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File Number: T 955/91 - 3.4.1  
Application No.: 83 900 326.6  
Publication No.: 0 098 285  
Title of invention: Electronic high frequency controlled device for operating  
gas discharge lamps

Classification: H05B 41/24

D E C I S I O N  
of 4 February 1993

Applicant: MINITRONICS PTY. LTD.

Opponent: 01) Siemens Aktiengesellschaft, Berlin und München  
02) N.V. Philips' Gloeilampenfabrieken

Headword:

EPC Article 56

Keyword: "Inventive step (of last auxiliary request: yes)"  
"Late-filed requests for amendments held inadmissible"



Case Number : T 955/91 - 3.4.1

**D E C I S I O N**  
of the Technical Board of Appeal 3.4.1  
of 4 February 1993

**Appellant :**  
(Proprietor of the patent)

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**Respondent :**  
(Opponent 01)

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**Respondent :**  
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**Decision under appeal :**

Decision of the Opposition Division of the  
European Patent Office dated 17 October 1991  
revoking European patent No. 0 098 285 pursuant  
to Article 102(1) EPC.

**Composition of the Board :**

**Chairman :** G.D. Paterson  
**Members :** H.J. Reich  
R.K. Shukla

## Summary of Facts and Submissions

- I. The Appellant is owner of European patent No. 0 098 285.
- II. The Respondents "Siemens Aktiengesellschaft" and "N.V. Philips Gloeilampenfabrieken" separately filed notices of opposition against this patent on the grounds mentioned in Article 100(a) EPC, citing against the patent as granted and subsequently during the opposition procedure against the Appellant's three auxiliary requests for maintenance in amended form the following documents:
- D1: US-A-4 251 752
  - D2: US-A-3 427 458
  - D3: DE-A1-2 931 794
  - D4: DE-A1-2 928 490
  - D5: DE-A1-3 002 435
  - D6: US-A-4 042 856
  - D7: US-A-4 127 893
  - D8: DE-A1-2 900 910
  - D9: US-A-4 075 476
  - D10: DE-B-1 057 221
  - D11: GB-A-2 057 205
  - D12: John Markus: "Electronics Dictionary", McGraw-Hill Inc., New York, US, 4th edition, 1978, page 174, item "dimmer"
  - D13: W. Elenbaas: "Fluorescent Lamps", Philips Technical Library, The MacMillan Press Ltd., Eindhoven, Holland, second edition, 1971, pages 131-133.
- III. The patent was revoked by a decision of the Opposition Division for the following reasons: The Appellant's main request, Claim 1 as granted was regarded as obvious in particular in view of documents D4 and D5. The skilled man would see that dimming is possible by varying via element

7 the output frequency of circuit 5 in Fig. 5 of document D4 and that the oscillating square wave form in Fig. 1 may result from complementary output signals of transistor switches  $TT_1$  and  $TT_2$  in Fig. 5 of document D4. He would have replaced choke Tr in Fig. 5 of document D4 by a transformer with E-core as known from document D13, page 132, Fig. 8.12 and thus arrived in an obvious way at the subject-matter of Claim 1 according to the Appellant's first auxiliary request, consisting of granted Claims 1 and 2. Claim 1 of the second auxiliary request, adding to the subject-matter of the foregoing requests the dimensioning rule of a large secondary inductance, sufficient to increase overshoot for striking the discharge, would be as well derivable from the last eight lines on page 132 of document D13. Claim 1 of the Appellant's third auxiliary request, incorporating the ballast as claimed in granted Claim 1 and the safe-guard system as specified in granted Claims 3 and 4, lacks an inventive step since the claimed subject-matter is a mere aggregation of dimming facilities and a safeguard circuit, the latter being a standard feature of ballast circuits. The safeguard circuit is implicitly disclosed also in document D4 and automatically realisable by only the claimed functioning.

III. The Appellant lodged an appeal against this decision citing documents:

D14: DE-A1-2 721 967, and

D15: DE-A1-2 736 963

as evidence that the term "dimmer" was used in the German language in a technically different sense than the term "Helligkeitsregler" in document D4. In response to a communication of the Board annexed to a summons to oral proceedings, the Appellant filed on 4 January 1993

an Affidavit by Kevin Charles Daly, dated 17 December 1992, pages 1 to 41,

a new main request (claim set A) and two new auxiliary requests (claim sets B and C) and on 21 January 1993 five additional auxiliary requests (claim sets D to H).

Claim 1 of the main request (claim set A) reads as follows:

"1. A high frequency electronic ballast for gas discharge lamps comprising a controlled oscillator (1) providing two complementary high frequency outputs (16,17; Q,Q) which are variable in frequency under at least one control input (10 to 15) to said oscillator (1), said complementary outputs (16,17; Q,Q) inputting to drive means (3; Q<sub>1</sub>,Q<sub>2</sub>) which, in turn, provides an input to an inverter (4), the output (24; Q<sub>6</sub>) of said inverter (4) being a source to a transformer (5;T<sub>2</sub>;32) which enables the inverter (4) to directly drive a gas discharge lamp (6; 30), said controlled oscillator (1) and driver means (3;Q<sub>1</sub>,Q<sub>2</sub>) being adapted to be supplied from a low DC voltage source (L.V.) and said inverter (4) being adapted to be supplied from a high DC voltage source (H.V.), characterised in that dimming control is provided by said at least one control input (10 to 15; 45) to the oscillator (1) to vary the frequency of the oscillator (1) and thereby vary the light output of the gas discharge lamp (6) and in that said transformer (5; T<sub>2</sub>) has primary and secondary windings (N1, N2) disposed such that loose coupling is obtained between the primary and secondary windings (N1, N2)."

Claim 1 of the auxiliary request according to claim set D reads as follows:

"1. A high frequency electronic ballast for gas discharge lamps comprising a controlled oscillator (1) providing two high frequency outputs (16,17; Q,  $\bar{Q}$ ) which are variable in frequency under at least one control input (10 to 15) to said oscillator (1), said outputs (16,17; Q,  $\bar{Q}$ ) inputting to drive means (3; Q<sub>1</sub>, Q<sub>2</sub>) which, in turn, provides an input to an inverter (4), the output (24; Q<sub>6</sub>) of said inverter (4) being a source to a circuit element (5; T<sub>2</sub>; 32) which enables the inverter (4) to directly drive a gas discharge lamp (6; 30), said controlled oscillator (1) and driver means (3; Q<sub>1</sub>, Q<sub>2</sub>) being adapted to be supplied from a low DC voltage source (L.V.) and said inverter (4) being adapted to be supplied from a high DC voltage source (H.V.), characterised in that the controlled oscillator (1) provides two complementary high frequency outputs and in that the circuit element (5; T<sub>2</sub>; 32) is a transformer (5; T<sub>2</sub>) which has primary and secondary windings (N1, N2) disposed such that loose coupling is obtained between the primary secondary windings (N1, N2) and further in that dimming control is provided by said at least one control input (10 to 15; 45) to the oscillator (1) to vary the frequency of the oscillator (1) and thereby vary the light output of the gas discharge lamp (6)."

The wording of Claims 1 of the auxiliary requests according to claims sets B and E corresponds to that of Claims 1 of claim set A and D respectively, wherein:

the "loose coupling" feature, i.e. the wording "... transformer (5; T<sub>2</sub>) (which) has primary and secondary windings (N1, N2) disposed such that loose coupling is obtained between the primary and secondary windings (N1, N2)"

is replaced by

an "E-core" feature, i.e. the wording "is an E-core transformer (5; T<sub>2</sub>) with primary and secondary windings disposed on opposite ends of the centre leg".

The wording of Claims 1 of the auxiliary requests according to claim sets C and F corresponds to that of Claims 1 of claim set A and D respectively and comprises additionally the "E-core" and the "loose coupling" feature in the wording as indicated above.

The wording of Claim 1 of claim set G reads as follows:

"1. A high frequency electronic ballast for gas discharge lamps comprising a controlled oscillator (1) providing two complementary high frequency outputs (16,17; Q,  $\bar{Q}$ ) which are variable in frequency under at least one control input (10 to 15) to said oscillator (1), whereby a dimming control can be achieved, said complementary outputs (16,17; Q,  $\bar{Q}$ ) inputting to driver means (3; Q<sub>1</sub>, Q<sub>2</sub>) which, in turn, provides an input to an inverter (4), the output (24; Q<sub>6</sub>) of said inverter (4) being a source to a transformer (5; T<sub>2</sub>; 32) or choke which enables the inverter (4) to directly drive a gas discharge lamp (6; 30), said controlled oscillator (1) and driver means (3; Q<sub>1</sub>, Q<sub>2</sub>) being adapted to be supplied from a low DC voltage source (L.V.) and said inverter (4) being adapted to be supplied from a high DC voltage source (H.V.), said driver means (3) comprising a push-pull transistor circuit (Q<sub>1</sub>, Q<sub>2</sub>) which is transformer (T<sub>1</sub>) coupled to said inverter (4) and is controlled by a safe-guard circuit, characterised in that said safe-guard circuit deactivates the push-pull transistor circuit (Q<sub>1</sub>, Q<sub>2</sub>) when the mains voltage drops below a predetermined level due to line voltage variation or power-up and power-down of said ballast."

The wording of Claim 1 of claim set H has the same precharacterising portion as Claim 1 of claim set G but its characterising portion reads as follows:

"... characterised in that the safe-guard circuit comprises a low voltage sensor (2) coupled via a transistor ( $Q_3$ ) to the emitters of said push-pull transistor ( $Q_1, Q_2$ ) and to the ground of the low voltage rail (Fig. 2) whereby said safe-guard circuit deactivates the push-pull transistor circuit ( $Q_1, Q_2$ ) when the mains voltage drops below a predetermined level due to line voltage or power-up and power-down of said ballast."

Claims 2 to 8 of claim sets A and D, Claims 2 to 7 of claim sets B, C, E and F and Claims 2 to 4 of claim sets G and H are dependent on Claim 1 of the corresponding requests, respectively.

IV. In preparing oral proceedings the Respondent "Siemens AG" filed documents:

D16: "Der Sprach-Brockhaus - deutsches Bildwörterbuch von A bis Z", 9th edition, 1984, p. 157; and

D17: "Wörterbuch Lichttechnik", 1990, vde-Verlag GmbH, Berlin, pp. 73 and 145,

and the Respondent "N.V. Philips" filed documents:

Pages 156 to 167, 172 and 173 of document D13

D18: H.R. Schlegel et al., "Impulstechnik", Fachbuchverlag Siegfried Schütz, Hannover, 1955, pp. 114, 115, 132-145;



- D19: K.A. Macfadyen: "Small Transformers and Inductors", Chapman & Hall Ltd., London, 1953, pp. 70, 71, 178, 179;
- D20: S. Moskowitz and J. Racker: "Pulse Techniques", Prentice-Hall, Inc., New York, 1951, pp. 84-93;
- D21: J.M. Doyle: "Pulse Fundamentals", Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1963, pp. 288-295;
- D22: J. Millman and H. Taub: "Pulse and Digital Circuits", McGraw-Hill Book Company Inc., New York, 1956, pp. 262-265, 270 and 271;
- D23: R. Zimmermann: "Lichttechnik", VEB Verlag Technik, Berlin, 1977, p. 122;
- D24: W. Elenbaas et al., "Fluorescent Lamps and Lighting", Philips Technical Library, 1962, p. 132;
- D25: W. Elenbaas et al., "Leuchtstofflampen und ihre Anwendung", Philips Technische Bibliothek, 1962, p. 148;

and handed over during the oral proceedings pages 224 and 225 of document D13.

- V. Oral proceedings were held on 4 February 1993, at the beginning of which the Appellant withdrew claim sets A and D and handed over a new main request (claim set D').

Claim 1 of claim set D' adds to the wording of Claim 1 of claim set D (after "such that loose coupling is obtained between the primary and secondary windings (N1,N2)), the words:

"so that there is no significant change in the voltage applied to the gas discharge lamp at any dimming level". This feature will be referred to as "constant voltage" feature.

- VI. At the end of the oral proceedings the Appellant (Patentee) requested that the decision under appeal be set aside and that the patent be maintained as amended according to claim set D' as main request or according to one of the claim sets B, C, E, F, G or H as auxiliary requests.

Further requests by way of additional amendments to claim set D' were also put forward orally, but such requests were not formulated in writing.

The Respondents (Opponents) requested that the appeal be dismissed.

- VII. In support of his requests based on claim sets B to F, the Appellant argued essentially as follows:

- (a) A skilled person cannot be expected to see in the closed loop system for constant brightness control as disclosed in the most relevant document D4 a technical starting point for creating a ballast for dimming control, i.e. for varying brightness, because the limited resonance bandwidth of choke Tr in Fig. 2 would not allow to start a discharge lamp within the widely varying frequency range necessary for dimming, and breaking the feedback control loop 6, 4, 2 in Fig. 2 could provide stability problems. It would represent an inventive merit to select from the extremely large variety of conventional ballasts precisely the claimed specific transformer means

which allows to start the lamp and to keep the voltage applied to it unchanged at any dimming level and to reduce the power consumption proportional to the dimmed brightness.

- (b) Document D13 does not disclose the use of a leakage transformer - i.e. a transformer with a loose coupling between its primary and secondary windings - in a high frequency ballast for dimming but in a 50 Hz ballast without brightness variation. The E-core of the leakage transformer in Fig. 8.12 on page 132 of document D13 is made of iron and would get too hot in the KHz region. Moreover, document D13, page 132, last three lines, discloses to realize a leakage which is sufficient to replace a choke, by iron shunts which are interposed between the primary and secondary windings, and not by simply disposing the primary and secondary windings on opposite ends of the centre leg as claimed.
- (c) In the ballast of document D11 a lamp is not directly driven by a transformer as claimed but by a capacitive coupling via C8 and C9 in Figures 1, 5 and 6. Document D10 leads away from the invention in using in addition to a leakage transformer a choke.
- (d) The ballast disclosed in document D5 gives little information with regard to the claimed subject-matter, having no controlled inverter and a permanent overshoot repetitively produced with each pulse.
- (e) None of the cited documents discloses the protective measures as claimed in claim sets G and H.

VIII. The above submissions were contested by the Respondents. The Respondent "Siemens AG" argued essentially as follows:

- (a) The Appellant's requests based on claim sets D, E, F, G, and H filed 21 January 1993 and on claim set D' filed during the oral proceedings on 4 February 1993 should not be admitted into the proceedings so as to ensure fair proceedings and legal security for an opponent especially in view of the Board's statement accompanying the summons that further observations should not be filed later than one month before the date of the oral proceedings.
- (b) A replacement of choke Tr in the ballast disclosed in document D4 by the claimed direct transformer coupling would not be inventive due to the fact that the corresponding advantages - in particular a successful lamp start at any dimming level - would be expected by a skilled person in view of the disclosure in document D5, which teaches to use a leakage transformer (3 in Fig. 1) for dimming by varying the frequency from 20 KHz to 100 KHz. The advantages indicated in column 9 of the patent under appeal would not be specific to the invention.
- (c) A skilled person derives from document D11, page 5, lines 120 to 124 that only the transformer coupling is effective in the start period, inciting him to dispense with capacitors C8 and C9. As follows from D11, page 6, lines 93 to 105 multivibrator C1 in Fig. 5 - as all multivibrators - has complementary outputs.

IX. The Respondent "N.V. Philips" contradicted the Appellant's arguments by making essentially the following submissions:

- (a) In the embodiment disclosed in Figures 3 and 5 of document D4 control means 7 is manually adjustable (page 9, lines 1-3). Hence, controlled oscillator 7, 8, 5, driver 3 and inverter 2 of this embodiment represent already an open loop system. The range of the oscillator working frequency from 10 KHz to 30 KHz permits a variation of the light output and thus dimming control. A particular frequency range for dimming control is not specified in any claim of the Appellant's requests. The arrangement of the driver circuit TT<sub>1</sub>, TD<sub>1</sub>, TD<sub>2</sub>, TT<sub>2</sub> in Fig. 5 discloses implicitly that controlled oscillator 5 provides two "complementary" high frequency outputs. An unchanged voltage applied to the lamps is an inherent property of the conventional means disclosed in document D4 and, being dependent on the primary voltage, no effect of a transformer coupling. Thus, Claim 1 of claim set D' differs from the prior art disclosed in document D4 only in the use of a leakage transformer.
  
- (b) Leakage transformers are a standard product available on the market, belonging to a skilled person's general knowledge. The 50 Hz example in document D13 will not be regarded as a technical difficulty in the use of a leakage transformer in a high frequency ballast, in particular not in view of the disclosure in document D5, page 1, paragraph 3, stating a successful use of a leakage transformer without choke in a region between 10 KHz and 100 KHz for dimming (see the title on page 1) by frequency variation. An analogous teaching is disclosed in document D11.

(c) E-core transformers with primary and secondary windings disposed on opposite ends of the centre leg are available on the market. Moreover, document D22, page 262, paragraph 4, teaches to vary the leakage inductance via the volume of the air between windings in a ferrite E-core transformer without iron shunts according to Fig. 9-10 on page 263. Therefore, the arrangement of the primary and secondary windings so that they are sufficiently "loose coupled" for avoiding an additional choke and for producing enough overshoot for starting a particular lamp, is a routine adaptation lying within the normal skills of the skilled person.

(d) The "power down" safeguard system as claimed in claim set G is the result of pure common sense in view of the general fail-safe system disclosed in document D1, column 11, lines 37 to 45, and the protective measures disclosed in document D7, column 5, lines 16 to 30 and column 5, line 61 to column 6, line 9.

X. At the conclusion of the oral proceedings the decision was announced that the decision of the Opposition Division is set aside and that the patent is maintained as amended on the basis of claim set H.

#### Reasons for the Decision

1. Procedural matters - Admissibility of the Appellant's late-filed requests

This appeal was characterised by a large number of alternative auxiliary requests filed by the Appellant at a very late stage in the appeal proceedings, both shortly before and during the oral proceedings, such auxiliary

requests being in respect of claims defining different combinations of technical features, as set out in paragraph III above.

As mentioned in paragraph VIII (a) above the Respondent Siemens AG objected to this conduct as being unfair and apparently deliberate (since the same thing had occurred before the Opposition Division), and said that he was tired of such abuse of procedure. The Board has considerable sympathy with such Respondent in this respect, although it accepts the Appellant's explanation that such numerous requests were not made deliberately in order to complicate the procedure, but were made in response to arguments from the Respondents.

Attention is drawn once again to Decision T 95/83 (OJ EPO 1985, 75), which has been constantly followed by the Boards of Appeal, and whose headnote states:

"If an applicant for a patent or a patentee desires to submit amendments to the description, claims or drawings of a European patent application or a European Patent in the course of appeal proceedings, this should be done at the earliest possible moment (OJ EPO 6/1981, 176; 8/1984, 376). It is only in the most exceptional circumstances, where there is some clear justification both for the amendment and for its late submission, that it is likely that an amendment not submitted in good time before oral proceedings will be considered on its merits in those proceedings by a Board of Appeal."

Similarly in Decision T 153/85 (OJ EPO 1988, 1), the Board of Appeal stated that "When deciding on an appeal during oral proceedings, a Board may justifiably refuse to consider alternative claims which have been filed at a very late stage, for example during the oral proceedings, if such alternative claims are not clearly allowable."

In the Board's view it is a misconception of the nature of opposition procedure, in particular opposition appeal procedure, to think that the Patentee can continue to file alternative sets of claims in response to an Opponent's attacks upon the patentee's previous requests, right up to and even during oral proceedings. In the present case the European patent application was filed in January 1983, and the application was granted in 1988. The documents on which the opposition was based were filed in July and August 1989, and remained the most relevant documents throughout the opposition proceedings including the appeal stage. Further documents cited and introduced during the course of the proceedings were of a subsidiary nature. The Patentee has had a long time in which to decide upon the form of the claims which he wishes to defend as satisfying the requirement of inventive step. The oral hearing in an opposition appeal is intended to be the very final stage in the opposition procedure, and the point in time at which the decision to maintain or to revoke the patent is taken. It is crucial that such oral hearing and the procedure immediately leading up to it is conducted in a manner which is fair to both sides (the Patentee and the Opponent(s)), and in a manner which allows the Board to make its decision in fair and proper circumstances.

For the reasons set out in paragraphs 2.1 to 2.7 and 3.1 to 3.4 below, the claim sets D to G filed on 21 January 1993 immediately prior to the oral hearing, and the claim set D' filed during the oral hearing on 4 February 1993, are not clearly allowable (Decision T 153/85), in that they do not clearly meet the requirements of Article 56 EPC. Such claim sets are therefore inadmissible.



Similarly, the unformulated proposals for amendment of claim set D' which were made during the oral proceedings on 4 February 1993 are inadmissible.

On the other hand, for the reasons set out in paragraph 3.5 claim set H filed on 21 January 1993 is clearly allowable, and is therefore admitted into the proceedings.

2. Inventive step of Claims 1 of claim sets A to F

2.1 Claims 1 of claim sets A and D add to the subject-matter of Claim 1 as granted in the specification of the patent under appeal the "loose coupling" feature defined in paragraph III, Claim 1 of claim set D' additionally the "constant voltage" feature. Claims 1 of claim sets B and E add to the subject-matter of granted Claim 1 the features of granted Claim 2 - i.e. the "E-core" feature - and correspond to the first auxiliary request before the Opposition Division. Claims 1 of claim sets C and F add to the subject-matter of granted Claim 1 as well the "loose coupling" and the "E-core" features. Due to this close technical interrelationship the question of inventive step underlying one of the main claims of claim sets A to F is examined in common:

2.2 From the nearest prior art according to document D4 it is known in the wording of Claims 1 of claim sets A, B, C, D, D', E and F:

"A high frequency (see D4, Claim 1, 10 KHz to 30 KHz) electronic ballast for gas discharge lamps comprising a controlled oscillator (D4, Fig. 5; 7, 8, 5; page 9, paragraph 1) providing two ... high frequency outputs (Fig. 5, "Ansteuerung"), which are variable in frequency under at least one control input (7, 8; page 14, lines 18

to 20) to said oscillator (5), said ... outputs inputting to drive means (3 in Fig. 5 and P<sub>1</sub> in Fig. 4), which, in turn, provides an input to an inverter (2 in Fig. 4), the output of said inverter being a source to a "circuit element" (Dr in Fig. 2) which enables the inverter to directly drive a gas discharge lamp (L in Fig. 2), said controlled oscillator and driver means being adapted to be supplied from a low DC voltage source (+15V in Fig. 5) and said inverter being adapted to be supplied from a high DC voltage source (+300V in Fig. 4), wherein ... control is provided by said at least one control input to the oscillator to vary the frequency of the oscillator and thereby vary the light output of the gas discharge lamp (page 8, lines 5 to 9; page 9, lines 1 to 3)."

- 2.3 Starting from the prior art disclosed in document D4, the objective technical problem underlying the patent under appeal with regard to claim sets A, C, D, D' and F is to provide a ballast wherein the circuit element, enabling the inverter to directly drive a gas discharge lamp, prevents additional energy losses in a choke and allows to strike a discharge lamp at its minimum dimmed level in the same way as at its full light level with little difference in striking time; see the description of the patent under appeal column 8, lines 8 to 10; column 9, lines 19, 20; and column 8, line 59, to column 9, line 1.

The problem of striking a discharge lamp is observable in practice. Also, a reduction of power consumption is a generally known problem in the art of gas discharge lamps. Thus, the formulation of the objective problem does not contribute to an inventive step underlying the subject-matter of the claims.

- 2.4 Having regard to claims sets A and D this problem is solved in that:

the circuit element "is a transformer, which has primary and secondary windings disposed such that loose coupling is obtained between the primary and secondary windings".

Such a circuit element is known from document D5; see 3 in Fig. 1 and page 2, lines 9 and 10. A skilled person derives from document D5, Claim 5, the "overshoot" properties of such loose coupling, also used in the patent under appeal for enabling a start at each dimming level, and from D5, page 1, lines 20-24, the advantage of eliminating the need for an additional choke, resulting from the loose coupling. Therefore, it is obvious for a skilled person to make analogous use of the transformer disclosed in document D5 for replacing the choke Tr in the ballast disclosed in document D4. In the Board's view, no technical difficulties are encountered on adapting the output of inverter 2 in Fig. 4 of document D4 to the input of transformer 3 of document D5. The ballast embodied in Figures 5 and 4 of document D4 represent already an open loop control circuit; see paragraph VII(a) and IX(a). Only when the brightness level is set via control input 7, feedback control via element 6 and 8 gets effective to maintain the manually set brightness level. An analogous additional feedback is also foreseen in an embodiment of the patent under appeal; see column 3, lines 5 to 9. Hence, a skilled person would have no technical prejudice that the unstability of the open loop ballast disclosed in document D4 prevents its use in dimming.

No particular frequency limits are defined in the claims or description of the patent under appeal. Thus, control input 7 of document D4 would automatically function as "dimming" control as claimed after inputting the output of inverter 4 of document D4 into the input of transformer 3

of document D5, the brightness variation of which is explicitly termed as "dimming" (see the title of D5).

Also the subject-matter of Claim 1 of claim sets A, C, D, D' and F results in a permanent overshoot repetitively produced with each pulse; see Fig. 6c with the corresponding description. For this reason the Appellant's argument in paragraph VII(d) is not relevant.

In order to find out that the outputs of oscillator 5 in Fig. 5 of document D4 should be "complementary" ones as claimed, a skilled person only needs to fill out an informational gap in this document by his general knowledge; see also paragraph IX(a).

For the reasons stated above, the Board regards the subject-matter of Claims 1 of claim sets A and D to be the result of an analogous use of the loose coupled transformer disclosed in document D5 in the technically close situation of the ballast disclosed in document D4 followed by routine adaptations. Therefore, Claims 1 of claim sets A and D are considered to lack an inventive step within the meaning of Article 56 EPC.

- 2.5 The feature added by the wording of Claim 1 of claim set D' to that of Claim 1 of claim set D: "so that there is no significant change in the voltage applied to the gas discharge lamp at any dimming level" is disclosed in the patent under appeal, column 8, lines 48 to 63, as a mere logical consequence of the use of a transformer. In the Board's view, a skilled person expects an unchanged secondary voltage as a generally known advantage which is automatically realised in the analogous use of the transformer disclosed in document D5 in the ballast of document D4.

2.6 Claims 1 of claim sets B and E specify mainly that in the ballast of document D4 (see paragraph 2.2 above):

the circuit element "is an E-core transformer with primary and secondary windings disposed on opposite ends of the centre leg".

E-core transformers are generally known to be leakage transformers with a variable range of the spread self-inductance (see for instance document D13, page 132) and thus per se, do not necessarily have the sufficient leakage to solve the objective problem as stated in paragraph 2.3 above. For this reason, the general claiming of an E-core transformer can only be attributed the function of a "circuit element which enables the inverter to directly drive a gas discharge lamp". Hence, the replacement of choke Tr in the ballast disclosed in document D4 by an E-core transformer such as disclosed in document D13 reduces to an obvious exchange of well-known equivalents. It belongs to the special knowledge of the skilled person that E-cores can be realised without iron shunts of ferrite, function in the high frequency region up to 1 MHz and are excellent for pulse transformers; see for instance document D22, page 262, lines 3 to 13 which is introduced into the proceedings according to Article 114(1) EPC. For these reasons the Appellant cannot be followed in his opinion according to paragraph VII(b), and Claims 1 of claim sets B and E are regarded not to satisfy Art. 56 EPC.

An interpretation of Claims 1 of claim sets B and E on the basis of Article 69 EPC would lead to the subject-matter of Claims 1 of claim sets C and F.

2.7 Having regard to claim sets C and F the objective problem defined in paragraph 2.3 above is solved in the identical

way as indicated with regard to claim sets A and D in paragraph 2.4 above, i.e. by a loose coupled transformer such as disclosed in document D5 and by specifying additionally that such transformer shall be

"an E-core transformer, which has primary and secondary windings disposed on opposite ends of the centre leg."

Continuing the reasoning in paragraph 2.4 above, the remaining issue of an inventive step underlying the subject-matter of the main claims of claim sets C and F reduces to the question whether it would be obvious to realise the generally disclosed transformer 3 document D5 with an E-core and the claimed winding arrangement on its centre leg.

In particular, in view of the Appellant's arguments according to paragraph VII the Board introduces late-filed document D22 into the proceedings as relevant for the decision to be taken. Document D22 discloses an E-core transformer particularly designed for use in the high frequency range (page 262, line 12). Moreover, a skilled person derives from D22, page 262, paragraph 4, that the leakage inductance is a function of the volume of the air between the windings, each having in the side by side arrangement the shape of a flat disk as also schematically indicated in Fig. 9-10(b) on page 263. In the Board's view, on the basis of such guidance a skilled person is able to dispose the primary and secondary windings "on opposite ends of the centre leg" in such a way that the E-core transformer according to Fig. 9-10(b) is able to exercise the functions of transformer 3 disclosed in document D5.

For these reasons, document D5 provides a hint to a skilled person to replace choke Tr in the ballast

disclosed in document D4 by the E-core transformer disclosed in document D22. Therefore, Claims 1 of claim sets C and F are considered to lack an inventive step within the meaning of Article 56 EPC.

3. Inventive step of Claim 1 of claim set G and H

3.1 Claim 1 of claim set G comprises the subject-matter of granted claims 1, 3 and 4 and corresponds to the third (and last) auxiliary request before the Opposition Division.

3.2 From the nearest prior art disclosed in document D4 it is known in the wording of Claims 1 of claim sets G and H

"A high frequency ballast for gas discharge lamps comprising a controlled oscillator (7,8,5 in Fig. 5) providing two high frequency outputs which are variable in frequency under at least one control input (7,8) to said oscillator (5), whereby a dimming control can be achieved (see paragraph 2.4 for details), said outputs inputting to driver means (3 in Fig. 5, P<sub>1</sub> in Fig. 4) which, in turn, provides an input to an inverter (2 in Fig. 4), the output of said inverter being a source to a choke (Tr in Fig. 2) which enables the inverter to directly drive a gas discharge lamp (L in Fig. 2), said controlled oscillator and driver means being adapted to be supplied from a low DC voltage source (+15V in Fig. 5) and said inverter being adapted to be supplied from a high DC voltage source (+300V in Fig. 4), said driver means comprising a push-pull transistor circuit (TD1, TD2 in Fig. 5) which is transformer (TR1 in Figures 5 and 4) coupled to said inverter."

3.3 The fact that the oscillator outputs are "complementary" results from an obvious filling of a gap in the

information of document D4. The alternative use of a transformer instead of a choke for enabling the inverter to directly drive a gas discharge lamp represents an obvious exchange of known equivalents; see paragraph 2.6 above for details. Thus, the objective problem underlying Claims 1 of claims sets G and H reduces to protecting the conventional ballast against damage from simultaneously conducting push-pull transistors at mains voltage drops; see the description of the patent under appeal, column 3, lines 20 to 23. In the Board's view, a skilled person is able to recognise that such "power down" events lead to simultaneously conducting push and pull transistors of the conventional driver circuit. Hence, the formulation of the objective problem is obvious to a skilled person.

3.4 Solving this problem in that - according to the remaining wording of Claim 1 of claim set G -

the driver means "is controlled by a safe-guard circuit, characterised in that said safe-guard circuit deactivates the push-pull transistor circuit when the mains voltage drops below a predetermined level due to line voltage variation or power up and power down of said ballast"

in the Board's view has to be regarded as the obvious result of a skilled person's logical thinking within his normal routine activities. Moreover, the claimed general principle of a deactivation of a failing component in the driver-inverter circuit for a gas discharge lamp is known from document D1, in particular column 11, lines 37 to 45; see also paragraph IX(d) above.

For these reasons, the subject-matter of Claim 1 of claim set G lacks an inventive step within the meaning of Article 56 EPC.



3.5 The objective problem defined in paragraph 3.3 above is solved - according to the wording of Claim 1 of claim set H - in addition to the solution in Claim 1 of claim set G, in that:

the safeguard circuit "comprises a low voltage sensor coupled via a transistor to the emitters of said push-pull transistors and to the ground of the low voltage rail".

The use of such means in a fail-safe system is nowhere mentioned in any one of the cited documents and, in the Board's view, involves an inventive step. It is to be noted that neither Respondent raised the objection of lack of inventive step and submitted any arguments in support of such an objection in respect of the particular solution claimed in Claim 1 of claim set H.

3.6 For the reasons stated above, in the Board's judgment the subject-matter of Claim 1 of claim set H involves an inventive step within the meaning of Article 56 EPC.

4. Hence, it follows that Claim 1 of claim set H is allowable. Dependent Claims 2 to 4 of claim set H concern particular embodiments of the apparatus according to Claim 1 and are likewise allowable.

Order

For these reasons, it is decided that:

1. The decision of the Opposition Division is set aside.
2. The case is remitted to the first instance with an order to maintain the patent on the basis of claim set H filed on 21 January 1993 and corresponding amendment to column 2, line 6 and following, filed during the oral proceedings.

The Registrar:



M. Beer

The Chairman:



G.D. Paterson

