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# United States Patent [19]

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Kim et al.

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[54] **OPTICAL PICK-UP APPARATUS CAPABLE OF READING DATA IRRESPECTIVE OF DISC TYPE**

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Korea

[21] Appl. No.: **09/224,798**

[22] Filed: **Dec. 31, 1998**

### Related U.S. Application Data

[62] Division of application No. 08/567,041, Dec. 4, 1995.

### Foreign Application Priority Data

Mar. 4, 1995 [KR] Rep. of Korea ..... 95-4410  
Mar. 6, 1995 [KR] Rep. of Korea ..... 95-4525  
Mar. 26, 1995 [KR] Rep. of Korea ..... 95-6238  
Oct. 31, 1995 [KR] Rep. of Korea ..... 95-39516

[51] Int. Cl.<sup>7</sup> ..... **G11B 7/00**

[52] U.S. Cl. .... **369/54; 369/94; 369/58;**  
**369/112; 369/110**

[58] Field of Search ..... 369/58, 54, 110,  
369/112, 44.11, 44.14, 94, 44.23, 44.27

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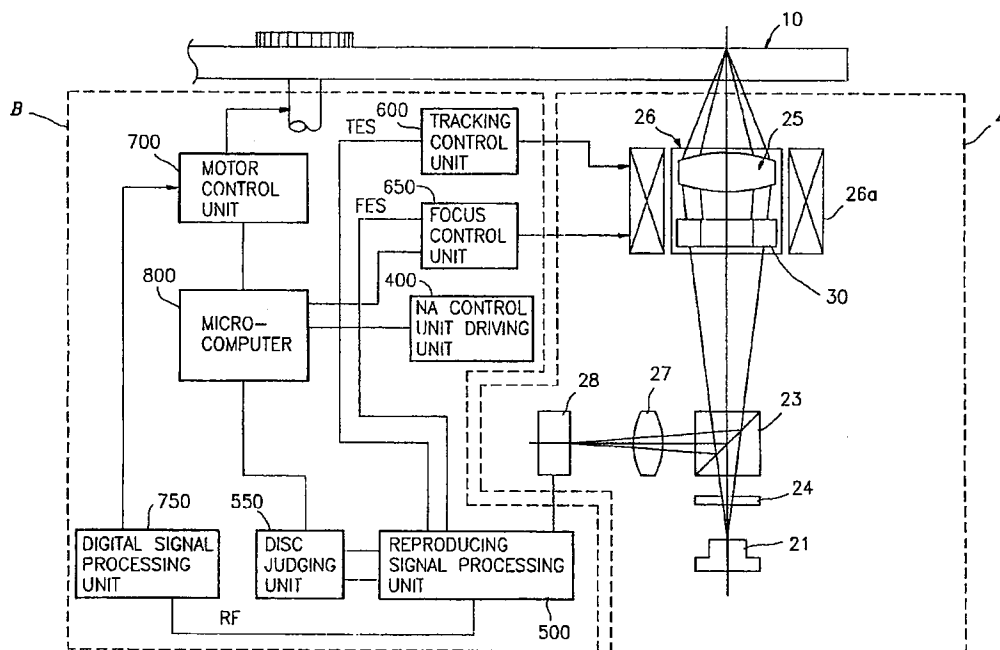
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### [57] ABSTRACT

An improved optical pick-up apparatus capable of reading data irrespective of disc type capable of reading various kinds of discs having different thicknesses and writing densities using only one pick-up apparatus, which includes a light source; a beam splitter for passing through or splitting a beam from the light source; an objective lens for condensing the beam onto corresponding disc among discs having different thicknesses and different densities; a numerical aperture control unit for controlling an effective numerical aperture of the objective lens so as to execute a focussing operation with respect to a certain disc; and a photo-detector for receiving the beam reflected by the disc and transmitted from the beam splitter.

16 Claims, 30 Drawing Sheets



LG Electronics, Inc. et al.  
**EXHIBIT 1004**

FIG. 1  
CONVENTIONAL ART

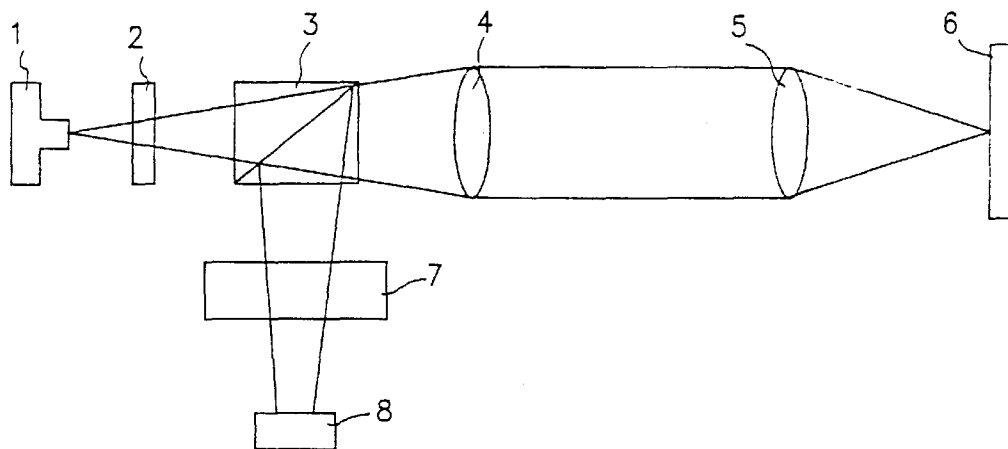


FIG. 2  
CONVENTIONAL ART

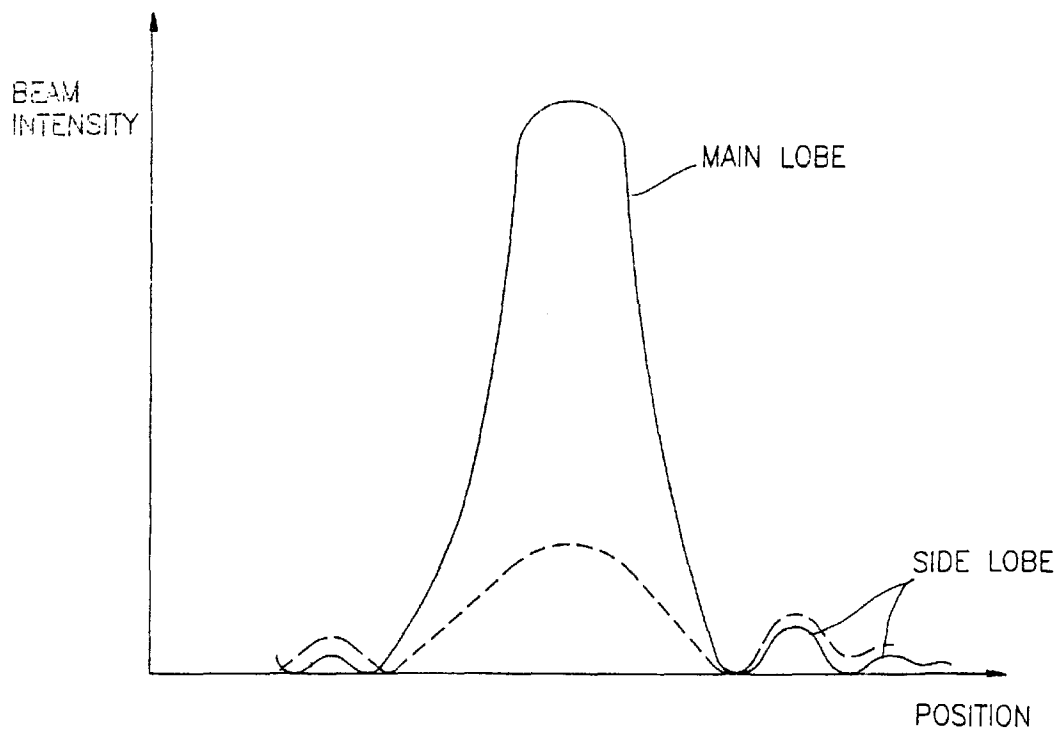


FIG. 3

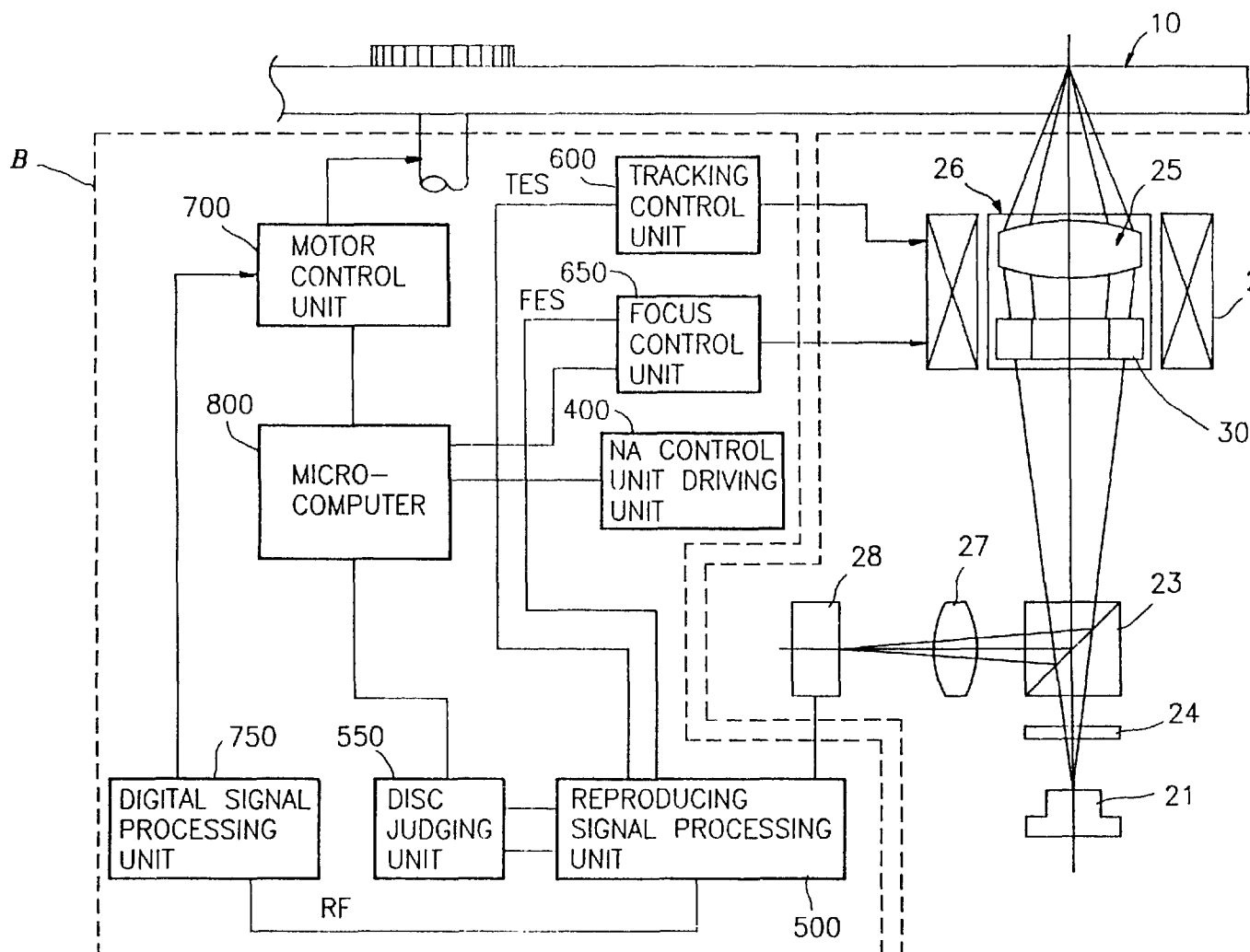


FIG. 4

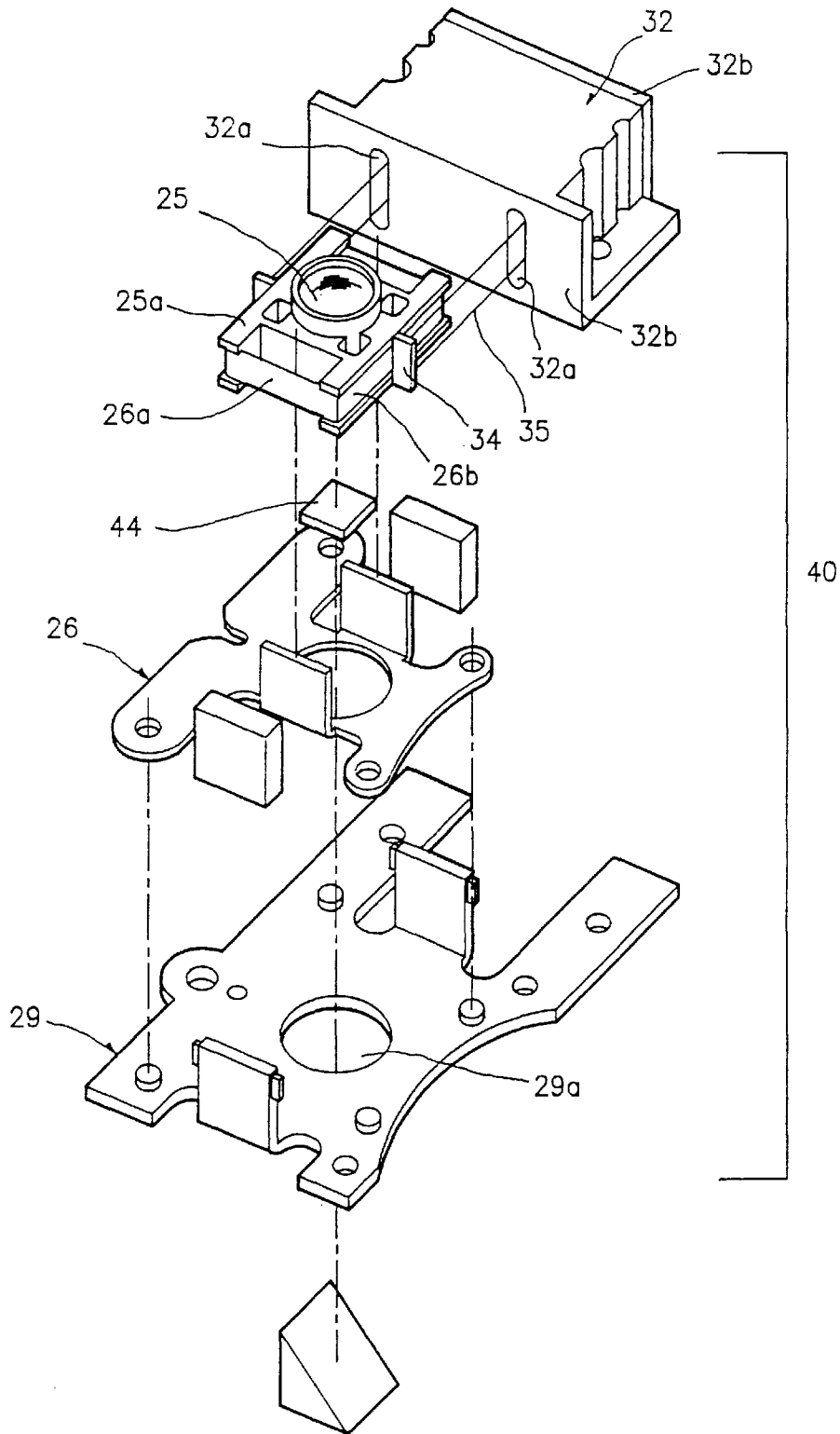
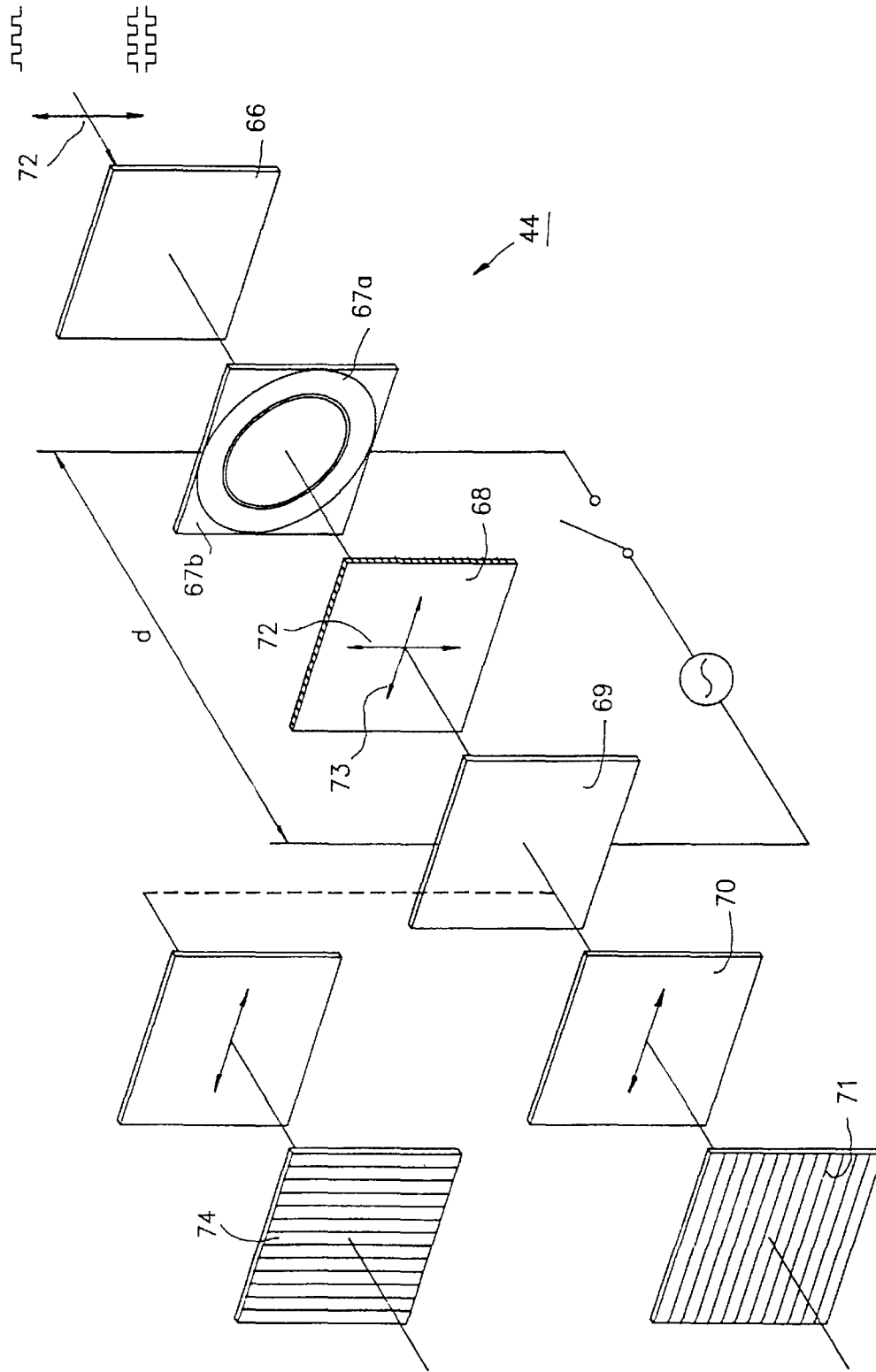


FIG. 5



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