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(54) **Filament alignment capsule for an electric lamp**

(57) A filament alignment capsule (10) for an electric lamp (30) comprising two hollow tubes (11a,11b) with rotational symmetry around their central longitudinal axes (12a,12b), wherein the diameter of the hollow tubes (11a,11b) is either constant along the length of the hollow tube or varies along the length of the hollow tube (11a, 11b), wherein the two hollow tubes (11a,11b) are aligned with their central longitudinal axes (12a,12b) parallel, and further the two hollow tubes (11a,11b) are joined together at one end by a joining element (20) which is provided with guidance means (28) for interacting with a filament (50) connectable with the filament alignment capsule (10), wherein the guidance means (28) lie on the central longitudinal axes (12a,12b) of each of the hollow tubes (11a,11b). An electric lamp (30) incorporating such a filament alignment capsule (10) and a method of fabricating the capsule (10) are also disclosed and claimed.

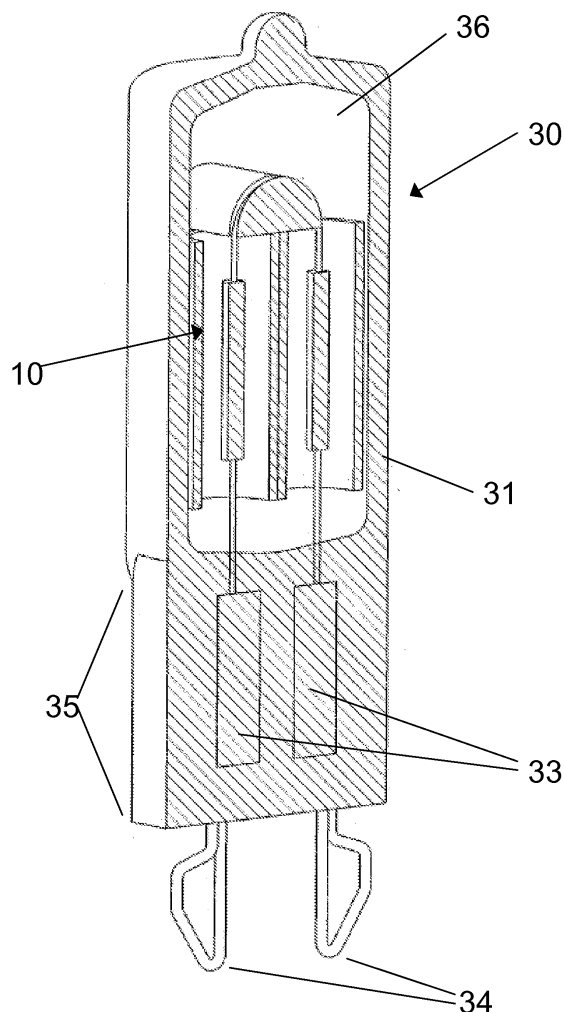


FIG. 1

Description

[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. 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.

[0003] 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.

[0004] 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.

[0005] Unfortunately, in attempting to combine a filament for use at ≥ 200 volts, ≤ 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.

[0006] 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.

[0007] 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.

[0008] 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.

[0009] 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.

[0010] EP 1 739 725 discusses a design for overcoming the above mentioned problems, in which the part of the housing of the bulb holding the incandescent coil, is shaped as two joined cylinders. These two joined cylinders do so in an overlapping manner, such that a figure of "8" cross-section design is obtained. The light generating coils are located along the central axis of each of the cylinders making up the figure of 8, thus aligning them at an equidistant point from the outer infra-red coated surface. This design unfortunately suffers from problems relating to the exact positioning of the coils along the central axes. Additionally, as the central point of the figure of 8 does not have a part of the cylindrical tube present, there is no infra-red coating between the two incandescent coils which leads to a loss of efficiency in the bulb.

[0011] The above problems and deficiencies in the prior art can advantageously be overcome by means of the filament alignment capsule according to claim 1, being utilised within an electric lamp. This filament alignment capsule is structured such that it provides a separate unit which is prefabricated, preferably from quartz, and is utilised to house a filament used in the electric lamp. This filament alignment capsule is sized and shaped so that incorporation of the filament will lead to the filament being accurately positioned within the filament alignment capsule, such that integration of this filament alignment capsule and filament within an electric lamp will lead to an improvement in the efficiency of the electric lamp in general.

[0012] The filament alignment capsule comprises a structure of two hollow elements, preferably tube-like elements, which are joined together by means of a joining element. This joining element is structured such that the hollow tubes are maintained with a known orientation with respect to each other. Each hollow tube is possessed of rotational symmetry around a longitudinal central axes of the tube. Preferably the tubes are, in fact, circular in cross-section. Further, the tubes may have a constant diameter along their longitudinal direction, such that the tubes can be considered as hollow cylindrical elements. It is also possible, and sometimes advantageous, to provide the tubes with a varying diameter along this longitudinal direction. Within the filament alignment capsule, the hollow tubes are aligned such that the longitudinal central axes are parallel with each other. The joining element is provided with guidance means which are intended to interact with a filament when incorporated within the filament alignment capsule. These guidance means are positioned on the joining element, joining block or joining piece, at a position which coincides with the longitudinal central axes of the hollow tubes. By positioning these guidance means in this location, when the filament alignment capsule is integrated within an electric

lamp, the filament will be guided and run through the hollow section of each of the tubes. This filament preferably runs through the hollow section of a first tube along its longitudinal central axes up to the guidance means on the joining element. The filament then runs across the joining element to the second guidance means and down through the longitudinal central axes of the second hollow tube. Clearly, by positioning the guidance means on the longitudinal axes of the hollow tubes, when a filament is incorporated into the filament alignment capsule it will be pre-positioned along the preferred longitudinal central axes of each of the hollow tubes.

[0013] When the filament is positioned to lie along the longitudinal central axes of the hollow tube, the distance from the filament to the hollow tube can be accurately determined and precisely controlled. If the hollow tube is possessed of a constant diameter along its longitudinal direction, the distance between the hollow tube and the filament will be a constant along its length. Should, by contrast, a design of the hollow tube be chosen where the diameter varies, obviously the distance is also varied along the longitudinal direction. Clearly, the exact positioning of the filament along the longitudinal central axes means that the distance from the filament to the hollow tube is well known.

[0014] In certain preferably designs, the hollow tubes of the filament alignment capsule have a diameter which is larger in the central part of the hollow tube. This leads to the hollow tubes having a slightly bowed outer surface, as the diameter at the ends of the tube are smaller than that at the centre. As such, the distance between a filament aligned appropriately along the central longitudinal axes of each of the tubes and the tube itself, will increase towards the centre of the tube. In particular, when a filament is incorporated within the filament alignment capsule and is being used, a greater concentration of heat is seen in the centre of the hollow tube, so it is sometimes preferable to increase the tubes' diameter at this point.

[0015] Advantageously the hollow tubes can be coated with a material which has properties of reflecting any, or most, of the infrared radiation which strikes it. Further, this material should be such that visible wavelengths are not affected by the material and these pass through. By coating, preferably on the outside, the hollow tubes of the filament alignment capsule with such an infrared reflective coating, the heat generated by the filament can be reflected back onto the filament itself. It is advantageous that the reflected infrared radiation from the filament bouncing back from the infrared reflective coating should be approximately equal along the length of the filament. In some circumstances this is achieved by the hollow tubes having the constant diameter along their length, such that the distance is constant between the filament and the infrared reflective coating. With certain filaments, typically higher power-rated filaments, it is advantageous that the distance between the filaments and the infrared reflective coating is slightly greater towards the centre of the filament. Within the centre of the hollow

tubes in the longitudinal direction, a greater temperature is seen, and it is of some advantage to reduce slightly the amount of reflected infrared radiation which strikes the filament at this point. As such, provision of the hollow tubes with a slightly larger diameter on their longitudinal centre is desirable.

[0016] Preferably, the two hollow tubes are arranged such that they contact each other along at least a part of the external surface thereof. Further preferably, it is possible that at this touching point the two tubes are connected together, and not just by means of the joining element.

[0017] One possible design for the guidance means, is that of a groove running on the upper surface of the joining element. The upper surface, is the surface which does not contact the hollow tubes. This groove runs from the position on one side of the joining element which coincides with the longitudinal central axes of a first hollow tube, through to a similar position on the other side of the joining element. In this way, a filament which will be introduced when the filament alignment capsule is used in a lamp, will be led from one longitudinal central axes of one hollow tube to the other longitudinal central axes of the other tube. Clearly, if a groove is provided in the joining element, it is possible for this to have a variety of cross-sectional shapes. Of these: semicircular, V-shaped or concave can be utilised.

[0018] It is not necessary, however, that the guidance means be provided by a groove in the joining element. Indeed, the joining element could be structured such that two holes are provided which pass through the joining element, and these two holes coincide with the central longitudinal axes of each of the hollow tubes. Further designs, could be simply notches in the side of the joining element again, positioned such that when a filament is provided within the filament alignment capsule, it is advantageously positioned along the centre axes of each of the hollow tubes. Obviously, the skilled person would be well aware that a myriad of designs for the guidance means exists, wherein any such means are suitable as long they are positioned and structured so as to fix the location of the filament along the central axes of each of the hollow tubes.

[0019] An electric lamp can be provided with the filament alignment capsule as described above, wherein this lamp is provided with an external casing for surrounding the filament alignment capsule and a filament. As has been discussed above, it is intended that the filament be provided within the filament alignment means, such that it lies along the longitudinal central axes of each of the two hollow tubes.

[0020] It is further considered that an advantageous filament for use in the electric lamp would be provided with two active regions, wherein only at the active regions will light and heat be given off. These two active regions will be positioned so as to lie along the central longitudinal axes of each of the hollow tubes in the filament alignment capsule. Electrically connecting these two active regions

together is an intermediate section, and this is not of a structure to give off light and heat. This intermediate section will preferably be positioned to interact with the guidance means and the joining element so as to ensure the filament lies appropriately in the filament alignment capsule.

[0021] The two free ends of the filament are preferably maintained in an appropriate position by means of the external casing of the lamp. The filament is positioned within the alignment capsule as discussed above, and when the filament lies along the central longitudinal axes of each of the two hollow tubes, the free ends can be held along these axes lines by means of the external casing. The interaction of the external casing and the filament alignment capsule advantageously leads to the desired positioning of the filament. Furthermore, this external casing is preferably provided with electrical contacts for contacting each end of the filament, and further preferably these contacts are electrically connected with electrodes at the outer side of the electric lamp. In the region of the contacts, electrodes and ends of the filament, the electric lamp may be provided with a gas-tight seal, which is preferably formed by pinch-sealing the end of the external casing.

[0022] One mechanism by which the filament alignment capsule is held within the external casing, is by the process of dimpling. This dimpling is achieved by pushing dimples inward from the external casing, to contact the filament alignment capsule which will then hold this capsule within the electric lamp. A further advantage of providing the filament alignment capsule out of quartz, is that a glass-to-glass connection will be made, which is very stable and reliable.

[0023] A method for production of the filament alignment capsule, is advantageously along the following lines: providing two of the hollow tubes as disclosed above and aligning their central longitudinal axes, followed by joining these together by means of the joining element. At this point, the filament alignment capsule is ready to be utilised within an electric lamp. It is further preferable at this stage to coat the filament alignment capsule with an infrared reflective coating as described above.

[0024] Once the filament alignment capsule has been fabricated, it is possible to then incorporate this into an electric lamp, by housing the filament alignment capsule in an external casing, after incorporating a filament within the capsule. Preferably, once the filament is within the capsule, and the capsule is incorporated within the external casing, the alignment of the filament along the longitudinal central axes is performed, and the external casing is pinched, to form a pinch-seal holding the filament in the desired position.

Once the capsule is held within the external casing, the external casing can be filled with an inert gas and this can be tipped so as to seal the external casing and create the lamp bulb.

Figure 1: This figure shows a perspective cut-away view of an electric lamp housing the filament alignment capsule of the invention.

Figure 2: This shows the front cross-sectional face of the lamp shown in Figure 1.

Figure 3: This figures shows a side view of the electric lamp shown in Figures 1 and 2, wherein the internal structure is shown in dashed lines.

Figure 4: This figures shows the structure of the filament alignment capsule as seen in Figures 1 and 2.

[0025] Figure 1 shows a perspective cut-away view of an electric lamp 30 according to the present invention. For additional clarification, Figure 2 shows a cross-section through the electric lamp 30, and Figure 3 shows a side-on view of the electric lamp 30 wherein internal features of the electric lamp 30 are shown with dashed line. As can be seen from these figures, the electric lamp 30 is provided with an external casing 31 which defines the central electric lamp bulb 36 in which are contained the filament 50 and a filament alignment capsule 10 for positioning the filament 50. The filament alignment capsule 10 shown in the figures gives one possible embodiment of the filament alignment capsule 10, but is not intended to limit this design.

[0026] Electric lamps 30 which take advantage of an infrared radiation coating 40, such that infrared radiation is reflected back from the coating 40 and optical wavelengths are substantially allowed to pass through the coating 40 unaffected, require specific placement of the filament 50 with relation to this coating 40. In particular, the effectiveness of an electric lamp 30 comprising this infrared coating 40 is very strongly dependent upon the relative positioning between the infrared coating 40 and the filament 50. If the distance between the filament 50 and the coating 40 varies even slightly, the efficiency of the electric lamp 30 can be significantly reduced. As such, it is desirable to strictly control the placement of the filament 50 in relation to the coating 40.

[0027] The filament alignment capsule 10 as shown in Figures 1 and 2, and as shown more clearly in Figure 4 which details just this filament alignment capsule 10, is designed so as to improve the accuracy with which the filament 50 is positioned with respect to the coating 40. As can be seen from the figures, the filament alignment capsule 10 primarily comprises two hollow tubes 11a and 11b, which are aligned such that their central longitudinal axes 12a and 12b lie parallel with each other. The two hollow tubes 11a, 11b shown in Figure 4 are represented as two hollow cylindrical tubes, wherein the cross-section is circular and the diameter of the tube remains constant along its length. This is by way of example only, and indeed it is desirable in some circumstances for the hollow tubes 11a, 11b to have a diameter which varies along

each of the central longitudinal axes 12a, 12b. In particular, each hollow tube 11a, 11b should be rotationally symmetrical around its central longitudinal axes 12a, 12b, wherein the diameter of the tube can be the same along its length. In some embodiments, however, the diameter of the hollow tube 11a, 11b can vary from a minimum at each end, up to a maximum in the centre of the hollow tube 11a, 11b as measured along the central longitudinal axes 12a, 12b. This would give the longitudinal profile of the hollow tube 11a, 11b as being slightly elliptical, or wider in the centre than at the ends. The advantage of providing the hollow tubes 11a, 11b with a slightly larger diameter in the centre, will be described more fully below with relation to its use in an electric lamp 30.

[0028] As can be seen in particular in Figure 4, a joining element 20 is located at one end of the two hollow tubes 11a, 11b. The structure shown in Figure 4 is merely one of a myriad of possibilities, and indeed the joining element 20 as shown in Figures 1 to 3 is clearly of a different structure. Not only can the joining element 20 be used to fix together the two hollow tubes 11a, 11b, but, as will be seen below, it is advantageously used to align the filament 50 within the two hollow tubes 11a, 11b. As can be seen in Figures 1 and 2 in particular, the filament 50 interacts with this joining element 20 which positions the filament 50 along the central longitudinal axes of the hollow tubes 11a, 11b.

[0029] The joining element 20 is structured such that guidance means 28 are provided on the joining element 20 at a point which lies on the central longitudinal axes 12a, 12b of each hollow tube 11a, 11b. In Figure 4, the guidance means 28 are provided by each end of a groove 23 seen in the top surface 24 of the joining element 20. The top or upper surface 24 is defined as the surface which is not in contact with the two hollow tubes 11a, 11b. As is obvious from Figures 1 and 2, the guidance means 28 provided on the joining element 20, are positioned on the central longitudinal axes 12a, 12b of each of the hollow tubes 11a, 11b, such that when the filament alignment capsule 10 is used in an electric lamp 30, and integrated with a filament 50, the filament 50 is guided such that it lies along the central longitudinal axes of each of the two hollow tubes 11a, 11b.

[0030] The guidance means 28 provided on joining element 20, can be provided by any structure which guides the filament 50 to lie along the central longitudinal axes 12a, 12b of the hollow tubes 11a, 11b. In each of Figures 1, 2 and 4, there is provided a groove 23 the first and second ends 26, 27 of which, are positioned directly in line with the central longitudinal axes 12a, 12b of each of the hollow tubes 11a, 11b. This is the key property of the joining element 20 and the guidance means 28. The actual construction of these two pieces is not particularly limited, simply the joining element 20 is provided to join together the two hollow tubes 11a, 11b, and is provided with these guidance means 28 which align exactly with the central longitudinal axes 12a, 12b of each of the two hollow tubes 11a, 11b. A filament alignment capsule

structured in this manner, can then be incorporated into an electric lamp 30, and will advantageously align the filament 50 when provided in the electric lamp 30 and filament alignment capsule 10 along the central longitudinal axes 12a, 12b of the hollow tubes 11a, 11b.

[0031] In an advantageous embodiment, the surfaces of the two hollow tubes 11a and 11b are coated by means of the infrared reflecting coating 40. In this embodiment, the distance between the filament 50 and the coating 40 is immediately controlled by means of the filament alignment capsule 10. That is, when the filament 50 is positioned such that it runs through the first of the hollow tubes 11a interacts with the guidance means 28 lying on the central longitudinal axes 12a of the hollow tube 11a, runs over the joining element 20 to the second guidance means 28 which aligns the filament with the central longitudinal axes 12b of the second hollow tube 11b, the final portion of the filament 50 will lie along the central longitudinal axes 12b of the second hollow tube 11b. The efficiency of the infrared coating 40 is, as has been disclosed above, strongly dependent upon controlling the distance between the filament 50 and the coating 40. By means of the filament alignment capsule 10, this distance can be accurately maintained, and the efficiency of an electric lamp 30 comprising the filament alignment capsule 10 is greatly improved.

[0032] Furthermore, it is anticipated that the filament 50 being utilised in the electric lamp 30 of the present invention, will not produce light from its full length. Indeed, the filament 50 which is advantageously used in the electric lamp 30 of the present invention, is possessed of two active sections 51a and 51b, as shown in Figures 1 and 2. In particular, these two active sections 51a, 51b are the sections at which the light and the heat are generated from the filament 50 when in use. It is important for these active sections 51a, 51b to be located along the central longitudinal axes 12a, 12b of the two hollow tubes 11a, 11b. When these active sections 51a, 51b lie along such a central longitudinal axes 12a, 12b, the distance from the light and heat generating section is controlled so as to be the same in all radial directions. This advantageously improves the efficiency of the infrared coating 40 and thus the general efficiency of the electric lamp 30.

[0033] The filament 50 as shown in Figures 1 and 2, is a specific filament 50 wherein two active sections 51a and 51b are provided along its length. In between these two active sections 51a, 51b is provided an intermediate section 52. This intermediate section 52 is not formed with an incandescent structure; that is, when the filament 50 is in use, the intermediate section 52 does not generate significant quantities of heat. Indeed, the intermediate section 52 is primarily a low resistance electrical connection between the two active sections 51a, 51b of the filament 50. Provided at the other ends of the active sections 51a, 51b are a first 53 and second 54 end to the filament 50. The first 53 and second 54 end of the filament 50, are used as the electrical connections to the filament 50 when it is incorporated within a electric lamp 30.

[0034] Furthermore, it is quite clear that each of the first 53 and second 54 ends of the filament 50 also have to be accurately positioned, such that the active sections 51a, 51b of the filament 50 lie along the central longitudinal axes 12a, 12b of each of the two hollow tubes 11a and 11b. This alignment of the filament 50 is achieved by means of the external casing 31 of the electric lamp 30. The filament 50 is integrated with the filament alignment capsule 10, such that the filament 50 is accurately positioned at the top of the hollow tubes 11a, 11b along the central longitudinal axes 12a, 12b. This filament alignment capsule 10 incorporating the filament 50 is then positioned within the external casing 31 of the electric lamp 30. By ensuring that the first 53 and second 54 end of the filament 50 are positioned such that the active sections 51a, 51b lie along the central longitudinal axes 12a, 12b when fixing the filament alignment capsule 10 into the external casing 31, the filament 50 can be held in the desired position. This structure is best seen in Figures 1 and 2. By ensuring that the filament 50 is appropriately aligned in the filament alignment capsule 10 and then by means of the external casing 31 of the electric lamp 30, an electric lamp 30 with high efficiency is produced. In particular, it is expected that the filament 50 will be aligned appropriately in the filament alignment capsule 10 and then positioned into the external casing 31. The external casing 31 will then be dimpled such that the filament alignment capsule 10 is secured within the external casing 31 by means of dimples 32. These dimples 32 can be seen in Figure 3, and are advantageously provided as interacting and fixing the joining element 20 of the filament alignment capsule 10. Obviously, it is possible to fix the filament alignment capsule 10 within the electric lamp 30 by alternative means, however the technique of dimpling is well established and provides a simple and effective way of fixing the alignment capsule 10.

[0035] Once the filament alignment capsule 10 and filament 50 are secured within the electric casing 31, this casing is pinch-sealed, to provide a gas-tight seal 35 at the lower end thereof. Within this gas-tight seal 35, are provided contacts 33 for electrically connecting to the first 53 and second 54 ends of the filament 50, as well electrodes 34 which electrically connect to the contacts 33. The further requirements of this pinching stage of production, is that the first 53 and second 54 ends of the filament 50 are accurately located such that the active sections 51a, 51b of the filament 50 lie along the central longitudinal axes 12a, 12b of each of the two hollow tubes 11a, 11b. At this point in the production, the hollow bulb section 36 of the electric lamp 30 is filled with an inert gas and halogen or a halogen compound, and the electric lamp is clipped off to fully seal this bulb 36 to form the electric lamp 30.

[0036] As can be seen from the above disclosure, the key elements to the current invention are the filament alignment capsule 10 interacting with the external casing 31 of the electric lamp 30. In particular, these two features interact such that a filament 50 positioned in the electric

lamp 30 is located, and active sections 51a, 51b if such a filament 50 is used, so as to lie along the central longitudinal axes 12a, 12b of the two hollow tubes 11a, 11b making up the filament alignment capsule 10. An electric lamp 30 fabricated in such a way, will have a greatly improved efficiency, as the distance between the filament 50 and the infrared reflective coating 40 can be accurately assured, and therefore the effectiveness of this coating 40 is improved.

[0037] When forming the filament alignment capsule 10, it is also possible for the two hollow tubes 11a, 11b to touch each other along a contact point 13a, 13b along the outside surfaces 14a, 14b of each of the two tubes 11a, 11b. Additionally, it is also possible for the two hollow tubes 11a, 11b to be joined together at this contact point 13a, 13b, as well as being joined together by means of the joining element 20. Obviously, joining together the two hollow tubes 11a, 11b further strengthens the structure of the filament alignment capsule 10.

[0038] As can be seen in Figure 4, the joining element can be comprised of guidance means 28 which are structured as a groove 23 in the upper surface. The groove 23 in the upper surface 24 of the joining element 20 can have any profile, and is not limited to the semicircular profile as given in Figure 4. Indeed, it is possible for the groove 23 to be a concave or V-shaped groove 23 in profile. If a groove 23 is provided in the joining element 20, the joining element 20 advantageously has a width which is the same distance as is present between the central longitudinal axes 12a, 12b of the two hollow tubes 11a, 11b. The first 26 and second 27 end of the groove 23 as shown in Figure 4 will then provide the guidance means 28 lying exactly on the central longitudinal axes 12a, 12b of each of the two hollow tubes 11a, 11b.

[0039] The joining element 20 as shown in Figure 4 has a generally rectangular profile. As can be seen from the joining element 20 in Figures 1 and 2, other shapes of the joining element 20 are equally acceptable. Indeed, the joining element 20 in Figures 1 and 2 is of a hemispherical cylindrical design, wherein the flat lower bottom is used as the surface to join the two hollow tubes 11a, 11b, and the filament 50 runs along and over the top of the circular profiled section of the cylinder. Additionally, it is possible that the joining element 20 as shown in Figures 1 and 2 also possesses a groove 23, the first 26 and second 27 end of this groove 23 providing the guidance means 28 for aligning the filament 50.

[0040] Additionally, it is advantageous for the filament alignment capsule 10 to be comprised of quartz material. That is, the two hollow tubes 11a, 11b as well as the joining element 20 all being fabricated from quartz. The advantage of providing the filament alignment capsule from quartz is that quartz can be produced to good dimensional tolerances, and is particularly suited to the high temperature environment within the electric lamp 30. Furthermore, if the joining element 20 is provided by quartz, the external casing 31 when dimpled to attach to the joining element 20 (should this be the method of at-

tachment) will form a glass to glass junction, which is extremely stable. Further, it is advantageous for each of the hollow tubes 11a, 11b to be identical in both size and shape. This leads to a more controllable structure in the filament alignment capsule 10.

[0041] The above description of an electric lamp 30 is provided as a general teaching of the inventive concept. The key element to the electric lamp 30 is that of the filament alignment capsule 10; also of a secondary importance is this capsule 10 interacting with the external casing 31, such that the filament 50 in the electric lamp 30 is extremely precisely located with relation to the infrared reflective coating 40. In such a way, the efficiency of the electric lamp 30 is greatly improved. The discussion presented above is not intended to limit the scope of protection, and indeed many further designs for the filament alignment capsule 10 and the electric lamp 30 will be obvious to the skilled person, and the full scope of the invention is defined by means of the attached claims.

Reference numeral

[0042]

10	Filament alignment capsule
11 a+b	2 hollow cylindrical tubes
12 a+b	Central longitudinal axes
13 a+b	Contact point
14 a+b	Outside surface
20	Joining element
21	Opposing side 1
22	Opposing side 2
23	Groove
24	Upper surface
25	Lower surface
26	First end
27	Second end
28	Guidance means
30	Electric lamp
31	External casing
32	Dimples
33	Contacts
34	Electrodes
35	Gas tight seal
36	Bulb
40	Coating
50	Filament
51 a+b	Active sections
52	Intermediate Section
53	First end
54	Second end

Claims

1. A filament alignment capsule (10) for an electric lamp (30) comprising:

- two hollow tubes (11a, 11b) with rotational symmetry around their central longitudinal axes, wherein the diameter of the hollow tubes (11a, 11b) is either constant along the length of the hollow tube (11a, 11b) or varies along the length of the hollow tube (11a, 11b), wherein the two hollow tubes (11a, 11b) are aligned with their central longitudinal axes (12a, 12b) parallel, and further the two hollow tubes (11a, 11b) are joined together at one end by a joining element (20) which is provided with guidance means (28) for interacting with a filament (50) connectable with the filament alignment capsule (10), wherein the guidance means (28) are aligned with the central longitudinal axes (12a, 12b) of each of the hollow tubes (11a, 11b).
2. The filament alignment capsule (10) of claim 1, wherein the diameter of the hollow tubes (11a, 11b) varies along their length, and is greater in the middle of the hollow tubes (11a, 11b) than at the ends of the hollow tubes (11a, 11b).
 3. The filament alignment capsule (10) of either claim 1 or claim 2, wherein the two hollow tubes (11a, 11b) are prefabricated, and have the same dimensions of size and shape.
 4. The filament alignment capsule (10) of any of the preceding claims, wherein the one or both of the joining element (20) and the two hollow tubes (11a, 11b) are made from quartz.
 5. The filament alignment capsule (10) of any of the preceding claims, wherein the two hollow tubes (11a, 11b) are arranged in contact along a part of their surface (13a, 13b) in their longitudinal direction.
 6. The filament alignment capsule (10) of any of claims 1 to 4, wherein the two hollow tubes (11a, 11b) are arranged in contact along a part of their surface (13a, 13b) in their longitudinal direction and are joined together at this part of their surface (13a, 13b).
 7. The filament alignment capsule (10) of any of the preceding claims, wherein the guidance means (28) are provided on each of the opposing sides (21, 22) of the joining element (20) at a position which coincides with the central longitudinal axes (12a, 12b) of each of the hollow tubes (11a, 11b).
 8. The filament alignment capsule (10) of any of the preceding claims, wherein the joining element (20) is provided with a groove (23) extending in its upper surface (24), the upper surface (24) being the surface opposite the surface (25) in contact with the two hollow tubes (11a, 11b), wherein the groove (21) is positioned such that the first end (26) is positioned at the central longitudinal axes (12a) of the first hollow tube (11a) and the second end (27) is positioned at the central longitudinal axes (12b) of the second hollow tube (11b) with the groove (23) extending there-between.
 9. The filament alignment capsule (10) of claim 8, wherein the cross-sectional shape of the groove (23) is one of: concave, V-shaped or semicircular.
 10. The filament alignment capsule (10) of any of the preceding claims, wherein the two hollow tubes (11a, 11b) have a coating (40) on at least their outside surfaces (14a, 14b) of a material which substantially reflects infra-red radiation, but is furthermore substantially transparent to optical wavelengths.
 11. An electric lamp (30) incorporating the filament alignment capsule (10) of any of the preceding claims, wherein the electric lamp (30) comprises a filament (50) which extends along the central longitudinal axes (12a) of the first hollow tube (11a) up to a first guidance means (28) on the joining element (20), across to a second guidance means (28) and along the central longitudinal axes (12b) of the second hollow tube (11b), wherein the first and second guidance means (28) position the filament (50) along the central longitudinal axes (12a, 12b) of each of the two hollow tubes (11a, 11b).
 12. The electric lamp (30) of claim 12, wherein the filament (50) is possessed of two active sections (51a, 51b) which are positioned along the central longitudinal axes (12a, 12b) of each of the two hollow tubes (11a, 11b) and an intermediate section (52), which electrically joins the two active sections (51a, 51b) of the filament (50), and which is positioned mainly between the guidance means (28) of the joining block (20).
 13. The electric lamp (30) of either of claims 12 or 13, wherein the lamp (30) further comprises an external casing (31) for surrounding the filament alignment capsule (10) and the filament (50), wherein the external casing (31) provides an airtight outer shell which completely encases the filament alignment capsule (10) and the filament (50).
 14. The electric lamp (30) of claim 14, wherein the external casing (31) holds the filament alignment capsule (10) in place by means of dimples (32) extending to contact the filament alignment capsule (10).
 15. The electric lamp (30) of either claims 12 or 13, wherein the external casing (31) holds the filament (50) at both of its ends (53, 54) such that the filament

lies along the central longitudinal axes (12a, 12b) of each of the two hollow tubes (11a, 11b).

- 16.** The electric lamp (30) of any of claims 14 to 16, wherein the filament (50) extends into the external casing (31) in which contacts (33) are located for electrically contacting the filament (50) with the outside of the external casing (31) by means of electrodes (34).

- 17.** A method of fabricating a filament alignment capsule (10), comprising the steps of:

aligning two hollow tubes (11a, 11b) such that their longitudinal axes (12a, 12b) are parallel and joining the two hollow tubes (11a, 11b) at one of their ends by means of a joining element (20), wherein guidance means (28) provided on the joining element (20) lie on the central longitudinal axes (12a, 12b) of each of the hollow tubes (11a, 11b).

- 18.** A method of fabricating an electric lamp (30), comprising the steps of:

fabricating a filament alignment capsule (10) according to claim 18, and further mounting a filament (50) into the filament alignment capsule (10).

- 19.** The method of claim 19, further comprising:

positioning the filament alignment capsule (10) and filament (50) within an external casing (31) and dimpling the external casing (31) to form dimples (32) which hold the filament alignment capsule (10) in place.

- 20.** The method of either of claims 19 or 20, further comprising:

positioning the filament ends (53, 54) such that the filament (50) lies along the longitudinal axes (12a, 12b) of the hollow tubes (11a, 11b) and pinching the external casing (31) to form a gas tight seal (35) and also to connect the ends of the filament (53, 54) to contacts (33) provided in the gas tight seal (35).

- 21.** The method of any of claims 19 to 21, further comprising coating the filament alignment capsule (10) with a coating (40) prior to mounting the filament, wherein the coating (40) is of a material which substantially reflects infra-red radiation, but is furthermore substantially transparent to optical wavelengths.

- 22.** The method of any of claims 19 to 22, wherein the

guidance means (28) are positioned such that the first is positioned on the side of the joining element (20) at the central longitudinal axes (12a) of the first hollow tube (11a) and the second is positioned on the side of the guidance element (20) at the central longitudinal axes (12b) of the second hollow tube (11b), and

the step of positioning the filament is done so that the filament (50) extends along the central longitudinal axes (12a) of the first hollow cylindrical tube (11a) up to the first guidance means (28) in the joining block (20) across to the second guidance means (28) and along the central longitudinal axes (12b) of the second hollow tube (11b), wherein the first and second guidance means (28) act to position the filament (50) along the central longitudinal axes (12a, 12b) of each of the two hollow tubes (11a, 11b).

- 23.** The method of claim 23, wherein the filament (50) is possessed of two active sections (51a, 51b) which are positioned along the central longitudinal axes (12a, 12b) of each of the two hollow cylindrical tubes (11a, 11b) and an intermediate section (52), which electrically joins the two active sections (51a, 51b) of the filament (50), and which is positioned mainly in the groove (23) of the joining block (20).

- 24.** The method according to any of claims 19 to 24, wherein after the gas tight seal (35) is formed in the external case (31), the lamp is filled with an inert gas and halogen or a halogen compound, and the open filling section (36) of the external case (31) is tipped off to fully seal the electric lamp (30).

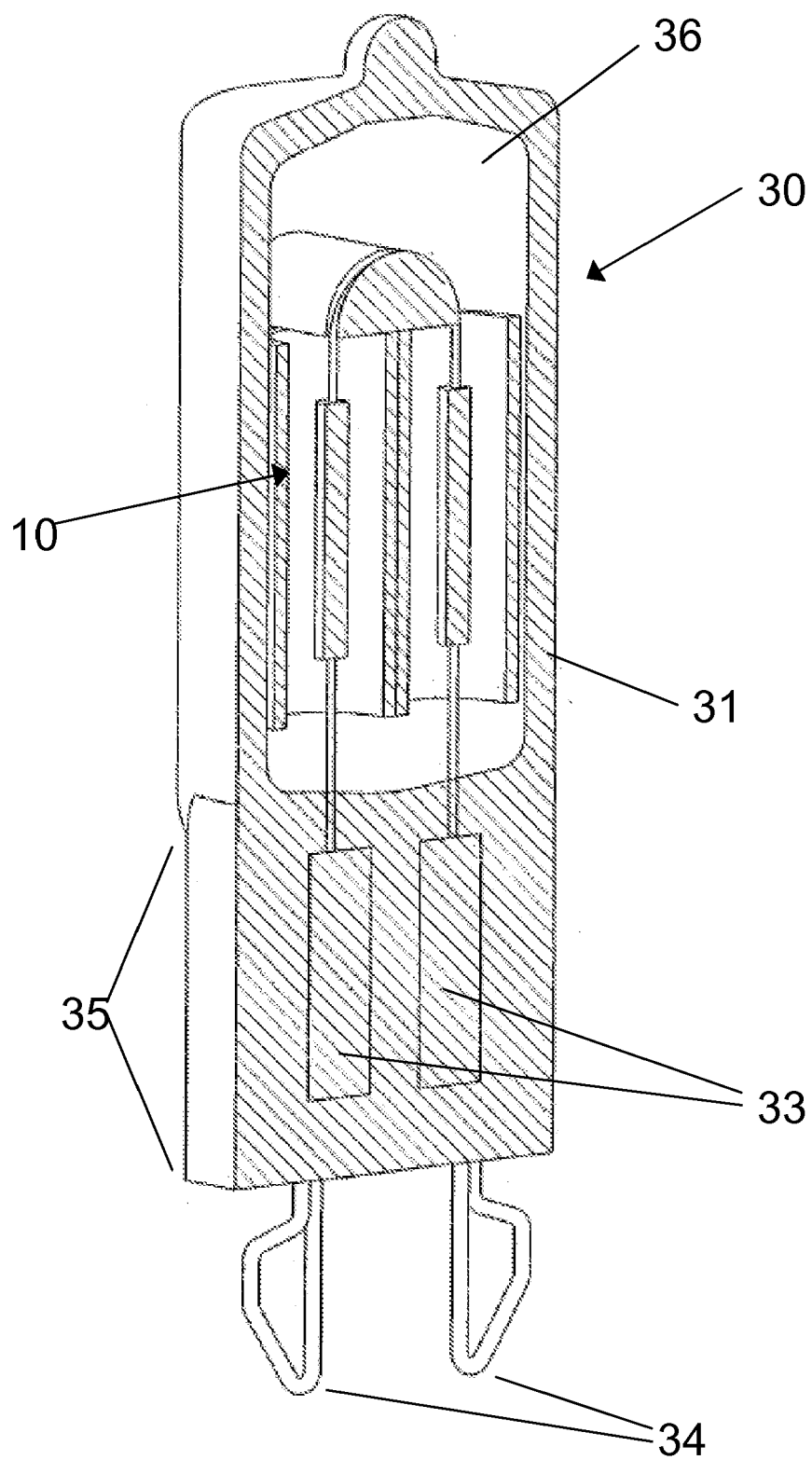


FIG. 1

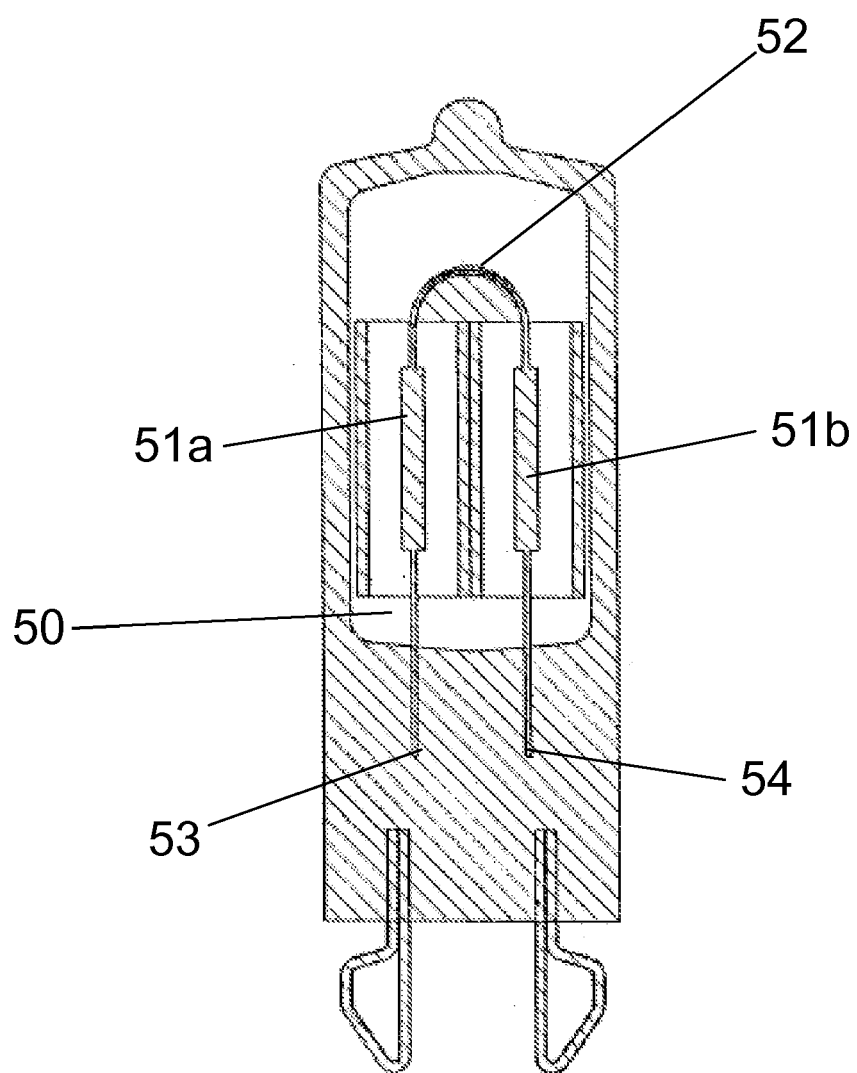


FIG. 2

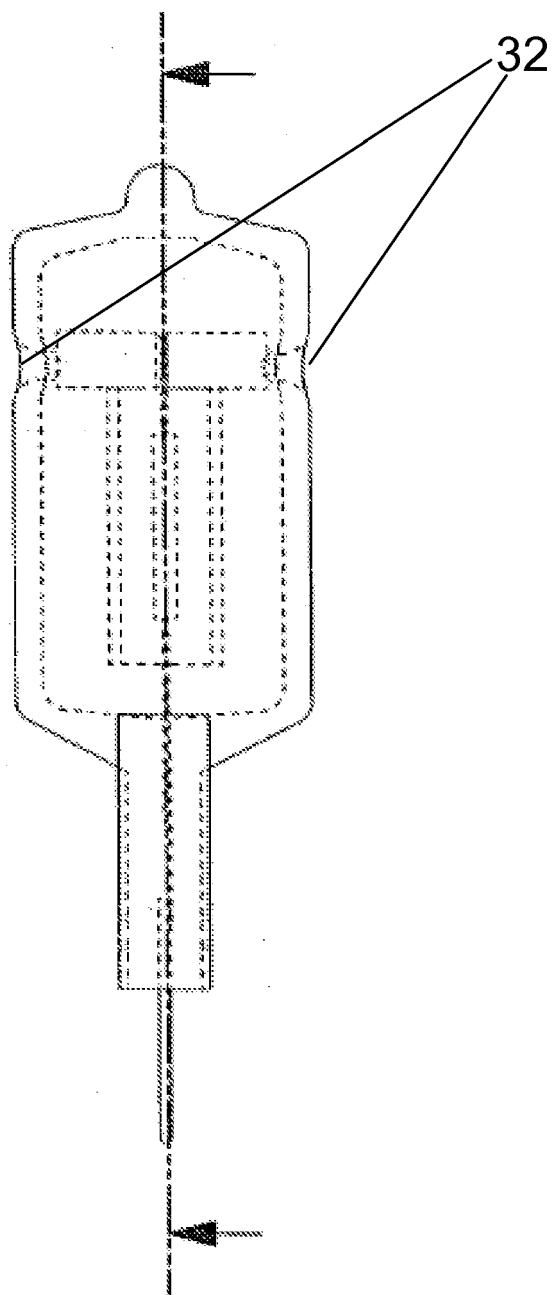
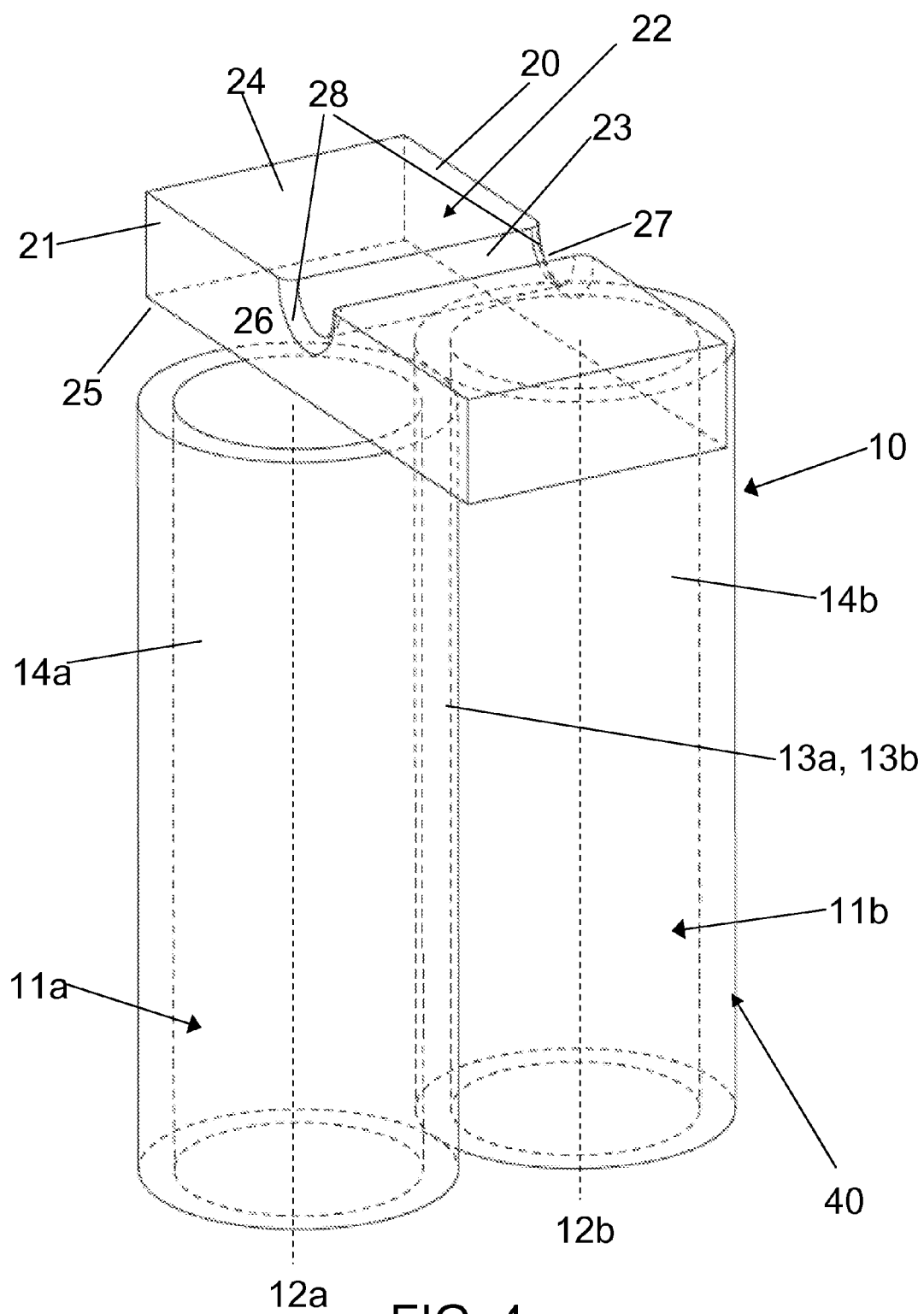


FIG. 3





EUROPEAN SEARCH REPORT

Application Number
EP 08 10 0597

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2007/036493 A (PATRA PATENT TREUHAND [DE]; GOIHL RUPERT [DE]; STARK ROLAND [DE]) 5 April 2007 (2007-04-05) * abstract * * page 11, line 6 - page 12, line 30 * * page 18, lines 28-31 * * figures 1,2 *	1-24	INV. H01K1/18 ADD. H01K1/32 H01K1/28
D,A	DE 102 36 549 A1 (PATRA PATENT TREUHAND [DE]) 4 March 2004 (2004-03-04) * abstract * * paragraphs [0010], [0017], [0018], [0022] * * figures 1-4 *	1	
D,A	WO 2004/084258 A (KONINKL PHILIPS ELECTRONICS NV [NL]; CLAASSEN WILHELMUS C M [NL]) 30 September 2004 (2004-09-30) * figure 1 *	1	
L	DE 20 2008 000664 U1 (FLOWIL INTERNAT LIGHTING HOLDI [NL]) 19 June 2008 (2008-06-19) Same (first) filing date * the whole document *	1-24	TECHNICAL FIELDS SEARCHED (IPC) H01K
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 18 May 2009	Examiner 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			

 1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 08 10 0597

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
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18-05-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007036493 A	05-04-2007	DE 102005046204 A1	29-03-2007
		DE 112006002335 A5	07-08-2008

DE 10236549 A1	04-03-2004	AT 327571 T	15-06-2006
		CN 1675741 A	28-09-2005
		WO 2004019371 A1	04-03-2004
		EP 1527477 A1	04-05-2005
		JP 2005535101 T	17-11-2005
		US 2005242733 A1	03-11-2005

WO 2004084258 A	30-09-2004	CN 1973353 A	30-05-2007
		US 2006181207 A1	17-08-2006

DE 202008000664 U1	19-06-2008	NONE	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2004084258 A [0007]
- DE 10236549 [0008]
- US 6400077 B [0009]
- EP 1739725 A [0010]