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

(11) Publication number : **0 598 619 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **93309199.3**

(51) Int. Cl.[5] : **F23D 11/00**

(22) Date of filing : **18.11.93**

(30) Priority : **19.11.92 KR 2280492**
26.12.92 KR 2663192

(43) Date of publication of application :
25.05.94 Bulletin 94/21

(84) Designated Contracting States :
BE DE FR GB

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(54) Liquid fuel burner.

(57) A liquid fuel burner comprises a heated liquid fuel vaporizer (21) and a combustion head (20) mounted over the liquid fuel vaporizing means (21). Primary combustion air is guided through the liquid fuel vaporizer (21) to the interior of the combustion head (20). Secondary combustion air is guided past the liquid fuel vaporizer (21) to the outside of the combustion head. Means (30) is provided for preventing cooling of the vaporizer (21) by the flow of secondary combustion air. This means may comprise air guide means (30) spaced from the vaporizer (21).

In another embodiment an agitator is provided for promoting uniting of vaporized fuel and primary combustion air.

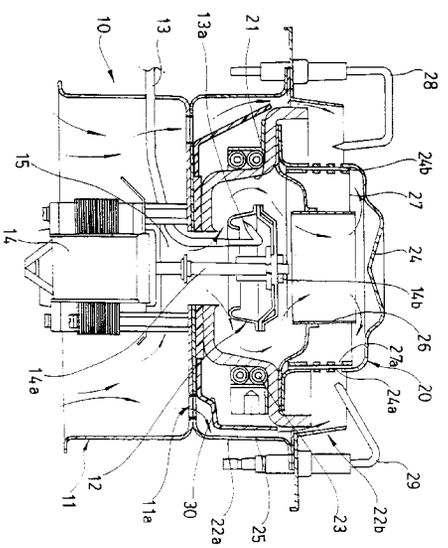

FIG. 2

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The present invention relates to a liquid fuel burner.

A known liquid fuel burner comprises a heated liquid fuel vaporizing means; a combustion head mounted over the liquid fuel vaporizing means; first guide means for guiding primary combustion air through the liquid fuel vaporizing means to the inside of the combustion head; and second guide means for guiding secondary combustion air past the liquid fuel vaporizing means to the outside of the combustion head.

Referring to Figure 1, a liquid fuel burner comprises: a vaporizer 10 wherein injected fuel is sprayed onto an inner surface of a burner body, preheated by a heater, for vaporizing the liquid fuel in a stream of air for primary combustion; and a combustion head 20 for burning fuel mixed with the primary combustion air.

The vaporizer 10 thus described comprises: a blowing barrel 11 for supplying air necessary for combustion; a sprayer 12 for being rotated by a motor 14 to radially spray the liquid fuel, supplied through a fuel supply tube 13 and a nozzle 13a; a burner body 21, pre-heated by a heater 23, for vaporizing the liquid fuel sprayed by the sprayer 12; and a temperature detecting sensor 25 disposed on the burner body 21 for detecting the temperature of the burner body 21.

The primary combustion air is supplied through the blowing barrel 11 and an air duct 15 into the interior of the burner body 21. The sprayer 12 is fixedly mounted to a shaft 14a of a motor 14 by way of a nut 14b.

The combustion unit 20 comprises: a lower burner cover 22a which has an opening at the top thereof and encompasses the burner, maintaining a predetermined distance from the burner body 31, and is disposed on top of the blowing barrel 11 to thereby guide to the top air for secondary combustion, introduced through guiding holes 11a from the blowing barrel 11; a guide plate 26 disposed at the top of the burner body 21 and for guiding upwards vapor mixed with the primary combustion air from the vaporizer 10; a filter 27 for removing foreign bodies from the fuel/air mixture guided upwards by the guide plate 26; a combustion head 24 for ejecting radially the gas mixture filtered by the filter 27; an ignition rod 28 for igniting the gas mixture ejected radially from the combustion head 24; and a frusto-conical upper burner cover 22b for supplying the secondary combustion air to the exterior of the combustion head 24 to thereby assist combustion.

A plurality of holes 27a and flame holes 24a are formed in the sides of the filter 27 and the combustion head 24 with a metal grid 24b disposed therebetween.

A flame detecting rod 29 for detecting whether or not there is a flame during operations of the combustion device is provided beside the combustion head 20.

When electric power is supplied to the burner, the preheater 23 is activated to preheat the burner body 21. The preheat temperature is detected by the temperature detecting sensor 25, installed on one side of the burner body 21, and when the temperature detected by the sensor 25 reaches an appropriate temperature, a control unit (not shown) activates an electric pump to supply fuel and a blowing fan to supply air for combustion. The liquid fuel supplied by the electric pump is ejected into the sprayer 12 through the fuel supply tube 13 and the nozzle 13a.

The blowing fan is activated in order to supply the primary combustion air to the interior of the burner body 21 through the blowing fan 11 and the air duct 15, and the secondary combustion air into the space formed by the burner body 21 and the lower burner cover 22a.

At the same time, the motor rotates the spray dish 12, disposed on the shaft 14a, and the liquid fuel is ejected into the interior of the burner body 21 by the spray dish 12. The ejected fuel is in turn vaporized because the burner body 21 has already been preheated by the heater 23.

The secondary combustion air is guided upwards by the upper burner cover 22b to be supplied to the flames so that combustion is accelerated.

However, the conventional liquid fuel burner, thus described, has a drawback in that the secondary combustion air is guided upward by the burner body 21 and the lower burner cover 22a and consequently contacts the exterior of the burner body 21, eventually cooling the burner body 21.

Accordingly, the burner body 21 cannot maintain the vaporizing temperature, resulting in fuel remaining unvaporized. Because the burner body 21 cannot maintain the vaporizing temperature, the heater is activated for temperature compensation which increases electric energy consumption.

Furthermore, because the fuel vaporized within the burner body 21 is not fully guided upward to the guide plate 26, fuel may flow downward generating tar which causes the generation of toxic gas.

It is an aim of the present invention to overcome the aforementioned disadvantages of the prior art.

According to the present invention, there is provided a liquid fuel burner, as defined above, characterized by means for preventing cooling of the liquid fuel vaporizing means by the flow of secondary combustion air.

As a consequence of the present invention, the liquid fuel vaporizing means is not cooled by the secondary combustion air thereby reducing the electric energy consumption of the burner and the generation of tar and toxic gas.

Preferably, said means for preventing cooling comprises an air guide member spaced from the liquid fuel vaporizing means.

Preferably, the liquid fuel vaporizing means and the combustion head are mounted coaxially within an annular housing, the primary combustion air flows substantially axially through the housing and through an opening in a lower wall of the liquid fuel vaporizing means, and the secondary combustion air flows substantially axially through the housing outside the liquid fuel vaporizing means.

Preferably, the liquid fuel vaporizing means includes a rotating liquid fuel sprayer.

Embodiments of the present invention will now be described, by way of example, with reference to Figures 2 to 4b of the accompanying drawings, in which:

Figure 1 is a sectional view illustrating a prior art liquid fuel burner;

Figure 2 is a sectional view illustrating a liquid fuel burner according to a first embodiment of the present invention;

Figure 3 is a sectional view illustrating a liquid fuel burner according to a second embodiment of the present invention; and

Figures 4a and 4b are a plan view and a front view respectively illustrating the nut shown in Figure 3.

Referring to Figure 2, a burner according to the present invention comprises a vaporizing unit 10 for vaporizing liquid fuel and mix the same with the primary combustion air and a combustion head 20 for burning the fuel air mixture.

The vaporizer 10 comprises: a blowing barrel 11 for supplying the air necessary for combustion; a sprayer 12, rotated by a motor 14, to radially spray the liquid fuel, supplied through a fuel supply tube 13 and a nozzle 13a; a burner body for mixing the liquid fuel with the primary combustion air, supplied through the air duct 15 from the blowing barrel 11, after vaporizing the liquid fuel preheated by a heater 23 and ejected by the sprayer 12; a temperature detecting sensor disposed on the burner body 21 to detect the temperature of the burner body 21; a lower burner cover 22a equipped with an opening at the top and encompassing the burner, maintaining a predetermined distance from the burner body 21, and disposed on top of the blowing barrel 11; and an air guide member 30 disposed between the burner body 21 and the lower burner cover 22a to guide upwards the secondary combustion air, infused into the lower burner cover 22a through the guiding holes 11a, without being in contact with the burner body 21.

The primary combustion air is supplied into the inner area of the burner body 21 through the air duct 15 formed by piercing the blowing barrel 11 and the burner body 21.

The sprayer 12 is fixedly installed to the shaft 14a of the motor 14 by a nut 14b.

The combustion head 20 comprises: a guide plate 26 disposed at the top of the burner 21 and guiding upwards the fuel/air mixture for primary combustion; a filter 27 for removing foreign bodies from the fuel/air mixture; a burner head 24 for ejecting radially the fuel/air mixture; an igniter 28 for igniting the fuel/air mixture ejected radially by the burner head 24; and a frusto-conical upper burner cover 22b for supplying to an inner area of the burner head 24 the secondary combustion air, guided upward by the lower burner cover 22a to assist the combustion.

A plurality of holes 27a and flame holes 24a are formed in the sides of the filter 27 and the burner head 24 and a metal grid 24b is disposed between the filter 27 and the burner head 24.

A flame detecting rod 29 for detecting whether or not there is any flame during operation of the burner is provided beside the burner head 24.

The present invention provides for a burner equipped with a vessel-like air guide member for cutting the secondary combustion air off from the burner body 21 while an external periphery of the burner body 21, within the burner cover 22, maintains a predetermined interval, with an opening being disposed thereon.

This kind of air guide member 30 is just a mere embodiment and it should be apparent that any construction of air guide member will be satisfactory if the secondary combustion air is prevented from contacting the burner body 21 disposed within the burner cover 22.

When the combustion unit 20 is turned on, the preheating heater 23 is activated, thereby preheating the burner body 21, and when the temperature detected from the temperature detecting sensor 25 reaches vaporizing temperature, the control unit (not shown) activates the blowing fan for supplying the air for combustion and an electric pump for supplying the fuel.

The liquid fuel being supplied by the electric pump is ejected into the sprayer 12 through the fuel supply tube 13 and the nozzle 13a. The blowing fan is activated so that the primary combustion air is supplied into the burner body 21 through the blowing barrel 11 and the air duct 15 and the secondary combustion air is supplied into the space formed between the air guide member 30 and the lower burner cover 22a through the blowing barrel 11 and the guiding holes 11a.

At the same time, the motor 14 is activated to rotate the spray dish 12 disposed on the shaft 14a, so that the liquid fuel is injected into the interior of the burner body 21, thereby causing the same to be vaporized.

The fuel (vaporized gas) vaporized in the interior of the burner body 21 is mixed with the primary combustion air and is guided upwards by the guide plate 26.

The fuel/air mixture, guided upwards by the guide plate 26, is cleaned of foreign bodies by the fil-

ter 27, then finely filtered by the metal grid 24b and ejected radially through the plurality of flame holes formed in the sides of the burner head 24. The ejected fuel/air mixture is ignited by the ignition rod 28.

The secondary combustion air is guided through the inner area of the blowing barrel 11 to the air guide duct formed between the air guide member 30 and the lower burner cover 22a and is supplied to the exterior of the burner head 24 by the upper burner cover 22b to thereby promote combustion.

As seen from the foregoing, the present invention prevents contact between the secondary combustion air and the burner body 21, thereby preventing the temperature of the burner body from dropping resulting in reduced electric energy consumption by reducing operation of the preheating heater 23.

Furthermore, the present invention can maintain optimum vaporizing condition at all times, so that liquid fuel is completely vaporized avoiding the problems of odor, soot, yellow flame, toxic gas and the like caused by incomplete combustion.

Referring to Figure 3, the secondary combustion air is infused into the blowing barrel 11 and then is infused into an inner area of the lower burner cover 22a through the guiding holes 11a formed by piercing the top of the blowing barrel 11 and the bottom of the lower burner cover 22a.

The air guide member 30 has a shape which encompasses the exterior of the burner body 21 so that the secondary combustion air, infused into the interior of the lower burner cover 22a through the guiding holes 11a, is guided upward without being in contact with the burner body 21. Of course, the secondary combustion air, guided upward through the space formed between the air guide member 30 and the lower burner cover 22a, is guided to the exterior of the burner head 24 by the upper burner cover 22b.

A nut 122 for fastening the sprayer 12 to the shaft 14a of the motor 14, as illustrated in Figures 4a and 4b, is formed with panhandles 122a and 122b. It should be noted that the panhandles 122a and 122b in the present invention can be formed integrally with the nut 122 or can be separately formed and welded, for instance, to the nut 122. Furthermore, the number of the panhandles 122a and 122b can be increased from two to whatever number is needed and the shape thereof can also be changed.

The operation of the second embodiment will now be described with reference to Figure 3.

When the burner is turned on, the burner body 21 is preheated by the preheating heater 23 and when the temperature detected by the temperature detecting sensor 25 reaches vaporizing temperature, the control unit (not illustrated) activates the electric pump for supplying fuel and the blowing fan for supplying the air for combustion.

The liquid fuel supplied by the electric pump is ejected into the interior of the sprayer 12 through the fuel supply duct 13 and the nozzle 13a, and with activation of the blowing fan, the primary combustion air is supplied into the interior of the burner body 21 through the blowing barrel 11 and the air duct 15, and the secondary combustion air is supplied to the space formed between the burner body 21 and the lower burner cover 22a through the blowing barrel 11 and the guiding holes 11a.

At the same time, the motor 14 is activated to rotate the spray dish 12, disposed on the shaft 14a, so that the liquid fuel is ejected into and vaporized in the burner body 21. The fuel vaporized within the burner body 21 is mixed with the primary combustion air, infused into the burner body 21 through the blowing barrel 11 and the air duct 15 and guided upwards by the guide plate 26. At this moment, because the motor is being rotated, the nut 122 fastened to the rotating shaft 14a is also rotated. When the nut 122 is rotated, the primary combustion air and the vaporized gas are mixed by the panhandles 122a and 122b.

In other words, the panhandles 122a and 122b formed at the nut 122 mix the gas vaporized within the burner body 21 with the primary combustion air, and at the same time, promote the same to rise upwards, so that the tar likely to be generated by unvaporized fuel flowing underneath is prevented.

The fuel/air mixture guided upwards by the guide plate 26 is then cleaned of foreign bodies by the filter 27, filtered finely by the metal grid 24b and is ejected radially through the plurality of flame holes 24a formed on the sides of the burner head 24. The fuel/air mixture is ignited by way of the ignition rod 28 (see Figure 2).

At this moment, the secondary combustion air is guided upwards by the air guide duct, formed between the air guide member 30 and the lower burner cover 22a through the blowing barrel 11 and the guiding holes 11a, and is supplied to the exterior of the burner head 24 by the upper burner cover 22b to promote the combustion.

As described above, the present invention can prevent the fuel ejected by rotation of the sprayer from being incompletely burnt because the fuel is vaporized by way of contact with the inner surface of the inner burner body, and at the same time, prevent the heater for preheating the burner body from being operated to thereby achieve a reduction in the electric energy consumption of the burner.

Furthermore, the present invention prevents unvaporized liquid fuel from flowing in the interior of the burner body to thereby prevent the generation of tar, so that odor, soot, toxic gas and like are not generated.

The above description has only dealt with a nut formed with two panhandles but the panhandles can be increased in number according to need.

Furthermore, the aforementioned description has explained panhandles formed at the nut however

it should be noted that the object of the present invention can be accomplished by forming the panhandles integrally with the nut.

Still furthermore, the aforesaid description has explained that the panhandles formed at the nut or at the sprayer are only operated to bring the mixed gas upwards but it should also be noted that, besides the above function, the panhandles can perform the operation of fully mixing the vaporized gas with the air for the primary combustion.

Claims

1. A liquid fuel burner comprising:
a heated liquid fuel vaporizing means (21);
a combustion head (20) mounted over the liquid fuel vaporizing means (21);
first guide means (11,21) for guiding primary combustion air through the liquid fuel vaporizing means (21) to the inside of the combustion head (20); and
second guide means (11,22a) for guiding secondary combustion air past the liquid fuel vaporizing means (21) to the outside of the combustion head (20),
characterized by
means (30) for preventing cooling of the liquid fuel vaporizing means (21) by the flow of secondary combustion air.

2. A liquid fuel burner according to claim 1, wherein said means for preventing cooling comprises an air guide member (30) spaced from the liquid fuel vaporizing means (21).

3. A liquid fuel burner according to claim 1 or 2, wherein the liquid fuel vaporizing means (21) and the combustion head (20) are mounted coaxially within an annular housing (11,22), the primary combustion air flows substantially axially through the housing and through an opening in a lower wall of the liquid fuel vaporizing means (21), and the secondary combustion air flows substantially axially through the housing (11,22) outside the liquid fuel vaporizing means (21).

4. A liquid fuel burner according to claim 1, 2 or 3, including an agitator (122a) for promoting mixing of vaporized fuel and primary combustion air.

5. A liquid fuel burner according to claim 1, 2 or 3, wherein the liquid fuel vaporizing means (21) includes a rotating liquid fuel sprayer (12).

6. A liquid fuel burner according to claim 5, including an agitator (122a) for promoting mixing of vaporized fuel and primary combustion air drivingly mounted to the liquid fuel sprayer (12).

7. A burner of a liquid fuel combustor comprising:
blowing means for supplying air necessary for combustion;
lower burner cover of a vessel shape for being disposed on a top area of the blowing means;
a burner body for being disposed inside the lower burner cover and for vaporizing liquid fuel being preheated by a heater and ejected by a sprayer for a mix with air for primary combustion supplied from the blowing means to thereby make mixed gas;
combustion means for guiding upwards the mixed gas made from the burner body to thereby burn the same; and
an air guide member for being disposed between the burner body and the lower burner cover in order to guide air for a secondary combustion to the combustion means without being in contact with the burner body when the air for the secondary combustion supplied from the blowing means is infused into an inner area of the lower burner cover through guiding holes to promote combustion of the combustion means.

8. A burner of a liquid fuel combustor as defined in claim 7, wherein the guiding holes are formed to allow the air for the secondary combustion supplied from the blowing means to pass through between the air guide member and the lower burner cover.

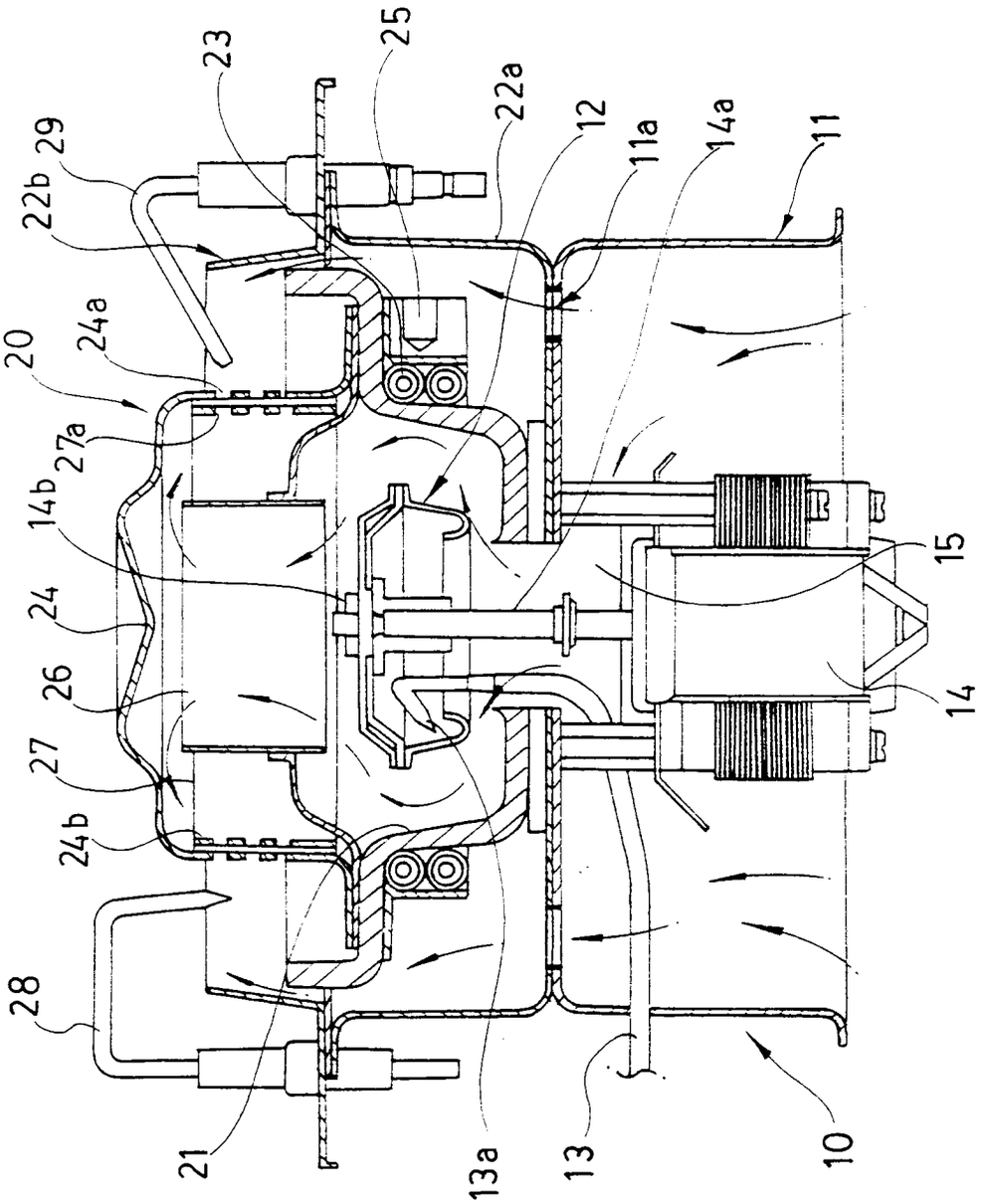
9. A burner of a liquid fuel combustor comprising:
blowing means for supplying the air necessary for combustion;
a lower burner cover of a vessel shape for being disposed on a top area of the blowing means;
a sprayer for being rotated by a motor to thereby eject the liquid fuel;
a burner body for being disposed inside the lower burner cover and for vaporizing the liquid fuel being preheated by a heater and ejected by the sprayer for a mix with the air for the primary combustion supplied from the blowing means to thereby make the mixed gas;
a fan for being disposed on a top area of the sprayer to thereafter bring upward the gas mixed at the burner body; combustion means for burning the mixed gas brought upward by the fan; and
an air guide member for being disposed between the burner body and the lower burner cover in order to guide air for the secondary combustion to the combustion means without being in contact with the burner body when the air for the secondary combustion supplied from the blowing means is infused into an inner area of the lower burner cover through guiding holes to promote combus-

tion of the combustion means.

10. A burner of a liquid fuel combustor as defined in claim 9, wherein the fan is formed integrally with the sprayer.

11. A burner of a liquid fuel combustor as defined in claim 9, wherein the fan is formed on a nut for fastening the sprayer to a shaft of a motor.

FIG. 1
(PRIOR ART)



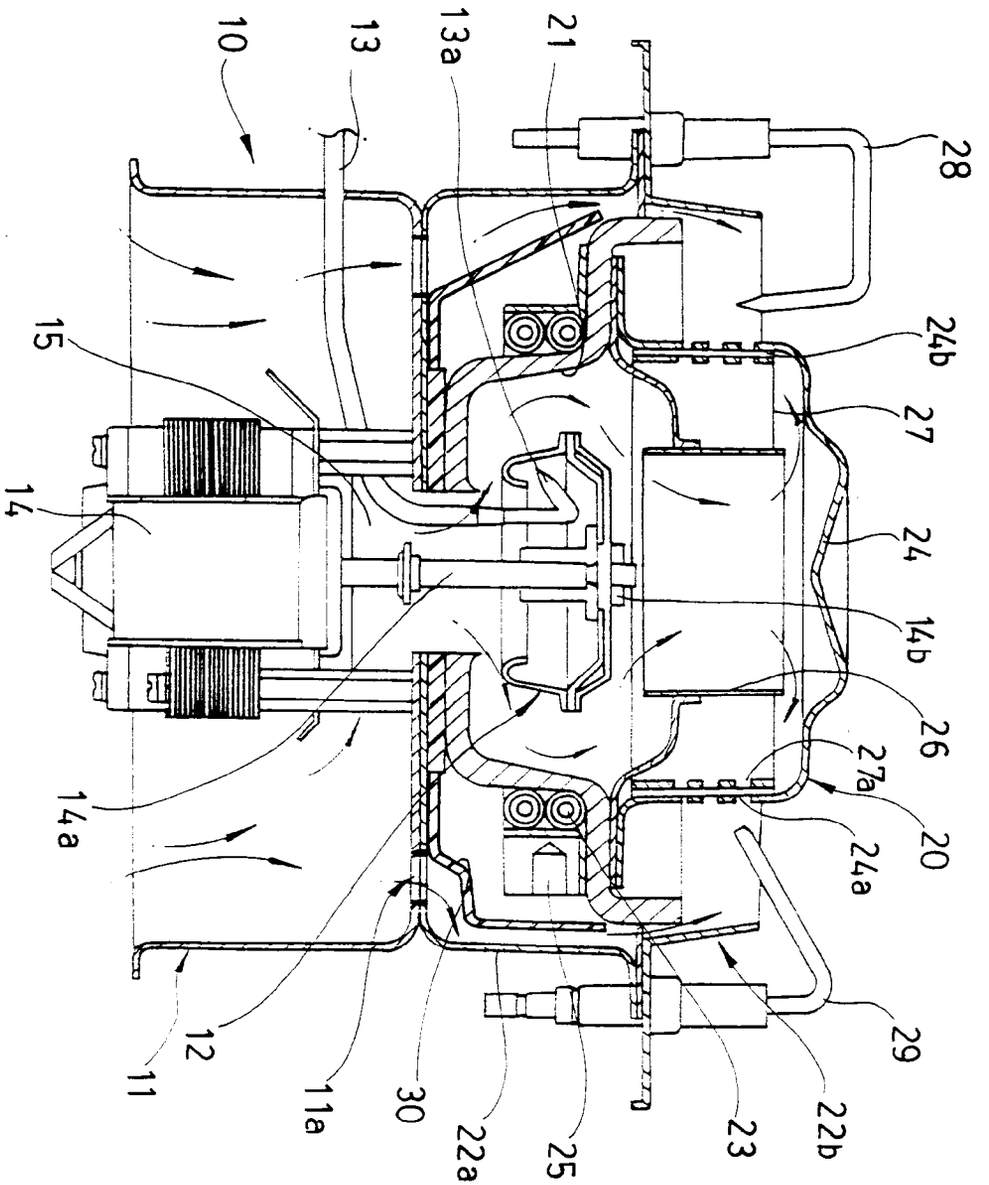

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FIG. 2

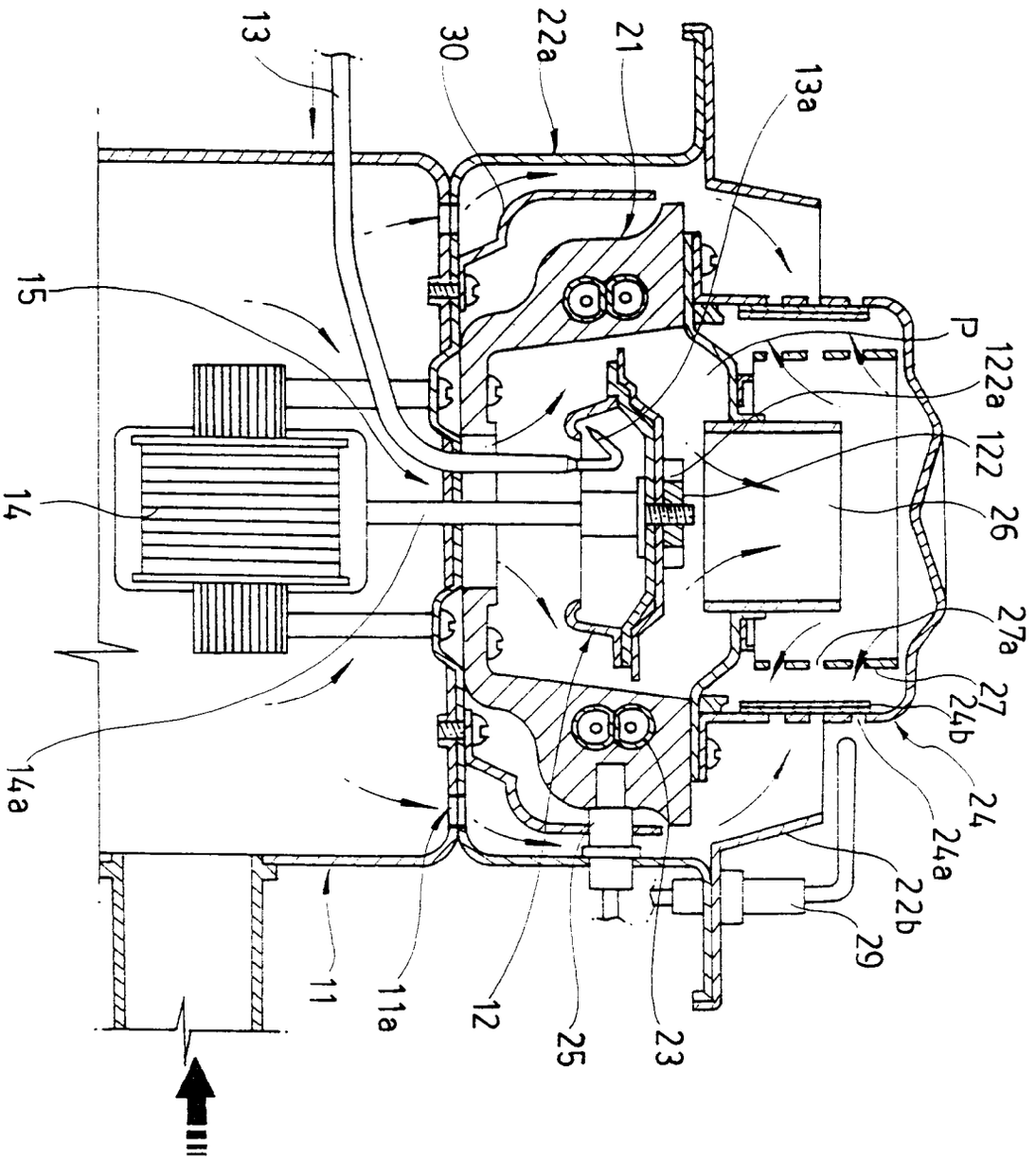
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FIG. 3

FIG. 4a

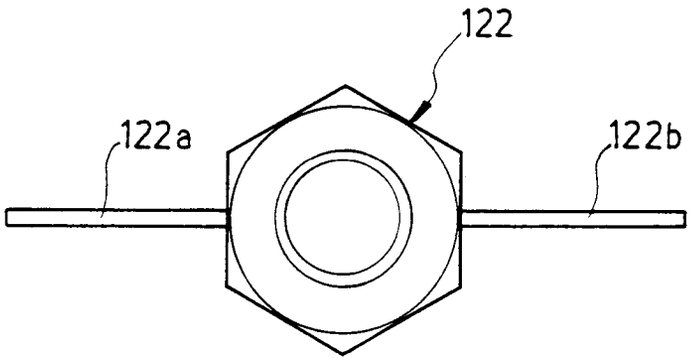
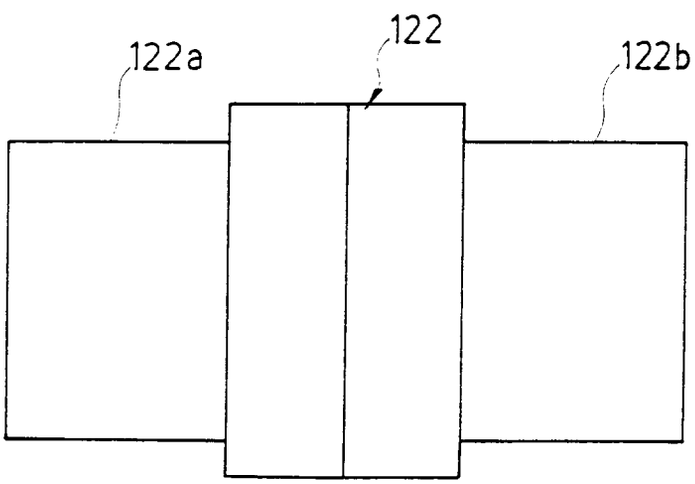


FIG. 4b



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EUROPEAN SEARCH REPORT

Application Number
EP 93 30 9199

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	PATENT ABSTRACTS OF JAPAN vol. 008, no. 124 (M-301)9 June 1984 & JP-A-59 027 110 (NIPPON DENSO KK) 13 February 1984 * abstract *	1-10	F23D11/00
X	PATENT ABSTRACTS OF JAPAN vol. 014, no. 159 (M-0956)28 March 1990 & JP-A-02 021 109 (MATSUSHITA ELECTRIC IND CO) 24 January 1990	1-3,5	
A	* abstract *	7,9	
X	EP-A-0 166 329 (FÜLLEMANN)	1,2,5	
A	* page 13, line 1 - page 14, line 9; figure 5 *	7,9	
X	PATENT ABSTRACTS OF JAPAN vol. 014, no. 432 (M-1026)17 September 1990 & JP-A-02 169 905 (MATSUSHITA ELECTRIC IND CO) 29 June 1990	1-6	TECHNICAL FIELDS SEARCHED (Int.Cl.5)
A	* abstract *	7,9,10	F23D
A	PATENT ABSTRACTS OF JAPAN vol. 008, no. 116 (M-299)30 May 1984 & JP-A-59 024 109 (NIPPON DENSO KK) 7 February 1984 * abstract *		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 February 1994	Vrugt, S

CATEGORY OF CITED DOCUMENTS

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