

**United States Patent** [19]

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**Watanabe et al.**

[45] **Date of Patent:** **Apr. 2, 1996**

[54] **LIQUID CRYSTAL DISPLAY APPARATUS WITH GAP ADJUSTING LAYERS LOCATED BETWEEN THE DISPLAY REGION AND DRIVER CIRCUITS**

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[75] Inventors: **Yoshihiro Watanabe**, Yokohama; **Hiroki Nakamura**, Chigasaki; **Takako Sugawara**, Kawasaki, all of Japan

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[73] Assignee: **Kabushiki Kaisha Toshiba**, Kawasaki, Japan

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[21] Appl. No.: **196,215**

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[86] PCT No.: **PCT/JP93/00975**

§ 371 Date: **Jul. 13, 1994**

§ 102(e) Date: **Jul. 13, 1994**

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PCT Pub. Date: **Mar. 2, 1994**

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*Attorney, Agent, or Firm*—Oblon, Spivak, McClelland, Maier & Neustadt

[30] **Foreign Application Priority Data**

Jul. 15, 1992 [JP] Japan ..... 4-187908

[51] **Int. Cl.<sup>6</sup>** ..... **G02F 1/1343; G02F 1/1339**

[52] **U.S. Cl.** ..... **359/59; 359/80; 359/81**

[58] **Field of Search** ..... **359/81, 82, 83, 359/59, 80**

[57] **ABSTRACT**

An object is to provide a liquid crystal display apparatus with an equal gap between two substrates so as to improve display image quality and display contrast. To accomplish this object, substrate gap adjusting region **33** or substrate gap adjusting layers **21, 22, 25, 27, 29,** and **31** are formed so that the substrate gap in a region extending from a display region having pixel electrodes **7** to a driver circuit **11** is kept equal to the substrate gap in a region extending from the display region to a driver circuit **15**. Thus, the gap between the two opposed substrates forming liquid crystal cells can be kept equal in any position.

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**8 Claims, 10 Drawing Sheets**

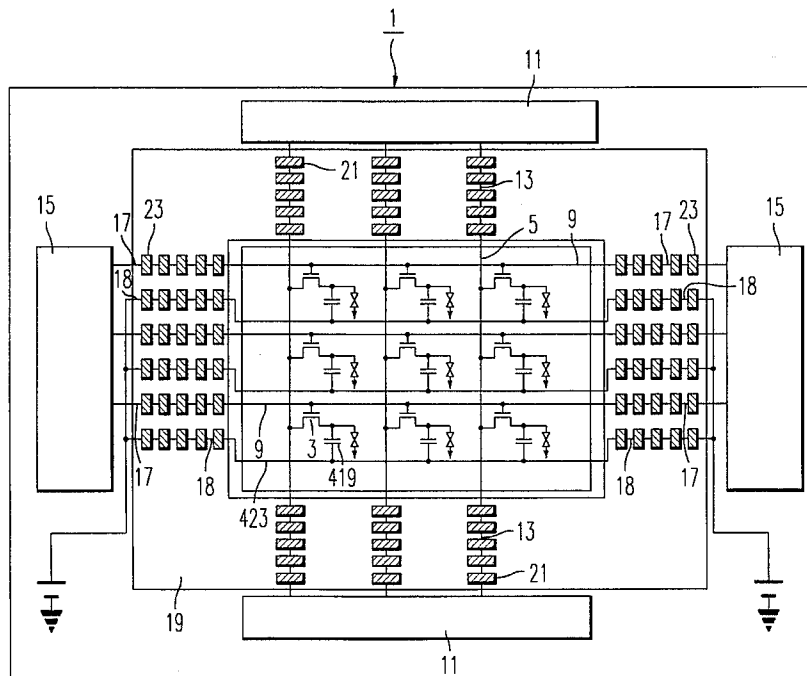
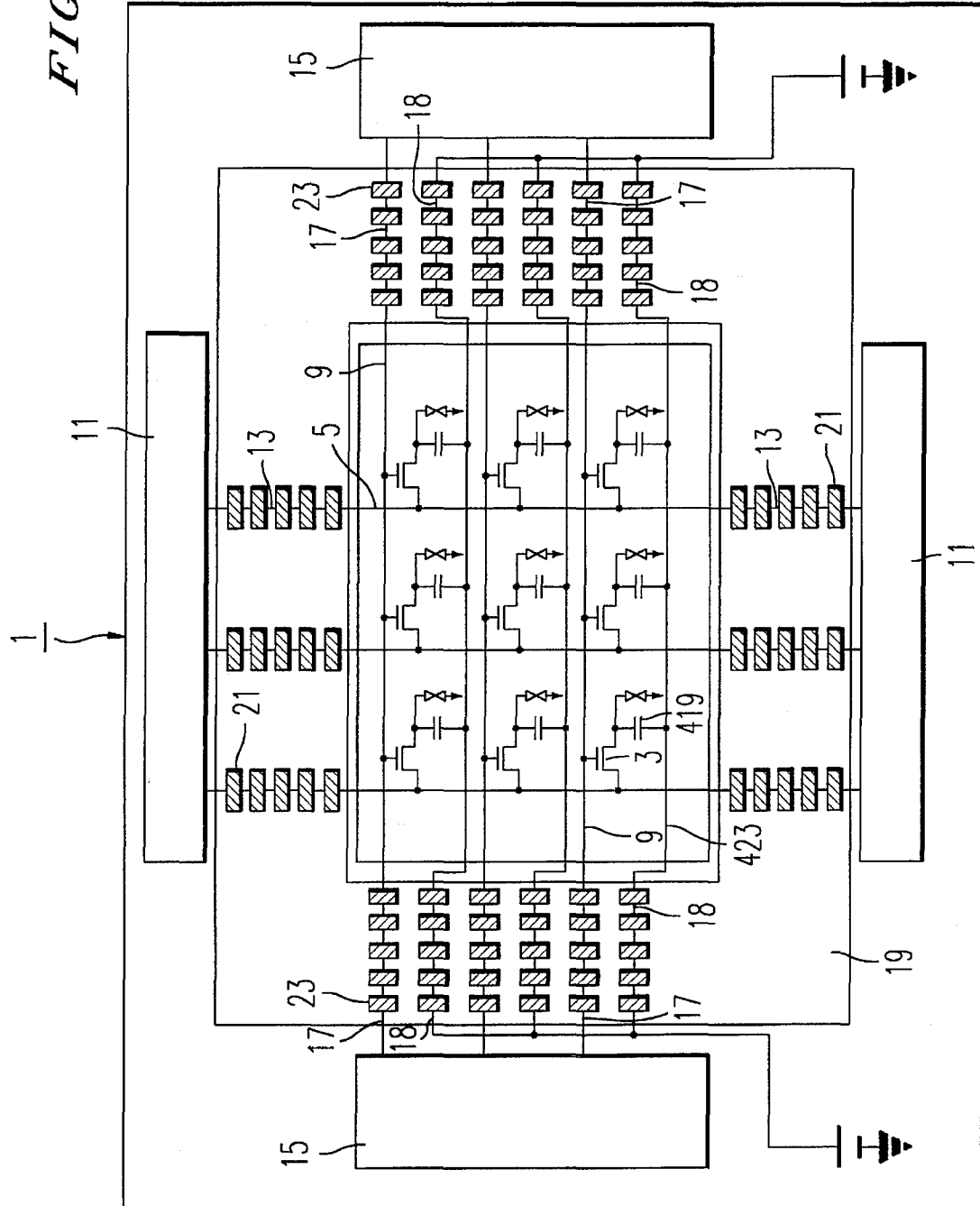
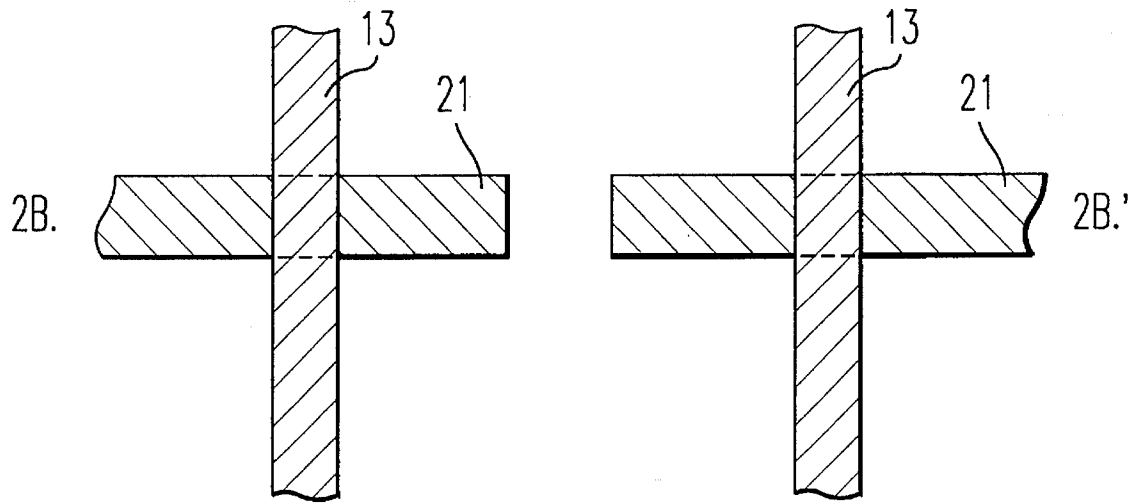
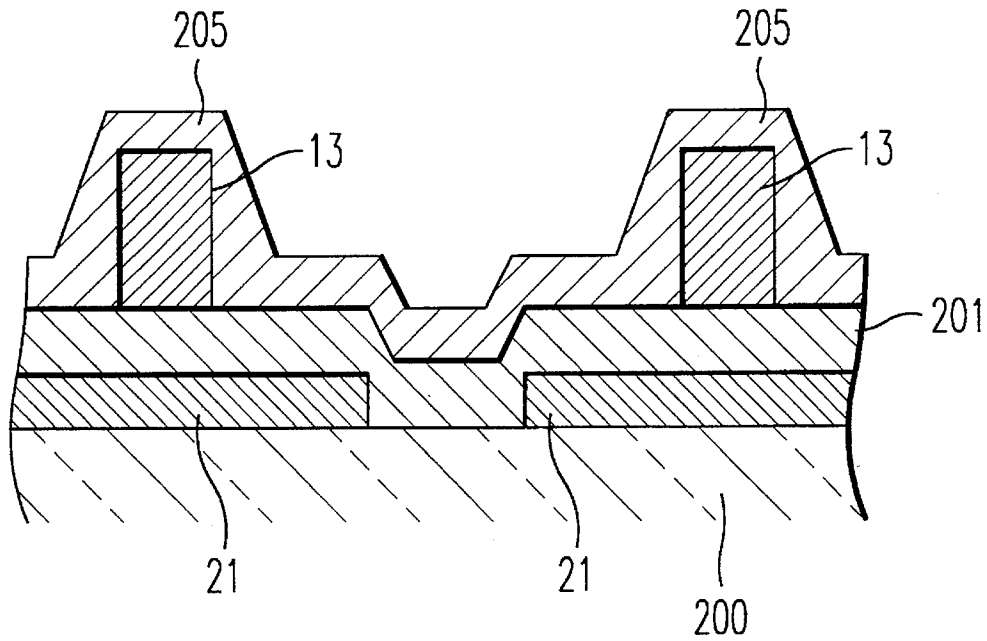


FIG. 1

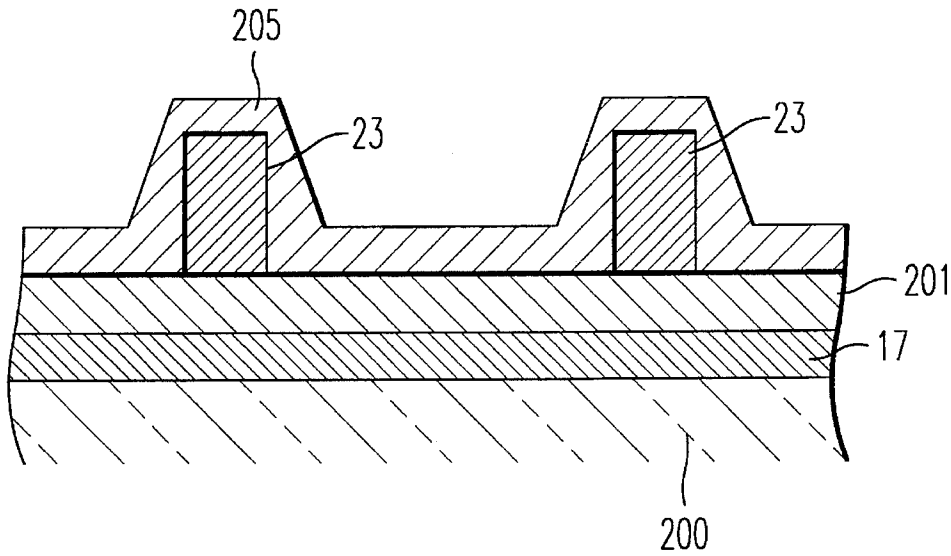
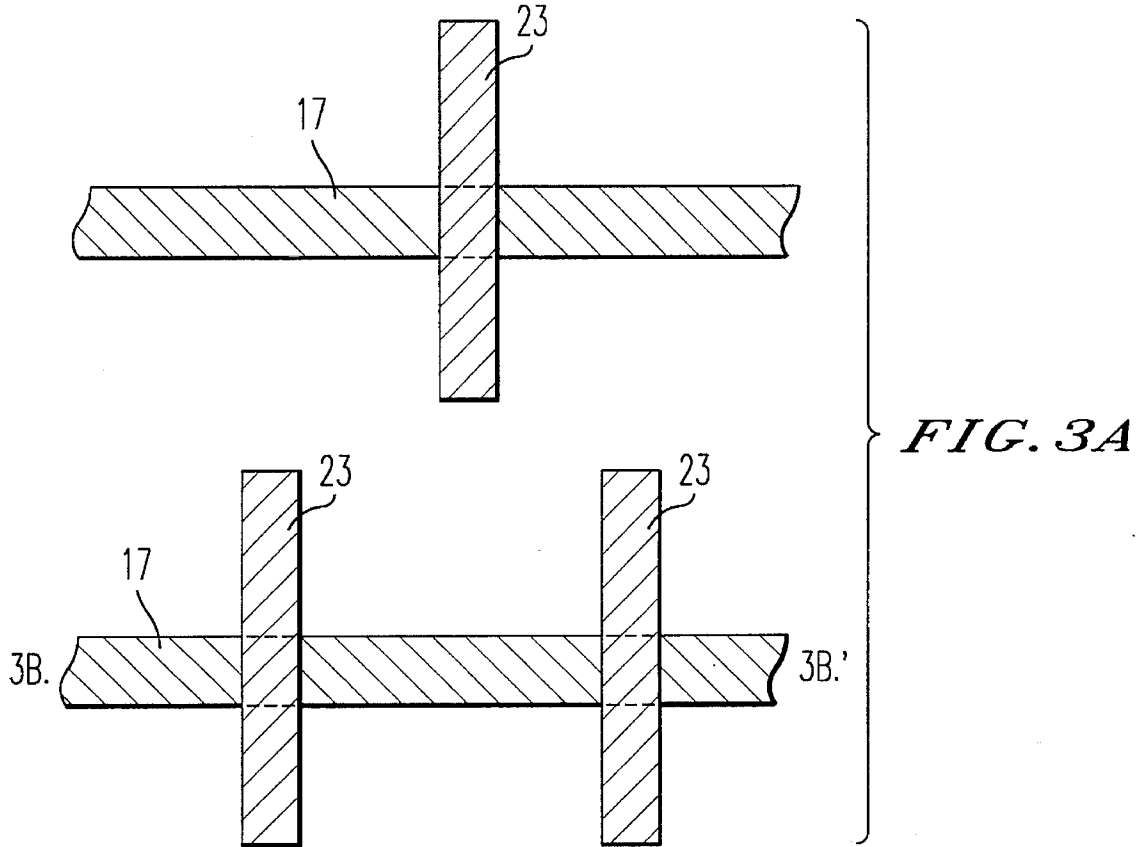




*FIG. 2A*



*FIG. 2B*



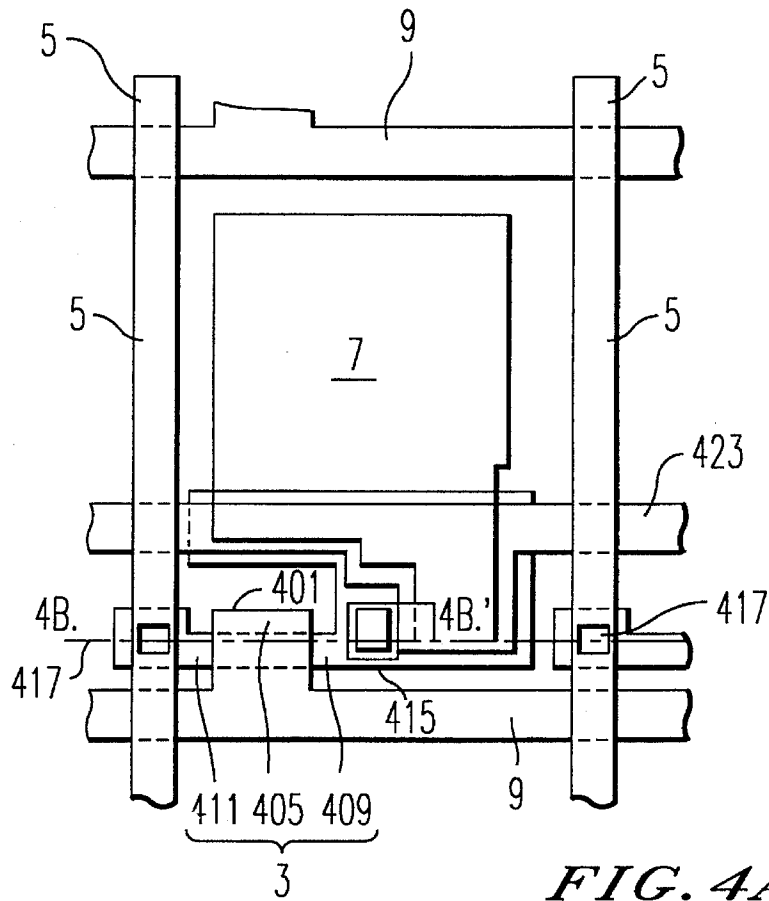


FIG. 4A

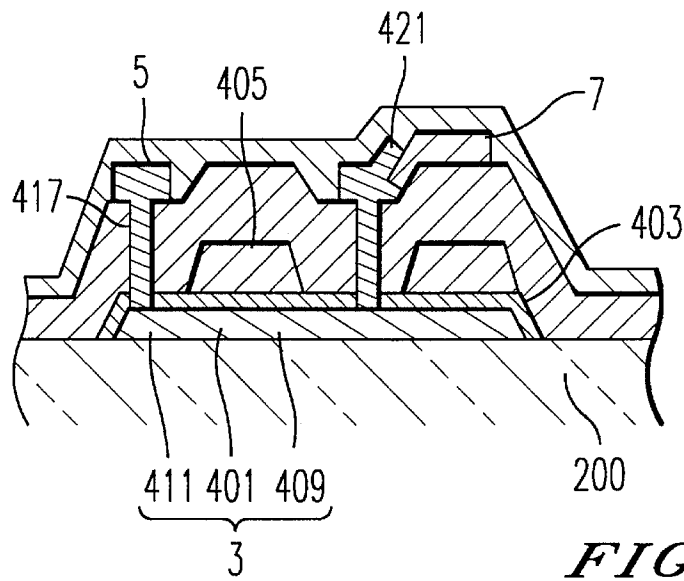


FIG. 4B

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