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(54) Starting source and method of fabrication.

(57) A starting source and method of fabrication thereof for an arc discharge lamp includes an envelope (44) having a seal (50), a gaseous fill material within the envelope, a conductive ribbon (40,66) which extends from the seal into the interior region of the envelope and a wire lead (42) for carrying electrical energy to the ribbon. In preferred embodiments the ribbon (40,66) and lead (42) are placed in contact and the seal is formed around them so that they form an electrical connection.

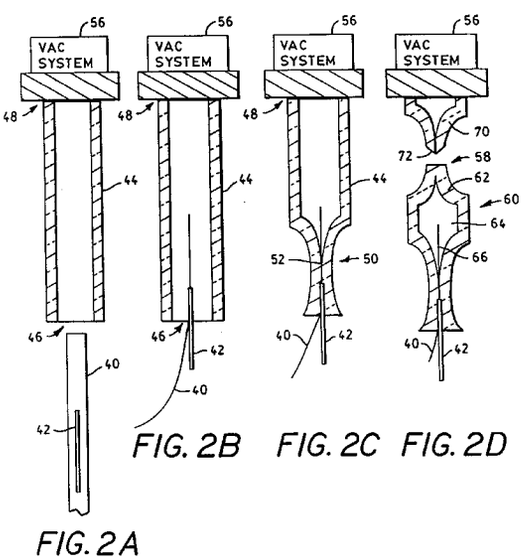

FIG. 2A FIG. 2B FIG. 2C FIG. 2D

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This invention relates to a starting source for an arc discharge lamp, and to a method of manufacture thereof.

High pressure metal halide arc discharge lamps typically comprise an arc tube which encloses an ionisable fill material and two electrodes at opposing ends of the tube. To reduce the time it takes to start the lamp, a starter electrode may be disposed inside the arc tube near one of the main electrodes, as shown in US-A-3,900,761. A discharge can be initiated between the starter electrode and one of the main electrodes at a voltage that is much lower than the voltage required to ignite an arc between the two main electrodes. The ultraviolet radiation and plasma from this discharge enhance discharge formation in the arc tube between the two main electrodes.

US-A-4,818,915 discloses a starting source which is separate from the arc tube and that typically has a borosilicate glass envelope enclosing an ionizable fill material and a single electrode. The single electrode additionally has a getter which removes certain gases when the envelope heats and outgasses. These gases, particularly oxygen, hydrogen, and nitrogen, contaminate the fill material. When energized, the starting source produces ultraviolet radiation which illuminates the path between the main electrodes within the arc tube, thus decreasing the time for generating a high intensity arc discharge.

The use of a getter increases the number of components in the starting source, limits how small the starting source can be made, and limits the operation of the starting source to a particular temperature range. With a getter, the starting source is sensitive to location within the lamp because of outgassing and the getter temperature range. Because of these size and location requirements, a starting source with a getter cannot be used for all applications, such as double-ended lamps which have a small diameter outer envelope.

A typical process for making a starting source begins with fabricating an electrode assembly which is inserted into a tube. The electrode assembly typically has a number of welded parts. As described in US-A-4,818,915 an electrode assembly includes an electrode which is welded to a lead for coupling electrical energy and which may additionally support a getter. Since the parts are welded, it can be difficult to produce these starting sources with an automated system. Electrode assemblies are fabricated first, then manually loaded onto trays.

Viewed from one aspect there is provided a starting source for an arc discharge lamp comprising an envelope having a seal and an interior region which contains a fill material for supporting an ultraviolet emitting discharge, an electrode in the interior region and a lead for carrying electrical energy to the electrode, characterised in that the electrode comprises a conductive ribbon which extends from the seal into the interior region of the envelope.

Viewed from another aspect there is provided a method of making a starting source for an arc discharge lamp comprising the steps of forming an envelope having an interior region, providing an electrode in the interior region, providing a lead for carrying electrical energy to the electrode, providing a fill material in the interior region for supporting an ultraviolet emitting discharge, and closing the envelope with a seal, characterised in that the electrode comprises a conductive ribbon which extends from the seal into the interior region of the envelope.

Preferred embodiments of the present invention may provide a starting source for an arc discharge lamp which comprises a sealed ultraviolet transmissive envelope enclosing a fill material which supports an ultraviolet emitting discharge. The sealed envelope has a seal and an interior region. A conductive ribbon extends from the press seal into the interior region of the envelope. A wire lead carries electrical energy to the conductive ribbon.

In preferred embodiments, the fill material comprises argon, and the conductive ribbon comprises molybdenum.

Preferred embodiments of the present invention may further provide a method for making an ultraviolet radiation starting source for an arc discharge lamp comprises passing a gaseous fill material through a tube which has a first end, a second end, and an interior region; inserting conductive a ribbon and a wire lead into first end; forming a first press seal at the first end so that the ribbon extends into the interior region of the tube and the wire lead extends to the exterior of the sealed tube; pumping from the second end of the tube to create a desired pressure within the tube; and forming a second seal at the second end of the tube to produce a sealed envelope enclosing the fill material and the ribbon.

In preferred embodiments, the seal forming steps each comprise forming a press seal. They may also comprise the steps of obtaining a remaining portion of the tube after the second seal has been formed and after the sealed envelope is removed, introducing a molybdenum ribbon and a wire lead into an open end of the remaining portion, and forming a seal at the open end to form a second sealed envelope.

In yet further preferred embodiments the present invention may provide a metal vapour arc discharge lamp comprising a sealed arc tube which encloses a first fill material and two electrodes; an ultraviolet radiation starting source comprising an ultraviolet-transmissive sealed envelope, a second fill material within the sealed envelope, a molybdenum ribbon extending from a seal into the interior region of the sealed envelope, and a wire lead for carrying electrical energy to the ribbon; an outer light-transmissive envelope enclosing the arc tube and the

UV source; and a means for coupling electrical energy to the two electrodes of the arc tube and to the UV source.

Also in preferred embodiments of the present invention, the ribbon and the wire lead may each be mounted on a spool and inserted into the tube by rotating each spool by a predetermined amount. After the seal is formed, the ribbon and wire are cut external to the tube. The method may further comprise vacuum pumping to create a desired pressure and forming a second seal at a second end of the tube to form a sealed envelope. After formation of a seal, the ribbon and the wire lead are in non-bonded contact with each other over a portion of the length of the ribbon.

In other preferred embodiments, the present invention provides a method for making a starting source for an arc discharge lamp that comprises the steps of providing an ultraviolettransmissive tube having an opening, inserting a conductive ribbon and wire lead into the opening, the ribbon and the wire lead not being attached to each other prior to formation of a seal at or near the opening in the tube, and forming a seal at or near the opening of the tube such that the tube material urges the ribbon and the wire lead together into electrical connection.

Further preferred methods of the present invention provide a system for producing a starting source in which the ribbon and the wire lead may be inserted into the tube without welding or other bonding, thus, eliminating electrode preassembly. The ribbon and the wire lead can be fed manually or automatically. Such a method makes it easier to produce starting sources with an automated system.

Fig. 1 shows a cross-sectional view of a prior art metal halide lamp,

Figs. 2(a)-2(d) illustrate the steps to produce a according to an embodiment of the present invention,

Figs. 3(a)-3(c) illustrate the steps to produce a according to another embodiment of the present invention, and

Fig. 4 is a pictorial representation of an apparatus for producing a starting source according to an embodiment of the present invention.

A prior art metal halide arc discharge lamp 10 is shown in Fig. 1. A sealed envelope 12 encloses a cylindrical quartz sleeve 14. The sleeve 14 surrounds an arc tube 16 which encloses two electrodes 18 located at opposite ends of the arc tube and a fill material, e.g., a combination of mercury, metal halides, and argon. Each electrode is coupled to a molybdenum ribbon 20 which is enclosed within a seal 22 that hermetically seals the arc tube. Electrical energy is coupled from a lamp base 28 through a lamp stem 30 and leads 32 and 26 to the electrodes 18 in the arc tube 16.

A starting source 24 has a sealed envelope 34 that encloses an electrode 25. The electrode 25 is coupled to the lead 26, and is capacitively coupled to the lead 32 which may include a conductor that is helically wrapped around the envelope 34. A typical starting source is about 4.0 mm in diameter and 15.0 to 20.0 mm in overall length. Other details relating to the prior art starting source 24 are discussed in US-A-4,818,915.

Figs. 2(a)-2(d) represent the steps to produce a starting source according to a preferred embodiment of the present invention. Referring to Fig. 2(a), a molybdenum ribbon 40 and a nickel wire 42 are positioned at a lower end 46 of a cylindrical quartz tube 44. The ribbon and wire are placed together, without being bonded to each other, and are inserted into the lower end 46 of tube 44. When inserted, the ribbon 40 extends further into the interior of the tube 44 than the wire 42, as shown in Fig. 2(b). The ribbon 40 has sharp edges which are produced by rollers. These edges provide high electric field concentration, which results in reliable breakdown.

A fill material, such as argon, can be introduced into an upper end 48 of the tube and flows downwardly through the tube and out the lower end 46. A seal 50 may be formed in the lower portion of the tube 44 by heating the tube and pressing the lower end together (Fig. 2(c)), a technique well known in the art. Referring to Fig. 2(d), coupled to the tube at upper end 48 is a vacuum system 56 which reduces the pressure in the tube down to a desired level, such as 666-2666 Pa (5-20 Torr). The vacuum system 56 may be coupled to the tube after the first seal is pressed, or it may be coupled during the entire process and activated only when needed to reduce pressure. A second seal 58, (shown as part of the remaining tube in Fig. 2(d)) is formed at the upper end of tube 44.

The resulting starting source 60 comprises a sealed envelope 62 which encloses a fill material 64, typically argon, and a strip 66 of molybdenum ribbon which is hermetically sealed within the envelope 62. The wire 42 is located in a portion of the seal area so as to maintain electrical contact with the ribbon 40, but is outside the interior of the sealed envelope 62. A second seal 72 closes one end of a remaining portion 70 of tube 44.

Referring to Fig. 3(a), a second molybdenum ribbon 76, and a wire 78 are positioned at an open end 80 of a dome 74, which corresponds to remaining portion 70. The vacuum system is temporarily removed, and the ribbon and wire are positioned in the interior 82 of dome 74. The vacuum system 56 reduces the pressure within dome 74 (Fig. 3(b)), and seal 84 is formed at the lower end of the dome (Fig. 3(c)). This process results in a second starting source similar to starting source 60.

Referring to Fig. 4, an automatic feeding system 90 includes molybdenum ribbon spool 92 and wire spool 94. These spools hold lengths of ribbon 96 and wire 98, and feed predetermined lengths them to-

gether into quartz tube 100 when they are rotated a desired amount. The quartz tube 100 may be positioned with its upper end in an exhaust tube 102 (part of the vacuum system). Adjacent to a lower end of the tube are press feet 104 which can form a seal. In operation, the spools feed the ribbon and wire into the tube, press feet 104 form a seal as represented in Figs. 2(c) and 3(c), and the ribbon and wire are cut below the seal. The interior of the tube 100 is then pumped, and a seal is formed at the upper end to finish the starting source. The ribbon and the wire are unattached prior to formation of a seal. After formation of a seal, the tube material may urge the wire and the ribbon into contact, thereby forming a reliable electrical connection without requiring welding or other bonding techniques. Another tube is loaded into exhaust tube 102 and the procedure is repeated. The wire and ribbon are fed without using adhesives or other bonding techniques, such as welding or soldering.

The resulting starting sources have been produced with dimensions of about 2.5 mm in diameter and about 10.0 mm long. The molybdenum ribbon is preferably about 0.02 mm to 0.03 mm thick, 1.0 mm wide, and about 4.0 to 7.0 mm long, of which about 2.0 mm to 3.0 mm is within the envelope. The wire has been described as nickel, but other conductors, such as tungsten or molybdenum may be used, depending on the temperature of the starter electrode and the lamp. The fill material may be substantially only argon, or may include other materials, such as mercury. The tube may be quartz, Vycor, or some other high temperature alumina silicate glass.

Life tests have been performed on samples in which the ribbon and wire were manually fed into the tube without being bonded together. These samples were 25.0 mm in length and 4.0 mm in diameter and had a fill pressure of 666-1333 Pa (5-10 Torr). Four samples were tested in an air oven for accelerated testing. For 500 hours, the oven was set to 250°C, and for the next 3864 hours the oven was set to 340°C. No apparent deterioration has been detected. In another test, five 100 watt metal halide lamps were made with starting sources as described above. The lamps reached 1560 hours of operation. The starting characteristics were checked every 500 hours. The seals of the starting sources remained hermetic, and the discharge was sufficient to provide instant starting.

A starting source of the present invention may be relatively inexpensive and easy to produce compared to prior art starting sources. The conductive ribbon is used in the seal to create a hermetic seal, and as an electrode. The source may be produced so that the only materials within the envelope are the gaseous fill material and the molybdenum ribbon. Fewer parts are necessary, no getter is used, no mercury is needed, and the starting source can be made smaller than prior art devices.

Embodiments of the present invention should provide a simplified method for fabricating a starting source which has fewer components than prior art devices, and which may operate under a broad range of conditions.

Claims

1. A starting source for an arc discharge lamp comprising an envelope (44;74;100) having a seal (50;84) and an interior region which contains a fill material for supporting an ultraviolet emitting discharge, an electrode (66;76;96) in the interior region and a lead (42;78;98) for carrying electrical energy to the electrode, characterised in that the electrode comprises a conductive ribbon which extends from the seal (50;84) into the interior region of the envelope (44;74;100).

2. A starting source as claimed in claim 1, characterised in that the ribbon (40,66;76;96) comprises molybdenum.

3. A starting source as claimed in claim 1 or 2, characterised in that the fill material comprises argon.

4. A starting source as claimed in claim 1, 2 or 3, characterised in that the interior region is not provided with a getter.

5. A starting source as claimed in any preceding claim, characterised in that the lead (42;78) is held in electrical contact against the ribbon (40,66;76) within the area of the seal (50;84).

6. A starting source as claimed in claim 5, characterised in that the lead (42;78) does not extend into the interior region.

7. An arc discharge lamp characterised in that it is provided with a starting source as claimed in any preceding claim.

8. A method of making a starting source for an arc discharge lamp comprising the steps of forming an envelope (44;74;100) having an interior region, providing an electrode (66;76;96) in the interior region, providing a lead (42;78;98) for carrying electrical energy to the electrode, providing a fill material in the interior region for supporting an ultraviolet emitting discharge, and closing the envelope with a seal (50;84), characterised in that the electrode (66;76;96) comprises a conductive ribbon which extends from the seal (50;84) into the interior region of the envelope (44;74;100).

9. A method as claimed in claim 8, characterised in that the ribbon (40,66;76;96) and the lead are placed in contact and the seal (50;84) is formed around them, so that they form an electrical connection.

10. A method as claimed in claim 8 or 9, characterised in that the ribbon (40,66;76;96) and the lead (42;78;98) are supplied separately as lengths which are cut into desired sections.

11. A method as claimed in claim 8, 9 or 10, characterised by the steps of providing a tube (44;100) to form the envelope, passing the fill material through a tube, inserting the ribbon (40,66;76;96) and the lead (42;78;98) into the tube at one end, forming said seal (50;84) at said one end around the ribbon and lead, pumping from the other end (48) of the tube (44;100) to create a desired pressure within the tube, and forming a second seal (58) at the end of the tube (62).

12. A method as claimed in claim 11, characterised in that after the second seal has been formed, the envelope is removed and a remaining portion (70) of the tube (44;100) is used to make a further starting source.

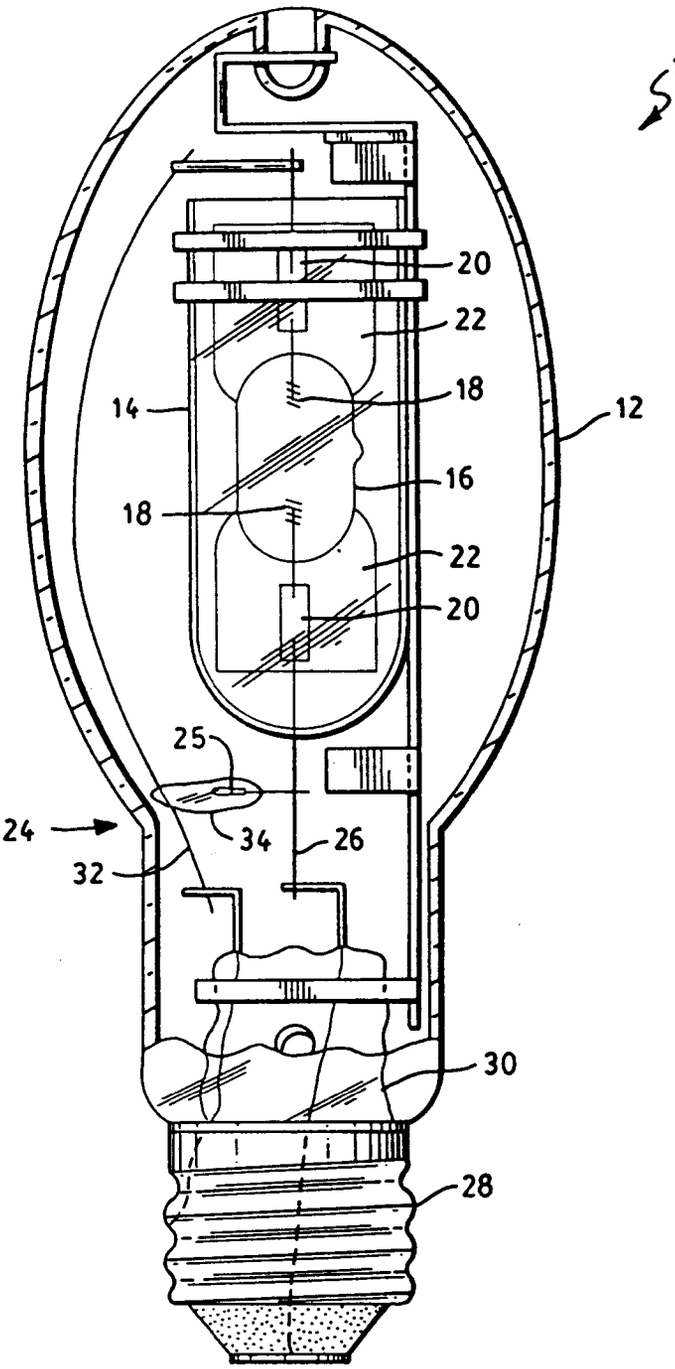

FIG. 1
PRIOR ART

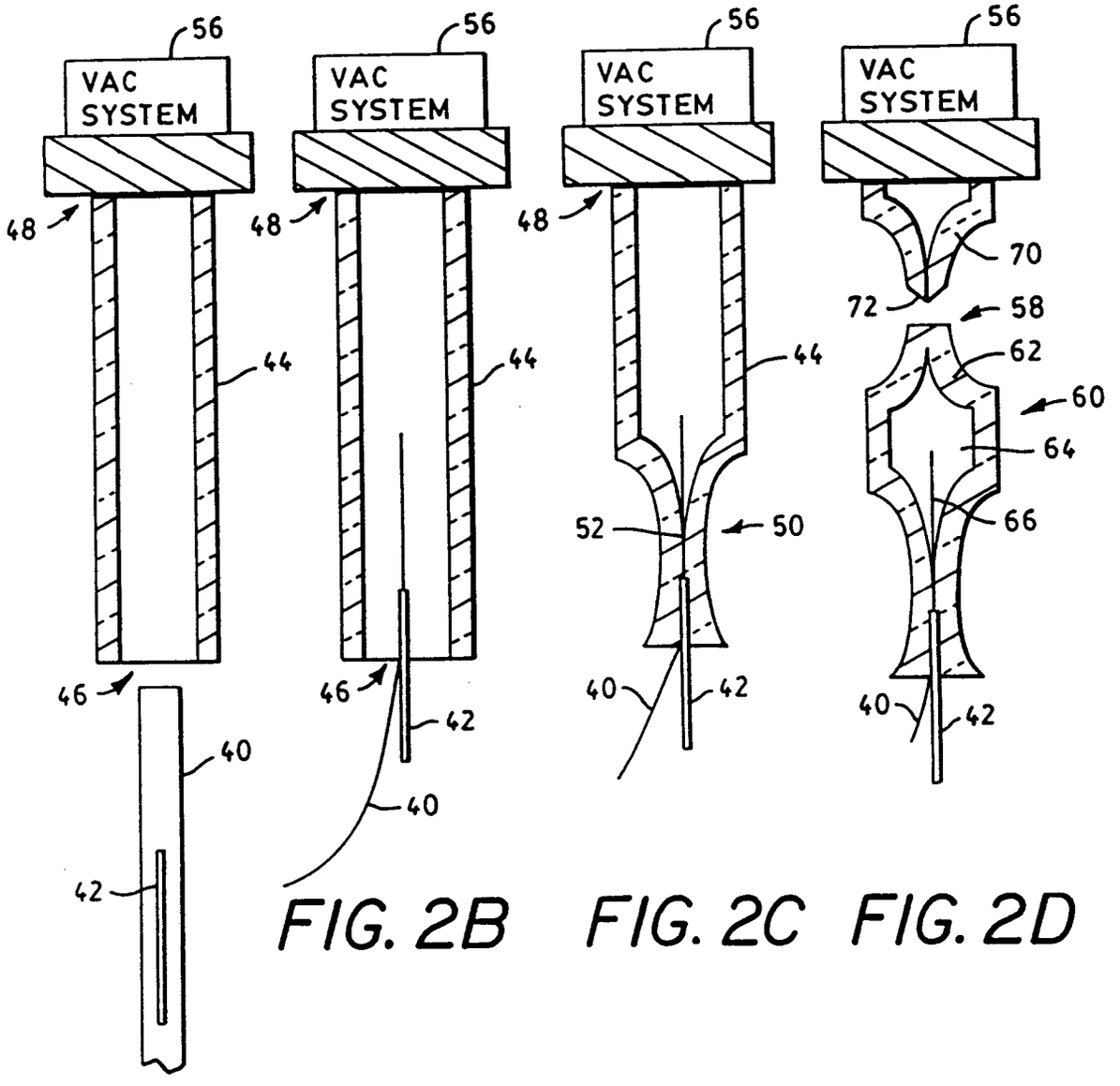

FIG. 2A FIG. 2B FIG. 2C FIG. 2D

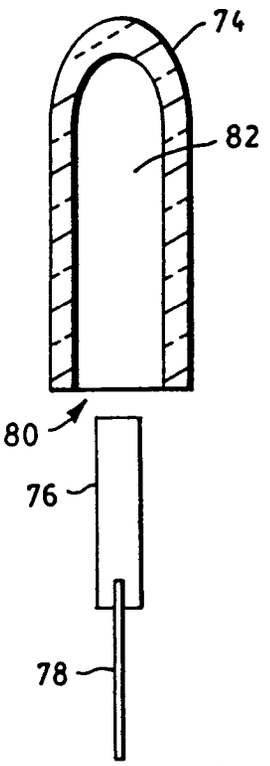

FIG. 3A

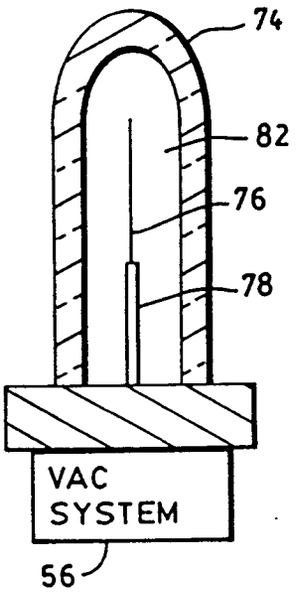

FIG. 3B

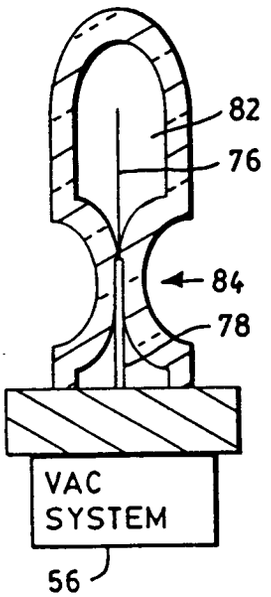

FIG. 3C

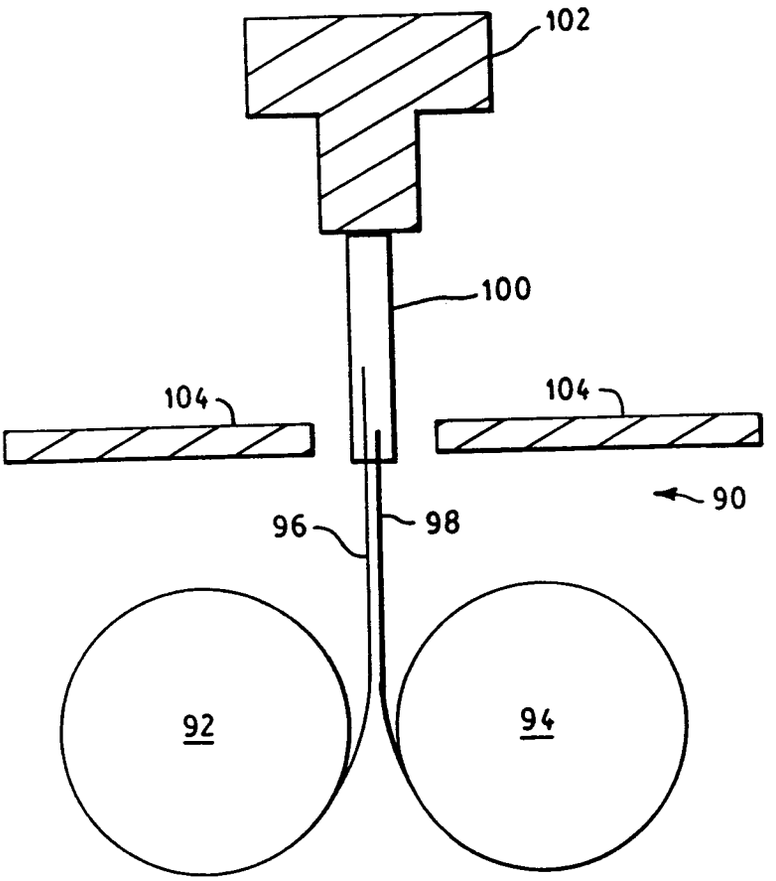

FIG. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 30 9292

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.5)
9	P,X	US-A-5 248 273 (GTE PRODUCTS CORPORATION) * the whole document * ---	1-12	H01J61/54 H01J61/36 H01J9/32
1	D,A	EP-A-0 313 027 (GTE PRODUCTS CORPORATION) * column 5, line 46 - column 6, line 54; figures 1-3 * -----	1,8	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

H01J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 January 1994	Schaub, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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