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54 **Fluorescent lamp.**

57 An electrodeless fluorescent lamp has an envelope configured to have a height-to-width ratio of less than one. According to one embodiment, the envelope is ellipsoidal. Advantageously, such lamps operate at high efficacies and are useful for replacing incandescent lamps in standard fixtures.

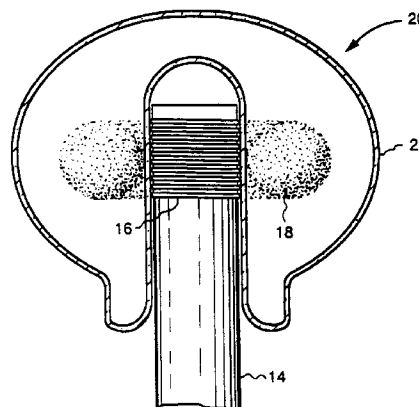


FIG. 2

Field of the Invention

The present invention relates generally to fluorescent lamps and, more particularly, to a high-efficacy electrodeless fluorescent lamp including an envelope configured to have a height-to-width ratio of less than one.

Background of the Invention

Fluorescent lamps generally require lower electrical power to operate than conventional incandescent lamps and are generally more efficient than incandescent lamps on a lumens per Watt basis. Some fluorescent lamps have therefore been designed to replace incandescent lamps in standard fixtures. However, the use of fluorescent lamps as incandescent lamp replacements is limited by the fact that practical fluorescent lamps are generally larger (i.e., longer) than incandescent lamps which produce the same light output.

As a class, electrodeless fluorescent lamps are generally smaller, i.e., shorter, than conventional fluorescent lamps, but are still not as short as desired. Typical electrodeless fluorescent lamps use an envelope with a height greater than or equal to the width. Many envelopes are spherical. By way of illustration, exemplary electrodeless fluorescent lamp configurations are shown in: commonly assigned U.S. Pat. No. 4,017,764 of J.M. Anderson; commonly assigned U.S. Pat. No. 4,187,447 of V.M. Stout and J.M. Anderson; and in the advertising brochure distributed by Philips Lighting at the Hanover Fair in April 1991.

For fluorescent lamps in general, there is a well-known trade-off in size versus lamp efficacy. That is, for a given light output, efficacy decreases as lamp size decreases. The reason is that discharge current density and electron density, and hence discharge loss mechanisms, increase as a result of a smaller discharge space.

Accordingly, it is desirable to reduce the size (more specifically, the height) of an electrodeless fluorescent lamp without sacrificing efficacy.

Summary of the Invention

An electrodeless fluorescent lamp has an envelope configured to have a height-to-width ratio of less than one. According to one embodiment, the envelope is ellipsoidal. Advantageously, electrodeless fluorescent lamps configured in accordance herewith operate at higher efficacies than incandescent lamps and are useful for replacing such lamps in standard fixtures.

Brief Description of the Drawings

The features and advantages of the present in-

vention will become apparent from the following detailed description of the invention when read with the accompanying drawings in which:

Figure 1 is a partial sectional view of an electrodeless fluorescent lamp envelope of the prior art; Figure 2 is a partial sectional view of an electrodeless fluorescent lamp envelope of the present invention; and

Figure 3 is a graphical comparison of average arc efficacy for standard spherical electrodeless fluorescent lamp envelopes and electrodeless fluorescent lamp envelopes according to the present invention, each lamp envelope having the same diameter.

Detailed Description of the Invention

Figure 1 illustrates a typical electrodeless fluorescent lamp 10 having a spherical bulb or envelope 12 containing an ionizable gaseous fill. A suitable fill, for example, comprises a mixture of a rare gas (e.g., krypton and/or argon) and mercury vapor and/or cadmium vapor. An induction transformer core 14 having a winding 16 thereon is situated within a re-entrant cavity within envelope 12. (However, it is to be understood that some fluorescent lamps do not employ a transformer core, and the principles of the invention apply equally to such lamps.) The interior surfaces of envelope 12 are coated in well-known fashion with a suitable phosphor which is stimulated to emit visible radiation upon absorption of ultraviolet radiation. Envelope 12 fits into one end of a base assembly (not shown) containing a radio frequency power supply with a standard incandescent lamp base at the other end.

In operation, current flows through winding 16, establishing a radio frequency magnetic field in transformer core 14. The magnetic field within transformer core 14 induces an electric field within envelope 12 which ionizes and excites the gas contained therein, resulting in an discharge 18. Ultraviolet radiation from discharge 18 is absorbed by the phosphor coating on the interior surface of the envelope, thereby stimulating the emission of visible radiation by the lamp envelope.

Disadvantageously, for a lamp with a spherical envelope such as that shown in Figure 1, there is a trade-off between height versus lamp efficacy. That is, for a lamp having a spherical envelope, to decrease the envelope height, the diameter of the envelope must be decreased, leading to lower efficacy. For example, an electrodeless lamp having a spherical envelope with a 68 mm diameter and producing 1300 lumens is known to have a lower efficacy than a lamp constructed with a spherical envelope with 80 mm diameter also producing 1300 lumens.

In accordance with the present invention, Figure 2 illustrates an electrodeless fluorescent lamp 20 hav-

ing an envelope with a height-to-width ratio of less than one. Since the top and bottom portions of the envelope have very low discharge density, these portions of the envelope can be substantially reduced in size according to the present invention without creating the increase in current density that would otherwise decrease the lamp efficacy. In particular, the fluorescent lamp of Figure 2 comprises an envelope 22 having an ellipsoidal (or "flattened spherical") shape. A preferred height-to-width ratio is in the range from approximately 0.5 to approximately 0.9. Advantageously, the shortened configuration of such fluorescent lamps, without sacrificing efficacy, render them as desirable replacements for incandescent lamps in standard base assemblies.

Example

Two spherical electrodeless fluorescent lamp envelopes, each having an outer diameter of 80 mm, and two ellipsoidal electrodeless fluorescent lamp envelopes, each being 80 mm high by 70 mm wide, were constructed. Each lamp envelope was dosed with mercury and 0.5 Torr of krypton; and was operated with an air core transformer. At five arc power levels, from 15 Watts to 35 Watts, each lamp envelope was allowed to warm up through its optimum mercury temperature. Peak lumen output and power output were measured at each arc power level, and peak efficacy was measured. A graph of average peak efficacy versus arc power for each pair of lamp envelopes is illustrated in Figure 3, the solid line representing average efficacy of the standard spherical lamp envelopes and the dashed line representing average efficacy of the ellipsoidal lamp envelopes.

Advantageously, as indicated by the data of Figure 3, the efficacy of an electrodeless fluorescent lamp is not sacrificed (and may even be improved) by configuring the lamp envelope according to the present invention, resulting in a small, high-efficacy replacement for incandescent lamps in standard fixtures. Specifically, lamp efficacy is not sacrificed by the shortened envelope configuration because current density is not increased.

While the preferred embodiments of the present invention have been shown and described herein, it will be obvious that such embodiments are provided by way of example only. Numerous variations, changes and substitutions will occur to those of skill in the art without departing from the invention herein. Accordingly, it is intended that the invention be limited only by the spirit and scope of the appended claims.

Claims

1. An electrodeless fluorescent lamp, comprising:
a light-transmissive envelope having an in-

terior phosphor coating for emitting visible radiation when excited by ultraviolet radiation, said envelope having a height-to-width ratio of less than one;

a magnetic core contained within said envelope;

means for establishing a radio frequency magnetic field in said core; and

an ionizable, gaseous fill contained in said envelope for sustaining an arc discharge when subjected to said radio frequency magnetic field and to emit ultraviolet radiation as a result thereof.

2. The electrodeless fluorescent lamp of claim 1 wherein said envelope is substantially ellipsoidal.

3. The electrodeless fluorescent lamp of claim 1 wherein the height-to-width ratio is in the range from approximately 0.5 to approximately 0.9.

4. The electrodeless fluorescent lamp of claim 1 wherein said means for establishing a radio frequency magnetic field comprises a drive coil wound about said core.

5. An electrodeless fluorescent lamp, comprising:
a light-transmissive envelope having an interior phosphor coating for emitting visible radiation when excited by ultraviolet radiation, said envelope having a height-to-width ratio of less than one;

a drive coil situated within said envelope;

means for coupling a radio frequency supply to said drive coil so as to generate a radio frequency magnetic field about said coil; and

an ionizable, gaseous fill contained in said envelope for sustaining an arc discharge when subjected to said radio frequency magnetic field and to emit ultraviolet radiation as a result thereof.

6. The electrodeless fluorescent lamp of claim 5 wherein said envelope is substantially ellipsoidal.

7. The electrodeless fluorescent lamp of claim 5 wherein the height-to-width ratio is in the range from approximately 0.5 to approximately 0.9.

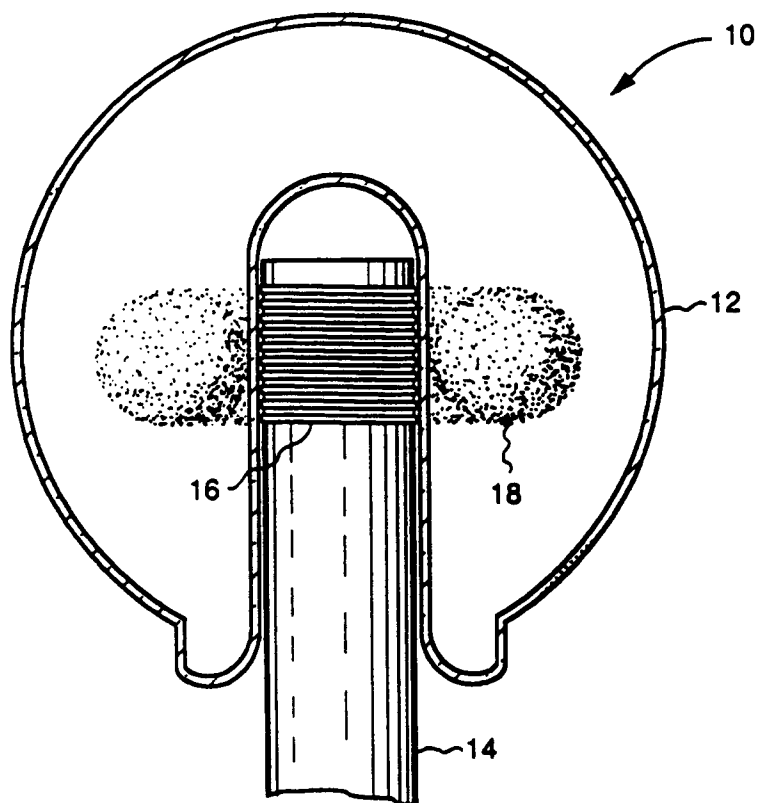


FIG. 1

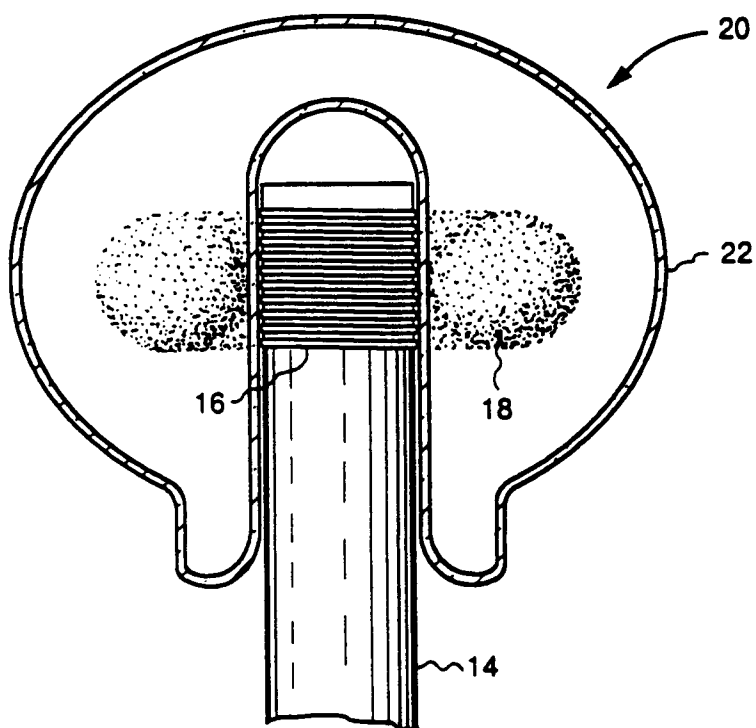


FIG. 2

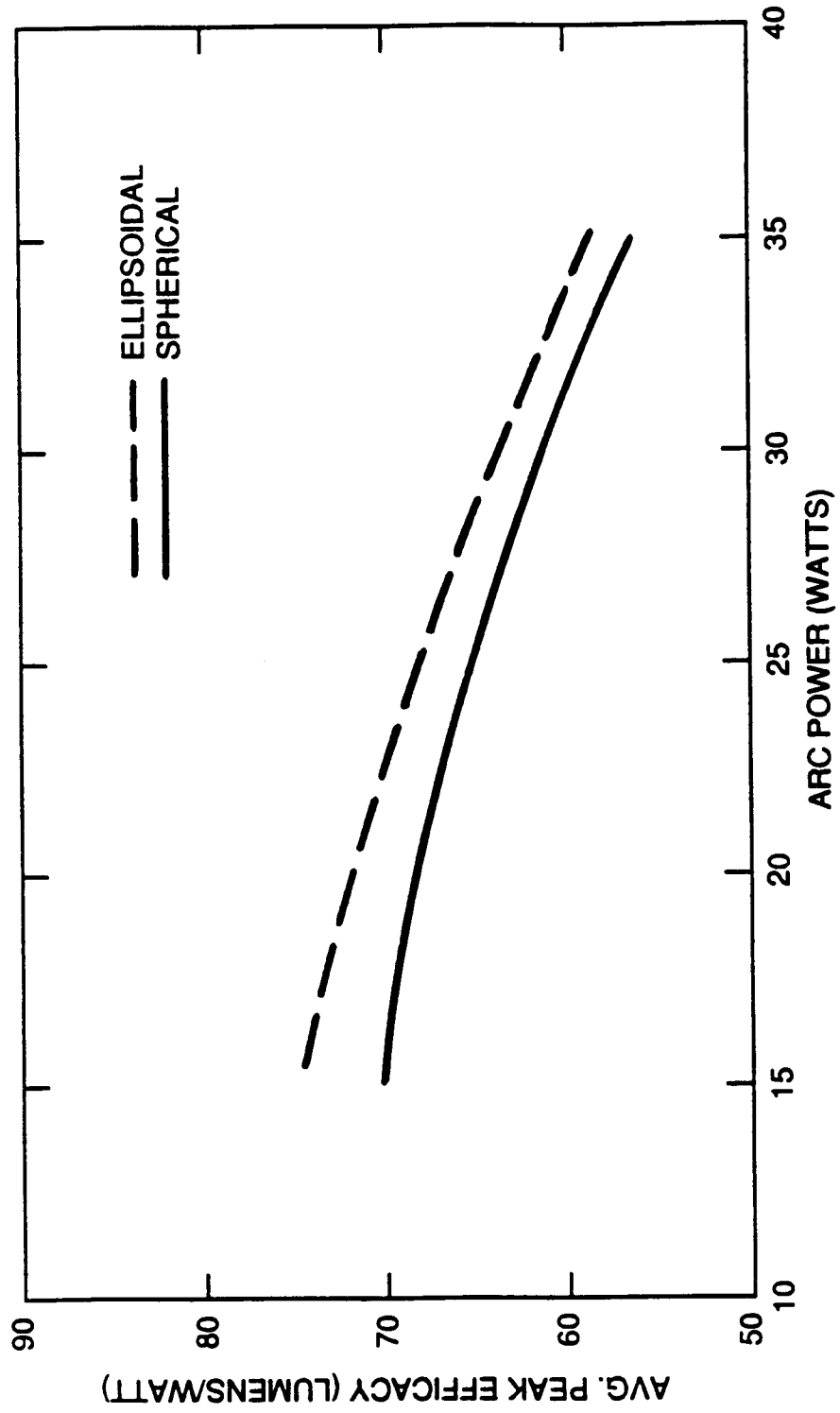


FIG. 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 30 6713

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
6 X	SOVIET PATENTS ABSTRACTS Section EI, Week 8546, 13 December 1985 Derwent Publications Ltd., London, GB; Class X26, AN 85-289032 & SU-A-1 156 168 (LIGHT-TECH RES DES) 15 May 1985 * abstract *	1,2,4-6	H01J65/04
1 A	<div style="text-align: center;">---</div> US-A-4 727 294 (HOUKES ET AL.) <div style="text-align: center;">-----</div>		
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			H01J
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 2 December 1993	Examiner Schaub, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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