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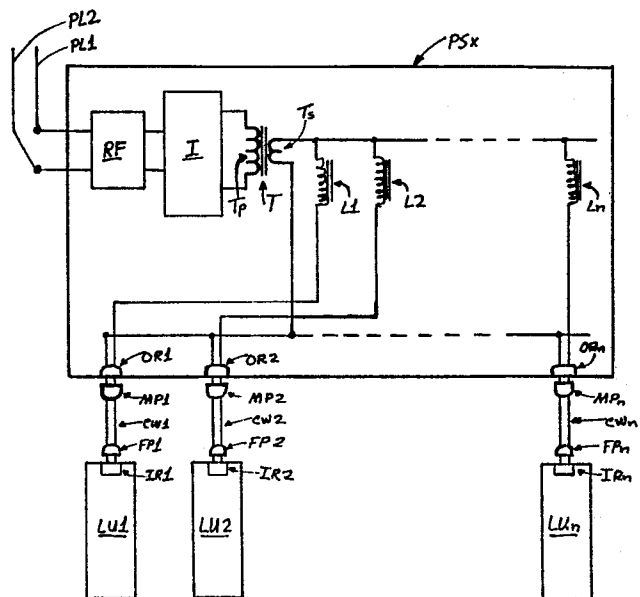
**Limited-power fluorescent ceiling lighting system.**

Subject invention constitutes a low-voltage limited-power fluorescent lighting system consists of the following principal component parts:

a) a number of power-line operated inverter power supplies, each such power supply providing for a plurality of power-line-isolated outputs of relatively low voltage magnitude (30 Volt RMS) and relatively high frequency (30 kHz) and having a substantial and predominantly inductive internal impedance,

b) a plurality of fluorescent lighting units, each unit comprising one or more fluorescent lamps and a matching network operative to derive the requisite lamp operating voltages and currents from one of the inductively current-limited outputs,

and  
c) a plurality of pairs of conductor wires adapted for plug-in connection between each of the individual outputs of said power supplies and each individual fluorescent lighting unit. The power provided to each lighting unit permits a power level of nearly 100 Watt to be provided to each lighting unit; which can provide for a light output of about 10,000 Lumens per lighting unit.



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**LIMITED-POWER FLUORESCENT CEILING LIGHTING SYSTEM****S P E C I F I C A T I O N****BACKGROUND OF THE INVENTION****Field of the Invention**

The present invention relates to power-line-operated low-voltage limited-power fluorescent lighting systems.

**Description of Prior Art**

To the best of my knowledge, no power-line-operated low-voltage limited-power fluorescent lighting system is available for purchase or has been described in published literature.

**Rationale Related to the Invention**

Due to potential shock and fire hazards, presently available power-line-operated electric lighting fixtures can not conveniently and safely be installed by persons of but ordinary skills. Moreover, the wiring means required for safe installation is costly to acquire and cumbersome to install.

On the other hand, if lighting fixtures could be powered by way of so-called Class 2 transformers (for definition of such transformers, see report entitled UL 506 Specialty Transformers by Underwriters Laboratories Inc., Northbrook, IL 60062), they could indeed conveniently and safely be installed by persons of but ordinary skills.

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However, the output of Class 2 transformers is strictly limited in maximum voltage (30 Volt RMS), maximum rated Volt-Amperes (100 VA) and maximum current (8 Amp RMS); and would not appear to yield enough power to provide an amount of illumination that would be considered adequate in a substantial number of ordinary lighting system installations.

Yet, within its maximum Volt-Amp rating, a Class 2 transformer does have enough power potentially available to provide for an amount of illumination that is nearly equal to that normally obtained from one of the commonly used four-lamp fluorescent ceiling fixtures.

Hence, if means were provided by which such ceiling fixtures could each be powered by way of a Class 2 power source, a very safe and easy-to-install and simple-to-modify ceiling lighting system would probably result.

Against this background, it would seem useful to provide for such a Limited-Power Fluorescent Ceiling Lighting System; which is indeed the overall object of the instant invention.

#### SUMMARY OF THE INVENTION

##### Objects of the Invention

A first object of the present invention is that of providing a high-efficiency easy-to-install fluorescent lighting system.

A second object is that of providing a fluorescent lighting system that is particularly adapted to be used with suspended ceiling systems and that can readily and safely be installed by persons of but ordinary skills.

A third object is that of providing means by which fluorescent lighting fixtures can safely and easily be installed and/or removed by the do-it-yourself'er without requiring the assistance of an electrician.

These as well as other objects, features and advantages of the present invention will become apparent from the following description and claims.

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Brief Description

Subject invention relates to a high-frequency, low-voltage, limited-power (Class 2) fluorescent lighting system and consists of the following principal component parts:

a) a number of power-line-operated inverter power supplies, each such power supply providing for a plurality of power-line-isolated outputs, each such output being of relatively low voltage magnitude (30 Volt RMS) and relatively high frequency (30 kHz) and having a substantial and predominantly inductive internal impedance, which inductive internal impedance is operative to limit the short-circuit output current from each individual output to a maximum not exceeding 8 Amp RMS;

b) a plurality of fluorescent lighting units, each such unit comprising one or more fluorescent lamps and a matching network operative to derive the requisite lamp operating voltages and currents from one of the inductively current-limited high-frequency low-voltage outputs of one of said inverter power supplies; and

c) a plurality of pairs of conductor wires adapted to provide for easy plug-in connection between each of the individual outputs of said power supplies and each individual fluorescent lighting unit -- generally with one such lighting unit being connected with each of said outputs.

The power provided to each lighting unit is provided at a high power factor, thereby (under the Class 2 provisions of the National Electrical Code) permitting a power level of nearly 100 Watt to be provided to each lighting unit; which, with the indicated high frequency operation and with presently available high-efficacy fluorescent lamps, can provide for a light output of about 10,000 Lumens per lighting unit.

Brief Description of the Drawings

Fig. 1 schematically illustrates, from an overall systems viewpoint, the preferred embodiment of the invention; and shows a plurality of power-line-operated inverter power supplies, each providing power-line-isolated current-limited high-frequency AC voltage for low-voltage power-limited operation of a number of individual fluorescent lighting units.

Fig. 2 schematically illustrates the preferred embodiment of one of said plurality of power-line-operated power supplies and its multiple current-limited outputs and corresponding individual connections with a number of fluorescent lighting units.

Fig. 3 schematically illustrates electrical circuit details of an individual fluorescent lighting unit.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Details of System and Circuits

In Fig. 1, a source S of 120Volt/60Hz voltage is applied to a pair of power line conductors PL1 and PL2. Connected at various points along this pair of power line conductors are a number m of power-line-operated inverter power supplies PS1, PS2 --- PSm.

To each such power-line-operated power supply are connected a variable number n of fluorescent lighting units LU1, LU2 --- LUn. (The number n may be different for different power supplies and/or at different times.)

Fig. 2 illustrates in further detail one of the power supplies of Fig. 1 and its associated n lighting units.

This one power supply is referred to as PSx, and is powered from power line conductors PL1 and PL2.

Inside PSx, power line conductors PL1 and PL2 are directly connected with a rectifier-filter combination RF, the substantially constant DC output voltage of which is applied to an inverter I.

The output from inverter I is a 30 kHz AC voltage, which AC voltage is applied to the primary winding Tp of an isolation transformer T.



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The output of transformer T is provided from its secondary winding Ts and is a 30 kHz AC voltage of approximately 30 Volt RMS magnitude. Secondary winding Ts is electrically isolated from primary winding Tp.

By way of a number n of inductor means L1, L2 --- Ln, this transformer output voltage is supplied to a number n of power output receptacles OR1, OR2 --- ORn, all respectively.

By way of male plugs MP1, MP2 --- MPn, conduction wire-pairs CW1, CW2 --- CWn, and female plugs FP1, FP2 --- FPn, the output receptacles OR1, OR2 --- ORn are connected with input receptacles IR1, IR2 --- IRn on fluorescent lighting units LU1, LU2 --- LUn, all respectively.

The assembly consisting of rectifier and filter means RF, inverter I, transformer T and the n output receptacles OR1, OR2 --- ORn, is referred to as power supply PSx.

Fig. 3 illustrates one of the n lighting units referred to in Fig. 2 as LU1, LU2 -- LUn. This one lighting unit is referred to as LUX and has a power input receptacle IRx.

Inside lighting unit LUX is a voltage-step-up auto-transformer AT, the input side of which is directly connected with input receptacle IRx and the output side of which is directly connected across a series-combination of two fluorescent lamps FL1 and FL2.

Fluorescent lamp FL1 has two cathodes C1a and C1b; and fluorescent lamp FL2 has two cathodes C2a and C2b.

Auto-transformer AT has three secondary windings ATs1, ATs2 and ATs3, all of which are electrically isolated from one another as well as from the input side of auto-transformer AT.

Secondary winding ATs1 is directly connected with cathode C1a; secondary winding ATs2 is directly connected with a parallel-connection of cathodes C1b and C2a; and secondary winding ATs3 is directly connected with cathode C2b.

A capacitor C is connected directly across the output side of auto-transformer AT.



### Description of Operation

The operation of the system and circuits illustrated in Figs. 1 to 3 may be explained as follows.

In Fig. 1, the pair of power line conductors PL1 and PL2 provides 120Volt/60Hz power to each and every inverter power supply: PS1, PS2 --- PSm.

Each and every inverter power supply converts its 120Volt/60Hz input voltage to a plurality of power-line-isolated power-limited high-frequency low-magnitude AC voltage outputs; and each such AC voltage output is directly connected with a fluorescent lighting unit -- powering this fluorescent lighting unit by way of said power-limited high-frequency low-magnitude AC voltage.

Fig. 2 shows how said power-line-isolated power-limited high-frequency low-magnitude AC voltage outputs are obtained.

The 120Volt/60Hz power line voltage is applied to a rectifier-filter combination of conventional construction; and the output from this rectifier-filter combination is a substantially constant DC voltage. This DC voltage is inverted by conventional inverter I to a 30 kHz AC voltage of essentially squarewave shape.

This 30 kHz squarewave inverter output voltage is applied to the primary winding of voltage-step-down high-frequency transformer T; which transformer is of conventional construction.

This transformer also provides for electrical isolation between its primary and secondary windings, thereby providing for the requisite power-line-isolation of the AC voltage outputs from power supply PSx.

The output of the secondary winding Ts of transformer T is a 30 kHz non-power-limited essentially squarewave-shaped AC voltage with a substantially constant RMS magnitude of about 30 Volt; which AC voltage is provided to the n power output receptacles P01, P02 --- P0n of power supply PSx by way of n inductors L1, L2 --- Ln.



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Thus, the magnitude of the current available at any one of these power output receptacles is limited by the reactance of the inductor connected in series circuit with that receptacle. The magnitude of the reactance of this inductor is chosen such that the current resulting when a given output receptacle is short-circuited is no higher than 8 Amp RMS.

The high-frequency AC voltage output from each of the n power output receptacles is applied to a fluorescent lighting unit by way of a conduction wire-pair and its associated male/female plug means.

Fig. 3 shows how the individual lighting units work and more particularly, how the ballasting of the fluorescent lamps is accomplished.

The output from one of the output receptacles of power supply PSx is applied by way of a conduction wire-pair to power input receptacle IRx of lighting unit LUX, from where it is applied directly to a voltage step-up transformer AT, the output of which is applied directly across two series-connected fluorescent lamps.

The actual ballasting of the two fluorescent lamps is accomplished by way of resonant interaction between the capacitor (which is connected in parallel across the two series-connected fluorescent lamps) and the particular inductor located in the power supply feeding power to the lighting unit LUX.

In other words, part of the ballasting function for the two fluorescent lamps of lighting unit LUX is accomplished by way of one of the inductors within the power supply PSx.

The rest of the circuit functions within LUX, such as the provision of cathode heating by way of the three secondary windings on AT, is accomplished in manners well understood by those skilled in the art.

It should be noted that any one of the lighting units, such as lighting unit LUX, may consist of any number of fluorescent lamps; and that these fluorescent lamps might even be mounted in different locations and/or located in different lighting structures and/or fixtures. However, within the context of the present invention, it is important that all the fluorescent lamps powered from a single output from any of the inverter power supplies, be ballasted as a single entity and that the aggregate Volt-Ampere product drawn from this output not exceed 100 VA.

It should also be noted that, due to the resonant matching of the fluorescent lamp loads to the source of high-frequency power, the current drawn from the inverter power supplies by the different lighting units will be nearly sinusoidal in waveshape; and it will be substantially in phase with the fundamental component of the squarewave AC voltage outputs provided by these power supplies. As a result, the power drawn by the lighting units is drawn with a high power factor, which implies a maximization of the power available within a set limit of Volt-Amperes. Moreover, resulting electromagnetic interference by radiation from lamps and/or conductor wires is minimized.

Yet another thing that should be noted is the fact that capacitor C, which is shown in Fig. 3 as being connected across the secondary side of transformer AT, may just as well be connected across the primary side of said transformer. In fact, to provide for the desired power factor correction, the capacitor may even be connected in series with the output or input side of said transformer.

It is additionally made note of the fact that the lighting units may comprise incandescent lamps.

It is believed that the present invention and its several attendant advantages and features will be understood from the preceding description. However, without departing from the spirit of the invention, changes may be made in its form and in the construction and interrelationships of its component parts, the form herein presented merely representing the preferred embodiment.

The invention may be summarized as follows:

1. A lighting system adapted to be powered from an ordinary electric utility power line and comprising:

a plurality of power supplies, each of said power supplies being operative to connect with said power line and to provide a number of separate outputs, with each one of such outputs: (i) being substantially non-coupled to each other one of such outputs, (ii) providing across a pair of output terminals an AC voltage of frequency substantially higher than that of the voltage on said power line, and (iii) having an inductive internal reactance;

a plurality of lighting units, each of said lighting units: (i) having a pair of power input terminals, (ii) being adapted to be powered by the AC voltage provided at one of said separate outputs, and (iii) comprising a capacitor means operative to resonantly interact with said internal inductive reactance;

a plurality of conductor wire-pairs operative to provide electrical connections between said lighting units and said separate outputs.

2. The lighting system of 1 wherein: a) said conductor wire-pairs comprise plug means, b) said lighting units comprise power input receptacle means adapted to receive said plug means, and c) power to said lighting units is provided by way of conductor wire-pairs comprising plug means, with each one of said lighting units being powered by way of but a single wire-pair.

3. The lighting system of 1 wherein said lighting units comprise fluorescent lamps, said lamps having thermionic cathodes.

4. The lighting system of 3 wherein said lighting units comprise transformer means, said transformer means being operative to provide heating power for said thermionic cathodes.



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5. The lighting system of 1 wherein said power supplies comprise means operative to provide for electrical isolation between said power line and said outputs.

6. The lighting system of 1 wherein the magnitude of said AC voltage does not exceed about 30 Volt RMS.

7. The lighting system of 1 wherein the magnitude of the current drawn from one of said outputs when subjected to a short-circuit does not exceed about 8 Amp RMS.

8. The lighting system of 1 wherein each of said outputs is characterized by having an open-circuit voltage and a short-circuit current, with the product of the RMS magnitudes of said open-circuit voltage and said short-circuit current being on the order of 100 Volt-Ampere or less.

9. The lighting system of 1 wherein the current flowing in response to said AC voltage is substantially in phase with said AC voltage, thereby providing for a near maximum of power to be delivered for a given Volt-Ampere product.

10. The lighting system of 1 wherein said outputs comprise power output receptacle means.

11. The lighting system of 10 wherein said plurality of conductor wire-pairs comprise electrical power connection plug means, said plug means being operative to be received by said output receptacle means.

12. A lighting system adapted to be powered from an ordinary electric utility power line and comprising:

a plurality of inverter power supplies, each of said power supplies being operative to be powered from said power line and to provide a number of separate AC voltage outputs, with each of said AC voltage outputs being characterized by: (i) being non-coupled to each other one of said AC voltage outputs, (ii) being electrically isolated from said power line, and (iii)



being of a frequency substantially higher than that of the voltage on said power line;

a plurality of lighting units, each of said lighting units being adapted to be powered from one of said AC voltage outputs by way of but a single pair of conductors; and

a plurality of conductor wire-pairs, each of said wire-pairs being operative to provide sufficient electrical connection between one of said lighting units and one of said AC voltage outputs.

13. The lighting system of 12 wherein each of said AC voltage outputs is additionally characterized by having an inductive internal reactance.

14. The lighting system of 13 wherein said internal reactance is operable to prevent the magnitude of the current drawn from one of said outputs, when subjected to a short circuit, from exceeding approximately 8 Amp RMS.

15. The lighting system of 12 wherein the magnitude of said AC voltage does not exceed approximately 30 Volt RMS.

16. The lighting system of 12 wherein said lighting units comprise a plurality of fluorescent lamps, with said lamps having incandescent cathodes.

17. The lighting system of 16 wherein said lighting units comprise transformer means operative to provide electric heating power for said incandescent cathodes.

18. The lighting system of 13 wherein said lighting units comprise capacitor means operative to resonantly interact with said inductive internal reactance.

19. A lighting system adapted to be powered from an ordinary electric utility power line and comprising:



a plurality of power supplies, each of said power supplies being operative to be powered from said power line and to provide an AC power output, said AC power output being of a frequency substantially higher than that of the voltage on said power line and being provided across a pair of primary power output terminals; and

for each of said power supplies:

a) a plurality of substantially reactive impedance means, with one each of said impedance means being coupled in circuit between said pair of primary power output terminals and one of a plurality of pairs of secondary power output terminals;

b) a number of lighting units, each one of said lighting units having a pair of power input terminals and being adapted to be powered from but one of said pairs of secondary power output terminals; and

c) a plurality of conductor wire-pairs, each of said wire-pairs being operative to permit electrical connection between the pair of power input terminals of one of said lighting units and one of said pairs of secondary power output terminals.

20. The lighting system of 19 wherein said lighting units comprise fluorescent lamps, said fluorescent lamps having thermionic cathodes.

21. The lighting system of 20 wherein said lighting units comprise transformer means operative to provide heating power for said cathodes.

22. The lighting system of 19 wherein at least one of said lighting units comprises a reactive impedance means operative to at least partially cancel the phase displacement caused by the reactive impedance means that is coupled in circuit between said pair of primary power output terminals and the one of said plurality of pairs of secondary power output terminals that is providing power to said one of said lighting units.

23. The lighting system of 19 wherein at least one of said lighting units comprises a reactive impedance means operative to resonantly interact with the reactive impedance means that is coupled in circuit between said pair of primary power output terminals and the one of said plurality of pairs of secondary power output terminals that is providing power to said one of said lighting units.

24. The lighting system of 19 wherein said power supplies comprise means operative to provide for electrical isolation between said power line and said pair of primary power output terminals.

25. The lighting system of 19 wherein at least one of said substantially reactive impedance means is operative to prevent the current drawn from one of said pairs of secondary power output terminals, when said power output terminals are shortcircuited, from exceeding approximately 8 Amp RMS.

26. The lighting system of 19 wherein the magnitude of the voltage provided across at least one of said plurality of pairs of secondary power output terminals does not exceed approximately 30 Volt RMS.

27. The lighting system of 19 wherein said plurality of pairs of secondary power output terminals comprise power output receptacle means connected in circuit therewith.

28. The lighting system of 27 wherein said plurality of conductor wire-pairs comprise electrical plug means, said plug means being operative to be received by said power output receptacle means and to provide for disconnectable electrical connections therebetween.

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29. The lighting system of 19 wherein:

said lighting units comprise electrical power input receptacle means connected in electrical circuit with said pair of power input terminals; and

said plurality of conductor wire-pairs comprise electrical plug means operative to provide for disconnectable electrical connections between said conductor wire pairs and said lighting units.

30. The lighting system of 19 wherein the Volt-Ampere product available from one of said pairs of secondary power output terminals is limited to a magnitude not exceeding about 100 Volt-Ampere, the Volt-Ampere product being defined as the product of the RMS magnitudes of the open-circuit voltage and the short-circuit current of one of said pairs of secondary power output terminals.

31. The lighting system of 19 in which said power supplies comprise inverter means.

32. A lighting system adapted to be powered from an ordinary electric utility power line and comprising:

a power supply operative to connect with said power line and to convert power drawn therefrom to an AC voltage output, said AC voltage being: (i) of a frequency substantially higher than that of the voltage on said power line, and (ii) made available across a pair of primary output terminals;

a plurality of substantially reactive impedance means, with one each of said impedance means being connected in circuit between said pair of primary power output terminals and one of a plurality of pairs of secondary power output terminals;

a plurality of lighting units, each one of said lighting units having a pair of power input terminals and being adapted to be operated from but one of said pairs of secondary power output terminals; and

a plurality of conductor wire-pairs, each one of said wire-pairs being operative to effect electrical connection

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between the pair of power input terminals of one of said lighting units and one of said pairs of secondary power output terminals.

33. The lighting system of 32 wherein said pairs of secondary power output terminals are non-coupled to each other, thereby preventing the loading of one of said pairs of secondary power output terminals from affecting the power supplied by others of said pairs of secondary power output terminals.

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34. The lighting system of 32 and means operative to provide electrical isolation between said power line and said pairs of secondary power output terminals.

35. The lighting system of 34 wherein said power supply comprises said means operative to provide said electrical isolation.

36. The lighting system of 32 wherein each of said pairs of secondary power output terminals is characterized by having an available Volt-Ampere product on the order of about 100 Volt-Ampere or less, said Volt-Ampere product being defined for each of said pairs of secondary power output terminals as the product of the RMS magnitudes of its open-circuit voltage and its short-circuit current.

37. The lighting system of 36 wherein said lighting units comprise fluorescent lamps, and where the Volt-Ampere product required for proper operation of said lighting units is approximately equal to or less than the Volt-Ampere product available from one of said secondary power output terminals, the Volt-Ampere product required for proper operation of said lighting units being defined as the product of the RMS magnitudes of the voltage required for starting the fluorescent lamps therein and the current required for running the same lamps.

38. A lighting unit adapted to be powered from a source of AC voltage, said source being characterized by having an open-circuit voltage and a short-circuit current, with the product of the RMS magnitudes of said voltage and said current being on the order of 100 Volt-Ampere or less, said lighting unit comprising:

power input terminals operative to connect with said source of AC voltage;

a set of fluorescent lamps, said lamps comprising thermionic cathodes; and

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transformer operative to provide electrical connection between said power input terminals and said set of fluorescent lamps, as well as to transform the voltage and current characteristics of said set of fluorescent lamps so as to permit the fluorescent lamps to be properly operated from said source of AC voltage.

39. The lighting unit of 38 wherein said transformer is also operative to provide heating power for said cathodes.

40. A lighting unit adapted to be powered from a source of AC voltage, said source having a substantially reactive internal source impedance and being characterized by having an open-circuit source voltage and a short-circuit source current, with the product of the RMS magnitudes of said open-circuit source voltage and said short-circuit source current being on the order of 100 Volt-Ampere or less, said lighting unit comprising:

a pair of power input terminals operative to provide connection with said source of AC voltage;

a fluorescent lamp, said lamp requiring for its proper operation a supply of AC voltage, with said supply having: (i) an open-circuit supply voltage of RMS magnitude different than that of said open-circuit source voltage, and (ii) an internal supply impedance operative to limit and stabilize the current provided to the lamp; and

transformer and impedance matching means connected in circuit between said pair of power input terminals and said fluorescent lamp, said transformer and impedance matching means being operative to convert: (i) said open-circuit source voltage to a magnitude substantially equal to that of said open-circuit supply voltage, and (ii) said source impedance to a magnitude substantially equal to that of said supply impedance.

41. The lighting unit of 40 wherein said impedance matching means comprises a capacitor means.



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42. A fluorescent lighting unit adapted to be powered from a source of AC voltage, said source having an inductive internal impedance and being characterized by having an open-circuit voltage not higher than about 30 Volt RMS, said lighting unit comprising:

a pair of power input terminals operative to connect with said source of AC voltage;

a fluorescent lamp, said lamp comprising thermionic cathodes;

capacitor means connected in circuit with said fluorescent lamp; and

transformer means connected in circuit between said pair of power input terminals and said fluorescent lamp, said transformer means being operative to transform the AC voltage provided to said pair of input terminals by said source to a magnitude suitable for starting and operating said fluorescent lamp, said magnitude being larger than 30 Volt RMS.

43. A fluorescent lighting means adapted to be powered from a source of AC voltage, said source having an inductive internal impedance operative to limit the short-circuit current available from said source to a magnitude not higher than approximately 8 Amp RMS, said lighting means comprising:

a pair of power input terminals operative to connect with said source of AC voltage;

a fluorescent lamp having thermionic cathodes; and

a transformer means connected in circuit with said pair of power input terminals and operative to provide the proper operating voltages and currents to said lamp, including the provision of cathode voltages.

44. The lighting means of 43 wherein a capacitor is connected in circuit with said fluorescent lamp, said capacitor being operative to improve the power factor of the power drawn by said lighting means from said source of AC voltage.



45. A lighting fixture adapted to be powered from a source of AC voltage, said source having an inductive internal impedance operative to limit the Volt-Ampere product available from said source to approximately 100 Volt-Ampere or less, said Volt-Ampere product being defined as the product of the RMS magnitudes of the open-circuit voltage and the short-circuit current of said source, said fixture comprising:

receptacle means operative to connect with said source;

lamp means having voltage and impedance characteristics; and

transformer means connected in circuit between said power receptacle and said lamp means, said transformer means being operative to match the voltage and impedance of said lamp to the voltage and impedance characteristics of said source.

46. The lighting fixture of 45 wherein said lamp means comprises a fluorescent lamp, said fluorescent lamp having thermionic cathodes.

47. The lighting fixture of 46 wherein said transformer means is additionally operative to provide low voltage power for heating said cathodes.

48. The lighting fixture of 44 comprising a capacitor means connected in circuit with said lamp means, said capacitor means being operative to improve the power factor of the power drawn by said fixture from said source.

49. A fluorescent lighting unit adapted to be powered from a source of current-limited AC voltage and comprising:

receptacle means operative to connect with said source;

fluorescent lamp means;

capacitor means connected in circuit with said fluorescent lamp means, thereby forming a lamp-capacitor combination; and

transformer means connected in circuit with said receptacle means and said lamp-capacitor combination, said transformer means being operative to transform the magnitude



of the complex impedance represented to said receptacle means by said lamp-capacitor combination substantially without changing the phase characteristics of said complex impedance.

50. A lighting system adapted to be powered from an ordinary electric utility power line and comprising:

a power supply operative to connect with said power line and to provide across a pair of primary output terminals an AC voltage of frequency substantially higher than that of the voltage on said power line;

a plurality of substantially inductive reactance means, with one of said inductive reactance means being connected in circuit between said pair of primary output terminals and each one of a plurality of pairs of secondary output terminals;

a plurality of lighting units, with each one of said lighting units having: (i) a pair of input terminals, (ii) lamp means, (iii) capacitor means connected in circuit with said lamp means to form a lamp-capacitor combination, and (iv) transformer means connected in circuit between said input terminals and said lamp-capacitor combination; and

a plurality of conductor wire-pairs, each one of said wire pairs being operative to effect electrical connection between the pair of input terminals of one of said lighting units and one of said pairs of secondary output terminals.

51. The lighting system of 50 wherein each of said pairs of secondary output terminals is operative to provide a maximum Volt-Ampere product on the order of 100 Volt-Ampere or less, said maximum Volt-Ampere product being defined as the product of the RMS magnitudes of the open-circuit voltage across one of said pairs of secondary output terminals and the short-circuit current available from those same terminals.

52. The system of 51 comprising electrical isolation between said secondary output terminals and said power line.



CLAIMS

1. A lighting system adapted to be powered from an ordinary electric utility power line and suitable to provide general and/or special lighting in a building intended for human occupancy, said system comprising:

a number of central power conditioners connected with said power line at spaced-apart points therealong, each of said central power conditioners having a plurality of separate Volt-Ampere-limited power outputs, each such output being limited to a maximum Volt-Ampere product extractable therefrom to an amount that under normally encountered circumstances in such a building may be considered safe from a fire-initiation viewpoint;

a set of lighting fixtures for each central power supply, each lighting fixture having: i) an electric lamp, ii) matching means connected with said lamp and operative to match the input characteristics of said lamp to the output characteristics of one of said power outputs, and iii) terminal means connected in circuit with said matching means and operative to receive the electrical output from one of said power outputs; and

connect cords operative to provide connections of said lighting fixtures to said Volt-Ampere-limited power outputs, with each one of these connect cords being used for connecting between one of said power outputs and the terminal means of one of said lighting fixtures.

2. The system of Claim 1 wherein said Volt-Ampere product is limited to an amount that is considered safe from a fire initiation standpoint in accordance with generally accepted guidelines, such as or similar to those specified for Class 2 and Class 3 circuits in ARTICLE 725 of the NATIONAL ELECTRICAL CODE published by NATIONAL FIRE PROTECTION ASSOCIATION, Quincy, Massachusetts, United States of America.

3. The system of Claim 1 wherein the voltage at each of said power outputs is limited to a magnitude that is considered to provide acceptable protection from electric shock in accordance with generally accepted guidelines, such as or similar to those specified for Class 2 circuits in ARTICLE 725 of the NATIONAL ELECTRICAL CODE published by NATIONAL FIRE PROTECTION ASSOCIATION, Quincy, Massachusetts, United States of America.

4. The system of Claim 1 wherein at least one of said central power conditioners comprises frequency conversion means operative to make the frequency of the voltage provided at its power outputs substantially higher than that of the voltage present on said ordinary electric utility power line.

5. The system of Claim 1 wherein at least one of said central power conditioners comprises impedance means operative to cause each of its separate power outputs to be manifestly limited in terms of the maximum Volt-Ampere product extractable therefrom to that amount which under normal circumstances in such a building may be considered safe from a fire-initiation viewpoint.

6. The system of Claim 1 wherein said electric lamp is a gas discharge lamp, and wherein the requisite ballasting for this gas discharge lamp is at least partly accomplished within the central power conditioner to which the particular lighting fixture having this gas discharge lamp is connected.

7. A power conditioner for use in a lighting system and operable to power a number of separate lighting fixtures suitable to provide general and/or special purpose lighting in spaces used for human occupancy, said power conditioner comprising:

means for connecting with and to be powered from an ordinary electric utility power line; and

means to provide for a plurality of separate Volt-Ampere-limited power outputs, each such power output being operable to connect with and to power at least one of said lighting fixtures with an output that may be as high as, but is limited to be not higher than, the maximum Volt-Ampere product that under normally encountered circumstances in such a building may be considered safe from a fire-initiation viewpoint.

8. The power conditioner of Claim 7 wherein said maximum Volt-Ampere product is limited to an amount that is considered safe from a fire initiation standpoint in accordance with generally accepted guidelines, such as or similar to those specified for Class 2 and Class 3 circuits in ARTICLE 725 of the NATIONAL ELECTRICAL CODE published by NATIONAL FIRE PROTECTION ASSOCIATION, Quincy, Massachusetts, United States of America.

9. The power conditioner of Claim 7 comprising frequency conversion means operative to cause the frequency of the voltage provided at said power outputs to be substantially higher than that of the voltage on said electric utility power line.

10. The power conditioner of Claim 7 wherein at least one of said lighting fixtures comprises a gas discharge lamp, and wherein at least part of the ballasting function for this gas discharge lamp is accomplished within said power conditioner.

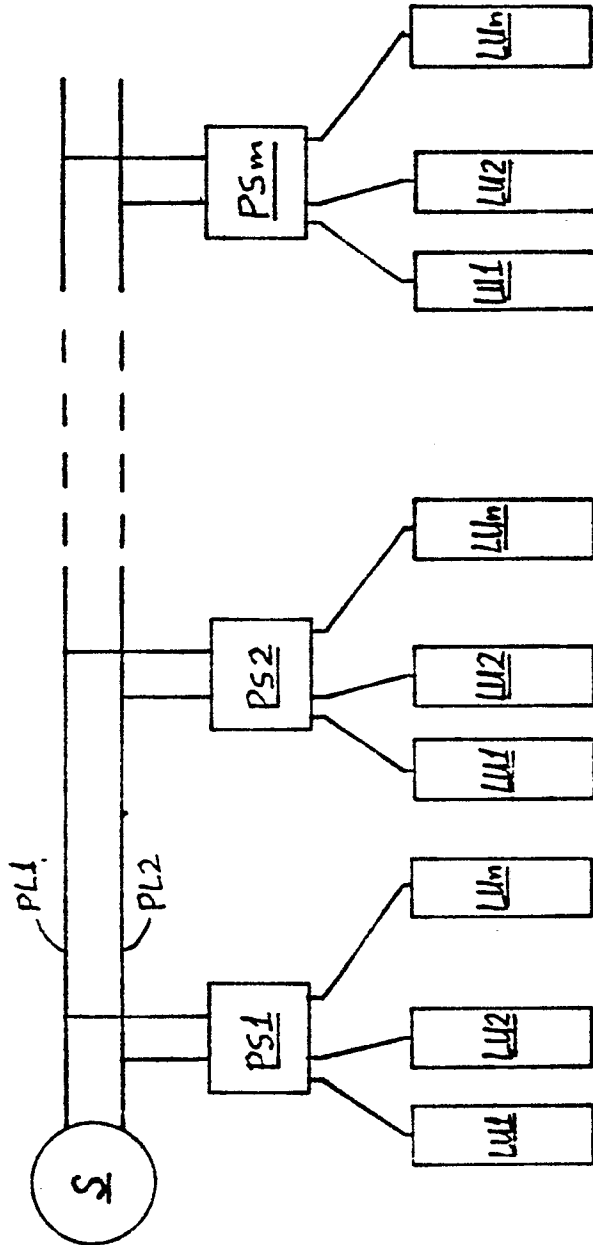


Fig. 1

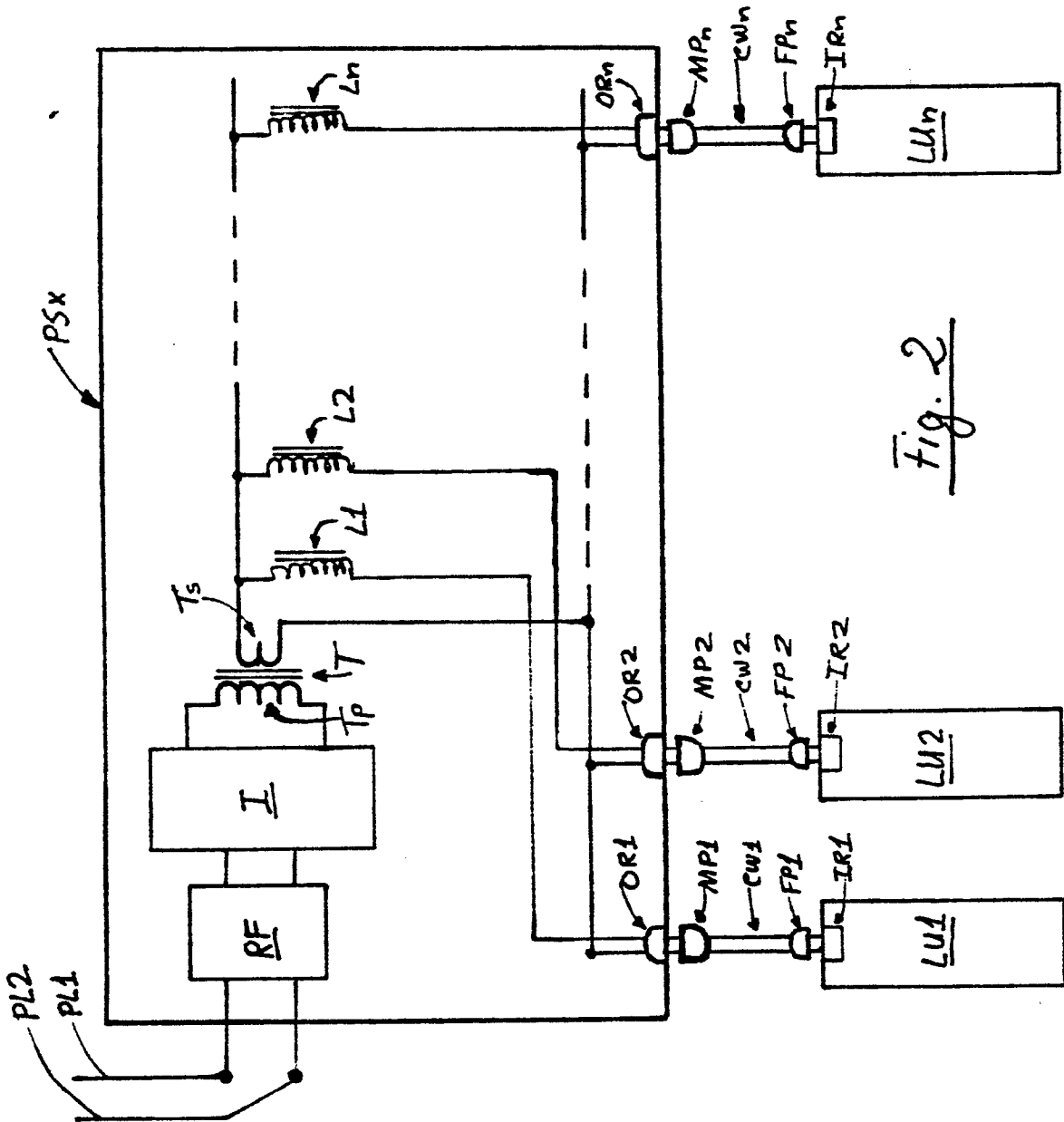


Fig. 2

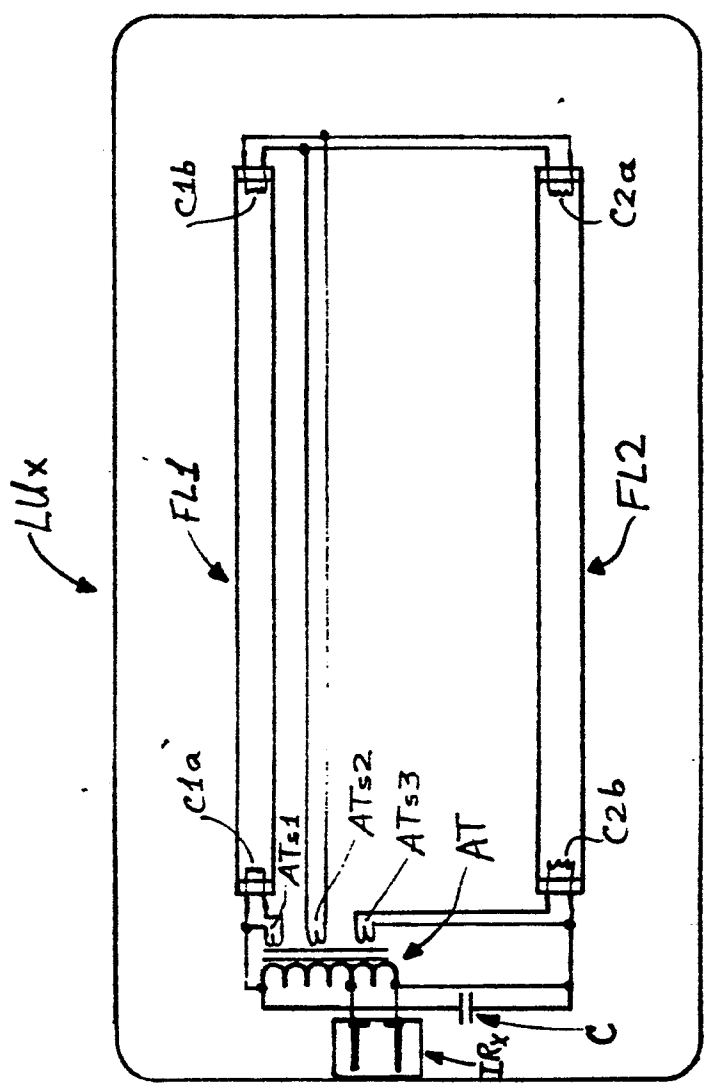


Fig. 3

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European Patent  
Office

### EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 83112323.7
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
A	DE - A1 - 2 705 969 (G.E.C.) * Fig. 1; claims 1-11 * --	1,4,5, 7,9	H 05 B 41/24
A	EP - A3 - 0 027 039 (VICTOR PRODUCTS) * Abstract; fig. 1,2,4 * --	1,7	
A	DE - A1 2 941 822 (PATENT-TREUHAND) * Fig. 1,2,3; claims 1-18 * --	1,4,5, 7,9	
A	DE - A1 - 3 025 629 (GTE) * Abstract; fig. * --	1,7	
A	GB - A - 2 021 335 (GTE) * Abstract; fig. 1 * -----	1,7	TECHNICAL FIELDS SEARCHED (Int. Cl. 7)  H 05 B 41/00 H 05 B 43/00
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 16-03-1984	Examiner VAKIL
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>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</p> <p>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</p> <p>&amp; : member of the same patent family, corresponding document</p>			