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(54) **HEATER AND GLOW PLUG EQUIPPED WITH SAME**

HEIZELEMENT UND DAMIT VERSEHENE GLÜHKERZE

ÉLÉMENT CHAUFFANT ET BOUGIE DE PRÉCHAUFFAGE ÉQUIPÉE DE CET ÉLÉMENT
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Description

Technical Field

[0001] The present disclosure relates to a heater utilized as, for example, a heater for ignition or flame detection in a combustion-type vehicle-mounted heating device, a heater for ignition for various combustion equipment such as an oil fan heater, a heater for a glow plug of a diesel engine, a heater for various sensors such as an oxygen sensor, a heater for heating measuring equipment, and a glow plug equipped with such a heater.

Background Art

[0002] As a heater, there have been known ceramic heaters such as that described in JP 2007-240080 A (hereinafter referred to as Patent Document 1), for example. The ceramic heater described in Patent Document 1 includes a base having a rod shape and made of ceramic, and a heating element embedded in this base. The heating element includes a pair of electrically conductive portions each having a rod shape and extending in an axis direction, and has a circular shape when the electrically conductive portions are viewed in a cross section perpendicular to the axis direction.

[0003] WO 2011/065366 A1 discloses a ceramic heater provided with a heat resistive element embedded in a bar-like ceramic base body, wherein the heat resistive element has a folded portion positioned in the leading end portion of the ceramic base body and two facing portions facing each other and extending in the axis direction of the ceramic base body from the folded portion.

[0004] US 2010/155389 A1 discloses a ceramic heater comprising a heating resistor with first and second conducting portions facing each other and a ceramic base in which the heating resistor is embedded, wherein the first conducting portion comprises a first burr which extends from the first conducting portion and is located between the first conducting portion and the second conducting portion and the second conducting portion comprises a second burr which extends from the second conducting portion and is located between the second conducting portion and the first conducting portion, and wherein at least a part of the first and second burrs is spaced apart from the line linking a starting point of the first burr and a starting point of the second burr in a cross-section perpendicular to a conduction direction of the first and second conducting portions.

[0005] EP 2343951 A1 discloses a ceramic heater constructed by embedding a heat-generator in a base body made of ceramics, wherein the heat-generator has a recess in a surface thereof, the ceramics being inside the recess.

Summary of Invention

[0006] The present invention provides a heater accord-

ing to claim 1, a heater according to claim 6, and a glow plug according to claim 9. Preferred embodiments are described in the dependent claims.

Brief Description of Drawings

[0007]

FIG. 1 is a vertical cross-sectional view illustrating an example of a heater.

FIG. 2 is a horizontal cross-sectional view of the heater illustrated in FIG. 1 taken along line A-A'.

FIG. 3 is a horizontal cross-sectional view illustrating another example of a heater.

FIG. 4 is a vertical cross-sectional view illustrating another example of a heater.

FIG. 5 is a vertical cross-sectional view illustrating another example of a heater.

FIG. 6 is a vertical cross-sectional view illustrating an example of an embodiment of a glow plug.

FIG. 7 is a horizontal cross-sectional view illustrating another example of a heater.

FIG. 8 is a schematic view illustrating a front surface of a heating resistor of a heater of another example.

Description of Embodiment

[0008] As illustrated in FIG. 1, a heater 1 includes a ceramic body 2, a heating resistor 3 embedded in the ceramic body 2, and leads 4 connected to the heating resistor 3 and drawn to a front surface of the ceramic body 2.

[0009] The ceramic body 2 of the heater 1 is formed into a rod shape having a longitudinal direction, for example. The heating resistor 3 and the leads 4 are embedded in this ceramic body 2. Here, the ceramic body 2 includes ceramic. As a result, it is possible to provide the heater 1 having high reliability under rapid temperature rise. Examples of the ceramic include ceramic having an electrical insulating property such as oxide ceramic, nitride ceramic, or carbide ceramic. Particularly, the ceramic body 2 may include silicon nitride ceramic. This is because silicon nitride, which serves as a primary component of silicon nitride ceramic, is excellent in terms of strength, toughness, electrical insulating property, and thermal resistance. The ceramic body 2 including silicon nitride ceramic is obtained by, for example, mixing from 3 to 12 mass% of rare earth element oxide such as Y_2O_3 , Yb_2O_3 , or Er_2O_3 as a sintering aid, from 0.5 to 3 mass% of Al_2O_3 , and from 1.5 to 5 mass% of SiO_2 in terms of an amount of SiO_2 contained in the sintered body into silicon nitride, which is the primary component, forming the mixture into a predetermined shape, and subsequently subjecting the mixture to hot press firing at a temperature of from 1650 to 1780°C. The length of the ceramic body 2 is set to from 20 to 50 mm, for example, and the diameter of the ceramic body 2 is set to from 3 to 5 mm, for example.

[0010] Note that, when the ceramic body 2 including silicon nitride ceramic is used, MoSiO_2 , WSi_2 , or the like may be mixed and dispersed into the ceramic body 2. In this case, a coefficient of thermal expansion of the silicon nitride ceramic serving as a base material can be made approximate to a coefficient of thermal expansion of the heating resistor 3, thus enhancing a durability of the heater 1.

[0011] The heating resistor 3 is provided in an interior of the ceramic body 2. The heating resistor 3 is provided on a leading end side (first end side) of the ceramic body 2. The heating resistor 3 is a member that generates heat by the flow of electrical current therethrough. The heating resistor 3 includes linear portions 32 extending in the longitudinal direction of the ceramic body 2, and a fold-back portion 30 connecting the linear portions 32. As the heating resistor 3, a heating resistor containing carbide, nitride, silicide or the like of W, Mo, Ti or the like as a primary component can be used. When the ceramic body 2 includes silicon nitride ceramic, from a viewpoint that a difference in the coefficients of thermal expansion of the heating resistor 3 and the ceramic body 2 is small and from a viewpoint that the heating resistor 3 exhibits high thermal resistance, tungsten carbide (WC) is excellent as the material of the heating resistor 3 among the materials described above.

[0012] Further, when the ceramic body 2 includes silicon nitride ceramic, the heating resistor 3 may contain WC, which is an inorganic electrically conductive material, as a primary component, and the content of silicon nitride to be added to WC may be 20 mass% or greater. For example, in the ceramic body 2 including silicon nitride ceramic, electrically conductive elements that form the heating resistor 3 have large coefficients of thermal expansion compared to the coefficient of thermal expansion of silicon nitride, and thus the heating resistor 3 is usually in a state where a tensile stress is applied to the heating resistor 3. In contrast, with the addition of silicon nitride into the heating resistor 3, the coefficient of thermal expansion of the heating resistor 3 can be brought close to the coefficient of thermal expansion of the ceramic body 2, and thus stress caused by the difference in coefficients of thermal expansion between a time where a temperature of the heater 1 is elevated and a time where a temperature of the heater 1 is lowered can be alleviated.

[0013] Further, when the content of silicon nitride contained in the heating resistor 3 is 40 mass% or less, a variation of a resistance value of the heating resistor 3 can be reduced. Accordingly, the content of silicon nitride contained in the heating resistor 3 may be from 20 to 40 mass%. Preferably, the content of silicon nitride is from 25 to 35 mass%. Further, as an additive to be added into the heating resistor 3 in the same manner as silicon nitride, from 4 to 12 mass% of boron nitride may be added in place of silicon nitride. A total length of the heating resistor 3 can be set to from 3 to 15 mm, and the cross-sectional area may be set to from 0.15 to 0.8 mm^2 .

[0014] The leads 4 are members for electrically con-

necting the heating resistor 3 and an external power supply. The leads 4 are connected to the heating resistor 3 and drawn to the front surface of the ceramic body 2. Specifically, the leads 4 are bonded to both end portions of the heating resistor 3, one lead 4 is connected to a first end of the heating resistor 3 on one end and led from a side surface near a rear end of the ceramic body 2 on the other end, and the other lead 4 is connected to a second end of the heating resistor 3 on one end and led from the rear end portion of the ceramic body 2 on the other end.

[0015] The leads 4 are formed using the same material as that of the heating resistor 3, for example. The leads 4 include WC, for example. The leads 4 have a greater cross-sectional area than that of the heating resistor 3, a lower content of the formation materials of the ceramic body 2 than that of the heating resistor 3, and thus a low resistance value per unit length. Further, the leads 4 may contain WC, which is an inorganic electrically conductive material, as a primary component, and the content of silicon nitride to be added to WC may be 15 mass% or greater. Along with the increase in content of silicon nitride, the coefficient of thermal expansion of the leads 4 can be brought close to the coefficient of thermal expansion of the silicon nitride constituting the ceramic body 2. Further, when the content of silicon nitride is 40 mass% or less, a resistance value of the leads 4 decreases and becomes stable. Accordingly, the content of silicon nitride may be from 15 to 40 mass%. Further, the content of silicon nitride may be from 20 to 35 mass%.

[0016] Here, the heater 1 of the present embodiment, as illustrated in FIG. 1, includes the ceramic body 2 having a rod shape, and the heating resistor 3 provided in the interior of the ceramic body 2, with the heating resistor 3 including the fold-back portion 30 and a projection 31 having a wire shape and extending across an entirety of an outer periphery of the fold-back portion 30 in a folding-back direction. The projection 31 projects outward and extends along an entirety of the fold-back portion 30 along the fold-back portion 30. In this way, with the provision of the projection 31 having a wire shape and extending across the entirety of the outer periphery of the fold-back portion 30 of the heating resistor 3 in the folding-back direction, the heat can be readily dispersed from the projection 31 having a wire shape to the ceramic body 2. This makes it possible to reduce the amount of heat momentarily trapped in the heating resistor 3 and thus reduce the thermal stress between the heating resistor 3 and the ceramic body 2. Thus, the possibility of the occurrence of cracks in the heating resistor 3 can be reduced. As a result, a long-term reliability of the heater 1 can be improved.

[0017] Further, as illustrated in FIG. 2, the projection 31 may be positioned on an outermost periphery of the fold-back portion 30. In this way, the heat can be more readily dispersed to the outer peripheral side of the ceramic body 2, making it possible to further reduce the amount of heat momentarily trapped in the heating re-

sistor 3. In the heater 1 illustrated in FIG. 2, the cross-section shape of the fold-back portion 30 is elliptical. The fold-back portion 30 folds back on an imaginary plane. The cross-section shape of the fold-back portion 30 has a major axis in the direction perpendicular to the imaginary plane on which the fold-back portion 30 folds back. The projection 31 is positioned on an extended line of a minor axis of the elliptical shape.

[0018] While the projection 31 has a triangular shape in FIG. 2, the shape is not limited thereto. For the projection 31, various shapes can be used. For example, the shape may be semicircular or semi-elliptical. The length (height) of the projection 31 in the direction of projection can be set to from 5 to 30 μm , for example.

[0019] Further, as illustrated in FIG. 3, a tip of the projection 31 when viewed in a cross section perpendicular to an extending direction of the projection 31 may have a smooth curved shape. In this way, the possibility of the occurrence of cracks in the ceramic body 2 caused by a contact portion that comes into contact with the projection 31 can be reduced.

[0020] Further, as illustrated in FIG. 4, the heating resistor 3 may include the fold-back portion 30 and the linear portions 32 connected to the fold-back portion 30, with the projection 31 extending to the linear portions 32. In this way, heat can be more readily transmitted from the heating resistor 3 to the ceramic body 2. This makes it possible to further reduce the trapping of heat in the heating resistor 3.

[0021] Further, with the projection 31 continuously formed from the fold-back portion 30 to the linear portions 32, end portions of the projection 31 are positioned on the linear portions 32 and not on the fold-back portion 30. Because the heat tends to become trapped particularly in the fold-back portion 30, the heating resistor 3 including the fold-back portion 30 may be subjected to a large concentration of thermal stress at the end portions of the projection 31 when the end portions of the projection 31 are positioned in the middle of the fold-back portion 30. By positioning the end portions of the projection 31 on the linear portions 32 as illustrated in FIG. 4, it is possible to reduce the possibility of concentration of thermal stress in the end portions of the projection 31.

[0022] Further, as illustrated in FIG. 5, the heating resistor 3 may further include a second projection 33 having a wire shape and extending across an entirety of an inner periphery of the fold-back portion 30 in the folding-back direction. In this way, heat can be more readily transmitted from the heating resistor 3 to the ceramic body 2. For the second projection 33, various shapes can be used. For example, the shape may be semicircular or semi-elliptical. The length (height) of the second projection 33 in the direction of projection can be set to from 5 to 30 μm , for example. Further, a tip of the projection 33 when viewed in a cross section perpendicular to an extending direction of the projection 33 may have a smooth curved shape. In this way, the possibility of the occurrence of cracks in the ceramic body 2 caused by a contact portion

that comes into contact with the second projection 33 can be reduced.

[0023] As illustrated in FIG. 6, a glow plug 10 includes the heater 1 described above, and a metal tube 5 having a tubular shape and attached so as to cover a rear end side (second end side) of the heater 1. The glow plug 10 further includes an electrode fitting 6 disposed on an inner side of the metal tube 5 and attached to the rear end of the heater 1. According to the glow plug 10, because the heater 1 described above is used, durability is improved.

[0024] The metal tube 5 is a member for holding the ceramic body 2. The metal tube 5 is a tubular member, and is attached so as to surround the rear end side of the ceramic body 2. That is, the ceramic body 2 having a rod shape is inserted into the inner side of the metal tube 5 having a tubular shape. The metal tube 5 is provided to a side surface on the rear end side of the ceramic body 2, and is electrically connected to the exposed portions of the leads 4. The metal tube 5 includes, for example, stainless steel or iron (Fe) - nickel (Ni) - cobalt (Co) alloy.

[0025] The metal tube 5 and the ceramic body 2 are bonded by a brazing material. The brazing material is provided so as to surround the rear end side of the ceramic body 2, between the metal tube 5 and the ceramic body 2. With the brazing material provided, the metal tube 5 and the leads 4 are electrically connected.

[0026] As the brazing material, a silver (Ag) - copper (Cu) brazing material, a silver brazing material, or a copper brazing material containing glass components in an amount from 5 to 20 mass% or the like can be used. The glass components have favorable wettability with the ceramic of the ceramic body 2 and a high friction coefficient, making it possible to improve a bonding strength between the brazing material and the ceramic body 2 or a bonding strength between the brazing material and the metal tube 5.

[0027] The electrode fitting 6 is positioned on the inner side of the metal tube 5, and attached to the rear end of the ceramic body 2 so as to be electrically connected to the leads 4. As the electrode fitting 6, various forms may be used. In the example illustrated in FIG. 9, the electrode fitting 6 is configured by connecting a cap portion attached to the rear end of the ceramic body 2 so as to cover the rear end including the leads 4, and a coil-shaped portion electrically connected to an external connecting electrode, by a wire-shaped portion. This electrode fitting 6 is kept separated from an inner peripheral surface of the metal tube 5 so as to not cause a short with the metal tube 5.

[0028] The electrode fitting 6 is a metal wire having a coil-shaped portion provided to alleviate stress in the connection with the external power supply. The electrode fitting 6 is electrically connected to the leads 4, and electrically connected to the external power supply. Voltage is applied between the metal tube 5 and the electrode fitting 6 by the external power supply, making it possible to allow electrical current to flow to the heating resistor

3 via the metal tube 5 and the electrode fitting 6. The electrode fitting 6 includes, for example, nickel or stainless steel. The heater 1 can be formed by, for example, injection molding or the like which uses metal molds having shapes of the heating resistor 3, the leads 4, and the ceramic body 2, respectively, of the configuration described above.

[0029] Further, as illustrated in FIG. 7, the heater 1 may include the ceramic body 2 having a rod shape, and the heating resistor 3 provided in the interior of the ceramic body 3, with the heating resistor 3 including the fold-back portion 30 and a stepped portion 34 having a wire shape and extending across the entirety of the outer periphery of the fold-back portion 30 in the folding-back direction. In this way, with the provision of the stepped portion 34 having a wire shape and extending across the entirety of the outer periphery of the fold-back portion 30 of the heating resistor 3 in the folding-back direction, the heat can be readily dispersed from the stepped portion 34 having a wire shape to the ceramic body 2. This makes it possible to reduce the amount of heat momentarily trapped in the heating resistor 3 and thus reduce the thermal stress between the heating resistor 3 and the ceramic body 2. Thus, the possibility of the generation of cracks in the heating resistor 3 can be reduced. As a result, the long-term reliability of the heater 1 can be improved.

[0030] Further, as illustrated in FIG. 7, the stepped portion 34 may be positioned on the outermost periphery of the fold-back portion 30. In this way, the heat can be more readily dispersed to the outer peripheral side of the ceramic body 2, making it possible to further reduce the amount of heat momentarily trapped in the heating resistor 3.

[0031] Further, the heating resistor 3 may further include a second stepped portion 35 having a wire shape and extending across the entirety of the inner periphery of the fold-back portion 30 in the folding-back direction. In this way, heat can be more readily transmitted from the heating resistor 3 to the ceramic body 2, making it possible to further reduce the trapping of the heat in the heating resistor 3.

[0032] Further, as illustrated in FIG. 8, the heating resistor 3 further includes a third projection 36 having a wire shape and extending across the inner periphery and the outer periphery. Note that, in FIG. 8, the focus is on the third projection 36 and thus the projection 31 or the stepped portion 34 is omitted. With the third projection 36 provided, heat can be more readily transmitted from the heating resistor 3 to the ceramic body 2.

[0033] In FIG. 8, the third projection 36 extends diagonally in the folding-back direction of the fold-back portion 30. In this way, the heat can be more readily dispersed to the inner peripheral side and the outer peripheral side across a wider range of the ceramic body 2, making it possible to further reduce the amount of heat momentarily trapped in the heating resistor 3 under rapid temperature rise. Note that the third projection 36 may extend diagonally in the folding-back direction, or may extend in

a direction perpendicular to the folding-back direction. When extended in a direction perpendicular to the folding-back direction, the third projection 36 may be provided across the entire periphery of the fold-back portion 30. In other words, the third projection 36 may be formed into an annular shape and provided across the entire periphery of the fold-back portion 30.

Reference Signs List

[0034]

- 1 Heater
- 2 Ceramic body
- 3 Heating resistor
- 30 Fold-back portion
- 31 Projection
- 32 Linear portion
- 33 Second projection
- 34 Stepped portion
- 35 Second stepped portion
- 36 Third projection
- 4 Lead
- 5 Metal tube
- 6 Electrode fitting
- 10 Glow plug

Claims

1. A heater (1) comprising:

a ceramic body (2) having a rod shape; and
a heating resistor (3) provided in an interior of the ceramic body (2),
wherein
the heating resistor (3) comprises a fold-back portion (30) and a projection (31) having a wire shape and extending across an entirety of an outer periphery of the fold-back portion (30) in a folding-back direction,
characterized in that
the heating resistor (3) further comprises a third projection (36) having a wire shape and extending across an inner periphery and an outer periphery of the heating resistor (3).

2. The heater (1) according to claim 1, wherein the cross-section shape of the fold-back portion (30) is elliptical, wherein the fold-back portion (30) folds back on an imaginary plane, wherein the cross-section shape of the fold-back portion (30) has a major axis in the direction perpendicular to the imaginary plane, and wherein the projection (31) is positioned on an extended line of a minor axis of the elliptical shape.

3. The heater (1) according to claim 1 or 2, wherein a

tip of the projection (31) when viewed in a cross-section perpendicular to an extending direction of the projection (31) has a smooth curved shape.

4. The heater (1) according to any one of claims 1 to 3, wherein the heating resistor (3) comprises the fold-back portion (30) and a linear portion (32) connected to the fold-back portion (30), and the projection (31) extends to the linear portions (32) .

5. The heater (1) according to any one of claims 1 to 4, wherein the heating resistor (3) further comprises a second projection (33) having a wire shape and extending across an entirety of an inner periphery of the fold-back portion (30) in the folding-back direction.

6. A heater (1) comprising:
- a ceramic body (2) having a rod shape; and
a heating resistor (3) provided in an interior of the ceramic body (2),
wherein
the heating resistor (3) comprises a fold-back portion (30) and a stepped portion (34) having a wire shape and extending across an entirety of an outer periphery of the fold-back portion (30) in a folding-back direction,
characterized in that
the heating resistor (3) further comprises a third projection (36) having a wire shape and extending across an inner periphery and an outer periphery of the heating resistor (3).

7. The heater (1) according to claim 6, wherein the cross-section shape of the fold-back portion (30) is elliptical, wherein the fold-back portion (30) folds back on an imaginary plane, wherein the cross-section shape of the fold-back portion (30) has a major axis in the direction perpendicular to the imaginary plane, and wherein the stepped portion (34) is positioned on an extended line of a minor axis of the elliptical shape.

8. The heater (1) according to claim 6 or 7, wherein the heating resistor (3) further comprises a second stepped portion (35) having a wire shape and extending across an entirety of an inner periphery of the fold-back portion (30) in the folding-back direction.

9. A glow plug (10) comprising:
- the heater (1) according to any one of claims 1 to 8 including the heating resistor (3) positioned on a first end side of the ceramic body (2); and

a metal tube (5) attached covering a second end side of the ceramic body (2).

Patentansprüche

1. Heizvorrichtung (1), aufweisend:

einen Keramikkörper (2) mit einer Stabform und einen Heizwiderstand (3), der in einem Inneren des Keramikkörpers (2) bereitgestellt ist, wobei
der Heizwiderstand (3) einen Zurückfaltabschnitt (30) und einen Vorsprung (31) aufweist, der eine Drahtform hat und sich über eine Gesamtheit eines äußeren Umfangs des Zurückfaltabschnitts (30) in einer Zurückfaltrichtung erstreckt,
dadurch gekennzeichnet, dass
der Heizwiderstand (3) ferner einen dritten Vorsprung (36) aufweist, der eine Drahtform hat und sich über einen inneren Umfang und einen äußeren Umfang des Heizwiderstandes (3) erstreckt.

2. Heizvorrichtung (1) gemäß Anspruch 1, wobei die Querschnittsform des Zurückfaltabschnitts (30) elliptisch ist, wobei der Zurückfaltabschnitt (30) auf einer imaginären Ebene zurückgefaltet ist, wobei die Querschnittsform des Zurückfaltabschnitts (30) eine Hauptachse in der Richtung senkrecht zu der imaginären Ebene hat, und wobei der Vorsprung (31) auf einer verlängerten Linie einer Nebenachse der elliptischen Form positioniert ist.

3. Heizvorrichtung (1) gemäß Anspruch 1 oder 2, wobei eine Spitze des Vorsprungs (31) bei Betrachtung in einem Querschnitt senkrecht zu einer Erstreckungsrichtung des Vorsprungs (31) eine glatte gekrümmte Form hat.

4. Heizvorrichtung (1) gemäß irgendeinem der Ansprüche 1 bis 3, wobei
der Heizwiderstand (3) den Zurückfaltabschnitt (30) und einen linearen Abschnitt (32) aufweist, der mit dem Zurückfaltabschnitt (30) verbunden ist, und
der Vorsprung (31) sich zu den linearen Abschnitten (32) erstreckt.

5. Heizvorrichtung (1) gemäß irgendeinem der Ansprüche 1 bis 4, wobei der Heizwiderstand (3) ferner einen zweiten Vorsprung (33) aufweist, der eine Drahtform hat und sich über eine Gesamtheit eines inneren Umfangs des Zurückfaltabschnitts (30) in der Zurückfaltrichtung erstreckt.

6. Heizvorrichtung (1), aufweisend:

- einen Keramikkörper (2) mit einer Stabform und einen Heizwiderstand (3), der in einem Inneren des Keramikkörpers (2) bereitgestellt ist, wobei
- der Heizwiderstand (3) einen Zurückfaltabschnitt (30) und einen Stufenabschnitt (34) aufweist, der eine Drahtform hat und sich über eine Gesamtheit eines äußeren Umfangs des Zurückfaltabschnitts (30) in einer Zurückfaltrichtung erstreckt,
- dadurch gekennzeichnet, dass**
- der Heizwiderstand (3) ferner einen dritten Vorsprung (36) aufweist, der eine Drahtform hat und sich über einen inneren Umfang und einen äußeren Umfang des Heizwiderstandes (3) erstreckt.
7. Heizvorrichtung (1) gemäß Anspruch 6, wobei die Querschnittsform des Zurückfaltabschnitts (30) elliptisch ist, wobei der Zurückfaltabschnitt (30) auf einer imaginären Ebene zurückgefaltet ist, wobei die Querschnittsform des Zurückfaltabschnitts (30) eine Hauptachse in der Richtung senkrecht zu der imaginären Ebene hat, und wobei der Stufenabschnitt (34) auf einer verlängerten Linie einer Nebenachse der elliptischen Form positioniert ist.
8. Heizvorrichtung (1) gemäß Anspruch 6 oder 7, wobei der Heizwiderstand (3) ferner einen zweiten Stufenabschnitt (35) aufweist, der eine Drahtform hat und sich über eine Gesamtheit eines inneren Umfangs des Zurückfaltabschnitts (30) in der Zurückfaltrichtung erstreckt.
9. Glühkerze (10), aufweisend:
- die Heizvorrichtung (1) gemäß irgendeinem der Ansprüche 1 bis 8, aufweisend den Heizwiderstand (3), der an einer ersten Endseite des Keramikkörpers (2) positioniert ist, und ein Metallrohr (5), das angebracht ist, so dass es eine zweite Endseite des Keramikkörpers (2) abdeckt.
- Revendications**
1. Dispositif de chauffage (1), comprenant :
- un corps céramique (2) ayant une forme de tige ;
et
une résistance chauffante (3) prévue à un intérieur du corps céramique (2),
dans lequel
la résistance chauffante (3) comprend une partie repliée (30) et une saillie (31) ayant une forme de fil et s'étendant sur une totalité d'une périphérie extérieure de la partie repliée (30) dans
- une direction de repli,
caractérisé en ce que
la résistance chauffante (3) comprend en outre une troisième saillie (36) ayant une forme de fil et s'étendant sur une périphérie intérieure et une périphérie extérieure de la résistance chauffante (3).
2. Dispositif de chauffage (1) selon la revendication 1, dans lequel la forme de section transversale de la partie repliée (30) est elliptique, dans lequel la partie repliée (30) se replie sur un plan imaginaire, dans lequel la forme de section transversale de la partie repliée (30) a un axe principal dans la direction perpendiculaire au plan imaginaire, et dans lequel la saillie (31) est positionnée sur une ligne prolongée d'un axe secondaire de la forme elliptique.
3. Dispositif de chauffage (1) selon la revendication 1 ou 2, dans lequel une pointe de la saillie (31), lorsqu'elle est vue en section transversale perpendiculaire à une direction d'extension de la saillie (31), a une forme incurvée lisse.
4. Dispositif de chauffage (1) selon l'une quelconque des revendications 1 à 3, dans lequel la résistance chauffante (3) comprend la partie repliée (30) et une partie linéaire (32) connectée à la partie repliée (30), et la saillie (31) s'étend aux parties linéaires (32).
5. Dispositif de chauffage (1) selon l'une quelconque des revendications 1 à 4, dans lequel la résistance chauffante (3) comprend en outre une deuxième saillie (33) ayant une forme de fil et s'étendant sur une totalité d'une périphérie intérieure de la partie repliée (30) dans la direction de repli.
6. Dispositif de chauffage (1) comprenant :
- un corps céramique (2) ayant une forme de tige ;
et
une résistance chauffante (3) prévue à un intérieur du corps céramique (2),
dans lequel
la résistance chauffante (3) comprend une partie repliée (30) et une partie en gradin (34) ayant une forme de fil et s'étendant sur une totalité d'une périphérie extérieure de la partie repliée (30) dans une direction de repli,
caractérisé en ce que
la résistance chauffante (3) comprend en outre une troisième saillie (36) ayant une forme de fil et s'étendant sur une périphérie intérieure et une périphérie extérieure de la résistance chauffante (3).
7. Dispositif de chauffage (1) selon la revendication 6,

dans lequel la forme de section transversale de la partie repliée (30) est elliptique, dans lequel la partie repliée (30) se replie sur un plan imaginaire, dans lequel la forme de section transversale de la partie repliée (30) a un axe principal dans la direction perpendiculaire au plan imaginaire, et dans lequel la partie en gradin (34) est positionnée sur une ligne prolongée d'un axe secondaire de la forme elliptique.

8. Dispositif de chauffage (1) selon la revendication 6 ou 7, dans lequel la résistance chauffante (3) comprend en outre une deuxième partie en gradin (35) ayant une forme de fil et s'étendant sur une totalité d'une périphérie intérieure de la partie repliée (30) dans la direction de repli.

9. Une bougie de préchauffage (10), comprenant :

le dispositif de chauffage (1) selon l'une quelconque des revendications 1 à 8, comprenant la résistance chauffante (3) positionnée sur un premier côté d'extrémité du corps céramique (2) ; et
un tube métallique (5) fixé de manière à couvrir une deuxième extrémité du corps céramique (2).

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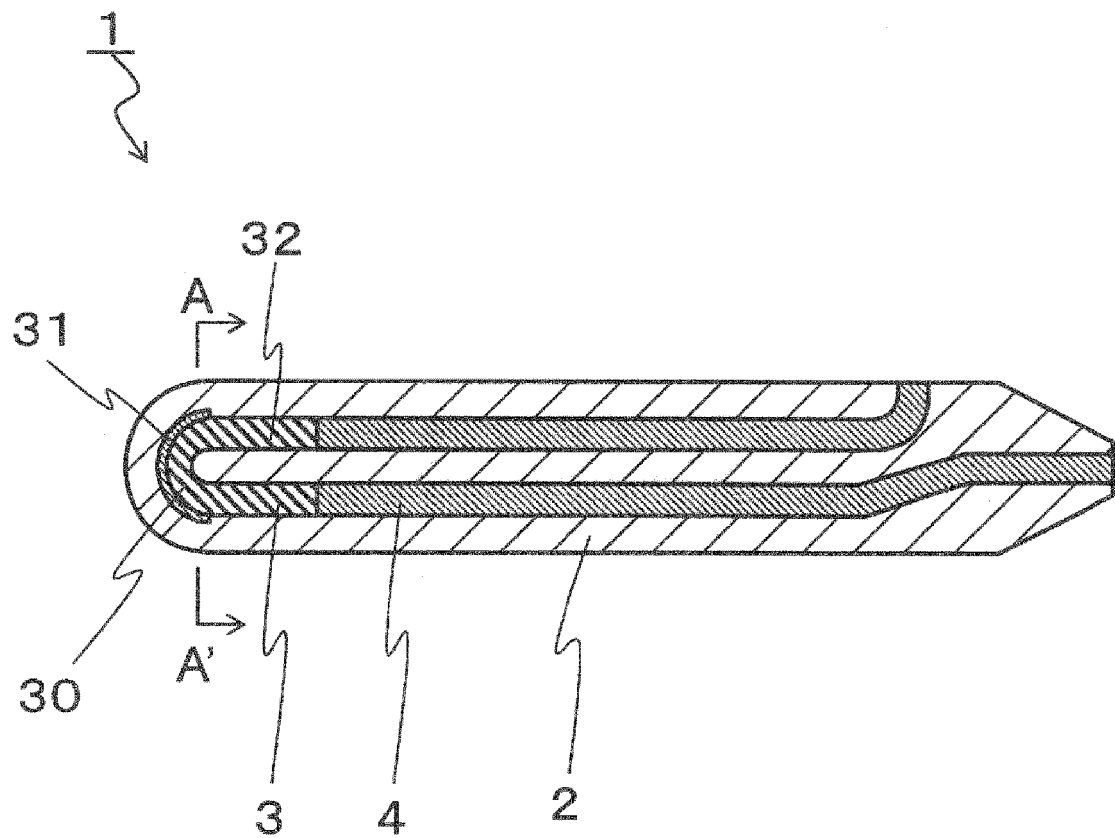


FIG. 1

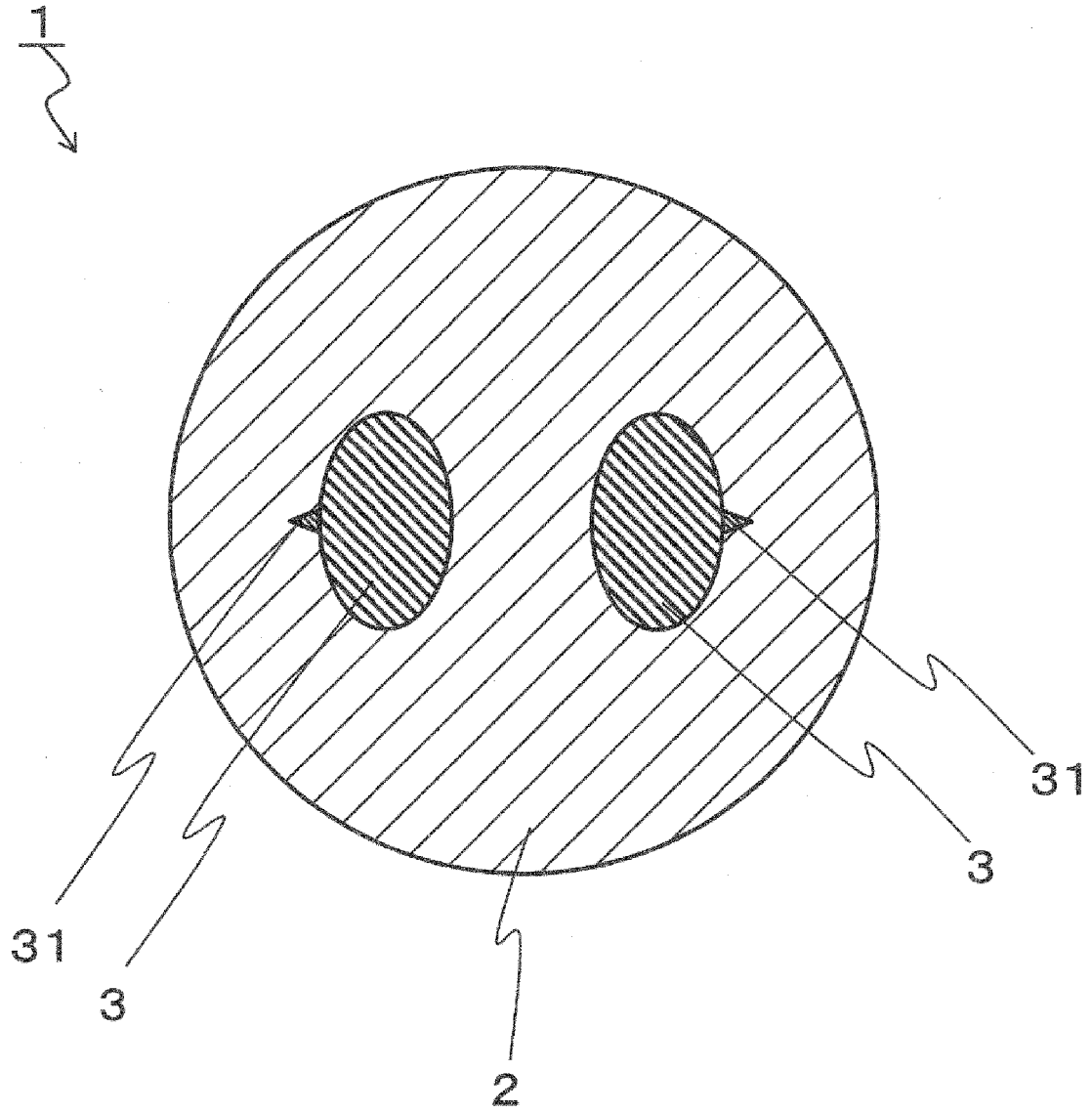


FIG. 2

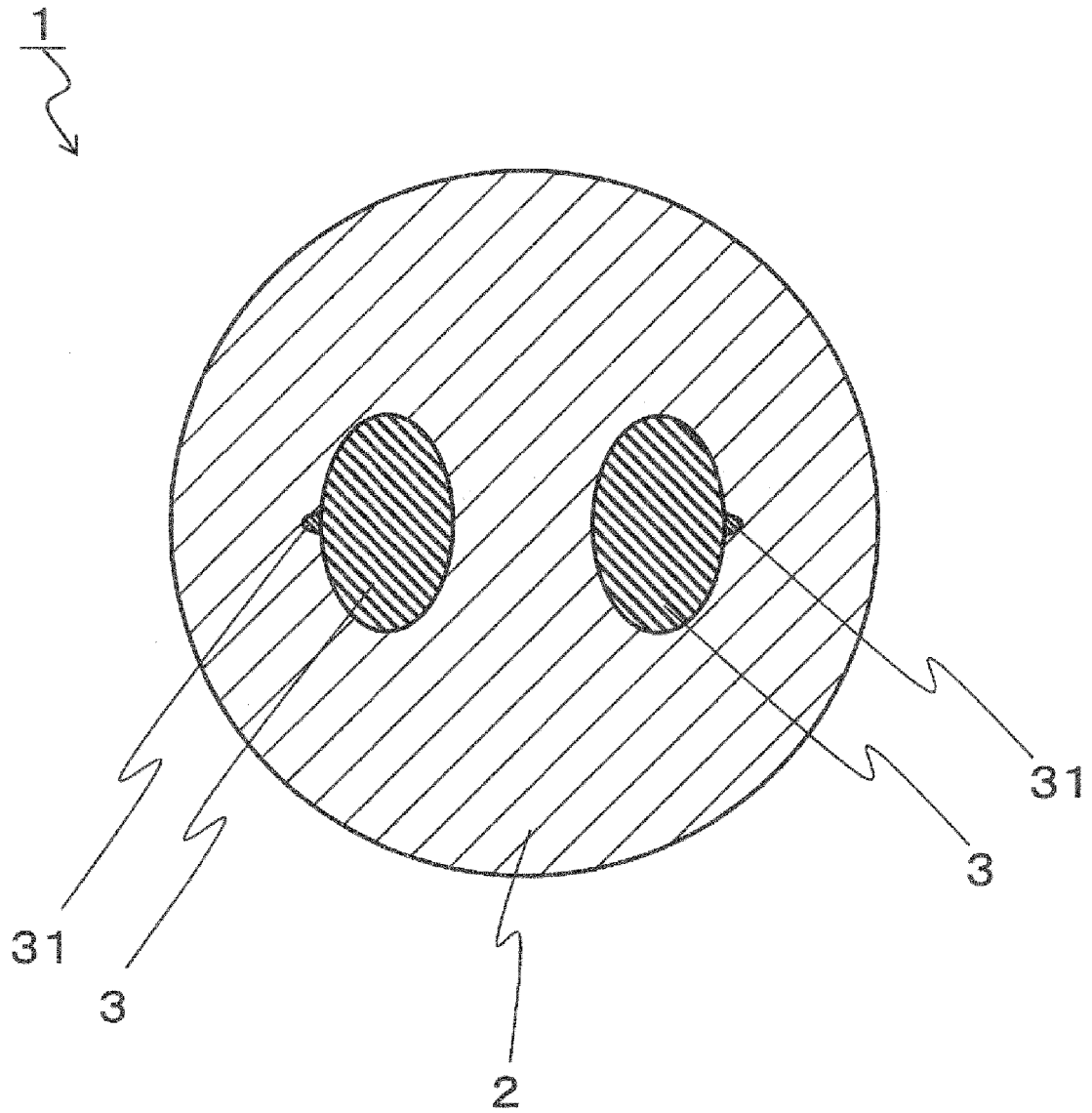


FIG. 3

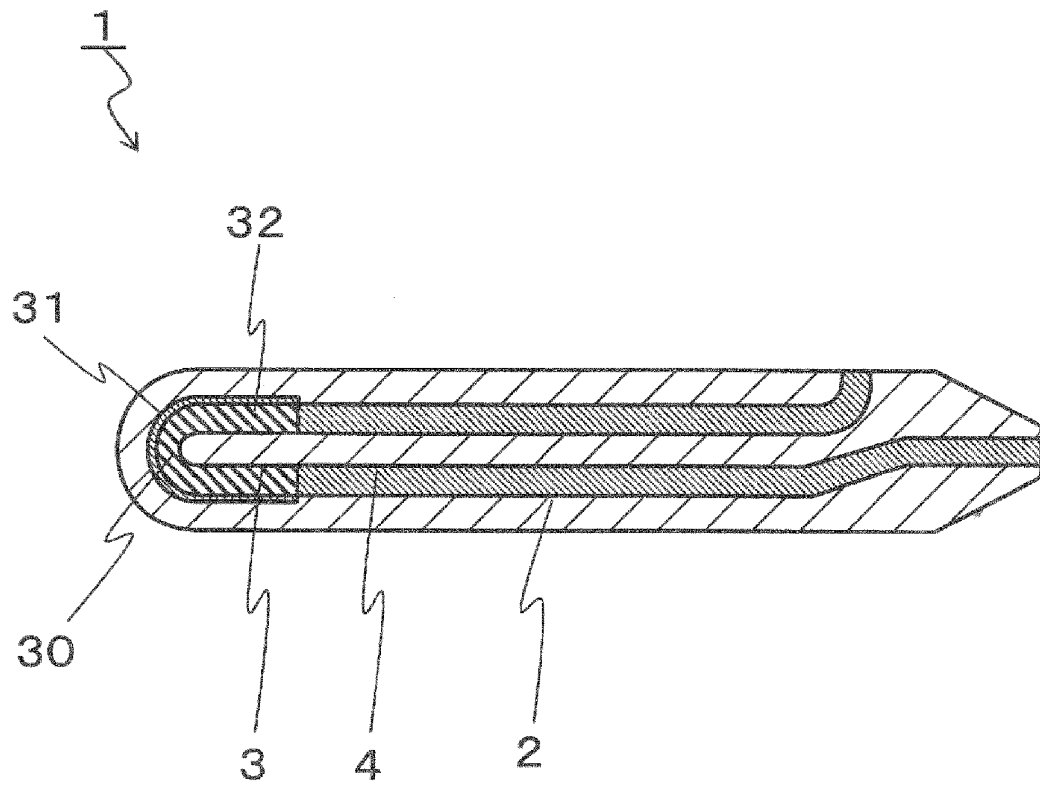


FIG. 4

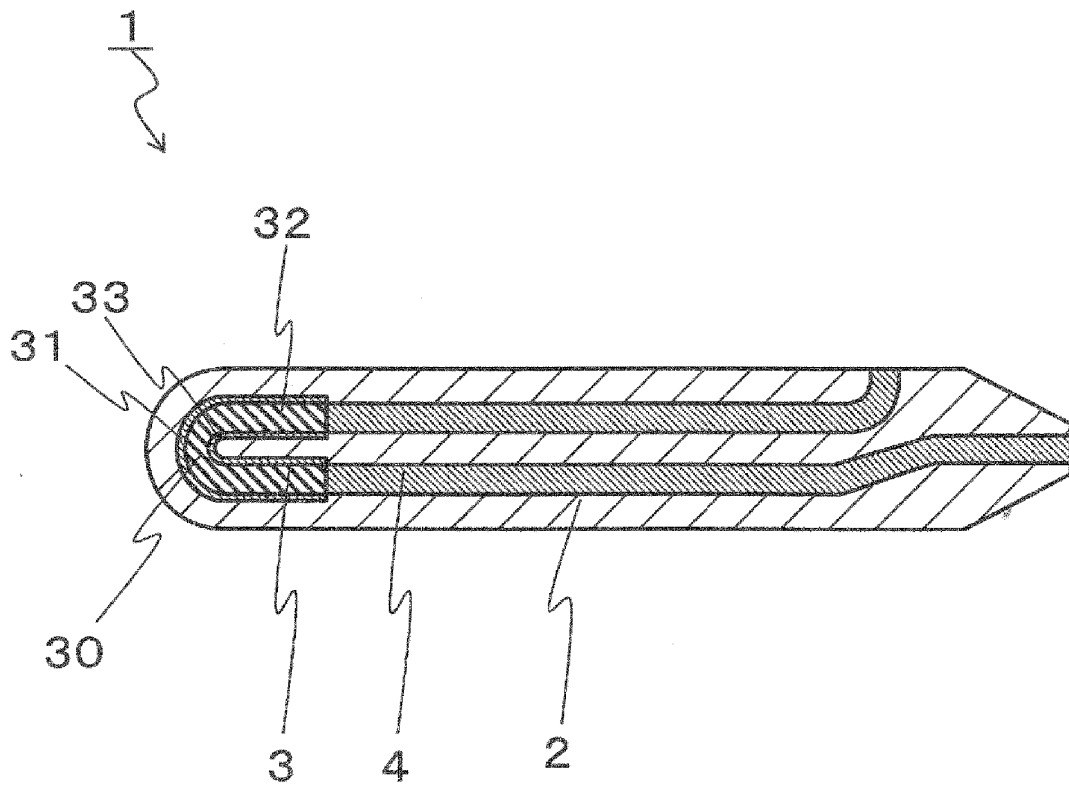


FIG. 5

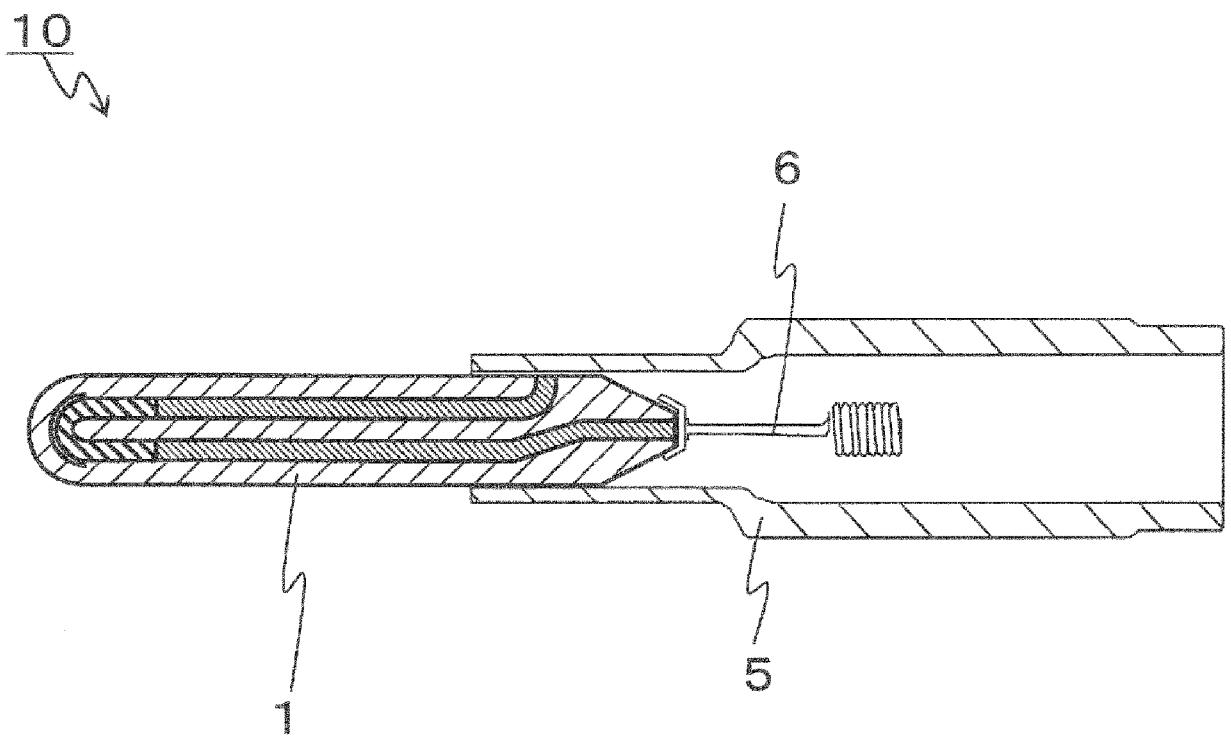


FIG. 6

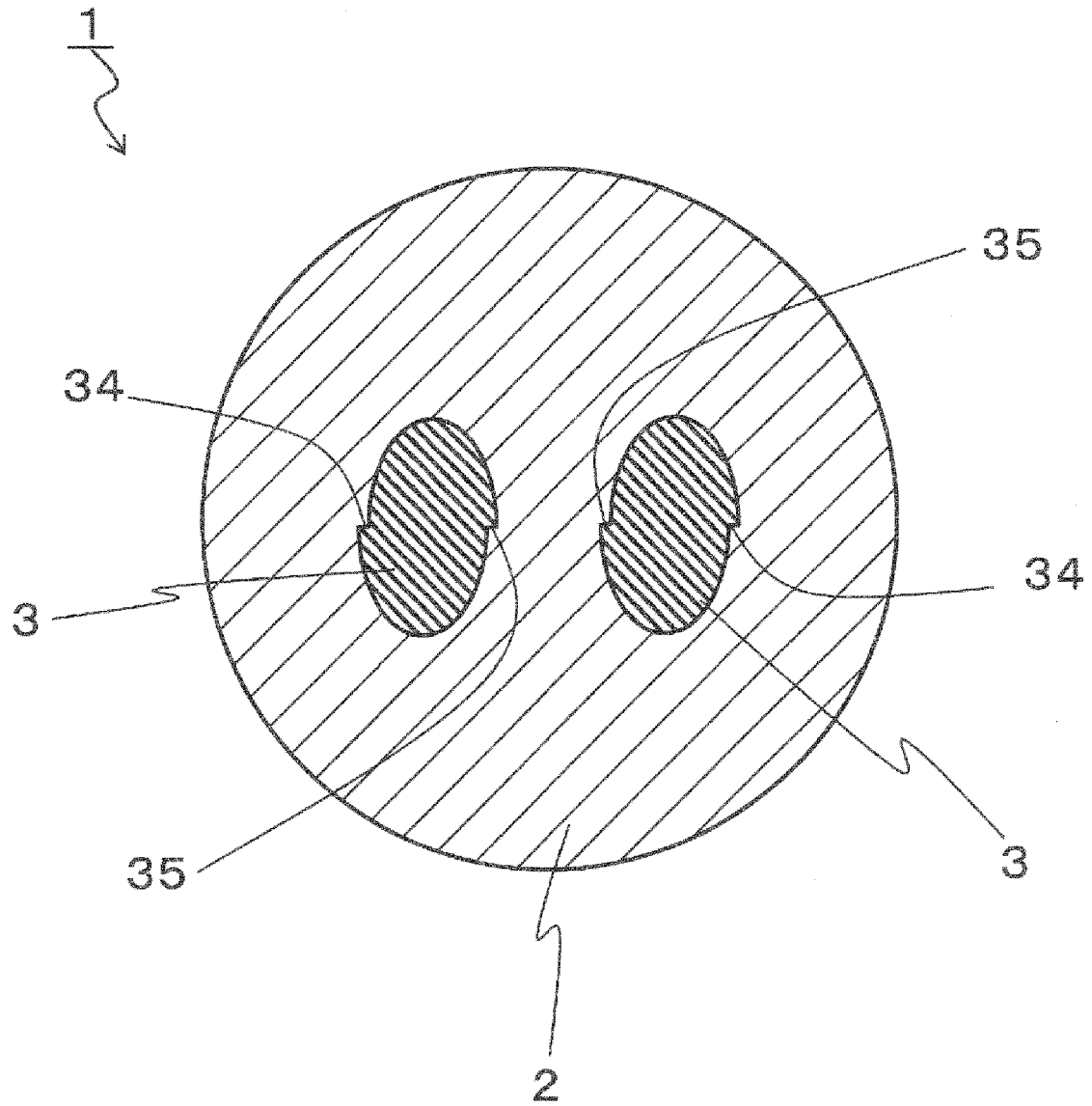


FIG. 7

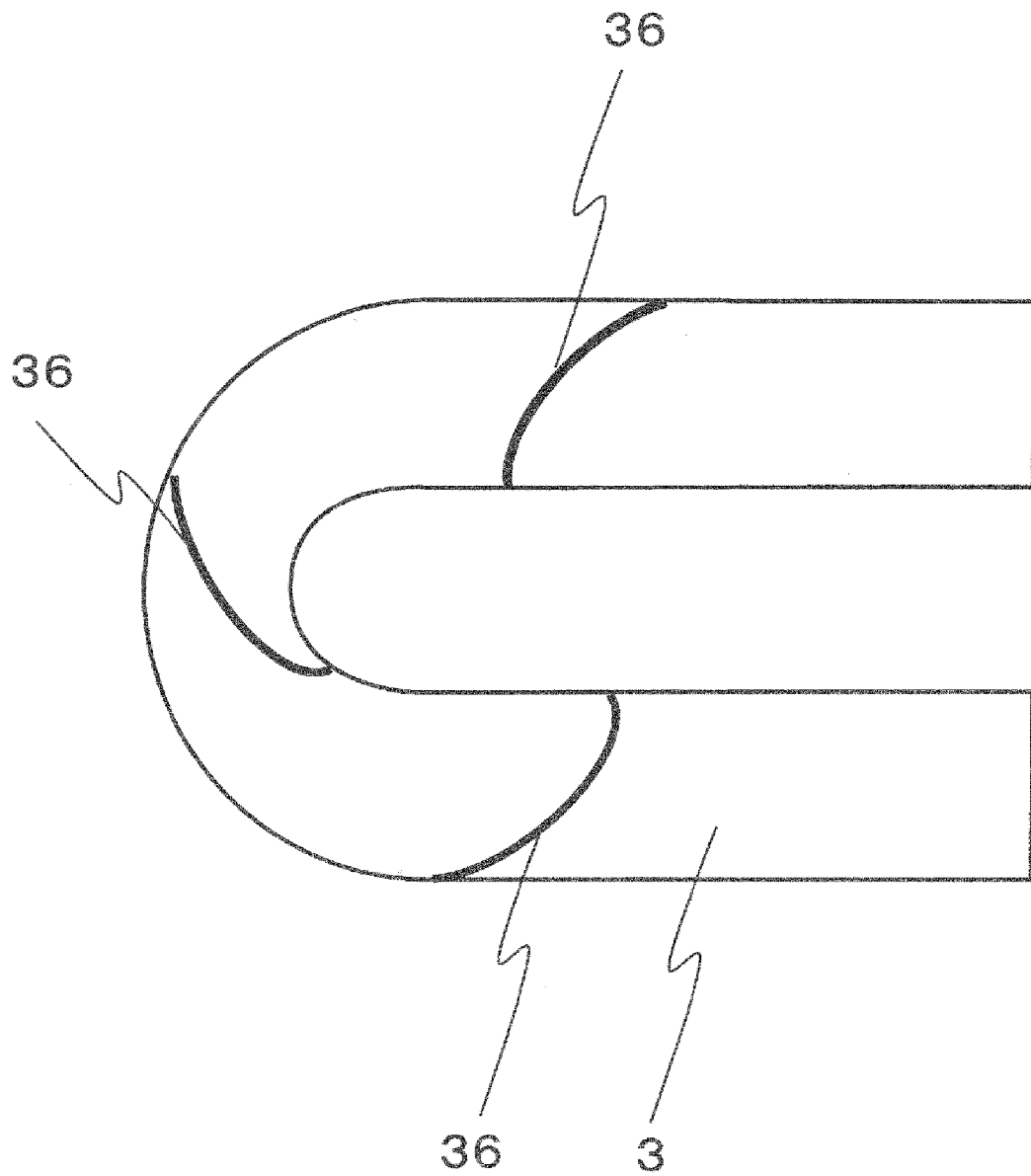


FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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