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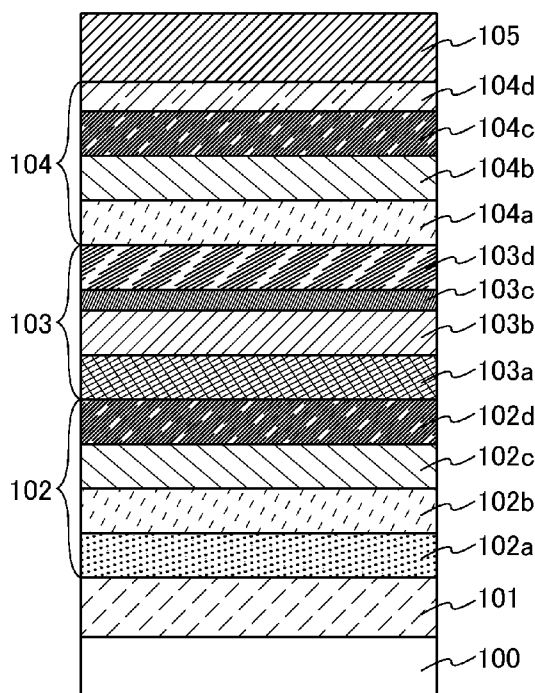
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(54) Title: LIGHT-EMITTING ELEMENT, LIGHTING DEVICE, AND ELECTRONIC APPLIANCE

FIG. 1



(57) Abstract: A tandem light-emitting element employing an inverted-structure is provided. The light-emitting element includes a cathode, a first EL layer over the cathode, a second EL layer over the first EL layer, an anode over the second EL layer, and an intermediate layer. The intermediate layer is between the first EL layer and the second EL layer. The intermediate layer includes a first layer, a second layer over the first layer, and a third layer over the second layer. The first layer includes a hole-transport material and an electron acceptor. The third layer includes an alkali metal or an alkaline earth metal. The second layer includes an electron-transport material.



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B. FIELDS SEARCHED		
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Published examined utility model applications of Japan 1922-1996 Published unexamined utility model applications of Japan 1971-2015 Registered utility model specifications of Japan 1996-2015 Published registered utility model applications of Japan 1994-2015		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/0235166 A1 (SEMICONDUCTOR ENERGY LABORATORY CO., LTD.) 2012.09.20, paragraphs [0093], [0166], [0173], [0199], [0204]-[0206], [0212]	1-4,6-8,11-13,16,18-22,25-27
Y	& JP 2011-9688 A & EP 2192633 A2 & KR 10-2010-0062930 A & CN 101752512 A & TW 201038120 A & KR 10-2011-0095839 A & CN 102255051 A & TW 201208475 A & CN 103904229 A & KR 10-2015-0005489 A	5,9-10,14-15,17,23-24,28-29
X	US 2006/0263629 A1 (XEROX CORPORATION) 2006.11.23, paragraphs [0032], [0083],[0089], [0099]	1,3-4,10-13,16,18-19,24-27
Y	& JP 2006-332048 A & GB 2426381 A & GB 610070 D0 & DE 102006023512 A & FR 2886057 A & KR 10-2006-0120505 A & CN 1866574 A & CN 102176514 A & TW 329374 B	2,14-15,28-29
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2012/0228588 A1 (SEIKO EPSON CORPORATION) 2012.09.13, paragraphs [0017],[0020],[0130] & JP 2012-186392 A & CN 102683604 A	5,10,17,24
Y	JP 2011-96406 A (SEIKO EPSON CORPORATION) 2011.05.12, paragraphs [0007] - [0008] , [0106] - [0107] , [0114] (No family)	5,10,17,24
Y	US2012/0205686 A1 (SEMICONDUCTOR ENERGY LABORATORY CO., LTD.) 2012.08.12, paragraphs [0120], [0174],[0192],Figs. 1A,5D & JP 2012-182126 A & EP 2487719 A2 & CN 102637829 A & KR 10-2012-0092518 A & TW 201241745 A	9,14-15,23,28-29