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(54) Low-pressure discharge lamp

(57) A low-pressure discharge lamp according to the invention is provided with a tubular glass discharge vessel (1) with end portions (2, 2') which is closed in a gastight manner and which has an ionizable filling comprising rare gas. The lamp is in addition provided with a cylindrically curved metal body (4) which has mutually opposed surfaces (4A, 4B) facing away from one another and which has a first tubular portion (5A) extending into the discharge vessel and a zone (4C) which is accessible from outside the discharge vessel. An end portion (2) of the discharge vessel (1) and a glass closing member (3) are each fused to a respective surface (4A, 4B) of the metal body. The lamp is of a simple construction which is comparatively easy to manufacture. The dark range, which extends from the end of the discharge path to the free end of the closing member, is comparatively short.

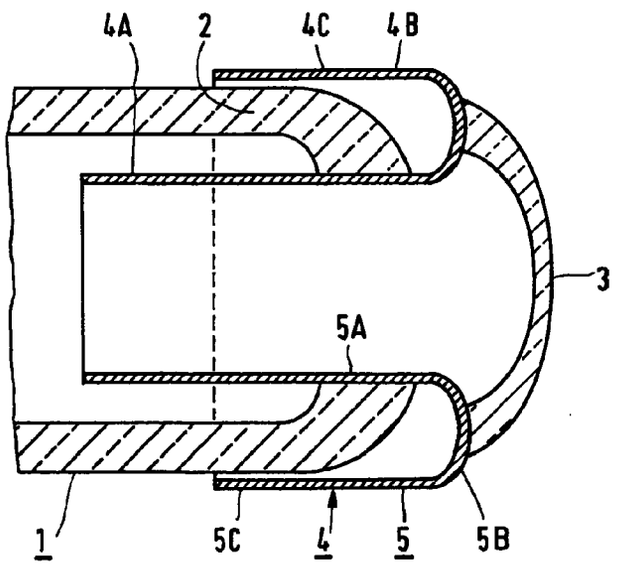

FIG.2

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Description

The invention relates to a low-pressure discharge lamp provided with a tubular glass discharge vessel which is closed in a gaslight manner, which comprises end portions, and which has an ionizable filling comprising rare gas, which lamp is further provided with a cylindrically curved metal body by means of which an end portion of the discharge vessel and a glass closing member are fused together and which has mutually opposed surfaces facing away from one another, which metal body has a first tubular portion extending into the discharge vessel as well as a zone which is accessible from outside the discharge vessel.

Such a lamp is known from EP 562 679 A1. The discharge vessel of the known lamp has a metal body in the form of a tube at either end. The inner and outer surfaces thereof form mutually opposed surfaces which face away from one another. The discharge vessel and the closing member are both fused to one of these surfaces of the metal tube, i.e. to the outer surface. The closing member is formed in that a glass tube fused to the metal tube is closed by fusion. The metal tubes have a multiple function. The first tubular portions thereof act as electrodes between which a discharge path extends. The portions extending outside the discharge vessel and in the discharge vessel wall act as current supply and current lead-through conductors. Between the seals of the discharge vessel and of the closing member, the tubes have a zone which is accessible from the outside and to which a current source can be connected. The lamp may be comparatively easily manufactured because the discharge vessel can be cleaned and provided with its filling through the metal tubes.

The lamp may be used, for example in the form of a low-pressure mercury vapour discharge lamp or low-pressure xenon discharge lamp, for creating decorative lighting, for example line-shaped lighting, or line-shaped safety lighting, or for radiating through a panel, for example a panel for displaying alphanumerical information, or alternatively as a signal lamp. The low-pressure discharge lamp with a filling of rare gas may be used, for example, as a signal lamp, for example as a traffic light lamp or a lamp in or at vehicles.

A disadvantage of the known lamp is that the portion at the end of the discharge path up to the end of the closing member, which portion does not contribute to the lumen output of the lamp, is comparatively long. This portion will be referred to hereinafter as the dark range.

It is an object of the invention to provide a lamp of the kind described in the opening paragraph whose dark range is comparatively short and which is nevertheless of a simple construction which is easy to manufacture.

According to the invention, the lamp of the kind described in the opening paragraph is for this purpose characterized in that the end portion of the discharge vessel and the closing member are each fused to a respective surface of the metal body. The fused joints of the closing member and of the end portion of the discharge vessel to the metal body may thus lie closer together in longitudinal direction, whereby the dark range of the lamp is shortened.

The metal body may comprise a metal having a coefficient of expansion which corresponds to that of the glass of the discharge vessel, for example, a CrNiFe alloy in the case of lime glass, for example Cr 6%, Ni 42%, remainder Fe (by weight). In the case of a hard-glass lamp vessel, for example borosilicate glass, a metal body of, for example, Ni/Fe or of NiCoFe may be used, for example Ni 29%, Co 17%, remainder Fe (by weight) may be used.

The discharge vessel may have such a construction, for example, at only one end portion. The discharge vessel may be joined together with the metal body at that end portion in the manufacture of the lamp according to the invention and subsequently be fused to the metal body. Before joining together, a glass tube may already have been fused to the metal body for forming a closing member.

After the discharge vessel has been given its filling, it may be closed off from the surroundings in that the glass tube which is to form the closing member is given a seal, for example by fusion or pinching.

The discharge vessel may be closed at the opposite end portion, for example, in that that end portion of the discharge vessel is closed by fusion. In the operational state of the lamp, a conductor may then be applied against and/or around this end portion in order to achieve a capacitive coupling to a supply source. In an embodiment, however, a metal tube may be present also at this end portion, for example a metal tube which is, for example, closed by pinching and/or welding. Alternatively, the metal body at this end portion may also be provided with a glass tube. The discharge vessel is closed at this end portion then in that this glass tube is fused so as to form a closing member. The glass tube may be, for example, drawn into a capillary in usual manner and subsequently closed. Alternatively, the tube may be closed by pinching. The end portions may, for example, have the same construction.

The discharge vessel under manufacture may be divested of impurities, for example, through heating, for example while it is flushed with a gas, for example with air, while still open at both ends. The discharge vessel may then be closed off at one end portion, possibly after it has been flushed with an inert gas, for example if it has previously been flushed with air. Then the discharge vessel may be closed off at its other end portion, after it has been provided with its filling.

The lamp according to the invention may have an ionizable filling of one or several rare gases, to which mercury may be added. An inner surface of the discharge vessel may be provided with a luminescent layer.

A very compact design is possible in an embodiment of the lamp according to the invention which is

characterized in that the metal body has a flange-shaped portion outside the discharge vessel transverse to the first tubular portion. A very flat closing member may be obtained with a glass tube fused to said flange-shaped portion in that the glass tube softened at its free end is abutted against a surface.

An attractive embodiment is characterized in that the flange-shaped portion of the metal body forms a bottom of a channel between the first tubular portion and a second tubular portion which lies outside the discharge vessel, the end portion of the discharge vessel and the closing member being fused to the first tubular portion in the channel and to the flange-shaped portion outside the channel, respectively. The end portion of the discharge vessel in this embodiment occupies comparatively little space radially with its metal body and closing member. The channel is formed, for example, by deep-drawing.

In the manufacture of this embodiment of the lamp, the end portion of the lamp vessel to be joined to the metal body is preferably first heated to close to its softening point, after which the heated end portion is introduced into the channel. Then the end portion of the discharge vessel is heated further until it curls inwards and flows over the surface of the first tubular portion. The metal body may be heated simultaneously therewith, for example, through high-frequency induction.

It is favourable when a metal tube extends in front of the metal body, which tube is coated with electron emitter and is connected to the metal body by electrically conducting means, the material of said means in cross-sections transverse to the metal tube having a surface area which is comparatively small relative to that of the material of the metal tube itself in cross-sections. Preferably, said surface area of the material of the electrically conducting means is at most 25% of that of the material of the metal tube. It is achieved by means of the comparatively small surface area of the electrically conductive means that the metal tube is thermally insulated from the metal body. This has the advantage on the one hand that the metal body has a comparatively low temperature during operation, while on the other hand the work function of the electrode formed by the metal tube is comparatively low, and thus the luminous efficacy of the lamp is comparatively high.

The metal tube is positioned in the discharge vessel, for example, in front of the metal body. A dark range which is as small as possible is realised when the metal tube is positioned in the closing member in front of the metal body. This has the additional advantage that material knocked off the tube is released not in the discharge vessel but in the closing member, so that the lamp retains a high luminous efficacy during its life.

This and other aspects of the low-pressure discharge lamp according to the invention will be explained in more detail with reference to the drawing, in which

Fig. 1 shows a first embodiment of the lamp according to the invention in elevation,

Fig. 2 shows a detail of the lamp of Fig. 1 in longitudinal sectional view,

Fig. 3 shows a detail of a second embodiment, and

Fig. 4 shows a detail of a third embodiment.

The low-pressure discharge lamp shown in Fig. 1 comprises a tubular glass discharge vessel 1 having end portions 2, 2' and closed in a gastight manner. The discharge vessel 1 has an ionizable filling which comprises rare gas. An end portion 2 of the discharge vessel 1 and a glass closing member 3 are fused to a cylindrically curved metal body 4 which has mutually opposed surfaces 4A, 4B (see also Fig. 2) which face away from one another. The metal body 4 has a first tubular portion 5A which extends into the discharge vessel and a zone 4C which is accessible from outside the discharge vessel.

The end portion 2 of the discharge vessel 1 and the closing member 3 are each fused to a respective surface 4A, 4B of the metal body 4. The discharge vessel has a similar construction at the other end 2'.

The discharge vessel 1 shown is bent into a meander shape. The lamp may be used, for example, for radiating through a screen. The discharge vessel 1 in the embodiment shown has an external diameter of 2.8 mm, a wall thickness of 0.6 mm, and a length of 1 m. The discharge vessel 1 may be made, for example, from lime glass to which CeO_2 is added as an UV absorber. The closing member 3 may be made, for example, from lime glass or lead glass. The metal body 4 may be manufactured from a metal which has a coefficient of thermal expansion which corresponds to that of the glass fused thereto, for example a CrNiFe alloy, for example with 6% Cr, 42% Ni, remainder Fe (by weight). Alternatively, the glass of the lamp may be hard-glass, for example borosilicate glass, in which case a metal body of, for example, 29% Ni, 17% Co, and the remainder Fe (again by weight), or a tube of Ni/Fe may have a suitable coefficient of expansion. The zone 4C of the metal body 4 which is accessible from the outside facilitates an electrical connection between the lamp and a supply source.

In the embodiment shown, the flange-shaped portion 5B of the metal body 4 forms a bottom of a channel 5 between the first tubular portion 5A and a second tubular portion 5C situated outside the discharge vessel, the end portion 2 of the discharge vessel and the closing member 3 being fused to the first tubular portion 5A in the channel and to the flange-shaped portion 5B outside the channel, respectively. The material of the metal body 4 has a thickness of 0.15 mm. The first tubular portion 5A has an external diameter and a length of 1 and 3 mm, respectively. The external diameter and length of the second tubular portion 5C are 3.5 and 2 mm, respectively. The glass tube fused to the flange-shaped portion 5B was abutted against a surface after being closed by fusion, whereby a very flat closing member is formed.

In Fig. 3, components corresponding to those of

Fig. 2 have reference numerals which are 10 higher. In the embodiment shown in Fig. 3, the closing member 13 is fused to the second tubular portion 15C. In the closing member 13 there is a metal tube 16 which is coated with electron emitter and which is fastened to the metal body 14 by electrically conducting means 17. The material of the electrically conducting means 17 has a surface area in cross-sections transverse to the metal tube 16 which is comparatively small in relation to the material of the metal tube 16 itself in cross-sections.

The emitter may be chosen, for example, from emitters familiar from use in lamps, for example low-pressure discharge lamps, or mixtures thereof. Very suitable is an emitter of BaO, CaO and SrO, for example obtained from equal molar portions of their carbonates. Alternatively, for example, $Ba_xSr_{1-x}Y_2O_4$ may be used, wherein x is, for example, 0.75.

The electrically conducting means 17 are formed here by a nickel wire with a cross-section whose surface area is less than 25% of the surface area of the cross-section of the tube 16.

In Fig. 4, components corresponding to those of Fig. 2 have reference numerals which are 20 higher. In the embodiment shown in Fig. 4, the metal body 24 is a tube 25 with a flange-shaped widening 25B. The closing member 23 is fused to an inner portion of the flange-shaped widening 25B. The outer portion of the flange-shaped widening 25B forms a zone 24C which is accessible from outside the discharge vessel and to which a supply source may be connected.

Claims

1. A low-pressure discharge lamp provided with a tubular glass discharge vessel (1) which is closed in a gastight manner, which comprises end portions (2, 2'), and which has an ionizable filling comprising rare gas, which lamp is further provided with a cylindrically curved metal body (4) by means of which an end portion (2) of the discharge vessel and a glass closing member (3) are fused together and which has mutually opposed surfaces (4A, 4B) facing away from one another, which metal body has a first tubular portion (5A) extending into the discharge vessel as well as a zone (4C) which is accessible from outside the discharge vessel,
characterized in that the end portion (2) of the discharge vessel (1) and the closing member (3) are each fused to a respective surface (4A, 4B resp.) of the metal body.

2. A low-pressure discharge lamp as claimed in Claim 1, characterized in that the metal body (4) has a flange-shaped portion (5B) outside the discharge vessel transverse to the first tubular portion (5A).

3. A low-pressure discharge lamp as claimed in Claim 2, characterized in that the flange-shaped portion (5B) of the metal body (4) forms a bottom of a channel (5) between the first tubular portion (5A) and a second tubular portion (5C) which lies outside the discharge vessel, the end portion (2) of the discharge vessel and the closing member (3) being fused to the first tubular portion (5A) in the channel and to the flange-shaped portion (5B) outside the channel, respectively.

4. A low-pressure discharge lamp as claimed in Claim 1, 2 or 3, characterized in that a metal tube (16) extends in front of the metal body (14), which tube is coated with electron emitter and is connected to the metal body (14) by electrically conducting means (17), the material of said means in cross-sections transverse to the metal tube (16) having a surface area which is comparatively small relative to that of the material of the metal tube (16) itself in cross-sections.

5. A low-pressure discharge lamp as claimed in Claim 4, characterized in that said surface area of the material of the electrically conducting means (17) is at most 25% of that of the material of the metal tube (16).

6. A low-pressure discharge lamp as claimed in Claim 4 or 5, characterized in, that the metal tube (16) is positioned in the closing member.

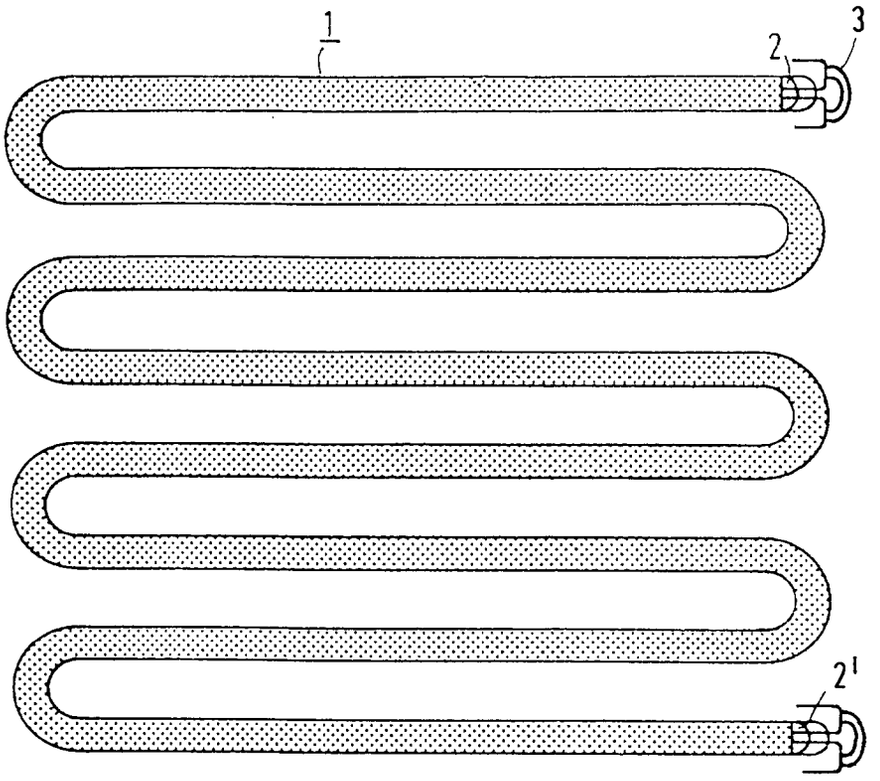


FIG.1

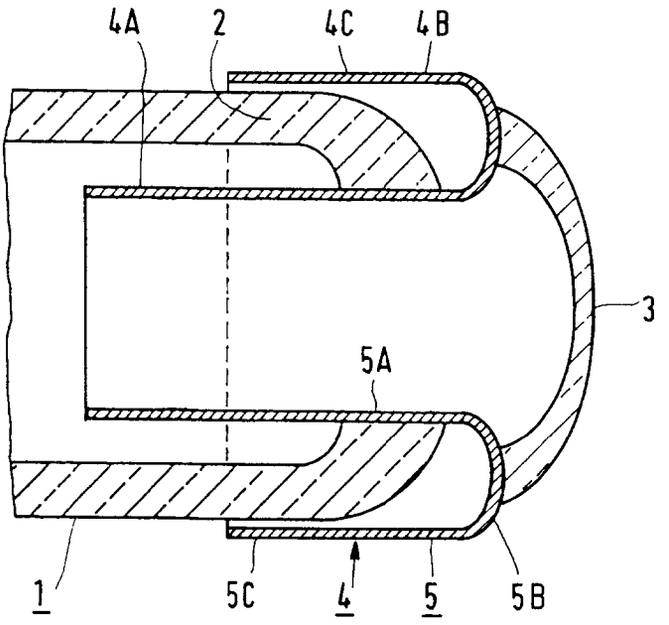
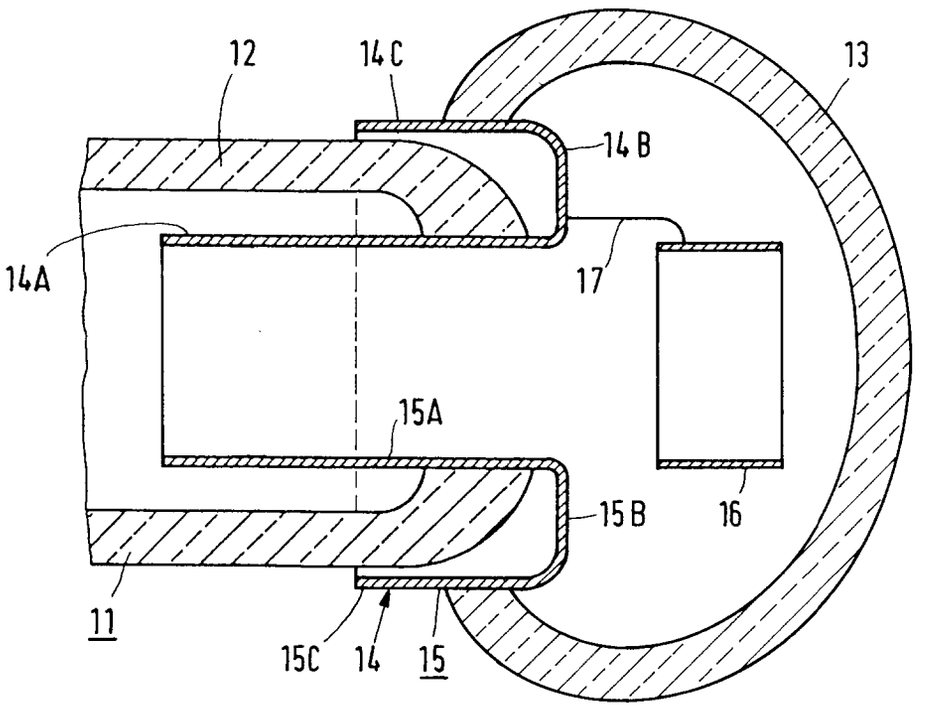


FIG.2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14C
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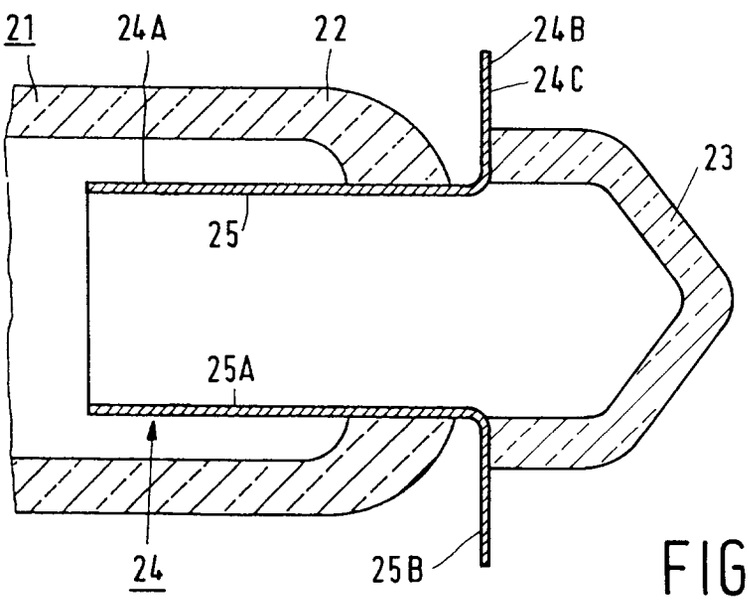
FIG.3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24A
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24B
24C
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25A
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25B

FIG.4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 1882

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.6)
D,A	DE-U-93 04 202 (PHILIPS ELECTRONICS NV) 27 May 1993 * page 7, line 24 - page 9, line 30; figures 1-3 * ---	1	H01J61/36 H01J61/09
A	RESEARCH DISCLOSURE, no. 372, 1 April 1995, page 263 XP000509071 "ELECTRIC LAMP" -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H01J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 October 1996	Schaub, G

CATEGORY OF CITED DOCUMENTS

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