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- (71) **Applicant (for all designated States except US):** **OSRAM AG** [DE/DE]; Hellabrunner Str. 1, 81543 München (DE).
- (71) **Applicant (for IT only):** **OSRAM S.P.A. - SOCIETA' RI-UNITE OSRAM EDISON CLERICI** [IT/IT]; Viale dell'Innovazione, n.3, I-20126 Milano (IT).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** **DE VILLAGOMEZ, Giancarlo** [IT/IT]; Vicolo Leopardi, 31, I-31038 Paese (Treviso) (IT). **AUGUSTO, Alessandro** [IT/IT]; Via Fratelli de Filippo, 1, I-70012 Bari (IT). **CAVICCHIA, Andrea** [IT/IT]; Via Martini, 4, I-70010 Valenzano (IT).
- (74) **Common Representative:** **OSRAM AG**; Intellectual Property IP, Postfach 22 13 17, 80503 München (DE).
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(54) **Title:** ILLUMINATION SYSTEM, RELATIVE COMPACT FLUORESCENT LAMP AND RELATIVE REPLACEMENT METHOD

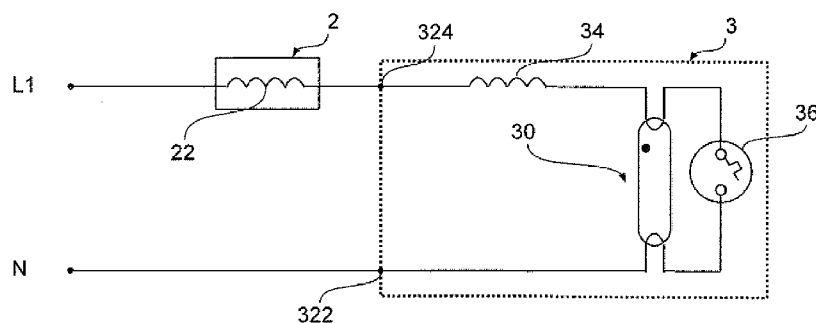


Fig. 4

(57) **Abstract:** An illumination system comprising a connector comprising two contacts (122, 124; 322, 324) for connection to a lamp (1; 3), a lamp (1; 3), and a conventional ballast (2) arranged between a power supply network (L1, N) and the connector, wherein the conventional ballast (2) comprises a reactor (22) connected in series with the lamp (1; 3), wherein the reactor (22) is configured for powering a high-pressure discharge lamp (1). In particular, the lamp is a compact fluorescent lamp (3) comprising : a connection part comprising a first (322) and a second (324) contact for connection to the connector, a discharge tube (302) comprising a first (304b) and a second (304a) electrode, wherein the first electrode (304b) is connected to the first contact (322) of the connection part, a reactor (34) connected between the second electrode (304a) and the second contact (324) of the connection part, and a starter (36) connected between the first (304b) and the second (304a) electrode. The reactor (34) and the starter (36) of the compact fluorescent lamp (3) are configured so that the compact fluorescent lamp (3) may be used with the conventional ballast (2).

Description

Illumination system, relative compact fluorescent lamp and relative replacement method

5

Technical field

The present description relates to illumination systems.

10 The present description is particularly concerned with the possible use thereof for replacing high-pressure discharge lamps.

Technical background

15

Illumination systems which comprise at least one light source, for example a discharge lamp, are known. In general, a discharge lamp is a type of bulb which is based on the emission of electromagnetic radiation by an ionized-gas plasma, that is the ionization of the gas is obtained by means of electric discharge through the gas itself.

By way of example, in applications for street lighting, or for lighting stadia, use is often made of high-pressure mercury vapor lamps. In particular, as the pressure increases the light emitted by such lamps is shown as white/blue light.

Figure 1 shows a typical embodiment of a lamp 1 having an outer glass bulb with a substantially elliptical form.

30

In the example under consideration, the lamp 1 comprises a connector 12, for example an Edison E27 connection part, comprising two contacts 122 and 124 for connection to a power supply.

35

A high-pressure mercury vapor lamp 10 is arranged within the lamp 1. In the example under consideration, the lamp 10 com-

prises a discharge tube 102 and four contacts 104a, 104b, 106a and 106b.

In the example under consideration, the contacts 104a and 104b are used as electrodes for the main discharge, and the contact 106b is used as the ignition electrode. To that end, for example, the electrodes 104a and 106a can be connected to the first contact 122 of the connector 12, and the contact 104b can be connected to the second contact 124 of the connector 12. Finally, the contact 106b can be connected to the first contact 122 of the connector 12 by way of an auxiliary resistor 14.

Consequently, when the lamp is cold, the ignition gas is generally ionized to a small degree and the pressure within the discharge tube 102 is low. To ignite the discharge, use is therefore made of the auxiliary electrode 106b, that is an electrode which has a gap smaller than the gap between the electrodes 104a and 104b for the main discharge. Indeed, the resistor 14 ensures that, in ignition phases, the discharge takes place between the main electrode 104b and the auxiliary electrode 106b, whereas in operation under normal operating conditions it takes place mainly between the two main electrodes 104a and 104b.

A person skilled in the art will appreciate that lamps of the type shown in figure 1 are not connected directly to the electricity network, for example a 230 VAC voltage, but instead it is necessary for there to be an external ballast for limiting the current which passes through the lamp 1.

In this context, figure 2 shows an embodiment in which use is made of a conventional ballast 2, that is a reactor 22. In particular, this reactor 22 is an inductive passive electromagnetic component. By way of example, the contact 124 of the lamp shown in figure 1 may be connected by means of the reactor to the live wire L1 of the power supply network, whereas the contact 122 may be connected directed to the neutral wire

N. By way of example, at a mains voltage of 230 V and 50 Hz, a 125 W commercial reactor used in common practice typically has a supplied current of between 1.10 A and 1.30 A and a power factor of between 0.50 and 0.53. An 80 W reactor, however, typically has a supplied current of between 0.75 A and 0.95 A and a power factor of between 0.50 and 0.53.

However, owing precisely to the increased presence of mercury, high-pressure mercury lamps will soon no longer be seen in Europe.

One possible solution to this problem is the direct replacement of these lamps, for example with high-pressure sodium vapor lamps made for direct replacement, that is there is no need to modify the installation of the remaining illumination system, for example the connectors and the ballasts.

Object and summary

The inventors have realized that replacement with sodium vapor lamps often does not achieve satisfactory results. Indeed, these lamps do not have an optimum chromatic yield, and they require a cooling cycle of 3-5 minutes before being ignited again.

It is an object of the invention to overcome the disadvantages outlined above.

Specifically, the inventors have realized that it is surprisingly possible to modify a compact fluorescent lamp, that is a low-pressure discharge lamp, so that it can be used in an illumination system intended for use with high-pressure lamps, for example high-pressure mercury vapor lamps.

According to the invention, this object is achieved by an illumination system having the features mentioned in the claims which follow. The invention also relates to a relative compact fluorescent lamp and to a relative replacement method.

The claims form an integral part of the technical teaching provided here in relation to the invention.

5 In various embodiments, a high-pressure discharge lamp is therefore replaced with a compact fluorescent lamp.

In various embodiments, the compact fluorescent lamp comprises a connection part which is compatible with the connection part of the original high-pressure discharge lamp. In
10 general, this connection part comprises two contacts.

In various embodiments, the compact fluorescent lamp also comprises a discharge tube comprising a first and a second electrode, wherein the first electrode is connected to one of
15 the contacts of the connection part.

In various embodiments, the second electrode is connected to the other contact of the connection part by way of a reactor, that is the reactor is connected between the second electrode
20 and the other contact of the connection part.

In various embodiments, the compact fluorescent lamp also comprises a starter connected in parallel with the electrodes.
25

In various embodiments, the reactor and the starter of the compact fluorescent lamp are configured so that the compact fluorescent lamp may be used with a conventional ballast intended for use with high-pressure discharge lamps, that is
30 the reactor and the starter are configured to compensate for the presence of the conventional ballast which is external to the compact fluorescent lamp.

Brief description of the figures

35

The invention will now be described, purely by way of non-limiting example, with reference to the accompanying figures, in which:

- figures 1 and 2 have already been described above;
- figure 3 shows a compact fluorescent lamp according to the present solution; and
- 5 - figure 4 shows an illumination system in which use is made of the lamp shown in figure 3.

Detailed description

10 In the following description, various specific details aimed at providing a fuller understanding of the embodiments are explained. The embodiments may be implemented without one or more of the specific details or using other methods, components, materials, etc. In other cases, known structures, materials or operations are not shown or described in detail so
15 that various aspects of the embodiments may be understood more clearly.

The reference to "an embodiment" in the context of this description indicates that a particular configuration, structure or feature described in relation to the embodiment is included in at least one embodiment. Therefore, phrases such as "in one embodiment", which may occur at various points in this description, do not necessarily refer to the same embodiment. Moreover, particular forms, structures or features
20 25 may be combined in any suitable manner in one or more embodiments.

The reference signs used here are provided solely for the sake of convenience and therefore do not define the scope of protection or ambit of the embodiments.
30

As mentioned above, the inventors have realized that it is possible to also use compact fluorescent lamps (CFL) in the illumination system shown in figure 2.
35

Figure 3 shows the structure of a conventional compact fluorescent lamp 3.

In the embodiment under consideration, the lamp 3 comprises a fluorescent lamp 30 made up of a glass tube 302, which may have a linear shape, a circular shape or various shapes.

5 Moreover, two electrodes 304a and 304b are present at the two ends of the tube.

In one embodiment, at first the inside of the tube 302 is evacuated, and then a noble gas is introduced, for example
10 argon, xenon, neon or krypton, at low pressure, that is the tube 302 contains a noble gas at low pressure. Typically, a small quantity of liquid mercury is also introduced, this evaporating in part when it mixes with the noble gas. A person skilled in the art will appreciate that the operation of
15 such a lamp is well known. By way of example, in a typical compact fluorescent lamp, the electrons moving between the two electrodes 304a and 304b excite the mercury atoms present in the gas, causing them to emit ultraviolet radiation.

20 In one embodiment, the lamp comprises a connector 32, for example an Edison E27 connection part, comprising two contacts 322 and 324 for connection to a power supply.

In one embodiment, the internal surface of the tube 302 is
25 coated with a fluorescent material. The fluorescent material which is used to coat the tube and which is subject to the radiation generated by the mercury in turn emits visible light.

30 In one embodiment, the lamp 3 also comprises a starter 36 for igniting the lamp 30 and a reactor 34 for current limitation.

In one embodiment, the reactor, for example an inductor, is connected in series with the lamp, that is with one of the
35 electrodes of the lamp. By way of example, in the embodiment under consideration, the reactor is connected in series with the electrode 304a.

The starter 36, on the other hand, is responsible for ignition of the lamp. By way of example, the starter 36 is typically connected in parallel with the lamp, that is between the electrodes 304a and 304b, so that the electrodes of the lamp are heated up, for example up to a temperature of about 1200 - 1300 K, thereby initiating the gas ionization process. This thus brings about the discharge, which then allows for the complete ionization of the gas and the normal operation of the lamp.

In one embodiment, the starter 36 is a switch in which the moving contact is formed by a bimetallic strip which deforms when it is heated up. A person skilled in the art will appreciate that the operation of such a starter is well known in the context of fluorescent lamps. In particular, the starter together with the reactor 34 can create an overvoltage so as to cause the discharge and consequent ionization of the gas of the lamp, with the latter being ignited.

Figure 4 shows a possible embodiment of an illumination system according to the present description.

In the embodiment under consideration, the system corresponds substantially to the system shown in figure 2, that is a system intended for use with a high-pressure mercury vapor lamp. The only difference is that, instead of the high-pressure mercury vapor lamp 1, use is made of a compact fluorescent lamp 3, that is a low-pressure discharge lamp.

As a result, the electrical connection, the external components, in particular the conventional ballast 2, that is the reactor 22, and the mechanical connector for connection to the lamp, for example a support for an Edison E27 connection part, remain unchanged.

In particular, the inventors have realized that a compact fluorescent lamp may be used in the illumination system shown in figure 2 by modifying the parameters of the reactor 34 and

of the starter 36 so that the lamp compensates for the presence of the conventional external ballast 2. Specifically, the inventors have realized that these modifications are necessary because, compared with fluorescent lamps, the voltage across the terminals of the high-pressure lamp, that is between the contacts 124 and 122, is lower (50...200 V), whereas the current may be significantly higher (typically 1...10 A). By way of example, the starter has to be suitably calibrated to obtain faster and more decisive ignition.

By way of example, in one embodiment use is made of a lamp comprising three or four glass tubes 302 with a diameter T5, that is 16 mm, connected in series.

In one embodiment, the closure voltage of the starter 36, that is the voltage at which the bimetallic contact of the starter closes, is at most 198 V.

In one embodiment, the non-reclosure voltage, that is the voltage below which the bimetallic contact no longer closes, is at least 140 V.

In one embodiment, the pulse or surge voltage, that is the minimum voltage which is generated together with the reactor for ignition of the lamp, is at least 800 V.

In one embodiment, the impedance of the additional reactor 34 is between 10 and 80 mH. As a result, the overall value of the impedance of the external reactor 22 and of the additional reactor 34 is between 500 and 900 mH.

In one embodiment, the power factor of the additional reactor is 0.1.

In one embodiment, the admissible current of the additional reactor is between 0.6 and 1.2 A, preferably between 0.8 and 1.2 A.

By way of example, in one embodiment use is made of the following components for a 125 W compact fluorescent lamp:

- a discharge tube 302 comprising 4 glass tubes 302 with a diameter T5 connected in series;
- 5 - a reactor connected in series with the discharge tube 302 having an impedance of about 20 mH, a power factor of 0.1 and an admissible current of 1.2 A; and
- a starter with a closure voltage of at most 198 V, a non-reclosure voltage of at least 140 V and a pulse
10 voltage of at least 900 V.

The inventors have realized that this lamp has about 5500 lm when it is used in the illumination system shown in figure 2.

- 15 A person skilled in the art will appreciate that the solution described here may also be used for other compact fluorescent lamps. By way of example, for 50 W lamps it is possible to use a reactor which limits the current to about 0.6 A, whereas for 80 W lamps the current should be about 0.8 A.

20

- In one embodiment, the solution described here may also envisage modifications to the filling gas, varying the percentages of argon between 100% and 20% and using other gases, such as neon or krypton, for adapting the electrical parameters of the lamp (lamp voltage and current) to the requirements.
25

- In one embodiment, the tube 302 of the lamp 3 also comprises amalgam. By way of example, in this respect it is possible to
30 use an alloy of metals such as In, Bi, Pb, Sn, Cu and Ag, with or without Hg, depending on the requirements. By way of example, the inventors have realized that it is possible to use amalgam InAg4 to improve the operation of a 60 W lamp 3, which may be used as a replacement for an 80 W mercury vapor
35 lamp. By way of example, this amalgam makes it possible to achieve a stable luminous flux which is greater than 90% of the maximum flux in a temperature range of between 5°C and 70°C.

In one embodiment, in order to achieve a faster luminous start-up of the lamp, it is possible to additionally also use the start-up amalgam, in the form of a sphere or a flag,
5 which is composed of In.

The solution described here has numerous advantages over replacement with high-pressure sodium vapor lamps, such as:

- the same brightness can be achieved with a lower power
10 consumption (a reduction of about 35%);
- the compact fluorescent lamps comprise fewer toxic substances;
- the chromatic yield is better; and
- the ignition times and the re-ignition times are
15 shorter.

Obviously, without affecting the principle of the invention, the constructional details and embodiments may vary, also significantly, with respect to that illustrated here purely
20 by way of non-limiting example, without thereby departing from the scope of the invention as defined in the accompanying claims.

Claims

1. An illumination system comprising:

- a connector comprising two contacts (122, 124; 322, 324) for connection to a lamp (1; 3),
- a lamp (1; 3) connected to said connector, and
- a conventional ballast (2) arranged between a power supply network (L1, N) and said connector, wherein said conventional ballast (2) comprises a reactor (22) connected in series with said lamp (1; 3), said reactor (22) of said conventional ballast (2) being configured for powering a high-pressure discharge lamp (1),

characterized in that said lamp is a compact fluorescent lamp (3) comprising:

- a connection part comprising a first (322) and a second (324) contact for connection to said connector,
- a discharge tube (302) comprising a first (304b) and a second (304a) electrode, wherein said first electrode (304b) is connected to said first contact (322) of said connection part,
- a reactor (34) connected between said second electrode (304a) and said second contact (324) of said connection part, and
- a starter (36) connected between said first (304b) and said second (304a) electrode,

wherein said reactor (34) and said starter (36) of said compact fluorescent lamp (3) are configured so that said compact fluorescent lamp (3) may be used with said conventional ballast (2).

2. The system as claimed in claim 1, wherein said compact fluorescent lamp (3) comprises three or four discharge tubes (302) with a diameter T5 connected in series.

3. The system as claimed in claim 1 or claim 2, wherein the closure voltage of said starter (36) is at most 198 V.

4. The system as claimed in any of the preceding claims,
wherein the non-reclosure voltage of said starter (36)
is at least 140 V.

5

5. The system as claimed in any of the preceding claims,
wherein the pulse voltage of said starter (36) is at
least 800 V.

10 6. The system as claimed in any of the preceding claims,
wherein the impedance of said reactor (34) of said com-
pact fluorescent lamp (3) is between 10 and 80 mH.

15 7. The system as claimed in any of the preceding claims,
wherein the power factor of said reactor (34) of said
compact fluorescent lamp (3) is 0.1.

20 8. The system as claimed in any of the preceding claims,
wherein the admissible current of said reactor (34) of
said compact fluorescent lamp (3) is between 0.6 and 1.2
A, preferably between 0.8 and 1.2 A.

25 9. A compact fluorescent lamp (3) adapted to be used in the
illumination system as claimed in any of the preceding
claims, comprising:

- a connection part comprising a first (322) and a
second (324) contact,
- a discharge tube (302) comprising a first (304b)
and a second (304a) electrode, wherein said first
30 electrode (304b) is connected to said first contact
(322) of said connection part,
- a reactor (34) connected between said second elec-
trode (304a) and said second contact (324) of said
connection part, and
- 35 - a starter (36) connected between said first (304b)
and said second (304a) electrode,

wherein said reactor (34) and said starter (36) of said
compact fluorescent lamp (3) are configured so that said

compact fluorescent lamp (3) may be used with said conventional ballast (2) of said illumination system.

10. A method of replacing the lamp in an illumination system comprising:

- a connector comprising two contacts (122, 124; 322, 324) for connection to a high-pressure discharge lamp (1),
- a lamp (1; 3) connected to said connector, and
- a conventional ballast (2) arranged between a power supply network (L1, N) and said connector, wherein said conventional ballast (2) comprises a reactor (22) connected in series with said lamp (1; 3), said reactor (22) of said conventional ballast (2) being configured for powering a high-pressure discharge lamp (1),

characterized in that said method comprises the steps of:

a) providing a compact fluorescent lamp (3) comprising:

- a connection part comprising a first (322) and a second (324) contact for connection to said connector,
- a discharge tube (302) comprising a first (304b) and a second (304a) electrode, wherein said first electrode (304b) is connected to said first contact (322) of said connection part,
- a reactor (34) connected between said second electrode (304a) and said second contact (324) of said connection part, and
- a starter (36) connected between said first (304b) and said second (304a) electrode,

wherein said reactor (34) and said starter (36) of said compact fluorescent lamp (3) are configured so that said compact fluorescent lamp (3) may be used with said conventional ballast (2), and

b) replacing said lamp (1; 3) with said compact fluorescent lamp (3).

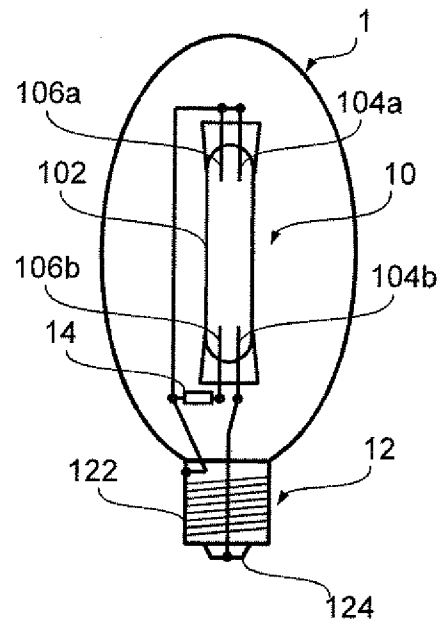


Fig. 1

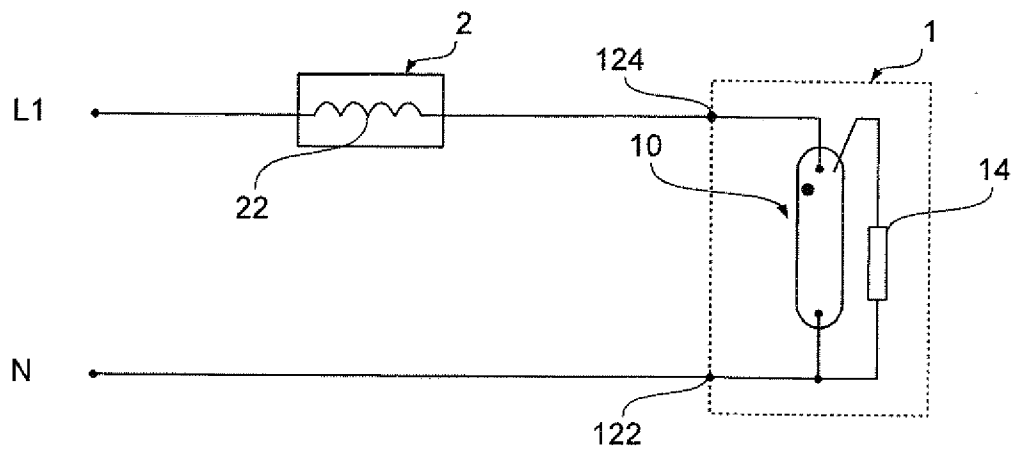


Fig. 2

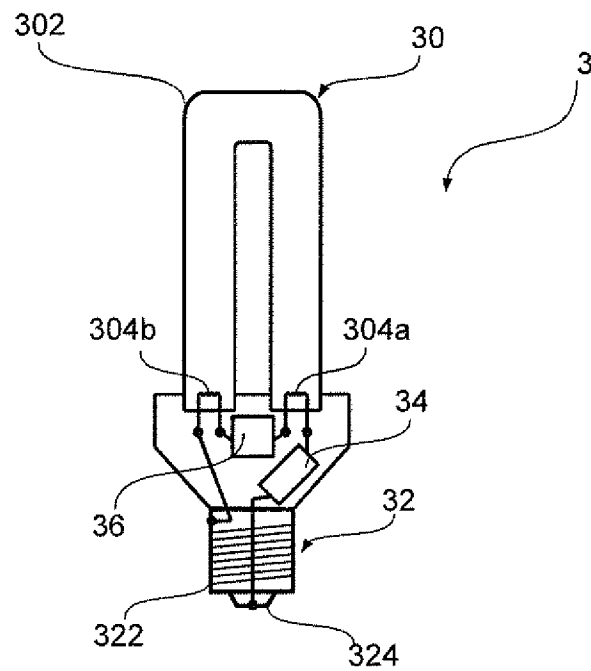


Fig. 3

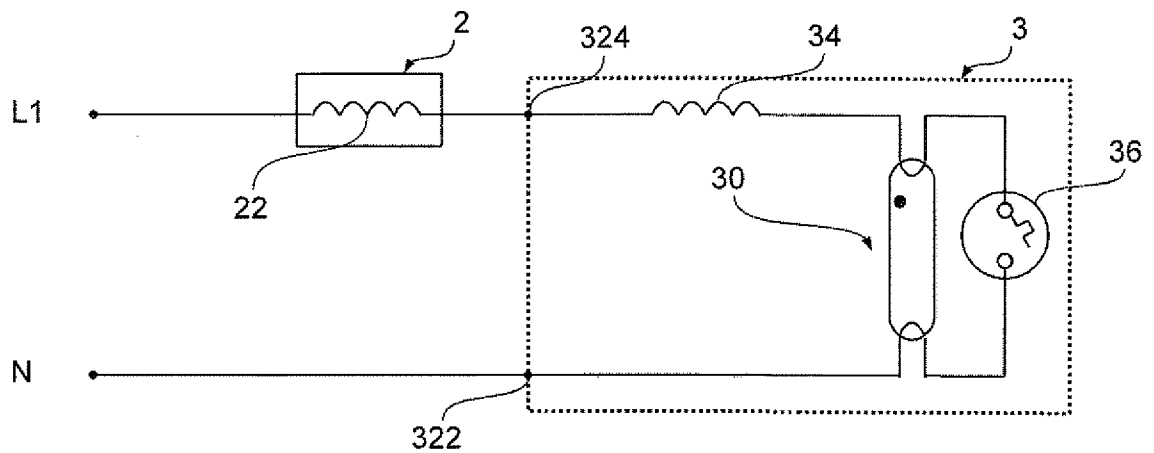


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/058145

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01J61/32 H01J61/56 H05B41/288
ADD.

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)
H01J H05B

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

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

EPO-Internal, COMPENDEX, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	----- CN 2 814 882 Y (HUANG TIANZAI [CN]) 6 September 2006 (2006-09-06) abstract page 1; figures	1,2,9,10
A	----- JP 2003 217506 A (MATSUSHITA ELECTRIC IND CO LTD) 31 July 2003 (2003-07-31) abstract paragraphs [0001] - [0005], [0010] - [0014], [0027], [0032], [0053], [0054]; figures 1-3 ----- -/--	1,2,9,10



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Schmidt-Kärst, S

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/058145

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DATABASE WPI Week 201133 Thomson Scientific, London, GB; AN 2011-E26617 XP002666215, -& CN 201 753 876 U (XIAMEN SUPERLITE LIGHTING CO LTD) 2 March 2011 (2011-03-02) abstract; figures -----	1,9,10
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2012/058145

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