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(54) **DETECTION/IGNITION SPARK PLUG FOR BOILERS OR THE LIKE SYSTEM AND METHOD FOR PRODUCING SUCH SPARK PLUG**

(57) A detection/ignition spark plug for boilers or the like, the spark plug comprising a filiform main electrode (2); a sleeve (5) for housing an intermediate portion of the main electrode (2); a fixing plate (4) provided with a lower surface configured for facing the combustion chamber of the boiler, an upper surface opposite to a combustion chamber, a housing hole (9) for the sleeve (5) so that a lower end of the main electrode (2) is inside the combustion chamber and an upper end of the main electrode (2) is outside the combustion chamber; a connecting terminal (6) coupled to the upper end of the main electrode (2) in series with the sleeve (5); fixing material (8) between the connecting terminal (6) and the upper end of the main electrode (2), between the main electrode (2) and the sleeve (5) and between the sleeve (5) and the fixing plate (4); wherein the fixing material (8) is a material that, at first, is applied in the fluid phase so that it adheres to the connecting terminal (6), to the main electrode (2), to the sleeve (6) and to the fixing plate (4) and subsequently is brought to the solid phase.

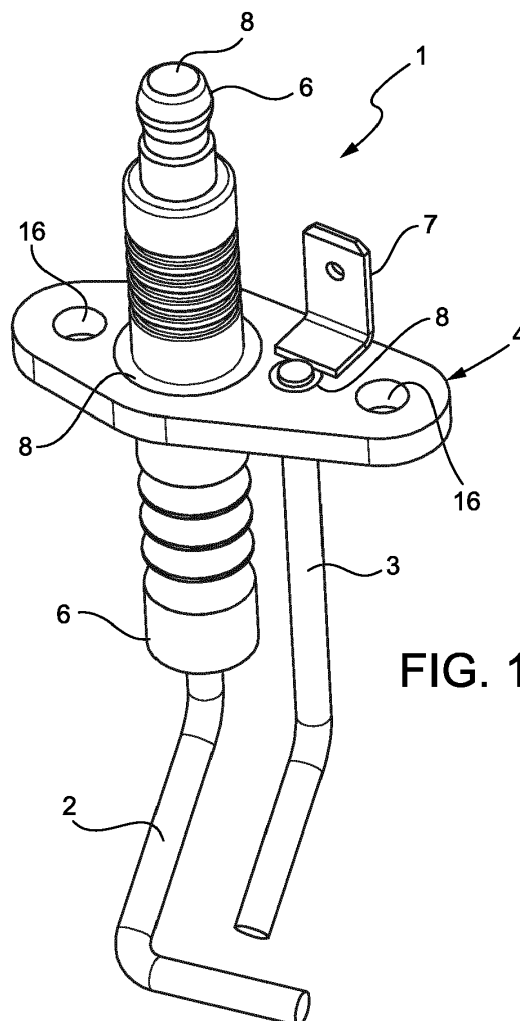


FIG. 1

Description

[0001] The invention relates to a detection/ignition spark plug for boilers or the like. The invention further relates to a system and a method for producing such spark plug.

[0002] Spark plugs are known and available in the market, which are configured to be at least partially housed inside combustion chambers of boilers. These known spark plugs usually comprise:

- a filiform main electrode;
- a sleeve, usually a ceramic sleeve, for housing an intermediate portion of the main electrode;
- a fixing plate provided with a lower surface configured for facing the combustion chamber of the boiler, an upper surface opposite to a combustion chamber, and a housing hole for the sleeve so that a lower end of the main electrode is inside the combustion chamber and an upper end of the main electrode is outside the combustion chamber;
- a connecting terminal coupled to the upper end of the main electrode and arranged in series with the sleeve.

[0003] According to the prior art, the aforesaid components are assembled with one another in subsequent steps and with different coupling technologies. For example, the coupling between the connecting terminal and the electrode is carried out with a different technology and in a following moment relative to the coupling between the sleeve and the electrode. In particular, nowadays the connecting terminal is coupled to the electrode through welding.

[0004] As to the coupling between the ceramic sleeve and the plate, a coupling that must be mechanically solid and create a seal in order to prevent fumes from flowing out of the combustion chamber, nowadays manufacturers use technologies other than welding.

[0005] In particular, one of the known technologies used for the aforesaid coupling involves the use of metallic rings interposed between the surface of the ceramic body of the spark plug and the inner surface of the housing hole. According to this technology, the rings are deformed so that they can adhere, on one side, to the surface of the ceramic body of the spark plug and, on the other side, to the inner surface of the housing hole. This fixing mode is affected by some evident problems, which are mainly due to the fact that the exerted mechanical forces can lead to a movement of the spark plug from its operating position or can locally generate pressure peaks, which cause the ceramic sleeve to break.

[0006] A different known technique used to couple the ceramic sleeve to the plate involves the use of a glass material as a fixing material between the ceramic sleeve and the plate. According to this technique, the glass material is applied in the solid phase, for example in the form of a glass ring, which is brought to the liquid phase

through heating, before going back to the solid state.

[0007] However, this solution is affected by some drawbacks, as well. As a matter of fact, micro-cracks can be created during the manual bending step to which the conductor wire is subjected following the firing step. These micro-cracks do not evidently ensure the seal to smokes. Furthermore, taking into account the fact that the electrode is subjected to continuous thermal changes, which change the morphology of the micro-cracks, you can experience actual detachments of the parts.

[0008] Therefore, it is evident that the currently used technique suffers from drawbacks both from a productive point of view, as it involves different subsequent technologies for the assembly of the spark plug, and from a qualitative point of view, in particular as to the coupling between the ceramic sleeve and the plate.

[0009] Starting from this prior art, the object of the invention is to provide an alternative spark plug for boilers or the like.

[0010] In particular, the object of the invention is to provide a spark plug and a relative production method, which allow manufacturers to overcome the drawbacks of the prior art discussed above in a simple and economic fashion, both from a functional point of view and from a constructive point of view.

[0011] In accordance with these object, the invention relates to a spark plug comprising:

- a substantially filiform main electrode, which is made of a metallic material;
- a sleeve, which is configured to house an intermediate portion of the main electrode;
- a fixing plate, which can be an actual metallic plate as well as a simple portion of a fixing wall and is provided with a lower surface, which is configured to face the combustion chamber of the boiler, an upper surface, which is opposite the combustion chamber, and a housing hole for the sleeve, so that a lower end of the main electrode is inside the combustion chamber and an upper end of the main electrode is outside the combustion chamber;
- a connecting terminal, which is arranged in series with the sleeve and is coupled to the upper end of the main electrode;
- fixing material between the connecting terminal and the upper end of the main electrode, between the main electrode and the sleeve and between the sleeve and the fixing plate.

[0012] In particular, the fixing material is such that it can be applied in the fluid phase, so as to adhere to the connecting terminal, to the main electrode, to the sleeve and to the fixing plate, and subsequently solidified, for example through heating of the spark plug in an oven.

[0013] Advantageously, according to the invention defined above in its most generic form, all the components contributing to the creation of the spark plug are fixed to one another by means of the same technology, namely

the application of the fixing material. Therefore, after the consolidation of the fixing material, the spark plug is ready to be used without any further thermal or mechanical treatment.

[0014] The sleeve is preferably made of a ceramic material. Alternatively, the sleeve can be entirely made of glass, or you can have a ceramic sleeve coated, both on the inside and on the outside, with glass cylinders. Alternatively, you can have a glass cylinder that can be housed inside the sleeve containing the main electrode.

[0015] According to a preferred embodiment of the invention, all the fixing material application seats are arranged on the outside of the combustion chamber, namely they are all accessible from a side, the upper one, of the plate. To this purpose, the invention preferably establishes that:

- the sleeve coupling hole comprises an enlarged, preferably tapered, portion for receiving the fixing material in the area of the upper surface of the plate;
- the sleeve comprises a main housing hole to house the main electrode, the hole comprising an enlarged portion for receiving the fixing material in the area of the upper end of the sleeve;
- the connecting terminal comprises a housing hole to house the upper end of the main electrode, the hole comprising an enlarged portion for receiving the fixing material in the area of the sleeve.

[0016] Alternatively, part of the enlarged portion of the main housing hole of the main electrode is occupied by the glass cylinder mentioned above. In this case, the glass cylinder ends before the connecting terminal, so as to leave a volume, which is delimited by the cylinder itself, by the electrode, by the sleeve and by the connecting terminal, for receiving the fixing material.

[0017] In particular, the non-enlarged parts of the aforesaid holes are cylindrical portions and substantially have the same dimensions as the component, sleeve or electrode to be housed by them. Indeed, according to the invention, the fixing material does not necessarily penetrate the cylindrical sections of the holes.

[0018] Alternatively, the coupling hole of the sleeve can be obtained through a counterbore, namely with walls that are parallel to the axis of the electrode and are not flared, as set forth in the example indicated above.

[0019] Alternatively, the coupling hole of the sleeve can be made as a through hole having a greater diameter than the sleeve. By "greater diameter" we mean a diameter that is such as to allow the fixing material to be inserted. In this case, a gasket is needed, which is configured to prevent the fixing material from getting out towards the lower surface of the fixing plate. Said gasket can be directly inserted into the hole, remaining flush with the lower surface of the fixing plate, or it can be coupled on the outside of the hole along the lower surface of the fixing plate. Advantageously, a mask can be provided, which is configured to hold the components of the spark

plug in position and to permit an easy application of the fixing material.

[0020] According to an embodiment of the invention, the hole on the inside of the connecting terminal has a greater length than the upper end of the main electrode projecting out of the sleeve. According to this embodiment, the fixing material is also applied in the upper free portion of said hole of the electrode.

[0021] Advantageously, in this way, the fixing material acts as a plug, thus further fixing the connecting terminal to the electrode.

[0022] Alternatively, the upper end of the main electrode projecting out of the sleeve is flush with the outer edge of the connecting terminal.

[0023] The remaining elements usually making up a spark plug for boilers or the like, namely the ground electrode and a fixing bracket, can be fixed to the spark plug described above in a known manner, for example by welding the ground electrode and the bracket to one another in a following step, or they can be fixed in the novel manner that will be described hereinafter.

[0024] According to an embodiment of the invention, the spark plug comprises a ground electrode and the plate comprises a secondary hole to house the ground electrode. Said hole is provided with an enlarged portion for receiving the fixing material in the area of the upper surface of the plate. This hole, as well, can have a flared shape or can be obtained through a counterbore, like the main hole for receiving the sleeve of the electrode.

[0025] Advantageously, according to the invention, the ground electrode is fixed to the plate at the same time and in the same way in which the remaining components are fixed to one another. In this example, as well, the enlarged portion of the hole for receiving the ground electrode is accessible from the upper surface of the plate.

[0026] Preferably, the spark plug comprises a metallic ring, which is housed inside the enlarged portion of the secondary hole of the plate and is configured to create a conductive bridge between the ground electrode and the plate, when the fixing material is applied in the enlarged portion of the secondary hole.

[0027] Advantageously, in this way, even if the fixing material penetrates the underlying portion of the secondary hole, the grounding is ensured.

[0028] In particular, the fixing material used in this invention comprises a ceramic material, in particular compositions of silica-soda or silica-alumina.

[0029] Advantageously, by so doing, manufacturers can avoid the formation of the aforesaid micro-cracks, which develop using the glass material according to the prior art.

[0030] According to an embodiment of the invention, the plate can comprise a through housing, for example of the same type as the sleeve containing hole, which houses an inspection glass, namely a glass lens, which, as it is transparent, allows you to look inside the combustion chamber to check whether there is a flame or not.

[0031] Even though the presence of said inspection

glass is already known, the innovation, besides the use of the ceramic material as fixing material, lies in the fact that said element is placed in position in the same moment as the other components, so that the spark plug taken out of the oven is ready to be used without further machining steps.

[0032] Therefore, the method for the production of the spark plug described above comprises the step of placing all the components of the spark plug in an assembling mask, which is configured to hold said components in an operating position even in the absence of the fixing material. Subsequently, the method comprises the step of applying the fixing material in the fluid form in the relative seats described above and of heating the spark plug supported by the mask, so as to cause the fixing material to reach the solid phase.

[0033] The method also comprises the preliminary step of bending, by means of suitable bending machines, both the main conductor and the ground conductor, which are then placed in the mask already in the correct and ready-for-use form. This preliminary bending step avoids causing stresses to the fixing material.

[0034] Furthermore, the ground conductor or the main conductor can be preliminarily subjected to chemical treatments or they can be covered with other metals, in order to improve their performances. In any case, this treatment step is prior to the mask assembling step, which produces, after the heating, a spark plug that is already ready to be used.

[0035] Further features and advantages of the invention will be best understood upon perusal of the following description of a non-limiting embodiment thereof, with reference to the accompanying drawing, wherein:

- figure 1 is a schematic perspective view of an example of a spark plug according to the invention;
- figure 2 is an enlarged view of a part of the spark plug of figure 1 before the application of the fixing material;
- figure 3 shows a sectional view of a part of the spark plug of figure 1, in particular a sectional view in the area of the fixing plate;
- figure 4 shows a sectional view of a part of the spark plug of figure 1, in particular a sectional view in the area of the connecting terminal;
- figure 5 shows a schematic view of a support mask of three spark plugs for the positioning of the fixing material;
- figure 6 shows a schematic view of a portion of the mask of figure 5 without the spark plug;
- figures 7-9 show alternative solutions for the coupling of the sleeve of the main electrode in the relative hole;
- figure 10 shows an alternative embodiment of the main electrode.

[0036] Figure 1 is a schematic perspective view of an example of a spark plug according to the invention. In

particular, the spark plug 1 comprises a main electrode 2 and a secondary or ground electrode 3. These electrodes 2, 3 are supported by a plate 4 so as to have an end inside a combustion chamber of a boiler or the like and another end outside the same combustion chamber. In particular, the secondary electrode 3 projects out of the combustion chamber only along a short section of the plate 4, whereas the main electrode 2 is coupled to a sleeve 5, preferably a ceramic one, which is housed in a hole 9 of the plate 4. The end of the main electrode 2 projecting out of the sleeve 5 on the outer side of the combustion chamber is coupled to a connecting terminal 6. According to the example of figure 1, you can see the presence of fixing material 8 between the sleeve 5 and the plate 4, between the secondary electrode 3 and the plate 4 and on top of the connecting terminal 6. The spark plug 1 of figure 1 further comprises a bracket 7, which is fixed to the plate 4 on the outside of the combustion chamber. Even though you cannot see it in figure 1, the same fixing material 8 is also present between the bracket 7 and the plate 4. Furthermore, figure 1 shows side holes 16 to help produce the spark plug 1. The use of these holes 16 will be best understood upon perusal of the description of figures 5 and 6. Indeed, said holes 16 are designed both to fix the plate to the combustion chamber and to couple the spark plug to an assembling mask during the production step.

[0037] Figures 2-4 show more in detail the seats for receiving the fixing material 8. In particular, figure 3 shows how the holes 9 and 12 for receiving the sleeve 5 and the secondary electrode 3 comprise an enlarged and flared portion 11, 14 in the area of the upper surface 32 of the plate 4. The remaining portions of the holes 9 and 12 are cylindrical portions 10, 13 having dimensions that are substantially equal to the sleeve 5 and the secondary electrode 3. The lower surface 33 of the plate 4 has neither projections nor recesses in the area of the holes 9, 12. As you can see in figure 3, on the inside of the enlarged portion 14 of the hole 12 there is a metallic ring 15, which, on one side, surrounds the secondary electrode 3 and, on the other side, is in contact with the plate 4, preferably a metallic one.

[0038] Figure 4 shows a cross section of the coupling area of the main electrode 2 to the sleeve 5 and to the connecting terminal 6. In particular, these couplings are obtained with the same fixing material 8. As you can see, the inner hole 17 of the sleeve 5 comprises an enlarged portion 19 at its upper end, where the fixing material 8 is applied. The connecting terminal 6 has an inner hole 20, as well, which is provided with an enlarged portion 22, which, in use, faces the enlarged portion 19 of the hole 17 of the sleeve 5. Figure 4 also shows the fact the the main electrode 2 ends before the upper edge of the hole 20 of the connecting terminal 6 and that this free portion of the hole 20 is filled with the fixing material 8.

[0039] Figure 5 shows a schematic view of a support mask of three spark plugs for the positioning of the fixing material and figure 6 shows a portion of this mask in the

absence of the spark plugs. With reference to figure 6, the mask 23 comprises two seats 29, 30 for longitudinally housing the sleeve 5 and the secondary electrode 3. Furthermore, the mask 23 comprises holes 28, which, in use, are aligned with the holes 16 of the plate 4, so that pins 24 can fix the spark plug 1 to the mask 23. The system further comprises a front plate 25, which is coupled by means of pins (not shown) housed in relative holes 26 and is configured to hold the sleeve 5 and the secondary electrode 3 in the relative seats 29, 30. To this purpose, the plate 25 comprises striking projecting portions for the electrodes 2, 3. With reference to figure 5, you can see how a mask 23 allows a plurality of spark plugs 1 to be held in a position that is such as to allow the fixing material 8 to be easily applied in the relative seats. The fixing material 8 is, in particular, a ceramic material, which turns from fluid into solid when it is heated. For example, ideal ceramic materials for this invention are compositions of silica-soda or silica-alumina. Silica-alumina compositions comprise, in turn, silica and alumina compounds, silicon compounds, dinas compounds, kyanite compounds, sillimanite compounds, mullite compounds, bauxite compounds, corundum compounds.

[0040] Figures 7-9 show alternative embodiments for the coupling of the sleeve 5 of the main electrode 2 in the relative hole 9. In the embodiment of figure 7, the hole 9 comprises an enlarged portion 11', which, however, is not tapered like in the example of figure 3, but is obtained through a counterbore and has walls that are parallel to the axis of the hole 9. Similarly, even though the figures do not show this, the hole 12 for receiving the secondary electrode 3 also comprises an enlarged portion, which can be obtained through a counterbore with walls that are parallel to the axis of the relative hole.

[0041] In the embodiment of figures 8 and 9, the hole 9 is a through hole 11" having a greater diameter than the sleeve 5. Therefore, these examples involve the use of a gasket 34, which is configured to prevent the fixing material 8 from getting out of the lower surface 33 of the plate 4. In the embodiment of figure 8, the gasket 34 is housed in the hole 9 and is flush with the lower surface 33 of the plate 4. In the embodiment of figure 9, the gasket 34 is on the outside of the hole 9 and is fixed to the lower surface 33 of the plate 4.

[0042] Figure 10 shows an alternative embodiment of the main electrode 2 relative to figure 4. In this embodiment, the enlarged portion 19 of the hole 17 extends from the upper end of the sleeve 5 past the plate 4. Along a part of this enlarged portion 19 there is housed a glass cylinder 35, which, in turn, houses the main electrode. Since the glass cylinder 35 has a smaller length than the enlarged portion 19 of the hole 17, in the area of the upper end of the sleeve 5 there is a volume that is enclosed, on the lower side, by the glass cylinder 35, on the inside, by the main electrode 2, on the outside, by the sleeve 5 and, on the upper side, by the connecting terminal 6. In an initial assembling step, this volume is filled with the fixing material 8 in the fluid form, so that, when it is heated,

it causes all the aforesaid elements to become integral to one another. In this example, the hole 20 of the connecting terminal 6 does not have enlarged portions and ends flush with the edge of the electrode 2. In figure 10, the main hole for receiving the sleeve 5 is obtained through a counterbore. However, this hole can also be made in other ways, for example - preferably - in the ways shown in figures 4, 8 or 9.

[0043] Finally, it is clear that the invention described herein can be subjected to changes and variations, without for this reason going beyond the scope of protection of the appended claims.

15 Claims

1. A detection/ignition spark plug for boilers or the like, the spark plug (1) comprising:

- a filiform main electrode (2);
- a sleeve (5) for housing an intermediate portion of the main electrode (2);
- a fixing plate (4) provided with a lower surface configured for facing the combustion chamber of the boiler, an upper surface opposite to a combustion chamber, a housing hole (9) for the sleeve (5) so that a lower end of the main electrode (2) is inside the combustion chamber and an upper end of the main electrode (2) is outside the combustion chamber;
- a connecting terminal (6) coupled to the upper end of the main electrode (2) in series with the sleeve (5);
- fixing material (8) between the connecting terminal (6) and the upper end of the main electrode (2), between the main electrode (2) and the sleeve (5) and between the sleeve (5) and the fixing plate (4);

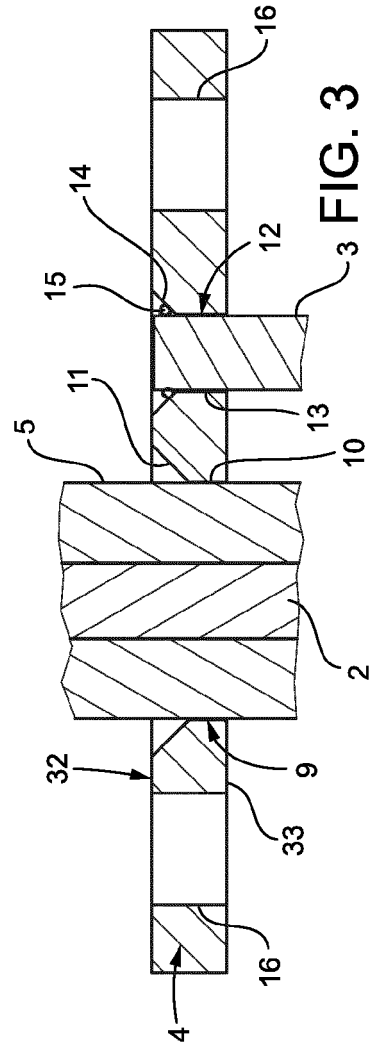
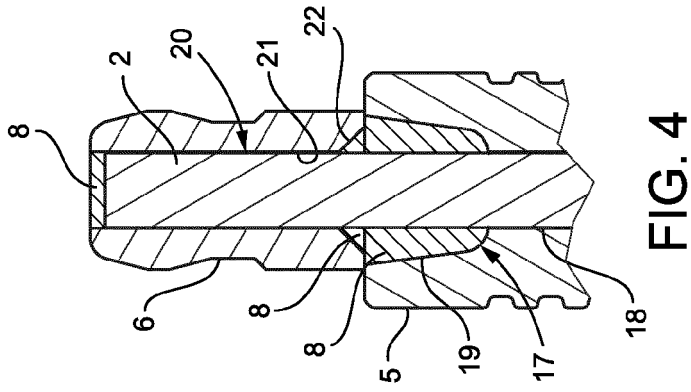
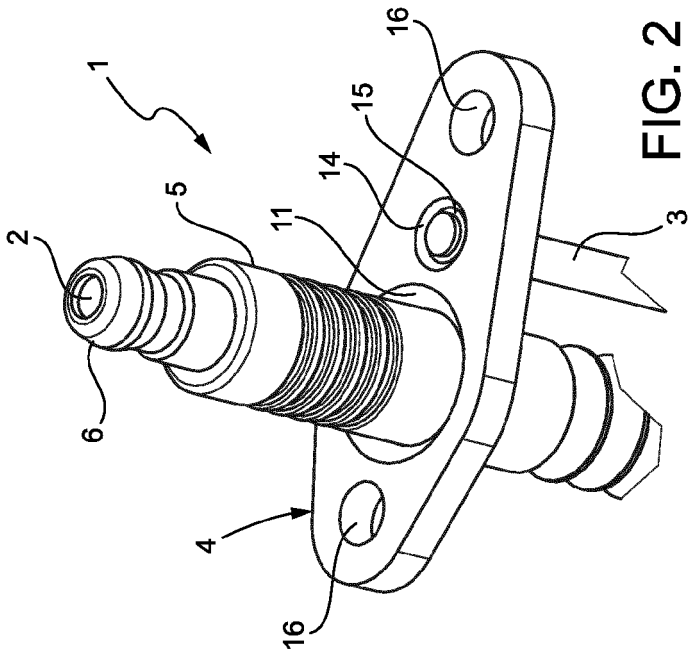
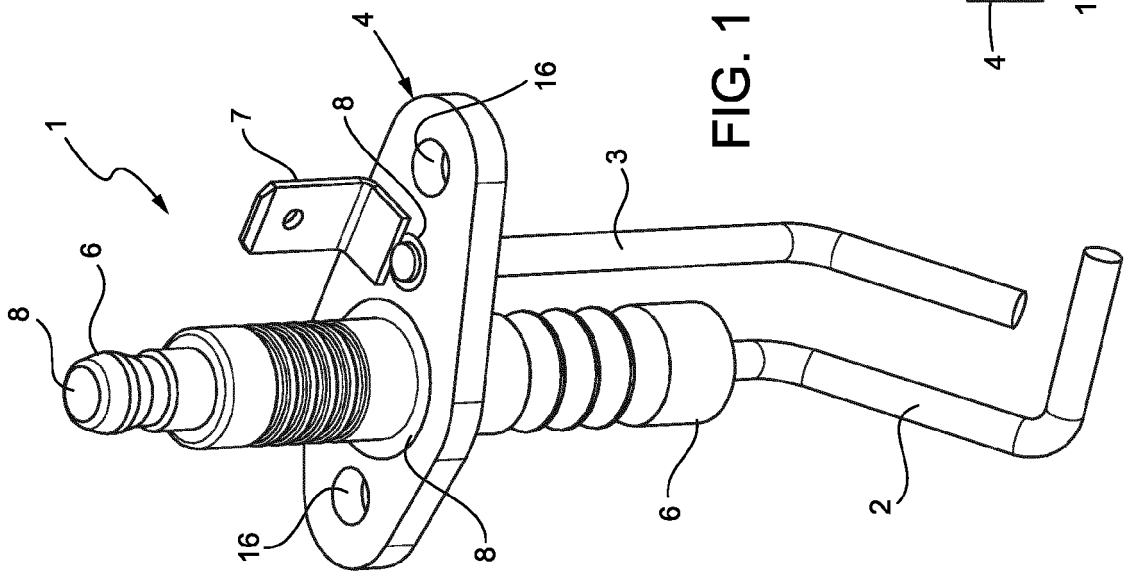
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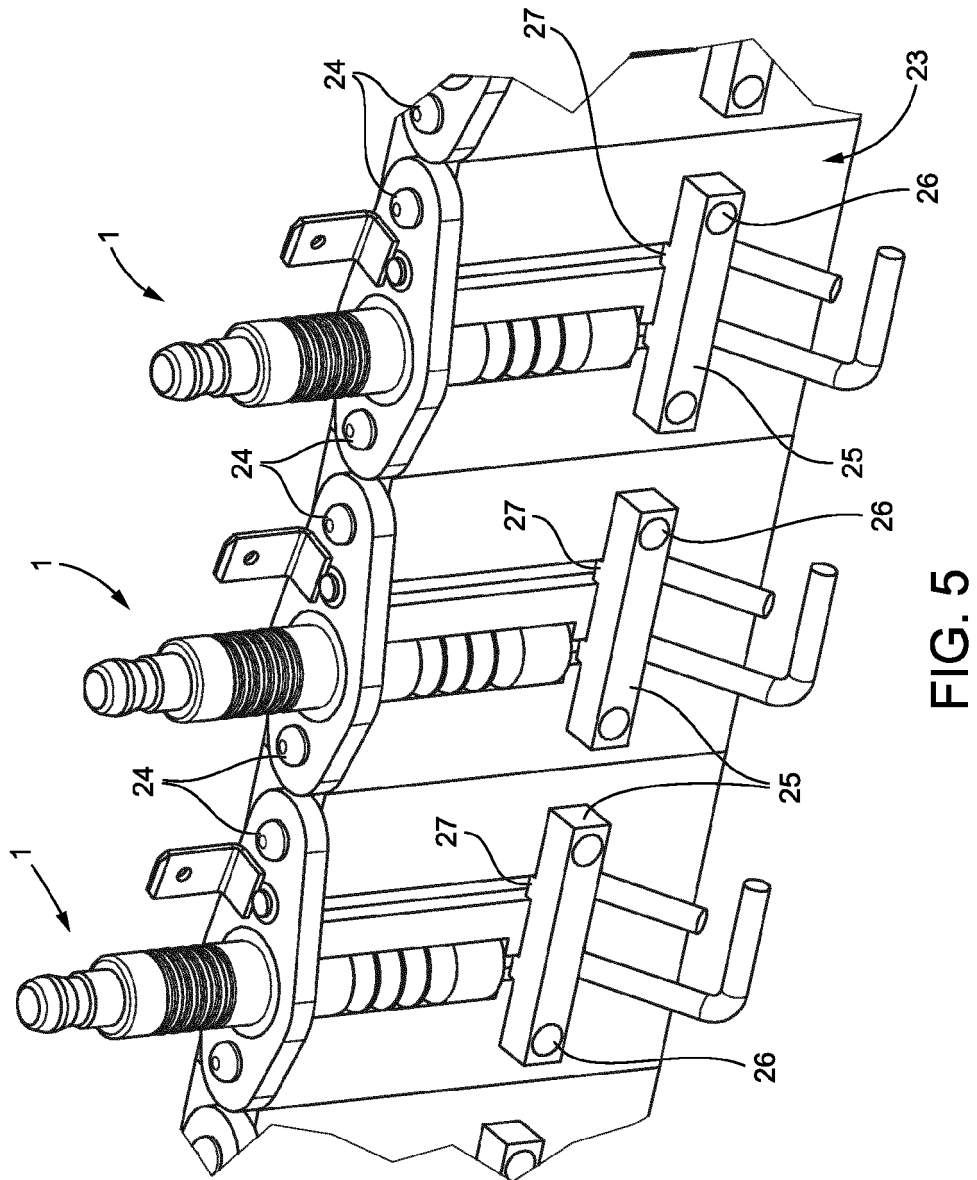
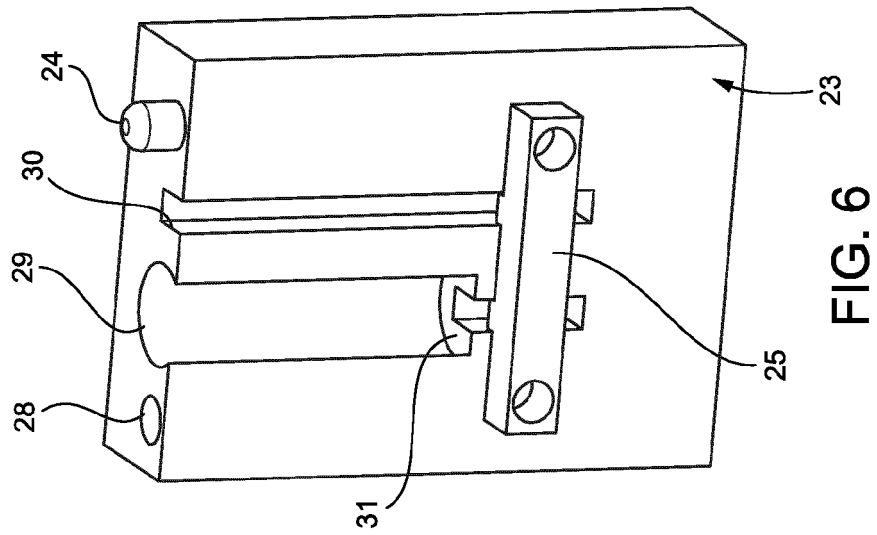
the fixing material (8) is a material that, at first, is applied in the fluid phase so that it adheres to the connecting terminal (6), to the main electrode (2), to the sleeve (5) and to the fixing plate (4) and subsequently is brought to the solid phase.

2. Spark plug as claimed in claim 1, wherein

- the housing hole (9) comprises an enlarged portion (11, 11', 11") with respect to the sleeve (5) at the upper surface (32) of the plate (4) for receiving the fixing material (8);
- the sleeve (5) comprises a main hole (17) for housing the main electrode (2), the hole (17) comprising an enlarged portion (19) at the upper end of the main electrode (2) for receiving the fixing material (8);
- the connecting terminal (6) comprises a hole

- (20) for housing the upper end of the main electrode (2), the hole (20) comprising an enlarged portion (22) at the sleeve (5) for receiving the fixing material (8).
3. Spark plug as claimed in claim 2, wherein the hole of the connecting terminal (20) has a greater length than the upper end of the main electrode (2) projecting out of the sleeve (5), the fixing material (8) being applied in the upper free portion of the hole (20).
4. Spark plug as claimed in claim 1, wherein
- the housing hole (9) comprises an enlarged portion (11, 11', 11'') with respect to the sleeve (5) at the upper surface (32) of the plate (4) for receiving the fixing material (8);
 - the sleeve (5) comprises a main hole (17) for housing the main electrode (2), the hole (17) comprising an enlarged portion (19) extending from the upper end of the main electrode (2) past the plate (4),
 - a glass cylinder, which is partly housed in the enlarged portion (19) of the hole (17) of the sleeve (5) housing the main electrode (2) and ends before the upper edge of the sleeve, so as to create a receiving volume for the fixing material (8);
 - the connecting terminal (6) comprises a hole (20) housing the upper end of the main electrode (2).
5. Spark plug as claimed in any one of the foregoing claims, wherein the spark plug (1) comprises a ground electrode (3), the plate (4) comprises a secondary hole (12) for housing the ground electrode (3) provided with an enlarged portion (14) with respect to the ground electrode (3) at the upper surface (32) of the plate (4) for receiving the fixing material (8).
6. Spark plug as claimed in claim 5, wherein the spark plug (1) comprises a metallic ring (15) housed inside the enlarged portion (14) of the secondary hole (12) of the plate (4) and configured for realizing a conductive bridge between the ground electrode (3) and the plate (4) when the fixing material (8) is applied inside the enlarged portion (14).
7. Spark plug as claimed in any one of the foregoing claims, wherein the fixing material (8) comprises a ceramic material.
8. A method for realizing a detection/ignition spark plug for boilers or the like, the method comprising the steps of:
- a) providing a spark plug (1) comprising:
 - a filiform main electrode (2);
 - a sleeve (5) for housing an intermediate portion of the main electrode (2);
 - a fixing plate (4) with a housing hole (9) for the sleeve (5);
 - b) providing a mask (23) for assembling the spark plug (1) configured for holding in position the elements of the spark plug in absence of the fixing material;
 - c) applying a fixing material (8) in the fluid form between the main electrode (2) and the sleeve (5) and between the sleeve (5) and the fixing plate (4);
 - d) heating the spark plug (1) supported inside the mask (23) so that the fixing material (8) is brought to the solid phase between the main electrode (2) and the sleeve (5) and between the sleeve (5) and the fixing plate (4).
9. Method as claimed in claim 8, wherein, according to step a), the spark plug comprises a connecting terminal (6) able to be coupled to the main electrode (2); according to step c), the fixing material (8) is applied between the connecting terminal (6) and the main electrode (2).
10. Method as claimed in claim 8 or 9, wherein, according to step a), the spark plug comprises a ground electrode (3) and the plate (4) comprises a secondary hole (12) for housing the ground electrode (3); according to step c), the fixing material (8) is applied between the plate (4) and the ground electrode (3).
11. Method as claimed in claim 10, wherein, according to step a), the spark plug comprises a metallic ring (15) housed inside the secondary hole (12) of the plate (4); according to step c), the fixing material (8) is applied between the plate (4) and the ground electrode (3) after the positioning of the metallic ring (15).





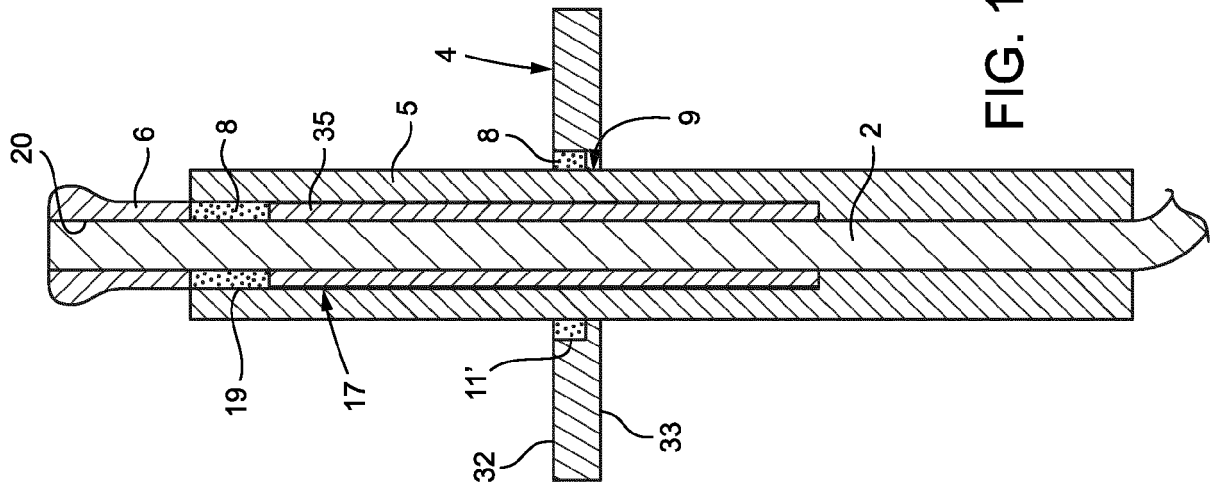


FIG. 10

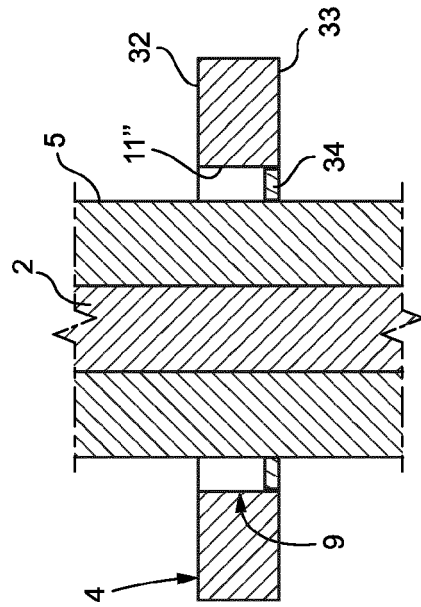


FIG. 8

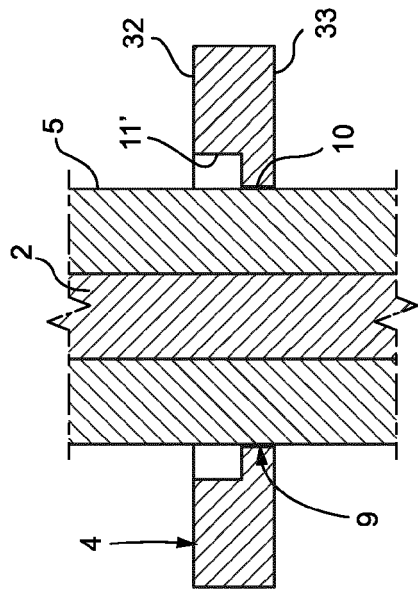


FIG. 7

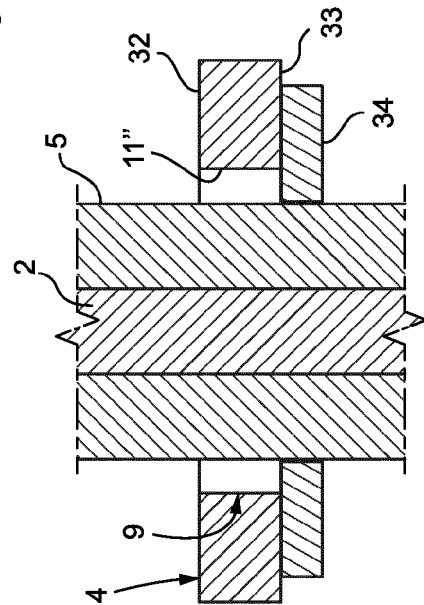


FIG. 9



EUROPEAN SEARCH REPORT

Application Number
EP 17 20 3655

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 388 523 A2 (CASTFUTURA SPA [IT]) 23 November 2011 (2011-11-23)	1-3,7-9	INV. F23Q3/00
Y	* paragraphs [0007], [0008], [0017],	5,10	H01T13/34
A	[0048], [0064], [0065], [0081], [0082]; claim 21; figures 16,712-14 *	6,11	H01T21/02

X	EP 0 915 298 A2 (BERU AG [DE]) 12 May 1999 (1999-05-12)	1	
Y	* paragraph [24.25.35]; figures 7,9 *	5,10	

			TECHNICAL FIELDS SEARCHED (IPC)
			F23Q H01T
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 13 April 2018	Examiner Verdoodt, Luk
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 20 3655

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82