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O'Callaghan et al.

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[54] **DIFFRACTIVE LIGHT MODULATOR**

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[73] Assignee: **Displaytech, Inc.**, Boulder, Colo.

[21] Appl. No.: **8,764**

[22] Filed: **Jan. 25, 1993**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 578,647, Sep. 7, 1990, Pat. No. 5,182,665.

[51] **Int. Cl.**[6] **G02F 1/13**

[52] **U.S. Cl.** **359/95**; 359/73; 359/53; 359/76; 359/78; 359/100

[58] **Field of Search** 359/53, 70, 73, 359/75, 89, 94, 95, 100

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[57] **ABSTRACT**

An arrangement (apparatus and method) for selectively modulating incident unpolarized light passing through a birefringent material, such as ferroelectric crystal. The apparatus includes a plate having one or more birefringent layers corresponding to first and second alignment regions. The birefringent layer corresponding to the first alignment region has a first optic axis selectably set in a first orientation and a second orientation. The birefringent layer corresponding to the second alignment region has a second optic axis selectably set in a third orientation and a fourth orientation. A switching means controls the optical axis states of the birefringent material by applying switching voltages to the areas of the birefringent layer. Light having passed through the birefringent layer at locations having the first orientation has a different phase from, and same polarization as, light having passed through locations with the third orientation, independent of a polarization state of the incident light. As a result, the birefringent material has a uniform state at locations where the corresponding optic axes between the first and second alignment regions are parallel, and a diffracting state produced by an interaction between the light having passed through areas having the first orientation and the light having passed through areas having the second orientation. The arrangement is effective for reflective modulators, multilayer modulators or polarization-preserving modulators, and has applications for intensity modulation, blurring modulation and beam steering.

30 Claims, 14 Drawing Sheets

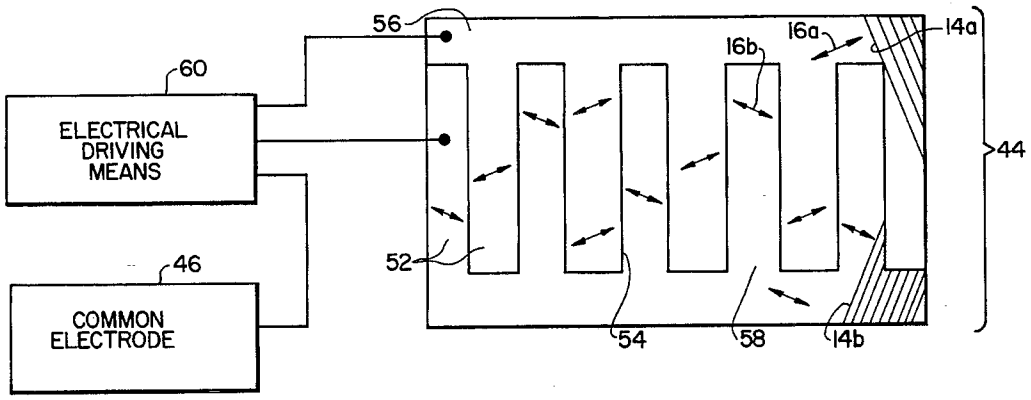

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FIG. 1A
(PRIOR ART)

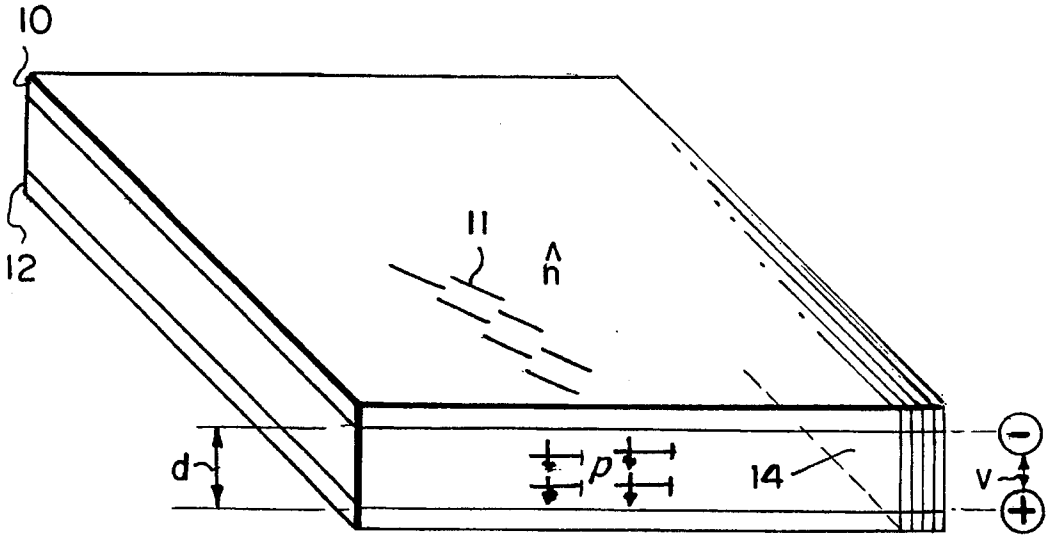


FIG. 1B
(PRIOR ART)

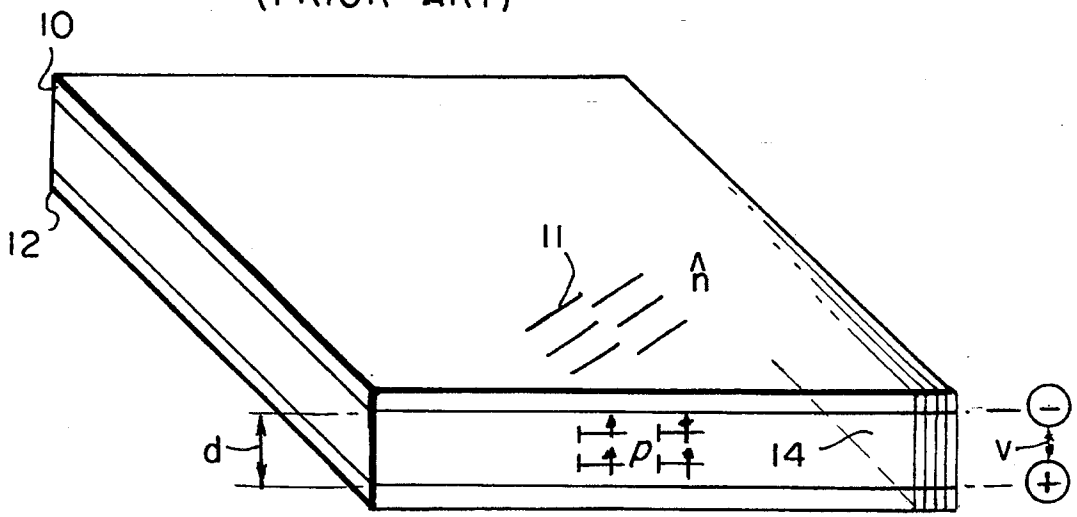


FIG. 2

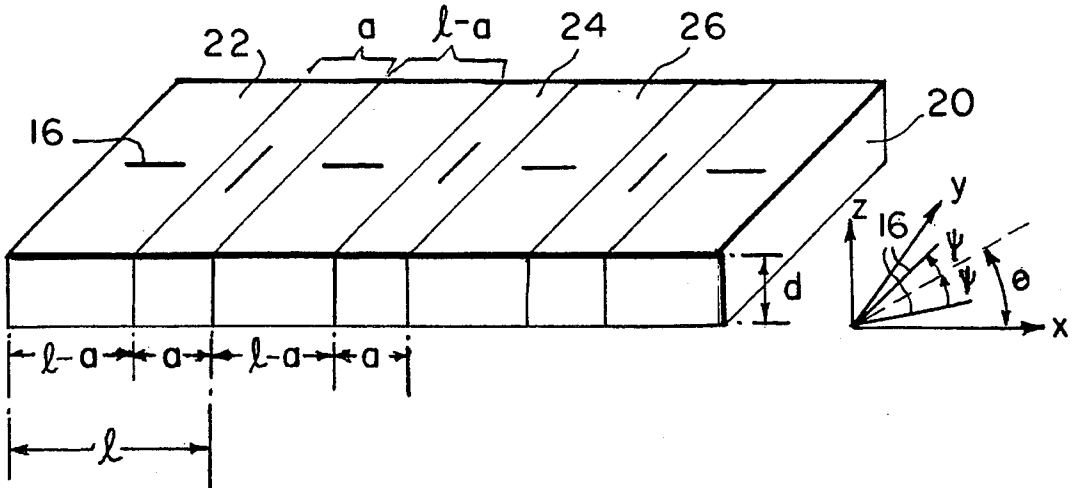
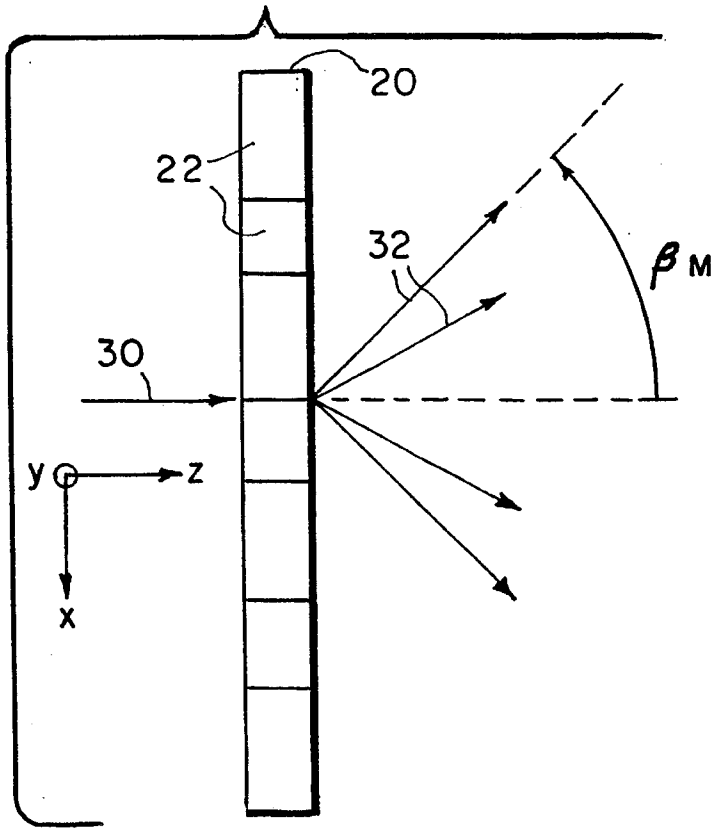


FIG. 3



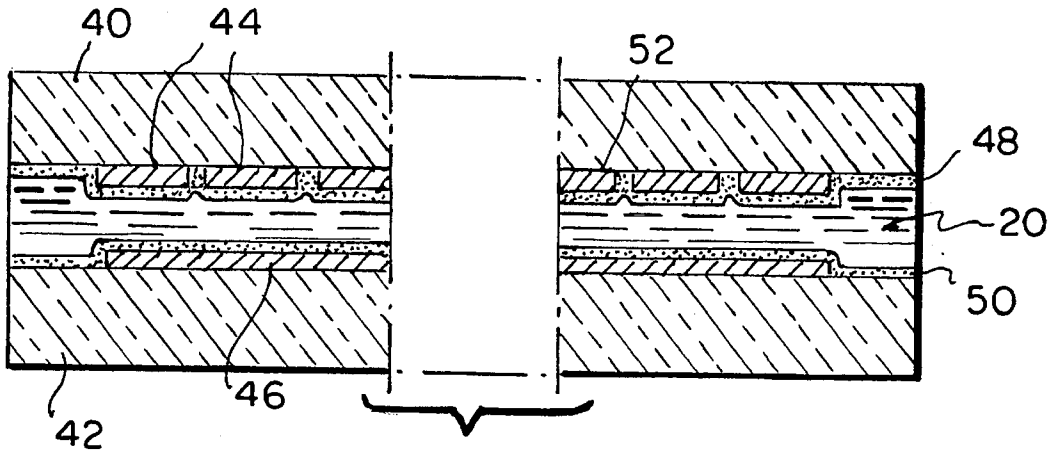


FIG. 4

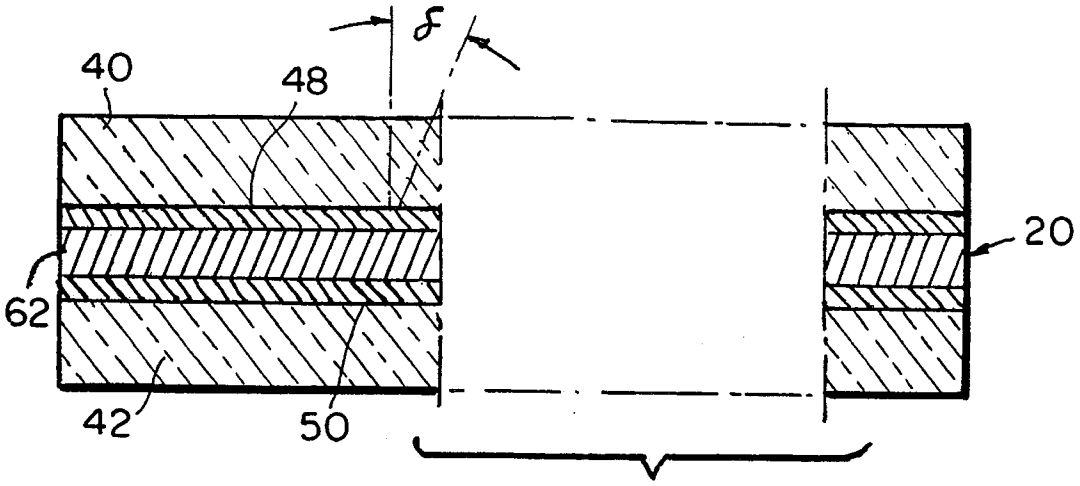


FIG. 6

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