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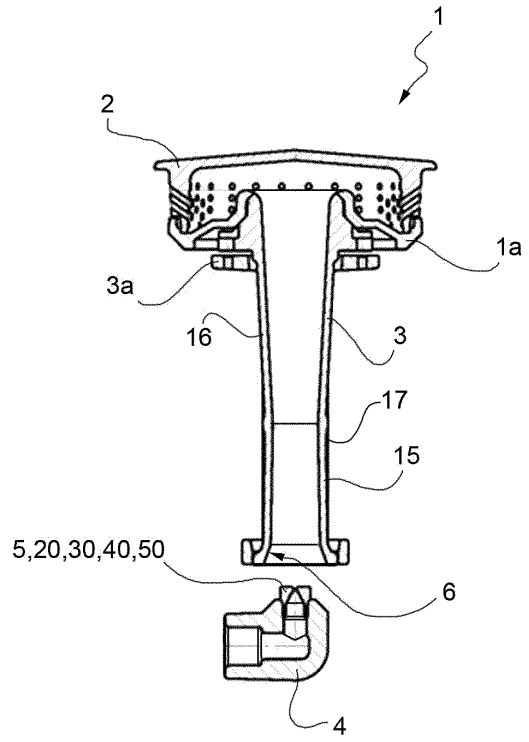
(54) Gas burner for a cooktop

(57) A gas burner comprises a flame ring, a Venturi tube to feed said flame ring, and a gas injector having a nozzle with an orifice to inject a burnable gas in said Venturi tube to feed said flame ring, wherein a flow perturbation element is provided in a region between said orifice and a middle portion of said Venturi tube to impact the air - gas mixing.

FIG. 2



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Description

[0001] The present invention relates to an improved gas burner for a cooktop.

[0002] A gas burner for a cooktop generally comprises at least a burning portion having a flame ring, and a gas injector to feed the flame ring with an ignitable gas medium. In particular, the burning portion comprises a Venturi tube having an inlet facing the gas injector and an outlet connected to the flame ring. The Venturi tube is placed below the flame ring and is substantially perpendicular with respect to the ring itself. The Venturi tube is designed to generate a mixing of air and gas for a more efficient and stable burning flame at the flame ring when the gas burner is functioning.

[0003] In particular, the inlet of the Venturi tube may be spaced from the gas injector and has a cross section that is large enough that both air and gas can enter the Venturi tube. When burnable gas is injected in the Venturi tube, air is dragged by the gas flow and the mixing takes place within the path from the inlet of the Venturi tube to the flame ring.

[0004] When a gas burner is connected to a supply of ignitable gas having a low pressure, e.g. a household gas supply, an optimal mixing of gas and air requires a quite long Venturi tube.

[0005] In some cases, it is not possible to provide a long Venturi tube to provide optimal air / gas mixing because a shortened burning portion and a flattened cooktop configuration are preferred, in particular on the mass market. In such a case it is preferred to provide more room for other kitchen appliances below the cooktop. Furthermore, more kitchen design options are available for the user. In particular, a flattened gas cooktop may be placed more easily within a kitchen, in particular within a small kitchen.

[0006] It is known to reduce the length of a Venturi tube within a gas burner for a cooktop. However, when the Venturi tube is shortened, mixing of air and gas is not optimal. In such a case, some regions of the flame ring are fed by an air / gas mixture that is rich in gas and other regions of the flame ring are fed by an air / gas mixture that is rich in air. This condition has several disadvantages that are mitigated by the air present in a region above the cooktop and surrounding the flame ring. In order to obtain a stable flame and a low unburned gas level when air / gas mixing is poor, the cooking plane for a cooking appliance shall be placed relatively far from the flame ring so that air surrounding the flame ring is such to improve the stability of the flame and the burning conditions. However, when the cooking plane is far from the flame ring the efficiency of heat transfer from the burner to the cooking appliance decreases.

[0007] A purpose of the present invention is to provide a gas burner for a cooktop with an increased mixing capability.

[0008] In compliance with the above aims, according to the present invention there is provided a gas burner comprising a flame ring, a Venturi tube to feed said flame ring with air /gas mix, and a gas injector having a nozzle with an orifice to inject a burnable gas into said Venturi tube, wherein a flow perturbation element is provided in a region between said orifice and a middle portion of said Venturi tube to impact the air - gas mixing.

[0009] Preferably, though not necessarily, the gas burner is furthermore **characterized in that** said flow perturbation element is set outside of said Venturi tube and between said inlet and said orifice.

[0010] Preferably, though not necessarily, the gas burner is furthermore **characterized in that** said flow perturbation element is carried by said nozzle.

[0011] Preferably, though not necessarily, the gas burner is furthermore **characterized in that** said flow perturbation element comprises a passive projection.

[0012] Preferably, though not necessarily, the gas burner is furthermore **characterized in that** said projection comprises a planar wall.

[0013] Preferably, though not necessarily, the gas burner is furthermore **characterized in that** said nozzle is a single body with said projection.

[0014] Preferably, though not necessarily, the gas burner is furthermore **characterized in that** said flow perturbation element is distanced from an axis of said orifice.

[0015] Preferably, though not necessarily, the gas burner is furthermore **characterized in that** the position of said projection is given by:

- $0,5*D < X < 5*D$
- $0,5*D < Y < 4*D$

[0016] Where:

D is the diameter of said orifice;
X is the height of a top edge of said projection with respect to said orifice;
Y is the distance of said projection from said axis.

[0017] Preferably, though not necessarily, the gas burner is furthermore **characterized in that** said flow perturbation element comprises a further projection.

[0018] Preferably, though not necessarily, the gas burner is furthermore **characterized in that** the position of said

further projection is given by:

- 0,5*D < X2 < 5*D
- 0,5*D < Y2 < 4*D

[0019] Where:

D is the diameter of said orifice;
X2 is the height of a further top edge of said further projection with respect to said orifice;
Y2 is the distance of said further projection from said axis.

[0020] Preferably, though not necessarily, the gas burner is furthermore, **characterized in that** said projection and said further projection are on opposite sides with respect to said axis.

[0021] Preferably, though not necessarily, the gas burner is furthermore **characterized in that** said further projection is different from said projection.

[0022] Preferably, though not necessarily, the gas burner is furthermore **characterized in that** said projection and said further projection define a slot.

[0023] Preferably, though not necessarily, the gas burner is furthermore **characterized in that** said Venturi tube comprises a diffuser having a divergent cross section along the gas flow to feed said flame ring and in that said flow perturbation element is placed upstream of said divergent portion.

[0024] In compliance with the above aims, according to the present invention there is further provided a method of operating a gas burner comprising a flame ring, a Venturi tube to feed said flame ring with an air/gas mixture and a gas injector having a nozzle with an orifice to inject a burnable gas in said Venturi tube, by providing a flow perturbation element in a region between said orifice and a middle portion of said Venturi tube to impact the air - gas mixing.

[0025] Preferably, though not necessarily, the method is further **characterized in that** said flow perturbation element is carried by said nozzle and that said nozzle is releasably connectable to a body of said injector.

[0026] A non-limiting embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

- Figure 1 is a perspective view of a gas burner according to the present invention;
- Figure 2 is a longitudinal cross section of figure 1;
- Figure 3a provides a perspective view and a correspondent longitudinal cross section of a nozzle for a gas burner according to prior art; and
- Figures 3b to e provide several embodiments, each of which is illustrated both in perspective view and corresponding longitudinal cross section, of a gas nozzle for a gas burner according to the present invention.

[0027] With reference to Figure 1, reference number 1 indicates as a whole a gas burner for a cooktop having a flame ring 2 to generate one or more rings of flames and a Venturi tube 3 supplying flame ring 2 with an air /gas mixture. Gas burner 1 further comprises a gas injector 4 having a nozzle 5 facing an inlet 6 of Venturi tube 3 to feed gas into the Venturi tube 3. Optionally, gas burner 1 comprises a burner body 1a extending radially from Venturi tube 3 and supporting flame ring 2. Burner body 1a can be supported by Venturi tube 3, as shown in figure 2.

[0028] Preferably, gas burner 1 comprises also a support member 7 defining a resting surface for positioning flame ring 2. In the illustrated embodiment, support member 7 also defines a rigid connection between the above-mentioned resting surface and the gas injector 4 and it is so shaped and dimensioned as to set a proper distance between nozzle 5 and inlet 6 of the Venturi tube. According to the embodiment of Figure 2, the resting surface contacts a flange 3a of the Venturi tube 3 so that flame ring 2 is positioned in space, in particular along the vertical direction, by burner body 1a and its shape. In a preferred embodiment, support member 7 and a main body 8 of gas injector 4 are a single body. In the particular embodiment here illustrated, the main body 8 of gas injector 4 is an L-shaped body, which has an inlet portion directed horizontally and releasably connected to a burnable gas line (not shown), e.g. a household gas line, and an outlet portion directed vertically and upwards. Nozzle 5 is connected, preferably releasably connected, to the outlet portion of the main body 8. Nevertheless, other configurations can be provided to hold flame ring 2 and Venturi tube 3 in a suitable relative position with respect to nozzle 5. In particular, various connections of the flame ring 2 with Venturi tube 3 and a horizontal main plate (not shown) of the cooktop are possible. In one configuration, Venturi tube 3 is releasably connected, e.g. by screwing, to the main plate of the cooktop and flame ring 2 is resting on top of Venturi tube 3 by gravity.

[0029] Figure 3a illustrate in greater detail nozzle 5 according to the prior art. Such nozzle has a flat head surface 9 and an orifice 10 to inject gas beyond head surface 9.

[0030] In a gas burner according to the prior art, air / gas mixing in the area immediately downstream nozzle 5 is

insufficient, in particular when burnable gas is provided through gas injector 4 at a low pressure, i.e. the pressure in a household or restaurant supply line or, more in general, in a city or municipal gas system. By contrast, a high pressure gas feed can be provided when a pressurized gas cylinder is connected to a gas burner, e.g. in camping gas cookers.

[0031] According to the present invention a flow perturbing element is provided either outside or inside an initial portion of Venturi tube 3 downstream of orifice 10. Depending on the many possible configurations, a Venturi tube 3 for a gas burner fed by ignitable gas having a low pressurization generally comprises two longitudinal portions: a lower portion 15 defining inlet 6 and an upper portion, or diffuser, 16 between the lower portion 15 and flame ring 2. The lower portion 15 and the upper portions 16 join at a middle portion 17 of the Venturi tube 3. Diffuser 16 has a divergent cross section towards flame ring 2 along the air / gas mixture flow and has the function of increasing the mixing of air and gas upstream of flame ring 2. The Applicant has found that when a flow perturbing element is provided downstream of orifice 10 and upstream of diffuser 16, i.e. between the orifice 10 and the middle portion 17, air / gas mixing is improved. Diffuser 16 can be used when vertical space available for gas burner 1 is reduced and gas is provided at a low pressure, in order to improve mixing.

[0032] Figure 3b discloses a nozzle 20 for a gas burner according to a first embodiment of the present invention, to be used in gas burner 1 in place of nozzle 5. Nozzle 20 is releasably connected to main body 8.

[0033] Nozzle 20 has a shaped head portion 21 defining a projection 22 whose profile intersects the trajectory of gas exiting orifice 10. If compared with the head portion of nozzle 5 of Figure 3a, the head portion 21 has substantially the same height at projection 22 and a much lower height in the remaining portion. Moreover, the head portion 21 is (seen from the above) preferably hexagonal, but may have any other shape that allows easy coupling of the nozzle 20 onto the main body 8. Nozzle 20 further comprises a connecting portion 25 set below head portion 21, for connecting nozzle 20 to main body 8. Head portion 21 and connecting portion 25 preferably form a single body. Connecting portion 25 is preferably cylindrical and externally threaded, so that it can be coupled with an internally threaded portion of the exiting hole of the main body 8. Head portion 21 normally projects from main body 8 and is placed below Venturi tube 3 to face inlet 6.

[0034] Advantageously, the circle circumscribing the head portion 21 has a greater diameter than the connecting portion 25, and the nozzle 20 comprises also a middle frusto-conical portion 26 joining the head portion 21 with the connecting portion 25, designed to abut on the edge of the exiting hole of gas injector 4.

[0035] The gas passage inside the nozzle 20 includes, in addition to the exiting orifice 10, an entrance hole 27, which is slightly smaller than the exiting hole of the main body 8 but larger than the orifice 10, and a middle tapered section 28 connecting the entrance hole 27 to the orifice 10.

[0036] When the gas burner according to the invention is functioning, the gas exiting from nozzle 20 tends to expand according to a tapered trajectory diverging from orifice 10. The projection 22 of head portion 21 is shaped and located to interfere with the gas flow exiting orifice 10 according to said tapered trajectory. This causes a perturbation of the gas flow that increases air / gas mixing. Furthermore, projection 22 of nozzle 20 perturbs the gas flow in a passive way, i.e. projection is not energized or actuated and perturbation is obtained because the projection functions as an obstacle to the gas flow. In this way flow perturbation is easily and cost effectively obtained.

[0037] According to the embodiment of Figure 3b, shaped head portion 21 is asymmetric with respect to an axis A of orifice 10. Preferably, shaped head portion 21 comprises a single projection 22 having a lateral wall 23 distanced from and facing axis A. Projection 22 extends from a plane containing an edge 10' of orifice 10. Edge 10' may be circular.

[0038] Position and shape of lateral wall 23 is such to reach a good compromise between two conflicting issues. On one side the closer the wall 23 to axis A the higher the turbulence generated. On the other side, the farther the wall 23 from axis A the higher the gas flow speed. In case of an excessive turbulence generated at the inlet 6 of Venturi tube 3, gas flow is slow and combustion is negatively impacted.

[0039] According to a preferred embodiment, let X and Y be defined as the height and horizontal distance of an upper edge 24 of lateral wall 23 from axis A respectively; and D be the diameter of orifice 10. A good compromise on the above conflicting issues is obtained when the above parameters meet conditions 1.1 and 1.2 below.

[0040] Lateral wall 23 may either be planar, as illustrated in Figure 3b in order to be easily manufactured, or be shaped differently within the range defined by the conditions below.

[0041] Figure 3c refers to a nozzle 30 according to a second embodiment of the present invention. Numerals identical to those of nozzle 20 are used in connection with nozzle 30 to designate elements that are functionally identical to those of nozzle 20. In practice, the only differences are in the upper part of the head portion.

[0042] Nozzle 30 comprises a shaped head portion 31 that is symmetrical with respect to axis A of orifice 10. In particular head portion 31 comprises a projection similar - but functionally identical, and therefore indicated with the same number - to projection 22 of Figure 3b, and a further projection 32 that is opposite to projection 22 with respect to axis A. The further projection 32 increases the turbulence of the gas flow. Projections 22 and 32 define a straight slot 34 as shown in figure 3c. The slot 33, in particular, defines an easy-to-manufacture embodiment to obtain the desired increase of air / gas mixing.

[0043] According to a preferred embodiment, let X be defined as the height of projections 22 and 32; Y be the distance

between (upper) edge 24 and a corresponding (upper) edge 33 of projection 32; and D be the diameter of orifice 10. A good compromise on the above conflicting issues is obtained when the above parameters meet conditions 1.1 and 1.2.

[0044] The lateral wall facing axis A of each projection 22, 32 may either be planar, as illustrated in figure 3c, or be shaped differently within the range defined by the conditions below. Moreover, such lateral walls may be vertical, as illustrated in Figure 3c, or inclined, as the lateral wall of projection 22 in Figure 3b.

[0045] Figure 3d refers to a nozzle 40 according to a third embodiment of the present invention. Numerals identical to those of nozzle 30 are used in connection with nozzle 40 to designate elements that are functionally identical to those of nozzles 20 or 30.

[0046] Nozzle 40 comprises a shaped head portion 41 that is asymmetrical with respect to axis A of orifice 10. In particular head portion 41 comprises a projection similar - but functionally identical, and therefore indicated with the same number - to projection 22 of Figures 3b and 3c, and a further projection 42 that is opposite to projection 22 with respect to axis A, wherein projection 22 is shorter and closer to axis A than projection 42.

[0047] According to a preferred embodiment, let X1 and X2 be defined as the height of projections 22 and 42 respectively; Y1 and Y2 be the distance between axis A and (upper) edge 24 and between axis A and a corresponding (upper) edge 43 of projection 42 respectively; and D be the diameter of orifice 10. A good compromise on the above conflicting issues is obtained when the above parameters meet conditions 1.1 and 1.2 below.

[0048] The lateral wall facing axis A of each projection 22, 42 may either be planar, as illustrated in figure 3d, or be shaped differently within the range defined by the conditions below. Moreover, such lateral walls may be vertical, as illustrated in Figure 3d, or inclined, as the lateral wall of projection 22 in Figure 3b.

[0049] Figure 3e refers to a nozzle 50 according to a fourth embodiment of the present invention. Numerals identical to those of nozzle 40 are used in connection with nozzle 50 to designate elements that are functionally identical to those of nozzles 20 or 30 or 40.

[0050] Nozzle 50 comprises a flat head portion 51 similar to that of Figure 3a, but combined with a flow perturbing element 52 having a curved lateral wall 53 positioned in proximity of orifice 10. Perturbing element 52 may be a cylinder, in particular a circular and straight cylinder that is substantially perpendicular to axis A. Perturbing element 52 may be separated from flat head surface 9 as shown in the cross section of figure 3e.

[0051] According to a preferred embodiment, let X be defined as the height of an upper edge 54 of lateral wall 23; Y be the distance between perturbing element 52 - in particular its lateral edge 53 - and axis A; and D be the diameter of orifice 10. A good performance of the gas burner is obtained when the above parameters meet the following conditions:

$$0{,}5*D < X, X1, X2 < 5*D \qquad (1.1)$$

$$0{,}5*D < Y, Y1, Y2 < 4*D \qquad (1.2)$$

[0052] The lateral wall facing axis A of perturbing element 52 may either be curved, as illustrated in figure 3e, or be shaped as a prism within the range defined by the above relationships.

[0053] When the position of the flow perturbing element satisfies conditions 1.1 and 1.2, the percentage of unburned gas considerably decreases, all other conditions remaining equal with respect to a gas burner that is not provided with a flow perturbing element.

[0054] According to the present invention, prior art nozzle 5 can be substituted in a very easy way by any of nozzles 20, 30, 40 or 50. It is therefore possible to upgrade an existing gas burner in order to obtain an improved air / gas mix. This is particularly easy when nozzle 5 is releasably attached to main body 8 of injector 4.

[0055] Clearly, changes may be made to the gas burner 1 as described above without, however, departing from the scope of the present invention.

[0056] For example the Venturi tube 3 may have further configurations and, in particular, diffuser element 16 can be substituted by a constant cross section tubular element or by a portion that is convergent towards the flame ring along the gas flow direction. In particular, a constant cross section tubular element is used when a wide vertical space is available, as for example in oven gas burners. In such a case, middle portion is located substantially half way of the Venturi tube 3. However, this is not the case when Venturi tube 3 comprises diffuser 16. In such an instance middle portion 17 is upstream of diffuser 16.

[0057] Burner body 1a, flame ring 2 and Venturi tube 3 can be connected in different ways, either by a combination of resting surfaces that are loaded by gravity force and are designed for a manual disassembly, or by rigid connections. In particular it is even possible that burner body 1a, flame ring 2 and Venturi tube 3 be manufactured as a single body by casting.

Claims

1. Gas burner (1) comprising a flame ring (2), a Venturi tube (3) to feed said flame ring (2) with air /gas mixture and a gas injector (4) having a nozzle (20, 30, 40, 50) with an orifice (10) to inject a burnable gas in said Venturi tube (3), **characterized in that** a flow perturbation element (22, 32, 42, 52) is provided in a region between said orifice (10) and a middle portion (17) of said Venturi tube (3) to impact the air - gas mixing.

2. Gas burner according to claim 1, **characterized in that** said flow perturbation element (22, 32, 42, 52) is set outside of said Venturi tube (3) and between an inlet (6) of said Venturi tube and said orifice (10).

3. Gas burner according to claim 2, **characterized in that** said flow perturbation element (22, 32, 42) is carried by said nozzle (20, 30, 40, 50).

4. Gas burner according to any of the preceding claims, **characterized in that** said flow perturbation element (22, 32, 42, 52) comprises at least an upward projection of said nozzle extending beyond the exit of the orifice (10) in a vertical direction.

5. Gas burner according to claim 4, **characterized in that** said flow perturbation element (22, 32, 42) comprises a planar wall (23) facing a central axis (A) of said orifice (10).

6. Gas burner according to claim 5, **characterized in that** said nozzle (20, 30, 40, 50) is a single body with said projection (22, 32, 42).

7. Gas burner according to any of the preceding claims, **characterized in that** said flow perturbation element (22, 32, 42, 52) is distanced from a central axis (A) of said orifice (10).

8. Gas burner according to any of claims 4 to 7 **characterized in that** the position of said perturbation element (22, 52) is given by:

   - $-0,5*D < X < 5*D$
   - $-0,5*D < Y < 4*D$

   Where:

   D is the diameter of said orifice (10);
   X is the height of a top edge (24, 54) of said perturbation element (22 ,52) with respect to the exit of said orifice (10);
   Y is the distance of said perturbation element (22, 52) from said axis (A).

9. Gas burner according to any of the preceding claims, **characterized in that** said flow perturbation element comprises a further perturbation element (32 ,42).

10. Gas burner according to claim 9, **characterized in that** the position of said further perturbation element (32, 42) is given by:

    - $-0,5*D < X2 < 5*D$
    - $-0,5*D < Y2 < 4*D$

    Where:

    X2 is the height of a further top edge (33, 43) of said further perturbation element (32, 42) with respect to said orifice (10);
    Y2 is the distance of said further perturbation element (32, 42) from said axis (A).

11. Gas burner according to any of claims 9 or 10, **characterized in that** said perturbation element (22) and said further perturbation element (32, 42) are on opposite sides with respect to said axis (A).

12. Gas burner according to any of claims 9 to 11 **characterized in that** said perturbation element (22) and said further perturbation element (32, 42) define a slot therebetween.

13. Gas burner according to any of the preceding claims, **characterized in that** said Venturi tube (3) comprises a diffuser (16) having a divergent cross section along the gas flow direction to feed said flame ring (2) and **in that** said flow perturbation element (22, 32, 42, 52) is placed upstream of said divergent portion (16).

14. Method of operating a gas burner (1) comprising a flame ring (2), a Venturi tube (3) to feed said flame ring (2) with air /gas mixture and a gas injector (4) having a nozzle (20, 30, 40, 50) with an orifice (10) to inject a burnable gas in said Venturi tube (3), by providing a flow perturbation element (22, 32, 42, 52) in a region between said orifice (10) and a middle portion (17) of said Venturi tube (3) to impact the air - gas mixing.

15. Method according to claim 14, **characterized in that** said flow perturbation element (22, 32, 42) is carried by said nozzle (10) and that said nozzle is releasably connectable to a body (8) of said injector (4).

FIG. 2

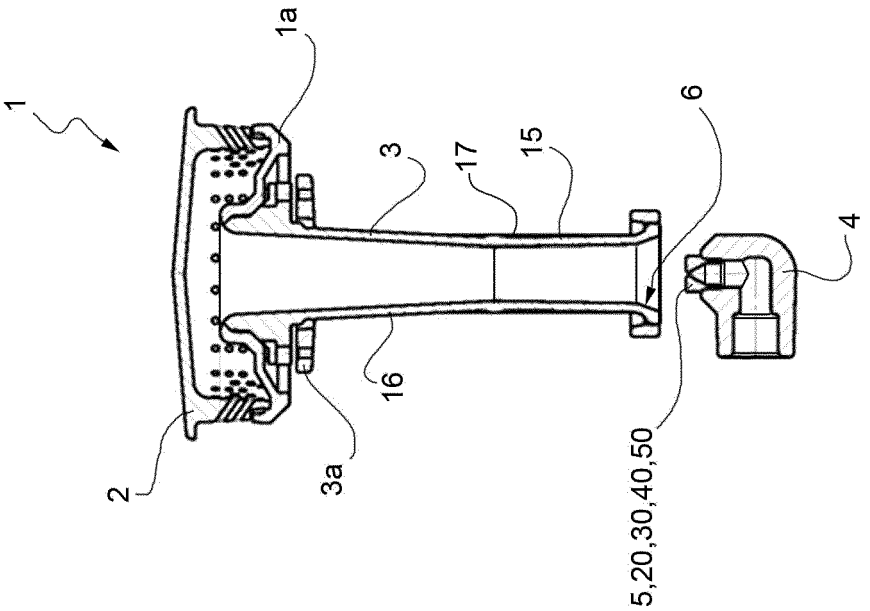


FIG. 1

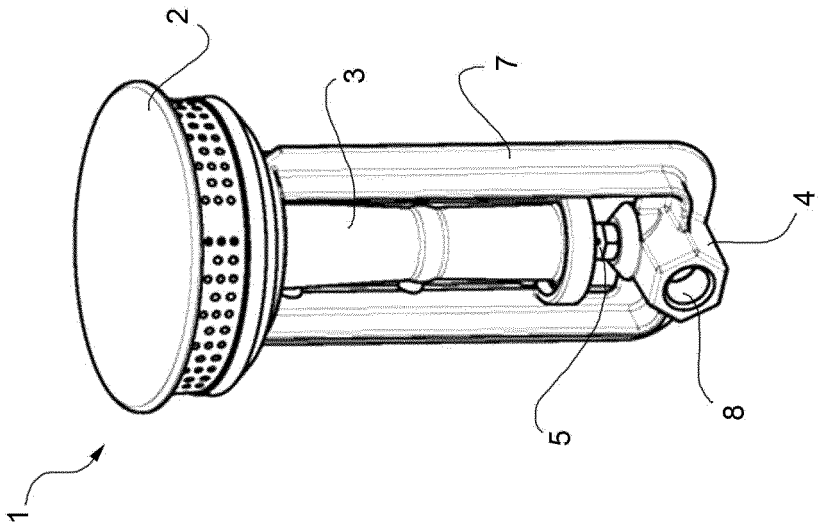


FIG. 3a

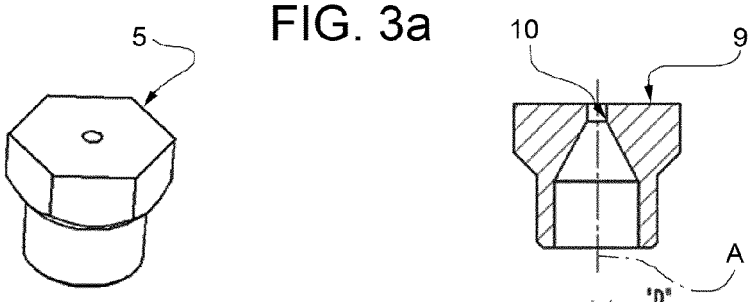


FIG. 3b

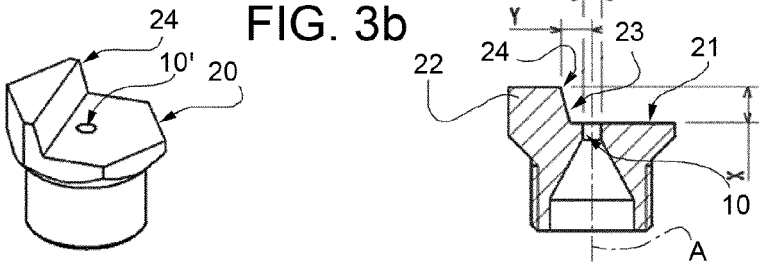


FIG. 3c

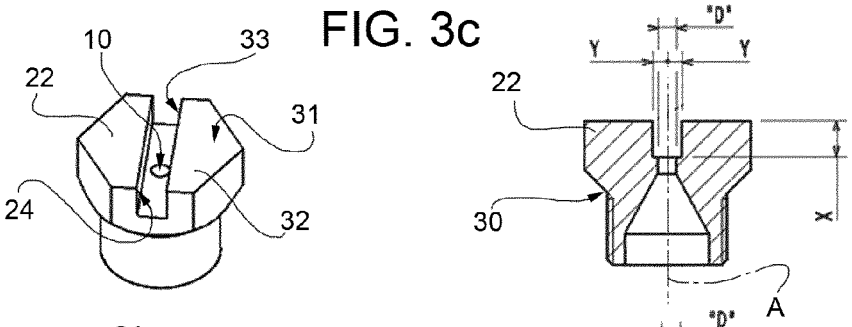


FIG. 3d

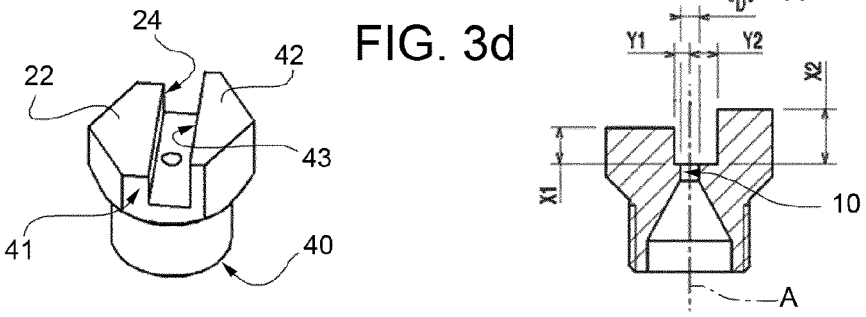
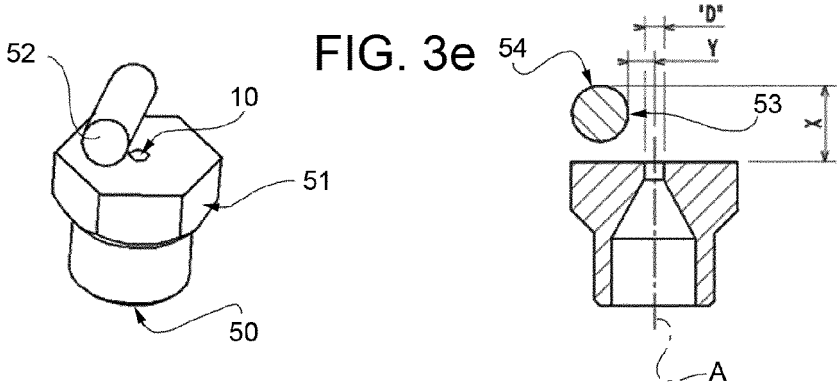


FIG. 3e



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EUROPEAN SEARCH REPORT

Application Number
EP 13 17 8981

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 Y	WO 2012/001714 A1 (SABAF SPA [IT]; BETTINZOLI ANGELO [IT]) 5 January 2012 (2012-01-05) * page 5, paragraph 6 - page 7, paragraph 4 * * page 10, paragraph 4 - page 11, paragraph 2 * * figures 1,2,7 * -----	1-4,6-8, 10,13-15 5,9,11, 12	INV. F23D14/06 F23D14/64 F23D14/70
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A	DE 295 00 619 U1 (VAILLANT JOH GMBH & CO [DE]) 23 February 1995 (1995-02-23) * page 3, paragraph 1 - paragraph 5 * * figure * -----	1,14	

TECHNICAL FIELDS SEARCHED (IPC)

F23D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 October 2013	Gavriliu, Costin

CATEGORY OF CITED DOCUMENTS

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