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(71) Applicant(s)
Kwong Lam

(72) Inventor(s)
Lin, Kwong Yung

(74) Agent / Attorney
Shelston IP, L 21 60 Margaret St, Sydney, NSW, 2000

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(71) 申请人及
(72) 发明人: **林光溃 (LIN, Kwong Yung)** [CN/CN]; 中国香港特别行政区新界锦田大马路 110 号, Hong Kong (CN)。

(74) 代理人: **深圳市顺天达专利商标代理有限公司 (SHENZHEN STANDARD PATENT & TRADEMARK AGENT LTD.)**; 中国广东省深圳市福田深南大道 7008 号阳光高尔夫大厦 810-815 室, Guangdong 518040 (CN)。

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(54) **Title**: BURNER FORMING AND APPLYING MIXED CYCLONE AND COMBUSTION METHOD USING THE BURNER

(54) **发明名称**: 产生并应用旋转混合气流的燃烧器及燃烧器的燃烧方法

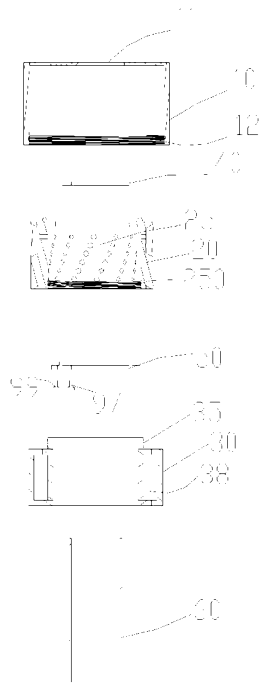

图 4 / Fig.4

(57) **Abstract**: A burner includes a sleeve-type top lid (10). An annular gas-separating box (30) is connected to the bottom of the top lid (10), consequently a space is formed between the top lid (10) and the gas-separating box (30), in which a cylindrical gas-mixing box (20) for mixing air and fuel gas is disposed. The gas-separating box (30) is provided with separate centric hole (31) through which air enters and fuel gas inlet hole (32) through which fuel gas enters. The cylindrical surface of the gas-mixing box (20) is arranged with several grooves (21) disposed at a distance from each other and inclined upwards, the surface of the grooves (21) is disposed with communicating holes (210) through which air exits. In this way, dispersed fuel gas and air are mixed sufficiently in the grooves inclined upwards and then whirls upwards, and flows to inverted frustoconic flame holes (11). As the fuel gas and air are mixed sufficiently and the mixed gas whirls upwards, the combust flame is full and not extinguished easily.

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(57) 摘要:

一种燃烧器，包括套筒状的炉头盖（10），炉头盖（10）下连接有圆环形分气盒（30），炉头盖（10）和分气盒（30）之间连接形成的空间设置有将空气和燃气混合的圆柱形混气盒（20），分气盒（30）设有独立的进空气的中心孔（31）和进燃气的进燃气孔（32）；混气盒（20）的圆柱表面设有若干互相间隔斜向上的凹槽（21），凹槽（21）表面设有排出空气的连通孔（210）。这样的结构使分散的燃气、空气在斜向上的凹槽里充分混合后旋转向上，最后到达倒圆锥台形焰孔（11），由于燃气和空气充分混合并且混合气体旋转向上，使燃烧的火焰更加充分，并且不易吹熄。

A BURNER AND BURNING METHOD TO GENERATE ROTATING BLEND FLOW OF GAS AND AIR

TECHNICAL FIELD

[0001] This invention relates to a kind of combustion technology, more specifically, relates to a method to generate rotating mixture of gas and air which may be used in canteen or kitchen of some hotels, companies and schools etc, and also relates to a burner applying such a method as well as a burning method by said burner.

BACKGROUND

[0002] In canteen or kitchen of many hotels, companies or schools, food is heated by gas furnace and common burners which are incapable to burn fuel fully due to incomplete mixing of gas and air, and may produce a flame so long that induce loss of heat, low combustion and produce a large amount of carbon monoxide.

[0003] It is an object of the present invention to overcome or ameliorate at least one of the disadvantages of the prior art, or to provide a useful alternative.

BRIEF DESCRIPTION OF PRESENT INVENTION

[0004] In at least one preferred form, this invention will provide a method to generate rotating blend flow with better mixing of gas and air.

[0005] In at least one preferred form, this invention will provide a burner and burning method to promote the mixing of the gas and air.

[0006] In a first aspect, the present invention provides a burner, comprising:

a gas-separating box used to import fuel gas and air respectively;

a mixing device used to mix air and fuel gas from the gas-separating box to form a mixed whirling flow; and

a third mixing device used to reflect the mixed whirling flow so that the mixed whirling flow rushes out of a flame hole and then forms a mixed upward whirling flow with a tiny bottom but a big top end;

wherein said mixing device comprises a top lid and a mixing box to compose a first mixing device and a second mixing device, wherein said top lid is in a shape of sleeve;

air from the gas-separating box is formed into a rotating airflow inclined upwardly by said first mixing device, and said second mixing device mixes the rotating airflow from the first mixing device and fuel gas from the gas-separating box into a mixed whirling flow;

the mixing box is a box having a countersunk hole communicated with said centric hole, on the side wall of the box several grooves are disposed at a distance from each other, whose amount and position are corresponding to that of the fuel gas outlets, and a plurality of first outlets are evenly distributed on the top surface of the gas-separating box.

[0007] In a second aspect, the present invention provides a combustion method for a burner, comprising the following steps:

S01 separating air and fuel gas into two flows, wherein a first flow of air enters into a centric hole and then into grooves through evenly distributed communicating holes to mix with a second flow of fuel gas and then goes upwards along inclined grooves to form a rotating mixed flow inclined upwardly;

S02 rotating the mixed flow inclined upwardly into a second mixing chamber and mixing again rotationally to form a swirly mixed flow;

S03 colliding the rotating mixed flow and the swirly mixed flow with each other and flow around, wherein the mixed flow is reflected onto a reflecting plate due to a frustoconic surface of a flame hole and then rushed out of the flame hole to form a whirling mixed flow with a tiny bottom and a large top end, which produces a flame and which looks like a hurricane with a small bottom but large head when ignited.

[0008] In one aspect of the burner of present invention, said mixing device comprises a burner head and a mixing box which compose a first mixing device and a second one, said burner head is in a shape of sleeve.

[0009] In one aspect of the burner of present invention, said first mixing device turns the air from the gas-separating box into a airflow rotating tilted upwardly, said second mixing device turn the rotating air flow and the gas from gas-separating box into rotating blend flow.

[0010] In one aspect of the burner of present invention, said mixing box is a box having a countersunk hole connected to said centre hole, on the box wall are provided with several separate notches whose amount and position are corresponding to that of the outlets of said gas, on the top of the box are first outlets arranged equispaced.

[0011] In one aspect of the burner of present invention, said first mixing device turns the air and gas into a rotating blend flow tilted upwardly by a first blending, said second mixing device turns the rotating blend flow from the first mixing device into a swirly blending flow.

[0012] In one aspect of the burner of present invention, said gas-separating box has a centre hole to let air in and at least one inlet to let gas in, and on the top of the gas-separating box are several gas outlet for gas out.

[0013] In one aspect of the burner of present invention, said mixing box is a box having a countersunk hole connected to said centre hole, on the box wall are several notches whose amount and position are corresponding to that of gas outlets, on the surface of said notches there are connecting hole connected to the air in said countersunk hole, and the notches will mix the air and gas primarily to form rotating blend flow which is tilted upwardly.

[0014] In one aspect of the burner of present invention, said notches tilt upward.

[0015] In one aspect of the burner of present invention, the angle between said notches and bottom surface of the mixing box is 10 to 80 degree.

[0016] In one aspect of the burner of present invention, said notches is at least 50mm long.

[0017] In one aspect of the burner of present invention, the cross section of said notches is in a shape of square or inverted trapezoidal.

[0018] In one aspect of the burner of present invention, the flame hole on the burner head for the mixed flow to rush up has a surface like a frustum of a cone which makes the spiraling blend flow reflected to a reflecting plate on the mixing box and then rush out of the flame hole to form a rotating mixed gas flow with its bottom much smaller than its top.

[0019] In one aspect of the burner of present invention, the size of the flame hole is one fifth or one third the size of the said top cap.

[0020] In one aspect of the burner of present invention, the gas outlets are equispaced while the connecting holes are equispaced too.

[0021] In one aspect of the burner of present invention, the diameter of the gas outlet and connecting hole are 0.5 to 3mm.

[0022] In one aspect of the burner of present invention, a mounting hole is set through the top surface of said mixing box, said mounting hole has a insulating sleeve which comprises a round plate mounted onto the countersunk hole and a ring matched with the mounting hole, on the insulating sleeve has a reflecting plate which is connected with a ground wire of flame ion controller, said mixing box has two pulse lighting-off torch.

[0023] In one aspect of the burner of present invention, said burner head is screwed onto the gas-separating box.

[0024] In one aspect of the burning method of the burner of present invention, it comprises the following steps:

[0025] In one aspect, the burner comprises a burner head in the shape of a sleeve, the gas-separating box is connected below the burner head, and between the burner head and gas-separating box is a device for air dispersion and gas mixture, and on the gas-separating box is a center hole to let air in and at least one inlet to let gas in, on the top of the gas-separating box are set several gas outlets to let gas out; said device for air dispersion and gas mixture is a box in which is a countersunk hole connected to the center hole, on the box wall are several spaced notches whose amount and position are corresponding to that of the gas outlets, and on the surface of the notches there are connecting holes connected to the air in the countersunk hole, the notches mix the air and gas primarily; said burner head has a flame hole in the shape of a cone frustum used to burn the gas and reflect the mixture, the inclined surface of the cone frustum of the flame hole reflects the mixture gas to make it rush onto the flame hole, the burner head and the top surface of the device for air dispersion and gas mixture make up the second mixing chamber. Such a structure promotes the dispersed gas and air to be fully mixed up in the notches of the gas mixing device and then flow slanted upward to the second mixing chamber and the flame hole as a cone frustum, the inclined surface of the flame hole reflects the mixed gas onto the reflecting plate and then flame hole and at last become a flame like a hurricane with its bottom small but the top huge, such a flame can be better concentrated and condensed to burn fully with no or less heat conduction between energy and the burner head and in further less carbon monoxide and being uneasy to be extinguished. Besides, the concentration and condensation of the flame reduces

needed space to burn, thus reduces the volume of the whole chamber and the burner correspondingly.

[0026] In further, in the burner of present invention, it is not necessary to use a ion detecting pin for the ion flame detector to detect the flame, only the ground wire of the ion flame detector being connected onto the insulated reflecting plate is needed. The detection can be achieved by the wire of the ion detecting pin connecting onto a metal piece of the burner. The burning of the flame produces ion, the flame leg is zero while the burning flame is positive (the ground wire is required to be connected onto the insulated reflecting plate, then ion detecting wire is connected to the meter piece of the burner, thus, when the meter is on fire, the meter will produce positive ion when sense the fire flame, so the ion flame detector tells that the burner is on fire.).

[0027] Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise", "comprising", and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to".

DRAWING DESCRIPTION

[0028] More details will be described by referring to the following drawing and embodiments, in which:

[0029] Fig.1 is the exploded drawing of a first embodiment of the burner of present invention;

[0030] Fig.2 is the enlarged drawing of part A of Fig.1;

[0031] Fig.3 is the top view of the first embodiment of the burner of present invention;

[0032] Fig.4 is the exploded B sectional view of Fig.3;

[0033] Fig.5 is the assembled B sectional view of Fig.3;

[0034] Fig.6 shows the device for air dispersion and gas mixture in the first embodiment of the burner in present invention;

[0035] Fig.7 is the top view of the mixing device of the burner in the first embodiment of present invention;

[0036] Fig.8 is the front view of the mixing device of the burner in the second embodiment of present invention;

[0037] Fig.9 is E sectional view of Fig.8;

[0038] Fig.10 is the exploded sectional view of the mixing device in a second embodiment of present invention;

[0039] Fig.11 is the exploded block diagram of the mixing device in a second embodiment of present invention;

[0040] Fig.12 is a third embodiment of the burner of present invention.

DETAIL DESCRIPTION OF EMBODIMENT

[0041] This invention provides a method to generate a rotating blend flow by air and gas, which comprises the following steps:

S1 mix air and gas into a swirly blend gas;

S2 turn the swirly blend gas from the step S1 into a spiraling blend flow with a velocity of rushing up and its bottom tapering but the top large.

Wherein the step S1 comprises the following steps:

S11 turn the air and gas into a rotating mixture by a first blending;

S12 turn the rotating mixture into a swirly mixture by a second blending.

[0042] The embodiment 1 is the overall process of generating the rotating mixture gas flow, while the embodiment 2 comprises step S1 and S2, but step S1 does not comprise step S11 and S12. More details will be described referring to the drawings.

[0043] As shown in Fig.1, the burner of present invention comprises a gas-separating box 30 used to bring in gas and air, a mixing device used to mix the gas and air from the gas-separating box and turn them into a rotating blend flow, and a third mixing device used to reflect the rotating blend flow to make it rush out of flame hole 11 and to form a spiraling blend flow with its bottom sharp but top large and having a uprush velocity, wherein the

mixing device comprises a burner head 10 and mixing box 20 composed of a first mixing device and a second mixing device.

[0044] The gas-separating box 30 is a round ring, comprises a center hole 31 and box body, wherein the box body is a cylinder, has several gas outlets 37 positioned along a circle on the top surface to disperse gas and a gas inlet 32 to let gas in on the bottom surface. The center hole 31 is round with its outer portion as a ring, while the top 39 of said ring is higher than the top surface of the box body and has external thread on it. The outer portion of the center hole 31 and the box body compose to be a gas-dispersing chamber 38 in the shape of a cylinder. In order to disperse gas completely, the gas outlets 37 can be positioned equispacedly.

[0045] The mixing gas 20 is a cylinder, and has a countersunk hole25 connected to the center hole 31. On the top of countersunk hole25 there is a round mounting hole 29. A insulating sleeve 50 setting on the mounting hole 29 comprises a round plate mounted in the countersunk hole25 and a round ring 1 matched with the mounting hole 29. Said insulating sleeve 50 has a reflecting plate 40 connected to ground wire of ion flame controller. On the outer surface of the cylinder are positioned several inclined upward projection 40 and notches 21 spaced with each other. The angle inclined of said projection 22 and notches 21 can be 10 to 80 degree. On each notch 21 are several connecting holes 210 connected onto the countersunk hole25, and the connecting hole 210 can be 0.5 to 3mm in diameter. The cross section of the notches 21 can be square or inverted trapezoidal. In order to position more connecting hole 21 to disperse air better, the length of the notches 21 could be less than 50mm, and the connecting hole 210 can be positioned on the notches 21 equispacedly.

[0046] The burner head 10 and the top face of the mixing box 20 compose the second mixing chamber 100 for the swirly blend flow forming a spiraling flow. The burner head 10 provides a flame hole 11 in the shape of a cone frustum for the mixture flow rushing out, the inclined surface of the cone frustum of the flame hole 11 reflects the spiraling blend flow to the reflecting plate 40 of the mixing box 20, then the spiraling blend flow rushes out of the flame hole 11 and form a rotating blend gas flow with its bottom tiny but top big.

[0047] In this invention, ion flame detector is applied to detect, the accessories of ion flame detector comprise insulating sleeve 50 and reflecting plate 40, while the insulating sleeve 50 is made of glass fiber, and it comprises a round ring 51 mounted onto the round plate, the reflecting plate 40 is a round plate made of metal.

[0048] The operation procedure of the embodiment of present invention is as follows:

As Fig.5, use screws 99 to fix the insulating sleeve 50 in the countersunk hole25 onto the mixing box 20, and then fix the reflecting plate 40 made of metal onto the round ring 51 of the insulating sleeve 50, connect the ground wire of the ion flame detector to a insulated reflecting plate 40 by a screw 97 and the positive wire of the ion flame detector to the burner head 10. When a flame burns the metal piece (e.g. Iron pan), the positive wire of the ion flame detector will sense the positive ion produced by the flame, thus the ion flame detector will tell that fire is detected.

[0049] The burner head 10 comprises a ring wall and top cap on the ring wall, while the top cap has a flame hole 11 in the shape of a cone frustum. In order to burn the gas fully, the size of top face of the flame hole 11 is selected as one fifth to one third of the size of the top cap. To facilitate igniting, in the burner of this invention are mounted two pulse ignition devices 60.

[0050] In order to connect the burner head 10 and gas-separating box 30 together, a internal thread 12 is set inside the burner head 10 and corresponding external thread 380 is set outside the gas-separating box 30.

[0051] In order to connect the mixing box 20 and gas-separating box 30 together, a matched thread 250 and 35 are set on the inner wall of countersunk hole25 of the mixing box 20 and on the outer ring of the center hole 31 of gas-separating box 30.

[0052] The work process of the burner in present invention is as follows:

Seen from Fig.1, 4, 5 and 6, firstly, the air and gas are two separate flow, the flow of air enters the centre hole 31 and then the notch 21 through the equispaced connecting hole 210 while the flow of gas enters the gas-dispersing chamber 38 by the inlet 32 and then enters the notch 21 through gas outlet 37 to mix with the air flow, later, they rush along the inclined notch 21 and form to be a upward inclined rotating blend flow; the upward inclined mixture flow enters the second mixing chamber 100 and mix a second time rotationally to form a swirly blend flow. The swirly blend flow and rotating blend flow collide with each other and flow around. Since the cone frustum surface of the flame hole 11 reflects the mixture flow to the reflecting plate to make it rush up to the flame hole 11, which helps to form a spiraling blend flow with its bottom tiny but the top big. Such a spiraling blend flow when be

ignited will become a flame like a hurricane which has a tiny bottom but a huge top. The flame like a hurricane is more concentrated and condensed. The energy produced by the flame burning will do no heat conduction with the burner head when the flame burns outside the burner head, which will bring about the effect of being hard to be extinguished, energy saving and less production of carbon monoxide. The concentration and condensation of the flame reduce the length of the flame, which will help the heat to stay rather than loss, and help the flame to burn in a small space. Short flame will decrease the contact of the flame to outer air, which can reduce the heat loss, reduce the volume of the burner chamber and in further the volume of the burner head. What's more, for those gas of different density such as gas of light density, the notches 21 can be made to be at an angle of 80 or even 90 degree with the bottom surface of the mixing box 30, which will contribute full mixing of the mixture gas reflected by the cone frustum surface of the flame hole 11, while those gas with high density such as that in present invention can be reflected by the cone frustum surface after two mixing processes.

[0053] Besides, a fan can be used to control the input of the air in the central hole 31 to ensure that there is adequate air to mix with the gas, which will reduce the production of carbon monoxide as burning, and has a effect of energy saving and environment protection.

[0054] The Fig.8 to 10 show the second embodiment of present invention, wherein the difference between the first and the second embodiment is: on the top surface of the mixing box 20 are several first outlets 300 positioned along a circle, and there is no connecting hole 210 between the countersunk hole25 and the notches 21, the air enters into the gas outlet 37 in the gas-separating box 30 and then the notches 21 and keep going up, then forms rotating air flow. The gas enters into the first outlet 300 equispaced on the top surface of the mixing box 20 and then the second mixing chamber 100, and then mix with rotating air flow to form swirly flow. The swirly blend flow and rotating blend flow collide with each other and flow around. Due to the inclined surface the cone frustum of the flame hole, the blend flow can be reflected to the reflecting plate and then rush up to the flame hole to form a spiraling mixture gas flow with its bottom tiny but the top big which when ignited will become a flame like a hurricane which also has a tiny bottom but big top. The other aspect is the same as that of the first embodiment, so no need to repeat.

[0055] Fig.12 shows the third embodiment of this invention which comprises a ignition 220, gas inlet 210, flow divider 230, air inlet 200, wherein the air inlet 200 is a circle pipe of

which the center line is non-intersected with that of the burner, the flow divider 230 are arc plates equispaced. The work process is as followed:

[0056] The air enters into the burner from the air inlet 200 to form a rotating air flow 900, while a portion of the air flow 900 flow along the circle and the other portion mix with the gas from the gas inlet 210 to form a swirly flow and then burn.

[0057] This invention is described referring some embodiment. The skilled in this art should comprehend that various modification and equal replacement for the characteristics and embodiment not beyond the spirit and scope of present invention is available. In light of present invention, modification on the characteristics and embodiments to adapt to specific situation and material is also won't beyond the spirit and scope of present invention. Therefore, this invention is not limited into what has been disclosed, all the embodiment in the scope of the claims belong to the protection scope of present invention.

CLAIMS

1. A burner, comprising:

a gas-separating box used to import fuel gas and air respectively;

a mixing device used to mix air and fuel gas from the gas-separating box to form a mixed whirling flow; and

a third mixing device used to reflect the mixed whirling flow so that the mixed whirling flow rushes out of a flame hole and then forms a mixed upward whirling flow with a tiny bottom but a big top end;

wherein said mixing device comprises a top lid and a mixing box to compose a first mixing device and a second mixing device, wherein said top lid is in a shape of sleeve;

air from the gas-separating box is formed into a rotating airflow inclined upwardly by said first mixing device, and said second mixing device mixes the rotating airflow from the first mixing device and fuel gas from the gas-separating box into a mixed whirling flow;

the mixing box is a box having a countersunk hole communicated with said centric hole, on the side wall of the box several grooves are disposed at a distance from each other, whose amount and position are corresponding to that of the fuel gas outlets, and a plurality of first outlets are evenly distributed on the top surface of the gas-separating box.

2. The burner according to claim 1, wherein air and fuel gas from the gas-separating box are firstly mixed into a rotating mixed flow inclined upwardly by the first mixing device, and the rotating mixed flow from the first mixing device is formed into a mixed whirling flow by the second mixing device.

3. The burner according to claim 2, wherein said gas-separating box has a centric hole through which air enters and at least one inlet through which fuel gas enters, and on the top surface of the gas-separating box, several fuel gas outlets are provided.

4. The burner according to claim 4, wherein said mixing box is a box having a countersunk hole communicated with said centric hole, on the side wall of the box several grooves are disposed at a distance from each other, whose amount and position are corresponding to that of the fuel gas outlets, and communicating holes are disposed on the surface of the grooves, communicating with air in said countersunk hole , and the grooves mix air and fuel gas primarily to form a rotating mixed flow inclined upwardly.

5. The burner according to claims 1 or 4, wherein said grooves are inclined upwards.

6. The burner according to claim 5, wherein an angle between said grooves and the bottom surface of the mixing box is 10 to 80 degree.

7. The burner according to claim 6, wherein said grooves are at least 50mm long.

8. The burner according to claim 7, wherein cross section of said grooves is in a shape of square or inverted trapezoidal.

9. The burner according to claim 8, wherein the flame hole on the top lid for the mixed flow to rush out has a frustoconic surface, which makes the whirly mixed flow be reflected onto a reflecting plate on the mixing box and then rush out of the flame hole to form a mixed whirling flow with a tiny bottom but a big top end.

10. The burner according to claim 9 wherein size of the flame hole is one fifth to one third the size of the top lid.

11. The burner according to claim 4, wherein the fuel gas outlets are evenly distributed, while the communicating holes are evenly distributed too.

12. The burner according to claim 11, wherein diameter of the fuel gas outlets and the communicating holes are 0.5 to 3mm.

13. The burner according to claims 1 or 4, wherein a mounting throughhole is arranged on the top surface of said mixing box, said mounting throughhole is provided with a insulating sleeve which comprises a round plate mounted within the countersunk hole and a ring matched with the mounting throughhole, on the insulating sleeve a reflecting plate is arranged, which is connected with a zero wire of a ion flame controller, and said mixing box has two pulse ignition rods.

14. The burner according to claim 1, wherein said top lid is screwed with the gas-separating box.

15. A combustion method for a burner, comprising the following steps:

S01 separating air and fuel gas into two flows, wherein a first flow of air enters into a centric hole and then into grooves through evenly distributed communicating holes to mix with a second flow of fuel gas and then goes upwards along inclined grooves to form a rotating mixed flow inclined upwardly;

S02 rotating the mixed flow inclined upwardly into a second mixing chamber and mixing again rotationally to form a swirly mixed flow;

S03 colliding the rotating mixed flow and the swirly mixed flow with each other and flow around, wherein the mixed flow is reflected onto a reflecting plate due to a frustoconic surface of a flame hole and then rushed out of the flame hole to form a whirling mixed flow with a tiny bottom and a large top end, which produces a flame and which looks like a hurricane with a small bottom but large head when ignited.

16. A burner substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

17. A combustion method substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

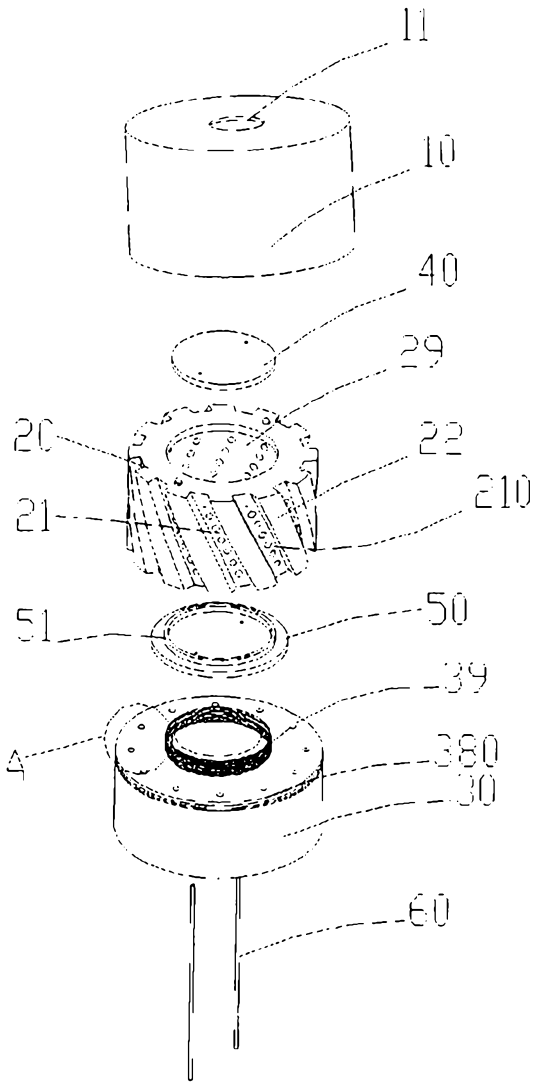

图 1

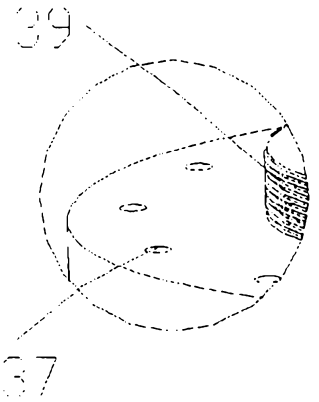

图 2

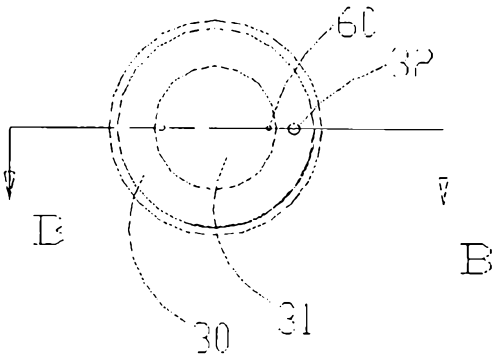

图 3

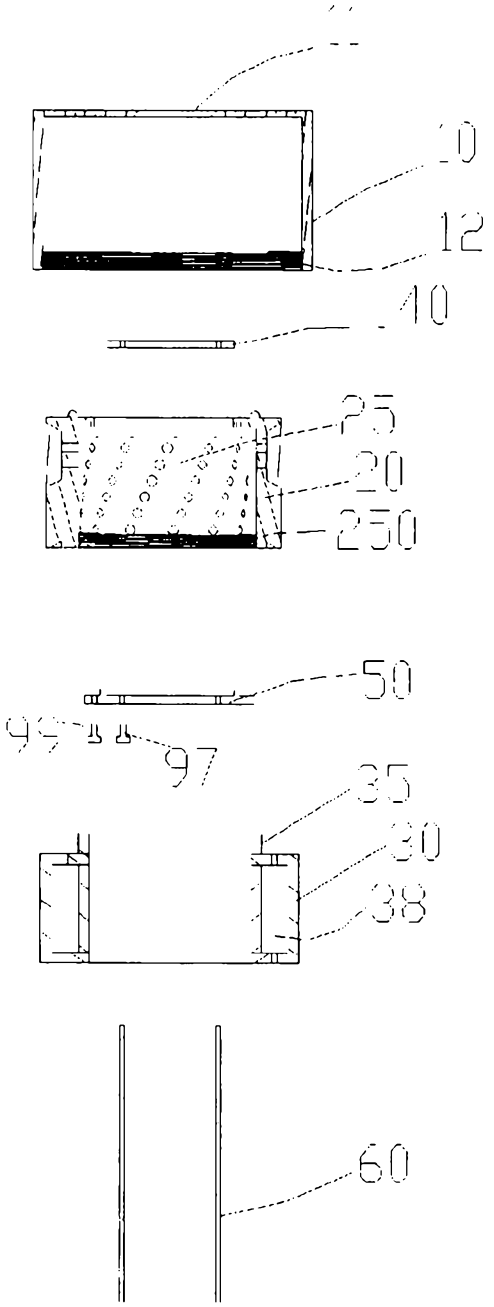

图 4

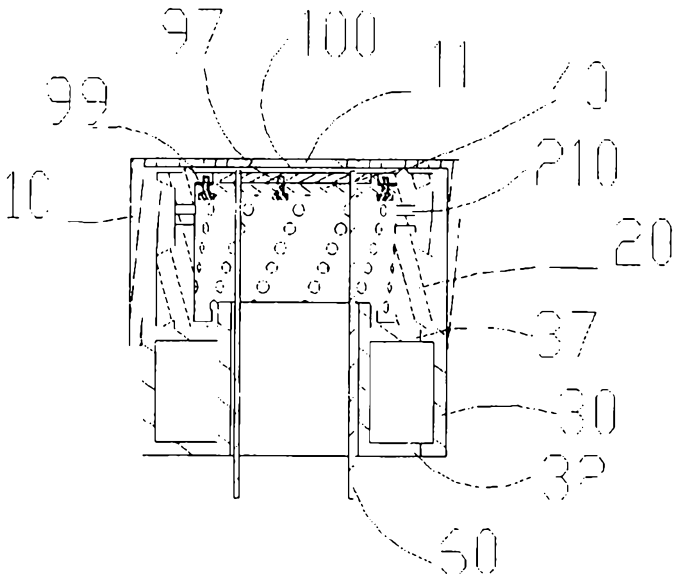

图 5

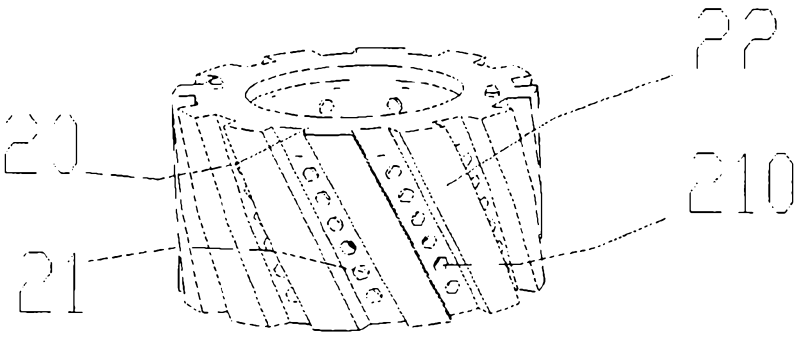

图 6

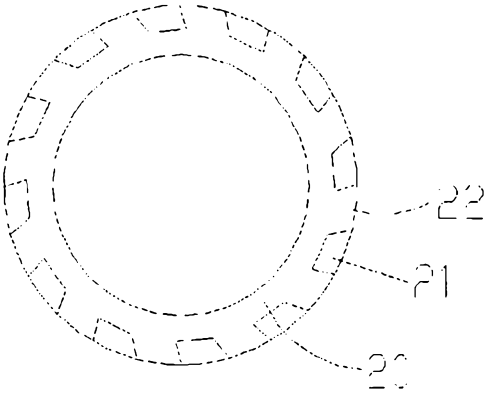

图 7

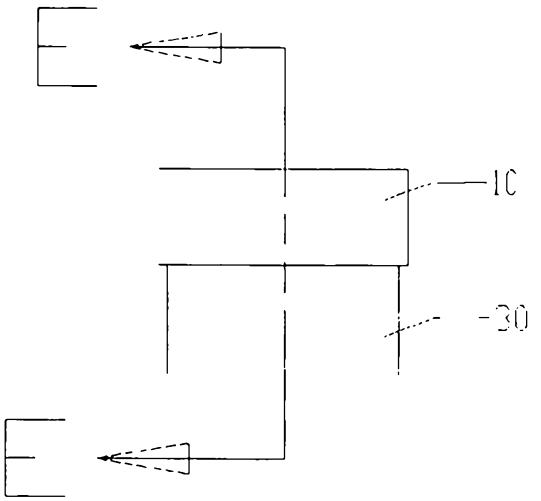

图 8

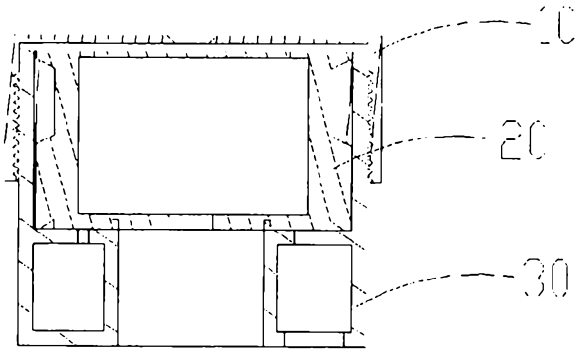

图 9

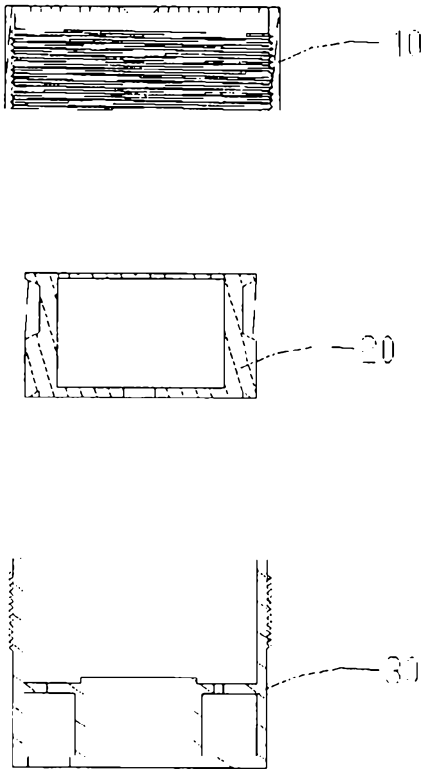

图 10

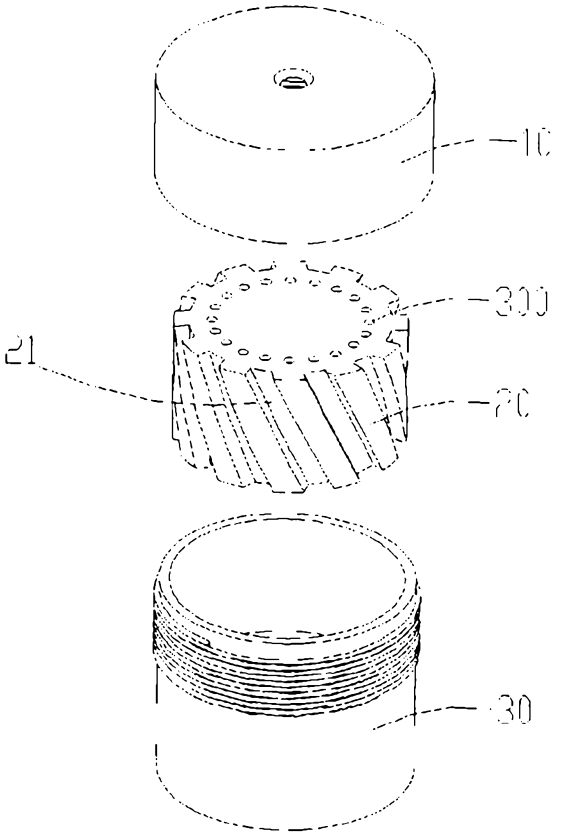

图 11

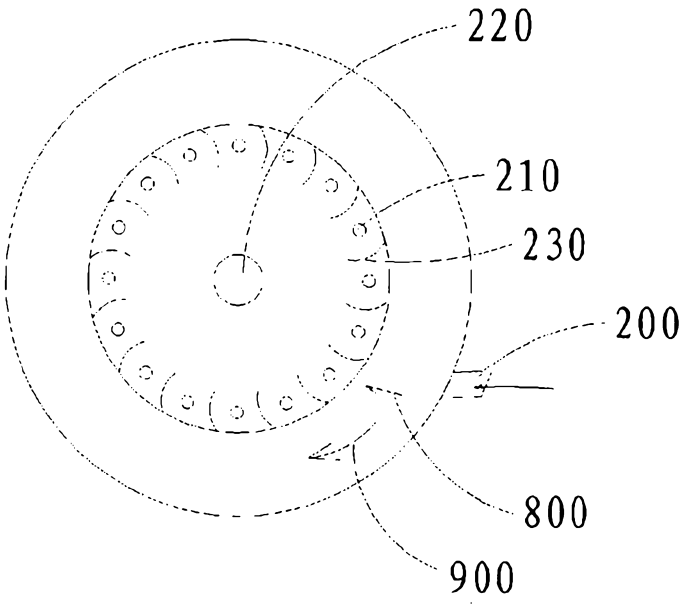

图 12