



US006449236B2

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

(10) **Patent No.:** US 6,449,236 B2  
(45) **Date of Patent:** Sep. 10, 2002

(54) **OPTICAL WAVEFRONT MODIFIER**

6,130,418 A \* 10/2000 Van Rosmalen et al. 250/201.5  
6,141,304 A \* 10/2000 Ogasawara ..... 369/44.32  
6,198,462 B1 \* 3/2001 Furukawa et al. .... 345/94

(75) Inventors: **Jeroen Wals; Joris Jan Vrehen;**  
**Sjoerd Stallinga**, all of Eindhoven  
(NL)

**FOREIGN PATENT DOCUMENTS**

(73) Assignee: **Koninklijke Philips Electronics N. V.**,  
Eindhoven (NL)

EP 0745980 12/1996

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

\* cited by examiner

*Primary Examiner*—Hung Xuan Dang  
*Assistant Examiner*—Tuyen Tra  
(74) *Attorney, Agent, or Firm*—Michael E. Belk

(21) Appl. No.: **09/745,939**

(22) Filed: **Dec. 22, 2000**

(30) **Foreign Application Priority Data**

Dec. 24, 1999 (EP) ..... 99204525

(51) **Int. Cl.**<sup>7</sup> ..... **G11B 7/00**

(52) **U.S. Cl.** ..... **369/112.02; 369/44.32;**  
369/44.23

(58) **Field of Search** ..... 359/254; 250/201.1,  
250/201.9, 201.5; 369/44.11–44.42, 112.02

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

6,125,088 A \* 9/2000 Ogasawara ..... 369/44.32

(57) **ABSTRACT**

An optical wavefront modifier modifies a wavefront of an optical beam passing through the modifier. The modifier comprises a first and a second transparent electrode layer and a flat medium for modifying the wavefront depending on electrical excitation of the medium and arranged between the electrode layers. The electrode layers are provide the electrical excitation to produce a first wavefront modification of a first order of a radius in the cross-section of the beam in the plane of the medium and simultaneously produce a second wavefront modification of a second order of the radius different from the first order.

**19 Claims, 9 Drawing Sheets**

