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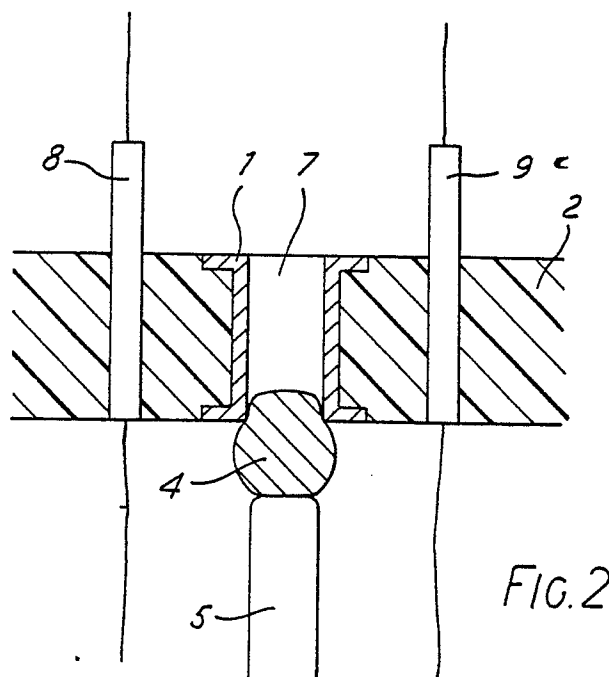
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(54) **Improvements in or relating to metal vapour discharge lamps.**

(57) A metal vapour discharge lamp includes a heat sink material (4) which is in thermal contact with the lamp exhaust tube (5). The heat sink material (4) bridges a gap between the exhaust tube (5) and a metal eyelet (1) mounted in an end cap (2) of the lamp. The heat sink material may be contained within a metal cap (10).



EP 0 269 360 A2

IMPROVEMENTS IN OR RELATING TO METAL VAPOUR DISCHARGE LAMPS

This invention is related to the provision of cool spots in metal vapour discharge lamps and particularly in fluorescent low pressure mercury vapour discharge lamps.

The light output of a fluorescent lamp depends to a great extent on the lamp loading, that is, the amount of power dissipated per unit area of the tube. If the current in a given lamp is increased, the voltage is lowered due to the negative voltage/current characteristic of the discharge and the power and lumen output are increased. However, the efficacy falls, partly because of increased cathode losses and partly because the mercury vapour pressure is increased due to higher bulb temperature which results in increased self-absorption of the resonance radiation.

It is desirable to design a fluorescent lamp so that its highest light output occurs at the normal (stable) working temperature.

A fluorescent lamp has a maximum light output and in a typical lamp this occurs when the temperature of the coolest part of the lamp is about 40°C. For many standard linear fluorescent lamps, this condition is closely approached in normal usage with ambient temperatures of the order of 25°C. At these temperatures the mercury vapour pressure is at an optimum for the generation of ultra-violet radiation at 253.7nm, but as the temperature increases the vapour pressure also increases, with detrimental results as described above.

In some applications, lamps are required to run at temperatures higher than those required for maximum light output, especially when they are enclosed in luminaires.

In such cases, several methods have been used to reduce the mercury vapour pressure in the lamp, such as having a bubble blown in the lamp bulb which acts as a cool spot where mercury can condense. The temperature of the cool spot controls the vapour pressure in the lamp.

Provision may be made on the arc tube for a cool spot or the exhaust tube may be used for this purpose.

It is an object of the invention to provide a lamp which is arranged to alleviate the problems as described hereinbefore.

According to the invention there is provided a metal vapour discharge lamp including an envelope, an exhaust, and a heat sink material in thermal contact with the exhaust for conducting heat away from the exhaust, thereby to control the vapour pressure in the lamp.

Such an arrangement allows the temperature of the exhaust, which acts as a cool spot, to be

controlled.

It is preferable for the heat sink material to be flexible.

The exhaust may be a substantially straight tube.

According to a further aspect of the invention there is provided a method of constructing a metal vapour discharge lamp having an envelope and an exhaust, the method including the step of placing a heat sink material in thermal contact with the exhaust.

In order that the invention may be clearly understood and readily carried into effect, it will be described by way of example with reference to the accompanying drawings, of which:

Figure 1 shows an end of a lamp having an exhaust tube with a heat sink material in contact with it,

Figure 2 shows an enlarged detail of Figure 1,

Figure 3 shows another version of a lamp having a heat sink,

Figure 4 shows an enlarged detail of Figure 3, and

Figure 5 is a part cross-sectional view of a lamp embodying the invention.

In Figure 1, a metal eyelet 1 (made of, for example, brass, copper or aluminium) is assembled in the base 2 of an end cap 3, typically of a plastics material, covering, in this instance, both ends of a generally U-shaped lamp, having an envelope shown in part at 6. The eyelet is a thermally conductive member. A heat sink material 4, such as a zinc oxide in silicon compound, for transferring heat away from the envelope, bridges the exhaust tube 5 and the eyelet 1. One suitable zinc oxide in silicon compound has thermal conductivity $0.712 \text{ Wm}^{-1} \text{ K}^{-1}$ and resistivity $2 \times 10^{13} \Omega \text{m}$ at 20°C. The heat sink compound transfers heat to the eyelet which is located between pins 8 and 9, which are electrical connectors, mounted in the end cap.

Another heat sink material which may be used is metal filled epoxy resin.

Figure 2 shows an enlarged detail of Figure 1. In Figure 2 it can be seen that the heat sink material is exposed to the air via aperture 7 of the eyelet.

The heat sink material is preferably flexible. If this is so, greater tolerances on the assembly are allowable. Otherwise, movement of the glass exhaust tubing with respect to the cap may have to be taken into account and relative expansion of the various components as they heat up would have to be allowed for.

When a flexible material is used, it is possible to position it by injection through aperture 7 using a syringe or similar device.

In Figure 3, heat sink compound 4 is contained within a metal cap 10 which is set into the base 2 and contacts the eyelet 1 (as can be seen more clearly in Figure 4).

Figure 5 shows a lamp embodying the invention, having an envelope 6 and an exhaust tube 5 at one end of the envelope in thermal contact with a heat sink compound 4. An exhaust 11 at the other end of the envelope is shown sealed off.

For one particular lamp having an exhaust tube and heat sink, the light output was found to peak at an ambient temperature of 32°C compared with 27°C for a lamp having a conventional straight tip. The invention therefore allows highly loaded lamps to be used which run hotter than average and it may also be used where light fittings tend to run hot.

It will be apparent that the exhaust tube does not have to be straight, although it is in the example shown.

Although a generally U-shaped lamp has been illustrated, the invention is applicable to other lamps including lamps having straight envelopes. Also, it will be obvious to a skilled person that materials other than those specifically mentioned are suitable.

In the illustrated embodiments, the metal vapour discharge lamp is a low pressure mercury vapour discharge lamp which may be a fluorescent lamp, but the invention also applies to other metal vapour discharge lamps.

A further advantage of the invention is that it does not require a special form of bend or join in the lamp envelope.

Claims

1. A metal vapour discharge lamp including an envelope, an exhaust, and a heat sink material in thermal contact with the exhaust for conducting heat away from the exhaust, thereby to control the vapour pressure in the lamp.

2. A metal vapour discharge lamp according to Claim 1 in which the exhaust is a substantially straight tube.

3. A metal vapour discharge lamp according to Claim 1 or Claim 2 in which the heat sink material is a heat sink compound.

4. A metal vapour discharge lamp according to Claim 3 in which the compound is zinc oxide in silicon.

5. A metal vapour discharge lamp according to any one of the preceding claims in which the heat sink material is flexible.

6. A metal vapour discharge lamp according to any one of the preceding claims including an end cap mounting a thermally conductive member, the heat sink material bridging said envelope and said member.

7. A metal vapour discharge lamp according to Claim 6 in which the member comprises a metal eyelet, the material being in contact with air via an aperture in the eyelet.

8. A metal vapour discharge lamp according to any one of Claims 1 to 5 in which the heat sink material is contained in a metal cap.

9. A metal vapour discharge lamp according to Claim 8 including an end cap mounting a thermally conductive member, said metal cap being in thermal contact with the conductive member.

10. A metal vapour discharge lamp according to Claim 9 in which the conductive member is a metal eyelet.

11. A metal vapour discharge lamp according to any one of Claims 6 to 10 in which the end cap mounts at least two electrical connectors and said thermally conductive member is located between said electrical connectors.

12. A metal vapour discharge lamp according to any one of the preceding claims which is a low pressure mercury vapour discharge lamp.

13. A metal vapour discharge lamp according to Claim 12 which is a fluorescent lamp.

14. A method of constructing a metal vapour discharge lamp having an envelope and an exhaust, the method including the step of placing a heat sink material in thermal contact with the exhaust.

15. A method according to Claim 14 including fitting an end cap to an end of the envelope and positioning the heat sink material by injecting it through an aperture in the end cap.

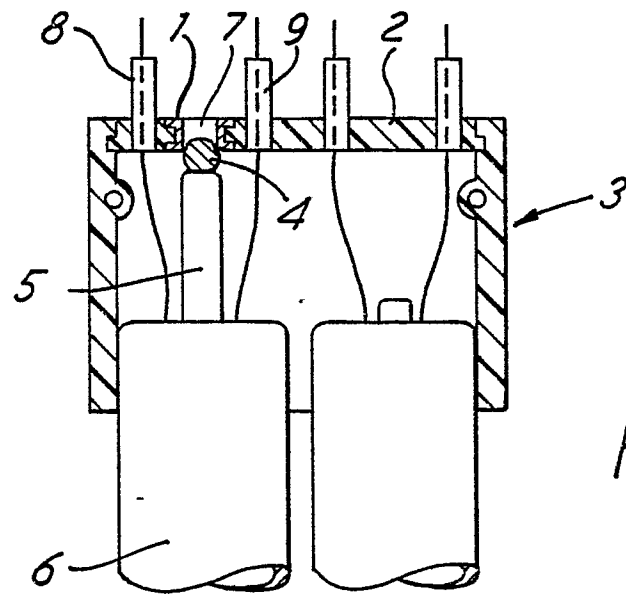


FIG. 1

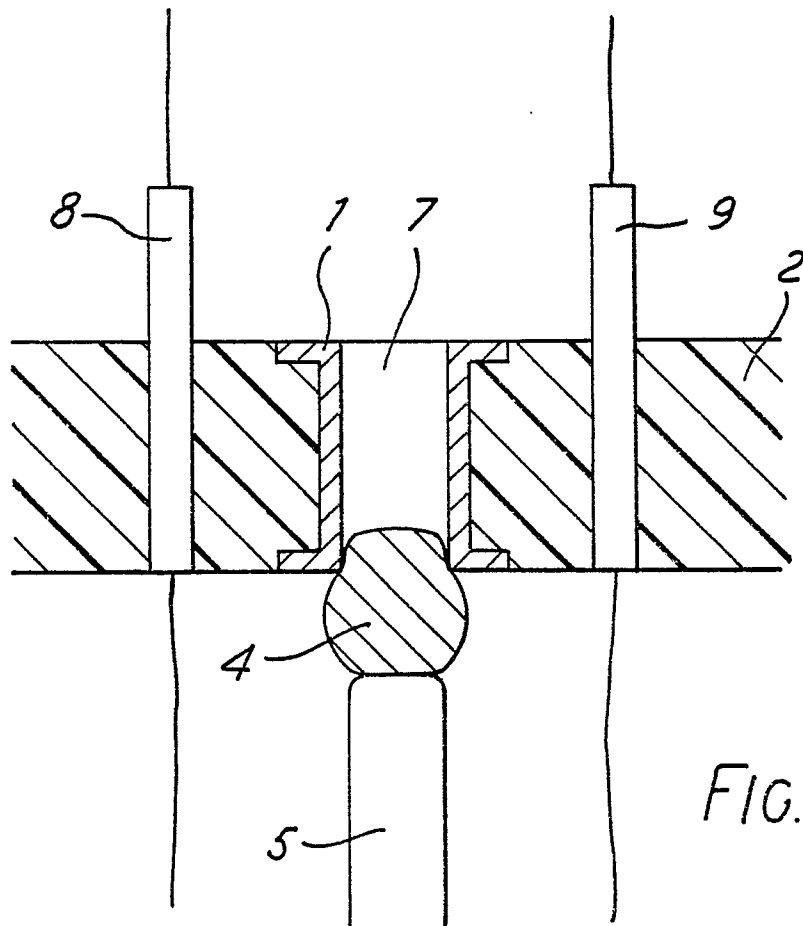


FIG. 2

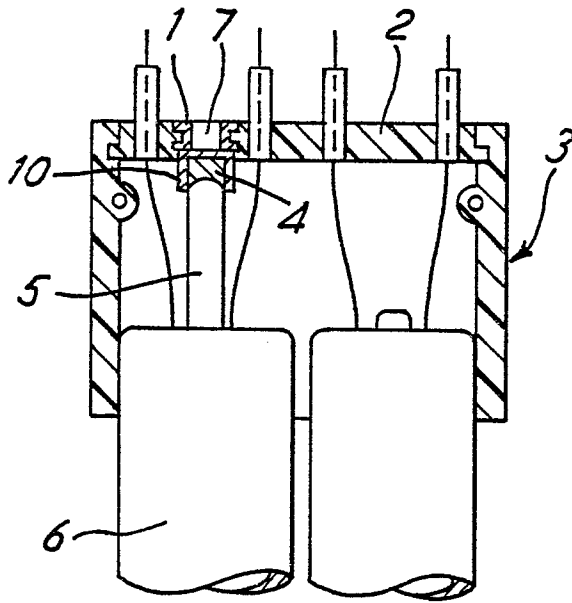


FIG. 3

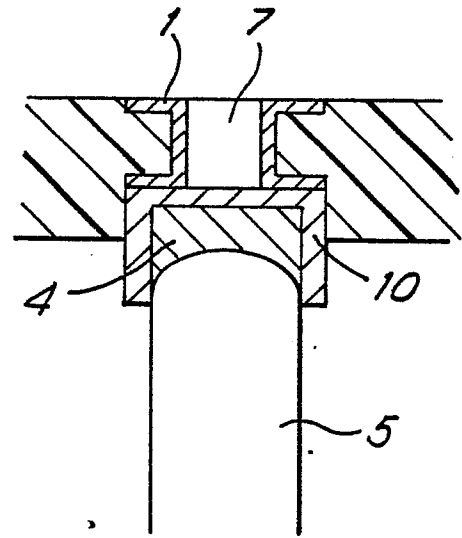


FIG. 4

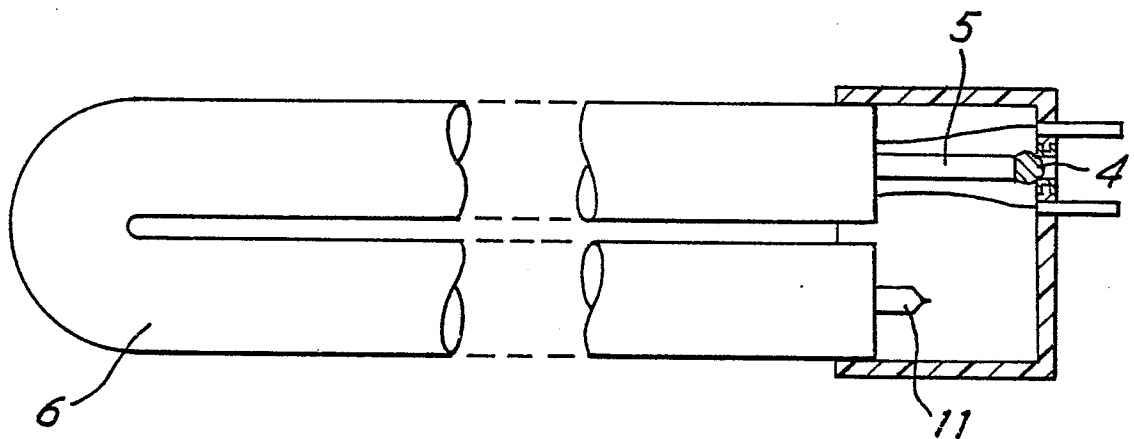


FIG. 5