(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 881 518 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
23.01.2008 Bulletin 2008/04

(21) Application number: **06015180.0**

(22) Date of filing: **20.07.2006**

(51) Int Cl.:
H01K 1/24 *(2006.01)* ***H01K 1/18*** *(2006.01)*
H01K 1/32 *(2006.01)* ***H01K 3/20*** *(2006.01)*

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(71) Applicant: **FLOWIL INTERNATIONAL LIGHTING (HOLDING) B.V.**
1097 JB Amsterdam (NL)

(72) Inventors:
- **Hooker, James**
  Birchgrove, Swansea (GB)
- **Adolf Marc**
  3300 Tienen (BE)
- **Van De Poel Gunther**
  3473 Waanrode (BE)

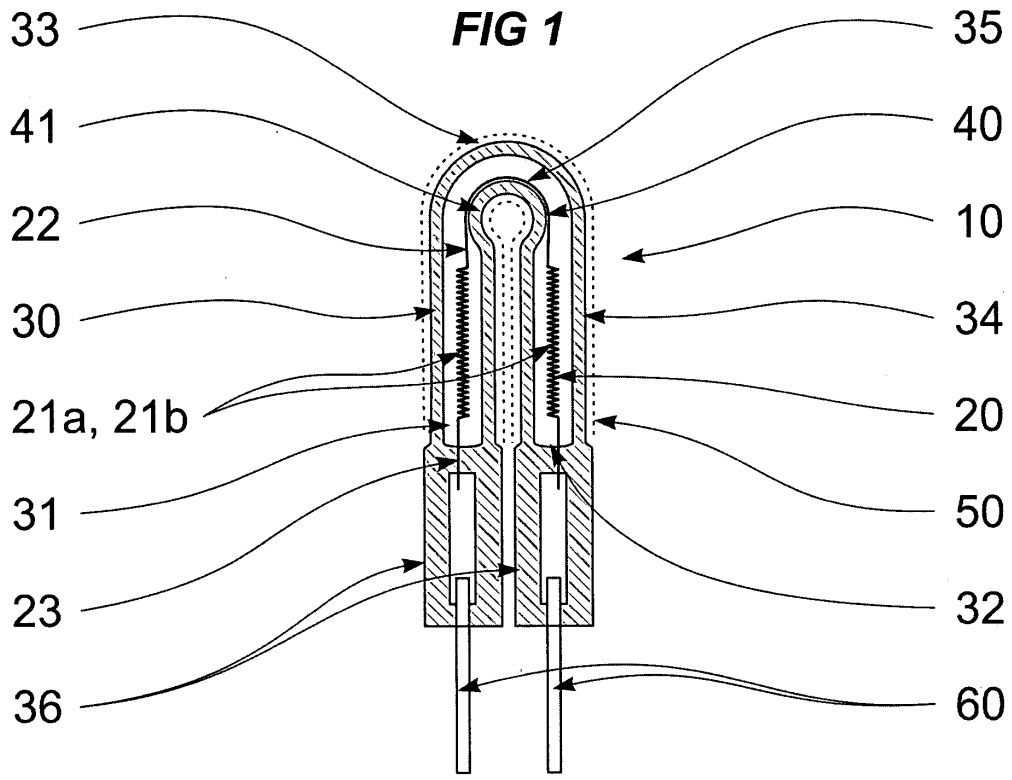
(74) Representative: **Zech, Stefan Markus et al**
Meissner, Bolte & Partner GbR
Widenmayerstrasse 48
80538 München (DE)

Remarks:
Amended claims in accordance with Rule 137 (2) EPC.

(54) **Incandescent lamp**

(57) This invention relates to an electric lamp (10) formed from a quartz tube (30) incorporating a U-bend (33). The filament (20) lies within a hollow central region (31), which is sealed at each end (32) in an airtight manner. Specific positioning means (40) are provided in the lamp (10) for insuring that sections of the filament (20) lie along these central axis of the puartz tube (30).

FIG 1



EP 1 881 518 A1

Description

Background to invention.

[0001] Since its invention, the electric light bulb or electric lamp, has become such a common item of household electrical equipment, that the provision of light is an accepted normality. Over the years, the simple electric lamp has taken on many different forms, from a white hot filament producing both heat and light, through to fluorescent tubes and discharge lamps. Of each of these lamps, however, the simple white hot filament lamp remains extremely popular in household use. This is, primarily, because the lamp is very simple to fabricate, is very reliable, it does not require any external electrical control gear, and as such is universally cheap and available to all.

[0002] Significant efficiency problems, however, exist with the filament electric light bulb or lamp. In particular, the use of an extremely hot filament for producing light is not a particularly efficient use of power. Much of the energy passing through the filament, is actually transferred into infra-red heat energy, which is invisible to the human eye. This low efficiency of the light, has led to numerous other designs for lamps and lights, such as those detailed above. However, there still remain significant problems with producing efficient light bulb designs of appropriately small dimensions. In particular, fluorescent tubes tend to be quite long, and do not provide a particularly warm 'colour' of light. More recently, more efficient plasma discharge type lights have come on the market, which are of a more compact design and similar in size to the old fashioned light bulb.

[0003] Currently, however, these lights cannot be provided in the very small light bulb lamp range, such as can be achieved by use of incandescent filaments. Additionally, they are complex devices based on expensive materials, and they all require some form of external electrical control gear.

[0004] In order to improve the efficiency of incandescent filament lamps, several designs have attempted to take advantage of the infra-red radiation being given off by the filaments. Using the infra-red radiation, in conjunction with a special coating to the outside of the electric lamp, the infra-red radiation can be reflected back towards the filament. Clearly, however, it is necessary to provide the lamp of such a design that the reflected infra-red radiation returns to, and is focused on, the incandescent filament. By re-focusing the infra-red radiation on the filament, the temperature of the filament will be increased, and therefore less current is required to pass through the lamp to generate the same amount of light. Unfortunately, while certain examples of these lamps do exist, there are significant technical difficulties for providing such in the useful household voltage and wattage requirements.

[0005] Normally, household lamps are run from mains electricity, which is generally provided at 200 volts or above. Furthermore, a common wattage requirement is in the low to medium wattage requirements, that is of powers less than approximately 200 watts. The main reason for a lack of such lamps in these voltage and wattage values (greater than or equal to 200 volts, less than or equal to 200 watts), resides in the material properties of the filaments. Filaments which are used at these voltage and wattage values, are normally rather long and thin and require support along their length. Normal incandescent light bulbs, provide the incandescent coiled filament supported in numerous positions along its length by simple mechanical means. That is, the electrical connections are made at either end of the coil, and then the coil is supported along its length by several support arms. These support arms, do not provide any light, and simply provide the incandescent coil with mechanical strength.

[0006] Unfortunately, in attempting to combine a filament for use at $\geq$ 200 volts, $\leq$ 200 watts, in a lamp with a coating such that the infra-red radiation is reflected back on the coil, is very difficult, as the necessary supporting structures would tend to cause a shadow or interfere with the reflected infra-red radiation back to the filament.

[0007] It is, therefore, an object of the present invention to provide a design for an electric lamp which can be used with an infra-red reflecting coating. In particular, this lamp should be useable at the household voltage levels, i.e. above 200 volts, and with low to medium wattage levels i.e. less than or equal to 200 watts. Furthermore, the lamp should be of such a design that the incandescent coil is provided at a position within the lamp such that the infra-red radiation reflected from the coating efficiently interacts with the coil, thereby improving the overall energy efficiency of the bulb or lamp. In particular, by placing the filament at the focus point of the reflected infra-red radiation from the coating.

[0008] WO 2004/084258 attempts to address the above problem, by providing an electric lamp which has an infra-red reflecting layer provided on the surface. In order that the infra-red reflected radiation impinges directly on the incandescent coil, the lamp of this design is provided with an elliptical cross section. Two incandescent coils, therefore, lie along the two foci of the ellipse, such that the infra-red radiation from the coils will be reflected back onto the coil. Significant manufacturing problems result from this design, however, as the positioning of the coil within a large elliptical lamp is technologically difficult. Additional problems exist with this lamp, in that the lamp will be provided by an elliptical cross section quartz tube. Producing elliptical cross section quartz tubes is also technologically challenging, therefore increasing the difficulties of fabricating such a lamp.

[0009] DE 102 36 549, attempts to overcome the design problems with the above mentioned document, by providing a filament bent into a U-shape which has two incandescent regions surrounded by a quartz tube provided with the infra-red reflecting material thereon. These two tubes and filament must be further held within an external casing, and therefore this design suffers from difficult and challenging manufacturing requirements.

[0010] A related document, that of US 6 400 077, describes a U-shaped lamp design. This lamp, however, is not anticipated as being used with an infra-red reflective coating, and is merely presented as a technique for providing support regions for filaments. This document contains no specific teaching as to provision of the filaments along any focal points for increased infra-red reflection and absorption.

[0011] The above problem and deficiencies of prior art techniques, are overcome by the electric lamp according to Claim 1. This electric lamp, is provided by a quartz tube with a hollow central region, which is further sealed to provide an airtight chamber. The seals are provided substantially at the ends of the quartz tube, and then the quartz tube is formed into a U-bend structure, giving two end regions and a middle U-bend region. With this U-bend design, the two ends of the quartz tube lie approximately next to each other, with their central axis being approximately parallel with each other. A filament is provided within the hollow central region of the tube, and each end of the filament is held by the sealing regions at the ends of the quartz tubes. The ends of the filament pass through the sealing regions and can be used to provide electrical contact to the filament within the tube. The filament is formed into several sections, two end or active sections and an intermediate region. When the filament is positioned within the U-bend quartz tube, the active sections of the filaments lie substantially within the end regions of the hollow central region in the tube. The intermediate section, is held within the U-bend region, and extends slightly into the end regions of the quartz tubes.

[0012] The U-bend region has an inner radius surface, which is within the inner hollow central region and provided on the inner curved region of the U-bend region. This inner radius surface is used to support the filaments along at least part of the intermediate section. The U-bend region is further provided with a positioning means, which is used to interact with the intermediate section of the filament. The interaction with this intermediate section, is of a nature such that the active sections to the filament are positioned along the central axis of the two end regions of the tube. The positioning means, is therefore designed to place the filament approximately in line with the point at which the filament passes through the end seals to the tube.

[0013] Preferentially, the positioning means of the lamp may be provided by a kink region in the quartz tube U-bend region. This kink, provides the inner radius surface of the hollow central region, with a diameter such that as the intermediate region of the filament passes over the surface, at the point it extends into the end regions of the tube it would be substantially in line with the central axis of the end region.

[0014] An alternative preferred design for the positioning means, is that of a series of dimples. These dimples extend from the outer surfaces of the quartz tube, in the region of the U-bend section, and are used to grip the filament in the intermediate region. Once again, the filament will be gripped such that the active sections will lie substantially along the axis of the end regions of the tube.

[0015] It is further preferred, that the intermediate section of the filament is provided by a non-incandescent section. That is, that the section of the filament which passes through the U-bend region of the tube, is just a simple piece of filament wire which is non-incandescent in use. Furthermore, the two active sections held within the end regions of the tube, may be provided by coiled or coiled-coil or triple-coil sections of the filament, which are incandescent in use.

[0016] It is further preferred that the quartz tube forming the lamp, is that of a circular cross section tube. In this manner, the end regions of the tube, are provided with one central axis at the centre of the circular cross section. Additionally, the surface of the lamp may be preferably coated with a material which substantially reflects infra-red radiation, but is substantially transparent to optical wave length. In this manner, the infra-red radiation emitted from the incandescent regions of the coils, is reflected from the material coating, back onto the surface of the filament.

[0017] It is further preferable, that the positioning means are substantially positioned away from the end sections of the filament. In this way, the incandescent material suffers from no shadowing from the infra-red radiation emitted and subsequently reflected back to it.

[0018] Preferably also, the filament for use in the lamp, is usable at a voltage rating of approximately 200 volts or higher, and at a wattage rating of approximately 200 watts or lower. Furthermore, the filament may be a simple incandescent filament, it is also preferably possible that the lamp is used with a Tungsten filament with a halogen gas filling the hollow central region.

Figure 1: U-bend lamp according to a first embodiment of the invention, wherein positioning means of the filament are provided by a kink in the tube.

Figure 2: U-bend lamp according to a second embodiment of the current invention, wherein the filament is positioned by means of dimples provided in the quartz tube.

Figure 3: A compact reflector using the lamp according to embodiment two as a source of light.

[0019] Looking at figure 1, a first embodiment of the lamp 10 according to the current invention is shown. This electric lamp 10 comprises a filament 20 which is housed within a quartz tube 30. Within the quartz tube 30, is provided a hollow central region 31, and it is within this that the filament 20 is positioned. As can be seen from the figure, the quartz tube 30 is provided with a substantially U-shaped geometry, such that two end regions 34 of the tube are formed lying substantially next to each other. Adjoining these two end regions 34, is a U-bend region

33, which is preferentially bent in such a way, that the two end regions 34 of the quartz tube 30 lie very close to each other. It is further preferential, that the axis lying along the centre of the quartz tube 30 in each of the end regions 34 lies parallel with each other. As can also be seen in the figure, the hollow central region 31 does not extend along the full length of the quartz tube 30, but is in fact sealed in an airtight manner at each end 32 of the tube 30. This simple design provides for a readily manufacturable lamp 10, which is compact and requires only one quartz element.

[0020] The filament 20 lying within the hollow region 31 of the quartz tube 30, is split into different sections. At either end of the filament 20, are provided end sections or active sections 21 a, 21 b, which are separated by an intermediate section 22. When within the hollow central region 31 of the quartz tube 30, the active sections 21a, 21b, are substantially positioned within the end regions 34 of the tube 30. The intermediate section 22 connecting the two end active sections 21a, 21b, of the filament 20, is then substantially positioned within the region of the U-bend in the quartz tube 33. Each tail end of the filament 23, passes through the sealed ends 32 of the quartz tube 30, and are held by pinch seals 36 positioned at the ends of the quartz tube 30. Whilst in the figures, the pinch seals 36 are individually formed at the ends of the quartz tube 30, this is only one option. It is possible for the pinch seals 36 to be formed on the bent quartz tube 30 at the same time, thereby creating a single pinch seal 36 at the adjacent ends of the quartz tube 30. In this configuration, the gab between the pinch seals 36, as seen in all of the figures, would not be present.

[0021] Within the U-bend region 33 of the quartz tube 30, an inner radius surface 35 is formed by the internal surface of the hollow central region 31 at the inner part of the U-bend. This inner radius surface 35, may further be used as a support for the filament 20 in the region of the intermediate section 22. That is, the filament 20 may be positioned such that the intermediate section 22 is at least at certain points or in certain regions in physical contact with this inner radius surface 35. The materials used to make the filament 20, are often quite flexible/ weak, and therefore it is advisable to provide such a support point between the two ends 23 of the filament 20.

[0022] As is shown in figure 1, it is preferentially chosen that the intermediate section 22 of the filament 20, is actually provided by a straight or singly coiled piece of filament wire. This is particularly advantageous, as in use the filament 20 will become quite hot, and therefore providing a region of just a single wire or single coil in contact with the quartz tube 30, will render this part of filament substantially non-incandescent so as to prevent any detrimental effects to the quartz inner radius 35. Furthermore, as the intermediate section 22 can be provided by such a straight or singly coiled section, this does not form part of the incandescent filament region. Optionally, the mandrel around which this filament is coiled may be left inside this intermediate section 22. The two active sections 21a, 21b, as is shown in figure 1, are preferentially provided by coiled-coil or triple coil pieces of filament wire. Such multiply coiled pieces of the filament 20, will become incandescent during use, and are used to provide the light from the lamp 10.

[0023] Positioning means 40 are provided in the region of the quartz tube 30 at the U-bend 33. In the embodiment according to figure 1, such positioning means 40 are actually provided by a kink 41 in the surface of the quartz tube 30 on the inner side of the U-bend 33. This kink 41 being a region of the quartz tube 30, where one side is pressed toward the other side, when the tube 30 is in the unbent state, to provide a curved, preferably part circular, indent in the tube 30. The kink 41 forming the positioning means 40 of this embodiment, is so sized and shaped such that at the point of first contact with the intermediate section 22 of filament 20, the incandescent active sections 21a, 21b, of the filament 20 are held substantially along the central axis of the end regions 34. It is the interaction of relative positioning of the positioning means 40, in this embodiment provided by the kink 41, and the position at which the ends of the filament 23 pass through the ends of the tube 32, which allows the active sections 21a, 21b to lie along the central axis of the end regions 34.

[0024] A further possibility not shown in the figures is for the U-shaped geometry to give a lamp 10 with an approximately "horse-shoe" shape. That is. The U-shape is such that the bend tends to position the end regions 34 such that they get progressively closer to each other. Clearly, for this geometry to function as above, the end regions 34 must be straight, and the kink 41 provided to align the active sections 21 a, 21 b along the centre of the end regions 34.

[0025] During manufacture of the tube 30 and filament 20, it is quite straightforward to provide the kink 41 in the appropriate point along the quartz tube 30. This kink 41 can be sized accurately, such that once the quartz tube 30 has been bent to form the U-bend region 33, the positioning means 40 will then allow the active sections 21a, 21b of the filament 20 to lie along the central axis of the end regions 34 of the quartz tube 30. Not only does this design and manufacturing method lead to a very simple and inexpensive lamp 10, it also allows for a high degree of repeatability and low losses during manufacture. It is a preferred option for the kink 41 in the tube 30 to be formed prior to threading the filament 20 inside the tube 30. Of course, the filament 20 could also be housed in the tube 30 prior to providing the kink 41.

[0026] In order to improve the efficiency of the lamp 10, a coating 50 may be applied to the external surface of the quartz tube 30. This coating 50, is chosen from a material or combination of materials which has a substantially high infra-red reflectivity, but is substantially transparent at optical wavelengths. Examples of this can be seen in patent: EP 0849769 B. Provision of this coating 50, will therefore mean that much of the heat radiated by the incandescent regions of the filament 20 will be reflected from the coating 50 back into the quartz tube 30.

Clearly, however, by providing this material with characteristics such that it is essentially transparent at optical frequencies, the effectiveness of the lamp 10 as a light source will not be impaired. With the provision of this reflective coating 50, it becomes obvious as to why the incandescent regions at the active sections 21a, 21b of the filament 20, advantageously lie preferentially along the axis of the end regions 34 of the quartz tube 30. When the active sections 21a, 21 b are provided along this axis, the infra-red radiation emitted from these sections 21a, 21b is reflected back from the coating 50, and impinges directly on the active sections 21a, 21b. With such reflected radiation being subsequently absorbed by the filament 20, the efficiency of the lamp 10 is substantially improved, as less power is used in running the filament 20 for a given light output.

[0027] A further advantage of the design as shown in figure 1, is that the positioning means 40 provided by the kink 41, are in a position substantially removed from the active sections 21a, 21b. That is, the positioning means and support means provided by the inner radius surface 35, are not in a position which interferes with the reflected infra-red radiation from the coating 50. In this manner, the efficiency is once again improved, as there is no shading or shadowing of the active sections 21a, 21b by the positioning means, or the support provided by the inner radius 35.

[0028] In light of the above discussion, therefore, it is clear that it is preferential once more for the quartz tube 30 to be provided with a circular cross section. Such a quartz tube 30, can have a diameter lying in the range 3 to 16mm, preferably 5 to 7mm. In this way, when the quartz tube 30 is bent to form the U-bend region 33 and then the lamp 10, the end regions 34 which house the active sections 21 a, 21 b of the filament 20, will be provided with only one focus point for the infra-red radiation reflecting of the coating 50, that of the central axis of the tube 30. This further improves efficiency of the design, as none of the reflected infra-red radiation is wasted.

[0029] As can be further seen from the diagram in figure 1, at the distal end of the pinch seals 36, are provided connecting wires 60. In addition to the simple design of the lamp 10 : that of the quartz tube 30 being bent into a U-shape, the lamp 10 can be of a very compact design. Indeed, it is possible to fabricate the lamp 10 such that the wire 60 extending from the distal end of the pinch seal 36 will fit into standard light formats and fittings. An example of which, is shown in figure 3, wherein the lamp 10 is shown in combination with a compact reflector 70. Further discussion of this will be given below.

[0030] Turning now to figure 2, we see a second embodiment of the current invention. This embodiment is very similar to the embodiment as disclosed in figure 1 and above. Much of the discussion above is applicable to the lamp 10 in embodiment 2, and need not be repeated. Indeed, the only significant difference between the embodiments according to figures 1 and 2, is that of the positioning means 40. As can be seen from figure 2, the positioning means 40 are not provided by a kink 41 on the surface of the quartz tube 30, but are in fact provided by a series of dimples 42.

[0031] As is seen clearly in figure 2, the dimples 42 are provided at the region of the U-bend region 33 in the quartz tube 30 lying next to the end regions 34. These dimples 42, are provided in the quartz tube 30 and extend into the hollow central region 31. The dimples 42 extend equally from both sides of the quartz tube 30 to provide a gripping portion 43 on the inside of the hollow central region 41. This gripping portion 43, is provided to grip the intermediate section 22 of the filament 20 at the appropriate position such that the active sections 21a, 21b of the filament 20, are then positioned along the central axis of the end regions 34 of the quartz tube 30. As in the case with embodiment 1, positioning the active sections 21a, 21b, which are substantially the incandescent regions of the filament 20, in the central axis of the end regions 34 will, with the provision of the infra-red reflecting coating 50, substantially improve the efficiency of the lamp 10. As can be seen in figure 2, the U-bend region 33 is still provided with an inner radius surface 35, however the filament does not make such substantial contact with this inner radius 35 as in the case for embodiment 1. Indeed, the inner radius 35 is substantially inactive in this second embodiment, since the gripping and centring action is performed by the gripping portions 43 from the dimples 42.

[0032] In fabrication, the lamp 10 according to embodiment 2 is manufactured in a very similar manner to that of embodiment 1. The only significant difference being, that once the tube 30 is provided with the filament 20 inside and held at the ends of the quartz tube 32, rather than providing the kink 41, the dimples 42 are provided at the appropriate positions on the quartz tube 30. These dimples 42 are provided such that the gripping portion 43 is aligned substantially along the central axis of the quartz tube 30. It is clear, that once the tube and filament 20 have been fabricated as such, with bending of the quartz tube 30 to provide the U-bend region 33 and subsequently the lamp 10, the active sections 21a, 21b of the filament 20 will be positioned at the appropriate central axis point along the end regions 34 of the tube 30.

[0033] Once again the lamp 10 according to embodiment 2, can be fabricated with the appropriate dimensions such that it is small enough to fit within the known and standard lamp formats. This can be seen in figure 3, wherein the lamp 10 is disclosed as being integrated with a compact reflector 70. This compact reflector 70, is of standard size for interaction with normal electrical light fittings. With careful and appropriate design, such a reflector 70 could be used to take advantage of the known positioning of the incandescent regions provided by the active sections 21 a, 21 b with the filament 20. That is, the internal reflector side of the reflector 70 could be shaped and sized such that the light being emitted from the filament 20 is properly focused through the front of the reflector 70. Whilst in figure 3 the lamp 10 according

to embodiment 2 is shown, it is quite obvious that the lamp 10 according to embodiment 1 could also be included.

[0034] A further advantage of the lamp 10 according to the designs of embodiment 1 and embodiment 2, is that a wide range of filaments 20 may be used within the lamp 10. General electric lamps are provided for use in a range of voltages, and at a range of wattages. For example, many lamps 10 which are used in bathroom fittings, are provided at low voltage levels, typically around 12 volts, such that the risk of electric shocks is reduced. The majority of lights, however, are provided for use directly with mains electricity, which is typically of 200 volts or higher. Additionally, the lamp 10 of each embodiment, can be utilized with normal incandescent materials, for an increased light output, with Tungsten and halogen. One significant problem with filaments 20 which are designed to be used at 200 volts or above and with a wattage of 200 watts or lower, preferably in the region of 25 - 200 watts, is that they are very delicate filaments and liable to breakages with mechanical stress.

[0035] Clearly, the provision of U-bend lamps 10, as in the current invention, and in particular those which are to be used with the infra-red reflective coating 50, cannot provide much in the way of support along the length of filament 20. In order to improve the infra-red reflective characteristics of the lamp 10, it is necessary for the filament 20 to be substantially free of shadows and shade which the support regions may provide. Clearly, having the inner radius surface 35 in the U-bend region 33 of the lamp 10, provides the necessary support for the filament 20 without introducing shadowing the reflected infra-red radiation. In light of this, it is possible for the lamps 10 according to both embodiment 1 and 2 discussed above, to be utilized with filaments which are appropriate for use at voltages above 200 volts, and at wattages below 200 watts, preferentially between 25-200 watts. Obviously, however, the use of such filaments 20 is not restricted in the lamps 10 according to the current invention, and indeed the lamps may be used with any filament 20. The current design, however, does provide the required amount of support for the filament 20 for use in this 200 volts and above, 200 watts and below, range.

[0036] Whilst various features and embodiments of the lamp 10 are discussed and disclosed above, this is not meant in any way to limit the design. The full scope of the invention is determined by the appended claims.

List of Reference Numerals

[0037]

10 Electric Lamp
20 Filament
21 a + b : Active sections
22 Intermediate Section
23 Ends of filament, or filament tails
30 Quartz Tube
31 Hollow Central Region
32 End of Tube
33 U-Bend Region
34 End Regions
35 Inner Radius Surface
36 Pinch Seal
40 Positioning Means
41 Kink
42 Dimples
43 Gripping Portion
50 Coating
60 Connecting Wires
70 Compact Reflector

Claims

1. An electric lamp (10) comprising:

a quartz tube (30) which comprises a hollow central region (31) which is sealed in an airtight manner at either end (32) by means of a pinch seal (36), wherein the quartz tube (30) is formed with a U-bend region (33) giving two end regions (34) which lie next to each other such that the central axis along each of the tubes in the end regions (34) lies approximately parallel with each other, or in a generally horse-shoe shape;
a filament (20) positioned within the hollow central region (31) of the quartz tube (30), comprising two active sections (21a, 21b) which are positioned within the end regions (34) of the hollow central region (31), and an intermediate section (22) which is positioned mainly within the U-bend region (33), wherein the ends of the filament (23) pass through the seals at the ends of the tube (32) which take the form of pinch seals (36);

wherein, the U-bend region (33) is formed so that an inner radius surface (35) supports the filament (20) along at least a part of its intermediate section (22); **characterised in that**:

the U-bend region (33) further provides a positioning means (40) which interacts with the intermediate section (22) of the filament (20) for aligning the active sections (21a, 21b) of the filament (20) along the central axis of the end regions (34) of the quartz tube (30).

2. The electric lamp (10) of claim 1, wherein the positioning means (40) are provided by a kink (41) in the quartz tube (30) in the U-bend region (33), which provides the inner radius surface (35) with a surface that at the first point of contact of the intermediate section of the filament (22), is positioned along the central axis of the end regions (34) of the quartz tube

(30).

3. The electric lamp (10) of claim 1, wherein the positioning means (40) are provided by two or more dimples (42) formed in the quartz tube (30), wherein the dimples (42) extend within the hollow central region (31) to form a gripping portion (43) along the central axis of the end regions (34) of the quartz tube (30).

4. The electric lamp (10) of any of the preceding claims, wherein the intermediate section (22) of the filament (20) is provided by a non-incandescent section, and wherein the active sections (21a, 21b) of the filament (20) are provided by incandescent sections.

5. The electric lamp (10) of claim 4, wherein the non-incandescent section of the filament (20) is provided by a straight or singly coiled piece of the wire forming the filament (20), optionally, the mandrel around which the filament is coiled may be left inside this intermediate section.

6. The electric lamp (10) of claim 4, wherein the incandescent section of the filament (20) is provided by a coiled piece of the wire forming the filament (20), which may be single, double or triple coiled.

7. The electric lamp (10) of any of the preceding claims, wherein the quartz tube (30) is formed from a circular cross section tube.

8. The electric lamp (10) of any of the preceding claims, wherein the outer surface of the quartz tube (30) has a coating (50) from a material which substantially reflects infra-red radiation, but is furthermore substantially transparent to optical wavelengths.

9. The electric lamp (10) of any of the preceding claims, wherein the positioning means (40) are positioned away from the end sections (23) of the filament (20).

10. The electric lamp (10) of claim 9, wherein the positioning means (40) are in a position that does not substantially interfere with the infra-red radiation reflected from the coating (50).

11. The electric lamp (10) of any of the preceding claims, wherein the lamp (10) is rated for operation at voltages of approximately 200V or higher, and at wattages of 200 Watts or lower.

12. The electric lamp (10) of any of the preceding claims, wherein the filament (20) is an incandescent filament.

13. The electric lamp (10) of any of the preceding claims, wherein the lamp (10) is a tungsten halogen lamp (10)

14. A process of manufacturing an electric lamp (10), in particular according to any of claims 1, 2 or 4-13, comprising the steps of:

providing a quartz tube (30) comprising a central hollow region (31);
providing a kink (41) in a position on the surface of the quartz tube (30), so as to move the inner surface of the quartz tube (30) toward the other side of the quartz tube (30);
positioning a filament (20) comprising an intermediate section (22) and two active sections (21 a & b) in the quartz tube (30) with the kink (41);
bending the quartz tube (30) in the region of the kink (41) to create a U-bend region (33) and to position the end regions (34) of the quartz tube (30) next to each other, wherein the intermediate section (22) of the filament (20) lies substantially within the U-bend region (33);
pinch sealing the end of the quartz tube (30) to fix the filament (20), such that the active sections (21a & b) of the filament (20) are held by the pinch seals (36) and interact with the kink (41) so as to lie along the central axis of the end regions (34) of the quartz tube (30).

15. The process according to claim 14, wherein the filament (20) is positioned within the quartz tube (30) prior to providing the kink (41).

16. A process of manufacturing an electric lamp (10), in particular according to any of claims 1, claim 2 or 3-13, comprising the steps of:

providing a quartz tube (30) comprising a central hollow region (31) in which is positioned a filament (20) comprising an intermediate section (22) and two active sections (21 a & b);
providing one or more dimples (42) in a position on the surface of the quartz tube (30), which extend within the centre of the tube and grip the filament (20) at its intermediate section (22);
pinch sealing the end of the quartz tube (30) to fix the filament (20), such that the active sections (21 a & b) of the filament (20) are held by the pinch seals (36) and the dimples (42) so as to lie along the central axis of the end regions (34) of the quartz tube (30).
bending the quartz tube (30) in the region between the two dimples (42) to create a U-bend region (33) and to position the end regions (34) of the quartz tube (30) next to each other, wherein the intermediate section (22) of the filament (20) lies substantially within the U-bend region (33);

Amended claims in accordance with Rule 137(2) EPC.

14. A process of manufacturing an electric lamp (10), in particular according to any of claims 1, 2 or 4-13, comprising the steps of:

providing a quartz tube (30) comprising a central hollow region (31);
providing a kink (41) in a position on the surface of the quartz tube (30), so as to move the inner surface of the quartz tube (30) toward the other side of the quartz tube (30);
positioning a filament (20) comprising an intermediate section (22) and two active sections (21a & b) in the quartz tube (30) with the kink (41);
bending the quartz tube (30) in the region of the kink (41) to create a U-bend region (33) and to position the end regions (34) of the quartz tube (30) next to each other, wherein the intermediate section (22) of the filament (20) lies substantially within the U-bend region (33);
pinch sealing the end of the quartz tube (30) to fix the filament (20), such that the active sections (21a & b) of the filament (20) are held by the pinch seals (36) and interact with the kink (41), the provision of the kink (41) and the pinch sealing being performed in such a way that the active sections (21a & b) of the filament (20) lie along the central axis of the end regions (34) of the quartz tube (30).

FIG 1

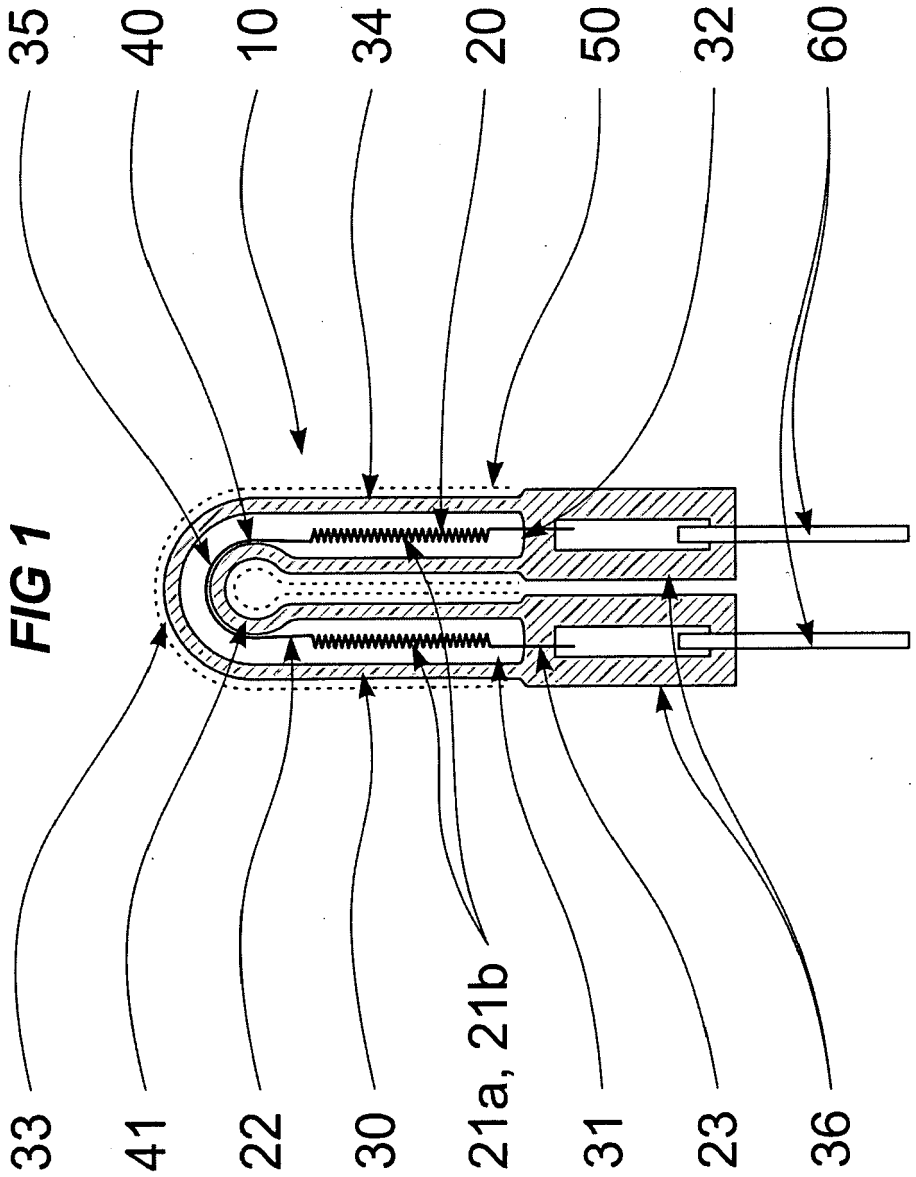
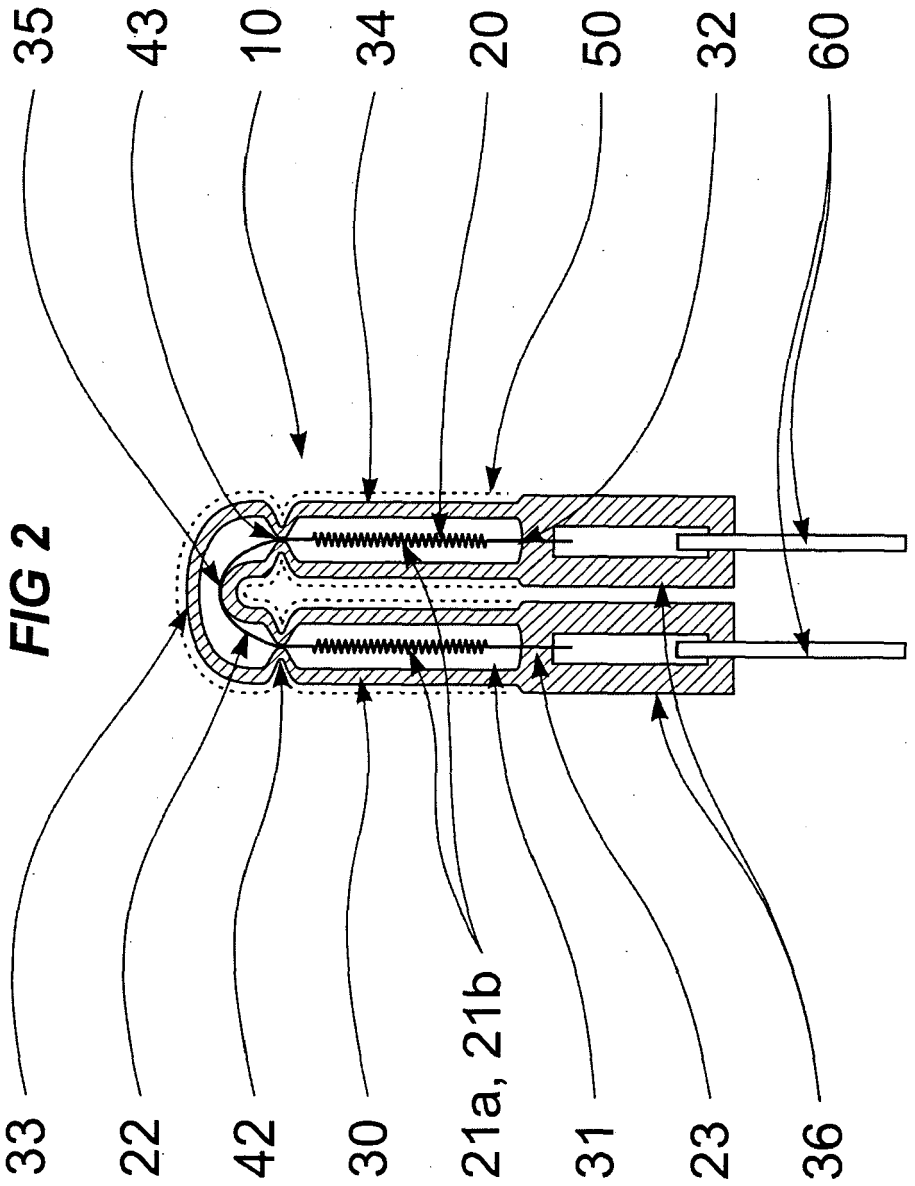


FIG 2



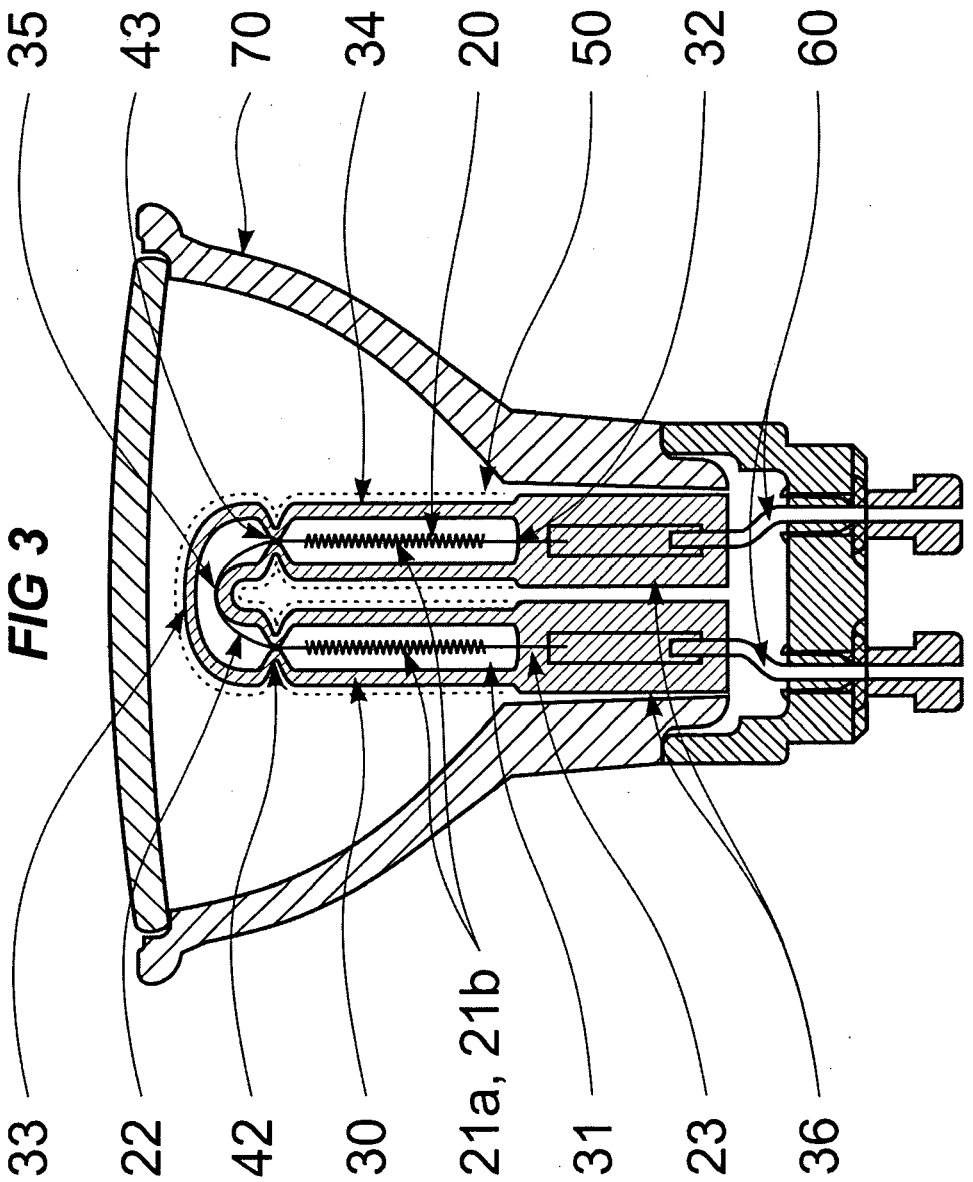


FIG 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 01 5180

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
D,X	US 6 400 077 B1 (MICHEL JEAN PIERRE ALAIN [FR] ET AL) 4 June 2002 (2002-06-04) * the whole document * -----	1-16	INV. H01K1/24 H01K1/18 H01K1/32
A	GB 2 300 297 A (GEN ELECTRIC [US]) 30 October 1996 (1996-10-30) * abstract * * page 1, lines 6,12 * * page 5, lines 20-27 * * page 7, lines 28,29 * * figure 4 * * claim 4 * -----	2,6-8, 12,13	H01K3/20
A	DE 24 48 348 A1 (GTE SYLVANIA INC) 24 April 1975 (1975-04-24) * the whole document * -----	6-8,12, 13	
D,A	EP 0 849 769 A2 (SCHOTT GLAS [DE]; ZEISS STIFTUNG [DE] ZEISS STIFTUNG [DE]) 24 June 1998 (1998-06-24) * page 2, lines 5-11 * -----	8	

TECHNICAL FIELDS SEARCHED (IPC)

H01K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 December 2006	Gijsbertsen, Hans

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

EPO FORM 1503 03.82 (P04C01)

2

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 01 5180

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-12-2006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6400077 B1	04-06-2002	CN 1304545 A	18-07-2001
		WO 0070652 A1	23-11-2000
		JP 2003500798 T	07-01-2003
GB 2300297 A	30-10-1996	JP 9017395 A	17-01-1997
DE 2448348 A1	24-04-1975	CA 1013804 A1	12-07-1977
		JP 50073468 A	17-06-1975
EP 0849769 A2	24-06-1998	CA 2224876 A1	17-06-1998
		DE 19652454 A1	25-06-1998
		JP 10188917 A	21-07-1998
		US 5945177 A	31-08-1999

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2004084258 A **[0008]**
- DE 10236549 **[0009]**
- US 6400077 B **[0010]**
- EP 0849769 B **[0026]**