DEVICE FOR UNITING TUBULAR ARTICLES WITH SEALING ELEMENTS IN A GASTIGHT MANNER

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[54] DEVICE FOR UNITING TUBULAR ARTICLES WITH SEALING ELEMENTS IN A GASTIGHT MANNER

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ABSTRACT

An oven device suitable for uniting in a gastight manner a plurality of tubular envelopes of densely sintered material having sealing members at both ends. The oven device can be made to cooperate with a vacuum system and a gas supply and comprises a U-shaped heating member of graphite where the envelopes, situated in a row between the limbs of the heating member are locally heated.

6 Claims, 6 Drawing Figures
An electric gas discharge lamp is known from the Dutch Patent application No. 6,704,681 laid open to public inspection in which the envelope of the discharge space consists of transparent densely sintered aluminum oxide and comprises at least one current supply member which is secured in the envelope in a gastight manner. The product described in said patent application comprises a tubular body which at one end comprises a cylindrical portion in which a sealing element consisting of a transparent densely sintered aluminum oxide is situated which is sintered to the envelope in a gastight manner and which comprises an aperture in which the current supply member is secured in a gastight manner by means of a solder glass having a melting point higher than 800° C. and lower than the melting point of the transparent densely sintered aluminum oxide and that of the metal of the current supply member. This lamp is furthermore provided with a cover consisting of transparent densely sintered aluminum oxide and bearing against the end of the cylindrical portion of the envelope and against the sealing element situated therein, said cover comprising an aperture for the current supply member and being secured in a gastight manner to the envelope, the sealing element, and the current supply member by means of a solder glass having a melting point higher than 800° C. and lower than the melting point of the transparent densely sintered aluminum oxide and that of the metal of the current supply member.

The said published Dutch patent application also describes how such a product can in principle be manufactured. The method used in said patent application is a chamber process in which the chamber is formed by a glass bell placed in the holder and evacuated or filled with an inert gas and in which the tubular article provided with a sealing member which is loosely laid on it can be arranged with the interposition of an adhesive. In said glass bell is furthermore arranged an annular member of graphite around the parts of the tubular article to be heated, said member being heated by means of a high-frequency field applied outside the glass bell in such manner that the radiant heat necessary for unifying the tube and the sealing member is produced in the graphite ring. So the article is only heated at its end, so locally.

The device described in the above-mentioned patent application is in principle suitable only to provide one article with a sealing member and hence less suitable for use in the manufacture of large series of said lamps.

Starting from the mounting principle described in the above-mentioned patent application, the object of the present invention is to provide a device with which a number of tubular articles can be simultaneously provided with a sealing member supporting an electrode.

The deice according to the invention is characterized in that it comprises an envelope which can be made to communicate with a vacuum system and, if desirable, with a gas dosing system in which at least two parallel arranged striplike heating members are rigidly secured and are connected to a voltage source the device furthermore comprising at least one holder in which the tubular articles which are each provided with a sealing member can be arranged in a row, if desirable with the interposition of an adhesive, said holder being arranged in the oven in such a manner that the articles are situated with their ends between the two strip-shaped current conveying heating members. So the oven meant here is a chamber oven. By introducing the strip-shaped heating elements which convey current by the direct connection to a voltage source and operate as heat radiators, it has surprisingly been found possible to heat the articles which are arranged in one or more rows simultaneously at their ends in a satisfactory manner. So the conventional high-frequency heating via a graphite ring around each of the articles may be omitted. This presents the possibility of using very compact apparatus; a bulky high-frequency apparatus is superfluous. Since no use is made of graphite rings which are arranged around the articles, it is also possible to arrange said articles at a short distance from each other in which it has appeared that even good results are obtained when the walls of the strip-shaped heating members facing each other are arranged in plane parallel.

By manufacturing said strip-shaped heating elements from graphite and causing them to extend as the limbs of U-shaped profile, the additional advantage is obtained that it is sufficient for said U-shaped element to be secured only at its free ends; the rigidity of such a U-shaped element has been found to be large enough, while in addition thermal stresses in said element are avoided substantially entirely when it is secured in this manner; actually it can expand freely in the longitudinal direction of the strip-shaped limbs.

According to a practical embodiment the oven comprises at least one sealing ring, in which the heating members are secured in one part and the holder can be placed on or is formed by the other part.

In order that the invention may be readily carried into effect, one embodiment thereof will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 shows a lamp to be composed which contains an envelope of sintered material;

FIG. 2 is a diagrammatic side elevation of an oven used in composing said lamp;

FIG. 3 is a cross-sectional view taken on the line III—III of FIG. 2;

FIG. 4 is a cross-sectional view taken on the lines IV—IV of FIG. 3 of the holder to be used with the oven shown in FIGS. 2 and 3;

FIGS. 5 and 6 are a plan view and a side elevation, respectively, of the heater device used in the oven.

FIG. 1 shows a part of a discharge lamp as is described in the published Dutch Patent application No. 6,704,681. This lamp comprises a tubular envelope of transparent densely sintered aluminum oxide. Current supply members 3 and 5 of niobium are situated at either end of the envelope 1. Two sealing elements which likewise consist of transparent densely sintered aluminum oxide are denoted by 7 and 9 and are secured in the envelope 1 by sintering. Also, 11 and 13 denote two covers which also consist of densely sintered aluminum oxide. Also, 15 denotes a solder glass with which the current supply member 3 is secured both to the cover 11 and to the sealing element 7. This solder glass is also present between the cover 11 and the sealing element. The electrode of the lamp consists of a tungsten rod 17 secured in the current supply member 3 by means of a titanium solder 19. This rod comprises a tungsten coil 21; the coil may be covered with a material which readily emits electrons.

In manufacturing said lamp, the envelope 1 is first provided with the two sealing elements 7 and 9 which comprise each a central aperture in accordance with the above-mentioned Dutch patent application. In one end of the envelope 1 the current supply member 3 comprising the parts 17, 19, 21 is held and the cover 11 is placed on the sealing element 7 with the interposition of a ring of glass or a melting ceramic material which closely surrounds the member 3. An analogous ring of glass is then placed on the cover. A glass material may be used such as the material described in British Patent specification No. 1,019,821. The assembly is placed in a glass bell in which an argon atmosphere is maintained and the envelope is surrounded at its one end by a ring of graphite which is heated by means of a high-frequency coil arranged outside the glass bell and which causes the solder glass to melt. Upon cooling the gastight seal is obtained. The glass bell is then removed. The other end of the envelope is then provided in an analogous manner with the cover and a current supply member 5, again with the interposition of the required glass rings. The assembly is then again exposed in the glass bell to a thermal treatment of the high-frequency induced ring of graphite. Previously, however, a quantity of mercury and alkali metal is provided in the tubular envelope in which, during the addition of this metal, an argon atmosphere must be maintained in the envelope. Be-
fore heating the tubular envelope in the glass bell, the latter is evacuated for degassing the various components and is then filled with xenon. As a result of this the interior of the envelope 1 is also provided with said xenon gas. Only then does heating take place. In this method only one glass bell per seal is used.

In the device according to the invention the same method is used in principle. This device comprises a chamber oven which is constructed for subjecting a large number of tubular envelopes 1, for example, 20, simultaneously to the thermal treatment.

The oven used in this device is shown in FIGS. 2 and 3. In these Figures, 23 denotes a cylindrical portion and 25 an angular portion, between which portions a sealing ring 27 is present. The angular portion 25 comprises ducts 26, 28, 30, 32 for water-cooling. This portion comprises a chamber 31 which can be made to communicate with the vacuum system (connection 38) by means of the duct 33. Via this chamber 31 a vacuum can extend up to in the cylindrical chamber 37 of the portion 23. This portion 23 comprises a block 39 in which chambers 41, 43, 45, 47, 49 and 51 are recessed which, together with the surrounding jacket 53, constitute a number of chambers which can also be made to communicate with a water-cooling system. A U-shaped heating member of graphite which is shown in broken lines in FIGS. 25 and 29 is denoted by 55, arranged in said portion; in FIG. 3 the limbs of the U are denoted by 57 and 59. This member (see also FIGS. 5 and 6) is secured with its widened poles 61 and 63 to two water-cooled high-vacuum-tight current lead-in members which are insulated relative to each other and to the oven wall and which are coupled to the connection terminals of a voltage source. This heating member is surrounded by a heat-reflecting screen 65 of molybdenum which is supported by the cylindrical chamber 67 in the portion 23 at only a few points of its circumference. A molybdenum plate 69 is secured to said screen 65. The two ends of the cylindrical portion 23 are closed by covers 71 and 73, the heating member 55 being secured to the cover 71 only via the widened poles 61 and 63. The inner side of the cover 73 is provided with a few layers of a heat-reflecting material.

The portions 23 and 25 belong to the stationary part of the oven. They furthermore comprise ducts which open into the chamber 31 and can be made to communicate with a gas supply device. The ducts 75 and 76 communicate with inlets of argon of different pressures, while the ducts 77 and 78 can be made to communicate with an inlet and outlet respectively, for xenon.

The oven furthermore comprises a movable bottom 79 which can close the chamber 31 via sealing ring 80. This bottom 79 comprises a fitting surface 81 on the upper side of which 20 holders 83 are secured. These holders are situated at equal distances from each other. Members 85 are forced upwards in said holders by compression springs 87. Said holders are constructed for containing the envelopes 1 at which their one end have to be united with sealing members in a gastight manner.

The bottom 79 bears on the platform 89 which is secured to a vertically movable rod 91. In a downward position, the bottom 79 can be removed from the platform and the holders 83 be provided with tubular envelopes 1. All this is arranged so that when the bottom part 79 is moved to its uppermost position, the tubular envelopes in the holders are just situated with their free ends between the limbs 58 and 59 of the U-shaped heating member 55.

The operation with this device is as follows. First the bottom 79 which is removed from its platform 89 is provided with a number of tubular envelopes 1 which are provided at both ends with sealing members 7 and 9 secured therein. Analogous to the known method, the free ends thereof are provided with a current supply member 3 and a cover 11 with the interposition of the glass sealing rings. The assembly is then placed on the platform in a prescribed position. The bottom 79 is then moved against the oven portion, the oven is evacuated and the oven space is then filled with argon as a protective gas (12 cm. of Hg absolute). In this atmosphere the U-shaped element is heated electrically by the direct passage of current of approximately 300 a. at 20 v. When the glass rings melt, the pressure by the spring 87 is transmitted to the pins 93 which are temporarily inserted in the current supply members and bear on the wall 69. In this manner the member 3, which has a wire 94 secured thereto and serving as an abutment, is oriented in the envelope 1 in an accurately prescribed manner. The assembly is cooled while maintaining an argon atmosphere in the oven. The bottom 79 is then removed. The cycle period for this first sealing in so far as it takes place in the oven is approximately 20 minutes.

The pins 93 are then removed and the envelopes 1 are placed in the holders 83 with their sealed ends. The tubular envelopes 1 are then filled with argon in a vertical position by means of a pipe connected to a supply of argon. While maintaining the flow of argon a pill of sodium amalgam is dosed in the envelope by means of a dosing device as is described in Dutch Pat. application No. 6,803,906. The cover 13, the current supply member 5 and a set of rings of glass or a melting ceramic are then rapidly placed on the envelope 1. After the 20 holders all comprise a thus prepared tubular envelope, the bottom 79 is again coupled to the oven portion 25. Then the oven is evacuated. The time expiring between the dosing of the first pill and the beginning of evacuation is approximately 4 minutes. Such a small quantity of ambient air is found to diffuse in the envelopes within these 4 minutes that the amalgam pills are not noticeably attacked. When the pressure in the oven space is sufficiently low, the heating member is heated at approximately 1,000°C. In this position the evacuation is continued for another approximately 3 minutes. The communication with the vacuum system is then closed and xenon gas is supplied at a filling pressure of 4 cm. of Hg absolute. Heating is continued until the heating member is heated to 1,500°C. The envelopes 1 are thus sealed at their other ends. The xenon gas present in the oven space outside the envelopes 1 is then recovered via a refreezing process for which purpose reference is made to the above-mentioned Dutch published Pat. application No. 6,704,681. Cooling in an argon atmosphere takes then place after which the bottom 79 can be removed again. It takes approximately 20 minutes to provide this second sealing in so far as the process occurs in the oven.

Although in principle it is possible to operate with one and the same oven both for the first and the second sealing, it is recommendable to use two ovens of substantially identical shape. One oven then serves for the first sealing and is constructed for that purpose, while the other oven serves for the second sealing and is constructed for that second purpose. Of course it is alternatively possible to use several pairs of ovens, for example, four ovens, which are operated so that totally only one energy source, one vacuum plant, one gas dosing device, one device for defreezing xenon are required. The whole assembly of ovens can be operated by one person.

Although only one row of envelopes can be treated with the device according to the invention as described, it is of course alternatively possible to arrange several rows of envelopes parallel to each other in the same oven space. In that case a few U-shaped heating members arranged parallel to each other may be used.

What is claimed is:
1. A device for uniting in a gastight manner a number of tubular articles with sealing elements provided with electrical circuits at their one ends, characterized in that it comprises an oven which is adapted to communicate with a vacuum system and, in which at least two parallel arranged strip-shaped heating members are rigidly arranged and are connected to a voltage source, the device furthermore comprising at least one holder in which one end of the tubular articles which are each provided with a sealing member bearing on the wall of the oven and arranged in the oven in such manner that each of the articles are situated with their other end between the two
strip-shaped current conveying heating members wherein the oven comprises at least two portions which can be separated from each other and between which a sealing ring is arranged in which the heating members are secured in one portion and the holder can be placed on or be formed by the other portion.

2. A device as claimed in claim 1, characterized in that the two heating members are manufactured from graphite.

3. A device as claimed in claim 2, characterized in that the two strip-shaped members constitute the limbs of a U-shaped heating member, which limbs are coupled at their free ends directly to a voltage source.

4. A device as claimed in claim 1, characterized in that one portion is stationary and the other portion is movable.

5. A device as claimed in claim 1, characterized in that the oven comprises an internal abutment for the ends of the articles to be heated which are arranged so as to be resilient in their locations of the holder, said abutment forming part of a heat-reflecting screen which surrounds the strip-shaped heating members for the greater part and which touches the wall of the oven at only a few points.

6. A device as claimed in claim 1 further comprising a gas dosing system connected to and cooperating with said oven and said vacuum system.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION


Inventor(s) JOHANNES MARIA VAN BRAGT

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

ON THE TITLE PAGE

Insert the following where appropriate:

-- Assignee: U.S. Philips Corporation, New York, New York --

Signed and sealed this 4th day of February 1975.

(SEAL)
Attest:

McCoy M. Gibson Jr. C. Marshall Dann
Attesting Officer Commissioner of Patents
UNITED STATES PATENT OFFICE
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