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(54) **Lamp with fuse**

(57) A fuse for a lamp (10) is formed in a flare (40) of the lamp. Leads (26) for an energizable light source (28), such as a tungsten filament, pass through a cavity (58) in the flare. A portion (60,62) of each lead within the flare cavity is fusible. Arcing is dissipated by an arc-quenching filler material (76), such as glass beads, which fill the flare cavity and surround the fusible portions. A sealant (86) retains the beads in the cavity.

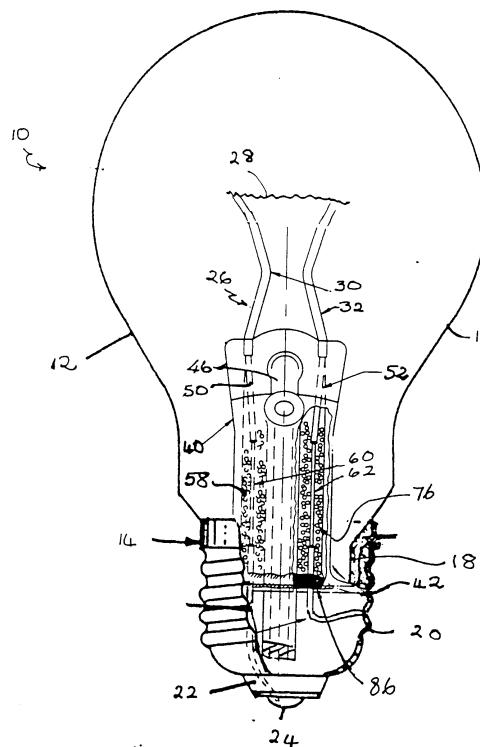


FIG. 1

Description

[0001] This invention relates to the lamp arts and, more particularly, to an electric lamp, which incorporates a Ballotini-type fuse into the flare.

[0002] In the manufacture of electric lamps, such as incandescent or halogen lamps, fuses are often used to interrupt excessive current flow to protect the lamp from damaging electric arcing. The fuses are typically formed from a strip of metal or alloy, such as Monel or nickel D wire. However, upon filament failure or fuse burnout, one or more internal arcs can develop. These arcs can melt a hole through the lamp base or weld the base to the lamp socket, with a resultant risk of fire and personal injury. In the case of a halogen filament tube, the current flow during arcing may result in rupturing of the filament tube, and resultant damage to the outer envelope of the lamp.

[0003] To reduce such arcs, manufacturers have sometimes filled the lamp base with one or more insulative or porous cement layers in an attempt to insulate the inside conductive surface of the base from fuse wire arcing. This type of solution requires additional steps in lamp manufacturing and considerable expense. Further, although base melt-through is reduced, it continues to be a problem.

[0004] Extinguishing the arc as fast as possible is therefore of primary importance. A present method of reducing arcing is to incorporate a commercially available Ballotini fuse as stand-alone component in the lamp. A Ballotini fuse consists of a smaller diameter tube (typically 2-3 millimeters in diameter) filled with glass beads or other arc-quenching material. A fuse wire is centered inside the glass bead-filled tube. When excessive current activates the fuse, the fuse wire melts and the arc is extinguished rapidly by the glass beads. The time of arcing is significantly reduced as compared with a fuse without the beads.

[0005] Additionally, the delivered current and the energy flowing into the lamp during arcing are much lower than without the beads, reducing the potential damage. However, the use of a Ballotini fuse requires separate manufacturing of the component and complicates the lamp assembly process.

[0006] The present invention provides a new and improved lamp and method of formation, which overcomes the above-referenced problems and others.

[0007] In an exemplary embodiment of the present invention a lamp is provided. The lamp includes a light transmitting envelope and an energizable light source within the envelope. A flare extends into the envelope, the flare including an interior cavity. Leads are provided for connecting the energizable light source with a source of power. The leads extend through the flare cavity. A portion of at least one of the leads comprises a fusible element.

[0008] An arc-quenching filler is disposed in the interior cavity around the at least one fusible element.

[0009] In another exemplary embodiment of the present invention, a flare for a lamp is provided. The flare includes a hollow tubular portion, which defines an interior cavity. An exhaust tube extends through the interior cavity to define a space between the tubular portion and the exhaust tube. Leads are provided for connecting an energizable light source with a source of power. The leads extend through the space in the flare interior cavity. A portion of at least one of the leads comprises a fusible element. A first end of the tubular portion is sealed around the exhaust tube and the leads and closes off the first end of the interior cavity. An arc-quenching filler is disposed in the space in the flare interior cavity around the at least one fusible element.

[0010] In another exemplary embodiment of the present invention, a method of forming a lamp is provided. The method includes providing a hollow tube with a first open end and a second open end and positioning an exhaust tube within the hollow tube to define an annular space between the exhaust tube and the hollow tube. The method further includes positioning leads through the annular space, at least one of the leads including a fusible element. Further, the method includes sealing the first end of the hollow tube to close off a first end of the annular space, ends of the leads extending through the sealed first end. An arc quenching material is disposed around the fusible element within the annular space.

[0011] One advantage of the present invention is that arcing and lamp damage is minimized.

[0012] Another advantage of the present invention is that manufacture of the lamp is simplified.

[0013] Still further advantages of the present invention will become apparent to those of ordinary skill in the art upon reading and understanding the following detailed description of the preferred embodiments.

[0014] Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

FIGURE 1 is a front sectional view of a lamp in accordance with the present invention;

FIGURE 2 is an enlarged sectional view of the flare with a Ballotini-type fuse of FIGURE 1;

FIGURE 3 is a side sectional view of a flare during formation of the lamp of FIGURE 1;

FIGURE 4 is a side view of the flare of FIGURE 3 after sealing to a lamp envelope; and

FIGURE 5 is a side view of the lamp envelope and flare of FIGURE 4 after tipping off the exhaust tube and filling the flare cavity with glass beads.

[0015] With reference to FIGURES 1 and 2, an incandescent lamp 10 has a light transmitting, glass envelope

12 secured to a base 14. The envelope shown in FIGURE 1 has a bulbous upper portion 16 and a narrower, generally cylindrical lower portion 18, although other envelope geometries are also contemplated. It should be appreciated that the terms "upper" and "lower", "above" and "below", and the like, refer to the lamp as shown in FIGURE 1, in which the base is shown extending below the envelope.

[0016] The base includes a metal shell 20, an insulative plug 22 and a standard contact 24. Four-part connecting leads 26 are used to connect a source of power (not shown) with an energizable light source 28, such as a coiled filament of tungsten, positioned within the bulbous portion 16 of the envelope. The four part leads include support leads 30 and 32, such as nickel or nickel-plated copper wires, which connect with and support the light source 28. A filament tube (not shown) may surround the filament, as in the case of an incandescent halogen lamp. Other light sources are also contemplated.

[0017] A generally cylindrical, flare or reentrant stem mount 40 is seated within the envelope. The flare is sealed around a lower end 42 thereof to the bottom periphery of the cylindrical portion 18 of the envelope. An exhaust tube 46 extends axially through the flare and is sealed off at a lower end of the tube to hermetically seal the envelope, which contains an inert gas, such as a mixture of nitrogen and argon, or may be evacuated.

[0018] Each support lead 30, 32 connects with an intermediate wire segment 50, 52, respectively, formed, for example, from DUMET wire, which extends through and is sealed into a press-on portion 54 of the flare 40. The press-on portion seals around the upper end of each of the intermediate wire segments and the lower ends of the support leads 30, 32 and the upper end of the exhaust tube. A hollow portion or generally annular cavity 58 is thus formed within the flare, between the flare 40 and the exhaust tube 46.

[0019] The wire segments 50, 52 extend at their lower ends into the cavity 58 of the flare, where they are connected with respective fusible elements, such as fuse wires 60, 62 of, for example, Monel or other nickel alloy, such as nickel 211. Monel is a nickel/copper alloy. A preferred fuse wire is formed from Monel 400, having a composition of 63-70% nickel, and maximums of 0.3% carbon, 2.0% manganese, 0.24% sulfur, and 0.5% silver, the remainder copper. Other materials, which melt on application of an excess current, may also be used for the fusible material.

[0020] The fuse wires are connected at their lower ends, within the hollow portion 58, to outer leads 70, 72, which in turn are connected to the center contact 24 and the upper rim of the shell 20, respectively, as shown in FIGURE 1.

[0021] The flare cavity 58 is filled with an arc-quenching filler material 76. In the event of an electric arc being generated (generally as a result of one of the fuses melting when excess current passes) the filler material 76

rapidly extinguishes the arc. The arc-quenching material melts and vaporizes in the arc, causing deionization of the arc space. The filler material is preferably in the form of particles and is not electrically conductive. The material preferably also has a low thermal conductivity. Suitable arc-quenching materials include glass beads, silica sand, quartz sand, gypsum, chalk, other known arc-quenching filler materials, and combinations thereof. The beads, or other arcquenching materials, preferably surround the fuses and are closely packed in the cavity. The material may be of the bound filler type, in which sand particles are bound together by, for example, colloidal silica particles. Without the beads, the time of arcing is significantly longer.

[0022] Optionally, the fuse wires 60, 62 are wound around a core (not shown). The core may be a supporting core or a core formed from a frozen mixture of arc-quenching material and liquid. The fuse wound core is then surrounded by additional arc-quenching material. The frozen core, if used, is melted prior to use and the liquid evaporated.

[0023] Either one or both of the leads 26 can include fuse wires. In the preferred embodiment, both the leads contain a fuse wire section 60, 62 for best results.

[0024] In the event of excessive passage of current, the fuse wire 60, 62 melts and the arc is extinguished rapidly by the glass beads, or other arc-quenching material. Without the glass beads, the time of the arcing is typically about 5 milliseconds. Adding the beads reduces the arcing to about 2 milliseconds.

[0025] To form the lamp, the four part leads 26, each comprising support lead 30,32, connecting lead 50, 52, fuse wire 60, 62 and outer lead 70,72 are inserted into a first open, upper end 80 of the flare and the exhaust tube 46 is axially aligned in the flare 40, as shown in FIGURE 3. The upper end 80 of the flare is hermetically sealed around the connecting leads by heating and pressing the glass at 54, as shown in FIGURE 2. The flare is then sealed around its lower end 42 to the envelope 12, as shown in FIGURE 4. The envelope is evacuated via the exhaust tube 46 and the nitrogen/argon (or krypton or xenon in place of argon) fill, if used, loaded into the envelope 12 through the exhaust tube, or the envelope is evacuated, in the case of an evacuated envelope. A lower end 82 of the exhaust tube is then "tipped off," to hermetically seal the fill or vacuum in the envelope, as shown in FIGURE 5. Mechanical sealing or melting of the glass can be used.

[0026] The glass beads 76, or other particles, are inserted into the flare cavity 58 via an open end 84 thereof to surround the fuse wires 60,62, as shown in FIGURE 5. The lower end 84 of the cavity is sealed by a seal 86, for example, an epoxy adhesive, a silicone sealant, such as RTV, or other sealing material, best shown in FIGURE 2. The seal formed need not be a hermetic seal but is sufficient to retain the beads 76 in the cavity 58. The base 14 is attached to the connecting leads 70,72 and attached to the lower end of the bulb to complete

the lamp forming process.

[0027] In an alternative method of production, the beads are inserted into the flare cavity, around the fuses, prior to sealing the flare to the envelope. The fill is inserted into the envelope and the bottom end of the exhaust tube sealed off as previously described. For most purposes, the first method is preferred over this method because it allows the flare to be integrally formed with the envelope. Other methods of assembling the lamp are also contemplated.

[0028] The flare with the incorporated Ballotini-type fuse according to FIGURES 1 and 2 can thus be manufactured as part of the lamp assembly process. This process is easily automated and eliminates the need for a specially manufactured Ballotini fuse.

Claims

1. A lamp comprising: a light transmitting envelope;
an energizable light source within the envelope;
a flare extending into the envelope, the flare including an interior cavity;
leads for electrically connecting the energizable light source with a source of power, the leads extending through the flare cavity, a portion of at least one of the leads comprising a fusible element;
an arc-quenching filler disposed in the interior cavity around the at least one fusible element.
2. The lamp of claim 1, wherein the arc-quenching filler comprises at least one of the group consisting of glass beads, silica sand, quartz sand, gypsum, chalk, and combinations thereof.
3. The lamp of claim 1, further including a seal which holds the arc-quenching filler material within the flare.
4. A flare for a lamp comprising:
a hollow tubular portion which defines an interior cavity;
an exhaust tube extending through the interior cavity, a space being defined between the tubular portion and the exhaust tube;
leads for connecting an energizable light source with a source of power, the leads extending through the space in the flare interior cavity, a portion of at least one of the leads comprising a fusible element;
a first end of the flare being sealed around the exhaust tube and the leads and closing off the first end of the interior cavity; and
an arc-quenching filler disposed in the space in the flare interior cavity around the at least one

fusible element.

5. The flare of claim 4, further including a seal at a second end of the flare which holds the arcquenching filler material within the space in the flare interior cavity.
6. A method of forming a lamp, the method comprising:
providing a hollow tube with a first open end and a second open end; positioning an exhaust tube within the hollow tube to define an annular space between the exhaust tube and the hollow tube;
positioning leads through the annular space, at least one of the leads including a fusible element;
sealing the first end of the hollow tube to close off a first end of the annular space, ends of the leads extending through the sealed first end; and
disposing an arc quenching material around the fusible element within the annular space.
7. The method of claim 6, further including:
sealing a second end of the annular space to retain the arc quenching material within the annular space.
8. The method of claim 6, further including:
sealing the hollow tube adjacent the second open end of the hollow tube to an envelope to define an interior space within the envelope which is accessed by the exhaust tube.
9. The method of claim 8, wherein the step of sealing the hollow tube adjacent the second open end of the hollow tube to the envelope is carried out prior to the step of disposing an arc quenching material around the fusible element within the flare.
10. The method of claim 8, further including, prior to the step of disposing an arc quenching material around the fusible element within the flare:
sealing off an end of the exhaust tube to create a hermetically sealed space in the envelope around the light source.

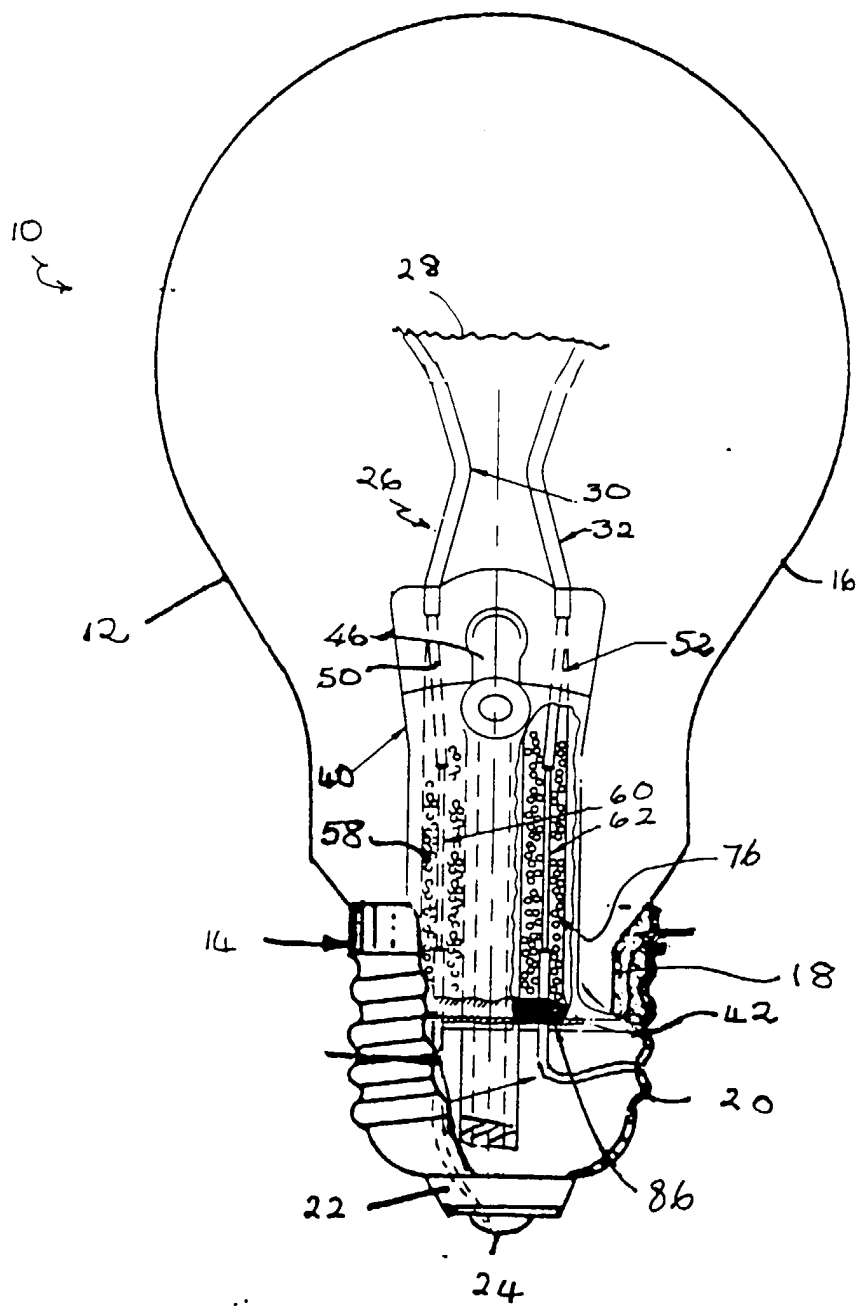


FIG. 1

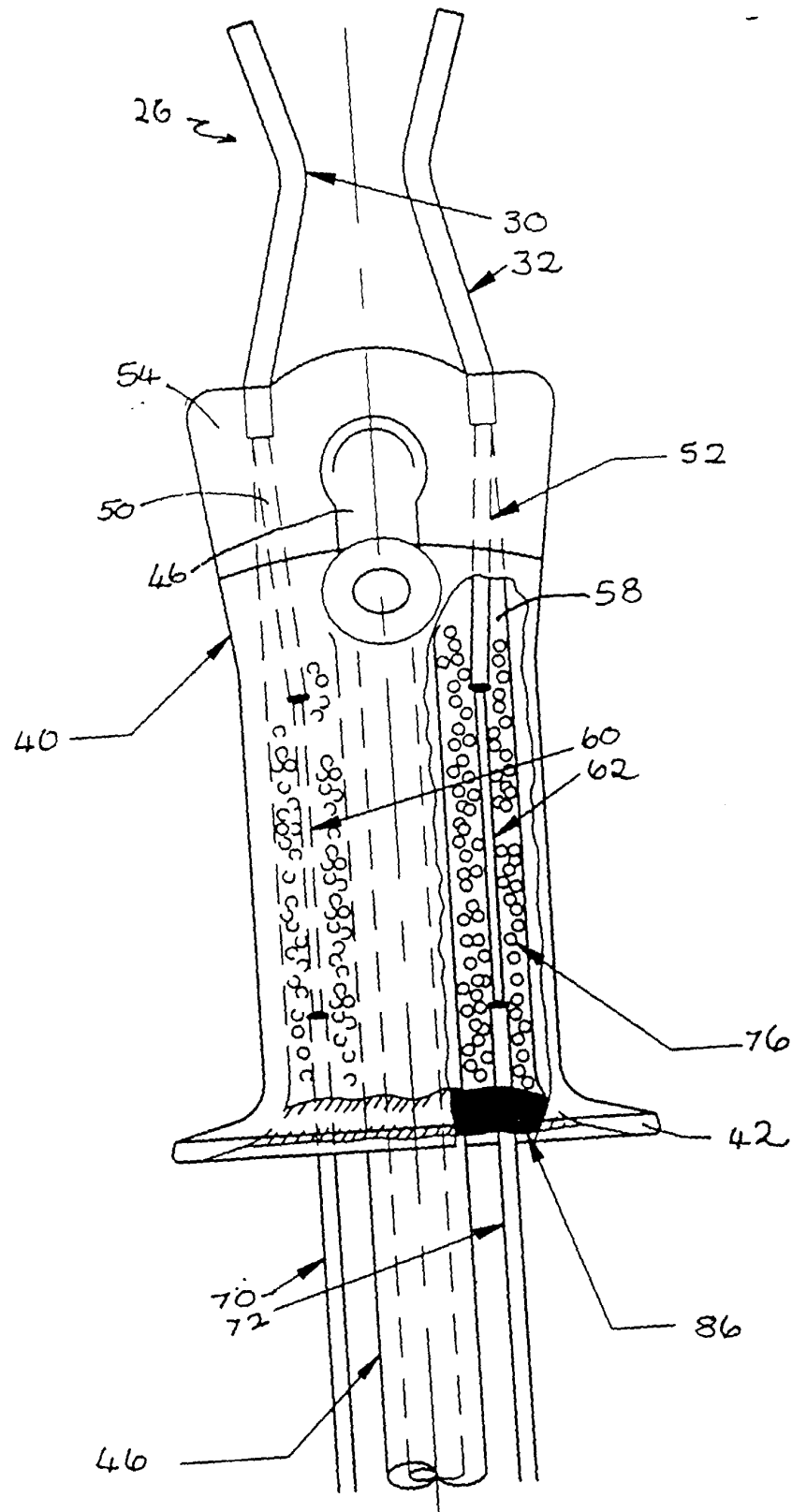


FIG. 2

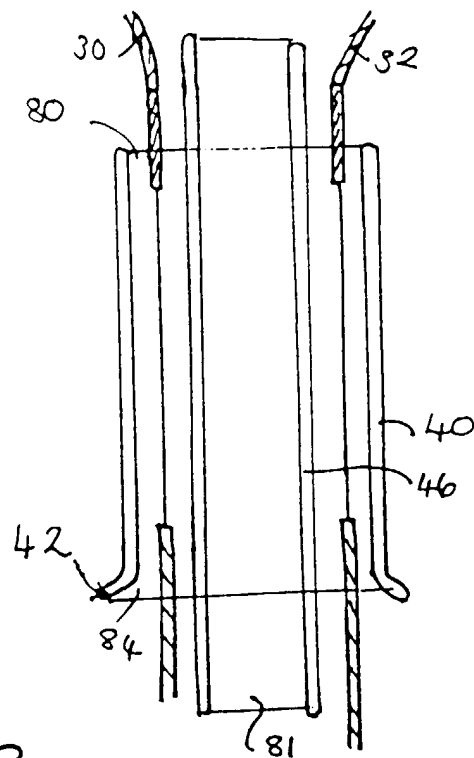


FIG. 3

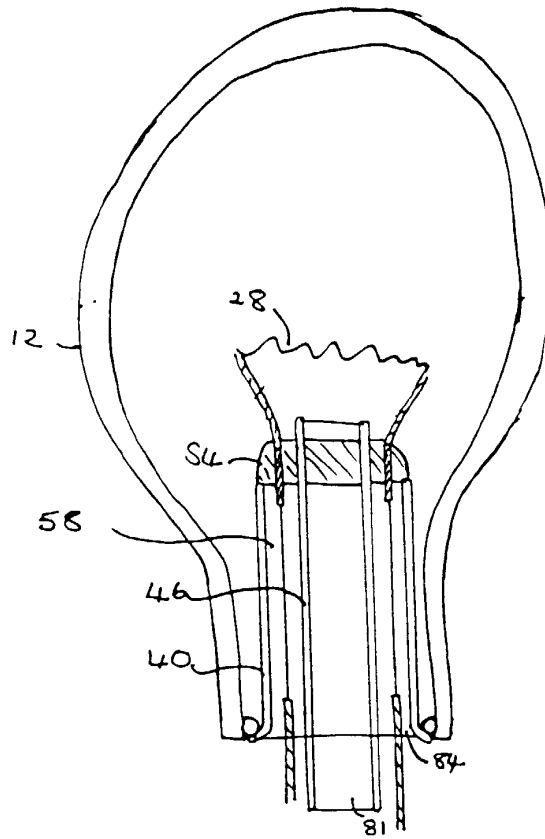


FIG. 4

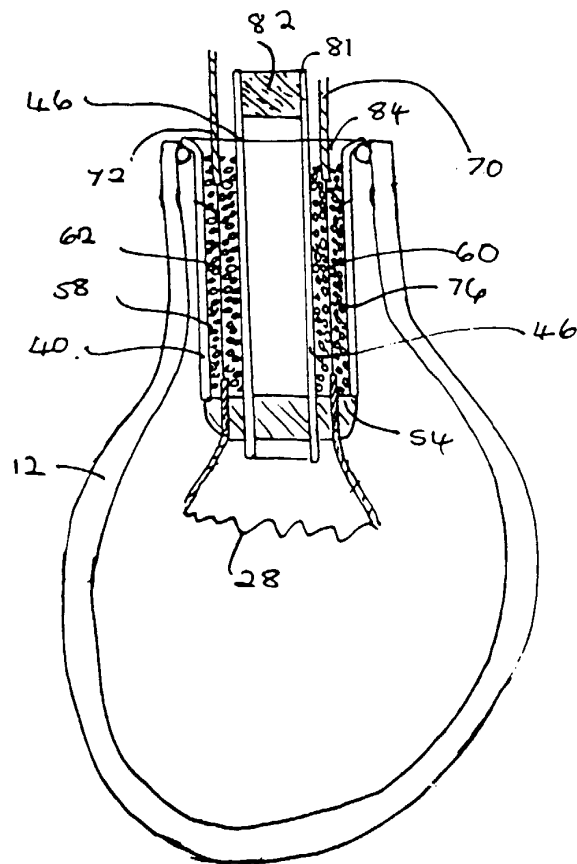


FIG. 5



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 00 30 8541

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.7)
X	EP 0 131 325 A (PHILIPS NV) 16 January 1985 (1985-01-16) * page 5, paragraph 1; figure 1 *	1,4	H01K1/66 H01J61/56
A	---	5,7-11	
X	GB 2 207 566 A (GEN ELECTRIC PLC) 1 February 1989 (1989-02-01) * page 4 - page 5; figures 1,2 *	1,4	
A	---	5-11	
A	EP 0 441 439 A (PHILIPS NV) 14 August 1991 (1991-08-14) * column 5, line 42 - column 6, line 47 *	1-6	
A	US 5 585 693 A (SHAFFER JOHN W) 17 December 1996 (1996-12-17) * column 2, line 60 - column 3, line 46; figures 3-5 *	1,4-6	
A	US 4 362 969 A (ROTHWELL HAROLD L ET AL) 7 December 1982 (1982-12-07) * column 3, line 34 - column 4, line 55; figures 1-5 *	1,4,6	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	EP 0 168 874 A (PHILIPS NV) 22 January 1986 (1986-01-22) * page 4 - page 6; figures 1,2 *	1,4,6	H01K H01J
A	US 3 767 965 A (COLLINS B ET AL) 23 October 1973 (1973-10-23) * claims 1,4,6; figures 1-4 *	1,4,6	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 12 January 2001	Examiner Deroubaix, P
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)

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

EP 00 30 8541

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12-01-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0131325 A	16-01-1985	CA 1218693 A	03-03-1987
		DE 3471204 D	16-06-1988
		HU 35422 A, B	28-06-1985
		JP 60014750 A	25-01-1985
		US 4622488 A	11-11-1986
GB 2207566 A	01-02-1989	EP 0300654 A	25-01-1989
		ZA 8805298 A	29-03-1989
EP 0441439 A	14-08-1991	CN 1055083 A	02-10-1991
		HU 56662 A	30-09-1991
		JP 7073859 A	17-03-1995
US 5585693 A	17-12-1996	CA 2181289 A	19-01-1997
		CN 1147689 A	16-04-1997
		DE 69607794 D	25-05-2000
		DE 69607794 T	31-08-2000
		EP 0755173 A	22-01-1997
		HU 9601953 A	28-05-1997
		JP 3034800 B	17-04-2000
		JP 9106781 A	22-04-1997
		CA 2169581 A	18-08-1996
		CN 1141498 A	29-01-1997
		DE 69608586 D	06-07-2000
		EP 0727809 A	21-08-1996
		HU 9600359 A	28-11-1996
		JP 2980548 B	22-11-1999
		JP 8250066 A	27-09-1996
		US 5705887 A	06-01-1998
US 4362969 A	07-12-1982	NONE	
EP 0168874 A	22-01-1986	HU 38179 A, B	28-04-1986
		JP 1820985 C	27-01-1994
		JP 5031268 B	12-05-1993
		JP 61024139 A	01-02-1986
		US 4897573 A	30-01-1990
US 3767965 A	23-10-1973	BE 796139 A	02-07-1973
		CA 962319 A	04-02-1975
		DE 2309690 A	13-09-1973
		GB 1372935 A	06-11-1974
		JP 913583 C	21-07-1978
		JP 48095091 A	06-12-1973
		JP 52045430 B	16-11-1977

EPO FORM P0459

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