(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 222 336**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **86115442.5**

(51) Int. Cl.⁴: **F23Q 2/28** , F23Q 3/00

(22) Date of filing: **07.11.86**

(30) Priority: **12.11.85 JP 173022/85 U**

(43) Date of publication of application:
20.05.87 Bulletin 87/21

(84) Designated Contracting States:
DE FR

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(54) **Piezoelectric gas igniter.**

(57) There is provided a piezoelectric gas igniter which generally comprises a gas tank, a valve provided on the gas tank and having a gas spouting nozzle, a pliable and conductive gas pipe having a discharge electrode at one end for conducting fuel gas spouting from the nozzle to the discharge electrode, a piezoelectric generator unit having electrodes at the opposite ends thereof, a lead connected to the electrode at one end of the piezoelectric generator unit, a discharge electrode provided at the other end of the lead in opposing and spaced relationship to the discharge electrode at the other end of the gas pipe and a lever for operating the valve.

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PIEZOELECTRIC GAS IGNITER

Background of the Invention

This invention relates to piezoelectric gas igniters and more particularly, to piezoelectric gas igniters of the type in which current from a piezoelectric generator unit provides spark discharge which ignites fuel gas.

A variety of piezoelectric gas igniters have been hitherto proposed and practically employed and these prior art piezoelectric gas igniters employ a piezoelectric generator unit having a piezoelectric element incorporated therein as an ignition means for igniting gas spouting from a gas lighter, gas range or the like combustion utensile.

Among the prior art peizoelectric gas igniters, one type piezoelectric gas igniter has a combustion nozzle provided at the leading end of a barrel as shown in Fig. 9. Referring to Fig. 9, the barrel 1 has a discharge electrode -combustion nozzle 2 at the leading end thereof and the gas tank 4 housed in the grip has an eccentric valve 3. In such a piezoelectric gas igniter, the gas spouting nozzle 3a of the valve 3 has a gas pipe 5 formed of pliable synthetic resin connected to the leading end thereof. The other end of the gas pipe 5 is connected to the trailing end of the discharge electrode -combustion nozzle 2 connected to the leading of the barrel 1. Connected to the discharge electrode -combustion nozzle 2 is a lead 7 which is in turn connected to one of the electrodes of a piezoelectric generator unit 6. Another discharge electrode 9 is disposed adjacent to the leading end of the discharge electrode -combustion electrode 2 and connected to the other electrode of the piezoelectric generator unit 6 through a lead 8 and a conductive sleeve 8a. The prior art piezoelectric gas igniter of Fig. 9 is so designed that when a lever 10 is operated to operate the piezoelectric generator unit 6 so as to open the valve 3 whereupon spark discharge is provided across the discharge electrodes.

And both in a table gas lighter in which a combustion nozzle is positioned in a high position and accordingly, the combustion nozzle and fuel tank are spaced by a long distance and in a gas lighter in which the gas tank and combustion nozzle are eccentric to each other, a pliable synthetic resin gas pipe is employed.

The prior art piezoelectric gas igniter employing such a pliable gas pipe presents the problem that in addition to the gas pipe, a lead is required to be interposed between the discharge electrode - combustion nozzle and one electrode on the piezoelectric generator unit which makes the assembling operation complicated resulting in high probability of defective assembling.

Summary of the Invention

Thus, the present invention has its object to provide a piezoelectric gas igniter which eliminates the problem inherent in the prior art piezoelectric gas igniter employing the pliable gas pipe referred to hereinabove and which simplifies the construction of the conductive components for discharge current whereby the conductive components can be simply assembled with less probability of defective assembling.

In order to attain the object, the present invention provides a piezoelectric gas igniter which comprises a gas tank, a gas pipe in fluid communication at one end with the gas tank, a discharge electrode provided at the other end of the gas pipe, a second discharge electrode provided in opposing and spaced relationship to the first-mentioned discharge electrode and a piezoelectric generator unit for applying voltage across the opposing and spaced discharge electrodes to provide spark discharge and which is characterized by the fact that the gas pipe is formed of pliable and conductive material so that current is allowed to flow through the gas pipe to the first-mentioned discharge electrode.

In the operation of the piezoelectric gas igniter of the present invention, one electrode of the piezoelectric generator unit is made in electrical communication with the first discharge electrode at the end of the gas pipe through the conductive gas pipe, the other electrode of the piezoelectric generator unit is made in electrical communication with the second discharge electrode through the leading lead and high voltage produced in the piezoelectric generator unit is applied across the opposing discharge electrodes to provide spark discharge in the discharge gap defined by the opposing discharge electrodes to thereby ignite fuel gas spouting from the combustion nozzle.

The above and other objects and attendant advantages of the present invention will be more readily apparent to those skilled in the art from a reading of the following detailed description in conjunction with the accompanying drawings which show one preferred embodiment of the invention for illustration purpose only, but not for limiting the scope of the same in any way.

Brief Description of the Drawings

Fig. 1 is a schematic view of one embodiment of the present invention;

Figs. 2a and 2b are end elevational and longitudinally sectional views of a first modification of the gas pipe, respectively;

Figs. 3a and 3b are end elevational and longitudinally sectional views of a second modification of the gas pipe, respectively;

Figs. 4a and 4b are end elevational and longitudinally sectional views of a third modification of the gas pipe;

Figs. 5a and 5b are end elevational and longitudinally sectional views of a fourth modification of the gas pipe, respectively;

Figs. 6a and 6b are end elevational and longitudinally sectional views of a fifth modification of the gas pipe, respectively;

Figs. 7a and 7b are end elevational and longitudinally sectional views of a sixth modification of the gas pipe, respectively;

Figs. 8a and 8b are end elevational and longitudinally sectional views of a seventh modification of the gas pipe, respectively; and

Fig. 9 is a longitudinally sectional view of a prior art piezoelectric gas igniter.

Preferred Embodiment of the Invention

The present invention will be now described referring to the accompanying drawings and more particularly, to Figs. 1 to 8 in which one preferred embodiment of the piezoelectric gas igniter constructed in accordance with the principle of the present invention is shown. Throughout the figures of the drawings, the same numerals denote similar components. Fig. 1 schematically shows the preferred embodiment of the piezoelectric gas igniter. The gas igniter generally comprises a gas tank 4 which is similar to the gas tank as described hereinabove in connection with the prior art piezoelectric gas lighter shown in Fig. 9. A valve 3 is provided at one or the leading end of the gas tank and has a gas spouting nozzle 3a through which fuel gas contained in the gas tank 4 is spouted when the valve 3 is operated so as to pull the gas spouting nozzle 3a outwardly of the valve 3. The valve 3 is operated by a valve operation lever 10 formed of conductive material. The valve operation lever 10 is operated when a piezoelectric generator unit 6 is operated to produce voltage so as to cause one electrode 12a on the piezoelectric generator unit to contact the operation lever 10.

Reference numeral 2 denotes a discharge electrode -combustion nozzle fixedly provided in a casing (not shown) as described hereinabove in connection with the prior art piezoelectric gas igniter of Fig. 9. Interposed between the rear end of the discharge electrode -combustion nozzle 2 and the gas spouting nozzle 3a is a gas pipe 13 which is adapted to conduct fuel gas spouted through the gas spouting nozzle 3a to and into the discharge electrode -combustion nozzle 2.

Furthermore, a second discharge electrode 9 is disposed in opposing and spaced relationship to the discharge electrode -combustion nozzle 2 with a discharge gap defined therebetween in the conventional manner and connected to the other electrode 12b of the piezoelectric generator unit 6 through a lead 8.

The above-mentioned gas pipe 13 is pliable like rubber and also conductive. As one example, the whole gas pipe may be formed of pliable material such as conductive rubber. Various modifications of the gas pipe are shown in Figs. 2a to 8b. In the embodiment shown in Figs. 2a and 2b, a conductive wire 14 extends through the hollow interior of a pliable synthetic resin pipe 13a. In the embodiment shown in Figs. 3a and 3b, a conductive wire 14 is embedded in and extends through the wall of a pliable synthetic resin pipe 13a. In the embodiment shown in Figs. 4a and 4b, a portion 15 of a pliable synthetic resin pipe 13a is formed of conductive material. In the embodiment shown in Figs. 5a and 5b, a pipe is formed by moulding pliable synthetic resin 17 into a pipe shape having a plurality of conductive wires 16 each comprising a simple or woven wire arranged in a circle in the hollow interior of said gas pipe in coaxial relationship to the pipe. In the embodiment shown in Figs. 6a and 6b, a plurality of circumferentially spaced conductive wires 14 are embedded in and extend through the wall of a pliable synthetic resin pipe 13a adjacent to the hollow interior of the pipe. In the embodiment shown in Figs. 7a and 7b, a plurality of circumferentially spaced conductive wires 14 are embedded in and extend through the wall of a pliable synthetic resin pipe 13a with portions of the wires exposed to the hollow interior of the pipe. In the embodiment shown in Figs. 8a and 8b, an insulating coating 19 is applied to the outer periphery of a pipe formed of conductive and pliable material such as conductive rubber.

By the employment of any one of the above-mentioned embodiments of the gas pipe, the piezoelectric gas igniter of the present invention has high heat conductivity and liquefied gas is perfectly vaporized before the gas reaches the discharge electrode -combustion nozzle to thereby attain stabilized combustion condition.

With the above-mentioned construction and arrangement of the components of the piezoelectric gas igniter of the invention, by the operation of the piezoelectric generator unit, in the initial operation step of the piezoelectric generator unit the electrode 12a on the piezoelectric generator unit contacts the valve operation lever 10 to operate the lever so as to pull the gas spouting nozzle 3a outwardly of the valve 3 to thereby open the valve 3 whereby gas flows to and through the gas pipe 13 to reach and flows through the combustion nozzle 2 from which the gas is spouted. In the final stage of the operation of the piezoelectric generator unit, the piezoelectric element of the piezoelectric generator unit is struck to generate high voltage across the electrodes 12a and 12b. A portion of the high voltage is conducted through the lever 10 and the gas spouting nozzle 3a to the discharge electrode -combustion nozzle 2 and another portion of the high voltage is conducted through the lead wire 8 to the discharge electrode 9 to thereby produce spark discharge across the discharge electrode -combustion nozzle 2 and the discharge electrode 9 to thereby ignite the gas spouting from the nozzle 2.

With the above-mentioned construction and arrangement of the components of the piezoelectric gas igniter according to the present invention, since the gas pipe which conducts fuel gas from the gas tank to the discharge electrode -combustion nozzle is a pliable and conductive pipe and current for discharge is conducted through the gas pipe, the gas flow path is provided by connecting the single lead wire to one of the opposing electrodes different from the conventional piezoelectric gas igniters in which two leads are employed for connecting between the two electrodes and thus, the piezoelectric gas igniter of the invention is substantially simpler in construction to make the assembling of the components easier. In addition to the simplified assembling operation, probability of defective assembling of the conductive components can be substantially reduced.

The advantages of the present invention, as well as certain changes and modifications of the disclosed embodiment thereof, will be readily apparent to those skilled in the art. It is the applicant's intention to cover by the applicant's claims all those changes and modifications which could be made to the embodiment of the invention herein chosen for the purpose of the disclosure without departing from the spirit of the invention. Protection by Letters Patent of this invention in all its aspects as the same are set forth in the appended claims is sought to the broadest extent that the prior art allows.

Claims

1. In a piezoelectric gas igniter comprising a gas tank holding fuel gas, a valve provided on said gas tank and having a spouting nozzle, a gas pipe in electrical communication at one end with said gas tank through said valve, a first discharge electrode provided at the other end of said gas pipe, a piezoelectric generator unit having electrodes at the opposite ends, an operation lever adapted to be contacted by the electrode at on end of said piezoelectric generator unit, a lead electrically connected at one end to the electrode at the opposite end of said piezoelectric generator unit and a second discharge electrode provided at the other end of said piezoelectric generator unit in opposing and spaced relationship to said first discharge electrode whereby voltage generated by said piezoelectric generator unit is applied across the two discharge electrodes to provide spark discharge, characterized by that said gas pipe is formed of pliable and conductive material so that current is provided to said first discharge electrode through said gas pipe.

2. The piezoelectric gas igniter as set forth in Claim 1, in which said gas pipe is formed of pliable synthetic resin.

3. The piezoelectric gas igniter as set forth in Claim 2, in which a conductive wire extends through the hollow interior of said pipe.

4. The piezoelectric gas igniter as set forth in Claim 2, in which a conductive wire is embedded in and extends through the wall of said gas pipe.

5. The piezoelectric gas igniter as set forth in Claim 2, in which a portion of said gas pipe is formed of conductive material.

6. The piezoelectric gas igniter as set forth in Claim 2, in which a plurality of circumferentially spaced conductive wires each comprising a simple or woven wire are arranged in a circle in and extend through the hollow interior of said gas pipe in coaxial relationship of the pipe.

7. The piezoelectric gas igniter as set forth in Claim 2, in which a plurality of circumferentially spaced conductive wires are embedded in and extend through the wall of said gas pipe adjacent to the hollow interior of the gas pipe.

8. The piezoelectric gas igniter as set forth in Claim 2, in which a plurality of circumferentially spaced conductive wires are embedded in and extend through the wall of said gas pipe with portions of the wires exposed to the hollow interior of the gas pipe.

9. The piezoelectric gas igniter as set forth in Claim 2, in which an insulative coating is applied to the outer periphery of said gas pipe.

FIG. 1

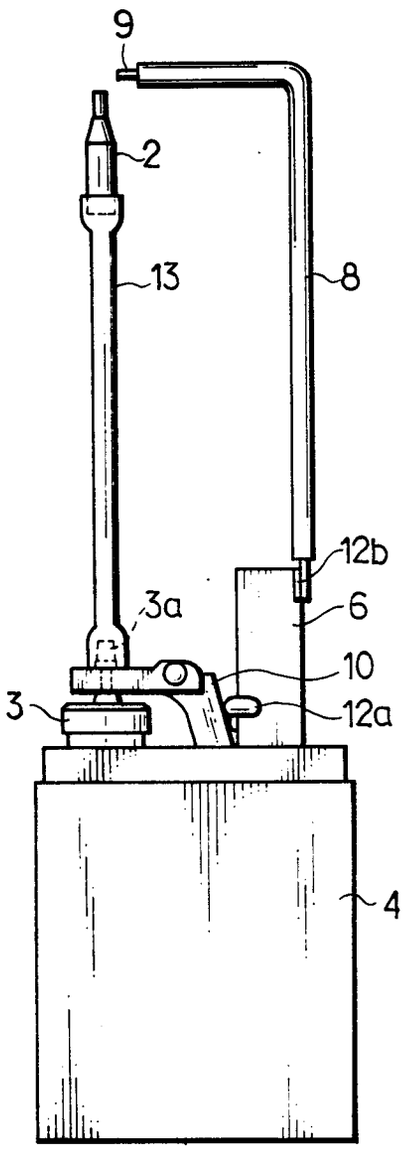

FIG. 2a

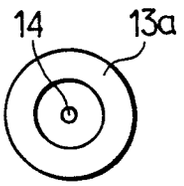

FIG. 2b

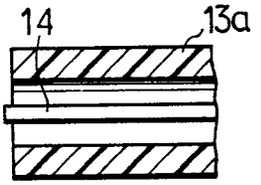

FIG. 3a

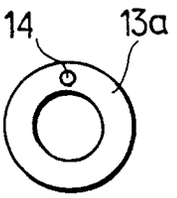

FIG. 3b

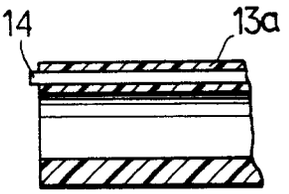

FIG. 4a

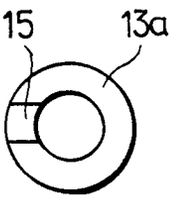

FIG. 4b

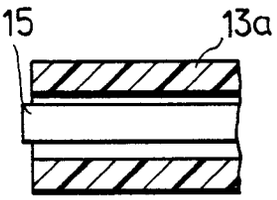

FIG. 5a

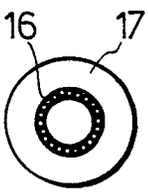

FIG. 5b

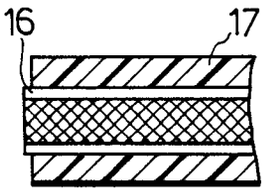

FIG. 6a

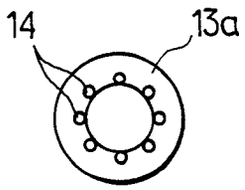

FIG. 6b

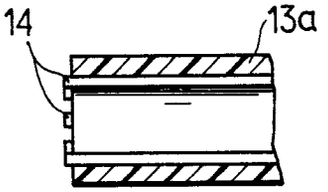

FIG. 7a

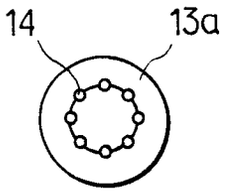

FIG. 7b

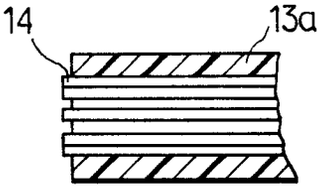

FIG. 8a

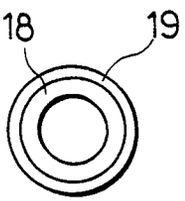

FIG. 8b

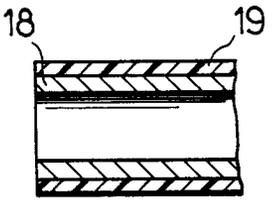

FIG. 9 PRIOR ART