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(54) **Fluorescent lamp**

(57) A lamp (1), comprising a fluorescent tube (7) which contains gas and a circuit to supply power and control the lamp (1), the fluorescent tube (7) comprising, at its ends, connections (11, 12, 21, 22), connected to

filaments (13, 23) inside the fluorescent tube (7), the lamp (1) further comprising a short circuit (10, 20) at the ends of the connections (11, 12, 21, 22) of the fluorescent tube (7).

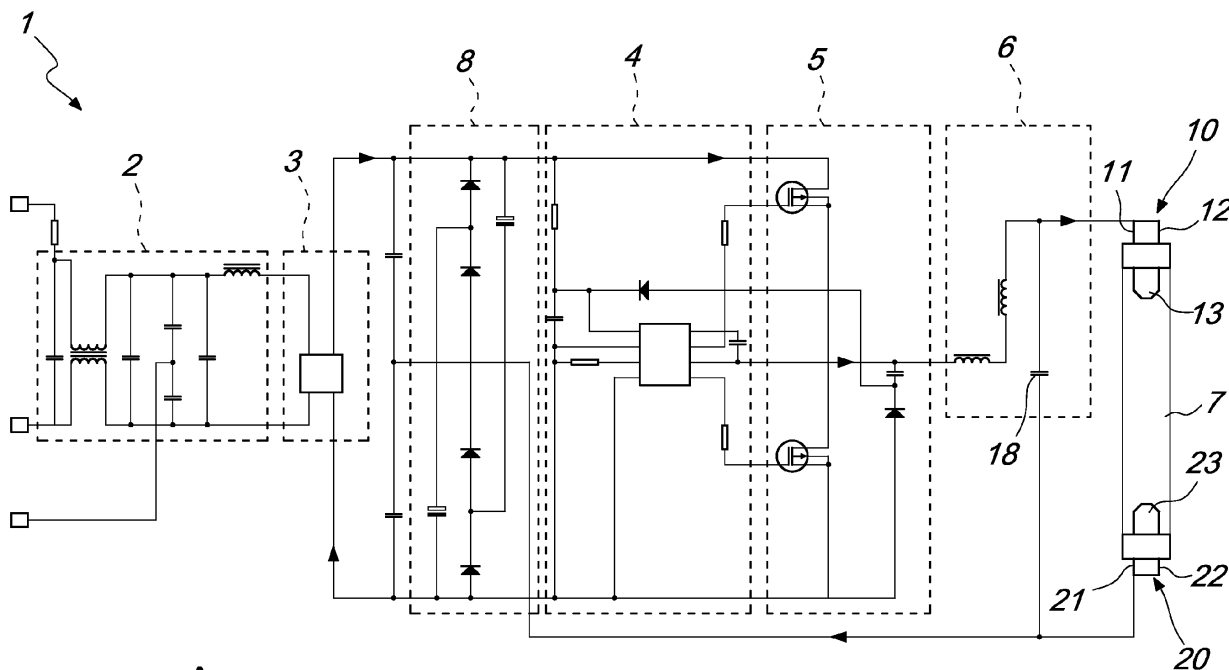


Fig. 2

Description

[0001] The present invention relates to a lamp.

[0002] With reference to fluorescent lamps, such lamps generally comprise a fluorescent tube, being tubular in shape and containing gas. Such lamps are provided with internal electrodes, or filaments, of a starter device, and of a reactor, more commonly known as a ballast, which is conveniently connected to the mains electricity supply.

[0003] The ballast is used, in conventional fluorescent lamps, to regulate the flow of current that arrives at the electrodes of the lamp, effectively regulating the emission of light that occurs in the gas inside the tube of the lamp.

[0004] Electronic ballasts for fluorescent lamps perform the function of generating alternating current at high frequency, regulating the flow thereof through the lamp.

[0005] Such conventional fluorescent lamps are not devoid of drawbacks among which is the fact that they reach excessively high temperatures.

[0006] Another drawback of such conventional lamps and in particular of conventional ballasts consists in that they do not contribute to limiting the consumption of energy of the fluorescent lamp and to extending their average lifetime.

[0007] The aim of the present invention is to provide a lamp that solves the above mentioned technical problem, compensates for the drawbacks and overcomes the limitations of the known art by making it possible to reduce the operating temperatures, thus reducing consumption and increasing the average lifetime.

[0008] Another object of the invention is to provide a lamp that is capable of offering the widest guarantees of reliability and safety in use.

[0009] Another object of the invention is to provide a lamp that is easy to implement and economically competitive when compared to the known art.

[0010] This aim and these and other objects, which will become better apparent hereinafter, are achieved by a lamp, comprising a fluorescent tube which contains gas and a circuit to supply power and control said lamp, said fluorescent tube comprising connections at its ends, said connections being connected to filaments inside said fluorescent tube, characterized in that it comprises a short circuit at the ends of said connections of said fluorescent tube.

[0011] Further characteristics and advantages of the invention will become better apparent from the description of a preferred, but not exclusive, embodiment of a lamp, which is illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a block diagram of an embodiment of a lamp of the fluorescent type, including the power supply and control circuit thereof, according to the invention;

Figure 2 is a circuit diagram of the embodiment of the power supply and control circuit for the lamp;

Figure 3 is a circuit diagram representing a portion of a power supply and control circuit for a conventional lamp of the fluorescent type;

Figure 4 is a circuit diagram representing a portion of a power supply and control circuit for a lamp of the fluorescent type according to the invention.

[0012] With reference to the figures, the lamp, generally designated by the reference numeral 1, comprises a fluorescent tube 7 and a power supply and control circuit of the lamp 1. The fluorescent tube 7 comprises, at its ends, connections 11, 12, 21, 22, connected, inside the fluorescent tube 7, to filaments 13 and 23. The connections 11, 12, 21, 22 are, outside the fluorescent tube 7, connected to the power supply and control circuit of the lamp 1.

[0013] According to the invention, the lamp 1 comprises a short circuit 10, 20 at the ends of the connections 11, 12, 21, 22 of the fluorescent tube 7. The power supply and control circuit of the lamp 1 comprises a filter 2 for electromagnetic interference, a rectifier circuit 3, an integrated circuit 4, an inverter circuit 5 and a resonant circuit 6.

[0014] The lamp 1 comprises moreover a passive power factor correction circuit 8.

[0015] The power supply and control circuit of the lamp 1 is designed to perform the function of electronic ballast.

[0016] Such circuit is adapted to generate high voltage, advantageously in the range comprised between 95 and 260 Volts, at high frequency to supply power to the lamp 1, while regulating the flow of current through the lamp 1 in the meantime. The resonant circuit 5 is adapted to manage the switching on of the fluorescent tube 7 by way of suitable heating of the filaments 13, 23 thereof; such switching on occurs advantageously after a delay of 3 seconds.

[0017] The alternating voltage of the power supply is converted to direct current by the rectifier circuit 3. Since fluorescent lamps need high voltage power supply and high frequencies, an inverter circuit 5 is used which is adapted to supply such power supply voltage to the lamp 1. In addition a filter 2 is present for the electromagnetic interference generated by such circuits.

[0018] The power supply and control circuit of the lamp comprises the passive power factor correction circuit 8. In fact, generally, the lower the power factor, the greater the harmonic distortions created in the current and the greater the consumption of current. The passive power factor correction circuit 8 is adapted to reduce harmonic distortions in current, reduce electromagnetic interference and improve electromagnetic compatibilities. The increase in the power factor also facilitates the implementation of filters for electromagnetic interference.

[0019] The passive power factor correction circuit 8 is moreover adapted to keep the sinusoidal wave form of the power supply current of the lamp 1 as similar as possible to the sinusoidal wave form of the power supply voltage, thus reducing the distortion and the phase dif-

ference of the current wave with respect to the voltage wave, by way of the feedback connection 9 between the fluorescent tube 7 and the passive power factor correction circuit 8.

[0020] Based on the value of the peak factor, the integrated circuit 4 implements functions to prevent damage to the lamp 1, by identifying situations wherein the filaments 13, 23 of the fluorescent tube 7 burn out and cutting the power supply thereof, protecting the lamp 1 and preventing damage to the fluorescent tube 7 in the event of possible current surges.

[0021] The peak factor is also used to identify the average voltage for the inverter circuit 5.

[0022] The power supply and control circuit of the lamp 1 provides for the application of fuses, advantageously of the "restorable" type.

[0023] Such circuit moreover provides for the separation of the current lines that carry high intensity current signals from the lines that carry low intensity current signals.

[0024] As illustrated in Figure 4, the ends of the filaments 13, 23 of the fluorescent tube 7, which can be considered a counter electrode, are directly connected in short circuit 10, 20, according to the cold cathode theory, differently from what occurs in conventional fluorescent lamps, as illustrated in Figure 3.

[0025] In conventional lamps, such as the lamp with fluorescent tube 37 in Figure 3, the electric current flows from a connection 31 to a connection 32 through a filament 33, then passing through an outer condenser 38 and then from a connection 42 to a connection 41 through a filament 43. Because the filaments 33 and 43 offer an internal resistance to the passage of current, they heat up. However, when the filaments 33 and 43 heat up, a passage of electrons occurs in the direction 39 in the gas present in the tube of the lamp. At this point, the filaments 33 and 43 tend to heat up further, owing to both the passage of current between the connections at the ends of the filaments, and the passage of charges that occurs in the gas in the tube of the lamp. Excessive heating of the filaments 33 and 43 and of the lamp generally involve increased energy consumption.

[0026] In the fluorescent tube 7 of the lamp 1 in Figure 4, the short circuits 10 and 20 that are provided respectively at the ends of the connections 11, 12 and 21, 22 make it possible to eliminate the resistance to the flow of current offered by the filaments 13 and 23, therefore reducing the passage of current from the connection 11 to the connection 21, through the filament 13, the connection 12, the outer condenser 18, the connection 22 and the filament 23. In this manner the filaments tend to not undergo evident heating, as a consequence also limiting the energy consumption of the lamp 1 and improving both the illumination and the efficiency.

[0027] The internal temperature of the fluorescent tube 7 of the lamp 1 settles at around 38°C, the temperature at which the luminophor content in the tube presents the maximum efficiency.

[0028] Since the filaments 13 and 23 tend to heat up less, in order to switch on the lamp 1 it is necessary to provide high power supply voltages at high frequency, so as to ensure the passage of electric current between the filaments 13 and 23, which is constituted by the passage of electrons through the gas contained in the fluorescent tube 7 of the lamp 1, in the direction 19. The ability to correct the power factor is also aimed at improving the operation of the power supply and control circuit of the lamp, against the use of high frequency, high power supply voltages. Such ability to correct the power factor is ensured by the presence of the feedback 9 between the fluorescent tube 7 and the passive power factor correction circuit 8.

[0029] In practice it has been found that the lamp, according to the present invention, achieves the intended aim and objects in that it makes it possible to have a lower operating temperature, improve lighting efficiency, extend the duration of the average lifetime and reduce energy consumption.

[0030] Another advantage of the lamp, according to the invention, consists in that it prevents overheating of the filaments of the lamp.

[0031] A further advantage of the lamp, according to the invention, consists in that it prevents damage to the circuit if the filaments of the lamp burn out.

[0032] The lamp, thus conceived, is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0033] Moreover, all the details may be substituted by other, technically equivalent elements.

[0034] In practice the materials employed, provided they are compatible with the specific use, and the contingent dimensions and shapes, may be any according to requirements.

[0035] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

45 Claims

1. A lamp (1), comprising a fluorescent tube (7) which contains gas and a circuit to supply power and control said lamp (1), said fluorescent tube (7) comprising connections (11, 12, 21, 22) at its ends, said connections (11, 12, 21, 22) being connected to filaments (13, 23) inside said fluorescent tube (7), **characterized in that** it comprises a short circuit (10, 20) at the ends of said connections (11, 12, 21, 22) of said fluorescent tube (7).
2. The lamp (1) according to claim 1, **characterized in that** said power supply and control circuit of said

lamp (1) comprises a filter (2) for electromagnetic interference, a rectifier circuit (3), connected to said filter (2), a passive power factor correction circuit (8), connected to said rectifier circuit (3), an integrated circuit (4) connected to said passive power factor correction circuit (8), an inverter circuit (5), connected to said integrated circuit (4), a resonant circuit (6), connected to said inverter circuit (5), said fluorescent tube (7) being connected to said resonant circuit (6).

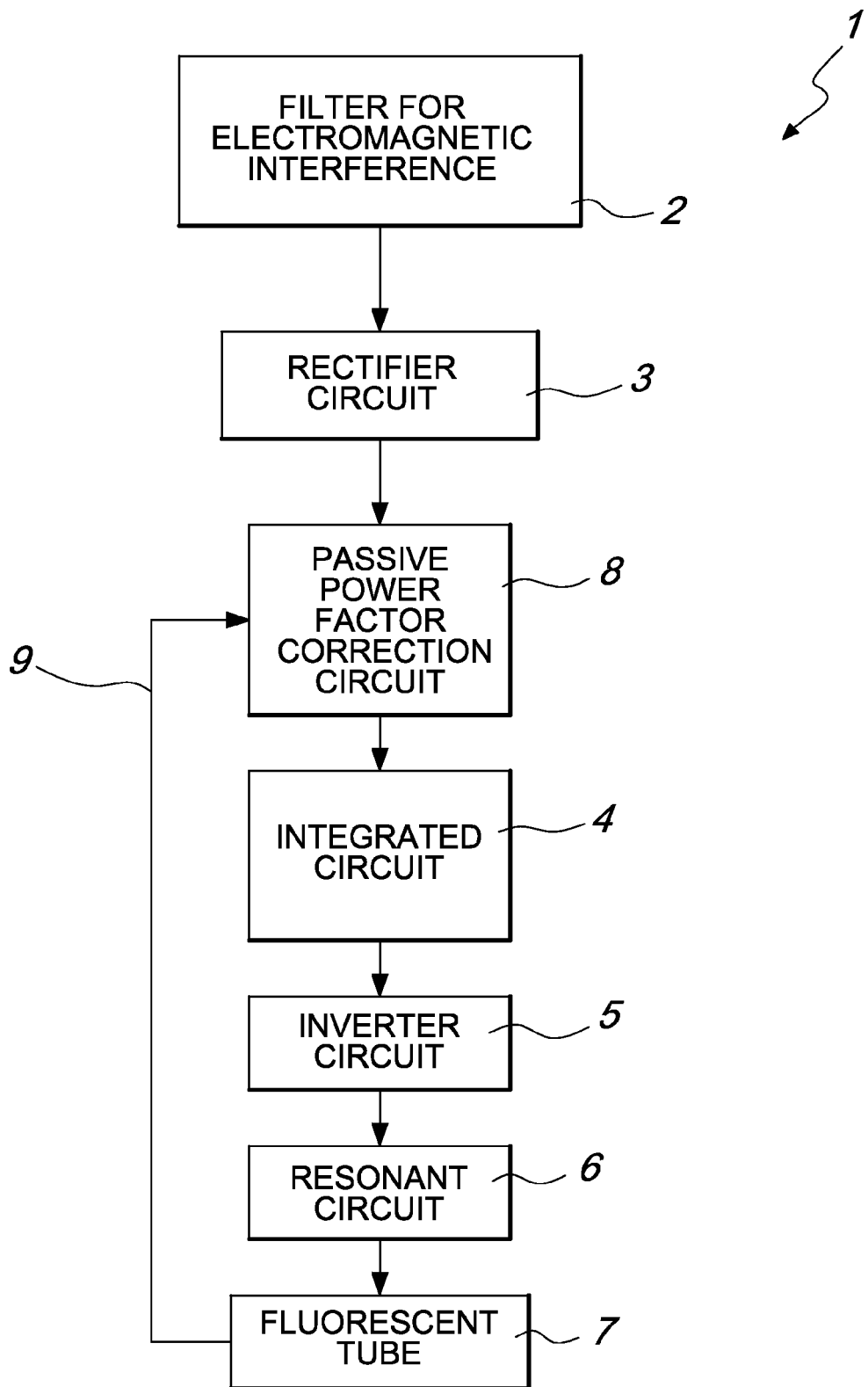
3. The lamp (1) according to claim 2, **characterized in that** said integrated circuit (4) identifies the value of the peak factor and implements functions to prevent damage to said power supply and control circuit of said lamp (1).
4. The lamp (1) according to claims 2 or 3, **characterized in that** said passive power factor correction circuit (8) is adapted to reduce harmonic distortions in current, reduce electromagnetic interference and improve electromagnetic compatibilities.
5. The lamp (1) according to one or more of the preceding claims, **characterized in that** between said fluorescent tube (7) and said passive power factor correction circuit (8) a feedback connection (9) is provided which is adapted to reduce the distortion and phase difference of the current wave of the power supply of said lamp (1) with respect to the voltage wave.
6. The lamp (1) according to one or more of the preceding claims, **characterized in that** said short circuit (10, 20) at the ends of the connections (11, 12, 21, 22) of said fluorescent tube (7) reduces the electrical resistance to the passage of current through the filaments (13, 23) of said fluorescent tube (7).

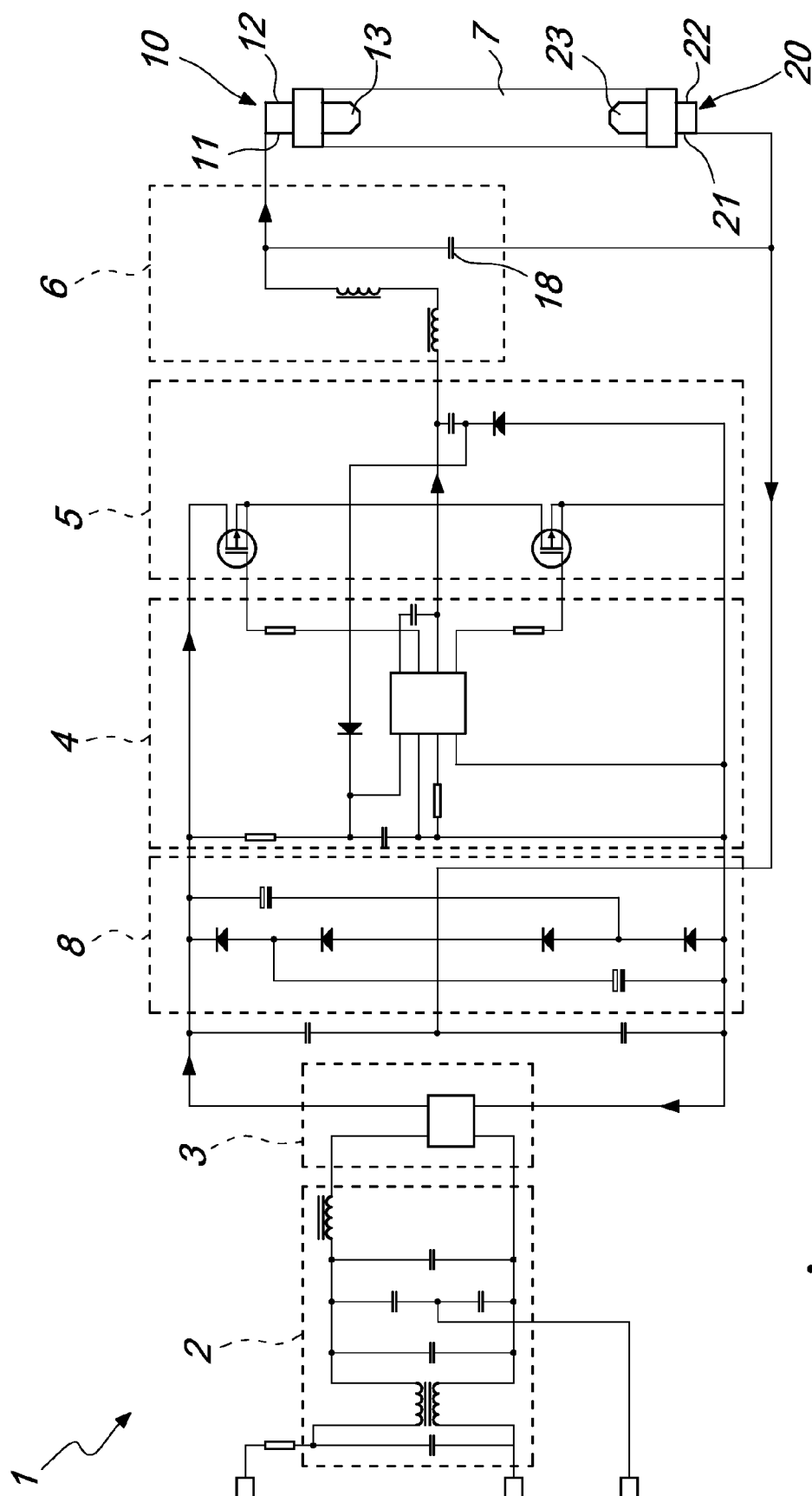
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*Fig. 1*



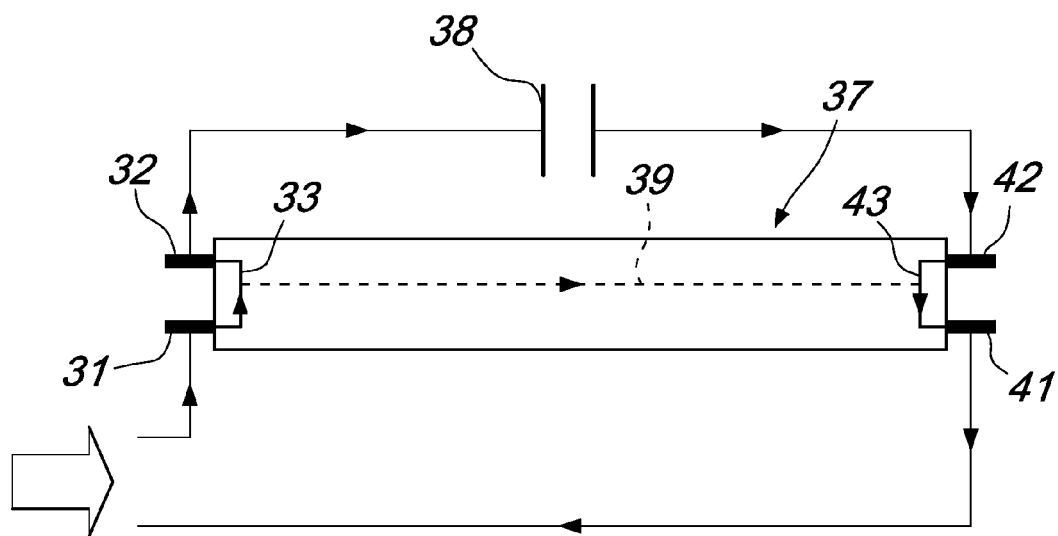


Fig. 3

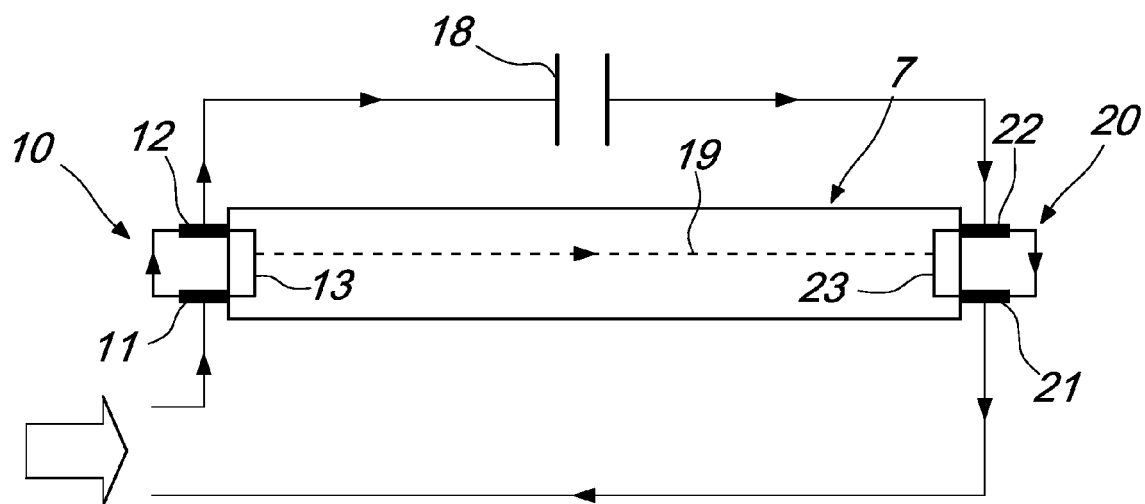


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 11 18 9419

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 581 161 A (GONG MINGFU [US]) 3 December 1996 (1996-12-03)	1,6	INV. H05B41/02 H05B41/282
Y	* column 7, line 11 - column 7, line 15; figure 1 *	2-5	

X	DE 21 51 854 A1 (ORIGINAL HANAU QUARZLAMPEN) 26 April 1973 (1973-04-26) * page 4, line 16 - page 5, line 30; figures 1,2 *	1,6	

X	WO 02/096163 A2 (INNOLUX GMBH [DE]; MENNA MAURIZIO [DE]) 28 November 2002 (2002-11-28) * page 32, line 1 - page 34, line 7; figures 6,8 *	1,6	

X	EP 0 750 447 A1 (ECKERLE IND ELEKTRONIK GMBH [DE]) 27 December 1996 (1996-12-27) * column 2, line 20 - column 2, line 42; figure 1 *	1,6	TECHNICAL FIELDS SEARCHED (IPC)
Y	EP 0 600 340 A1 (PATRA PATENT TREUHAND [DE]) 8 June 1994 (1994-06-08) * abstract; figure 1 *	2-5	H05B
Y	EP 0 338 109 A1 (ZUMTOBEL AG [AT]) 25 October 1989 (1989-10-25) * column 3, line 2 - column 5, line 15; figure 1 *	2-5	

The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 14 June 2012	Examiner Speiser, Pierre
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)



Application Number

EP 11 18 9419

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 11 18 9419

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1, 6

Fluorescent lamp with short-circuited filaments, operating
as instant-start lamp

2. claims: 2-5

Additional details of the lamp ballast, without any relation
with the type (instant-start or rapid-start) of fluorescent
lamp

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 18 9419

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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EPO FORM P0459

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