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(71) Applicant: **Castfutura S.p.A.**
20123 Milano (IT)

(72) Inventor: **Offredi, Giorgio**
I-23851, Galbiate (LC) (IT)

(74) Representative: **Karaghiosoff, Giorgio Alessandro**
Studio Karaghiosoff e Frizzi S.r.l.
Via F. Baracca 1R 4° piano
17100 Savona (IT)

(54) **System for fastening igniters of boilers or the like**

(57) System for fastening igniters (4) for boilers or the like, comprising a bracket or a fastening plate (1) with an hole housing the ceramic body (104) of the igniter (4), which housing hole axially projects for a certain length at least from one side of the bracket (1) beyond the thickness thereof such to form a cylindrical housing (5) for the ceramic body (104) of the igniter (4), a cylindrical tightening ring (8) being provided having such internal and external radial dimensions that it can be inserted by forcing it between the inner wall of the cylindrical housing (5) of the bracket (1) and the external wall of the ceramic body (104) of the igniter (4) such to generate a predetermined radial tightening force of the igniter (4) inside the cylindrical housing (5) of the bracket (1). According to the invention, the cylindrical housing (5) of the bracket has a shell wall which is at least internally broached, while at least on one side of the bracket (1) elastic sealing means are provided cooperating at least with the cylindrical housing and the tightening ring and/or the shell surface of the portion of the ceramic body projecting beyond said cylindrical housing and such to obtain a tight seal between one side and the other one of the bracket.

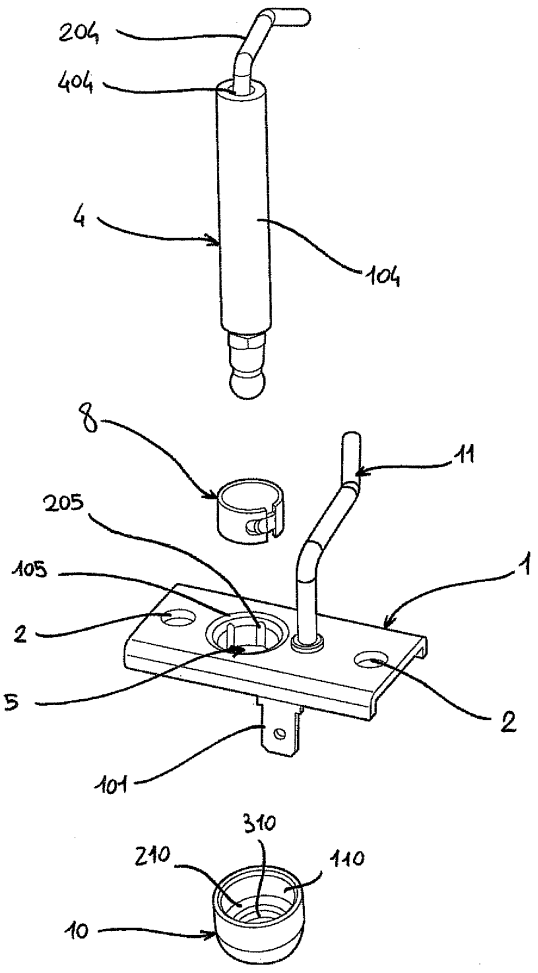

Fig. 1

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Description

[0001] The present invention relates to a system for fastening igniters of boilers, burners, hot plates, or the like, comprising a fastening plate or bracket having an hole housing the ceramic body of the igniter.

[0002] Many different kinds of above brackets are known. Each one acts for keeping an igniter in a predetermined position useful for generating ignition sparks for liquid or gaseous fuels. On the contrary another type of igniter acts for indicating the presence of the flame. Said igniters generally comprise a coating ceramic member with an elongated, generally cylindrical shape, for heat and electric insulation, wherein a metal conducting member is included projecting outside thereof on both ends. The electric conductor is connected to one end, while at the opposite end the spark is generated. The igniter has to be firmly supported in a specific position, particularly at a predetermined distance and constant over time from the earth member. Moreover, when condensing boilers have been introduced wherein the furnace is under a pressure slightly higher than the atmospheric pressure, it has become essential for the igniter to be fastened on the bracket such that a perfect pneumatic pressure-tight seal occurs between the bracket and the ceramic insulator, that is between one side and the opposite side of the bracket. In fact, if the fastening system is not a tight seal one, a vapor draft can come out of the furnace spreading in the environment that sometimes is the home environment. Systems known at present do not meet one or both said requirements in a satisfying manner. In fact, systems based on making cuts all around the housing hole in order to push the metal material of the bracket inwardly the hole against the ceramic wall of the igniter or based on making permanent deformations in the area about the hole which are pushed against the ceramic wall do not guarantee the seal effect, as well as in many cases the tightening force may be too strong and such to crack or break the ceramic. Moreover it is difficult to guarantee the perfect orthogonality between the bracket and the igniter due to the little contact surface between the bracket and the ceramic body of the igniter. The type of brackets providing on the bracket itself at the hole housing the igniter a cylindrical member with an axial extension greater than the bracket thickness, and a further cylindrical member like an axially open ring that is fitted on the ceramic body of the igniter and axially forced inside the cylindrical member such to be elastically deformed inwardly and to tighten the igniter body, does not guarantee the pressure-tight seal. On the other hand, the drawback of manufacturing a shaped ceramic body is a limit in positioning the igniter on the bracket. The system with threaded igniter body and fastening screw provides a long assembling and sometimes it is difficult due to overall dimensions of burner components or due to the location inside furnace cavities in locations difficult to be reached or where working areas are small. Moreover it is necessary to provide a great number of components, at least a tightening monkey spanner, and it is necessary to consider the high cost of threading bodies or bushings. Fastening systems by means of clamps of various type lead to a little safe and strong fastening.

[0003] EP 1 747 402 describes a system according to what disclosed hereinbefore wherein the hole housing the igniter axially projects for a certain length at least from one side of the bracket beyond the thickness thereof such to form a cylindrical housing for the ceramic body of the igniter. A cylindrical tightening ring is further provided having such internal and external radial dimensions that it can be inserted by forcing it between the inner wall of the cylindrical housing of the bracket and the external wall of the ceramic body of the igniter such to generate a predetermined radial tightening force of the igniter inside the cylindrical housing of the bracket and such to obtain a tight seal between one side and the other one of the bracket.

[0004] The locking coupling provides that when the ring is pressed between the inner edge of the hole housing the igniter and the external wall of the igniter, a partial deformation is obtained with an expansion of the housing hole in the bracket and a partial deformation with the radial compression of the ring.

[0005] The relation between the deformation of the bracket hole with an expansion thereof and of the ring with a compression thereof depends on the fact whether materials of the bracket and ring are the same or different one with respect to the other or anyway whether they have the same or different deformability.

[0006] The inside diameter of the hole housing the igniter has a such size with respect to the external diameter of the igniter that the difference of the diameter is slightly lower than the ring thickness.

[0007] The ring particularly is a member for compensating and recovering the tightening radial pressure that eventually exceeds a predetermined pressure value for properly tightening the igniter inside the cylindrical housing of the bracket and such to avoid the breaking or the cracking of the ceramic body and cooperating with the broached cylindrical housing having such function too.

[0008] On the insertion side advantageously the ring has a conical reduction or taper allowing it to be fitted between the inner edge of the hole of the cylindrical housing and the external surface of the igniter in a position ready for the axial force compression in the final position locking the igniter in the bracket hole.

[0009] Even if in said system the provision of a sort of cylindrical glass housing the igniter allows the igniter and the bracket surface to be perfectly orthogonal one with the other, while the use of a tightening ring made of metal material that can be deformed lead to work in a precise way without exceeding the compression force that the ceramic can support, guaranteeing the maximum axial positioning freedom of the igniter on the bracket, and a firm and safe fastening, the seal effect is not completely guaranteed, since tightening deformations of the glass and of the ring can casually lead to leakage cracks. More-

over, even if the risk of damaging the ceramic body of the igniter when it is tightened against the glass and the ring has been reduced, such event is not completely improbable.

[0010] Therefore the present invention aims at overcoming all the above drawbacks, and by simple and inexpensive means at manufacturing an improved fastening system of the type disclosed hereinbefore allowing the igniter to be easily, quickly, inexpensively and firmly fastened over time on the bracket in a specific position and with a perfect orthogonal arrangement with respect to the two faces of the bracket, using a very small amount of components. Moreover it is desired for the igniter to be fastened on the bracket with a pressure-tight seal effect, such to allow it to be used even with condensing boilers.

[0011] The invention achieves the above aims by means of a fastening system of the type described hereinbefore wherein the hole housing the igniter axially projects for a certain length at least from one side of the bracket beyond the thickness thereof such to form a cylindrical housing for the ceramic body of the igniter. It is further provided a cylindrical tightening ring having such internal and external radial dimensions that it can be inserted by forcing it between the inner wall of the cylindrical housing of the bracket and the external wall of the ceramic body of the igniter such to generate a predetermined radial tightening force of the igniter inside the cylindrical housing of the bracket and wherein, the cylindrical housing of the bracket has a shell wall which is at least internally broached, while at least on one side of the bracket elastic sealing means are provided cooperating at least with the cylindrical housing and the tightening ring and/or the shell surface of the portion of the ceramic body projecting beyond said cylindrical housing and such to obtain a tight seal between one side and the other one of the bracket.

[0012] According to a first preferred embodiment, at least on one side of the bracket elastic sealing means an elastic bushing or an elastic cap with a central through hole is provided that is intended to be tightly engaged outwardly to the portion of the cylindrical housing projecting from at least a side of the bracket and against the shell surface of the portion of the ceramic body projecting beyond said cylindrical housing and such to obtain a tight seal between one side and the other one of the bracket.

[0013] The broach is composed of an inner crown of axial grooves spaced apart at an angle and at which the thickness of the wall of the cylindrical housing is smaller than the thickness of the axial wall bands dividing grooves.

[0014] At broaches, i.e. at grooves the wall thickness becomes smaller from about 10% to 80% of the maximum wall thickness of the glass member.

[0015] According to a preferred embodiment the thickness of the wall at broaches or grooves is 3/10 the maximum thickness of the wall of the glass member.

[0016] The bracket and the ring are made of metal material in order to guarantee the igniter to have a constant position over time. While any metal materials can be used, metal materials having a good thermal resistance are preferred, with reference to the wear thereof due to thermal stress.

[0017] Metal materials of the bracket and of the ring can be the same or different one with respect to the other. In the case of different metal materials it is advantageous to provide two metal materials whose difference in thermoelectric potential is negligible. That for avoiding electric corrosion situations and eddy current overlapping situations that can affect the proper operation of the igniter.

[0018] The locking coupling provides that when the ring is pressed between the inner edge of the hole housing the igniter and the external wall of the igniter, a partial deformation is obtained with an expansion of the housing hole in the bracket and a partial deformation is obtained with a radial compression of the ring.

[0019] The relation between the deformation of the bracket hole with an expansion thereof and of the ring with a compression thereof depends on the fact whether materials of the bracket and of the ring are the same or different one with respect to the other or anyway whether they have the same or a different deformability.

[0020] The inside diameter of the hole housing the igniter has such a size with respect to the external diameter of the igniter that the difference in diameter is slightly lower than the ring thickness.

[0021] The ring and the cylindrical broached housing particularly are a member for compensating and recovering the tightening radial pressure that eventually exceeds a predetermined pressure value for properly tightening the igniter inside the cylindrical housing of the bracket and such to prevent the ceramic body from being broken or cracked.

[0022] The broach, i.e. grooves making the wall of the ring thinner act as preference deformation members by which possible local peaks of tightening forces are absorbed that otherwise could be released on the ceramic body of the igniter causing it to be locally damaged or broken.

[0023] As regards the manufacturing process the broach can be easily made during the process for manufacturing the bracket for example and preferably by cutting and forming a sheet plate.

[0024] As regards the ring, it can be of any type.

[0025] The fact of making the ring with brass and the bracket with a different material such as steel, stainless steel, or the like allows at least the bracket to be made of a material that is less expensive and that can be processed or formed by a shearing process. The fastening obtained is also a good one. However the combination of the two different materials leads to a thermoelectric potential that cannot be absolutely ignored and leads to the arise of deterioration cases due to said difference in potential.

[0026] By the present invention, advantages of the known fastening system are guaranteed and moreover

a safe, adjustable, repeatable protection of the ceramic body of the igniter against potentially damaging and destructive deformations is generated and the seal effect is safely and repeatably guaranteed, i.e. without risks of an undesired and not predictable or verifiable generation of leakage slots.

[0027] According to an advantageous embodiment both the bracket, i.e. at least the cylindrical housing and the tightening ring are made of steel or stainless steel. As already denoted above the use of the same material for the bracket and the ring guarantees that a difference in thermoelectric potential is not generated whose micro currents can cause oxidation and corrosion cases over time. If the ceramic material has through cracks, it is possible to have also micro currents cases generated by bracket- ring and electrode members with respect to the earth, that in the case of flame detection electrodes, can be considered as a current of the signal denoting the presence of the flame even when the flame burns out with the valve controlling the gas flow supplying the burner going on in the open condition. In this case unburnt gas can came out from the boiler that can cause dangerous explosions. In the simple case of an ignition electrode, the latter could not properly operate.

[0028] Even in this case the housing hole axially projects for a certain length at least from one side of the bracket beyond the thickness thereof such to form a cylindrical housing for the ceramic body of the igniter, but the tightening ring is made of a material, particularly metal, with a low ductility or deformability, particularly it is made of the same material as the bracket, particularly steel, stainless steel or the like.

[0029] Steel, and particularly stainless steel have an optimum resistance to thermal stresses and are a relatively inexpensive material. Moreover, they allow structural parts to be manufactured by simply shearing them from a continuous sheet, thereby the manufacturing cost of the finished piece is generally very low, and manufacturing processes have a high efficiency.

[0030] In spite of the low deformability with respect to metals having a greater ductility, such as brass the ring may be shaped such to have one or more areas for compensating and recovering the tightening radial pressure that eventually exceeds a predetermined pressure value that can be supported by the ceramic.

[0031] More specifically, the tightening ring may have one or more openings for releasing and recovering the radial deformation of the ring when the igniter is tightened inside the cylindrical housing of the bracket.

[0032] In this case, the ring at a first head edge of two facing head edges of a strip that is bent and closed on itself in a cylindrical shape has a reclined U-shaped hooking recess respectively with the two side arms of the U shape parallel one to the other and extending perpendicularly to the axis of the ring, while the second head edge has a U-shaped projection whose shape, orientation and dimensions correspond to the U-shaped recess on the first head edge such that the projection can penetrate and slide inside the recess when the tightening ring is radially widened or narrowed.

[0033] Moreover particularly the U-shaped projection can have a length smaller than the recess in a direction parallel to lateral arms perpendicular to the axis of the tightening ring.

[0034] According to a variant embodiment, the recess on the first head edge becomes narrower as regards its dimension in the axial direction of the ring at the corresponding head edge of the strip forming the ring and which recess is a hooking seat that cooperates with a hooking protrusion that is composed of the projection on the second head edge and whose shape is complementary to the hooking seat and it has a material portion for the connection to the corresponding head side of the bent strip forming the ring with an axial dimension smaller than the remaining part of said hooking protrusion. Said hooking recess or seat and the cooperating hooking protrusion are complementary means for mutually fastening facing head sides of the bent strip, that is they are means for closing the ring.

[0035] The hooking recess and protrusion of the tightening ring may be provided in substantially intermediate positions of respective straight portions of head sides of the strip forming the ring, which straight portions are connected to said recess and said protrusion in a rounded way.

[0036] According to a possible improvement, the tightening ring may have at least one, preferably a plurality of notches originating from the two opposite circular head edges of the ring and extending only for a portion of the axial extension of the ring, such to guarantee the pressure-tight seal by the ring itself.

[0037] Said notches may have all the same lengthways extension. Particularly said extension may range from about a third to about an half of the axial extension of the ring.

[0038] Particularly and advantageously notches have such an axial length to delimit an intermediate continuous annular band of the ring having a very small axial dimension and such that it can be easily deformed. Generally such intermediate, continuous, annular band has an axial dimension of some millimeters and more precisely ranging from 1 to 3 mm.

[0039] Said notches can be arranged alternately one with respect to the other, that is each notch can originate from a circular head edge of the tightening ring opposite to the circular head edge from which the immediately adjacent notch originates.

[0040] This embodiment allows the low ductility and the low compressibility of the ring material to be compensated and at the same time it guarantees a seal effect by itself since it generates no axial continuous through slots, which seal effect can be improved by assembling the elastic sealing bushing or the elastic sealing cap.

[0041] Again according to an improvement, the projection closing the tightening ring may have a root with a narrow shape projecting in the substantially circumfer-

ential direction of the ring with a substantially circular widened part, while the corresponding recess placed on the opposite end of the tightening ring may have a shape substantially complementary to the one of said projection.

[0042] Advantageously, the hooking recess and the corresponding hooking protrusion of the tightening ring have complementary shapes but dimensions of the hooking recess are slightly smaller than the hooking protrusion ones and they can be secured one inside the other by forcing them, causing the ring to be firmly closed.

[0043] Due to the arrangements considered in said second embodiment of the invention, if required, it is possible to manufacture the ring with the same material as the bracket guaranteeing the possibility of recovering the tightening radial deformation. The ring is simple to be made, for example by shearing it and then closing it on itself. The provision of the recess and of the projection in the circumferential direction and which circumferentially slidably engage together makes the ring more strong and stout and firm when it is compressed inside the bracket and it avoids also axial movements staggering the two head edges of the ring at the opening cut thereof.

[0044] The structural manufacturing of the ring by means of a metal material strip that is sheared from a continuous metal material sheet allows to have a quick and inexpensive manufacturing method and allowing considerable performances to be obtained. Moreover the material of the ring has no problems inducing thermoelectric phenomena, and it can be used for different insulator diameters. The ring may be manufactured in order to consider different situations and inevitable manufacturing allowances. The assembling is very simple even as regards an industrial automation.

[0045] According to an alternative embodiment of the present invention in addition or in place of the elastic bushing or the elastic cap tightly engaged outwardly to the portion of the cylindrical housing projecting from at least one side of the bracket and against the shell surface of the portion of the ceramic body projecting beyond said cylindrical housing, the tight seal between one side and the other of the bracket is obtained by means of a sealing sheet of elastomeric material provided between the radially outer surface of the tightening ring and the internal surface of the said cylindrical housing having such an elastic behavior and such thickness dimensions that the said sheet is compressed between the said tightening ring and the inner surface of the housing so to fill the notches of the broached internal surface of the cylindrical housing and providing a sealing between the two sides of the bracket.

[0046] In a first embodiment, the sealing sheet of elastomeric is in the form of a layer of said elastomeric material covering the radially outer surface of the tightening ring, i.e. the surface of the ring facing the broached internal surface of the cylindrical housing.

[0047] The said layer of elastomeric material can be applied to the surface of the tightening ring by means of different techniques and particularly by overprinting.

[0048] As a further embodiment the tightening ring can be provided with a layer of sealing elastomeric material also on its inner surface or all over its surface.

[0049] In a second embodiment the said sealing sheet of elastomeric material is in the forma of a cylindrical bushing having such an inner diameter and such an outer diameter that it fits on the radially outer surface of the tightening ring and inside the cylindrical housing and in the mounted condition the said sealing bushing is pressed between the said tightening ring and the said cylindrical housing in such a way that the notches of the broached surface are filled with the compressed elastomeric material of the said sealing bushing and a sealing is provided between the bracket, the tightening ring and the ceramic body.

[0050] According to a further variant a second sealing bushing can be provided between the inner surface of the tightening ring and the shell of the ceramic body.

[0051] The above mentioned alternative embodiments can of course be provided also in combination with a sealing bushing or sealing cap of the kind engaging the outer surface of the cylindrical housing and the shell of the part of the ceramic body projecting beyond said cylindrical housing.

[0052] Any kind of elastomeric material either natural or synthetic can be used which features are such as to be compatible with the ambient in which it is used in the present bracket.

[0053] Particularly suitable elastomeric materials are fluoroelastomers (FKM) such as the ones known as viton or similar or Perfluoroelastomer (FFKM) which are well known in the art.

[0054] The invention relates also to a bracket or plate for fastening igniters of boilers or the like, which shows one or more of the above mentioned combination of features either alternatively or in combination.

[0055] The invention also relates to a method for making a bracket or plate for fastening igniters of boilers or the like. In the more general embodiment of the said method the bracket has a hole housing the ceramic body of the igniter, which housing hole axially projects for a certain length at least from one side of the bracket beyond the thickness thereof such to form a cylindrical housing for the ceramic body of the igniter and said cylindrical housing being provided with a broach at least on the inner side and said bracket being made by a single shearing and molding process.

[0056] Further characteristics and improvements will form the subject of the dependent claims.

[0057] Characteristics of the invention and advantages deriving there from will be more clear from the following detailed description of the annexed drawings, in which:

- fig. 1 is a perspective exploded view of an igniter fastened on a bracket according to the present invention by a first embodiment of the tightening ring.

- fig.2 is an enlarged view of details of the tightening ring and of the cylindrical housing for the igniter.
- fig.3 is a top perspective view of the exploded assembly of fig.1 in the assembled condition
- fig.4 is a bottom perspective view of the exploded assembly of fig.1 in the assembled condition,
- fig.5 is a front view of the assembly of figs. 1 to 4;
- fig.6 is a side view of the assembly of figs 1 to 4,
- fig.7 is a bottom plan view of the assembly of figs. 1 to 4,
- fig.8 is a perspective view of a variant embodiment of the tightening ring.
- fig. 9 is a side, partial cross-sectional view of the tightening ring according to figure 8.
- fig.10 is a plan view of the tightening ring according to figures 8 and 9, in the deployed condition.
- figure 11 shows a view similar to the one of figure 1 of a first variant of an alternative embodiment of the present invention in which the sealing between the tightening ring and the cylindrical housing is obtained by a sealing sheet of elastomeric material compressed between the said tightening ring and the broached inner surface of the cylindrical housing and in which the said sheet is a layer of elastomeric material overprinted on the tightening ring.
- figure 12 illustrates similarly to figure 11 a further variant of the said alternative embodiment in which the sealing sheet of elastomeric material is a sealing bushing of elastomeric material interposed between the inner surface of the cylindrical housing and the external surface of the tightening ring.

[0058] Referring to figures, the bracket 1 comprises a substantially flat annular plate-like part connected to a remaining part of the bracket 1, which has holes 2 for the passage of screws fastening the bracket 1 on the boiler. The bracket 1 further comprises an hole for housing the igniter 4, which hole has a shape complementary to the external section of the igniter 4 that generally has a cylindrical shape. The igniter 4 is composed of a cylindrical ceramic body 104 provided with an axial hole 404 inside which there is provided a metal electrode 204. With the electrode 204 being fastened inside the hole 404 of the ceramic body 104, said electrode 204 projects to a predetermined extent from both ends thereof. A projecting end has such a shape that it can be connected to an electric conductor, for example by means of a Faston type connector or the like, while the opposite end projects from the ceramic body 104 to a greater extent and, in the shown embodiment, it is bent at an angle such that, with the igniter 4 applied on the boiler, it is at a predetermined distance from the earth member for generating the ignition spark. Concerning this, although the present invention is shown in combination with an igniter 4, it is to be noted that it can be advantageously applied even for fastening igniters detecting the presence of flame, or the like. The cylindrical hole 5 for housing the igniter 4 axially extends for a certain length on a side of the bracket 1 beyond the thickness thereof towards the ignition end of the igniter 4 such to form a cylindrical housing 5 for the ceramic body 104 of the igniter 4. However, in a different embodiment, it is possible for the cylindrical housing 5 to be faced in the opposite direction or in both directions.

[0059] The cylindrical housing 5 has a broach therein. Particularly this is made of a crown of notches 205 made in the thickness of the wall of the cylindrical housing 5 and said thickness is decreased to a predetermined extent by means of them.

[0060] The decrease in thickness with respect to the greatest one of axial bands dividing notches can change depending on the type of metal and on the deformation force required for circumferentially stretching or compressing said notches 205. The latter act for reducing the thickness of the wall of the cylindrical housing 5 such that said notches or the broach form predetermined deformation areas for compensating or absorbing peaks of deformation forces that otherwise would be released on the ceramic body 104 of the igniter 4 damaging it or leading to breaks.

[0061] The inside diameter of the cylindrical housing 5 is greater than the external diameter of the ceramic body 104, a first embodiment of the cylindrical tightening ring 8 being provided with such internal and external radial dimensions that it can be inserted by forcing it between the internal wall of the cylindrical housing 5 of the bracket 1 and the external wall of the ceramic body 104 of the igniter 4 such to provide a predetermined radial tightening force of the igniter 4 inside the cylindrical housing 5 of the bracket 1.

[0062] The pressure-tight seal between the combustion environment and the external environment is guaranteed by the presence of a sealing cap or bushing 10 with an hole. The seal cap or bushing 10 are made of an elastic material, such as rubber or a plastic material whose elasticity is similar to the rubber and the through hole has a first cylindrical end portion 110 having a diameter and tapering by a conical portion 210 to the diameter of a second cylindrical portion 310 at the opposite end, the diameter of the first cylindrical portion 110 having such a size that it can be engaged by elastically forcing it on the cylindrical housing 5, while the smaller diameter of the second cylindrical portion is such that it is engaged by forcing it against the body 104 of the igniter 4 thus generating a removable tight seal that can be easily mounted and removed and which is made of an inexpensive structural part.

[0063] The plate-like bracket 1 has a earth member 11 having such a shape, that when the igniter is in the proper tightening position, the two ends of the conductor 204 of the igniter and of the earth electrode 11 are spaced apart such that the ignition spark can be generated. The earth electrode is mechanically fastened to the bracket and in such a way to generate an electric contact between it and said electrode, while the bracket 1 has a protrusion 101 having such a shape to make a contact for connecting a conductor for the earth connection or for the con-

nection to a predetermined potential of the bracket and so of the earth electrode.

[0064] Due to the fact that the cylindrical housing 5 has a certain axial extension and it is perpendicular to the surface of the bracket 1, the perfect orthogonality is guaranteed between the igniter 4 and the surface of the bracket 1. In order to facilitate the insertion of the tightening ring 8 inside the cylindrical housing 5, the circular edge of the cylindrical housing 5 that is coplanar to one of the two faces of the bracket 1 has an entrance flare 105. On the other hand, one or both the circular head ends of the cylindrical tightening ring 8 has a beveled or rounded edge 608 for facilitating the insertion of the tightening ring 8 inside the cylindrical housing 5 of the bracket 1

[0065] Particularly when the tightening ring is made of the same material as the bracket 1, generally steel, in order to satisfy particular situations wherein the presence of two different metals, that of the ring 8 and that of the bracket 1, the above drawbacks can occur, such as eddy currents or the like, said tightening ring 8 is preferably made as an open ring.

[0066] In this case the tightening ring 8 is made by shearing and winding in a cylindrical shape a strip of metal material and therefore it has an opening cut that is rectilinear and parallel to the central axis of the ring 8. Both for allowing the ring to be closed, that is the connection of the two faced end edges of the material strip and for guaranteeing also a firm axial positioning of the two ends of the ring at the cut, at the same time allowing the ring to be radially narrowed and/or widened and so allowing the two ends of the ring to have a certain relative circumferential sliding at the cut, an head side on one end of the material strip forming the tightening ring 8 placed at the opening cut has a recess 208, while the head side of the opposite end has an projection intended to be engaged into said recess 208 for closing the tightening ring 8 on itself. The recess 208 and the projection 308 closing the tightening ring 8 are provided in positions that are substantially intermediate in the respective straight portions of the head sides of ends of the ring 8, and said recess 208 and said projection 308 are connected to said straight portions in a rounded way.

[0067] In a first variant embodiment, the recess 208 and the projection 308 closing the tightening ring 8 have a reclined U-shape , with the two straight arms being oriented parallel one with the other and being oriented circumferentially, i.e. perpendicularly to the axis of the ring.

[0068] The projection 308 and the recess 208 advantageously have substantially the same dimension in the axial direction, i.e. have the same width, while as regards the lengthwise extension, i.e. the circumferential extension of the projection or protrusion 308 can be smaller than the recess 208, such to allow it to axially slide in the narrowing direction however even with the ring 8 in the expanded condition said protrusion or projection 308 being engaged within the recess 208.

[0069] A not shown variant can provide two or more protrusions or projections 308 along the opening cut of the ring each one being associated to a corresponding recess 208 on the other end.

[0070] According to a further variant embodiment, in figures 8 to 10, the projection 308 closing the tightening ring 8 has a narrow-shaped root 408 extending in the substantially circumferential direction of the ring 8 with a widened portion having a substantially circular shape, while the corresponding recess 208 placed on the opposite end of the tightening ring 8 has a shape that is substantially complementary to the one of said projection 308. However, the size of the projection 308 is slightly greater than that of the hooking recess 208. Due to this arrangement, the projection 308 engages by forcing it into the recess 208, firmly mechanically connecting the two facing head ends of the strip forming the ring and generating also a seal adhesion of perimetral edges of the hooking recess with the hooking projection.

[0071] The arrangement disclosed above regarding the hooking member and the recess with widened head and the rounded shape facilitates the generation of contact areas between the edge of the recess and the edge of the projection that constitute sealing areas and therefore avoiding the passage of gas, thus, in the assembled condition, the fastening system according to this embodiment allows to have at least partial sealing conditions for gases which become definitive and sure by means of the provision of the sealing bushing or cap 10.

[0072] The sealing effect is particularly important when the above system is used in condensing boilers.

[0073] The manufacturing of the open ring in turn allows it to be manufactured by shearing the material strip from a continuous material coil.

[0074] Again according to a variant embodiment that can be provided as an alternative or in combination to the preceding ones and which is particularly advantageous with a tightening ring 8 made of a material that can be substantially little deformed and having a greater resistance to the deformation, provides said tightening ring 8 to be provided with a plurality of notches 108 originating from the two opposite circular head edges of the ring 8 and extending for about a third and about an half of the axial extension of the ring 8. Said notches 108 are arranged alternately one with respect to the other, that is each notch 108 originates from a circular head edge of the tightening ring 8 opposite to the circular head edge from which the immediately adjacent notch 108 originates and a continuous intermediate annular band is formed there between having a very small dimension in the axial direction of the ring particularly ranging from 1 to 3 mm.

[0075] When the extension of notches in the axial direction of the ring is a half of the total axial extension of the ring, it is also possible that no intermediate continuous annular band is formed. During the insertion by forcing the ring 8 inside the cylindrical housing 5, said notches 108 become progressively narrower in a progressive way starting from the closed ends thereof in the direction of the open ends thereof such to compensate and recover

the tightening radial pressure that eventually exceeds a predetermined pressure value for properly tightening the igniter 4 inside the cylindrical housing 5 of the bracket 1, and such to avoid cracking or even the breaking of the ceramic body 104.

[0076] Obviously, the invention is not limited to the embodiments described and illustrated herein but may be greatly varied, especially as regards construction, without departing from the guiding principle disclosed above and claimed below.

[0077] Thus for example the shape of the broach 205 of the housing 5 for the igniter 4 can be made both on the inner and external side and can have a different shape. Moreover always remaining within the guiding principle, the ring can have different shapes in order to allow the deformability and the elasticity when the material used is not so much elastic or it is easy to be deformed. That for example can be represented by the two edges of the opening cut of the ring or partial cuts that can be made with different shapes while still having the same function.

[0078] According to an alternative embodiment of the present invention which is illustrated in figures 11 and 12, in addition or in place of the elastic bushing or the elastic cap which are shown in the figures 1 to 10 and which are tightly engaged outwardly to the portion of the cylindrical housing projecting from at least one side of the bracket and against the shell surface of the portion of the ceramic body projecting beyond said cylindrical housing, the tight seal between one side and the other of the bracket is obtained by means of a sealing sheet 15 of elastomeric material provided between the radially outer surface of the tightening ring 8 and the internal surface of the said cylindrical housing 5. The elastomeric material has such an elastic behavior and the sheet made thereof has such a thickness that the said sheet 15 is compressed between the said tightening ring and the inner surface of the housing so to fill the notches 205 of the broached internal surface of the cylindrical housing 5 and to provide a sealing between the two sides of the bracket 1.

[0079] In a first embodiment illustrated in figure 11, the sealing sheet of elastomeric is in the form of a layer of said elastomeric material covering the radially outer surface of the tightening ring 8, i.e. the surface of the ring 8 facing the broached inner surface of the cylindrical housing 5.

[0080] The said layer of elastomeric material can be applied to the surface of the tightening ring 8 by means of different techniques and particularly by overprinting.

[0081] As a further embodiment the tightening ring 8 can be provided with a layer of sealing elastomeric material also on its inner surface or all over.

[0082] In a second embodiment illustrated in figure 12 the said sealing sheet of elastomeric material is in the forma of a cylindrical bushing indicated also by 15 having such an inner diameter and such an outer diameter that it fits on the radially outer surface of the tightening ring 8 and inside the cylindrical housing 5.

[0083] In the mounted condition the said sealing bushing 15 is pressed between the said tightening ring 8 and the said cylindrical housing 5 in such a way that the notches 205 of the broached surface of the said cylindrical housing are filled with the compressed elastomeric material of the said sealing bushing 15 and a sealing is provided between the said cylindrical housing, the tightening ring and the ceramic body which separates the two sides of the bracket one from the other.

[0084] According to a further variant (not illustrated) a second sealing bushing can be provided between the inner surface of the tightening ring and the shell of the ceramic body.

[0085] The above mentioned alternative embodiments can of course be provided also in combination with a sealing bushing or sealing cap of the kind engaging the outer surface of the cylindrical housing and the shell of the part of the ceramic body projecting beyond said cylindrical housing as disclosed and described in relating to figures 1 to 10 and also in combination only with the features of the cylindrical housing and or of the tightening ring.

[0086] Any kind of elastomeric material, either natural or synthetic, can be used. Obviously the features of the said materials must be such as to be compatible with the ambient in which the material is used in the present bracket.

[0087] Particularly suitable elastomeric materials are fluoroelastomers (FKM) such as the ones known as viton or similar or Perfluoroelastomer (FFKM) which are well known in the art.

Claims

1. System for fastening igniters (4) for boilers or the like, comprising a bracket or a fastening plate (1) with an hole housing the ceramic body (104) of the igniter (4), which housing hole axially projects for a certain length at least from one side of the bracket (1) beyond the thickness thereof such to form a cylindrical housing (5) for the ceramic body (104) of the igniter (4), a cylindrical tightening ring (8) being provided having such internal and external radial dimensions that it can be inserted by forcing it between the inner wall of the cylindrical housing (5) of the bracket (1) and the external wall of the ceramic body (104) of the igniter (4) such to generate a predetermined radial tightening force of the igniter (4) inside the cylindrical housing (5) of the bracket (1), **characterized in that** the cylindrical housing (5) of the bracket has a shell wall which is at least internally broached, while at least on one side of the bracket (1) elastic sealing means are provided cooperating at least with the cylindrical housing and the tightening ring and/or the shell surface of the portion of the ceramic body projecting beyond said cylindrical hous-

ing and such to obtain a tight seal between one side and the other one of the bracket.

2. System according to claim 1, **characterized in that** the said elastic sealing means are formed by an elastic sealing bushing or an elastic sealing cap (10) with a central through hole is provided and that is intended to be tightly engaged outwardly to the portion of the cylindrical housing (5) projecting from at least a side of the bracket and against the shell surface of the portion of the ceramic body (104) of the igniter (4) projecting beyond said cylindrical housing (5) and such to obtain a tight seal between one side and the other one of the bracket (1).

3. System according to claim 1 or 2, **characterized in that** the broach is composed of an inner crown of axial grooves (205) spaced apart at an angle and where the thickness of the wall of the glass-like housing is smaller than the thickness of axial wall bands dividing grooves (205).

4. System according to claim 3, **characterized in that** at broaches, i.e. at grooves (205) the wall thickness becomes smaller from about 10% to about 80% of the maximum wall thickness of the cylindrical housing (5) and preferably said thickness of the wall at broaches or grooves is 3/10 of the maximum thickness of the wall of the cylindrical housing (5).

5. System according to one or more of the preceding claims, **characterized in that** the circular edge of the cylindrical housing (5) for the igniter (4) that is coplanar to one of the two faces of the bracket (1) has an entrance flare (105) in order to facilitate the insertion of the tightening ring (8) inside said cylindrical housing (5).

6. System according to one or more of the preceding claims, **characterized in that** the circular end of the tightening ring (8) faced in the insertion direction into the cylindrical housing (5) has a beveled or rounded edge for facilitating the insertion of the tightening ring (8) inside the cylindrical housing (5) of the bracket (1).

7. System according to one or more of the preceding claims, **characterized in that** the tightening ring (8) is made of a material, particularly metal, having a high resistance to deformability, particularly it is made of the same material as the bracket (1), and it is shaped such to have one or more areas (108, 208) for compensating and recovering the radial tightening pressure that eventually exceeds a predetermined pressure value for properly tightening the igniter (4) inside the cylindrical housing (5) of the bracket (1).

8. System according to one or more of the preceding claims, **characterized in that** the tightening ring (8) has one or more openings (108, 208) for releasing and recovering the radial deformation of the ring (8) when the igniter (4) is tightened inside the cylindrical housing (5) of the bracket (1).

9. System according to one or more of the preceding claims, **characterized in that** the tightening ring (8), at its annular intermediate band, has at least one opening (9) or slot for releasing and recovering the radial narrowing occurring in said annular intermediate band when the igniter (4) is tightened inside the cylindrical housing (5) of the bracket (1).

10. System according to one or more of the preceding claims, **characterized in that** the tightening ring (8) is of the open type.

11. System according to claim 10, **characterized in that** the tightening ring (8) at a first head edge of two facing head edges of a strip that is bent and closed on itself in a cylindrical shape has a reclined U-shaped hooking recess (208) respectively with the two side arms of the U shape parallel one to the other and extending perpendicularly to the axis of the ring (8), while the second head edge has a U-shaped projection (308) whose shape, orientation and dimensions correspond to the U-shaped recess on the first head edge such that the projection can penetrate and slide inside the recess when the tightening ring is radially widened or narrowed.

12. System according to claim 11, **characterized in that** the U-shaped projection (308) has a length smaller than the U-shaped recess (208) in a direction parallel to lateral arms perpendicular to the axis of the tightening ring (8).

13. System according to claim 11, **characterized in that** the tightening ring (8) has means for mutually fastening the two facing ends at the opening cut by forcing them, the recess and the projection (208, 308) having such dimensions to be engaged by forcing one within the other one generating mutual contact perimetral surfaces forming a seal closure for the opening cut of the ring (8).

14. System according to claim 13, **characterized in that** the hooking recess (208) and projection (308) of the tightening ring (8) are provided in substantially intermediate positions of the respective straight end portions of the ring (8), said recess and said projection being connected in a rounded way with such straight portions.

15. System according to claim 13 or 14, **characterized in that** the hooking projection (308)

of the tightening ring (8) has a narrow shape root (408) projecting in the substantially circumferential direction of the ring (8) with a substantially circular widened part, while the corresponding hooking recess (208) on the opposite end of the tightening ring (8) has a shape that is substantially complementary to the one of said projection (308).

16. System according to one or more of the preceding claims, **characterized in that** the tightening ring (8) has at least one, preferably a plurality of notches (108) originating from the two opposite circular head edges of the ring (8) and extending only for a portion of the axial extension of the ring (8).

17. System according to one or more of the preceding claims, **characterized in that** said notches (108) are arranged alternately one with respect to the other, that is each notch (108) originates from a circular head edge of the tightening ring (8) opposite to the circular head edge from which the immediately adjacent notch (108) originates.

18. System according to claim 1 or to one or more of the preceding claims 3 to 17 for fastening igniters (4) for boilers or the like, comprising a bracket or a fastening plate (1) with an hole housing the ceramic body (104) of the igniter (4), which housing hole axially projects for a certain length at least from one side of the bracket (1) beyond the thickness thereof such to form a cylindrical housing (5) for the ceramic body (104) of the igniter (4), a cylindrical tightening ring (8) being provided having such internal and external radial dimensions that it can be inserted by forcing it between the inner wall of the cylindrical housing (5) of the bracket (1) and the external wall of the ceramic body (104) of the igniter (4) such to generate a predetermined radial tightening force of the igniter (4) inside the cylindrical housing (5) of the bracket (1), **characterized in that** the cylindrical housing (5) of the bracket has a shell wall which is at least internally broached, while a sealing sheet of elastomeric material is provided between the radially outer surface of the tightening ring and the internal surface of the said cylindrical housing having such an elastic behaviour and such thickness dimensions that the said sheet is compressed between the said tightening ring and the inner surface of the housing so to fill the notches of the broached internal surface of the cylindrical housing and providing a sealing between the two sides of the bracket when it is forced inside the said cylindrical housing (5) together with the tightening ring (8) and the ceramic body (104).

19. System according to claim 18, **characterized in that** the sealing sheet of elastomeric is in the form of a layer of said elastomeric material covering at least the radially outer surface of the tightening ring (8), i.e. the surface of the ring facing the broached internal surface of the cylindrical housing.

20. System according to claim 18, **characterized in that** the said sealing sheet of elastomeric material is in the forma of a cylindrical bushing having such an inner diameter and such an outer diameter that it fits on the radially outer surface of the tightening ring and inside the cylindrical housing and in the mounted condition the said sealing bushing is pressed between the said tightening ring and the said cylindrical housing in such a way that the notches of the broached surface are filled with the compressed elastomeric material of the said sealing bushing and a sealing is provided between the bracket, the tightening ring and the ceramic body.

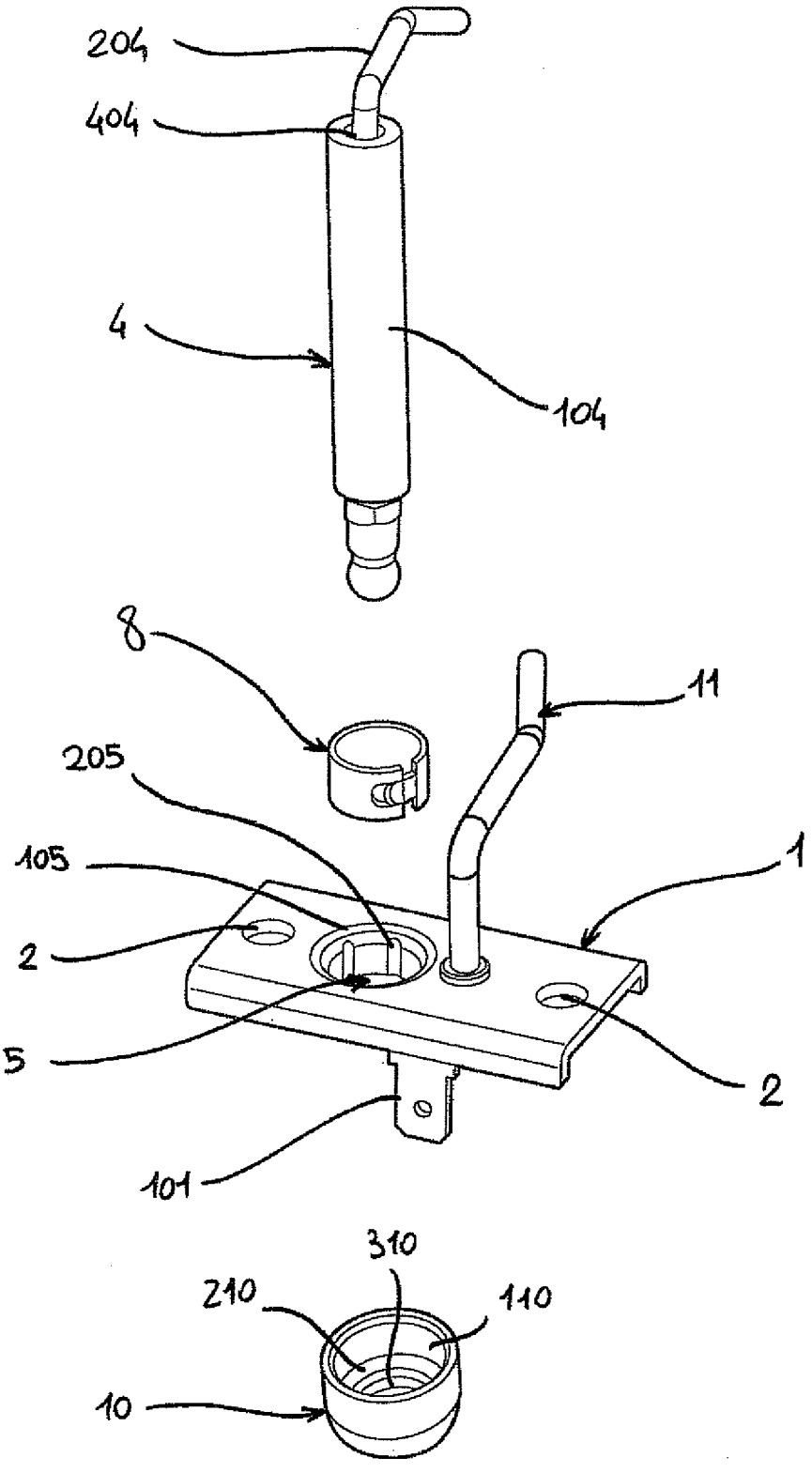

Fig. 1

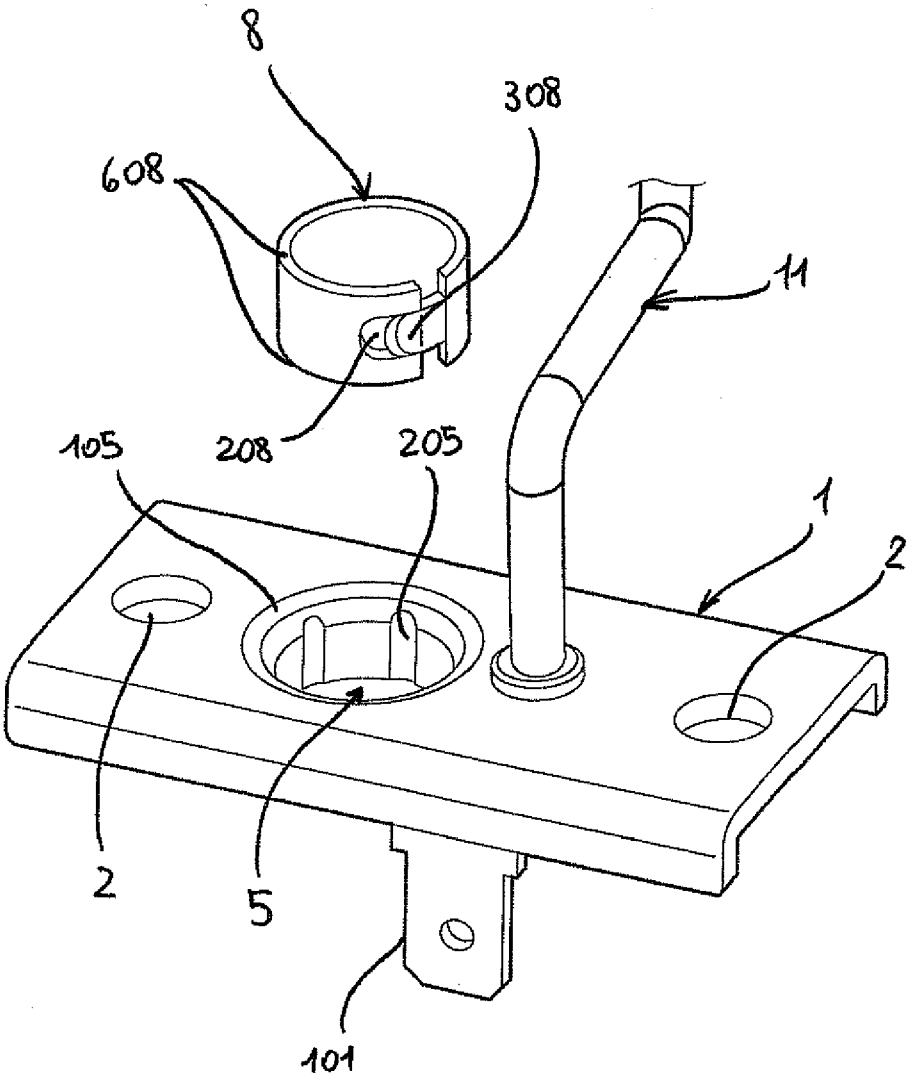

Fig. 2

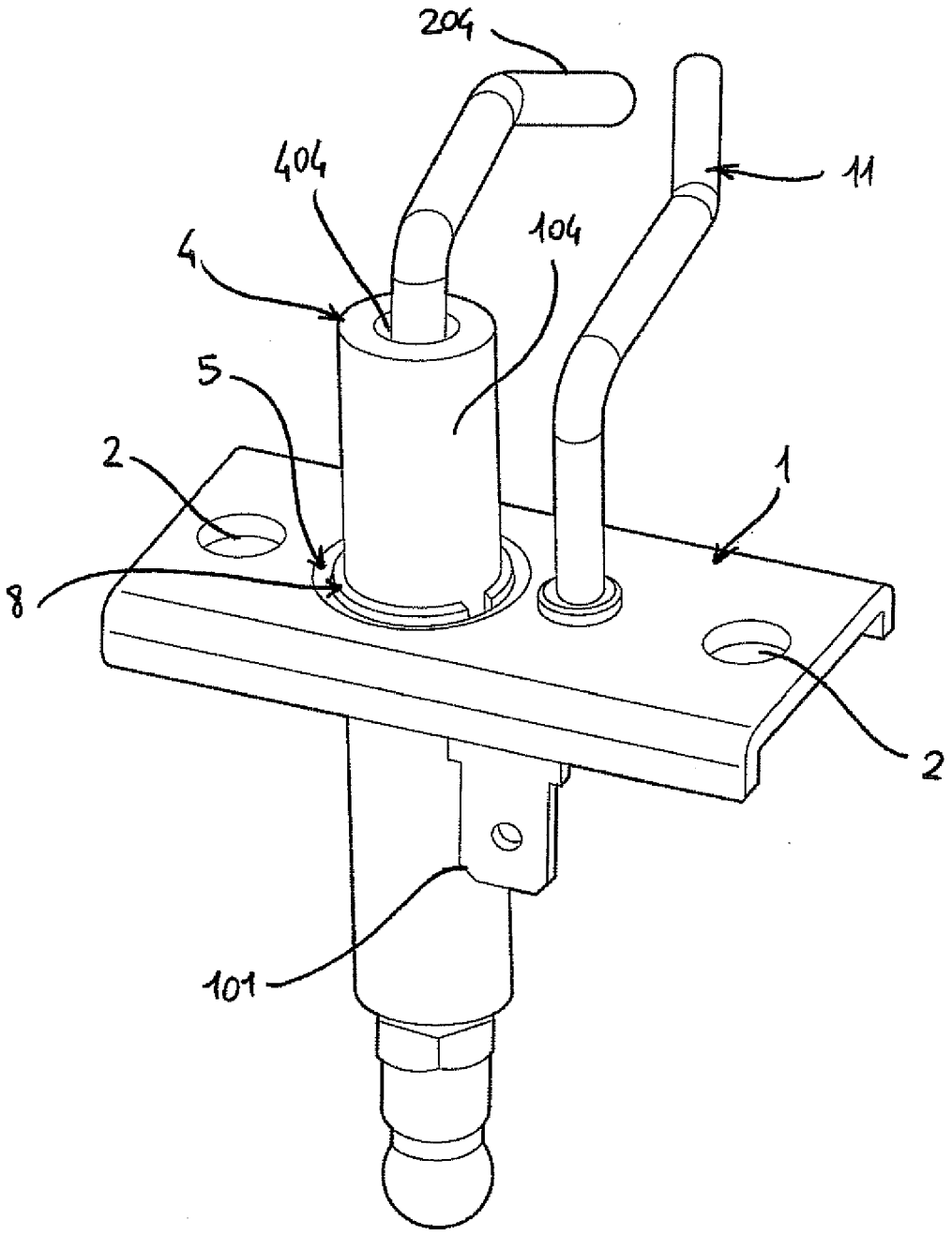

Fig. 3

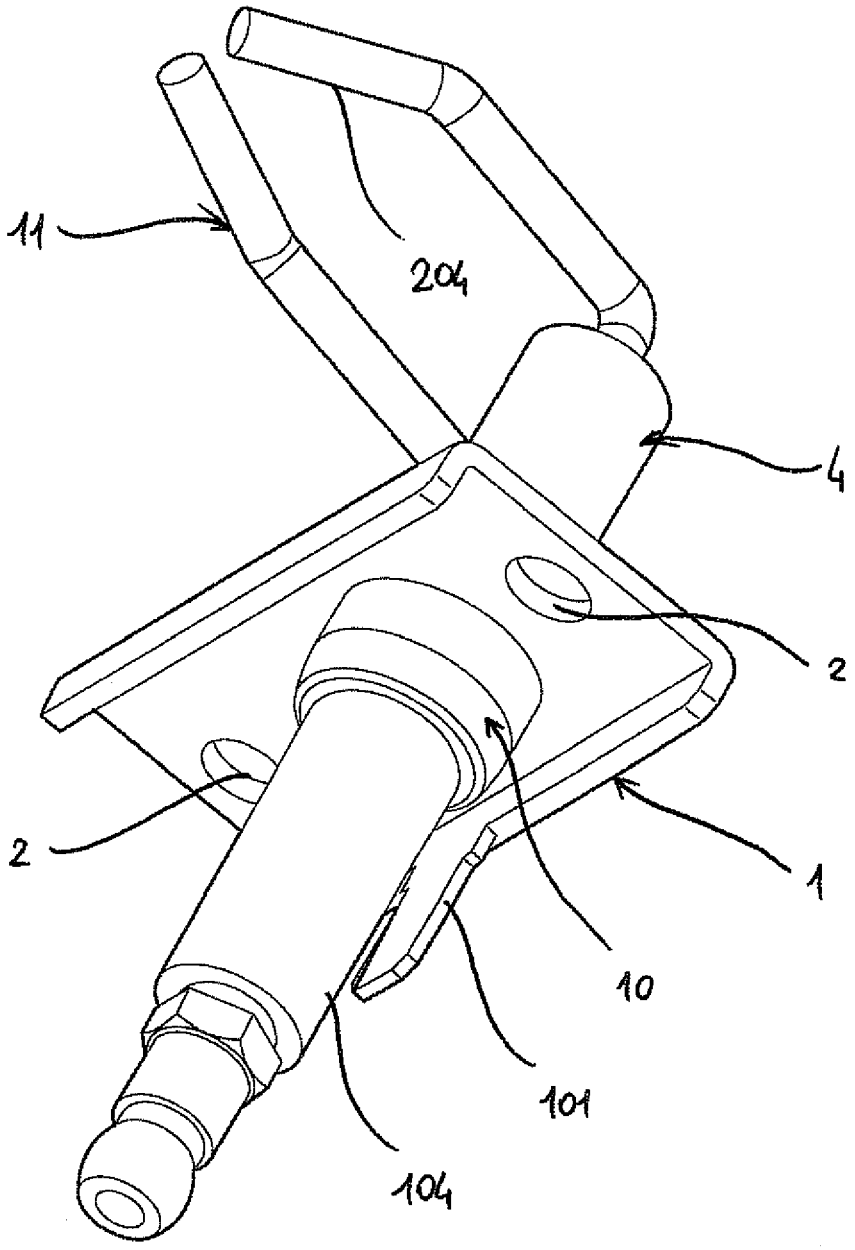

Fig. 4

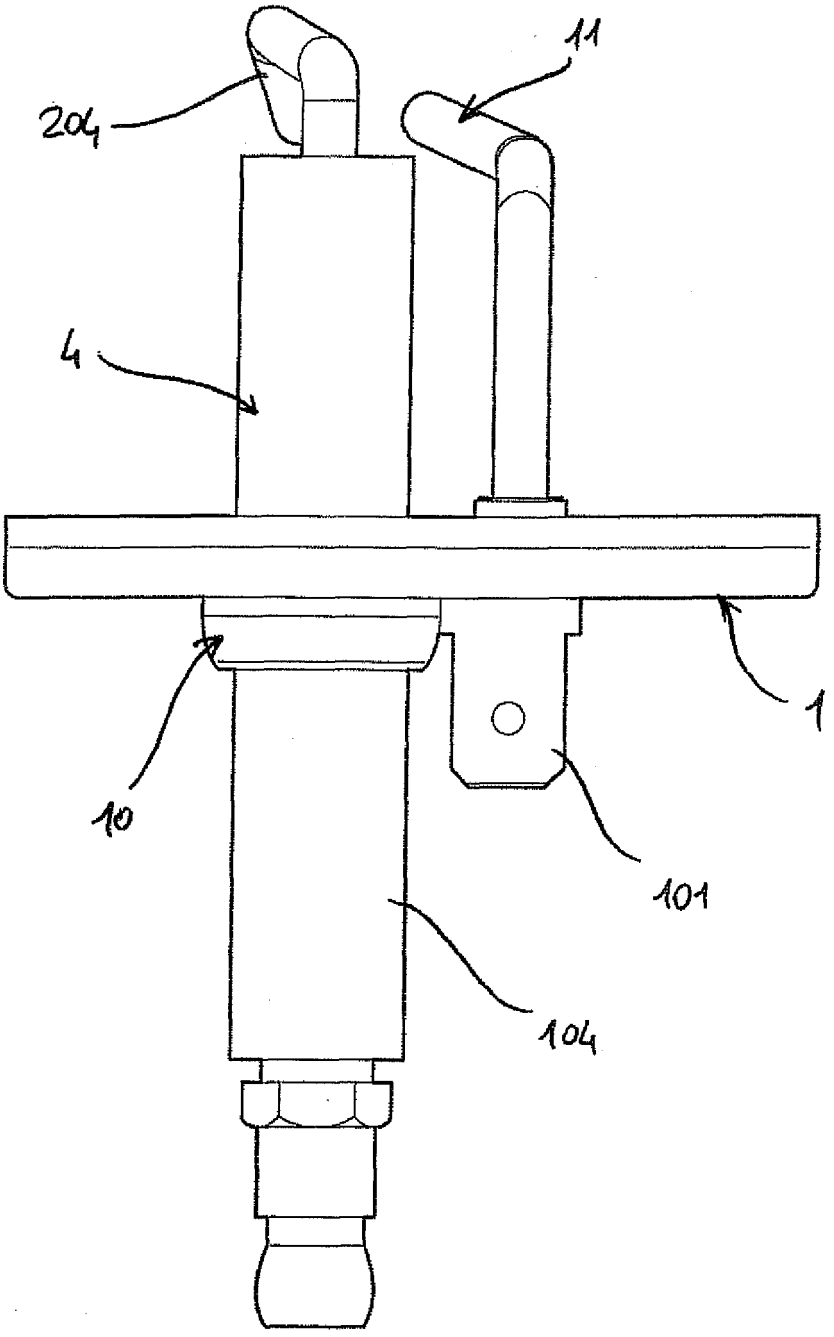

Fig. 5

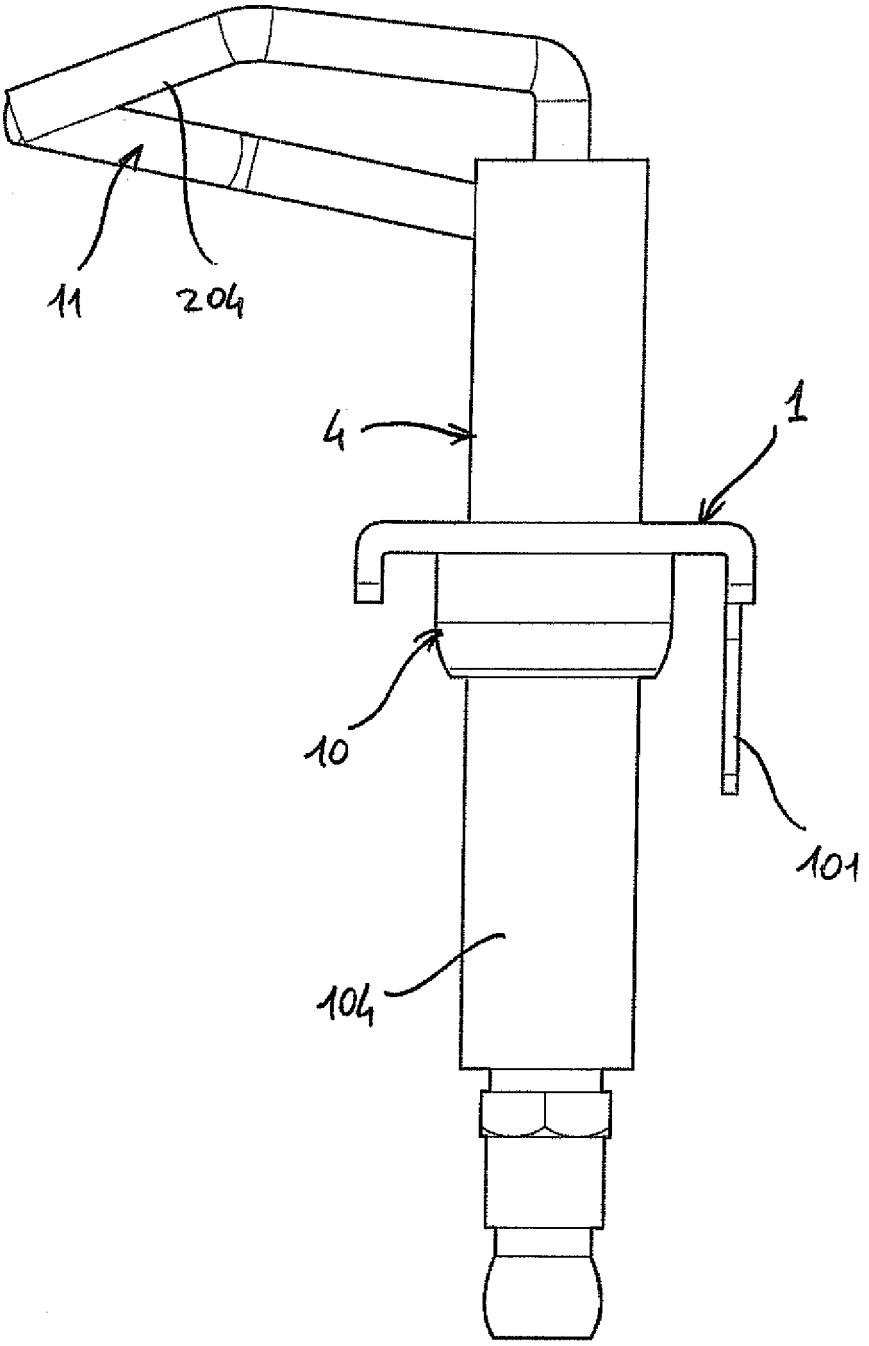

Fig. 6

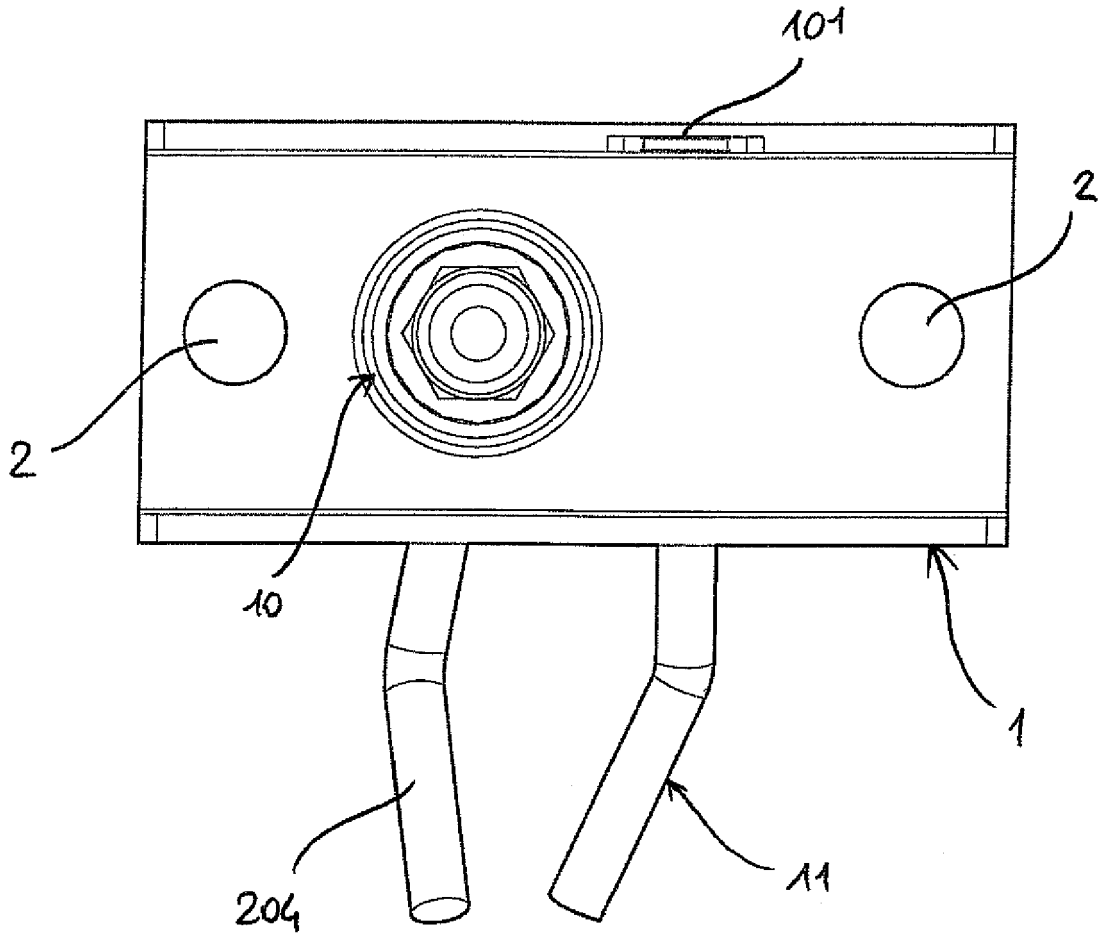

Fig. 7

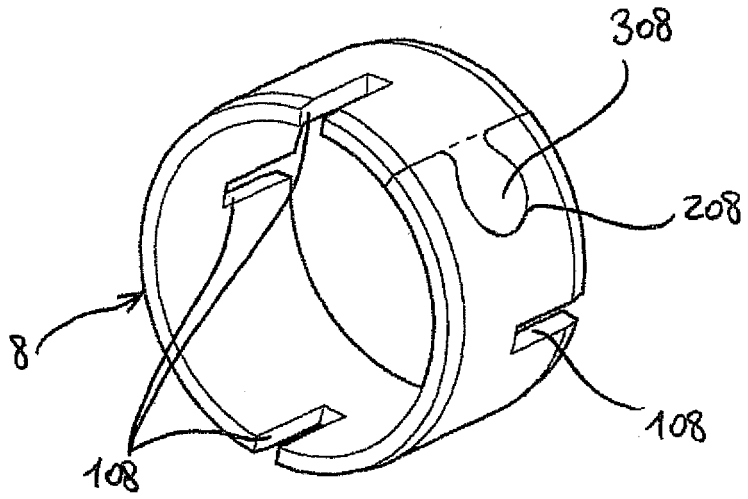

Fig. 8

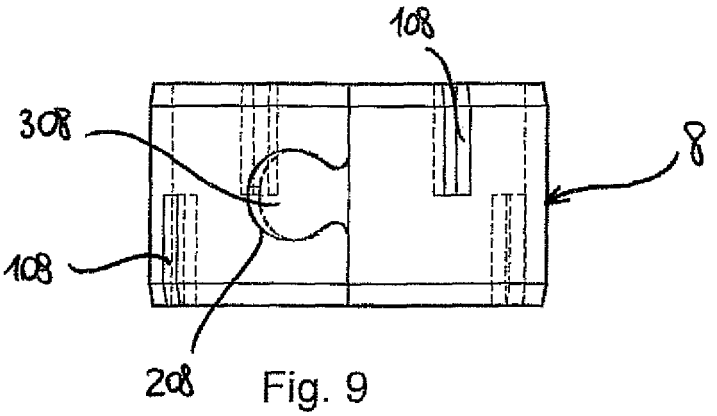

Fig. 9

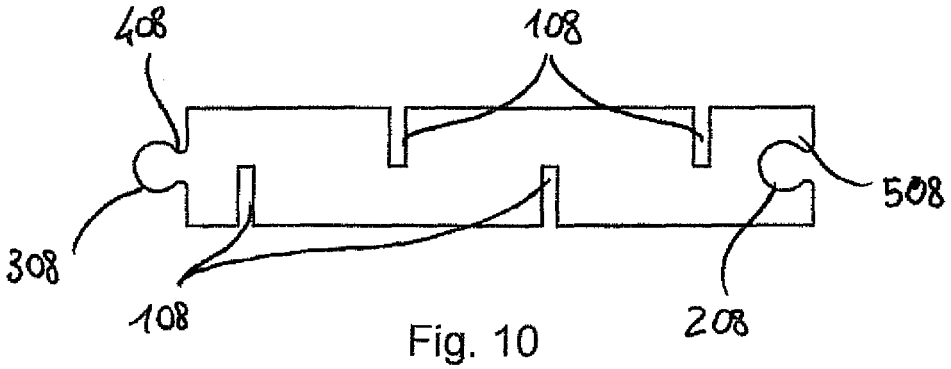

Fig. 10

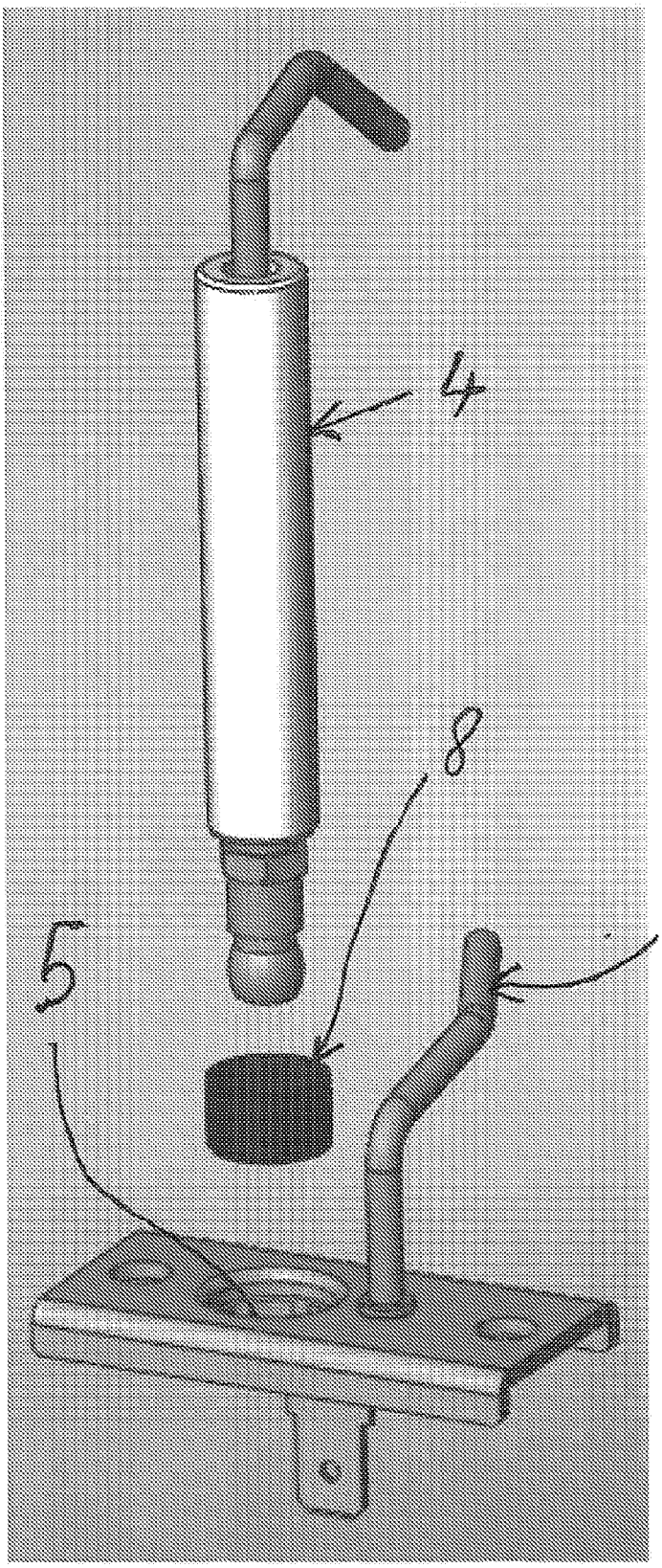

Fig. 11

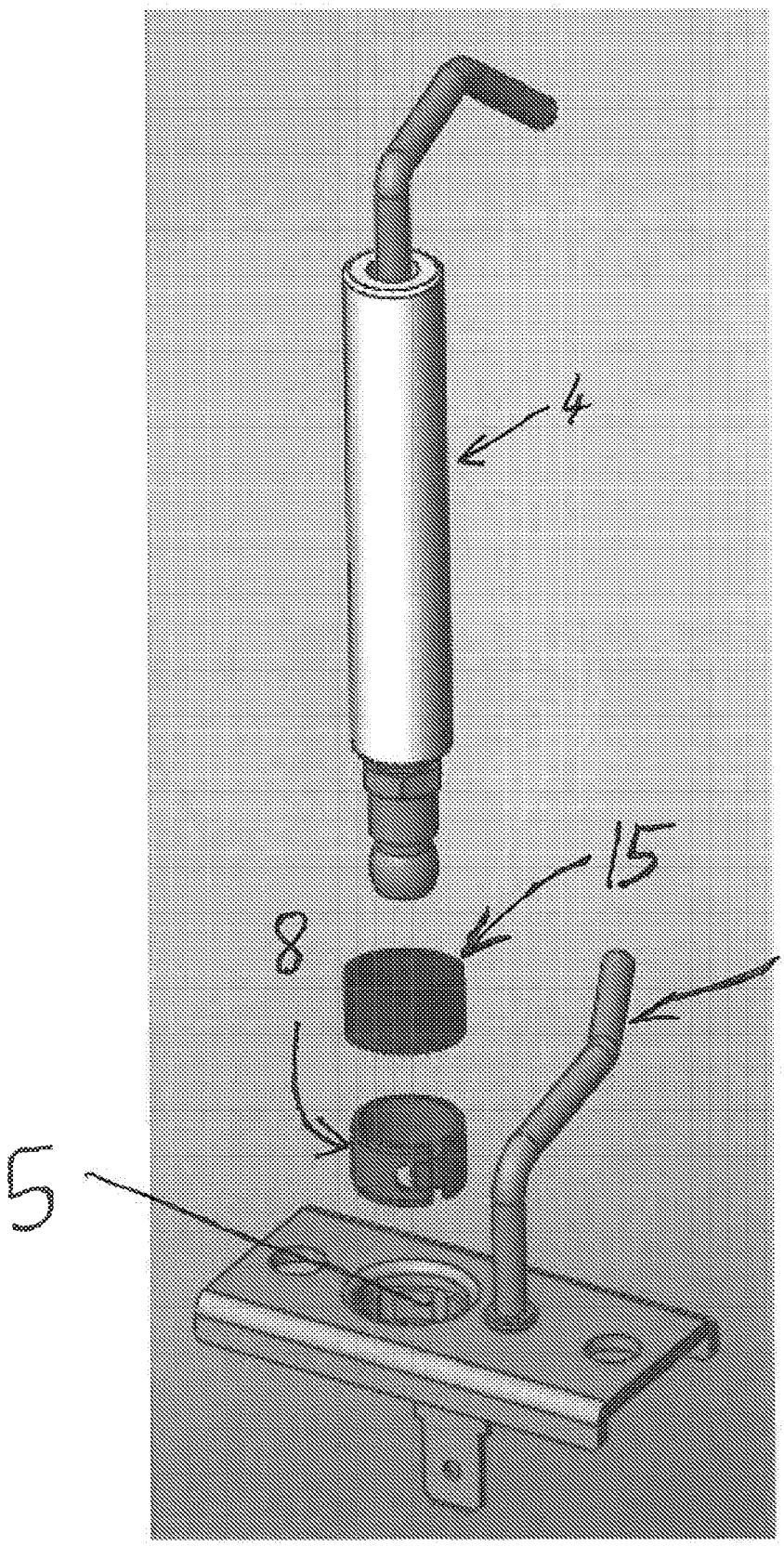

Fig. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 10 15 1162

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2005/111500 A2 (CAST S P A [IT]; OFFREDI GIORGIO [IT]) 24 November 2005 (2005-11-24) * figures 8-10, 12-14 *	1-20	INV. F23Q3/00
A	FR 2 834 049 A1 (SAPCO [FR]) 27 June 2003 (2003-06-27) * page 6, line 20 - page 7, line 28; figures 2-5 *	1-20	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 April 2010	Verdoodt, Luk

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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1

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