

GAS NOZZLE OF BURNER FOR COOKING APPLIANCE

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001]

The present invention relates to a gas nozzle of a burner for cooking appliance.

2. Background of the Related Art

[0002]

As this kind of gas nozzle, there is known one including: a nozzle main body having a nozzle hole for emitting a fuel gas toward an inlet portion of a mixing tube of the burner for cooking appliance, the nozzle main body being mounted by screwing to a nozzle support member; and a cylindrical portion protruded from the nozzle main body in an axial direction, that is defined as a direction of emitting the fuel gas, in a manner to enclose an emission space of the fuel gas. The cylindrical portion has a plurality of suction holes for primary air, formed therethrough at a circumferential distance from one another (see, for example, Patent Document 1). According to this arrangement, accompanied by the emission of the fuel gas from the nozzle hole, the primary air is sucked from the suction holes into the cylindrical portion. As a result, the mixture of the fuel gas and the primary air is emitted from the front end, in the axial direction, of the cylindrical portion toward the inlet portion of the mixing tube.

[0003]

Further, according to this arrangement, the mixing tube has a venturi portion which is reduced in diameter than the inlet portion. Due to the negative pressure to be generated in the venturi portion, it is so arranged that the primary air is sucked also from the inlet portion.

Then, a rotatable damper plate is mounted at the inlet portion so that, by varying the degree of opening at the inlet portion for the primary air by the damper plate, the volume of suction of the primary air can be adjusted.

[0004]

By the way, depending on the geographical region (particularly in foreign countries), there are cases where the gas composition and the gas pressure fluctuate even with the same kind of gas. It therefore becomes necessary to perform fine and delicate adjustments of the volume of the primary air to suit the fluctuations. It is to be noted here that, with the above-mentioned gas nozzle, although the primary air is sucked into the cylindrical portion of the gas nozzle, the ratio of the primary air to be sucked through the inlet portion of the mixing tube, out of the entire primary air, is large among the primary air to be supplied to the burner. Therefore, even rotating the damper plate that is mounted on the inlet portion of the mixing tube by a small amount of angle, the volume of the primary air to be supplied to the burner varies relatively largely, whereby it becomes difficult to perform a fine and delicate adjustment of the volume of the primary air.

[0005]

Further, as the burner for cooking appliance, there is also known one in which there is provided a burner head in which a mixing tube is integrally disposed at a lower surface thereof so as to be elongated vertically downward such that the primary air is sucked from the inlet portion at the lower end of the mixing tube due to a radial venturi effect generated by a radial expansion, inside the burner head, of the gas flow from the mixing tube (see, for example, Patent Document 2). This burner can be dismounted by the user together with the mixing tube for maintenance purpose. In this case, if the damper plate is mounted at the inlet portion of the mixing tube, the user may remove the damper

plate out of position by mistake or positionally deviate the damper plate. As a result, there is a possibility that the volume of the primary air will be out of an appropriate range, thereby causing poor combustion.

[Prior Art Literature]

[Patent Document]

[0006]

[Patent Document 1] JP-A-1999-182819

[Patent Document 2] JP-A-2011-52947

SUMMARY

[0007]

In view of the above-mentioned problems, this invention has a problem of providing a gas nozzle of a burner for cooking appliance in which the above-mentioned known gas nozzles are improved so that the volume of the primary air to be supplied to the burner can be finely and delicately adjusted.

MEANS FOR SOLVING THE PROBLEMS

[0008]

In order to solve the above-mentioned problems, according to this invention there is provided a gas nozzle of a burner for cooking appliance having the following features. In other words, the gas nozzle comprises a nozzle main body having a nozzle hole for emitting a fuel gas toward an inlet portion of a mixing tube of the burner for cooking appliance. The nozzle main body is mounted by screwing to a nozzle support member. The gas nozzle also includes a cylindrical portion protruded from the nozzle main body in an axial direction, that is defined as a direction of emitting the fuel gas, in a manner to enclose an emission space of the fuel gas. The cylindrical portion has a plurality of suction holes for primary air which are formed through the cylindrical portion at a circumferential

distance from one another. A clearance in the axial direction is secured between an axial tip of the cylindrical portion and the inlet portion of the mixing tube, thereby allowing for suction of the primary air into the inlet portion of the mixing tube. The gas nozzle includes a damper sleeve (or damper spool piece) rotatably inserted onto an outer surface of the cylindrical portion. The damper sleeve has a plurality of air adjusting holes which are formed through the damper sleeve at a circumferential distance from one another such that a degree of overlapping of each of the air adjusting holes with each of the suction holes varies with rotation of the damper sleeve, thereby adjusting the degree of opening of each of the suction holes.

[0009]

According to this invention, the basic volume of the primary air to be supplied to the burner can be controlled by the amount of clearance in the axial direction between the axial tip of the cylindrical portion and the inlet portion of the mixing tube. It is to be noted here that the volume of the primary air to be sucked into the cylindrical portion of the gas nozzle through the suction holes is smaller than the volume of the primary air to be sucked through the inlet portion of the mixing tube. Therefore, by adjusting the degree of opening of the suction holes, the volume of the primary air to be supplied to the burner is capable of fine and delicate adjustments. In addition, even in case the suction holes are totally closed by mistake, the basic volume of primary air can still be sucked through the inlet portion of the mixing tube. Therefore, the combustibility will not be so aggravated as to give rise to incomplete combustion, thereby securing safety.

[0010]

In this invention, preferably the axial tip of the cylindrical portion comprises a flange portion formed to protrude radially outward. The length in the axial direction of the damper sleeve is equivalent to the

distance in the axial direction between the nozzle support member and the flange portion such that the damper sleeve is sandwiched between the nozzle support member and the flange portion. According to this arrangement, the opening degree of the suction holes can be prevented from getting out of alignment, for example, by positional deviation in the axial direction of the damper sleeve due to vibrations and the like during transportation of the cooking appliance.

[0011]

There is a case in which the damper sleeve positionally deviates in the circumferential direction, with the result that the degree of opening of the suction holes gets out of alignment. As a solution, preferably the damper sleeve is constituted by a spring material formed into a tubular shape of a C cross-section such that, due to elastic force of the spring material, the damper sleeve comes into elastic contact with an outer peripheral surface of the damper sleeve.

[0012]

In addition, preferably each of the air adjusting holes is rectangular having a dimension in the axial direction larger than each of the suction holes. According to this arrangement, even if the damper sleeve deviates in the axial direction to a certain degree, the degree of opening of each of the suction holes advantageously does not change.

[0013]

Further, preferably the burner comprises a burner head in which a mixing tube is integrally disposed at a lower surface thereof so as to be elongated vertically downward such that the primary air is sucked from the inlet portion at the lower end of the mixing tube due to a radial venturi effect generated by a radial expansion, inside the burner head, of the gas flow from the mixing tube. Then, the following advantages can be attained by employing the gas nozzle according to this invention. In other words, a damper plate for adjusting the primary air at the inlet

portion of the mixing tube can be dispensed with. Therefore, at the time when the user dismounts the burner head together with the mixing tube for maintenance purpose, the damper plate can be prevented from getting removed out of position by mistake, or can be prevented from getting positionally deviated. In this manner, the volume of the primary air can be prevented from getting out of an appropriate range.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG. 1 is a perspective view illustrating an example of the gas nozzle for cooking appliance to which the gas burner according to an embodiment of this invention is applied.

FIG. 2 is a sectional view taken along the line II-II of FIG. 1.

FIG. 3 is an exploded perspective view of the gas nozzle according to the embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015]

With reference to the accompanying figures, i.e., FIGS. 1 and 2, reference numeral 1 denotes a burner holder, which supports a burner 2 for cooking appliance. The burner holder 1 has: a base portion 11 which serves as a nozzle support member on which is mounted a gas nozzle 3; a supporting column portion 12 which is vertically disposed on one end of the base portion 11; and an upper plate portion 13 which is elongated from the upper end of the supporting column portion 12 in a manner to lie opposite to the base portion 11. The base portion 11 has a gas passage 11a which is formed therein for supplying the gas nozzle 3 with a fuel gas. The upper plate portion 13 has a support tube portion 13a which is coaxial with the gas nozzle 3.

[0016]

The burner 2 for cooking appliance is provided with: a burner head 22 which is in a circular shape as seen in plan view and which integrally suspends a mixing tube 21 from a central portion of the lower surface of the burner head 22; and a burner cap 23 which is of a circular disc shape and which is to be mounted on the burner head 22. In this arrangement, by inserting the mixing tube 21 into an inside of the support tube portion 13a of the burner holder 1, the burner head 22 is supported by the burner holder 1 in an aligned state so that the gas nozzle 3 and the mixing tube 21 are aligned on the same axial line. The mixing tube 21 does not have a venturi portion which is reduced in diameter relative to the inlet portion 21a, but sucks the primary air from the inlet port 21a by a radial venturi effect which is described hereinafter.

[0017]

The burner head 22 has: an annular protruded portion 22a which protrudes upward from the open edge portion at the upper end of the mixing tube 21; and an annular wall 22b which projects upward from the peripheral portion of the upper surface. The burner cap 23 is seated on an upper end surface of this annular wall 22b. The annular wall 22b has a plurality of burner port grooves which are formed at a distance in a circumferential direction from one another, the burner ports being dented from the upper end surface of the annular wall 22b downward. By blocking (or closing) the upper end of these burner port grooves with the burner cap 23, there will be formed burner ports 24 between the burner head 22 and the burner cap 23.

[0018]

On a lower surface of the burner cap 23 there is attached a back plate 25 which lies opposite to the upper end surface of the annular protruded portion 22a at a predetermined clearance therebetween. Along the periphery of the back plate 25, there are vertically suspended a plurality of alignment pieces 25a at a circumferential distance from one

another. As a result of bringing the lower end portion of the alignment pieces 25a into contact with the outer peripheral surface of the annular protruded portion 22a, the burner cap 23 is aligned relative to the burner head 22. Then, when the fuel gas is emitted from the gas nozzle 3, the gas flow that comes into the burner head 22 through the mixing tube 21 gets into contact with the lower surface of the back plate 25. The gas flow then gets spread in the radial direction to give rise to a so-called radial venturi effect so that the primary air gets sucked from the inlet portion 21a at the lower end of the mixing tube 21.

[0019]

With reference also to FIG. 3, the gas nozzle 3 is provided with: a nozzle main body 30 which has a nozzle hole 31 for emitting the fuel gas toward the inlet portion 21a of the mixing tube 21 and which is mounted by screwing to the base portion 11; and a cylindrical portion 32 protruded from the nozzle main body 30 in an axial direction (upward), that is defined as a direction of emitting the fuel gas, in a manner to enclose an emission space of the fuel gas. The cylindrical portion 32 has a plurality of (e.g., four) suction holes 33 for the primary air, which are formed at a circumferential distance from one another. Each of the suction holes 33 is a tapered round hole which is enlarged in diameter toward the diametrically inside.

[0020]

At an axial tip (upper end) of the cylindrical portion 32 there is formed a hexagonal flange portion 32a which protrudes radially outwards. It is so arranged that the flange portion 32a is engaged with a tool such as a wrench and the like to thereby mount the nozzle main body 30 to the base portion 11. It is to be noted that the shape of the flange portion 32a is not limited to the hexagonal shape but may be non-circular so as to serve as a latch for engaging the tool with the flange portion 32a at the time of fixing the nozzle main body 30 to the base portion 11.

[0021]

Further, between the axial tip of the cylindrical portion 32, i.e., the flange portion 32a and the inlet portion 21a of the mixing tube 21, there is secured a clearance in the axial direction, the clearance being intended to allow for the suction of the primary air from the inlet portion 21a. Gas nozzles 3 having different hole diameters of the nozzle holes 31 and different lengths of the cylindrical portions 32 are prepared to cope with different kinds of gases. It is thus so arranged that the basic volume of primary air to be supplied to the burner 2 for cooking appliance can be controlled by the amount of clearance in the axial direction between the flange portion 32a and the inlet portion 21a of the mixing tube 21.

[0022]

The gas nozzle 3 further has a damper sleeve 34 which is to be inserted onto an outside of the cylindrical portion 32 in a rotatable manner. The damper sleeve 34 has a plurality of air adjusting holes 35 which are formed to open at a circumferential distance from one another. It is thus so arranged that the rotation of the damper sleeve 34 varies the degree of overlapping of each of the air adjusting holes 35 with each of the suction holes 33, thereby adjusting the degree of opening of each of the suction holes 33.

[0023]

According to the gas nozzle 3 of this embodiment, as a consequence of the emission of the fuel gas from the nozzle hole 31, the primary air gets sucked from each of the suction holes 33 into the cylindrical portion 32, and the mixture gas of the fuel gas and the primary air is emitted from the front end, as seen in the axial direction, of the cylindrical portion 32 toward the inlet portion 21a of the mixing tube 21. It is to be noted here that the volume of the primary air to be sucked from the suction holes 33 into the cylindrical portion 32 is smaller than

the volume of the primary air to be sucked from the inlet portion 21a of the mixing tube 21. Therefore, by adjusting the degree of opening of the suction holes 33 by means of the damper sleeve 34, the volume of the primary air to be supplied to the burner 2 for cooking appliance can be finely and delicately adjusted. As a result, even if the gas composition and the gas pressure may fluctuate within the same kind of gas, the fine and delicate adjustment of the volume of the primary air can be easily performed to suit the fluctuations. Further, even in case the suction holes 33 are totally closed by mistake, the basic volume of the primary air is sucked from the inlet portion 21a of the mixing tube 21. Therefore, the combustibility will not be so aggravated as to cause incomplete combustion to take place, thereby securing safety.

[0024]

In addition, according to the burner 2 for cooking appliance of this embodiment, the user can detach the burner head 22 together with the mixing tube 21 for maintenance purpose. In this case, if a damper plate for adjusting the primary air is mounted at the inlet portion 21a of the mixing tube 21, there is a possibility that the user may remove the damper plate by mistake or cause it to be positionally deviated. The volume of the primary air thus goes out of an appropriate range to thereby cause incomplete combustion. According to this embodiment, on the other hand, since the volume of the primary air can be adjusted by the damper sleeve 34 that is mounted on the gas nozzle 3, it is not necessary to attach a damper plate for primary air adjustment to the inlet portion 21a of the mixing tube 21. The above-mentioned disadvantage therefore does not occur.

[0025]

By the way, there is a case where, due to vibrations and the like during transportation of the cooking appliance, the damper sleeve 34 deviates in the axial direction or in the circumferential direction, thereby

causing the degree of opening of the suction holes 33 to get wrong. As a solution, according to the embodiment of this invention, the following arrangement has been made, namely, the length in the axial direction of the damper sleeve 34 is set to be substantially equal to the distance in the axial direction (up and down direction) between the base portion 11 and the flange portion 32a in a state in which the nozzle main body 30 is mounted in position on the base portion 11. It is thus so arranged that the damper sleeve 34 is sandwiched between the base portion 11 and the flange portion 32a. According to this arrangement, the damper sleeve 34 will not be positionally deviated in the axial direction, and the degree of opening of the suction holes 33 can thus be prevented from going out of alignment.

[0026]

By the way, if the length in the axial direction of the damper sleeve 34 becomes longer, due to dimensional tolerance, than the distance in the axial direction between the base portion 11 and the flange portion 32a, the damper sleeve 34 will be strongly pressed by the base portion 11 and the flange portion 32a, so that the damper sleeve 34 will become difficult to be rotated. As a solution, according to this embodiment, by taking into account the dimensional tolerance, the length in the axial direction of the damper sleeve 34 is made to be slightly smaller than the design distance in the axial direction between the base portion 11 and the flange portion 32a. The arrangement in this embodiment shall also be regarded to correspond to the above-mentioned "substantially equal."

[0027]

In this arrangement, however, there is a possibility that the damper sleeve 34 is positionally deviated slightly in the axial direction and, as a result, the degree of opening of the suction holes 33 may go out of alignment. As a solution, according to this embodiment, each of the air adjusting holes 35 is made to be square which is larger in the axial

dimension (up and down direction) than each of the suction holes 33. According to this arrangement, even in case the damper sleeve 34 is deviated in the axial direction to a certain degree, the degree of opening of each of the suction holes 33 will not change, whereby the disadvantage as pointed out above will not occur. Each of the suction holes 33 need not always be circular in shape, but the similar effect can be attained if each of the air adjusting holes 35 is made to be square in shape as noted above.

[0028]

Furthermore, according to this embodiment, the damper sleeve 34 is constituted into a tubular shape of C cross-section having a split portion 34a in one position as seen in the circumferential direction such that, due to elastic force of the spring material, the damper sleeve 34 comes into contact with an outer peripheral surface of the damper sleeve 34. According to this arrangement, the damper sleeve 34 can be prevented from getting positionally deviated, due to vibrations and the like, in the circumferential direction off from an adjusted position. This prevention is attained by means of frictional force of the damper sleeve 34 relative to the cylindrical portion 32. In this manner, the degree of opening of the suction holes 33 can be prevented from going out of alignment.

[0029]

In this embodiment the following arrangement has been made, namely, the width in the circumferential direction of the split portion 34a is made equivalent to the width in the circumferential direction of the air adjusting hole 35. The split portion 34a is thus made to function as an air adjusting hole of the suction hole 33 which is disposed in a position as seen in the circumferential direction of the corresponding cylindrical portion 32. In addition, on both sides in the circumferential direction of the split portion 34a, there are formed tongue portions 34b which are

formed by bending so as to protrude in a radially outward direction. It is thus so arranged that the damper sleeve 34 can be rotated for adjustment by engaging the user's fingers with the tongue portions 34b.

[0030]

A description has so far been made of an embodiment of this invention with reference to the accompanying drawings. This invention is, however, not limited to the above. For example, the gas nozzle 3 of the above embodiment is applied to a burner 2 for use in a cooking appliance which, without forming a venturi portion in the mixing tube 21, sucks the primary air from the inlet portion 21a of the mixing tube 21 by means of the radial venturi effect. This invention can similarly be applied to a burner for cooking appliance which is provided with a mixing tube having a venturi portion.

EXPLANATION OF MARKS

[0031]

1 ... burner holder	11 ... base portion (nozzle support member)
2 ... burner for cooking appliance	
21 ... mixing tube	3 ... gas nozzle
30 ... nozzle main body	31 ... nozzle hole
32 ... cylindrical portion	33 ... suction hole
34 ... damper sleeve	35 ... air adjusting hole

What is claimed is:

1. A gas nozzle of a burner for cooking appliance, the gas nozzle comprising:

a nozzle main body having a nozzle hole for emitting a fuel gas toward an inlet portion of a mixing tube of the burner for cooking appliance, the nozzle main body being mounted by screwing to a nozzle support member; and

a cylindrical portion protruded from the nozzle main body in an axial direction, that is defined as a direction of emitting the fuel gas, in a manner to enclose an emission space of the fuel gas, the cylindrical portion having a plurality of suction holes for primary air, formed therethrough at a circumferential distance from one another,

wherein a clearance in the axial direction is secured between an axial tip of the cylindrical portion and the inlet portion of the mixing tube, thereby allowing for suction of the primary air into the inlet portion of the mixing tube,

the gas nozzle further includes a damper sleeve rotatably inserted onto an outer surface of the cylindrical portion, the damper sleeve having a plurality of air adjusting holes formed therethrough at a circumferential distance from one another such that a degree of overlapping of each of the air adjusting holes with each of the suction holes varies with rotation of the damper sleeve, thereby adjusting a degree of opening of each of the suction holes, and

wherein the clearance in the axial direction between the axial tip of the cylindrical portion and the inlet portion of the mixing tube is set such that a basic volume of primary air is sucked from the inlet portion of the mixing tube through the clearance in the axial direction, the basic volume of primary air being such that the combustibility is not so aggravated as to give rise to incomplete combustion even in case the suction holes are totally closed.

2. The gas nozzle of a burner for cooking appliance according to claim 1, wherein the axial tip of the cylindrical portion comprises a flange portion formed to protrude radially outward,

wherein a length in the axial direction of the damper sleeve is equivalent to the distance in the axial direction between a nozzle support member and the flange portion such that the damper sleeve is sandwiched between the nozzle support member and the flange portion.

3. The gas nozzle of a burner for cooking appliance according to claim 1 or 2, wherein the damper sleeve is constituted by a spring material formed into a tubular shape of a C cross-section such that, due to elastic force of the spring material, the damper sleeve comes into elastic contact with an outer peripheral surface of the cylindrical portion.
4. The gas nozzle of a burner for cooking appliance according to any one of claims 1 - 3, wherein each of the air adjusting holes is rectangular having a dimension in the axial direction larger than each of the suction holes.
5. The gas nozzle of a burner for cooking appliance according to any one of claims 1 - 4, wherein the burner comprises a burner head in which a mixing tube is integrally disposed at a lower surface thereof so as to be elongated vertically downward such that the primary air is sucked from the inlet portion at the lower end of the mixing tube due to a radial venturi effect generated by a radial expansion, inside the burner head, of the gas flow from the mixing tube.