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Yokoyama

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(54) **BURNER FOR PORTABLE GAS COOKING STOVE**

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(52) **U.S. Cl.** **431/247**; 431/264; 431/266
(58) **Field of Search** ..... 431/247, 263, 431/264, 266, 343, 344; 126/38, 40, 39 E; 361/253

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(57) **ABSTRACT**

There is provided a burner to be used for a portable gas cooking stove, including (a) a mixture gas pipe having an open end through which a gas mixture of combustible gas and air is exhausted, (b) a burner head connected to the mixture gas pipe in a hermetically sealed condition and having at least one opening at a surface thereof, the gas mixture blowing out through the opening, and (c) an igniter igniting the gas mixture blowing out through the opening of the burner head, the igniter generating a spark in a direction perpendicular to a flow of the gas mixture blowing out through the opening of the burner head. The burner makes it possible for the spark to make contact with the gas mixture flow in a larger contact area than that of a conventional burner. Accordingly, it is possible to stably ignite the gas mixture, even if the gas mixture has a great flow velocity.

12 Claims, 7 Drawing Sheets

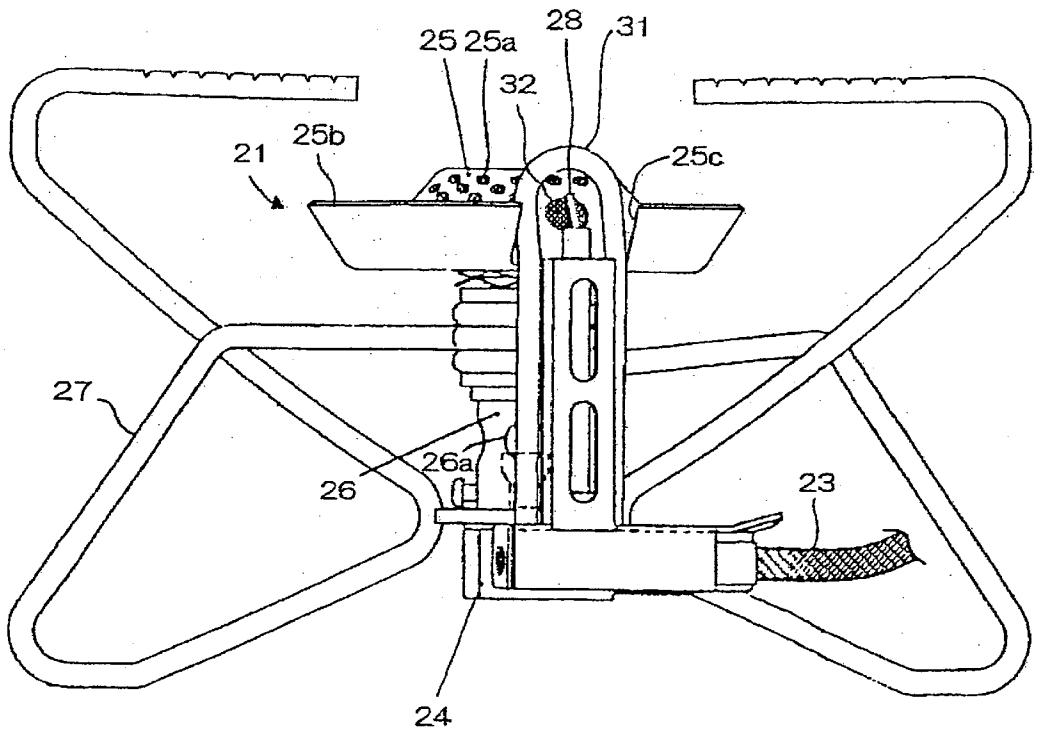
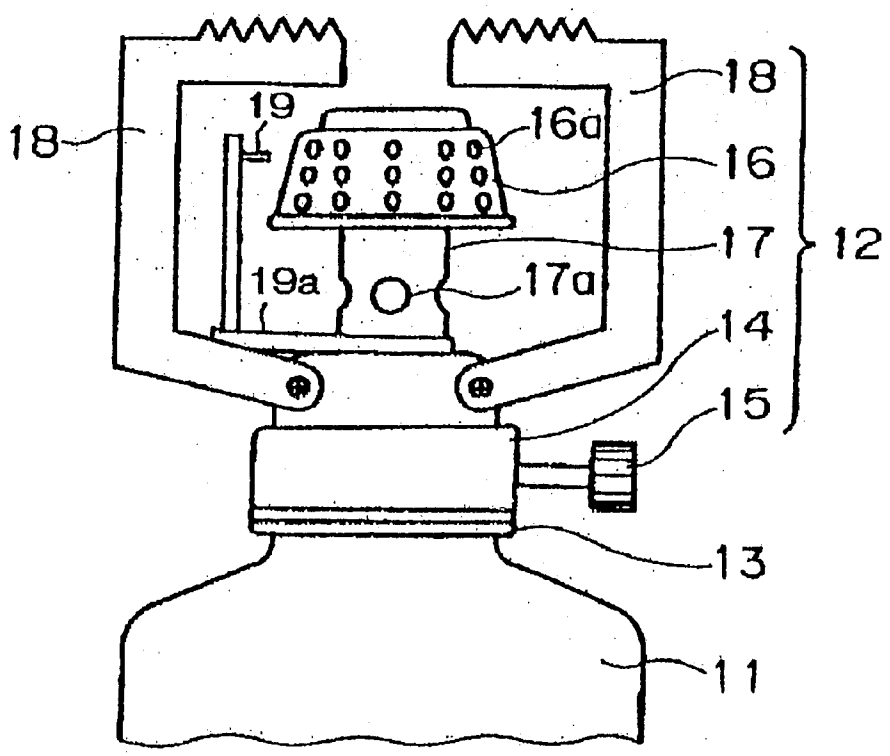


FIG. 1
PRIOR ART



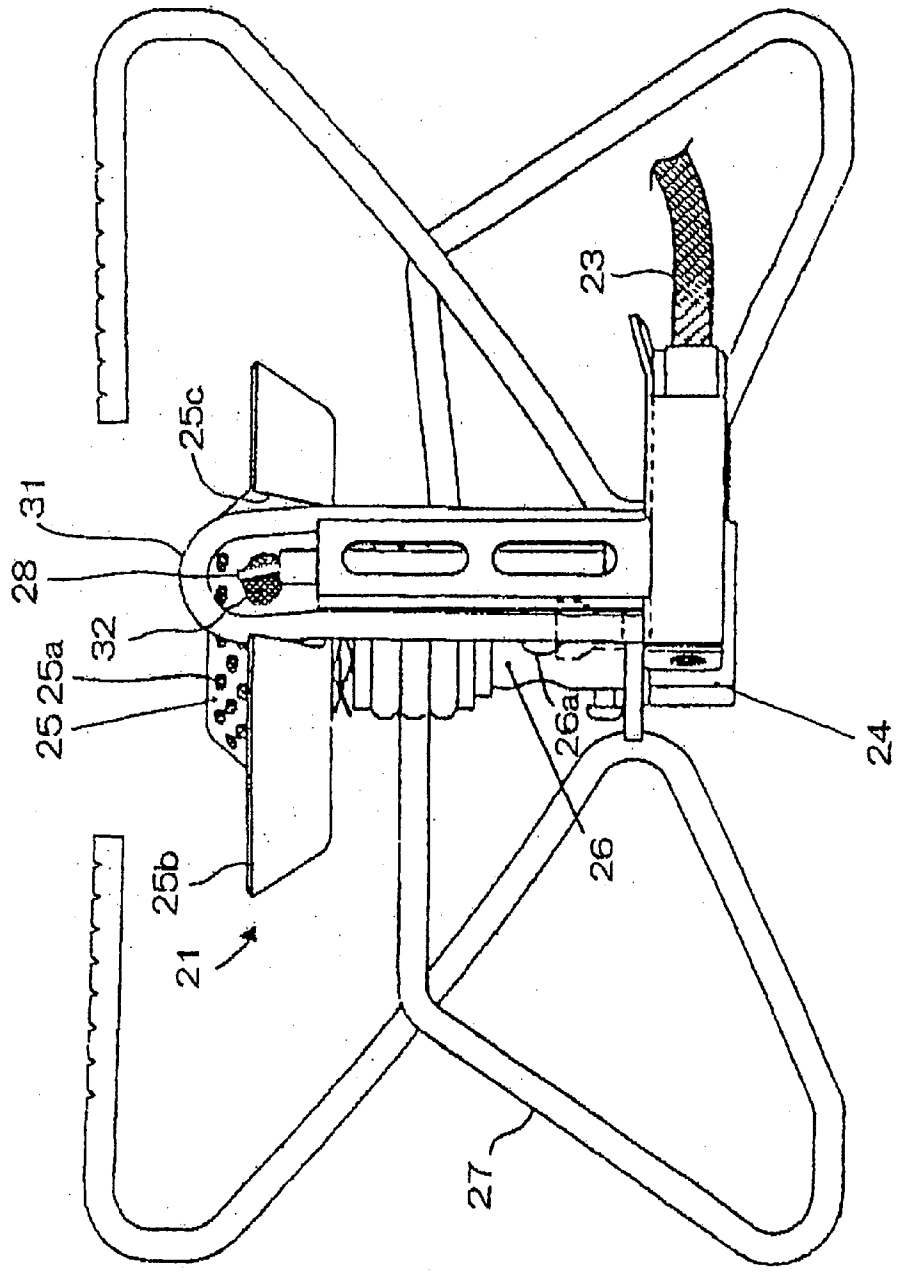


FIG. 2

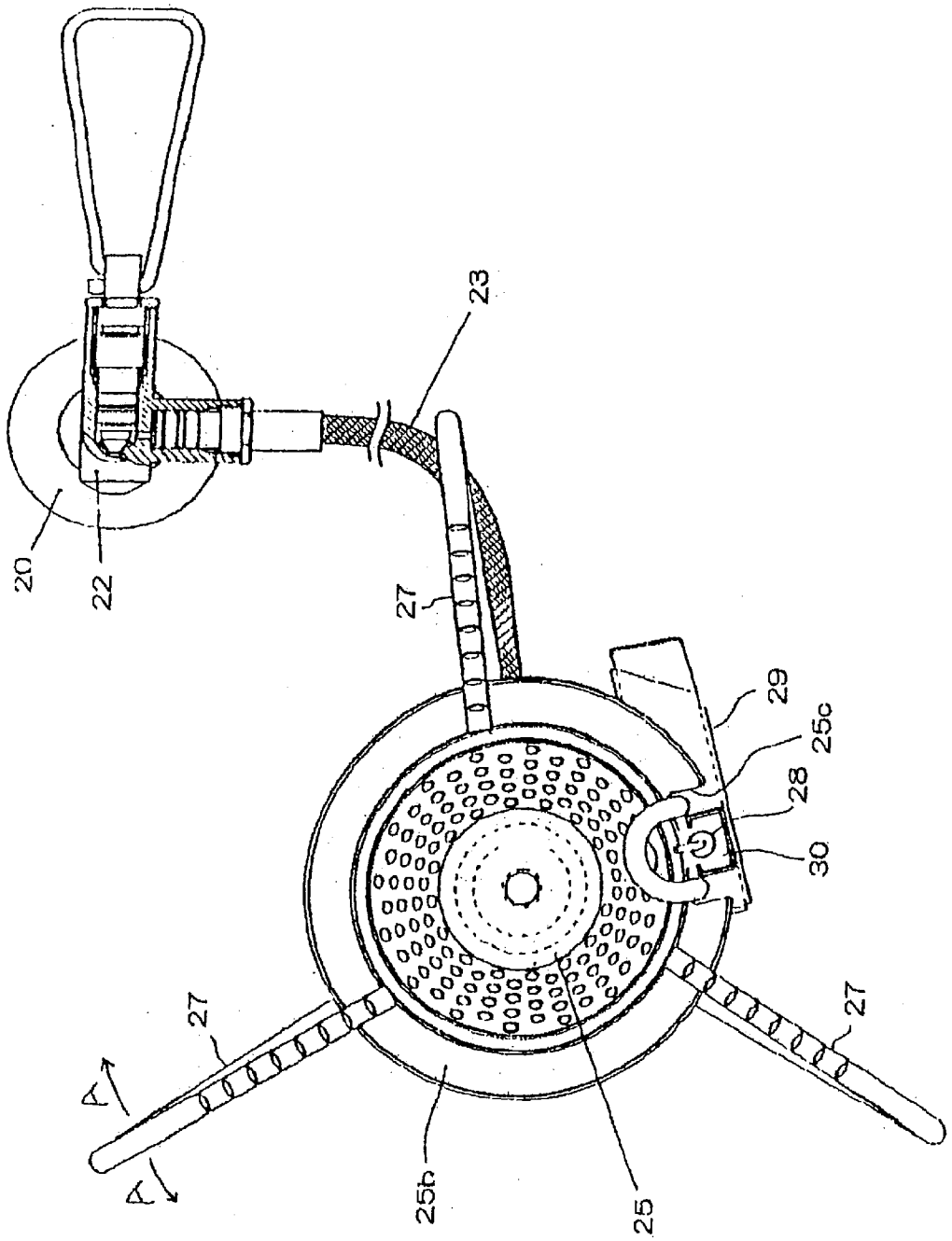


FIG. 3

FIG. 4A

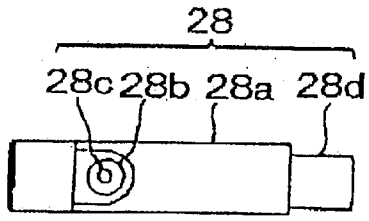


FIG. 4B

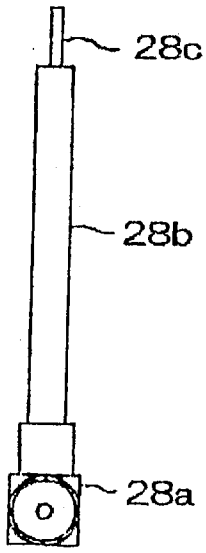


FIG. 4C

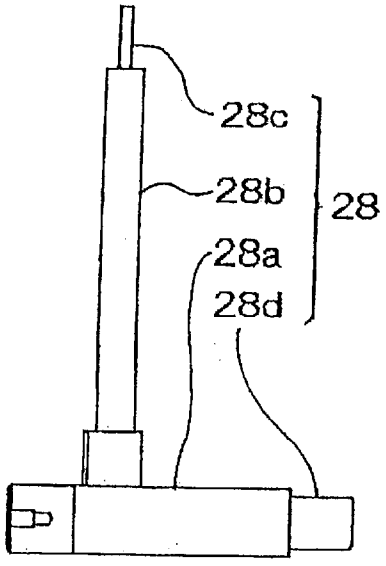


FIG. 5A

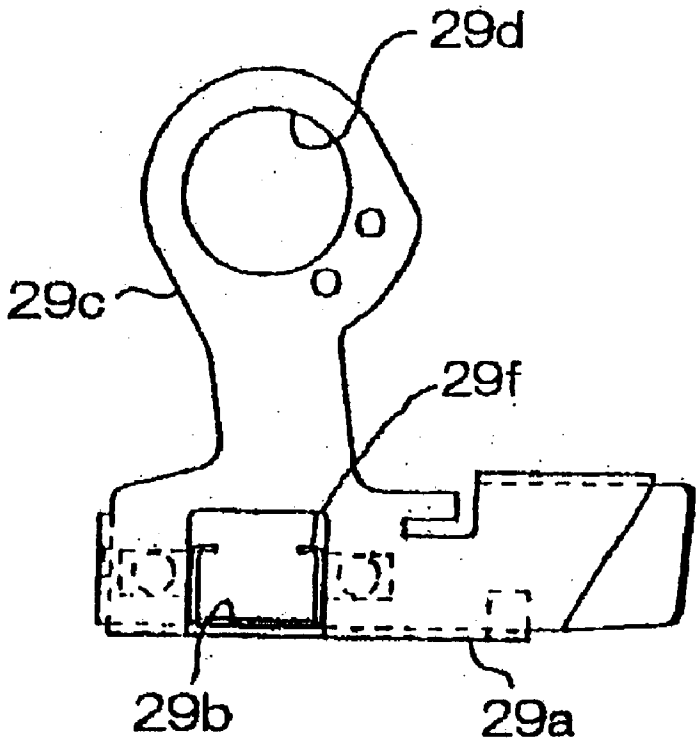


FIG. 5B

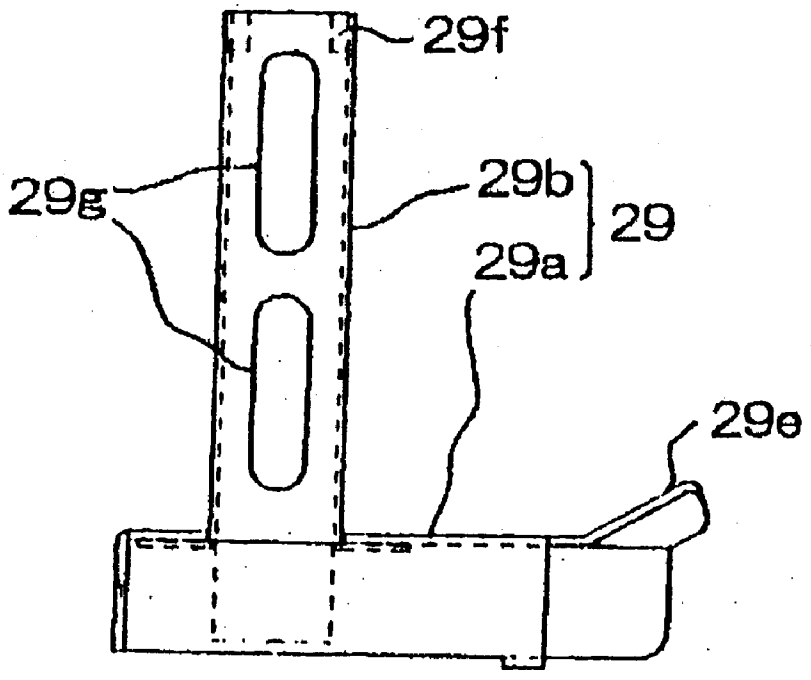


FIG. 6

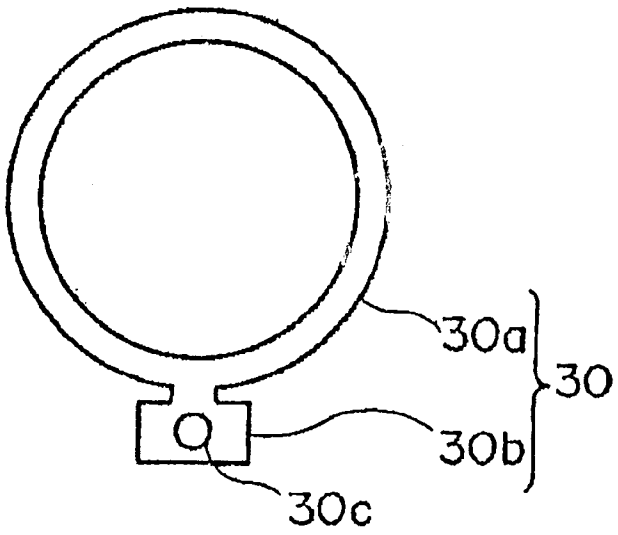


FIG. 7A

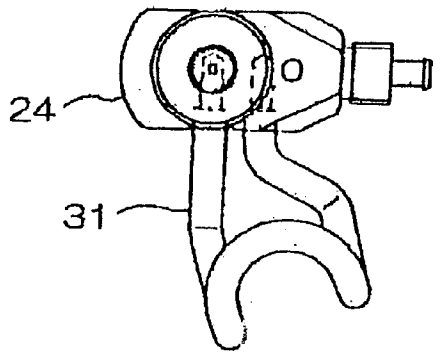


FIG. 7B

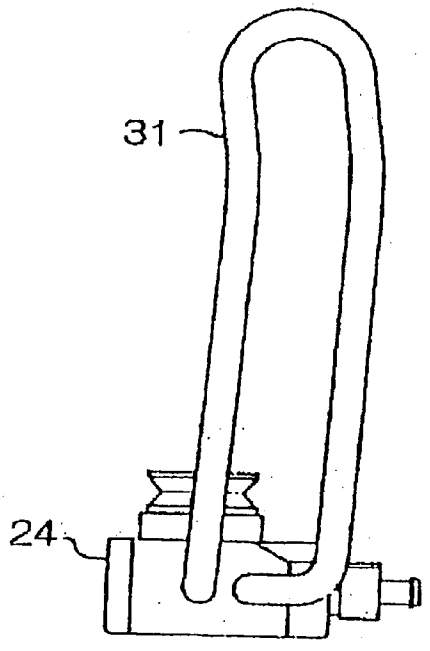
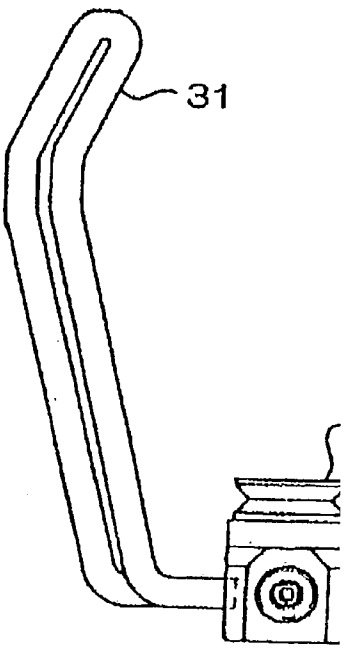


FIG. 7C



BURNER FOR PORTABLE GAS COOKING STOVE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a so-called outdoor portable gas cooking stove, and more particularly, to a burner structure of a portable gas cooking stove.

2. Description of the Related Art

FIG. **1** shows an example of a portable gas cooking stove known in the art.

Normally, the portable gas cooking stove **10** includes a gas cartridge **11** filled with compressed combustible gas, and a gas burner **12** mounted detachably on the gas cartridge **11**. The gas cartridge **11** and the gas burner **12** are coupled to each other in a hermetically sealed condition through a gasket **13**.

The gas burner **12** is comprised of a plug fitting **14** which is connected to the gas cartridge **11** and through which combustible gas supplied from the gas cartridge **11** passes, a gas flow adjusting spindle **15** which adjusts a degree of opening of a gas passage formed inside the plug fitting **14** to thereby adjust a flow of the combustible gas passing through the plug fitting **14**, a burner head **16** with a number of openings **16**a formed on a surface thereof, a mixing tube **17** connecting the plug fitting **14** to the burner head **16**, kettle holders **18** that are fixed on the mixing tube **17** and extend over the burner head **16**, and an igniter **19** mounted on a support **19***a*.

The combustible gas is filled in the gas cartridge **11** in a pressurized condition. Hence, when the gas passage is opened by the gas flow adjusting spindle **15**, the combustible gas in a pressurized condition enters the mixing tube **17** from the gas cartridge **11** through the plug fitting **14**. Thus, the combustible gas enters the mixing tube **17** with a gas flow thereof being adjusted by the gas flow adjusting spindle **15**.

The mixing tube **17** is formed with a number of openings **17***a* (only one of them is illustrated in FIG. **1**). External air is absorbed into the mixing tube **17** through the openings **17***a* by virtue of negative pressure produced when the combustible gas passes through the mixing tube **17**. The combustible gas is mixed with air entering the mixing tube **17** through the openings **17***a*, into a gas mixture of the combustible gas and air.

After the gas mixture enters the burner head **16**, the gas is discharged through the openings **16***a*, and is ignited by the electric igniter **19** located in the vicinity of the burner head **16**.

The flame of the burning gas mixture heats an object to be heated such as a pan, kettle, food, etc., put on the kettle holders **18**.

In general, outdoor appliances, not limited only to portable gas cooking stoves, are required to be small. Regarding a portable gas cooking stove, the gas cartridge **11** cannot be fabricated smaller in size than a practical limit determined to ensure a volume of gas to maintain a gas-burning time required for practical use. Consequently, in a portable gas cooking stove, miniaturization has been focused mainly on the gas burner **12**, and more particularly, on the burner head **16**.

However, if the burner head **16** is simply reduced in size, a flow of the gas mixture may exceed the proper gas burning rate, because a volume of the burner head **16** becomes smaller relative to a gas flow from the gas cartridge **11**, resulting in a greater rate of the gas mixture discharged through the openings **16***a* of the burner head **16**.

If the gas mixture is discharged at a great rate, the gas mixture is rarely ignited by the spark generated by the igniter **19**, resulting in incomplete combustion of the gas mixture.

In addition, in the gas burner illustrated in FIG. **1**, the igniter **19** is supported only by the support **19***a*, resulting in that the igniter **19** cannot be stably fixed relative to a gas flow of the gas mixture discharged through the openings **16***a*. This also causes incomplete combustion of the mixture gas.

SUMMARY OF THE INVENTION

In view of the above-mentioned problems in the conventional gas burners, it is an object of the present invention to provide a burner which is capable of stably igniting a gas mixture discharged from a burner head, and is capable also of stably supporting an igniter to thereby ensure ignition of the gas mixture.

There is provided a burner to be used for a portable gas cooking stove, including (a) a gas mixture pipe having an open end through which a mixture gas of combustible gas and air is exhausted, (b) a burner head connected to the mixture gas pipe in a hermetically sealed condition and having at least one opening at a surface thereof, the gas mixture blowing out through the opening, and (c) an igniter igniting the gas mixture blowing out through the opening of the burner head, the igniter generating a spark in a direction perpendicular to a flow of the gas mixture blowing out through the opening of the burner head.

As illustrated in FIG. **1**, the igniter **19** is positioned facing the burner head **16** in the conventional burner. Accordingly, the igniter **19** generates spark in parallel with a flow of a gas mixture discharged through the openings **16***a* of the burner head **16**. Thus, a contact area between the spark and the gas mixture flow is relatively small. As a result, if the gas mixture had a great velocity, it was difficult to ignite the gas mixture by spark generated by the igniter **19**.

In contrast, the burner in accordance with the present invention includes an igniter which is positioned perpendicularly to a flow of gas mixture discharged through openings of a burner head. As a result, the spark is generated in a direction perpendicularly to a flow of gas mixture. Hence, a contact area between the spark and a flow of gas mixture in the burner in accordance with the present invention is greater than the same in the conventional burner illustrated in FIG. **1**.

Hence, the burner in accordance with the present invention makes it possible to stably ignite a gas mixture, even if the gas mixture has a great flow velocity.

It is preferable that the igniter is supported at lower and upper ends thereof by the mixture gas pipe.

It is preferable that the burner further includes an igniter cover in which the igniter is accommodated. The igniter cover is designed to have a projecting portion projecting in a direction, the projecting portion being formed with an opening having a diameter almost equal to a diameter of the mixture gas pipe. The igniter cover is fixed relative to the mixture gas pipe by engaging the projecting portion to the mixture gas pipe.

The igniter may be comprised of (a) a base block extending in a first direction, (b) a pillar extending in a second direction perpendicular to the first direction, (c) an igniter section extending from a summit of the pillar, and (d) a switch movable in the first direction, and the igniter cover may be comprised of (a) a first cover portion covering the base block therewith, and (b) a second cover portion covering the pillar therewith.

It is preferable that the first cover portion has a portion located above the switch and bent upwardly and obliquely.

It is preferable that the igniter is supported by the mixture gas pipe through an igniter support which is comprised of a ring engageable to the mixture gas pipe and a projection fittable into the second cover portion of the igniter cover, the projection being formed with an opening into which the pillar is to be fit.

There is further provided a burner to be used for a portable gas cooking stove, including (a) a gas mixture pipe having an open end through which a gas mixture of combustible gas and air is exhausted, (b) a burner head connected to the mixture gas pipe in a hermetically sealed condition and having at least one opening at a surface thereof, the gas mixture blowing out through the opening, (c) an igniter igniting the gas mixture blowing out through the opening of the burner head, the igniter generating a spark in a direction perpendicular to a flow of the gas mixture blowing out through the opening of the burner head, and (d) a generator comprised of a pipe through which the combustible gas flows, the generator being arranged outside and close to the burner head.

The burner includes the generator. Combustible gas supplied from the gas cartridge passes through the generator, and then, passes through the mixture gas pipe, and is mixed with air into the gas mixture while passing through the mixture gas pipe. Since the generator is located close to the burner head, the generator is heated by burning the gas mixture blowing out of the burner head. Accordingly, the gas mixture passing through the generator is also heated, and is discharged from the burner head at a high temperature.

The gas mixture of combustible gas and air at a higher temperature is more likely to be ignited. Thus, the gas mixture which has been heated during passing through the generator can be readily ignited by the spark generated by the igniter.

It is preferable that the igniter generates the spark between the burner head and the generator.

By arranging the burner head, the generator and the igniter in this order, these three parts can be arranged in a smallest space, ensuring reduction in the size of the burner.

It is preferable that the generator is reverse U-shaped, and that the igniter is positioned surrounded by the generator when viewed from a front of the generator.

By arranging the igniter within the generator, the generator acts as a windscreen for the igniter. As a result, a flow of the gas mixture discharged through the openings of the burner head can be stabilized, ensuring stable ignition of the gas mixture.

The above and other objects and advantageous features of the present invention will be made apparent from the following description made with reference to the accompanying drawings, in which like reference characters designate the same or similar parts throughout the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front view of a conventional portable gas cooking stove.

FIG. **2** is a front view of a gas cooking stove including the burner in accordance with the present invention.

FIG. **3** is a top plan view of the gas cooking stove illustrated in FIG. **2**.

FIG. **4A** is a top plan view of an igniter.

FIG. **4B** is a front view of the igniter illustrated in FIG. **4A**.

FIG. **4C** is a side view of the igniter illustrated in FIG. **4A**.

FIG. **5A** is a top plan view of an igniter cover.

FIG. **5B** is a side view of the igniter cover illustrated in FIG. **5A**.

FIG. **6** is a plan view of an igniter support.

FIG. **7A** is a top plan view of a generator.

FIG. **7B** is a front view of the generator illustrated in FIG. **7A**.

FIG. **7C** is a side view of the generator illustrated in FIG. **7A**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. **2** and **3** illustrate a gas cooking stove including the burner in accordance with a preferred embodiment.

As illustrated in FIGS. **2** and **3**, the gas cooking stove is comprised of a gas cartridge **20** (illustrated only in FIG. **3**) filled with pressurized combustible gas, a gas burner **21** to which combustible gas is supplied from the gas cartridge **20** and which burns the combustible gas, a plug fitting **22** adjusting a flow of the combustible gas supplied from the gas cartridge **20**, and a gas tube **23** through which the combustible gas is supplied from the gas cartridge **20** to the gas burner **21**.

The gas burner **21** is comprised of a joint block **24** to which the gas tube **23** is connected, a burner head **25** having a number of openings **25***a* at a surface thereof, a saucer-shaped windshield **25***b* surrounding the burner head **25**, a mixing tube **26** connecting the joint block **24** to the burner head **25**, kettle holders **27** connected to the mixing tube **26**, and an igniter **28** igniting the gas mixture of air and the combustible gas, discharged from the burner head **25** through the openings **25***a*.

Each of the kettle holders **27** is wound at one end thereof around the mixing tube **26**, and is designed to be swingable in directions indicated with arrows A in FIG. **3**.

FIGS. **4A** to **4C** illustrate a structure of the igniter **28**. The igniter **28** is comprised of a base block **28***a* in the form of a square pole, a cylindrical pillar **28***b* upwardly extending from the base block **28***a*, an igniter section **28***c* upwardly extending from an upper end of the pillar **28***b* and generating a spark, and a switch **28***d* activating the igniter **28** when pushed relative to the base block **28***a*.

The igniter **28** is accommodated in an igniter cover **29** illustrated in FIGS. **5A** and **5B**. The igniter cover **29** is comprised of a first cover portion **29***a* and a second cover portion **29***b*.

The first cover portion **29***a* is open at a bottom thereof. The base block **28***a* of the igniter **28** is accommodated in the first cover portion **29***a*.

As illustrated in FIG. **5A**, the first cover portion **29***a* is formed at an upper surface thereof with a projecting portion **29***c*. The projecting portion **29***c* is formed with a circular opening **29***d*. The igniter cover **29** is fixed relative to the mixing tube **26** by inserting the mixing tube **26** into the circular opening **29***d*.

The first cover portion **29***a* is formed at an upper surface at an end through which the switch **28***d* is inserted, with an inclined portion **29***e* obliquely, upwardly and outwardly inclining. Hence, the switch **28***d* can be readily pushed.

The pillar **28***b* of the igniter **28** is accommodated in the second cover portion **29***b*. The second cover portion **29***b* has a rectangular cross-section, and is open at a side. As illustrated in FIG. **5A**, the second cover portion **29***b* is formed at

upper ends thereof with hookers **29***f* formed by inwardly bending walls of the second cover portion **29***b*.

The second cover portion **29***b* is formed with vertically arranged oval openings **29***g* for diffusing heat from the igniter **28**.

The igniter cover **29** can be formed by, for instance, separately fabricating the first cover portion **29***a* and the second cover portion **29***b*, and welding them to each other.

FIG. **6** is a plan view of an igniter support **30** which supports the igniter **28** at an upper end thereof.

The igniter support **30** is comprised of a ring **30***a* and a rectangular portion **30***b* outwardly projecting from the ring **30***a*.

The ring **30***a* is designed to have such an inner diameter that the ring **30***a* can be engaged to the mixing tube **26** just below the burner head **25**.

The rectangular portion **30***b* is designed to have the same size as a rectangular cross-section of the second cover portion **29***b*. Hence, the rectangular portion **30***b* can be inserted into the second cover portion **29***b*.

The rectangular portion **30***b* is formed centrally with a circular opening **30***c*. The circular opening **30***c* is designed to have a diameter equal to a diameter of the pillar **28***b* of the igniter **28**. Accordingly, the pillar **28***b* can be fit into the circular opening **30***c* of the rectangular portion **30***b*.

When the igniter **28** is to be accommodated in the igniter cover **29**, the ring **30***a* is engaged to the mixing tube **26** and the rectangular portion **30***b* is inserted into the second cover portion **29***b*. Then, the igniter **28** is positioned below the igniter cover **28**, and then, is upwardly inserted into the igniter cover **29**. Thus, the base block **28***a* is accommodated in the first cover portion **29***a*, and the pillar **28***b* is accommodated in the second cover portion **29***b*.

Then, as illustrated in FIG. **3**, pillar **28***b* is inserted in the vicinity of an upper end thereof into the circular opening **30***c* of the igniter support **30**.

Thus, the opening **29***d* formed in the projecting portion **29***c* is fit around the mixing tube to thereby ensure that the igniter **28** is fixed at a lower end thereof relative to the gas burner **21** and hence the mixing tube **26**, and the opening **30***c* formed in the rectangular portion **30***b* is fit into the pillar **28***b* of the igniter **28** to thereby ensure that the igniter **28** is fixed at an upper end thereof relative to the gas burner **21** and hence the mixing tube **26**.

FIGS. **7**A to **7**C illustrates a generator **31**. The generator **31** is comprised of a hollow, reverse-U shaped pipe, and is connected at a free end thereof to the joint block **24**.

The combustible gas having been supplied from the gas cartridge **20** through the plug fitting **22** and the gas tube **23** passes through the joint block **24**, and then, through the generator **31**, and returns to the joint block **24**. Thereafter, the combustible gas is supplied to the mixing tube **26** from the joint block **24**.

As illustrated in FIGS. **2** and **3**, the windshield **25***b* is formed with a cutout **25***c*. The generator **31** is positioned close to the burner head **25** in the cutout **25***c*. The generator **31** is designed to have such a height that a summit of the generator **31** is either almost level with or slightly higher than a summit of the burner head **25**.

When viewed from the burner head **25**, the igniter **28** is located slightly outside the generator **31**. When viewed horizontally, the igniter **28** is completely surrounded by the generator **31**.

As illustrated in FIG. **2**, the burner head **25** is formed at a surface thereof with a flame hole **32** as well as the openings **25***a*. The flame hole **32** has a greater size than a size of the opening **25***a*. A mesh sheet is arranged all over the flame hole **32**. The igniter **28** is positioned such that the igniter section **28***c* faces the flame hole **32**. In this embodiment, the igniter section **28***c* is slightly inclined towards the flame hole **32**.

The gas cooking stove in the instant embodiment is used as follows.

The combustible gas under pressure is adjusted in a flow rate in the plug fitting **22**, and then, is supplied to the joint block **24** through the gas tube **23**. Then, the combustible gas is supplied to the generator **31** from the joint block **24**.

Since the generator **31** is positioned close to the burner head **25** as mentioned earlier, the generator **31** is heated by burning combustible gas blowing out from the burner head **25**. Accordingly, the gas mixture passing through the generator **31** is also heated, and then, supplied to the mixing tube **26**.

The mixing tube **26** is formed at a surface thereof with a plurality of openings **26***a*. External air is absorbed into the mixing tube **26** through the openings **26***a* by virtue of negative pressure generated when the combustible gas passes the mixing tube **26**. Thus, the combustible gas is mixed with air into a gas mixture of air and combustible gas.

After entering the burner head **25**, the gas mixture blows out through the openings **25***a*, and is ignited by the igniter **28** located in the vicinity of the burner head **25**. The thus ignited gas mixture is burnt, and as a result, flame blows out through the openings **25***a*.

The flame heats cooking appliances and/or food (not illustrated) put on the kettle holders **27**.

In the instant embodiment, the igniter section **28***c* is positioned perpendicular to a flow of the gas mixture discharged through the openings **25***a*. Hence, the spark generated by the igniter section **28***c* flies perpendicularly to a flow of the gas mixture.

In the conventional burner illustrated in FIG. **1**, the spark generated by the igniter **19** flies in parallel with a flow of the gas mixture. Hence, a contact area of the spark with the gas mixture was relatively small.

In contrast, the spark flies perpendicularly to a flow of gas mixture in the instant embodiment. As a result, a contact area of the spark with the gas mixture is greater than the same in the conventional burner. Hence, even if the gas mixture had a great velocity, it would be possible to stably ignite the gas mixture.

The gas mixture of combustible gas and air at higher temperature is more likely to be ignited. Thus, the gas mixture which has been heated during passing through the generator **31** can be readily ignited by the spark generated by the igniter **28**.

While the present invention has been described in connection with certain preferred embodiments, it is to be understood that the subject matter encompassed by way of the present invention is not to be limited to those specific embodiments. On the contrary, it is intended for the subject matter of the invention to include all alternatives, modifications and equivalents as can be included within the spirit and scope of the following claims.

The entire disclosure of Japanese Patent Application No. 11-2872 filed on Jan. 8, 1999 including specification, claims, drawings and summary is incorporated herein by reference in its entirety.

What is claimed is:

1. A burner to be used for a portable gas cooking stove, comprising:

(a) a mixture gas pipe having an open end through which a gas mixture of combustible gas and air is exhausted;

(b) a burner head connected to said mixture gas pipe in a hermetically sealed condition and having at least one opening at a surface thereof, said gas mixture blowing out through said opening; and

(c) an igniter igniting said gas mixture blowing out through said opening of said burner head,

said igniter generating a spark in a direction perpendicular to a flow of said gas mixture blowing out through said opening of said burner head; and said igniter being supported at lower and upper ends thereof by said mixture gas pipe.

2. The burner as set forth in claim **1**, further comprising an igniter cover in which said igniter is accommodated, said igniter cover having a projecting portion projecting in a direction, said projecting portion being formed with an opening having a diameter almost equal to a diameter of said mixture gas pipe, said igniter cover being fixed relative to said gas mixture pipe by engaging said projecting portion to said mixture gas pipe.

3. The burner as set forth in claim **2**, wherein said igniter is comprised of:

(a) a base block extending in a first direction;

(b) a pillar extending in a second direction perpendicular to said first direction;

(c) an igniter section extending from a summit of said pillar; and

(d) a switch movable in said first direction,

and wherein said igniter cover is comprised of:

(a) a first cover portion covering said base block therewith; and

(b) a second cover portion covering said pillar therewith.

4. The burner as set forth in claim **3**, wherein said first cover portion has a portion located above said switch and bent upwardly and obliquely.

5. The burner as set forth in claim **3**, wherein said igniter is supported by said mixture gas pipe through an igniter support,

said igniter support being comprised of a ring engageable to said mixture gas pipe and a projection fittable into said second cover portion of said igniter cover,

said projection being formed with an opening into which said pillar is to be fit.

6. A burner to be used for a portable gas cooking stove, comprising:

(a) a mixture gas pipe having an open end through which a gas mixture of combustible gas and air is exhausted;

(b) a burner head connected to said mixture gas pipe in a hermetically sealed condition and having at least one opening at a surface thereof, said gas mixture blowing out through said opening;

(c) an igniter igniting said gas mixture blowing out through said opening of said burner head, said igniter generating a spark in a direction perpendicular to a flow of said gas mixture blowing out through said opening of said burner head; and

(d) a generator comprised of a pipe through which said combustible gas flows, said generator being arranged outside and close to said burner head; said igniter generating a spark between said burner head and said generator.

7. The burner as set forth in claim **6**, wherein said generator is reverse U-shaped, and wherein said igniter is positioned surrounded by said generator when viewed from a front of said generator.

8. The burner as set forth in claim **6**, wherein said igniter is supported at lower and upper ends thereof by said mixture gas pipe.

9. The burner as set forth in claim **8**, further comprising an igniter cover in which said igniter is accommodated, said igniter cover having a projecting portion projecting in a direction, said projecting portion being formed with an opening having a diameter almost equal to a diameter of said gas mixture pipe, said igniter cover being fixed relative to said gas mixture pipe by engaging said projecting portion to said mixture gas pipe.

10. The burner as set forth in claim **9**, wherein said igniter is comprised of:

(a) a base block extending in a first direction;

(b) a pillar extending in a second direction perpendicular to said first direction;

(c) an igniter section extending from a summit of said pillar; and

(d) a switch movable in said first direction,

and wherein said igniter cover is comprised of:

(a) a first cover portion covering said base block therewith; and

(b) a second cover portion covering said pillar therewith.

11. The burner as set forth in claim **10**, wherein said first cover portion has a portion located above said switch and bent upwardly and obliquely.

12. The burner as set forth in claim **10**, wherein said igniter is supported by said mixture gas pipe through an igniter support,

said igniter support being comprised of a ring engageable to said mixture gas pipe and a projection fittable into said second cover portion of said igniter cover,

said projection being formed with an opening into which said pillar is to be fit.

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