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# United States Patent [19]

[11] Patent Number: **5,446,565**

**Komma et al.**

[45] Date of Patent: **Aug. 29, 1995**

[54] **COMPOUND OBJECTIVE LENS HAVING TWO FOCAL POINTS**

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[75] Inventors: **Yoshiaki Komma, Kyoto; Sadao Mizuno; Seji Nishino, both of Osaka, all of Japan**

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[73] Assignee: **Matsushita Electric Industrial Co., Ltd., Osaka, Japan**

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[21] Appl. No.: **190,520**

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[22] Filed: **Feb. 1, 1994**

[30] **Foreign Application Priority Data**

*Primary Examiner*—Martin Lerner  
*Attorney, Agent, or Firm*—Lowe, Price, Leblanc & Becker

Feb. 1, 1993 [JP] Japan ..... 5-014432  
Aug. 4, 1993 [JP] Japan ..... 5-193353

[51] Int. Cl.<sup>6</sup> ..... **G02B 5/32; G11B 7/00**

[52] U.S. Cl. .... **359/19; 369/44.23; 369/94; 369/103; 369/112**

[58] Field of Search ..... **359/15, 16, 19; 369/94, 369/103, 109, 112, 44.23**

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[57] **ABSTRACT**

**U.S. PATENT DOCUMENTS**

A compound objective lens is composed of a hologram lens for transmitting a part of incident light without any diffraction to form a beam of transmitted light and diffracting a remaining part of the incident light to form a beam of first-order diffracted light, and an objective lens for converging the transmitted light to form a first converging spot on a front surface of a thin type of first information medium and converging the diffracted light to form a second converging spot on a front surface of a thick type of second information medium. Because the hologram lens selectively functions as a concave lens for the diffracted light, a curvature of the transmitted light differs from that of the diffracted light. Therefore, even though the first and second information mediums have different thicknesses, the transmitted light incident on a rear surface of the first information medium is converged on the its front surface, and the diffracted light incident on a rear surface of the second information medium is converged on the its front surface. That is, the compound objective lens has two focal points.

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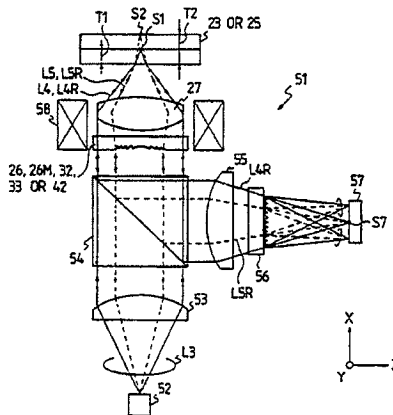
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**34 Claims, 43 Drawing Sheets**



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**EXHIBIT 1006**

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FIG. 1  
PRIOR ART

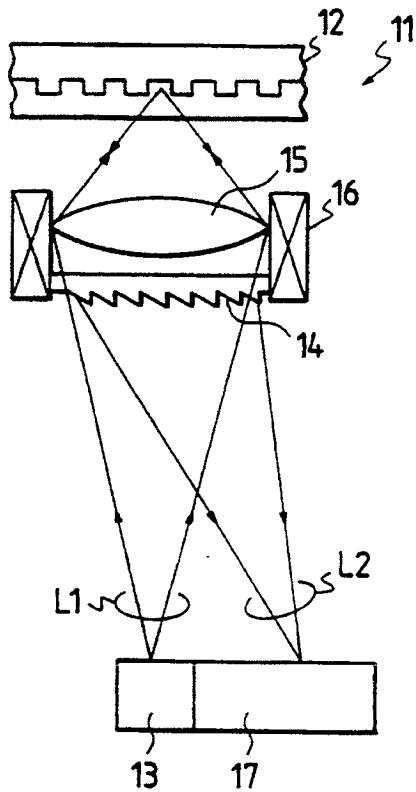


FIG. 2A  
PRIOR ART

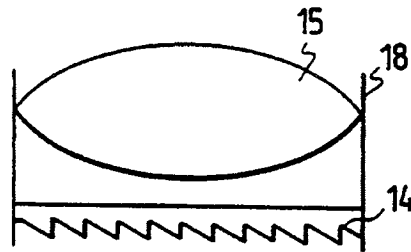


FIG. 2B  
PRIOR ART

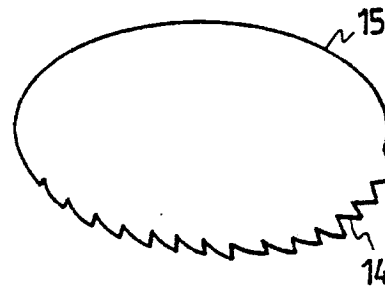


FIG. 3 PRIOR ART

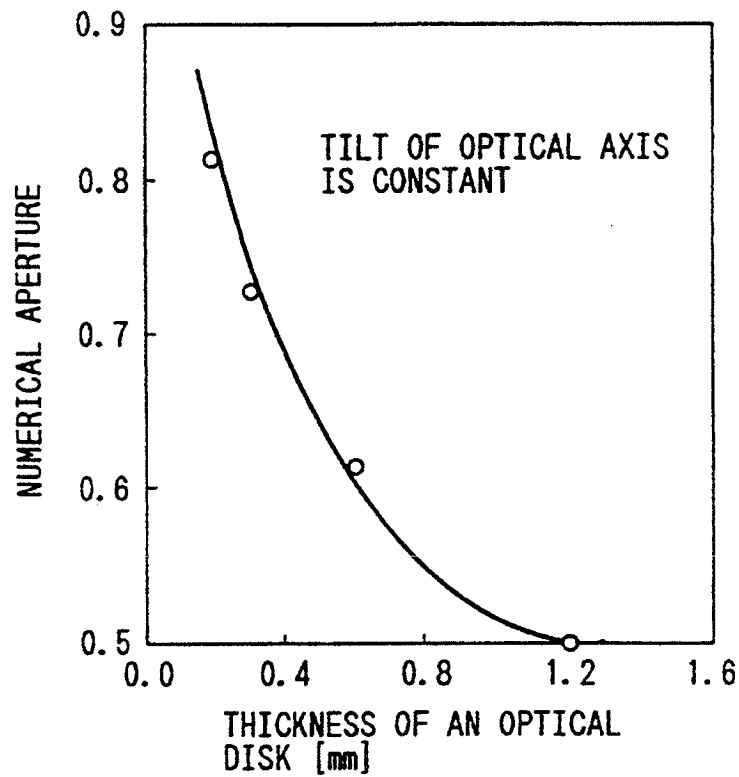


FIG. 4A

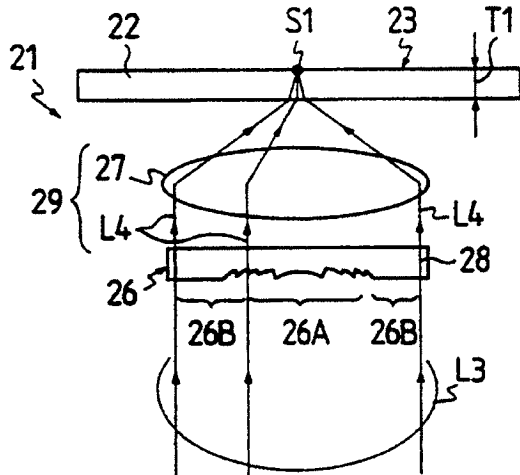


FIG. 4B

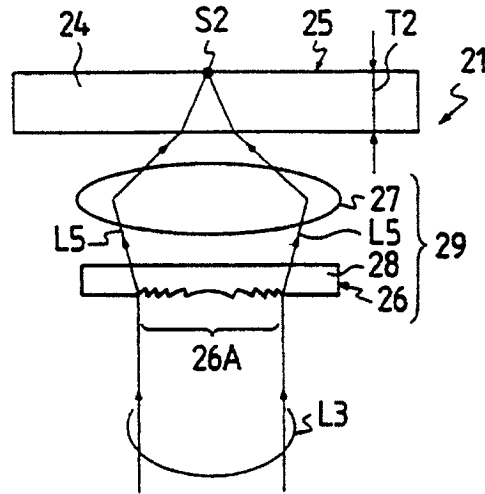
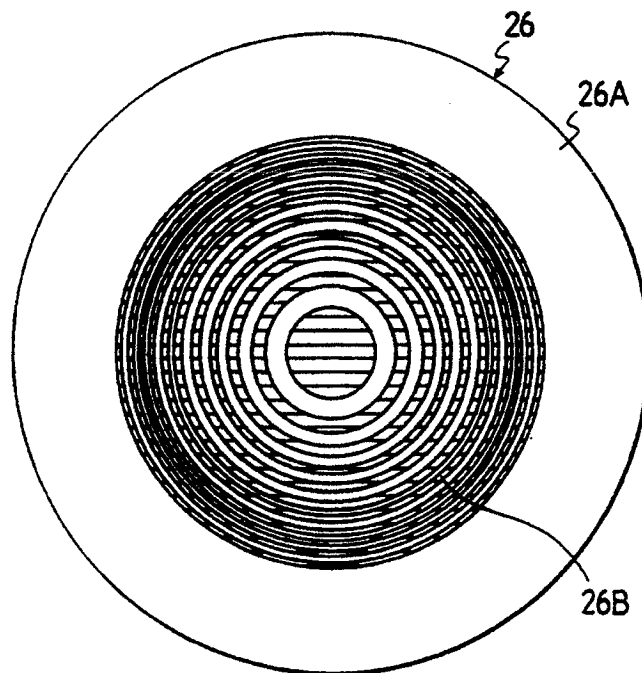


FIG. 5



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