

# EXHIBIT 2



US006977704B2

(12) **United States Patent**  
**Kataoka**

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- (54) **LIQUID CRYSTAL DISPLAY**
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- (73) Assignee: **Fujitsu Display Technologies Corporation, Kawasaki (JP)**
- (\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 134 days.

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(30) **Foreign Application Priority Data**

Mar. 30, 2001 (JP) ..... 2001-098455

(51) **Int. Cl.<sup>7</sup>** ..... **G02F 1/1337**

(52) **U.S. Cl.** ..... **349/130; 349/136**

(58) **Field of Search** ..... 349/130-136;  
428/1.1, 1.3

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(57) **ABSTRACT**

The invention relates to a liquid crystal display based on an MVA mode of multi-division alignment in which alignment states of liquid crystal molecules having a negative dielectric anisotropy are made different from each other, and provides a liquid crystal display in which a drop in transmittance is suppressed and response characteristics are improved. The liquid crystal display is constructed so as to include a pair of substrates having a predetermined cell gap and arranged opposite to each other, vertical alignment films formed between the pair of substrates, a liquid crystal layer sealed between the vertical alignment films and having a negative dielectric anisotropy, an alignment regulating structural member arranged on at least one of the pair of substrates, for regulating a total alignment direction of liquid crystal molecules in the liquid crystal layer at a time of voltage application, and a cured material provided in the liquid crystal layer and including a liquid crystal skeleton for tilting the liquid crystal molecules.

**5 Claims, 52 Drawing Sheets**

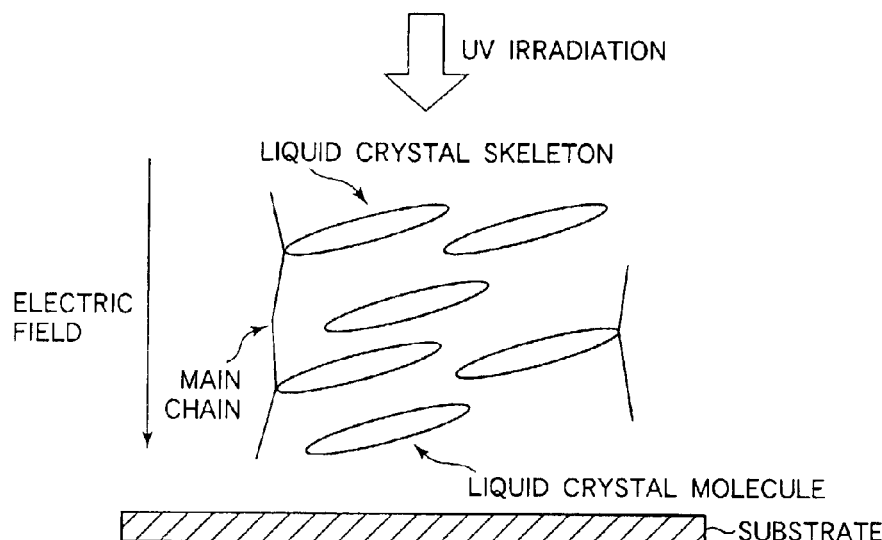


FIG.1A

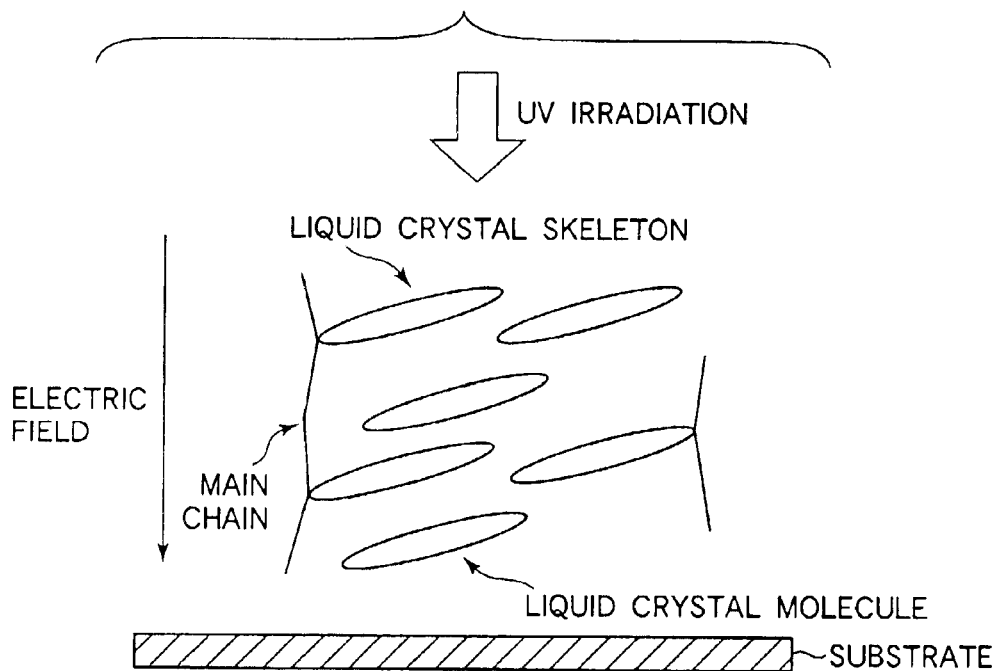


FIG.1B

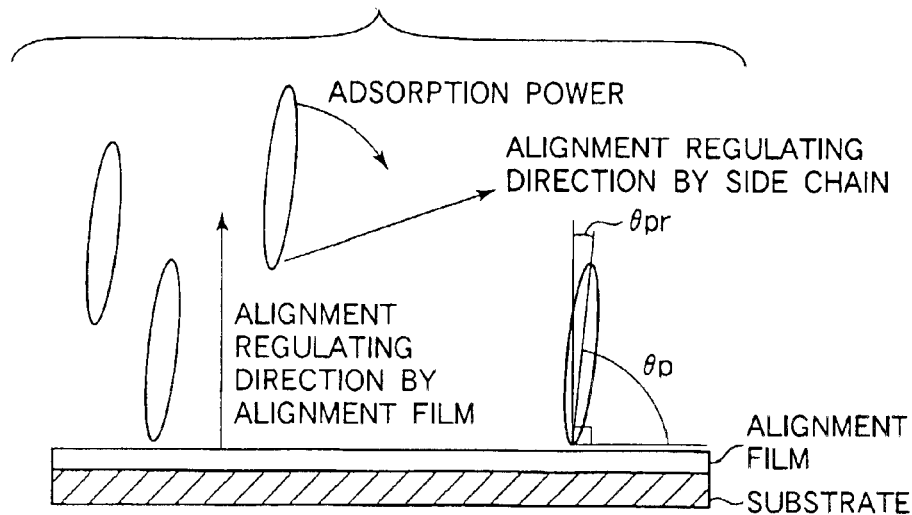


FIG.2

MODE	TN	a-TN	ECB (HORIZONTAL)	OCB	IPS	ASM	FLC	MVA
INTERFACE ALIGNMENT PROCESSING	PERFORMED	NOT PERFORMED	PERFORMED	PERFORMED	PERFORMED	NOT PERFORMED	PERFORMED	NOT PERFORMED
MAIN EFFECT	FIXATION OF DISCRIMINATION (AT A TIME OF ALIGNMENT DIVISION) HIGH PRE-TILT	SUPPRESSION OF REVERSE TILT	IMPARTING OF TILTING POWER TOWARD RISING DIRECTION	FIXATION OF BEND ORIENTATION	IMPARTING OF TILTING POWER TOWARD SWITCHING DIRECTION	FIXATION OF AXIS SYMMETRY ALIGNMENT ERASURE OF PROPAGATION OF TILT	DISAPPEARANCE OF BISTABILITY (MULTI- GRADATION DISPLAY) SUPPRESSION OF CHEVRON STRUCTURE	APPEARANCE OF BULK TILT ERASURE OF DEVIATION IN ORIENTATION ANGLE DIRECTION OF PROPAGATION OF TILT
RESPONSE SPEED IMPROVEMENT	X~Δ	Δ	Δ~○	X	Δ	○	X	◎
PRODUCED PROBLEM	DROP IN OPTICAL ROTATORY POWER DROP IN CONTRAST	DROP IN OPTICAL ROTATORY POWER DROP IN CONTRAST	DETERIORATION IN BLACK LUMINANCE	DROP IN RESPONSE SPEED DROP IN TRANSMITTANCE SCATTERING	DETERIORATION IN BLACK LUMINANCE DROP IN TRANSMITTANCE	(DIFFICULT IF THERE IS NO PS)	DROP IN RESPONSE SPEED DECREASE OF TILT ANGLE	ALIGNMENT DISTURBANCE AROUND SINGULAR POINT
USE VALUE	X	Δ	Δ	X	X	◎	X	◎
TOTAL PERFORMANCE OF PS	X	Δ	Δ	X	X	◎	○	◎

FIG.3

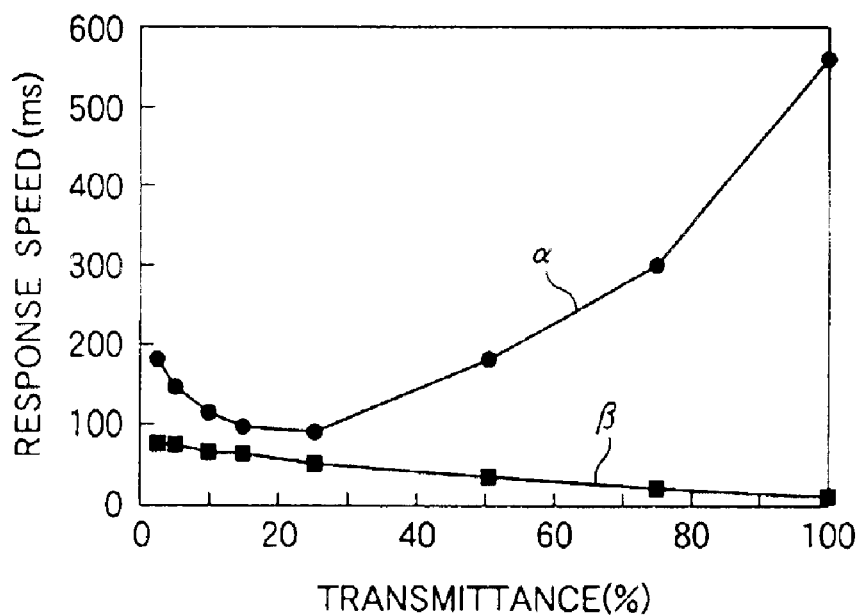
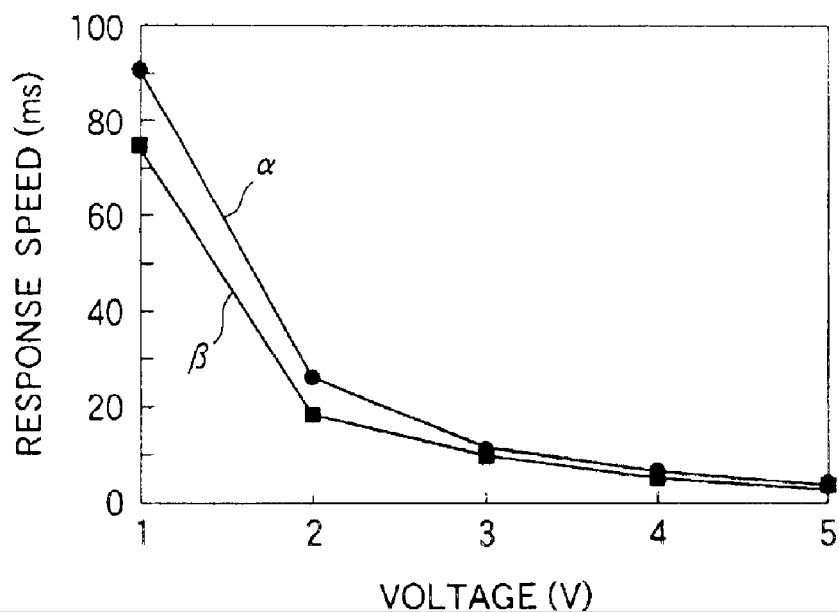


FIG.4



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