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(54) **Electric igniter for boiler or the like, and method of manufacturing said igniter**

(57) The present invention relates to a method for fixing igniters for boilers or the like, which method includes insertion of said igniter into a hole for receiving the ceramic body of the igniter, which receiving hole is formed in a wall or fixing plate and is of such a size as to form a gap area of predetermined size between the outer surface of said ceramic body of the igniter and the inner surface of said receiving hole, when the igniter is inserted in the hole, means for fixing and sealing the igniter to said fixing plate being provided in said gap area.

Said fixing and sealing means consist of a glassy material that is previously converted to the liquid or semi-liquid phase to ensure mechanical adhesion and/or physico-chemical bonding to the outer surface of said ceramic body of the igniter and the inner surface of said receiving hole and later converted to the solid phase.

The present invention further relates to a device obtained by said method.

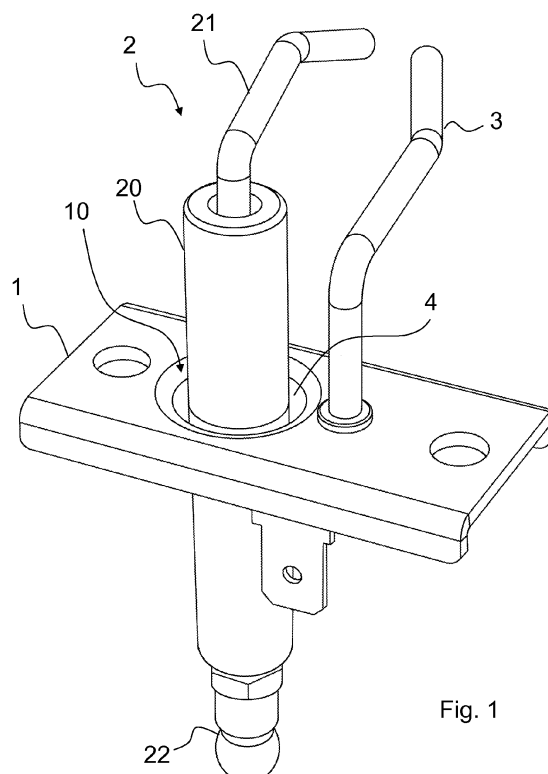


Fig. 1

Description

[0001] The present invention relates to an electric igniter according to the preamble of claim 1.

[0002] In prior art igniters, the electric conductor is fixed in the hole by gluing. Particular shapes of the hole and the conductor may be designed for mechanically securing the conductor to the ceramic body, against any angular displacement of said conductor relative to said ceramic body.

[0003] The present invention aims at obtaining the fixing of the electrode in the ceramic body.

[0004] The invention solves the above mentioned problem with an igniter according to the preamble of claim 1, further comprising the characterizing part of claim 1.

[0005] Claims 2 to 7 describe alternative and/or preferred embodiment of the above mentioned general scope of the invention.

[0006] The present invention relates also to a method of manufacturing said igniter, whose steps are described in claim 8.

[0007] The present invention relates also to a method for fixing igniters for boilers or the like, according to the preamble of claim 9.

[0008] The present invention further relates to a device obtained by said method, according to the preamble of claim 21.

[0009] The method and device of the present invention are meant for use with condensing boilers but may be also employed with other types of boilers, furnaces or the like.

[0010] In prior art solutions for fixing igniters for boilers or the like, the ceramic insulating body of the igniter is retained in a metal plate, particularly in a receiving hole formed therein, by means of various insulators such as fixing rings, resins of various origins or by riveting the metal part over the ceramic part.

[0011] For example, in the case of fixing rings, a ring, typically made of metal, is interposed between the surface of the ceramic body of the igniter and the inner surface of the receiving hole, which ring is deformed by compression, to fit both the surface of the ceramic body of the igniter and the inner surface of the receiving hole, thereby fixing the igniter to the metal plate.

[0012] This will also afford fluid tightness, and prevent flue gases and/or condensed liquids from leaking out of the boiler.

[0013] This fixing arrangement suffers from apparent drawbacks, mainly in that the mechanical forces exerted thereby might cause the igniter to be displaced from its operating position or generate local pressure peaks that would lead to failure of the ceramic insulator.

[0014] On the other hand, if higher tolerances are introduced to avoid the risk of failure, the ring may not perfectly adhere to the walls upon deformation, thereby failing to ensure a sealing action or, in worse cases, adequate fixation, i.e. providing loose fixation when the radial forces that act upon the igniter are not strong enough to

ensure it is held in position.

[0015] All the above prior art solutions involve additional costs, as they require checks on the dielectric strength of the materials in use, pressure tightness checks and pull-out strength checks.

[0016] The present invention has the object of obviating the drawbacks of prior art solutions by providing a method and a device having the characteristics as defined above.

[0017] The invention fulfills the above objects by the provision that said fixing and sealing means consist of a glassy material that is previously converted to the liquid or semiliquid phase to ensure mechanical adhesion and/or physico-chemical bonding to the outer surface of said ceramic body of the igniter and the inner surface of said receiving hole and later converted to the solid phase.

[0018] This will reduce the probability of failure of the insulator, such as the fixing ring, to negligible levels, during both assembly and operation of the boiler.

[0019] Furthermore, this will ensure a higher mechanical resistance as compared with prior art solutions, eliminate any out-of-roundness problem, both in the receiving hole and the insulators, and obviate any need for excessive diameter tolerance, that might affect mechanical strength and pressure tightness.

[0020] All these advantages involve cost savings, both by preventing structural failure of the elements and requiring less maintenance, and by dramatically reducing the need for checks, such as dielectric strength, mechanical strength and pressure tightness checks.

[0021] Although three different materials are generally involved (a metal material for the plate, a ceramic material for the igniter and glass or the like as a fixing and sealing material), which undergo alternate heating and cooling steps, whereby their different thermal expansion and shrinkage coefficients would be expected to cause progressive degradation of both mechanical strength and fixation (due to the separation of the contact surfaces of said three materials), it was surprisingly experimentally found that the metal-glass-ceramic connection maintains its stability and thus ensures both mechanical strength and fixation.

[0022] More in detail, the method of the present invention comprises the steps of:

a) forming a hole for receiving the ceramic body of the igniter in a fixing plate, which receiving hole is of such a size and shape as to allow insertion of said igniter therein;

b) inserting said igniter into said receiving hole, thereby causing the creation of a gap area of predetermined size between the outer surface of said ceramic body of the igniter and the inner surface of said receiving hole;

c) filling said gap area with a glassy material in the liquid or semiliquid phase, or in the solid phase to be later converted into the liquid or semiliquid phase, so that once that said glassy material has reached

its liquid or semiliquid phase, it will stick with the outer surface of said ceramic body of the igniter, and the inner surface of said receiving hole;

d) converting said glassy material to the solid phase for fixing the igniter to said fixing plate and sealing it thereagainst.

[0023] The gap area created between the inner surface of the hole (hole edge) and the outer surface of the ceramic body of the igniter is preferably of annular shape, i.e. extends seamlessly around the ceramic body of the igniter and in the hole. The inner surface of the hole and/or the outer surface of the igniter may possibly have one or more teeth or axial ridges of any shape. These teeth or ridges may also be in form of annular crowns. Instead of or in combination with the above, the inner surface of the hole and/or the surface of the ceramic body of the igniter, at least in the area that coincides with the inner surface of the hole, may be knurled, i.e. with axial knurling, transverse knurling relative to the longitudinal axis and intersecting knurling, e.g. combinations of axial knurling and transverse knurling relative to axial knurling.

[0024] In a first embodiment, the glassy material is placed in the gap area in powder or granule form and later converted to the liquid or semiliquid phase by heating.

[0025] In an alternative embodiment, the glassy material is placed in said gap area as a plug nut, particularly in ring form, of such a size as to allow placement thereof both in the receiving hole and around said ceramic body of the igniter.

[0026] Once again, the glassy material is converted to the liquid or semiliquid phase by heating.

[0027] In a further alternative embodiment, the glassy material is already placed in the gap area in liquid or semiliquid form after a previous heating step.

[0028] The conversion from the liquid or semiliquid phase to the solid phase may generally occur by cooling, caused either by natural means or by cooling means.

[0029] The use of a glassy material in liquid or semiliquid form or locally converted to the liquid or semiliquid phase ensures optimized adhesion both to the walls of the receiving hole and to the ceramic body of the igniter.

[0030] In a further embodiment, the receiving hole has a larger size at the top surface of the fixing plate and a smaller size at the bottom surface thereof.

[0031] Thus, the distance between the surface of the ceramic body of the igniter and the inner surface of the receiving hole is reduced at the bottom surface of said fixing plate, to prevent the glassy material in the solid, liquid or semiliquid phase from leaking by gravity along the surface of the ceramic body of the igniter from said gap area.

[0032] Therefore, the gap area is narrowed at the bottom, where the inner surface of the receiving hole and the surface of the ceramic body of the igniter are in mutual contact, or are at a sufficiently reduced distance as to prevent the glassy material in powder form, in plug nut

or ring form or in liquid form from leaking by gravity along the surface of the ceramic body of the igniter.

[0033] According to another embodiment, a removable refractory element is placed below said receiving hole, to adhere both to the bottom side of the plate at least in the hole area, and to the surface of the ceramic body of the igniter.

[0034] Such removable refractory element is placed before filling the gap area with the glassy material, and has the considerable advantage of preventing the glassy material in solid, liquid or semiliquid form from leaking by gravity along the surface of the ceramic body of the igniter from said gap area.

[0035] Once the glassy material has bonded with the outer surface of said ceramic body of the igniter and the inner surface of said receiving hole and has been converted back to the solid phase, said removable refractory element is removed.

[0036] Said receiving hole and said gap area may be formed in the thickness of said fixing plate, otherwise said receiving hole may axially extend along a preset length beyond the thickness of the fixing plate, a raised or belled edge extending axially at least on one side of said fixing plate.

[0037] Such axial extension of the receiving hole by said raised edge allows the gap area to extend to a larger portion of the surface of the ceramic body of the igniter, thereby affording the advantage of ensuring a better grip of the glassy material on the igniter and thus more effective fixation.

[0038] In the solid phase, the glassy material may be clear and/or dyed.

[0039] In a preferred embodiment, the igniter is located at the center of the receiving hole.

[0040] Nevertheless in different embodiments, the igniter may be located in the receiving hole in an eccentric position.

[0041] In both cases, if the glassy material is clear, the gap may have such an axial width as to allow the glassy material area to provide a sufficient area for inspection, for at least part of its length.

[0042] This configuration is particularly advantageous, as it combines the mechanical benefits as described above and the additional advantage of allowing, for instance, flame detection in the boiler through the luminescence emitted through the glassy material.

[0043] This is particularly useful if the igniter is situated in an eccentric position, i.e. closer to one area of the inner surface of the receiving hole than to another area thereof, as this allows a wider surface of glassy material to be available in the area in which the igniter is farther from the inner surface of the receiving hole, for an even more accurate visual inspection of the interior of the boiler.

[0044] These and other features and advantages of the invention will be more apparent from the following description of a few embodiments shown in the accompanying drawings, in which:

Fig. 1 shows an embodiment of the fixing device of the present invention;

Fig. 2 is an exploded view of this embodiment, in which the glassy material is in ring form;

Fig. 3 is a bottom view of such embodiment;

Fig. 4 is a lateral cross sectional view of this embodiment;

Fig. 5 is a schematic lateral cross sectional view of the device of the present invention, in which a lower removable and refractory element is used for holding the glassy material in position before conversion thereof to the solid phase;

Fig. 6 is a schematic lateral cross sectional view of the device of the present invention, in which the ceramic body of the igniter has different diameters along the longitudinal axis of the igniter, and the receiving hole is narrowed at the bottom;

Fig. 7 is a view like that of Fig. 6, in which a removable refractory element is provided for lateral retention of the glassy material before conversion thereof to the solid phase;

Figs. 8, 9, 10 and 11 show different embodiments, differing in the shape of the receiving hole and/or arrangement of the igniter in said hole;

Figs. 12 to 14 show an entire axial sectional view and the details of the end sections of an igniter respectively, in which the principle of fixation of the ceramic body in the plate is employed for the fixation of the resistive conductor of the igniter in a through hole for receiving the ceramic body that exteriorly covers it.

[0045] Figure 1 shows an embodiment of the fixing device for igniters 2 of boilers or the like of the present invention, which device comprises a fixing plate 1 with a hole 10 for receiving the ceramic body 20 of the igniter 2.

[0046] The figure also shows the central electrode 21 of the igniter 2, the connecting terminal 22 of the igniter 2 and the ground electrode 3.

[0047] Said receiving hole 10 is of such a size that said igniter 2 may be inserted therein with a gap area of predetermined size being defined between the outer surface of said ceramic body 20 of the igniter 2 and the inner surface of said receiving hole 10.

[0048] Means are placed in said gap area for fixing and sealing the igniter 2 against said fixing plate 2, which means consist of a glassy material 4 that is previously converted to the liquid or semiliquid phase to ensure adhesion to the outer surface of said ceramic body 20 of the igniter 2 and the inner surface of said receiving hole 10 and later converted to the solid phase.

[0049] In a preferred embodiment, the fixing plate 1 is made of metal.

[0050] This device is obtained by the method of the present invention, which comprises the steps of:

a) forming a hole 10 for receiving the ceramic body 20 of the igniter 2 in a fixing plate 1, which receiving

hole 10 is of such a size and shape as to allow insertion of said igniter 2 therein;

b) inserting said igniter 2 into said receiving hole 10, thereby causing the creation of a gap area of predetermined size between the outer surface of said ceramic body 20 of the igniter 2 and the inner surface of said receiving hole 10;

c) filling said gap area with a glassy material 4 in the liquid or semiliquid phase, or in the solid phase to be later converted into the liquid or semiliquid phase, so that once that said glassy material 4 has reached its liquid or semiliquid phase, it will stick with the outer surface of said ceramic body 20 of the igniter 2, or the inner surface of said receiving hole 10;

d) converting said glassy material 4 to the solid phase for fixing the igniter 2 to said fixing plate 1 and sealing it thereagainst.

[0051] In a first embodiment, the glassy material 4 is placed in the gap area in powder or granule form and later converted to the liquid or semiliquid phase by heating.

[0052] In an alternative embodiment, the glassy material is already placed in the gap area in liquid or semiliquid form after a previous heating step.

[0053] In a further alternative embodiment, as shown in Figure 2, the glassy material 4 is placed in said gap area as a plug nut, particularly in ring form, of such a size as to allow placement thereof both in the receiving hole and around said ceramic body of the igniter.

[0054] Once again, the glassy material is converted to the liquid or semiliquid phase by heating.

[0055] Said receiving hole 10 and said gap area may be formed in the thickness of said fixing plate 1, as shown for instance in Figure 5, otherwise said receiving hole 10 may axially extend along a preset length beyond the thickness of the fixing plate 1, a raised edge 11 extending axially at least on one side of said fixing plate.

[0056] This is shown in Figure 3, i.e. a bottom view of the device, and in Figure 4, i.e. a lateral cross sectional view thereof.

[0057] In this embodiment, said raised edge 11 is formed on the bottom surface of the fixing plate 1.

[0058] A raised edge of identical or different shape may be also provided on the top surface of the fixing plate 1, in combination with or instead of it.

[0059] According to another embodiment, as shown in Figure 5, a removable refractory element 50 is placed below said receiving hole 10, to adhere to the surface of the ceramic body 20 of the igniter 2.

[0060] Such removable refractory element is placed before filling the gap area with the glassy material 4, and prevents the glassy material 4 in solid, liquid or semiliquid form from leaking by gravity along the surface of the ceramic body 20 of the igniter 2 from said gap area.

[0061] Once the glassy material 4 has bonded with the outer surface of said ceramic body 20 of the igniter 2 and the inner surface of said receiving hole 10 and has been

converted back to the solid phase, said removable refractory element 50 is removed.

[0062] It should be noted that, while all the examples of the figures involve the use of a cylindrical igniter, any igniter shape or size may be used.

[0063] Likewise, the receiving hole 10 may also have any shape whatever, e.g. a cylindrical or frusto-conical shape.

[0064] In one embodiment, the receiving hole 10 has a larger size at the top surface of the fixing plate 10 and a smaller size at the bottom surface thereof.

[0065] Thus, the distance between the surface of the ceramic body 20 of the igniter 2 and the inner surface of the receiving hole 10 is reduced at the bottom surface of said fixing plate 1, to prevent the glassy material 4 in the solid, liquid or semiliquid phase from leaking by gravity along the surface of the ceramic body 20 of the igniter 2 from said gap area.

[0066] Therefore, the gap area is narrowed at the bottom, where the inner surface of the receiving hole 10 and the surface of the ceramic body 20 of the igniter 2 are in mutual contact, or are at a sufficiently reduced distance as to prevent the glassy material 4 in powder form, in plug nut or ring form or in liquid form from leaking by gravity along the surface of the ceramic body of the igniter.

[0067] This is particularly shown in Figures 6 and 7, in which such bottom narrowing arrangement prevents, for instance, a ring of glassy material like the one of Figure 2, from slipping down out of position before being heated to its liquid phase.

[0068] Once the glassy material 4 has reached its liquid phase, it penetrates the bottom narrowed part, whereby the distance between the surface of the ceramic body 20 of the igniter 2 and the inner surface of the receiving hole 10 is such that the interaction of the glassy material 4 with the walls prevent any leakage thereof by gravity along the surface of the ceramic body 20 of the igniter 2 from said gap area.

[0069] Figure 6 shows an embodiment in which the ceramic body 20 of the igniter 2 has various diameters along the longitudinal axis of the igniter 2.

[0070] Particularly, the figure shows an expansion step in the ceramic body 20 of the igniter 2, located in the section of the igniter 2 above the receiving hole 10.

[0071] In cases like those of Figures 6 and 7, the glassy material 4 may also extend to an area located above the receiving hole 10.

[0072] In the implementation of this embodiment, an additional removable refractory element 51 may be provided, as shown in Figure 7, which is placed in contact with the top surface of the fixing plate 1 for lateral retention of the glassy material 4 before its conversion to the solid phase.

[0073] In the solid phase, the glassy material may be clear and/or dyed.

[0074] In a preferred embodiment, as schematically shown in Figure 8, the igniter 2 is located at the center

of the receiving hole.

[0075] In different embodiments, as shown in Figures 9, 10 and 11, the igniter 2 may be located in the receiving hole 10 in an eccentric position.

[0076] In both cases, if the glassy material is clear, it will provide a sufficient area for inspection.

[0077] Such inspection area is defined by the glassy material 4 and delimited by the surface of the ceramic body 20 of the igniter 2 and the inner surface of the receiving hole 10 and may be of any shape.

[0078] In Figure 10, for example, the receiving hole 10 has a rectangular shape, whereas in Figure 11 it has an irregular shape, which allows optimization of the width of the inspection area and the mechanical strength of the glassy material 4.

[0079] It shall be further noted that the conversion of the glassy material for sealing and fixing the igniter in position in the plate to the solid phase may generally occur by cooling to the solidification temperature. Such temperature may be reached by natural cooling or possibly by forced or induced cooling, i.e. using cooling means that generate flows of fluid coolants to enhance the natural cooling action by convection and/or radiation.

[0080] Figures 12 to 14 show a section of an igniter 2 as taken along an axial diametrical plane, which includes a cylindrical ceramic body 20 with a through axial hole, preferably at its center and with an electric conductor (such as a wire, a metal rod or the like), designated by numeral 21, inserted therein. In prior art igniters, the electric conductor 21 is fixed in the hole by gluing. Particular shapes of the hole and the conductor may be designed for mechanically securing the conductor 21 to the ceramic body 20, against any angular displacement of said conductor relative to said ceramic body.

[0081] According to the present invention, the arrangements as described and claimed herein for fixing the ceramic body 20 in the hole 4 of the plate 1 may be used to fix the electric conductor 21 in the ceramic body 20.

[0082] Therefore, the invention is also particularly directed to an igniter comprising a tubular ceramic body 20 with an electric conductor 21 fixed therein, the latter extending out of both ends of the ceramic body 20 with an end for connection to a power circuit and with a free electric arc generating end, and wherein the means for fixing the electric conductor in the ceramic body consist of a glassy material 4 previously converted to the liquid or semiliquid phase to ensure mechanical adhesion and/or physico-chemical bonding to the inner surface of said tubular ceramic body 20 of the igniter 2 and the outer surface of said conductor 21, which glassy material is later converted to the solid phase.

[0083] The main advantages, in addition to preventing damaging, especially during mechanical processing, consist in that the conductor is fixed in the ceramic body in such a manner that the conductor is secured to the ceramic body against both axial displacement and rotation relative to the ceramic body, without requiring the use of adhesives and especially mechanical processing

to obtain particular mutual engagement arrangements between the conductor 21 and the ceramic body 20.

[0084] In this use of the above technology for fixation of the igniter in the support plate, the features and method as disclosed above with reference to the previous embodiment in which use is related to the fixation of the igniter to the plate shall apply with no substantial principle differences. This will be true for any combination or sub-combination of the above described features.

[0085] Therefore, also in the use according to the embodiment of Figures 12 and 13 the following shall apply:

The invention also relates to a method for fixing the conductor 21 in the tubular ceramic body of an igniter 2, which method comprises the steps of:

- a) forming a through central hole open at its ends in a tubular segment of ceramic material having a predetermined length;
- b) introducing an electric conductor into said through central hole of the tubular ceramic body, which conductor consists of a segment of a predetermined length, greater than the axial length of the tubular ceramic body, thereby causing the creation of a gap area of predetermined radial size (thickness) between the outer surface of said electric conductor and the inner surface of the hole formed in the ceramic body of the igniter;
- c) placing the electric conductor in the mounting position in which a section of predetermined length extends out of each end of the ceramic body;
- d) filling said gap area with a glassy material in the liquid or semiliquid phase, or in the solid phase to be later converted into the liquid or semiliquid phase, so that once that said glassy material has reached its liquid or semiliquid phase, it will stick with the outer surface of said ceramic body of the igniter, or the inner surface of said receiving hole;
- e) converting said glassy material to the solid phase for fixing the electric conductor to the ceramic body of the igniter and creating a seal between said conductor and said ceramic body.

[0086] The gap area created between the inner surface of the hole in the ceramic body 20 and the outer surface of the conductor 21 of the igniter 2 is preferably of annular shape, i.e. extends seamlessly around the electric conductor 21.

[0087] A few possible variants are listed below:

While mechanical processing is not required, if strong angular stresses are expected on the conductor, in terms of rotation thereof relative to the ceramic body, then the inner surface of the hole of the ceramic body and/or the outer surface of the conductor may

possibly have one or more teeth or axial ridges of any shape. These teeth or ridges may also be in form of annular crowns. Instead of or in combination with the above, the inner surface of the central hole in the ceramic body 20 and/or the outer surface of the conductor may be knurled, i.e. with axial knurling, transverse knurling relative to the longitudinal axis and intersecting knurling, e.g. combinations of axial knurling and transverse knurling relative to axial knurling, along at least part of their length.

[0088] In a first embodiment, the glassy material is placed in the gap area in powder or granule form and later converted to the liquid or semiliquid phase by heating.

[0089] In an alternative embodiment, the glassy material is placed in said gap area as a plug nut, particularly in ring form, of such a size as to allow placement thereof between the inner wall of the receiving hole in the ceramic body 20 and the outer wall of the conductor received in said hole.

[0090] Once again, the glassy material is converted to the liquid or semiliquid phase by heating.

[0091] In a further alternative embodiment, the glassy material is already placed in the gap area in liquid or semiliquid form after a previous heating step.

[0092] The conversion from the liquid or semiliquid phase to the solid phase may generally occur by cooling, caused either by natural means or by cooling means.

[0093] In a preferred embodiment, the conductor is secured to the inner wall of the through hole of the ceramic body 20 at certain points only. Particularly, the fixing means made of glassy material are only placed in certain areas of the overall axial length of the ceramic body 20, which areas are axially spaced from each other and have a predetermined axial extension.

[0094] Preferably and advantageously, fixation occurs at least at one end side, preferably both end sides of the ceramic body, and the interposition area between the electric conductor and the inner wall of the hole in the ceramic body has a certain predetermined axial depth from said end side.

[0095] This will considerably reduce the amount of material required for fixation. Furthermore optimized accessibility to the material is ensured in this position, namely for heating and cooling. By providing the fixing means at both end sides of the tubular ceramic body 20, two fixing areas and two sealing areas are obtained, which will afford easier fixation according to the invention, as well as twice the effectiveness of the sealing action, for improved safety.

[0096] Particularly, for easier, quicker, simpler and more effective implementation of the method, the central hole 120 has a radially enlarged portion 220 at the end sections of the ceramic body on the two end sides thereof.

[0097] While the figure shows a step-like radial enlargement, various shapes thereof may be envisaged, such as an enlarged portion of conical shape, or with a

curved wall or the like.

[0098] The enlarged end portion of the through hole on one or both end sides of the ceramic body provides an annular compartment for receiving the glassy material in either solid form, i.e. powder, granule or ring form, or in liquid or semiliquid form. By forming the rest of the through hole of the ceramic body with a smaller diameter, and substantially larger than that of the electric conductor, a compartment is obtained for the glassy material both before its conversion to the liquid phase and in said liquid phase, as well as during the later solidification step.

[0099] As clearly shown in the figures, the step-like enlarged portion at one of the end sides may be also useful to create a diametrical or radial abutment limit stop surface for the electric conductor 21, which is designed to cooperate with one or more radial ridges or annular radial abutment surfaces 121 of the electric conductor 21.

[0100] In the same manner as described for fixation of the igniter 2 in the plate 1, once the glassy material has bonded with the outer surface of the electric conductor 21 and the inner surface of said receiving hole formed in the ceramic body 20 and has been converted back to the solid phase, the conductor is firmly secured in the ceramic body against both axial displacement and rotation of the conductor relative to the ceramic body. Furthermore the passageway between the inner wall of the conductor receiving hole and the outer surface of the conductor is tightly sealed.

[0101] In the solid phase, the glassy material may be clear and/or dyed.

Claims

1. An electric igniter comprising a tubular ceramic body (20) with an electric conductor (21) fixed therein, which extends out of both ends of the ceramic body (20) with an end for connection to a power circuit and with a free electric arc generating end, **characterized in that** the means for fixing the electric conductor in the ceramic body consist of a glassy material (4) that is previously converted to the liquid or semiliquid phase to ensure mechanical adhesion and/or physico-chemical bonding to the inner surface of said tubular ceramic body (20) of the igniter (2) and the outer surface of said conductor (21), which glassy material is later converted to the solid phase.
2. An igniter as claimed in claim 1, wherein the glassy material means (4) for fixing the conductor to the inner wall of the through hole of the ceramic body (20) are only provided in certain axially spaced areas having a predetermined axial length.
3. An igniter as claimed in claim 2, wherein the fixing means are provided at least at one end side, preferably both end sides of the ceramic body, and the

interposition area between the electric conductor and the inner wall of the hole in the ceramic body has a certain predetermined axial depth from said end side.

4. An igniter as claimed in claim 3, wherein the central hole (120) has a radially enlarged portion (220) at the end sections of the ceramic body on the two end sides thereof, said radially enlarged portion having a predetermined axial length and forming an annular compartment for the glassy material fixing means (4), both before their conversion to the liquid phase and during the later solidification step, and both in solid form, i.e. as an annular plug nut, or in powder or granule form, or in liquid or semiliquid form.
5. An igniter as claimed in claim 4, characterized in that the radially enlarged portion at one of the end sides creates a diametrical or radial abutment limit stop surface for the electric conductor (21), which is designed to cooperate with one or more radial ridges or annular radial abutment surfaces (121) of the electric conductor (21).
6. An igniter as claimed in one or more of the preceding claims 1 to 5, **characterized in that** the inner surface of the hole of the ceramic body and/or the outer surface of the conductor possibly have one or more teeth or axial ridges possibly in the form of annular crowns and/or, instead of or in combination with it, the inner surface of the central hole in the ceramic body (20) and/or the outer surface of the conductor may be knurled, i.e. with axial knurling, transverse knurling relative to the longitudinal axis and intersecting knurling, along at least part of their length.
7. An igniter as claimed in one or more of the preceding claims 1 to 6, wherein the gap area created between the inner surface of the hole in the ceramic body (20) and the outer surface of the conductor (21) of the igniter (2) is preferably of annular shape, i.e. extends seamlessly around the electric conductor (21).
8. A method of manufacturing an electric igniter, which method includes fixation of an electric conductor (21) in a tubular ceramic body, as well as the steps of:
 - a) forming a through central hole open at its ends in a tubular segment of ceramic material having a predetermined length;
 - b) introducing an electric conductor into said through central hole of the tubular ceramic body, which conductor consists of a segment of a predetermined length, greater than the axial length of the tubular ceramic body, thereby causing the creation of a gap area of predetermined radial size (thickness) between the outer surface of said electric conductor and the inner surface of

the hole formed in the ceramic body of the igniter;

c) placing the electric conductor in the mounting position in which a section of predetermined length extends out of each end of the ceramic body;

d) filling said gap area with a glassy material in the liquid or semiliquid phase, or in the solid phase to be later converted into the liquid or semiliquid phase, so that once that said glassy material has reached its liquid or semiliquid phase, it will stick with the outer surface of said ceramic body of the igniter, or the inner surface of said receiving hole;

e) converting said glassy material to the solid phase for fixing the electric conductor to the ceramic body of the igniter and creating a seal between said conductor and said ceramic body.

9. A method for fixing igniters for boilers or the like, which method includes insertion of an igniter (2) into a hole (10) for receiving the ceramic body (20) of the igniter (2), which hole is formed in a wall or a fixing plate (1) and which receiving hole (10) is of such a size as to form a gap area of predetermined size between the outer surface of said ceramic body (20) of the igniter (2) and the inner surface of said receiving hole (10), when the igniter is inserted in said hole, means being provided in said gap area for fixing and sealing the igniter (2) against said fixing plate (1)

characterized in that

said fixing and sealing means consist of a glassy material (4) that is previously converted to the liquid or semiliquid phase to ensure mechanical adhesion and/or physico-chemical bonding to the outer surface of said ceramic body (20) of the igniter (2) and the inner surface of said receiving hole (10) and later converted to the solid phase.

10. A method for fixing igniters for boilers or the like as claimed in claim 9, comprising the steps of:

a) forming a hole (10) for receiving the ceramic body (20) of the igniter (2) in said fixing plate (1), which receiving hole (10) is of such a size and shape as to allow insertion of said igniter (2) therein;

b) inserting said igniter (2) into said receiving hole (10), thereby causing the creation of a gap area of predetermined size between the outer surface of said ceramic body (20) of the igniter (2) and the inner surface of said receiving hole (10);

characterized in that

it further comprises the steps of:

c) filling said gap area with a glassy material (4) in the liquid or semiliquid phase, or in the solid phase to be later converted into the liquid or

semiliquid phase, so that once that said glassy material (4) has reached its liquid or semiliquid phase, it sticks by mechanical adhesion and/or physico-chemical bonding with the outer surface of said ceramic body (20) of the igniter (2), and the inner surface of said receiving hole (10);

d) converting said glassy material (4) to the solid phase for fixing the igniter (2) to said fixing plate (1) and sealing it thereagainst.

11. A method for fixing igniters for boilers or the like as claimed in one or more of the preceding claims 9 to 10, wherein said glassy material (4) is placed in said gap area in powder or granule form and later converted to the liquid or semiliquid phase by heating.

12. A method for fixing igniters for boilers or the like as claimed in one or more of the preceding claims 9 to 11, wherein said glassy material (4) is placed in said gap area in the form of a solid ring of such a size as to allow placement thereof both in the receiving hole (10) and around said ceramic body (20) of the igniter (2), and is later converted to the liquid or semiliquid phase by heating.

13. A method for fixing igniters for boilers or the like as claimed in one or more of the preceding claims 9 to 12, wherein said receiving hole (10) has a larger size at the top surface of said fixing plate (1) and a smaller size at the bottom surface of said fixing plate (1), so that the distance between the surface of the ceramic body (20) of the igniter (2) and the inner surface of the receiving hole at the bottom surface of said fixing plate (1) is reduced to such an extent as to prevent the glassy material in solid, liquid or semiliquid form from leaking by gravity along the surface of the ceramic body (20) of the igniter (2) from said gap area.

14. A method for fixing igniters for boilers or the like as claimed in one or more of the preceding claims 9 to 13, wherein a removable refractory element (50) is provided which, once said igniter (2) has been introduced into said receiving hole (10), thereby causing the creation of a gap area of predetermined size between the outer surface of said ceramic body (20) of the igniter (2) and the inner surface of said receiving hole (10), is placed below said receiving hole (10), to adhere to the surface of the ceramic body (20) of the igniter (2), so as to prevent the glassy material (4) in solid, liquid or semiliquid form from leaking by gravity along the surface of the ceramic body (20) of the igniter (2) from said gap area, and is removed once the glassy material (4) has bonded with the outer surface of said ceramic body (20) of the igniter (2) and the inner surface of said receiving hole (10) and has been converted back to the solid phase.

15. A method for fixing igniters for boilers or the like as claimed in one or more of the preceding claims 9 to 14, wherein said receiving hole (10) and said gap area are formed in the thickness of said fixing plate (1). 5
16. A method for fixing igniters for boilers or the like as claimed in one or more of the preceding claims 9 to 15, wherein said receiving hole (10) extends axially along a preset length beyond the thickness of the fixing plate, a raised edge (11) extending axially at least on one side of said fixing plate (1). 10
17. A method for fixing igniters for boilers or the like as claimed in one or more of the preceding claims 9 to 16, wherein the igniter (2) is located at the center of the receiving hole (10). 15
18. A method for fixing igniters for boilers or the like as claimed in one or more of the preceding claims 9 to 17, wherein the igniter (2) is located in the receiving hole (10) in an eccentric position. 20
19. A method for fixing igniters for boilers or the like as claimed in one or more of the preceding claims 9 to 18, wherein the glassy material (4) is clear and/or dyed. 25
20. A method for fixing igniters for boilers or the like as claimed in one or more of the preceding claims 9 to 19, wherein the glassy material (4) provides a sufficient area for inspection. 30
21. A device for fixing igniters for boilers or the like, comprising a wall or a fixing plate (1) with a hole (10) for receiving the ceramic body (20) of the igniter (2), which receiving hole (10) is of such a size that said igniter (2) may be inserted therein with a gap area of predetermined size being defined between the outer surface of said ceramic body (20) of the igniter (2) and the inner surface of said receiving hole (10), means being provided in said gap area for fixing and sealing said igniter (2) against said fixing plate (1) **characterized in that** 35
said fixing and sealing means consist of a glassy material (4) that is previously converted to the liquid or semiliquid phase to ensure mechanical adhesion and/or physico-chemical bonding to the outer surface of said ceramic body (20) of the igniter (2) and the inner surface of said receiving hole (10) and later converted to the solid phase. 40 45 50
22. A device for fixing igniters for boilers or the like as claimed in claim 21, wherein said fixing plate (1) is formed of a metal material. 55
23. A device for fixing igniters for boilers or the like as claimed in claim 21 or 22, wherein said receiving hole (10) has a larger size at the top surface of said fixing plate (1) and a smaller size at the bottom surface of said fixing plate (1), so that the distance between the surface of the ceramic body (20) of the igniter (2) and the inner surface of the receiving hole (10) at the bottom surface of said fixing plate (1) is reduced to such an extent as to prevent the glassy material (4) in solid, liquid or semiliquid form from leaking by gravity along the surface of the ceramic body (20) of the igniter (2) from said gap area.
24. A device for fixing igniters for boilers or the like as claimed in one or more of claims 21 to 23, wherein said receiving hole (10) and said gap area are formed in the thickness of said fixing plate (1).
25. A device for fixing igniters for boilers or the like as claimed in one or more of claims 21 to 24, wherein said receiving hole (10) extends axially along a preset length beyond the thickness of the fixing plate (1), a raised edge (11) extending axially at least on one side of said fixing plate (1).
26. A device for fixing igniters for boilers or the like as claimed in one or more of claims 21 to 25, wherein the igniter (2) is located at the center of the receiving hole (10).
27. A device for fixing igniters for boilers or the like as claimed in one or more of claims 21 to 26, wherein the igniter (2) is located in the receiving hole (10) in an eccentric position.
28. A device for fixing igniters for boilers or the like as claimed in one or more of claims 21 to 27, wherein the glassy material (4) is clear and/or dyed.
29. A device for fixing igniters for boilers or the like as claimed in one or more of claims 21 to 28, wherein the glassy material (4) provides a sufficient area for inspection.

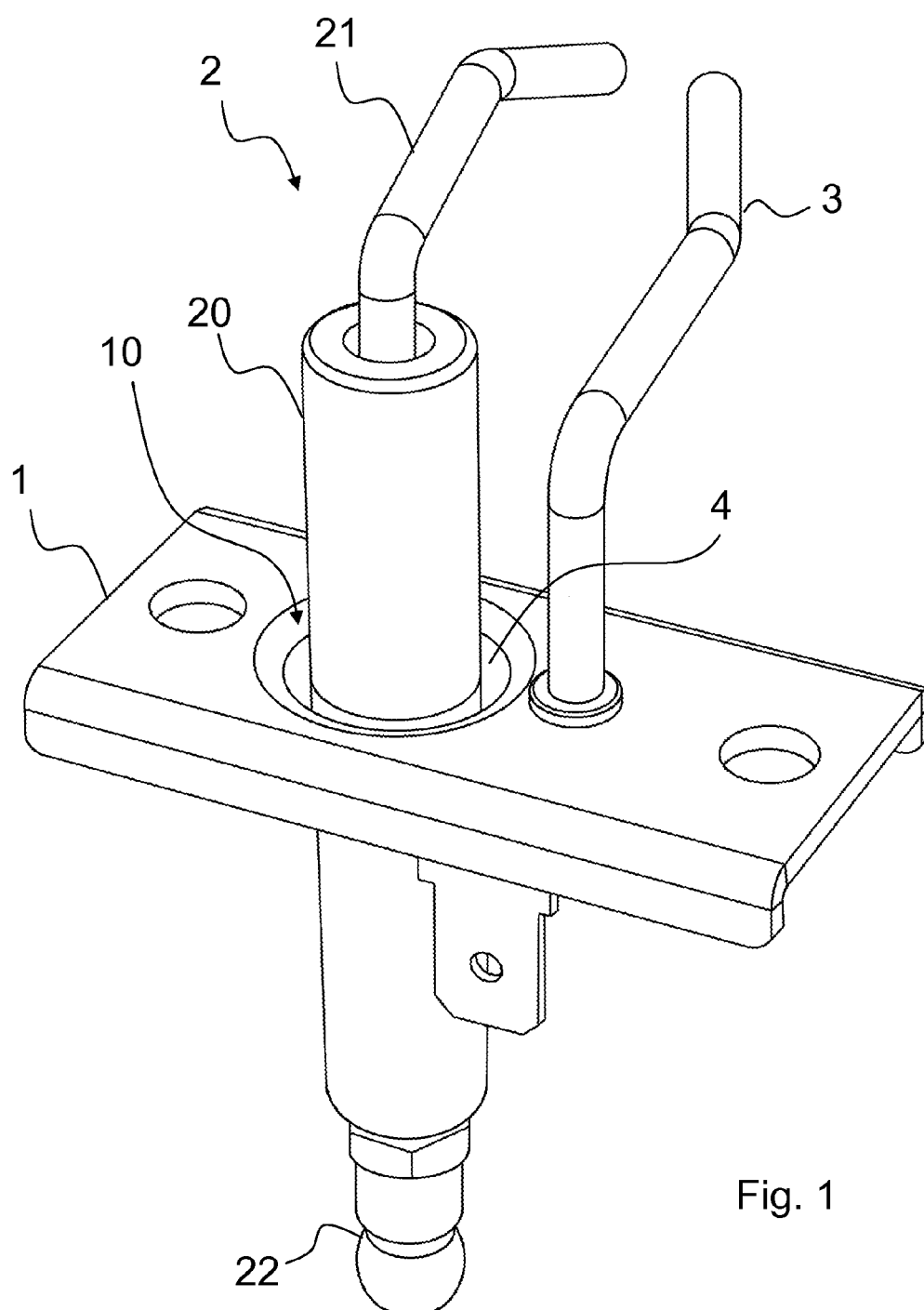


Fig. 1

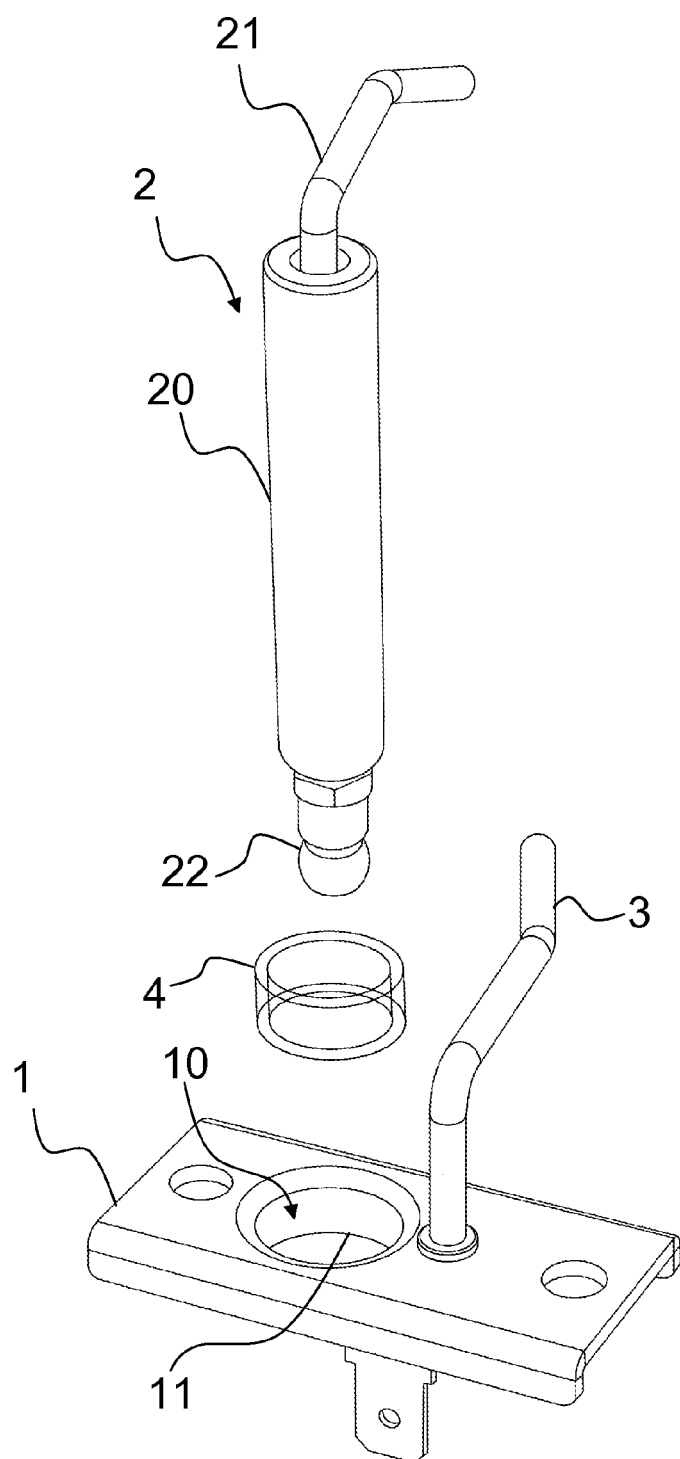
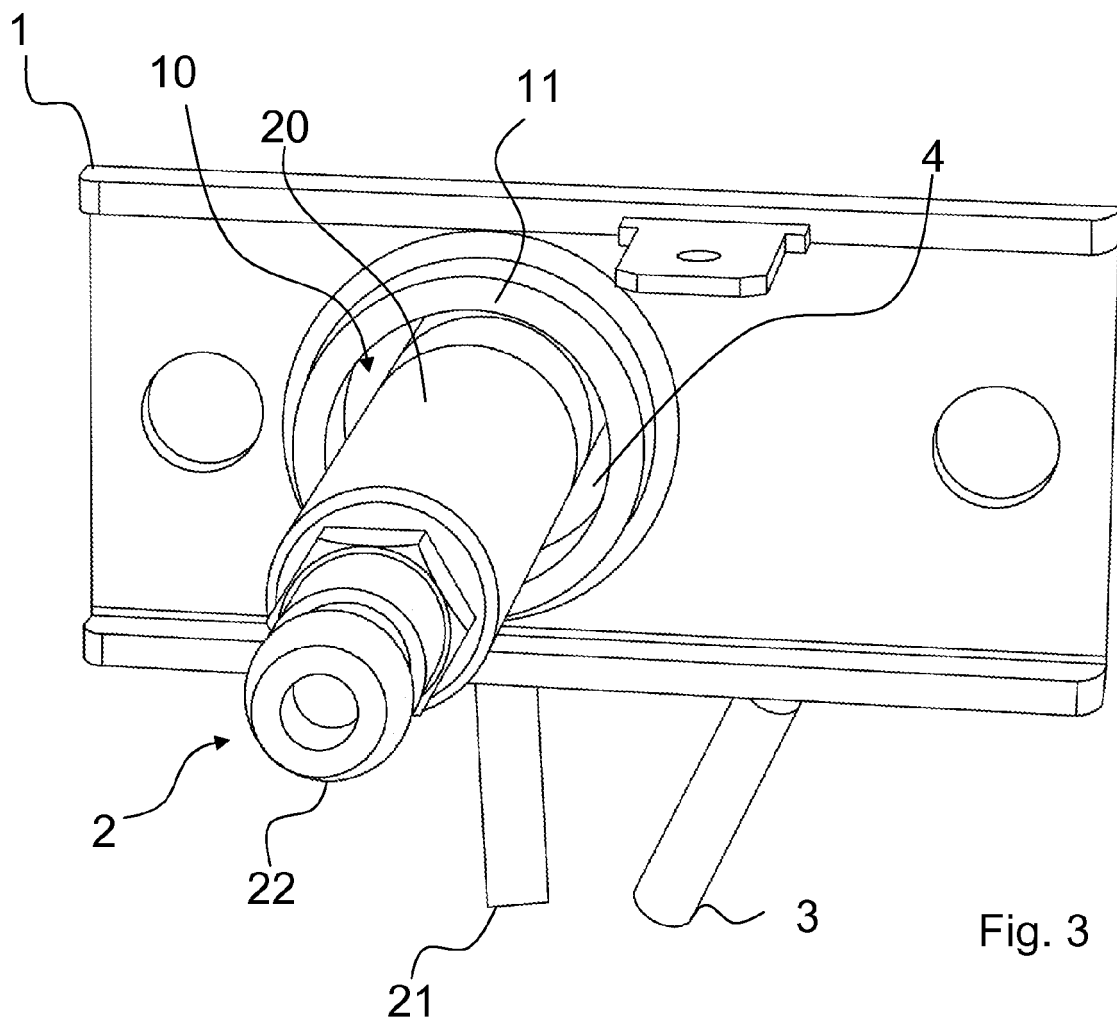
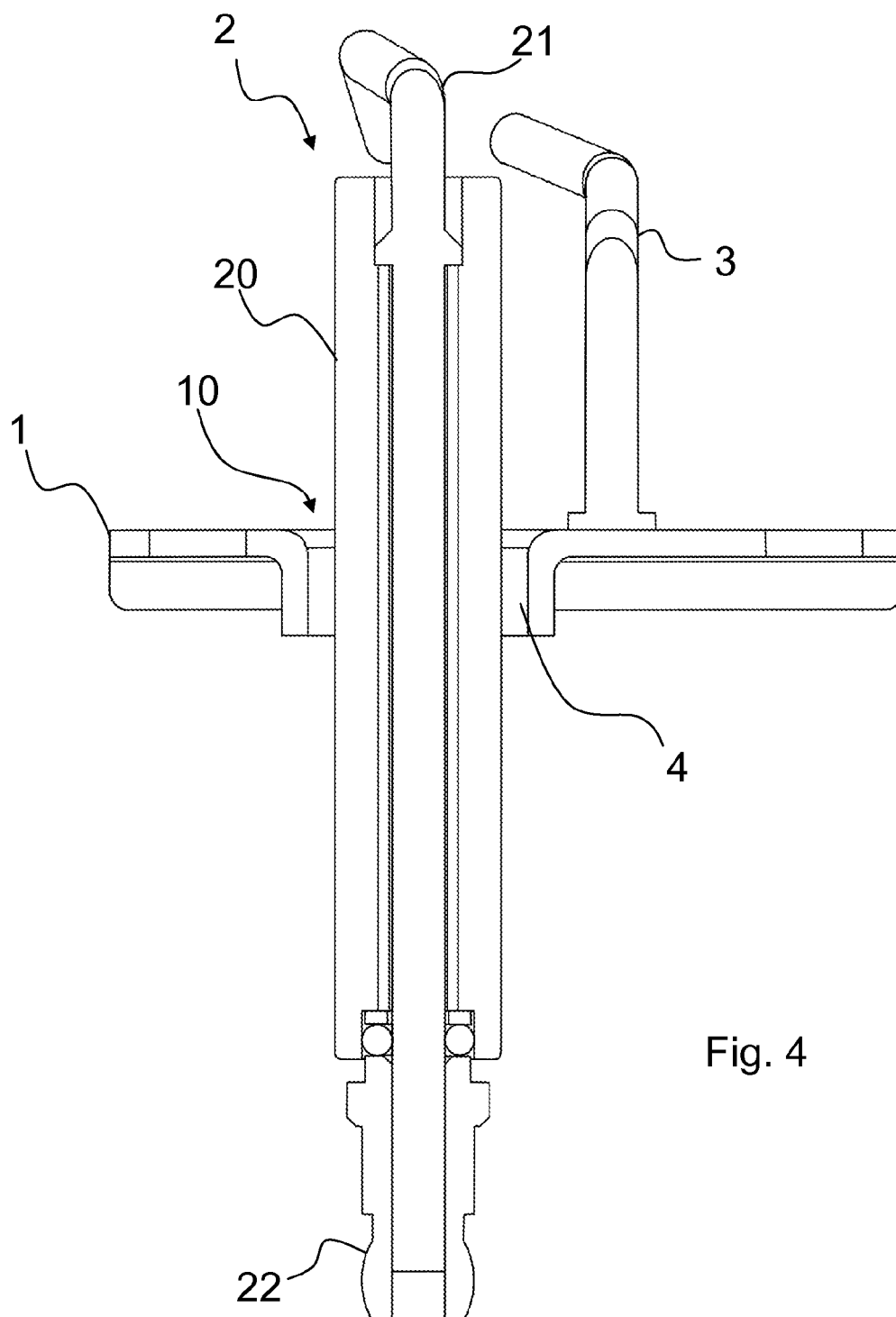


Fig. 2





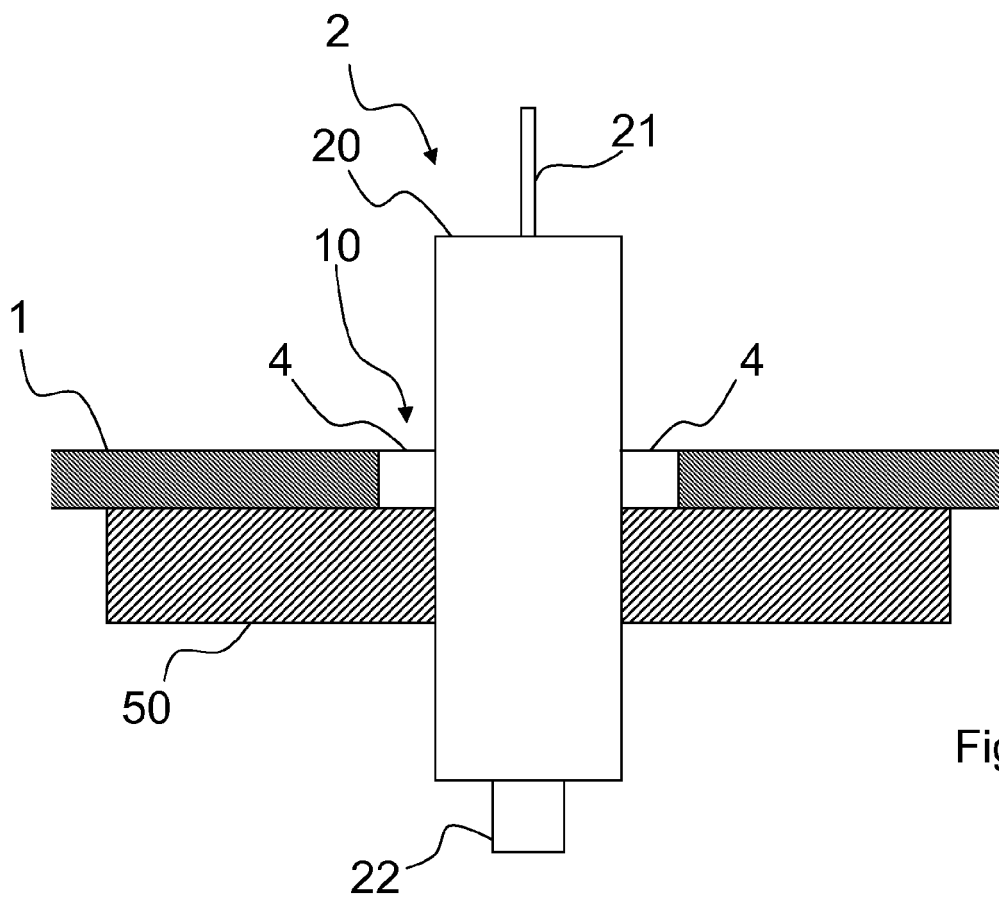


Fig. 5

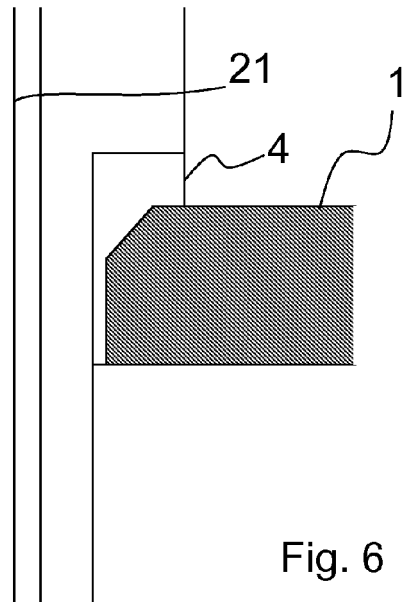
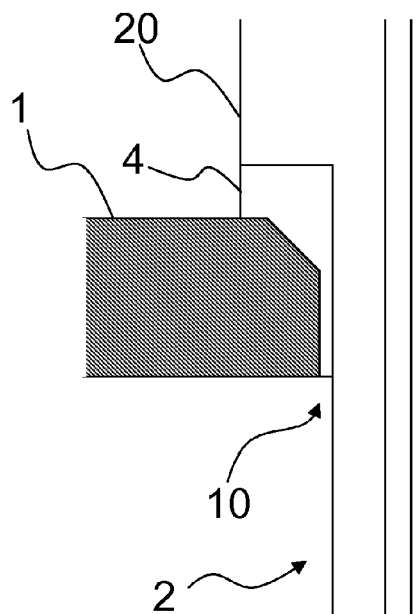


Fig. 6

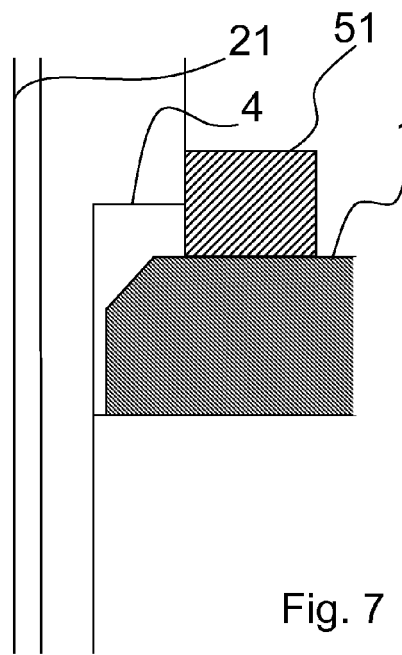
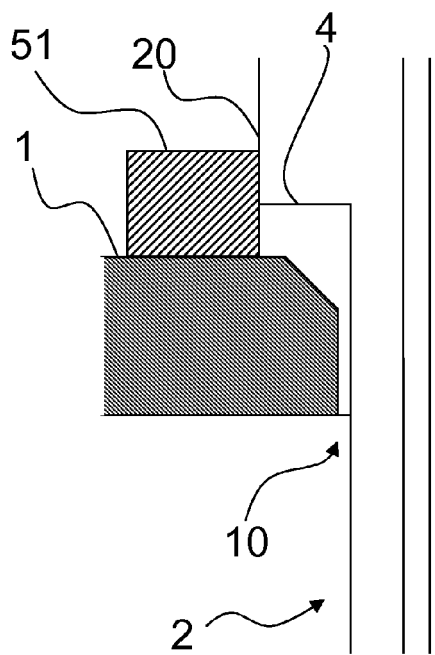


Fig. 7

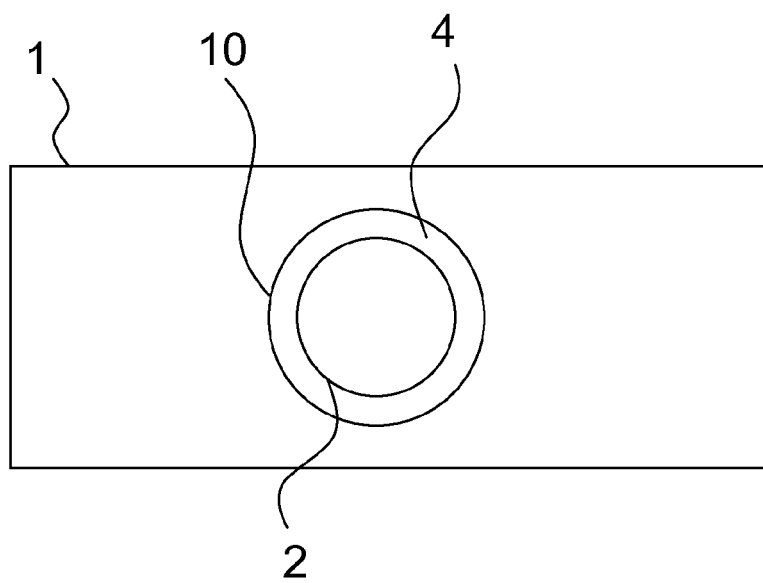


Fig. 8

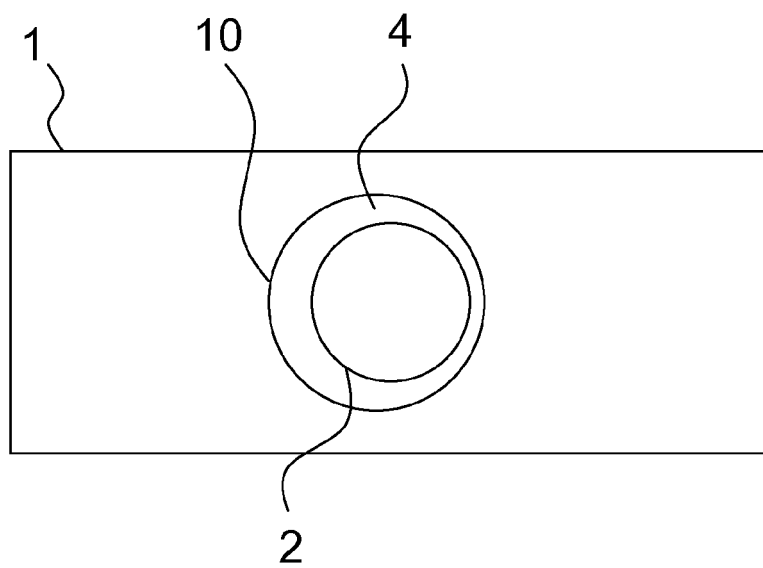


Fig. 9

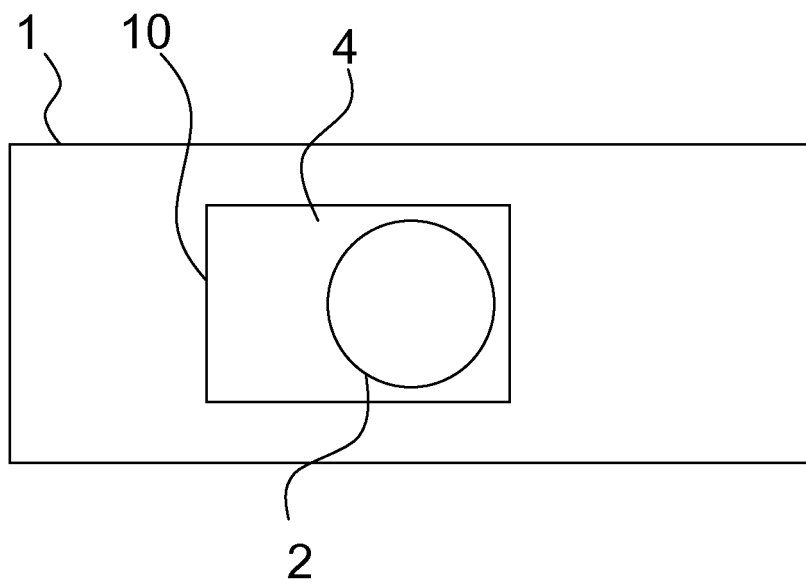


Fig. 10

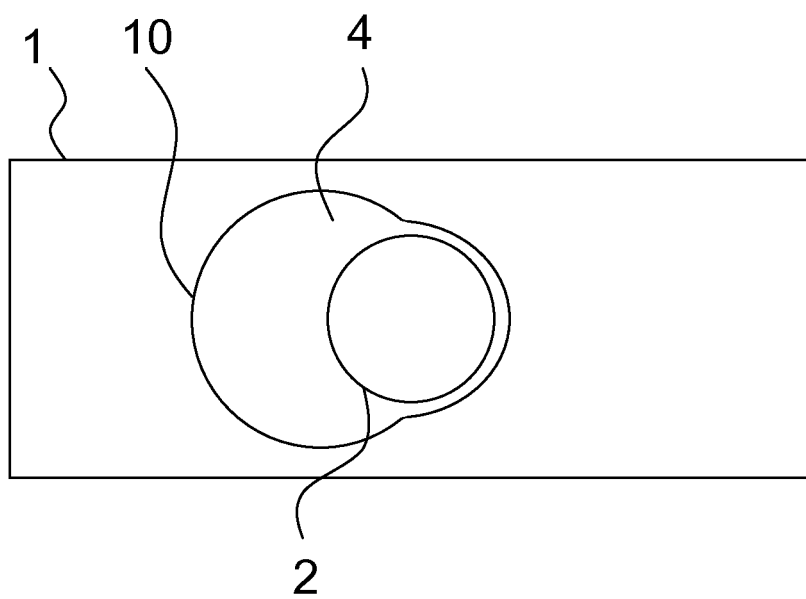


Fig. 11

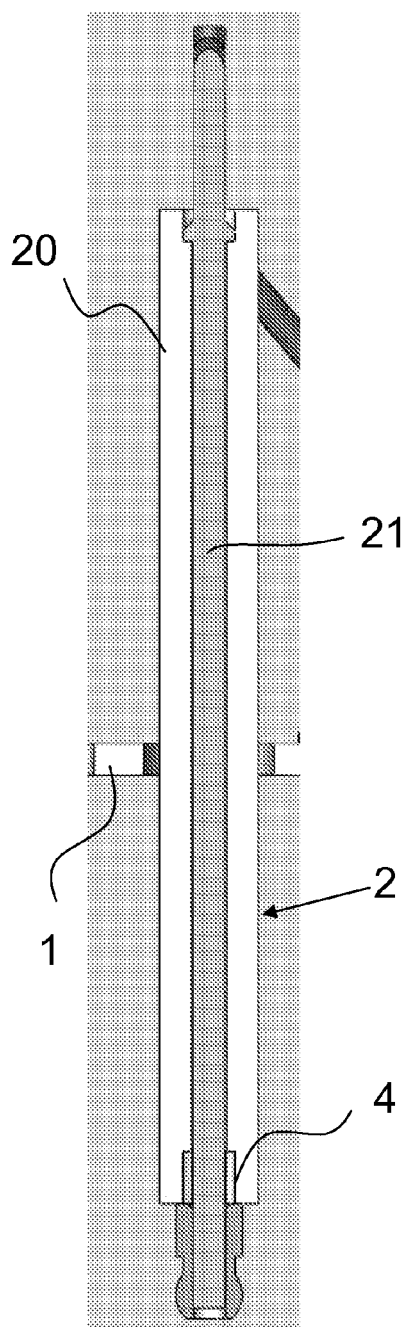


Fig. 12

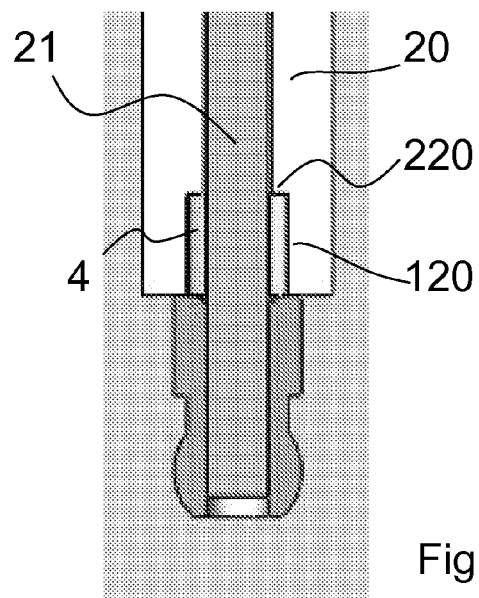


Fig. 13

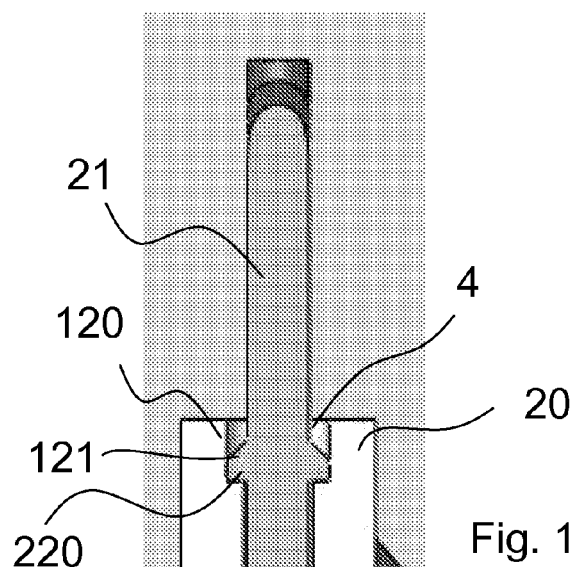


Fig. 14