

## TITLE OF THE INVENTION

Dust Suction Body and Vacuum Cleaner with a Dust Suction Body

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to a dust suction body equipped with a rotary cleaning body and a vacuum cleaner with this dust suction body.

### 2. Description of the Prior Art

A conventional dust suction body of a vacuum cleaner is shown in Figs. 23 and 24 by way of example. This dust suction body 100 is connected to an extension tube, which in turn communicates with the main body of a cleaner (not shown). The dust suction body 100 collects dust through the opening 103 of the bottom surface portion 102 of the dust suction body 100 by the suction force of the dust collecting fan of the cleaner main body. The dust suction body 100 is formed from a hollow body and is equipped with an internal rotary cleaning body 104. The opposite end portions of the rotary cleaning body 104 are provided with fans 105 for receiving wind and rotating the rotary cleaning body 104, respectively. The front wall portion 100F of the dust suction body 100 is formed with right and left openings 106 for feeding air to the fans 105. The bottom surface portion 102 of the dust suction body 100 is provided with four rollers 107 in the back-and-forth direction and the right-and-left direction, and a clearance is formed between the bottom surface portion 102 and a floor surface to be cleaned.

The rotary cleaning body 104 has a plurality of flat blades 109 each projecting straight from a shaft core portion 108 in the radial direction. The rotary cleaning body 104 is rotated by rotations of the two fans 105. That is, air is introduced from the right and left openings 106 of the front wall portion 100F into the dust suction body 100 by the suction force of the dust collecting fan of the cleaner main body. Then, the introduced air is struck on the fans 105, and the fans 105 are rotated. Next, the shaft core portion 108 and the blades 109 integrally attached to the fans 105 are rotated.

Japan Laid-Open Patent Publication No. HEI 3-162814 discloses another dust suction body. In this dust suction body, the exhaust wind of a vacuum cleaner is circulated by a circulating pipe to a suction port for sucking dust. This exhaust is employed for rotating a rotary body which scrapes away dust from a floor surface. The rotary body is arranged in a chamber partitioned from the dust suction port by a wall which partitions a suction pipe and the circulating pipe.

However, in the conventional dust suction body 100 of the vacuum cleaner shown in Figs. 23 and 24, since the fans 105 of the rotary cleaning body 104 are provided on the opposite end portions of the rotary cleaning body 104, the dimension of the lateral width of the rotary cleaning body 104 is reduced compared with the lateral width of the dust suction body 100, and consequently, there is the problem that the dust collecting ability will be reduced at the right and left ends of the dust suction body 100. In addition, since the fans 105 are separately formed and attached to the shaft core portion 108, the assembly process and the formation process are added and therefore there is the additional problem

that the manufacturing cost will be increased.

In the dust suction body disclosed in the aforementioned Japan Laid-Open Patent Publication No. HEI 3-162814, since the exhaust wind of the vacuum cleaner is utilized, a circulating pipe must be provided for rotating the rotary cleaning body. Particularly, in canister vacuum cleaners, since a dust suction body is connected to the cleaner main body through a hose and an extension pipe, a circulating pipe has to be provided in the cleaner main body, extension pipe, hose, and the dust suction body, so there is the problem that the structure will be extremely complicated. Further, because the rotary cleaning body is provided in the chamber partitioned from the dust suction port, there is the problem that the dust scraped away by the rotary cleaning body will not be efficiently sucked through the dust suction port.

#### SUMMARY OF THE INVENTION

It is an object of the present invention to provide a dust suction body which is light in weight and compact in size without having an exclusive motor for a rotary cleaning body and a power transmission mechanism, while preventing a reduction in the lateral width of the rotary cleaning body.

Another object of the present invention is to provide a dust suction body which is capable of enhancing the rotation function of the rotary cleaning body with simple constitution and enhancing dust collecting efficiency.

Still another object of the present invention is to provide a vacuum cleaner having the dust suction body.

To achieve the aforementioned objects and in accordance with one important aspect of the present invention, there is provided a dust suction body comprising: a suction main body which communicates with a cleaner main body, the suction main body being formed with an opening for collecting dust at an exterior surface opposite a surface to be cleaned; and a rotary cleaning body arranged within the suction main body; wherein the rotary cleaning body is arranged facing the opening and has a radially extending blade around a shaft core portion which is a center of rotation, and the rotary cleaning body is rotated by striking wind sucked in the cleaner main body to the blade.

In accordance with another important aspect of the present invention, there is provided a dust suction body comprising: a suction main body which communicates with a cleaner main body, the suction main body being formed with an opening for collecting dust at a first exterior surface opposite a surface to be cleaned; and a rotary cleaning body arranged within the suction main body; wherein the rotary cleaning body is arranged facing the opening and has a radially extending blade around a shaft core portion which is a center of rotation, and at an exterior surface other than the first exterior surface, the suction main body is formed with an air introduction port for introducing wind that is struck on the blade.

In accordance with still another important aspect of the present invention, there is provided a dust suction body comprising: a suction main body which communicates with a cleaner main body, the suction main body being formed with an opening for collecting dust at an exterior surface opposite a surface to be cleaned; and a rotary cleaning body

arranged within the suction main body, facing the opening; wherein the rotary cleaning body has a radially extending blade around a shaft core portion which is a center of rotation, the blade is convex on a forward side of a rotational direction, and the suction main body is formed with an air introduction port for introducing wind that is struck on the blade.

In accordance with a further important aspect of the present invention, there is provided a dust suction body comprising: a suction main body which communicates with a cleaner main body, the suction main body being formed with an opening for collecting dust at an exterior surface opposite a surface to be cleaned; and a rotary cleaning body arranged within the suction main body; wherein the rotary cleaning body is arranged facing the opening and has a radially extending blade around a shaft core portion which is a center of rotation, and the suction main body is formed with an air introduction port for introducing wind that rotates the rotary cleaning body in a forward direction with respect to a direction in which the suction main body moves forward and for blowing the wind to the blade.

In accordance with a further important aspect of the present invention, there is provided a dust suction body comprising: a suction main body which communicates with a cleaner main body, the suction main body being formed with an opening for collecting dust at an exterior surface opposite a surface to be cleaned; and a rotary cleaning body arranged within the suction main body; wherein the rotary cleaning body is arranged facing the opening and has a plurality of radially extending blades around a shaft core portion which is a center of rotation, and the suction main body is formed with an air introduction port which

introduces wind that rotates the rotary cleaning body and blows the wind to the blade and in which a position of the blade at which the wind is blown is varied in correspondence with a position to which the blade is rotated and moved.

The above and other objects and advantages of the present invention will become apparent from the following detailed description of the preferred embodiments of the invention when read in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view showing a vacuum cleaner according to the present invention;

FIG. 2 is a sectional view showing a dust suction body according to a first embodiment of the present invention;

FIG. 3 is a bottom view of the dust suction body shown in FIG. 2;

FIG. 4 is a front view of the dust suction body shown in FIG. 2;

FIG. 5 is a perspective view of the dust suction body shown in FIG. 2;

FIG. 6 is a perspective view showing a first modification of the dust suction body according to the first embodiment;

FIG. 7 is a sectional view of the first modification shown in FIG. 6;

FIG. 8 is a perspective view showing a second modification of the dust suction body according to the first embodiment;

FIG. 9 is a sectional view of the second modification shown in FIG. 8;

FIG. 10 is a sectional view showing a dust suction body according to a second embodiment of the present invention;

FIG. 11 is a part-enlarged view of the blade shown in FIG. 10;

FIG. 12 is a sectional view showing a modification of the dust suction body according to the second embodiment;

FIG. 13 is a perspective view showing a dust suction body according to a third embodiment of the present invention;

FIG. 14 is a bottom view of the dust suction body shown in FIG. 13;

FIG. 15 is a sectional view of the dust suction body shown in FIG. 13;

FIG. 16 is a front view of the dust suction body shown in FIG. 13;

FIG. 17 is a perspective view of the rotary cleaning body shown in FIG. 16;

FIG. 18 is a sectional view showing a first modification of the dust suction body according to the third embodiment;

FIG. 19 is a perspective view showing a second modification of the dust suction body according to the third embodiment;

FIG. 20 is a front view showing a dust suction body according to a fourth embodiment of the present invention;

FIG. 21 is a perspective view of the rotary cleaning body shown in FIG. 20;

FIG. 22 is a front view showing a modification of the dust suction body according to the fourth embodiment;

FIG. 23 is a bottom view showing a conventional dust suction body; and

FIG. 24 is a front view of the dust suction body shown in FIG. 23.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of a vacuum cleaner with a dust suction body according to the present invention will hereinafter be described in detail in reference to the drawings.

### (First Embodiment)

In Fig. 1, reference numeral 1 denotes the main body of a vacuum cleaner. The main body 1 is provided with an electric air blower 3 so that negative pressure is produced in a dust collecting chamber 2. The dust collecting chamber 2 is provided with a dust filter 4. A hose 5 is detachably connected to the cleaner main body 1 at one end thereof and to a control pipe 6 at the other end. The control pipe 6 is constituted by a grip portion 6A and a control portion 6B. The control portion 6B has an off switch S1 for turning off power to the electric air blower 3 and set switches S2 and S3 for setting power to the electric air blower 3.

An extension pipe 7 is detachably connected to the control pipe 6.

The point end portion of the extension pipe 7 is detachably connected to a dust suction body 9.

The dust suction body 9, as shown in Fig. 2, is constituted by a main body 10 and a connection pipe 11 provided on the rear portion of the main body 10. The connection pipe 11 is detachably connected to the point end portion of the extension pipe 7. The dust suction main body 10 has a dome-shaped upper casing 10a and a lower casing 10b attached to the upper casing 10a. The bottom portion of the lower casing 10b is formed with an opening 12 for collecting dust, as shown in Fig. 3. The

rear cylindrical portion 10c of the dust suction main body 10 is provided with the connection pipe 11 to which the extension pipe 7 is detachably connected. Reference numerals 17 denote rollers provided on the lower casing 10b.

The dust suction main body 10 is formed with a suction chamber R in which a rotary cleaning body 13 is arranged. The rotary cleaning body 13 faces the dust opening 12 and extends in the lateral direction of the dust suction main body 10. The rotary cleaning body 13 rotates and thereby scrapes away dust and dirt from a floor surface FL to be cleaned.

The dust opening 12 of the lower casing 10b has a configuration slightly greater than the contour of the rotary cleaning body 13. The rotary cleaning body 13 is rotatably supported at the opposite end portions by bearings (not shown) provided in the dust suction main body 10. The rotary cleaning body 13, including the opposite end portions, is nearly equal to the lateral width of the dust suction main body 10.

The rotary cleaning body 13 has a plurality of blades 14 for sweeping out the floor surface FL, and each blade 14 extends straight from one end of the rotary cleaning body 13 to the other end. The front portion 10F of the upper casing 10a is formed with an air introduction port 15 for striking air on the blades 14 of the rotary cleaning body 13 and rotating the rotary cleaning body 13, as shown in Fig. 5.

A guide wall 15a for effectively striking wind on the blades 14 is formed on the interior side of the dust suction main body 10 of the air introduction port 15. This air introduction port 15, as shown in Fig. 4, is formed into a size equivalent to the lateral width of the blade 14 and slightly less than the lateral width of the dust opening 12, so air can be

struck over the entire width of the blade 14.

The cross section of the blade 14 is formed into a circular arc, and the point end portion 14b extends rearward from the proximal portion 14a with respect to the rotational direction of the rotary cleaning body 13. If air is struck on the blades 14, the rotary cleaning body 13 will be rotated counterclockwise (in Fig. 2).

The cross section of the blade 14 may extend approximately linearly if the point end portion 14b is positioned in the rearward of the proximal portion 14a with respect to the rotational direction of the rotary cleaning body 13. While the blade 14 is formed from elastomer such as synthetic rubber and mounted on the hard shaft core portion 16, it may be formed integrally on the shaft core portion 16 by hard wear-resisting material such as plastic material.

The blade 14 is curved in the form of a circular arc so that the front side in the rotational direction is convex and the rear side facing the air introduction port 15 is concave, so if the blade 14 strikes on the floor surface FL, it will be easily bendable. However, if air is struck from the air introduction port 15 on the blade 14, the blade will be difficult to bend and can rotate the rotary cleaning body 13 with reliability.

Now, the operation of the aforementioned vacuum cleaner will be described.

First, the cleaner main body 1, the hose 5, the extension pipe 7, and the dust suction body 9 are connected together as shown in Fig. 1. Then, if the switch S1 or S2 is depressed, the electric air blower 3 will be operated at the set power and negative pressure will be produced in the dust collecting chamber 2. With this negative pressure in the dust

collecting chamber 2, negative pressure is produced in the suction chamber R of the dust suction body 9 through the hose 5, the extension pipe 7, and through the connection pipe 11. If negative pressure is produced in the dust chamber R, air will be sucked through the dust opening 12 and the air introduction portion 15.

If the dust suction main body 10 is put on the floor surface FL, a narrow clearance 18 will be formed between the floor surface FL and the lower casing 10b by the rollers 17. Air is sucked through the clearance 18 and gets into the dust opening 12. However, since the clearance 18 is narrow, air which is introduced through the air introduction port 15 is increased in quantity. The wind pressure on the blades of the rotary cleaning body 13 is increased, so the rotary cleaning body 13 begins rotating.

In addition, since the lateral width of the air introduction portion 15 is formed into the equivalent dimension of the lateral width of the blade 14, the area of the blade 14 on which air from the air introduction port 15 strikes is widened. Furthermore, since the vertical width of the air introduction port 15 is narrow, air is introduced toward the blades 14 at high speed. For these reasons, air strongly strikes from the air introduction port 15 on the blades 14 and can rotate the rotary cleaning body 13 with reliability. With this rotation, the rotary cleaning body 13 sweeps out and cleans the floor surface FL.

In the case where the floor surface FL is a carpet, the dust opening 12 is closed with the floor surface FL. As a result, since the quantity of air which is introduced through the air introduction port 15 is further increased, the wind pressure on the blade 14 becomes stronger and

the rotational force of the rotary cleaning body 13 further rises. That is, in the case of a carpet where the blade 14 requires a stronger scraping operation, the rotational force of the rotary cleaning body 13 will further rise.

The dust scraped away from the floor surface FL by the blade 14 is sucked into the dust collecting filter 4 through the connection pipe 11, the extension pipe 7, and the hose 5.

If the suction main body 10 is moved away from the floor surface FL, the air pressure in the suction chamber R will be the same as the atmospheric pressure. Therefore, the air suction from the air introduction port 15 is reduced and the rotation of the rotary cleaning body 13 is stopped or reduced. When the rotary cleaning body 13 rotates, the contact area between the blade 14 and the floor surface FL becomes wider than in the case where a blade extends straight from shaft core portion 16 in the radial direction, because the point end portion 14b of the blade 14 extends rearward from the proximal portion 14a with respect to the rotational direction. Consequently, the dust collecting effect or dust scraping effect is enhanced.

In addition, according to the aforementioned first embodiment, both air sucked through the dust opening 12 and air sucked through the air introduction port 15 act so that the rotary cleaning body 13 is rotated in the same direction. Therefore, the rotational force of the rotary cleaning body 13 is enhanced. That is, the rotation function of the rotary cleaning body 13 will be enhanced.

As previously described, the rotary cleaning body 13 is rotated by air struck on the blade 14 which scrapes away dust, so there is no need to

provide an exclusive fan or motor for rotating the rotary cleaning body 13.

For this reason, the present invention can provide a dust suction body which is light in weight and compact in size.

Furthermore, the air introduction port 15 is provided in the dust suction main body 10 so that the outside air around the dust suction main body 10 is sucked through the port 15, and the rotary cleaning body 13 is rotated only with the sucked wind. Therefore, the constitution is very simple. For this reason, the present invention can provide the dust suction body 9 and vacuum cleaner which are inexpensive.

Figs. 6 and 7 show a dust suction body 40 as a modification of the dust suction body 9. In this dust suction body 40, a recess 41 is provided in the front lower surface of the lower casing 10b. The recess 41 constitutes an air introduction port 42. Reference numeral 43 denotes a guide wall.

A bumper 44 is attached to the exterior circumference of the dust suction main body 10. The front portion 44A of the bumper 44 protrudes forward beyond the front end of the air introduction port 42. When cleaning a wall K, the front portion 44A of the bumper 44 prevents the air introduction port 42 from being closed by the wall K.

According to the dust suction body 40, in addition to the aforementioned enhancement in the rotational force of the rotary cleaning body 13, it becomes possible to suck up dust in front of the dust suction main body 10.

Figs. 8 and 9 show a dust suction body 45 as a second modification of the dust suction body 9. This dust suction body 45 is provided with air introduction ports 46 on the lateral opposite sides of the

rear portion of the upper casing 10a. Reference numeral 47 denotes a guide wall. Even in this dust suction body 45, the rotational force of the rotary cleaning body 13 can be enhanced because both air sucked through the dust opening 12 and air sucked through the air introduction ports 46 act so that the rotary cleaning body 13 is rotated in the same direction.

(Second Embodiment)

Figs. 10 and 11 show a dust suction body 50 according to a second embodiment of the present invention. This dust suction body 50 is equipped with a dust suction main body 20 and a connection pipe 25.

The dust suction main body 20 has an upper casing 21 and a lower casing 22 attached to the upper casing 21. The upper casing 21 is formed with an air introduction port 34 at the front side thereof. The lower casing 22 is formed with a dust opening 23. The rear cylindrical portion 24 of the dust suction body 20 is provided with a connection pipe 25 to which an extension pipe is detachably connected.

The dust suction body 20 is formed with a suction chamber 26 in which a rotary cleaning body 27 is arranged. The rotary cleaning body 27 faces the dust opening 23 and extends in the lateral direction of the dust suction body 20. The rotary cleaning body 27 rotates and collects dust, while scraping away dust and dirt from a floor surface 28 which is a surface to be cleaned. The dust opening 23 of the lower casing 22 has a configuration equivalent to the flat surface configuration of the rotary cleaning body 27. Note that the lateral length of the rotary cleaning body 27 is the same as the first embodiment.

The rotary cleaning body 27 has a shaft core portion 29 and a cylindrical portion 32 formed integrally with blades 30 and fans 31. The

blades 30 for sweeping out the floor surface 28 and the fans 31 are alternately formed integrally on the cylindrical portion 32. The cylindrical portion 32 is fixedly attached to the shaft core portion 29. Since the blades 30 and the fans 31 are integrally formed on the cylindrical portion 32, they are easily fixed to the shaft core portion 29 and also the rotational force of air received by the fans 31, as it is, becomes the rotational force of the blade 30.

The blade 30 is formed into the same configuration as the blade 14 of the first embodiment. The radial length of the blade 30 is set so that it becomes longer than that of the fan 31. The radial length of the fan 31 is set so that the point end portion does not strike on the floor surface 28 through the dust opening 23 of the lower casing 22.

The blade 30 is formed, for example, with a rectangular opening 33, as shown in Fig. 11. This opening 33 is used to give rotational force to the fan 31. That is, the air introduced through the air introduction port 34 of the front wall portion of the upper casing 21 is struck on the fan 31 through the opening 33 formed in the blade 30. In this way, rotational force is given to the fan 31.

The blade 30 is formed with material more easily bendable than that of the fan 31. If the blade 30 strikes on the floor surface 28, it will be bent so that the floor surface 28 can be easily swept out. The fan 31 and the cylindrical portion 32 are formed with hard material. The fan 31 is formed thicker in thickness than the blade 30 and is harder than the blade 30. The material of the blade 30 is the same as the first embodiment. The material of the fan 31 is, for example, PP resin or ABS resin.

In order to integrally form the blade 30, the fan 31, and the

cylindrical portion 32 in the case where they are different materials, the cylindrical portion 32 and the fans 31, for example, are formed with hard resin and then the resin consisting of the cylindrical portion 32 and the fans 31 is set to an insert forming die, and the portion of the blade 30 is formed last. When the cylindrical portion 32 and the fans 31 are formed, the protruded portion consisting of blades 30 may be previously formed on the circumference of the cylindrical portion 32. In the case where the blades 30 and fans 31 are formed with the same material, it is possible to thicken the thickness of the fan 31 so that the fan 31 becomes more difficult to bend than the blade 30.

The opening 33 formed in the blade 30 is formed so that it is positioned in the path of air flow B which is rolled in from the air introduction port 34 to the rotary cleaning body 27. Also, the opening 33 is provided so that air can be efficiently struck on the fan 31. A guide wall 35 is formed on the exterior side of the air introduction port 34. Since air is fed in a forward direction along the rotational direction A of the rotary cleaning body 27, so the guide wall 35 of the air introduction port 34 is formed so that air is introduced from the rear side of the rotating fans 31 to the forward side. Also, in this embodiment, the axial direction of the cylindrical portion 24 and the direction of the guide wall 35 are nearly the same and also the air introduction port 34 is positioned on a plane within or near the cross section of the cylindrical portion 24, so air sucked through the air introduction port 34 is linearly sucked into the cylindrical portion 24. For this reason, the passage resistance is small and the suction efficiency of air through the air introduction port 34 is enhanced.

The lateral length of the air introduction port 34, as with the first embodiment, is nearly the same as that of the blade 30.

In the second embodiment, although the blade 30 is formed so that it is easily bendable so as not to damage carpets, the rotational force of the rotary cleaning body 27 can be raised by hardening the fan 31. For this reason, the dust scraping effect can be raised without damaging carpets. In addition, since the rotary cleaning body 27 rotates clockwise (in Fig. 10), the relative moving speed of the blade 30 with respect to the floor surface 28 is increased when the dust suction main body 20 moves forward (in the left direction in Fig. 10). Therefore, the blade 30 can scrape a carpet more strongly and the scraping efficiency of the blade 30 is enhanced.

In addition, since the opening 33 has been formed in the blade 30, air sucked through the air introduction port 34 would be struck through the opening 33 on the fan 31, even if air were blown against the blade 30.

Therefore, the bending of the blade 30 by the blowing is prevented and it is prevented that sufficient rotational force will no longer be obtainable.

For this reason, the rotary cleaning body 27 will be efficiently rotated by air sucked through the air introduction port 34.

Fig. 12 shows a dust suction body 60 as a modification of the dust suction body 50 of the second embodiment. In this dust suction body 60, a blade 61 has a fan function and a rotary cleaning body 62 is rotated clockwise. The remaining parts are the same as the second embodiment and therefore the description is omitted.

#### (Third Embodiment)

Figs. 13 through 16 show a dust suction body 70 according to a

third embodiment of the present invention. This dust suction body 70 is equipped with a rotary cleaning body 71, as shown in Fig. 17. This rotary cleaning body 71 has a plurality of blades 72 and the constitution of the rotary cleaning body 71 is exactly the same as that shown in Fig. 12, so the description is omitted.

The main body 73 of the dust suction body 70 has an upper casing 74 and a lower casing 22 attached to the upper casing 74. The upper casing 74 is formed with right and left air introduction ports 75 and 76 at the front side thereof. The height positions at which the air introduction ports 75 and 76 are formed are different from each other, and there is a difference of height L between them.

According to this embodiment, the portion of the blade 72 on which air blown through the air introduction ports 75 and 76 is struck varies according to an angle that the rotary cleaning body 71 rotates. That is, wind blown through the air introduction port 76 is struck on the left portion of the blade 72B (Figs. 13 and 15), and if this blade 72B moves to the position of the blade 72A, wind blown through the air introduction port 75 will be struck on the right portion of the blade 72B.

If done in the aforementioned way, the rotary cleaning body can be smoothly rotated with less fluctuation in the rotational speed, for the following reasons.

Assume that when the rotary cleaning body 71 is rotated an angle of  $\alpha$ , for example, the blade 72B moves from its position indicated by a solid line to the position of the blade 72A indicated by a broken line. Also, assume that when the rotary cleaning body 71 is rotated an angle of  $\alpha/2$ , the blade 72B moves from its position indicated by a solid line to the

position of the blade 72B indicated by a broken line. In the case where the air introduction port 76 is at the same height position as the air introduction port 75, when the rotary cleaning body 71 is rotated an angle of  $\alpha/2$  and the blade 72B moves from the position indicated by a solid line to the position indicated by a broken line, the blade 72B is pushed back by air blown from the air introduction ports 75 and 76 (i.e., the blade 72B is subjected to rotational force in the counterclockwise direction). For this reason, the rotational force of the rotary cleansing body 71 is suddenly reduced and large noise develops. At this stage, the rotational force of the rotary cleaning body 71 becomes minimum.

Also, in the case where the air introduction port 76 is at the same height position as the air introduction port 75, if it is assumed that the blade 72 receives the maximum wind pressure of air blown from the air introduction ports 75 and 76 when the blade 72B moves to the position of the blade 72B indicated by a solid line, the rotary cleaning body 71 will obtain rotational force  $F$  from the two air introduction ports 75 and 76 at the same time, each time the rotary cleaning body 71 is rotated an angle of  $\alpha$ . The rotational force  $F$  becomes maximum.

That is, the rotary cleaning body 71 rotates while receiving the maximum rotational force for each angle of  $\alpha$ , and the difference between the maximum rotational force and the minimum rotational force becomes large. That is, since there is a large fluctuation in the rotational force and, furthermore, the rotary cleaning body 71 rotates while receiving rotational force for each angle of  $\alpha$ , the rotary cleaning body 71 does not rotate smoothly. For this reason, vibration and noise occur.

On the other hand, if the height positions of the air introduction

ports 75 and 76 differ from each other, the rotary cleaning body 71 will obtain a rotational force of  $F/2$  for each angle of  $\beta$  less than an angle of  $\alpha$  and the difference between the maximum rotational force and the minimum rotational force will be small. That is, since the fluctuation in the rotational force becomes small and, furthermore, the rotary cleaning body 71 rotates while receiving a small rotational force  $F/2$  for each angle of  $\beta$  less than an angle of  $\alpha$ , the rotary cleaning body 71 rotates smoothly and therefore vibration and noise can be suppressed to a small degree. In addition, air blown from the air introduction ports 75 and 76 does not impinge on the same blade 72 at a time, so the impingement sound caused by the air becomes small.

Fig. 18 shows a dust suction body 70' as a first modification of the dust suction body 70 of the third embodiment. The dust suction body 70' is equipped with the aforementioned rotary cleaning body 27 instead of the aforementioned rotary cleaning body 71.

Fig. 19 shows a dust suction body 70" as a second modification of the dust suction body 70. In the dust suction body 70", a single air introduction port 78 extending in the lateral direction is provided in an upper casing 74 instead of providing the aforementioned two air introduction ports 75 and 76 in the upper casing 74. This air introduction port 78 varies in height position at the opposite end portions 78A and 78B. The dust suction body 70" is equipped with the rotary cleaning body 71 or the rotary cleaning body 27.

#### (Fourth Embodiment)

Fig. 20 shows a dust suction body 80 according to a fourth embodiment of the present invention. This dust suction body 80 is

equipped with a rotary cleaning body 90 shown in Fig. 21. The blade 91 of this rotary cleaning body 90 is twisted in the form of a spiral along a shaft 92. The sectional configuration of the blade 91 is the same as the blade 72 shown in Fig. 15 and the material is the same as that of the blade 72, so a description of the blade 91 is omitted.

The upper casing 82 of the dust suction body 80 is formed with right and left air introduction ports 83 and 84 at the front side thereof.

The height positions at which the air introduction ports 83 and 84 are formed are the same, but the blade 91 of the rotary cleaning body 90 is spirally twisted, so the same advantage as the third embodiment is obtainable.

Fig. 22 shows a dust suction body 80' as a modification of the dust suction body 80 of the fourth embodiment. In this dust suction body 80', a single air introduction port 85 extending in the lateral direction is provided in the front portion of the upper casing 82 instead of providing the aforementioned two air introduction ports 83 and 84.

In all the aforementioned embodiments, while the air around the dust suction body (10, 20, or 73) has been sucked through the air introduction port (15, 34, 42, 46, 75, 76, 78, 83, 84, or 85) and the rotary cleaning body (13, 27, 71, or 90) has been rotated by the sucked air, air exhausted by the vacuum cleaner 3 may be circulated to rotate the rotary cleaning body (13, 27, 71, or 90) with the exhaust air. In this case, there is a need to provide a pipe in the hose 5 and the extension pipe 7 to guide the exhaust air to the air introduction port (15, 34, 42, 46, 75, 76, 78, 83, 84, or 85).

While the present invention has been described with reference to

preferred embodiments thereof, the invention is not to be limited to the details given herein, but may be modified within the scope of the appended claims.

## WHAT IS CLAIMED IS:

## 1. A dust suction body comprising:

a suction main body which communicates with a cleaner main body, the suction main body being formed with an opening for collecting dust at an exterior surface opposite a surface to be cleaned; and

a rotary cleaning body arranged within said suction main body;

wherein said rotary cleaning body is arranged facing said opening and has a radially extending blade around a shaft core portion which is a center of rotation, and said rotary cleaning body is rotated by striking wind sucked in said cleaner main body to said blade.

## 2. A dust suction body comprising:

a suction main body which communicates with a cleaner main body, the suction main body being formed with an opening for collecting dust at a first exterior surface opposite a surface to be cleaned; and

a rotary cleaning body arranged within said suction main body;

wherein said rotary cleaning body is arranged facing said opening and has a radially extending blade around a shaft core portion which is a center of rotation, and at an exterior surface other than said first exterior surface, said suction main body is formed with an air introduction port for introducing wind that is struck on said blade.

## 3. A dust suction body comprising:

a suction main body which communicates with a cleaner main body, the suction main body being formed with an opening for collecting



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dust at an exterior surface opposite a surface to be cleaned; and

a rotary cleaning body arranged within said suction main body, facing said opening;

wherein said rotary cleaning body has a radially extending blade around a shaft core portion which is a center of rotation, said blade is convex on a forward side of a rotational direction, and said suction main body is formed with an air introduction port for introducing wind that is struck on said blade.

4. The dust suction body as set forth in claim 1 or 3, wherein said blade and a fan for receiving air introduced from said air introduction port and rotating said rotary cleaning body are formed on said shaft core portion, a radial length of said fan is shorter than that of said blade, and said fan is more difficult to bend than said blade.

5. The dust suction body as set forth in claim 4, wherein said blade and said fan are integrally formed with each other.

6. The dust suction body as set forth in claim 4 or 5, wherein said blade is formed with an opening for striking wind on said fan.

7. A dust suction body comprising:

a suction main body which communicates with a cleaner main body, the suction main body being formed with an opening for collecting dust at an exterior surface opposite a surface to be cleaned; and

a rotary cleaning body arranged within said suction main body;



wherein said rotary cleaning body is arranged facing said opening and has a radially extending blade around a shaft core portion which is a center of rotation, and said suction main body is formed with an air introduction port for introducing wind that rotates said rotary cleaning body in a forward direction with respect to a direction in which said suction main body moves forward and for blowing said wind to said blade.

8. The dust suction body as set forth in claim 7, wherein said air introduction port is provided on a front side of said suction main body and below a rotational axis of said rotary cleaning body.

9. The dust suction body as set forth in claim 7, wherein said air introduction port is formed by a recess provided in a front lower surface of said suction main body.

10. The dust suction body as set forth in claim 2, wherein said air introduction port is provided in a front side of said suction main body, and a protrusion is provided so that it protrudes forward beyond said air introduction port provided in said front side.

11. The dust suction body as set forth in claim 10, wherein said protrusion is a bump provided on said suction main body.

12. A dust suction body comprising:  
a suction main body which communicates with a cleaner main



body, the suction main body being formed with an opening for collecting dust at an exterior surface opposite a surface to be cleaned; and

a rotary cleaning body arranged within said suction main body;

wherein said rotary cleaning body is arranged facing said opening and has a plurality of radially extending blades around a shaft core portion which is a center of rotation, and said suction main body is formed with an air introduction port which introduces wind that rotates said rotary cleaning body and blows said wind to said blade and in which a position of said blade at which said wind is blown is varied in correspondence with a position to which said blade is rotated and moved.

13. The dust suction body as set forth in claim 12, wherein said plurality of blades are flat in shape and said air introduction port is constituted by a plurality of air introduction ports provided at different height positions.

14. The dust suction body as set forth in claim 12, wherein said plurality of blades are formed spirally along a rotational axis of said rotary cleaning body, and said air introduction port is constituted by a plurality of air introduction ports provided along a direction of said rotational axis at the same height position.

15. A vacuum cleaner comprising the dust suction body as set forth in any one of claims 1 through 14.



## ABSTRACT

## TITLE OF THE INVENTION

Dust Suction Body and Vacuum Cleaner with a Dust Suction Body

The main body (10) of a dust suction body (9) is formed with an opening (12) for collecting dust at an exterior surface opposite a floor surface (FL). The suction main body (10) communicates with the main body of a cleaner. The dust suction body (9) includes a rotary cleaning body (13) arranged within the suction main body (10). The rotary cleaning body (13) collects dust through the opening (12) and is equipped with a blade (14) for sweeping out the floor surface (FL). At a front surface other than the exterior surface opposite the floor surface (FL), the suction main body (10) is formed with an air introduction port (15) for striking air to the blade (14) of the rotary cleaning body (13) to rotate the rotary cleaning body (13).

Fig. 1

FIG. 1

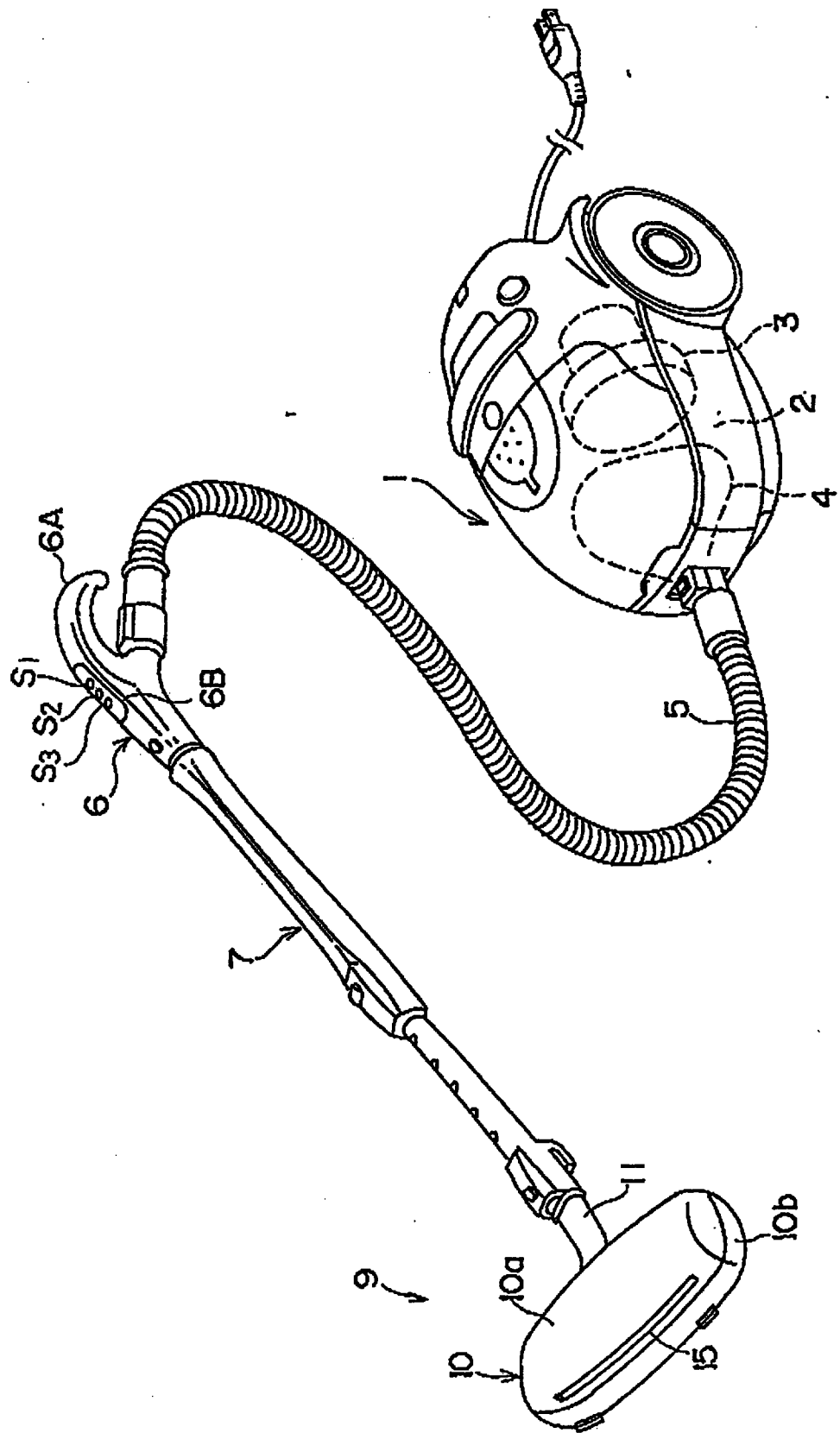


FIG. 2

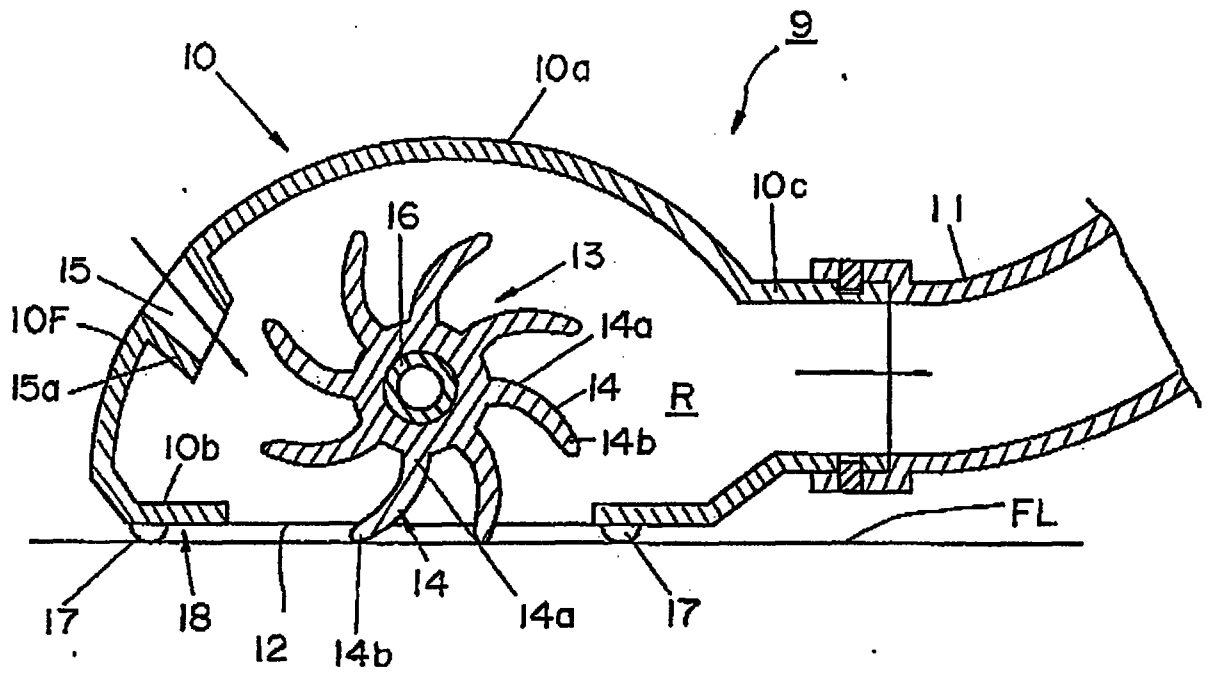


FIG. 3

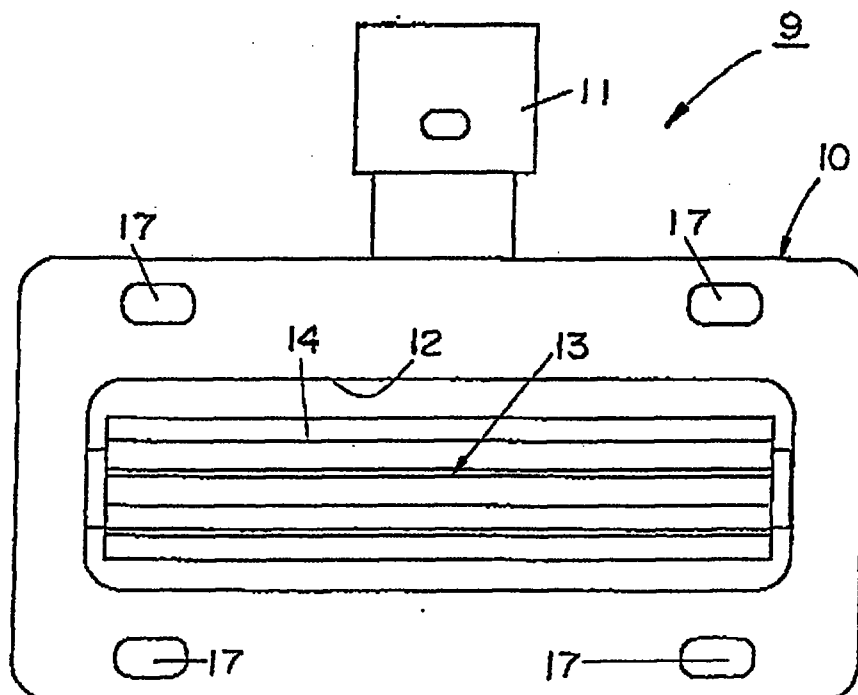


FIG. 4

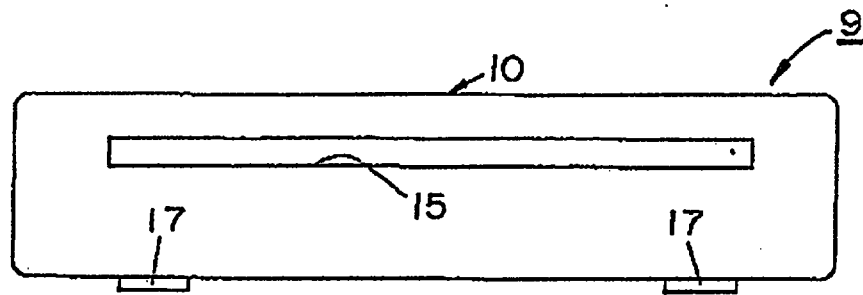


FIG. 5

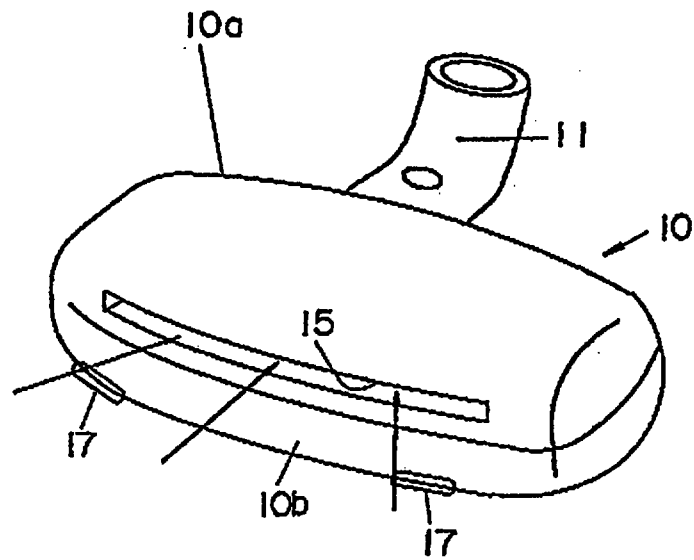


FIG. 6

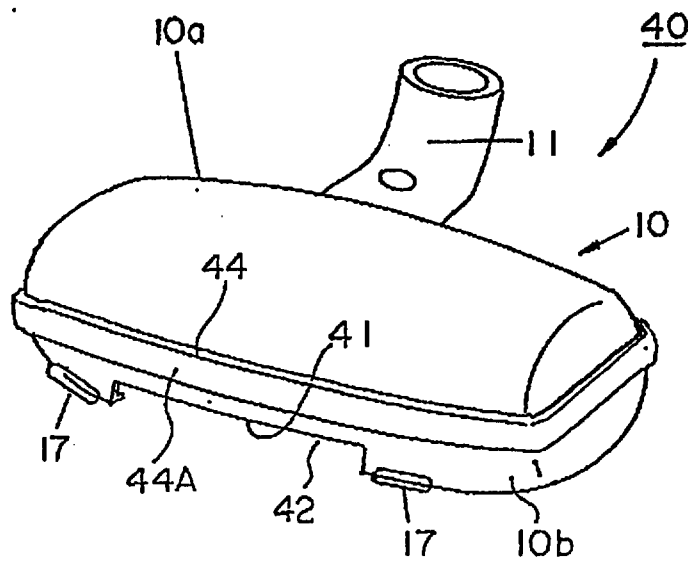


FIG. 7

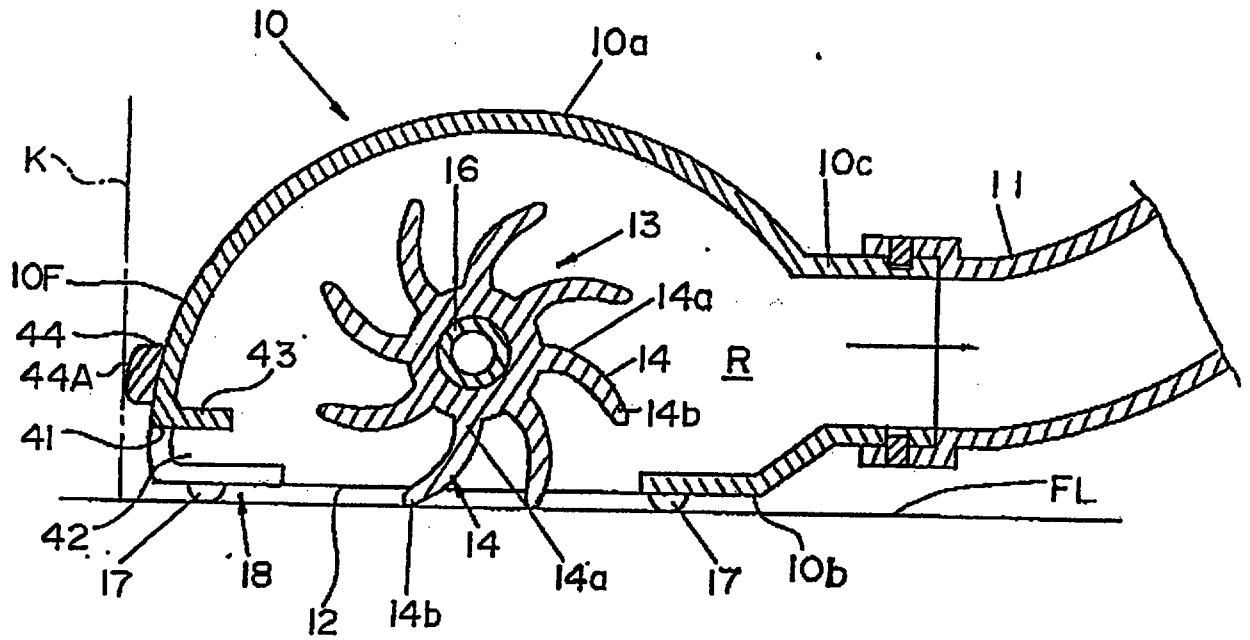
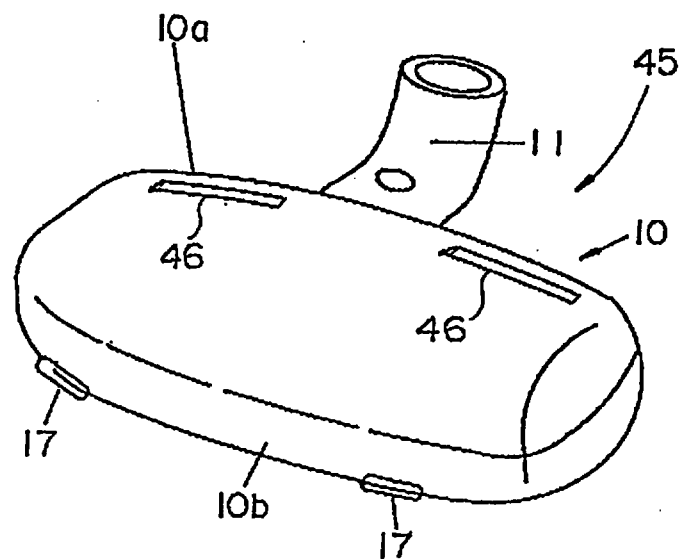


FIG. 8





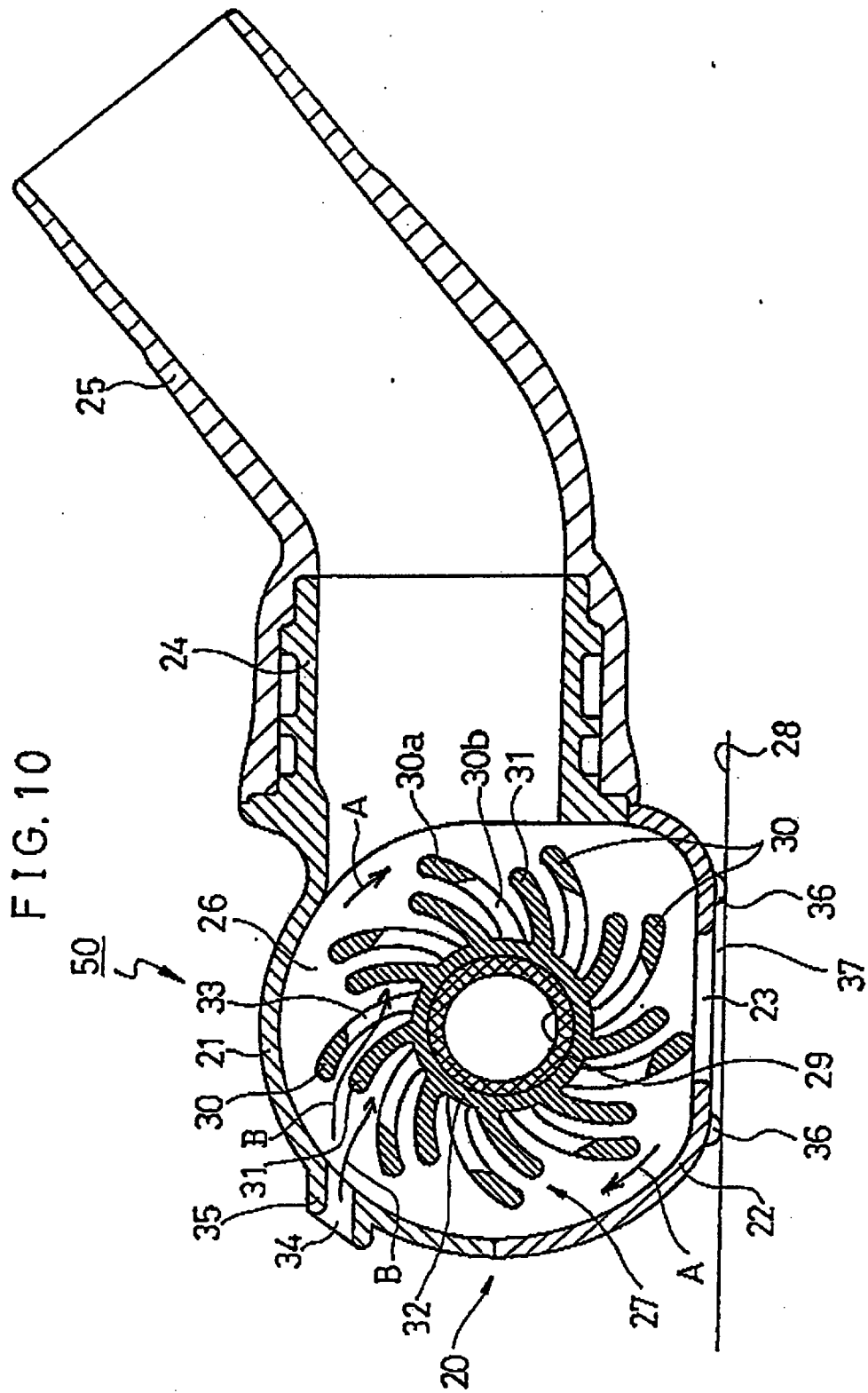


FIG. 11

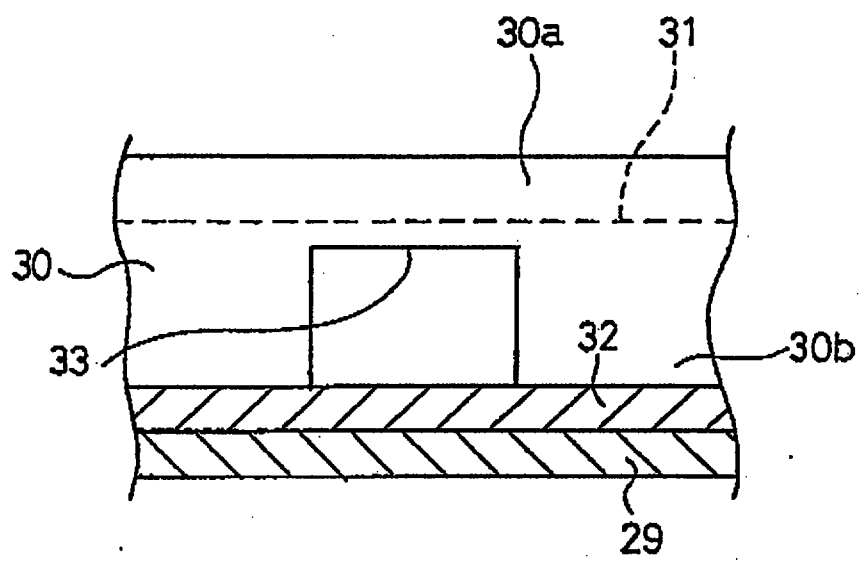
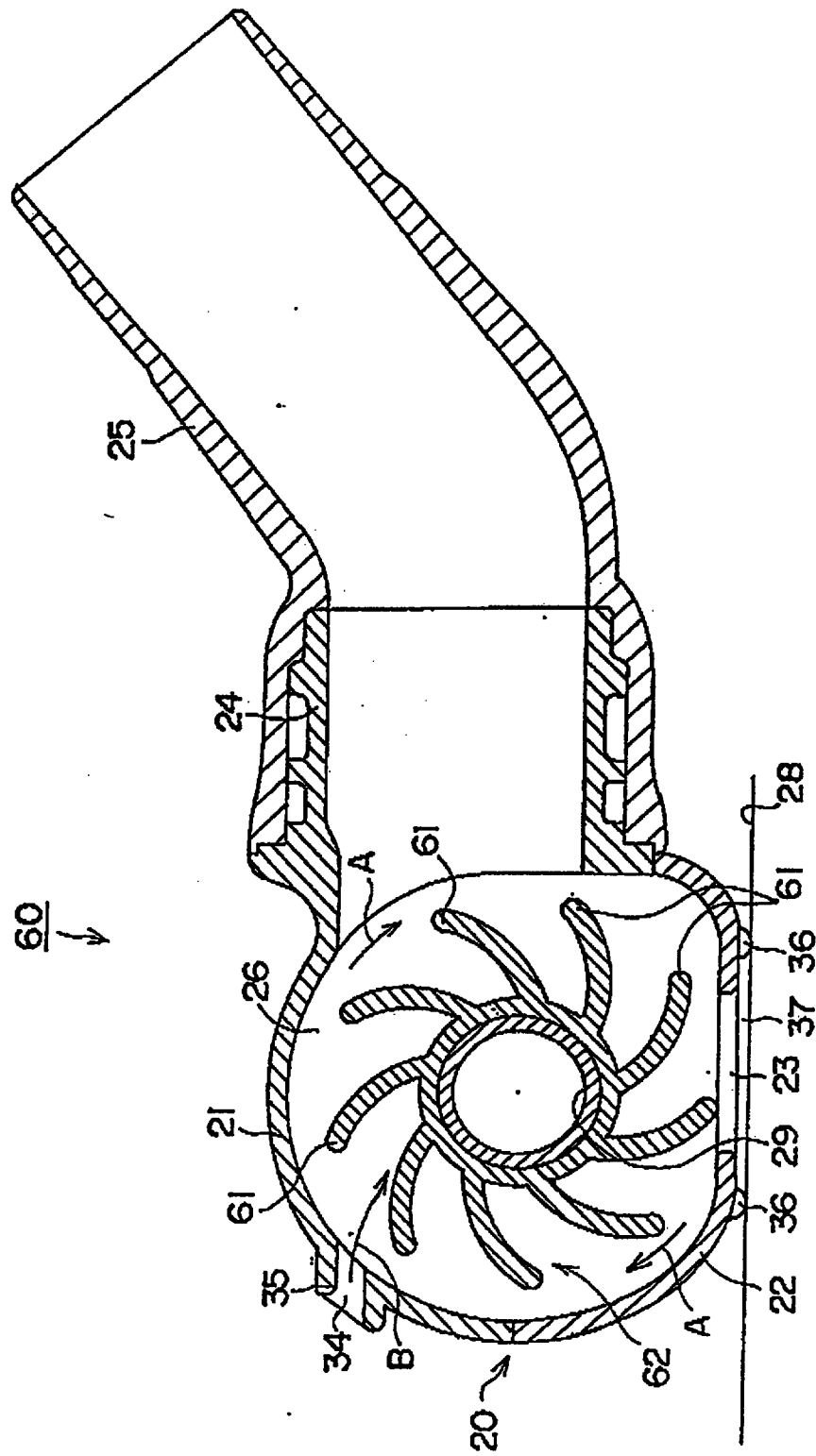


FIG. 12



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FIG. 13

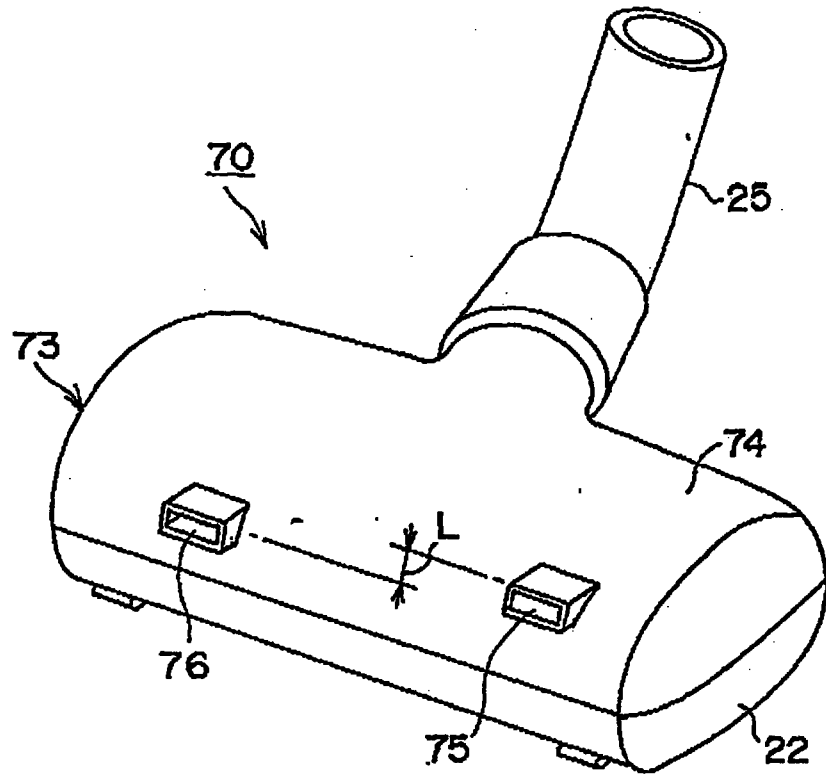


FIG. 14

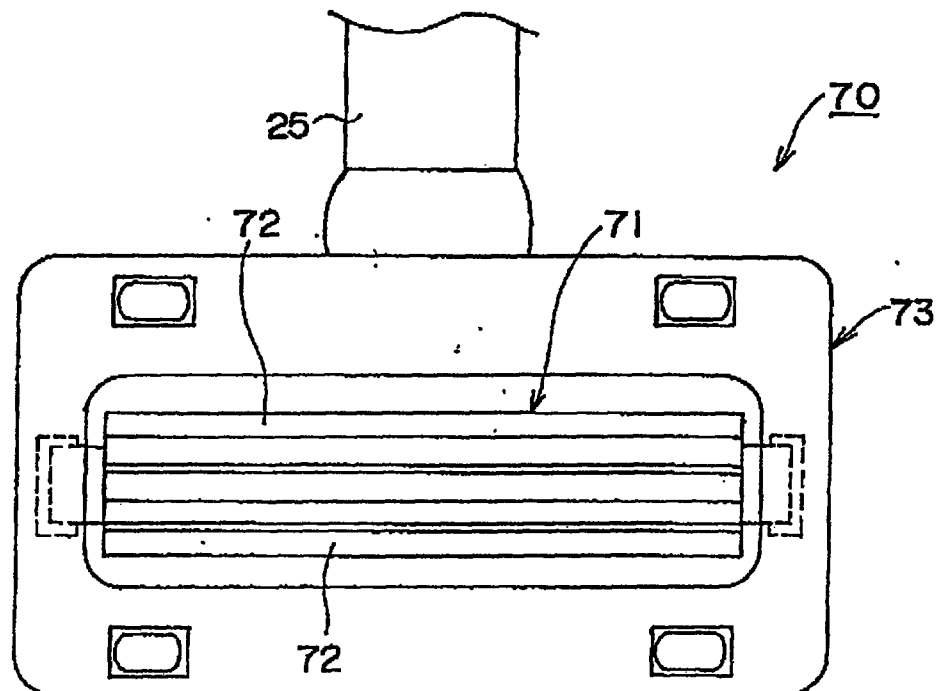


FIG. 15

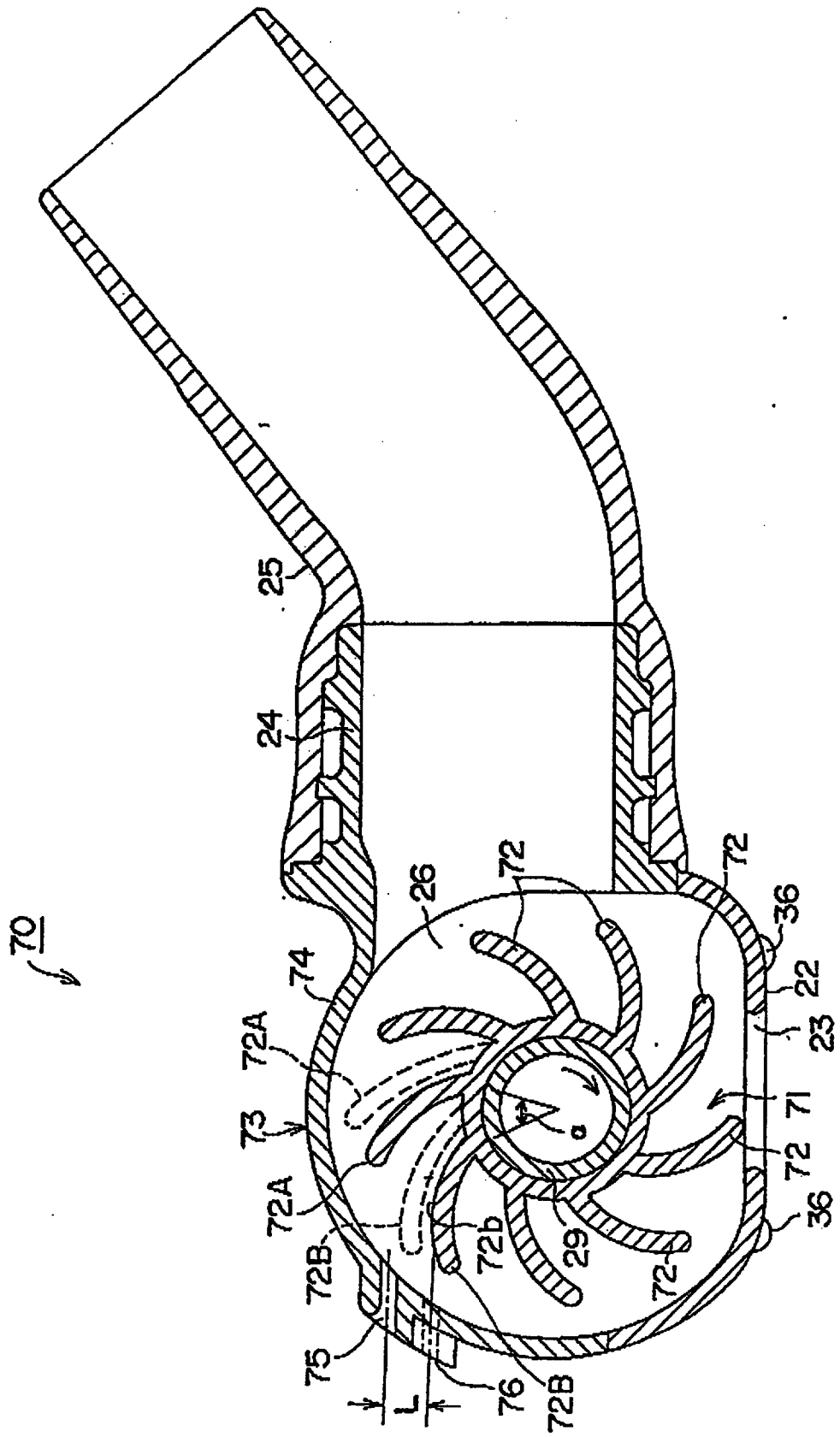


FIG. 16

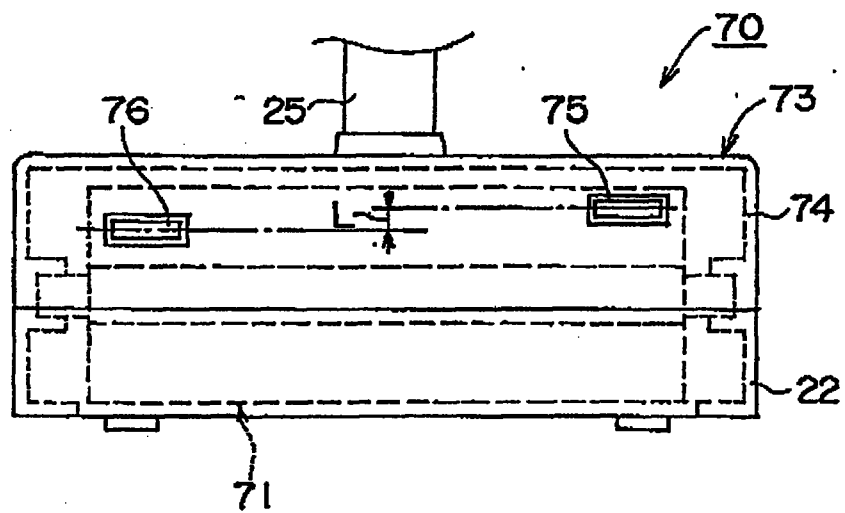


FIG. 17

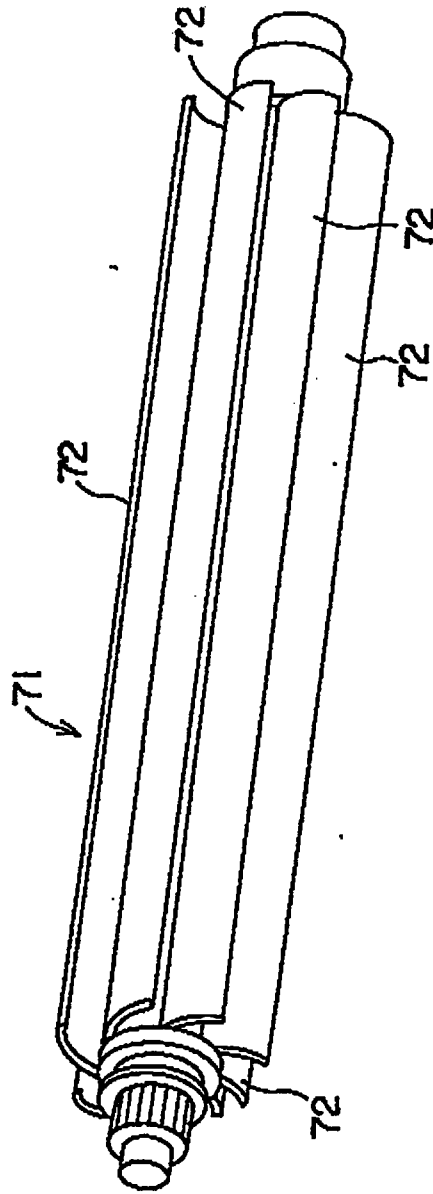




FIG. 19

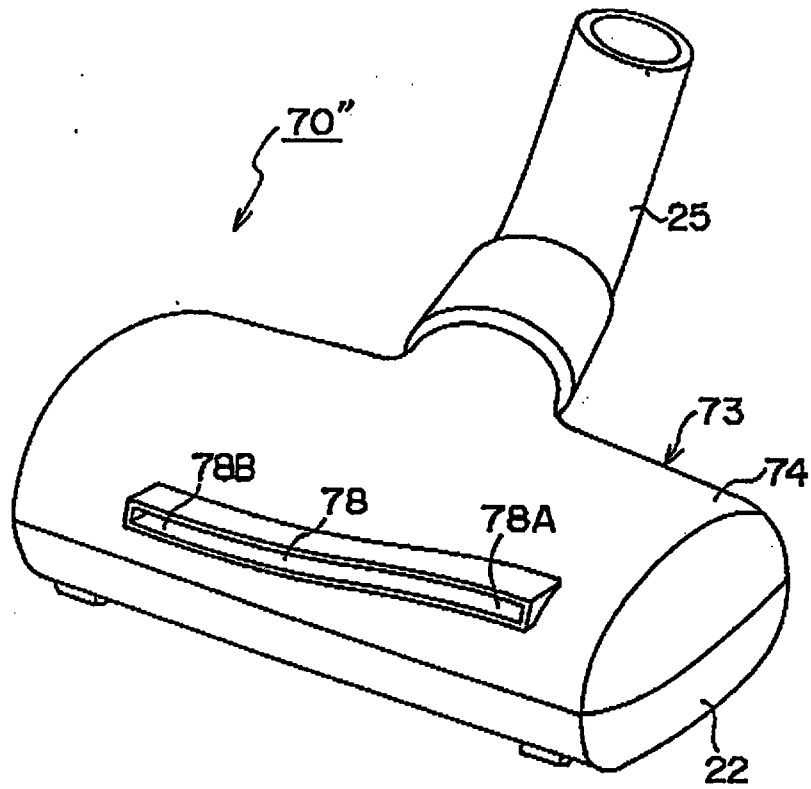


FIG. 20

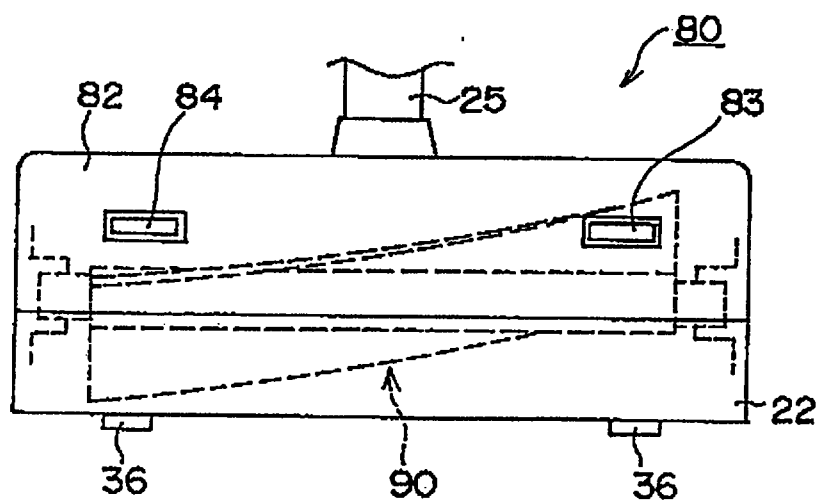


FIG. 21

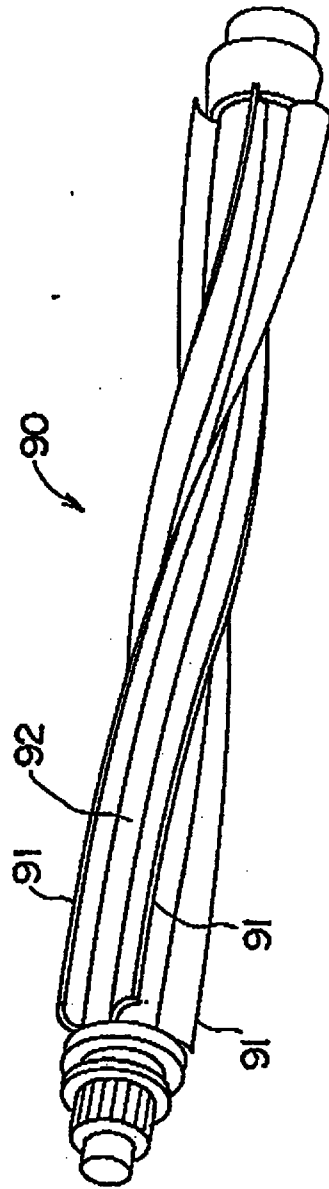


FIG. 22

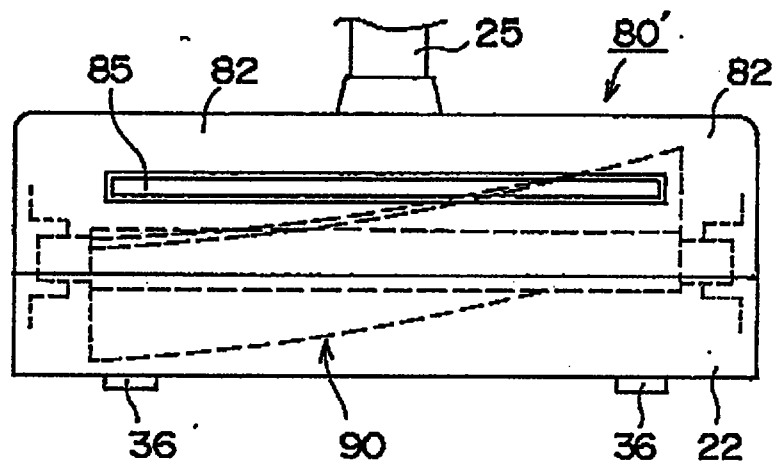


FIG. 23

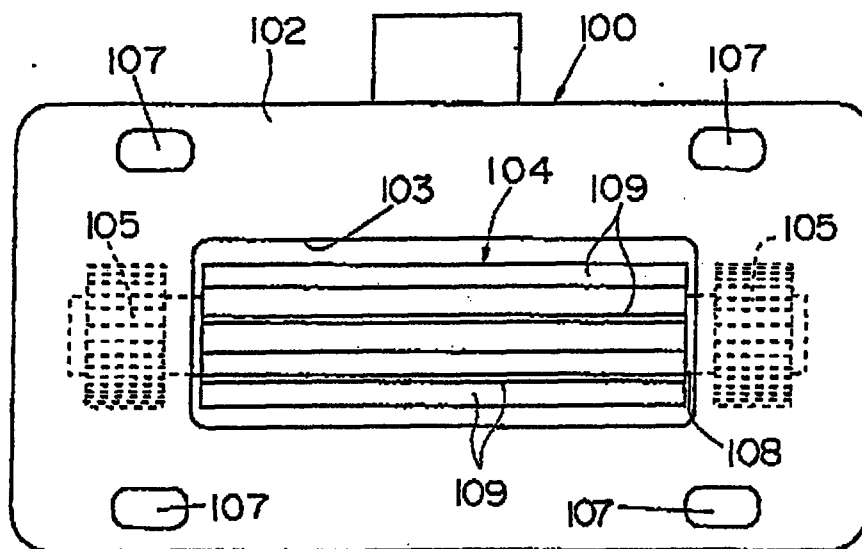


FIG. 24

