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(54) Luminaire ballast

(57) The invention relates to a luminaire ballast [10] comprising a connector [1] presenting four studs [21,22,23,24] to plug a fluorescent lamp [11] comprising two filaments [F1, F2], said connector [1]being linked, through at least a ballast inductor [Lbal], to supply means [3] dedicated to provide a current feedback allowing power control by varying switching frequency during lamp burning in order to perform a dimming function for said fluorescent lamp [11]. According to the invention, said ballast [10] is such that the two studs [21,22 or 23,24] dedicated to be connected to a same filament [F1 or F2] are connected to a same electrical point [P1 or P2], one of the both studs [21,22 or 23,24] being further provided with a supplementary inductor [L1 or L2] dedicated to be in serial between said electrical point [P1 or P2] and the corresponding filament [F1 or F2] of said fluorescent lamp [11] when said lamp [11] is plugged on the studs [21,22,23,24].

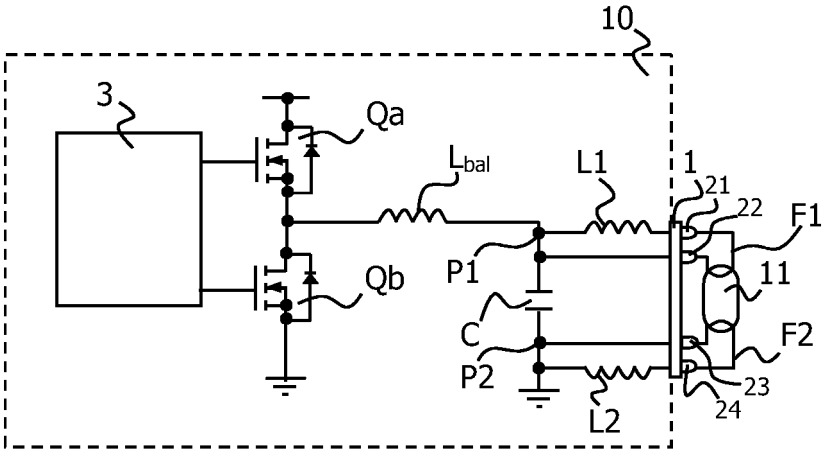

FIG.1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the field of ballasts for circuits powering fluorescent lamp.

[0002] The invention applies particularly to such ballast implementing current feedback allowing power control by varying switching frequency during lamp burning in order to perform a dimming function for said fluorescent lamp.

BACKGROUND OF THE INVENTION

[0003] Ballasts are optionally implemented using analog components like capacitors and resistors or using digital controllers.

[0004] Ballasts having a dimming function often implement digital and analog components.

[0005] Generally, ballasts enable the fluorescent lamp to be preheated before lightning.

[0006] Such preheating is managed by taking into account the characteristics of the lamp, said analog and digital components being calculated in function.

[0007] Nevertheless, known ballasts do not enable to protect the lamp from blackening during utilization.

[0008] Furthermore, when a microcontroller is used, known ballasts are generally able to protect said microcontroller in case of failing of the fluorescent lamp (filament breakage etc.)

OBJECTS AND SUMMARY OF THE INVENTION

[0009] An object of the invention is to prevent blackening of the fluorescent lamp by providing the ballast of the invention with a specific combination of components.

[0010] To this end, the invention provides a luminaire ballast comprising a connector presenting four studs to plug a fluorescent lamp comprising two filaments, said connector being linked, through at least a ballast inductor, to supply means dedicated to provide a current feedback allowing power control by varying switching frequency during lamp burning in order to perform a dimming function for said fluorescent lamp, said ballast being characterized in that the two studs dedicated to be connected to a same filament are connected to a same electrical point, one of the both studs being further provided with a supplementary inductor dedicated to be in serial between said electrical point and the corresponding filament of said fluorescent lamp when said lamp is plugged on the studs.

[0011] With such a configuration for the studs, in case of failing of the fluorescent lamp like a filament breakage, the supply is provided to the ballast inductor but also to the supplementary inductor connected to the other filament.

[0012] Therefore, the supply means, for example implementing a microcontroller, have a normal functioning without any risk of overheat.

[0013] In fact, the invention proposes a derivation circuit in case of failure of fluorescent lamp.

[0014] Furthermore such a derivation is provided on each filament assuring a protection for the both.

[0015] Moreover, the presence of said supplementary inductors enables to have a supplementary parameter to adjust the preheating characteristics.

[0016] Thus, enhanced preheating would be realized thanks to the invention by choosing adapted supplementary inductor values.

[0017] According to an advantageous characteristic, the two electrical points are connected to each other through a capacitor.

[0018] This configuration enables to assure an optimal derivation circuit when the fluorescent lamp fails.

[0019] Indeed, with this characteristic, the supply means are looped on inductors and on the capacitor enabling to optimize the derivative behavior.

[0020] Advantageously, said two supplementary inductors share a same ferrite core.

[0021] This enables to damp the electrical energy by an electrical converter effect.

[0022] Even more advantageously, said ferrite core is also common with the ballast inductor.

[0023] This enables to enhance and extend the converter effect and to realize a simplified embodiment of the invention where a single ferrite core is needed.

[0024] According to a specific feature, the electrical point that is connected to the positive output of supply means is also connected to an overload pin of said supply means.

[0025] This feature enables to additionally drain a excess of energy in the case where the derivative circuit of the invention is revealed not to be sufficient to drain the totality of the energy.

[0026] Such a feature is particularly used when a breakage occurs when full power is supplied to said fluorescent lamp.

[0027] In an embodiment, said supply means are a specific integrated circuit.

[0028] The use of an integrated circuit in particularly useful to manage the convert between a potentiometer and a variable frequency.

[0029] Furthermore it enables to manage the preheating characteristics and other features of a luminaire of the invention.

[0030] Precisely, the invention also concerns a luminaire comprising a luminaire ballast according to the invention, supply means dedicated to provide a current feedback allowing power control by varying switching frequency during lamp burning in order to perform a dimming function for said fluorescent lamp and a power factor correction stage.

[0031] According to an advantageous characteristic, said power factor correction stage and at least part of said supply means being deported in a control device connected by wire to said ballast, said luminaire further

comprises an electromagnetic compatibility module adapted in relation with characteristics of said wire.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] Other aspects and advantages of the present invention appear more clearly on reading the following description of particular embodiments, which description is given purely by way of non-limiting example and is made with reference to the accompanying drawings, in which :

- Figure 1 shows an embodiment of a luminaire ballast in accordance with the invention ;
- Figure 2 shows a specific embodiment of a digital luminaire ballast in accordance with the invention ;
- Figure 3 shows an advantageous implementation of the invention further comprising a power factor corrector module, a rectifier, electromagnetic filters, protection fuse and a lightning arrester.

MORE DETAILED DESCRIPTION

[0033] Figure 1 shows an embodiment of a lamp-control circuit as implemented in a ballast 10 according to the invention.

[0034] Said ballast 10 is intended to control the functioning of a dimmable fluorescent lamp 11 connected to a connector 1 provided on said ballast 10 and presenting at least four studs 21, 22, 23, 24.

[0035] Said fluorescent lamp 11 comprises two filaments F1 and F2 each being connected by their two extremities to two of said studs, respectively 21, 22 and 23,24.

[0036] The two studs 21, 22 or 23, 24 dedicated to be connected to a same filament F1 or F2 are connected to a same electrical point P1 or P2.

[0037] One of the both studs 21, 22 or 23, 24 is further provided with a supplementary inductor L1 or L2 dedicated to be in serial between said electrical point P1 or P2 and the corresponding filament F1 or F2 of said fluorescent lamp 11 when said lamp 11 is plugged on the studs 21, 22, 23, 24.

[0038] According to an additional characteristic of the invention said two points P1 and P2 are connected through a capacitor C.

[0039] Said ballast 10 further comprises supply means 3 and transistors Qa and Qb dedicated to provide a current feedback allowing power control by varying switching frequency during lamp burning in order to perform a dimming function for said fluorescent lamp 11.

[0040] Transistors Qa and Qb are driven by driver signals output from supply means 3. They consequently deliver an output voltage.

[0041] Current resulting from said transistors Qa and Qb functioning flows through a ballast inductor Lbal.

[0042] According to the invention, it further flows through inductors L1, L2 and capacitor C that constitute a resonant circuit.

[0043] Said dimmable fluorescent lamp 11 is part of this resonant circuit.

[0044] If ever one of the two filaments is damaged, said resonant circuit is able to absorb and to derive the electrical energy provided by said supply means 3 and transistors Qa and Qb without creating any damage to said supply means 3 or to transistors Qa and Qb.

[0045] Figure 2 shows a particularly interesting embodiment wherein said supply means are constituted by a microcontroller 30 especially programmed to manage the dimming of a lamp 11 connected to connector 1 by varying switching frequency.

[0046] Said microcontroller 30 has among others a pin LVG (for "Low Side Driver Output") dedicated to be connected to the low side power MOSFET transistor Qb gate of the half bridge.

[0047] It has also a pin HPV (for "High Side Driver Output") dedicated to be connected to the high side power MOSFET transistor Qa gate of the half bridge.

[0048] It further comprises a High Side Driver Floating Reference OUT that must be connected close to the source of the high side power transistor.

[0049] Said microcontroller 30 also comprises a pin EN1 (for enable 1) dedicated to force the microcontroller in a latched shutdown state.

[0050] Said microcontroller thus functions as in the under voltage conditions.

[0051] It is designed for strong fault like lamp disconnection or lamp failure.

[0052] Said pin EN1 is connect to the lamp connector 1 through at least a diode D1 and a resistor R4.

[0053] A circuit R5,C5 is advantageously placed at the entrance of pin EN1 in order to amortize the peaks (damping phenomenon).

[0054] Resistors R1, R2 and R3 are participating in the resonant circuit with Lbal, L1, L2, C1 and Cbal by looping the circuit in order not to damage said microcontroller 30 in case of overload.

[0055] Said inductors Lbal, L1 and L2 are advantageously implemented on the same ferrite core in order to assure a synchronized functioning.

[0056] Figure 3 is detailing a complete circuit for a luminaire constructed with a ballast 10 of the invention.

[0057] Said circuit further comprises a power factor corrector module 12 connected to supply means 3.

[0058] Said supply means are further connected to a variation device 13 able to communicate a variable signal to supply means 3.

[0059] Said variable signal is such that said supply means 3 modify the switching frequency provided to said fluorescent lamp 11.

[0060] The power factor correction module 12 is classically connected to a diode bridge 14.

[0061] According to an advantageous characteristic of the invention, said diode bridge is further connected to an electromagnetic compatibility (EMC) device 15.

[0062] Said EMC device comprises several stages

adapted in function of the electromagnetic characteristic of the different wires used to connect the different part of the luminaire.

[0063] If, for example said variation device 13 is implemented in a box intended to be activated by the foot of a user, the wire between the different parts of the luminaire can behave like an antenna and provoke interferences in the luminaire (scintillation effect) or with external devices (TV set, radio...).

[0064] This is the role of the electromagnetic compatibility device 15 to avoid such damageable interferences.

[0065] The presented EMC device 15 is adapted for such a context and is constituted of three low-band pass filters.

[0066] It further advantageously comprises a fusible F and is directly connected to the socket-outlet 16 of the luminaire.

[0067] A lightning arrester LA is advantageously implemented for protection peak voltage electrical.

[0068] The role of such a known device inserted in a power line is to protect equipment from sudden fluctuations in current or voltage, for example during big storms. Indeed, such fluctuations are damageable for the components.

Claims

1. A luminaire ballast [10] comprising a connector [1] presenting four studs [21, 22, 23, 24] to plug a fluorescent lamp [11] comprising two filaments [F1, F2], said connector [1] being linked, through at least a ballast inductor [Lbal], to supply means [3] dedicated to provide a current feedback allowing power control by varying switching frequency during lamp burning in order to perform a dimming function for said fluorescent lamp [11], said ballast [10] being **characterized in that** the two studs [21,22 or 23,24] dedicated to be connected to a same filament [F1 or F2] are connected to a same electrical point [P1 or P2], one of the both studs [21, 22 or 23, 24] being further provided with a supplementary inductor [L1 or L2] dedicated to be in serial between said electrical point [P1 or P2] and the corresponding filament [F1 or F2] of said fluorescent lamp [11] when said lamp [11] is plugged on the studs [21, 22, 23, 24].

2. A luminaire ballast [10] according to claim 1, wherein the two electrical points [P1, P2] are connected to each other through a capacitor [C].

3. A luminaire ballast [10] according to claim 1, wherein said two supplementary inductors [L1, L2] share a same ferrite core.

4. A luminaire ballast [10] according to claim 4, wherein said ferrite core is also common with the ballast inductor [Lbal].

5. A luminaire ballast [10] according to claim 1, wherein the electrical point [P1] that is connected to the positive output [OUT] of supply means [30] is also connected to an overload pin [EN1] of said supply means [30].

6. A luminaire ballast according to claim 1, wherein said supply means [3] are a specific integrated circuit [30].

7. A luminaire comprising a luminaire ballast [10] according to claims 1 to 6, supply means [3,30] dedicated to provide a current feedback allowing power control by varying switching frequency during lamp burning in order to perform a dimming function for said fluorescent lamp [11], a power factor correction stage.

8. A luminaire according to claim 7, said power factor correction stage and at least part of said supply means [3] being deported in a control device [13] connected by wire to said ballast [10], said luminaire further comprises an electromagnetic compatibility module [15] adapted in relation with characteristics of said wire.

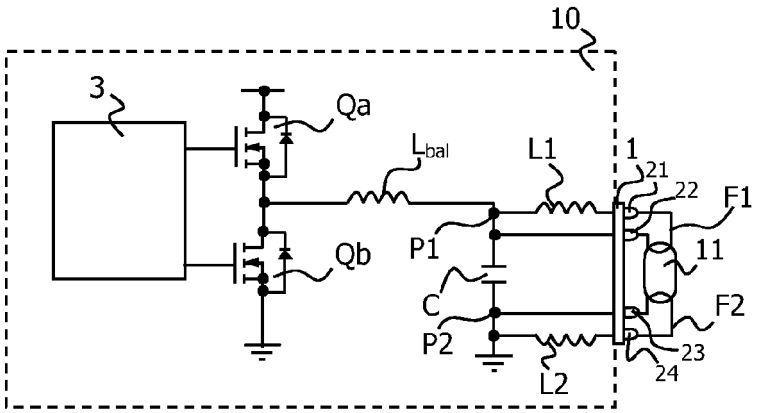

FIG.1

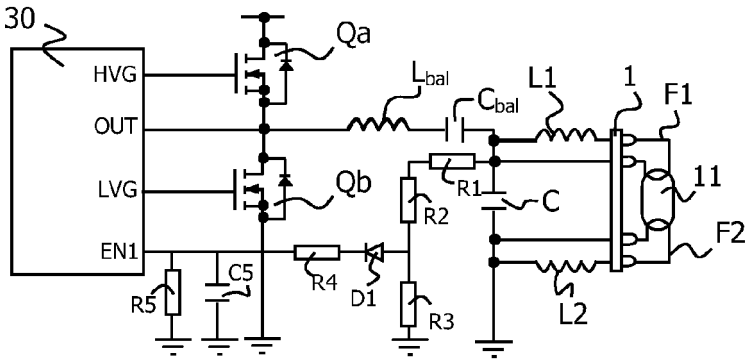

FIG.2

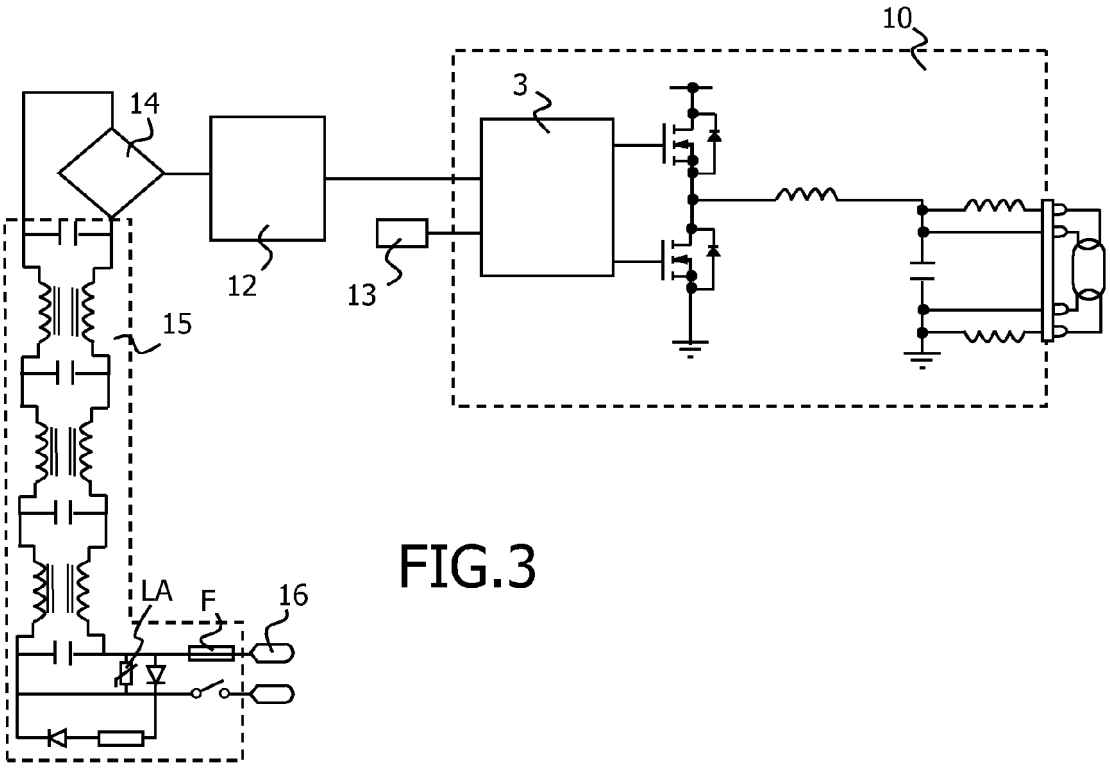

FIG.3

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EUROPEAN SEARCH REPORT

Application Number
EP 07 30 0882

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 5 969 483 A (LI EDWARD [US] ET AL) 19 October 1999 (1999-10-19) * column 10, line 40 - line 44; figure 3 * -----	1-8	INV. H05B41/298 H05B41/392
Y	US 6 232 727 B1 (CHEE ALLAND [US] ET AL) 15 May 2001 (2001-05-15) * claim 1; figure 2 * -----	1-8	ADD. H05B41/282
A	EP 1 675 442 A (OSRAM SYLVANIA INC [US]) 28 June 2006 (2006-06-28) * abstract; figure 2 * -----	1-8	

TECHNICAL FIELDS SEARCHED (IPC)

H05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 July 2007	Boudet, Joachim

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 30 0882

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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27-07-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5969483 A	19-10-1999	NONE	
US 6232727 B1	15-05-2001	NONE	
EP 1675442 A	28-06-2006	CA 2512449 A1	27-06-2006
		US 2006138968 A1	29-06-2006

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82