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- (71) Applicant: **MICROGLASS LLC** [US/US]; 17647 Trenton Drive, Castro Valley, CA 94546 (US).

(54) Title: ENERGY BAND STRUCTURES FOR LIGHT EMITTING DEVICES

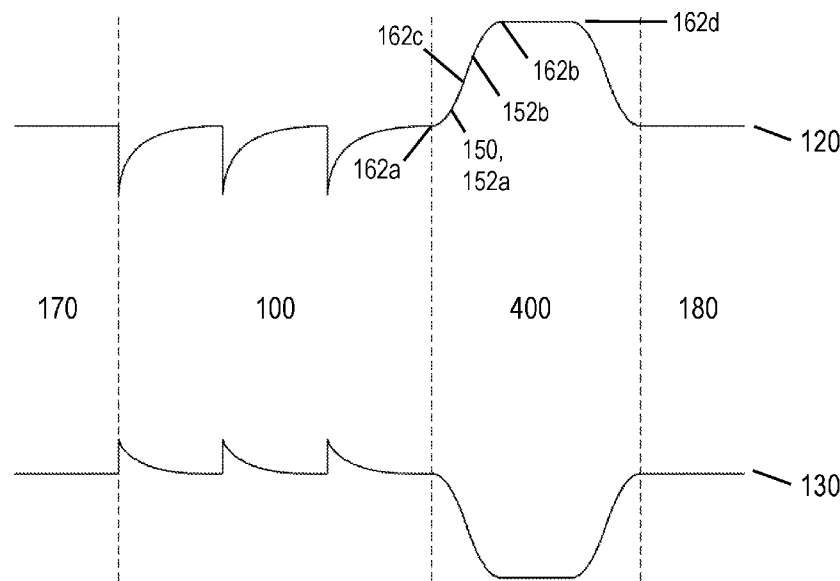


FIG. 17A

(57) **Abstract:** An apparatus and method for reducing the quantum confined Stark effect and electron leakage in polarized compound semiconductors optical gain regions is disclosed. The apparatus comprises a continuously graded multi-quantum well (MQW) band structure wherein the quantum wells (QWs) are concatenated with no quantum barriers (QBs) in between and no more than one heterojunction interface per well. An alternative, equivalent MQW band structure comprises continuously graded QWs separated by continuously graded QBs with no more than one heterojunction interface per well. In both embodiments the band structures are devoid of constant bandgap layers. Non-uniform period and non-uniform bandgap range MQW structures are contemplated. Non-uniform QW/QB thickness ratio MQW structures are also considered. Smoothly graded electron barrier layers (EBLs) with tangent energy bands on the MQW side and no more than one heterojunction interface on the p-injection side may be used to improve electron confinement



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**Declarations under Rule 4.17:**

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
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and hole injection.

## INTERNATIONAL SEARCH REPORT

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| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br><b>H01L 33/06(2010.01)i; H01L 33/00(2010.01)i</b>  |  |   |
|--|--|---|
| According to International Patent Classification (IPC) or to both national classification and IPC  |  |   |
| <b>B. FIELDS SEARCHED</b>  |  |   |
| Minimum documentation searched (classification system followed by classification symbols)<br>H01L 33/06(2010.01); H01L 29/205(2006.01); H01L 31/06(2006.01); H01L 33/00(2010.01)   |  |   |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched<br>Korean utility models and applications for utility models<br>Japanese utility models and applications for utility models  |  |   |
| Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)<br>eKOMPASS(KIPO internal) & Keywords: energy band, bandgap, quantum well, discontinuity, electron barrier layer, quantum barrier   |  |   |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>  |  |   |
| Category*  | Citation of document, with indication, where appropriate, of the relevant passages                             | Relevant to claim No.   |
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| <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.  |  |   |
| * Special categories of cited documents:<br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"D" document cited by the applicant in the international application<br>"E" earlier application or patent but published on or after the international filing date<br>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"P" document published prior to the international filing date but later than the priority date claimed<br>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention<br>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone<br>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art<br>"&" document member of the same patent family |  |   |
| Date of the actual completion of the international search<br><b>25 November 2024</b>   |  | Date of mailing of the international search report<br><b>25 November 2024</b> |
| Name and mailing address of the ISA/KR<br><b>Korean Intellectual Property Office<br/>189 Cheongsa-ro, Seo-gu, Daejeon<br/>35208, Republic of Korea</b><br>Facsimile No. +82-42-481-8578  |  | Authorized officer<br><b>LEE, Kang Ha</b><br>Telephone No. +82-42-481-5687    |



**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

International application No.

**PCT/US2024/033170**

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