



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.06.2021 Bulletin 2021/22

(51) Int Cl.:
F21K 9/278 ^(2016.01) **F21S 41/148** ^(2018.01)
B60Q 1/02 ^(2006.01) **F21Y 103/10** ^(2016.01)
F21Y 115/10 ^(2016.01)

(21) Application number: **20206881.3**

(22) Date of filing: **11.11.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME KH MA MD TN

(72) Inventors:
• **BARP, Marco**
I-31100 Treviso (IT)
• **MUNARIN, Marco**
I-31032 Casale sul Sile (Treviso) (IT)
• **GREGIANIN, Francesco**
I-30014 Cavarzere (Venezia) (IT)

(30) Priority: **26.11.2019 IT 201900022149**

(74) Representative: **Bosotti, Luciano**
Buzzi, Notaro & Antonielli d'Oulx S.p.A.
Corso Vittorio Emanuele II, 6
10123 Torino (IT)

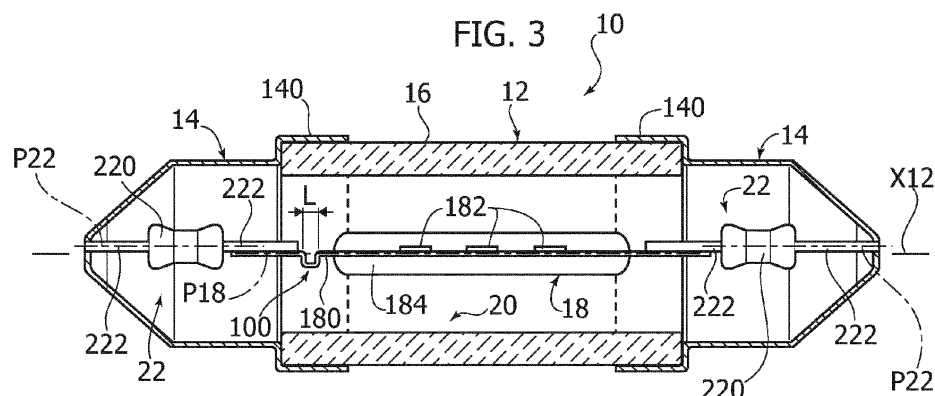
(71) Applicants:
• **OSRAM GmbH**
80807 München (DE)
• **OSRAM S.P.A. - SOCIETA' RIUNITE OSRAM EDISON CLERICI**
20126 Milano (IT)
Designated Contracting States:
IT

(54) **LAMP AND CORRESPONDING METHOD**

(57) A solid-state lamp (10) for vehicles comprises: a housing (12) extending in a longitudinal direction (X12) between opposed electrically conductive end caps (14), with a light-permeable portion (16) of the housing between the end caps (14), a solid-state light source (18), e.g. a LED source (182), arranged at the light-permeable portion (16) of the housing (12), electrically-conductive support formations (22) between

the end caps (14) and the light source (18), the support formations (22) being configured to support the light source (18) and to provide a power supply path between the end caps (14) through the light source (18).

The lamp (10) comprises at least one spring-like element (100) having a length (L) in said longitudinal direction (X12) and being deformable to vary its length (L) in the longitudinal direction (X12) so as to be able to absorb deformation stresses caused by thermal cycles.



Description

Technical Field

[0001] The description refers to lamps.

[0002] One or more embodiments may be applied to lamps employing solid-state light generators, e.g. LED light generators.

[0003] One or more embodiments may advantageously be employed in the automotive sector, e.g. as automotive retrofit lamps.

Technological Background

[0004] Lamps (or bulbs) for the automotive sector are increasingly making use of solid-state light sources, e.g. LED sources. Such a lamp is described, e.g., in US 2018/0266636 A1.

[0005] In such an environment, thermal stresses play a significant role.

[0006] For a lamp which is adapted to be employed in the automotive sector, such as e.g. a C5W bulb which may be used as a retrofit bulb, it is desirable to have a reliable operation over a rather wide temperature range, e.g. -40°C to +65°C, such performance being verifiable through power thermal cycle (PCT) tests.

[0007] Such lamps may include different materials (metal, plastics, carbon or ceramic materials, etc.) which may have rather different coefficients of thermal expansion. The risk therefore exists that such materials may undergo different elongations as a function of temperature, with a consequent potential damage to the lamp itself, e.g. to the light source.

[0008] For example, in sources comprising a LED "filament" including light-generating chips mounted on a so-called leadframe with wire bonding connections, the thermal stresses and the consequent elongations of the materials may lead to wire bonding being damaged, and therefore to jeopardizing lamp operation. This may take place even if the lamp is structured in such a way as to allow a certain movement of the source within the lamp housing.

Object and Summary

[0009] One or more embodiments aim at contributing to overcoming the drawbacks outlined in the foregoing.

[0010] According to one or more embodiments, such an object can be achieved thanks to a lamp having the features set forth in the claims that follow.

[0011] One or more embodiments may refer to a corresponding method.

[0012] The claims are an integral part of the technical teaching provided herein with reference to embodiments.

[0013] One or more embodiments facilitate designing lamps adapted to meet usage requirements in fields such as the automotive sector, with the capability of passing PCT tests over a temperature range of -40°C to +65°C

without being damaged, and therefore improving the reliability and the lifetime of the lamp.

Brief Description of the Annexed Figures

[0014] One or more embodiments will now be described, by way of non-limiting example only, with reference to the annexed figures, wherein:

Figures 1 and 2 are a side view and a partially cut-away view of a conventional automotive lamp, respectively, and

Figures 3 to 10 exemplify embodiments according to the present description, in a view substantially corresponding to the view of Figure 2.

Detailed Description of Exemplary Embodiments

[0015] In the following description, various specific details are given to provide a thorough understanding of various exemplary embodiments according to the specification. The embodiments may be implemented without one or several specific details, or with other methods, components, materials, etc. In other instances, well-known structures, materials or operations are not shown or described in detail in order to avoid obscuring the various aspects of the embodiments.

[0016] Reference throughout this specification to "an embodiment" or "one embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, the possible appearances of the phrases "in an embodiment" or "in one embodiment" in various places throughout the present specification are not necessarily all referring to one and the same embodiment. Furthermore, particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

[0017] The references/headings provided herein are given for convenience only, and therefore do not interpret the extent of protection or scope of the embodiments.

[0018] As a general introduction, it is to be noted that features and characteristics which are exemplified - either individually or in mutual combination - with reference to any of the annexed figures are adapted to be applied - either individually or in combination - to embodiments according to any other annexed Figure.

[0019] Therefore, the description of a given feature or characteristic with reference to a specific figure shall not be construed, not even indirectly, as implying that such feature or characteristic is uniquely adapted to be used (only) in embodiments exemplified in the corresponding figure. In other words, the features and characteristics illustrated herein with reference to the annexed figures are adapted to be freely transferred from one embodiment to another of the embodiments as exemplified herein.

[0020] In the figures, reference 10 denotes an automo-

tive lamp, e.g. a lamp known as C5W, adapted to be used for retrofitting or optionally for the first equipment of lights (high beam headlamps, low beam headlamps, fog lights, rear lights etc.) of a (motor) vehicle.

[0021] According to a solution which may be considered as conventional per se (see Figures 1 and 2), lamp 10 may have a shape substantially similar to a fuse, comprising a housing 12 extending in a longitudinal direction (axis X12 in the figures) between a pair of end caps 14 which are at least partly electrically conductive, between which there is arranged a light-permeable intermediate portion 16 (e.g. of a transparent or cut-out material).

[0022] In one or more embodiments, the end caps 14 may have a cup shape (e.g. a dome shape) and they may be applied and mounted, e.g. via end collars 140, onto the ends of the housing portion 16, which may have a tubular, e.g. cylindrical, shape.

[0023] In one or more embodiments, the end caps 14 may comprise electrically conductive material such as e.g. a metal material, with the light-permeable portion 16 which may comprise transparent plastic or glass material.

[0024] Within the housing 12 there is arranged a solid-state light source 18, e.g. a LED source, which may extend e.g. in the longitudinal direction of housing 12 (i.e. in the direction of axis X12, in the example shown in the figures).

[0025] As exemplified herein, the source 18 may have an elongate shape, being supported within the cavity 20 of housing 12 by support formations 22 extending between the end caps 14 and the opposed ends of light source 18, which is arranged at the light-permeable portion 16.

[0026] As exemplified herein, the support formations 22 are electrically conductive, therefore providing a power supply path extending between the end caps 14 through the light source 18.

[0027] In that way, a supply voltage V applied across the end caps 14 is transferred to source 18, which is therefore activated, with a consequent light emission through the portion 16 which is permeable to the light of the lamp 10.

[0028] One or both support formations 22 may comprise resistors 220 provided with respective electrodes (rheophores) 222.

[0029] The light source 18 may comprise a substrate 180 such as e.g. a so-called leadframe (or lead frame) of metal material, having mounted (fixed) thereon one or more solid-state light generators (e.g. LED chips) 182.

[0030] The electrical connection of generators 182 may be provided by electrically conductive formations such as e.g. a so-called wire bonding structure (not visible in the figures because of the scale). The leadframe 180 and the generators 182 (as well as the wire bonding) may be embedded into a mass 184 of light-permeable material (such as a transparent resin) adapted to form a sort of protective sheath of light source 18.

[0031] A lamp 10 as described so far in its general features with reference to Figures 1 and 2 is to be considered

substantially known in the art, which makes it unnecessary to provide a more detailed description herein.

[0032] For the purposes herein, it will be noted that the source 18 in such a lamp 10 (see for instance Figure 1) may be considered as extending in a plane P18 which may substantially coincide, for example, with the extension or lying plane of substrate 180. Such plane is not visible in Figure 2, where the light source 18 is viewed substantially in plan view.

[0033] On the other hand, Figure 2 shows that the support formations 22 may be considered as extending in a plane P22 which may substantially coincide, for example, with a plane wherein electrodes 222 extend: in an example as shown in Figure 2 such a plane may be e.g. any transversal or diametral plane of the lamp.

[0034] On the other hand, it will be observed that planes such as planes P18 and P22 as considered herein must not necessarily pass through axis X12; as can be seen in some of the figures they may be offset from said axis.

[0035] As discussed in the introduction to the present specification, the various elements of a lamp 10 as considered herein may include elements of different materials (e.g. end caps 14 of a metal material, intermediate portion 16 of a plastic material or glass, resistors 220 of carbon or ceramic material, etc.) having coefficients of thermal expansion (CTEs) which are correspondingly different. Such elements may therefore experience different elongations as a function of temperature: such a phenomenon may pose a risk of damaging the lamp, e.g. at the wire bonding of source 18.

[0036] In one or more embodiments, the possible drawbacks described in the foregoing may be countered by providing at least one element (or optionally more elements) of the light source 18 and/or the support formations 22 with at least one spring-like element 100.

[0037] Such an element is adapted to originate a portion with enhanced deformability in the longitudinal direction of the body of lamp 10 (e.g. in the direction of axis X12 exemplified in the figures).

[0038] In one or more embodiments, the spring-like element 100 may comprise a curvilinear (i.e. non-straight), e.g. meandering, portion.

[0039] The latter may be e.g. a portion of the light source 18 (e.g. of substrate 180) and/or of at least one of the support formations 22, which extends out of the plane of the light source 18 and/or out of the plane of at least one of the support formations 22.

[0040] In one or more embodiments, the spring-like element 100 may comprise a soft and compliant, e.g. electrically conductive, material.

[0041] Whatever the chosen implementation may be, the spring-like element 100 may have a width L (as measured in the longitudinal direction of lamp 10, i.e. in the direction of axis X12, in the presently exemplified embodiments) which may vary, and therefore absorb the strains (stresses) which may be input into the structure of lamp 10, deriving from different length variations which

the components of lamp 10 may experience due to their different coefficients of thermal expansion, as a consequence of the exposure to a thermal cycle.

[0042] In one or more embodiments, such a spring-like element 100 (which may exhibit enhanced deformability, or a deformability which is concentrated with respect to the adjoining portions) may be arranged at the light source 18, at least at one of the support formations 22 (optionally comprising resistor 220) or else at all said possible positions (light source 18 and one or both support formations 22).

[0043] For example, Figure 3 refers to an element 100 provided in the leadframe 180 of light source 18 and having e.g. an omega shape.

[0044] Figures 4 and 5 exemplify embodiments comprising one (or more, in the case of Figure 5) elements 100, having a similar arrangement, and having:

a V shape (or in other words a U shape), see Figure 4,
a Z shape (or in other words an S shape), see Figure 5.

[0045] Figures such as Figures 6 to 10 exemplify the possibility of providing elements 100 at the support formations 22.

[0046] For example, one of the electrodes (rheophores) 222 of resistor 220 - e.g. the leftmost electrode in Figure 6 - may have a coiled shape having an axial length L1, such a length being adapted to vary because such shape causes the element to behave substantially as a helical spring, which is again adapted to absorb strains or stresses which may derive from a thermal cycle, according to what has been stated in the foregoing.

[0047] Figure 5 shows a first example of the possible simultaneous presence of a plurality of spring-like elements 100, which in this case are provided at the light source 18, e.g. on opposed sides of leadframe 180, the lengths whereof (which are respectively denoted as L1 and L2) are both adapted to vary, so as to originate a cooperative action for absorbing the thermal deformation stresses.

[0048] Figure 6 shows a second example of the possible simultaneous presence of a plurality of spring-like elements 100, one provided by the coiled shape of one of the electrodes 222 of the leftmost resistor 220 in Figure 6, and the other provided at the light source 18, the respective lengths L1 and L2 whereof, once again, are both adapted to vary, so as to originate a cooperative action for absorbing the thermal deformation stresses.

[0049] Spring-like elements 100 as shown in the presently annexed Figures may therefore be implemented as a single element 100, which may be arranged:

either at light source 18, as exemplified in Figures 3 to 4, or
at either support formation 22, as exemplified in Figure 8 which will be further explained in the following.

[0050] As stated in the foregoing, it is also possible to envisage the simultaneous presence of two (or more) spring-like elements 100 which are arranged, for example:

both at light source 18 (see e.g. Figure 5),
one at light source 18 and the other at one of the support formations 22 (see for example Figure 6 or Figures 7, 9 and 10, which will be further explained in the following);
at both support formations 22;
at light source 18 and at both support formations 22.

[0051] The last two possibilities are not explicitly exemplified in the figures; however, as discussed in the introduction to the present specification, it must be borne in mind that elements and characteristics shown - individually or in mutual combination - with reference to any of the annexed figures are adapted to be applied - individually or in mutual combination - to embodiments according to any other of the annexed figures.

[0052] Figure 7 exemplifies (on the left side of the Figure) the possibility of providing a spring-like element 100 at one (or optionally both) support formations 22, by imparting to the electrodes (rheophores) 222 a curvilinear shape (e.g. a U shape), so as to originate a curvilinear or meandering portion having the general shape of an S or a serpentine, the resistor 220 being arranged in a central position.

[0053] The spring-like element 100 having such a shape may have again a variable length L1, so as to perform (optionally together with a further element 100 arranged at light source 18 and having a length L2) an action of absorbing the thermal deformation stresses.

[0054] Figure 8 exemplifies embodiments provided with an element 100 having a length L1, including a wire-like member having a coiled shape similar to the element 100 visible in the left part of Figure 6.

[0055] One or more embodiments as exemplified in Figure 8 may be considered as virtually corresponding to the option (which may be applied also in embodiments as exemplified in the other figures) of omitting one or both resistors 220 (the presence whereof is not strictly mandatory in itself) by imparting to one or more electrodes 222 a curvilinear or meandering shape, such as the coiled shape which is visible on the left part of Figure 8.

[0056] In one or more embodiments as exemplified in Figure 8, the "omission" of one of resistors 220 (e.g. the resistor on the left side of the Figure, in the presently exemplified embodiment) may be compensated for by the provision, on the opposed side (on the right side, in the presently exemplified embodiment) of an enhanced resistor 220, which is adapted to improve the dissipation, by a single resistor, of the power which originally was supposed to be dissipated by two resistors.

[0057] One or more embodiments may envisage the presence of one or more spring-like elements 100 which extend, at least partially, out of a plane of at least one of

the light source 18 and the support formations 22.

[0058] As already discussed with reference to Figures 1 and 2, a plane P18 of the source 18 may substantially coincide, e.g., with the extension or lying plane of substrate 180, while a plane P22 of the support formations 22 may substantially coincide, for example, with a plane wherein the electrodes 222 extend (at least at their rear ends). As already stated in the foregoing, the planes P18 and P22 must not necessarily pass through axis X12, as they may be offset from said axis, as may be seen in some of the Figures.

[0059] Figure 3 shows a situation wherein an element 100 extends nearly completely out of the plane P18 of source 18, the same considerations applying, for example, to similar spring-like elements 100 which are visible e.g. in Figure 4 or (with length L2) in Figures 9 and 10.

[0060] Moreover, as will be appreciated especially in the case of either spring-like element 100 of the example of Figure 5, one or more spring-like elements 100 as explained herein may be considered as extending both out of plane P18 of light source 18 and out of one or more planes P22 (e.g. parallel to plane P18 of source 18) of the support formations 22, such planes being identifiable according to the criteria discussed in the foregoing, i.e. as the planes wherein the electrodes 222 (at least at the outer ends thereof) lie.

[0061] It will be noted that such considerations also apply to the spring-like elements 100 having length L2, which are visible, for example, in Figure 6 or in Figure 7.

[0062] In the case of Figure 7, wherein source 18 is seen in plan view, so that plane P18 is not visible, it is possible to identify also a plane P22 of the support formations 22 which is at least approximately transversal to plane P18, with the portions of electrodes 222, which comprise the resistor 220 between them (and which may define a spring-like element 100), extending out of said plane P22.

[0063] In the case of Figures 6 and 8, which show wire-shaped members which are wound in a helix or a coil and which are adapted to define a spring-like element 100, the helical or coiled shape is such that the corresponding spring-like element extends, at least partially, out of any plane P22 which may be defined by referring at least to the outer ends of electrodes 222 (and optionally out of plane P18 of source 18).

[0064] Without wishing to be bound by any specific theory, in one or more embodiments such mechanism of exiting a plane (P18 and/or P22, for example) may be considered as originating a spring-like behaviour thanks to a beam buckling phenomenon.

[0065] Once again, one has to bear in mind that the presence and the description of a given feature or characteristic with reference to a given Figure must not be construed, not even indirectly, as implying that such a feature or characteristic is uniquely adapted to be used (only) in embodiments exemplified in the corresponding figure.

[0066] In other words, the features and characteristics

illustrated herein with reference to the annexed Figures are adapted to be freely transferred from one to another of the presently exemplified embodiments.

[0067] Figures 9 and 10 exemplify the possibility of providing, in one of the support formations 22 (on the right side of the example shown in the figures), a spring-like element 100 comprising a deformable, e.g. elastically deformable, electrically conductive element 222', i.e. a soft conductive element.

[0068] In one or more embodiments, element 222' may be the only spring-like element present in lamp 10.

[0069] In one or more embodiments, on the other hand, element 222' may be present together with other spring-like elements 100, which may be similar to it or different from the former.

[0070] In one or more embodiments as exemplified in Figures 9 and 10, element 222' may represent a sort of interface portion of electrode 222 facing the corresponding end cap (the end cap 14 towards which electrode 222 extends), said interface portion being adapted to vary its length L1 while performing the function of absorbing stresses, already repeatedly explained in the foregoing.

[0071] Moreover, said electrode is adapted to adopt, thanks to the presence of said (widened) interface end portion, a general T shape or mushroom shape.

[0072] In one or more embodiments, as exemplified in Figure 9, element 222' may comprise an electrically conductive adhesive, e.g. a silicone or epoxy adhesive. The adhesives available under the trademarks Henkel ICP 4000 or QMI 516 IE, or other electrically conductive silicone adhesives which are used e.g. for shielding gaskets against electromagnetic interference (EMI shielding gaskets) exemplify materials which may be used in one or more embodiments.

[0073] In one or more embodiments as exemplified in Figure 10, which is globally similar to Figure 9, element 222' may comprise a spongy electrically conductive material, e.g. of the kind used as a sponge and/or shielding against electromagnetic interference (EMI conductive sponge and/or EMI shielding).

[0074] It will be appreciated that, although it may be considered an additional element, which may lead to shortening the body of the corresponding electrode, the material 222' may be inserted without appreciably altering the value of electrical resistance which may be detected across the end caps 14.

[0075] In one or more embodiments as exemplified in Figures 9 and 10, element 222' is adapted to perform the function of absorbing the stresses by cooperating with another element 100 of length L2, which is provided e.g. at the leadframe 180, e.g. of the kind exemplified in any of the Figures 3 to 7.

[0076] Such an element 222' (or a similar element) may also be used alone, or in order to implement a portion 100 at any other of the positions exemplified herein.

[0077] Once again, if a certain feature or characteristic is explained herein with reference to a certain figure, this does not imply, not even indirectly, that such a feature

or characteristic is uniquely adapted to be used (only) in the embodiments exemplified in the corresponding figure. In other words, the features and characteristics illustrated herein with reference to the annexed figures may be freely transferred from one embodiment to any other embodiment exemplified herein.

[0078] An automotive solid-state lamp (e.g. 10) for a vehicle, as exemplified herein, may comprise:

a housing (e.g. 12) extending in a longitudinal direction (e.g. X12) between opposed electrically conductive end caps (e.g. 14) with a light-permeable portion (e.g. 16) between the end caps, a solid-state light source (e.g. 18) arranged at the light-permeable portion of the housing, electrically-conductive support formations (e.g. 22) between the end caps and the light source, the support formations being configured to support the light source and to provide a power supply path between the end caps through the light source, wherein the lamp comprises at least one spring-like element (e.g. 100) in at least one of the light source and the support formations, the at least one spring-like element having a length (e.g. L; L1; L2) in said longitudinal direction and being deformable to vary said length in said longitudinal direction.

[0079] In this way, the strains (stresses) which may be induced into the lamp structure due to the different length variations that the various components may undergo because of their different coefficients of thermal expansion (for example after the exposure to a thermal cycle) may be concentrated in an enhanced or concentrated deformation region, which is provided in at least one of the light source and the support formations. It is thus possible to originate a variation of lengths L, L1 or L2, i.e. a deformation which takes place locally, (only) at the spring-like element, while avoiding deformation effects which may involve the light source and/or the support formations on the whole, with the negative consequences which may arise therefrom (referring to an example already mentioned in the foregoing, damage to the wire bonding of the light source).

[0080] In a lamp as exemplified herein, the light source may comprise a support member (e.g. a laminar support member such as 180) having at least one light generator (e.g. 182) thereon, with said at least one spring-like element provided at said support member of the light source.

[0081] In a lamp as exemplified herein, the support member may comprise a leadframe of the light source, which carries at least one light-generating chip thereon.

[0082] In a lamp as exemplified herein, at least one of the support formations may comprise a wire-like member (e.g. an electrode or rheophore 222), with said at least one spring-like element provided at said wire-like member.

[0083] In a lamp as exemplified herein, said at least one of the support formations may comprise a resistor

(e.g. 220) having wire-like electrodes (e.g. 222), with at least one of said wire-like electrodes (222) comprising said at least one spring-like element.

[0084] In a lamp as exemplified herein, said at least one of the support formations may comprise a resistor having a pair of opposed wire-like electrodes, wherein said wire-like electrodes in the pair provide said at least one spring-like element (see for example Figure 7).

[0085] In a lamp as exemplified herein, said at least one spring-like element may comprise a curvilinear or meandering element. This may consist for example of a portion of light source 18 (e.g. of substrate 180) and/or at least one of the support formations 22, which extends out of the plane of light source 18 (e.g. substrate 180) and/or out of the plane of at least one of the support formations 22 (e.g. passing through the outer ends of electrodes 222).

[0086] In a lamp as exemplified herein, said at least one spring-like element may have a shape selected out of an omega shape, a V shape, a U shape, a Z shape, an S shape (see e.g. Figures 3 to 5 and also Figures 6 and 7 as well as 9 and 10) and a coiled shape (see e.g. Figures 6 and 8, on the left side).

[0087] In a lamp as exemplified herein, said at least one spring-like element may extend out of a plane (e.g. P18, P22) of at least one of the light source and the support formations.

[0088] In a lamp as exemplified herein, said at least one spring-like element may comprise soft electrically conductive material (see for example reference 222' in Figures 9 and 10).

[0089] In a lamp as exemplified herein, at least one of said support formations (see for example formation 22 on the right side in Figures 9 and 10) may comprise said soft electrically conductive material (e.g. 222') at an interface position with a respective end cap of the housing.

[0090] In a lamp as exemplified herein:

the end caps and the light-permeable portion of the housing,
the light source, and
the support formations
may comprise materials having different coefficients of thermal expansion.

[0091] In a lamp as exemplified herein, the solid-state light source may comprise at least one LED light generator (e.g. 182).

[0092] A method of providing a lamp as exemplified herein may comprise:

arranging a solid-state light source in a housing extending in a longitudinal direction between electrically conductive opposed end caps, with a light-permeable portion of the housing between the end caps, supporting the solid-state light source arranged at the light-permeable portion of the housing via electrically conductive support formations between the

end caps and the light source, the support formations being configured to provide a power supply path between the end caps through the light source, providing at least one spring-like element (100) in at least one of the light source and the support formations, the at least one spring-like element having a length in said longitudinal direction and being deformable in order to vary said length in said longitudinal direction.

[0093] Without prejudice to the basic principles, the implementation details and the embodiments may vary, even appreciably, without departing from the extent of protection.

[0094] Said extent of protection is defined by the annexed claims.

LIST OF REFERENCE SIGNS

[0095]

Lamp	10
Housing	12
End cap	14
End cap collar	140
Light-permeable portion	16
(LED) light source	18
Substrate (leadframe)	180
Light-emitting chip	182
Protective resin	184
Housing cavity	20
Support formation	22
Resistor	220
Resistor electrode (rheophore)	222
Longitudinal axis of housing	X12
Supply voltage	V
Spring-like element	100
Variable length of spring-like portion	L, L1, L2
Soft conductive element	222'
Plane of the source	P18
Plane of the support formation	P22

Claims

1. An automotive solid-state lamp (10) for a vehicle, comprising:

a housing (12) extending in a longitudinal direction (X12) between opposed electrically-conductive end caps (14) with a light-permeable portion (16) of the housing between the end caps (14),
a solid-state light source (18) arranged at the light-permeable portion (16) of the housing (12), electrically-conductive support formations (22)

between the end caps (14) and the light source (18), the support formations (22) configured to support the light source (18) and to provide a power supply path between the end caps (14) through the light source (18),
wherein the lamp (10) comprises at least one spring-like element (100) in at least one of the light source (18) and the support formations (22), the at least one spring-like element (100) having a length (L; L1, L2) in said longitudinal direction (X12) and being deformable to vary said length (L; L1, L2) in said longitudinal direction (X12).

2. The lamp (10) of claim 1, wherein the solid-state light source (18) comprises a support member (180) having at least one light generator (182) thereon with said at least one spring-like element (100) provided at said support member (180) of the light source (18).

3. The lamp (10) of claim 2, wherein the support member comprises a leadframe (180) of the light source (18), the leadframe (180) having at least one light-generating chip (182) thereon.

4. The lamp (10) of any of the previous claims, wherein at least one of the support formations (22) comprises a wire-like member (222) with said at least one spring-like element (100) provided at said wire-like member (222).

5. The lamp (10) of claim 4, wherein said at least one of the support formations (22) comprises a resistor (220) having wire-like electrodes (222) with at least one of said wire-like electrodes (222) comprising said at least one spring-like element (100).

6. The lamp (10) of claim 5, wherein said at least one of the support formations (22) comprises a resistor (220) having a pair of opposed wire-like electrodes (222), wherein said wire-like electrodes (222) in the pair provide said at least one spring-like element (100).

7. The lamp (10) of any of the previous claims, wherein said at least one spring-like element (100) comprises a curvilinear element.

8. The lamp (10) of any of the previous claims, wherein said at least one spring-like element (100) has a shape selected out of an omega shape, a V shape, a U shape, a Z shape, a S shape and a coiled shape.

9. The lamp (10) of any of the previous claims, wherein said at least one spring-like element (100) extends out of a plane (P18, P22) of at least one of the light source (18) and the support formations (22).

10. The lamp (10) of any of the previous claims, wherein said at least one spring-like element (100) comprises soft electrically-conductive material (222').
11. The lamp (10) of claim 10, wherein at least one of said support formations (22) comprises said soft electrically-conductive material (222') at an interface position with a respective end cap (14) of the housing (12) .
12. The lamp (10) of any of the previous claims, wherein the end caps (14) and the light-permeable portion (16) of the housing (12), the light source (18) and the support formations (22) comprise materials having different coefficients of thermal expansion.
13. The lamp (10) of any of the previous claims, wherein the solid-state light source (18) comprises at least one LED light radiation generator (182).
14. A method of providing a lighting lamp (10), the method comprising:
- arranging a solid-state light source (18) in a housing (12) extending in a longitudinal direction (X12) between electrically conductive opposed end caps (14) with a light-permeable portion (16) of the housing between the end caps (14), supporting the solid-state light source (18) arranged at the light-permeable portion (16) of the housing (12) via electrically-conductive support formations (22) between the end caps (14) and the light source (18), the support formations (22) configured to provide a power supply path between the end caps (14) through the light source (18), providing at least one spring-like element (100) in at least one of the light source (18) and the support formations (22), the at least one spring-like element (100) having a length (L; L1, L2) in said longitudinal direction (X12) and being deformable to vary said length (L; L1, L2) in said longitudinal direction (X12).

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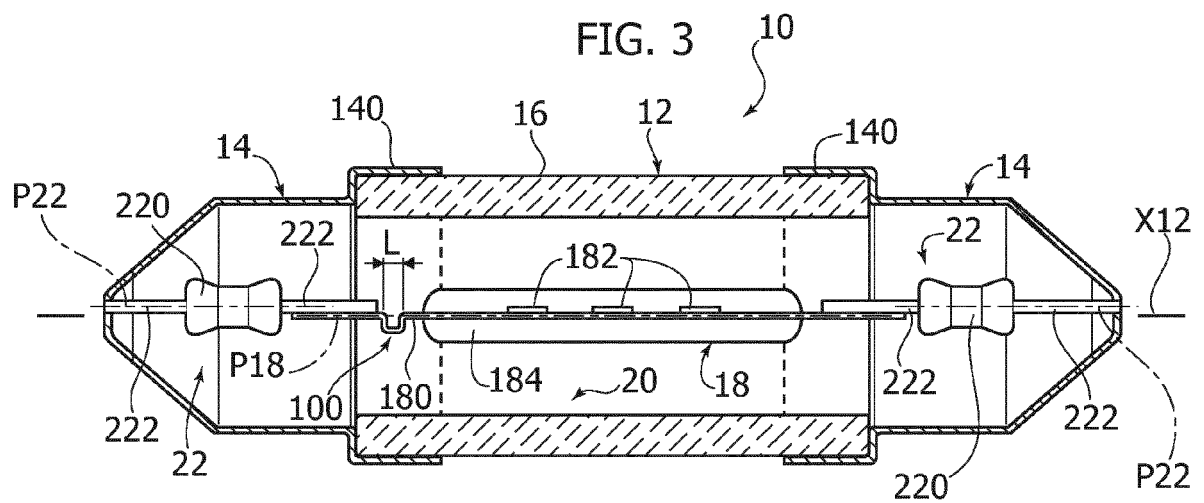
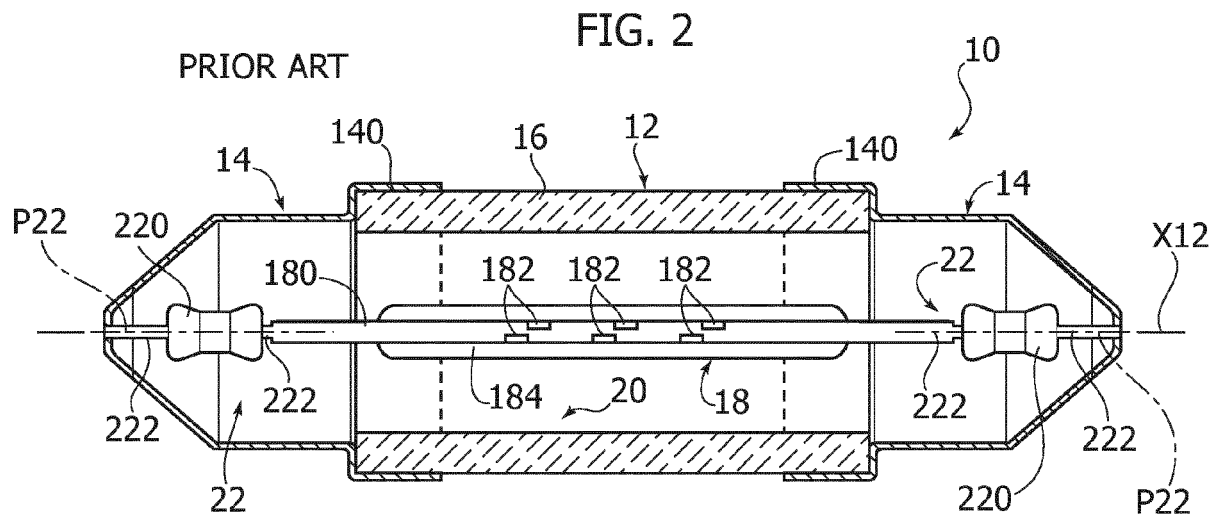
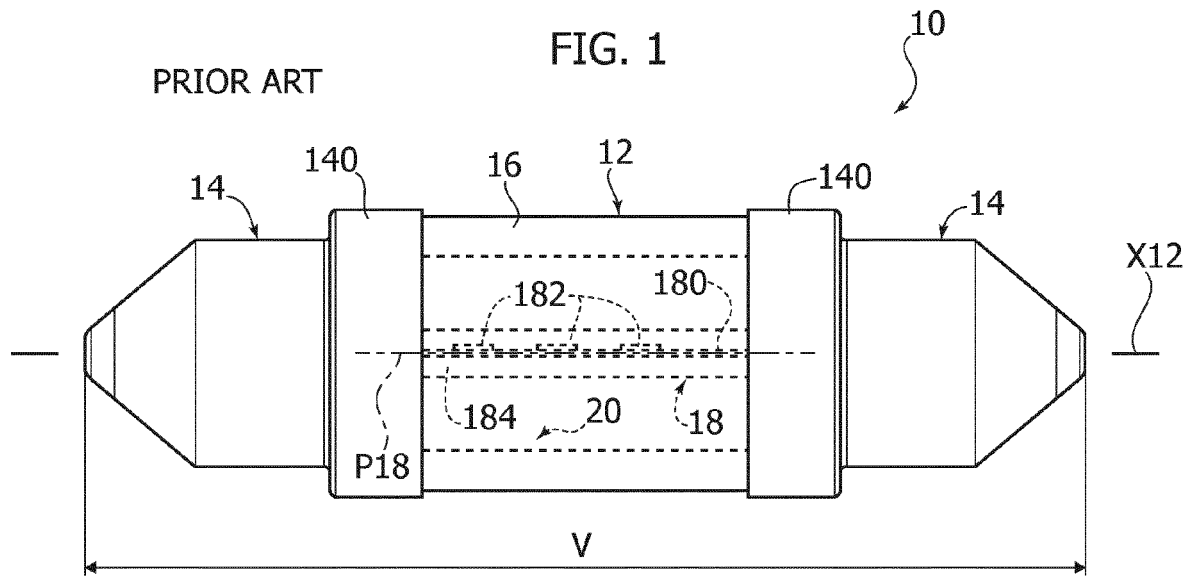


FIG. 4

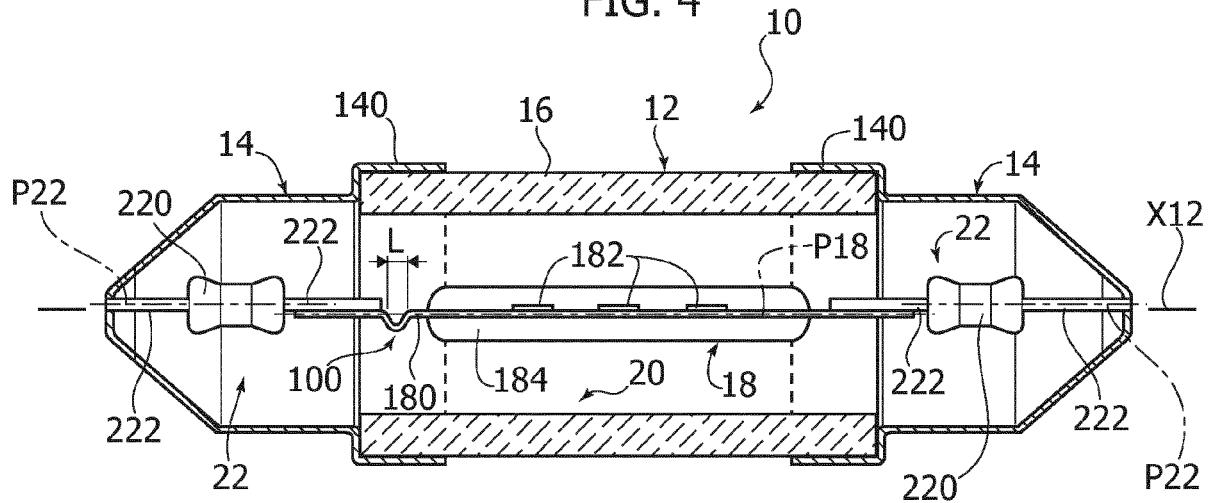


FIG. 5

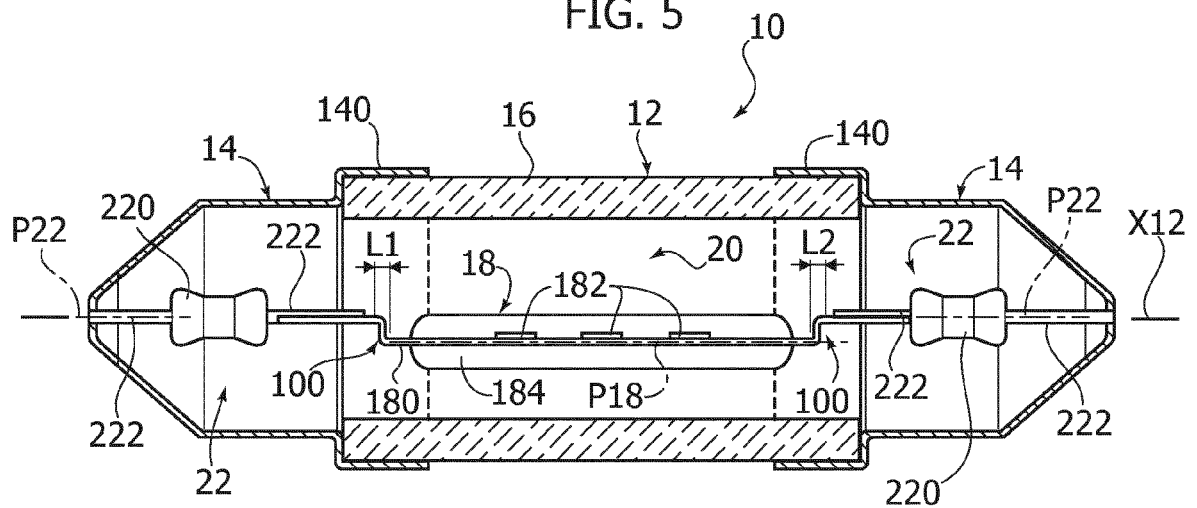


FIG. 6

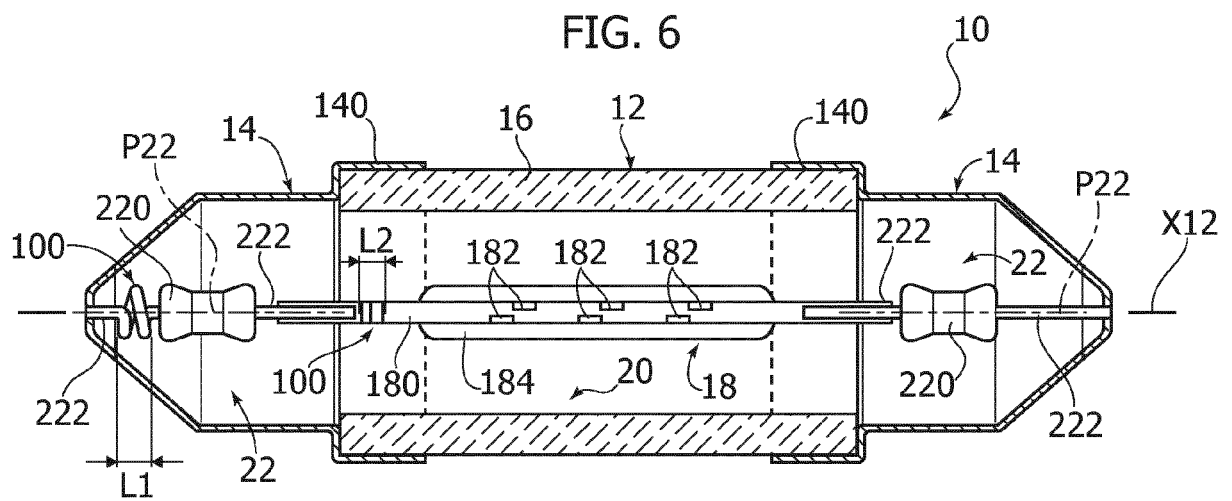


FIG. 7

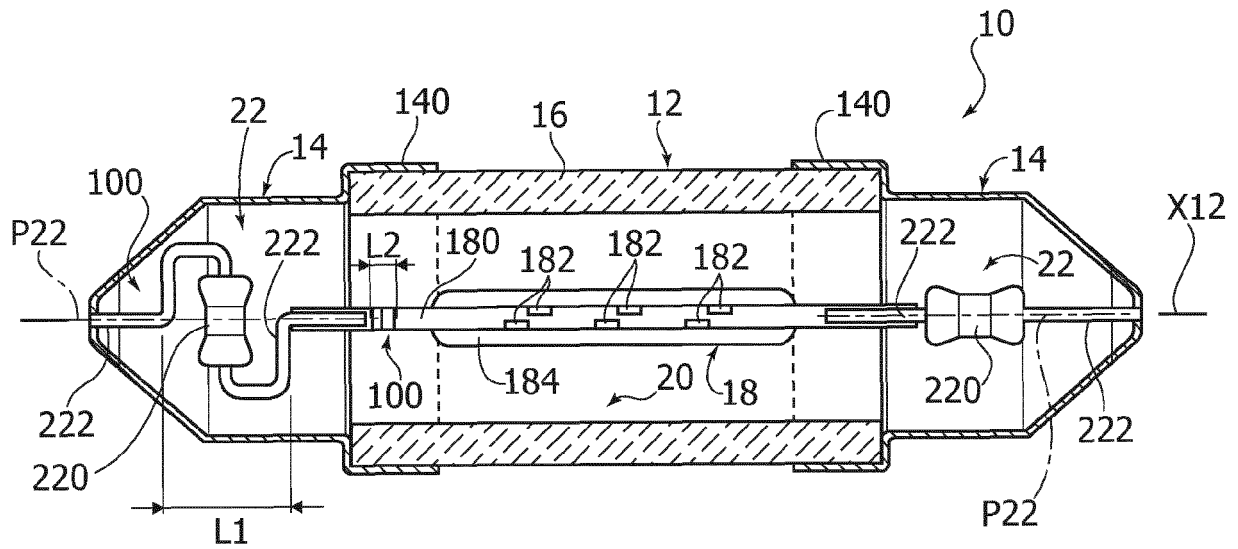


FIG. 8

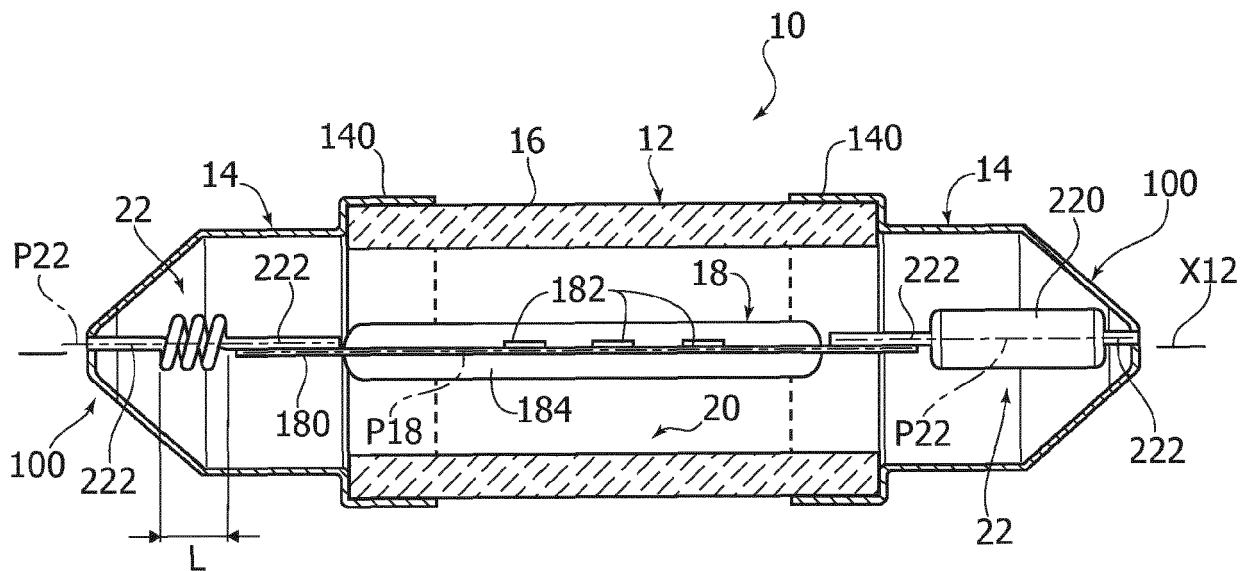


FIG. 9

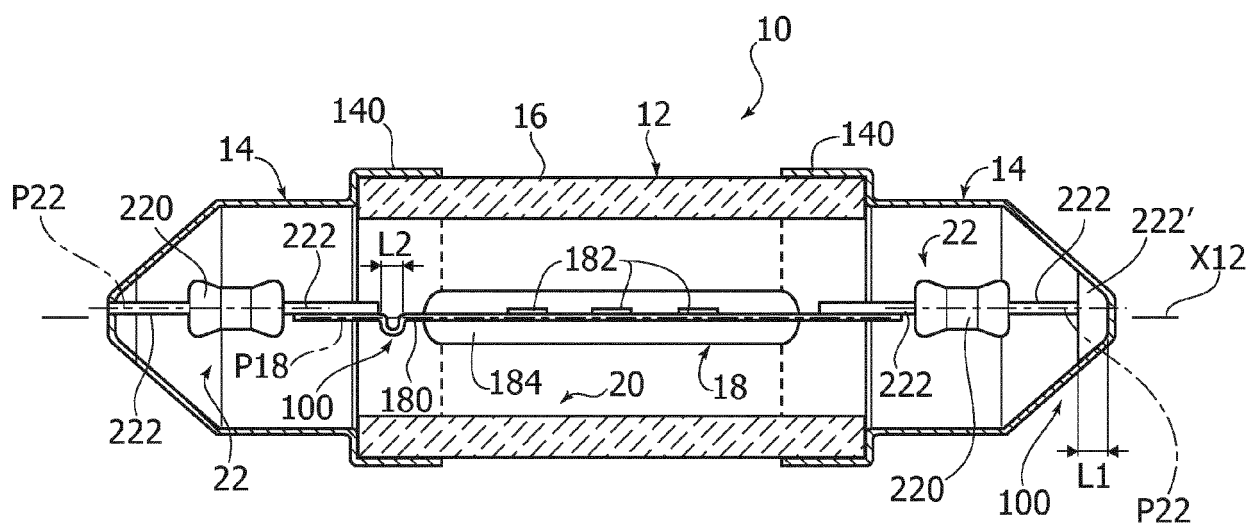
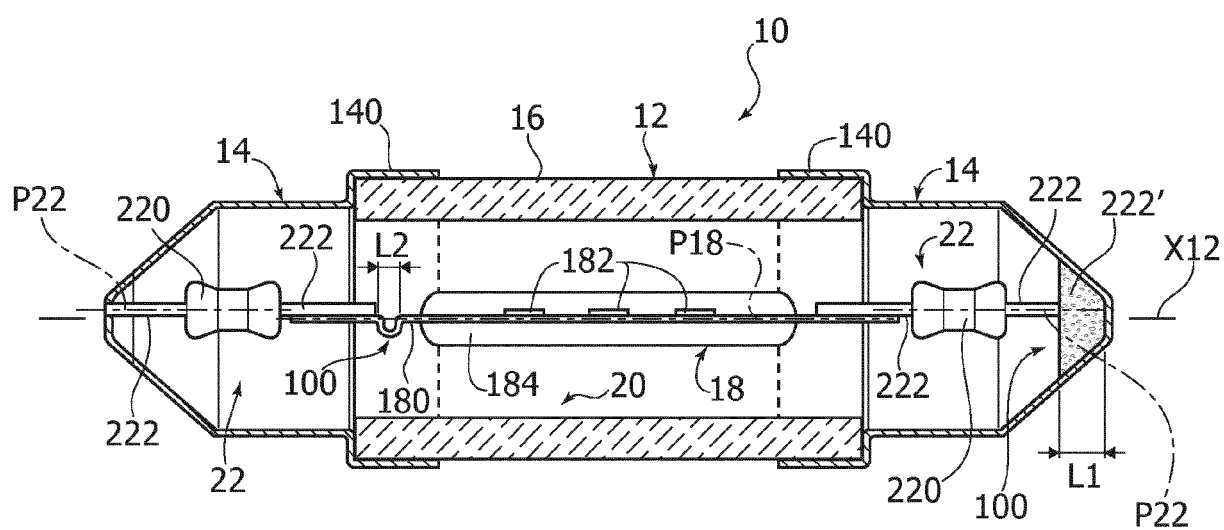


FIG. 10





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			F21K F21Y F21S B60Q
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 28 January 2021	Examiner Demirel, Mehmet
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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