

- [54] **SODIUM VAPOR LAMP HAVING
IMPROVED STARTING MEANS
INCLUDING A HEATER**

2,581,959 1/1952 Koehler.....313/15

[75] Inventor: **Sheppard Cohen**, Danvers, Mass.

Primary Examiner—Roy Lake
Assistant Examiner—Darwin R. Hostetter
Attorney—Norman J. O'Malley et al.

[73] Assignee: **GTE Sylvania Incorporated**, Danvers, Mass.

[22] Filed: **June 26, 1972**

[57] **ABSTRACT**

[21] Appl. No.: 266,294

[52] U.S. Cl.313/15, 313/17, 313/44,
315/47

[51] Int. Cl. H01j 7/24

[58] **Field of Search**315/46, 47, 48; 313/15, 17,
313/44

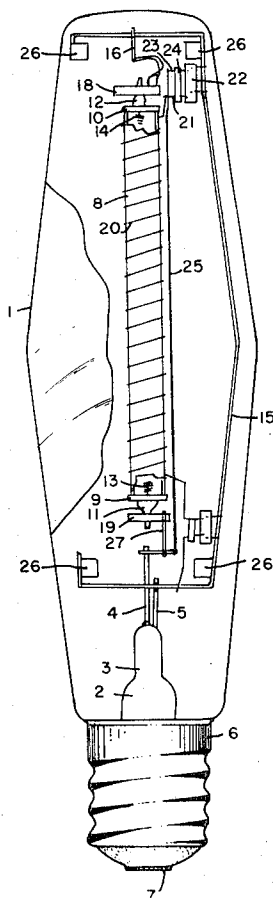
The arc tube of a sodium vapor arc discharge lamp has an external heater in heat transfer relationship with the arc tube and extending about the length of the arc tube. The ends of the heater are electrically connected to electrodes at the respective opposite ends of the arc tube in order to reduce the starting voltage of the lamp.

[56] **References Cited**

2 Claims, 1 Drawing Figure

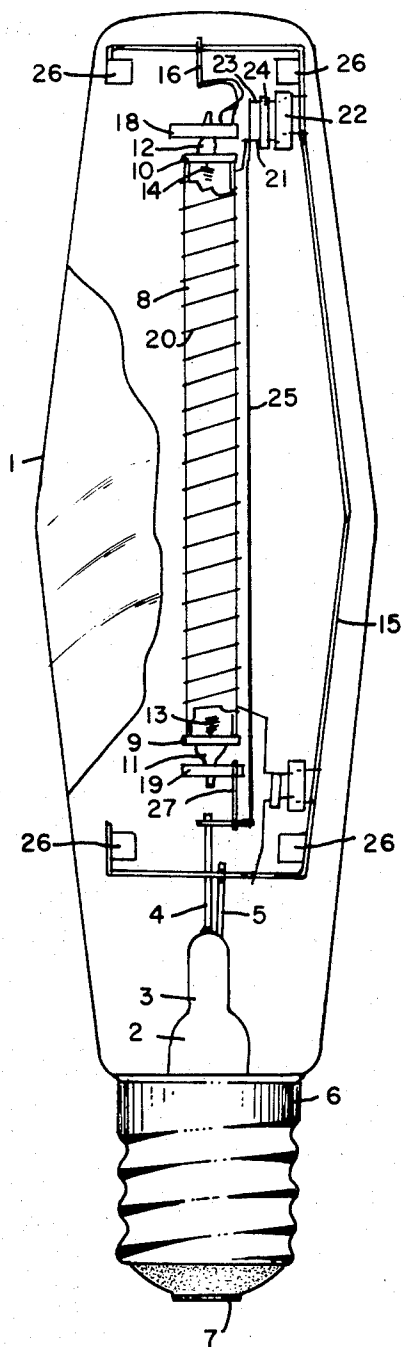
UNITED STATES PATENTS

2,765,416	10/1956	Beese et al.	313/15
-----------	---------	-------------------	--------



PATENTED MAR 20 1973

3,721,846



SODIUM VAPOR LAMP HAVING IMPROVED STARTING MEANS INCLUDING A HEATER

BACKGROUND OF THE INVENTION

1. Field Of The Invention

This invention relates to arc discharge lamps and, in particular, to high pressure sodium vapor lamps.

2. Description Of The Prior Art

Within the past few years, high pressure sodium vapor lamps have become commercially useful, especially for outdoor lighting applications, because of their high efficiency, generally in excess of 100 lumens per watt. The sodium operating vapor pressure in such lamps can vary from several millimeters to about 1,000 millimeters Hg.

Such lamps are called high pressure in order to distinguish them from low pressure sodium vapor lamps in which the sodium operating vapor pressure is in the order of a few microns. Low pressure sodium lamps have been in use for about 30 or 40 years, but, although efficient, they produce an unattractive monochromatic yellow light. The color of light from high pressure sodium lamps is considerably improved over that from low pressure sodium lamps.

High pressure sodium lamps generally comprise an alumina ceramic arc tube and an arc tube fill of sodium, mercury and an inert gas. Examples of such lamps are shown in the following U. S. Pat Nos.: 3,248,590; 3,384,798; 3,448, 319; 3,453,477; 3,485,343; 3,519,406; 3,521,108; 3,558,963.

One of the problems of high pressure sodium arc discharge lamps relates to the starting thereof. Such lamps require a considerably higher starting voltage to initiate an arc discharge than do other types of arc discharge lamps, such as fluorescent, mercury or metal halide. This higher starting voltage requirement necessitates the use of a special ballast for high pressure sodium lamps.

It is an object of this invention to provide a high pressure sodium vapor lamp having a reduced starting voltage, thereby eliminating the high voltage requirements of the ballast. Thus, a simpler more economical ballasting arrangement becomes quite practicable and, in fact, conventional mercury lamp ballasts can often be used. Although such a lamp is shown in copending application Ser. No. 214,000 filed 12-30-72, entitled "Arc Discharge Tube With Surrounding Starting Coil" and assigned to the same assignee as the instant application the invention disclosed in the instant application reduces starting voltage to an even greater extent.

In another copending application Ser. No. 259,085 entitled "Sodium Vapor Lamp Having Improved Starting Means" by Audesse, same assignee, filed on June 2, 1972, a sodium vapor lamp having a heater adjacent the arc tube is disclosed, for the purpose of reducing the arc tube starting voltage. In the instant application, however, arc tube starting is again improved to an even greater extent.

SUMMARY OF THE INVENTION

A high pressure sodium vapor lamp in accordance with this invention comprises an arc tube having electrodes at its ends and containing a fill including sodium, mercury and an inert gas. In heat transfer relationship with the arc tube is a coiled heater made of refractory metal wire such as tungsten extending substantially the

entire length of the arc tube. The wattage and spacing of the heater are such that the heater will heat up the arc tube sufficiently in less than about 3 or 4 minutes to permit ignition thereof by a relatively low voltage between the electrodes. The relatively low voltage, about 180 volts for an existing 400 watt design, is in relation to the approximate two kilovolt pulse that is normally needed to initiate the arc discharge in a high pressure sodium lamp and which high voltage pulse requires a special ballast.

The tungsten heater is electrically connected to a thermal switch that opens and removes the heater from the circuit after the arc has been struck between the electrodes.

Each end of the heater is electrically connected to an electrode at the opposite respective end of the arc tube. The effect of this is to reduce the length of the arc discharge starting gap, since the starting voltage will be impressed across the relatively short distance between a heater end and its adjacent electrode, in comparison to the relatively long distance between the two electrodes. After an arc discharge is initiated in the vicinity of an electrode, this discharge transfers to the opposite electrode to become the main arc discharge.

We have found that lamp startability is surprisingly improved by this arrangement, even though the arc tube wall is directly in the discharge path between a heater end and its adjacent electrode.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE in the drawing is an elevational view, partly broken away, of a high pressure sodium vapor lamp in accordance with this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A high pressure sodium vapor lamp in accordance with this invention comprises an outer glass envelope 1 which can be of elongated ovoid shape, such as is commonly used in high pressure sodium lamps, or of bulbous shape, such as is commonly used in mercury vapor and metal halide lamps. The neck of the envelope is closed by a reentrant stem 2 having a press 3 through which extend stiff lead-in wires 4,5 connected at their outer ends to a threaded shell 6 and center contact 7 of a conventional screw base.

Disposed within envelope 1 is an alumina arc tube 8 sealed at its lower end by niobium end cap 9 and at its upper end by niobium end cap 10. Niobium tubes 11, 12 are brazed or welded to end caps 9,10 and are used to support arc tube 8 as well as to conduct current to electrodes 13,14 within the arc tube. In addition, one of the niobium tubes serves as an exhaust tube during manufacture and is used to introduce a fill including an inert gas (e.g., argon or xenon), sodium and mercury into the arc tube, after which the niobium tube is sealed, such as by a cold weld.

Arc tube 8 is supported within envelope 1 by a structure consisting of side support wire 15, vertical support wire 16, metal strap 17 and horizontal metal strap 18. Support wire 15 is welded to lead-in wire 5, support wire 16 is welded to wire 15, strap 17 is welded to wire 16, strap 18 is welded to strap 17 and strap 18 is connected to upper niobium tube 12. Electrical connection between lead-in wire 5 and upper electrode 14 is established by said structure.

The lower end of arc tube 8 is supported by metal strap 19 which is connected between niobium tube 11 and support wire 27, with support wire 27 being welded to lead-in wire 4. Electrical connection is also established thereby between lead-in wire 4 and lower electrode 13.

Wound around arc tube 8 is a tungsten heater 20 extending substantially the entire length of the electrode gap. Heater 20 is of the type disclosed in Ser. No. 214,000, mentioned above, the disclosure of which is incorporated herein by reference.

The upper end of heater 20 is connected to a horizontal metal post 21 which is insulatively supported on wire 15 by means of glass rod 22. At the other end of glass rod 22 is another horizontal metal post 23 to which thermostatic switch 24 is attached. At room temperature switch 24 is closed and establishes electrical contact between posts 21 and 23. After an arc discharge is established between electrodes 13 and 14, switch 24 opens as a result of the heat generated within the lamp.

A metal wire 25 connects post 23 to support wire 27, the effect of which is to place the upper end of heater 20 and lower electrode 13 at the same potential, when switch 24 is closed.

The lower end of heater 20 may be electrically connected to upper electrode 14 by means of a similar structure, including a glass rod, two horizontal posts and a thermostatic switch at the lower end of the lamp.

When a voltage is applied to the lamp, said voltage is impressed across heater 20, which heats arc tube 8. But this voltage is also impressed between the lower end of heater 20 and proximate lower electrode 13 and, in addition, between the upper end of heater 20 and proximate upper electrode 14. Since the discharge starting gap is considerably reduced by this arrangement, lamp

starting is materially improved and/or the starting voltage is significantly lowered.

Attached to the upper and lower ends of side wire 15 are spring fingers 26 which press against the interior wall of envelope 1 and provide increased support for the arc tube.

In lamps having heater connections reversed in accordance with this invention, starting was obtained with a 180 volt input within 1½ minutes after the voltage was applied. In contrast, the same lamps without heater reversal required 2½ minutes to start, even with an input of 240 volts.

This invention may also be used with lamps having arc tube heaters spaced from the arc tube, such as disclosed in the copending application mentioned above under "Description Of The Prior Art," although with less effectiveness because of the increased distance between a heater end and its proximate electrode.

I claim:

1. A high pressure sodium vapor lamp comprising: a glass envelope; an alumina arc tube disposed within said envelope and having electrodes sealed therein at the ends thereof and containing a filling including sodium, mercury and an inert gas; a heater proximate said arc tube and in heat transfer relationship therewith and extending about the length of said arc tube, one end of said heater being electrically connected to the electrode at the opposite end of said arc tube through a thermal switch, said switch being normally closed during non-operation of said lamp, said switch being open during lamp operation, the other end of said heater being connected to the electrode at the opposite end of said arc tube.

2. The lamp of claim 1 wherein said heater comprises refractory metal wire wound directly on said arc tube.

* * * * *

40

45

50

55

60

65