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(54) **A vaporizing type burner.**

(57) A vaporizing type burner includes a cylindrical body (28) of which one end is closed with a wall plate (18), and an axially extending combustion chamber (46) is defined in the cylindrical body (28). A support member (32) for a fuel absorber (34) is received in the combustion chamber (46). A cylindrical mixer (48) axially protruding into the combustion chamber (46) for a gas mixture by mixing combustion air from an air swirl flow chamber (14) with vaporized fuel from the fuel absorber (34). In addition, the burner includes a guide pipe (58) of which one end communicates with the air swirl flow chamber (14) and of which the other end communicates with the combustion chamber (46), and is provided to extend through the support member (32) and the fuel absorber (34). To ignite the gas mixture, an ignition plug (60) is disposed in the guide pipe (58) in a concentric relationship. To introduce the combustion air from the air swirl flow chamber (14) into the guide pipe (58), an air path (62) is formed around the ignition plug (60). A plurality of vaporizing holes (64) are formed in the guide pipe (58) so as to allow passage of the vaporized fuel from the fuel absorber (32). Ignition flame blow holes (66) are formed in the guide pipe (58) to provide a communication with the combustion chamber (46).

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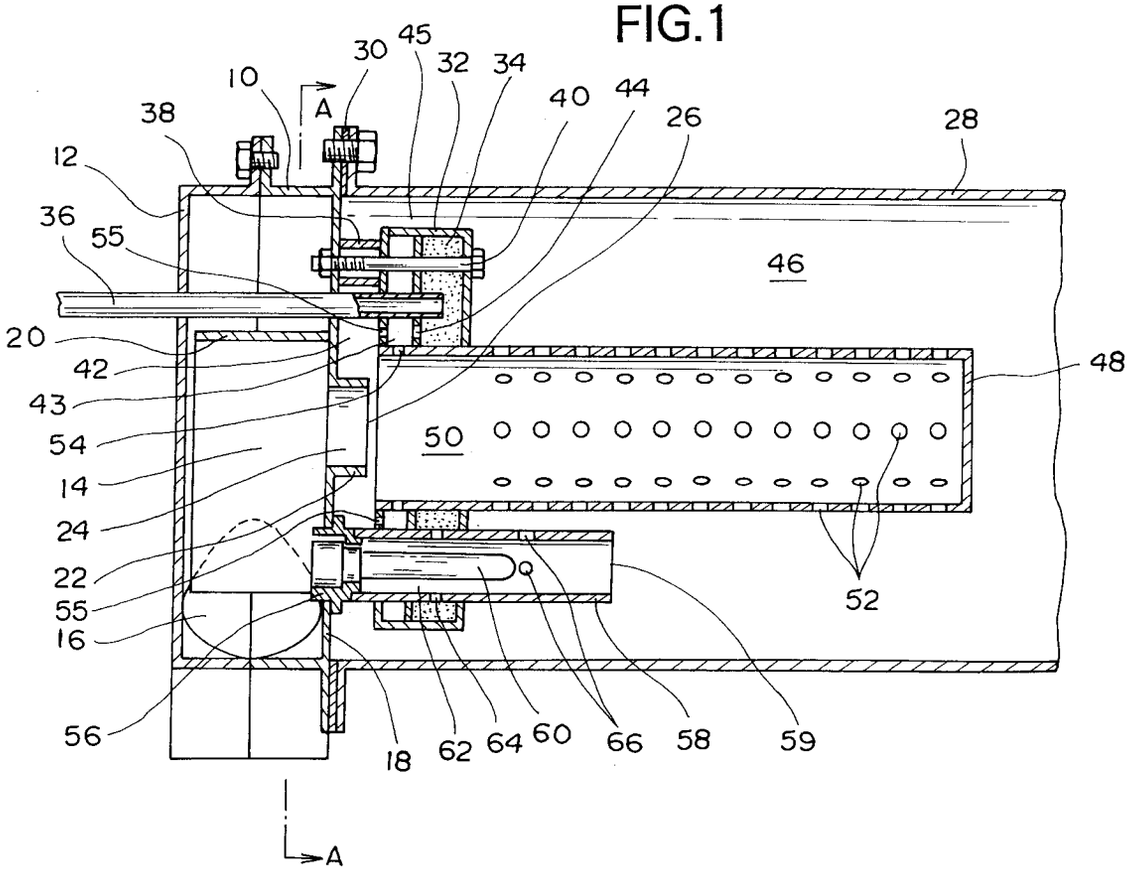
FIG.1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The present invention relates to a vaporizing type burner preferably employable for a heating unit such as a heater for a vehicle, a heater for a ship, a multi-purposed portable type heater or the like.

In general, a vehicle or a ship is usually equipped with one or more vaporizing type burners for the purpose of heating as disclosed in an official gazette of e.g., JP-A 59-60109. According to this prior art, a conventional vaporizing type burner includes a cylindrical body in which a combustion chamber is formed in such a manner that a fuel absorbing section is arranged directly in the combustion chamber or the fuel absorbing chamber is located opposite to the combustion chamber in order to produce a fuel vapor by vaporizing a fuel from the fuel absorbing section. On the other hand, an air inflow hole is formed through a peripheral wall of a cylindrical body for the purpose for allowing combustion air to flow through the air inflow hole, whereby the combustion air introduced into the combustion chamber and the fuel vaporized from the fuel absorbing section are mixed with each other in the combustion chamber to produce a mixture gas consisting of the fuel vapor and the combustion air. The resultant mixture gas is ignited by activating an igniting plug.

However, since the conventional vaporizing type burner is constructed such that the fuel vapor and the combustion air are introduced into the combustion chamber from separate positions, there arises a malfunction so that it is practically difficult to completely mix the combustion gas with the fuel vapor, and moreover, it is also practically difficult to properly determine the position where the air inflow hole is to be formed on the peripheral wall surface of the cylindrical body, resulting in satisfactory combustion failing to be achieved with the conventional vaporizing type burner.

In addition, since the fuel absorbing section is arranged in the combustion chamber, residual products derived from the combustion of the mixture gas in the combustion chamber are increasingly deposited on the fuel combustion section as time passes by. This leads to the result that the fuel is incompletely vaporized, and moreover, an incorrect combustion is liable to take place. In addition, residual products are deposited also on a coil type ignition plug which is disposed in the combustion chamber in a protruded state, causing wire disconnection or thermal wire damage to readily occur. As a result, there often arise an occasion that the burner cannot be put in practical use any more.

Additionally, in the case that a heavy oil based fuel is used as a thermal energy source for the burner, there arises a malfunction that white smoke-like unburnt fuel gas is often produced with this fuel because the latter cannot easily be ignited by the ignition plug.

The present invention has been made in consideration of the foregoing background.

An object of the present invention is to provide a vaporizing type burner which ensures that the operation lifetime of the burner can substantially be elongated by minimizing the deposition of resultant products derived from combustion on a fuel absorber, a mixer, an ignition plug and associated components after a combustion gas has been produced in the combustion chamber.

Another object of the present invention is to provide a vaporizing type burner which ensures that an improved combustion efficiency can be obtained by elongating a travel distance in the movement of a mixture gas consisting of air and vaporized fuel so as to allow the air and the vaporized fuel to be satisfactorily mixed with each other in the cylindrical mixer.

Another object of the present invention is to provide a vaporizing type burner which ensures that the vaporized fuel can reliably be ignited by an ignition plug in the combustion chamber without any production of white smoke-like unburnt fuel gas derived from incomplete combustion in the combustion chamber.

The present invention provides a vaporizing type burner wherein the fuel received in a fuel absorber is vaporized, the vaporized fuel is mixed with combustion air to prepare a mixture gas which in turn is ignited and burnt by an ignition plug in a combustion chamber defined by a cylindrical body, wherein the vaporizing type burner is characterized in that it includes: a support member having the fuel absorber received therein without any direct exposure to the combustion chamber; an air swirl flow chamber into which the combustion chamber is introduced in the spirally flowing state; a cylindrical mixer having a mixing path formed therein so as to allow the combustion air from the air swirl flow chamber and the vaporized fuel from the fuel absorber to be mixed with each other in the mixing path of the cylindrical mixer, the cylindrical mixer being axially protruded in the combustion chamber; a number of blow ports formed around the outer periphery of the cylindrical mixer to provide a communication between the mixing path and the combustion chamber via the blow ports; a guide pipe having the ignition plug received therein; an air introduction path formed around the ignition plug while providing a communication with the air swirl flow chamber; a plurality of vaporizing holes formed through the guide pipe to provide a communication between the fuel absorber and the air introduction path via the vaporizing holes; and a number of ignition flame blow holes formed through the guide pipe to provide a communication between the air introduction path and the combus-

tion chamber via the ignition flame blow holes; and further characterized in that the vaporized fuel from the fuel absorber and the combustion air from the air swirl flow chamber are mixed with each other in the mixing path of the cylindrical mixer, the resultant mixture gas is radially blown through the blow ports, the mixture gas prepared by mixing the combustion air from the air swirl flow chamber with the fuel vaporized from the fuel absorber via the vaporizing holes is ignited by activating the ignition plug with electricity, and the ignition flame is blown through the ignition flame blow holes formed through the guide pipe so that the mixture gas prepared in the mixing path of the cylindrical mixer and blown through the blow ports is ignited with the ignition flame blown through the ignition flame blow holes.

To activate the ignition plug with electricity, the ignition lug includes a rod-shaped electrical heating portion made of a tungsten wire or the like. The guide pipe having the ignition plug received therein is provided to extend through the support member and the fuel absorber.

Usually, the ignition flame blow holes are formed through the guide pipe at positions in the vicinity of the foremost end of the ignition plug. Alternatively, the ignition flame blow holes may be formed at different positions as seen in the axial direction of the guide pipe.

It is desirable that a recirculating chamber, of which the one end is communicating with the combustion chamber and of which the other end is communicating with an inlet port of the cylindrical mixer, is formed between a wall plate of a case and the support member so that a part of the combustion gas produced in the combustion chamber is introduced into the recirculating chamber in the flameless state so as to allow the foregoing part of the combustion gas to be introduced into the mixing path of the cylindrical mixer together with the combustion air from the air swirl flow chamber.

To ensure that the combustion air from the air swirl flow chamber is introduced into the mixing path of the cylindrical mixer in the form of a swirling flow, it is recommendable that the air swirl flow chamber includes a plurality of spirally extending guide blade fixedly secured to the wall plate of the case.

The vaporizing holes formed through the guide pipe serve to allow the fuel vaporized from the fuel absorber to be introduced directly into the air introduction path of the mixing pipe via the vaporizing holes.

Other objects, features and advantages of the present invention will become apparent from reading of the following description of the accompanying drawings.

Fig. 1 is a sectional side view of a vaporizing type burner constructed according to an embodiment of the present invention.

Fig. 2 is a fragmentary enlarged cross-sectional view of the vaporizing type burner taken along line A - A in Fig. 1.

The present invention will now be described in detail hereinafter with reference to the accompanying drawings which illustrate a preferred embodiment thereof.

The vaporizing type burner (hereinafter referred to simply as a burner) includes a casing 10 and a cover 12 both of which define an air swirl flow chamber 14. In addition, the casing 10 includes an air inlet port 16 through which combustion air is introduced into the air swirl flow chamber 14. A plurality of arc-shaped guide plates 20 (three guide plates 20 in the shown embodiment) are fixedly secured to a wall plate 18 of the casing 10 in the air swirl flow chamber 14, see Fig. 2.

As is best seen in Fig. 2, each of the guide plates 20 is contoured such that the inflow of the combustion air through the inlet port 16 is oriented toward the central part of the air swirl flow chamber 14 along the respective guide plates 20. A short cylindrical member 22 projecting away from the guide plates 20 is made integral with the wall plate 18 at the central part of the air swirl flow chamber 14 so that an air path 24, i.e., the inner space of the cylindrical member 22 is communicating with the air swirl flow chamber 14 so as to allow the combustion air introduced into the air path 24 from the air swirl flow chamber 14 to be blown out through an outlet port 26.

A cylindrical body 28 of which opposite ends are open and exposed to the outside is attached to the rear surface of the wall plate 18 relative to the guide plates 20 with a sealing member 30 interposed between the wall plate 18 and the cylindrical body 28. As is apparent from Fig. 1, the wall plate 18 of the casing 10 serves as a closed end surface of the cylindrical body 28 on the left-hand side of the latter. In addition, a cylindrical support member 32 is attached to the wall plate 18 in a spaced relationship with a predetermined gap held therebetween. An annular fuel absorber 34 made of a porous ceramic material, a metallic material or the like is received together with a cylindrical mixer 48 to be described later in the support member 34 without any direct exposure to a combustion chamber 46. To supply fuel with the fuel absorber 34, a fuel supply tube 36 is provided to extend through the wall plate 18, the cover 12 and the casing 10.

A plurality of spacers 32 are interposed between the wall plate 18 and the support member 32 in a clamped state, and the support member 32 having the fuel absorber 34 received therein is fixedly secured to the wall plate 18 together with

the spacers 38 by tightening a plurality of bolts 4. Since the spacers 32 are arranged in the above-described manner, a recirculating chamber 42 is defined in the form of a hollow space between the support member 32 and the wall plate 18. The support member 32 includes a homogenizing or uniformalizing chamber 43 on the left-hand side thereof adjacent to the recirculating chamber 42, and the uniformalizing chamber 42 is communicating with the hollow space having the fuel absorber 34 received therein so that the fuel vaporized from the fuel absorber 34 is introduced into the uniformalizing chamber 43 through a plurality of first vaporizing ports 44 so as to allow the uniformalizing chamber 43 to be filled with the vaporized fuel having a constant concentration.

The support member 32 and the cylindrical body 28 are arranged in a concentrical relationship to define an annular gap 45 between the outer peripheral surface of the support member 32 and the inner peripheral surface of the cylindrical body 28 to serve as a communication path between the combustion chamber 46 and the recirculating chamber 42. With such a construction, the combustion chamber 46 is communicating with the recirculating chamber 42 via the annular gap 45.

In particular, the inner space of the cylindrical body 28 of which left-hand end is closed with the wall plate 18 is substantially composed of the combustion chamber 26 defining a main part of the space of the cylindrical body 28 on the opposite side relative to the wall plate 18, the annular communication path 45, and the recirculating chamber 42 communicating with the latter. Thus, the recirculating chamber 42 is communicating with the combustion chamber 46 via the annular communication path 45.

The cylindrical mixer 48 of which the right-hand end is closed with an end plate is axially protruding through the central part of the supporting member 32 and the fuel absorber 34 while the left-hand end of the cylindrical mixer 48 is secured to the support member 32. An opening portion of the cylindrical mixer 48 located on the left-hand side is located opposite to the wall plate 18, and the opening portion of the cylindrical mixer 48 is slightly protruding from the fuel absorber 34 toward the wall plate 18. The center axis of the cylindrical mixer 48 is located to coincide with the center axis of the cylindrical member 22, and an inner diameter of the cylindrical mixer 48 is dimensioned to be larger than an outer diameter of the cylindrical member 22.

As shown in Fig. 1, a blowing port 26 at the foremost end of the cylindrical member 22 is not usually protruding inside of the opening portion of the cylindrical mixer 4. However, the present invention is not limited only to this structure. Alternatively, the blowing port 26 of the cylindrical member 22 may slightly be received in the cylindrical mixer 48. The inner space of the cylindrical mixer 48 serving as a mixing path 50 is communicating with the recirculating chamber 42 via an annular gap defined between the opening portion of the cylindrical mixer 48 and the foremost end of the cylindrical member 22.

The right-hand closed end of the cylindrical mixer 48 is largely protruding into the combustion chamber 46 away from the supporting member 32, and a number of blow ports 52 each serving as a burning flame blow port are formed around the outer peripheral surface of the cylindrical mixer 48. In addition, a plurality of second vaporizing ports 54 are formed through the cylindrical mixer 48 on the left-hand side of the latter at the positions located around the inner peripheral surface of the cylindrical mixer 48 in an equally spaced relationship.

The fuel vaporized from the fuel absorber 34 enters the uniformalizing chamber 43 via a plurality of first vaporizing ports 44 formed through a partition plate between the fuel absorber 34 and the uniformalizing chamber 43 so that the vaporized fuel is uniformly mixed with the combustion air introduced into the uniformalizing chamber 42 via a plurality of third vaporizing holes 55 formed through the left-hand side wall of the support chamber 32. The resultant mixture consisting of vaporized fuel and combustion air is blown into the inner space of the cylindrical mixer 48, i.e., the mixing path 50 in the uniformalized state through the second vaporizing holes 54.

A cylindrical ignition plug holder 56 is fixedly secured to the wall plate 18 while it is projecting inside of the wall plate 18. The left-hand end of the ignition plug holder 56 is opened and exposed to the air swirl flow chamber 14, while the right-hand end of the same is opened and exposed to the combustion chamber 46. A cylindrical guide pipe 58 is firmly fitted to the ignition plug holder 56 on the right-hand side of the latter. As is apparent from Fig. 1, the guide pipe 58 is provided to extend through the support member 32 and the fuel absorber 34, and an opening portion 59 of the guide pipe 58 at the foremost end of the latter reaches a predetermined position at the central part of the combustion chamber 46. Both the ignition plug holder 56 and the guide pipe 58 are provided so as to extend in parallel with the cylindrical mixer 48 in the region below the cylindrical mixer 48. Thus, the guide pipe 58 is projecting inside of the wall plate 18 while extending through the lower part of the fuel absorber 34.

An ignition plug 60 including a rod-shaped heating portion is held in the ignition plug holder 56 and the guide pipe 58. It is recommendable that a

so-called glow plug molded of a ceramic material such as silicon nitride or the like and having a heating element of a tungsten wire embedded in the ceramic material is employed for the ignition plug 60. The structure of the glow plug should not be limited only to the foregoing one. Any type of ignition plug may be employed for the burner, provided that it is proven that it is properly activated with electricity. The foremost end of the ignition plug 60 is located inside of the fuel absorber 34 while the ignition plug 60 is axially projecting toward the combustion chamber 46. While the ignition plug 60 is held in the ignition plug holder 56 and the guide pipe 58 in that way, an annular air introduction path 62 is formed in the guide pipe 58 while making communication with the air swirl flow chamber 14. It is obvious that the ignition plug holder 56 and the guide pipe 58 may be integrated with each other.

A plurality of fourth vaporizing holes 64 are formed through the guide pipe 58 at suitable positions defined in the fuel absorber 34. As fuel is vaporized from the fuel absorber 34, the vaporized fuel is introduced into the air introduction path 62 via the fourth vaporizing holes 64. In addition, a plurality of ignition flame outlet blow holes 66 are formed through the guide pipe 59 at positions in the vicinity of the foremost end of the ignition plug 60 while providing a communication with the combustion chamber 46. The combustion air introduced from the air swirl flow chamber 14 and the vaporized fuel introduced through the fourth vaporizing holes 64 are mixed with each other in the air introduction path 62 so that the resultant mixture gas is ignited by the ignition plug 60, causing the ignition flame to be blown into the combustion chamber 46 through the ignition flame holes 66 and the opening portion 59.

Next, a mode of operation of the vaporizing type burner constructed in the aforementioned manner will be described below.

As combustion air is introduced into the air swirl flow chamber 14 via the air inlet port 16, it is collected at the central part of the air swirl flow chamber 14 while swirling around the guide plates 20. Subsequently, the combustion air spirally enters the air path 24 in the cylindrical member 22 and it is then introduced into the mixing path 50 of the cylindrical mixer 48. On the other hand, fuel is continuously supplied in the fuel absorber 34 through the fuel supply tube 36. Once the fuel has been ignited, the fuel absorber 34 is heated, causing the fuel received in the fuel absorber 34 to be vaporized to form an inflammable vapor. A large part of the vaporized fuel produced from the fuel absorber 34 enters the uniformalizing chamber 43 located adjacent to the fuel absorber 34 via the first vaporizing holes 44, and thereafter, the vaporized fuel is introduced into the hollow space of the cylindrical mixer 48, i.e., the mixing path 50 via the second vaporizing holes 54. At this time, a part of the vaporized fuel is blown into the recirculating chamber 42 via the third vaporizing holes 55. As the combustion air flows in the mixing path 50 via the outlet port 26 of the air path 24, the vaporized fuel in the uniformalizing chamber 43 is introduced into the mixing path 50 by the function of outflow of the combustion air. Thus, the combustion air and the vaporized fuel are mixed with each other in the mixing path 48 of the cylindrical mixer 48. At this time, since the combustion air is introduced into the mixing path 50 in the spirally flowing state, the combustion air and the vaporized fuel are satisfactorily mixed with each other.

In addition, the vaporized fuel which has entered the recirculating chamber 42 via the third vaporizing holes 55 is introduced from the recirculating chamber 42 into the mixing path 50 together with the combustion air. As the vaporized fuel and the combustion gas are well mixed with each other in the cylindrical mixer 48, the resultant mixture gas is blown into the combustion chamber 47 while flowing radially through the blow ports 52.

In contrast with a conventional vaporizing type burner wherein combustion air and fuel are separately introduced into a combustion chamber so that ignition takes place only at the position where the ignition air and the fuel are mixed with each other, according to the present invention, since combustion air and vaporized fuel are preliminarily mixed with each other to prepare a mixture gas which in turn is blown into the combustion chamber 46, ignition reliably takes place in the combustion chamber 46 immediately after the mixture gas has been blown therein via the blow ports 52 while a plurality of rows of radially burning flames are produced with the combustion gas. With such a construction as mentioned above, the length of the combustion chamber 46 can be shortened compared with a conventional vaporizing type burner.

When the mixture gas is to be ignited, the ignition plug 60 is first activated with electricity to generate heat for heating the fuel absorber 34 therewith. As fuel in the fuel absorber 34 has been vaporized to generate fuel vapor, a part of the vaporized fuel enters the air introduction path 62 directly via the fourth vaporizing holes 64 to prepare a mixture gas consisting of combustion air and vaporized fuel in the air introduction path 62. Subsequently, the mixture gas is ignited with the ignition plug 60 to produce an ignition flame. This ignition flame is blown into the combustion chamber 46 via a plurality of ignition flame blow holes 66 as well as the opening portion 59 at the foremost end of the guide pipe 58. The ignition flame blown through the ignition flame blow holes 66 and

the ignition flame blown through the opening portion 59 serve to heat the cylindrical mixer 48 at a plurality of locations.

In the case that the mixture gas is blown radially into the combustion chamber 46 via a number of blow holes 52 on the cylindrical mixer 48, and moreover, the ignition plug 60 is disposed at the base end part of the cylindrical mixer 48, it is for sure that the fuel gas blown through the blow holes 66 formed in the vicinity of the ignition plug 60 is readily ignited by the ignition plug 60. However, since some time is taken until the ignition flame moves to the region remote from the ignition plug 60, there arises a malfunction that white smoke-like unburnt fuel gas is readily produced in the foregoing region. Especially, in the case that heavy oil based fuel is used for the burner, white smoke-like unburnt fuel gas of the foregoing type is liable to appear.

In contrast with the aforementioned case, according to the present invention, the ignition plug 60 is surrounded by the guide pipe 58 into which combustion air and vaporized fuel are introduced to produce an ignition flame by igniting the mixture gas with the ignition plug 60, and subsequently, the ignition flame is blown into the combustion chamber 46 not only through the blow ports 52 at the base end part of the cylindrical mixer 48 but also through the blow ports 52 located remote from the base end part of the cylindrical mixer 48, whereby the cylindrical mixer 48 can be heated at many locations. This leads to the result that the ignition flame can be spread across the whole length of the cylindrical mixer 48 for a short time. Consequently, even in the case that heavy oil based fuel is employed for the burner, there does not arise any malfunction that white smoke-like unburnt fuel gas is undesirably produced.

Referring to Fig. 1 again, a plurality of ignition flame blow holes 66 are formed through the guide pipe 58 at a single location as seen in the axial direction. Alternatively, a plurality of ignition flame blowing holes 66 may be formed through the guide pipe 58 at a plurality of locations as seen in the axial direction of the guide pipe 58 having an increased length. In addition to the ignition flame holes 66, the guide pipe 58 includes an opening portion at the foremost end thereof. Since an ignition flame is blown also through the opening portion 59, it may be considered that the opening portion 59 likewise serves as a kind of ignition flame blow port.

According to the present invention, since the ignition plug 60 does not come directly in contact with the fuel absorber 34, even in the case that ignition fails to take place due to a lower temperature, there does not arise a necessity for draining the remaining fuel from the fuel absorber 34. Thus, an igniting operation can easily be restarted within a short time.

After the mixture gas in the combustion chamber 46 has been ignited by the ignition flame blown through the blow holes 52 of the cylindrical mixer 48, normal combustion proceeds. As this normal combustion continues, a quantity of air flowing through the air introduction path 62 of the guide pipe 58 increases, causing the ignition flame blowing from the opening portion 59 at the foremost end of the guide pipe 58 to be shortened and converging in the form of blue flame. However, as the normal combustion continues further, the blue flame disappears, and finally, any flame is not blown from the opening portion 48 of the guide pipe 58. Consequently, the normal combustion in the combustion chamber 46 is not affected by the ignition flame blown from the guide flame 58.

After the ignition of the mixture gas in the combustion chamber 46, the support member 32 is heated by the combustion gas produced in the combustion chamber 46, and the fuel absorber 34 is then heated by the heat conducted from the support member 32. Since a part of the combustion gas produced in the combustion chamber 46 reaches the recirculating chamber 42 via the communication path 45, the fuel absorber 34 is additionally heated by the foregoing part of the combustion gas which has reached the recirculating chamber 42.

Thereafter, the foregoing part of the combustion gas is introduced into the mixing path 50 of the cylindrical mixer 48 together with the combustion air blown from the blow port 26 of the combustion air path 24 via the communication path 45 and the recirculating chamber 42. Additionally, the foregoing part of the combustion gas is mixed with the vaporized fuel blown through the third vaporizing holes 55, and the resultant hot mixture gas is then introduced into the mixing chamber 50. Since the mixture gas introduced in the mixing chamber 50 in that way is kept hot by the combustion gas contained in the mixture gas, it is burnt in the combustion chamber 46 at a higher temperature after it has been blown through the blow ports 52 on the cylindrical mixture 48. Thus, the normal combustion proceeds in the combustion chamber 46 at a higher temperature.

While the present invention has been described above with respect to a single preferred embodiment thereof, it should of course be understood that the present invention should not be limited only to this embodiment but various change or modification may be made without departure from the scope of the present invention.

## Claims

1. A vaporizing type burner wherein the fuel received in a fuel absorber (34) is vaporized, the vaporized fuel is mixed with combustion air to prepare a mixture gas which in turn is ignited and burnt by an ignition plug (60) in a combustion chamber (46) defined by a cylindrical body (28),
characterized in that said vaporizing type burner includes
   - a supporting member (32) having said fuel absorber (34) received therein without any direct exposure to said combustion chamber (46),
   - an air swirl flow chamber (14) into which the combustion air is introduced in a spirally flowing state,
   - a cylindrical mixer (48) having a mixing path (50) formed therein so as to allow the combustion air from said air swirl flow chamber (14) and the vaporized fuel from said fuel absorber (34) to be mixed with each other in said mixing path (50) of said cylindrical mixer (48), said cylindrical mixer (48) being axially protruded in said combustion chamber (46),
   - a number of blow ports (52) formed around the outer periphery of said cylindrical mixer (48) to provide a communication between said mixing path (50) of said guide pipe (58) and said combustion chamber (46) via said blow ports (52),
   - a guide pipe (58) having said ignition plug (60) received therein,
   - an air introduction path (62) formed around said ignition plug (60) in said guide pipe (58) while providing a communication with said air swirl flow chamber (14),
   - a plurality of vaporizing holes (64) formed through said guide pipe (58) to provide a communication between said fuel absorber (34) and said air introduction path (62) via said vaporizing holes (64), and
   - a number of ignition flame blow holes (66) formed through said guide pipe (48) to make communication between said air introduction path (62) of said guide pipe (58) and said combustion chamber (46) via said ignition flame blow holes (66),

and in that the vaporized fuel from said fuel absorber (32) and the combustion air from said air swirl flow chamber (14) are mixed with each other in said mixing path (50) of said cylindrical mixer (48), the resultant mixture gas is radially blown through said blow ports (52), the mixture gas prepared by mixing the combustion air from said air swirl flow chamber (14) with the fuel vaporized from said fuel absorber (32) via said vaporizing holes (64) is ignited by activating said ignition plug (60) with electricity, and the ignition flame is blown through said ignition flame blow holes (66) formed through said guide pipe (58)
so that the mixture gas prepared in said mixing path (50) of said cylindrical mixer (60) and blown through said blow ports (52) is ignited with the ignition flame blown through said ignition flame blow holes (66).

2. The burner as claimed in claim 1,
characterized in that said ignition plug (60) includes a rodshaped electrical heating portion, and said guide pipe (58) having said ignition plug (60) received therein is provided to extend through said support member (32) and said fuel absorber (32)

3. The burner as claimed in claim 1 or 2,
characterized in that said ignition flame blow holes (66) are formed through said guide pipe (58) at the positions in the vicinity of the foremost end of said ignition plug (60).

4. The burner as claimed in any of claims 1 to 3,
characterized in that said ignition flame blow holes (66) are formed through said guide pipe (58) at different positions as seen in the axial direction of said guide pipe (58).

5. The burner as claimed in any of claims 1 to 4,
characterized in that a recirculating chamber (42), of which the one end communicates with said combustion chamber (46) and of which the other end communicates with an inlet port of said cylindrical mixer (48), is formed between a wall plate (18) of a case (10) and said support member (32) so that a part of the combustion gas produced in said combustion chamber (46) is introduced into said recirculating chamber (42) in the flameless state so as to allow said part of the combustion gas to be introduced into said mixing path (50) of said cylindrical mixer (46) together with the combustion air from said air swirl flow chamber (14).

6. The burner as claimed in any of claims 1 to 5,
characterized in that said air swirl flow chamber includes a plurality of spirally extending guide plates (20) fixedly secured to a wall plate (18) of a case (10) so as to allow the combustion air from said air swirl flow chamber (14) to be introduced into said mixing path (50) of said cylindrical mixer (48) in the form of a swirling

flow.

**7.** The burner as claimed in any of claims 1 to 6, characterized in that said vaporizing holes (64) formed through said guide pipe (58) serve to allow the fuel vaporized from said fuel absorber (32) to be introduced directly into said air introduction path (62) of said guide pipe (58) through said vaporizing holes (64).

FIG.1

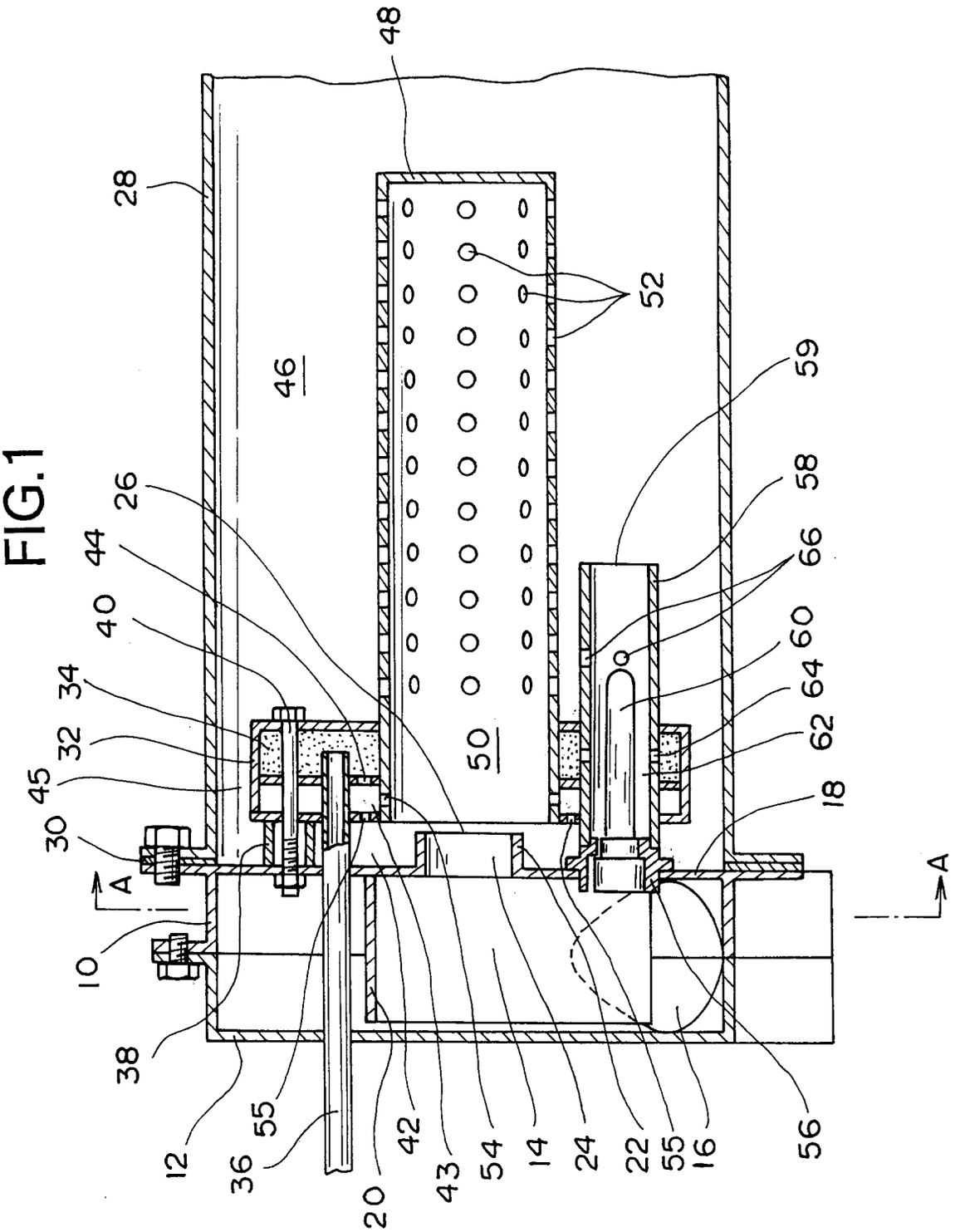
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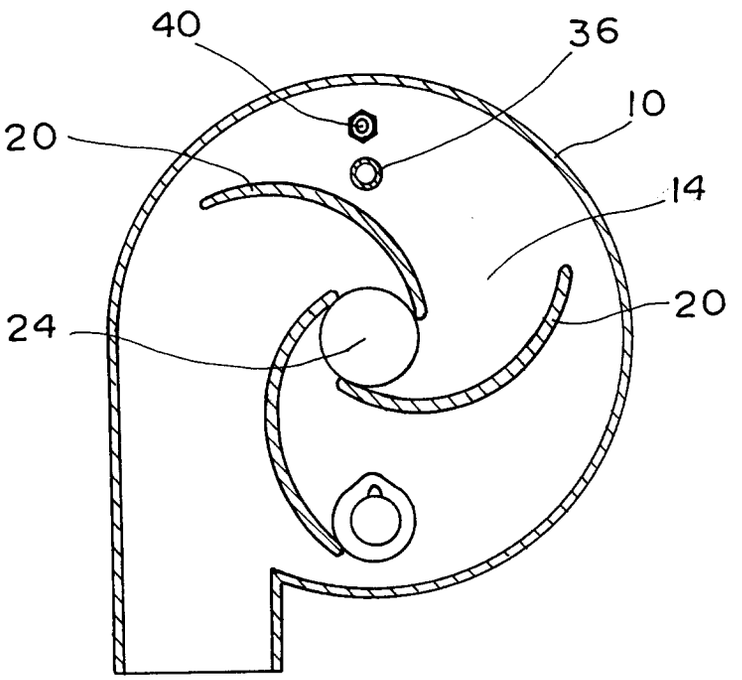
FIG.2



European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 93 11 4279

## 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) |
|---|---|---|---|
| A,P | DE-A-42 25 749 (MIKUNI KOGYO K.K.)<br>* abstract; figures 1-4 * | 1,5,6 | F23D11/44<br>F23D3/40 |
| A | US-A-3 086 579 (BROWN)<br>* column 1, line 68 - column 2, line 33 *<br>* column 2, line 52 - column 3, line 19 *<br>* figures 1,2,4 * | 1 | |
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| TECHNICAL FIELDS SEARCHED (Int.Cl.5) |
|---|
| F23D<br>F24H |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 27 January 1994 | Phoa, Y |

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