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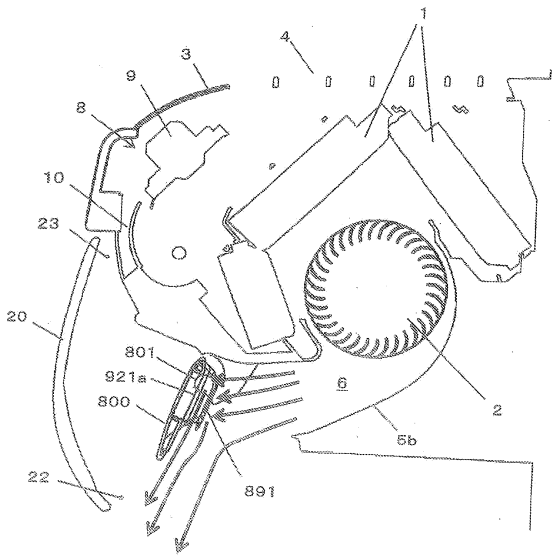
(54) AIR CONDITIONER

(57) According to the present invention, there is provided an air conditioner which is capable of, even when the direction of wind blown out from a blow-out port is greatly changed, efficiently releasing ions to a distant place. Specifically, the air conditioner according to the present invention is configured by including a wind direction changing plate 800 which changes the direction of wind WO blown out from a blow-out port 5, an ion generating section 921a which is provided in the wind direction changing plate 800, and a guiding section 891 which, when the wind direction changing plate 800 is held in an inclined attitude oriented at an angle with respect to the blow-out direction of the wind, protects the ion generating section 921a by preventing the wind WO blown out from the blow-out port 5 from being brought into direct contact with the ion generating section 921a, and which guides the wind flowing along the wind direction changing plate 800 into the ion generating section 921a.

FIG. 4



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Description

Technical Field

[0001] The present invention relates to an air conditioner having an ion generating section.

Background Art

[0002] In recent years, as an air conditioner having a high added value, there has been introduced an air conditioner provided with an ion generating apparatus which generates positive and negative ions by electric discharge. Meanwhile, positive and negative ions are extinguished in nature when they collide with an obstacle in the process of being carried by an air flow.

[0003] Therefore, as for the mounting position of the ion generating apparatus in an air conditioner, the ion generating apparatus is preferably provided at a position on the downstream side of the louver provided in the blow-out port, and is normally provided at a position slightly above the air blow-out port in many cases. However, when the ion generating apparatus is provided at this position, and when the flow direction of the air blown out from the blow-out port is adjusted obliquely downward by the louver, there is a problem that ions can be hardly carried by the air flow and hence the number of positive and negative ions carried by the air flow is reduced so as to thereby increase the loss of the ions.

[0004] As an air conditioner configured to solve the above described problem, there is known a type, as described in Patent Document 1, in which an ion generating electrode for generating ions is formed on the surface of the louver. In the above described air conditioner, on the downstream side of the flow of the air which flows along the surface of the blade section of the louver, there is no obstacle impeding the flow, and hence the number of positive and negative ions generated from the ion generating electrode body can be prevented from being reduced, so that the supply efficiency of positive and negative ions can be improved.

Patent Document 1: Japanese Patent Laid-Open No. 2004-347264

Disclosure of the Invention

Problems to be Solved by the Invention

[0005] Meanwhile, when the direction of the wind blown out from the blow-out port is greatly changed in the air conditioner having the above described configuration, the louver is greatly inclined to the flow of the wind. At this time, in the case where the ion generating electrode is formed on the surface of the louver surfaces, which surface faces the upstream side of the wind flow, the generated ions are pressed against the louver surface by the wind blown out from the blow-out port. Thereby, the positive and negative ions are made to collide with the louver, so that the number of ions is reduced.

[0006] On the other hand, in the case where the ion generating electrode is formed on the surface of the louver surfaces, which surface faces the downstream side of the wind flow, it is not possible to make the generated ions smoothly carried by the wind blown out from the blow-out port. This makes it difficult to send the ions generated by the ion generating electrode to a distant place.

[0007] In view of the above, it is an object of the present invention to provide an air conditioner which is capable of, even when the direction of the wind blown out from the blow-out port is greatly changed, efficiently releasing ions to a distant place.

Means for Solving the Problems

[0008] In order to achieve the above described object, an air conditioner according to the present invention is characterized by including: a wind direction changing plate which is rotated so as to change the direction of wind blown out from a blow-out port; an ion generating section which is provided in the wind direction changing plate; and a guiding section which guides the wind to the ion generating section, and is characterized in that, when the wind direction changing plate is held in an attitude inclined at an angle with respect to the blow-out direction of the wind, the wind flowing along the wind direction changing plate is guided by the guiding section to the ion generating section.

[0009] According to the above described configuration, since the guiding section is provided, even when the wind direction changing plate is oriented so as to be inclined at an angle with respect to the blow-out direction of the wind, the ions generated by the ion generating section can be smoothly carried by the wind flowing along the wind direction changing plate, so as to be sent to a distant place.

[0010] Specifically, the guiding section includes a guide plate which is separated from the wind direction changing plate so as to face the wind direction changing plate, and is configured such that an air passage is formed between the guide plate and the wind direction changing plate, and that the ion generating section is arranged in the air passage.

[0011] According to the above described configuration, while the ions are generated in the space in the air passage, the generated ions can be smoothly carried to the outside of the air passage by the wind passing through the air passage. Note that the guiding section may only include the guide plate, and a side wall for supporting the guide plate can also be suitably provided.

[0012] Further, it is also possible to use, as the guiding section, a tubular member configured such that the ion generating section is surrounded by the guide plate and the side wall. In this case, it may be configured such that the tubular member is provided on the wind direction changing plate so as to allow the lengthwise direction of

the tubular member to be set in parallel with the surface of the wind direction changing plate, and that the ion generating section is arranged in the tubular member.

[0013] The upstream side end section of the guide plate in the flow direction of the wind blown out from the blow-out port at the time when the guide plate is held in an inclined attitude is preferably arranged so as to be located on the wind flow direction downstream side from the proximal end of the wind direction changing plate. Thereby, the amount of the wind introduced into the guiding section can be increased, and the wind having passed through the guiding section can be smoothly mixed with the wind having detoured the guide section, so that the ions can be efficiently carried to a distant place.

[0014] Further, it is also possible to increase the amount of the wind introduced into the guiding section by forming the guide plate in such a manner that the upstream side end section of the guide plate in the flow direction of the wind at the time when the guide plate is held in an inclined attitude is inclined to the wind direction changing plate so that the distance between the guide plate and the wind direction changing plate is increased toward the upstream side.

[0015] Further, when a guard member which prevents a finger from entering the air passage is provided in each of the inlet and outlet ports of the air passage formed by the guiding section, it is possible to prevent electric shock at the ion generating section. Thereby, it is possible to improve the safety of the air conditioner.

[0016] The ion generating section may be configured to generate either positive ions expressed as $H^+(H_2O)$ (where m is an arbitrary natural number) or negative ions expressed as $O_2^-(H_2O)_n$ (where n is an arbitrary natural number). The ion generating section may be configured such that the positive and negative ions are alternately generated by the same ion generating section. However, it is preferred to use the ion generating sections, each of which independently generates the positive ions or the negative ions.

[0017] When the positive ion generating section and the negative ion generating section are separately formed as the ion generating section, it is preferred that the respective ion generating sections are arranged at an interval respectively in parallel with the direction of the wind flowing along the wind direction changing plate. This makes it possible to prevent that the positive and negative ions, which are generated by the respective ion generating sections, are brought into contact and reaction with each other, so as to thereby be extinguished.

[0018] Specifically, as the above described wind direction changing plate, there can be listed a wind guide panel which is provided as a part of a cabinet in the front side of the blow-out port. In this case, the ion generating section and the guiding section may be formed in a part of the inner surface of the wind guide panel. Further, the air conditioner having the above described wind guide panel can also be configured such that the wind direction changing plate is an auxiliary louver which, while rectifying the wind blown out from the blow-out port, changes the vertical wind direction, and in which the ion generating section is provided, and such that there is provided a control section which performs drive control of the wind direction changing plate so as to change the vertical angle of the wind direction changing plate according to the attitude of the wind guide panel.

[0019] Further, it can also be configured such that at least one louver of a louver group including a plurality of louvers provided in the blow-out port of a conventional air conditioner is used as the wind direction changing plate as described in the present invention, and that the ion generating section and the guiding section are provided in the wind direction changing plate.

Effects of the Invention

[0020] As described above, according to the present invention, the guiding section is provided in the wind direction changing plate, and the ion generating section is provided in the air passage formed in the guiding section. Thereby, even when the wind direction changing plate is oriented at an angle with respect to the wind flow direction, the ions can be efficiently released to a distant place.

Brief Description of the Drawings

[0021]

Figure 1 is a perspective view of an indoor unit of an air conditioner, showing a first embodiment according to the present invention;

Figure 2 is a schematic sectional view of the indoor unit when a wind guide panel is closed;

Figure 3 is a perspective view of the indoor unit when the wind guide panel is upwardly opened;

Figure 4 is a schematic sectional view of the indoor unit when the wind guide panel is upwardly opened;

Figure 5 is a perspective view of the indoor unit when the wind guide panel is downwardly opened;

Figure 6 is a schematic sectional view of the indoor unit when the wind guide panel is downwardly opened;

Figure 7 is a control block diagram of the air conditioner;

Figure 8 is a schematic sectional view of the indoor unit, showing an opening and closing mechanism of the wind guide panel;

Figure 9 is a figure for explaining movement of a changing section in a regulating section, in which Figure 9(a) shows an initial state, and Figure 9(b) shows an upwardly opened state, and in which Figure 9(c) shows a downwardly opened state;

Figure 10 is a figure for explaining movement of the regulating section, in which Figure 10(a) shows the initial state, and Figure 10(b) shows the upwardly opened state, and in which Figure 10(c) shows the downwardly opened state;

Figure 11 is a schematic sectional view of the indoor unit, showing a moving section when the wind guide panel is closed;
Figure 12 is a schematic sectional view of the indoor unit, showing the moving section when the wind guide panel is upwardly opened;
Figure 13 is a schematic sectional view of the indoor unit, showing the moving section when the wind guide panel is downwardly opened;
Figure 14 is an exploded perspective view of the regulating section;
Figure 15 is an exploded perspective view of the moving section;
Figure 16 is an exploded perspective view of an auxiliary louver;
Figure 17 is an exploded sectional view of the auxiliary louver;
Figure 18 is an exploded perspective view of an ion generating element;
Figure 19 is a figure showing function blocks of an ion generating apparatus;
Figure 20 is an external perspective view of the ion generating apparatus;
Figure 21 is a plan view showing a part of the auxiliary louver in the state where the guide plate is removed;
Figure 22 is a sectional view of the auxiliary louver;
Figure 23 is a sectional view showing another mode of the auxiliary louver;
Figure 24 is an enlarged sectional view showing the auxiliary louver in Figure 4;
Figure 25 is an enlarged sectional view showing the auxiliary louver in Figure 6;
Figure 26 is a schematic sectional view of an indoor unit of an air conditioner according to a second embodiment, showing a state where a wind guide panel is upwardly opened; and
Figure 27 is a schematic sectional view of the indoor unit in Figure 26 when the wind guide panel is downwardly opened.

Description of Symbols

[0022]

3	Cabinet
5	Blow-out port
20	Wind guide panel
22	Lower shaft
23	Upper shaft
31	Support
32	Rod
800	Auxiliary louver
801	Rotary shaft
803	Louver motor
804	Upper member
805	Lower member
805a	Opening
891	Guide plate
892	Air passage
893	Guard member
910	Ion generating element
920	Ion generating apparatus
921	Case
921a	Ion generating section

Best Mode for Carrying Out the Invention

[First embodiment]

[0023] Figures 1 and 2 show an indoor unit of an air conditioner of a first embodiment according to the present invention. The indoor unit includes a heat exchanger 1 and an indoor fan 2 which are housed in a cabinet 3. The cabinet 3 is formed in a box shape which has a depth greater than a height and which has a curved surface extending from the front surface to the bottom surface. A suction port 4 is formed in the upper surface of the cabinet 3, and a blow-out port 5 is formed in the curved surface.

[0024] An air passageway 6 extending from the suction port 4 to the blow-out port 5 is formed in the inside of the cabinet 3, and the heat exchanger 1 and the indoor fan 2 are arranged in the air passageway 6. A filter 7 is arranged between the suction port 4 and the heat exchanger 1, so as to remove dust from the indoor air sucked from the suction port 4. There is provided a cleaning apparatus 8 which cleans the filter 7.

[0025] The filter 7 is moved by the cleaning apparatus 8 in the cabinet 3 so as to pass through a dust removing section 9. Thereby, the dust adhering to the filter 7 is removed in the dust removing section 9. A guide passage 10 curved in a U-shape in side view is formed on the front side in the cabinet 3, and a moving section made of a motor and a gear reciprocates the filter 7 along the guide passage 10. In the dust removing section 9, the dust is scraped by a rotating brush from the filter 7 passing through the dust removing section 9. By a suction fan, air is made to flow in the direction substantially in parallel with the filter 7 (in the left and right direction), so that the scraped dust is sucked and discharged.

[0026] A wind guide panel 20 which opens and closes the blow-out port 5 is provided on the curved surface of the cabinet 3. As shown in Figure 3 to Figure 6, the wind guide panel 20 is configured to be able to be upwardly and downwardly opened, and there is provided an opening and closing mechanism which opens and closes the wind guide panel 20.

[0027] The wind guide panel 20 is formed by one curved panel, so as to have a width which is the same as the width of the cabinet 3 and which is larger than the width of the blow-out port 5. Further, in the front surface of the cabinet 3, a front panel 21 is formed from the middle stage portion of the front surface to the bottom surface so as to be one stage lower than the front surface. Thereby, a recessed section is formed over the whole width direction so that the wind guide panel 20 can be fit into

the recessed section. An opening is formed in the front panel 21 which forms the recessed section, and the opening serves as the blow-out port 5. Therefore, the wind guide panel 20 is located in front of the blow-out port 5, so as to cover the blow-out port 5 and the front panel 21 around the blow-out port 5. At this time, the wind guide panel 20 is held in a closed attitude as shown in Figure 2.

[0028] When the wind guide panel 20 is held in the closed attitude, there are formed gaps between the cabinet and the front and rear ends of the wind guide panel 20. As shown in Figures 4 and 6, when the wind guide panel 20 is opened or closed, the end section of the wind guide panel 20 is made to enter the gap. Thus, the wind guide panel 20 can be smoothly rotated without being brought into contact with the cabinet 3. Further, it is possible to prevent the leaking of the blown-out wind by forming the front and rear end sections of the wind guide panel 20 in such a manner that the wind guide panel 20 is brought into contact with the cabinet 3 at the time when the wind guide panel 20 is fully opened upward or downward. In particular, in the case of cool air, it is possible to prevent dew condensation on the bottom surface side of the cabinet 3.

[0029] In this way, the outer surface of the wind guide panel 20 forms a smooth curved surface extending from the front surface to the bottom surface of the cabinet 3. That is, the wind guide panel 20 is formed as a member, which configures a part of the front surface of the cabinet 3. In other words, a part of the panel of the cabinet 3 is used as the wind guide panel 20. Thereby, the wind guide panel 20 is formed into a long panel having a total length greater than that of the louver adopted in a conventional air conditioner.

[0030] The wind guide panel 20 is rotated about an upper or lower shaft in the different directions so as to thereby be upwardly or downwardly opened. The upper shaft 23 and the lower shaft 22 are formed in parallel with the left and right direction of the cabinet 3. As shown in Figures 5 and 6, at the time of the cooling operation, the wind guide panel 20 is downwardly opened about the lower shaft 22. When held in the downwardly opened attitude, the wind guide panel 20 is connected to the low wall of the blow-out port 5, so that a long nozzle is formed by the wind guide panel 20 and the upper wall of the blow-out port 5. The wind guide panel 20 guides the cool air in the obliquely upward direction so that the cool air is blown out toward the ceiling.

[0031] As shown in Figures 3 and 4, at the time of the heating operation, the wind guide panel 20 is upwardly opened about the upper shaft 23. When held in the upwardly opened attitude, the wind guide panel 20 covers the front of the blow-out port 5 and suppresses the flow of warm air blown out toward the front so as to guide the warm air toward the floor surface. Note that at the initial stage of the cooling operation, the wind guide panel 20 is held in the upwardly opened attitude to allow the cool air to be blown out toward the floor surface, so that the rapid cooling is performed. As shown in Figure 2, at the non-operation time, the wind guide panel 20 is held in the closed attitude and covers the blow-out port 5 so as to be integrated with the cabinet 3.

[0032] In the present embodiment, an auxiliary louver 800 is provided in the blow-out port 5 in addition to vertical louvers 24. The vertical louver 24 changes its angle in the left and right direction so as to change the wind direction in the left and right direction. The auxiliary louver 800, which is provided at an outlet portion of the blow-out port 5 in front of the vertical louvers 24, changes the vertical angle thereof according to the attitude of the wind guide panel 20, and vertically changes the wind direction W0 of the wind blown out from the blow-out port 5 while rectifying the wind. In the present embodiment, the auxiliary louver 800 is used as a wind direction changing plate, and a guiding section and an ion generating section are provided in the auxiliary louver 800. In the following, the auxiliary louver 800 will be described in detail.

[0033] The auxiliary louver 800 is formed in a plate shape which is long in the left and right direction, and the front and rear end sections of which are formed in a tapered shape. On the rear end section side (proximal end side) of the auxiliary louver 800, a rotary shaft 801 whose axial direction is set in the left and right direction is fixed to shaft connecting sections formed in the left and right end sections of the auxiliary louver 800. Among upper and lower walls 5a and 5b which form the air passageway 6 reaching the blow-out port 5, the rotary shaft 801 is arranged on the side of the upper wall 5a, so as to be rotatably borne by penetrating the left and right side walls of the blow-out port 5. Further a louver motor 803 is connected to the shaft end of the rotary shaft 801 (see Figure 7) via a speed reducing mechanism (not shown), and is driven and controlled by a control section 41.

[0034] As shown in Figure 16 and Figure 17, the auxiliary louver 800 is configured by an upper member 804 and a lower member 805. An ion generating apparatus 920 is housed in the inside of the auxiliary louver 800. That is, one or more ion generating apparatuses 920 are incorporated in the auxiliary louver 800 in such a manner that the upper member 804 and the lower member 805 are combined to sandwich the ion generating apparatuses 920 therebetween. Note that in the present embodiment, three ion generating apparatuses 920 are incorporated in the auxiliary louver 800.

[0035] An opening 805a is formed in the lower member 805 so that a portion of the ion generating apparatus 920 is exposed from the opening 805a. An ion generating section 921a is formed in the portion of the ion generating apparatus 920, which portion is exposed from the lower member 805, and positive and negative ions are generated from the ion generating section 921a. Note that the portion of the ion generating apparatus 920, which portion is exposed from the opening 805a, is formed on the same surface as the surface of the lower member around the opening 805a, so as to allow the wind to smoothly flow along the surface of the lower member.

[0036] As shown in Figure 18 to Figure 20, the ion gen-

erating apparatus 920 includes an ion generating element 910, a case 921, a power supply input connector 922, a drive circuit 923, a high voltage generating circuit 924, a positive high voltage generating circuit 925, and a negative high voltage generating circuit 926.

[0037] The ion generating element 910 includes an induction electrode 901, a discharge electrode 902, and a substrate 903. The discharge electrode 902 has a needle-like tip. The substrate 903 includes through holes 903a in each of which the discharge electrode 902 is inserted, and through holes 903b in each of which an insertion portion 901d2 of a substrate insertion section 901d is inserted.

[0038] Each of the needle-like discharge electrodes 902 is supported by the substrate 903 in the state of being inserted or pressed into each of the through holes 903a so as to penetrate the substrate 903. Thereby, one end of the needle-like discharge electrode 902 is made to project to the front surface side of the substrate 903, while a lead wire and a wiring pattern can be electrically connected, with solder 904, to the other end projecting to the rear surface side of the substrate 903.

[0039] The insertion portion 901d2 of the induction electrode 901 is inserted into the through hole 903b, so as to be supported by the substrate 903 in the state of penetrating the substrate 903. Further, a lead wire and a wiring pattern can be electrically connected, with solder, to the tip of the insertion portion 901d2 projecting to the rear surface side of the substrate 903.

[0040] In the state where the induction electrode 901 is supported by the substrate 903, a step section located at the boundary between a supporting portion 901d1 and the insertion portion 901d2 is brought into contact with the surface of the substrate 903. Thereby, a top plate section 901a of the induction electrode 901 is supported at a predetermined distance from the substrate 903. Further, the tip of each of substrate supporting sections 901e of the induction electrode 901 is supplementally brought into contact with the surface of the substrate 903. That is, the induction electrode 901 can be positioned in the thickness direction of the substrate 903 by the substrate insertion section 901d and the substrate supporting section 901e.

[0041] Further, in the state where the induction electrode 901 is supported by the substrate 903, the discharge electrode 902 is arranged so that the needle-like tip of the discharge electrode 902 is located at the center of a circular through hole 901b and is located within the range of the thickness of the peripheral section of the through hole 901b (that is, within the range of the bent length of a bent section 901c).

[0042] In order to allow ions of both polarities, that is, positive ions and negative ions to be released, the induction electrode 901 is made to face each of the needle-like tips of the discharge electrodes 902 through an air space in such a manner that the position of the needle-like tip of the discharge electrode 902 for generating the positive ions, and the position of the needle-like tip of the discharge electrode 902 for generating the negative ions are respectively arranged by securing a predetermined distance therebetween, and that each of the needle-like tips of the discharge electrodes 902 is positioned at the center of each of the through holes 901b of the induction electrode 901 and is also arranged within the thickness range of the through hole 901b of the induction electrode 901.

[0043] In the above described ion generating element 910, when the plate-shaped induction electrode 901 and the needle-like discharge electrode 902 are arranged by securing the predetermined distance therebetween as described above, and when a high voltage is applied between the induction electrode 901 and the discharge electrode 902, corona discharge is generated at the tip of the needle-like discharge electrode 902. At least either the positive ions or negative ions are generated by the corona discharge, so that the ions are released to the outside of the ion generating element 910 from the through hole 901b provided in the induction electrode 901. Further, the ions can be released more effectively by additionally blowing the air.

[0044] Here, the positive ion is a cluster ion in which a plurality of water molecules attach around a hydrogen ion (H^+), and is expressed as $H^+(H_2O)_m$ (where m is an arbitrary natural number). Also, the negative ion is a cluster ion in which a plurality of water molecules attach around an oxygen ion (O_2^-), and is expressed as $O_2^-(H_2O)_n$ (where n is an arbitrary natural number).

[0045] Further, in the case where the ions of both polarities, that is, the positive ions and the negative ions are released, when the positive ions of $H^+(H_2O)_m$ (where m is an arbitrary natural number) and the negative ions of $O_2^-(H_2O)$, (where n is an arbitrary natural number) are respectively generated in the air in substantially the same amount, both the ions surround mold bacteria and viruses which float in the air, so that the floating mold bacteria, and the like, can be removed by the action of hydroxide radicals (•OH) as active species generated at this time.

[0046] In the above described ion generating apparatus, positive corona discharge is generated at the tip of one of the discharge electrodes 902, so as to generate positive ions, while negative corona discharge is generated at the tip of the other of the discharge electrodes 902, so as to generate negative ions. The waveform of the applied voltage is not particularly limited here, and it is assumed that a DC high voltage, a positively or negatively biased high voltage having an AC waveform, a high voltage having a pulse waveform, or the like, is used. The voltage value of the applied voltage is selected in a voltage range which is sufficient to generate the discharge and the predetermined ionic species.

[0047] In the power supply input connector 922, the DC power supply or mains AC power supply is supplied as input power supply. The drive circuit 923, to which the input voltage is supplied via the power supply input connector 922, boosts the input voltage by driving the high voltage generating circuit 924, so as to generate a high

voltage. The one end of the high voltage generating circuit 924 is electrically connected to the induction electrode 901. Further, the high voltage generating circuit 924 applies, through the positive high voltage generating circuit 925, the high voltage of positive polarity with respect to the induction electrode 901 to the needle-like discharge electrode 902 for generating positive ions. Further, the high voltage generating circuit 924 applies, through the negative high voltage generating circuit 926, the high voltage of negative polarity with respect to the induction electrode 901 to the needle-like discharge electrode 902 for generating negative ions.

[0048] The case 921 houses in the inside thereof the ion generating element 910, the power supply input connector 922, the drive circuit 923, the high voltage generating circuit 924, the positive high voltage generating circuit 925, and the negative high voltage generating circuit 926. The power supply input connector 922 is exposed to the outside of the case 921 in order to receive the input power supply from the outside.

[0049] Further, the case 921 has the hole 921a in the wall facing the through hole 901b of the ion generating element 910, and the hole 921a is used as the ion generating section. That is, in the state where the ion generating apparatus 920 is incorporated in the auxiliary louver 800, the ion generating section 921a is exposed to the outside from the opening 805a, so that positive and negative ions are released to the outside.

[0050] As shown in Figure 21, in the ion generating section, the positive ion generating section 921a for generating positive ions and the negative ion generating section 921a for generating negative ions are formed separately from each other, and the ion generating sections 921a and 921a are arranged at an interval respectively in parallel with the front and rear direction A in the state of being incorporated in the auxiliary louver 800.

[0051] Further, in the auxiliary louver 800, there is provided a guiding section which protects the ion generating section 921a by preventing the wind W0 blown out from the blow-out port 5 from being brought into direct contact with the ion generating section 921a, and which guides, to the ion generating section 921a, the wind flowing along the auxiliary louver 800 serving as the wind direction changing plate.

[0052] As shown in Figure 22, the guiding section includes a guide plate 891 which is arranged opposite to the lower member 805 at a position away from the lower member 805 so as to cover the ion generating section 921a. In other words, the guide plate 891 is larger than at least the ion generating section 921a. Note that a guide plate having a size enough to cover the case 921 is used in the present embodiment. Further, the space between the guide plate 891 and the lower member 805 is used as an air passage 892, and the wind is made to flow in the direction shown by the arrow.

[0053] The guide plate 891 in the present embodiment is arranged at a fixed interval from the surface of the lower member 805 so as to face the surface of the lower member 805. Therefore, when the surface of the lower member 805 is curved, the guide plate 891 is formed to have a similarly curved shape. Thereby, the air passage 892 is formed in parallel with the lower member 805. Note that the fixed interval is preferably set to an interval which makes it possible to secure a space distance and a creepage distance from the electrode of the ion generating element 910.

[0054] Note that the guide plate 891 is arranged so that the position of the end section 891a on the wind flow direction upstream side is set on the wind flow direction downstream side from the position of the proximal end 800a of the auxiliary louver 800. Further, as shown in Figure 23, the guide plate 891 can be formed in such a manner that the shape of the end section 891a on the wind flow direction upstream side is inclined with respect to the auxiliary louver 800 so that the distance from the auxiliary louver 800 is increased toward the upstream side. Thereby, it is possible to more efficiently take the wind into the air passage 892.

[0055] In an inlet 892a and an outlet 892b of the air passage 892, there are respectively installed guard members 893 which prevent a finger from entering the air passage 892. As the guard member 893 in the present embodiment, there is used, in each of the inlet and outlet of the air passage 892, a thin and long bar stretched in the left and right direction at an intermediate position between the guide plate 891 and the lower member 805.

[0056] The guard member 893 is formed to have a tapered shape at the front and rear end sections thereof, and is formed into a shape with low air resistance so that the flow of the wind flowing through the air passage 892 is disturbed as little as possible. Note that the ion generating section 921a in the present embodiment has a structure in which the needle-like discharge electrode 902 is installed in the recessed section. Thereby, the creepage distance can be increased, so that the safety can be further improved.

[0057] There will be specifically described the operation of the auxiliary louver 800 configured as described above. As shown in Figures 1 and 2, when the auxiliary louver 800 is held in the upwardly facing attitude so as to be in contact with the upper wall 5a, the auxiliary louver 800 can be housed in the space inside the blow-out port 5, so that the wind guide panel 20 can be closed.

[0058] In the state where the wind guide panel 20 is held in the upwardly opened attitude in which the lower end of the wind guide panel 20 is opened toward the front side by being rotated about the upper shaft 23, the control section 41 drives and control the louver motor 803 so that the auxiliary louver 800 is held in an inclined attitude oriented at an angle with respect to the flow of the wind so as to change the wind direction. Further, in the state where the wind guide panel 20 is held in the downwardly opened attitude in which the upper end of the wind guide panel 20 is downwardly opened by being rotated about the lower shaft 22, the control section 41 drives and control the louver motor 803 so that the auxiliary louver 800

is controlled so as to be oriented in parallel with the wind flow.

[0059] More particularly, the control section 41 controls the attitude of the auxiliary louver 800 so that when the wind guide panel 20 is held in the upwardly opened attitude, the auxiliary louver 800 covers the front of blow-out port 5 and suppresses the flow of air blown out toward the front so as to guide the air downward. Further, the control section 41 controls the angle of the auxiliary louver 800 so that when the wind guide panel 20 is held in the upwardly opened attitude, the direction of the wind blown out from the blow-out port 5 is changed in two steps by allowing the wind to hit the two members of the auxiliary louver 800 and the wind guide panel 20. In the following, there will be exemplified the attitudes of the wind guide panel 20 and the auxiliary louver 800. Note that Figure 8, Figure 11, Figure 12 and Figure 13 are illustrated by omitting the auxiliary louver in order to make it easy to understand mechanisms of a moving section and a regulating section of the wind guide panel, as will be described below.

[0060] Figure 4 shows an example in which the wind guide panel 20 is held in the upwardly opened attitude so that the auxiliary louver 800 is oriented at an angle with respect to the flow of the wind, and Figure 24 is a partially enlarged view of Figure 4. As shown in the figure, when the auxiliary louver 800 is held in an attitude inclined to the wind W0 blown out toward the front from the blow-out port 5 through the air passageway 6, the lower member 805 is oriented to the upstream side with respect to the flow of the wind W0, so that the wind W0 directly hits the surface of the lower member. In order that the ions generated in the ion generating section 921a are carried by the flow of the wind so as to be sent to a distant place, it is preferred to form the ion generating section 921a in the surface of the lower member 805 which is directly hit by the wind.

[0061] However, in the case where the ion generating section 921a is provided in the surface of the lower member 805, when the auxiliary louver 800 is held in the inclined attitude, many of the generated ions may be extinguished by being pressed onto the surface of the lower member 805 by the wind blown toward the lower member 805.

[0062] Thus, in the present invention, as shown in the figure, the ion generating section 921a is protected in such a manner that the guide plate 891 is provided to thereby prevent the ion generating section 921a from being directly hit by the wind W0. Also, the air passage 892 is used as a space in which the ions are generated. Further, when the wind W0 hits a portion of the lower member 805 on the upstream side of the air passage 892, the wind W0 is changed in the direction thereof, and is introduced into the air passage 892, so as to push out the ions generated in the air passage 892 to the downstream side along the surface of the auxiliary louver (lower member). The wind W1 containing the ions and introduced from the air passage 892 is smoothly mixed with the wind W2 whose direction is changed by the surface of the guide plate 891 or the surface of the lower member 805. Thereby, the positive and negative ions can be carried by the wind W2 so as to be efficiently released to a distant place. Further, it is possible to reduce the number of generated ions which are extinguished by being pressed onto the surface of the lower member 805 by the wind blown toward the lower member 805.

[0063] Figure 6 shows an example in which the wind guide panel is held in the downwardly opened attitude so that the auxiliary louver 800 is oriented in parallel with the flow of the wind W0, and Figure 25 is a partially enlarged view of Figure 6. In this example, the wind guide panel 20 is downwardly rotated about the lower shaft 22 so as to be held substantially in a horizontal attitude. That is, when held in the downwardly opened attitude, the wind guide panel 20 is connected to the lower wall of the blow-out port 5 so that a long nozzle is formed by the wind guide panel 20 and the upper wall 5a of the blow-out port 5. Therefore, the wind is guided by the wind guide panel 20 in the obliquely upward direction, so as to be able to be blown out to a distant place along the ceiling. At this time, since the lower member 805 and the guide plate 891 of the auxiliary louver 800 are oriented in parallel with the flow of the wind W0, the wind W0 is introduced into the air passage 892 without being interrupted by the guide plate 891, so as to act to guide the air blown out from the blow-out port 5 together with the ions to a distant place.

[0064] Next, there will be described a mechanism for upwardly or downwardly opening the wind guide panel. Supports 31 are provided on both the left and right sides of the inner surface of the wind guide panel 20. The wind guide panel 20 is detachably attached to the supports 31. The support 31 is attached to the cabinet 3 via a rod 32. That is, the wind guide panel 20 is detachably attached to the cabinet 3 via the rod 32.

[0065] As shown in Figure 5, on both the left and right sides of the wind guide panel 20, there are provided claws 33 which can be freely slid in the left and right direction. The claw 33 faces the peripheral wall formed in the front and rear direction, and is energized by an urging member, such as a spring, toward the peripheral wall. The wind guide panel 20 is attached to the support 31 in such a manner that the support 31 is sandwiched between the claw 33 and the peripheral wall. The wind guide panel 20 can be removed from the support 31 by sliding the claw 33 in the direction away from the peripheral wall.

[0066] Note that the claw 33 may be provided at least on one side in the front and rear direction. In this case, on the other side, a pin is provided in one of the wind guide panel 20 and the support 31, and a hole is formed in the other in which the pin is not provided. The wind guide panel 20 is engaged with the support 31 by fitting the pin into the hole. When the claw 33 is formed on the one side, it is preferred to provide the pin on the rear side in consideration of workability. In this case, the user is able to attach or detach the wind guide panel 20, while

looking at the claw 33 in the state where the wind guide panel 20 is held in the downwardly opened attitude. Therefore, the user is able to easily and surely attach or detach the wind guide panel 20 and is also able to perform the attaching or detaching operation while supporting the wind guide panel 20 with a single hand. Thus, it is possible to prevent the falling off of the wind guide panel 20.

[0067] The upper shaft 23 of the wind guide panel 20 is provided on the front side of the support 31, while the lower shaft 22 is provided on the rear side of the support 31. The lower and upper shafts 22 and 23 are arranged along the left and right direction, and both ends of the lower and upper shafts 22 and 23 are supported so as to be separated from the support 31. The lower and upper shafts 22 and 23 are located on the outside of the blow-out port 5 in the front-and-rear and right-and-left directions, and are located in front of the blow-out port 5. Therefore, the lower and upper shafts 22 and 23 do not impede the flow of the wind blown out from the blow-out port 5.

[0068] Note that the support 31 may be integrated with the wind guide panel 20. The rod 32 is directly attached to the wind guide panel 20. In this case, when the rod 32 is detachably attached to the wind guide panel 20, the wind guide panel 20 can be detachably attached to the cabinet 3.

[0069] In the air conditioner, the outdoor unit (not shown) is installed in an outdoor location. A compressor, a heat exchanger, a four way valve, an outdoor fan, and the like, are incorporated in the outdoor unit, and a refrigerating cycle 40 is formed by the components and the heat exchanger 1 on the indoor side. Further, as shown in Figure 7, the control section 41 which controls the refrigerating cycle 40 is provided in the indoor unit. The control section 41 made of a microcomputer controls the refrigerating cycle 40 to perform the cooling and heating operation, on the basis of a user's instruction and detection signals of various sensors 42, such as temperature sensors which detect the room temperature and the outdoor air temperature. At this time, the control section 41 opens or closes the wind guide panel 20 by controlling an opening and closing mechanism according to the cooling or heating operation. Further, the control section 41 cleans the filter 7 by controlling the cleaning apparatus 8 periodically or according to the instruction from the user.

[0070] The opening and closing mechanism is configured by a moving section 50 which brings the wind guide panel 20 close to or away from the cabinet 3 as shown in Figure 7, and a regulating section 51 which regulates the opening direction of the wind guide panel 20 at the time when the wind guide panel 20 is moved.

[0071] When the wind guide panel 20 is opened, the moving section 50 moves the wind guide panel 20 in the direction in which the wind guide panel 20 is separated from the cabinet 3. At this time, the regulating section 51 allows either the upward opening or the downward opening of the wind guide panel 20, and changes the opening direction of the wind guide panel 20 by regulating the opening in the other direction. When the downward opening is regulated, the wind guide panel 20 is upwardly opened. On the contrary, when the upward opening is regulated, the wind guide panel 20 is downwardly opened. When the wind guide panel 20 is closed, the wind guide panel 20 is moved by the moving section 50 in the direction of approaching the cabinet 3.

[0072] That is, the regulating section 51 regulates the opening direction by locking the movement of one of the upper shaft 23 and the lower shaft 22. When the wind guide panel 20 is downwardly opened, the lower shaft 22 is locked. When the wind guide panel 20 is upwardly opened, the upper shaft 23 is locked.

[0073] Further, the regulating section 51 has a function to hold the closed attitude of the wind guide panel 20. The wind guide panel 20 in the closed attitude is held close to the front panel 21 of the cabinet 3. At this time, the regulating section 51 locks the upper shaft 23 and the lower shaft 22. Even when the external force is applied to separate the wind guide panel 20, the wind guide panel 20 is not moved because both the shafts 22 and 23 are locked.

[0074] In this way, a driving source only for moving the wind guide panel 20 only needs to be provided as the driving source for opening or closing the wind guide panel 20. Further, the driving source only needs to effect a simple operation, such as reciprocating the wind guide panel 20. Therefore, the moving section 50 can be realized by a simple mechanism which reciprocates the wind guide panel 20. Thereby, the opening and closing mechanism can be simplified and miniaturized.

[0075] As shown in Figures 9 and 10, the regulating section 51 includes a pair of upper and lower hooks 52 and 53 which respectively hold the upper and lower shafts 23 and 22, a changing section 54 which changes the opening direction by regulating the operation of each of the hooks 52 and 53, a linkage section 55 which enables the hooks 52 and 53 to be operated in linkage with each other, and a driving section 56 which drives the linkage section 55. As show in Figures 11 to 13, the moving section 50 includes the rod 32 which holds the wind guide panel 20, a moving mechanism section 57 which moves the rod 32 into and out of the cabinet 3, and a driving section 58 which drives the moving mechanism section 57.

[0076] A left and right pair of the regulating sections 51 are provided in the cabinet 3, and are arranged outside the blow-out port 5 in the left and right direction. As shown in Figure 14, the regulating section 51 is configured, as a unit, on a base plate 60. The base plate 60 is fixed to the inside of the cabinet 3.

[0077] The upper hook 52 and the lower hook 53 are respectively rotatably supported by fixed shafts 61 fixed to the base plate 60. Inlet/outlet ports 21a which respectively allow the hooks 52 and 53 to be projected or retracted are formed in the upper and lower portions of the front panel 21, respectively. The upper hook 52 is projected from the inlet/outlet port 21a, so as to hook the

upper shaft 23 from the lower side. The upper shaft 23 is held by being sandwiched between a receiving base 62 formed in the front panel 21 and the upper hook 52. Similarly, the lower hook 53 is also projected from the inlet/outlet port, so as to hook the lower shaft 22 from the lower side, so that the lower shaft 22 is held by being sandwiched between a receiving base 63 and the lower hook 53.

[0078] The linkage section 55 enables each of the hooks 52 and 53 to be operated by using a link mechanism. Specifically, the linkage section 55 is configured by a pair of upper and lower links 64 and 65, and a linkage plate 66. The upper and lower links 64 and 65 connect the upper and lower hooks 52 and 53 to the linkage plate 66, respectively. That is, a shaft 64a is formed at one end of the upper link 64, so as to be fitted into a shaft hole of the upper hook 52. The upper hook 52 is rotatably supported at the one end of the upper link 64. The lower link 65 and the lower hook 53 are also similarly configured.

[0079] The other end of the upper link 64 is rotatably attached to the linkage plate 66. The linkage plate 66 is formed into a fan-shaped gear, and gear teeth are formed on the circular arc surface of the linkage plate 66. The linkage plate 66 is rotatably supported by a fixed shaft 67 which is projectingly provided on the base plate 60. A pair of long grooves 68 are formed in the linkage plate 66, and other end shafts 64b and 65b of the upper and lower links 64 and 65 are fitted into the long grooves 68, respectively. Each of the long grooves 68 is extended in the radial direction from the fixed shaft 67 serving as the center. The other end shafts 64b and 65b of the links 64 and 65 are respectively made movable in the radial direction, so that a play is provided by each of the long grooves 68.

[0080] By the rotation of the linkage plate 66, the links 64 and 65 are respectively moved in linkage with each other between the fixed shafts 61 of the hooks 52 and 53 and the fixed shaft 67 of the linkage plate 66. Thereby, the hooks 52 and 53 can be rotated about the fixed shafts 61, respectively.

[0081] The driving section 56 is configured by a plurality of gears 69 and a regulating motor 70. The regulating motor 70 is provided on a mounting base 71 attached to the base plate 60. The motor shaft of the regulating motor 70 is fitted into the gear 69, so that the driving force of the regulating motor 70 is transmitted to the linkage plate 66 via the plurality of gears 69. When the regulating motor 70 is driven, the linkage plate 66 is rotated about the fixed shaft 67.

[0082] As shown in Figure 10, the changing section 54 respectively guides the movement of the other end shafts 64b and 65b of the links 64 and 65. A regulating groove 72 is formed in the mounting base 71, and both the other end shafts 64b and 65b are fitted in the regulating groove 72. The movement of each of the hooks 52 and 53 is defined in such a manner that the links 64 and 65 are moved differently from each other by the regulating groove 72. That is, when one of the hooks 52 and 53 is moved, the other of the hooks 52 and 53 is regulated so as not to be moved. The changing section 54 defines the movement of the hooks 52 and 53 according to the opening direction.

[0083] The regulating groove 72 is formed approximately in a U-shape. The regulating groove 72 is configured by three grooves of an upper locking groove 72a, a neutral groove 72b, and a lower locking groove 72c, and the three grooves are continuously connected. The upper locking groove 72a is formed along a circular arc centering on one end shaft 64a of the upper link 64. The lower locking groove 72c is formed along a circular arc centering on one end shaft 65a of the lower link 65. The neutral groove 72b is formed along a circular arc centering on the fixed shaft 67 of the linkage plate 66.

[0084] As shown in Figure 9(a) and Figure 10(a), when both the other end shafts 64b and 65b are located in the neutral groove 72b, the hooks 52 and 53 respectively hold the upper and lower shafts 23 and 22, so that both the shafts 23 and 22 are locked. The state at this time is assumed as the initial state. As shown in Figure 9(b) and Figure 10(b), when the other end shafts 64b of the upper link 64 is located in the upper locking groove 72a, the upper shaft 23 is held by the upper hook 52 so as to be locked. The lower hook 53 is separated from the lower shaft 22. As shown in Figure 9(c) and Figure 10(c), when the other end shaft 65b of the lower link 65 is located in the lower locking groove 72c, the lower shaft 22 is held by the lower hook 53 so as to be locked. The upper hook 52 is separated from the upper shaft 23.

[0085] In the initial state, when the linkage plate 66 is rotated clockwise, the other end shaft 64b of the upper link 64 is moved along the upper locking groove 72a. The other end shaft 64b of the upper link 64 is moved in the circumferential direction with the one end shaft 64a as the center. The upper link 64 is not radially moved, and hence the one end shaft 64a is also not moved. Thereby, the upper hook 53 is not rotated. On the other hand, the other end shaft 65b of the lower link 65 is moved along the neutral groove 72b. The one end shaft 65a is moved by being pulled. The lower hook 53 is rotated clockwise. Thereby, as shown in Figure 9(b) and Figure 10(b), the lock of the lower shaft 22 is released. In the initial state, when the linkage plate 66 is rotated counter clockwise, as shown in Figure 9(c) and Figure 10(c), the lock of the upper shaft 23 is similarly released. Note that the control section 41 drives the regulating motor 70 so that the above described operations are synchronized with each other in the left and right regulating sections 51. Note that a stepping motor is used as the regulating motor 70, so as to be normally or reversely rotated according to the opening direction.

[0086] A pair of the moving sections 50 are provided on the left and right sides in the cabinet 3, so as to be arranged outside the regulating sections 51 in the left and right direction, respectively. As shown in Figures 11 to 13, the rod 32 is made to project to the outside from a vertically long hole 21b (see Figure 3) formed in the front

panel 21. A support shaft 80 for attaching the rod 32 is provided on the support 31. The front end of the rod 32 is rotatably supported by the support shaft 80. The support shaft 80 is positioned so as to be shifted to the front side from the center in the front and rear direction. The rod 32 is formed to have a circular cross section. When the wind hits the rod 32, the wind is allowed to easily flow along the surface of the rod 32. Thus, even when the cool air is blown at the rod 32, dew condensation hardly occurs. Further, the rod 32 is formed to have a hollow structure. Thereby, the weight of the rod 32 can be reduced while the strength of the rod 32 is maintained. As a result, the load of the motor to move the rod 32 is reduced.

[0087] When opening the wind guide panel 20, the moving mechanism section 57 moves the front end of the rod 32 to the front side. When closing the wind guide panel 20, the moving mechanism section 57 moves the front end of the rod 32 to the rear side. The moving mechanism section 57 is formed as a moving plate 81 which is reciprocated while holding the rod 32. As shown in Figure 15, the moving plate 81 is formed into a fan-shape, and is rotatably supported by a fixed shaft 83 which is fixed to a base plate 82. The base plate 82 is fixed to the cabinet 3.

[0088] The moving section 50 is also configured as a unit similarly to the regulating section 51. Here, the regulating section 51 and the moving section 50 are arranged side by side in each of the spaces respectively provided on the left and right sides of the cabinet 3. When both the regulating section 51 and the moving section 50 are configured as one unit, they can be handled as an opening and closing mechanism unit, so as to be easily attached. Further, the moving section 50 can be configured by a small number of components, so that the size and the thickness of the unit can be reduced. Thereby, the opening and closing mechanism can be housed in a limited space, so that the width of the blow-out port 5 can be increased. When the width of the blow-out port 5 is increased, the blowing range of the wind in the width direction can be increased, and thereby it is possible to supply the wind to all corners of a room.

[0089] The rear end of the rod 32 is rotatably attached to the vicinity of the front end of the moving plate 81 via a rotary shaft 84. A circular arc groove 85 is formed in the moving plate 81. The circular arc groove 85 is formed on a circular arc centering on the fixed shaft 83. A rack is formed in the circular arc groove 85. The driving section 58 is configured by an opening and closing motor 86 and a gear 87 attached to the motor shaft of the opening and closing motor 86. The gear 87 is inserted into the circular arc groove 85, so as to mesh with the rack.

[0090] When the opening and closing motor 86 is driven, the moving plate 81 is rotated about the fixed shaft 83 in association with the rotation of the gear 87, so that the rod 32 is moved into and out of the front panel 21. When the wind guide panel 20 is held in the closed attitude as shown in Figure 11, the moving plate 81 is located in the rear side. Only the front end of the rod 32 is made to project from the front panel 21. This state is the initial state.

[0091] When the lock of the lower shaft 22 is released, and when the opening and closing motor 86 is driven, the moving plate 81 is rotated counter clockwise as shown in Figure 12. The rod 32 is pushed out so as to be moved to the front side. The wind guide panel 20 is rotated about the upper shaft 23, so as to be upwardly opened. Note that the opening and closing motor 86 is controlled so that the moving plate 81 is rotated by a fixed angle of, for example, 50 degrees.

[0092] When the lock of the upper shaft 23 is released, and when the opening and closing motor 86 is driven, the moving plate 81 is rotated counter clockwise as shown in Figure 13. The rod 32 is pushed out, so that the front end of the rod 32 is moved to the front side. The wind guide panel 20 is rotated about the lower shaft 22, so as to be downwardly opened. At this time, the wind guide panel 20 is opened so as to be moved downward, and hence the front end of the rod 32 is also moved to the front side while being gradually moved downward. Also in this case, the moving plate 81 is rotated by a fixed angle.

[0093] When the wind guide panel 20 is opened, and when the opening and closing motor 86 is driven to cause the moving plate 81 to rotate clockwise, the wind guide panel 20 is closed. By the rotation of the moving plate 81, the rear end of the rod 32 is moved to the rear side. The rod 32 is drawn into the cabinet 3. Thereby, the wind guide panel 20 is rotated about the upper shaft 23 or the lower shaft 22. The wind guide panel 20 is made to approach the cabinet 3, so as to be held in the closed attitude.

[0094] Note that the control section 41 drives the opening and closing motors 86 on the left and right sides so that the above described operations are synchronized with each other in the left and right side moving sections 50. A stepping motor is used as the opening and closing motor 86 and is normally and reversely rotated according to the opening and closing operations.

[0095] When the wind guide panel 20 is opened during the cooling or heating operation, one of the lower and upper shafts 22 and 23 of the wind guide panel 20 is locked. Here, when the wind guide panel 20 is pulled and the external force is applied to the wind guide panel 20, one of the shafts is pushed (here, it is assumed that the upper shaft 23 is pushed). When the upper shaft 23 is pushed, the upper hook 52 is made to rotate counter clockwise. The upper link 64 is pushed in the shaft direction. The shaft direction is the direction which connects the one end and the other end of the upper link 64. The other end of the upper link 64 pushes the mounting base 71 through the regulating groove 72. At this time, the direction of the upper locking groove 72a, at which the other end of the upper link 64 is located, is substantially orthogonal to the shaft direction of the upper link 64. Since the mounting base 71 is fixed, the upper link 64 is

not moved in the shaft direction. Further, the acting direction of the force from the upper link 64 is substantially orthogonal to the direction of the upper locking groove 72a. No force acts on the other end of the upper link 64 in the direction in parallel with the direction of the upper locking groove 72a. As a result, the upper link 64 is not moved along the upper locking groove 72a, so that the rotation of the upper hook 52 is prevented.

[0096] Therefore, in the state where the wind guide panel 20 is opened, even when external force is applied, it is possible to prevent the lock from being released because the direction of one of the links 64 and 65 is made orthogonal to the direction of the regulating groove 72. Thereby, it is possible to prevent the occurrence of the state in which the opened wind guide panel 20 is hung down by being supported by the rod 32.

[0097] Meanwhile, when the wind guide panel 20 is fully opened, the moving amount of the rod 32 is fixed regardless of the opening direction. However, the front end of the rod 32 is positioned to be eccentric with respect to the wind guide panel 20. Thus, as shown in Figures 4 and 6, the opening angle at the time when the wind guide panel 20 is upwardly opened is different from the opening angle at the time when the wind guide panel 20 is downwardly opened. The upwardly opening angle is set larger than the downwardly opening angle. That is, the opening angle is increased as the distance from the center to the fulcrum is reduced at the time when the wind guide panel 20 is opened. The center is the upper shaft 23 or the lower shaft 22, while the fulcrum is the position of the front end of the rod 32. Since the rod 32 is attached near the upper shaft 23, the upwardly opening angle is set large, and the downwardly opening angle is set small.

[0098] The wind guide panel 20 is downwardly opened at the time of cooling operation. However, when the downwardly opening angle is large, the wind guide panel 20 is set below the horizontal line. This causes the cool air to flow in the horizontal direction, and does not cause the air to flow toward the ceiling. The reaching distance of the cool air is reduced, and the cool air directly hits a person. Therefore, in the case where the wind guide panel 20 is downwardly opened, it is preferred to reduce the opening angle. The wind guide panel 20 is upwardly opened at the time of heating operation. However, when the opening angle is small, the outlet of the warm air is narrowed. The warm air, which is returned after hitting the wind guide panel 20, has no place to escape, and hence collides with the blown-out warm air, so as to thereby disturb the flow of the air. As a result, the velocity of the air blown out toward the floor surface is reduced, so as to prevent the warm air from reaching the floor surface.

[0099] In this way, efficient air delivery cannot be performed at the time of cooling or heating operation, so that the cooling and heating performance cannot be maximally exhibited. However, as described above, when the upwardly opening angle is set large, and when the downwardly opening angle is set small, the cool air can be blown out toward the ceiling at the time of cooling operation, and the outlet of the warm air is increased at the time of heating operation so that a smooth flow of the warm air can be formed. Therefore, the maximum capacity of the air conditioner can be fully exhibited.

[0100] In the air conditioner, the cooling or heating operation is performed on the basis of an instruction generated when the user operates the remote controller or when the set time of the timer is reached. The control section 41 controls the refrigerating cycle 40, and also controls the opening and closing of the wind guide panel 20 and the auxiliary louver 800. At this time, the control section 41 operates the moving section 50 and the regulating section 51 in association with each other.

[0101] When performing the cooling or heating operation, the control section 41 turns on and off the driving of the regulating motor 70 and the opening and closing motor 86 according to a predetermined timing. Further, the control section 41 turns on and off the driving of the louver motor 803 of the auxiliary louver 800. That is, the motors 70, 86 and 803 are sequence-controlled, respectively.

[0102] The operation timing of the auxiliary louver 800 is set such that the auxiliary louver 800 is rotated to be opened after the wind guide panel 20 is opened, and that the auxiliary louver 800 is rotated to be closed before the wind guide panel 20 is closed. At the time of rapid cooling, the attitude of the wind guide panel 20 is changed in such a manner that the wind guide panel 20 is once held in the upwardly opened attitude by being rotated about the upper shaft, and that the wind guide panel 20 is then held in the closed attitude and then held in the downwardly opened attitude by being rotated about the lower shaft. At this time, however, the auxiliary louver 800 is sequence-controlled so as to be opened after the opening operation of the wind guide panel 20, and to be rotationally closed before the closing operation of the wind guide panel 20.

[0103] Further, the control section 41 performs an initializing operation before the start of operation. That is, the control section 41 determines the position of the wind guide panel 20 at the time when the operation is stopped. When the wind guide panel 20 is not set in the initial state, the control section 41 operates, as the initializing operation, the moving section 50 and the regulating section 51 so that the wind guide panel 20 is set in the initial state. When the operation is started, and when the wind guide panel 20 is set in the initial state, the control section 41 starts the operation without performing the initializing operation. Note that the state where the wind guide panel 20 is held in the closed attitude is the initial state, and the opening angle of the wind guide panel 20 is associated with the states of the respective members of the moving section 50 and the regulating section 51.

[0104] As shown in Figure 11, position detecting sensors 90 for detecting the position of the wind guide panel 20 are provided in the moving section 50. Note that the position detecting sensors 90 are provided in the left and right moving sections 50, respectively. A limit switch is

used as the position detecting sensor 90. The position detecting sensor 90 is attached to the base plate 82 of the moving section 50 in the cabinet 3. The position detecting sensor 90 is arranged so as to be positioned close to the moving plate 81 which is set in the initial state. When the moving plate 81 is set in the initial state, the rod 32 attached to the moving plate 81 is brought into contact with the position detecting sensor 90. Therefore, the position detecting sensor 90 detects that the wind guide panel 20 is set in the initial state, that is, in the closed attitude.

[0105] Note that the position detecting sensor 90 may also be configured to directly detect the position of the wind guide panel 20. The position detecting sensor is not limited to the contact type sensor, such as the limit switch, and non-contact type sensors, such as an optical sensor and a camera, may also be used as the position detecting sensor.

[0106] On the basis of a detection signal of the position detecting sensor 90, the control section 41 determines whether or not the wind guide panel 20 is set in the initial state. Usually, when the operation is stopped, the wind guide panel 20 is held in the closed attitude, and hence the moving section 50 and the regulating section 51 are set in the initial state. However, when the wind guide panel 20 is not set in the initial state due to a certain reason, the control section 41 determines, on the basis of the detection signal from the position detecting sensor 90, that the wind guide panel 20 is not set in the initial state. Then, the control section 41 performs the initializing operation so as to forcibly set the wind guide panel 20 in the initial state.

[0107] Conventionally, it is configured such that the time period during which the wind guide panel 20 is changed from the fully opened state to the closed state (initial state) is stored as the initialization time period, and that when the cooling or heating operation is started, the initializing operation of closing the wind guide panel 20 is necessarily performed during the initialization time period, and then the normal operation, such as the cooling or heating operation, is performed. However, in the conventional initializing operation, even when the wind guide panel 20 is set in the initial state at the time of starting an operation, such as the cooling or heating operation, the initializing operation is necessarily performed during the initialization time period, and hence it takes a time until the operation is shifted to the normal operation of the cooling or heating operation.

[0108] As in the present embodiment, when the position detecting sensor 90 is provided, it is possible to detect, at the time of starting the operation, whether or not the wind guide panel 20 is set in the initial state. Thus, when the wind guide panel 20 is set in the initial state at the time of starting the operation, it is possible to perform the cooling operation or heating operation without performing the initializing operation.

[0109] Further, when the wind guide panel 20 is not set in the initial state at the time of starting the operation, the initializing operation is performed. When the position detecting sensor 90 detects that the wind guide panel 20 is set in the initial state, the initializing operation is ended, so that the operation can be shifted to the cooling or heating operation. Further, even when the wind guide panel 20 is not set in the fully opened state, but in a slightly opened state or in a substantially half opened state, the initializing operation is performed. However, the initializing operation is ended when the position detecting sensor 90 detects that the wind guide panel 20 is set in the initial state. Thus, the initializing operation is shifted to the cooling or heating operation without being performed during the initialization time period.

[0110] As described above, the time required for the initializing operation can be reduced by using the detection result from the position detecting sensor 90, so that the operation can be rapidly shifted to the normal operation. Note that it is configured such that when it is not detected by the position detecting sensor 90 that the wind guide panel 20 is set in the initial state, the opening operation of the wind guide panel 90 is not performed and only the closing operation of the wind guide panel 90 is performed.

[0111] Note that it may also be configured such that even when after the initializing operation is performed for the predetermined time period, it is not detected by the position detecting sensor 90 that the wind guide panel 20 is set in the initial state, the wind guide panel 20 is once set in the fully opened state (by performing the opening operation for the time period required for shifting the closed state to the fully opened state), and such that the auxiliary louver is set in the closed state and thereafter the wind guide panel 20 is set in the closed state. Even when this operation is performed and when it is not detected by the position detecting sensor 90 that the wind guide panel 20 is set in the initial state, an error display is performed as an operation failure.

[0112] In such cases where a receptacle of an air conditioner is first connected to an AC power source, and where the power supply to the air conditioner is once interrupted due to power failure, it is necessary to set the auxiliary louver 800 in the closed state. Thus, first, the wind guide panel 20 is opened to the extent in which the auxiliary louver 800 can be rotated (for example, the wind guide panel 20 is fully opened). After the auxiliary louver 800 is closed, the wind guide panel 20 is set in the initial state.

[0113] In the initial state, the moving plate 81 is positioned on the rear side in the moving section 50 as shown in Figure 11. In the regulating section 51, the other end shafts 64b and 65b of the upper and lower links 64 and 65 are located in the neutral groove 72b as shown in Figure 8 and Figure 10(a).

[0114] When the heating operation is started, the control section 41 first drives the regulating motor 70 of the regulating section 51. By the driving, the linkage plate 66 is rotated clockwise. The upper link 64 is rotated about the one end. The other end shaft 65b of the lower link 65

is moved along the neutral groove 72b, and thereby the lower link 65 is pulled up. The lower hook 53 is rotated clockwise, so that the lock of the lower shaft 22 is released.

[0115] The control section 41 drives the opening and closing motor 86 of the moving section 50 with a slight delay from the timing of starting the regulating motor 70. The timing of starting the opening and closing motor 86 is set after the lower hook 53 is separated from the lower shaft 22. That is, the control section 41 stops the regulating motor 70, when a predetermined first timing is reached. The first timing is a timing which is determined according to the time period until the other end shaft 64b of the upper link 64 reaches the end of the upper locking groove 72a as shown in Figure 10(b). After stopping the regulating motor 70, the control section 41 drives the opening and closing motor 86.

[0116] When the opening and closing motor 86 is driven, the moving plate 81 is rotated counterclockwise. The rod 32 is pushed out to the front side, so that the wind guide panel 20 is moved in the direction away from the cabinet 3. The wind guide panel 20 is opened about the upper shaft 23. When the wind guide panel 20 is opened at a set opening angle, the control section 41 stops the opening and closing motor 86. Note that the opening angle is calculated from the number of steps of the opening and closing motor 86.

[0117] The control section 41 drives the opening and closing motor 86 for a fixed time period, and stops the opening and closing motor 86 when a second timing is reached. At this time, the opening angle reaches the maximum opening angle as shown in Figure 12. The wind guide panel 20 is held in the upwardly opened attitude, so that the warm air is blown out toward the floor surface.

[0118] Thereafter, the control section 41 controls the operation of the louver motor 803 so that the auxiliary louver 800 is operated to be opened at a predetermined angle. Thereby, the warm air is blown out toward the floor surface.

[0119] Also, in the case of the cooling operation, the control section 41 controls the regulating motor 70 and the opening and closing motor 86 at the same timing. However, the regulating motor 70 is rotated in the direction opposite to the direction at the time of the heating operation. The opening and closing motor 86 is rotated in the same direction as the direction at the time of the heating operation.

[0120] When the opening and closing motor 86 is driven for a fixed time period, and when the second timing is reached, the opening and closing motor 86 is stopped. At this time, the opening angle reaches the maximum opening angle as shown in Figure 13. The wind guide panel 20 is held in the downwardly opened attitude, so that the cool air is blown out toward the ceiling. Thereafter, the control section 41 controls the operation of the louver motor 803 so that the auxiliary louver 800 is operated to be oriented in parallel with the flow of the wind. Thereby, the cool air is blown out toward the ceiling.

[0121] When the cooling or heating operation is ended, the control section 41 first operates the louver motor 803 so that the auxiliary louver 800 is operated to be closed. Next, the control section 41 drives the opening and closing motor 86. The rod 32 is pulled back, so that the wind guide panel 20 is made to approach the cabinet 3. The control section 41 stops the opening and closing motor 86 when a predetermined third timing is reached. At this time, as shown in Figure 11, the wind guide panel 20 is held in the closed attitude, and the moving plate 81 is positioned on the rear side. That is, the third timing is a timing which is determined according to the time period during which the moving plate 81 is returned to the initial state. Note that the position detecting sensor 90 detects that the moving plate 81 is returned to the initial state. The third timing may also be set according to the detection timing.

[0122] Then, the control section 41 drives the regulating motor 70. For example, when the heating operation is performed, the state shown in Figure 10(b) is changed to the state shown in Figure 10(a). The lower hook 53 is rotated, so that the lower shaft 22 is locked. The control section 41 stops the regulating motor 70 when a predetermined fourth timing is reached. The fourth timing is a timing determined according to the time period during which the other end shaft 65b of the lower link 65 is moved from the connecting position between the upper locking groove 72a and the neutral groove 72b, to reach the connecting position between the neutral groove 72b and the lower locking groove 72c.

[Second embodiment]

[0123] Figure 26 and Figure 27 are schematic sectional views of an indoor unit of an air conditioner, showing a second embodiment according to the present invention. Figure 26 shows a state where the wind guide panel is held in the upwardly opened attitude, while Figure 27 shows a state where the wind guide panel is held in the downwardly opened attitude.

[0124] In the present embodiment, the wind direction is changed by changing the attitude of the wind guide panel 20, without using the auxiliary louver. The present embodiment is different from the first embodiment in that the wind guide panel is used as the wind direction changing plate, and that the ion generating section and the guiding section are provided in the wind guide panel. The other configuration of the second embodiment is the same as the first embodiment.

[0125] In the present embodiment, as shown in Figure 26 and Figure 27, the ion generating apparatus 920 is attached to the rear surface of the lower end section of the wind guide panel 20 so as to allow the ion generating section 921a to be exposed. The guide plate 891 as the guiding section is arranged so as to face the ion generating section 921a at a fixed interval.

[0126] In the above described configuration, when the wind guide panel 20 is held in the upwardly opened atti-

tude, the ion generating apparatus 920 is positioned at the distal end section of the wind guide panel 20 as shown in Figure 26, so that the wind guide panel 20 is held in an attitude inclined with respect to the wind W0 blown out toward the front side from the blow-out port 5 through the air passageway 6. The guide plate 891 protects the ion generating section 921a so that the ion generating section 921a is prevented from being directly hit by the wind W0. Also, the wind W0 hitting the portion of the wind guide panel 20, which portion is located on the upstream side from the guide plate 891, is changed in its direction, so as to be introduced into the air passage 892, and pushes out the ions generated in the air passage 892 to the downstream side along the surface of the guide plate 891.

[0127] The wind W1 containing the ions and introduced from the air passage 892 is mixed with the wind W2 whose direction is changed by the surface of the guide plate 891 or by the surface of the lower member 805, so that the positive and negative ions can be carried by the wind W2 so as to be efficiently released to a distant place.

[0128] On the other hand, when the wind guide panel 20 is held in the downwardly opened attitude, the ion generating apparatus 920 is positioned at the rear end section of the wind guide panel 20 as shown in Figure 27, so that the rear surface of the wind guide panel 20 and the guide plate 891 are oriented in parallel with the flow of the wind W0. Thereby, the wind W0 is introduced into the air passage 892 without being interrupted by the guide plate 891, and acts to guide the air blown out from the blow-out port 5 together with the ions to a distant place.

[0129] Note that the present invention is not limited to the above described embodiments, but numerous modifications and changes can be obviously made therein without departing from the spirit and scope of the present invention. For example, it can also be configured such that at least one louver of the louver group made of the plurality of louvers installed in the blow-out port of the conventional air conditioner is used as the wind direction changing plate as described in the present invention, and such that the ion generating section and the guiding section are provided in the one louver. Further, the ion generating element may be configured to generate only positive ions or only negative ions. Alternatively, the ion generating element may also be configured as an ozone generating element.

[0130] Further, as the air conditioner, the embodiments are described by using a separate type air conditioner, but the present invention can also be applied to a wind direction changing plate of an air cleaner, a wind direction changing plate of a cool air fan configured to blow out cool air by using evaporation heat, and the like.

Industrial Applicability

[0131] The present invention can be effectively used for an air conditioner which is capable of blowing out conditioned air in the cooling or heating operation.

Claims

1. An air conditioner comprising: a wind direction changing plate which is rotated so as to change the direction of wind blown out from a blow-out port; an ion generating section provided in the wind direction changing plate; and a guiding section which guides the wind to the ion generating section, wherein when the wind direction changing plate is held in an attitude inclined at an angle with respect to the blow-out direction of the wind, the guiding section guides to the ion generating section the wind flowing along the wind direction changing plate.

2. The air conditioner according to claim 1, wherein the guiding section includes a guide plate which is separated from the wind direction changing plate so as to face the wind direction changing plate, wherein an air passage is formed between the guide plate and the wind direction changing plate, and wherein the ion generating section is arranged in the air passage.

3. The air conditioner according to claim 2, wherein the upstream side end section of the guide plate in the flow direction of the wind blown out from the blow-out port is arranged on the wind flow direction downstream side from the proximal end of the wind direction changing plate.

4. The air conditioner according to claim 3, wherein the upstream side end section of the guide plate in the flow direction of the wind is formed to be inclined to the wind direction changing plate so that the distance between the guide plate and the wind direction changing plate is increased toward the upstream side.

5. The air conditioner according to claim 2, wherein a guard member which prevents a finger from entering the air passage is provided in each of the inlet and outlet ports of the air passage.

6. The air conditioner according to claim 1, wherein in the ion generating section, a positive ion generating section configured to generate positive ions expressed as $H^+(H_2O)_m$ (where m is an arbitrary natural number) and a negative ion generating section configured to generate negative ions expressed as $O_2^-(H_2O)_n$ (where n is an arbitrary natural numbers) are formed separately from each other, and wherein the respective ion generating sections are arranged at an interval respectively in parallel with the direction of the wind flowing along the wind direction changing plate.

7. The air conditioner according to claim 1, wherein a wind guide panel is provided as a part of a cabinet

on the front side of the blow-out port, wherein the wind direction changing plate is an auxiliary louver which while rectifying the wind blown out from the blow-out port, changes the vertical wind direction, and wherein there is provided a control section which performs drive control of the wind direction changing plate so as to change the vertical angle of the wind direction changing plate according to the attitude of the wind guide panel.

8. The air conditioner according to claim 1, wherein the wind direction changing plate is a wind guide panel which is provided as a part of a cabinet on the front side of the blow-out port, and wherein the ion generating section and the guiding section are formed in a part of the inner surface of the wind guide panel.

FIG. 1

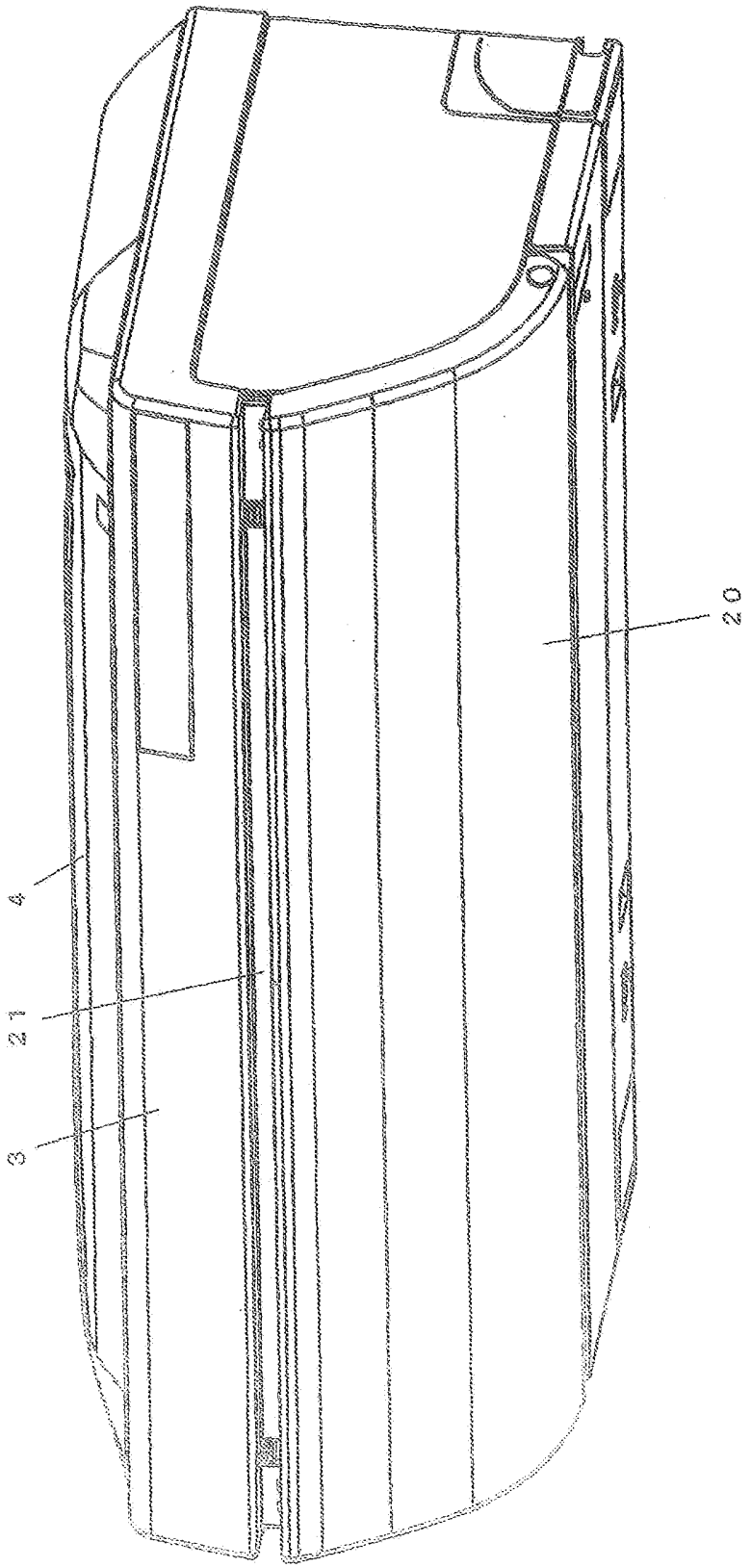


FIG. 2

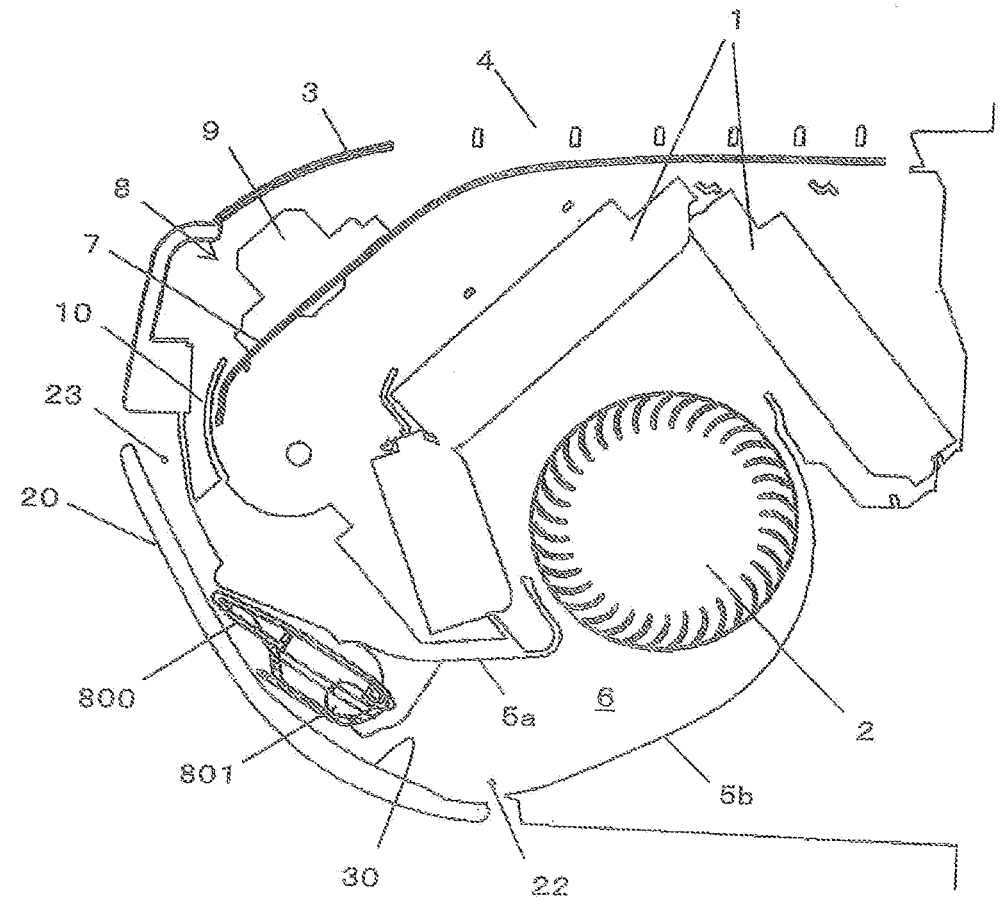


FIG. 3

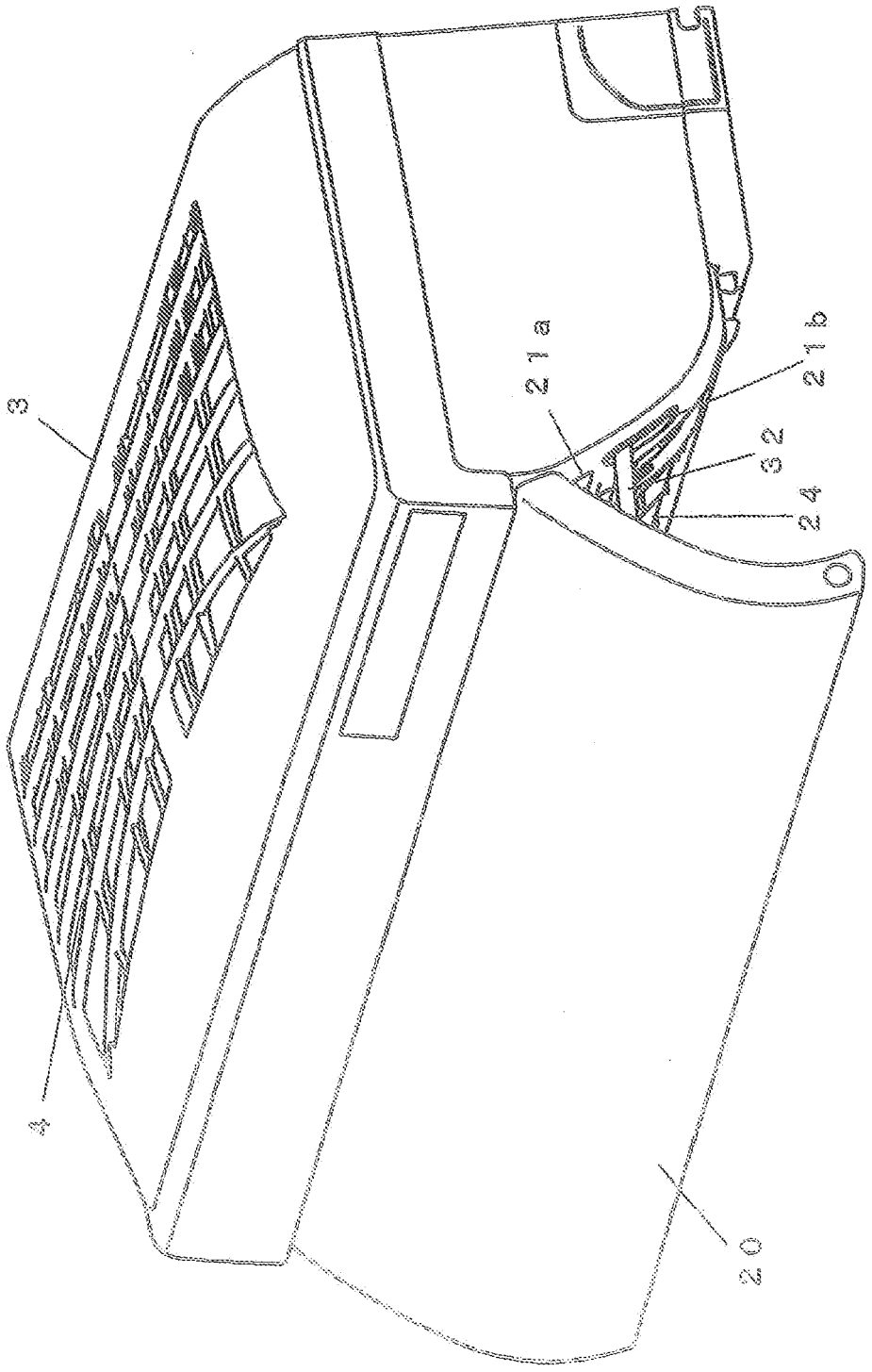


FIG. 4

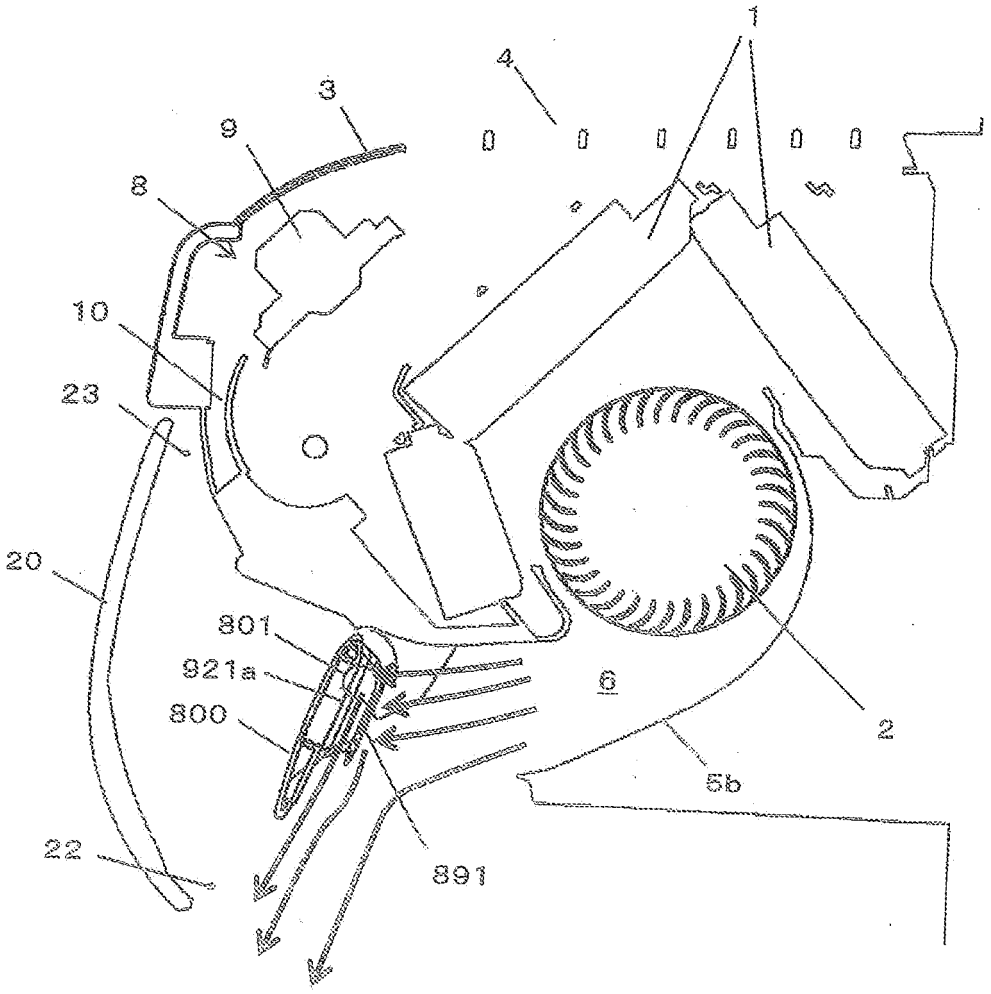


FIG. 5

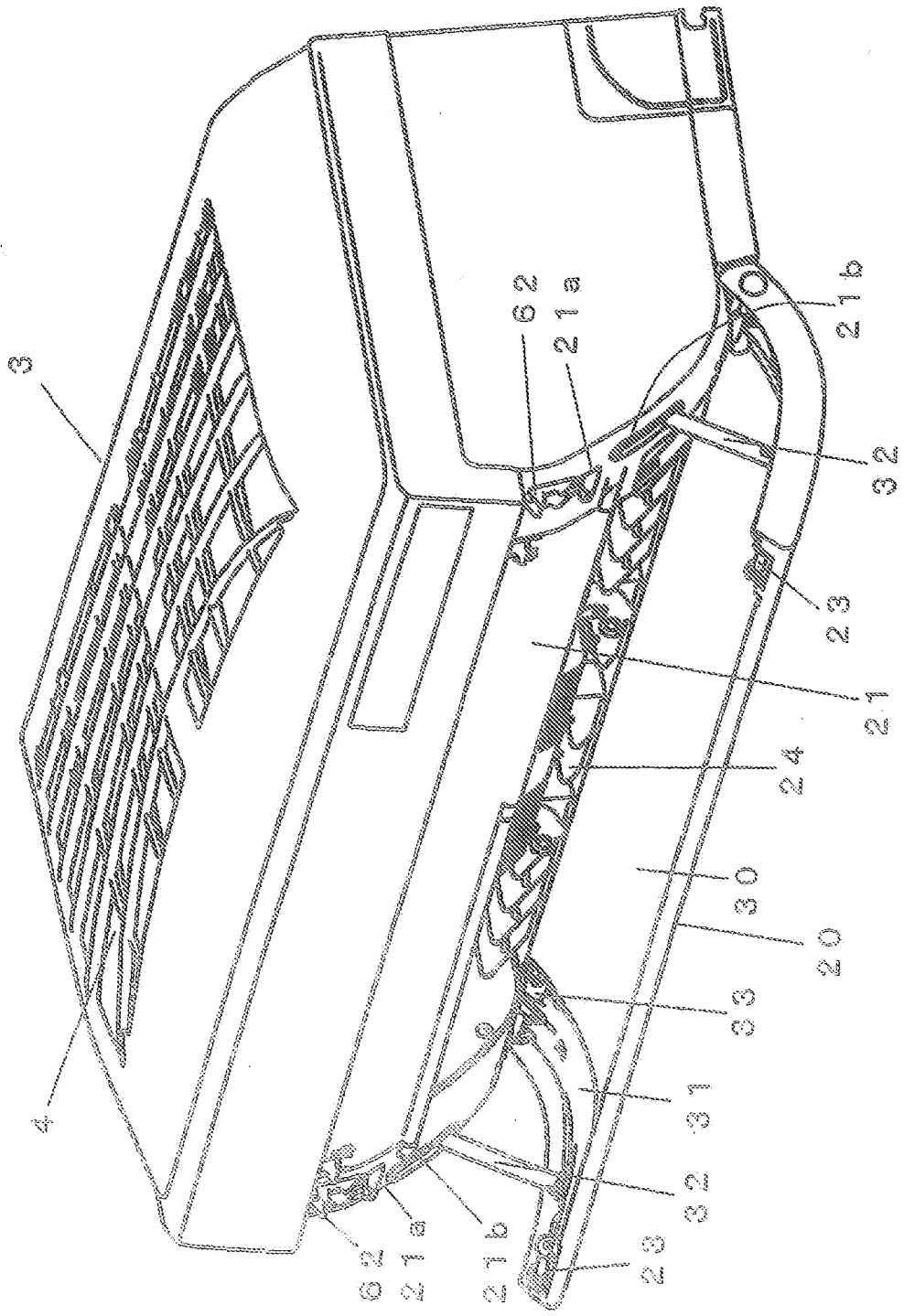
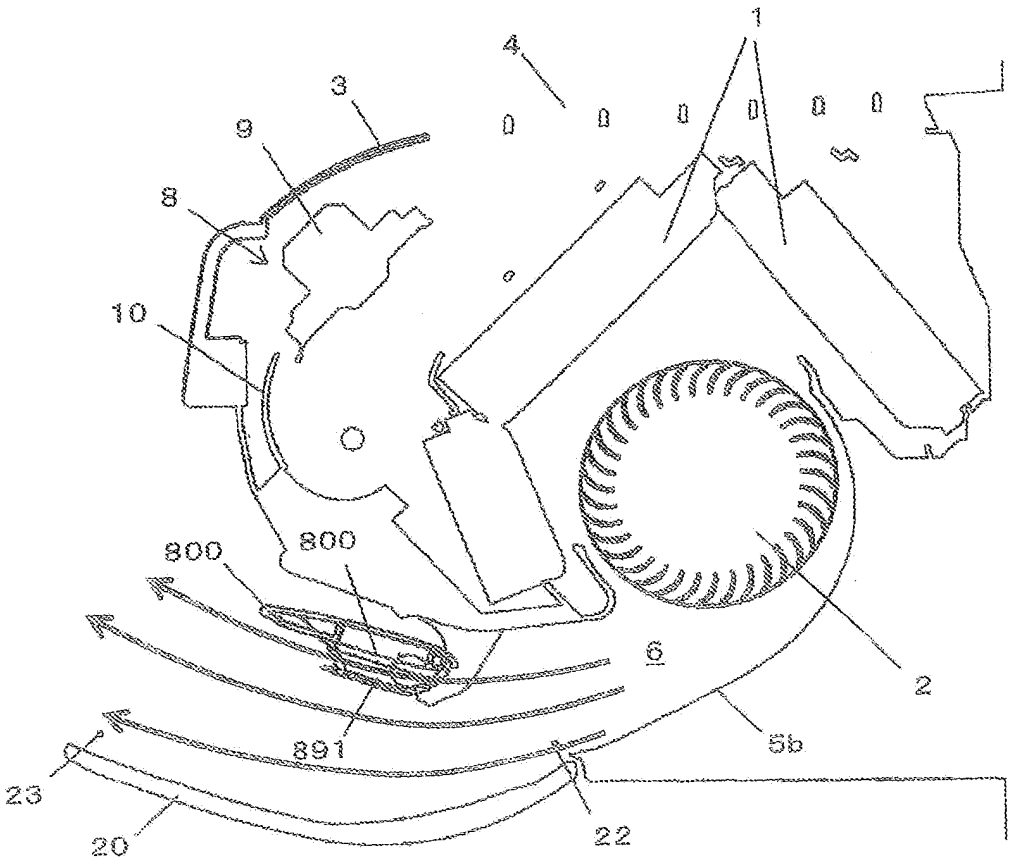


FIG. 6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4
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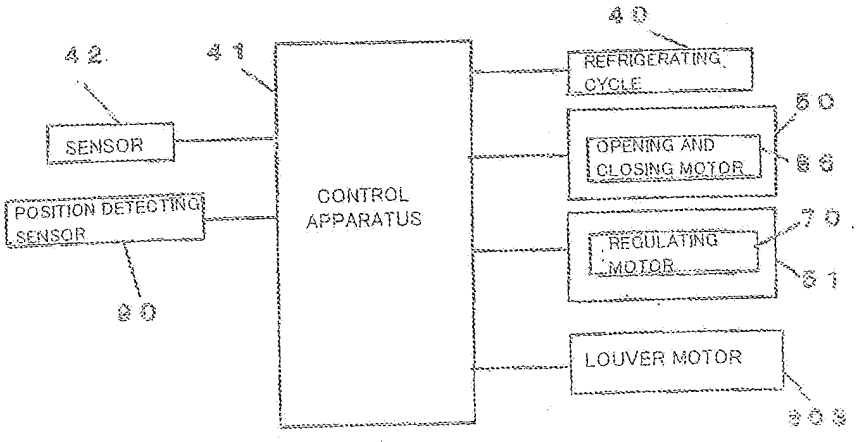
10
800
800
6
2
891
5b
23
20
22

FIG. 7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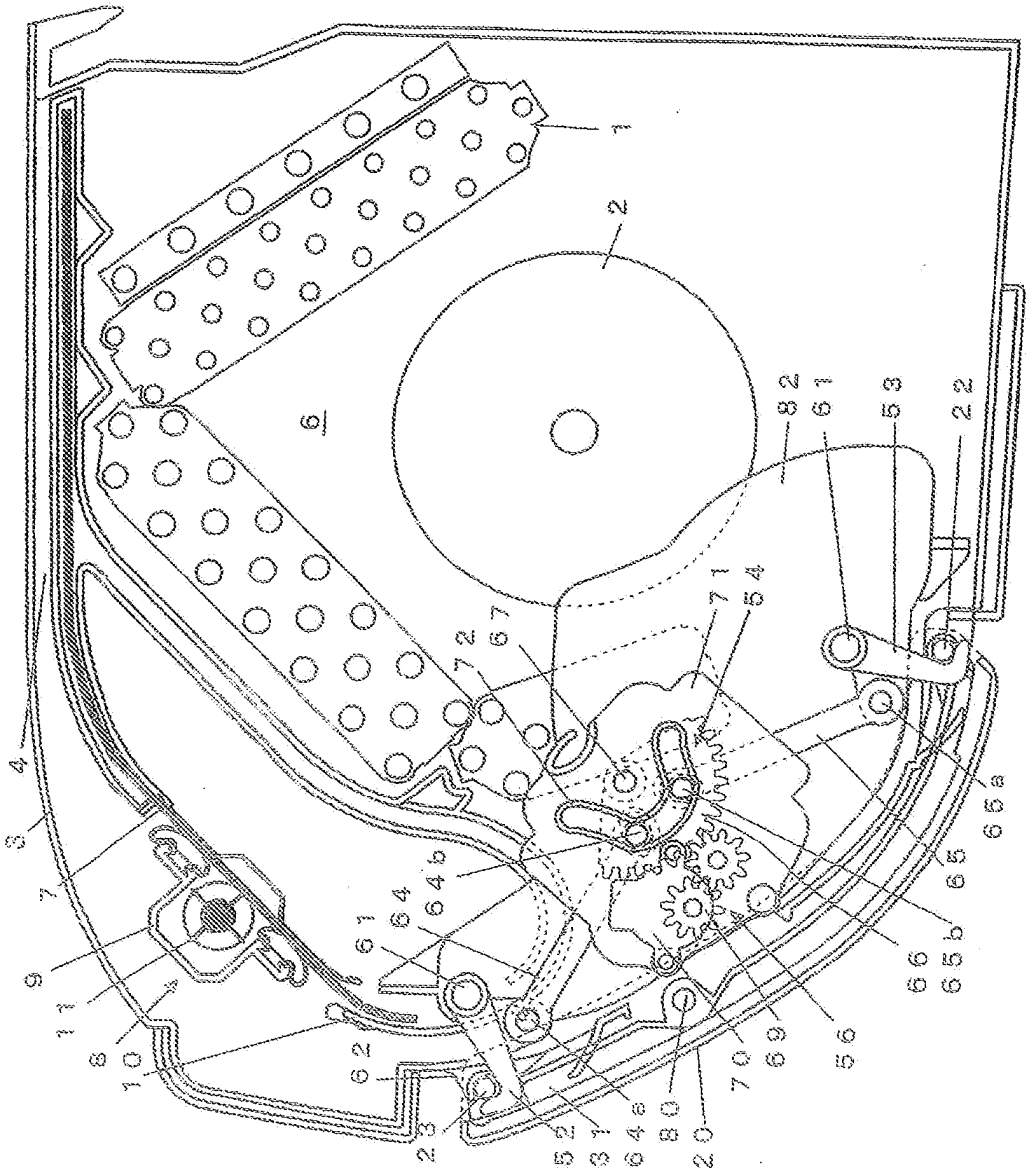
42
41
REFRIGERATING CYCLE
50
SENSOR
OPENING AND CLOSING MOTOR
60
CONTROL APPARATUS
70
POSITION DETECTING SENSOR
REGULATING MOTOR
71
80
LOUVER MOTOR
90

FIG. 8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82
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72
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64b
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69
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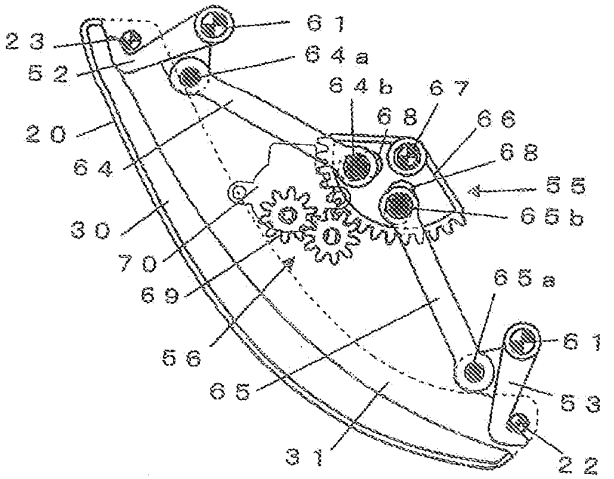
66
65b
65
65a

FIG. 9

(a)


61
23
64a
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64b
67
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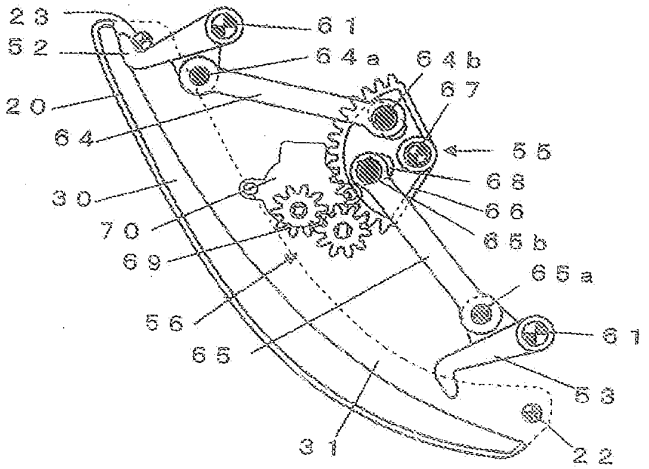
31
22

(b)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64a
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31
22

(c)

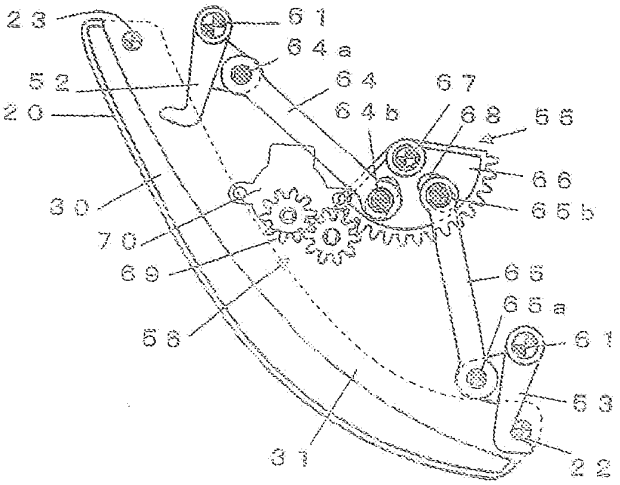
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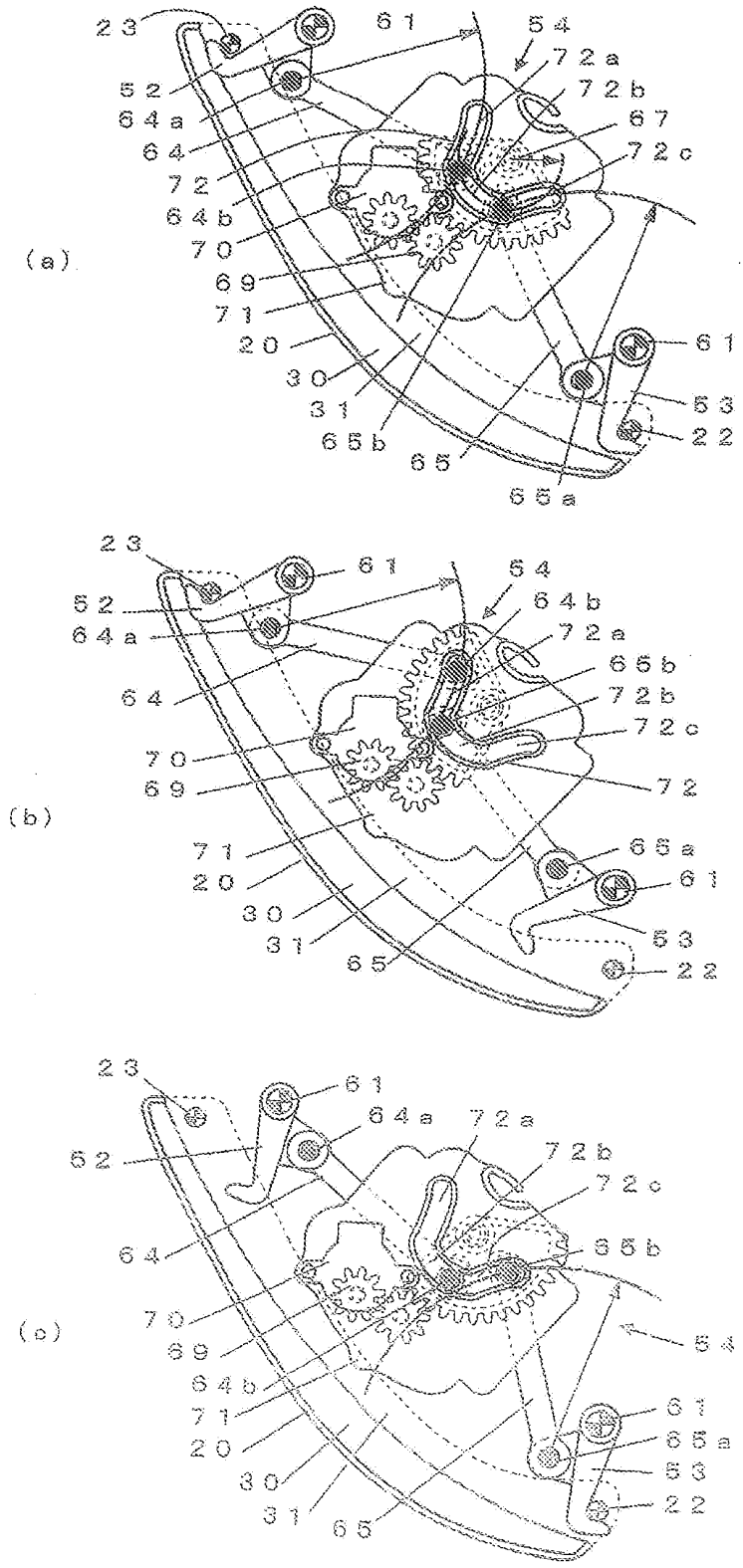
FIG. 10


(a)
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30
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65b
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65a
53
22
(b)
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61
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64b
52
64a
72a
65b
64
72b
72c
70
69
72
71
65a
20
61
30
53
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(c)
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64a
72a
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72b
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FIG. 11

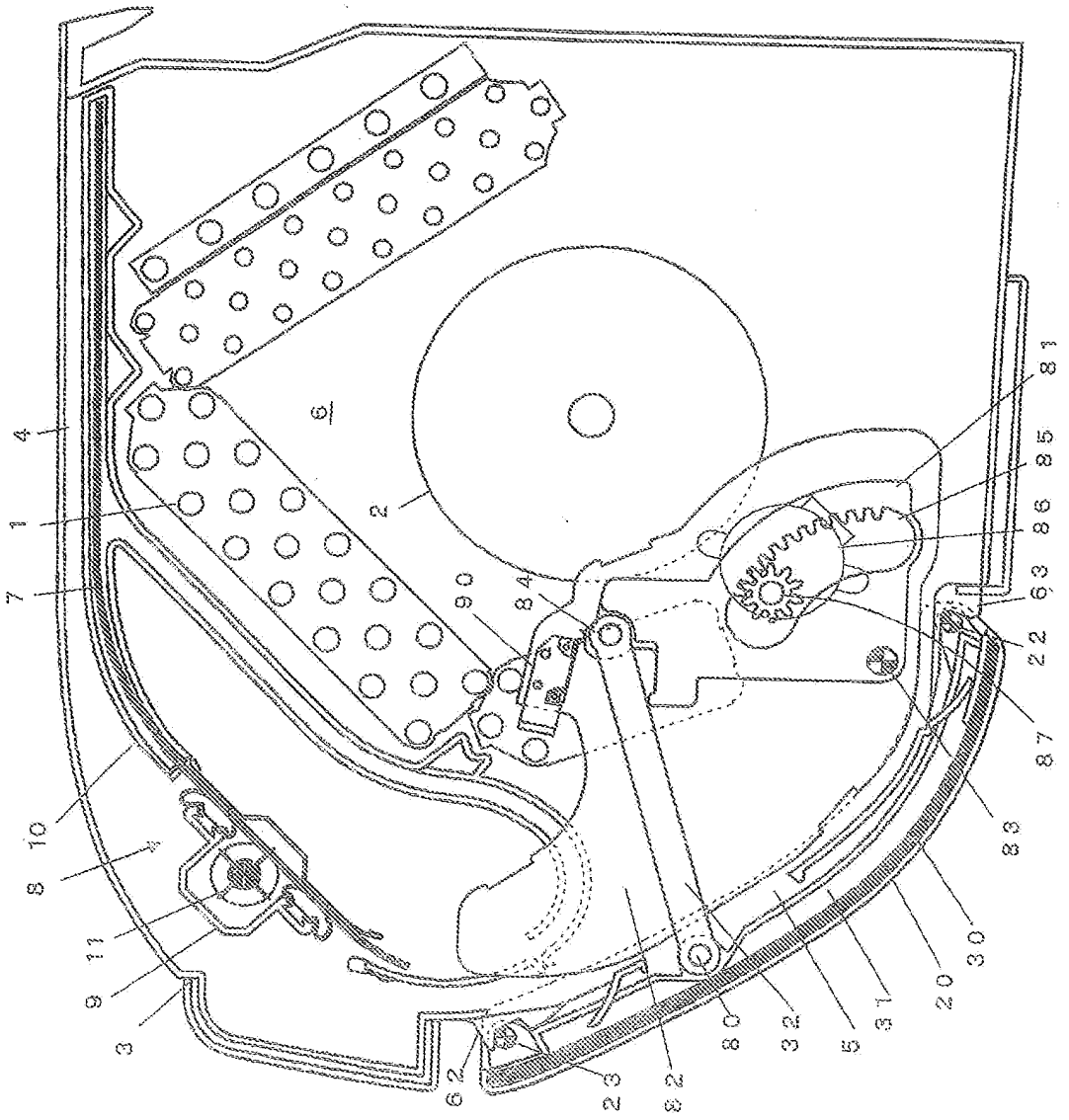

FIG. 12

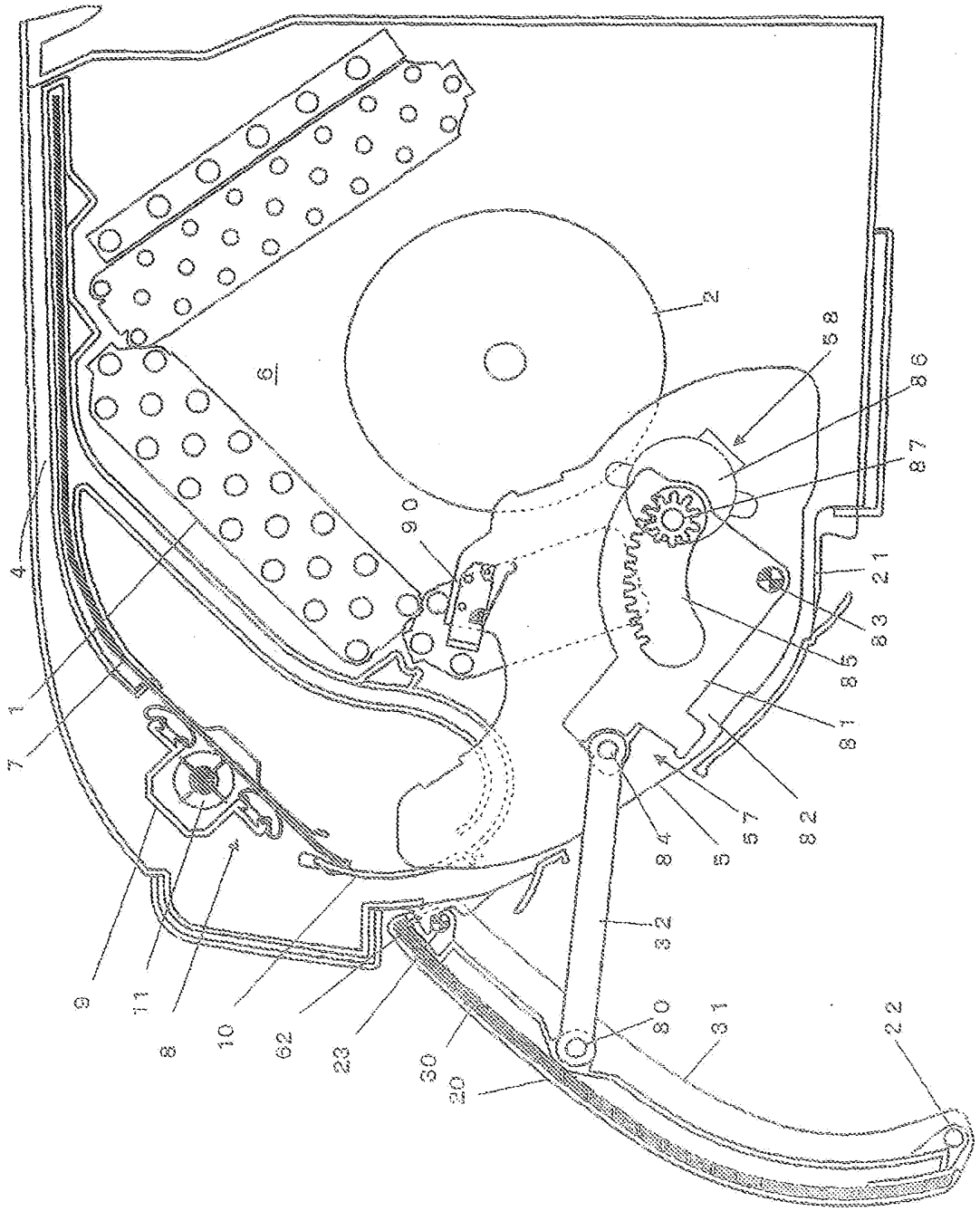

FIG. 13

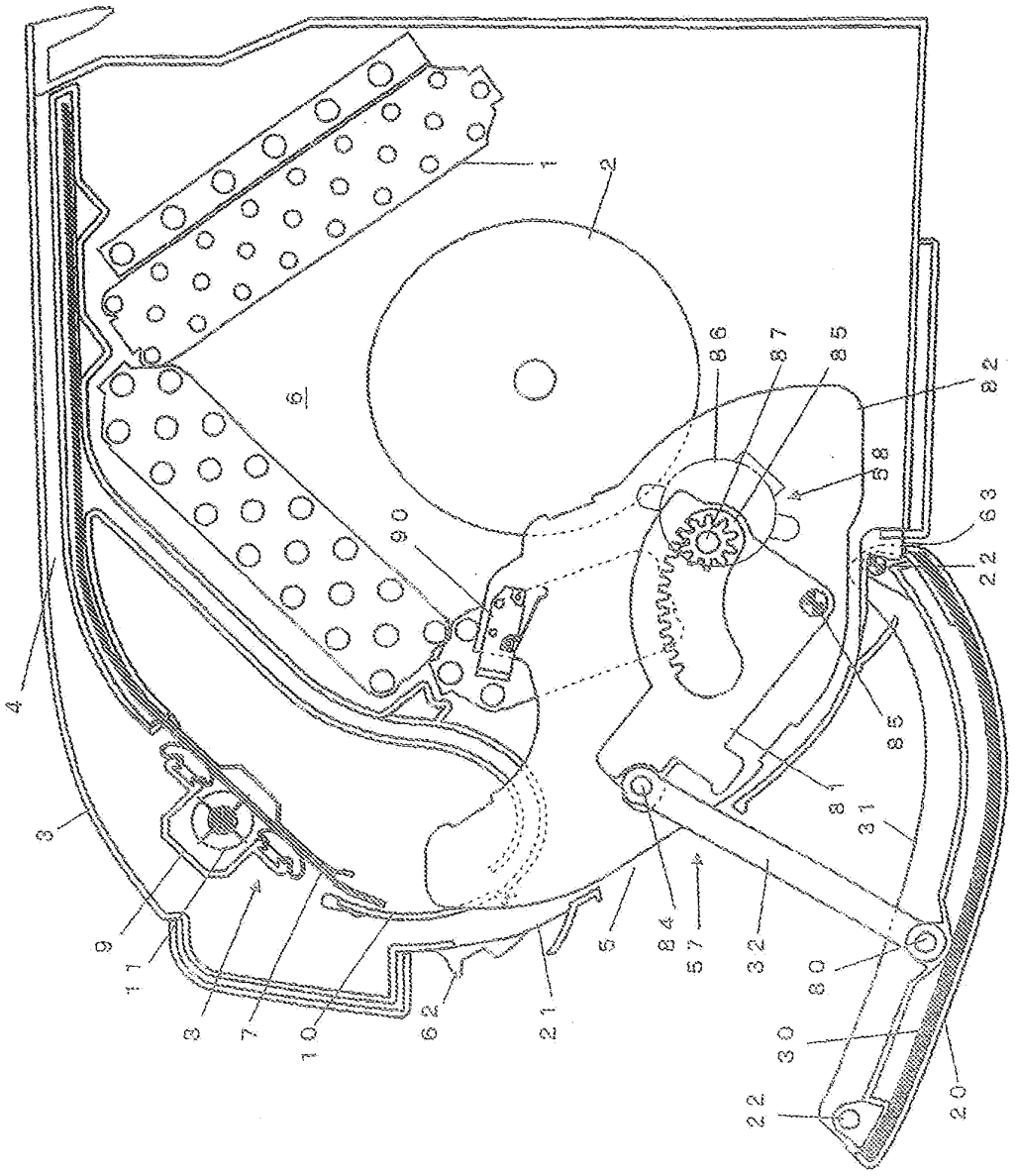
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FIG. 14

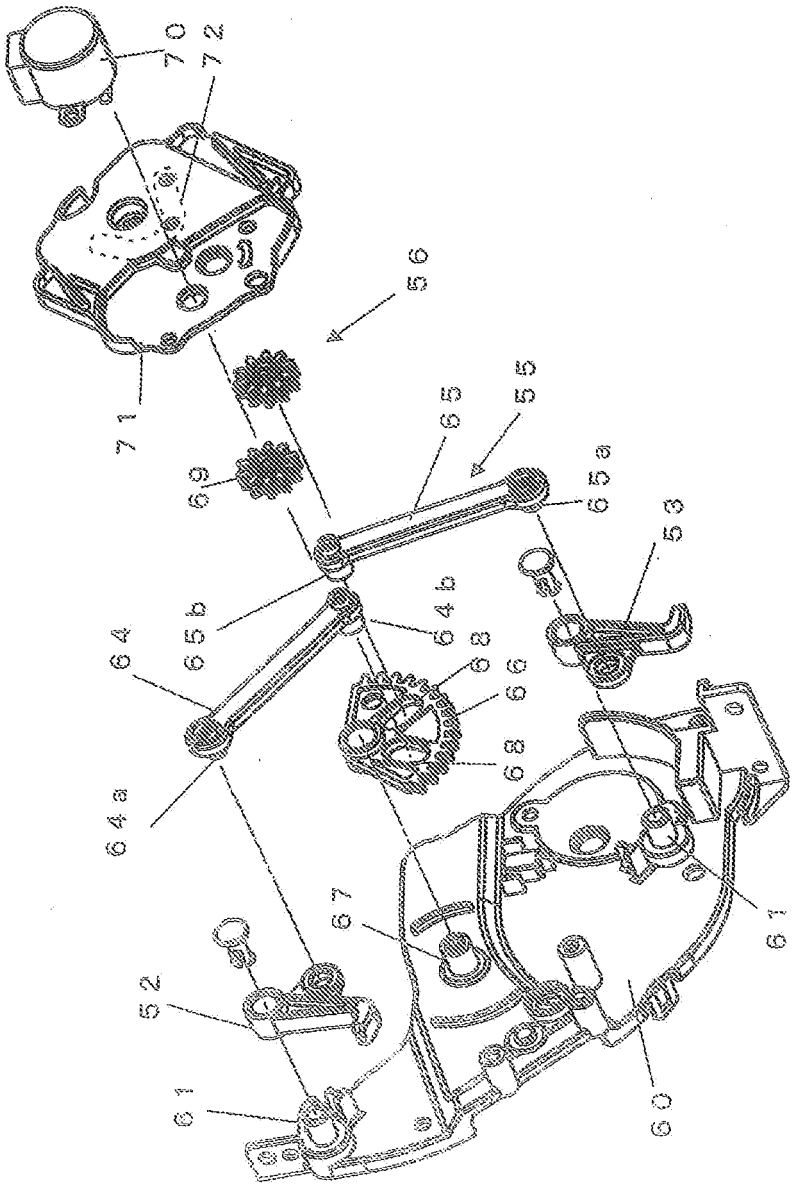


FIG. 15

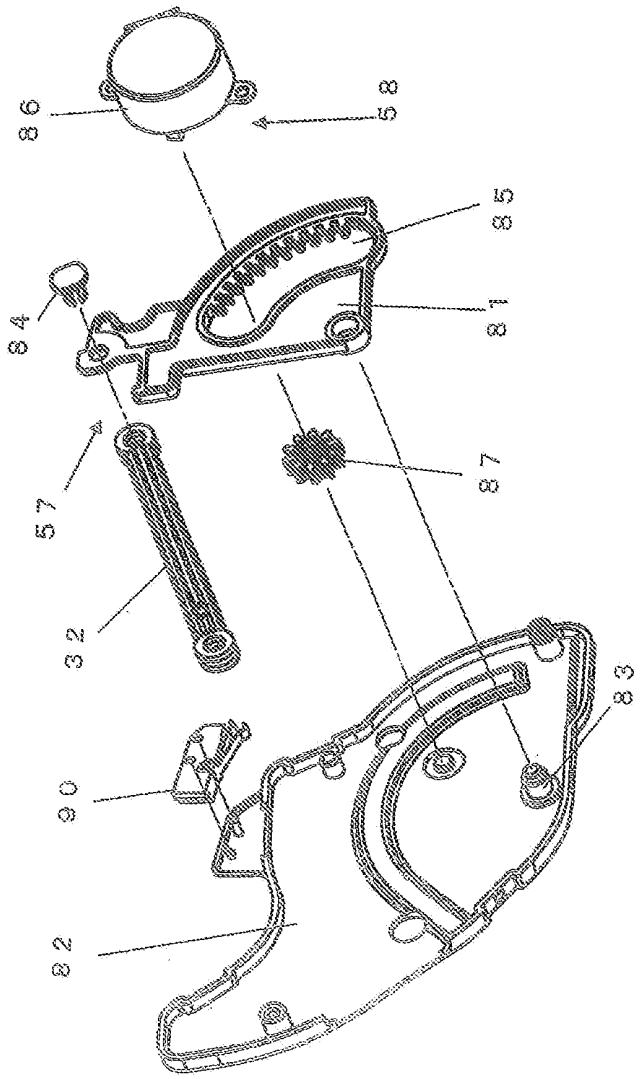


FIG. 16

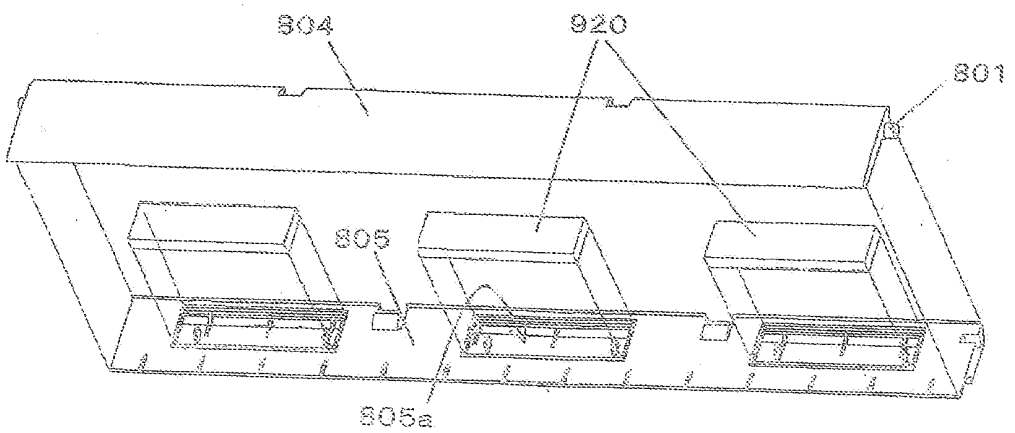
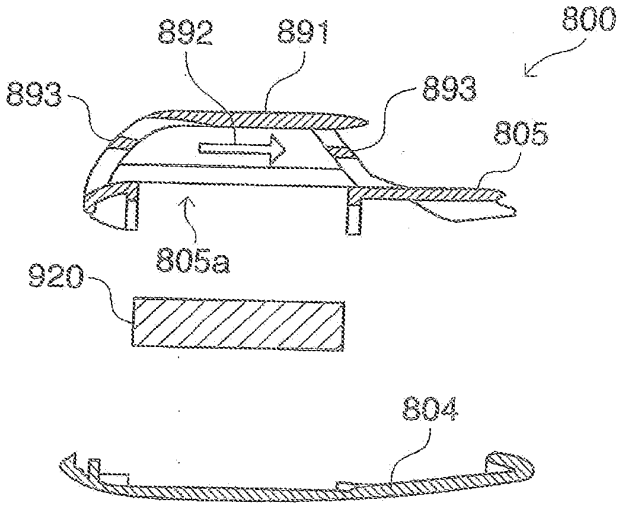


FIG. 17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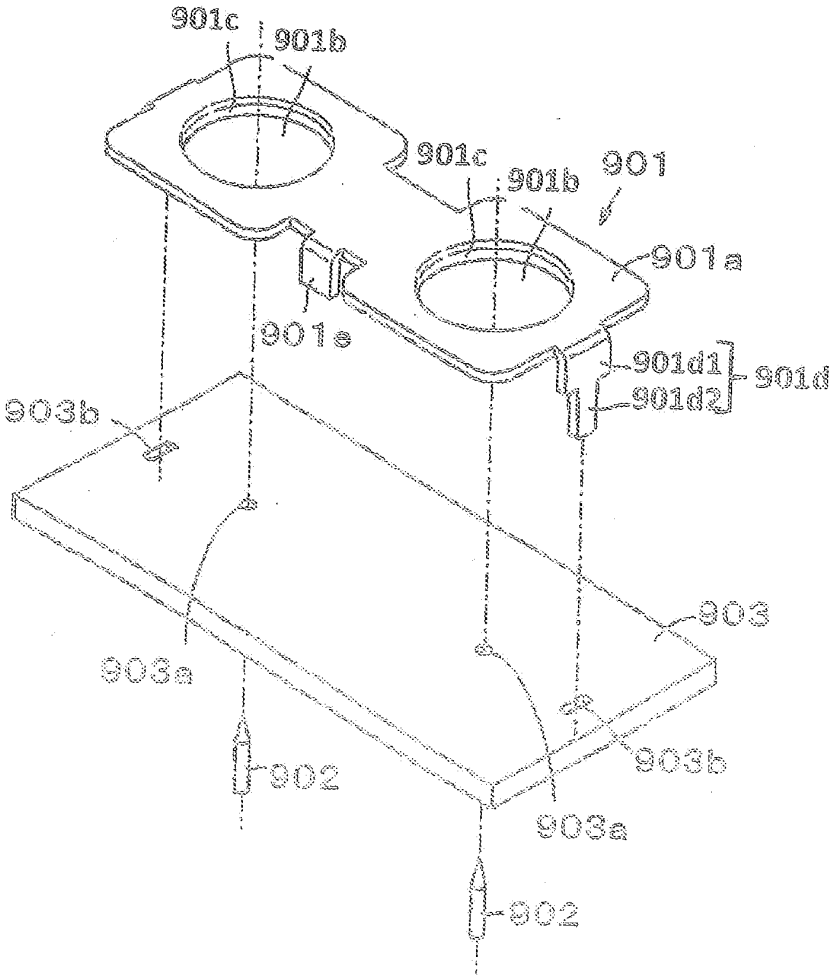
805a
920
804

FIG. 18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903a
902

FIG. 19

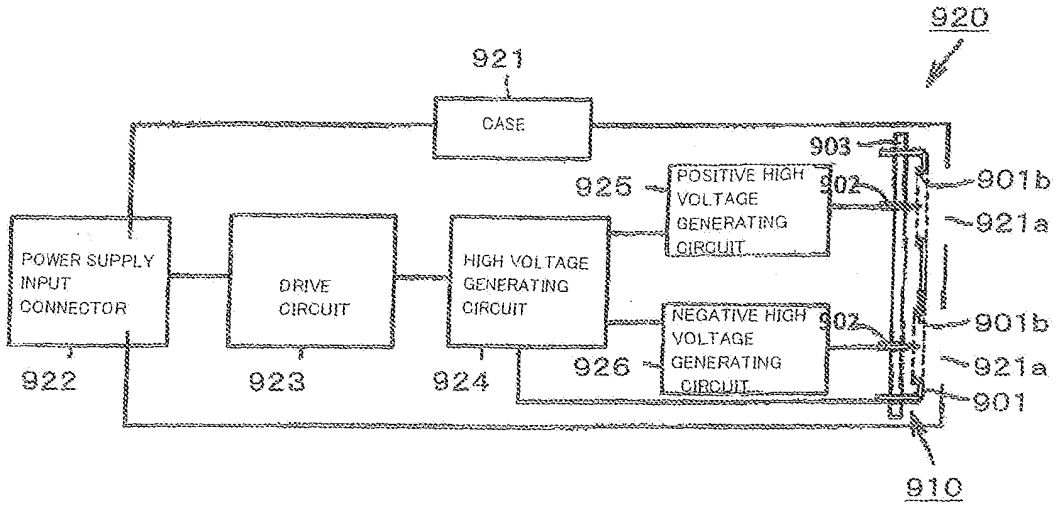


FIG. 20

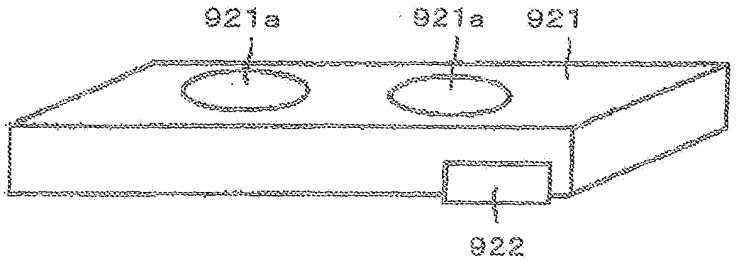


FIG. 21

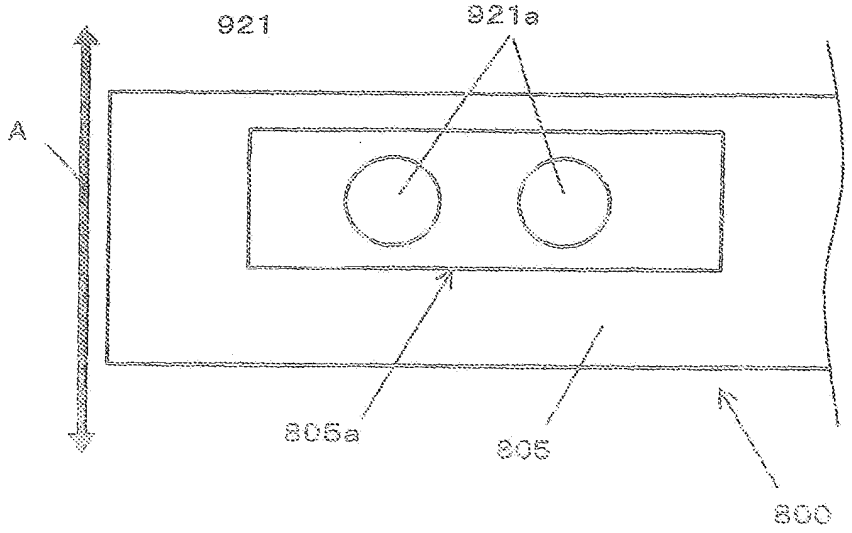


FIG. 22

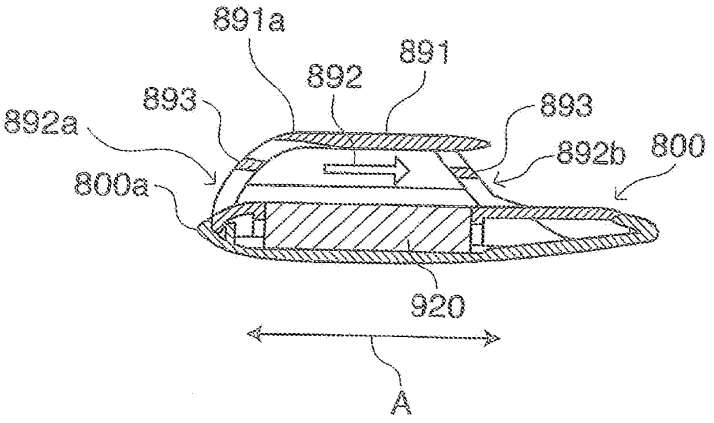


FIG. 23

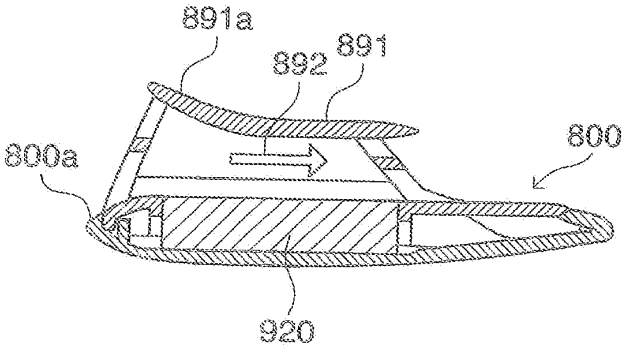


FIG. 24

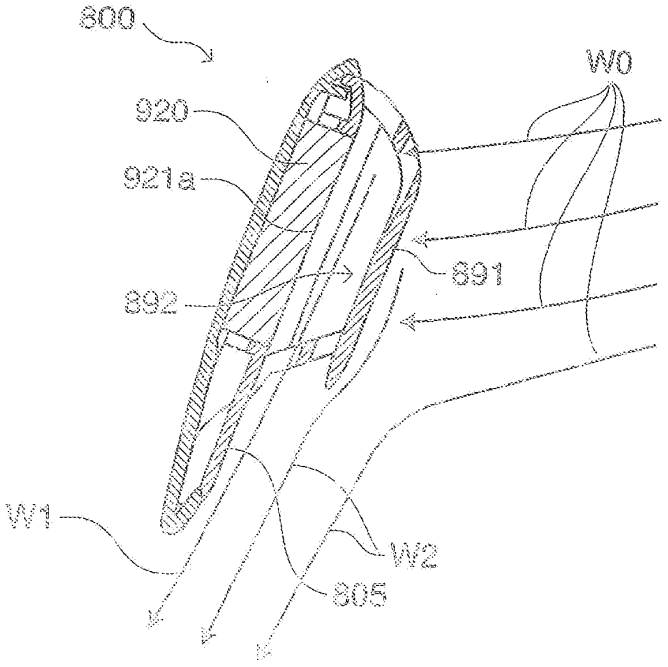


FIG. 25

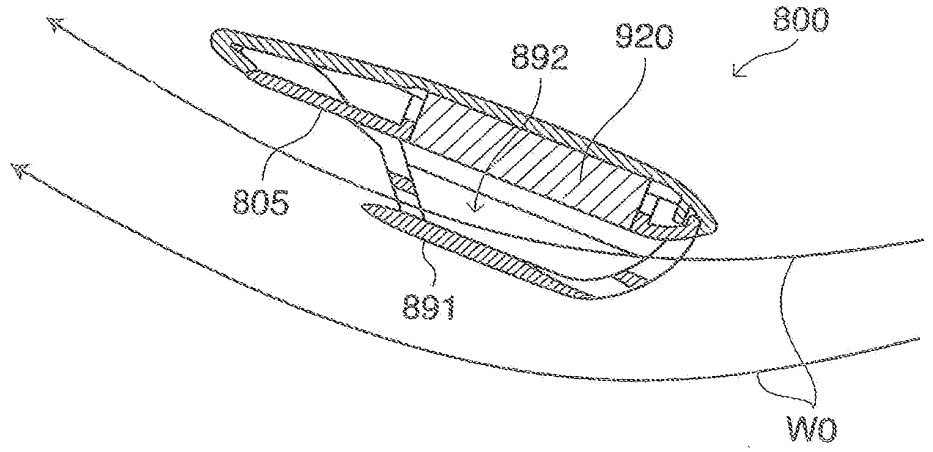


FIG. 26

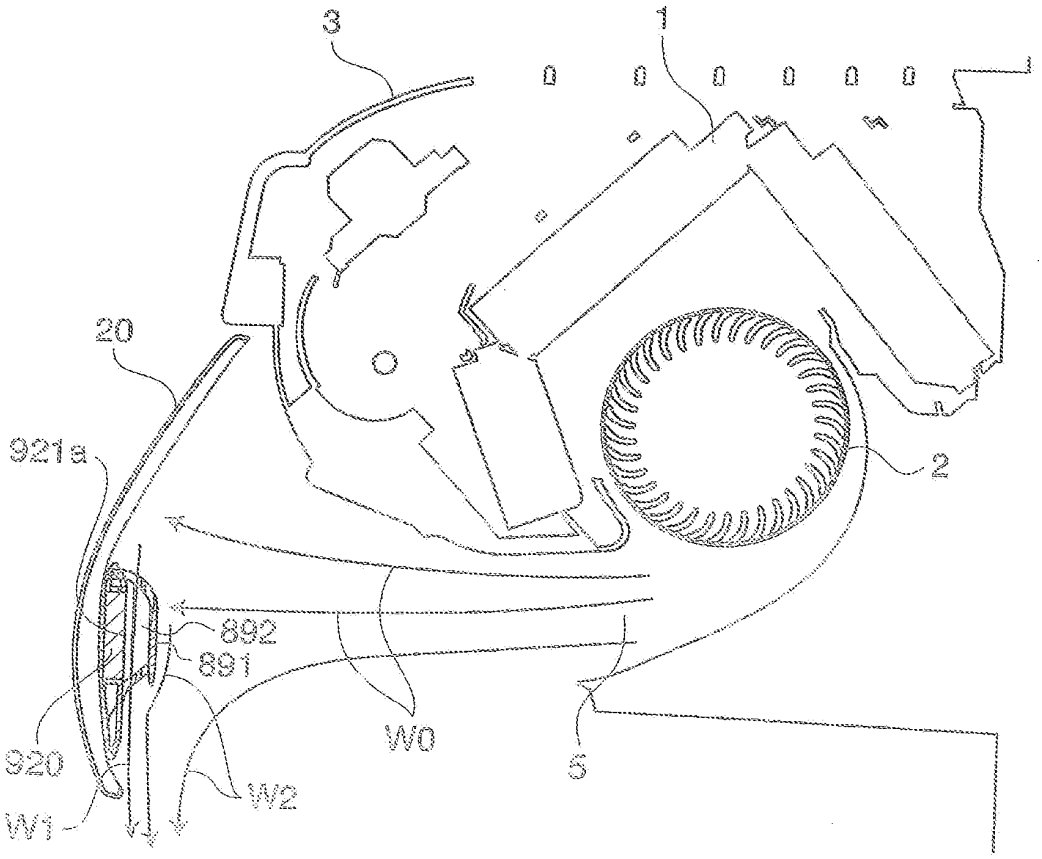
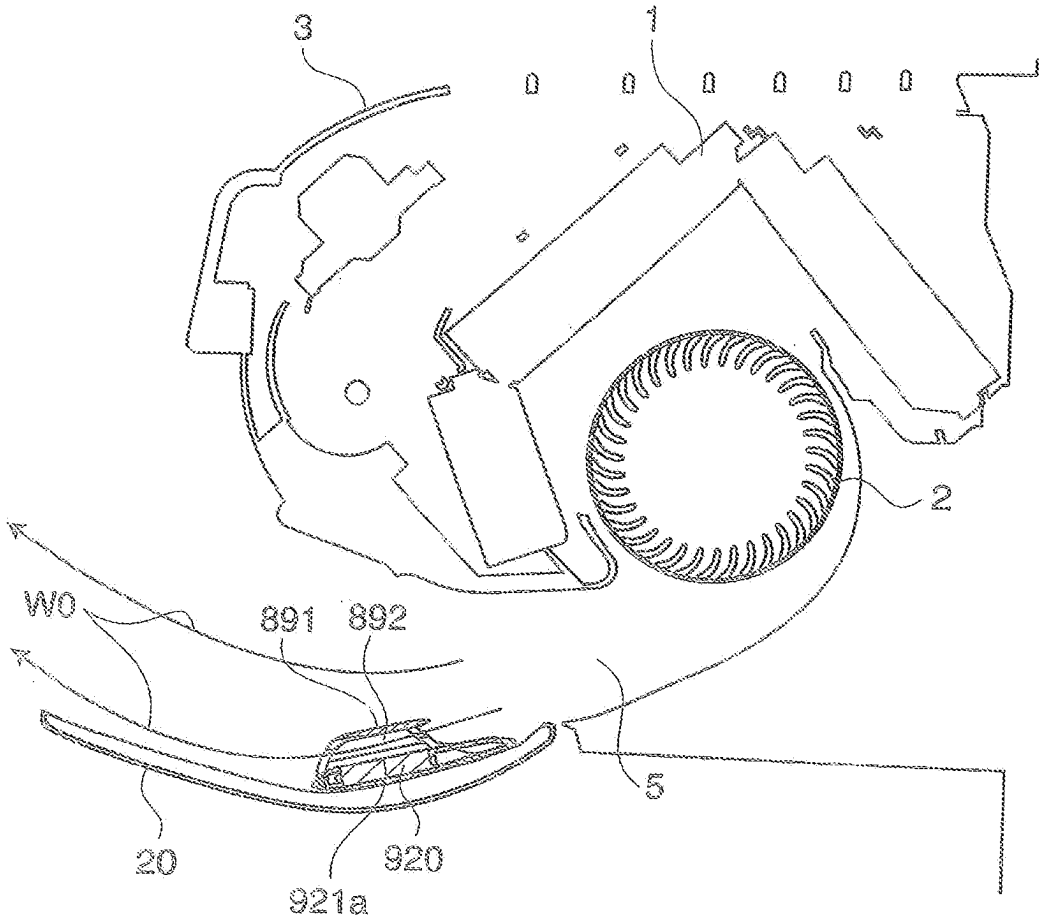


FIG. 27



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/057619

A. CLASSIFICATION OF SUBJECT MATTER
F24F13/14(2006.01)i, *F24F1/00*(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F24F13/14, F24F1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2009
Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009

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.
A	JP 2004-347264 A (Sharp Corp.), 09 December, 2004 (09.12.04), Full text; all drawings (Family: none)	1-8
A	JP 2007-51866 A (Sharp Corp.), 01 March, 2007 (01.03.07), Full text; all drawings (Family: none)	1-8

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

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Date of the actual completion of the international search	Date of mailing of the international search report
06 July, 2009 (06.07.09)	14 July, 2009 (14.07.09)
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Patent documents cited in the description

- JP 2004347264 A **[0004]**