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(54) **TORCH APPARATUS**

(57) For improving predictability and stability of the hot process gas output of a torch apparatus (1; 1'), in particular a manually guided ambient air torch apparatus, the torch apparatus comprises a first, upstream section, the upstream section including a combustible gas intake member (2) and a gas mixing tube (4), and a second, downstream section, the downstream section including a burner array (12; 12'), the burner array being flow connected to the combustible gas mixing tube (4) by a flow spreader (7; 7'), the burner array together with the flow spreader being enclosed by an enclosure (21; 21'), the enclosure being configured to allow ambient air to enter at an upstream located position and to mantle the hot process gas output produced by the burner array.

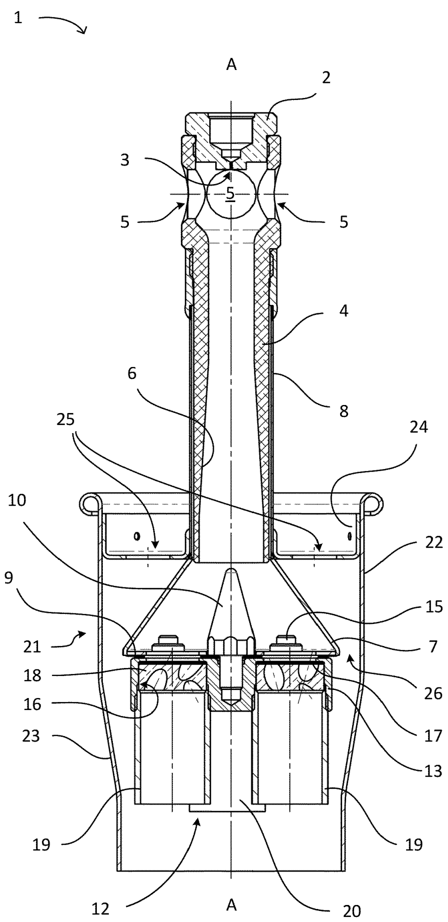

Fig. 1

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of gas burners and, more particularly, to manually guided ambient air torch apparatus.

BACKGROUND

[0002] Manually guided ambient air torch apparatuses are known in waste variety for many purposes including heating, drying, flaming, laminate sheet welding or shrinking and the like. Relative to laminate sheet welding a very common application can be found in roofing where roofing membrane material have to be locally heated for melting the bitumen. Here, in typical working scenarios, a worker unrolls a coil of roofing membrane material thereby progressively heating the material along the zone in between the membrane sheets which is most proximate to get into contact with the substrate.

[0003] In order to accommodate for the workers convenience to maintain an upright or merely slightly bent posture while applying the roofing cardboard the torch apparatus may be provided with an elongated handle or extension bar thereby moving the hot gas output of the burner to a position remote from the handle. In such circumstances, a practical need may be seen in having the hot process gas output homogeneously spread onto a sufficiently broad area in order to compensate for lesser exact handling thereby avoiding unintentional exposure of eventually inflammable materials in the proximity of the working zone to the hot process gas output of the burner at the same time.

[0004] As an objective underlying the present disclosure it may be seen to provide for an improvement to gas burners and manually guided ambient air torch apparatus in view of predictability and stability of the hot process gas output.

SUMMARY

[0005] The present disclosure proposes an approach for meeting with the above objective in the concept of a torch apparatus with a first, upstream located section, the upstream located section including a combustible gas intake member and a gas mixing tube, and a second, rather downstream located section, the downstream located section including a burner array with a burner array socket and multiple burners mounted therein.

[0006] Additionally, the conceptual torch apparatus has flow spreader for connecting the gas mixing tube to the multiple burners. In the conceptual torch apparatus, the burner array together with the flow spreader is enclosed or surrounded by an enclosure such that, in particular, the flow spreader and/or the burner array socket together with the enclosure restrict and define an ambient air passage leading from the interior of the enclosure upstream of the burner array socket to the interior of the enclosure downstream of the burner array socket to an gap essentially surrounding the burner array.

[0007] This design will allow ambient air to enter at an upstream located position and to rather mantle around than integrally mixing with the hot process gas output produced by the burner array during operation. Apparently, this concept may be applied to manually-guided, ambient air torch apparatus. The use of a burner array may allow shorter package at comparable heat production. Additionally, the burner array allows a reliable definition of the overall flame and hot process gas output. Beyond this, encapsulating or shielding the burner array into a mantle air guide may be useful for creating a reliable mixing of the hot exhaust gas produced by the burner array with cooler ambient air in order to achieve an overall hot process gas output at the desired temperature. Further, the mantling of the hot process gas jet may reduce a potential tendency of the jet for creating instabilities.

[0008] In addition thereto, the torch apparatus may have the burner array flow connected to the gas mixing tube by a flow spreader, whereby the burner array together with the flow spreader are enclosed by the mantle air guide. The mantle air guide may in instances be configured for guiding the ambient air such as to pass over the outer surface of the flow spreader before mixing with the hot exhaust gas.

[0009] This aforementioned configuration may allow to apply cooling to the flow spreader. Cooling may, in operation, reduce the tendency of the gas mixture inside the flow spreader to undergo an undesired ignition. Sources for undesired ignition may be found in self-ignition because of excessive gas temperature and ignition due to the contact of the gas with an overheated flow spreader wall section. Any ignition occurring inside the flow spreader has comparable effect as flame flashback and potentially impacts handling safety and performance of the torch apparatus.

[0010] In addition thereto, the conceptual torch may have the flow spreader in frustoconical shape, the smaller top portion being connect to the gas mixing tube and the wider bottom portion being connected to the burner array. Alternatively, the torch apparatus may have the flow spreader provided in a triangular-prismatic shape with a smaller side wall portion being connected to the gas mixing tube and the wider side wall portion connected to the burner array.

[0011] The assembly of the flow spreader and the burner array may be provided with a generally uninterrupted cross-section at the widest perimeter such as to restrict the mantle flow of ambient air to laterally pass along the burner field, in particular in essentially parallel direction to the hot process gas streams created in the burner array. In addition, the flow spreader may be shaped such as to provide a sufficiently smooth transition in the mantle flow of ambient air in order to avoid instabilities and turbulences.

[0012] In addition thereto, the conceptual torch apparatus may have a tapered flow dividing body located inside the flow spreader, the narrower portion of the flow dividing body pointing towards the gas flow entering into the flow dividing body form the combustible gas mixing tube.

[0013] The torch apparatus may additionally be provided with a mesh or diaphragm and, in particular, with a metallic mesh, cross-sectionally located in the gas flow path between the flow spreader and the burners in the burner array. Such metallic mesh or diaphragm may serve as a flashback prevention to prevent an flame in any of the burners to strike back into the flow spreader. This may in particular useful to allow reliable operation of the torch apparatus at decreased flow rates of combustible gas. This, in particular, may be used to put the torch apparatus into a pilot or idle mode rather that completely shutting down the operation.

[0014] In addition thereto, the conceptual torch apparatus may have the burner array comprising a number of vortex burners, each of the vortex burners including a vortex member, in particular a swirl disc, for superposing a rotational component to the flow movement of the gas mixture entering into the burner from the flow spreader.

[0015] In addition thereto, the conceptual torch apparatus may have the entirety of the number of vortex burners being provided with vortex members or swirl disks with the same rotational sense.

[0016] In addition thereto, the conceptual torch apparatus may have each of the number of vortex burners including a preferably cylindrically shaped burner tube located downstream from the vortex member or swirl disk, respectively.

[0017] In addition thereto, the conceptual torch apparatus may have a number of vortex burners comprising a first set of vortex burners and a second set of vortex burners, the vortex burners of the first portion having opposite rotational sense than the burners of the second portion.

[0018] In addition thereto, the conceptual torch apparatus may have the enclosure being provided in a rotationally symmetrical shape, the centre axis of the tubular enclosure preferably matching with or being aligned in parallel with the centre axis of the gas mixing tube. Alternatively, the enclosure may be provided in a rather flat configuration of an inclined tubing of mainly rectangular cross-section. A rather flat enclosure may be configured to flatly lay on the ground or soil in typical use cases. In addition, a flat enclosure may have outer walls being in tapered inclination to the ground or soil in this use case. This may support a user in sliding the enclosure underneath a sheet material when placed on the ground and heating from the contact-side is needed.

[0019] In addition thereto, the conceptual torch apparatus may have the array of burners provided in a planar symmetrical arrangement respective to a plane perpendicular to the centre axis of the tubular mantle air guide. In addition thereto, the conceptual torch apparatus may have the burner array consisting of four square-packed burners of identical diameter.

[0020] Alternatively, the torch apparatus may have the array of burners provided in a linear arrangement and, in particular, with a number of substantially identical burners lined up in substantially equally distribution, the orientation of the burners being such as to have the axis of process gas output of the burners being substantially parallel to each other.

[0021] In addition thereto, the conceptual torch apparatus may have the burner array comprising a first set of identically shaped burners and a second set of identically shaped burners, the shape of the burners in the first set being different from the shape of the burners in the second set.

[0022] In addition thereto, the conceptual torch apparatus may have the first set of burners in the burner array comprising all except of one burner in the burner array, wherein the difference in the shape of the burners in the respective sets is a difference in the axial extension of the burner along the gas stream direction.

[0023] Such kind of layout might be considered advantageous because of the low number of different parts in production. It has however been found that, in a highly symmetrical burner array layout, e.g. in a layout wherein all individual burners have identical shape and identical flow properties and the burners are in addition spread in space in a symmetric manner, there may be an increased tendency for generating operational noise.

[0024] In addition, the conceptual torch apparatus may additionally comprise an extension stem fixedly connected to the burner array for allowing a user to manually guide the hot process gas output from a remote position. In particular, a handle may be mounted to the extension stem at a position remote from the connection to the burner array.

[0025] In more particular elaboration, the extension stem may be provided with a gas pipe having one end portion mounted to the combustible gas in-take member for allowing supply of combustible gas to the combustible gas intake member. The gas pipe may in instances be integrally made with the stem extension. In more specific situation, the stem extension may be provided in the configuration of a stiff metal tube.

[0026] In addition, the aforementioned conceptual torch apparatus may additionally have the handle provided with a hose coupling and internal conduits in a configuration for feeding combustible gas supplied to the hose coupling to the interior of the extension stem. In instance, the handle may be further equipped with a number of controls which are connected to a gas flow manipulator. In such layout, the controls together with the gas flow manipulator may be configured for allowing a user to control the operation of the torch apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] In the following, a detailed description will be provided relative to a selection of exemplary embodiments of a manually guided ambient air torch apparatus in consistency with the numerous principles and concepts summarized above. For the sake of illustration, reference will be made to the attached schematic drawings, wherein:

Fig. 1 outlines a sectioned longitudinal view on a first exemplary embodiment of a manually guided ambient air torch apparatus;

Fig. 2 outlines a perspective exploded view on the first exemplary embodiment of a manually guided ambient air torch apparatus according to Fig. 1;

Fig. 3 outlines a perspective view on a refinement applicable to the torch apparatus according to the Figs. 1 and 2 for facilitating the manoeuvrability and manageability;

Fig. 4 outlines a sectioned longitudinal view on a second exemplary embodiment of a manually guided ambient air torch apparatus;

Fig. 5 outlines a perspective exploded view on the second exemplary embodiment of a manually guided ambient air torch apparatus according to Fig. 4; and

Fig. 6 outlines a perspective view on a refinement applicable to the torch apparatus according to the Figs. 4 and 5 for facilitating the manoeuvrability and manageability.

DETAILED DESCRIPTION OF EXMPLARY EMBODIMENTS AND RELATED USE CASES

[0028] A first exemplary embodiment of a manually guided ambient air torch apparatus 1 may be, as shown in Fig. 1 and 2, provided in a straight configuration. In the exemplified situation, the straight configuration essentially extends along the stream of gas from the intake of the combustible gas and ambient air downwards to the output of the hot process gas. With particular reference to Fig. 1 the aforementioned operational gas stream can be understood to promote from the upper end to the lower end, whereas in particular reference to Fig. 2 the operational gas flow direction can be understood to promote from top right to bottom left.

[0029] According to Fig. 1, in more detail, a combustible gas intake member 2 may be provided at the uppermost point. The combustible gas intake member 2 may be provided as an internally threaded connector. The internal thread may, for example, be suitable for connecting the combustible gas intake member 2 to a standard gas feeding tube or pipe in a well-known manner. At a downstream location relative to the internal thread the combustible gas intake member 2 may have a restriction or nozzle 3. The nozzle 3 may serve for limiting the amount of combustible gas passing through the combustible gas intake 1 and entering into a gas mixing tube 4 located downstream from the gas intake member 3.

[0030] In the exemplary situation, the mixing tube 4 has some lateral openings 5 located adjacent to the nozzle 3 of the combustible gas intake member 1. These lateral openings 5 may be configured for allowing ambient air to enter into the gas mixing tube 2 and to thereby generate a flammable mixture of the combustible gas and ambient air. The ambient air is drawn into the mixing tube by means of the Venturi effect caused by the jet of combustible gas leaving the nozzle 3 and passing adjacent to the lateral openings 5.

[0031] In a more downstream portion of the gas mixing tube 4, in particular an extended cylindrical propagation space may be provided as shown in Fig. 1. This propagation space may serve for the purpose of allowing the mixture of combustible gas and ambient air to homogenize to a sufficient extent. In the specific situation, this propagation space includes a cylindrical section of the gas mixing tube 4, as illustrated, subsequent to short conical or smooth transition downstream the section where the lateral openings 5 are located. In addition, a conical widening 6 where the flow speed of the gas mixture will reduce in operation.

[0032] Again, according to the sectioned view in Fig. 1, the conical widening 6 of the exemplary gas mixing tube 4 feeds into a flow spreader 7. The flow spreader 7 may be provided in rotationally symmetrical shape relative to the centre axis A of the gas mixing tube 4. In particular, as shown in the exemplary views, the circumferential wall of the flow spreader 7 may have frustoconical shape. In instances, the upstream or intake opening of the flow spreader 7 may be provided in an annular sealed connection to the downstream end portion of the gas mixing tube 4. In even more particular embodiments, the gas mixing tube 4 may be connected to the flow spreader 7 by means of guiding sleeve 8 fixedly mounted to the flow spreader 7, as shown in the exemplary situation wherein a large downstream portion of the gas mixing tube 4 is firmly enclosed therein.

[0033] According to the illustration provided by Figs. 1 and 2, the downstream end of the exemplary flow spreader 7 may have a downstream circular wall plate with a number of round openings. In particular, in a central location of the flow spreader 7, a flow dividing body 10 may be provided. In the illustrated configuration, the flow dividing body 10 has a conical shape, the rounded tip portion thereof pointing against the gas flow entering into the flow spreader 6. The flow dividing body 10 may be understood to serve for preventing the incoming flow from generating turbulences. Such kind of turbulence might occur in circumstances where a gas flow directly hits against a perpendicular obstacle. Adjacent to the circular wall plate of the flow spreader 7, a the gasket disk 9 may be provided, the gasket disk 9 having four larger diameter holes 11 matching with the round openings in the circular wall plate for allowing the gas mixture to leave the flow spreader 7 in the direction of the centre axis at locations offset thereto.

[0034] At a location downstream from the gas spreader 7 a burner array 12 may be provided. Here, an exemplary quadratic layout of a square 2x2 burner array 12 will be explained with reference to Figs. 1 and 2. The exemplary quadratic burner array 12 may comprise a burner array socket 13 having an upstream mounting surface 14 flatly mounted to the gasket disk 9, as illustrated. To this extent, the flow dividing body 10 may be configured for fulfilling an additional function of a fixation member, in particular, by provision of a cylindrical screw portion extending from the bottom and reaching downstream into a fixation bore of the burner array socket 13, as exemplified. A set of additional fixation members 15 may be provided at other location as, for example, on a reference circle adjacent to the circumferential border of the gasket disk 9. For the sake of simplification these further fixation members 15 are not shown in Fig. 2.

[0035] The exemplified burner array socket 13 is additionally provided with four profiled passages 16 at positions matching with the holes 11 of the gasket disk 9 when mounted. As exemplified, the profiled passages 16 may be provided each with an annular recess at a location proximal to the mounting surface 14. The annular recess may serve as an end stop for fixation of cylindrical or round members. As exemplified, the profiled passages 16 in the burner array socket 13 may comprise threaded portions adjacent to their ends distal from the mounting surface 14.

[0036] In particular, each of the profiled passages 16 of the burner array socket 11 may contains a stack including a metallic mesh 17 and a swirl disk 18. With the exemplified profiled passages 16, the metallic meshes 17 may be provided in round shapes circumferentially abutting against the annular recess of the respective profiled passage 16. The metallic meshes 17 may be understood to provide for flashback barriers in order to preventing flames from striking back into the upstream located flow spreader 7 and gas mixing tube 4. In particular, the metallic meshes 17 may, in appropriate configuration, allow the quadratic burner array 12 to safely operate over a range of flow rates in the feeding of the mixture of combustible gas and ambient air. In particular, the quadratic burner array 12 may be operated at a rather low flow rate rather than being completely turned off. An idle or pilot operation mode of the torch apparatus 1 may be configured such that no flames are exiting from the enclosure 21 when chosen.

[0037] The ability of the torch apparatus 1 for entering into an idle or pilot operation mode may, in particular, when supported by an appropriate gas flow rate switching support, allow a user, during phases when no hot air production is needed, to put the torch apparatus 1 into the idle or pilot operation mode rather than completely shutting it off. Restarting hot air production from the idle or pilot operation mode is apparently more quicker and flexible than reigniting the torch apparatus 1. This also avoids the need for a pilot flame or electric ignition system which would otherwise be necessary to facilitate usage to approximately the same extent.

[0038] In the exemplified layout, a set of four burner tubes 19, 20 is mounted to the profiled passages 16 of the burner array socket 13. The burner tubes 19, 20 may be provided with outer threaded end sections in order to allow a screwed fixation to a respective threaded portion of the respective profiled passage 16, as exemplified. The burner tubes 19, 20 may, as shown, be provided in an essentially straight and cylindrical configuration. In particular, each of the stacks of a metallic mesh 17 and a cylindrical swirl disk 18 is fixed to remain in the respective bore by engagement with the end portion of the respective burner tube 19, 20 mounted to the respective profiled passage 16.

[0039] The burner tubes 19, 20 may have, as shown, the same internal diameter. This may, in connection with identical or similar metallic meshes 17 and/or swirl disks 18 result in all or at least some burners in the burner array 12 having the same hot process gas output in operation. This may be desired when a humogen and/or isotropic overall hot process gas beam is targeted to. In principle, the burner tubes 19, 20 might also be configured to have the same axial internal space between the downstream surfaces of the respective swirl disk 18 to the respective downstream orifice.

[0040] However, for the reasons set out in the summary section, the exemplified burner array is provided with two diametrically opposed burner tubes 20 having an increased length, whereas the other two diametrically opposed burner tubes 19, 20 have the same, slightly reduced length. The difference in length may amount in a typical dimensioning to approx. 2-3 millimetres in absolute or something between 5-10% in relative. This breaking of the intrinsic symmetry in the burner array 12 may help to reduce the tendency of neighboured burners to pairwise excite acoustical instabilities. Acoustical instabilities may, in circumstances, cause significant sound or noise which may be found constituting a subjective impairment of the working situation. Apparently, there are other approaches for breaking the symmetry of a generally symmetric burner array as, for example, applying changes to the swirl disk or apply other slight deviations from a perfect geometrical symmetry.

[0041] As shown, the quadratic burner array 12 may be included into an enclosure 21. This enclosure 21 is provided not only as a protection for the burners and hot process gas beams but also for the function of creating an internal mantle air flow as will be explained in more detail below. In the exemplified layout and as shown in Figs. 1 and 2, the quadratic burner array 12 may be, together with the flow spreader 7, included into an exemplary tubular enclosure 21. In instances, the enclosure 21 may comprise a round outer shell 22, the upstream end thereof being covered by a perforated top lid 24. The top lid 24 may have an annular grooved shape having its outer collar tightly mounted to the upstream end section of the outer shell 22. The internal collar of the top lid 24 may be mounted to the guiding sleeve 8 thereby maintaining the outer shell 22 of the enclosure 21 in a co-axial orientation relative to the gas mixing tube 4 and flow spreader 6. The top lid 24 may be provided with a number of holes 25 located in the flat section for allowing a flow of ambient air to enter the internal space inside the enclosure 22 in operation of the first embodiment of a torch apparatus 1.

[0042] The geometry of the outer shell 23 of the enclosure 21 may be adopted to have a portion extending beyond the orifices of the burner tubes 19, 20 of the quadratic burner array 12 in the downstream direction. An appropriate annular clearance 26 may be provided between the outer circumference of the quadratic burner array 12, in particular the outer circumference of the burner array socket 13, and the inside of the outer shell 23 for allow ambient air to flow around the quadratic burner array 12 and, in particular, the flow spreader 7. Further, the outer shell 22 may be provided with a constriction 23 in cross section. The constriction 23 may be provided on the height of the burner array 12, as shown in the exemplified layout.

[0043] In operation, pressurized combustible gas may be supplied to the illustrated embodiment of a torch apparatus 1. The combustible gas may, for instances, comprise butane or propane or a mixture of both, at an appropriate pressure. The combustible gas may be fed into the upstream side of combustible gas intake member 2. Driven by the pressure, the combustible gas passes through the nozzle 3 thereby creating a small jet that mixes with ambient air drawn through the lateral openings 5 into the gas mixing tube 4. This is a principle which is commonly known from a wide variety of so-called "Venturi burners".

[0044] The gas mixture made of combustible gas and ambient air, while travelling downstream along the gas mixing tube 4, homogenizes before entering into the internal space of the flow spreader 7. In the flow spreader 7, because of the wider space, the kinetic energy of the gas mixture flow translates into an increase in pressure. The increased pressure may be understood as the supply pressure to the quadratic burner array 12. With to the exemplified layout, each burner in the burner array 12 is supplied with nearly the same mixture of combustible gas at the same pressure. As the exemplified layout provides for essentially identical profiled passages 16 in the burner array socket 13, as well as essentially identical metallic meshes 17 and essentially identical swirl disks 18 the gas mixture flowing into the four burner tubes 19, 20 will be at nearly the same level. Before entering burner tubes 19, 20, the four exemplary gas flows, while passing through the swirl disks 18, have a tangential velocity added in order to create a vortex flow inside of the burner tubes 19, 20. Vortex flow burners are commonly known in the field and shall not be explained in detail. In summary, the effect resulting from the vortex flow can be found in a decreased flame extension together with an improved stability of the flame.

[0045] Once ignited, e.g. by means of an auxiliary ignition aid, the gas mixture fed to the internal space of the burner tubes 19, 20 will continuously enter into the flame reaction zone partially located in the interior of the specific burner tube burner tubes 19, 20. According to the feed rate of the gas mixture, the flames will extend more or less far beyond the orifice of the respective burner tube 19, 20. In the flame, a significant increase in gas volume occurs because of the reaction heat, the energy thereof driving the hot exhaust gas away from the burner tubes 19, 20, mainly in an axial downstream direction. A number of flames with tipped shape according to the number of burners in the burner array 12 will be the typical situation in operation.

[0046] Downstream from the orifices of the burner tubes 19, 20, the hot exhaust gas jets will mix with each other and, to some extent, with ambient air which is drawn by virtue of another Venturi effect form the internal space adjacent to the burner tubes 19, 20. This is somewhat similar to the Venturi effect explained before with reference to the mixing tube 4. Here, however, the Venturi effect will cause ambient air to be drawn through the holes 25 in the top lid 24 of the enclosure 21. This flow of ambient air passes through the annular clearance 26 separating the flow spreader 7 and burner array socket 13 outer circumference from the internal surface of the outer shell 23.

[0047] This mantle flow of ambient air does not only reduce the temperature of the hot exhaust gas to the desired level in view of the specific application but it also creates a kind of ambient air curtain enveloping the hot exhaust gas. This, in instances will reduce the tendency of the hot exhaust gas streams to create flow instabilities when passing over into the ambient and may thereby reduce a tendency to deviate from the expected propagation path as a cause of such instabilities. Otherwise, dynamically occurring instabilities could cause the hot process gas to reach beyond the intended working area. This, in specific situations, may support a user to avoid unintended exposure of inflammable items to the hot process gas stream and therefore may lead to an increase in operational safety.

[0048] Beyond that, the mantling flow of ambient air provides some cooling effect to the upstream side of flow spreader 7. This cooling may reduce the risk of undesired ignition of the gas mixture inside of the flow spreader 7. Such kind of undesired upstream ignition could be due to self-ignition of overheated gas or ignition by contact of the gas with an overheated surface.

[0049] According to Fig. 3, the torch apparatus 1 may further include additional assemblies in order to adapt for a specific purpose or operational mode. In the exemplified configuration, the torch apparatus 1 may include an extension stem 27. The extension stem 27 may have one end mounted to the combustible gas intake member 2. The other end of the extension stem 27 may be provided in the configuration of a handle or, particularly, may have a handle 28 mounted, as shown in the illustration. The length of the extension stem 27 may be chosen as to provide for a distance from the handle 28 to the hot process gas output opening of the enclosure 21 being sufficient for convenient and secure handling and operation. Secure operation may in instances require the hot process gas output being far enough remote from the worker person in order to safeguard against potential damage of clothing and/or burn injuries. Occupational safety may in addition require the torch apparatus to fit for being operated in an upright posture, for example in roofing.

[0050] The extension stem 27 may further be provided in the configuration of a tube or pipe thereby allowing to feed combustible gas to the combustible gas intake member 2 from a remote location. Alternatively, the combustible gas supply could be routed through a hose or similar which is not illustrated.

[0051] The handle 28 may, in addition, be provided with a number of controls 29, 30 for allowing a worker to control the operation of the torch apparatus in a single-handed operational manner. This may in particular include controlling of the torch apparatus in terms of the momentary output of hot process gas. The hot process gas output may, in instances, be controlled by changing the flow rate and/or pressure in the combustible gas supply to the combustible gas intake member 2. As shown, the controls may in particular be provided as a base setting wheel 29 and a quick change lever 30. The base setting wheel may be configured for setting the limit of gas flow at full operation whereby the quick change lever 30 may be configured to allow the user to switch from an idle or pilot operation mode to full operation.

[0052] To this extent, the handle 28 may be provided with a gas flow manipulator 31 in operational connection to the controls 29, 30. The gas flow manipulator 31 may be configured for adjusting the gas flow rate and/or pressure of the combustible gas by means, for example, of pressure reducer, restriction valves and the like. In the illustrated layout, a two-layered control scheme is implemented which allows the user of the embodiment of a torch apparatus 1 to apply a base operational setting by adjusting a base setting rod 29 and to apply momentary changes thereto by actuation of a quick setting lever 30.

[0053] The handle 28 may have the controls 29, 30 and the gas flow manipulator fully integrated together with a hose coupling 31 and an internal gas conduit. In the specific layout of a tubular gas feeding extension stem 27 this may beneficially result in a completely shielded gas flow path.

[0054] In addition the first exemplary embodiment of a torch apparatus 1 may additionally include a stand 33, as illustrated. The stand 33 may help a user to safely place the torch apparatus 1 on the soil in a post-operational or operating situation without the risk of unintentional tilt or movement. This may in particular desired when, after the operation has been stopped, the enclosure 21 is still hot or when the torch apparatus 1 is put in idle or pilot operation mode, as explained before.

[0055] A second exemplary embodiment of a torch apparatus 1' is schematically illustrated in Figs. 4 to 6. The second exemplary embodiment may have many parts similar or even identically shaped to the one included in the first exemplary embodiment. These elements will have the same reference numerals assigned to whereas functionally similar but structural different elements will be denoted by the same reference numerals with an apostrophe.

[0056] Again, according to Figs. 4 and 5, the torch apparatus 1' has a combustible gas intake member 2 with a nozzle 3 at the uppermost point of a gas mixing tube 4. The gas mixing tube 4 of the second embodiment may be, as shown, structurally identical to the gas mixing tube of the first embodiment and may operate in the same or very similar way. For further details, reference is therefore made to the explanations relative to Figs. 1 and 2.

[0057] The gas mixing tube 4 may also be inserted into a sort of guiding sleeve 8' connected to a flow spreader 7', which, indifference to the first embodiment, has a generally flat triangular-prismatic shape as apparent from Fig. 5. The interior space of the flow spreader 7' is provided with a tapered baffle plate or similar prismatic flow deflector 10'. The flow deflector 10' may be designed for splitting the incoming mixture of combustible gas and ambient air into two principal streams, each thereof following one of the upper, two roof-like sidewalls of the flow spreader 7', according to the view and orientation in Fig. 4.

[0058] Again, in this orientation, the bottom side of the flow spreader 7' has a number of passage holes 11' which may be arranged linearly at equal distances. The passage holes 11' are provided for allowing the mixture of combustible gas and ambient air to travel to a number of burners in an linear burner array 12' mounted to the bottom side of the flow spreader 7' in the view and orientation of Fig. 4.

[0059] The linear burner array 12' has an elongated burner array socket 13' with a number of profiled passages 16, each thereof pairwise mating with one of the passage holes 11' in the flow spreader 7' bottom side. An elongated gasket plate 9' may be provided between, as shown.

[0060] The linear burner array 12' may have structurally similar or identical individual burners as the quadratic burner array 12 of the first embodiment. In particular, each individual burner in the elongated burner array 12' may include a stack of a metallic mesh 17, a swirl disk 18 and a burner tube 19, 20.

[0061] Further similar to the first embodiment, the burner tubes 19, 20 in the linear burner array 12' may have groupwise different length. In particular, as shown in Fig. 4, a first group of burner tubes 19 may have identical first length and a second group of burner tubes 20 may have a second length, different from the first length. This will allow the linear burner array 12' to have no burner tubes 19, 20 of equal length at neighbouring positions. This may, as in the first embodiment, help to break a symmetry in the linear burner array 12' thereby lowering a tendency of the burners to produce undesired sound or noise.

[0062] The linear burner array 12' together with the prismatic flow spreader 7' and an adjacent portion of the mixing tube 4 are included in a flat enclosure 21'. The flat enclosure 21' may include an outer shell 22' being provided in approximate shape of an angled rectangular tubing. A rear portion 22.1' of the shell 22' completely includes the triangular-prismatic flow spreader 7' and an adjacent portion of the mixing tube 4. An orifice portion 22.2' of the shell 22' mainly surrounds the linear burner array 12' and may be provided with generally rectangular cross section. In addition, the orifice portion 22.2' of the shell 22' may be longitudinally aligned with the axis of the burner tubes 19, 20 in the elongated burner array 12' enclosed therein, as shown in Figs. 4 and 5. The rear portion 22.1' and the orifice portion 22.2' of the shell 22' may, in particular, be provided in an angled configuration which adapts to the inclination between the mixing tube 4 and the axis of the burner tubes 19, 20 in the linear burner array 12'.

[0063] The dimensions of the orifice portion 22.2' and the outer extension of the burner array socket 13' may be chosen such as to yield a rectangular clearance 26' between the inner wall of the shell 22' and the outer circumference of the burner array socket 13'. Such clearance 26' may be provided in order to allow ambient air to be drawn from the rear portion of the flat enclosure 21' to the orifice portion 22.2' by a Venturi effect caused by the intense flow of hot process gas from the burners. Again as in the first embodiment, this ambient air may expected to mantle around the hot air beams to some extent thereby stabilizing and shielding these beams.

[0064] The rear portion back wall 22.3' of the flat enclosure 21' may be, as apparent from Fig. 5, provided in some inclination to the direction perpendicular to its parallel top and bottom walls. The underlying reason may become more apparent when turning to Fig. 6.

[0065] According to Fig. 6, the second embodiment of a torch apparatus 1' in the same way suits for being mounted to a handle 28 via an extension stem 27 as the first embodiment 1 does. As shown, the handle 28 may be identical in terms of shape and function to the handle shown in Fig. 3 whereas the extension stem 27' may slightly differ therefrom in terms of the bending adjacent its interface to the torch apparatus 1'. According to Fig. 6, the bending allows the bottom wall of the flat enclosure 21' to be substantially parallel to the soil or ground when a user holds the handle 28 in normal posture.

[0066] In this exemplary configuration, the second embodiment of a torch apparatus 1' therefore may be found suitable for heating membrane material on an even or slightly inclined surface as, for example a roof or walking lane. In further adaption to this use case, the stand 33' may be provided in a rather sideways orientation which, when placed on an approximately even surface, will result in an orientation of the linear burner array 12' having the burners lined up vertically and having the axis of the burner tubes 19, 20 extending parallel or merely slightly inclined to the surface.

LIST OF REFERENCE NUMERALS

[0067]

1; 1'	Torch apparatus
2	Combustible gas intake member
3	Nozzle
4	Gas mixing tube
5	Lateral openings in gas mixing tube 4
6	Conical widening
7; 7'	Flow spreader, conical; triangular-prismatic
8	Guiding sleeve
9; 9'	Gasket disk; gasket plate
10; 10'	_Flow dividing body
11	Passage holes in gasket disk 9
12; 12'	Burner array, quadratic; elongated
13; 13'	Burner array socket, round; elongated
14	Mounting surface of round burner array socket 13
15	Fixation members, set
16	Profiled passages, set
17	Metallic meshes, set
18	Swirl disks, set
19	Burner tubes, shorter, set
20	Burner tube, longer, set
21; 21'	Enclosure, round; flat
22; 22'	Outer shell of enclosure 21, round; flat
22.1'	Rear portion of flat enclosure 22'
22.2'	Orifice portion of flat enclosure 22'
22.3'	Trailing back wall of flat enclosure 22'
23	Constriction in outer shell 22, round
24	Top lid of round enclosure 21
25	Holes in the top lid 24 of round enclosure
26; 26'	Clearance, annular; rectangular
27; 27'	Extension stem
28	Handle
29	Base setting wheel
30	Quick change lever
31	Gas flow manipulator
32	Hose coupling
33; 33'	Stand

Claims

1. A torch apparatus (1; 1'), in particular a manually guided ambient air torch apparatus, the torch apparatus comprising a first, upstream section, the upstream section including a combustible gas intake member (2) and a gas mixing tube (4), and a second, downstream section, the downstream section including a burner array (12; 12'), the burner array having a burner array socket (13; 13') with multiple burners, a flow spreader (7; 7') connecting the gas mixing

tube (4) to the multiple burners, the burner array together with the flow spreader being surrounded by an enclosure (21; 21'), the flow spreader and/or the burner array socket together with the enclosure being configured for restricting ambient air flow between the interior of the enclosure located upstream to the burner array socket into the interior of the enclosure located downstream to the burner array socket into an gap (26; 26'), whereby the gap essentially surrounds the burner array to create an ambient air flow mantling around the hot process gas produced in the burner array during operation.

2. A torch apparatus (1; 1') according to claim 1 having the burner array socket (13; 13') provided in a planar shape, the multiple burners mounted therein being spread across the planar extension thereof.

3. A torch apparatus (1; 1') according to claim 1 or 2, wherein the enclosure (21; 21') is configured for guiding ambient air such as to pass over the outer surface of the flow spreader (7; 7') before mixing with the hot process gas produced in the burner array (12; 12') during operation.

4. A torch apparatus (1) according to any preceding claim wherein a flow dividing body (10; 10') is located inside the flow spreader (7; 7'), a tip portion of the flow dividing body (10; 10') pointing towards the gas flow entering into the flow spreader (7; 7') from the gas mixing tube (4).

5. A torch apparatus (1; 1') according to any preceding claim additionally provided with a mesh or diaphragm (17) and, in particular, with a metallic mesh, in the gas flow path between the flow spreader (7; 7') and the burners in the burner array (12; 12'), the mesh or diaphragm serving as a flashback prevention to prevent an flame in any of the burners to strike back into the flow spreader.

6. A torch apparatus (1; 1') according to any preceding claim wherein the burner array (12; 12') comprises a number of vortex burners, each of the vortex burners including a vortex member, in particular a swirl disc (18), for superposing a rotational component to the flow direction of the gas mixture entering into the vortex burners from the flow spreader (7; 7'), and wherein a number of the vortex burners includes a preferably cylindrically shaped burner tube (19, 20) located downstream from the respective swirl disk (18).

7. A torch apparatus (1; 1') according to claim 6, wherein the entity of the number of vortex burners has swirl disks (18) of the same rotational sense

8. A torch apparatus (1; 1') according to claim 6 or 7, including a multiple of vortex burners, including a first set of vortex burners and a second set of vortex burners, the vortex burners in the first set having opposite rotational sense than the vortex burners in the second set.

9. A torch apparatus (1) according to any preceding claim, wherein the enclosure (21) is provided in a tubular and/or rotationally symmetrical shape, the centre axis of the enclosure essentially matching with or being substantially aligned in parallel with the centre axis of the gas mixing tube (4) and/or the hot process gas output flow produced by the burner array (12) during operation.

10. A torch apparatus (1) according to claim 9, wherein the array of burners (12) is provided in a planar symmetrical arrangement respective to a plane perpendicular to the centre axis of the tubular mantle air guide (21).

11. A torch apparatus (1) according to any preceding claim, wherein the burner array (12) comprises a first set of identically shaped burners and a second set of identically shaped burners, the shape of the burners in the first set being different from the shape of the burners in the second set.

12. A torch apparatus (1) according to claim 11, wherein the first set of burners in the burner array (12) comprises all except of one burner in the burner array and wherein the difference in the shape of the burners in the respective sets is a difference in the axial extension of the burner along the gas stream direction.

13. A torch apparatus (1) according to claim 11, wherein the burners in the first set of burners in the burner array (12) are not located pairwise neighbouring and/or the burners in the second set of burners in the burner array (12) are not located pairwise neighbouring.

14. A torch apparatus (1) according to any of claims 11 to 13, wherein the burner array (12) consists of four square packed burners.

15. A torch apparatus (1') according to any of claims 1 to 8, wherein the flow spreader (7') being provided in a triangular-prismatic shape with a smaller side wall portion connected to the gas mixing tube (4) and the wider side wall portion connected to the burner array (12).

16. A torch apparatus (1') according to claim 15, wherein the array of burners (12') is provided in a linear arrangement and, in particular, with a number of substantially identical burners lined up in substantially equally distribution, the orientation of the burners being such as to have the axis of process gas output of the burners being substantially parallel to each other.

17. A torch apparatus (1; 1') according to any preceding claim, the torch apparatus additionally comprising an extension stem (27; 27') connected to the burner array (12; 12') for allowing manual manoeuvring thereof from position remote from the hot process gas output.

18. A torch apparatus (1; 1') according to claim 17, additionally comprising a handle (28) mounted to the extension stem (27; 27') at a position remote from the connection to the burner array (12; 12').

19. A torch apparatus (1; 1') according to claim 18, wherein the extension stem (27; 27') is provided with a gas pipe, the gas pipe having one end portion mounted to the combustible gas intake member (2) for allowing supply of combustible gas to the combustible gas intake member through the interior of the stem extension (27; 27').

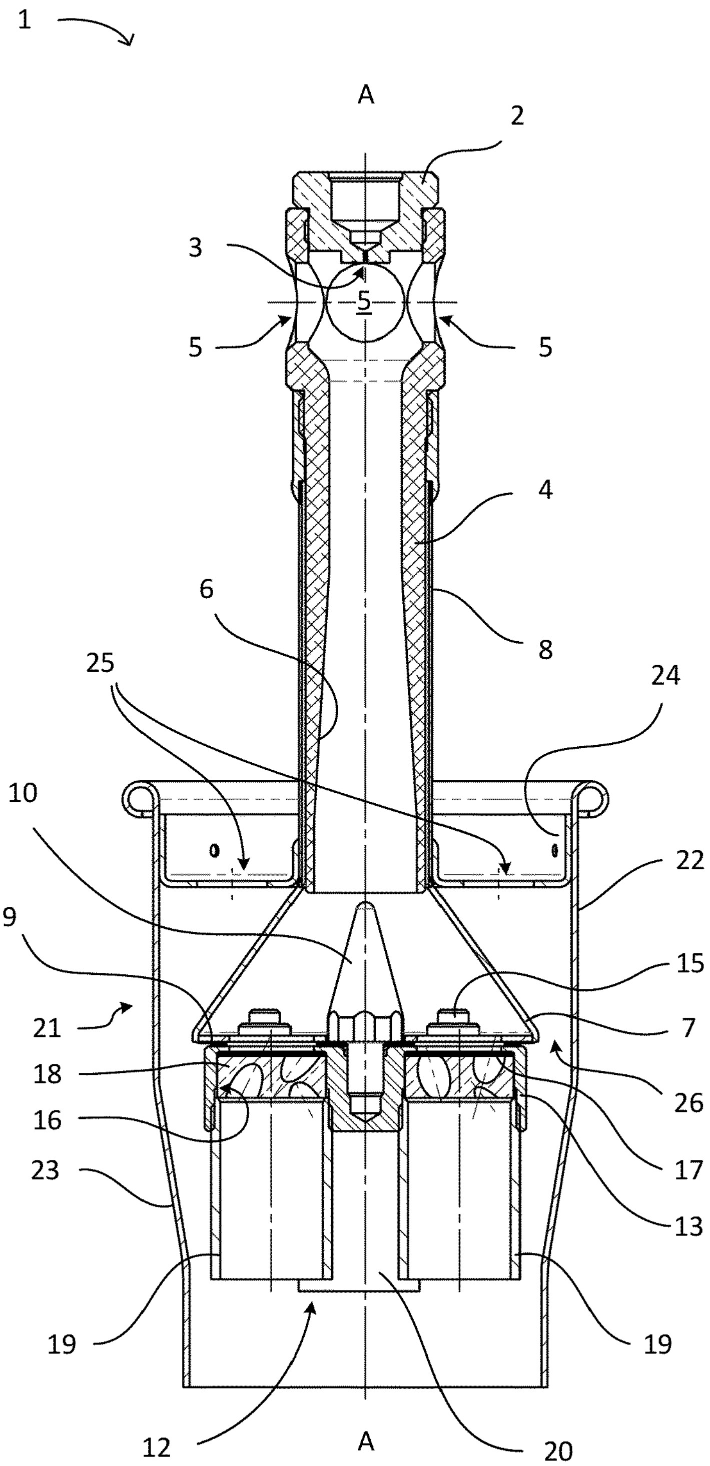

Fig. 1

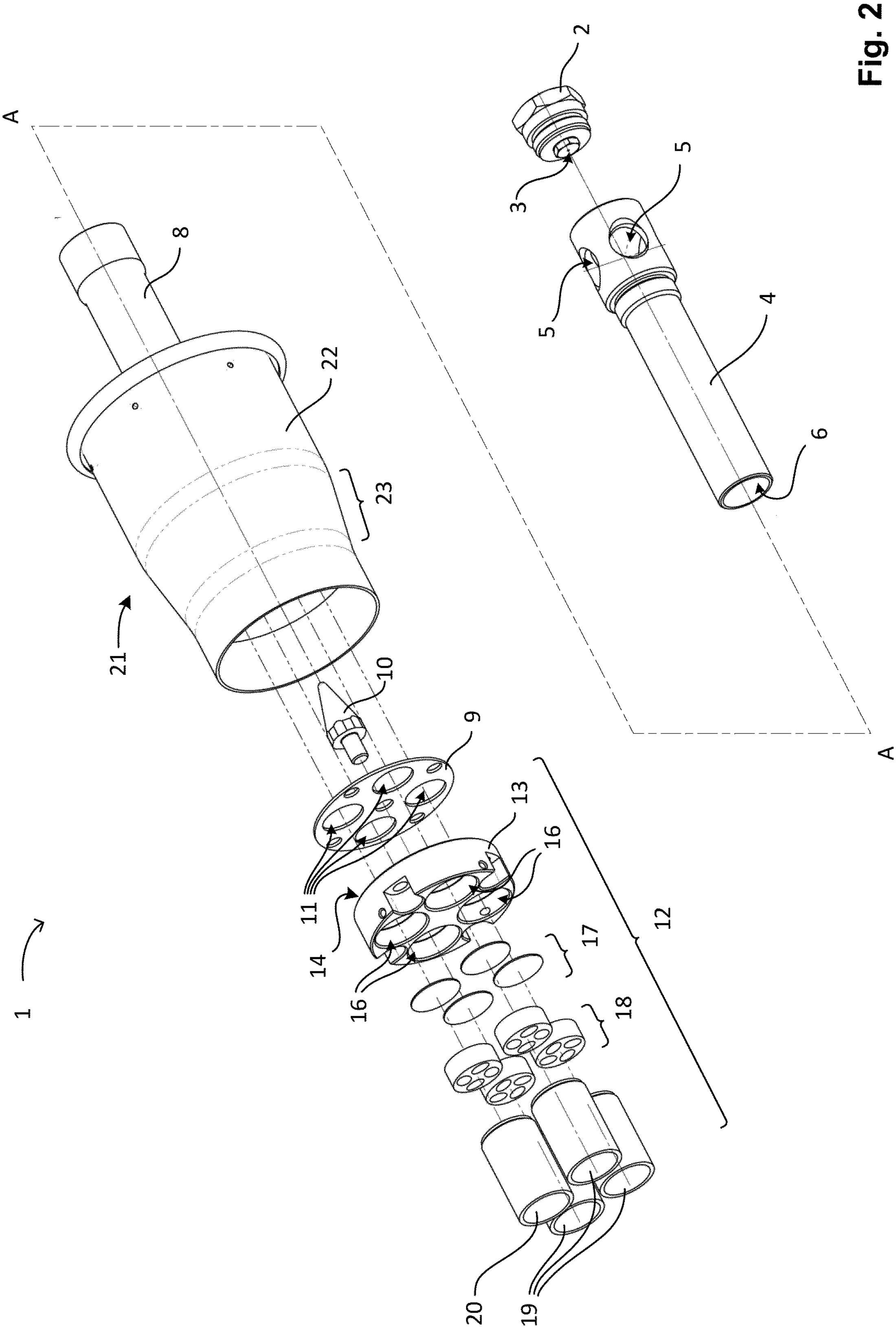

Fig. 2

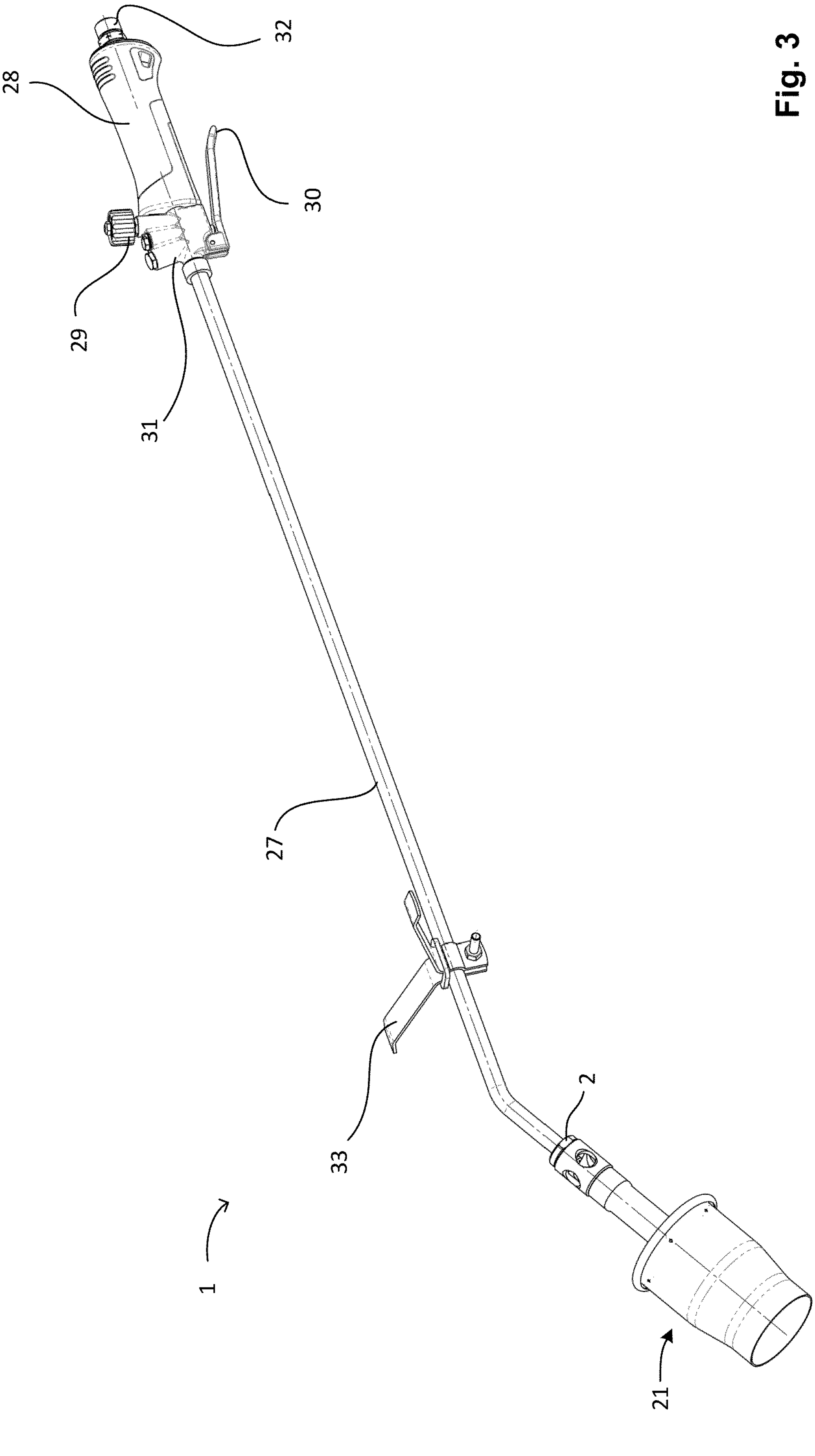

Fig. 3

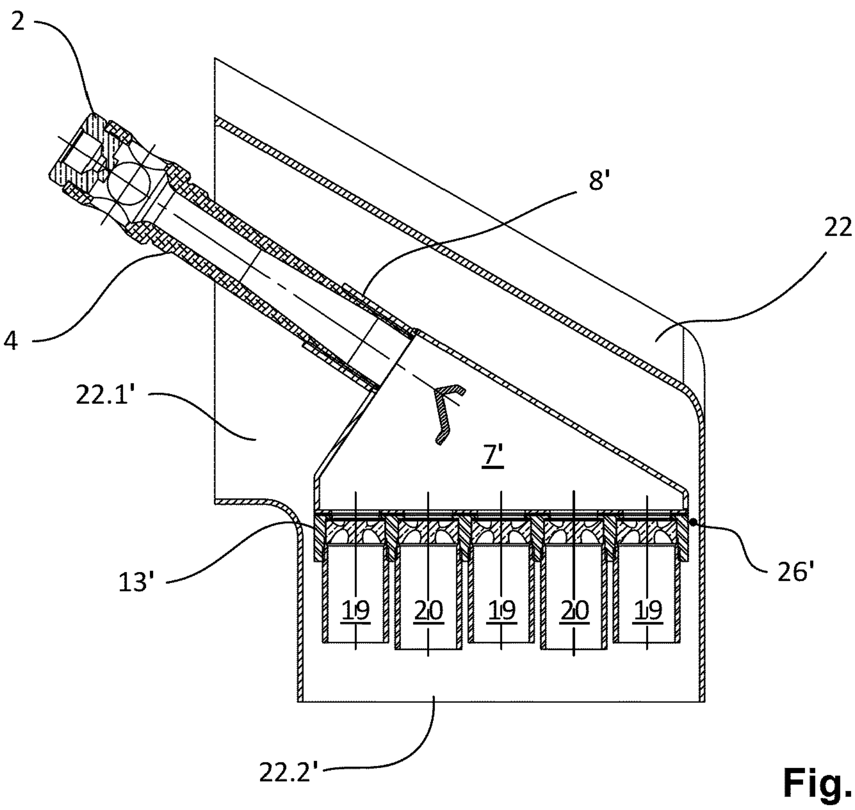
2
8'
22'
4
22.1'
7'
13'
26'
19
20
19
20
19
22.2'

Fig. 4

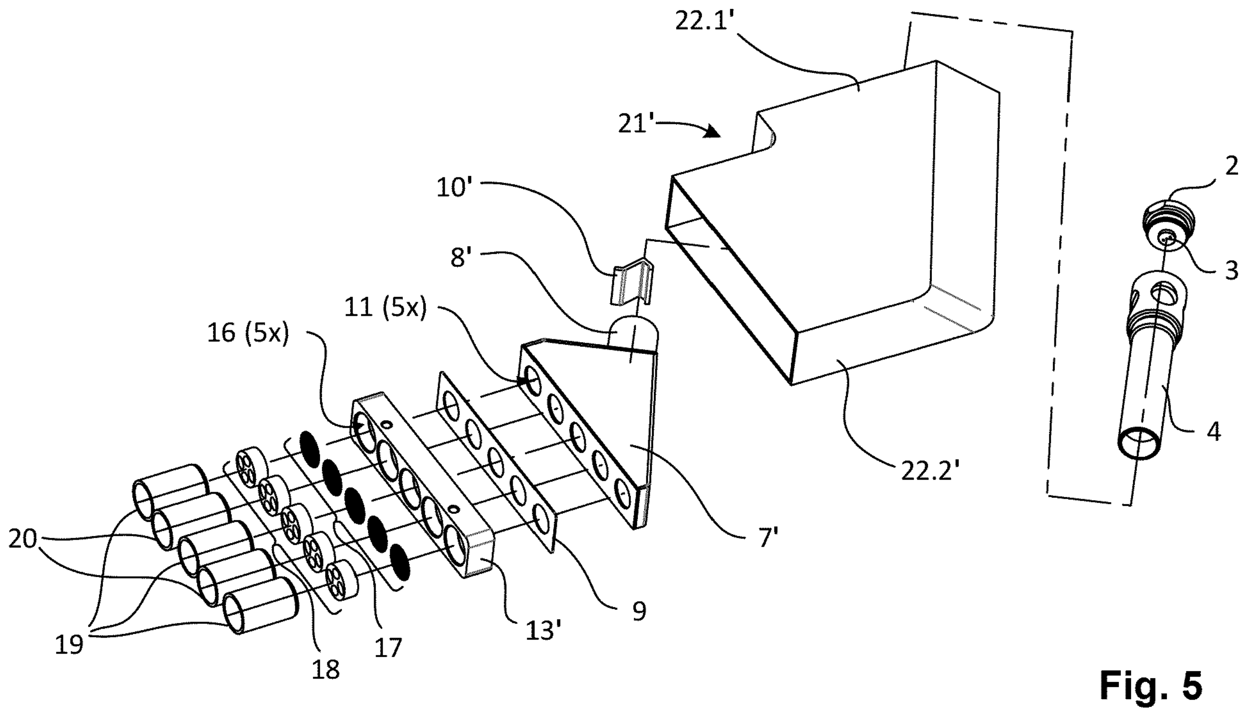
22.1'
21'
2
10'
3
8'
11 (5x)
16 (5x)
4
22.2'
7'
20
9
13'
17
19
18

Fig. 5

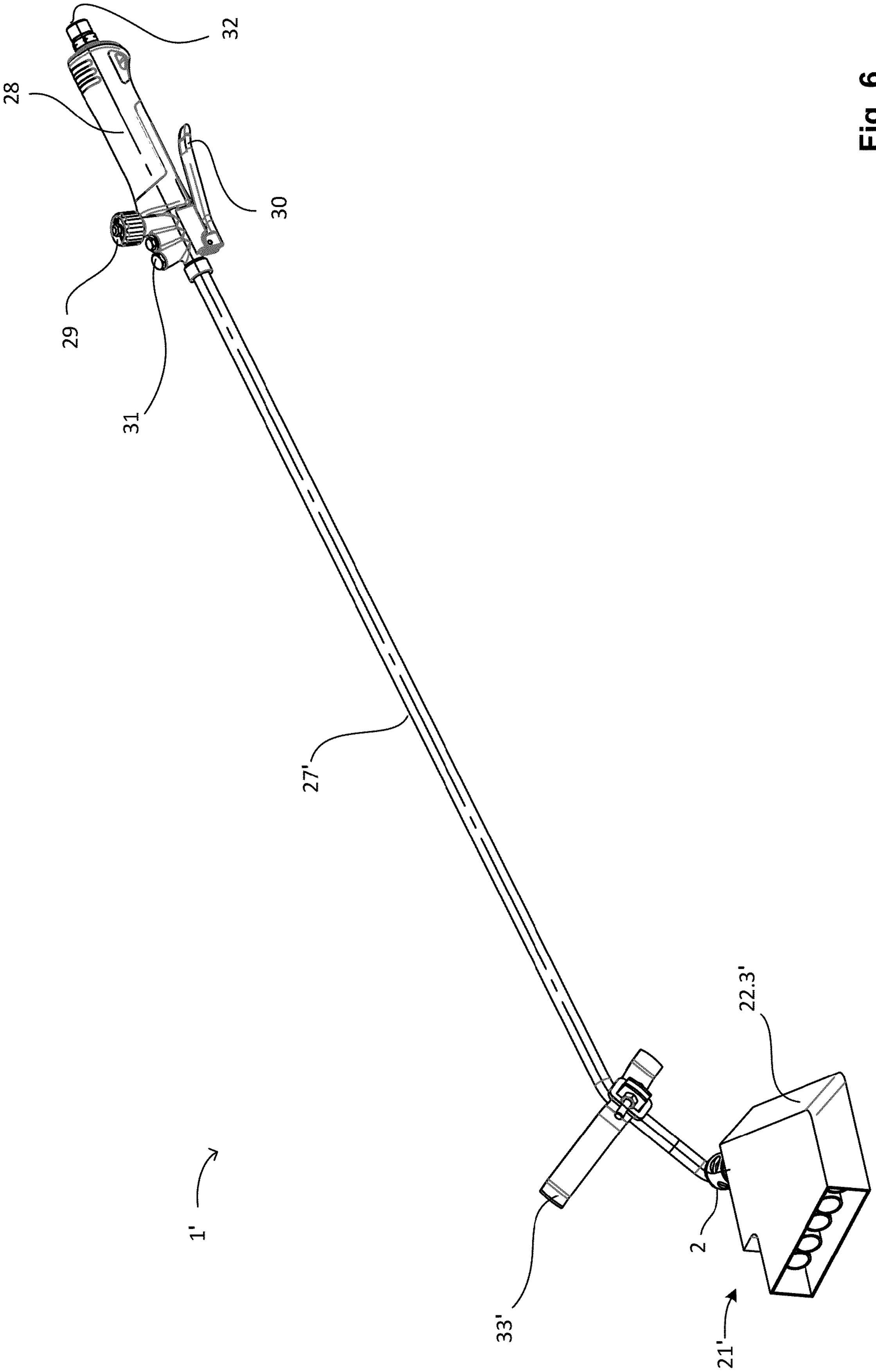

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 22 15 8894

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 3 917 442 A (ZAGOROFF DIMITER S) 4 November 1975 (1975-11-04) * column 5, line 67 - column 7, line 10; figures 4-6, 8-10 * -----	1-19	INV. F23D14/38 F23D14/52 F23D14/70
A	US 2004/072113 A1 (CHUAN CHIN-CHUNG [TW]) 15 April 2004 (2004-04-15) * the whole document * -----	1-19	
A	US 2 533 143 A (SCHARBAU KURT A ET AL) 5 December 1950 (1950-12-05) * the whole document * -----	1-19	

TECHNICAL FIELDS SEARCHED (IPC)

F23D

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	29 July 2022	Theis, Gilbert

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29-07-2022

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