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(54) Biasing system for reducing ion loss in lamps

Vorspannungssystem zur Verminderung des Ionenverlustes in Lampen

Système de polarisation pour réduire la perte d'ions dans les lampes

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Description

This invention relates to luminaire and ballast circuit techniques for minimizing the loss of plasma chemicals and ions from the confining arc tube of an energized plasma in a high intensity discharge lamp.

GB-A-2056760 discloses a glass sleeve within the outer tube of a discharge lamp, the sleeve being disposed around the arc tube and being connected to a potential which is positive relative to the arc tube, in order to prevent sodium loss from the arc tube. Other ion loss inhibiting means within the outer tube or forming integral part of the discharge tube are disclosed in GB-A-1227810 and, respectively, FR-A-1413359.

It has been recognized for many years that sodium ions in high pressure sodium (HPS) lamps, as well as ions of other elements in other lamp types, are lost by the migration of those ions through the walls of the arc-containing media in which the ionized gases are confined under electrically energized and operating conditions. The basic problem has been discussed in texts as well as some prior patents. Metals, such as sodium, which are placed within the lamps and are evaporated and driven into a gas discharge are essential for the creation and maintenance of an ionized plasma conductor which creates the light output produced by the lamp. Each type of lamp is produced with a fill or starting gas, with certain amounts of metals, halides and amalgam, and frequently with a mixture of elements, each to be operated at a selected partial vapor pressure magnitude, so that the light output will have the desired color spectrum and lumen output level when it is appropriately electrically energized. Clearly, when plasma materials escape from the discharge lamp as a result of the ion loss, the characteristics of the lamp deteriorate with color shifts and fall-off of lumen output level and are no longer in accordance with the design and operating characteristics desired. In addition, the useful life of the lamp is shortened considerably because of the drops in lamp performance and because the lamp operating voltage rises which results in undesired electrical operating changes.

While certain proposals have been advanced to mitigate this loss, a practical, effective and economical solution to the problem has not been found. Sodium loss is one of the major causes of high intensity discharge performance fall-off with operating time.

An object of the present invention is to provide an electrical system to reduce the loss of gas ions from lamp structures in a luminaire.

A further object is to provide a circuit which is simple and inexpensive, which operates effectively and which, in conjunction with the ballast and fixture, can be provided for lamps and ballasts of a wide variety of types and sizes.

These objects are achieved by the system defined in claim 1 and the corresponding methods defined in claims 15 and 16.

Preferably, the electrically conductive surface includes a reflector normally used physically close to the lamp and, in a fixture having a transparent light window surface near the lamp but on the opposite side thereof from the reflector, a second conductive surface comprising a substantially transparent thin film on the glass or plastic window can be provided to establish a lamp-enclosing electric bias voltage field. Other conductive parts of the fixture housing can also be used as bias-producing conductive surfaces but the physically close reflector has the greatest impact. Some luminaires have a primary reflector placed in front of the lamp and a larger secondary reflector placed behind the lamp. Each of these reflectors can provide bias surfaces.

In order to impart full understanding of the manner in which these and other objects are attained in accordance with the invention, particularly advantageous embodiments thereof will be described with reference to the accompanying drawings, which form a part of this specification, and wherein:

Fig. 1 is a schematic diagram of a luminaire including a plasma conductor chamber therein illustrating the principle of the invention;

Fig. 2 is a diagram of the bias voltage fields produced in a typical luminaire structure in accordance with an embodiment of the invention;

Fig. 3 is a schematic diagram of a first embodiment of a luminaire including a system in accordance with the invention;

Fig. 4 is a schematic diagram of a further embodiment of a luminaire incorporating the system of the present invention;

Fig. 5 is a schematic circuit diagram of another embodiment of a luminaire incorporating a system in accordance with the invention;

Fig. 6 is a schematic side elevation, in partial section, of a portion of a luminaire having primary and secondary reflectors usable in conjunction with the present invention; and

Fig. 7 is a schematic diagram of the application of the invention to a large number of lighting fixtures in a building.

Fig. 1 illustrates, in a simplified form, the interconnection of major components of the apparatus in accordance with the invention. The invention will be described in the context of a luminaire having a high pressure sodium or metal halide light source therein. It should be emphasized, however, that a variety of types of lighting fixtures can benefit from the invention and that a variety of other types of discharge lamps using gases other than sodium are usable with the invention.

The luminaire of Fig. 1 has a housing, schematically indicated at 10, having a transparent portion 12 which can be a refractor or an openable access door typically having a glass panel therein. The light source itself includes a plasma conductor 14 formed within a chamber

such as an arc tube 16 which contains an ionizable gas and which can be surrounded by an outer jacket or envelope 17. The lamp may, however, not have an outer jacket as is the case with many double-ended lamps. The shapes and sizes of these components are variable with the type of lamp and the manufacturer. A reflector 18 is schematically illustrated as being on the opposite side of the light source from the door or refractor 12 and, as is commonly the case, can be curved to direct light from a portion of the source to create a particular light output pattern as well as to enclose the light source.

A supply circuit has terminals 22 which are connectable to a standard AC source of voltage. Supply circuit 20 provides an AC output on conductors 24 and 25 which are connected to the lamp terminals at opposite ends of chamber 16. A DC circuit 28 is conveniently powered from the supply circuit 20 and produces a DC potential at output terminals 30 and 31 which are positive and negative, respectively. In the embodiment shown, which involves a sodium vapor plasma conductor 14 in chamber 16, the positive terminal of DC circuit 28 is connected to reflector 18 and negative terminal 31 is connected to the arc tube at one end of the plasma conductor.

In the operation of the simple circuit of Fig. 1, the AC supply circuit 20 provides AC operating current on lines 24 and 25 into the ends of arc tube chamber 16 to the plasma conductor in chamber 16, maintaining the plasma in a condition to create light which passes through door or refractor 12. The light is directed or focused by reflector 18. At the same time, DC potentials are placed on the reflector and the plasma conductor causing the reflector to be positive with respect to the plasma. Because the plasma contains sodium ions which have positive charges, a positive potential with respect to the plasma conductor is placed on reflector 18, causing an electric field between the reflector and the plasma ions which tends to repel the positively charged plasma particles away from the reflector and which thereby helps confine those particles within chamber 16. This electric field significantly reduces the amount of migration of these positive ions through the walls of arc tube 16, lengthening the life of the tube and maintaining the sodium design balance, thus improving the color and light output thereof for an extended interval of time.

The operation of the apparatus of Fig. 1 is improved by adding an electrically conductive coating 34 to a surface of door or refractor 12 and connecting positive terminal 30 to coating 34. The result of this arrangement is to completely enclose the plasma in a repelling electric field from all sides of the light source, enhancing the confinement of ions within the plasma body and further improving and lengthening the operation thereof.

Fig. 1 also shows the connection 35 of the positive terminal of the DC source to fixture housing 10. The housing is made partly or entirely of metal or, if not, can be made partially electrically conductive by the addition

of a conductive film or filler. By connection 35 to this conductive region, the entire housing 10 can be used to enhance the field which aids in confinement of the ions in chamber 16.

Of particular importance is the provision of a surface or surfaces substantially surrounding and enclosing the lamp and the development on those surfaces of a potential which repels and confines ions in the arc tube chamber. This is accomplished without adding devices inside of the structure of the lamp itself which is an expensive and undesirable approach. It will be apparent that when extra devices are included in the lamp outer jacket, they are necessarily thrown away with the lamp when its useful life has ended, but circuitry added to the luminaire structure remains and is effective to lengthen the life of every lamp installed therein.

Fig. 2 schematically illustrates the relationship between a light source 38, a reflector 39, a refractor 40 and an enclosing housing 41 where the reflector is metal or has a metallized surface and the refractor 40 also has a metallized surface, both of these components and the conductive housing 41 being connected to the positive terminal of DC source 28 while the negative terminal thereof is connected to the plasma conductor light source. Again, assuming a sodium vapor lamp, a three-dimensional field 42 is produced between the plasma conductor and the surrounding shell-like bodies which is extremely effective in confining the plasma components within their containing chamber. Because the bodies themselves substantially surround or enclose the light source, the confining effect is considerable. The geometric relationship illustrated is commonly arranged as shown in Fig. 2 for optical reasons but has not been employed for electric field reasons or for the confinement of ions in a plasma stream heretofore.

The application of this principle to one form of luminaire is shown in Fig. 3 wherein the components of the luminaire are largely contained within a housing 44. Housing 44 is either metal, filled with metal particles or is coated with a metallized surface. The housing includes an opening which receives a glass or plastic refractor 46 having a conductive coating 48 on the inner surface thereof. Coating 48 can be, for example, a thin layer of tin oxide or indium oxide which leaves the refractor substantially transparent but which renders the inner surface thereof electrically conductive. Such a layer can be placed on glass by conventional deposition techniques.

Behind the refractor 46 is a plasma chamber 16 surrounded by an outer jacket 17 and behind this light source is a reflector 18.

An AC supply circuit indicated generally at 20 includes a conventional metal halide lamp ballast indicated at 50, the ballast typically being a constant wattage auto-transformer or peak lead autoregulator with the tap and common points arranged for connection to an AC source. The usual single ballast capacitor, which would be connected in series between the ballast transformer

and the plasma chamber, is replaced by two ballast capacitors 52 and 53 which are connected in series with the two AC lines leading from the ballast transformer to the light source. In order for the lamp operating wattage to be correct, each of capacitors 52 and 53 is selected to have a value of twice the capacitance of the single series capacitor which would normally be used with the ballast transformer. These capacitors provide isolation for the light source so that a DC bias can be placed thereon.

A voltage divider means includes a potentiometer 54 connected across the output of transformer 50 with the movable contact 55 being connected to the DC circuit means 28. Contact 55 is connected through a series resistor 56 and diode 58 to the parallel connection of a capacitor 60 and a resistor 61. The other side of the parallel circuit is connected to the common line which is also connected to conductive housing 44 at a screw terminal 62.

The positive output terminal of this DC circuit, which is the common line, is also connected to reflector 18 and conductive coating 48 on the refractor. The negative side is connected to the movable contact 59 of a potentiometer 57. The ends of the potentiometer are connected to the terminals of the plasma conductor chamber. The resulting field tends to confine positive ions in chamber 16, inhibiting migration thereof through the walls of the chamber. Because the positive terminal is connected to the housing at terminal 62, the housing itself, which is made of conductive material, can participate in creation of the confining field.

As previously indicated, this apparatus as illustrated in Fig. 3 can be used without coating 48, relying upon the field produced by physically close reflector 18 and the housing. As suggested by Fig. 2, reflector 18 can be formed as a shell-like structure to more fully enclose the chamber and improve the effect of the confining field.

It should also be noted that the reversal of diode 58 causes reversal of the DC field so that either positive or negative ions can be confined using essentially the same circuit, the choice being made on the basis of the type of lamp and the ions or chemicals used therein.

A circuit which uses an electromagnetic regulator is illustrated in Fig. 4. Many of the components including the housing, refractor, reflector and light source are the same as in Fig. 3 and are similarly numbered. The AC supply circuit indicated generally at 64 includes a magnetic regulator having a core 66 with three windings all of which are electrically insulated from the core and from each other. An isolated primary winding 68 is connectable to a conventional AC source. An output winding 70 is connected at its ends to chamber 14 and is tapped for connection to a starting circuit 72. Starting circuit 72 can be any of a variety of starting circuits which are now conventional in this art, using a discharge circuit to provide voltage pulses across the smaller, upper portion of winding 70 which is magnified by the auto transformer effect in winding 70 to provide a relatively high voltage pulses

across conductors 74 and 75 for application to the deionized lamp to effect ignition. A suitable starting circuit is shown, for example, in Fig. 2 and other figures of U.S. patent 4,763,044, Nuckolls et al. Magnetic shunts 65 and 67 extend across windings 68 and 70.

A separate floating ballast capacitor winding 76 is provided with a shunt capacitor 78 which performs the ballast capacitor function. This separate ballast winding does not interfere with the electrical isolation of the primary winding and does not interfere with the normal AC operation of the ballast-lamp system. Winding 70 is connected through a diode 80 to a capacitor 82 across which the DC bias voltage appears for connection to the light system components. A bleeder resistor 83 is connected in parallel with capacitor 82. In the embodiment shown, intended for use with a sodium vapor lamp, the negative terminal of this DC supply is connected to common line 75 and to the plasma conductor chamber 16. The positive terminal is connected to reflector 18, conductive coating 48 and the conductive housing 44. The function is the same as in connection with the other embodiments discussed above in which a field is produced between the reflector, the refractor and the plasma conductor chamber to confine gases and ions therein.

These biasing techniques permit lamp design changes such as increased arc tube wall loading (watts per square cm.) with quartz and polycrystalline alumina to generate higher lumen-per-watt (L.P.W.) output and better color and other characteristics without the normal increase in the rate of sodium loss from the plasma and arc tube.

Fig. 5 shows a still further embodiment of a plasma-combining circuit apparatus in accordance with the invention which is particularly simple and therefore economically advantageous as well as being effective. In a manner similar to the embodiment of Fig. 3, an auto-transformer 92 is connected to a AC source and supplies AC current to a lamp indicated generally at 94 through series capacitors 96 and 97. A lamp starting circuit 98 is connected between the lamp sides of capacitors 96 and 97. A reflector 99 is positioned to reflect the light produced within lamp 94.

A DC circuit indicated generally at 100 includes the series connection of a diode 102 and a resistor 104 with the addition of a radio frequency choke 106 which is included to block high frequency, high voltage pulses from the lamp starting circuit. The diode is polarized so that the inductive ballast side of capacitor 97 is positive relative to the lamp side of the capacitor, and the polarization of capacitor 96 is also such that the inductive ballast side of the capacitor is positive with respect to the lamp side. Capacitor 96 is dielectrically insulated from the housing of the fixture. Finally, a conductor 108 interconnects the neutral or ground side of the line at inductor 92 to the reflector and also to the lamp housing 90.

With this circuit, the neutral side of the inductive ballast is positive with respect to the lamp as well as the lamp circuitry on the lamp side of capacitors 96 and 97.

Thus, the plasma conductor itself is negative with respect to the reflector and the housing, again producing the ion migration-inhibiting field which improves lamp operation and lengthens life. Electrical isolation of capacitor 96 from the fixture housing by dielectric insulation prevents the high frequency, high voltage lamp ignition pulses from circuit 98 from being capacitively shorted out. The ballast secondary coil serves as an inductance which holds off the starting pulses from the starter circuit. The charging network comprising diode 102, resistance 104 and the choke charges the ballast capacitor 96 with the polarity shown. When the lamp strikes and draws high AC lamp current, part of the charge on capacitor 96 is conducted to ballast capacitor 97 until their DC voltages are equal and opposite so that the net DC voltage around the lamp power loop is zero. However, the lamp plasma circuit is biased negatively with respect to the neutral or metal parts.

The AC voltage swings across the operating lamp in this circuit are allowed to have a peak amplitude approaching or nearly equal to the DC biased voltage. Thus, there exists very little if any voltage time in a half cycle in which a reverse-bias exists and which would tend to drive sodium ions through the walls of the arc tube.

The DC voltage is self-adjusting by the lamp voltage clamping mechanism in this circuit. Note that two of these charging networks 100 could be used, but it is not necessary because the AC power operation carries the required charge from one capacitor to the other.

Resistor 104, typically having a value of 10 K ohms, 1 watt, is used to limit the charging circuit current. As previously indicated, the RF choke tends to block the high voltage from the starter, allowing the high frequency, high voltage to raise and ignite the lamp and also keeping the high voltage from damaging other charging circuit components. The diode, of course, allows the half-wave DC charging to take place.

If discharging of the ballast and starter capacitors are required when the ballast is deenergized, high resistance bleeder resistors can be connected across those capacitors. Rapid discharging, if desired, can be accomplished by connecting a small relay having individual normally closed contacts series connected with a small resistor across each capacitor, the relay coil being connected across the line or the ballast secondary.

Fig. 6 shows a reflector arrangement which can be used in conjunction with the present invention to considerable advantage. In some fixtures, the lamp 110 is positioned between a primary reflector and a secondary reflector 112. The two reflectors are used to project light from the lamp through refractor or cover 113 in a particular pattern. As before, these components are mounted in a housing 114.

By connecting one side of the DC supply to both reflectors and the other side of the supply to one or both terminals of the lamp, the reflectors form an enclosing field which is highly effective because the reflectors sub-

stantially enclose the lamp and are physically closer to the lamp than the remainder of the housing. Any of the circuit arrangements discussed herein can be applied to this reflector arrangement.

The invention has thus far been described in the context of a single lighting fixture or luminaire. However, it is quite possible to apply the Invention to all lighting fixtures of a similar type in an entire building. As will be recognized, this has advantages of economy. A technique for doing this is schematically illustrated in Fig. 7 wherein a building 120 has a large number of lighting fixtures, two of which are illustrated at 122 and 123. Each fixture typically has a ballast transformer 125 and a ballast capacitor 126 which can be arranged in a manner similar to the circuits illustrated in Figs. 3 and 4 but need not be. Each fixture also has a lamp 127, such as a sodium vapor lamp, and a reflector 128. Starting circuit means can also be provided in or associated with the ballast circuitry.

The primary winding of an AC power and DC isolation transformer 130 is connected to the conventional AC lines feeding the building. The fixtures 122, 123, ... are connected in parallel across the high and common terminals of the transformer secondary winding. In the particular embodiment of the fixtures shown, the primary portion of each fixture ballast transformer is connected thus to the AC supply.

A DC supply unit 132 is connected between the AC common line from the secondary of transformer 130 and building ground, i.e., the green wire in a three-wire electrical system, with the positive output terminal of the DC source being connected to building ground. This establishes a DC bias between the common line and building ground with ground being positive relative to the common line. In order to provide the desired bias to confine the material in the lamp in accordance with the invention, it is only necessary to connect the reflector and/or the housing of each fixture (depending upon the specific reflector and housing structures) to building ground. Since the plasma conductor is connected to the common AC line, it is automatically biased negative relative to ground. The reflector and/or housing is thus made positive relative to the plasma, creating the desired confining field. It is necessary to be sure that all wiring used for fixtures in this fashion are connected to the isolation transformer 130 if other AC supply cables are employed for other purposes in the building. A dedicated cable for this DC biasing is preferred.

While certain advantageous embodiments have been chosen to illustrate the invention, it will be understood by those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention as defined in the appended claims.

Claims

1. An electrical system for inhibiting ion loss from a plasma conductor in a high intensity discharge lamp having an arc tube chamber (16) containing an ionizable fill gas and plasma materials, including a metal halide, which, when evaporated and in discharge, contribute to the formation of a plasma conductor, said chamber having first and second terminals, first circuit means (20, 50) including a ballast connected to said first and second terminals for providing AC operating voltage to said chamber, an electrically conductive surface or surfaces (18, 34, 44, 48) substantially surrounding and enclosing said chamber, second circuit means (28) connected to a voltage source for developing a DC potential, said second circuit means having positive and negative DC output terminals, characterized in that said electrically conductive surface or surfaces (18, 34, 44, 48) is disposed outside, the outer surface of said lamp, and in that a third circuit means (30, 31) is provided for connecting one of the DC output terminals to a terminal of said chamber (16) and the other of said output terminals to said electrically conductive surface or surfaces to establish an electric field between said surface or surfaces and said chamber to thereby confine in said chamber ions having the polarity of said surface or surfaces.
2. An electrical system according to claim 1 characterized in that said electrically conductive surface or surfaces comprises an electrically conductive reflector (18) positioned at one side of said chamber to direct light produced therein in a desired direction.
3. An electrical system according to claim 1 or 2, characterized in that a portion of said electrically conductive surface or surfaces (18) is curved.
4. An electrical system according to claim 1, 2 or 3, characterized in that said first circuit means includes inductive circuit means (50) connectable to a source of AC power and having first and second conductors for supplying AC operating voltage to opposite ends of the chamber (16) and for acting as an inductive ballast during operation, first and second ballast capacitors connected in series circuit relationship with said first and second conductors, respectively, and voltage divider means (54, 57) connected to said inductive circuit means, and in that said second circuit means is connected to said voltage divider means for developing said DC potential difference.
5. An electrical system according to claim 1, 2, 3 or 4 characterized in that said conductive surface or surfaces includes a first electrically conductive surface (18) on one side of said chamber and a second electrically conductive surface (34) on the opposite side of said chamber from said first conductive surface, and in that said third circuit means (30, 31) includes a connection of said first and second electrically conductive surfaces to said other of said output terminals.
6. An electrical system according to claim 1 which includes an at least partially transparent housing (10; 44, 46) and characterized in that said electrically conductive surface comprises an electrically conductive reflector (18) positioned at one side of said chamber to direct light produced therein in a desired direction, and an electrically conductive and substantially transparent film (34) supported on a surface (12) of said housing on the opposite side of said chamber from said reflector.
7. An electrical system according to claim 6 characterized in that said at least partially transparent housing includes an electrically conductive outer housing (10; 44, 46) for lamp components and circuits, said outer housing comprising a transparent portion (46), and in that said third circuit means includes a connection of said positive output terminal to said outer housing.
8. An electrical system according to claim 6 or 7 characterized in that said at least partially transparent housing supporting said conductive film (34) comprises a light transmitting wall (46) of said outer housing.
9. An electrical system according to any one of claims 1 to 8, comprising an outer envelope (17) enclosing said arc tube chamber (16) and said conductive surface or surfaces are outside said envelope.
10. An electrical system according to any one of claims 1 to 9 characterized in that said voltage source (64) includes said first circuit means.
11. An electrical system according to any one of the preceding claims, characterized in that said first circuit means includes inductive circuit means (65, 66, 67, 70, 76) connectable for acting as an inductive ballast during operation having a magnetically permeable core (66) with a first winding (68) connectable to a source of AC power, a second winding (70) for supplying AC operating voltage to opposite ends of said chamber, and a third winding (76), and a ballast capacitor (78) connected across the ends of said third winding, and in that said third winding (76) is connected to said second circuit means (80, 82, 83) for developing said DC potential.
12. An electrical system according to any one of claims

1 to 9, wherein said first circuit means includes inductive circuit means (92) connectable to a source of AC power and having first and second conductors for supplying AC operating voltage to opposite ends of the chamber (94) and for acting as an inductive ballast during operation, first and second ballast capacitors (96, 97) connected in series circuit relationship with said first and second conductors, respectively, in that said second circuit means includes a diode (102) and resistor (104) in series circuit relationship connected between the chamber side of said first ballast capacitor and the inductive ballast side of said second ballast capacitor, and in that said third circuit means includes a conductor between said inductive ballast side of said second capacitor and said conductive surface.

13. An electrical system according to claim 12, characterized in that a fixture housing contains said lamp and said first, second and third circuit means, said fixture housing being at least partially electrically conductive, and in that at least said first ballast capacitor (96) is electrically insulated from said fixture housing.

14. An electrical system according to claim 12 or 13 characterized in that said third circuit means additionally connects said inductive side of said second capacitor to electrically conductive parts of said fixture housing.

15. A method of inhibiting ion loss from a plasma conductor in a high intensity discharge lamp of the type comprising a chamber (14) containing an ionizable gas which contributes to the formation of the plasma conductor, the chamber having first and second terminals, an outer envelope (17) containing the chamber, first circuit means (50) including a ballast connected to the first and second terminals for providing AC operating voltage to the chamber, and an electrically conductive surface or surfaces (18, 48) in the vicinity of the chamber, characterized by producing a DC potential having positive and negative outputs; positioning the electrically conductive surface outside of said outer envelope (17), and connecting one of the DC outputs having the opposite polarity from the ions of the plasma conductor to one of the first and second terminals of the chamber and the other of the DC outputs to the conductive surface or surfaces (18, 48) to establish an electrical field between the surface or surfaces and the chamber to thereby confine in the chamber ions having the polarity of the surface or surfaces.

16. A method of inhibiting ion loss from a plasma conductor in a high intensity discharge lamp of the type comprising a chamber (14) containing an ionizable gas which contributes to the formation of the plasma

conductor, the chamber having first and second terminals, first circuit means (50) including a ballast connected to the first and second terminals for providing AC operating voltage to the chamber, and an electrically conductive surface or surfaces (18, 48) in the vicinity of the chamber, characterized in that said electrically conductive surface or surfaces (18, 48) is disposed outside the outer surface of the lamp, and a DC potential is produced and one DC polarity, having the opposite polarity from the ions of the plasma conductor, is connected to one of the first and second terminals of the chamber and the other DC polarity is connected to the conductive surface or surfaces (18, 48) to establish an electrical field between the surface and the chamber to thereby confine in the chamber ions having the polarity of the surface or surfaces.

20 Patentansprüche

1. Elektrisches System zur Verhinderung des Ionenverlustes aus einem Plasmaleiter in einer Hochintensitäts-Entladungslampe mit einer Bogenentladungsröhrenkammer (16), die ein ionisierbares Füllgas und Plasmamaterialien einschließlich eines Metallhalogenids enthält, die, wenn sie verdampft sind und sich entladen, zur Bildung eines Plasmaleiters beitragen, wobei die Kammer eine erste und eine zweite Anschlußklemme aufweist, ersten Schaltungsmitteln (20, 50), die ein Vorschaltgerät umfassen, das zur Lieferung von Betriebswechselspannung an die Kammer mit der ersten und der zweiten Anschlußklemme verbunden ist, einer elektrisch leitenden Oberfläche oder Oberflächen (18, 34, 44, 48), welche die Kammer im wesentlichen umgibt/umgeben und umschließt/umschließen, sowie zweiten Schaltungsmitteln (28), die an einer Spannungsquelle angeschlossen sind, um ein Gleichspannungspotential zu erzeugen, wobei die zweiten Schaltungsmittel eine positive und eine negative Gleichspannungs-Ausgangsklemme aufweisen, dadurch gekennzeichnet, daß die elektrisch leitende(n) Oberfläche(n) (18, 34, 44, 48) außerhalb der Außenfläche der Lampe angeordnet ist/sind und daß ein drittes Schaltungsmittel (30, 31) vorgesehen ist, um eine der Gleichspannungs-Ausgangsklemmen mit einer Klemme der Kammer (16) und die andere der Ausgangsklemmen mit der/den elektrisch leitenden Oberfläche(n) zu verbinden, um ein elektrisches Feld zwischen der Oberfläche oder den Oberflächen und der Kammer aufzubauen und hierdurch Ionen mit der Polarität der Oberfläche oder Oberflächen in der Kammer einzuschließen.
2. Elektrisches System nach Anspruch 1, dadurch gekennzeichnet, daß die elektrisch leitende(n) Ober-

fläche(n) einen elektrisch leitenden Reflektor (18) umfaßt/umfassen, der auf einer Seite der Kammer angeordnet ist, um darin erzeugtes Licht in eine gewünschte Richtung zu lenken.

3. Elektrisches System nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß ein Teil der elektrisch leitenden Oberfläche(n) (18) gekrümmt ist.
4. Elektrisches System nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß das erste Schaltungsmittel induktive Schaltungsmittel (50), die an eine Wechselstromquelle angeschlossen werden können und einen ersten und einen zweiten Leiter aufweisen, um Betriebswechselspannung an entgegengesetzte Enden der Kammer (16) zu liefern und während des Betriebs als induktives Vorschaltgerät zu wirken, einen ersten und einen zweiten Vorschaltgerätkondensator, die in Reihenschaltungsbeziehung jeweils mit dem ersten und dem zweiten Leiter verbunden sind, sowie mit den induktiven Schaltungsmitteln verbundene Spannungsteilmittel (54, 57) einschließt und daß das zweite Schaltungsmittel mit den Spannungsteilmitteln verbunden ist, um die Gleichspannungspotentialdifferenz zu erzeugen.
5. Elektrisches System nach Anspruch 1, 2, 3 oder 4, dadurch gekennzeichnet, daß die elektrisch leitende(n) Oberfläche(n) eine erste elektrisch leitende Oberfläche (18) auf einer Seite der Kammer und eine zweite elektrisch leitende Oberfläche (34) auf der bezüglich der ersten leitenden Oberfläche entgegengesetzten Seite der Kammer einschließt/einschließen und daß das dritte Schaltungsmittel (30, 31) eine Verbindung der ersten und der zweiten elektrisch leitenden Oberfläche mit der anderen der Ausgangsklemmen einschließt.
6. Elektrisches System nach Anspruch 1, das ein zumindest teilweise durchsichtiges Gehäuse (10; 44, 46) einschließt und dadurch gekennzeichnet ist, daß die elektrisch leitende Oberfläche einen elektrisch leitenden Reflektor (18), der auf einer Seite der Kammer angeordnet ist, um darin erzeugtes Licht in eine gewünschte Richtung zu lenken, sowie einen elektrisch leitenden und im wesentlichen durchsichtigen Film (34) umfaßt, der auf einer Oberfläche (12) des Gehäuses auf der bezüglich des Reflektors entgegengesetzten Seite der Kammer getragen wird.
7. Elektrisches System nach Anspruch 6, dadurch gekennzeichnet, daß das zumindest teilweise durchsichtige Gehäuse ein elektrisch leitendes äußeres Gehäuse (10; 44, 46) für Lampenelemente und Schaltungen einschließt, wobei dieses äußere Gehäuse einen durchsichtigen Teil (46) umfaßt, und

daß das dritte Schaltungsmittel eine Verbindung der positiven Ausgangsklemme mit dem äußeren Gehäuse einschließt.

- 5 8. Elektrisches System nach Anspruch 6 oder 7, dadurch gekennzeichnet, daß das zumindest teilweise durchsichtige Gehäuse, welches den leitenden Film (34) trägt, eine lichtdurchlässige Wand (46) des äußeren Gehäuses umfaßt.
- 10 9. Elektrisches System nach einem der Ansprüche 1 bis 8, umfassend eine Außenhülle (17), welche die Bogenentladungsröhrenkammer (16) umschließt, und wobei sich die leitende(n) Oberfläche(n) außerhalb dieser Hülle befindet/befinden.
- 15 10. Elektrisches System nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß die Spannungsquelle (64) das erste Schaltungsmittel einschließt.
- 20 11. Elektrisches System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das erste Schaltungsmittel induktive Schaltungsmittel (65, 66, 67, 70, 76), die anschließbar sind, um während des Betriebs als induktives Vorschaltgerät zu wirken, das einen magnetisch permeablen Kern (66) mit einer ersten Wicklung (68), die an eine Wechselstromquelle anschließbar ist, einer zweiten Wicklung (70) zur Lieferung von Betriebswechselspannung an entgegengesetzte Enden der Kammer und einer dritten Wicklung (76) aufweist, sowie einen Vorschaltgerätkondensator (78) einschließt, der zwischen den Enden der dritten Wicklung angeschlossen ist, und daß die dritte Wicklung (76) mit dem dritten Schaltungsmittel (80, 82, 83) zur Erzeugung des Gleichspannungspotentials verbunden ist.
- 30 12. Elektrisches System nach einem der Ansprüche 1 bis 9, wobei das erste Schaltungsmittel induktive Schaltungsmittel (92), die an eine Wechselstromquelle angeschlossen werden können und einen ersten und einen zweiten Leiter aufweisen, um Betriebswechselspannung an entgegengesetzte Enden der Kammer (94) zu liefern und während des Betriebs als induktives Vorschaltgerät zu wirken, und einen ersten und einen zweiten Vorschaltgerätkondensator (96, 97) einschließt, die in Reihenschaltungsbeziehung jeweils mit dem ersten und dem zweiten Leiter verbunden sind, dadurch gekennzeichnet, daß das zweite Schaltungsmittel eine Diode (102) und einen Widerstand (104) in Serienschaltungsbeziehung einschließt, die zwischen der Kammerseite des ersten Vorschaltgerätkondensators und der induktiven Vorschaltgerätkondensator des zweiten Vorschaltgerätkondensators angeschlossen sind, und daß das dritte Schaltungsmittel
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einen Leiter zwischen der induktiven Vorschaltgerätsseite des zweiten Kondensators und der leitenden Oberfläche einschließt.

13. Elektrisches System nach Anspruch 12, dadurch gekennzeichnet, daß ein Beleuchtungskörpergehäuse die Lampe und das erste, zweite und dritte Schaltungsmittel enthält, wobei dieses Beleuchtungskörpergehäuse zumindest teilweise elektrisch leitend ist, und daß zumindest der erste Vorschaltgerätkondensator (96) elektrisch von dem Beleuchtungskörpergehäuse isoliert ist.

14. Elektrisches System nach Anspruch 12 oder 13, dadurch gekennzeichnet, daß das dritte Schaltungsmittel außerdem die induktive Seite des zweiten Kondensators mit elektrisch leitenden Teilen des Beleuchtungskörpergehäuses verbindet.

15. Verfahren zur Verhinderung des Ionenverlustes aus einem Plasmaleiter in einer Hochintensitäts-Entladungslampe von der Art mit einer Kammer (14), die ein ionisierbares Gas enthält, das zur Bildung des Plasmaleiters beiträgt, wobei die Kammer eine erste und eine zweite Anschlußklemme aufweist, einer Außenhülle (17), welche die Kammer enthält, ersten Schaltungsmitteln (50), die ein Vorschaltgerät umfassen, das zur Lieferung von Betriebswechselspannung an die Kammer mit der ersten und der zweiten Anschlußklemme verbunden ist, und einer elektrisch leitenden Oberfläche oder Oberflächen (18, 48) in der Nähe der Kammer, gekennzeichnet durch die Erzeugung eines Gleichspannungspotential mit einem positiven und einem negativen Ausgang, die Anordnung der elektrisch leitenden Oberfläche außerhalb der Außenhülle (17) und die Verbindung eines der Gleichspannungsausgänge, der eine entgegengesetzte Polarität wie die Ionen des Plasmaleiters aufweist, mit einer der ersten und zweiten Anschlußklemmen der Kammer und des anderen der Gleichspannungsausgänge mit der/den leitenden Oberfläche(n) (18, 48), um ein elektrisches Feld zwischen der Oberfläche oder den Oberflächen und der Kammer aufzubauen und hierdurch Ionen mit der Polarität der Oberfläche oder Oberflächen in der Kammer einzuschließen.

16. Verfahren zur Verhinderung des Ionenverlustes aus einem Plasmaleiter in einer Hochintensitäts-Entladungslampe von der Art mit einer Kammer (14), die ein ionisierbares Gas enthält, das zur Bildung des Plasmaleiters beiträgt, wobei die Kammer eine erste und eine zweite Anschlußklemme aufweist, ersten Schaltungsmitteln (50), die ein Vorschaltgerät umfassen, das zur Lieferung von Betriebswechselspannung an die Kammer mit der ersten und der zweiten Anschlußklemme verbunden ist, und einer elektrisch leitenden Oberfläche oder Oberflächen

(18, 48) in der Nähe der Kammer, dadurch gekennzeichnet, daß die elektrisch leitende(n) Oberfläche(n) (18, 48) außerhalb der Außenfläche der Lampe angeordnet ist/sind und ein Gleichspannungspotential erzeugt wird und die eine Gleichspannungspolarität, die eine entgegengesetzte Polarität wie die Ionen des Plasmaleiters aufweist, mit einer der ersten und zweiten Anschlußklemmen der Kammer verbunden wird und die andere Gleichspannungspolarität mit der/den leitenden Oberfläche(n) (18, 48) verbunden wird, um ein elektrisches Feld zwischen der Oberfläche und der Kammer aufzubauen und hierdurch Ionen mit der Polarität der Oberfläche oder Oberflächen in der Kammer einzuschließen.

Revendications

1. Système électrique pour empêcher la perte d'ions à partir d'un conducteur de plasma dans une lampe à décharge à intensité élevée ayant une chambre de tube à arc (16) contenant un gaz de remplissage ionisable et des matériaux de plasma, incluant un halogène métallique qui, lorsqu'il est évaporé et en décharge, contribue à la formation d'un conducteur de plasma, ladite chambre comportant des première et seconde bornes, des premier moyens de circuit (20, 50) incluant un ballast connecté auxdites première et seconde bornes pour fournir une tension de fonctionnement en courant alternatif à ladite chambre, une ou des surfaces (18, 34, 44, 48) électriquement conductrices entourant sensiblement et enfermant ladite chambre, des seconds moyens de circuit (28) connectés à une source de tension pour développer un potentiel en courant continu, lesdits seconds moyens de circuit ayant des bornes de sortie positive et négative en courant continu, caractérisé en ce que la ou lesdites surfaces (18, 34, 44, 48) électriquement conductrices sont disposées à l'extérieur de la surface extérieure de ladite lampe et en ce que l'on prévoit des troisièmes moyens de circuit (30, 31) pour connecter l'une des bornes en courant continu à une borne de ladite chambre (16) et l'autre desdites bornes de sortie à la ou auxdites surfaces électriquement conductrices afin d'établir un champ électrique entre ladite surface ou lesdites surfaces pour ainsi confiner dans ladite chambre, des ions ayant la polarité de la ou desdites surfaces.
2. Système électrique selon la revendication 1 caractérisé en ce que la ou lesdites surfaces électriquement conductrices comportent un réflecteur (18) électriquement conducteur, positionné sur un côté de ladite chambre pour diriger dans une direction désirée de la lumière qui y est produite.
3. Système électrique selon la revendication 1 ou 2

caractérisé en ce qu'une portion de la ou desdites surfaces électriquement conductrices (18) est incurvée.

4. Système électrique selon la revendication 1, 2 ou 3 caractérisé en ce que lesdits premiers moyens de circuit comprennent des moyens de circuit inductifs (50) pouvant être connectés à une source d'énergie en courant alternatif et ayant des premier et second conducteurs pour délivrer une tension de fonctionnement en courant alternatif aux extrémités opposées de la chambre (16) et pour agir en tant que ballast inductif lors du fonctionnement, des premier et second condensateurs ballasts connectés en relation de circuit série avec lesdits premier et second conducteurs, respectivement, et des moyens diviseurs de tension (54, 57) connectés auxdits moyens de circuit inductif et en ce que lesdits second moyens de circuit sont connectés auxdits moyens diviseur de tension pour développer ladite différence de potentiel en courant continu.

5. Système électrique selon la revendication 1, 2, 3 ou 4 caractérisé en ce que la ou les surfaces conductrices comportent une première surface électriquement conductrice (18) sur un côté de ladite chambre et une seconde surface électriquement conductrice (34) sur le côté de ladite chambre opposé à ladite première surface conductrice et, en ce que les troisième moyens de circuit (30, 31) comprennent une connexion desdites première et seconde surfaces électriquement conductrices à ladite autre des bornes de sortie.

6. Système électrique selon la revendication 1 qui comprend un logement au moins partiellement transparent (10;44;46) et caractérisé en ce que ladite surface électriquement conductrice comprend un réflecteur électriquement conducteur (18) positionné sur un côté de ladite chambre pour diriger, dans une direction désirée, de la lumière qui y est produite et une pellicule électriquement conductrice et sensiblement transparente (34) supportée sur une surface (12) dudit logement sur le côté de ladite chambre opposé audit réflecteur.

7. Système électrique selon la revendication 6 caractérisé en ce que ledit logement au moins partiellement transparent comprend un logement extérieur électriquement conducteur (10;44;46) pour les circuits et les composants de la lampe, ledit carter extérieur comprenant une partie transparente (46) et en ce que lesdits troisièmes moyens de circuit comportent une connexion de ladite borne positive de sortie audit logement extérieur.

8. Système électrique selon la revendication 6 ou 7 caractérisé en ce que ledit logement au moins par-

tiellement transparent supportant ladite pellicule conductrice (34) comprend une paroi (46), transmettant la lumière, dudit logement extérieur.

9. Système électrique selon l'une quelconque des revendications 1-8 comprenant une enveloppe extérieure (17) enfermant ladite chambre de tube d'arc (16) et la ou les surfaces conductrices sont extérieures à ladite enveloppe.

10. Système électrique selon l'une quelconque des revendications 1 à 9 caractérisé en ce que ladite source de tension (64) comporte lesdits premiers moyens de circuit.

11. Système électrique selon l'une quelconque des revendications précédentes caractérisé en ce que lesdits premiers moyens de circuit comprenant des moyens de circuit inductif (65, 66, 67, 70, 76) pouvant être connectés de façon à agir comme un ballast inductif lors du fonctionnement, ayant un noyau magnétiquement perméable (66), avec un premier enroulement (68) pouvant être connecté à une source d'énergie en courant alternatif, un second enroulement (70) pour délivrer une tension de fonctionnement en courant alternatif aux extrémités opposées de ladite chambre et un troisième enroulement (76), et un condensateur ballast (78) connecté sur les extrémités dudit troisième enroulement, et en ce que ledit troisième enroulement (76) est connecté auxdits seconds moyens de circuit (80, 82, 83) pour développer ledit potentiel en courant continu.

12. Système électrique selon l'une quelconque des revendications 1 à 9 dans lequel lesdits premier moyens de circuit comportent des moyens de circuit inductif (92) pouvant être connectés à une source d'énergie en courant alternatif et ayant des premier et second inducteurs pour délivrer une tension de fonctionnement en courant alternatif aux extrémités opposées de la chambre (94) et pour agir en tant que ballast inductif lors du fonctionnement, des premier et second condensateurs ballasts (96, 97) connectés en relation de circuit série avec lesdits premier et second conducteurs, respectivement, en ce que lesdits seconds moyens de circuit comprennent une diode (102) et une résistance (104) en relation de circuit série, connectées entre le côté de la chambre dudit premier condensateur ballast et le côté du ballast inductif dudit second condensateur ballast et en ce que lesdits troisièmes moyens de circuit comprennent un conducteur entre ledit côté ballast inductif du second condensateur et ladite surface conductrice.

13. Système électrique selon la revendication 12 caractérisé en ce qu'un logement de montage contient

ladite lampe et lesdits premier, second et troisièmes moyens de circuit, ledit logement de montage étant au moins partiellement électriquement conducteur et en ce qu'au moins ledit premier condensateur ballast (96) est électriquement isolé dudit logement de montage.

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14. Système électrique selon la revendication 12 ou 13 caractérisé en ce que lesdits troisième moyens de circuit connectent additionnellement ledit côté inductif du second condensateur à des parties électriquement conductrices dudit logement de montage.

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15. Procédé pour empêcher la perte d'ions à partir d'un conducteur de plasma dans une lampe à décharge à intensité élevée du type comprenant une chambre (14) contenant un gaz ionisable qui contribue à la formation du conducteur de plasma, la chambre comprenant des première et seconde bornes, une enveloppe extérieure (17) contenant la chambre, des premiers moyens de circuit (50) incluant un ballast connecté aux première et seconde bornes pour fournir une tension de fonctionnement en courant alternatif à la chambre, et une ou des surfaces électriquement conductrices (18, 48), au voisinage de la chambre, caractérisé en ce qu'on produit un potentiel en courant continu ayant des entrées positive et négative ; on positionne la surface électriquement conductrice à l'extérieur de ladite enveloppe extérieure (17) et on connecte l'une des sorties en courant continu ayant la polarité opposée à celle des ions du conducteur de plasma, sur l'une des première et seconde bornes de la chambre et l'autre des sorties en courant continu sur la ou les surfaces conductrices (18, 48) afin d'établir un champ électrique entre la ou les surfaces et la chambre pour ainsi confiner dans la chambre des ions ayant la polarité de la ou des surfaces.

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16. Procédé pour empêcher la perte d'ions à partir d'un conducteur de plasma dans une lampe à décharge à intensité élevée du type comprenant une chambre (14) contenant un gaz ionisable qui contribue à la formation du conducteur de plasma, la chambre ayant des première et seconde bornes, des premiers moyens de circuit (50) incluant un ballast connecté aux première et seconde bornes pour fournir une tension de fonctionnement en courant alternatif à la chambre, et une ou des surfaces électriquement conductrices (18, 48) au voisinage de la chambre, caractérisé en ce que la ou les surfaces électriquement conductrices (18, 48) sont disposées à l'extérieur de la surface extérieure de la lampe et l'on produit un potentiel en courant continu et, une polarité en courant continu, ayant la polarité opposée à celle des ions du conducteur de plasma, est connectée à l'une des première et seconde bor-

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nes de la chambre et l'autre polarité en courant continu est connectée à la ou les surfaces conductrices (18, 48) afin d'établir un champ électrique entre la surface et la chambre et confiner ainsi dans la chambre des ions ayant la polarité de la ou des surfaces.

FIG. 1

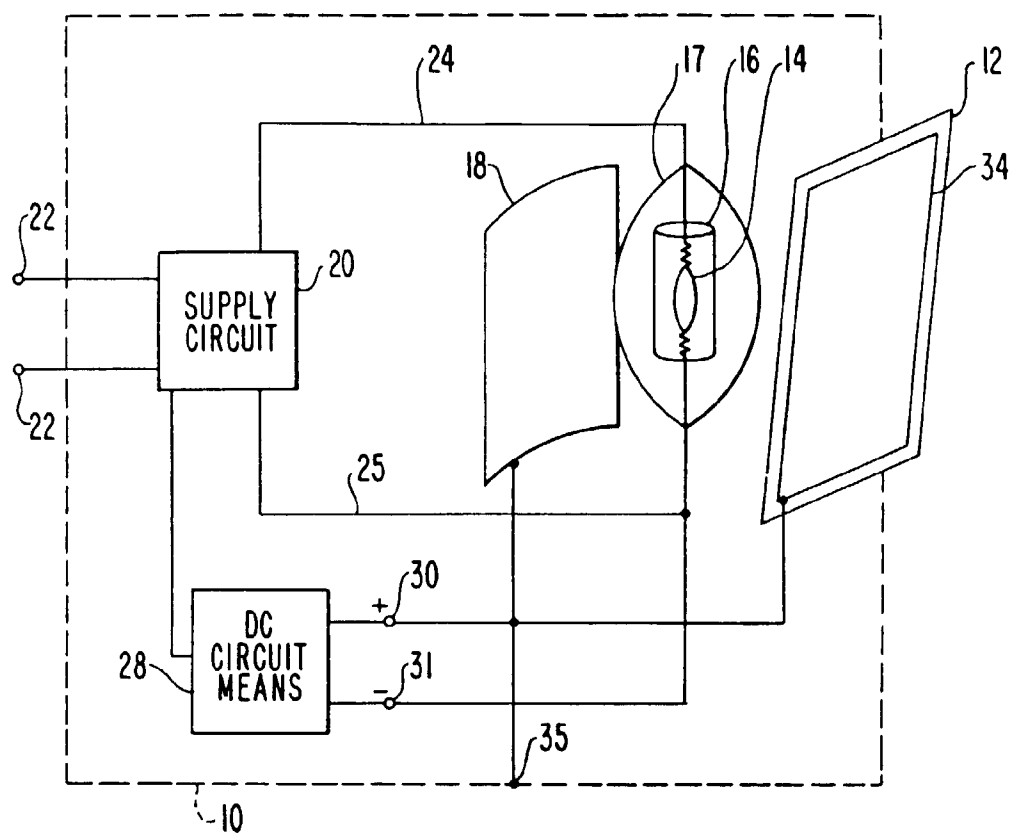


FIG. 2

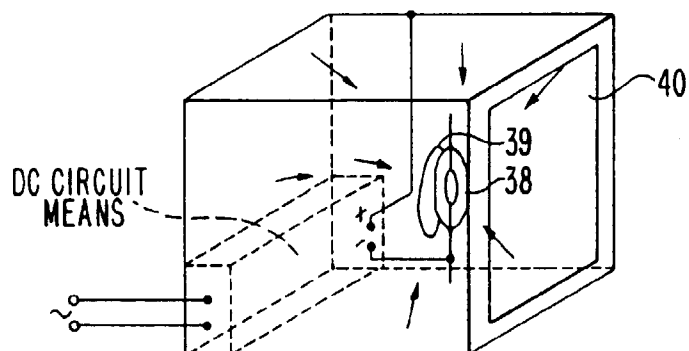


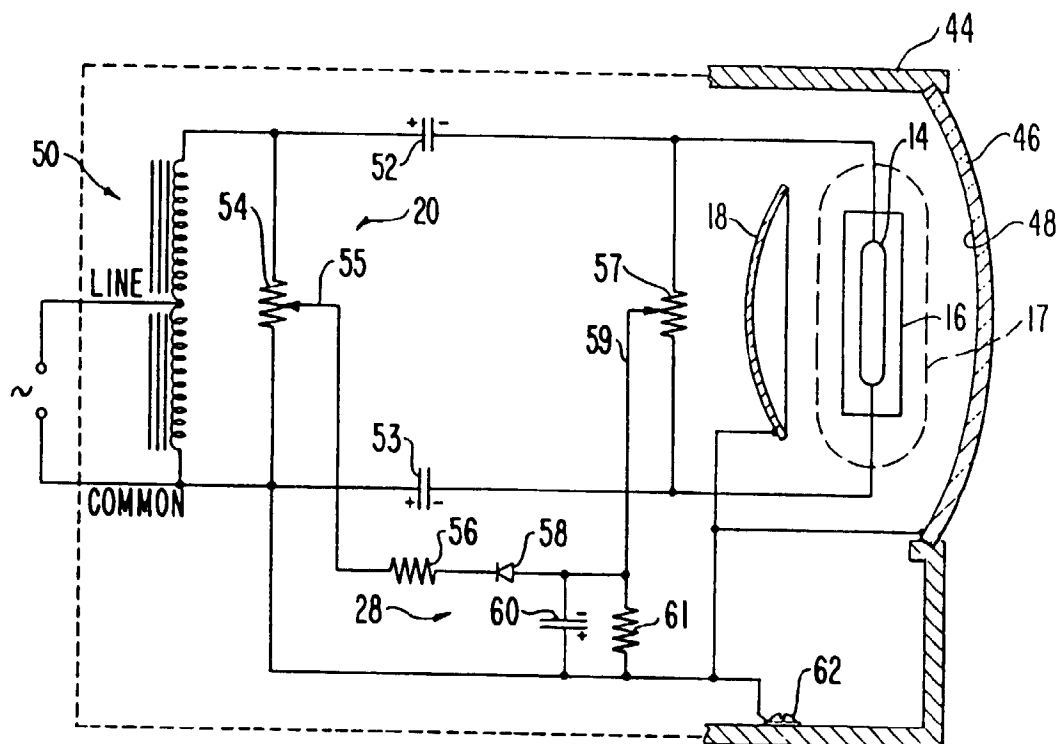
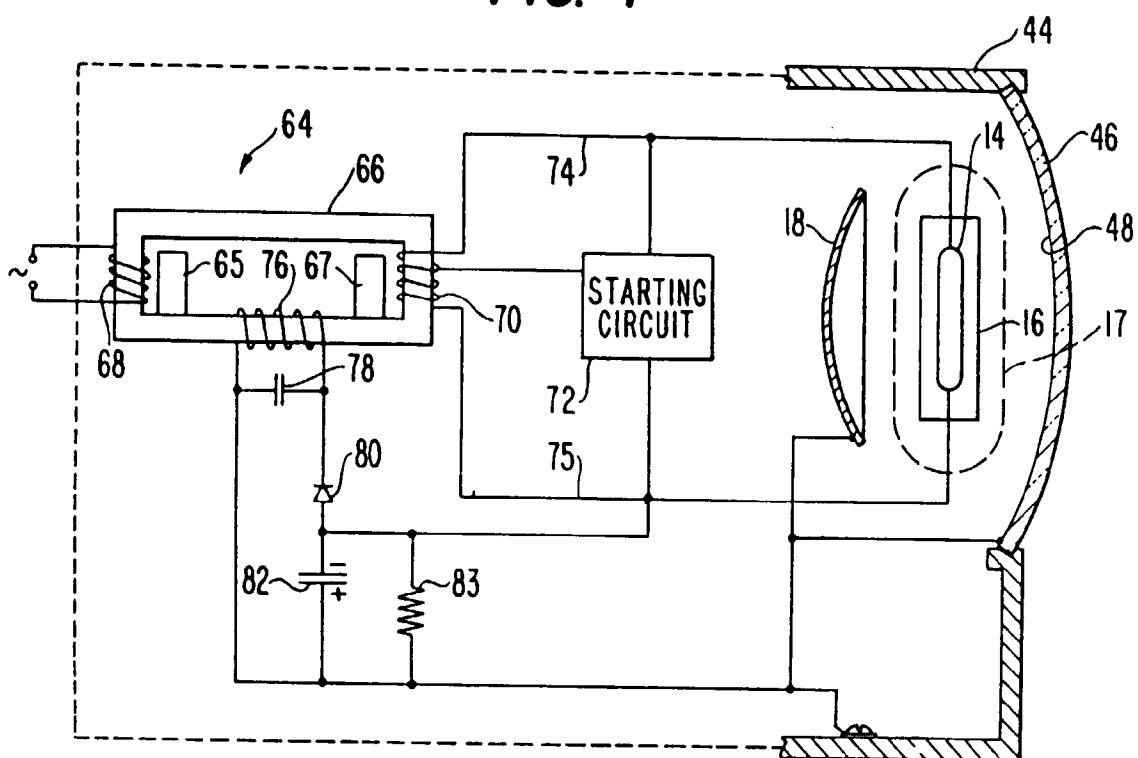
FIG. 3**FIG. 4**

FIG. 5

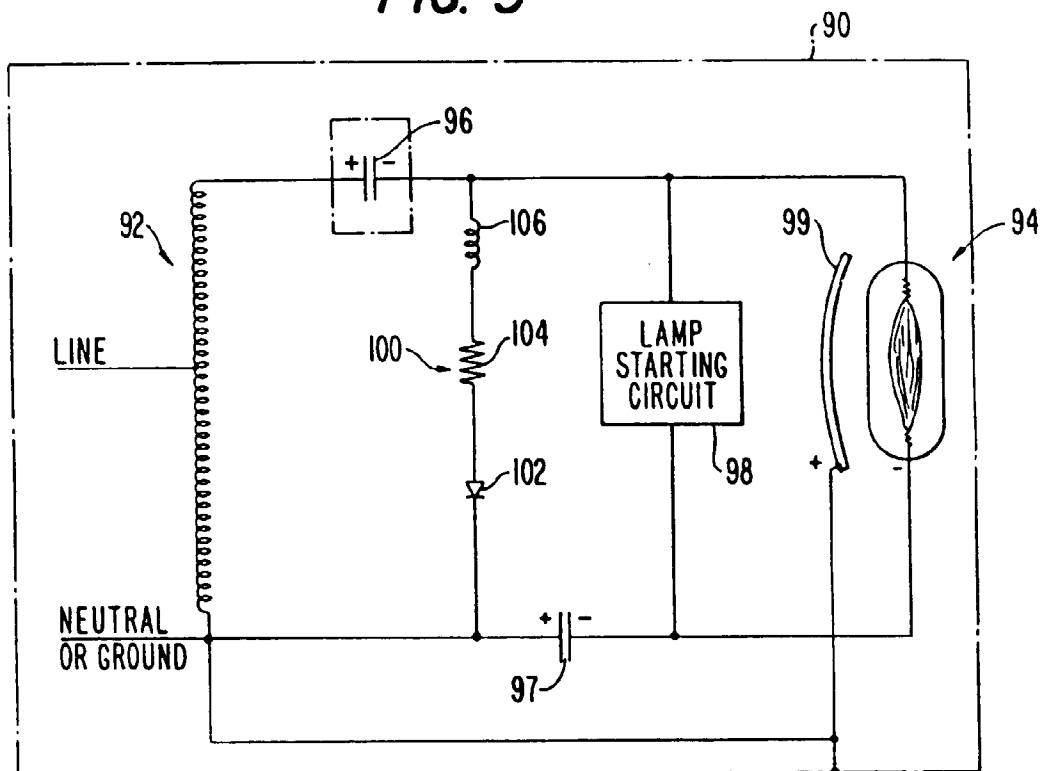


FIG. 7

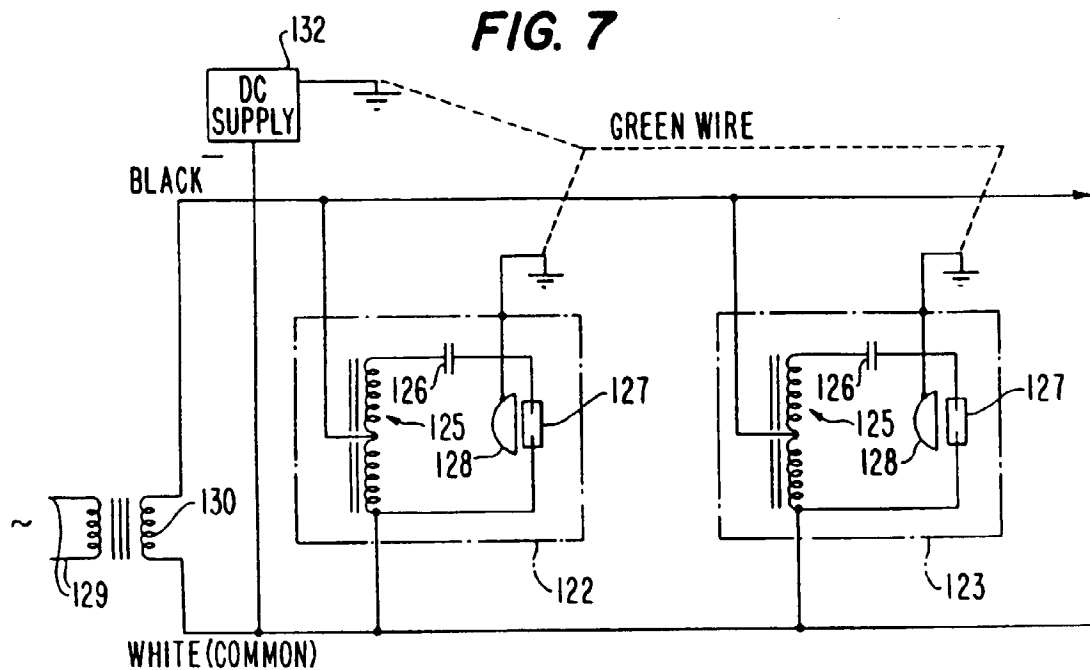


FIG. 6

