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Bezeichnung der Erfindung: Method of and apparatus for manufacturing small-size gas-filled lamps
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : H01K 3/00

ENTSCHEIDUNG / DECISION

vom / of / du 19 October 1990

Anmelder / Applicant / Demandeur : Hamai Electric Lamp Co., Ltd.

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé : "Inventive step (yes)"

Leitsatz / Headnote / Sommaire

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Case Number: T 79/90 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 19 October 1990

Appellant : Hamai Electric Lamp Co., LTD
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Representative : Goddar, Heinz J., Dr.
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Decision under appeal : Decision of Examining Division 045 of the European Patent Office dated 27 June 1989 refusing European patent application No. 84 100 043.3 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : K. Lederer
Members : R. Shukla
C. Holtz

Summary of Facts and Submissions

I. European patent application No. 84 100 043.3 (publication No. 116 271) was refused by a decision of Examining Division.

II. The reason for the refusal was that the subject-matter of the unique claim did not involve an inventive step having regard to the following prior art documents:

US-A-3 698 784 (D1)
US-A-3 311 439 (D2).

III. The Applicant lodged an appeal against this decision, and submitted with the Statement of Grounds a new single claim.

IV. In a communication accompanying summons to oral proceedings, the Board cited the following prior art document and expressed its provisional opinion that the application did not appear to meet the requirement of inventive step:

(D3) Encyclopedia of Chemical Technology, Volume 4, John Wiley & Sons, Inc. 1978, page 616.

V. At the oral proceedings, the Appellant requested that the appealed decision be set aside and a patent be granted on the basis of the following application documents:

Claims: The single claim as presented at the oral proceedings;
Description: pages 1 to 16 as presented at the oral proceedings;
Drawings: sheets 1/2 to 2/2 as originally filed.

VI. The single valid claim reads as follows:

"1. A method of manufacturing small-size gas-filled lamps, comprising the steps of:

(a) preparing an assembly of a bulb (15) having a closed head and an open end, and a bead (19) disposed in the open end of the bulb (15) and supporting a pair of lead wires (18) with a filament thereto;

(b) placing said assembly in a chamber (1) with the closed head of the bulb (15) supported on a support stand (6);

(c) surrounding said open end of the bulb (15) by a resistance heating element (4) and supporting said lead wires (18) on a lead wire holder (3), said support stand, said heating element (4) and said lead wire holder (3) all beeing disposed in said chamber (1),

(d) developing a vacuum in said chamber (1) to evacuate the air therefrom;

(e) heating said resistance heating element (4) to fuse the open end of the bulb (15) and said bead (19) together;

(f) stopping the heating of said open end of the bulb (15) and said bead (19) which are fused together;

(g) taking the assembly out of the chamber,

characterised in that

(h) a plurality of said assemblies are placed in the chamber (1) wherein each of the closed heads of the bulbs (15) is received in a recess (22) in a bulb holder jig;

(i) a carbon jig is used as resistance heating element (4);

(j) during evacuation, the chamber (1), the jigs (4, 6) and the wire holder (3) are degassed by passing an electric current through the heating carbon jig (4);

(k) a gas under a desired pressure in excess of atmospheric pressure is introduced in the chamber (1);

(l) the open end of the bulb and the bead are fused together by increasing the current through the carbon jig and

(m) simultaneously, a coolant liquid is passed through the bulb holder jig (6) thereby cooling the closed head of the bulb (15)."

VII. In support of the allowability of his request, the Appellant submitted essentially the following arguments:

The valid claim is correctly delimited against the method described with reference to figure 7 in D1 which deals with the manufacture of individual evacuated lamps. In comparison with this known method, the present invention provides mass-production of gas-filled lamps using a carbon jig as a heating element not only for fusing the bulb, but also for degassing the vacuum chamber during evacuation. Although the basic idea of cooling one end of a bulb while heating the other to seal it in order to fill the bulb with a gas is known from D2, this document deals exclusively with a method for filling gas without evacuation and does not disclose the use of a bulb holder jig for cooling the closed heads of the bulbs.

Reasons for the Decision

1. The appeal is admissible.

2. Amendments

The Board is satisfied that the application documents as amended do not contain subject-matter extending beyond the content of the application as filed so that the application meets the requirements of Article 123(2).

In particular, the single claim contains in substance the features of the original claims 1 to 5 and incorporates subject-matter disclosed in the original Example 2. The description has been amended to meet the requirements of Rule 27(1)(c), and for consistency with the claimed subject-matter.

3. Novelty

3.1 The methods described in the embodiments of figures 1 and 2 in D1 are concerned with the manufacture of evacuated lamps so that the characterising features (k), (l) and (m) of the present invention, for introducing gas in the bulb (4) are not disclosed. Also, a bead (5) supporting a pair of lead wires (1, 2) is sealed to a part of the bulb nearer to its closed end and not to the open end of the bulb (4) so that a resistance heating element (29, figure 4), e.g. of nichrome wire, surrounds the part to be sealed and not the open end which is infact connected to a vacuum circuit (C1) (column 2, lines 33 to 46; column 3, lines 12 to 40; column 4, lines 60 to 61; column 5, lines 15 to 33; figures 1 and 2). Further, the known method is for manufacturing one lamp at a time so that a bulb holder jig (21) to hold a plurality of bulb heads (feature (h)) is not provided in this method of D1.

3.2 In the method described with reference to figure 7 in D1 (column 5, line 60 to column 6,line 39),

(a) an assembly of a bulb (52) and a bead (55) is prepared, the bulb having a closed head and an open end (52') and the bead supporting a pair of leads (56, 57) with a filament attached thereto;

(b) the assembly is placed in a chamber (41) and the closed head of the bulb is supported on a support stand (54);

(c) the open end of the bulb is surrounded by a resistance heating element (51) and the lead wires are supported on a lead wire holder (48), the support stand, the heating element and the lead wire holder all being disposed in the chamber;

(d) the chamber is evacuated;

(e) electric current is passed through the resistance heating element to fuse the open end of the bulb and the bead together and finally

(f) the current is switched off once the fusion is completed (column 5, line 60 to column 6, line 39). In the above method, the sealed lamp has to be removed from the chamber once the assembly has cooled down so that the feature

(g) of the claimed method is implicit.

Contrary to the claimed method, the above method deals with the manufacture of evacuated lamps so that the characterising features (k), (l) and (m) of the claimed method are not employed. Since the known method is not intended for mass production, a bulb holder (54, 53) holds only one bulb (52) (cf. feature (h)), and although a resistance heating element (51) surrounds an assembly of a bead (55) and an open end of the bulb (52) in an evacuated chamber (41), a carbon jig is not employed as the heating element (cf. feature (i)). Finally, during the evacuation, degassing of the assembly is not carried out (cf. feature (j)).

3.3 In the prior art method described with reference to figures 8 and 9 in D1, a plurality of lamps are produced simultaneously. However,in this method a bead (60) is disposed on the open end of the bulb and not within it. Heating to fuse the bead with the bulb is carried out by a resistance heating element (64) in the form of a coil surrounding a vacuum chamber and not by a carbon jig within the vacuum chamber. Finally, there is no degassing, introduction of gas under pressure and cooling of the bulb heads (column 6, line 39 to column 7, line 12). Thus whereas the features (b), (d), (e), (f), (g) and (h) are disclosed, the features (a), (c) and (i) to (m) are not.

3.4 The remaining prior art documents on the file are far less relevant for the assessment of novelty.

3.5 The subject-matter of the single claim is therefore new (Article 54 EPC).

4. Inventive step

4.1 In the Board's view, the method described in connection with figure 7 in D1 (hereinafter, method A), and neither the embodiment described with reference to either of figures 1 and 2 in D1 (hereinafter, method B) nor the embodiment of figures 8 and 9 in D1 reflects the closest prior art, since in the method A the bead (56) with lead wires (56, 57) is aligned with the open end of the bulb and is also fused to the latter as in the present invention. In the method B on the other hand, the bead (5) carrying lead wires (1, 2) is fused with a part of an elongate bulb (4) nearer to its closed end and the open end of the bulb has to be engaged by an air-tight rubber packing (22) in an opening (16) for connection with a vacuum circuit (C1).

4.2 In view of what is stated in paragraph 3.2 above, the present invention is distinguished correctly over the method A by the characterising features (h) to (m) of the claim.

4.3 Reference to the method B shows that in manufacturing of a plurality of bulbs simultaneously, it is known to receive, and thereby support, closed heads of bulbs (59) in a common jig (61). For the skilled person concerned with the mass-production of bulbs, the use of a common jig as in the feature (h) would therefore be obvious. Also, it is evident from the disclosure in D3 (see "Electric Heating Elements") that carbon in machined shapes is widely used as heating elements to produce temperatures up to 3300 K in applications utilizing nonoxidising atmospheres so that not only the use of carbon as a heating element but the use of a common heating element (feature (i)) for the bulbs to simplify the heating arrangement, would readily occur to the skilled person.

As regards the features (k),(l) and (m), these enable a gas to be filled in the bulb at a pressure higher than atmospheric pressure without the danger of the gas blowing out during the sealing of the bulb (page 4, last line to page 5, line 13 of the original application). The skilled person faced with the task of manufacturing small-size lamps filled at a pressure higher than the atmospheric pressure would be aware of the teaching of D2 according to which incandescent lamps containing gas at a pressure of several atmospheres can be produced by immersing a closed end of a glass tube (12/20) in a coolant (29) prior to sealing so that during the sealing of the open end of the tube, a gas introduced in the tube remains condensed on the cooled wall portions of the tube (column 1, lines 13 to 24; column 2, lines 45 to 72; figure 1). Although in D2 the gas is introduced in the glass tube through a hollow needle (18b), it would be within the competence of the skilled person to

realise that this measure is necessary in the method of D2 wherein the gas is filled without preliminary pumping, whereas in the method A, it would suffice to introduce the gas through a pipe (43) in the chamber (41) after a desired degree of vacuum is obtained. The Board is also of the view that the skilled person having decided to take advantage of the teaching of D2 would realise that the cooling arrangement there would interfere with the vacuum conditions in the method A and would therefore consider other generally known cooling techniques, such as circulating a coolant through a support to be cooled. In view of the above, the feature (k) to (m) would be obvious to the skilled person.

In the method A, degassing of the chamber (41), bulb support stand (54) or of the heating element (51) is not carried out during evacuation. Although such degassing is disclosed in the method B (column 3, lines 41 to 53), in this method an external electric furnace is used to degas the entire assembly. In the method according to the invention, on the other hand, the heating element in the form of a carbon jig is used not only to fuse the bead and the open end of the bulb together, but to degas the chamber, the jigs and the wire holder. Thus, not only the degassing arrangement is simplified, but a more effective degassing of the carbon jig itself and the assembly of the bead and the open end is achieved, because of the proximity of the carbon jig to the assembly. Thus, even if the skilled person following the teaching of the method B considered degassing during evacuation, the method of degassing employed in the present invention is not rendered obvious by the available prior art.

5. For the foregoing reasons, the subject-matter of the single claim is regarded as involving an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant the patent as requested at the oral proceedings and set out in paragraphe V above.

The Registrar | The Chairman

P. Martorana | K. Lederer