

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD**

Affidavit of STEPHANIE BOX

I, STEPHANIE BOX, hereby declare are follows:

1. I am a citizen of the United States of America, and I am over 18 years of age. I have personal knowledge of the matters stated in this affidavit, all of which are true and correct.

2. I am a Translator for TransPerfect.

3. I submit this declaration to certify the accuracy of the translation I performed relating to International Patent Application Publication No. WO2006028073A1, entitled “CHIP COMPONENT TYPE LIGHT EMITTING DEVICE AND WIRING BOARD FOR THE SAME,” (hereinafter “WO2006028073A1”).

4. I am qualified to translate Japanese technical documents into English, including translating Japanese patent documents into English. My qualifications include near-native fluency in Japanese with degrees such as a Bachelor of Arts in Chemistry (August 1998), Bachelor of Arts in Japanese (August 1998), Master’s of Science in Chemical Engineering and Technical Japanese (June 2001), all of which degrees were obtained at the University of Washington in Seattle, along with a Master’s of Philosophy in General Linguistics (July 2007) from Oxford University in England, and more than 25 years of translation and interpretation experience.

5. Attached as **Exhibit A** is a true and accurate copy of WO2006028073A1.

6. Attached as **Exhibit B** is a true and accurate copy of an English translation of WO2006028073A1, which I prepared based on **Exhibit A** and my personal knowledge of the Japanese and English languages.

7. I understand that by submitting this declaration I may be called to testify about the facts contained in this affidavit and/or my translation of WO2006028073A1, and I agree to make myself available to testify at a reasonable location and time.

8. I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: September 16, 2025

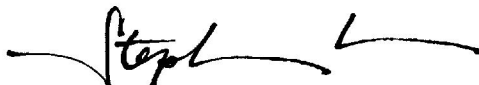
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EXHIBIT A

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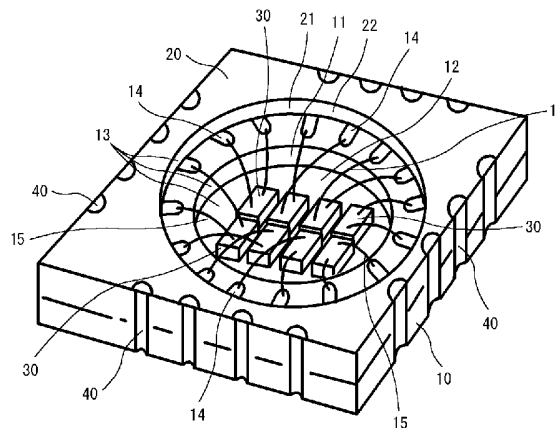
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(54) Title: CHIP COMPONENT TYPE LIGHT EMITTING DEVICE AND WIRING BOARD FOR THE SAME

(54) 発明の名称: チップ部品型発光装置及びそのための配線基板



(57) Abstract: A chip component type light emitting device, which is provided with a plurality of light emitting elements for providing high optical output at a higher conversion efficiency, and a wiring board for such light emitting device are provided. The chip component type light emitting device having the plurality of light emitting diodes (30, 30...) inside an insulating board is provided with a base board (10) and a reflector board (20) laminate bonded on the upper plane of the base board. On the base board, a through hole (11) is formed, a heat sink (12) made of a thick metal film is formed on the rear plane of the through hole, a reflecting film (13) is formed on the inner circumference and the bottom part of the heat sink, and wiring patterns (14, 14...) are formed. On the reflector board (20), a through hole (21) having a diameter larger than that of the through hole of a base board is formed, and on the inner circumference plane of the through hole, a reflecting film (22) is formed. The reflector board is arranged and bonded on the upper plane of the base board at a position where a part of the wiring pattern exposes through the through hole, and the arranged light emitting diodes are mounted by being connected with the wiring pattern on the base board.

(57) 要約: 複数の発光素子を備え、高い光出力をより変換効率よく得ることが可能なチップ部品型発光装置及びそのための配線基板を提供する。 複数の発光ダイオード 30、30...を絶縁基板の内部に搭載するチップ部品型発光装置は、ベース基板 10 と、その上面に積層接着したリフレクター基板 20 とを備えている。ベース基板には貫通穴 11 が形成され、その裏面には厚い金属薄膜の放熱板 12 形成され、その内周及び底部には反射膜 13 が形成され、更に、

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DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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配線パターン 14、14…が形成される。一方、リフレクター基板 20 には、ベース基板の貫通穴よりも径の大きな貫通穴 21 が形成され、その内周面には反射膜 22 が形成される。このフレクター基板は、ベース基板の上面に、その貫通穴を介して配線パターンの一部が露出する位置に配置接着され、配置された複数の発光ダイオードは、ベース基板上の配線パターンに接続されて実装される。

明 細 書

チップ部品型発光装置及びそのための配線基板

技術分野

- [0001] 本発明は、基板内部に複数の発光素子を搭載し、各種の表示パネル、液晶表示装置のバックライト、照明装置などの光源として利用することの可能なチップ部品型発光装置に関し、更には、そのための配線基板に関する。

背景技術

- [0002] 従来、チップ部品型のLEDに代表されるチップ部品型発光装置は、表示パネル、液晶表示装置のバックライト、照明装置などの光源として利用されている。なお、かかるチップ部品型発光装置は、近年におけるフラットパネルの用途の拡大に伴って、その適用される用途が更に広がってきている。かかる用途の拡大に伴い、チップ部品型発光装置には、素子自体の発光量の増大と共に、消費電力に対する発光量の増大、換言すれば、光への変換効率の向上が求められており、そして、更には、特に、大量生産に適しており、もって、比較的安価に製造することの可能なチップ部品型発光装置の構造が強く求められている。
- [0003] なお、従来におけるかかるチップ部品型発光装置は、例えば、以下の特許文献1～3に示すように、一般に、絶縁基板の一部に、貫通穴、又は、テーパ面を備えた穴を形成すると共に、その表面に電氣的接続を行うための配線パターンを形成した配線基板を利用して製造されていた。即ち、例えば、発光ダイオード等の1個の発光素子を、上記配線基板の貫通穴の底面に取り付けた金属薄板からなる放熱板の上に搭載し、その後、素子の電極を上記配線パターンにワイヤボンディングにより接続してチップ部品型発光装置として完成する。

- [0004] 特許文献1:特許第3137823号公報

特許文献2:特開2000－223752号公報

特許文献3:特開2003－31850号公報

発明の開示

発明が解決しようとする課題

- [0005] しかしながら、上述した従来技術になるチップ部品型発光装置の実装構造は、各基板に対して、例えば発光ダイオード等の発光素子を、ただ1個を搭載する構造であり、そのため、上述したように、各素子の発光量の増大に対応し、複数の発光素子その内部に搭載するに適した構造とはなっていない。
- [0006] 即ち、上記特許文献1により知られる構造では、貫通穴の裏面に取り付けた金属薄板を配線パターンに接続し、もって、その内部に搭載する発光ダイオードの一方の電極を当該金属薄板に接続すると共に、その他方の電極を、例えば、ワイヤボンディングなどにより、やはり配線基板の一部に形成した他の接続配線パターンに接続する。しかしながら、この配線基板の一部に形成した他の接続配線パターンは、複数の発光ダイオードを、貫通穴の裏面に取り付けた金属薄板上に搭載した場合に適した構造とはなっていない。
- [0007] また、上記特許文献1により知られる構造では、内部に搭載する発光ダイオードの他方の電極をワイヤボンディングなどによって配線基板の一部に形成した接続配線パターンに接続し、その後、発光ダイオードを内部に搭載した貫通穴に透明樹脂を充填して光学素子を形成する。しかしながら、発光ダイオードの電極と配線パターンとを接続するワイヤボンディングが、上記配線基板の上方に突出してしまい、そのため、その後の貫通穴に透明樹脂を充填するプロセスにおいて障害となり、透明樹脂の充填が正確に行うことが出来ない。更に、上記特許文献1は、その内部に発光ダイオードを搭載した貫通穴を取り囲んで、配線基板の上面に反射ケース板を添設する構造を開示している。しかしながら、かかる構造では、配線基板上に複数の発光素子を配置した後に、当該反射ケース板を正確に取り付けることは難しく、更には、発光ダイオードから出射される光の一部が、上記配線基板と反射ケース板との接合部から漏れ出てしまい、そのため、光の変換効率が低下してしまう。特に、複数の発光ダイオードを上記貫通穴内に搭載した場合には、なおさらである。
- [0008] なお、上記特許文献2及び3により知られる構造では、絶縁性基板に形成した貫通穴の裏面には放熱板となる金属薄板を取り付け、その表面に発光ダイオードを配置するが、上記特許文献1とは異なり、発光ダイオードの電極の電氣的接続を、上記基板の表面に形成した配線パターンとの間で行う。しかしながら、なお、その構造から、

複数の発光ダイオードを、貫通穴の裏面に取り付けた金属薄板上に搭載するに適した構造とはなっていない。即ち、やはり、これら特許文献2及び3により知られる構造でも、上述したと同様の問題点があった。

[0009] そこで、本発明は、上述した従来技術における問題点に鑑みて成されたものであり、具体的には、特に、その内部に複数の発光素子を搭載するチップ部品型発光装置であって、光変換効率の向上を図ることが可能であり、更には、大量生産に適していることから比較的安価に製造することの可能な構造のチップ部品型発光装置を、更には、そのための配線基板を提供することを目的とする。

課題を解決するための手段

[0010] 上記の目的を達成するため、本発明によれば、まず、発光素子を絶縁基板の内部に収納・搭載したチップ部品型発光装置、又は、そのための配線基板であって、収納する発光素子を搭載するベース基板と、前記ベース基板の上面に積層接着したリフレクター基板とを備えており、前記ベース基板は、その一部に発光素子を内部に搭載する非貫通穴が形成されると共に、このベース基板の上端周辺部には前記の発光素子を電氣的に接続するための配線パターンが形成されており、更に、前記非貫通穴の底面には、前記配線パターンを形成する金属薄膜より厚さの厚い放熱導体が形成されており、前記リフレクター基板は、前記ベース基板に形成された非貫通穴を塞がず、前記非貫通穴よりも径の大きな貫通穴が形成されており、その内周表面には金属薄膜からなる反射膜が形成されると共に、当該リフレクター基板を前記ベース基板の上面に配置した際、そのリフレクター基板の貫通穴底面に露呈して、前記ベース基板の非貫通穴の上端周辺部に配線パターンの一部(発光素子接続ランド)が形成されているチップ部品型発光装置、又は、配線基板が提供される。

[0011] また、本発明によれば、前記に記載したチップ部品型発光装置、又は、配線基板において、前記リフレクター基板の貫通穴の内周表面、又は前記ベース基板の非貫通穴の内周表面には金属薄膜からなる反射膜が、白色光に対して反射効率の良い、銀、ニッケル、アルミニウムのいずれかの金属薄膜で形成されていることが好ましい。

[0012] さらに、本発明によれば、前記に記載したチップ部品型発光装置、又は、配線基板

において、前記ベース基板とその上面に積層接着した前記リフレクター基板の端面には、更に、前記両基板を貫通して貫通穴が複数形成され、発光素子を搭載した後、前記両基板の貫通穴の略中心に沿って切断されると共に、当該貫通穴の内周には、前記ベース基板の貫通穴の周辺部に形成された前記配線パターンの一部(発光素子接続ランド)と、それぞれ、電氣的に接続された導体層が形成されており、前記発光素子を外部に接続するための端子電極を備えていることが好ましい。

[0013] また、本発明によれば、前記に記載したチップ部品型発光装置、又は、前記に記載した配線基板において、前記端子電極では、前記ベース基板とその上面に積層接着した前記リフレクター基板の両基板を貫通している貫通穴の前記リフレクター基板の上端面、又は前記ベース基板の下端面のいずれか一方が閉鎖部材で閉口された非貫通穴が形成され、発光素子を搭載した後、前記両基板の非貫通穴の略中心に沿って切断して端子電極とすることが好ましい。

[0014] 加えて、本発明によれば、前記に記載したチップ部品型発光装置、又は、配線基板において、前記ベース基板の非貫通穴が、一つの非貫通穴の内部に複数の発光素子を搭載する $\Phi 2.0 \sim 6.0$ の非貫通穴が形成されていることが好ましい。

[0015] そして、本発明によれば、前記に記載したチップ部品型発光装置、又は、配線基板において、前記ベース基板の上面に積層接着したリフレクター基板に形成された貫通穴の内周の反射面が、当該ベース基板の底面より上端面が広がっているテーパ形状であること(テーパ角度 $90^\circ \sim 120^\circ$)が好ましい。

発明の効果

[0016] 上述したように、本発明によれば、高い光出力をより変換効率よく得ることが可能なチップ部品型発光装置と共に、そのための配線基板が提供されるという優れた効果を発揮する。

発明を実施するための最良の形態

[0017] 以下、本発明の実施の形態について、添付の図面を参照しながら、詳細に説明する。

[0018] まず、図1は、本発明の一実施の形態になるチップ部品型発光装置、及び、そのための配線基板を示す。このチップ部品型発光装置、及び、そのための配線基板は、

図からも明らかなように、外形を略正方形の板状に形成されており、基本的には、ベース基板10と、このベース基板の上面に積層接着したリフレクター基板20と、そして、複数の発光素子、例えば、本例では、8個の発光ダイオード30、30…とによって構成されている。なお、これら複数の発光素子である、8個の発光ダイオード30、30…は、上記ベース基板10の略中央に形成された貫通穴11の裏(底)面に設けられて放熱板を形成する厚い金属薄膜12の表面上に、所定の位置に並べられて配置されている。なお、このベース基板10に形成された貫通穴11の内周面及び上記金属薄膜12の表面には、後にも詳細に説明するが、例えば、銀などの金属薄膜からなる反射膜13が、一体に形成されている。

[0019] また、添付の図2には、上記チップ部品型発光装置、及び、そのための配線基板を構成するベース基板10だけを取り出して示しており、この図からも明らかなように、上記ベース基板10の上面には、その製造工程については後に詳細に説明するが、上記複数の発光ダイオード30、30…を図示しない外部の駆動回路と電氣的に接続するための、所謂、配線パターン14、14…が、上記貫通穴11を取り囲むように、それぞれ、その周辺部に等間隔に配置されて形成されている。そして、図1において、符号15、15…は、これら複数の発光ダイオード30、30…を上記配線パターン14、14…との間で電氣的に接続するための、例えば、ワイヤボンディングにより配線されたワイヤを示している。

[0020] 一方、上記ベース基板10の上面に積層接着したリフレクター基板20にも、やはり、その略中央部に貫通穴21が形成されており、この貫通穴21の内周面にも、やはり後にその製造工程を詳細に説明するが、例えば、銀などの金属薄膜からなる反射膜22が形成されている。なお、この貫通穴21は、上記ベース基板10に形成された貫通穴11の径よりも大きく、そのため、上記図1から明らかなように、このリフレクター基板20を上記ベース基板10の上面に積層接着した状態で、その貫通穴21を介して、上記ベース基板10の上面に形成した配線パターン14、14…の一部が、より具体的には、ベース基板10の貫通穴11の周辺部に形成された配線パターンの一部が露出している。即ち、ベース基板10の上面にリフレクター基板20を積層接着した基板に複数の発光ダイオード30、30…を配置し、その後、上述したように、例えば、ワイヤボンデ

イングなどにより、上記ベース基板10の上面に形成された配線パターン14、14…との間で、電氣的に接続することが出来る。そのため、上記配線パターン14、14…との間で電氣的に接続するためのワイヤ15、15…を、上記積層接着した二枚の基板(ベース基板10及びリフレクター基板20)の内部において、即ち、ワイヤ15を、リフレクター基板20の上面から突出させることなく、接続することが可能となる。

[0021] 更に、上記の図1からも明らかなように、チップ部品型発光装置、及び、そのための配線基板を構成するベース基板10とリフレクター基板20との各端面には、複数(本例では、 $8 \times 2 = 16$ 個)の端面電極40、40…が形成されている。即ち、これら端面電極40、40…により、当該チップ部品型発光装置を、例えば、マザーボードなどの他の基板上に搭載した際、基板上に形成された配線パターンと間の電氣的な接続を図ることが出来る。

[0022] 続いて、上記にその詳細構造を説明したチップ部品型発光装置、及び、そのための配線基板において、特に、ベース基板10をリフレクター基板20上に積層接着してなる基板の製造方法について、以下、添付の図3～図5を参照しながら説明する。

[0023] なお、添付の図3は、上記したベース基板10の製造方法を示しており、この図では、ベース基板10の製造過程の各段階における断面構造を示す。

[0024] まず、例えば、エポキシ樹脂等の絶縁材からなる、厚さが約0.3mmのコア基材300を用意し、その一方の面(図の例では上面)には、厚さが約 $18 \mu\text{m}$ の銅箔310を付着すると共に、他方の面(図の例では下面)には、厚さが約 $25 \mu\text{m}$ の接着シート320を張る(図3(a))。次に、上記で用意した基材300の表面には、上記貫通穴11(上記図1を参照)の位置に、例えば、NCにより、例えば本例では、 $\phi 3.1$ 程度の穴を開ける(図3(b))。その後、上記基材300の下面、即ち、銅箔310を付着した面とは反対の面には、上記銅箔310よりも厚い、例えば、厚さが約 $70 \mu\text{m}$ の銅箔330を接着する(図3(c))。その後、端面電極40、40…(上記図1を参照)を形成する位置に、例えば、 $\phi 0.6$ 程度の穴を開け(図3(d))、更に、その全体に、厚さ約 $20 \mu\text{m}$ の銅めっき層340を施す(図3(e))。

[0025] 続いて、上記基材300の上面、即ち、上記リフレクター基板20とのボンディング(接着)面に、例えばエッチングによって上記の銅箔310を除去することにより、所定の回

路パターン14を形成する(図3(f))。その後、形成した所定の回路パターンの上から、予め所定の位置に開口部を形成した接着シート350を接着し(図3(g))、もって、上記ベース基板10を得る。なお、上記により得られたベース基板10の一例が、上記の図2に示されている。

[0026] 次に、添付の図4には、上記リフレクター基板20の製造方法を示しており、この図でも、やはり、上記リフレクター基板20の製造過程の各段階における断面構造を示している。

[0027] まず、やはり、エポキシ樹脂等の絶縁材からなる、厚さが約0.3mmのコア基材400を用意し、その両面に、厚さが約25 μ mの接着シート410、420を付着する(図4(a))。続いて、上記基材400の表面には、上記貫通穴21(上記図1を参照)の位置に、例えば、NCにより、 ϕ 5.0程度の穴を開けると同時に、上記端面電極40、40…を形成する位置にも、 ϕ 0.6程度の穴を開ける(図4(b))。そして、上記基材400の表(上)面には、予め上記貫通穴21の位置に ϕ 5.0程度の穴を開けた銅箔430を、一方、その裏(下)面には、予め上記貫通穴21と上記端面電極40の位置に ϕ 5.0程度の穴を開けた銅箔440を接着する(図4(c))。その後、その全体に、厚さ約20 μ mの銅めっき層450を施し(図4(d))、更に、上記基材300の表(上)面に形成された銅箔430をエッチングによって除去し、所定のパターンを形成し(図4(e))、上記リフレクター基板20を得る。

[0028] 次に、上記により得られたリフレクター基板20をベース基板10上に積層して接着する工程について、図5を参照して説明する。なお、ここでも、積層接着して製造されるリフレクター基板20とベース基板10とが、その製造過程における各段階での断面構造により示されている。

[0029] まず、上記図4(e)で得られたリフレクター基板20を、上記図3(g)で得られたベース基板10上に積層する(図5(a))。即ち、上記ベース基板10の上面に接着された接着シート350の上に、リフレクター基板20を積層して接着する。続いて、上記積層接着したベース基板10の下面に接着された厚さが約70 μ mの銅箔330を、やはり、エッチングなどによって除去し、チップ部品型発光装置の半田面の回路を形成する(図5(b))。その後、その全体に、例えば、厚さ約5 μ mのニッケル(Ni)層と厚さ約0.3

μm の金(Au)層とからなる貴金属めっき層510を施す(図5(c))。更に、ベース基板10の下面全体にマスキングテープ520を貼り(図5(d))、その全体に、銀(Ag)層530を、約 $0.3\mu\text{m}$ の厚さで施す(図5(e))。その後、上記ベース基板10の下面全体に貼ったマスキングテープを剥離し(図5(f))、もって、ベース基板10をリフレクター基板20上に積層接着してなる基板を完成する。その後、更に、上記ベース基板10の貫通穴11内において、複数の発光ダイオードを、その裏(底)面に設けられた放熱板12上に配置し、配線を行ってチップ部品型発光装置を得る。なお、以上に述べた工程では、多数の装置を同時に製作するため、その表面積の大きな基板を用い、多数の基板を一体として作成する。そして、上記図5(f)における一点鎖線は、上記基板内に複数の発光ダイオードを実装してチップ部品型発光装置を完成した後、個々のチップ部品として分離切断するための切断線を示している。

[0030] なお、上述した製造工程により得られたチップ部品型発光装置の配線基板によれば、添付の図6にも示すように、上記基板を構成するベース基板10の略中央部に形成した貫通穴11の裏(底)面に設けられた放熱板(金属薄膜)12の上に、伝熱性の高いモールド樹脂材60を介して、上記複数の発光ダイオード30、30…を所定の位置に固定する。その後、例えば、ワイヤボンディングにより配線が行われる。その際、上記図1からも明らかなように、発光ダイオードとの間で配線を施す配線パターン14、14…が、二層に積層された基板の下方の基板である上記ベース基板10の表(上)面に形成されており、かつ、これら配線パターン14、14…の一部が、その上に接着されたリフレクター基板20の表面に開口された貫通穴21を介して露出されており、複数の発光ダイオード30、30…の各々の電極は、これら配線パターン14、14…との間でワイヤボンディングによって配線が行われる。なお、この図6においても、配線されたワイヤが符号15により示されている。

[0031] このように、上記の構成によれば、上記複数の発光ダイオード30、30…の電極と配線パターン14、14…との間に配線されたワイヤ15は、上記チップ部品型発光装置の基板の表(上)面、即ち、リフレクター基板20の表(上)面から外部へ突出することなく、基板内部に実装することが可能となる。すなわち、チップ部品型発光装置のかかる構成によれば、発光ダイオード30、30…を基板上に搭載した後に、その配線部を保

護するために、その上部に透明樹脂を充填する必要もない。

[0032] 換言すれば、上記図6に示すように、発光ダイオード30、30…を基板内部に実装した状態で、チップ部品型発光装置として、例えば、表示パネル、液晶表示装置のバックライト、照明装置などの光源として利用することが出来る。なお、上述したように複数の発光ダイオード30、30…を搭載可能であることから、高い光出力が得られると共に、このように、発光ダイオード30の上面に透明樹脂を充填する必要がないことから、素子から出射した光が当該透明樹脂によってその一部が吸収されることもなく、より変換効率の高いチップ部品型発光装置を得ることが出来る。加えて、上述した発光ダイオード30の上面に透明樹脂を充填する必要がないことによれば、素子内部での発熱が、その上面に充填された当該樹脂により周囲へ拡散されることから妨害され、又は、当該樹脂内部に篳ってしまい、発光ダイオードの温度を上昇してしまう事態を回避することが出来る。

[0033] また、上記図6にも示すように、上記配線基板を構成するベース基板10の上にはリフレクター基板20が一体に形成されており、加えて、ベース基板10に開口した貫通穴11の底面及びその内周面、及び、リフレクター基板20に開口した貫通穴21の内周面には、上述したように、その全面に亘って、ニッケル(Ni)層と金(Au)層とからなる貴金属めっき層510が施され、更に、その表面には銀(Ag)層530(厚さ約1 μ m)からなる反射膜13、22が形成されている。このことから、ベース基板10の貫通穴11の内部に設けられた複数の発光ダイオード30、30…から出射した光は、これら反射膜13、22によって反射され、外部に漏出することなく、リフレクター基板20に開口した貫通穴21の上部から導出される。即ち、複数の発光素子による高い光出力を、変換効率良く得ることが可能となる。

[0034] 添付の図7には、上記に示したチップ部品型発光装置、及び、そのための配線基板の変形例を示す。図からも明らかなように、この変形例によれば、上述したチップ部品型発光装置の構成において、更に、そのリフレクター基板20の表(上)面に、例えば、ガラスや樹脂などの透明な板状部材70を取り付け、そして、この板状部材70の一部には、例えば、光を拡散するためのレンズ等の、所謂、光学素子を一体に形成したものである。即ち、かかる構成によれば、上述した実施例と同様に、発光素子

の放熱性に優れると共に、複数の発光素子による高い光出力を、変換効率良く得ることが可能となると共に、その出力光を拡散して出射することから、特に、表示パネル、液晶表示装置のバックライト、照明装置などの光源として利用するチップ部品型発光装置に適している。更に、かかる構造によれば、特に、板状部材70により、装置の外部からの異物が貫通穴11、21の内部に侵入し、例えば、ワイヤ15間を短絡させ、又は、破損し、もって発光ダイオード30を破壊することから防止することが出来る。

[0035] 更に、添付の図8には、上記に示したチップ部品型発光装置、及び、そのための配線基板の他の変形例を示す。なお、図からも明らかなように、この変形例によれば、上記ベース基板10及びリフレクター基板20に開口した貫通穴11、21の内部に、透明な樹脂80を充填し、その内部に搭載された複数の発光ダイオード30、30…及びその配線用のワイヤ15を浸漬させて固化し、かつ、その外周面を、例えば、凸状に形成し、もって、所謂、光学素子を一体に形成したものである。なお、かかる構成によれば、複数の発光素子による高い光出力を、変換効率良く得ることが可能となると共に、その出力光を拡散して出射することから、特に、表示パネル、液晶表示装置のバックライト、照明装置などの光源として利用するチップ部品型発光装置に適している。また、装置の外部からの異物の侵入に対し、ワイヤや発光ダイオード30を安全に保護することが可能となる。

[0036] なお、上記した図7又は図8に示した変形例において、例えば、上記ベース基板10に開口した貫通穴11、21の内部に配置する複数の発光ダイオード30、30…を青色発光ダイオードとした場合、リフレクター基板20の表(上)面に取り付ける透明な板状部材70、又は、貫通穴11、21の内部に充填する透明な樹脂80に、青色光を白色光に変換する部材を混入することによれば、容易に、表示パネル、液晶表示装置のバックライト、照明装置などの光源として好ましい白色光が得られるチップ部品型発光装置を得ることが出来る。なお、かかる部材としては、例えば、エポキシ樹脂に微細なシリカ、YAG蛍光体を混入したものが挙げられる。

[0037] また、上記のチップ部品型発光装置、及び、そのための配線基板では、特に、上記ベース基板10とリフレクター基板20とを積層してなる基板の各端面に形成された端面電極40、40の構造によれば、その上端面を半円形の導体層41で閉止されている

ことから、上記透明な樹脂80を充填する際、貫通穴11、21から外部へ漏れ出しても、その電極面にまで及ぶことがなく、確実に、端面電極40、40を得ることが出来る。

[0038] 更に、添付の図9は、上記ベース基板10に開口した貫通穴11の内部において、その裏(底)面に設けられた放熱板(金属薄膜)12の表面に、複数配置される発光ダイオードの配列についての他の例が示されている。即ち、上記の実施例では、その一例として、8個の発光ダイオード30、30…が、それぞれ、4行2列に配置されている。しかしながら、本発明は、上記の例に限定されることなく、この図に示すように、上記貫通穴11の内周面に沿って配置することも可能である。あるいは、これら8個の発光ダイオードが、例えば、1個のブロック30'として供給される場合には、添付の図10のように、上記貫通穴11の内部において、その放熱板(金属薄膜)12の表面のほぼ中央部に配置することが出来る。更に、その他の方法で配列することも可能である。

[0039] 加えて、上記図2には、上記チップ部品型発光装置、及び、そのための配線基板において、そのベース基板10の上面に形成された複数の配線パターン13、13…の一例が示されている。この図からも明らかなように、この実施例では、互いに隣接する配線パターン14、14が電氣的に接続されている。より具体的には、それぞれ、互いに隣接する一対の発光ダイオードの「+」及び「-」の電極に接続される配線パターンが、「+」「+」「-」「-」の順に配列されていることを意味する。なお、かかる配線パターン13、13…の配列によれば、基板内に配置した複数の発光ダイオード30、30…をワイヤボンディングなどによって配線パターン14、14…との間で電氣的に接続した際、その後、配線されたワイヤ15、15同士が互いに近接し、又は、接触しても、同極性であることから、短絡の発生から回避することが可能となるという効果を発揮する。

[0040] なお、以上に種々述べた実施例においては、上記ベース基板10及びリフレクター基板20に開口した貫通穴11、21は、円形であるとして説明したが、しかしながら、本発明はそれにのみ限定されるものではなく、これを、例えば、楕円形や方形に形成することも可能である。なお、その場合にも、上記と同様の効果が得られることは明らかであろう。また、上記の実施例においては、上記ベース基板10及びリフレクター基板20に開口した貫通穴11、21は、その内周面を垂直に形成するものとして説明したが、これについても、やはり、本発明はそれにのみ限定されるものではなく、例えば、基

材に貫通穴11、21を形成する際(上記図3(b)又は図4(b)を参照)、例えば、テーパドリル等を利用することにより、その内周面を傾斜して形成することも可能である。

- [0041] また、上記の説明では、上記の構成になるチップ部品型発光装置、及び、そのための配線基板において、特に、そのベース基板10の貫通穴11の内部に配置される複数の発光素子を、その一例として、8個の発光ダイオード30、30…として説明した。しかしながら、本発明はこれに限定されることなく、2個又はそれ以上の個数(例えば、好ましくは、4個、6個、9語、10個等)でもよく、また、発光素子としては、上記の発光ダイオードに限らず、その他の半導体発光素子でもよいことは、当業者であれば明らかであろう。また、上記ベース基板10の貫通穴11の内部に配置される複数の発光素子を、光の三原色である赤色、緑色、青色の発光ダイオードにより構成することも可能である。また、その際、上記三色の発光ダイオードを組み合わせることで上記ベース基板10の貫通穴11内に配置することによれば、白色光を得ることが可能であり、あるいは、少なくともその2種又はそれ以上を組み合わせ、もって、所望の色調の光を得ることも可能となる。

図面の簡単な説明

- [0042] [図1]本発明の一実施の形態になるチップ部品型発光装置、及び、そのための配線基板の構成を示す拡大斜視図である。
- [図2]上記チップ部品型発光装置、及び、そのための配線基板を構成するベース基板の構造を示す拡大斜視図である。
- [図3]上記ベース基板の製造方法を示すための工程図であり、その製造過程の各段階における断面構造を示す。
- [図4]上記リフレクター基板の製造方法を示すための工程図であり、その製造過程の各段階における断面構造を示す。
- [図5]上記ベース基板の上面に上記リフレクター基板を積層接着して基板を製造する方法を示す工程図であり、その製造過程の各段階における断面構造を示す。
- [図6]上記により得られた基板に複数の発光素子を搭載してなるチップ部品型発光装置の構造を示す断面図である。
- [図7]上記チップ部品型発光装置、及び、そのための配線基板の変形例による構造

を示す断面図である。

[図8]上記チップ部品型発光装置、及び、そのための配線基板の他の変形例による構造を示す断面図である。

[図9]上記チップ部品型発光装置における発光素子の配列について他の例を示す断面図である。

[図10]上記チップ部品型発光装置における発光素子の配列について更に他の例を示す断面図である。

符号の説明

- [0043]
- 10 ベース基板
 - 11 貫通穴
 - 12 放熱板(厚い金属薄膜)
 - 13 反射膜
 - 14 配線パターン
 - 15 配線用ワイヤ
 - 20 リフレクター基板
 - 21 貫通穴
 - 22 反射膜
 - 30 発光ダイオード
 - 40 端面電極。

請求の範囲

- [1] 発光素子を絶縁基板の内部に収納・搭載したチップ部品型発光装置であって、当該絶縁基板は、収納する発光素子を搭載するベース基板と、前記ベース基板の上面に積層接着したリフレクター基板とを備えており、
- 前記ベース基板は、その一部に発光素子を内部に搭載する非貫通穴が形成されると共に、このベース基板の上端周辺部には前記の発光素子を電氣的に接続するための配線パターンが形成されており、更に、前記非貫通穴の底面には、前記配線パターンを形成する金属薄膜より厚さの厚い放熱導体が形成されており、
- 前記リフレクター基板は、前記ベース基板に形成された非貫通穴を塞がず、前記非貫通穴よりも径の大きな貫通穴が形成されており、その内周表面には金属薄膜からなる反射膜が形成されると共に、当該リフレクター基板を前記ベース基板の上面に配置した際、そのリフレクター基板の貫通穴底面に露呈して、前記ベース基板の非貫通穴の上端周辺部に配線パターンの一部(発光素子接続ランド)が形成されていることを特徴とするチップ部品型発光装置。
- [2] 前記請求項1に記載したチップ部品型発光装置において、前記リフレクター基板の貫通穴の内周表面、又は前記ベース基板の非貫通穴の内周表面には金属薄膜からなる反射膜が、白色光に対して反射効率の良い、銀、ニッケル、アルミニウムのいずれかの金属薄膜で形成されていることを特徴とするチップ部品型発光装置。
- [3] 前記請求項1に記載したチップ部品型発光装置において、前記ベース基板とその上面に積層接着した前記リフレクター基板の端面には、更に、前記両基板を貫通して貫通穴が複数形成され、発光素子を搭載した後、前記両基板の貫通穴の略中心に沿って切断されると共に、当該貫通穴の内周には、前記ベース基板の貫通穴の周辺部に形成された前記配線パターンの一部(発光素子接続ランド)と、それぞれ、電氣的に接続された導体層が形成されており、前記発光素子を外部に接続するための端子電極を備えていることを特徴とするチップ部品型発光装置。
- [4] 前記請求項3に記載したチップ部品型発光装置において、前記配線基板の端子電極では、前記ベース基板とその上面に積層接着した前記リフレクター基板の両基板を貫通している貫通穴の前記リフレクター基板の上端面、又は前記ベース基板の

下端面のいずれか一方が閉鎖部材で閉口された非貫通穴が形成され、発光素子を搭載した後、前記両基板の非貫通穴の略中心に沿って切断して端子電極とすることを特徴とするチップ部品型発光装置。

[5] 前記請求項1に記載したチップ部品型発光装置において、前記ベース基板の非貫通穴が、一つの非貫通穴の内部に複数個の発光素子を搭載するΦ2.0～6.0の非貫通穴が形成されていることを特徴とするチップ部品型発光装置。

[6] 前記請求項1に記載したチップ部品型発光装置において、前記ベース基板の上面に積層接着したリフレクター基板に形成された貫通穴の内周の反射面が、当該ベース基板の底面より上端面が広がっているテーパ形状であることを特徴とするチップ部品型発光装置。(テーパ角度90°～120°)

[7] 発光素子を絶縁基板の内部に収納・搭載するための配線基板であって、収納する発光素子を搭載するベース基板と、前記ベース基板の上面に積層接着したリフレクター基板とを備えており、

前記ベース基板は、その一部に発光素子を内部に搭載する非貫通穴が形成されると共に、このベース基板の上端周辺部には前記の発光素子を電氣的に接続するための配線パターンが形成されており、更に、前記非貫通穴の底面には、前記配線パターンを形成する金属薄膜より厚さの厚い放熱導体が形成されており、

前記リフレクター基板は、前記ベース基板に形成された非貫通穴を塞がず、前記非貫通穴よりも径の大きな貫通穴が形成されており、その内周表面には金属薄膜からなる反射膜が形成されると共に、当該リフレクター基板を前記ベース基板の上面に配置した際、そのリフレクター基板の貫通穴底面に露呈して、前記ベース基板の非貫通穴の上端周辺部に配線パターンの一部(発光素子接続ランド)が形成されていることを特徴とする配線基板。

[8] 前記請求項7に記載した配線基板において、前記リフレクター基板の貫通穴の内周表面、又は前記ベース基板の非貫通穴の内周表面には金属薄膜からなる反射膜が、白色光に対して反射効率の良い、銀、ニッケル、アルミニウムのいずれかの金属薄膜で形成されていることを特徴とする配線基板。

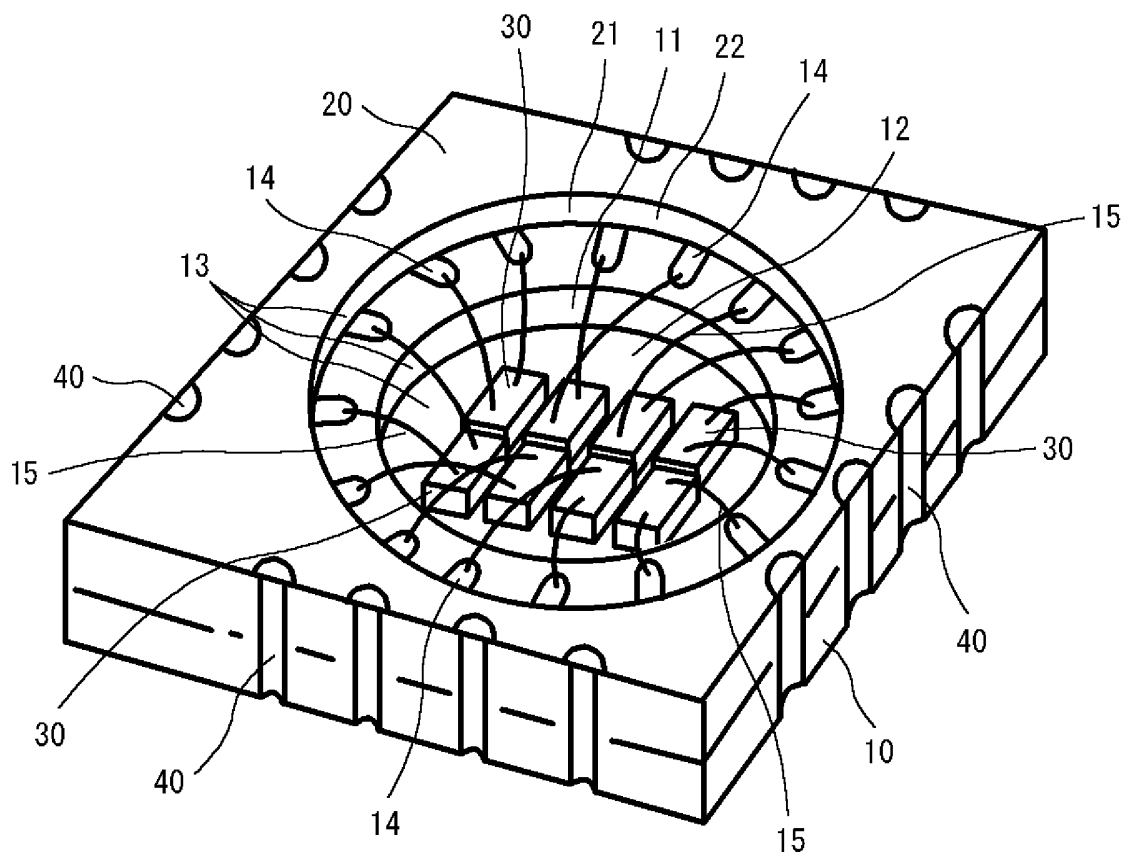
[9] 前記請求項7に記載した配線基板において、前記ベース基板とその上面に積層接

着した前記リフレクター基板の端面には、更に、前記両基板を貫通して貫通穴が複数形成され、発光素子を搭載した後、前記両基板の貫通穴の略中心に沿って切断されると共に、当該貫通穴の内周には、前記ベース基板の貫通穴の周辺部に形成された前記配線パターンの一部(発光素子接続ランド)と、それぞれ、電氣的に接続された導体層が形成されており、前記発光素子を外部に接続するための端子電極を備えていることを特徴とする配線基板。

- [10] 前記請求項9に記載した配線基板において、前記端子電極では、前記ベース基板とその上面に積層接着した前記リフレクター基板の両基板を貫通している貫通穴の前記リフレクター基板の上端面、又は前記ベース基板の下端面のいずれか一方が閉鎖部材で閉口された非貫通穴が形成され、発光素子を搭載した後、前記両基板の非貫通穴の略中心に沿って切断して端子電極とすることを特徴とする配線基板。
- [11] 前記請求項7に記載した配線基板において、前記ベース基板の非貫通穴が、一つの非貫通穴の内部に複数個の発光素子を搭載する $\Phi 2.0 \sim 6.0$ の非貫通穴が形成されていることを特徴とする配線基板。
- [12] 前記請求項7に記載した配線基板において、前記ベース基板の上面に積層接着したリフレクター基板に形成された貫通穴の内周の反射面が、当該ベース基板の底面より上端面が広がっているテーパ形状であることを特徴とする配線基板。(テーパ角度 $90^{\circ} \sim 120^{\circ}$)

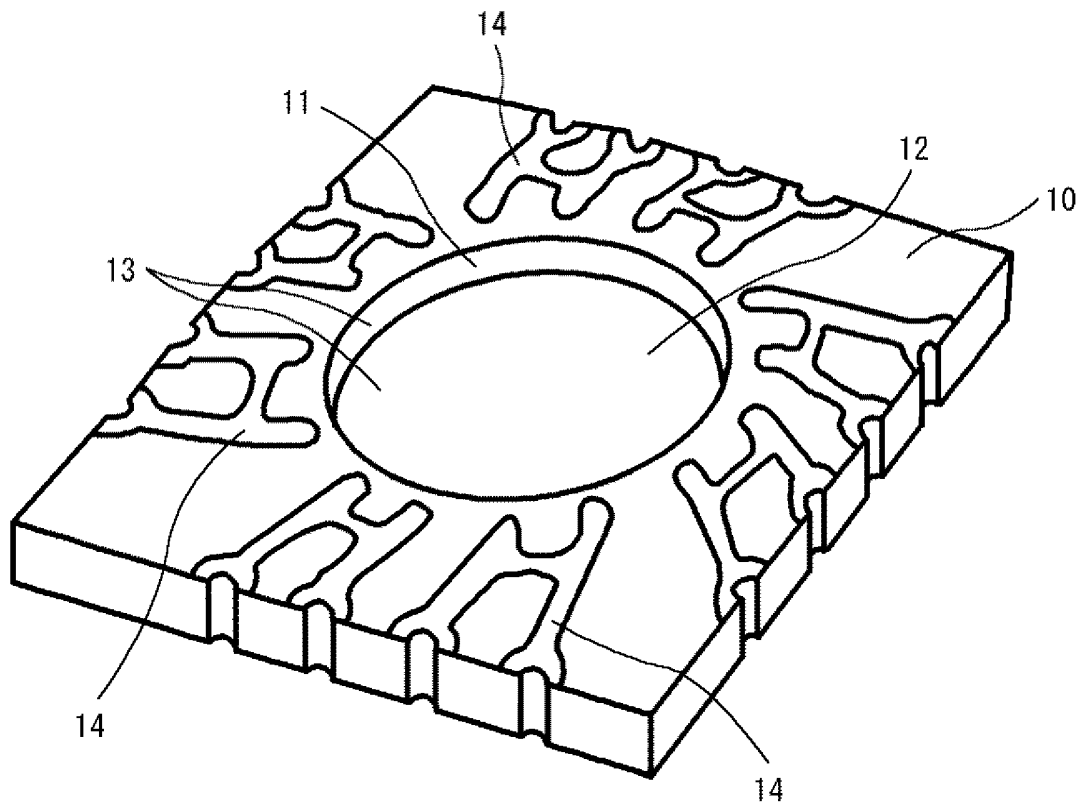
[図1]

图 1



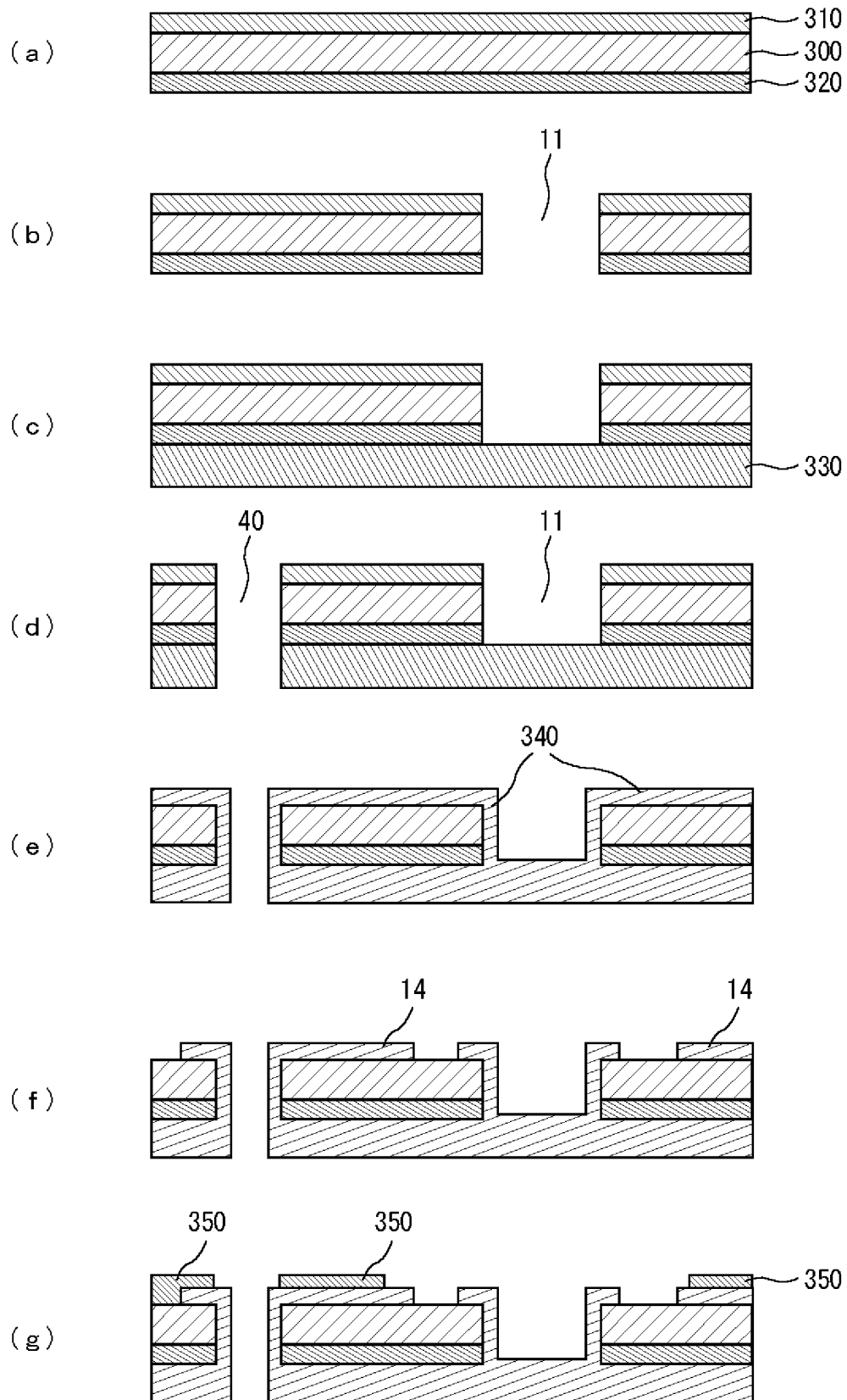
[図2]

図 2



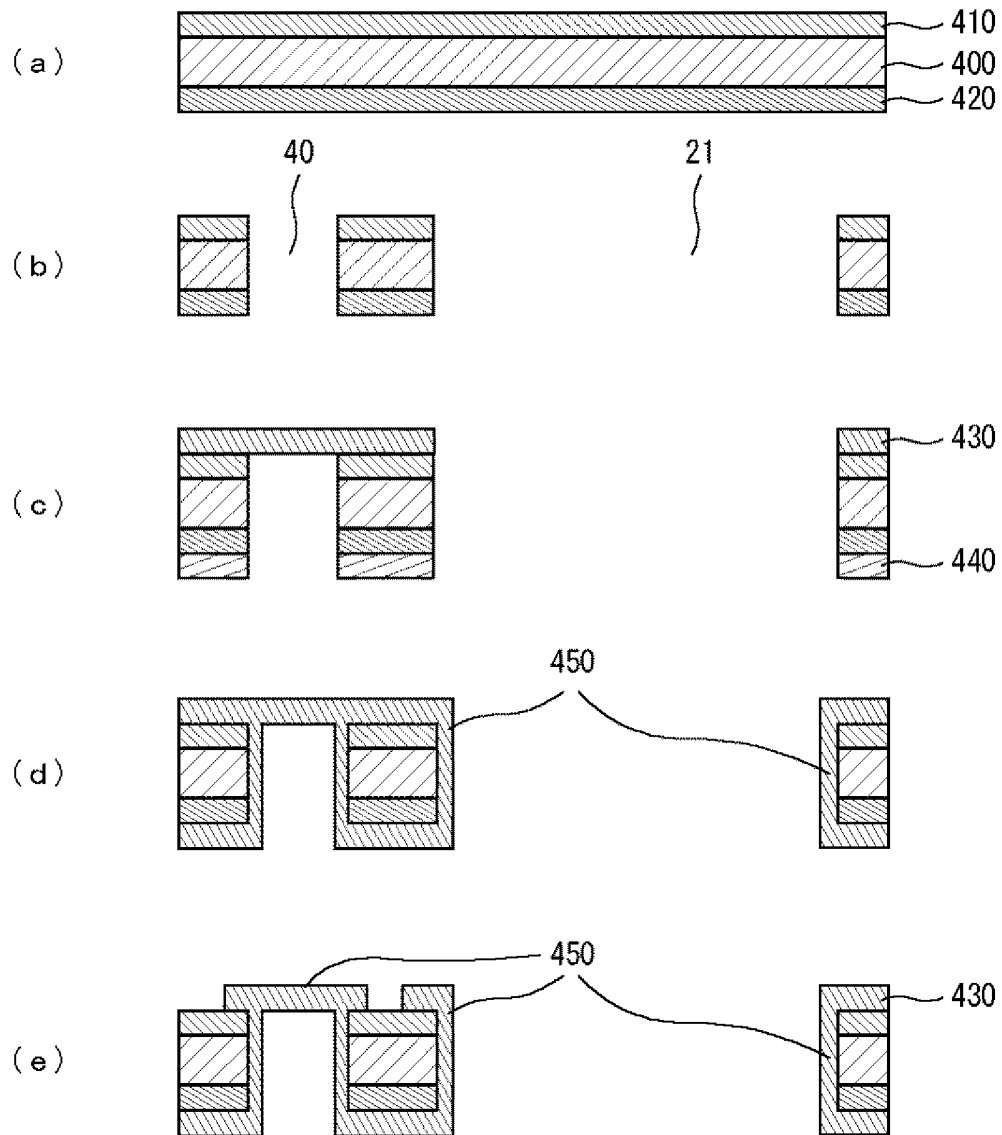
[図3]

図 3



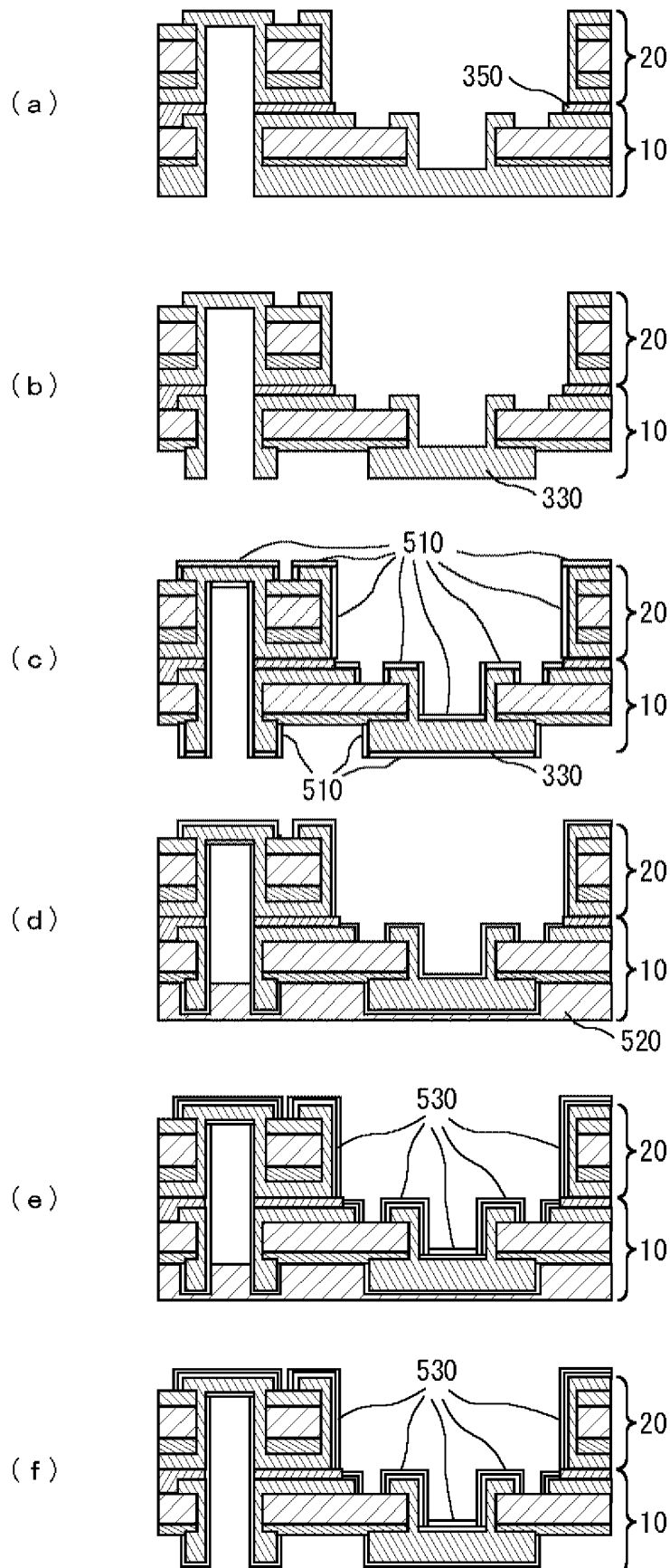
[図4]

図 4



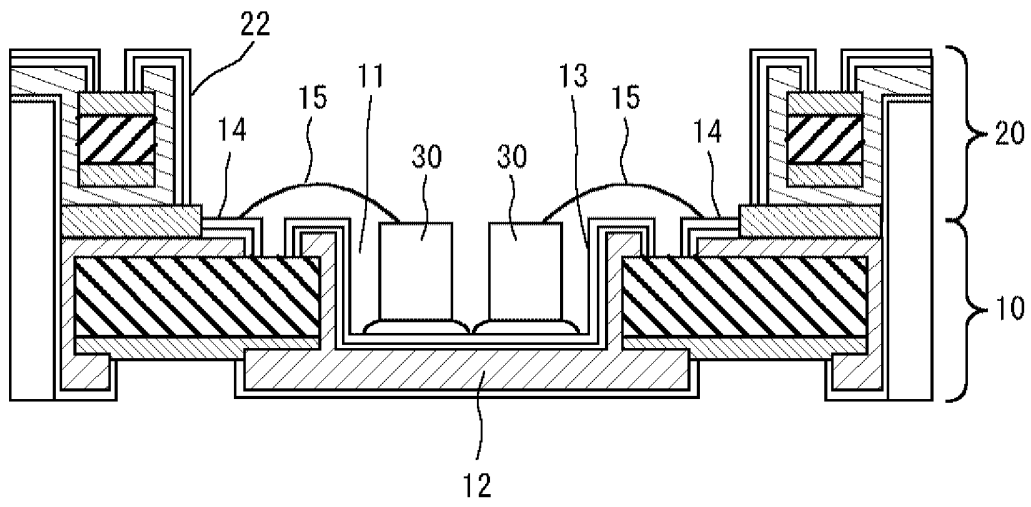
[図5]

図 5



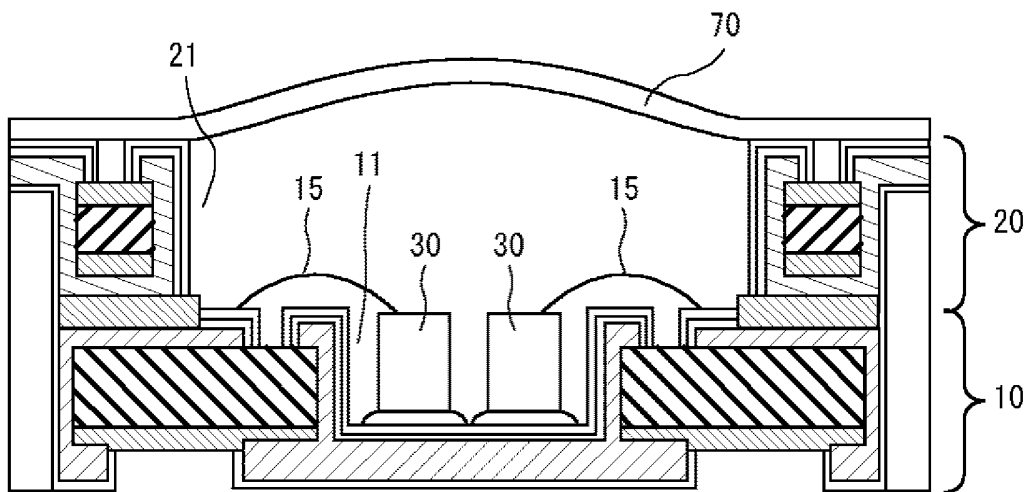
[図6]

図 6



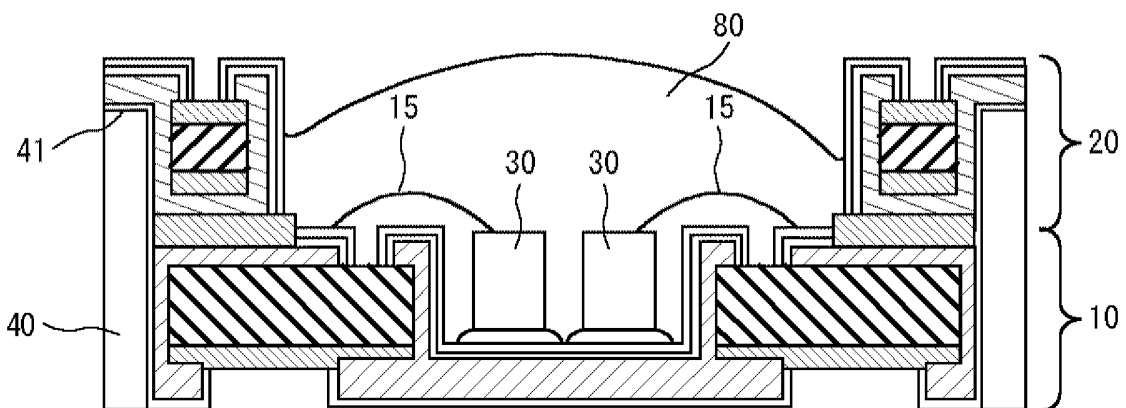
[図7]

図 7



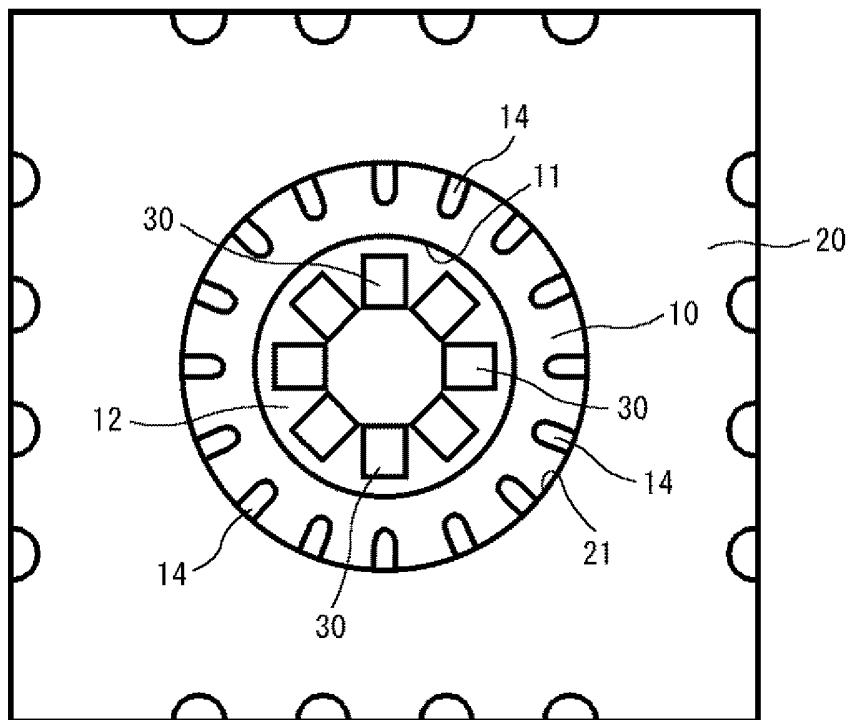
[図8]

図 8



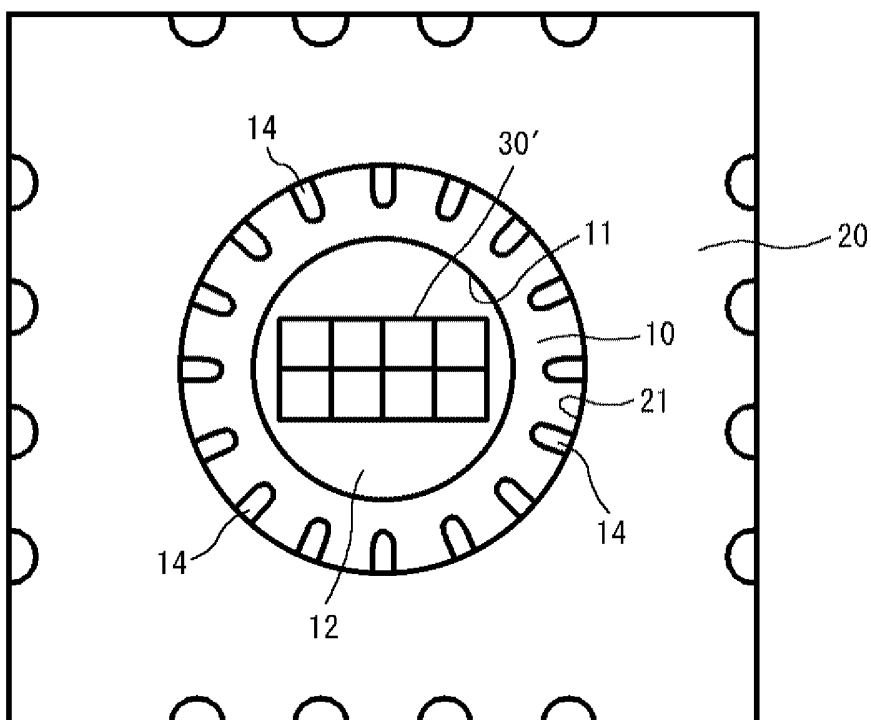
[図9]

図 9



[図10]

図 10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2005/016300

A. CLASSIFICATION OF SUBJECT MATTER H01L33/00 (2006.01)		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) H01L33/00 (2006.01)		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2005 Kokai Jitsuyo Shinan Koho 1971-2005 Toroku Jitsuyo Shinan Koho 1994-2005		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPI		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 7-235696 A (Sharp Corp.), 05 September, 1995 (05.09.95), Page 5, right column, line 47 to page 6, right column, line 45; Fig. 8 (Family: none)	1-12
Y	JP 11-237850 A (NOKEG & G Optoelectronics), 31 August, 1999 (31.08.99), Par. Nos. [0011] to [0014]; Figs. 2, 7 (Family: none)	1-12
Y	JP 2002-344108 A (Hitachi AIC Inc.), 29 November, 2002 (29.11.02), Par. Nos. [0011] to [0028]; Figs. 4, 5, 7 (Family: none)	1-12
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "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) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "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 "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 "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 "&" document member of the same patent family		
Date of the actual completion of the international search 28 November, 2005 (28.11.05)		Date of mailing of the international search report 13 December, 2005 (13.12.05)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2005/016300

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2002-094122 A (Matsushita Electric Works, Ltd.), 29 March, 2002 (29.03.02), Figs. 1, 2, 15 & WO 02/84750 A1 & US 2003-189830 A1 & EP 1387412 A1 & CN 14363 A & TW 517402 B	1-12
A	JP 64-141788 A (Mitsubishi Cable Industries, Ltd.), 25 June, 1987 (25.06.87), Figs. 2, 10 (Family: none)	1-12

A. 発明の属する分野の分類 (国際特許分類 (IPC))
Int.Cl. **H01L33/00** (2006.01)

B. 調査を行った分野

調査を行った最小限資料 (国際特許分類 (IPC))
Int.Cl. **H01L33/00** (2006.01)

最小限資料以外の資料で調査を行った分野に含まれるもの

日本国実用新案公報	1922-1996年
日本国公開実用新案公報	1971-2005年
日本国実用新案登録公報	1996-2005年
日本国登録実用新案公報	1994-2005年

国際調査で使用した電子データベース (データベースの名称、調査に使用した用語)

WPI

C. 関連すると認められる文献

引用文献の カテゴリー*	引用文献名 及び一部の箇所が関連するときは、その関連する箇所の表示	関連する 請求の範囲の番号
Y	JP 7-235696 A (シャープ株式会社) 1995.09.05, 第5頁右欄第47行-第6頁右欄第45行、第8図 (ファミリーなし)	1-12
Y	JP 11-237850 A (エヌオーケーイージーアンドジーオプトエレクトロニクス株式会社) 1999.08.31, 段落11-14、第2, 7図 (ファミリーなし)	1-12
Y	JP 2002-344108 A (日立エーアイシー株式会社) 2002.11.29, 段落11-28、第4, 5, 7図 (ファミリーなし)	1-12

☒ C欄の続きにも文献が列挙されている。

☐ パテントファミリーに関する別紙を参照。

* 引用文献のカテゴリー

「A」 特に関連のある文献ではなく、一般的技術水準を示すもの
「E」 国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの
「L」 優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献 (理由を付す)
「O」 口頭による開示、使用、展示等に言及する文献
「P」 国際出願日前で、かつ優先権の主張の基礎となる出願

の日の後に公表された文献

「T」 国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの
「X」 特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの
「Y」 特に関連のある文献であって、当該文献と他の1以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの
「&」 同一パテントファミリー文献

国際調査を完了した日

28.11.2005

国際調査報告の発送日

13.12.2005

国際調査機関の名称及びあて先

日本国特許庁 (ISA/J P)
郵便番号100-8915
東京都千代田区霞が関三丁目4番3号

特許庁審査官 (権限のある職員)

金高 敏康

電話番号 03-3581-1101 内線 3255

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様式PCT/ISA/210 (第2ページ) (2005年4月)

C (続き) . 関連すると認められる文献		
引用文献の カテゴリー*	引用文献名 及び一部の箇所が関連するときは、その関連する箇所の表示	関連する 請求の範囲の番号
A	JP 2002-094122 A (松下電工株式会社) 2002.03.29, 第1, 2, 1 5 図 & WO 02/84750 A1 & US 2003-189830 A1 & EP 1387412 A1 & CN 14363 A & TW 517402 B	1 - 1 2
A	JP 64-141788 A (三菱電線工業株式会社) 1987.06.25, 第2, 10 図 (ファミリーなし)	1 - 1 2

EXHIBIT B

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
March 16, 2006 (03.16.2006)

PCT

(10) International Publication Number
WO 2006/028073 A1

(51) International Patent Classification:
H01L 33/00 (01.2006)

(21) International Application No.: PCT/JP2005/016300

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(25) Filing Language: Japanese

(26) Publication Language: Japanese

(30) Priority Data:

Japanese Patent Application 2004-259302 September 7, 2004
(09.07.2004) JP

(71) Applicant (for all designated states except US): Hitachi AIC Inc. (HITACHI AIC INC.) [JP/JP]; 31-1 Nishi-gotanda-1-chome, Shinagawa-ku, Tokyo 1410031 (JP).

(72) Inventor; and

(75) Inventor/Applicant (for the United States only): Takanori Nishida (NISHIDA, Takanori) [JP/JP];

c/o Hitachi AIC Inc., 1065 Oaza Kugeta, Ninomiya-machi, Haga-gun, Tochigi-ken 3214521 Tochigi(JP). Satoshi Isoda (ISODA, Satoshi) [JP/JP]; c/o Hitachi AIC Inc., 1065 Oaza Kugeta, Ninomiya-machi, Haga-gun, Tochigi-ken 3214521 Tochigi (JP). Ryouji Sugiura (SUGIURA, Ryouji) [JP/JP]; c/o Hitachi AIC Inc., 4-5 Kashiwabara, Ishioka-shi, Ibaraki-ken 3150002 Ibaraki (JP). Masayuki Sakurai (SAKURAI, Masayuki) [JP/JP]; c/o Hitachi AIC Inc., 31-1 Nishi-Gotanda-1-chome, Shinagawa-ku, Tokyo 1410031 Tokyo (JP).

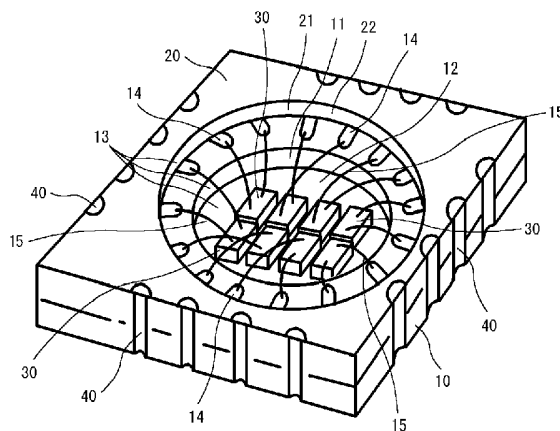
(74) Agent: Katsuo Ogawa (OGAWA, Katsuo); 8th floor, Arai Building, No. 17, 3-3 Shinkawa-1-chome, Chuo-ku, Tokyo 1040033 (JP).

(81) Designated States (unless otherwise indicated, for every kind of regional protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK,

/Continued/

(54) Title: CHIP COMPONENT TYPE LIGHT EMITTING DEVICE AND WIRING BOARD FOR THE SAME

(54) TITLE OF THE INVENTION: Chip component type light emitting device and wiring board for the same



(57) Abstract: A chip component type light emitting device, which is provided with a plurality of light emitting elements for providing high optical output at a higher conversion efficiency, and a wiring board for such light emitting device are provided. The chip component type light emitting device having the plurality of light emitting diodes (30, 30...) inside an insulating board is provided with a base board (10) and a reflector board (20) laminated bonded on the upper plane of the base board. On the base board, a through hole (11) is formed, a heat sink (12) made of a thick metal film is formed on the rear plane of the through hole, a reflecting film (13) is formed on the inner circumference and the bottom part of the heat sink, and wiring patterns (14, 14...) are formed. On the reflector board (20), a through hole (21) having a diameter larger than that of the through hole of a base board is formed, and on the inner circumference plane of the through hole, a reflecting film (22) is formed. The reflector board is arranged and bonded on the upper plane of the base board at a position where a part of the wiring pattern exposes through the through hole, and the arranged light emitting diodes are mounted by being connected with the wiring pattern on the base board.

(57) ABSTRACT: A chip component type light emitting device that is equipped with a plurality of light emitting elements and that is capable of obtaining high optical output at a higher conversion efficiency, along with a wiring board for the same, is provided. The chip component type light emitting device in which a plurality of light emitting diodes 30, 30... has been incorporated in an insulating substrate, wherein said chip component type light emitting device is equipped with base board 10 and reflector board 20 that has been laminated bonded on the top surface of said base board 10. Through-hole 11 is formed in the base board, while heat sink 12 is formed of a thick metal thin film on the back surface thereof, reflection film 13 is formed on the inner circumference and base part thereof, and further,

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— International Search Report

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wiring patterns 14 and 14... are formed. On the other hand, through hole 21 is formed in reflector board 20 such that the diameter is larger than that of the through hole in the base board, and reflecting film 22 is formed on the inner circumferential surface thereof. The reflector board is placed and adhered to the top surface of the base board at a position through which a portion of the wiring pattern will be exposed via the through hole, and the plurality of light emitting diodes disposed thereon are connected and mounted to the wiring pattern on the base board.

SPECIFICATION

Chip component type light emitting device and wiring board for the same
TECHNICAL FIELD

[0001] The present invention relates to a chip component type light emitting device that is equipped with a plurality of light emitting elements inside the substrate, and that may be used as the light source for various types of display panels, the backlight of liquid crystal display devices, or as the light source for lighting devices, etc., and further, the present invention relates to a wiring board for this purpose.

BACKGROUND ART

[0002] Conventionally, chip component type light emitting devices, such as chip component type LEDs, are used as the light source for display panels, backlights of liquid crystal display devices, and lighting devices, etc. In addition, the applications to which this type of chip component type light emitting device may be applied have expanded in recent years accompanying the expansion of flat panel applications. Accompanying this type of expansion of applications, in addition to increasing the amount of light emitted from the elements themselves, it has become necessary for chip component light emitting devices to increase the amount of light emitted in relation to power consumption, or in other words, to increase the efficiency of conversion to light. Further, there is a strong need for a structure of a chip component light emitting device that is suitable for mass production and can, therefore, be manufactured relatively inexpensively.

[0003] It should be noted that this type of chip component type light emitting device in the past was generally manufactured using a wiring board on which, in addition to forming a through hole or hole equipped with a tapered surface in one part of the insulating substrate, a wiring pattern to make the electrical connections was formed on the surface thereof, as shown in Patent Literature 1 to 3 below. In other words, for example, a single light emitting element such as a light emitting diode may be mounted on a heat sink constructed of a thin metal plate that was attached to the bottom surface of the through hole of the above-noted wiring board, and then the electrode of the element may be connected to the above-noted wiring pattern through wire bonding to complete the chip component type light emitting device.

[0004] Patent Literature 1: Japanese Patent No. 3137823

Patent Literature 2: Japanese Unexamined Patent Application Publication 2000-223752

Patent Literature 3: Japanese Unexamined Patent Application Publication 2003-031850

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

- [0005] However, the mounting structure of the chip component type light emitting device according to the prior art described above is a structure in which only a single light emitting element, such as a light emitting diode, is mounted onto each substrate, and therefore, as described above, it is not a structure that is suitable for mounting a plurality of light emitting elements therein in response to the increase in the amount of light emitted by each element.
- [0006] In other words, in the structure according to Patent Literature 1 above, a thin metal plate that was attached to the back surface of the through hole is connected to the wiring pattern, and one of the electrodes of the light emitting diode mounted therein is connected to the thin metal plate, while the other electrode is connected to another connecting wiring pattern that has also been formed in part of the wiring substrate, for example, through wire bonding. However, the other connection wiring patterns formed in part of this wiring board are not suitable for mounting multiple light emitting diodes on the thin metal sheet that was mounted on the back surface of the through hole.
- [0007] In addition, in the structure according to Patent Literature 1 above, the other electrode of the light emitting diode mounted therein is connected to the connection wiring pattern formed in part of the wiring board through wire bonding, etc., and then the through hole mounted therein is filled with transparent resin in order to form an optical element. However, the wire bonding that connects the light emitting diode electrode and the wiring pattern will protrude above the above-noted wiring board, and as a result, it will become an obstacle in the process to fill the through hole with the transparent resin, preventing the filling of the transparent resin from being performed accurately. In addition, the above-noted Patent Literature 1 discloses a structure in which a reflective case plate is attached to the upper surface of the wiring board, surrounding the through hole into which the light emitting diode was mounted. However, in this type of structure, it will be difficult to accurately install the reflective case plate after mounting a plurality of light emitting elements on the wiring board, and furthermore, a portion of the light that may be emitted from the light emitting diodes will leak out of the junction between the wiring board and the reflective case plate, thereby reducing the efficiency of light conversion. This problem will be further worsened, particularly if a plurality of light emitting diodes is mounted in the through hole as described above.
- [0008] In the above-noted Patent Literature 2 and 3, a thin metal plate is attached to the back surface of the through hole that was formed in the insulating substrate, and a light emitting diode is placed on the surface, but unlike the above-noted Patent Literature 1, the electrical connection of the electrode of the light emitting diode is made with the wiring pattern that was formed on the

surface of the above-noted substrate. However, this structure is unsuitable for mounting a plurality of light emitting diodes on the thin metal sheet that may be attached to the back surface of the through hole. In other words, even the structures that have become known according to these Patent Literature 2 and 3 suffer the same problems as described above.

[0009] Therefore, the present invention was achieved in consideration of the problems in the prior art described above, and in particular, the objective is to provide a chip component type light emitting device that is equipped with a plurality of light emitting elements therein and that can improve light conversion efficiency. Further, the objective is to provide a chip component type light emitting device with a structure that can be manufactured relatively inexpensively because it is suitable for mass production, and furthermore, to provide a wiring board for this purpose.

MEANS FOR SOLVING THE PROBLEM

[0010] In order to achieve the above-noted objectives, the present invention provides a chip component type light emitting device in which light emitting elements have been stored and mounted inside an insulating substrate, or the wiring board for that purpose, that has been equipped with a base board to mount the light emitting elements to be stored and a reflector board that has been laminate bonded to the top surface of said base board, wherein, in addition to the formation of non-through holes for the mounting of the light emitting elements therein in part of said base board, a wiring pattern is formed for the electrical connection of said light emitting elements in the top edge periphery of that base board. Further, a heat conductor with a thickness that is thicker than that of the metal thin film that forms said wiring pattern is formed on the bottom surface of said non-through holes, while through holes with a diameter that is larger than that of said non-through holes are formed on said reflector board without blocking the non-through holes that were formed on said base board, and in addition to the formation of a reflecting film constructed of a metal thin film on the inner circumferential surface thereof, a part of the wiring pattern (light emitting element connection land) is formed in the top edge periphery of the non-through holes of said base board such that, when said reflector board is placed on the top surface of said base board, there will be exposure to the bottom surface of the through holes of said reflector board.

[0011] Also, according to the present invention, it is preferable for the reflecting film that is constructed of a metal thin film and that may be formed on the inner peripheral surface of the through holes of said reflector board or the inner peripheral surface of the non-through holes of said base board in the chip component type light emitting device described above, or in the wiring substrate, to be formed of either silver, nickel, or aluminum that boasts good reflectivity in relation to white light.

[0012] Furthermore, in the chip component type light emitting device as described above, or the wiring

board for that purpose, according to the present invention, it is preferable for a plurality of through holes to be further formed on said base board and on the edge surface of said reflector board that has been laminate bonded to the top surface thereof to pass through to both of said substrates, and after mounting the light emitting elements, to cut along the approximate center of the through holes of both of said substrates. Further, it is preferable for part of said wiring pattern (light emitting elements connection land) that was formed in the periphery of the through holes of said base board and a conductor layer that is electrically connected thereto to be formed in the inner circumference of said through holes, and to provide terminal electrodes for the external connection of said light emitting elements.

[0013] Further, in the chip component type light emitting device as described above, or the wiring board as described above, according to the present invention, it is preferable for non-through holes, for which one of either the top edge surface of said reflector board of the through holes that pass through both of said base board and said reflector board that was laminate bonded to the top surface thereof or the bottom edge surface of said base board has been blocked using a sealing element, to be formed in said terminal electrodes, and after mounting the light emitting elements, to cut along the approximate center of the non-through holes of both of said substrates for use as the terminal electrode.

[0014] Additionally, in the chip component type light emitting device as described above, or the wiring board, according to the present invention, it is preferable for the non-through holes of said base board to be formed as non-through holes with $\Phi 2.0$ to 6.0 for the installation of a plurality of light emitting elements inside a single non-through hole.

[0015] Further, in the chip component type light emitting device as described above, or the wiring board, according to the present invention, it is preferable for the reflective surface on the inner circumference of the through holes formed in the reflector board that was laminate bonded to the top surface of said base board to be a tapered shape in which the top edge surface spreads beyond the bottom surface of said base board (with a taper angle of 90° to 120°).

EFFECT OF THE INVENTION

[0016] As described above, according to the present invention, it will be possible to achieve the superior effect of the provision of a chip component type light emitting device that can obtain high optical output at a higher conversion efficacy, as well as the provision of a wiring board for that purpose.

BEST EMBODIMENTS OF THE INVENTION

[0017] The examples of embodiment of the present invention will be described in detail with reference to the attached drawings below.

[0018] First, Figure 1 shows the chip component type light emitting device pertaining to the first example of embodiment of the present invention, as well as the wiring board for the same. As will

be clear from the figure, this chip component type light emitting device and the wiring board for the same have an external shape that is formed in an approximately square sheet shape. More specifically, this chip component type light emitting device is constructed of base board 10, reflector board 20 that has laminate bonded to the top surface of this base board, and further, a plurality of light emitting elements, or in this example of embodiment, eight light emitting diodes 30, 30... The eight light emitting diodes 30, 30..., which are these plurality of light emitting elements, are arranged in a line at the specified position on the surface of thick metal thin film 12 that forms a heat sink on the back (bottom) surface of through hole 11 that was formed in the approximate center of said base board 10. Reflecting film 13 that may be constructed of a metal such as silver is formed as a single unit on the inner circumferential surface of through hole 11 that has been formed in this base board 10 and on the surface of said metal thin film 12, as will be discussed in detail later as well.

[0019] Also, the attached Figure 2 shows only base board 10 that constitutes the above-noted chip component type light emitting device and the wiring board for the same, and as will be clear from this figure, the so-called wiring patterns 14, 14... may be arranged and formed at equal intervals in the periphery of the top surface of said base board 10 so as to enclose said through hole 11 for use in electrically connecting said plurality of light emitting diodes 30, 30... with an external drive circuit (not shown in the figure), as will be discussed in detail regarding the manufacturing processes later. Further, 15, 15... in Figure 1 are the wires that may be provided through, for instance, wire bonding, for use in electrically connecting these plurality of light emitting diodes 30, 30... with said wiring patterns 14 and 14....

[0020] On the other hand, through hole 21 is also formed in the approximate center of reflector board 20 that has been laminate bonded to the upper surface of said base board 10, and reflecting film 22 that may be constructed of a metal thin film of silver or the like may be formed on the inner circumferential surface of this through hole 21 as well, as will be discussed in detail when describing the manufacturing processes later. It should be noted that the diameter of this through hole 21 is larger than the diameter of through hole 11 that was formed in said base board 10, and therefore, as will be clear from Figure 1 as described above, in the state in which this reflector board 20 has been laminate bonded to the top surface of said base board 10, part of wiring patterns 14, 14... that were formed on the top surface of said base board 10 will be exposed via this through hole 21, or more specifically, part of the wiring pattern that was formed in the periphery of through hole 11 of base board 10 will be exposed. In other words, by arranging a plurality of light emitting diodes 30, 30... on a substrate prepared by laminate bonding reflector board 20

to the top surface of base board 10, and then, as noted above, performing wire bonding or the like, it will be possible to make the electrical connection with wiring patterns 14, 14... that were formed on the top surface of base board 10. Therefore, it will be possible to use wires 15, 15... for the electrical connection with said wiring patterns 14, 14... on the inside of the two said substrates that have been laminate bonded together (base board 10 and reflector board 20), or in other words, to make the connection without the need to protrude wire 15 from the top surface of reflector board 20.

- [0021] Furthermore, as will also be clear based on the above Figure 1, a plurality (in this example of embodiment, $8 \times 2 = 16$ units) of end surface electrodes 40, 40... may be formed on each end surface of base board 10 and reflector board 20 that constitute the chip component type light emitting device and wiring board for the same. In other words, these end face electrodes 40, 40... make it possible to achieve an electrical connection with the wiring patterns formed on the substrate when said chip component type light emitting device has been installed on another substrate, such as a motherboard or the like.
- [0022] Next, the manufacturing method for the chip component type light emitting device and the wiring board for the same, of which the detailed structure was described above, and in particular, for the substrate that may be obtained by laminate bonding base board 10 on top of reflector board 20 will be described while referring to the attached Figure 3 to Figure 5.
- [0023] The attached Figure 3 shows the manufacturing method for base board 10 as described above, and this figure shows the cross-sectional structure at each stage of the manufacturing process of base board 10.
- [0024] First, core substrate material 300 that has a thickness of approximately 0.3 mm and that is constructed of an insulating material such as epoxy resin is prepared, and in addition to adhering copper foil 310 that has a thickness of approximately 18 μm to the surface of one side of said core substrate material 300 (the top surface in the example shown in the figure), adhesive sheet 320 that has a thickness of approximately 25 μm is spread over the surface of the other side (the bottom surface in the example shown in the figure) (Figure 3 (a)). Next, a hole, of approximately $\phi 3.1$ in this example of embodiment, is opened up in the surface of substrate material 300 that was prepared as described above in the position of the above-noted through hole 11 (see Figure 1 above) through NC (Figure 3 (b)). Then, copper foil 330 that is thicker than copper foil 310, such as with a thickness of approximately 70 μm , is attached to the lower surface of said substrate material 300, or in other words, to the opposite surface to the surface to which copper foil 310 was adhered (Figure 3 (c)). Next, at the position where end face electrodes 40 and 40 ... (see Figure 1 above) will be formed, for example, a hole of approximately $\phi 0.6$ (Figure 3 (d)) may be opened up, and further, copper plating layer 340 with a thickness of approximately 20 μm may be applied over the entirety (Figure 3 (e)).
- [0025] Subsequently, a predetermined circuit pattern 14 may be formed by removing copper foil 310 as described above, for example by etching, on the top surface of said substrate material 300, or in

other words, on the bonding (adhesion) surface with said reflector board 20 (Figure 3 (f)). Next, adhesive sheet 350 on which an opening part was formed in the predetermined position is attached from above the specific circuit pattern that was formed (Figure 3 (g)), resulting in said base board 10. An example of base board 10 that was obtained through the above-noted process is shown in Figure 2 above.

[0026] Next, the attached Figure 4 shows the manufacturing method for reflector board 20, and this figure also shows the cross-sectional structure at each stage of the manufacturing process for reflector board 20.

[0027] First, core substrate material 400 that has a thickness of approximately 0.3 mm and that is constructed of an insulating material such as epoxy resin or the like is prepared, and adhesive sheets 410 and 420 that have a thickness of approximately 25 μm are adhered to both surfaces thereof (Figure 4 (a)). Subsequently, at the same time as the opening of a hole of approximately ϕ 5.0 on the surface of substrate material 400 at the position of through hole 21 (see Figure 1 above), for example, through NC, a hole of approximately ϕ 0.6 may be opened up in the position of the formation of said end face electrodes 40, 40... as well (Figure 4 (b)). Further, copper foil 430, in which a hole of approximately ϕ 5.0 was opened up at the position of said through hole 21 in advance, is attached to the top (upper) surface of said substrate material 400, while copper foil 440, in which holes of approximately ϕ 5.0 were opened up in advance at the position of said end face electrode and said through hole 21, is attached to the bottom (lower) surface (Figure 4 (c)). Next, copper plating layer 450 with a thickness of approximately 20 μm is applied to the entirety thereof (Figure 4 (d)), and further, copper foil 430 that was formed on the top (upper) surface of said core substrate material 300 is removed by etching to form a predetermined pattern (Figure 4 (e)), resulting in reflector board 20.

[0028] Next, the processes for the lamination and bonding of reflector board 20 as obtained above onto base board 10 will be described with reference to Figure 5. Here again, reflector board 20 and base board 10 that may be manufactured through laminated bonding are shown as the cross-sectional structure at each stage in the manufacturing process.

[0029] First, reflector board 20 that was obtained in Figure 4 (e) above is laminated onto base board 10 that was obtained in Figure 3 (g) above (Figure 5 (a)). In other words, reflector board 20 is laminated and adhered onto adhesive sheet 350 that was attached to the top surface of base board 10. Subsequently, copper foil 330 that has a thickness of approximately 70 μm and that was attached to the lower surface of said laminated and bonded base board 10 is also removed by etching, etc., to form a circuit on the solder surface of the chip component type light emitting device (Figure 5 (b)). Next, noble metal plating layer 510, which may be constructed of a nickel (Ni) layer with a thickness of approximately 5 μm and a gold (Au) layer with a thickness of

approximately 0.3 μm , is applied over the entirety (Figure 5 (c)). Further, masking tape 520 is applied to the entire lower surface of base board 10 (Figure 5 (d)), and silver (Ag) layer 530 may be applied over the entirety to a thickness of approximately 0.3 μm (Figure 5 (e)). Then, the masking tape that was attached to the entire lower surface of base board 10 is peeled off (Figure 5 (f)) to complete the substrate that is constructed of the laminated bonding of base board 10 onto reflector board 20. After that, a plurality of light emitting diodes are arranged on heat sink 12 that has been provided on the back (bottom) surface thereof in through hole 11 of said base board 10, and wiring is prepared in order to obtain the chip component type light emitting device. In the processes described above, a board with a large surface area is used to prepare a large quantity of boards as a single unit in order to simultaneously manufacture a large quantity of devices. Further, the dotted line in Figure 5 (f) above indicates the cutting line for separating and cutting the board as individual chip components after mounting a plurality of light emitting diodes inside said board in order to complete the chip component type light emitting device.

[0030] According to the wiring board of the chip component type light emitting device that may be obtained through the manufacturing processes described above, the plurality of light emitting diodes 30 and 30 ... are anchored in place via mold resin material 60 that boasts high heat transfer on heat sink (metal thin film) 12 that has been provided on the back (bottom) surface of through hole 11 formed in the approximate center of base board 10, which constitutes said board as shown in the attached Figure 6. Then, the wiring may be prepared, for example, through wire bonding. At that time, as will be clear from Figure 1 above, wiring patterns 14, 14..., which act as the wiring connecting the light emitting diodes, may be formed on the surface (top) of said base board 10, which is the board below the board that was laminated in two layers, and further, a portion of these wiring patterns 14, 14... is exposed via through hole 21 that was opened up on the surface of reflector board 20 that was attached on top of this structure, and the electrodes of each of the plurality of light emitting diodes 30, 30... are connected via wire bonding to these wiring patterns 14, 14... In this Figure 6 as well, 15 indicates the wire of the wiring that was prepared.

[0031] In this way, according to the above configuration, wire 15 that connects the electrodes of the plurality of light emitting diodes 30, 30... and wiring patterns 14, 14... can be mounted inside the board without projecting outwardly from the top (upper) surface of the board of the chip component type light emitting device, or in other words, from the top (upper) surface of reflector board 20. In other words, according to this type of configuration of the chip component type light emitting device, after mounting light emitting diodes 30, 30... on the board, there is no need to

add transparent resin to fill up to the top in order to protect the wiring part.

[0032] In other words, as shown in Figure 6 above, in the state in which light emitting diodes 30, 30... have been mounted inside the board, it will be possible to use the structure as a chip component type light emitting device, such as the light source for a display panel, the backlight of a liquid crystal display device, or a lighting fixture, etc. As described above, because it will be possible to install a plurality of light emitting diodes 30, 30..., it will not only be possible to obtain high optical output, because there will be no need to use transparent resin to perform filling on the upper surface of light emitting diode 30, the light that may be emitted from the element will not be absorbed by the transparent resin, making it possible to obtain a chip component type light emitting device that boasts higher conversion efficiency. In addition, according to the fact that there is no need to use transparent resin to perform filling on the upper surface of light emitting diode 30 as described above, it will be possible to prevent the heat that may be generated inside the element from spreading to the surroundings as a result of the resin applied to the upper surface, and it will be possible to prevent the heat that may be generated from becoming trapped inside the resin, causing the temperature of the light emitting diode to rise.

[0033] As also shown in Figure 6 above, reflector board 20 is integrally formed on top of base board 10 that constitutes the above-noted wiring board, and additionally, the bottom surface and the inner peripheral surface of through hole 11 that has been opened up on base board 10, as well as the inner peripheral surface of through hole 21 that has been opened up on reflector board 20, are provided with noble metal plating layer 510 constructed of a nickel (Ni) layer and a gold (Au) layer, while reflecting films 13 and 22 are formed on the surface silver (Ag) layer 530 (with a thickness of approximately 1 μm). As a result, the light that may be emitted from the plurality of light emitting diodes 30 and 30 ... provided inside through hole 11 of base board 10 will be reflected by these reflecting films 13 and 22, and will be drawn out from the top of through hole 21 that was opened up on reflector board 20 without being leaked externally. In other words, it is possible to obtain high optical output using multiple light emitting elements with good conversion efficiency.

[0034] Attached Figure 7 shows the chip component type light emitting device as described above, and an alternative embodiment of the wiring board therefor. As will be clear from this figure, according to this alternative embodiment, in the configuration of the chip component type light emitting device as described above, transparent plate member 70, made of a material such as glass or resin, may be further attached to the upper (top) surface of reflector board 20, and a portion of plate member 70 may be integrally formed with an optical element, such as, for example, a lens for diffusing light. In other words, according to this type of configuration, as in the example of embodiment described above, it will be possible to obtain high optical output with good conversion efficiency using a plurality of light emitting elements with excellent heat dissipation

properties, and at the same time, because the light that is outputted will be diffused prior to emission, this configuration will be particularly suitable for chip component type light emitting devices that may be used as the light source for display panels, backlights of liquid crystal display devices, or lighting devices, etc. Furthermore, according to this type of configuration, in particular, the use of plate member 70 will make it possible to prevent foreign objects from entering the interior of through holes 11 and 21, or in other words, to prevent any shorting or breaking between wires 15 that could damage light emitting diode 30.

[0035] Also, attached Figure 8 shows the chip component type light emitting device as described above, and another alternative embodiment of the wiring board therefor. As will be clear from this figure, according to this alternative embodiment, the interior of through holes 11 and 21 that were opened up on base board 10 and reflector board 20 is filled with transparent resin 80, while the plurality of light emitting diodes 30 and 30 ... mounted therein and wire 15 for its wiring are immersed and solidified within that resin, and the outer peripheral surface may be formed, for example, as a convex shape that is integral with the so-called optical elements. According to this type of configuration, it will be possible to obtain high optical output with good conversion efficiency using a plurality of light emitting elements, and at the same time, because the light that is outputted will be diffused prior to emission, this configuration will be particularly suitable for chip component type light emitting devices that may be used as the light source for display panels, backlights of liquid crystal display devices, or lighting devices, etc. In addition, it will be possible to safely protect the wires and light emitting diodes 30 against the entrance of foreign objects from the outside of the device.

[0036] In the alternative embodiments shown in Figure 7 or Figure 8 above, for example, if the plurality of light emitting diodes 30 and 30 ... that may be provided inside through holes 11 and 21 that were opened up in said base board 10 are blue light emitting diodes, by adding to transparent plate member 70 that may be attached to the upper (top) surface of reflector board 20 or to transparent resin 80 that may be used to fill the inside of through holes 11 and 21 a member that converts blue light into white light, it will be possible to easily obtain a chip component light emitting device that can obtain the white light that is preferable for use in a light source for a device such as a display panel, backlight of a liquid crystal display device, or lighting device, etc. Examples of this type of member include, for example, members to which epoxy resin mixed with fine silica or YAG phosphors were added.

[0037] In addition, in the chip component type light emitting device and the wiring board for this as described above, in particular, according to the structure of end face electrodes 40 and 40 that may be formed on each end face of the substrate that was laminated with base board 10 and reflector board 20, the upper end face will be closed by semi-circular conductor layer 41, so even if there is

external leakage from through holes 11 and 21 when filling the holes with transparent resin 80 as described above, this leakage will not extend to the electrode surface, and it will be possible to reliably obtain end face electrodes 40 and 40.

[0038] Furthermore, the attached Figure 9 shows another example of the array of the light emitting diodes that may be arranged on the surface of heat sink (metal thin film) 12 that was provided on the back (bottom) surface inside through hole 11 that was opened up on base board 10. In other words, in the above-noted example of embodiment, eight light emitting diodes 30 and 30 ... are each arranged in four rows and two columns as an example. However, the present invention is not limited to the above-noted examples, and as shown in this figure, it is also possible to arrange the diodes along the inner circumferential surface of through hole 11 as described above. Alternatively, if these eight light emitting diodes are supplied, for example, as a single block 30', the diodes may be arranged in the interior of through hole 11, as shown in the attached Figure 10, at approximately the center of the surface of heat sink (metal thin film) 12. Further, other methods may be used for these arrays.

[0039] In addition, Figure 2 above shows an example of the plurality of wiring patterns 13, 13... that were formed on the top surface of base board 10 in the above-noted chip component type light emitting device and the wiring board for the same. As will be clear from this figure as well, in this example of embodiment, adjacent wiring patterns 14 and 14 are electrically connected to each other. More specifically, this means that the wiring patterns connected to the "+" and "-" electrodes of a pair of adjacent light emitting diodes are arranged in the sequence of "+," "+," "-", and "-." According to this arrangement of wiring patterns 13, 13..., when a plurality of light emitting diodes 30, 30... that have been arranged inside a board are electrically connected with wiring patterns 14, 14... through wire bonding or the like, and then wires 15 and 15 are brought in close proximity to each other or in contact with each other, because the wires will be homopolar, it will be possible to achieve the effect of being able to avoid the occurrence of shorting.

[0040] Although, in the above-noted examples of embodiment, through holes 11 and 21 that were opened up on base board 10 and reflector board 20 were described as being circular, the present invention is not limited to these examples, and it is also possible to form these holes as, for example, ovals or squares. It will be clear that the same effect as described above can be achieved in this case as well. In the above-noted examples of embodiment, through holes 11 and 21 that were opened up on said base board 10 and reflector board 20 are described as having vertical inner circumferential surfaces, but the present invention is also not limited to these examples, and it is also possible to form the inner circumferential surfaces as a slope, for example, when forming

through holes 11 and 21 in the base material (see Figure 3 (b) or Figure 4 (b) above), for example by utilizing a taper drill or the like.

[0041] Also, the explanations above described the plurality of light emitting diodes that may be arranged in the chip component type light emitting device and the wiring board for the same according to the configuration described above, and more particularly, inside through hole 11 of base board 10, as eight light emitting diodes 30, 30... as an example. However, the present invention is not limited to this example, and it will be clear to those skilled in the art that the number of light emitting diodes may be two or more (such as the use of four diodes, six diodes, nine diodes, or ten diodes preferably), and it is also clear that the light emitting elements are not limited to the above-noted light emitting diodes, and that it will also be possible to use semiconductor light emitting elements as well. It is also possible to use a construction in which the plurality of light emitting elements that may be arranged inside through hole 11 of base board 10 as described above are red, green, and blue light emitting diodes, which are the three primary colors of light. In addition, by using a combination of the three colors of light emitting diodes as described above and placing them inside through holes 11 of base board 10 as described above, it will be possible to obtain white light. Alternatively, at least two or more of these colors may be combined to obtain light of the desired color.

BRIEF DESCRIPTION OF THE DRAWINGS

[0042] [FIGURE 1] This is an enlarged perspective view showing the configuration of the chip component type light emitting device, and the wiring board for the same, in accordance with one example of embodiment of the present invention.

[FIGURE 2] This is an enlarged perspective view showing the structure of the chip component type light emitting device and the base board constituting the wiring substrate for the same.

[FIGURE 3] This is a process diagram that shows the method of manufacturing the base board described above, as well as the cross-sectional structure at each stage of the manufacturing process.

[FIGURE 4] This is a process diagram that shows the method of manufacturing the reflector board described above, as well as the cross-sectional structure at each stage of the manufacturing process.

[FIGURE 5] This is a process diagram showing the manufacturing method for the board by laminating and bonding the reflector board described above to the upper surface of the base board described above, as well as the cross-sectional structure at each stage of the manufacturing process.

[FIGURE 6] This is a cross-sectional view showing the structure of the chip component type light emitting device in which a plurality of light emitting elements are mounted on the board obtained using the manufacturing method described above.

[FIGURE 7] This is a cross-sectional view showing the structure according to an alternative embodiment of the chip component type light emitting device and the wiring board for the same.

[FIGURE 8] This is a cross-sectional view showing the structure according to another alternative embodiment of the chip component type light emitting device and the wiring board for the same.

[FIGURE 9] This is a cross-sectional view showing another example of the arrangement of the light emitting elements in the chip component type light emitting device described above.

[FIGURE 10] This is a cross-sectional view showing yet another example of the arrangement of the light emitting elements in the chip component type light emitting device described above.

EXPLANATION OF REFERENCES

- [0043]
- 10 Base board
 - 11 Through hole
 - 12 Heat sink (thick metal thin film)
 - 13 Reflecting film
 - 14 Wiring pattern
 - 15 Wiring wire
 - 20 Reflector board
 - 21 Through hole
 - 22 Reflecting film
 - 30 Light emitting diode
 - 40 End face electrodes.

SCOPE OF CLAIMS

- [1] A chip component type light emitting device in which light emitting elements have been stored and mounted inside an insulating substrate, wherein the chip component type light emitting device characterized in that said insulating substrate is equipped with a base board to mount the light emitting elements to be stored and a reflector board that has been laminate bonded to the top surface of said base board;
- in addition to the formation of non-through holes for the mounting of the light emitting elements therein in part of said base board, a wiring pattern is formed for the electrical connection of said light emitting elements in the top edge periphery of said base board, and further, a heat conductor with a thickness that is thicker than that of the metal thin film that forms said wiring pattern is formed on the bottom surface of said non-through holes;
- through holes with a diameter that is larger than that of said non-through holes are formed on said reflector board without blocking the non-through holes that were formed on said base board, and in addition to the formation of a reflecting film constructed of a metal thin film on the inner circumferential surface thereof, a part of the wiring pattern (light emitting element connection land) is formed in the top edge periphery of the non-through holes of said base board such that, when said reflector board is placed on the top surface of said base board, there will be exposure to the bottom surface of the through holes of said reflector board.
- [2] The chip component type light emitting device as described in Claim 1 above characterized in that a reflecting film that is constructed of a metal thin film and that may be formed on the inner peripheral surface of the through holes of said reflector board or the inner peripheral surface of the non-through holes of said base board is formed of either silver, nickel, or aluminum that boasts good reflectivity in relation to white light.
- [3] The chip component type light emitting device as described in Claim 1 above characterized in that a plurality of through holes are further formed on said base board and on the edge surface of said reflector board that has been laminate bonded to the top surface thereof to pass through to both of said substrates, and after mounting the light emitting elements, to cut along the approximate center of the through holes of both of said substrates, while at the same time, part of said wiring pattern (light emitting elements connection land) that was formed in the periphery of the through holes of said base board and a conductor layer that is electrically connected thereto is formed in the inner circumference of said through holes in order to provide terminal electrodes for the external connection of said light emitting elements.
- [4] The chip component type light emitting device as described in Claim 3 above characterized in that non-through holes, for which one of either the top edge surface of said reflector board of the through holes that pass through both of said base board and said reflector board that was laminate bonded to the top surface thereof or the bottom edge surface of said base board has been blocked

using a sealing element, are formed in the terminal electrodes of said wiring board, and after mounting the light emitting elements, a cut is made along the approximate center of the non-through holes of both of said substrates for use as the terminal electrodes.

[5] The chip component type light emitting device as described in Claim 1 above characterized in that the non-through holes of said base board are formed as non-through holes with $\Phi 2.0$ to 6.0 for the installation of a plurality of light emitting elements inside a single non-through hole.

[6] The chip component type light emitting device as described in Claim 1 above characterized in that the reflective surface on the inner circumference of the through holes formed in the reflector board that was laminate bonded to the top surface of said base board has a tapered shape in which the top edge surface spreads beyond the bottom surface of said base board (with a taper angle of 90° to 120°).

[7] A wiring board in which light emitting elements have been stored and mounted inside an insulating substrate, wherein the wiring board characterized in that it is equipped with a base board to mount the light emitting elements to be stored and a reflector board that has been laminate bonded to the top surface of said base board;

in addition to the formation of non-through holes for the mounting of the light emitting elements therein in part of said base board, a wiring pattern is formed for the electrical connection of said light emitting elements in the top edge periphery of said base board, and further, a heat conductor with a thickness that is thicker than that of the metal thin film that forms said wiring pattern is formed on the bottom surface of said non-through holes;

through holes with a diameter that is larger than that of said non-through holes are formed on said reflector board without blocking the non-through holes that were formed on said base board, and in addition to the formation of a reflecting film constructed of a metal thin film on the inner circumferential surface thereof, a part of the wiring pattern (light emitting element connection land) is formed in the top edge periphery of the non-through holes of said base board such that, when said reflector board is placed on the top surface of said base board, there will be exposure to the bottom surface of the through holes of said reflector board.

[8] The wiring board as described in Claim 7 above characterized in that a reflecting film that is constructed of a metal thin film and that may be formed on the inner peripheral surface of the through holes of said reflector board or the inner peripheral surface of the non-through holes of said base board is formed of either silver, nickel, or aluminum that boasts good reflectivity in relation to white light.

[9] The wiring board as described in Claim 7 above characterized in that a plurality of through holes

are further formed on said base board and on the edge surface of said reflector board that has been laminate bonded to the top surface thereof to pass through to both of said substrates, and after mounting the light emitting elements, to cut along the approximate center of the through holes of both of said substrates, while at the same time, part of said wiring pattern (light emitting elements connection land) that was formed in the periphery of the through holes of said base board and a conductor layer that is electrically connected thereto is formed in the inner circumference of said through holes in order to provide terminal electrodes for the external connection of said light emitting elements.

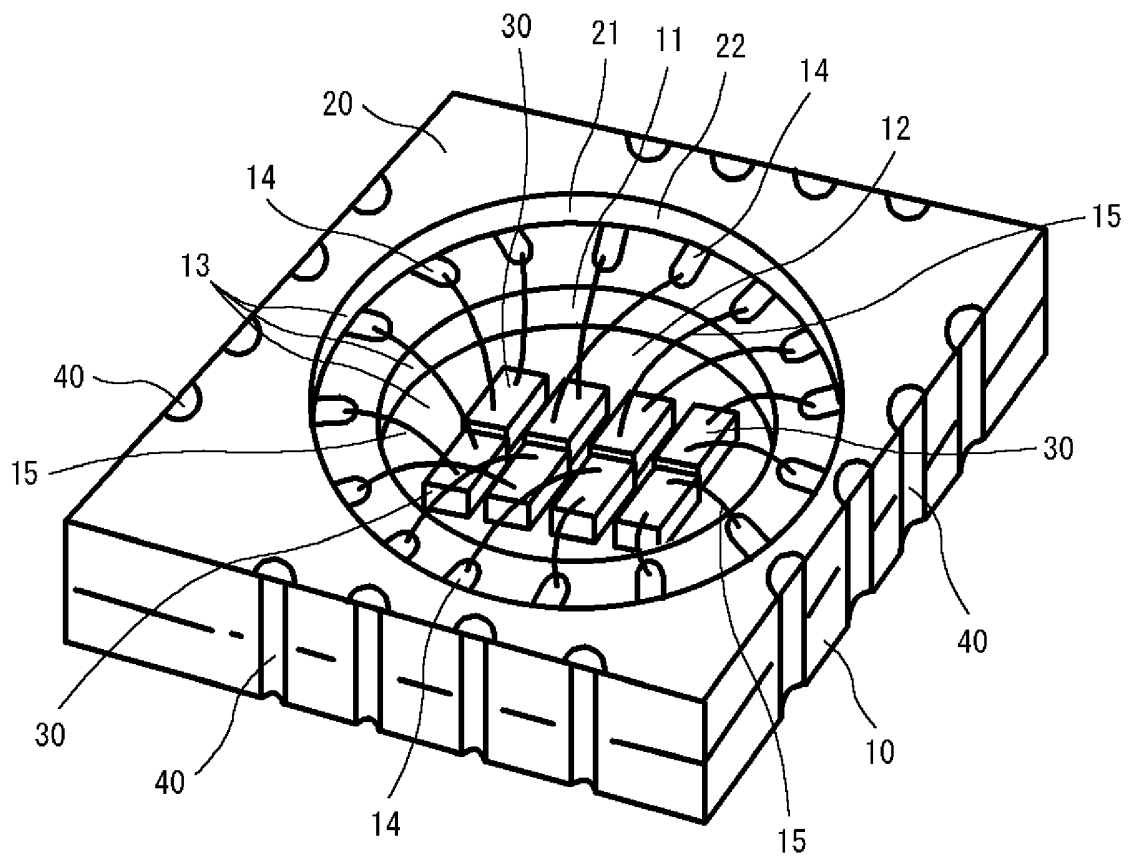
[10] The wiring board as described in Claim 9 above characterized in that non-through holes, for which one of either the top edge surface of said reflector board of the through holes that pass through both of said base board and said reflector board that was laminate bonded to the top surface thereof or the bottom edge surface of said base board has been blocked using a sealing element, are formed in the terminal electrodes of said wiring board, and after mounting the light emitting elements, a cut is made along the approximate center of the non-through holes of both of said substrates for use as the terminal electrodes.

[11] The wiring board as described in Claim 7 above characterized in that the non-through holes of said base board are formed as non-through holes with $\Phi 2.0$ to 6.0 for the installation of a plurality of light emitting elements inside a single non-through hole.

[12] The wiring board as described in Claim 7 above characterized in that the reflective surface on the inner circumference of the through holes formed in the reflector board that was laminate bonded to the top surface of said base board has a tapered shape in which the top edge surface spreads beyond the bottom surface of said base board (with a taper angle of 90° to 120°).

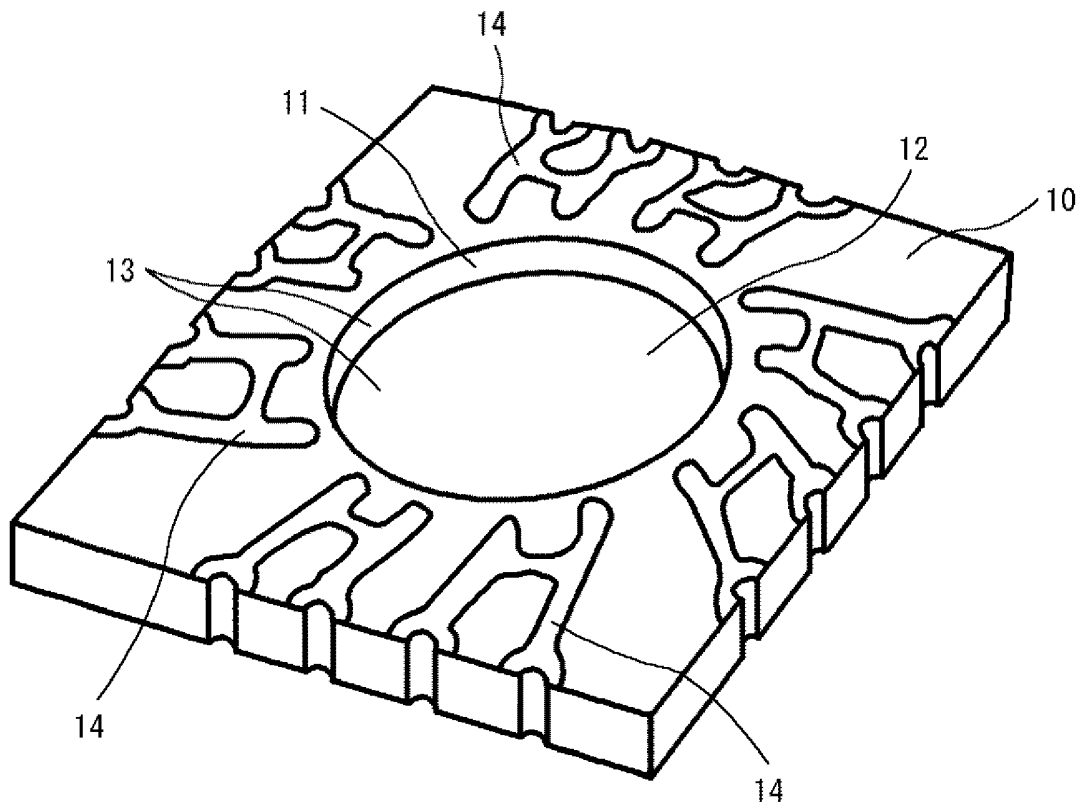
[FIGURE 1]

FIGURE 1



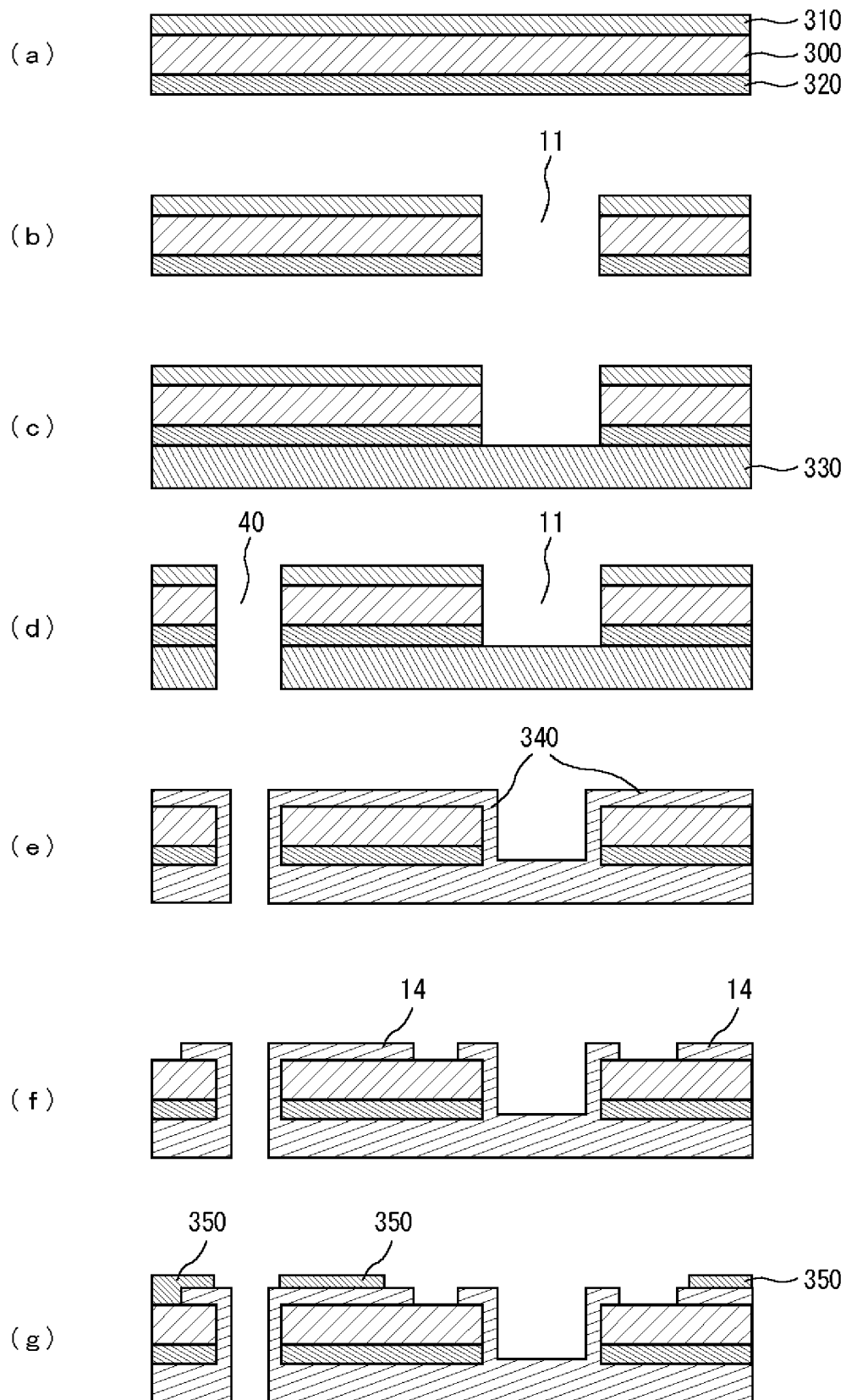
[FIGURE 2]

FIGURE 2



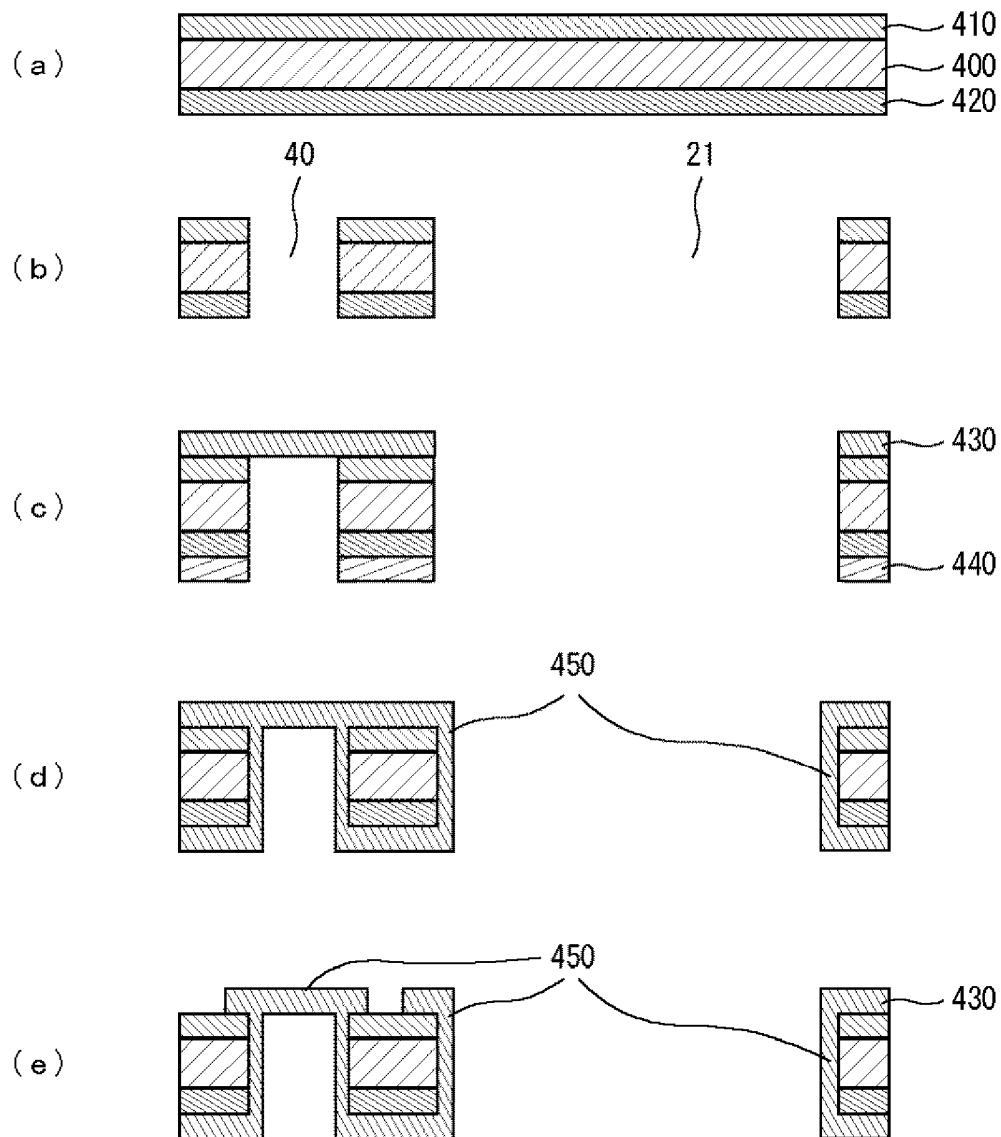
[FIGURE 3]

FIGURE 3



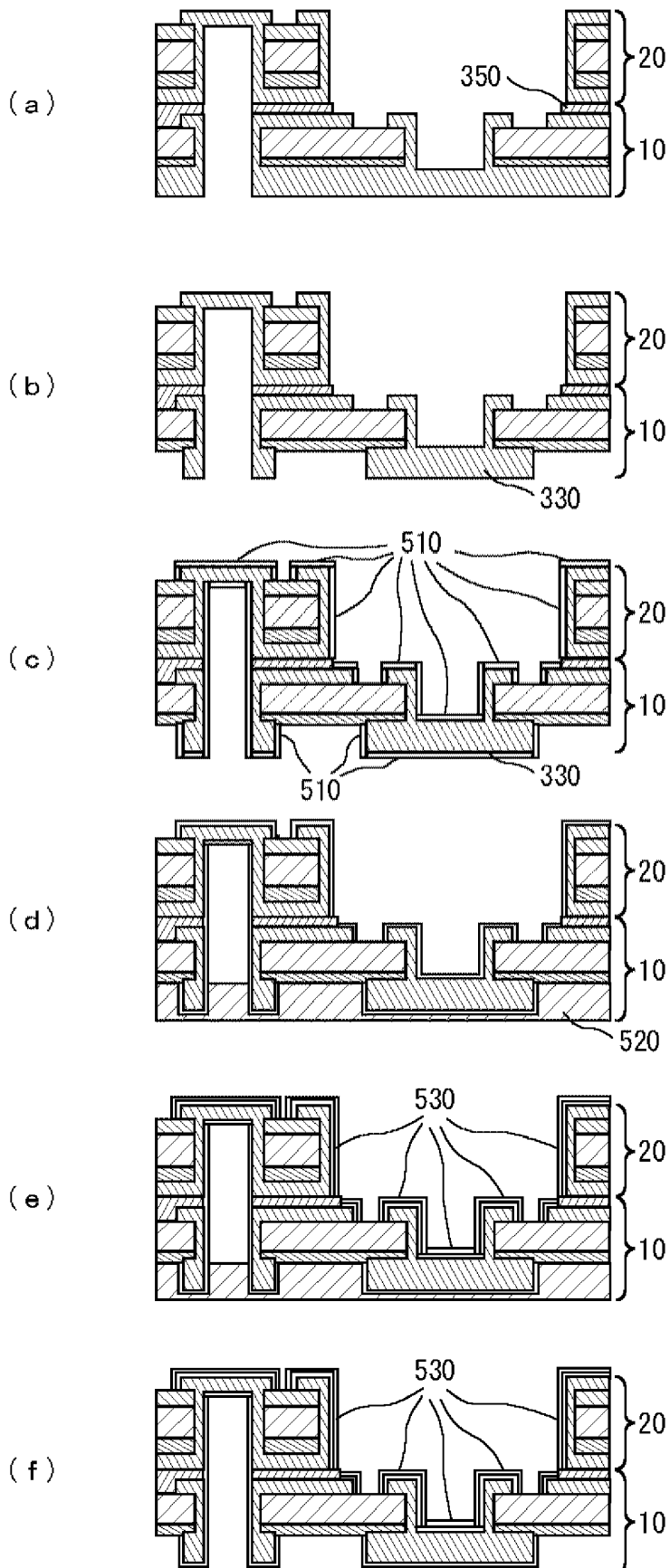
[FIGURE 4]

FIGURE 4



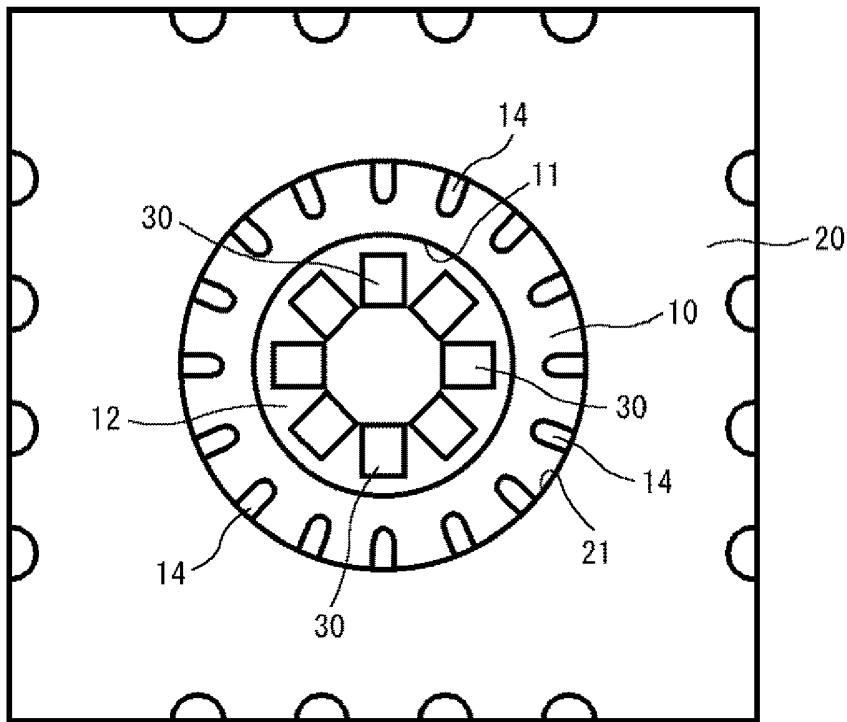
[FIGURE 5]

FIGURE 5



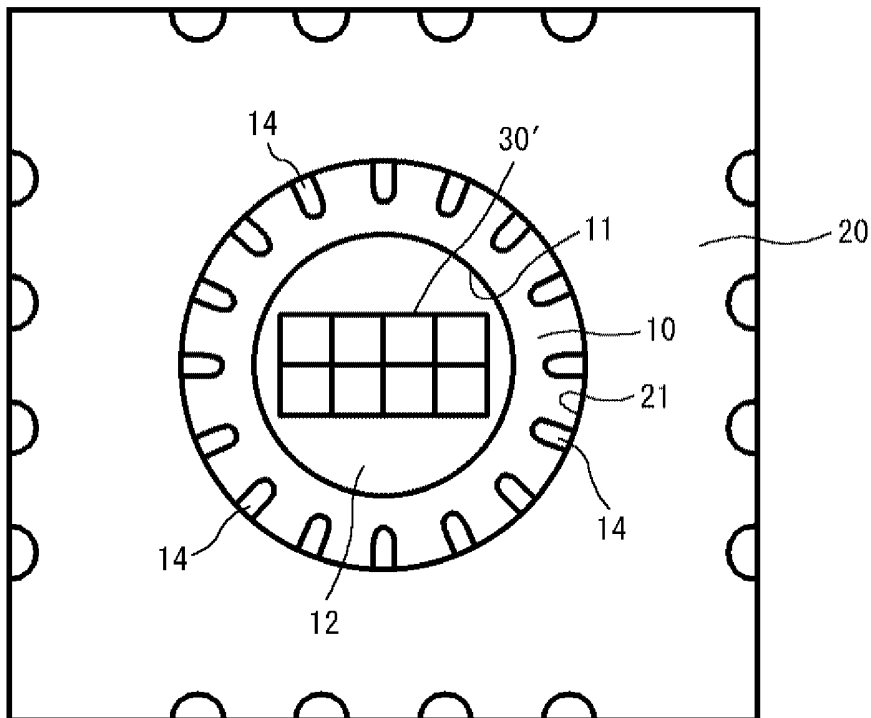
[FIGURE 9]

FIGURE 9



[FIGURE 10]

FIGURE 10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2005/016300

A. CLASSIFICATION OF SUBJECT MATTER
H01L33/00 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01L33/00 (2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2005
Kokai Jitsuyo Shinan Koho	1971-2005	Toroku Jitsuyo Shinan Koho	1994-2005

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 7-235696 A (Sharp Corp.), 05 September, 1995 (05.09.95), Page 5, right column, line 47 to page 6, right column, line 45; Fig. 8 (Family: none)	1-12
Y	JP 11-237850 A (NOKEG & G Optoelectronics), 31 August, 1999 (31.08.99), Par. Nos. [0011] to [0014]; Figs. 2, 7 (Family: none)	1-12
Y	JP 2002-344108 A (Hitachi AIC Inc.), 29 November, 2002 (29.11.02), Par. Nos. [0011] to [0028]; Figs. 4, 5, 7 (Family: none)	1-12

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document member of the same patent family

Date of the actual completion of the international search
28 November, 2005 (28.11.05)Date of mailing of the international search report
13 December, 2005 (13.12.05)Name and mailing address of the ISA/
Japanese Patent Office

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2005/016300

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2002-094122 A (Matsushita Electric Works, Ltd.), 29 March, 2002 (29. 03. 02), Figs. 1, 2, 15 & WO 02/84750 A1 & US 2003-189830 A1 & EP 1387412 A1 & CN 14363 A & TW 517402 B	1-12
A	JP 64-141788 A (Mitsubishi Cable Industries, Ltd.), 25 June, 1987 (25. 06. 87), Figs. 2, 10 (Family: none)	1-12

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International Search Report		International Application No. PCT/JP2005/016300													
A. Classification of the field to which the invention belongs (International Patent Classification (IPC)) Int. Cl. H01L 33/00 (01.2006)															
B. Fields searched Minimum documentation searched (International Patent Classification (IPC)) Int. Cl. H01L 33/00 (01.2006)															
Documentation searched other than the minimum documentation that may be included in the fields searched <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Japanese Utility Model Application Publications</td> <td style="width: 50%;">1922 – 1996</td> </tr> <tr> <td>Japanese Unexamined Utility Model Application Publications</td> <td>1971 – 2005</td> </tr> <tr> <td>Japanese Utility Model Application Registered Publications</td> <td>1996 – 2005</td> </tr> <tr> <td>Japanese Registered Utility Model Application Publications</td> <td>1994 – 2005</td> </tr> </table>				Japanese Utility Model Application Publications	1922 – 1996	Japanese Unexamined Utility Model Application Publications	1971 – 2005	Japanese Utility Model Application Registered Publications	1996 – 2005	Japanese Registered Utility Model Application Publications	1994 – 2005				
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Electronic database used in the international search (name of the database and terms used in the search) WPI															
C. Literature considered to be relevant <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Cited literature category*</th> <th style="width: 70%;">Name of the cited literature and indication of the relevant location when part of the literature is relevant</th> <th style="width: 20%;">Relevant No. in the Scope of Patent Claims</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Y</td> <td>JP 7-235696 A (Sharp Corporation) 09.05.1995, Page 5 right column line 47 – Page 6 right column line 45, Figure 8 (no family)</td> <td style="text-align: center;">1-12</td> </tr> <tr> <td style="text-align: center;">Y</td> <td>JP 11-237850 A (NOK EG and G Optoelectronics Corp.) 08.31.1999, Paragraphs 11-14, Figures 2 and 7 (no family)</td> <td style="text-align: center;">1-12</td> </tr> <tr> <td style="text-align: center;">Y</td> <td>JP 2002-344108 A (Hitachi AIC Inc.) 11.29.2002, Paragraphs 11–28, Figures 4, 5 and 7 (no family)</td> <td style="text-align: center;">1-12</td> </tr> </tbody> </table>				Cited literature category*	Name of the cited literature and indication of the relevant location when part of the literature is relevant	Relevant No. in the Scope of Patent Claims	Y	JP 7-235696 A (Sharp Corporation) 09.05.1995, Page 5 right column line 47 – Page 6 right column line 45, Figure 8 (no family)	1-12	Y	JP 11-237850 A (NOK EG and G Optoelectronics Corp.) 08.31.1999, Paragraphs 11-14, Figures 2 and 7 (no family)	1-12	Y	JP 2002-344108 A (Hitachi AIC Inc.) 11.29.2002, Paragraphs 11–28, Figures 4, 5 and 7 (no family)	1-12
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☒ Further documents are listed in the continuation of Box C. ☐ See the attachment on the patent family.															
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Date of the completion of the international search 11.28.2005		Date of the mailing of the international search report 12.13.2005													
Name and mailing address of the international search organization Japan Patent Office (ISA/JP) Postal Code 100-8915 3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo		<table style="width: 100%; border: none;"> <tr> <td style="width: 70%; border: none;"> Patent Office Examiner (authorized employee) Toshiyasu Kanetaka Telephone number 03-3581-1101 </td> <td style="width: 30%; border: none; text-align: center;"> 2K 9712 Extension 3255 </td> </tr> </table>		Patent Office Examiner (authorized employee) Toshiyasu Kanetaka Telephone number 03-3581-1101	2K 9712 Extension 3255										
Patent Office Examiner (authorized employee) Toshiyasu Kanetaka Telephone number 03-3581-1101	2K 9712 Extension 3255														

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A	JP 64-141788 A (Mitsubishi Cable Industries, Ltd.) 06.25.1987. Figure 2, Figure 10 (no family)	1-12

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