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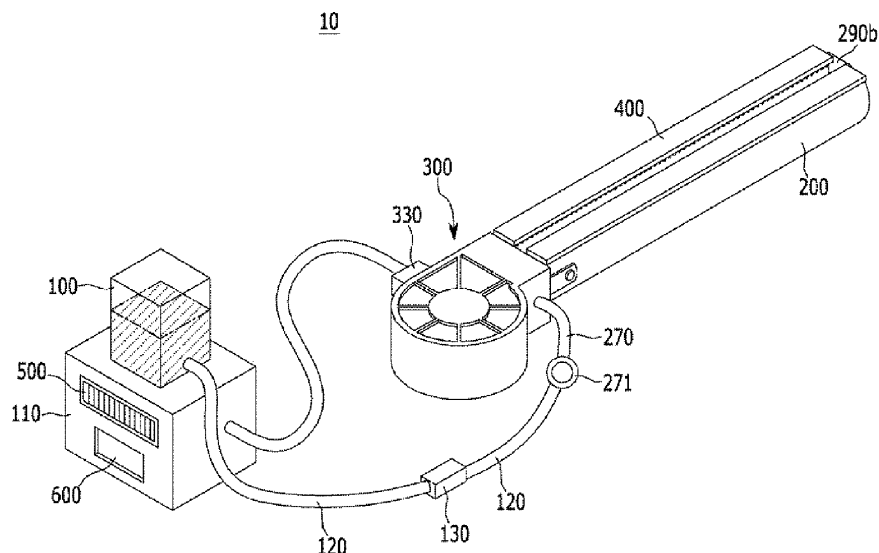
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(54) **COMBUSTION APPARATUS**

(57) A combustion apparatus according to one aspect of the present invention comprises a fuel storage container for storing fuel, a combustor having a certain length and connected to the fuel storage container and a pipe so as to be supplied with fuel and combust fuel, an air blower disposed at one end of the combustor and supplying air into the combustor, and a flame plate disposed over the combustor in a longitudinal direction and perfectly combusting air that is imperfectly combusted in

the combustor. The combustor has a groove formed in a longitudinal direction of the combustor, an ignition heater disposed in the longitudinal direction of the groove and generating heat, an ignition wick disposed over the ignition heater, absorbing fuel, and igniting by heat, and a pair of combustion wicks disposed in the longitudinal direction of the combustor so as to be spaced away from the ignition wick by a certain distance and combusting fuel.

[Fig. 1]



## Description

### Technical Field

[0001] The present invention relates to a combustion apparatus, and in particular to a combustion apparatus which is able to efficiently combust a fuel oil, for example, a liquid state animal oil, a liquid state plant oil, etc., which is not readily ignited due to a relatively high ignition point and tends to generate a lot of tar due to a high viscosity.

### Background Art

[0002] The global warming is in quick progress due to the increase in carbon dioxide which generates during the combustion of fossil fuel. As the fossil fuel is gradually depleted, the interest in an alternative energy which might substitute such fossil fuel is increasing.

[0003] The interest in the alternative energy has brought in a new term called a green growth.

[0004] The aforementioned green growth is a novel concept wherein a weather change and an environment damage can be reduced in such a way to save and efficiently use energy and resource, and a self-reliance on energy can be obtained, and any economic crisis can be recovered through a research and development process on a clean energy and a green technology, thus seeking a new growth driving source and providing more job opportunities. The term of the aforementioned green growth was first used by the magazine "Economist" in January, 2000 and started to be widely used by the Davos Forum.

[0005] The slogan "Seoul Initiative (SI) for Green Growth" was adapted in the MECD 2005 (Ministerial Conference on Environment and Development in Asia and the Pacific 2005), and the UNESCAP (UN Economic and Social Commission for Asia and the Pacific) actually started a discussion thereon.

[0006] The policy of the green growth is directed to an efficient greenhouse gas reduction, a de-oil, an energy self-reliance reinforcement, and a weather change adaptation power enforcement (a weather change adaptation and an energy self-reliance), a green technology development, a growth driving source motorization, an industrial greening movement, a green industry growth, an advanced industrial structure, and a green economy foundation establishment (a new growth driving source creation), and a green land and a green traffic establishment, a green revolution in life, and a worldwide green growth model nation embodiment (a life quality improvement and a nation status enforcement).

[0007] As the interest in the green growth is increasing, there is an effort wherein an eco-friendly liquid animal or plant oil is more used than a conventional fossil fuel in case of the fuel which is used in a combustion apparatus.

[0008] The fossil fuel generates carbon dioxide during the combustion. The thusly generated and emitted carbon dioxide may cause a part of the global warming. The plant oil may generate carbon dioxide during the com-

bustion, but the plant which is the material of the plant oil absorbs the carbon dioxide in the air when it grows. The actual total amount of the carbon dioxide which is generated due to the use of the plant oil may be zero since the amount of the carbon dioxide generated during the combustion of the plant oil can be offset with the amount of the carbon dioxide which is absorbed during the growth of the plant.

[0009] Despite of the aforementioned advantages of the liquid animal or plant oil, it is not actually used as a fuel of the combustion apparatus since the liquid animal or plant oil has a high ignition point, which entails a bad ignition ability, whereupon a lot of tar generates. For the use of a fuel oil, an ignition ability should be high, and the viscosity should be low enough for it to roll. In order for the liquid animal or plant oil to be used as a fuel oil in consideration of the aforementioned natural characteristics of the liquid animal or plant oil, the liquid animal or plant oil should be processed to have a low viscosity. Processing the liquid animal or plant oil costs a lot, for which the use of the liquid animal or plant oil is not economical.

[0010] For the aforementioned problems, it urgently needs to develop a new combustion apparatus which is able to use, as a fuel oil, a liquid animal or plant oil which has a bad ignition ability and a high viscosity without processing the liquid animal or plant oil.

## Disclosure of Invention

### Technical Problem

[0011] Accordingly, the present invention is made in an effort to resolve the above-mentioned problems. It is an object of the present invention to provide a combustion apparatus which is able to readily ignite a liquid animal or plant oil which has a bad ignition ability since it has a high ignition point.

[0012] It is another object of the present invention to provide a combustion apparatus which is able to reduce the generation amount of tar with the aid of the complete combustion of a liquid animal or plant oil.

[0013] It is further another object of the present invention to provide a combustion apparatus which is able to simultaneously supply a huge amount of fire power in a large space, for example, of a factory, a vinyl house and a combined heat and power plant.

### Technical Solution

[0014] To achieve the above object, there is provided a combustion apparatus, which may include, but is not limited to, a fuel storage container which is adapted to store fuel; a combustor which has a certain length and connected to the fuel storage container and a pipe so as to be supplied with fuel and combust fuel; an air blower which is disposed at one end of the combustor and supplying air into the combustor; and a flame plate which is

disposed over the combustor in a longitudinal direction and converge the flame or gas to the flame and perfectly combusting flame or gas that is imperfectly combusted in the combustor, wherein the combustor may include a groove which is formed in a longitudinal direction of the combustor; an ignition heater which is disposed in the longitudinal direction of the groove and generating heat; an ignition wick which is disposed over the ignition heater, absorbing fuel, and igniting by heat; and a pair of combustion wicks which are disposed in the longitudinal direction of the combustor so as to be spaced away from the ignition wick by a certain distance and combusting fuel.

**[0015]** The combustor further may include a combustion chamber wherein the fuel supplied from the fuel storage container can be combusted; and an air supply chamber which is able to receive air from the air blower and supply the air to the combustion chamber, wherein a plurality of air holes are formed between the air supply chamber and the combustion chamber so as to supply air of the air supply chamber in order for the fuel, which has been supplied into the combustion chamber, to be efficiently combusted.

**[0016]** The combustor may include an inner wall which is equipped with a plurality of air holes at its side surface; and an outer wall which is installed spaced apart at a certain distance from the inner wall from an outer side of the inner wall and defines the air supply chamber together with the inner wall.

**[0017]** The air hole may include a first combustion air hole which is formed at a lower portion of the inner wall and is adapted to supply air which will be used to first combust the fuel stored in the combustion chamber.

**[0018]** The air hole may include a second combustion air hole which is formed at an upper portion of the first combustion air hole and is adapted to second combust the fuel which has been first combusted.

**[0019]** The air hole may further include a plurality of flame alignment air holes which are formed at regular distances at an upper portion of the second combustion air hole and are adapted to align toward the center the flame which has been combusted in the combustion chamber.

**[0020]** There may be further provided a metallic fuel supply pipe which is installed extending from the groove, wherein a fuel adjusting device is provided between the fuel supply pipe and the pipe so as to adjust the amount of the fuel which is inputted into the combustor.

**[0021]** The air blower may include an air blowing fan which is engaged to a motor shaft and is adapted to generate wind; and an air blowing duct which is able to guide toward the air supply chamber the air which is being blown from the air blowing fan, wherein the air blowing duct is equipped with a through hole through which the fuel supply pipe passes through.

**[0022]** The flame plate may include a ceramic member which is provided at an upper portion of the combustor and is able to completely combust the gas, which has

been incompletely combusted by the combustor, in such a way to reheat the incompletely combusted gas; and a discharge port which is formed smaller than the width of the combustion chamber with the aid of the ceramic member, thus discharging the gas combusted by the combustor.

**[0023]** A fuel pump is installed at the pipe so as to smoothly supply the fuel to the combustor.

### **Advantageous Effects**

**[0024]** In the combustion apparatus of the present invention, it is possible to readily ignite a fuel, for example, a liquid animal or plant oil, which has a bad ignition ability since it has a high ignition point.

**[0025]** Moreover, the generation amount of tar can be reduced since it is possible to completely combust a fuel, for example, a liquid animal or plant oil the complete combustion thereof was difficult.

**[0026]** Furthermore, the combustion apparatus of the present invention has a certain length, whereupon it is possible to simultaneously supply a huge amount of fire-power in a large space, for example, of a factory, a vinyl house and a combined heat and power plant.

### **Brief Description of Drawings**

**[0027]**

Figure 1 is a perspective view illustrating the whole configuration of a combustion apparatus according to an embodiment of the present invention.

Figure 2 is an enlarged perspective view illustrating a combustor according to an embodiment of the present invention.

Figure 3 is a cross sectional view illustrating a combustor and a flame plate according to an embodiment of the present invention.

Figure 4 is a perspective view illustrating an air blower according to an embodiment of the present invention.

### **Modes for carrying out the invention**

**[0028]** The combustion apparatus according to an embodiment of the present invention will be described with reference to the accompanying drawings.

**[0029]** Figure 1 is a perspective view illustrating the whole configuration of a combustion apparatus according to an embodiment of the present invention. Figure 2 is an enlarged perspective view illustrating a combustor according to an embodiment of the present invention. Figure 3 is a cross sectional view illustrating a combustor and a flame plate according to an embodiment of the present invention.

**[0030]** As illustrated in Figures 1 to 3, the combustion apparatus 10 according to an embodiment of the present invention may include, but is not limited to, a fuel storage

container 100 adapted to store fuel, a combustor 200 which is connected to the fuel storage container 100 via a pipe 120 and is adapted to receive and combust the fuel, an air blower 300 which is provided at an end portion of the combustor 200 and is adapted to supply air to the combustor 200, and a flame plate 400 which is provided in the longitudinal direction at the top of the combustor 200 and is adapted to completely combust the air which has been incompletely combusted by the combustor 200.

**[0031]** The fuel oil used in the combustion apparatus 10 according to an embodiment of the present invention may be a fuel which has a high viscosity like an animal or plant oil (including a waste edible oil) of a liquid phase.

**[0032]** The fuel storage container 100 adapted to store fuel oil may be provided separate from the combustor 200. Since the filling amount of the fuel, for example, a liquid animal or plant oil, is determined based on the capacity of the fuel storage container 100, a lot of fuel can be filled and stored at a time by increasing the volume of the fuel storage container 100.

**[0033]** The fuel storage container 100 is connected to the combustor 200 via the pipe 120, thus supplying the fuel oil stored in the fuel storage container 100 to the combustor 200. The fuel storage container 100 may be installed higher than the combustor 200, by means of which the fuel oil stored in the fuel storage container 100 can be naturally supplied to the combustor 200 without using any supply device.

**[0034]** The fuel storage container 100 is further provided with a support unit 110 in order for the fuel storage container 100 to be installed higher than the combustor 200, wherein the fuel storage container 100 is supported by the support unit 110.

**[0035]** Moreover, a fuel pump 130 may be connected to the pipe 120 so as to smoothly supply the fuel oil stored in the fuel storage container 100 irrespective of the position of the fuel storage container 100.

**[0036]** While it has been described in this embodiment that the fuel pump 130 is provided for the sake of a smooth fuel supply of the fuel oil stored in the fuel storage container 100, it will be apparent to anyone skilled in the art that it is equally applicable to any other profiles wherein various devices, for example, a fuel heating (not illustrated) and supply device (not illustrated) in addition to the fuel pump 130 may be connected to the pipe 120.

**[0037]** Meanwhile, the combustor 200 may include, but is not limited to, a groove 210 defined in the longitudinal direction of the combustor 200, an ignition heater 280 provided in the longitudinal direction of the groove 210 and adapted to generate heat, an ignition wick 220a which is provided at the top of the ignition heater 280 and is ignited by the heat while absorbing the fuel, and a pair of combustion wicks 220b which are provided in the longitudinal direction of the combustor 200 and are spaced apart at a certain distance from the ignition wick 220a, thus combusting the fuel.

**[0038]** The combustor 200 has a certain length and as illustrated in the drawing is configured in a cylindrical

shape one side of which is open. The combustor 200 is able to supply a lot of firepower at a time since it has a certain length.

**[0039]** The combustor 200 may be provided in various shapes including a linear shape based on a predetermined situation, for example, a use purpose, an installation place, etc.

**[0040]** Moreover, while it has been described in this embodiment that the combustor 200 is formed in a cylindrical shape, it will be apparent to anyone skilled in the art that it is equally applicable to any other shapes including a polygonal shape in addition to the aforementioned cylindrical shape.

**[0041]** Furthermore, in order to prevent the combustor 200 from moving, a support member (not illustrated) may be provided at a lower portion of the combustor 200, thus preventing the combustion device 100 from stopping or catching on fire due to the movement of the combustor 200 during the operation of the combustion device 10.

**[0042]** Meanwhile, the combustor 200 may include, but is not limited to, an inner wall 260a defining a combustion chamber 230, and an outer wall 260b defining an air supply chamber 240 together with the inner wall 260a.

**[0043]** A fuel oil, for example, a liquid animal or plant oil, is supplied to the combustion chamber 230, and air is supplied to the air supply chamber 240 so as to efficiently combust the fuel which has been supplied to the combustion chamber 230.

**[0044]** A metallic fuel supply pipe 270 is provided extending toward the groove 210 so as to supply the fuel oil to the combustion chamber 230.

**[0045]** Moreover, a fuel adjusting device 271 may be provided between the fuel supply pipe 270 and the pipe 120 so as to adjust the amount of the fuel which is inputted from the fuel storage container 100 to the combustor 200, whereupon the user can readily adjust the amount of the fuel supplied from the fuel storage container 100 to the combustor 200 in such a way to adjust the fuel adjusting device 271.

**[0046]** An upper plate 261 may be provided at the top of the air supply chamber 240 defined between the inner wall 260a and the outer wall 260b, wherein the upper plate 261 is engaged in a row to the inner wall 260a and the outer wall 260b. With the provision of the aforementioned upper plate 261, it is possible to enhance the engagement between the inner wall 260a and the outer wall 260b, and a flame plate 400, which will be described later, can be engaged to the top of the upper plate 261.

**[0047]** Moreover, a first end plate 290a may be provided at an end portion in the longitudinal direction of the combustor 200 connected to an end portion of an air blower 300, which will be described later, so as to seal the combustion chamber 230, and a second end plate 290b may be provided at the other end in the longitudinal direction of the combustor 200 so as to prevent the fuel oil and the air from leaking to the outside of the combustor 200 in such a way to seal the combustion chamber 230 and the end portion of the air supply chamber 240.

**[0048]** A hole 291 is formed at the first end plate 290a, wherein a part of the fuel supply pipe 270 will be inserted in the hole 291 so as to supply the fuel oil to the groove 210.

**[0049]** Moreover, a groove 210 is formed in the longitudinal direction of the combustor 200 and in the center of a bottom plate 262 adapted to interconnect the inner wall 260a and its neighboring inner wall 260a. An ignition heater 280 may be provided in the longitudinal direction of the combustor 200 and in the groove 210 or a heat may be generated using electric power, gas, etc. While it has been described in this embodiment that the ignition heater 280 is formed in a cylindrical shape, it will be apparent to anyone skilled in the art that it is equally applicable to any other profiles, more specifically, the ignition heater 280 may be formed in various shapes including a cylindrical shape, a polygonal shape, etc.

**[0050]** An ignition wick 220a is provided at the top of the ignition heater 280 to ignite the combustion apparatus 10. The ignition wick 220a can be ignited if it receives a predetermined level heat from the ignition heater 280 after it has absorbed the fuel oil stored in the groove 210. The ignition wick 220a will be described in more detail later.

**[0051]** A pair of combustion wicks 220b are provided at the bottom plate 262 and are disposed spaced apart at a certain distance from the ignition wick 220a. The combustion wicks 220b are made from the same material as and in the same types as the ignition wick 220a.

**[0052]** The fuel oil supplied from the fuel storage container 100 may be stored in the lower surface of the bottom plate 262 including the groove 210. Since the combustion wick 220b, therefore, is able to maintain a state wherein it has absorbed the fuel oil, the flame of the ignition wick 220a may transfer to the combustion wicks 220b, thus consequently generating the firepower from three wicks.

**[0053]** Meanwhile, an end portion of the air supply chamber 240 is connected to the air blower 300 and is able to receive air from the air blower 300.

**[0054]** Since the air can be sucked into the combustion chamber 230, the ignition wick 220a installed inside of the combustion chamber 230 can be quickly ignited. Moreover, since air can be sufficiently supplied to the inside of the combustion chamber 230, the fuel like a liquid animal or plant oil having a high viscosity can be prevented from burning incompletely.

**[0055]** A plurality of air holes 250 may be formed at the inner wall 260a so as to enhance the combustion efficiency in the combustion chamber 230 when the air blower 300 supplies air to the combustion chamber 230 in the distributed form.

**[0056]** A first air hole 250a may be formed at the lowest portion of the inner wall 260a between a pair of the inner walls 260a so as to supply air which will be used to first combust the fuel inside of the combustion chamber 230.

**[0057]** The first combustion air hole 250a may be formed higher than the wick, where corresponds to  $\frac{1}{2}$  of

the height of the combustion chamber 230 and may be formed spaced apart at a certain distance from the bottom plate 262. If the air is supplied into the inside of the combustion chamber 230 via the first combustion air hole 250a, the air will circulate along the inner wall surface of the combustion chamber 230 and may be spread up to over the portion which is lower than the lower end of the first combustion air hole 250a. Since the air can be supplied to the ignition wick 220a positioning inside of the combustion chamber 230, the fuel oil which has been absorbed by the ignition wick 220a can be readily ignited. Moreover, since air is continuously supplied to the ignited ignition wick 220a, the fuel oil which has been absorbed by the ignition wick 220a can be thermally decomposed.

**[0058]** Moreover, a second combustion air hole 250b may be formed at the top of the first combustion air hole 250a so as to supply air which will be used to second combust the first combusted fuel. Here, the second combustion air hole 250b may be formed at a portion which corresponds to  $\frac{1}{2}$  of the height of the combustion chamber 230.

**[0059]** Meanwhile, the aforementioned second combustion air hole 250b may be formed at another inner wall 260a which makes a pair with the inner wall 260a where the first combustion air hole 250a is formed.

**[0060]** Likewise, the reason why the second combustion air hole 250b is formed in the direction where the first combustion air hole 250a is not formed is that it can move while forming curves inside of the combustion chamber 230, and the air can circulate evenly inside of the combustion chamber 230 with the aid of the aforementioned movements.

**[0061]** With the aid of the aforementioned configuration, a thermal decomposition layer (D) can be formed at a lower portion of the combustion chamber 230, and a combustion layer (C) can be formed at an upper portion of the combustion chamber 230.

**[0062]** The thermal decomposition layer (D) is a layer where the fuel oil absorbed by the ignition wick 220a made of a ceramic fiber material is decomposed by the heat.

**[0063]** The combustion procedure at the thermal decomposition layer (D) will be described. The viscosity of the fuel oil into which a radiation energy of the ignition wick 220a made of a ceramic fiber material is transferred, is lowered, and the fuel oil the viscosity of which has been lowered, will ascend toward the top of the ignition wick 220a with the aid of the capillary phenomenon. Moreover, since the temperature of the ignition wick 220a increases, the fuel oil can be readily decomposed inside of the thermal decomposition layer (D), whereby a heat recirculation will occur between the ignition wick 220a made of a ceramic fiber material and a combustion flame, thus generating a high temperature flame through a continuous fuel supply and a continuous air supply.

**[0064]** The fuel oil which has been thermally decomposed at the thermal decomposition layer (D) by the air supplied from the first combustion air hole 250a may be

converted into gas and may be supplied to the combustion layer (C). The combustion layer (C) is a layer where a high temperature gas combusts. The high temperature gas supplied from the thermal decomposition layer (D) is mixed with the air supplied from the second combustion air hole 250b and then is combusted. The fuel oil, for example, a liquid animal or plant oil, having a high viscosity, therefore, can be completely combusted, thus reducing the generation of tar.

[0065] Meanwhile, a plurality of flame alignment air holes 250c are formed at regular distances in the longitudinal direction at the tops of a pair of the inner walls 260a which define the combustor 200. The aforementioned flame alignment air holes 250c are provided to guide toward the center the flame which is erupting from the combustor 200.

[0066] Since the first combustion air hole 250a and the second combustion air hole 250b are formed at the combustor 200, the flame from the combustor 200 may erupt ascending in the slanted direction, not erupting and ascending in the vertical direction. In order to prevent the flame from erupting in the slanted direction, air is injected toward the center of the combustor 200 via the flame alignment air holes 250c just before the flame is erupted from the combustor 200, whereby it is possible to align the flame erupting from the combustor 200 toward the center.

[0067] The ignition wick 220a is made of an inflammable ceramic-like fiber wherein a thread is woven crossing in vertical and horizontal directions on a lattice-shaped metallic wire mesh. A wick leg part 221 can be manufactured using the vertical threads which are left behind after the horizontal threads at a lower portion of the fiber has been removed by a predetermined height. The reason why the wick leg part 221 is formed at the ignition wick 220a is that a part of a high temperature gas at the combustion layer (C) formed at an upper portion of the combustion chamber 230 can circulate over a lower end of the combustion wick, and the viscosity of the fuel oil stored at a lower portion of the ignition wick 220a can decrease, whereupon the aforementioned fuel oil can be quickly absorbed by the ignition wick 220a with the aid of the capillary phenomenon.

[0068] Meanwhile, at the top of the combustor 200, there are installed a ceramic member 410 which is able to completely combust the fuel which has been incompletely combusted by the combustor 200 by reheating the incompletely combusted fuel, and a flame plate 400 which is equipped with a discharge port 420 through which the combusted air can be emitted.

[0069] The flame plate 400 is able to completely combust the gas which has been incompletely combusted by the combustor 200, using a high temperature flame in such a way to converge the flame through the discharge port 420 the width of which is narrower than that of the combustor 200. Most of the emitting gas is discharged via the discharge port 420 after it has been contacted with the ceramic member 410.

[0070] Since the ceramic member 410 is in a heated state after it has been mounted on the top of the combustor 200, the gas which is emitted from the combustor 200 is reheated by the radiation energy which is radiating from the ceramic member 410, whereupon the gas which has been incompletely combusted by the combustor 200 can be completely combusted as it passes through the narrow discharge port 420 which has been heated by the flame plate 400.

[0071] Even though a liquid animal or plant oil is used as the fuel oil of the combustion apparatus 10, it can be completely combusted, thus reducing the generation of tar which tends to generate in case of the incomplete combustion.

[0072] Meanwhile, an air blower 300 may be installed at an end portion of the air supply chamber 240 so as to supply air to the combustor 200.

[0073] The air blower 300 adapted to supply air to the combustor 200 will be described.

[0074] Figure 4 is a perspective view illustrating an air blower according to an embodiment of the present invention.

[0075] As illustrated in Figure 4, the air blower 300 according to an embodiment of the present invention may include, but is not limited to, an air blowing fan 310 which is engaged to a motor shaft and is adapted to generate wind, and an air blowing duct 320 which is adapted to guide the wind from the air blowing fan 310 to an air supply chamber 240.

[0076] The air blowing unit 300 is engaged to the combustor 200 via an engaging member 340, for example, a screw, etc. A through hole 321 may be formed at one surface of the air blowing duct 320, wherein the fuel supply pipe 270 is passing through the through hole 321.

[0077] The air, therefore, can be supplied to the air supply chamber 240 via the air blowing duct 320, and the fuel can be supplied to the combustion chamber 230 via the fuel supply pipe 270.

[0078] As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described examples are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the meets and bounds of the claims, or equivalences of such meets and bounds are therefore intended to be embraced by the appended claims.

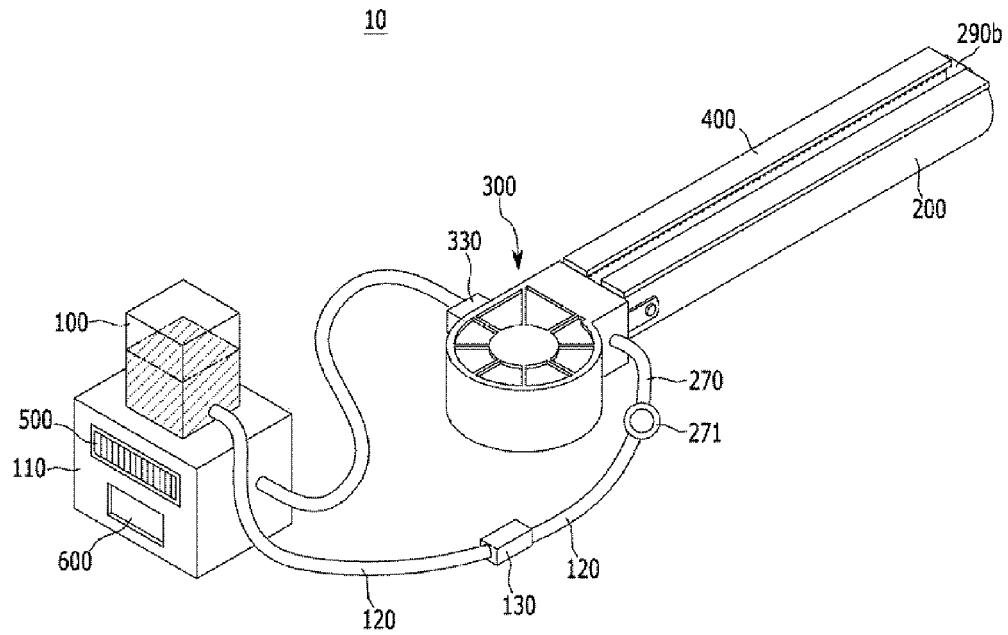
## Claims

1. A combustion apparatus, comprising:

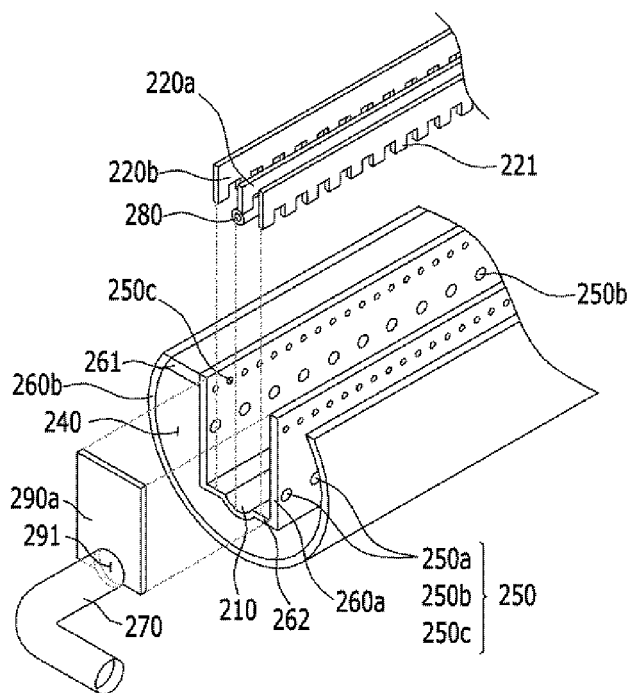
- a fuel storage container which is adapted to store fuel;
- a combustor which has a certain length and con-

- nected to the fuel storage container and a pipe so as to be supplied with fuel and combust fuel; an air blower which is disposed at one end of the combustor and supplying air into the combustor; and  
 a flame plate which is disposed over the combustor in a longitudinal direction and perfectly combusting air that is imperfectly combusted in the combustor,  
 wherein the combustor comprises:
- a groove which is formed in a longitudinal direction of the combustor;  
 an ignition heater which is disposed in the longitudinal direction of the groove and generating heat;  
 an ignition wick which is disposed over the ignition heater, absorbing fuel, and igniting by heat; and  
 a pair of combustion wicks which are disposed in the longitudinal direction of the combustor so as to be spaced away from the ignition wick by a certain distance and combusting fuel.
2. The apparatus of claim 1, wherein the combustor further comprises:
- a combustion chamber wherein the fuel supplied from the fuel storage container can be combusted; and  
 an air supply chamber which is able to receive air from the air blower and supply the air to the combustion chamber,  
 wherein a plurality of air holes are formed between the air supply chamber and the combustion chamber so as to supply air of the air supply chamber in order for the fuel, which has been supplied into the combustion chamber, to be efficiently combusted.
3. The apparatus of claim 2, wherein the combustor comprises:
- an inner wall which is equipped with a plurality of air holes at its side surface; and  
 an outer wall which is installed spaced apart at a certain distance from the inner wall from an outer side of the inner wall and defines the air supply chamber together with the inner wall.
4. The apparatus of claim 3, wherein the air hole comprises a first combustion air hole which is formed at a lower portion of the inner wall and is adapted to supply air which will be used to first combust the fuel stored in the combustion chamber.
5. The apparatus of claim 4, wherein the air hole comprises a second combustion air hole which is formed at an upper portion of the first combustion air hole and is adapted to second combust the fuel which has been first combusted.
6. The apparatus of claim 5, wherein the air hole further comprises a plurality of flame alignment air holes which are formed at regular distances at an upper portion of the second combustion air hole and are adapted to align toward the center the flame which has been combusted in the combustion chamber.
7. The apparatus of claim 3, further comprising:
- a metallic fuel supply pipe which is installed extending from the groove, wherein a fuel adjusting device is provided between the fuel supply pipe and the pipe so as to adjust the amount of the fuel which is inputted into the combustor.
8. The apparatus of claim 7, wherein the air blower comprises:
- an air blowing fan which is engaged to a motor shaft and is adapted to generate wind; and  
 an air blowing duct which is able to guide toward the air supply chamber the air which is being blown from the air blowing fan,  
 wherein the air blowing duct is equipped with a through hole through which the fuel supply pipe passes through.
9. The apparatus of claim 2, wherein the flame plate comprises:
- a ceramic member which is provided at an upper portion of the combustor and is able to completely combust the gas, which has been incompletely combusted by the combustor, in such a way to reheat the incompletely combusted gas; and  
 a discharge port which is formed smaller than the width of the combustion chamber with the aid of the ceramic member, thus discharging the gas combusted by the combustor.
10. The apparatus of claim 1, wherein a fuel pump is installed at the pipe so as to smoothly supply the fuel to the combustor.

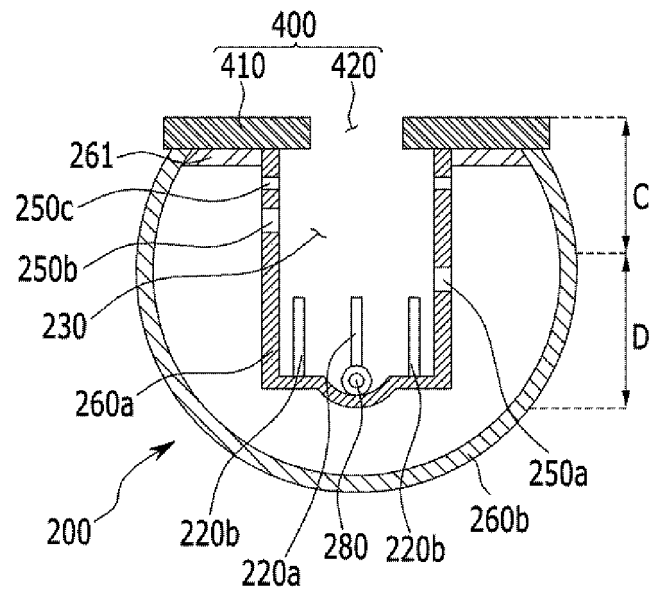
[Fig. 1]



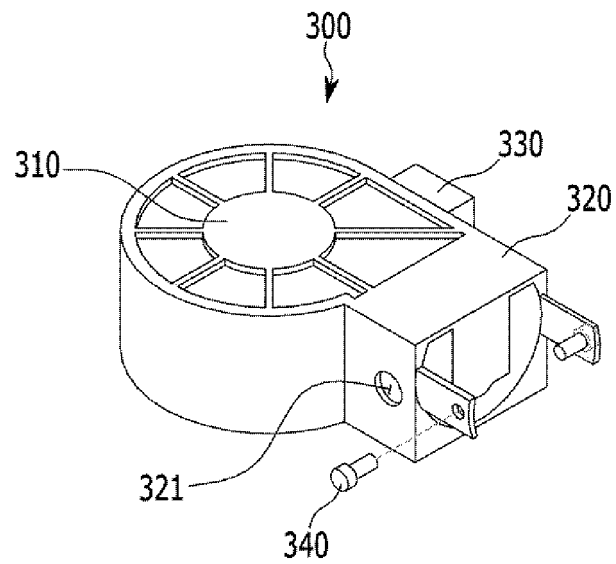
[Fig. 2]



[Fig. 3]



[Fig. 4]



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2014/008941

## A. CLASSIFICATION OF SUBJECT MATTER

**F23D 3/02(2006.01)i, F23D 3/08(2006.01)i, F24C 5/04(2006.01)i, F23L 9/00(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F23D 3/02; F23G 7/05; F23D 11/10; F23D 3/08; F24C 5/04; F23L 9/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: vegetable oil, animal oil, paraffin, wick, combustor, combustion device

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                     | Relevant to claim No. |
|-----------|--------------------------------------------------------------------------------------------------------|-----------------------|
| A         | KR 10-2005-0083859 A (YAMAICHI METAL CO., LTD. et al.) 26 August 2005<br>See abstract; figures 1 and 2 | 1-10                  |
| A         | KR 10-1270320 B1 (AHN, Hyung Geun) 31 May 2013<br>See abstract; figure 2                               | 1-10                  |

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

06 NOVEMBER 2014 (06.11.2014)

Date of mailing of the international search report

06 NOVEMBER 2014 (06.11.2014)

Name and mailing address of the ISA/KR



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Republic of Korea

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Authorized officer

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INTERNATIONAL SEARCH REPORT  
Information on patent family members

International application No.

PCT/KR2014/008941

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member | Publication<br>date |
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| KR 10-2005-0083859 A                      | 26/08/2005          | AU 2003-221033 A1       | 14/07/2004          |
|                                           |                     | AU 2003-221033 A8       | 14/07/2004          |
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|                                           |                     | US 2006-0063118 A1      | 23/03/2006          |
|                                           |                     | US 7585170 B2           | 08/09/2009          |
| KR 10-1270320 B1                          | 31/05/2013          | WO 2004-057235 A1       | 08/07/2004          |
|                                           |                     | NONE                    |                     |
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