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(54) BURNER AND BURNER UNIT

(57) A burner unit that houses burners (33, 34) to be assembled into a combustion apparatus for burning a fuel gas. A plurality of burners are arranged in a housing (35). A connection port (35a) for connecting a gas inlet (33b) of the burner is disposed in this housing (35). Each gas inlet of each burner is pushed to the connection port of the housing by biasing means. Accordingly, the gas inlet of the burner and the connection port of the housing can be reliably connected.

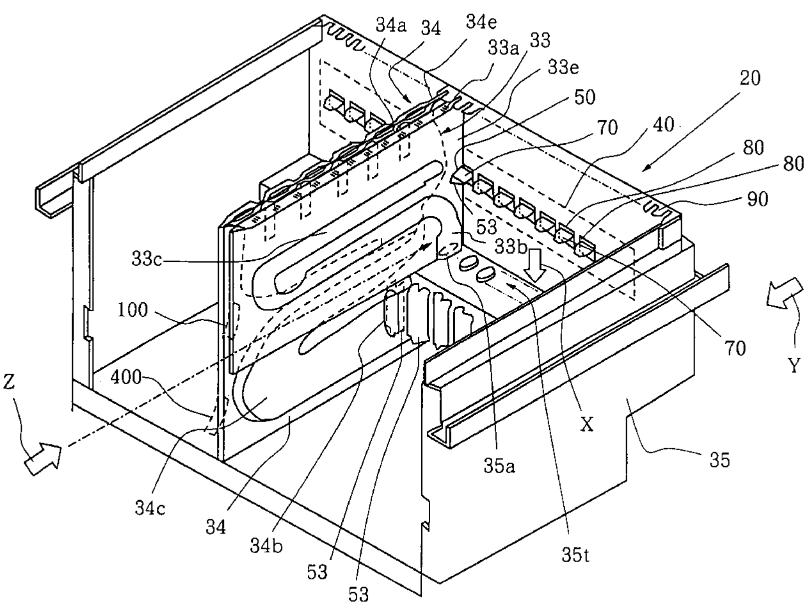

Fig. 2

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Description

TECHNICAL FIELD

The present invention relates to an improvement in a burner unit which is suitably used in a combustion apparatus for a hot water supply system, a bath heater, and burner thereof.

BACKGROUND TECHNIQUE

A combustion apparatus for a water supply system, a bath heater or the like is provided with a burner unit. The burner unit is constructed so that a plurality of rows of burners for combustion are arranged within a container made of metal. In the combustion apparatus, a heat exchanger or the like is disposed on the burner unit, and a combustion fan or the like for charging/discharging gas is provided under the burner unit.

In a container body Q for a conventional burner unit shown in Fig. 12, under the condition that a plurality of combustion burners B are arranged, an inlet port (which is sometimes referred to as a bell mouth) for combustion gas for each burner B must be connected without fail to a connection port Q1 of the container body Q.

However, in this type of conventional burner unit, a planar member C is mounted on the container body Q so that the combustion gas inlet B1 of the combustion burner B is positively connected to the connection port Q of the container body Q. As shown in Figs. 23 and 24, the planar member C pushes an upper end of each combustion burner B so as to hold it securely to the container body Q.

As shown in Fig. 24, however, this member C can push only the combustion burners and suffers from a problem that a space S is formed between the upper ends of the combustion burners B in the middle and the member C. The formation of this space S is caused by a warpage or the like of the spring-like member C or the non-uniformity in dimensional deviation in manufacture of each combustion burner B.

More specifically, in a system in which the burners are fixed at both ends as shown in Fig. 23, in the case where larger burners BB and smaller burners BD than a predetermined length are given due to the dimensional error in manufacture of the burners B as shown in Fig. 24, the member C is deformed by the larger burners BB. As a result, the shorter burners BD remote from the member C are moved.

Therefore, in the prior art, unless a lap height H for burring of the connection port Q1 of the container body Q which is much larger than a dimension through which the shorter burners BD are moved is determined so as to absorb the error of the burner dimension, it is impossible to positively connect the gas inlet B1 with the connection port Q1 of the container body Q. Then, it is necessary not only to determine the lap height H but also to perform the surface contact so as to eliminate space between the connection port Q1 of the container body Q and the gas inlet B1.

In spite of the fact that the member C is thus depressed, if the burners which are located in the middle would be floated, there would be a problem that the gas inlet B1 of the floated burner B could not be positively connected to the connection port Q1 of the container body Q. If the positive connection would not be performed in this way, the gas mixture which is to be introduced through the inlet port B1 for the combustion gas and the connection port Q1 for the combustion burner B would leak to the outside between the connection port Q1 and the combustion gas inlet port B1. Resultantly, there is a problem that the combustion would be worse, and its gas mixture would leak in between the container body Q and the combustion burner B or between the adjacent combustion burners B.

Therefore, the present invention has been made in order to solve the above-described tasks. An object thereof is to provide a burner unit in which the combustion burner gas inlet and the connection port of the container body may be connected with each other without fail.

DISCLOSURE OF THE INVENTION

The above-described object is attained by the present invention, in a burner unit comprising a plurality of combustion burners provided inlet ports for combustion gas, and a container body having connection ports for connection with the inlet ports of said combustion gas inlets of said combustion burners and in which said plurality of burners are received and arranged, said burner unit being mounted on said container body and being comprised of a biasing means provided in correspondence with each of said combustion burners for pushing the combustion gas inlet ports of said combustion burners against the connection port of said container body relative to said combustion burners arranged in said container body.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a view showing an example of a hot water supply system as a combustion apparatus provided with a burner unit according to the present invention;

Fig. 2 is a perspective view showing an assembled condition of a container body, high concentration gas combustion burners and low concentration gas combustion burners of Fig. 1 and a biasing means;

Fig. 3 is a plan view showing the burner unit of Fig. 2;

Fig. 4 is a frontal view showing the burner unit of Fig. 3;

Fig. 5 is a side elevational view of the burner unit as viewed in a direction R of Fig. 3;

Fig. 6 is a perspective view showing an example of the biasing means;

Fig. 7 is a view showing an example of the assembly of the container body and the high concentration gas combustion burner;

Fig. 8 is a perspective view showing an example of an engagement condition between a single elastic claw of the biasing means and a cutaway portion of the high concentration gas combustion burner;

Fig. 9 is a perspective view showing an example of the cutaway portion of the high concentration gas combustion burner;

Fig. 10 is a perspective view as viewed from a front portion of the container body 35 of Fig. 2;

Fig. 11 is a cross-sectional view showing a connection example of the combustion gas inlet port (bell mouth) of the high concentration ga combustion burner and the connection port of the container body 35;

Fig. 12 is a frontal view showing an example of the burner for attaining a good pre-mixture;

Fig. 13 is a plan view of the burner shown in Fig. 12;

Fig. 14 is an enlarged cross-sectional view taken along the line H-H of Fig. 12;

Fig. 15 is a cross-sectional view showing another embodiment of a burner;

Fig. 16 is a cross-sectional view showing an embodiment of yet another embodiment of a burner;

Fig. 17 is an enlarged cross-sectional view taken along the line G-G of Fig. 16;

Fig. 18 is a developed view showing a burner in accordance with yet another embodiment;

Fig. 19 is a cross-sectional view of Fig. 18;

Fig. 20 is a cross-sectional view showing yet another embodiment;

Fig. 21 is a cross-sectional view showing yet another embodiment;

Fig. 22 is a cross-sectional view showing yet another embodiment;

Fig. 23 is a perspective view showing an example of a conventional burner unit; and

Fig. 24 is a view illustrating a problem inherent in the conventional burner unit.

BEST MODE FOR EMBODYING THE INVENTION

A preferred embodiment of the present invention will now be described with the accompanying drawings.

Incidentally, since the following embodiment is one of preferred embodiments of the present invention, the embodiment is limited with a variety of preferable technical limitations. However, the scope of the present invention is not limited to these embodiments as far as the explanation particularly limits the present invention in the following description. Fig. 1 shows the preferred embodiment of a combustion apparatus having a burner unit according to the present invention. The combustion apparatus is, for example, a hot water supply system.

In Fig. 1, a hot water system case 21 of a hot water system has therein a burner unit 20, a charging/discharging gas combustion fan 22, a heat exchanger 24, a nozzle holer 26 and the like.

The heat exchanger 24 is disposed on the burner unit 20. A combustion fan 22 is disposed below the burner unit 20. A nozzle holder 26 is disposed to face the front of the burner unit 20.

The nozzle holder 26 is constructed so as to provide the gas mixture to the combustion burners of the burner unit 20 to be described later. Namely, the nozzle holder 26 has a gas mixture nozzle 72 and a gas mixture nozzle 92. The gas mixture nozzle 72 is directed in the horizontal direction, whereas the gas mixture nozzle 92 is directed up and down.

The structure of the burner unit 20 will now be described in more detail.

As shown in Figs. 2 and 3, the burner unit 20 is provided with a plurality of high concentration gas combustion burners 33, a plurality of low concentration gas combustion burners 34, a container body 35 and a biasing means 40.

The biasing means 40 has a structure as shown in Fig. 6.

The high concentration gas combustion burners 33 and the low concentration gas combustion burners 34 will first be described.

As shown in Figs. 2 and 3, the plurality of high concentration gas combustion burners 33 and the plurality of low concentration gas combustion burners 34 are disposed within the container body 35 so as to be adjacent to each other. The high concentration gas combustion burners 33 are of a high concentration gas combustion burner type and are generally referred to as Bunsen burners or semi-Bunsen burners in which air for combustion is fed from the environment of the burners and high concentration premixed gas is injected from flame ports 33a. The low concentration gas combustion burners 34 are of a low concentration gas combustion burner type in which the burners cannot burn by themselves with gas injected from flame ports 34a but can burn by supplying energy for combustion from the environment. The low concentration premixed gas is injected from the flame ports 34a. The low concentration premixed gas means mixture gas which has a larger amount of air to be mixed with the combustion gas than that of stoichiometric air. Thus, the high concentration gas combustion turners 33 and the low concentration gas combustion burners 34 are used in combination, so that clean combustion may prevent nitrogen oxide NOx from being generated to some extent.

As shown in Figs. 2 and 7, the high concentration gas combustion burners 33 are made by pressing thin plates of metal and are provided with the above-described flame ports 33a and at the same time with combustion gas inlet holes 33b. The gas inlet ports 33b are opened downwardly, and are constructed so as to be connected to connection ports 35a of the container body 35 as shown in Fig. 2. The flame ports 33a and the combustion gas inlet ports 33b are connected with each other through gas passages 33c.

A cutaway portion 50 is formed at a front end portion of the high concentration gas combustion burner 33. As shown in Figs. 7, 8 and 9, the cutaway portion 50 is preferably formed substantially into a lateral V-shape. As shown in Fig. 9, for the cutaway portion 50, a plate 51 of the high concentration gas combustion burner 33 is made different in shape from the other plat 52 to thereby form the cutaway portion 50. One of the plates 51 is a cutaway which is substantially in the form of a rectangular, whereas the other plate 52 is substantially in the form of a V-shape. Thus, since it is possible to form the above-described cutaway portion 50 only with the V-shaped cutaway portion 52a of the other plate 52, there is a small amount of accumulation of error. Also, it is unnecessary to align the shapes of both the plates 50 and 52 with each other.

On the other hand, as shown in Figs. 2 and 3, the low concentration gas combustion burners 34 are provided flame ports 34a and combustion gas inlet ports 34b. The combustion gas inlet ports 34b and the flame ports 34a are connected with each other through gas passages 34c. As shown in Fig. 2, the combustion gas inlet ports 34b are connected to the connection ports 53 of the container body 35.

As shown in Fig. 1, the connection ports 35a of the container body 35 are arranged to face gas mixture nozzles 92 of the above-described nozzle holder 26. In contrast, as shown in Fig. 1, other connection ports 53 of the container body 35 are arranged to face the nozzles 72 of the nozzle holder 26.

The above-described biasing means 40 will now be described.

The biasing means 40 is mounted relative to the container body 35 as shown in Fig. 40 for biasing the high concentration gas combustion burners 33 in a direction (downward) indicated by the arrow X relative to the container body 35. Thus, the high concentration gas combustion burners 33 are biased in the direction X indicated by the arrow X relative to the inner surface 35t of the container body 35, whereby the combustion gas inlets 33b of the high concentration gas combustion burners 33 are brought into intimate contact with the connection ports 35a of the container body 35 and are connected thereto.

In the biasing means 40, as shown in Figs. 2 and 6, elastic claws 70 corresponding to the number of the high concentration gas combustion burners 34 are formed to project in a direction indicated by an arrow Y perpendicular to the direction indicated by the arrow X. Each elastic claw 70 may project into an interior of the container body 35 from a window portion 80 of the container body 35 shown in Fig. 2. A body 41 of the biasing means 40 of Fig. 6 may be formed so as to be detachably relative to screw holes 71a of Fig. 10 by, for example, screws 71 of Fig. 6 in a direction indicted by an arrow Y from a back surface wall 81 side of the container body 35 shown in Fig. 10.

Under the assembled condition of the burner unit shown in Figs. 2 and 3, the high concentration gas combustion burners 33 and the low concentration gas combustion burners 34 are arranged in alignment by positioning claws 90 ad 91 of the container body 35. Namely, front end portions 33e of the high concentration gas combustion burners 33 and front end portions 34e of the low concentration gas combustion burners 34 are inserted between the positioning claws 90. In contrast, on the positioning claw 91 side, rear end portions 33f of the high concentration gas combustion burners 33 and rear end portions 34f of the low concentration gas combustion burners 34 are inserted.

Thus, under the condition that the high concentration gas combustion burners 33 and the low concentration gas combustion burners 34 are arranged in parallel so as to be clamped by the positioning claws 90 and 91 within the container body 35, as shown in Figs. 7 and 8, the elastic claws 70 are inserted into the cutaway portions 50 of the high concentration gas combustion burners 33, and the elastic claws 70 are biased elastically relative to lower edges 53 of the cutaway portions 50. Namely, the elastic claws 70 push the high concentration gas combustion burners 33 in the direction indicated by the arrow X. Thus, the combustion gas inlet ports 33b of the high concentration gas combustion burners 33 may be positively connected relative to the connection ports 35a of the container body 35. Accordingly, since there is no space between the connection ports 35a and the combustion gas inlet ports 33b, there is no fear that the gas mixture would leak from between these components. Accordingly, there are no noises in the burner unit.

In addition, in this embodiment, as shown in Fig. 7, the high concentration gas combustion burners 33 are held by posture holding means 100 along a direction indicated by an arrow Z. The posture holding means 100 is a spring and also a biasing means for connecting further positively the combustion gas inlet ports 33b of the high concentration gas combustion burners 33 and the connection ports 35a of the container body 35. The front end sides 33e of the high concentration gas combustion burners 33 may press against the front end inner wall 35g of the container body 35. Thus, since the horizontal right posture of the high concentration gas combustion burners 33 may be held as shown in Figs. 2 and 7 in the interior of the container body 35, the connection ports 35a of the container body 35 and the combustion gas inlet ports 33b of the high concentration gas combustion burners 33 are connected more positively with each other.

Incidentally, as shown in Figs. 1 and 5, the above-described burner unit 20 is received in a burner case 110. A burner case cover 120 of the burner case 110 shown in Figs. 3 through 5 is provided with an electrode unit 130 and a high voltage generating device 140. The electrode unit 130 is provided with an igniter electrode 132, an earth electrode 133 and a flame rod electrode 134 for a base portion 131 made of ceramics.

The igniter electrode 132 is arranged to extend above the low concentration gas combustion burner 34 as shown in Fig. 3 with its tip end above the flame port 33a of the high concentration gas combustion burner 33. The earth electrode 133 is arranged substantially above the low concentration gas combustion burner 34. The flame rod 134 is arranged to extend above the low concentration gas combustion burner 34 with its tip end above the flame port 33a of the high concentration gas burner 33. By the action of the high voltage generating circuit 140, the igniter electrode 132 is subjected to the high voltage to perform a spark charge to the earth electrode 133. Thus, the spark is formed and an ignition is effected through the gas-rich gas mixture from the flame port 33a of the high concentration gas combustion burner 33 and the air-rich gas mixture from the flame port 34a of the low concentration gas combustion burner 34. The flame rod electrode 134 detects the current ion in the flame to thereby detect whether the flame is put out or not.

As described above, in the embodiment of the present invention, since the combustion gas inlet ports 33b of the high concentration gas combustion burners 33 are positively connected to the connection ports 35a of the container body 35 as shown in Figs. 2 and 11, each elastic claw 70 of the biasing means 40 is inserted into the cutaway portion 50 for the engagement of the high concentration gas combustion burner 33 one by one, and at the same time the high concentration gas combustion burner 33 is pressed against the container body 35 in the direction indicated by the arrow X. In addition, the high concentration gas combustion burners 33 are pressed in the direction Z one by one by the biasing means 100 which also serves as the posture holding means.

Thus, in the burner unit in which the high concentration gas combustion burners 33 and the low concentration gas combustion burners 34 are closely arranged and the burner combustion range is narrow, even if there is non-uniformity in dimension of height in the direction X of each high concentration gas combustion burner 33, each connection port 35a of the container body 35 may be positively connected to each combustion gas inlet port 33b of each high concentration gas combustion burner 33 so that the leakage of the gas mixture may be prevented and the generation of noises due to the leakage may be prevented.

An example of the operation of the combustion apparatus using the burner in accordance with the embodiment will be described briefly.

In Fig. 1, the gas mixture which has been mixed at a predetermined mixture ratio between the air and gas is supplied from a combustion gas supply source (not shown) through the gas supply portion. As shown in Fig. 7, the combustion gas given from the nozzles 92 of the nozzle holder 26 is blown out from the flame ports 33a through the gas passage 33c and through the combustion gas inlet ports 33b of the high concentration gas combustion burners 33. In the same way, the combustion gas given from the nozzles 72 of the nozzle holder 26 is blown out from the flame ports 34a of the low concentration gas combustion burners 34 through the gas passage 34c and through the combustion gas inlet ports 34b of the low concentration gas combustion burners 34 and the connection ports 53 shown in Fig. 2.

Namely, the combustion gas injected from the nozzles 72 are blown to the combustion gas inlet ports 34b of the low concentration gas combustion burners 34 and the combustion gas is introduced into the gas passage 34c of the low concentration gas combustion burners 34. The introduced combustion gas and air are mixed in the gas passage 34c uniformly and the low concentration premixed gas is injected from the flame ports 34a.

In the same way, the combustion gas to be injected from the thin nozzles 92 is injected upwardly relative to the combustion gas inlet ports 33b of the high concentration gas combustion burners 33. The gas and air introduced into the combustion gas inlet ports 33b are uniformly mixed in the gas passage 33c, and the high concentration premixed gas is injected from the flame ports 33a. A high temperature flame of the high concentration premixed gas is formed in the flame ports 33a of the high concentration gas combustion burners 33, and a combustion flame of the low concentration premixed gas is formed in the flame ports 34a of the low concentration gas combustion burners 34. The combustion of the low concentration premixed gas combustion by the low concentration gas combustion burner 34 and the combustion of the high concentration premixed gas combustion by the high concentration gas combustion burner 33 are about at a ratio of 6 to 4. Accordingly, the flame formed on the formation surface of all the flame ports 33a and 34a of the burner unit 20, i.e., the combustion surface of the burner unit 20 is occupied by the flame in which the flame peak temperature of 1,500°C or less by the low concentration premixed gas and the NOx is hardly generated. Thus, a clean combustion in which a small amount of nitrogen oxide is small is performed.

When such a combustion is performed, since the high concentration gas combustion burners 33 are biased positively in the direction indicated by the arrow X by the elastic pieces 70 of the biasing means 40, the connection ports 35a of the container body 35 and the combustion gas inlet ports 33b of the high concentration gas combustion burners 33 are firmly connected as shown in Fig. 11. Accordingly, there is no leakage of the mixture gas.

In addition, in this embodiment, as shown in Fig. 7, since the high concentration gas combustion burners 33 are biased in the direction indicated by the arrow Z by the biasing means 100 which also serves as the posture holding means, and their postures are held within the container body 35, it is possible to further positively connect the connection ports 35a and the combustion gas inlet ports 33b. Thus, there is no leakage of the gas mixture, and there is no generation of noises by the leakage.

By the way, the present invention is not limited to the above-described embodiment.

For example, in the above-described embodiment, since the combustion gas inlet ports 33b are directed downwardly (in the direction indicated by the arrow X), only the high concentration gas combustion burners are biased in the direction indicated by the arrow X by the biasing means. However, without the limitation to this, in the case where the combustion gas inlet ports of the low concentration gas combustion burners 34 are structured in the same way as the combustion gas inlet ports of the high concentration gas combustion burner, the cutaway portions which are the same as the cutaway portions 50 may be formed for the low concentration gas combustion burner and the pressure may be applied by inserting the elastic claws 70 of the biasing means 40.

Also, with respect to the low concentration gas combustion burners 34, instead of the biasing means 40 used for the high concentration combustion burners, a biasing means 400 which also serves as the posture holding means which is the same as the biasing means 100 which is the posture holding means for the high concentration gas combustion burners 33 is provided at a portion of the container body 35 facing the nozzles 72.

With the structure like the low concentration gas combustion burners 34, it is possible to eliminate the leakage with the posture holding means 400 for biasing the gas inlet ports 34 and the connection ports 53 in the direction Z.

By the way, also, in the embodiment according to the present invention, as shown in Fig. 2, it is possible to bias the above-described high concentration gas combustion burners 33 and low concentration gas combustion burners 34 in the direction Z. With respect to the high concentration gas combustion burners 33, it is possible to positively connect the connection ports 35a of the container body 35 and the combustion gas inlet ports 33b of the high concentration gas combustion burners 33 by the biasing means and the biasing means 100 which serves as the posture holding means. Also, with respect to the low concentration gas combustion burners 34, it is possible to positively connect the connection ports 53 of the container body 35 and the combustion gas inlet ports 34b of the high concentration gas combustion burners 33.

Also, the shape of the biasing means 40 is not limited to a tongue-shaped elastic claw. It is possible to use any other shape. For example, spring steel, SUS or the like may be used as material for the biasing means 40. However, it is possible to use any specific material if it is elastic and durable against heat.

Figs. 12 to 14 show a structural example of a burner by which combustion gas and air may be well mixed.

Incidentally, in the case where these burners are combined with the above-described burner unit, as indicated by dotted lines, it is possible to form a cutaway portion 50 corresponding to the biasing means 40. A gas burner E for low concentration gas combustion is made by doubling back a single plate (thin metal plate) 600 machined by pressing. Namely, the plate 600 has a pair of plate portions 600a and 600b each of which has substantially the same shape. The plate 600 is doubled back so that the pair of the plate portions 600a and 600b overlap each other. One of the plate portions 600a has a bending portion 600 at its edge. The bending portion 600c is folded back to the other plate portion 600b by press-fit, thereby forming the gas burner. Each of he pair of plate portions 600a and 600b has expanded portions for forming a mixture portion 510 and a diffusion portion 52.

An end of the above-described mixture portion 510 is provided as an inlet port 511. The mixture portion 510 has, in the vicinity of the inlet port 511, a throat portion 512 which has a smaller flow path cross-sectional area than that of the inlet port 51, and further has an extension portion 513 which extends to the middle and to the right in Fig. 12 from the throat portion 512. In the extension portion 513, the flow path cross-sectional area is gradually increased downstream.

The diffusion portion 520 is located above the mixture portion 510. The diffusion portion 520 has a first portion 521 which is integral with a right end of the extension portion 513 of the above-described mixture portion 510 and at the same time extends obliquely upwardly to the left, a second portion which is located at the uppermost position and extends in the horizontal direction, and a third portion 523 which connects the first portion 521 and the second portion 522 and which is thinner than these portions. An upper surface of the above-described second portion 522 is flat and has a number of flame ports 523 formed as shown in Fig. 13.

The high concentration gas combustion burner (not shown) has also the similar structure to that of the low concentration gas combustion burner E. However, the cross-sectional area of the throat portion 512 of the low concentration gas combustion burner E is larger than that of a throat portion of the high concentration gas combustion burner.

A gas mixture nozzle 550 is disposed in the vicinity of the burner unit F. This gas mixture nozzle 550 extends in a direction perpendicular to the paper surface of Fig. 12 and has a number of gas injection portions 551 at an interval. These gas injection portions 551 are face the inlet ports 511 of he low concentration gas combustion burners E as shown and the flow inlets of the high concentration gas combustion burners. A port diameter of the gas injection portions facing the low concentration gas combustion burner E is larger than a port diameter of the gas injection portions facing the high concentration gas combustion burner. As a result, a larger amount of fuel gas may be supplied to the low concentration gas combustion burners E.

With such a structure, the gas from the above-described gas injection portions 551 is supplied together with air out of a fan (see Fig. 1) located, for example, below the burner unit to the inlet ports 511 of the low concentration gas combustion burners E. The air and gas are premixed in the process through the mixture portion 510. The premixed gas is diffused in the diffusion portion 520 and injected from the flame ports 525 to form flame. In the same manner, flame is supplied from he flame ports of the high concentration gas combustion burners. The flame heats water that passes through the heat exchanger located above the burner unit F.

As shown in Figs.12 and 14, a pair of projecting portions 530a and 530b are formed as obstacles in the vicinity of the inlet port 511 in the flow path of the mixture portion 510 of the above-described low concentration gas combustion burner E. More specifically, these projecting portions 530a and 530b are arranged in the vicinity of the throat portion 512 and downstream of the throat portion 512. These projecting portions 530a and 530b are formed by inwardly projecting the plate portions 600a and 600b provided as the walls of the mixture portion 510. The pair of projecting portions 530a and 530b face each other and contact each other at tip end portions.

Since the air and gas supplied to the inlet port 511 for the above-described low concentration gas combustion burner E are somewhat turbulent when passing through the throat portion 512 in the initial stage and subsequently strongly turbulent by the projecting portions 530a and 530b, the pre-mixture is accelerated at once. The premixed gas is further introduced uniformly through the mixture portion 510 into the diffusion portion 520. For this reason, in the low concentration gas combustion burner E, although the flow path cross-sectional area of the throat portion 512 is large, the good pre-mixture is carried out and the oxygen concentration is made substantially uniform in all the flame ports 525 (in other words, the gas concentration is made substantially uniform). As a result, it is possible to carry out the substantially uniform combustion in any of the flame ports 525.

Other embodiments will now be described with reference to the drawings. In these drawings, the same reference numerals are used to the structural members corresponding to those of the foregoing embodiment and their detailed explanation will be omitted. In an embodiment shown in Fig. 15, a pair of projecting portions 530a and 530b face each other but are separated from each other.

In an embodiment shown in Figs. 16 and 17, a pair of projecting portions 530a and 530b are formed in the walls facing each other but are arranged offset in the longitudinal direction of the mixture portion 510. In this embodiment, it is possible to suppress, to a minimum extent, the reduction of the flow path cross-sectional area of the mixture portion 510 due to the provision of the projecting portions 530a and 530b.

In an embodiment shown in Figs. 18 and 19, in the same manner as in the first-mentioned embodiment, the burner is made by doubling back a single plate 600 which is pressed. As shown in Fig. 18, a thin long strip 630 is caused to project from an edge of the plate portion 600b of the plate 600. A circular plate portion 630a is formed as an obstacle in the middle of the strip 630. As shown in Fig. 19, under the condition that the plate 600 is doubled back, both ends of the strip 630 are clamped by the pair of plate portions 600a and 600b or a part thereof is supported. The central circular plate portion 630a is arranged within the flow path of the mixture portion 510 downstream of the throat portion 512 and in the vicinity of the inlet part 511. This strip 630 is twisted, whereby the circular plate portion 630a is perpendicular to the longitudinal direction of the above-described mixture portion 510 and sufficiently serves to make turbulent the flow of the gas and air. Incidentally, the central porion of the strip 630 may bend and project on the side of, for example, the flow inlet.

In an embodiment shown in Fig. 20, a rivet 730 which passes through a wall in the vicinity of and downstream of the throat portion is mounted in the mixture portion 510. A portion of a stem 730a of the rivet 730 is formed as an obstacle for the gas and air.

In an embodiment shown in Fig. 21, a single rod 830 is used as an obstacle to pass through all the mixture portions 510 of the low concentration gas combustion burners E of the burner unit. Incidentally, in this embodiment, the high concentration gas combustion burners are arranged between the low concentration gas combustion burners. However, the mixture portion of the high concentration gas combustion burner is arranged above the mixture portion of the low concentration gas combustion burner.

In an embodiment shown in Fig. 20, in the same way as in the embodiment shown in Fig. 21, the rod 930 is used as an obstacle to pass through the mixture porion 510 but has a cross-section that diverges on the downstream side. This cross-section causes the gas and air flow to turbulent more than the circular cross-section.

Furthermore, the present invention is not limited to the embodiments shown but may be modified into various types. For example, it is possible to dispense with the throat portion. Also, the present invention is not limited to the low concentration gas combustion burner in all primary air type burner units but may be applied to any type of gas burner in which the flow path cross-sectional area of the mixture portion has to be increased and to any type of a gas burner in which the mixture portion has to be shortened. Also, the shape of the flame port 525 (see Fig. 13) of the gas burner may be formed into one like the burner 34a of Fig. 10.

As described above, according to the present invention, it is possible to connect positively the inlet ports of the combustion burners and the connection ports of the container body.

INDUSTRIAL APPLICABILITY

Thus, the present invention is suitable to a burner and a burner unit installed in a combustion apparatus for burning combustion gas.

Claims

1. A burner unit comprising a plurality of combustion burners provided inlet ports for combustion gas, and a container body having connection ports for connection with the inlet ports of said combustion gas inlets of said combustion burners and in which said plurality of burners are received and arranged,
   characterized in that said burner unit being mounted on said container body and being comprised of a biasing means provided in correspondence with each of said combustion burners for pushing the combustion gas inlet ports of said combustion burners against the connection port of said container body relative to said combustion burners arranged in said container body.

2. The burner unit according to claim 1, wherein said biasing means pushes side end porions of said combustion burners substantially in a horizontal direction.

3. A burner unit comprising a plurality of combustion burners provided inlet ports for combustion gas, and a container body having connection ports for connection with the inlet ports of said combustion gas inlets of said combustion burners and in which said plurality of burners are received and arranged,
   characterized in that said burner unit being mounted on said container body, and being comprised of a biasing means elastically engaged with cutaway portions of said combustion burners and provided in correspondence with each of said combustion burners for pushing the combustion gas inlet ports of said combustion burners against the connection port of said container body relative to said combustion burners arranged in said container body.

4. The burner unit according to claim 3, wherein said biasing means enters through window portions of said container body and elastically engages with the cutaway portions of said combustion burners.

5. The burner unit according to claim 4, wherein said combustion burners comprise high concentration gas combustion burners.

6. The burner unit according to claim 5, further comprising a posture holding means for holding postures of said combustion burners within said container body in a direction perpendicular to a direction in which the combustion gas inlet ports of said combustion burners are pushed against the connection ports of said container body by said biasing means.

7. A gas burner comprising a mixture portion extending to have at its end an inlet port facing a gas nozzle, and a diffusion portion which is integral with the other end of said mixture portion and having a number of flame ports, for introducing gas injected from said gas nozzle together with air through said inlet port, premixing the gas and air in the mixture portion, diffusing this mixture gas in said diffusion portion and injecting the gas from said flame ports to form flame,
   characterized in that an obstacle is provided in a flow path of said mixture portion.

8. The gas burner according to claim 7, wherein said obstacle is provided in the vicinity of the inlet port of said mixture portion.

9. The gas burner according to claim 8, wherein a throat portion having a smaller flow path cross-sectional area than that of the inlet port in the vicinity of the inlet port, and said obstacle is provided on the downstream side of the throat portion and in the vicinity of the throat porion.

10. The gas burner according to claim 7, wherein said obstacle comprises a projecting portion made by projecting walls of the mixture portion inwardly.

11. The gas burner according to claim 7, wherein said mixture portion and said diffusion portion are formed by overlapping a pair of plate portions which have been pressed, a thin long strip projects from an edge of one of the plate portions, and at least part of the strip is formed as the obstacle disposed in the flow path of said mixture portion.

12. The gas burner according to claim 7, wherein the obstacle comprises a rod portion which passes through said mixture portion.

Fig. 1

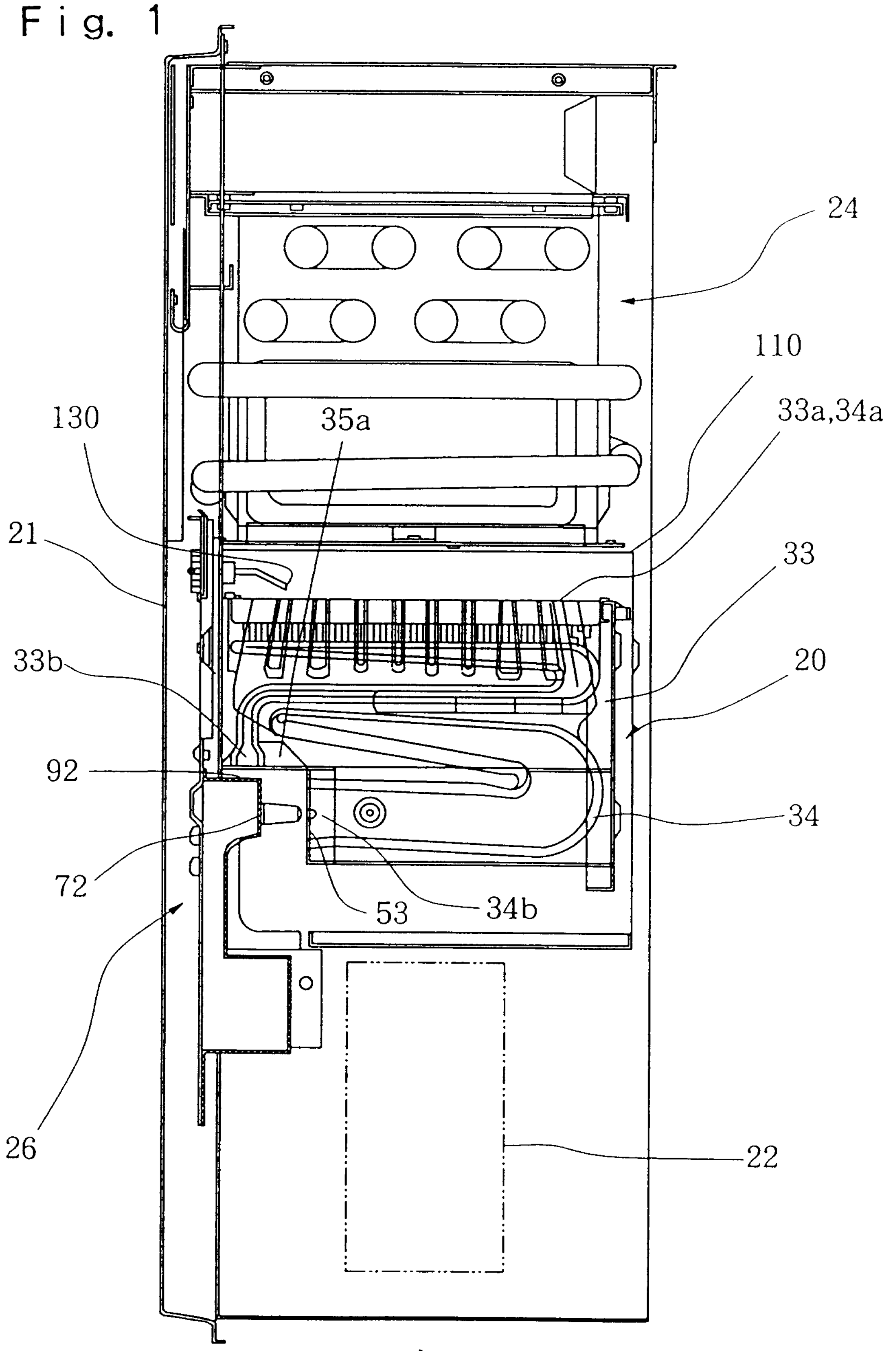

Fig. 2

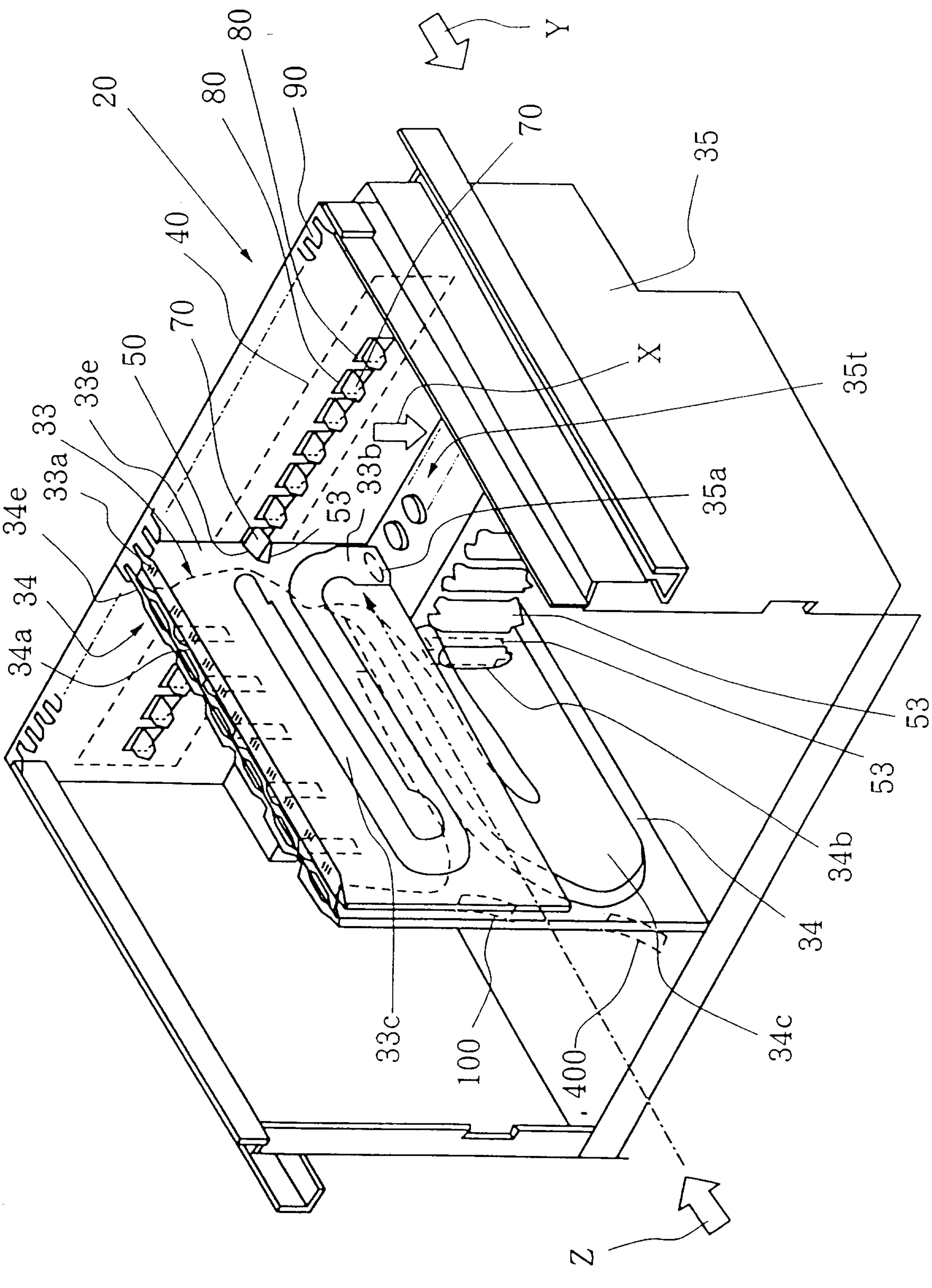
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Fig. 3

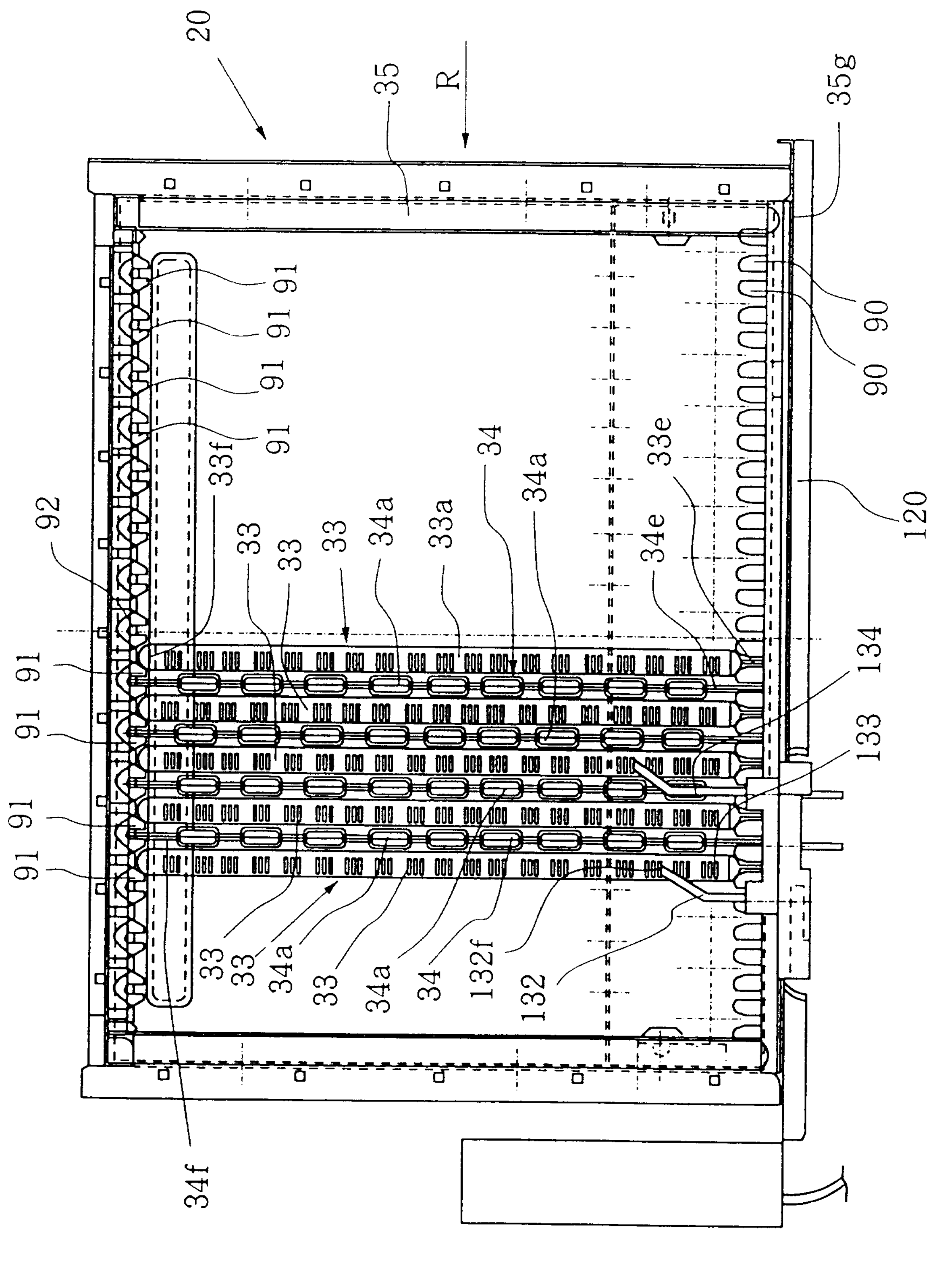
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Fig. 4

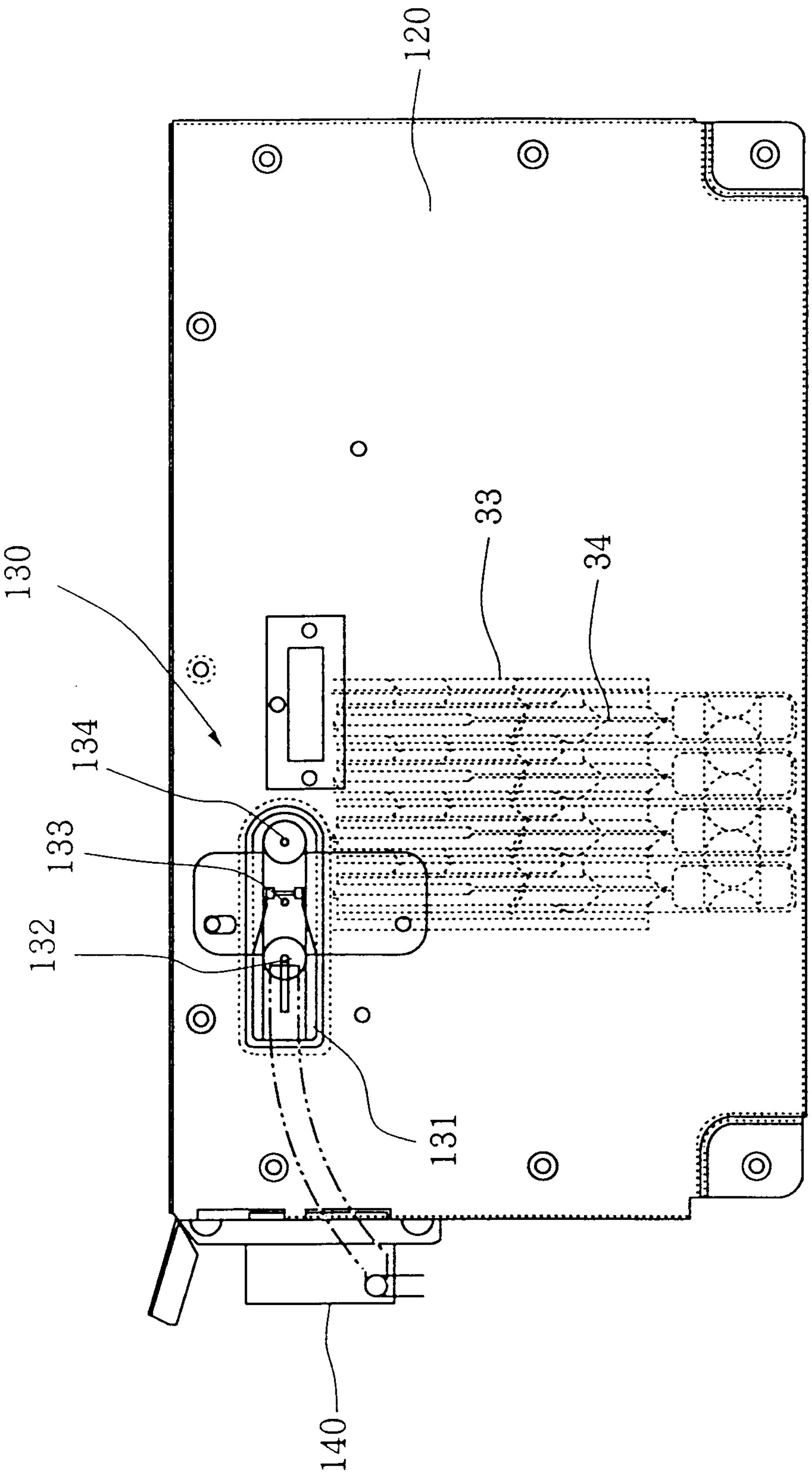
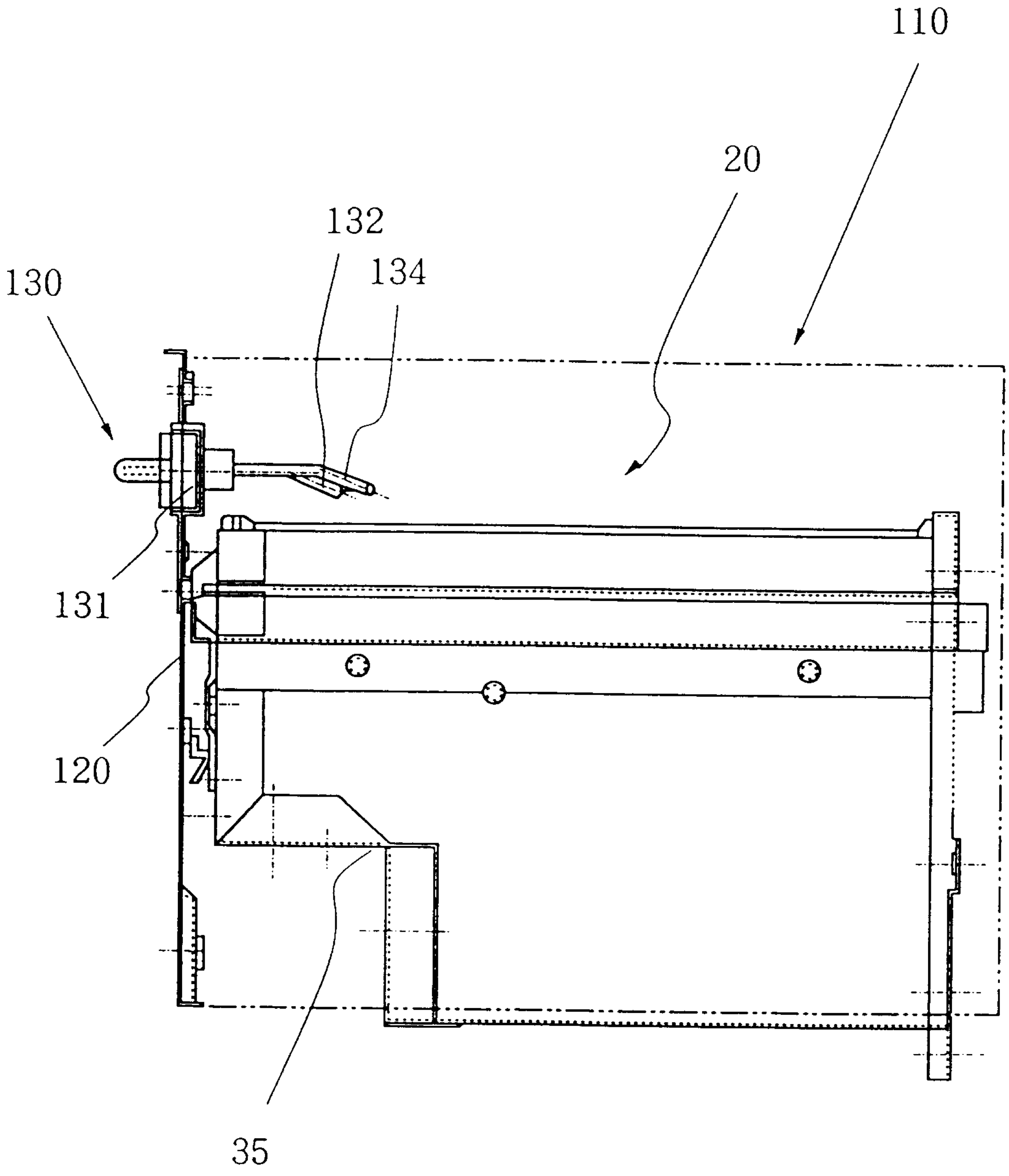


Fig. 5



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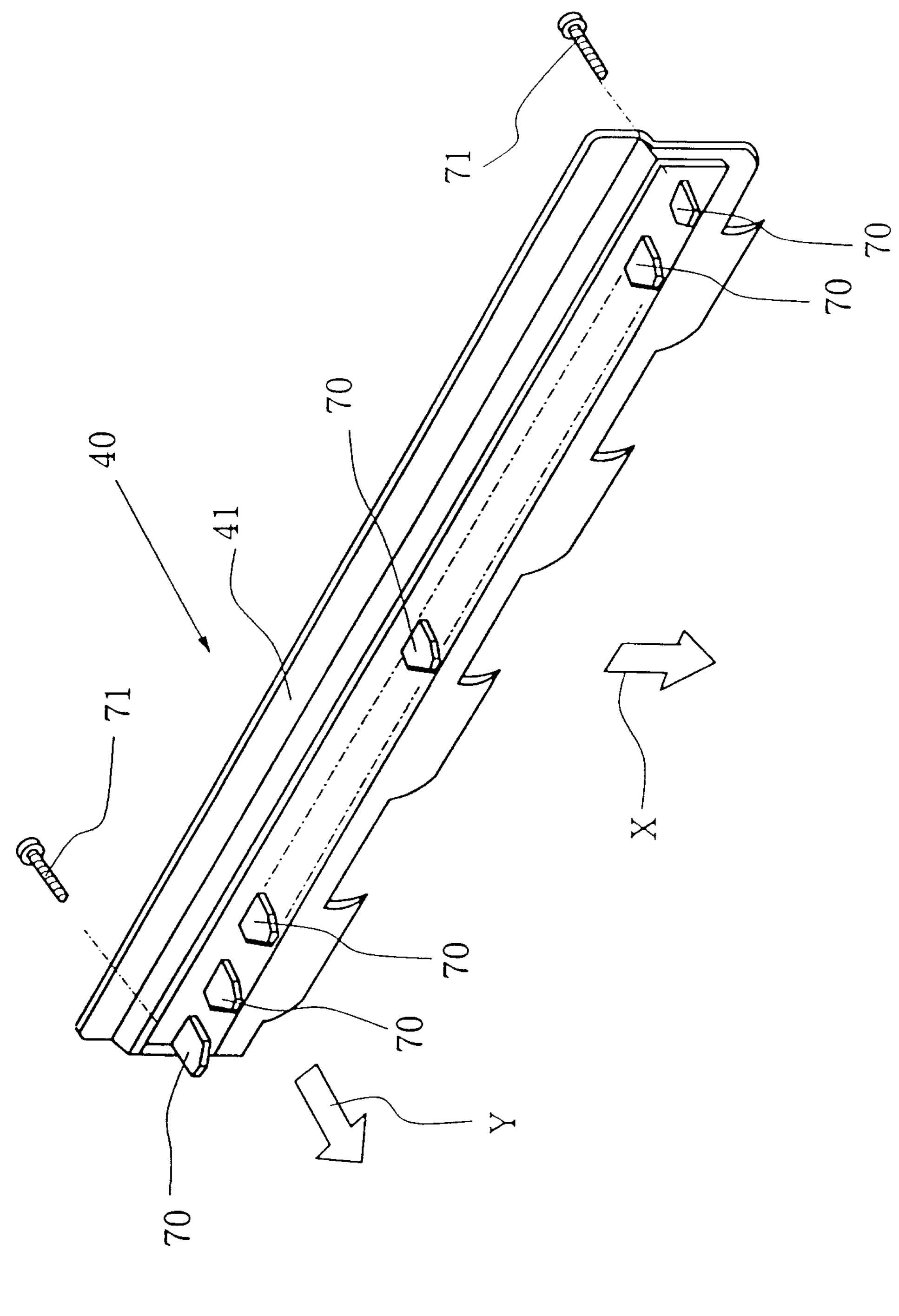

Fig. 7

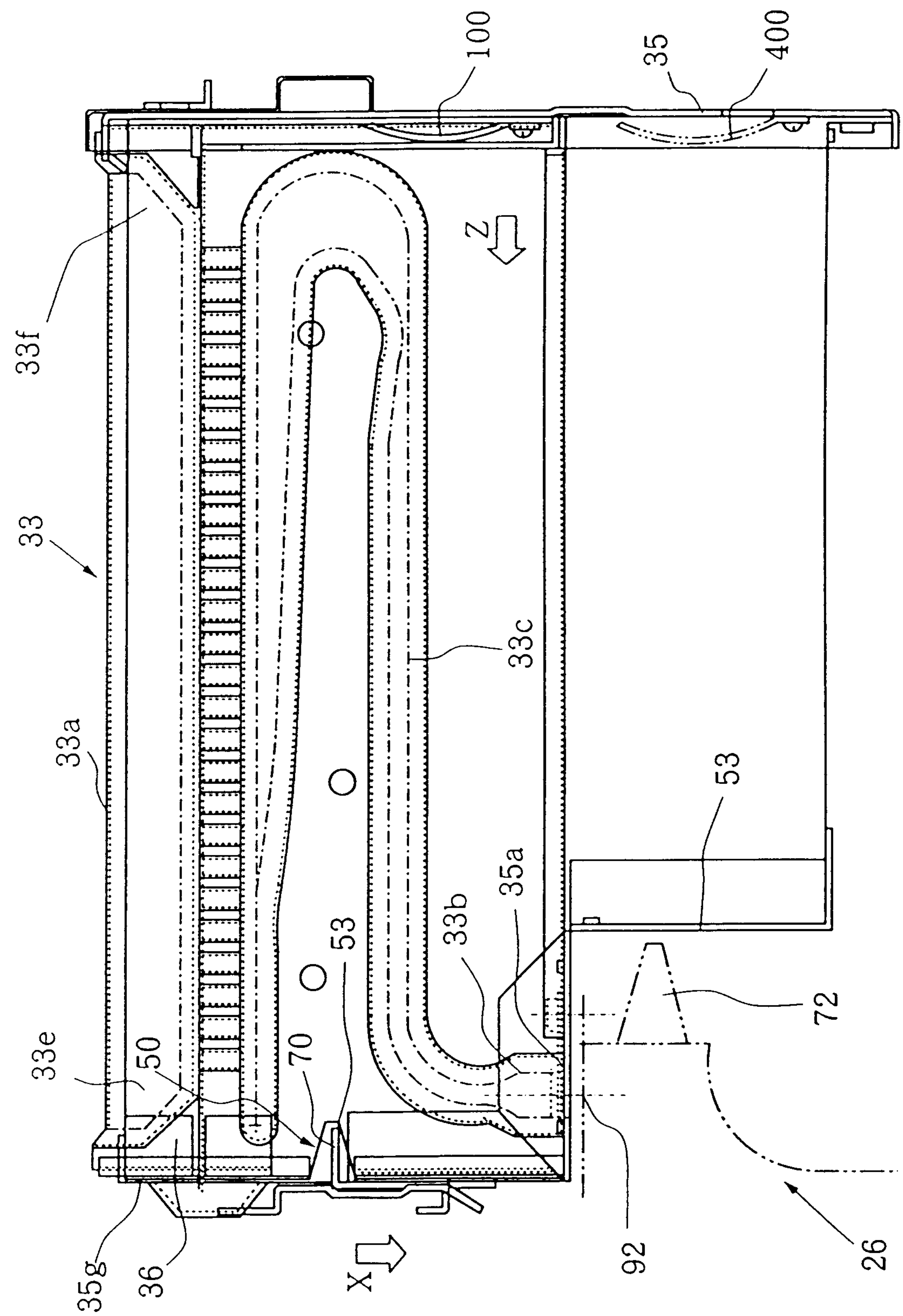

Fig. 8

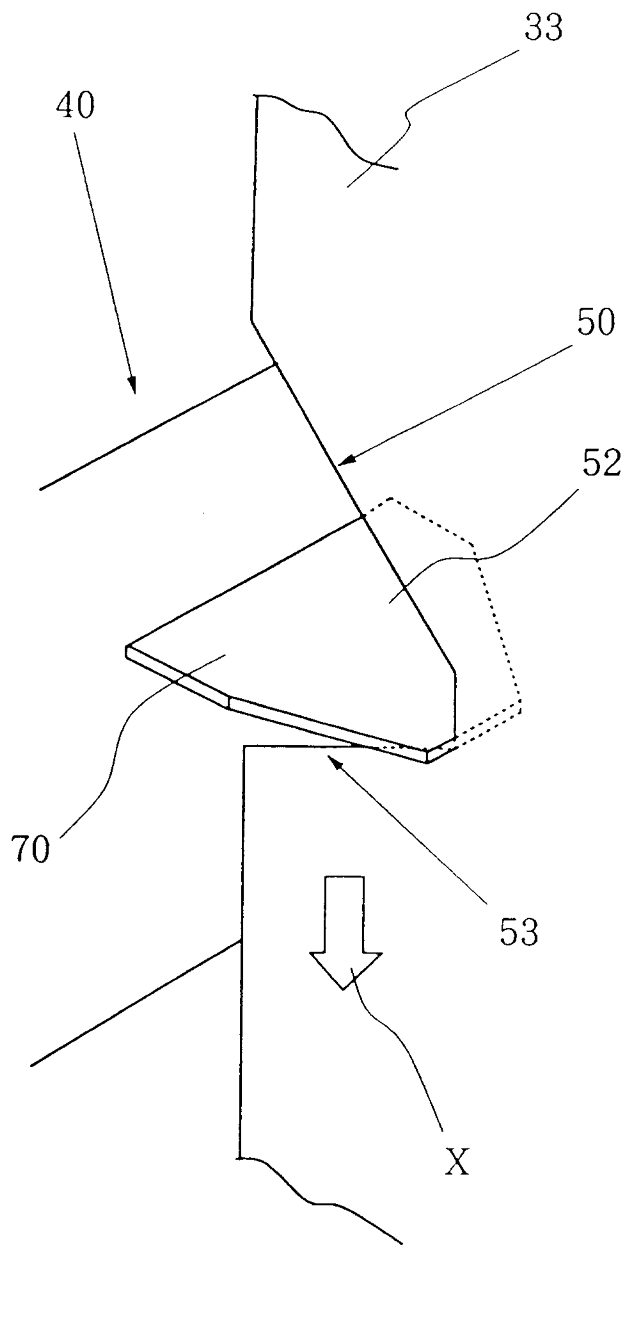

Fig. 9

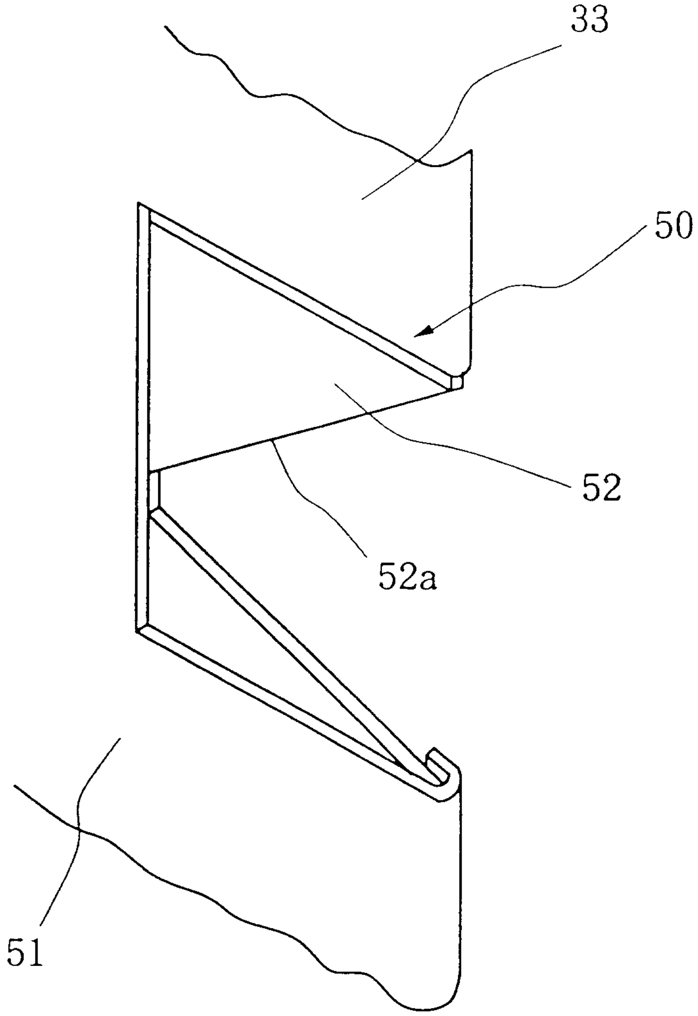

Fig. 10

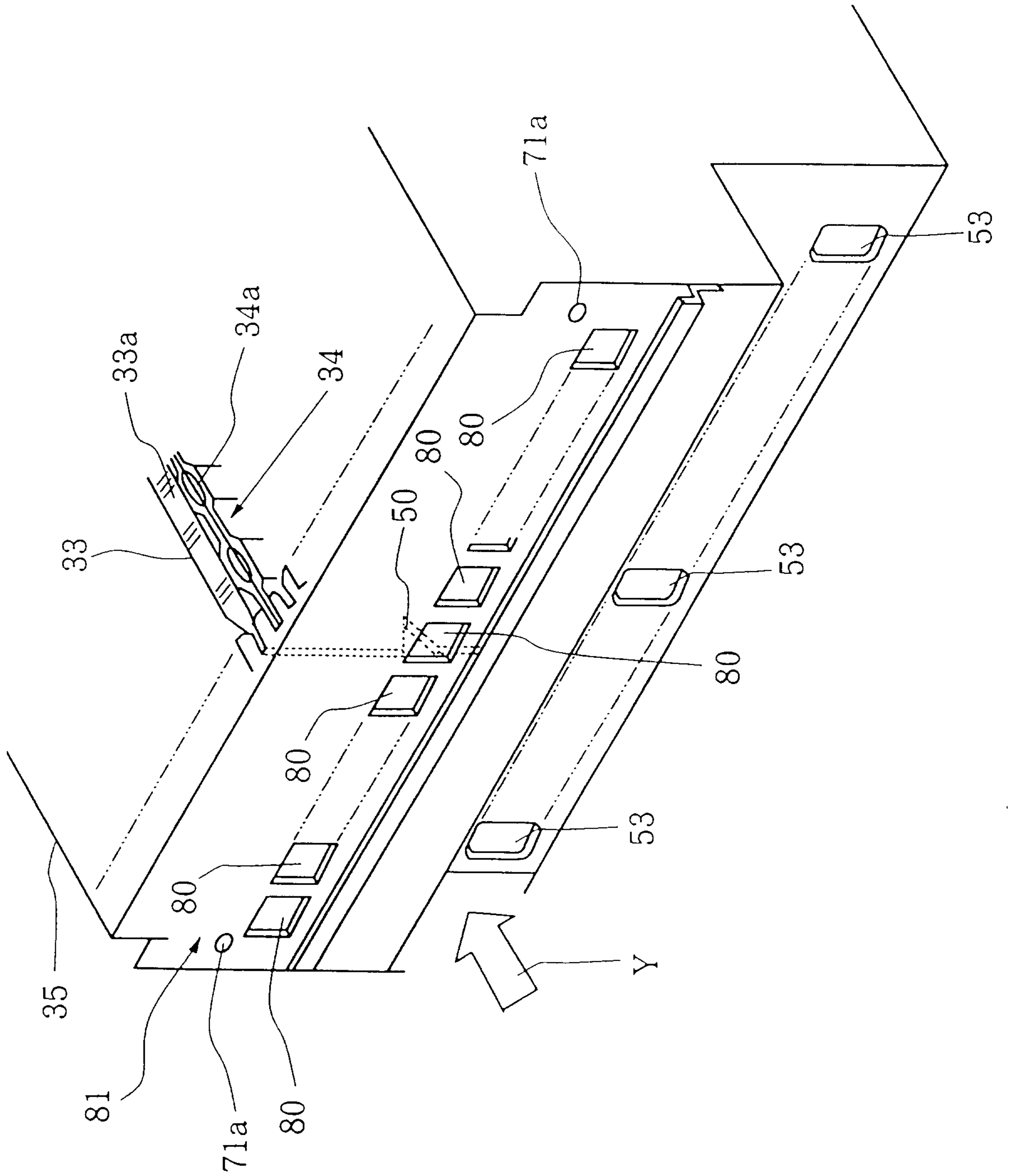

Fig. 11

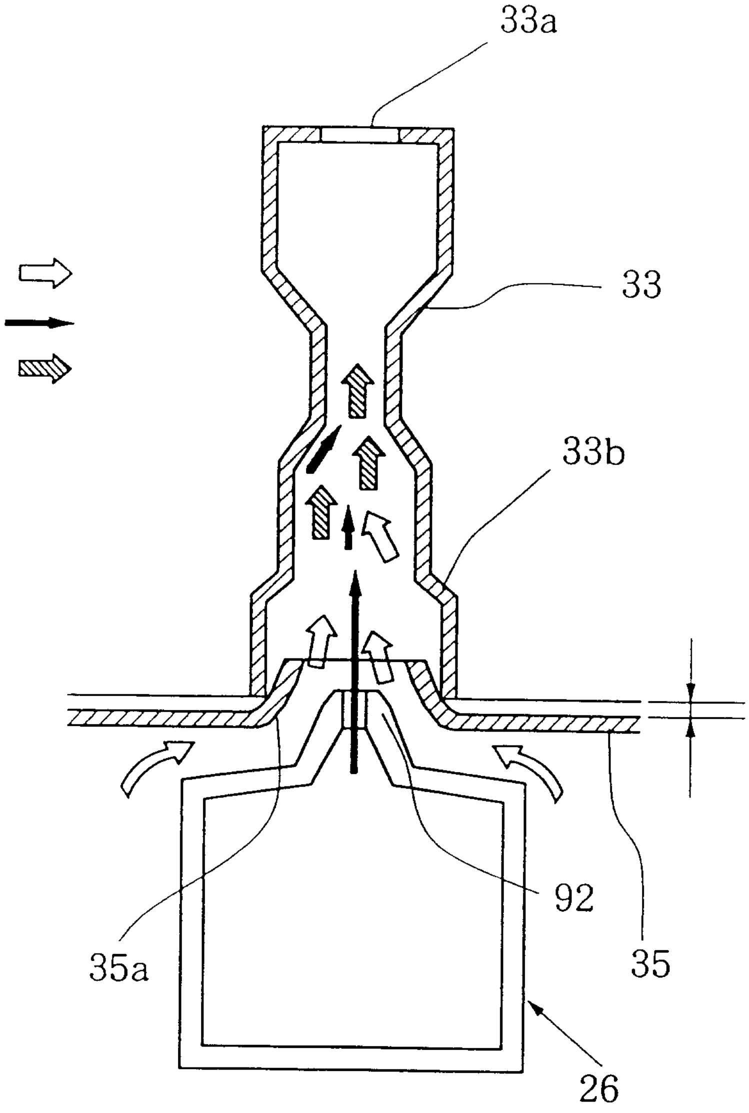

Fig. 12

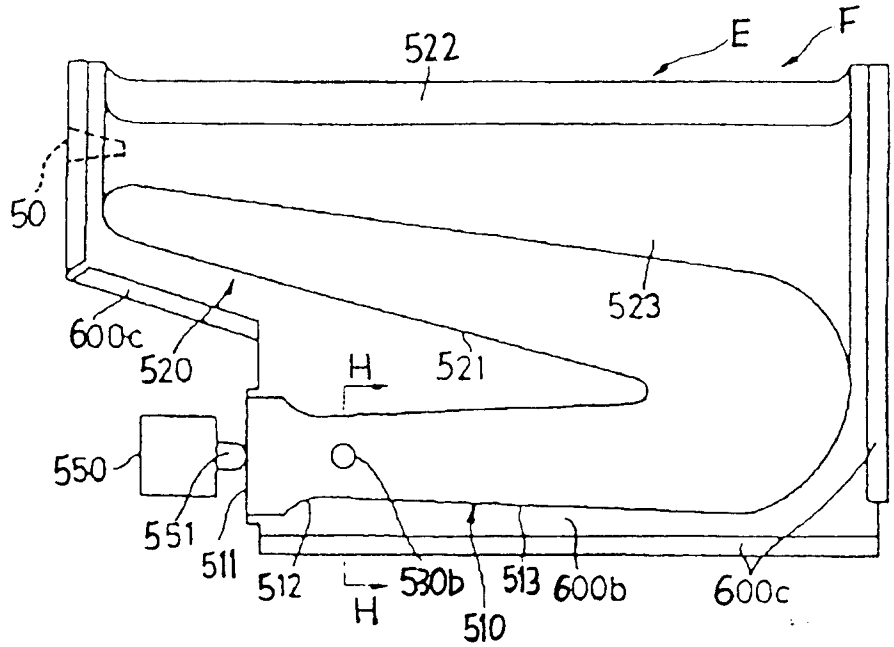
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Fig. 13

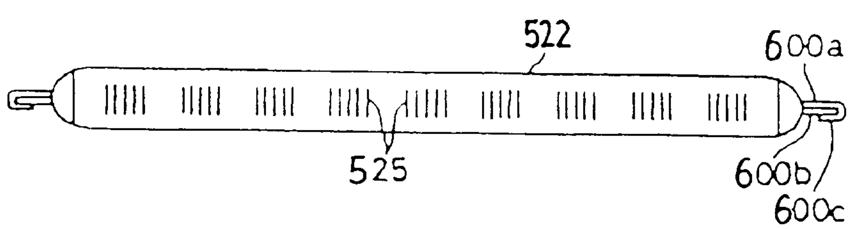
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Fig. 14

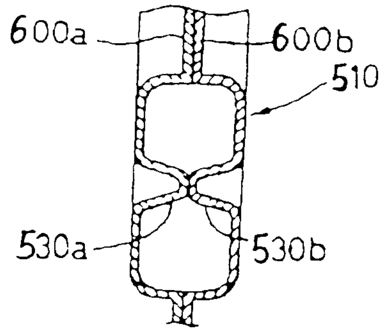


Fig. 15

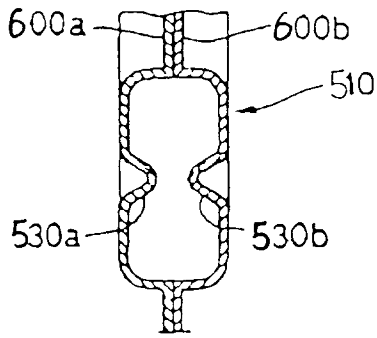


Fig. 16

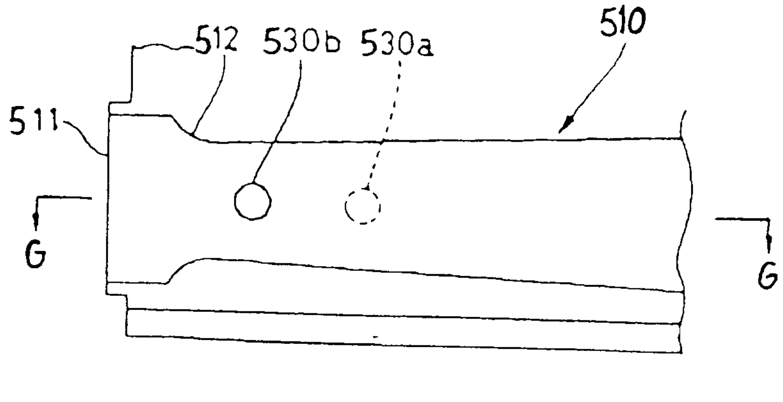


Fig. 17

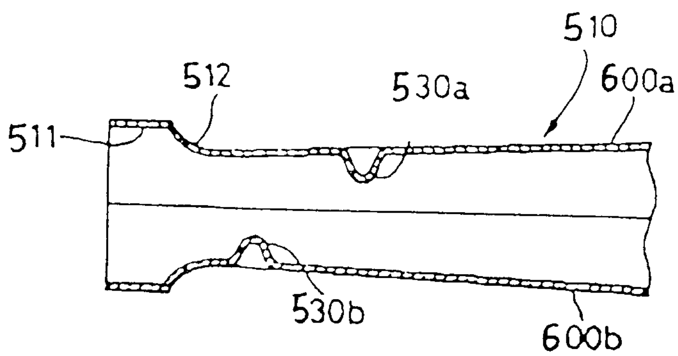


Fig. 18

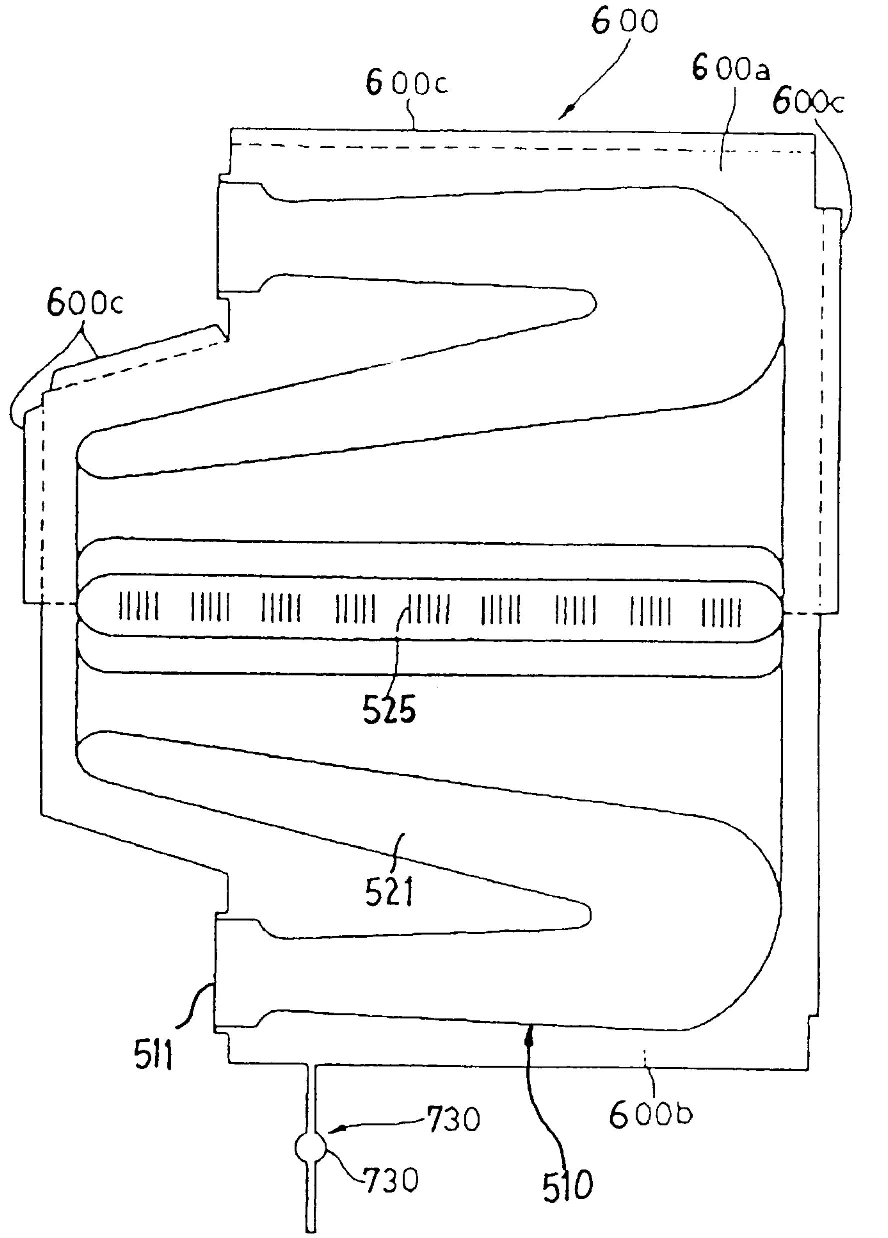


Fig. 19

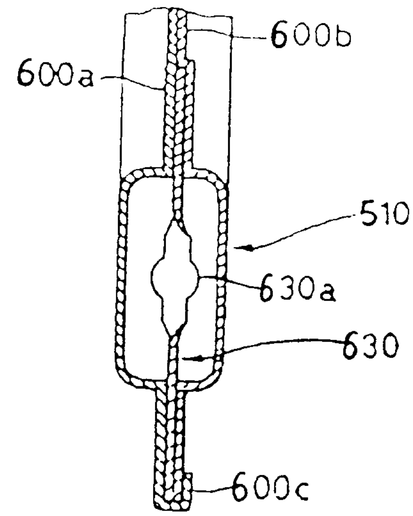


Fig. 20

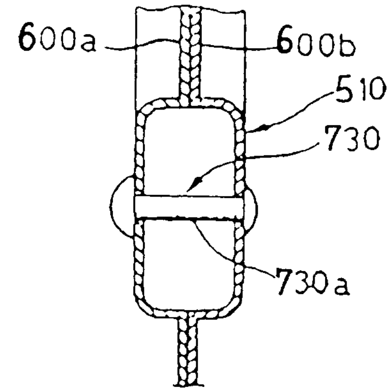


Fig. 21

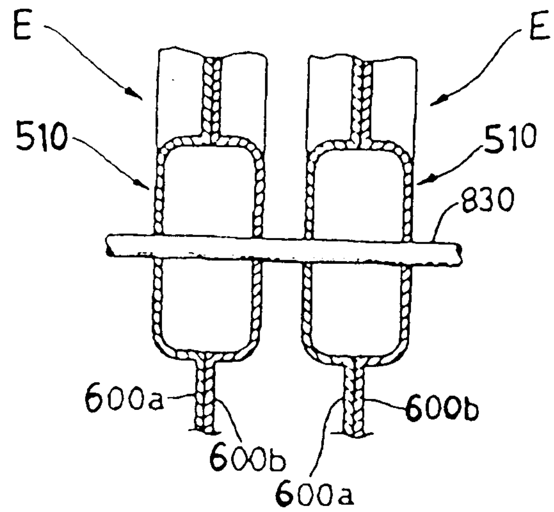


Fig. 22

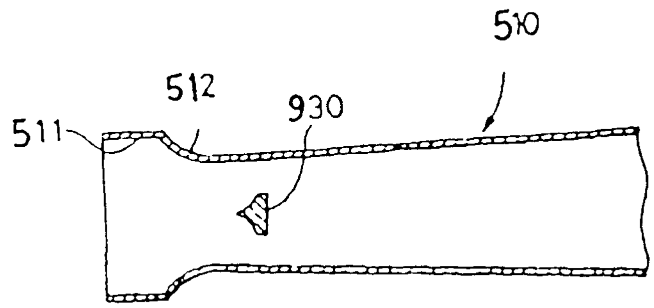


Fig. 23

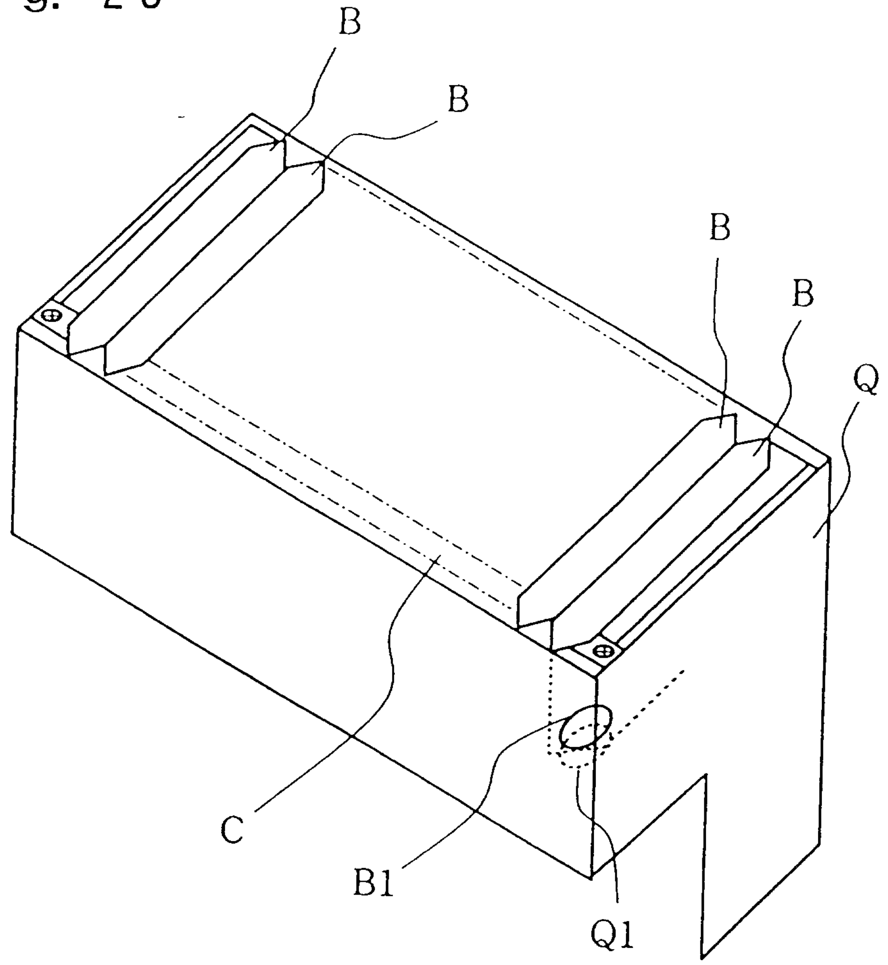
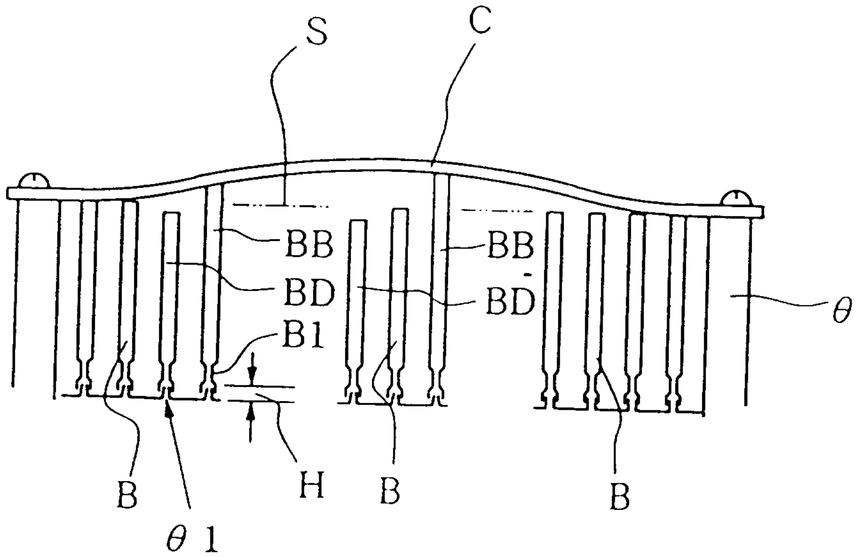


Fig. 24



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP96/00138

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl[6] F23C5/02, F23D14/08, F23D14/64, F23D14/70, F24H9/18

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl[6] F23C5/00-5/02, F23D14/00-14/08, 14/62-14/64, 14/70, F24H9/18

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

Jitsuyo Shinan Koho 1926 - 1996
Kokai Jitsuyo Shinan Koho 1971 - 1996
Toroku Jitsuyo Shinan Koho 1994 - 1996

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 63-82162, U (Atago Seisakusho K.K.), May 30, 1988 (30. 05. 88)(Family: none)	1
X	JP, 55-77003, U (Paloma Industries, Ltd.), May 27, 1980 (27. 05. 80)(Family: none)	1, 2
A	JP, 6-300228, A (Osaka Gas Co., Ltd.), October 28, 1994 (28. 10. 94)(Family: none)	3 - 6
X	JP, 51-31837, U (Toshiba Corp.), March 8, 1976 (08. 03. 76)(Family: none)	7, 8
X	JP, 5-508469, W (Joh Vaillant GmbH u. Co.), November 25, 1993 (25. 11. 93), Lines 5 to 8, lower left column, page 6, Fig. 7 & DE, 4207814, A & EP, 529042, A1 & WO, 9216796, A1	7 - 9
PX	JP, 7-63310, A (Gaster K.K.), March 7, 1995 (07. 03. 95)(Family: none)	7 - 12

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

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"P" document published prior to the international filing date but later than the priority date claimed
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
March 18, 1996 (18. 03. 96)	April 9, 1996 (09. 04. 96)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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