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Schmidt

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[54] **GAS DISCHARGE LAMP AND METHOD FOR MAKING SAME**

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[52] **U.S. Cl.** **313/220,** 313/110

[51] **Int. Cl.** **H01g 61/30**

[58] **Field of Search** 313/220, 110

[56] **References Cited**

UNITED STATES PATENTS

3,297,863	1/1967	Robbiano	240/11.4
2,554,584	5/1951	Metz	88/57
2,743,388	4/1956	Bartley	313/317
1,746,024	2/1930	Brandt	313/220

FOREIGN PATENTS OR APPLICATIONS

469,166	11/1950	Canada	313/220

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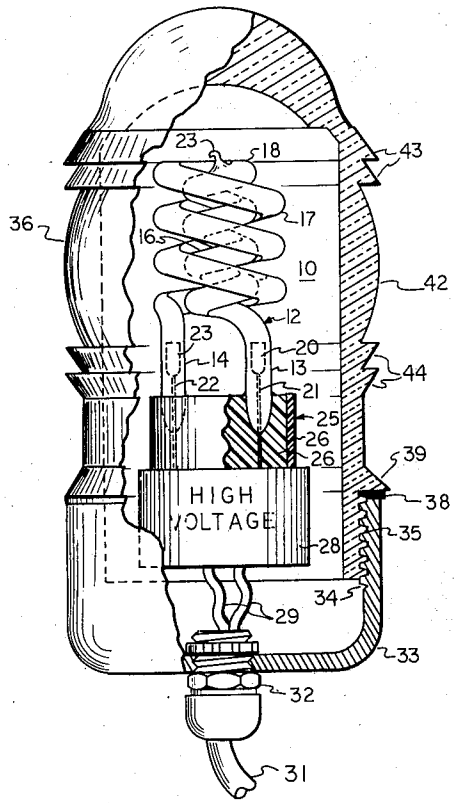
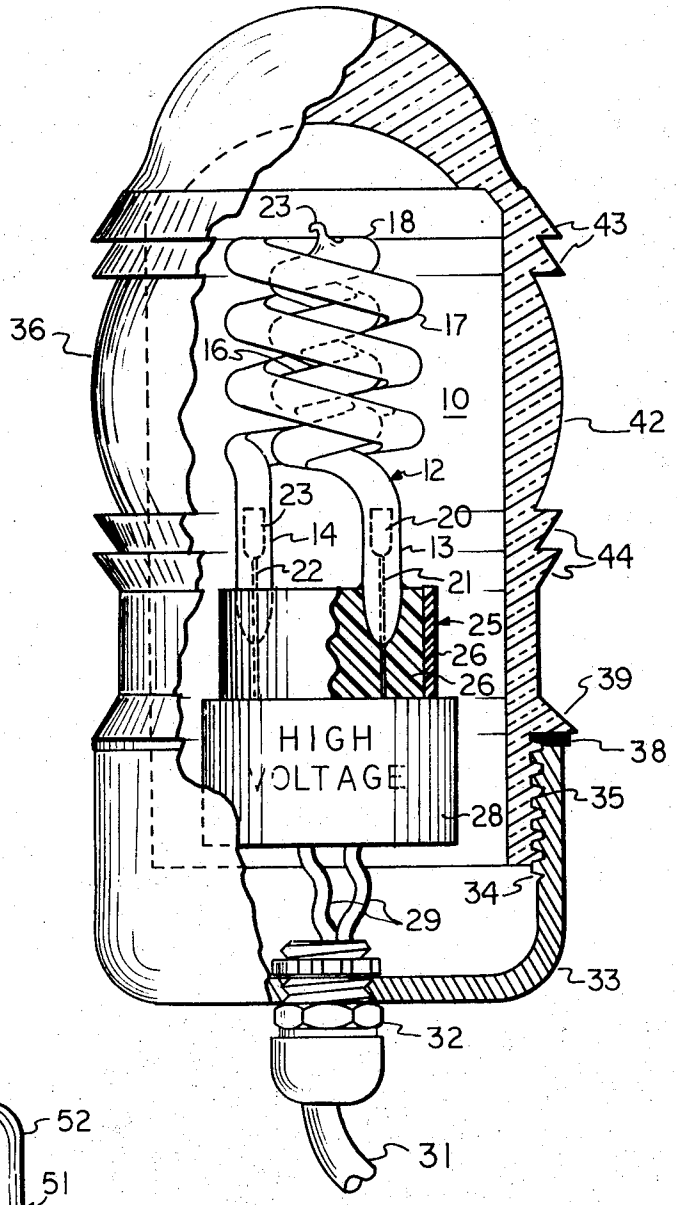
[57] **ABSTRACT**

A gas discharge lamp has a glass tube which constitutes a first helix extending in the manner of a multi-turn screw thread from a first end portion, and a second helix encompassing the first helix. The second helix is interconnected with the first helix and extends in the manner of a multi-turn screw thread to a second end portion of the glass tube. Lamp electrodes are located in the mentioned first and second end portions. A gas filling is contained in the glass tube to provide the requisite gas discharge for emiting light from the lamp.

The lamp may include a hollow-cylindrical echelon lens encompassing the first and second helices. This lens may have an annular oblate-spheroidal central portion encompassing the first and second helices.

10 Claims, 2 Drawing Figures

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HIGH
VOLTAGE
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FIG. 1

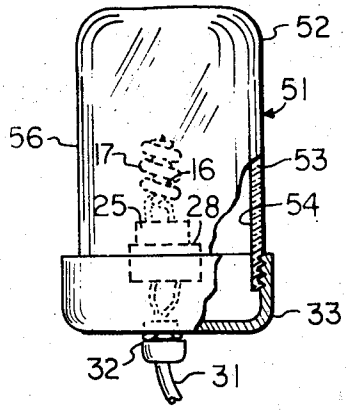
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FIG. 2

GAS DISCHARGE LAMP AND METHOD FOR MAKING SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The subject invention relates to lighting and, more particularly, to gas discharge lamps and methods for making same.

2. Description of the Prior Art

Gas discharge lamps typically have a higher efficiency and a longer life than incandescent lamps. On the other hand, incandescent lamps typically are able to provide a more concentrated light source than gas discharge lamps.

This is a drawback in many applications. For instance, government requirements, such as Federal Aviation Administration regulations, provide for warning beacons and markers which have a high brilliance within a certain angular range relative to a horizontal plane, while having a low brightness at angles beyond that range. So far, it has been possible to meet these requirements with incandescent lamps provided with echelon or Fresnel type lenses. However, efficient incandescent lamps have a rather limited life time. This has not only increased the maintenance cost of the particular lights, but has created dangerous situations because of frequent inaction of warning or marker lights.

As may, for instance, be seen from U.S. Pat. No. 3,297,863, by F. Robbiano, issued Mar. 10, 1967, proposals have been made in the past to provide a more concentrated gas discharge lamp by winding the glass tube of the lamp in the form of spirals into adjacent flat planes. This proposal is, however, not suitable for solving the subject problem, since closely wound flat spiral glass tube structures are difficult to manufacture and impart to the lamp excessive lateral dimensions, rendering it difficult for echelon type lenses to accommodate the lamp. Also, this type of spiral-wound lamp emits an excessive amount of light in a vertical direction as seen from the above mentioned horizontal plane.

SUMMARY OF THE INVENTION

It is an object of this invention to solve the above mentioned problems.

It is a further object of this invention to provide a gas discharge lamp which constitutes a more concentrated source of light.

It is a further object of the invention to provide a gas discharge lamp which constitutes a more directional source of light.

It is a further object of this invention to provide warning lights, marker beacons and the like which employ gas discharge lamps and have certain directional characteristics formerly attainable only with incandescent lamps.

Other objects will become apparent in the further course of this disclosure.

From one aspect thereof, the invention resides in a gas discharge lamp comprising, in combination, a glass tube having a first end portion and a second end portion, and constituting a first helix extending in the manner of a multi-turn screw thread from the first end portion, and a second helix encompassing the first helix, the second helix being interconnected with the first helix and extending in the manner of a multi-turn screw thread to the second end portion, first lamp electrode and terminal means in and at the first end portion, second lamp electrode and terminal means in and at the second end portion, and a gas filling in the glass tube.

The mathematical concept of a helix is well known. However, certain reference works loosely apply the expression "helix" to such things as flat spirals. Since this invention does not employ glass tubes which are wound in the form of flat spirals, the phrase "helix extending in the manner of a multi-turn screw thread" has been coined herein to distinguish the type of helices herein disclosed from flat spiral structures.

In accordance with a preferred embodiment of this invention, the lamp includes a hollow lens structure encompassing the defined first and second helices. This lens may be a hollow-cylindrical echelon lens. The lens may have an annular oblate-spherical central portion which encompasses the two helices.

In the latter case, the first helix may extend essentially along a first imaginary cylinder located inside of and being essentially concentric with the hollow-cylindrical lens, and the second helix may extend essentially along a second imaginary cylinder located inside of and being essentially concentric with the first imaginary cylinder.

Because of the geometrical configuration of the lamp according to the subject invention, the lamp with the two helices has inherent directional characteristics which render staggered or Fresnel lenses unnecessary. Therefore, in accordance with a further preferred embodiment of the subject invention, the lamp includes a hollow cover glass encompassing the first and second helices and having an essentially cylindrical outer surface and an essentially cylindrical inner surface.

Similarly, in accordance with a preferred embodiment of the subject invention, the lamp includes a hollow cover glass encompassing the first and second helices and having a part laterally surrounding the first and second helices. At least the part laterally surrounding the first and second helices has an essentially uniform wall thickness.

In accordance with the presently most preferred embodiment of the subject invention, one of the first and second helices extends in the manner of a right-hand multi-turn screw thread, and the other of the first and second helices extends in the manner of a left-hand multi-turn screw thread. This embodiment is very advantageous since it provides for part of a turn of each helix to appear in coincidence with gaps between the turns of the other helix. In this manner, the continuity of the lateral light flux of the lamp is materially improved.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention and its objects will become more readily apparent from the following detailed description of preferred embodiments thereof, illustrated by way of example in the accompanying drawings, in which:

FIG. 1 is an elevation, partially in section, of a lamp in accordance with a first preferred embodiment of the subject invention; and

FIG. 2 is a side view, on a reduced scale, of a lamp in accordance with a second preferred embodiment of the subject invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

The gas discharge lamp **10** shown in FIG. 1 has a

glass tube 12 having a first end portion 13 and a second end portion 14. The glass tube 12 constitutes a first helix 16 extending in the manner of a multi-turn screw thread from the first end portion 13. The glass tube 12 further constitutes a second helix 17 which encompasses the first helix 16 and which is interconnected with the first helix at 18. The second helix 17 extends in the manner of a multi-turn screw thread to the second end portion 14.

In the illustrated preferred embodiment, the first helix 16 extends in the manner of a right-hand multi-turn screw thread, and the second helix 17 extends in the manner of a left-hand multi-turn screw thread. This has the substantial advantage of providing behind each gap between adjacent turns of the helix 17 a part of a turn of the helix 16, and of covering up substantially each gap between adjacent turns of the helix 16 with part of a turn of the helix 17. As a result, the continuity of the lateral light flux from the lamp is substantially improved over versions in which both helices are wound in the same sense. The same advantage may be realized by winding the helix 16 in the manner of a mult-turn left-hand screw thread and the helix 17 in the manner of a multi-turn right-hand screw thread.

The lamp 10 further has a lamp electrode 20 with terminal means 21 in and at the first end portion 13, and a lamp electrode 23 and terminal means 22 in and at the second end portion 14. These lamp electrode and terminal means may be provided in a conventional manner.

The lamp 10 also includes a gas filling in the glass tube 12. This gas filling may be provided in a conventional manner, such as by evacuating the glass tube and then inserting a gas charge into the evacuated glass tube. A point 23 shown in FIG. 1 constitutes the melted-down version of an evacuation and gas filling tube (not shown) for the glass tube 12.

By way of example and in accordance with conventional practice, neon can be provided in the glass tube 12 for a red light output, and helium can be employed for a cream color light output. The term "gas filling" is not used herein in a restrictive sense and is intended to be broad enough to cover argon and mercury fillings, which provide a blue light output, as well as other compound or gas fillings for desired light effects. It is also to be understood that fluorescent powders may be used in the lamp 10 to provide or enhance a desired color effect of the generated light.

In the illustrated preferred embodiment of FIG. 1, the lower parts of the end portions 13 and 14 are cemented in a socket 25. The socket 25 has an outer ring 26 which may be of metal or of an electrically insulating material and a cement filling 26 which is of an electrically insulating cement or synthetic resin.

The terminal means 21 and 22 extend through the socket 25 into high voltage equipment 28. The high voltage equipment 28 may, for instance, include a high voltage transformer which transforms line voltage received from leads 29 into the requisite high voltage needed for the operation of the lamp 10. High voltage equipment of this type is conventional and is, therefore, not described or illustrated in detail herein. The showing of the high voltage equipment 28 is, accordingly, highly schematic and it should be understood that the high voltage transformer may be located outside of the lamp structure shown in FIG. 1.

The leads 29 are included in a cable 31 which extends through a bushing 32 in a lamp base 33. The lamp base 33 may, for instance, be of a weather-resistant metal or synthetic resin.

The lamp base 33 has an internal thread 34 for receiving a threaded end portion 35 of a hollow echelon or Fresnel-type lens 36 which encompasses the first and second helices 16 and 17.

A gasket 38 is located between the top of the lamp base 33 and a shoulder 39 of the lens 36 to prevent the intrusion of water into the lamp structure.

The echelon lens 36 has an annular oblate-spheroidal central portion 42 encompassing the first and second helices. The lens also includes a plurality of saw-tooth shaped annular ribs 43 and 44 for enhancing the directional effect of the lens on the light generated by the lamp.

The lens 36 may be made of glass or of a transparent organic substitute therefor.

Reverting to the helices 16 and 17, it may be seen that the first helix 16 may be considered as extending essentially along a first imaginary cylinder located inside of and substantially concentric with the lens 36. Similarly, the second helix 17 may be considered as extending essentially along a second imaginary cylinder located inside of and being essentially concentric with the first imaginary cylinder. This distinguishes the lamp according to the subject invention from such structures as the lamp structure shown in the above mentioned Robbiano patent in which the lamp is composed of two flat spirals which extend along parallel imaginary flat planes.

In contrast to the lamp of FIG. 1, the lamp 51 according to the preferred embodiment of FIG. 2 does not have a hollow lens structure. Rather, it has a hollow cover glass 52 which encompasses first and second helices 16 and 17 and which has an essentially cylindrical outer surface 53 and an essentially cylindrical inner surface 54. The cover glass need not necessarily be cylindrical, as long as at least the part 56 of the cover glass which laterally surrounds the first and second helices 15 and 16 has an essentially uniform wall thickness, as shown in FIG. 2.

The possibility of using a simple type of glass cover instead of an expensive echelon or Fresnel type lens structure is rendered possible by the directional characteristics of the dual helix lamp configurations of the subject invention.

It should also be noted at this juncture that a special coloration of the lens structure 36 or of the cover glass 51 is rendered unnecessary by the fact that a desired coloration of the generated light may be provided by an appropriate gas filling of the helices 16 and 17 with or without the use of metallic or other additions of fluorescent powders.

The expression "cover glass" is herein employed in a broad sense since it is intended to cover not only glass but also organic substitutes thereof.

The lamp of the subject invention may be manufactured by conventional techniques. For instance, a cylindrical or threaded mandrel may be employed for winding the inner helix 16 and a hollow-cylindrical mandrel of a similar type may then be employed for winding the outer helix 17 from a heated glass tube.

It will now be recognized that the subject invention provides substantial technological advances in the gas discharge lamp field. Variations and modifications

within the spirit and scope of the subject invention will suggest themselves or become apparent from the subject disclosure to those skilled in the art.

I claim:

1. A gas discharge lamp comprising in combination:

a glass tube having a first end portion and a second end portion, and constituting a first helix extending in the manner of a multi-turn screw thread from said first end portion, and a second helix encompassing said first helix, said second helix being interconnected with said first helix and extending in the manner of a multi-turn screw thread to said second end portion;

first lamp electrode and terminal means in and at said first end portion;

second lamp electrode and terminal means in and at said second end portion; and

a gas filling in said glass tube.

2. A lamp as claimed in claim **1**, including in said combination:

a hollow lens structure encompassing said first and second helices.

3. A lamp as claimed in claim **1**, including in said combination:

a hollow echelon lens encompassing said first and second helices.

4. A lamp as claimed in claim **3**, wherein:

said lens has an annular oblate-spheroidal central portion encompassing said first and second helices.

5. A lamp as claimed in claim **4**, wherein:

said first helix extends essentially along a first imaginary cylinder located inside of and being essentially concentric with said lens; and

said second helix extends essentially along a second imaginary cylinder located inside of and being essentially concentric with said first imaginary cylinder.

6. A lamp as claimed in claim **1**, including in said combination:

a hollow cover glass encompassing said first and second helices and having an essentially cylindrical outer surface and an essentially cylindrical inner surface.

7. A lamp as claimed in claim **1**, including in said combination:

a hollow cover glass encompassing said first and second helices and having a part laterally surrounding said first and second helices, at least said part laterally surrounding said first and second helices having an essentially uniform wall thickness.

8. A gas discharge lamp comprising in combination:

a glass tube having a first end portion and a second end portion, and constituting a first helix extending in the manner of a multi-turn screw thread from said first end portion, and a second helix encompassing said first helix, said second helix being interconnected with said first helix and extending in the manner of a multi-turn screw thread to said second end portion, one of said first and second helices extending in the manner of a right-hand multi-turn screw thread, and the other of said first and second helices extending in the manner of a left-hand multi-turn screw thread;

first lamp electrode and terminal means in and at said firs end portion;

second lamp electrode and terminal means in and at said second end portion; and

a gas filling in said glass tube.

9. A gas discharge lamp as claimed in claim **8**, including in said combination:

a hollow cover glass encompassing said first and second helices and having an essentially cylindrical outer surface and an essentially cylindrical inner surface.

10. A gas discharge lamp as claimed in claim **8**, including in said combination:

a hollow cover glass encompassing said first and second helices and having a part laterally surrounding said first and second helices, at least said part laterally surrounding said first and second helices having an essentially uniform wall thickness.

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