

PATENT SPECIFICATION

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(54) BURNER NOZZLE ASSEMBLY FOR A GAS LIGHTER

(71) We, OHSAWA MANUFACTURING Co., LTD., of 48 Toshincho 1-chome Itabashi-ku, Tokyo, Japan, a Japanese Corporation, do hereby declare the invention for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
 The present invention is concerned with a burner nozzle assembly, and more particularly, it relates to a burner nozzle assembly for a gas-fuelled lighter.
 There have been proposed various types of gas-fuelled lighter utilising a piezoelectric element. Such a proposed gas lighter is arranged usually so that the piezoelectricity which is generated by the piezoelectric element as a result of an impact applied thereto is caused to effect a spark discharge between a pointed discharge electrode and the burner nozzle so that the fuel gas emitted from the nozzle is ignited by an electric spark. However, the life of such an electric spark which is generated in this way is of quite short duration. Also, the heat energy of this electric spark is likewise small. For these reasons, the fuel gas emitted from the burner nozzle of such gas lighters often fails to be ignited, as desired, and thus the performance of such gas-fuelled lighters is far from being satisfactory.
 This poor performance can be attributed to the fact that the fuel gas emitted from the nozzle fails to be mixed sufficiently with the ambient air. In order to overcome this condition, there have been made various proposals to improve mixing of the fuel gas with the ambient air by modifying the structure and configuration of the burner nozzle. Such prior proposals include an assembly wherein the nozzle is provided with a secondary gas ejection orifice in addition to the main nozzle orifice, an arrangement in which a mixing member is mounted at an end of the nozzle, and an

arrangement in which a damper device is provided above the nozzle. The damper device is a device positioned in the area where gases are ejected from the nozzle which causes turbulence in the gas so that the gas is mixed with air. Such prior assemblies, however, were found to be still unsatisfactory with respect to ignition characteristics. Accordingly, the more recent proposals are directed towards prolonging the length of time of the spark discharge, thereby to improve ignition, by inserting a resistor in series between the piezoelectric element and the discharge electrode.

Thus, the most widely used type of gas lighter utilising a piezoelectric element, which is commercially available at present, is that which comprises in combination, one of the above described nozzle assemblies which can improve the mixing of the fuel gas with the ambient air, and a device for prolonging the length of time of the spark discharge by the action of an inserted resistor.

However, such a gas lighter has the drawbacks that it leads naturally to an increase in the cost of its manufacture and, at the same time, to a complication in the nozzle assembly structure as well as to a considerable difficulty in manufacturing such small parts as the burner nozzle of the lighter.

According to the present invention, there is provided a burner nozzle assembly which is for a gas-fuelled lighter utilizing a piezoelectric element and which comprises a nozzle having a bore terminating at an end thereof, and at least two mixing members, each said mixing member being in the form of a substantially non-combustible, helically wound coil having an opening defined between its turns, one coil being disposed in said bore of the nozzle and having a portion extending beyond the said end of the nozzle, and the or each other coil being mounted

[Price 25p]

price 75p

on the exterior surface of said nozzle and having a portion extending beyond the said end of the nozzle, said coils being spaced radially from each other and extending in substantially co-axial relationship.

Embodiments of the present invention will now be described by way of example, with reference to the accompanying drawings, in which:—

10 Figure 1 is a longitudinal sectional view of a first burner nozzle assembly according to the present invention for a gas lighter.

Figure 2 is a similar view of a second burner nozzle assembly,

15 Figure 3 is a similar view of a third burner nozzle assembly, and

Figure 4 is a similar view of a fourth burner nozzle assembly.

As a result of extensive experiments, the Applicants have found that an economical and easy way of accomplishing an efficient ignition in a gas lighter is to use two cylindrical coils formed of helically wound wire made of a substantially non-combustible material, such as stainless steel, one of the coils being smaller in both the diameter and the pitch of the helical turns than the other coil and being disposed in the bore of a portion of a generally cylindrical burner nozzle and shaped so as to be a snug-fit therein while extending a few millimeters beyond the end of the nozzle and the other coil being mounted on the outer circumference of the nozzle and shaped so as to be a snug-fit therearound while extending a few millimeters beyond the end of the nozzle. These two coils extend substantially co-axially and are spaced radially apart by the thickness of the wall of the nozzle.

40 The reasons for the use of these coils are, that they are available easily on the market, are cheap and are easily mounted on the generally cylindrical nozzle. The size of these coils may vary as required to match the size of the nozzle employed. The nozzle is provided with shoulders or stepped portions on the inner as well as the outer circumferences of the nozzle on which the lower ends of the coils are to be supported.

50 In conventionally sized gas lighters, having a nozzle of 0.2 mm wall thickness for example, the inner coil preferably, has an external diameter of 1.2 mm with a tolerance of +0 mm, -0.05 mm, in the case where the coil is made with a wire diameter of 0.18 - 0.25 mm, preferably 0.2mm, and the pitch of the helical turns of such a coil is about 0.06 - 0.02 mm, preferably 0.05 - 0.03 mm, and the length of that portion of the coil extending beyond the upper end of the nozzle

60 is 1.5 - 3.0 mm, preferably 2.0mm. On the other hand, the outer coil preferably has an external diameter of 2.0 mm and an internal diameter of 1.6 mm, with an opening of 0.08 - 0.12 mm, preferably 0.1mm,

between the respective turns and extends for a distance of 1.5 - 3.0 mm beyond the upper end of the nozzle. There may be a difference between the lengths of the extended portions of these inner and outer coils within the range of 0 - 1.4 mm. An excessive difference in the lengths of the extended portions will cause the positioning of the coil such that it is subjected to the highest temperature region of the flame of the burner, and the coil could burn up. Also, the distance between the exterior of the inner coil and the interior of the outer coil is 0.2 - 0.225 mm, preferably 0.2 mm.

In conventional gas lighters utilising a piezoelectric element having no nozzle assembly of the above described type, the most effective distance between the end of the discharge electrode and the nozzle which serves as the cathode to ensure good igniting condition is 3.0 mm.

This positional relation between the discharge electrode and the nozzle requires a precise manufacture to secure their exact positioning. However, the coils greatly alleviate this manufacturing difficulty since mixed streams of fuel gas and air flow outwardly and upwardly form the opening defined between the turns so that they are readily ignitable by the spark.

Referring now to Figure 1, a burner nozzle 1 is mounted on an upper end portion of a fuel container (not shown) with its bore 2 communicating with the interior of the container. This nozzle 1, is provided with an axial bore 2 formed longitudinally therein to allow the fuel gas to pass through. This bore 2 opens at an end portion 1a of the nozzle 1 to provide an outlet orifice for the gas. An outer end portion 3 of this bore 2 is formed with a diameter which is slightly greater than that of the remaining portion so as to define a shoulder 6 in the bore 2. A first mixing member 4 which will be described in detail later is disposed in the bore 2 in the end portion 3 thereof and has a diameter such that it is supported on the shoulder 6, and extends longitudinally of the nozzle 1 to project an appropriate length, 0.2 mm in this example, beyond the end of the portion 1a of the nozzle 1. A second mixing member 5 is mounted on the outer surface of the end portion 1a of the nozzle 1 and is supported on an external shoulder 7 defined by an enlarged portion 1b of the nozzle 1. This second mixing member 5 extends for the same distance beyond the end of the portion 1a of the nozzle 1 as the first mixing member 4 and is substantially coaxial with the first mixing member 4, the two mixing members being radially spaced apart by the thickness of the wall of the end portion 1a of the nozzle 1.

The first and the second mixing members

4 and 5 are formed respectively of two pieces of wire which are helically wound into cylindrical coils of different diameter and pitch. The first mixing member 4 has an air-communicating opening, defined between the turns of the coil, which is narrower than that of the second mixing member 5. In this embodiment, the first, or inner, mixing member 4 is a coil made of stainless steel wire having a diameter of 0.20 mm, with the air-communicating opening existing between the helical turns of the coil being 0.05 mm wide and the pitch of the coil being 0.25 mm. The second, or outer, mixing member 5 is a coil made of similar stainless steel wire having a diameter of 0.2 mm, an air-communicating opening 0.1 mm wide existing between the helical turns of the coil, and the pitch of the coil being 0.3 mm.

A gas lighter having a nozzle assembly as described above is operated in a known manner to ignite the fuel gas emitted from the bore 2 of the nozzle 1. The fuel gas stream emitted under pressure from the bore 2 is first divided into streams which pass through the opening existing between the helical turns of the first mixing member 4 to flow into the space between the first mixing member 4 and the second mixing member 5. The streams of gas thus flowing through this space are then divided further as they pass through the opening of the second mixing member 5 to flow to the outside thereof. Thus, the flow rate of the stream of gas ejected from the nozzle 1 is attenuated as it is first divided into a number of streams when it passes through the opening of the first mixing member 4 and again as the already divided streams of gas are divided further when they pass through the opening of the second mixing member 5. During the passage of the fuel gas in this manner, the flow rate of the gas streams ejected through the openings of the second mixing member 5 is reduced considerably by these two mixing members 4 and 5 since the streams are divided. As a result, the fuel gas which flows outside the second mixing member 5 in a plurality of streams is mixed with the ambient air at a very desirable volume ratio for combustion and thus there is obtained an ideal gaseous mixture suitable for ignition by even a weak spark. Therefore, such a mixture of the fuel gas and the air is unfailingly ignited by a discharge spark which discharges between a discharge electrode A which is electrically connected to a piezoelectric element (not shown) and positioned to face the nozzle 1 and the second or outer mixing member 5. Thus, the nozzle assembly described above completely eliminates the need to prolong the duration of the spark discharge which is normally effected by the provision of a

resistor.

The nozzle assembly of the present invention is simple in structure, that is to say, at least two mixing members 4 and 5 are mounted on the inner and outer circumferences of the nozzle without the need of a resistor, so that this nozzle assembly can be manufactured in a simple manner and at low cost. Even when the space between the two mixing members 4 and 5 is blocked by dust for some reason or other during use, such dust tends to be burnt away completely by the flame.

The nozzle assembly shown in Figure 2 is similar to that of Figure 1 except that the outer or second mixing member 5 extends further beyond the end of the portion 1a of the nozzle 1 than the first mixing member 4, and therefore has a portion 5a which extends for some distance, e.g., up to 1.0 mm, beyond the free end of the first or inner mixing member 4. In this extended portion 5a of the outer mixing member 5, that part of the fuel gas ejected from the axial passageway of the inner mixing member 4 enters into that part of the opening of the second mixing member 5 is located in said portion 5a, and joins the secondary stream of fuel gas travelling upwardly in the space between the two mixing members 4 and 5. In this way, all of the fuel gas streams are caused to make a smooth upward flow as a whole so that an undesirable pulsating flame and the blow-out of the flame by the pressure of the jet stream of fuel gas which often occurred in previously proposed gas lighters of the prior art are eliminated, and thus a desirable normal flame can be obtained.

In the arrangement of Figure 3, the first or inner mixing member 4 extends further beyond the end of the portion 1a of the nozzle 1 than the second mixing member 5, and therefore has a portion 4a which extends beyond the second or outer mixing member 5. The gas ejected out from the orifice of the bore 2 is divided into three streams i.e., a first stream ascending through the axial passageway in the first mixing member 4, a second stream ascending through the space between the first and the second mixing members 4 and 5, and a third stream flowing on the outside of the second mixing member 5. This third stream is attenuated sufficiently with regard to its flow rate as it travels through the space between the first and the second mixing members 4 and 5, that, on the outside of the second mixing member 5, the stream of gas is mixed well with air to provide a condition of being quite easily ignited by the weak spark as in the preceding examples.

Furthermore, the aforesaid first gas stream is positively directed upwardly by the extended portion 4a of the first mixing member 4, and the flame from the nozzle orifice is

thus elongated and is of a reduced diameter. Thus, even in the case where the distance between the end of the nozzle and the free end of the first mixing member 4 is substantially large, an effective flame extending beyond the upper end of this first mixing member 4 is ensured. Furthermore, the first gas stream flows external of the extended portion 4a through the opening therein to form around this extended portion 4a a concentrated fuel gas region. Such a concentrated fuel gas region, however, makes it difficult for the discharge spark to pass through said region. Therefore, the electric spark is passed through another region where the third gas stream is present, and the mixture of gas and air is ignited in this latter region. Thus, an unfailing ignition can be expected.

The particular description has been directed to instances wherein the nozzle assembly comprises one inner and one outer mixing member. The present invention is not limited to the use of two such mixing members, but it can use more than two such mixing members.

As shown in Figure 4, three mixing members 4, 5 and 10 are supported on respective shoulders 6, 7 and 8, so as to extend upwardly in radially spaced substantially co-axial relationship. The inner mixing member 4 is disposed in the enlarged portion 3 of the bore 2. The free ends of the extended portions of these three mixing members 4, 5 and 10 may be aligned or they may be staggered in position relative to each other as shown, for example, in Figure 4. In either of these instances, the user of the lighter can obtain equally unfailing ignition of the fuel gas.

WHAT WE CLAIM IS:—

1. A burner gas nozzle assembly which is for a gas-fuelled lighter utilising a piezoelectric element and which comprises a nozzle having a bore terminating at an end thereof,

and at least two mixing members, each said mixing member being in the form of a substantially non-combustible, helically wound coil having an opening defined between its turns, one coil being disposed in said bore of the nozzle and having a portion extending beyond the said end of the nozzle, and the or each other coil being mounted on the exterior surface of said nozzle and having a portion extending beyond the said end of the nozzle, said coils being spaced radially from each other and extending in substantially co-axial relationship.

2. A burner nozzle assembly according to claim 1, in which said extending portion of the said one coil is longer than that of the or each said other coil.

3. A burner nozzle assembly according to claim 1, in which said extending portion of said one coil is shorter than that of the or each said other coil.

4. A burner nozzle assembly according to claim 1, in which the extending portions of the coils are all of the same length.

5. A burner nozzle assembly according to claim 2 or 3, in which there are provided at least three coils, and the extending portions of the coils mounted on the exterior surface of said nozzle are of different lengths.

6. A burner nozzle assembly according to any one of claims 1 to 5, in which the said one coil has an opening defined between its turns which is narrower than that of the or each other coil.

7. A burner nozzle assembly for a gas-fuelled lighter, substantially as hereinbefore described with reference to Figure 1 or Figure 2 or Figure 3 or Figure 4 of the accompanying drawings.

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thus elongated and is of a reduced diameter. Thus, even in the case where the distance between the end of the nozzle and the free end of the first mixing member 4 is substantially large, an effective flame extending beyond the upper end of this first mixing member 4 is ensured. Furthermore, the first gas stream flows externally of the extended portion 4a through the opening therein to form around this extended portion 4a a concentrated fuel gas region. Such a concentrated fuel gas region, however, makes it difficult for the discharge spark to pass through said region. Therefore, the electric spark is passed through another region where the third gas stream is present, and the mixture of gas and air is ignited in this latter region. Thus, an unfailing ignition can be expected.

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