United States Patent

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[54] NONELECTRODE RF LIGHT SOURCE

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[51] **Int. Cl.** **H01j 1/02,** H01j 7/26

[58] **Field of Search** 313/31; 315/248

[56] **References Cited**

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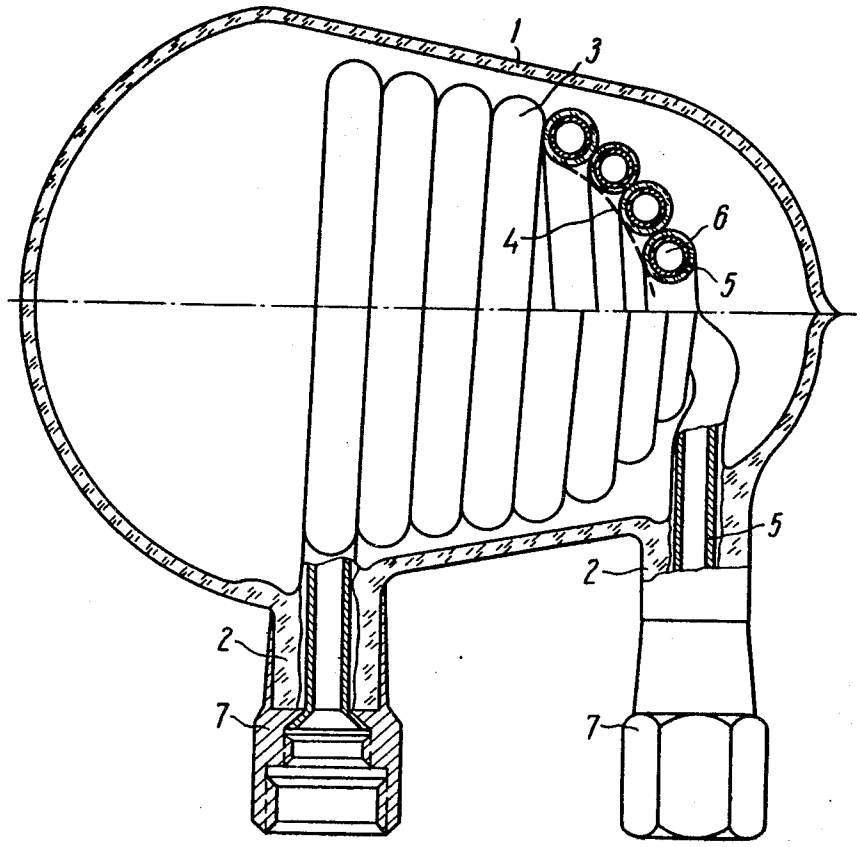
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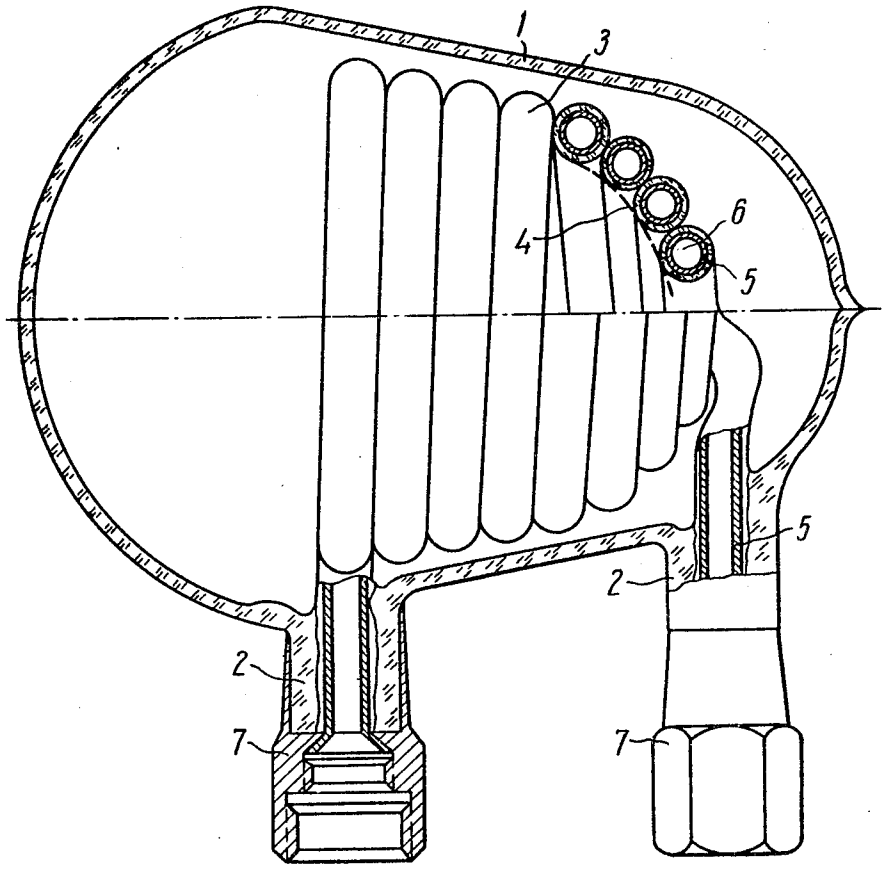
[57] **ABSTRACT**

A nonelectrode RF light source of directional radiation which is an optically transparent bulb filled with a discharge gas, holding a starting inductor having turns of a monotonically decreasing diameter. For its whole length and shape, the inductor is enclosed in an insulating tube whose inner surface has a coating acting as an optical reflector.

The said light source produces a discharge with luminous and spectral characteristics constant with time and uniform in spatial distribution.

2 Claims, 1 Drawing Figure




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NONELECTRODE RF LIGHT SOURCE

The present invention relates to gas-discharge devices, and more specifically to nonelectrode RF light sources intended for use as, for example, sunlamps.

There exists a nonelectrode RF light source comprising an optically transparent glass bulb filled with a discharge gas, and a starting inductor placed inside the bulb and made in the form of a solenoid energized by an RF oscillator.

The starting inductor is fabricated from a copper wire wound into a three-demensional helix enclosed for its whole length and shape in a transparent insulating tube through which a cooling agent is passed to abstract the heat from the inductor.

The said nonelectrode light source has a low coefficient of utilization of the discharge radiation, which is especially noticeable when the nonelectrode RF light source is used in optical devices of directional radiation.

Besides, the passage of some radiation through the cooling agent produces a spatial inhomogeneity in the energy spectrum of the discharge radiation.

A particular object of the invention is to provide a nonelectrode RF light source which emits directional radiation and secures a high coefficient of utilization of radiation along with a uniform energy spectrum of the discharge radiation.

The present invention resides in a nonelectrode RF light source comprising a bulb made from an optically transparent material and filled with a discharge gas, which holds a starting inductor in the form of a solenoid enclosed for its whole length and shape in an optically transparent insulating tube, the inner surface of the insulating tube has, according to the invention, a coating which acts as an optical reflector, while the inductor has turns of a monotonically decreasing diameter.

It is preferable to make the said coating from an electrically conducting material, such as silver. In such a case, the coating will also act as a starting inductor.

The nonelectrode light source disclosed herein is a source of directional radiation and produces a discharge with luminous and spectral characteristics constant with time and uniform in spatial distribution.

The invention will be best understood from the following description of a preferred embodiment when read in connection with the drawing, which sows a cross-sectional view through a nonelectrode RF light source according to the invention.

Referring to the drawing, there is a nonelectrode RF light source comprising a quartz bulb **1** with two pipe unions **2**, filled a discharge gas, such as xenon, under a pressure of 250 to 300 mm. Hg.

The bulb **1** holds a quartz insulating tube **3** which is a three-dimensional helix with turns of a monotonically decreasing diameter such that the inside surface **4** of the helix has the shape of a cup.

The inner surface of the insulating tube **3** has a coating **5** of an electrically conducting material with a high reflection coefficient for optical radiation, such as silver. The coating **5** acts as both an optical reflector and a starting inductor. Inside the insulating tube **3** there is a duct **6** to let in a cooling agent, such as water. The ends of the insulating tube **3** are led out of the bulb **1** through the pipe unions **2** which are sealed to metal adapters **7** intended for connection of the light source to an RF oscillator and a cooling system.

The light source disclosed herein operates as follows.

When the light source is connected to an RF oscillator (not shown in the drawing), an RF current is caused to flow in the starting inductor (the coating **5**).

The alternating electromagnetic field established in the bulb **1** leads to the ionization of the discharge gas within the space bounded by the cup-shaped surface **4**, resulting in a discharge which gives out a luminous flux. The emitted luminous flux is shaped within the solid angle bounded by the surface **4** and is a sum of the luminous flux due to the direct radiation of the plasma within the said solid angle and the luminous flux reflected from the mirror walls of the surface **4**.

Among the advantages of the invention disclosed herein is that the emitted luminous flux has an increased density (two or three times as great as compared with the nonelectrode light source in which the starting inductor has the shape of a cylindrical three-dimensional helix).

It should also be noted that an inductor with turns of a variable diameter secures a steady discharge.

Besides, since the luminous flux in the light source disclosed herein is directional and is not radiated through the walls of the insulating tube **3**, but is reflected from them, it is not affected by variations in the transparency of the quartz insulating tube **3** that may be caused by, say, insignificant impurities in the cooling water.

The cooling agent used in the light source disclosed herein may be common (nondistilled) water, in which case the source still secures a constant intensity of the luminous flux, its spectral composition, and the radiation pattern. Because of these advantages, the nonelectrode RF light source disclosed herein may be used in spectroscopy, color control, and in tests for color fastness.

What is claimed is:

1. A nonelectrode RF light source comprising: a bulb made from an optically transparent material and filled with a discharge gas; a starting inductor made in the form of a solenoid with turns of a monotonically decreasing diameter and enclosed in said bulb; an insulating tube from an optically transparent material enclosing said inductor for its whole length and shape; a coating applied to the inner surface of said insulating tube and acting as an optical reflector.

2. A light source, as claimed in claim **1**, in which said coating is made from an electrically conducting material.

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