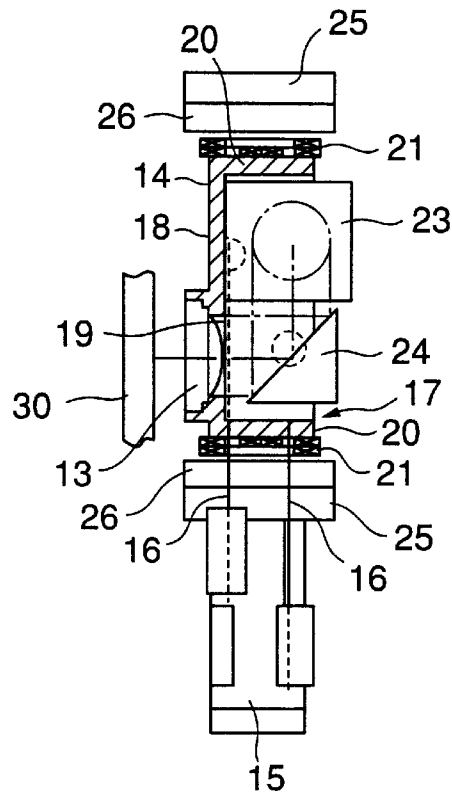
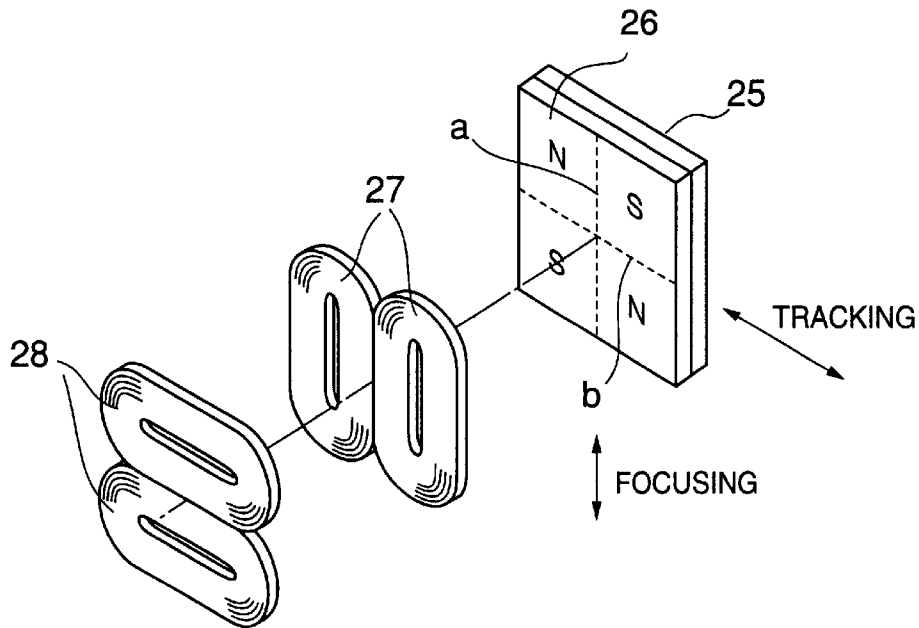


FIG.6



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