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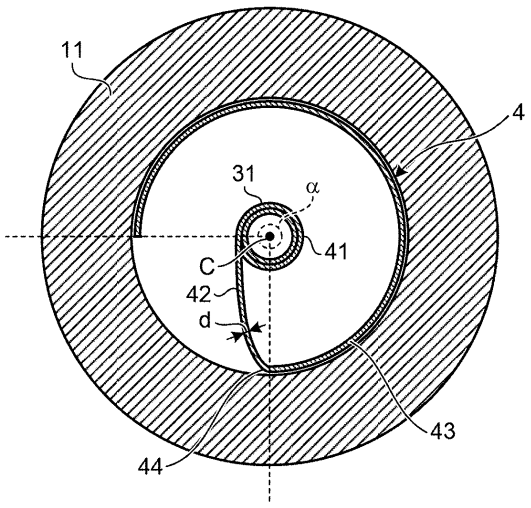
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(54) TUBULAR HEATER AND HEATING DEVICE

(57) A tubular heater 1 of an embodiment includes: an elongated glass tube 10; a filament 3 arranged so as to extend along a tube axis in an interior of the glass tube 10; and a plurality of anchors 4 mounted on the filament 3, wherein the anchor 4 includes an engaging portion 41 connected to the filament, an extending portion 42 connected at one end thereof to the engaging portion 41 and extending at the other end thereof in a direction of a tube wall of the glass tube 10, and a holding portion 43 formed so as to extend from the other end of the extending portion 42 along the tube wall, and the holding portion 43 has a center angle α at a center C of the glass tube 10 satisfying a relationship of $180° \leq \alpha < 360°$. Accordingly, a reduction of the amount of usage of a metal wire which constitutes the anchor is achieved.

FIG.3



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Description

Technical Field

[0001] An embodiment of the present invention relates to a tubular heater and a heating apparatus used in manufacture of solar batteries, molding of plastic bottles, heaters, copying machines, fixation of toner in printers, and the like.

Background Art

[0002] A tubular heater has a structure in which a filament is arranged in an interior of a cylindrical glass tube. The filament is arranged so as to be positioned at a center of the glass tube by an anchor formed by winding a metal wire. A plurality of such anchors are provided along a direction of a tube axis of the glass tube. In the case of a large-sized tubular heater having an entire length exceeding 1000 mm as those used in manufacture of solar batteries and the like, the number of the anchors is extremely large, and an increase of an amount of usage of the metal wire for the anchors accelerates an influence of an increased weight or costs.

Citation List

Patent Literature

[0003] Patent Literature 1: JP-A-H05-082106

Summary of Invention

Technical Problem

[0004] It is an object of the present invention to provide a tubular heater and a heating apparatus that allow a reduction of an amount of usage of the metal wire for forming an anchor.

Solution to Problem

[0005] In order to achieve above object, a tubular heater of an embodiment includes: an elongated glass tube; a filament arranged so as to extend along a tube axis in an interior of the glass tube; and a plurality of anchors mounted on the filament, wherein the anchor includes an engaging portion connected to the filament, an extending portion connected at one end thereof to the engaging portion and extending at the other end thereof in a direction of a tube wall of the glass tube, and a holding portion formed so as to extend from the other end of the extending portion along the tube wall and configured to hold the filament with respect to the glass tube by coming into contact with the tube wall, and the holding portion has a center angle α at a center C of the glass tube satisfying a relationship of $180° \leq \alpha < 360°$.

Brief Description of Drawings

[0006]

[Fig. 1] Fig. 1 is a drawing for explaining a tubular heater of a first embodiment.
[Fig. 2] Fig. 2 is a drawing for explaining part of the tubular heater of the first embodiment.
[Fig. 3] Fig. 3 is a drawing for explaining a cross section of the tubular heater of the first embodiment.
[Fig. 4] Fig. 4 is a drawing for explaining a filament holding function when an center angle α of the holding portion is changed.
[Fig. 5] Fig. 5 is a drawing for explaining temperatures of upper portions and lower portions of a glass tube in the tubular heaters of Example 2 and a related art.
[Fig. 6] Fig. 6 illustrates drawings for explaining other examples of the anchor.
[Fig. 7] Fig. 7 is a drawing for explaining the tubular heater of a second embodiment.
[Fig. 8] Fig. 8 is a drawing for explaining a cross section of the tubular heater of the second embodiment.
[Fig. 9] Fig. 9 is a drawing for explaining a heating apparatus using the tubular heater of a third embodiment.

Description of Embodiments

[0007] Embodiments for carrying out the invention will be described below.

(First Embodiment)

[0008] A tubular heater of a first embodiment will be described with reference to drawings. Fig. 1 is a drawing for explaining the tubular heater of the first embodiment, Fig. 2 is a drawing for explaining part of the tubular heater of the first embodiment, and Fig. 3 is a drawing for explaining a cross section of the tubular heater of the first embodiment.

[0009] A tubular heater 1 includes a glass tube 10 formed of, for example, quartz glass as a principal portion. The glass tube 10 is an elongated tube having an entire length of, for example, 1900 mm, and includes a cylindrical portion 11 and seal portions 12. The cylindrical portion 11 is a cylindrical portion having an outer diameter, which occupies a major part of the glass tube 10, of 12 mm for example. Part of the cylindrical portion includes a chip 111 used for performing exhausting and gas introduction from and to the interior of the glass tube 10 formed thereon. The seal portions 12 are plate-shaped sealing portions having a width of, for example, 12.5 mm and are formed at both ends of the cylindrical portion 11 by pinch sealing. The seal portions 12 may be formed into a cylindrical shape formed by shrink sealing.

[0010] A space 13 is formed in the interior of the glass

tube 10. The space 13 is filled with, for example, a minute amount of halogen substance such as bromine, or iodine, or gas such as argon, neon, or nitrogen encapsulated therein.

[0011] Metal foils 2 are sealed in the interiors of the seal portions 12. The metal foils 2 are thin plates formed of, for example, molybdenum, and are arranged so as to extend along plate-shaped planes of the seal portions 12.

[0012] A filament 3 is provided in the interior of the glass tube 10. The filament 3 is a metal wire formed of, for example, tungsten, and includes a main portion 31 and leg portions 32. The main portion 31 is a portion that generates heat when being illuminated, and the length thereof is, for example, 1800 mm. The main portion 31 is arranged in the space 13. The leg portions 32 are portions that feed power to the main portion 31, are arranged at both ends of the main portion 31, and are connected to the metal foils 2.

[0013] Anchors 4 are provided as support members in the interior of the glass tube 10. The anchor 4 is a metal wire formed of, for example, tungsten, and includes an engaging portion 41, an extending portion 42, and a holding portion 43 . The engaging portion 41 is a portion to be connected to the main portion 31 of the filament 3, and is wound around the periphery of the main portion 31 by several turns. The extending portion 42 is a portion formed by an end of the engaging portion 41, and extends toward a tube wall of the cylindrical portion 11 of the glass tube 10. The holding portion 43 is a portion formed of the other end of the extending portion 42, and is provided so as to extend from the extending portion 42 in the vicinity of the tube wall along a tube wall surface. A plurality of the anchors 4 are provided in a direction of a tube axis so as to maintain a first pitch (approximately 16 mm) and a second pitch (approximately 29 mm), and support the main portion 31 of the filament 3 so as to be positioned at a substantially center of the space 13.

[0014] Two lead wires 5 are connected to sides of the metal foils 2 on which the leg portions 32 are not connected. The lead wires 5 are metal wires formed of, for example, molybdenum, tungsten, or the like, and the ends on other side are drawn out from the seal portions 12 so as to extend the tube axis.

[0015] Here, the holding portion 43 of the anchor 4 of this embodiment is an arc having a range of the holding portion 43 with respect to a center C (center angle α) satisfying a relationship of $180° \leq \alpha < 360°$, where a center of the cylindrical portion 11 of the glass tube 10 is C. For example, as illustrated in Fig. 3, it is a major arc having the center angle α of 270°. In other words, a free end side of the holding portion 43 does not reach a fixed end side, that is, a boundary portion 44 between the extending portion 42 and the holding portion 43. The plurality of such anchors 4 are provided along the tube axis.

[0016] When the tubular heater 1 of Example 1 is manufactured and illuminated, problems such as displacements of the position of the filament 3 from the axial line or deflections of the filament 3 during illumination are not specifically generated. In contrast, several centimeters of the metal wire per anchor can be saved in comparison with a tubular heater of the related art in which the metal wire is wound around by 1.5 turns at the holding portion 43. In other words, when several tens of the anchors are provided, the amount of metal wire to be used for the anchors may be saved as long as 1 m or so, and hence a weight reduction and a reduction of member costs are achieved.

[0017] Subsequently, an experiment about a holding function of the filament 3 when the center angle α of the holding portion 43 of the anchor 4 is changed was conducted. The result is illustrated in Fig. 4.

[0018] It is found from the result that the center angle α of 90° is not sufficient to achieve the holding function of the filament 3, but the center angle α of 180° or more does not cause any specific problem in the holding function. The reason when the holding function is not sufficient when the center angle α is 90° is that there is a case where the holding portion 43 can hardly come into contact with an inner wall of the glass tube. Although holding of the filament 3 is possible also with the center angle α of 360°, the effect of a reduction in the amount of usage of the metal wire is small. Therefore, the holding portion 43 preferably has the center angle α at the center C of the cylindrical portion 11 satisfying a relationship of $180° \leq \alpha < 360°$.

[0019] In the tubular heater 1 of this configuration, an additional effect that a larger temperature difference than that of the tubular heater of the related art at the tube wall of the illuminating cylindrical portion 11 is allowed is obtained. The result is illustrated in Fig. 5.

[0020] Fig. 5 is a drawing for explaining temperatures of upper portions and lower portions of the glass tube in the tubular heaters of Example 2 and the related art. Example 2 is a tubular heater having a plurality of anchors having the center angle α of 180° as illustrated in Fig. 6(a), and the related art is a tubular heater having a plurality of anchors having the center angle α of 360° as illustrated in Fig. 6(b), both arranged in the direction of the tube axis in the same orientation. The temperature is measured by using a thermoviewer.

[0021] From the result, it is found that the temperature difference between the upper portion and the lower portion of the cylindrical portion 11 is larger in Example 2 than in the related art. More specifically, although the temperature is high at the glass tube wall in the vicinity of the boundary portion 44, which corresponds to a boundary portion between the extending portion 42 and the holding portion 43 and the temperature of the glass tube wall on the opposite side is low both in Example 2 and in the related art consequently, such a temperature difference is larger in Example 2. This is because the heat of the filament 3 is transferred to the boundary portion 44 via the extending portion 42, and transferred from the boundary portion 44 to the holding portion 43, and in Example 2, the heat is transferred to the opposite side of the boundary portion 44 via a single metal wire, while

the heat is transferred to the opposite side of the boundary portion 44 via two metal wires in the related art since the center angle α is 360°. In other words, it is considered that the temperature difference becomes consequently larger in Example than in the related art because the heat of the filament 3 transferred via the extending portion 42 is transferred only to the half surface of the glass tube 10 in Example 2, while the heat is transferred to the entire surface thereof in the related art. The reason why the temperature difference is larger when the boundary portion 44 faces downward than when facing upward is that the boundary portion 44 comes into contact with the inner wall of the glass when facing downward by the gravitational force, so that the lower side of the glass tube 10 can easily be heated. By utilizing the characteristic that a temperature gradient is formed in a circumferential direction of the glass tube wall as a lamp of Example 2, a certain portion may be heated intensively or, in contrast, cooled down, or heated to enhance the uniformity of the temperature depending on arrangements of the boundary portion 44. The same result as illustrated in Fig. 5 is obtained when the center angle α is in a range of 180° $\leq \alpha <$ 360°.

[0022] In the first embodiment, since the holding portion 43 is formed so that the center angle α at the center C of the cylindrical portion 11 satisfies a relationship of 180° $\leq \alpha <$ 360°, a total amount of usage of the metal wire that constitutes the anchors 4 may be significantly reduced while maintaining the filament 3 sufficiently. In addition, since the temperature difference may be generated between the boundary portion 44 which corresponds to the other end of the extending portion 42 and the glass tube wall on the side opposite thereto, intensive heating, or inversely, lowering of the temperature, and heating with higher uniformity of temperature are enabled by utilizing the characteristic thereof.

(Second Embodiment)

[0023] Fig. 7 is a drawing for explaining the tubular heater of a second embodiment. Among the respective components of the second embodiment, components which are the same as the components of the tubular heater of the first embodiment are denoted by the same reference numerals, and the description thereof is omitted.

[0024] In this embodiment, a reflecting film 6 is formed along the tube axis on part of an outer surface of the cylindrical portion 11 of the glass tube 10. The reflecting film 6 is a reflecting film presenting with white color formed of oxidation products such as silica or alumina by a method of dipping, blowing, or the like. The range of formation thereof on the circumference of the cylindrical portion 11 is, as illustrated in Fig. 8, for example, 180°, but may be varied within a range of 90° to 300° depending on the object. The boundary portion 44 of the anchor 4 is not positioned in a reflecting area RA of the glass tube 10 where the reflecting film 6 is formed, but on an irradiating area LA side, which is an area other than the reflecting area RA.

[0025] The reflecting film 6 has a lower heat resistivity in comparison with the glass tube 10, which is formed of quartz glass, and when the temperature is increased to a high temperature, the reflecting film 6 is liable to be separated from the glass tube 10. Therefore, a low temperature is preferable. In contrast, since the opening side of the glass tube 10 on which the reflecting film 6 is not formed is a side that heats an object to be irradiated. Therefore, the higher temperature is preferable so as to cause a heating effect by conduction and convection in addition to heating with an infrared ray. As described above, the temperature of the glass tube wall in the vicinity of the boundary portion 44 is liable to be high and the temperature on the opposite side is liable to be low. Therefore, in this configuration, enhancement of the heating efficiency is achieved while suppressing separation of the reflecting film 6.

[0026] In the second embodiment, when the reflecting film 6 is formed on an outer surface of the glass tube 10, and an area of the glass tube 10 formed with the reflecting film 6 on the circumference of the glass tube 10 is defined as the reflecting area RA and an area other than that is defined as the irradiating area LA, enhancement of the heating efficiency is achieved while suppressing separation of the reflecting film 6 by the arrangement of the boundary portion 44 of the anchor 4 on the irradiating area LA side.

(Third Embodiment)

[0027] Fig. 9 is a drawing for explaining a heating apparatus of a third embodiment.

[0028] A fixing apparatus includes a housing 7 and the tubular heater 1.

[0029] The housing 7 is a case formed of, for example, stainless steel, and includes a wall portion 71 and a side wall portion 72 connected to an end side thereof. An opening portion 73 is provided on the side opposing the wall portion 71.

[0030] The tubular heater 1 is a heater which is the same as that of the first embodiment, and a plurality of the tubular heaters 1 are arranged in an internal space of the housing 7 so that the tube axes extend in substantially parallel to each other.

[0031] In this case, the tubular heaters 1 are each positioned so that the boundary portion 44 of the anchor 4 is arranged in the reflecting area RA, which is an area opposing the wall portion 71, and is not positioned in the irradiating area LA which is an area opposing the opening portion 73. Normally, in the object to be irradiated, portions immediately below the tubular heaters 1 are liable to be a high temperature, and portions immediately under parts between the adjacent tubular heaters 1 are liable to be a low temperature. However, in this arrangement, the temperature immediately below may be lowered, and hence unevenness of the temperature of the object to be

irradiated may be alleviated.

[0032] In the third embodiment, the temperature of the object to be irradiated may be uniformized by arranging the tubular heaters 1 so that the boundary portion 44 of the anchor 4 faces toward the wall portion 71. As regards heating of the object to be irradiated, if being high temperature is required and being uniform in temperature is not required, the tubular heaters 1 may be arranged so that the boundary portion 44 faces the direction of the opening portion 73.

[0033] The present invention is not limited to the above-described embodiment, and various modifications may be made.

[0034] Although the main portion 31 of the filament 3 is formed into a coil-shaped portion as a whole, there may be provided a non-light-emitting portion, which has a simple linear shape, at a midsection thereof. In this case, the holding portion 43 of the anchor 4 may be provided on the coil-shaped portion. In this case, the number of the anchors 4 to be mounted on the respective coil-shaped portions may be one or plural.

[0035] The holding portion 43 is not limited to an arc shape, and polygonal shapes such as a triangle shape and a square shape are also applicable. In other words, corner portions thereof may be brought into contact with the inner wall surface of the glass tube 10. In this shape, the amount of usage of the metal wire for the anchors 4 may further be reduced in comparison with a circular shape.

[0036] All of the boundary portions 44 from among the plurality of anchors 4 do not necessarily have to face the same direction, and some may face different directions as long as it is within an extent of variations or several tens percent of the entire part. For example, what is essential is that more than half the plurality of anchors 4 are arranged so that the boundary portions 44 are positioned in the irradiating area LA in the second embodiment and in the reflecting area RA in the third embodiment. However, controlling all the anchors 4 so as to face substantially the same direction is optimal in terms of suppression of transfer of heat to the reflecting film 6 or suppression of non-uniformity of the temperature to the object to be irradiated. The direction of the boundary portions 44 may be at random. In this arrangement, such an event that areas where the filament 3 cannot be supported by the anchor 4 are generated continuously and hence the filament 3 is deflected may be prevented.

[0037] Although the range of the holding portion 43 with respect to the center C (center angle α) is formed into an arc that satisfies a relationship of $180° \leq \alpha < 360°$, an arc that satisfies a relationship of $225° \leq \alpha \leq 315°$ is more preferable. The center angle α is set to 225° or more because there is a case where the deflection under the weight of the filament 3 of its own cannot be sufficiently suppressed if the holding portion 43 does not exist below when the tubular heater 1 is arranged horizontally when the center angle α is 180°. The center angle α is set to 315° or smaller in order to obtain an effect of increasing a temperature difference to be larger than that with the tubular heater of the related art at the tube wall of the cylindrical portion 11 when illuminating in consideration of variations at the time of manufacture of the anchor 4 because the center angle α may become 360° or more due to variations at the time of manufacture of the anchor 4 when the center angle α is smaller than 360° but near 360°.

[0038] It is also possible to align the boundary portions 44 of the plurality of anchors 4 along the axial direction. In this case, when arranging the tubular heater 1 horizontally, the tubular heater 1 is arranged so that the boundary portion 44 of each of the anchors 4 faces downward. Preferably, the anchors 4 are each arranged so that an opening portion between free ends of the boundary portion 44 and the holding portion 43 faces upward. Accordingly, the filament 3 trying to be deflected under its own weight may be reliably held by the anchors 4.

[0039] Also, a wire diameter d of each of the anchors 4 (see Fig. 3) is preferably increased in thickness so as to hold the filament 3 reliably. For example, the wire diameter d of each of the anchors 4 is preferably 0.32 mm or larger, more preferably, 0.36 mm or larger. By increasing the wire diameter d of each of the anchors 4, a holding force with respect to the filament 3 may be increased, whereby the filament 3 may be reliably held by the anchors 4. In order to also achieve a reduction of the amount of usage of the metal wire to be used for the anchors 4, the wire diameter of each of the anchors 4 is preferably 0.42 mm or lower.

[0040] Also, the density of arrangement of the respective anchors 4 with respect to the filament 3 is preferably set to a high density in order to hold the filament 3 reliably. For example, the wiring density of L/n is preferably set to 17 mm/piece or lower, more preferably 14 mm/piece or lower, where L is a length of the main portion 31 of the filament 3 (see Fig. 1) , and n is the number of the anchors 4 provided for the length L. By increasing the arrangement density of the anchors 4 with respect to the filament 3, the holding force with respect to the filament 3 may be increased, whereby the filament 3 may be reliably held by the anchors 4. In order to achieve also the reduction of the amount of usage of the metal wire to be used for the anchors 4, 10 mm/piece or more is preferable.

[0041] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

Reference Signs List

[0042]

1	Tubular heater
10	Glass tube
2	Metal foil
3	Filament
4	Anchor
42	Extending portion
43	Holding portion
44	Boundary portion
5	Lead wire

Claims

1. A tubular heater comprising:

an elongated glass tube;
a filament arranged so as to extend along a tube axis in an interior of the glass tube; and
a plurality of anchors mounted on the filament, wherein
the anchor includes an engaging portion connected to the filament, an extending portion connected at one end thereof to the engaging portion and extending at the other end thereof in a direction of a tube wall of the glass tube, and a holding portion formed so as to extend from the other end of the extending portion along the tube wall and configured to hold the filament with respect to the glass tube by coming into contact with the tube wall, and
the holding portion has a center angle α at a center C of the glass tube satisfying a relationship of $180° \leq \alpha < 360°$.

2. The tubular heater according to Claim 1, wherein the plurality of anchors have the other ends of the extending portions of the anchors aligned along an axial direction, and are formed so that the other ends of the extending portions of the anchors come below when the tubular heater is arranged horizontally.

3. The tubular heater according to Claim 1 or 2, wherein a reflecting film is formed on an outer surface of the glass tube, and the other end of the extending portion of the anchor is arranged on an irradiating area side when defining an area of the circumference of the glass tube on which the reflecting film is formed as a reflecting area, and other portion as the irradiating area.

4. A heating apparatus comprising:

a housing provided with a reflecting portion and an opening portion opposing each other; and the tubular heater according to Claim 1, arranged so that the other end of the extending portion of the anchor faces the reflecting portion side.

FIG.1

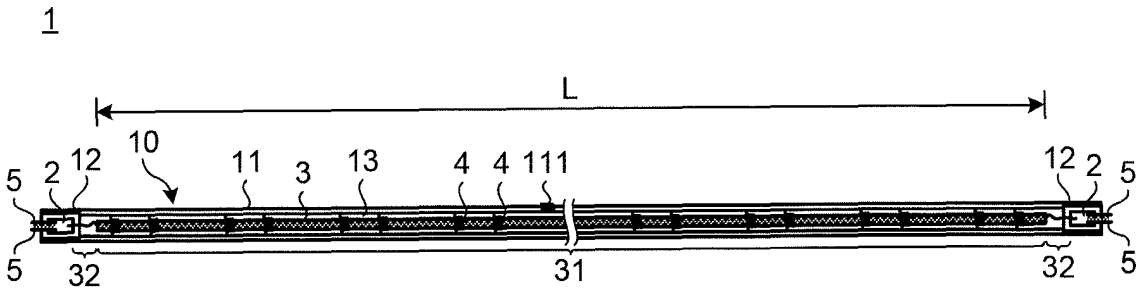

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FIG.2

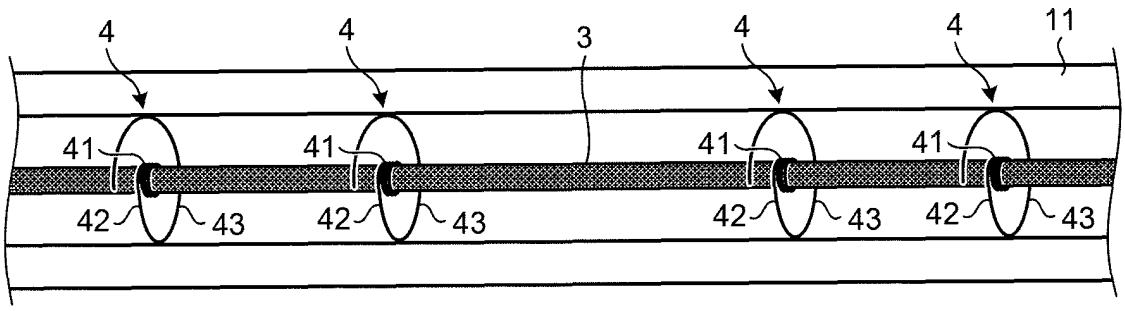

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FIG.3

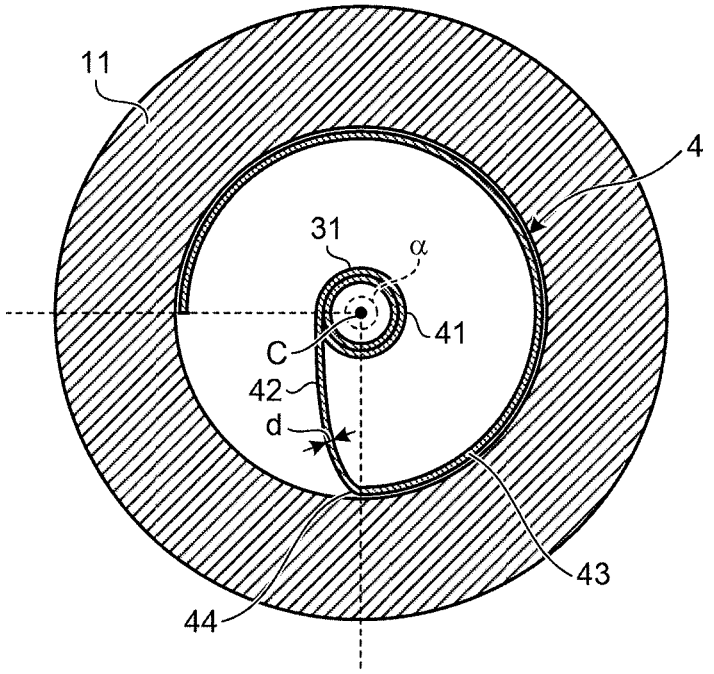


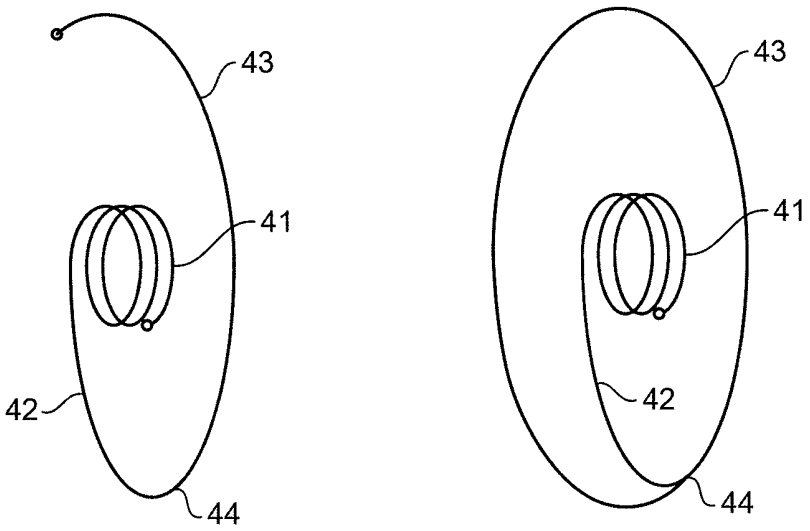
FIG.4

CENTER ANGLE α (°)	90	180	225	270	315	350	360
FILAMENT HOLDING FUNCTION	×	○	◎	◎	◎	◎	◎

FIG.5

	EXAMPLE 2		RELATED ART	
	BOUNDARY PORTION 44 FACES UPWARD	BOUNDARY PORTION 44 FACES DOWNWARD	BOUNDARY PORTION 44 FACES UPWARD	BOUNDARY PORTION 44 FACES DOWNWARD
TEMPERATURE OF UPPER PORTION OF GLASS TUBE (°C)	498	474	507	479
TEMPERATURE OF LOWER PORTION OF GLASS TUBE (°C)	472	532	493	503
ABSOLUTE VALUE OF TEMPERATURE DIFFERENCE (°C)	26	58	14	24

FIG.6



(a) (b)

FIG.7

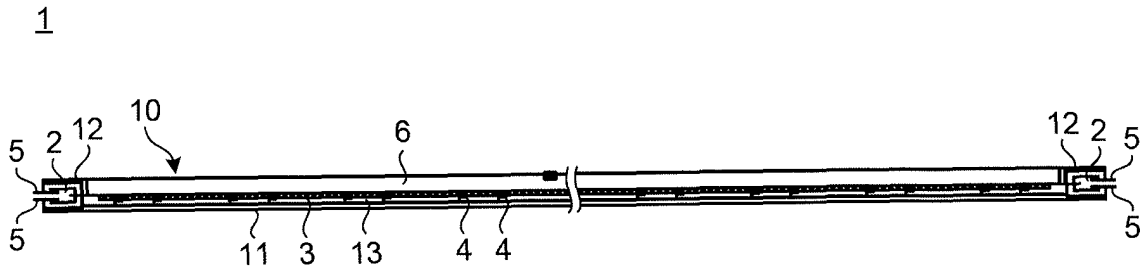


FIG.8

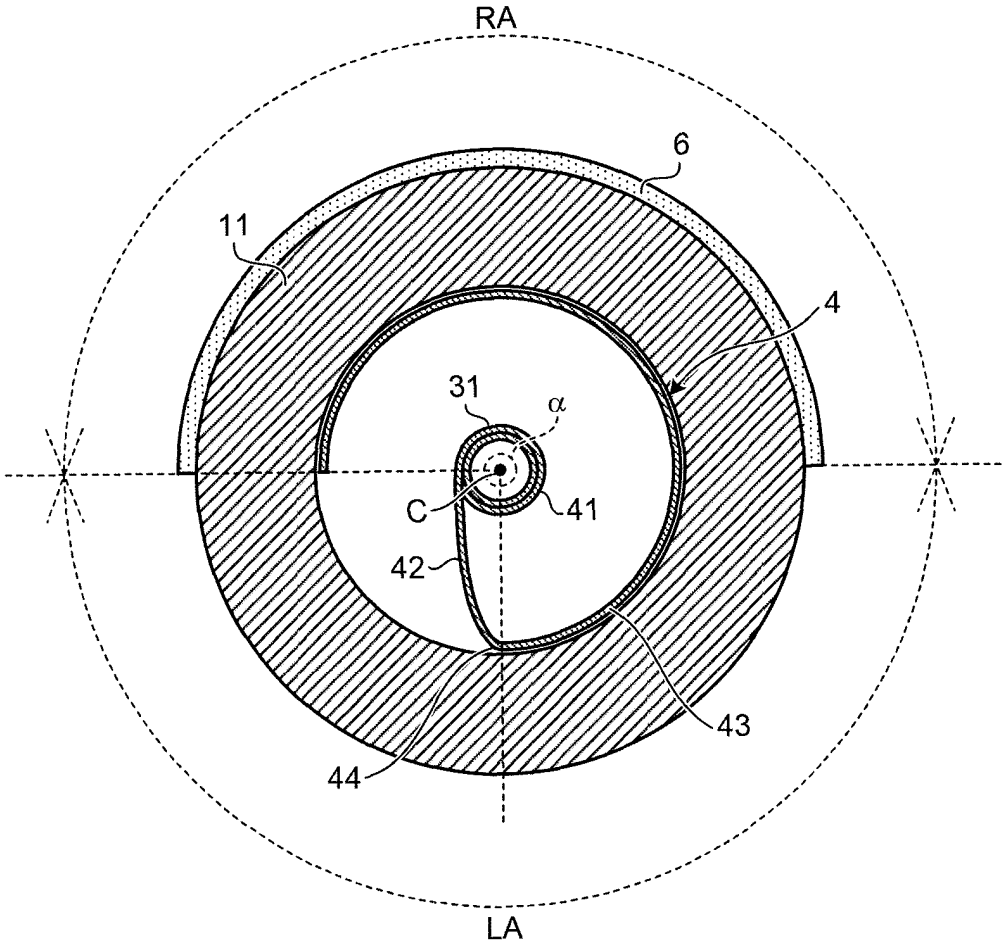
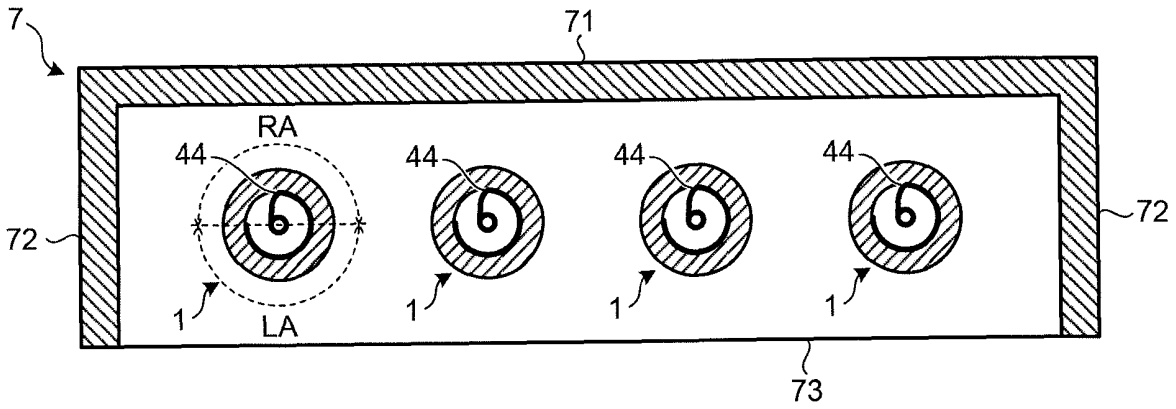


FIG.9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/074429

A. CLASSIFICATION OF SUBJECT MATTER
H05B3/06(2006.01)i, *G03G15/20*(2006.01)i, *H01K1/18*(2006.01)i, *H01K1/24*(2006.01)i, *H05B3/00*(2006.01)i, *H05B3/44*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H05B3/06, G03G15/20, H01K1/18, H01K1/24, H05B3/00, H05B3/44

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2012
Kokai Jitsuyo Shinan Koho	1971-2012	Toroku Jitsuyo Shinan Koho	1994-2012

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 4857/1985(Laid-open No. 123309/1986) (Rinnai Corp.), 04 August 1986 (04.08.1986), specification, page 5, line 2 to page 8, line 11; fig. 1, 3, 4, 5 (Family: none)	1,2,4 3
Y A	JP 3-216947 A (Toshiba Lighting & Technology Corp.), 24 September 1991 (24.09.1991), page 2, lower left column, line 3 to lower right column, line 14; fig. 1 to 3 (Family: none)	1,2,4 3

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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Date of the actual completion of the international search 22 October, 2012 (22.10.12)	Date of mailing of the international search report 30 October, 2012 (30.10.12)
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/074429

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 89131/1990(Laid-open No. 47253/1992) (Ushio Inc.), 22 April 1992 (22.04.1992), fig. 1 (Family: none)	2 3
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 71478/1990(Laid-open No. 31251/1992) (Ushio Inc.), 13 March 1992 (13.03.1992), specification, page 4, line 4 to page 9, line 15; fig. 1, 2 (Family: none)	4
A	JP 61-153940 A (Toshiba Corp.), 12 July 1986 (12.07.1986), fig. 1 to 3 (Family: none)	1-3

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H05082106 A **[0003]**