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# United States Patent [19]

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Dutta et al.

[45] Date of Patent: **Jan. 19, 1999**

[54] **SURFACE EMITTING VISIBLE LIGHT EMITTING DIODE HAVING RING-SHAPED ELECTRODE**

[56] **References Cited**

**FOREIGN PATENT DOCUMENTS**

[75] Inventors: **Achyut Kumar Dutta; Akira Suzuki**, both of Tokyo, Japan

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[21] Appl. No.: **629,470**

[22] Filed: **Apr. 11, 1996**

[57] **ABSTRACT**

[30] **Foreign Application Priority Data**

Apr. 11, 1995 [JP] Japan ..... 7-085128

Disclosed is a surface emitting visible light emitting diode, which has: a first conductivity-type substrate; and a first conductivity-type buffer layer, a first conductivity-type cladding layer, an active layer, a second conductivity-type cladding layer, a second conductivity-type current spreading layer and a second conductivity-type cap layer which are in turn grown on the substrate; wherein the second conductivity-type cap layer has a ring shaped electrode formed thereon.

[51] **Int. Cl.<sup>6</sup>** ..... **H01L 33/00**

[52] **U.S. Cl.** ..... **257/91; 257/95; 257/98; 257/99; 257/100**

[58] **Field of Search** ..... **257/91, 94, 95, 257/98, 99, 100**

**2 Claims, 16 Drawing Sheets**

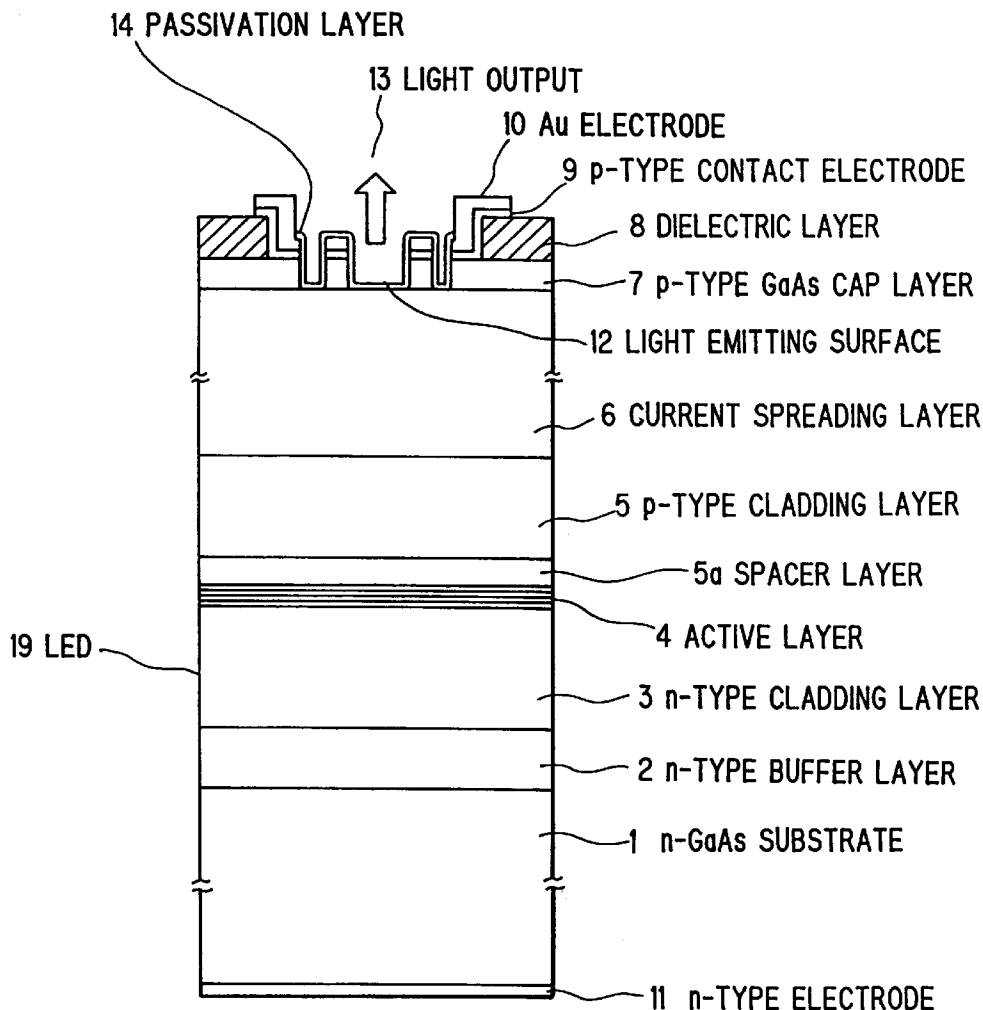


FIG. 1A  
PRIOR ART

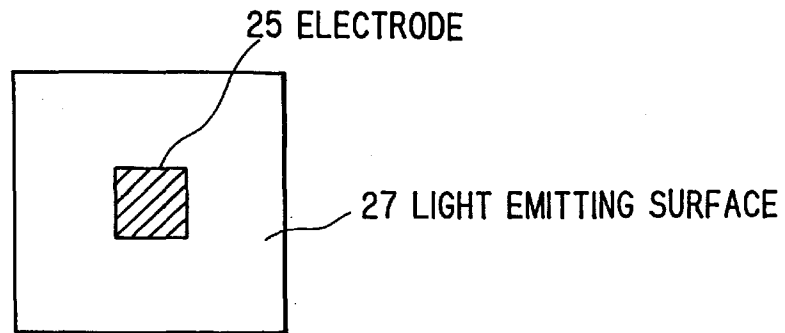


FIG. 1B  
PRIOR ART

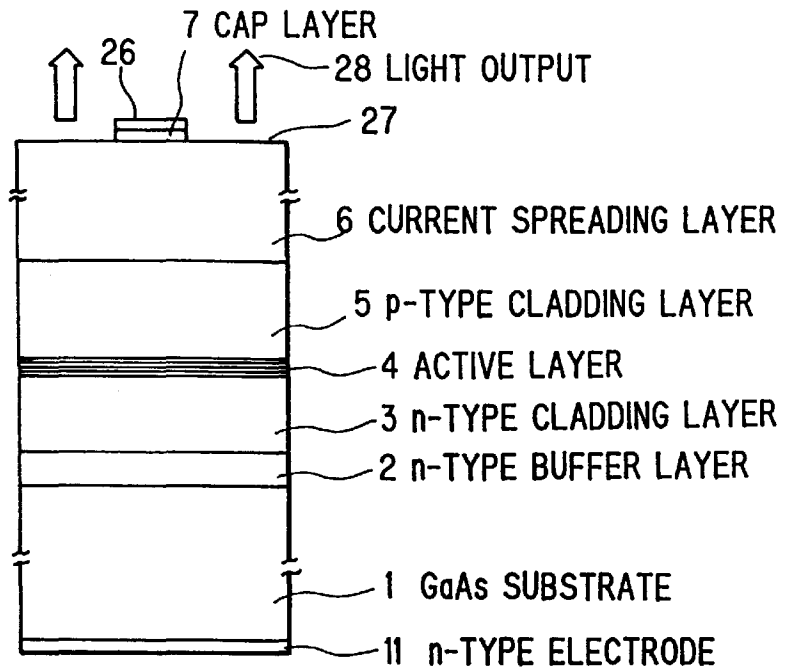
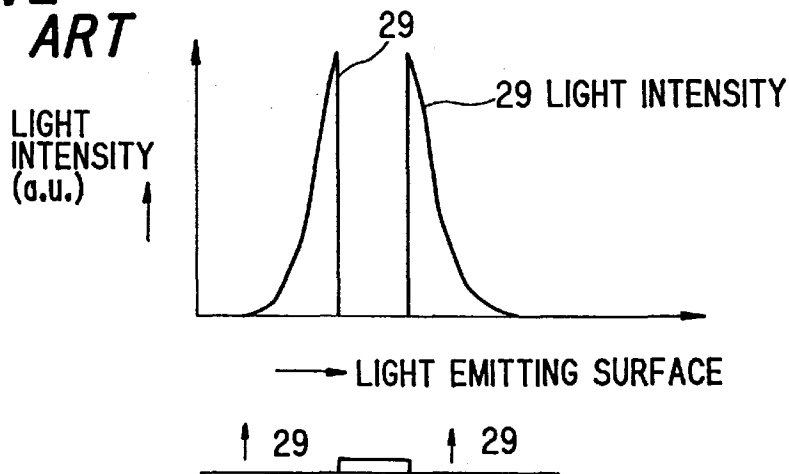


FIG. 2  
PRIOR ART



**FIG. 3 PRIOR ART**

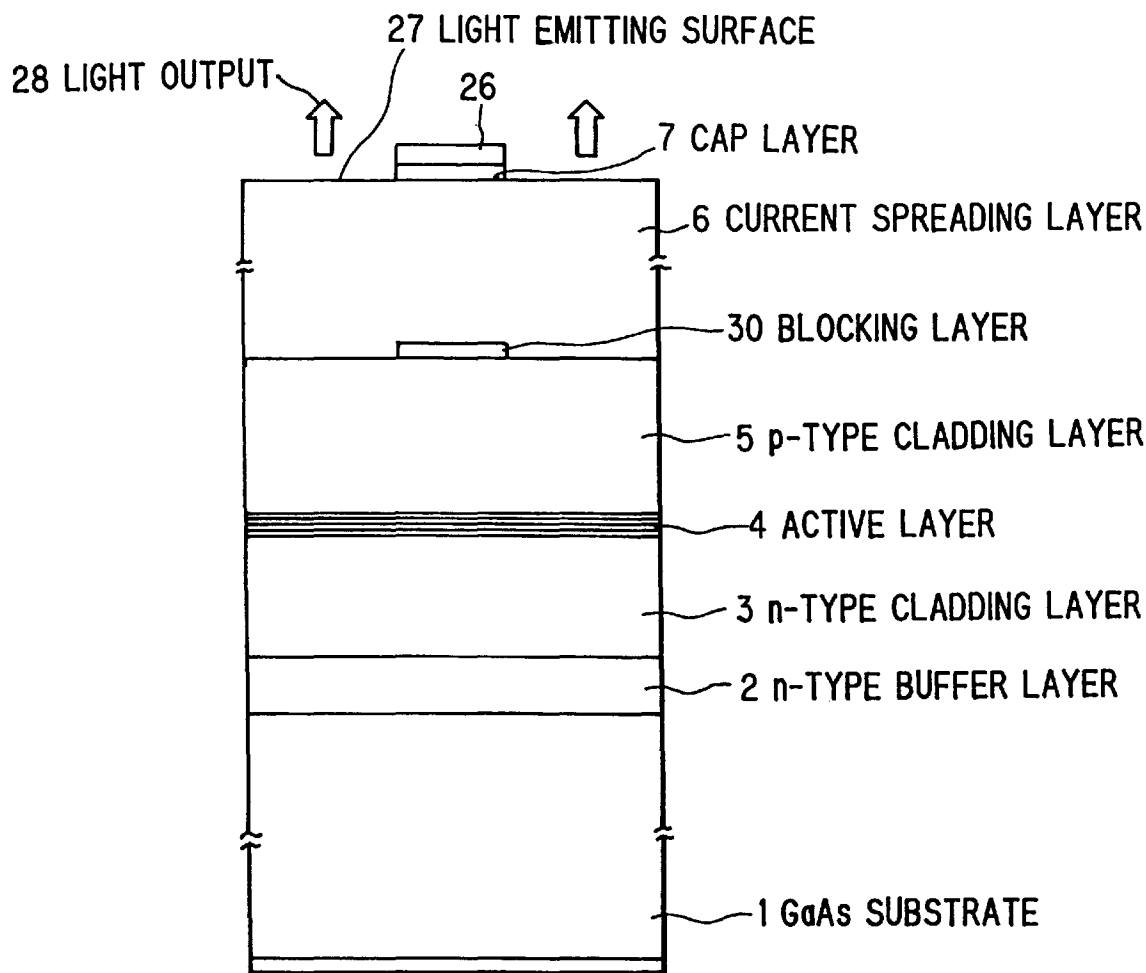
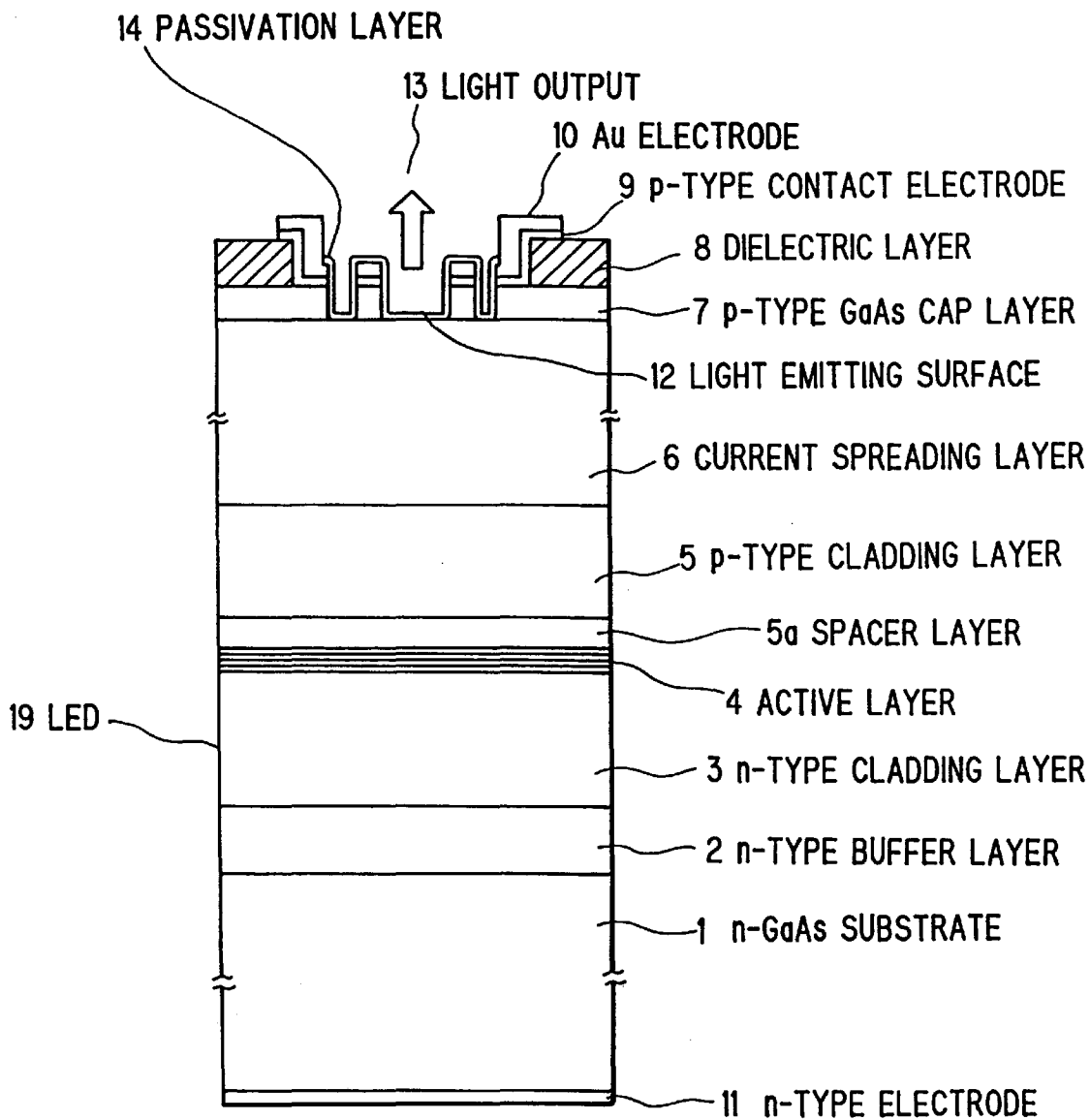
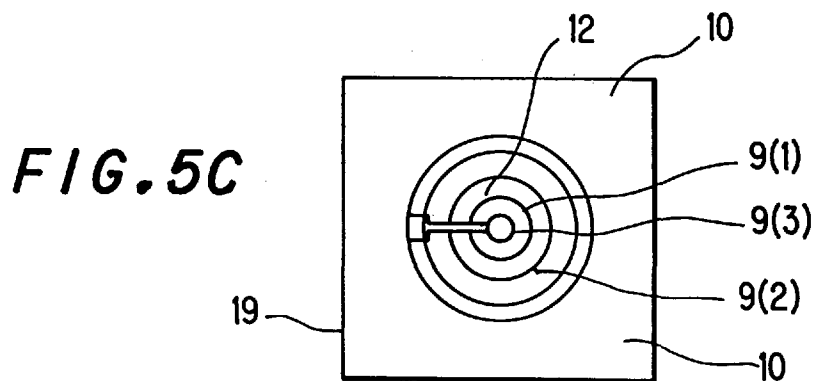
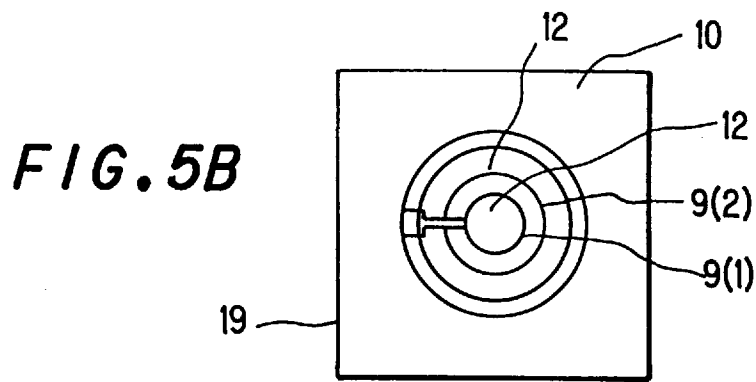
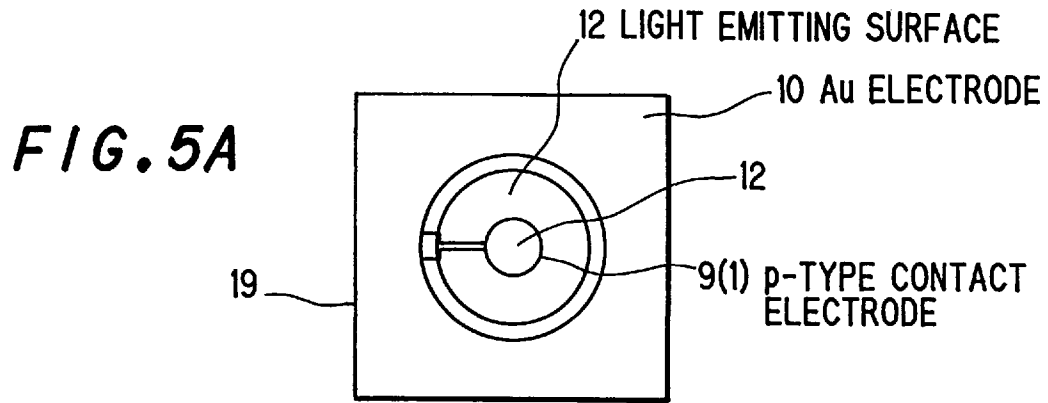


FIG. 4





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