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(54) Abstract Title: **Vacuum cleaner with selectively driven roller**

(57) A vacuum cleaner includes a vacuum cleaner main body 20 having a vacuum source and a dust-collecting receptacle for the drawn-in dust. A nozzle unit main body is fluidly connected to the vacuum cleaner main body 20. A rotatable brush 12 is mounted on the nozzle unit main body and a drive pulley 42 is mounted on the rotatable brush. An idler pulley 44 is disposed adjacent to the drive pulley 42. A belt 46 can be located either on the drive pulley 42 or the idler pulley 44 and on a drive shaft 28 of the vacuum source. A belt guide unit has a belt guide member 52 movable between a first position connecting the belt 46 with the drive pulley 42 and a second position connecting the belt with the idler pulley 44. A belt guide member controller is provided for moving the belt guide member 52 to one of the first position and the second position. The belt guide unit may further comprise a spring 56 for biasing the belt guide member into the first position.

FIG. 5

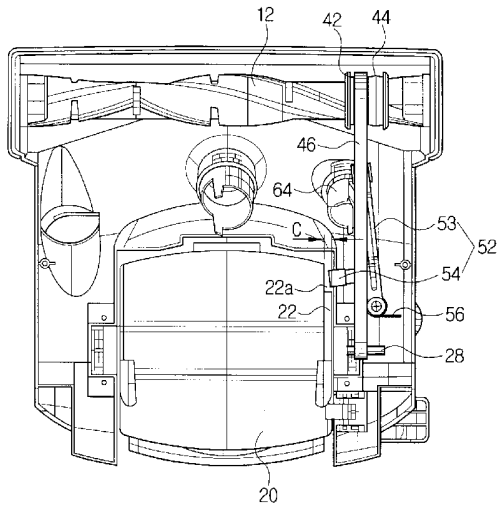

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FIG. 1

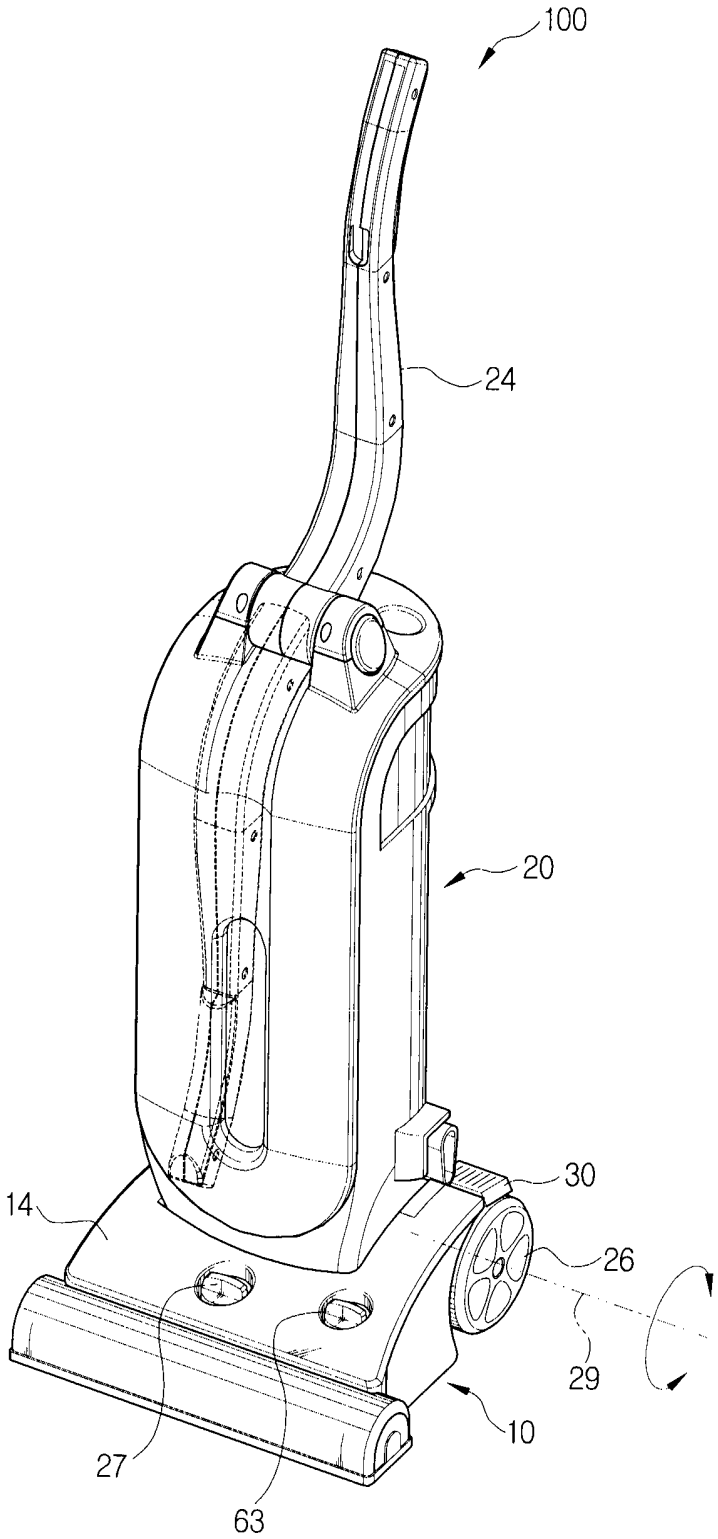


FIG. 2

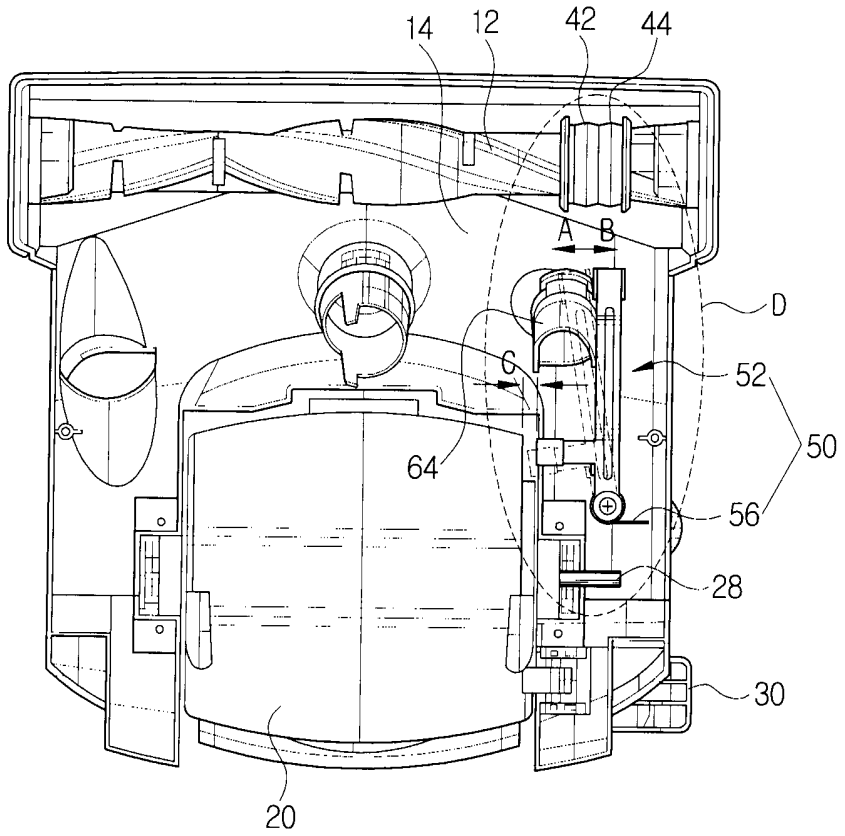


FIG. 3

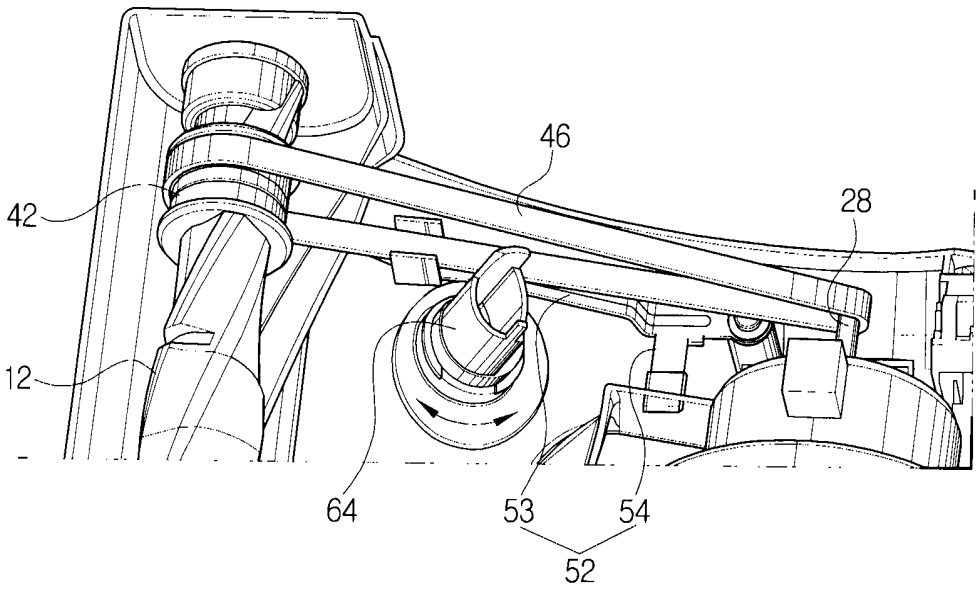


FIG. 4

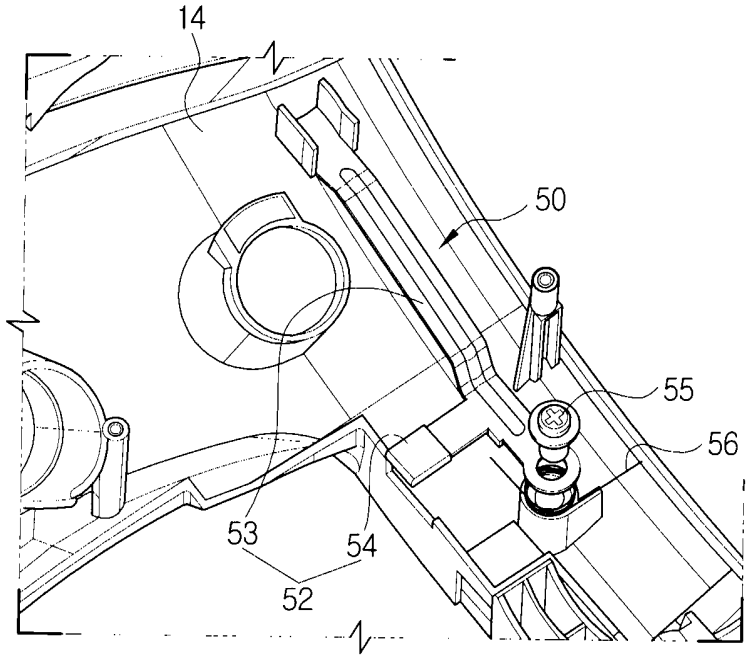


FIG. 5

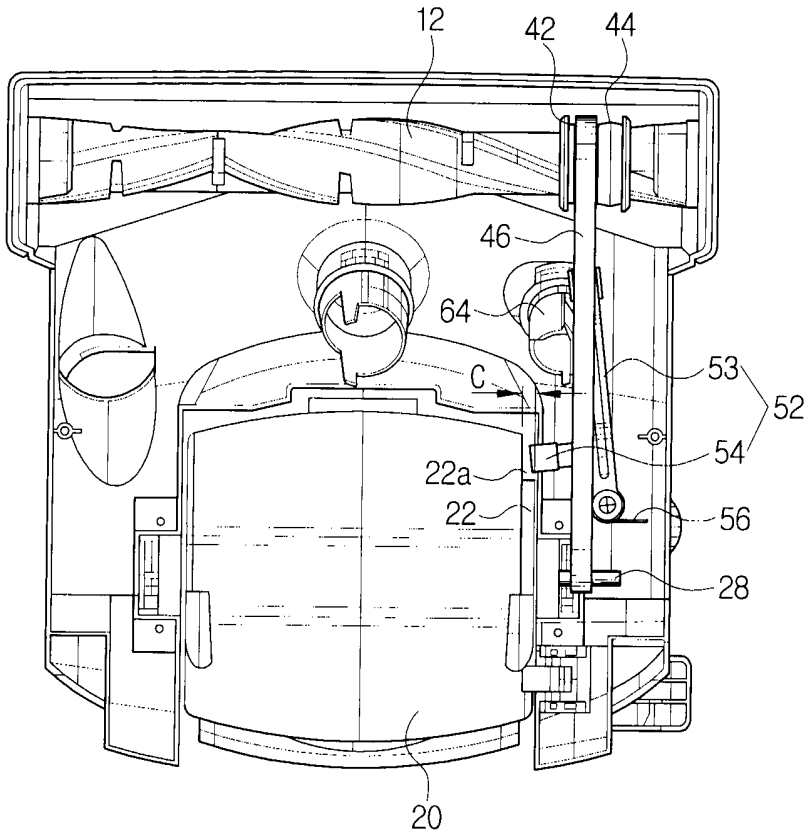


FIG. 6

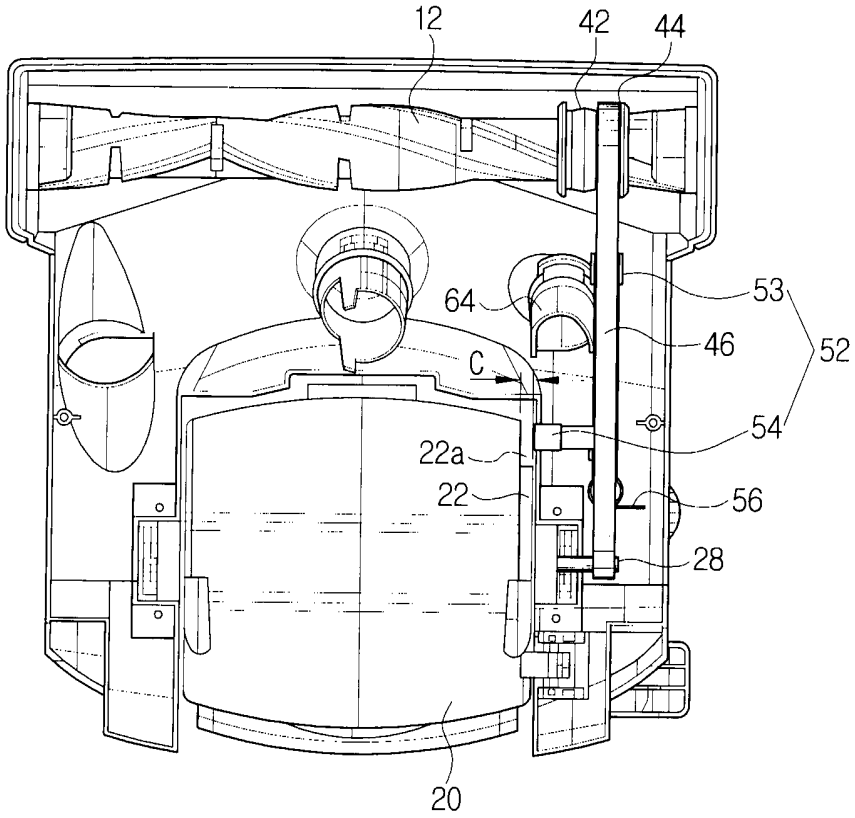


FIG. 7

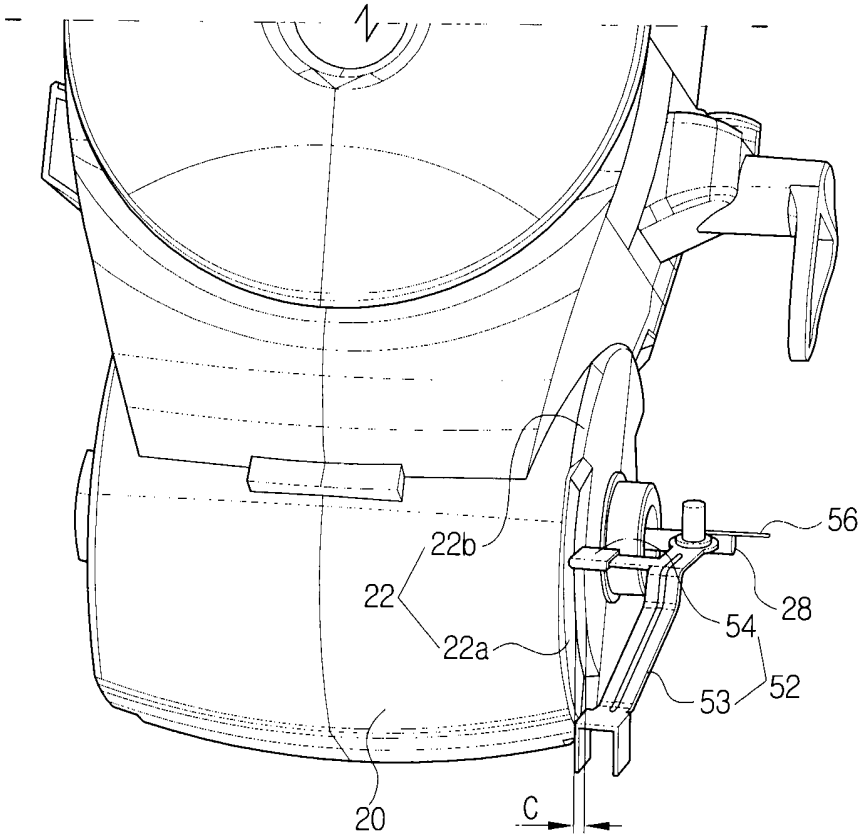


FIG. 8

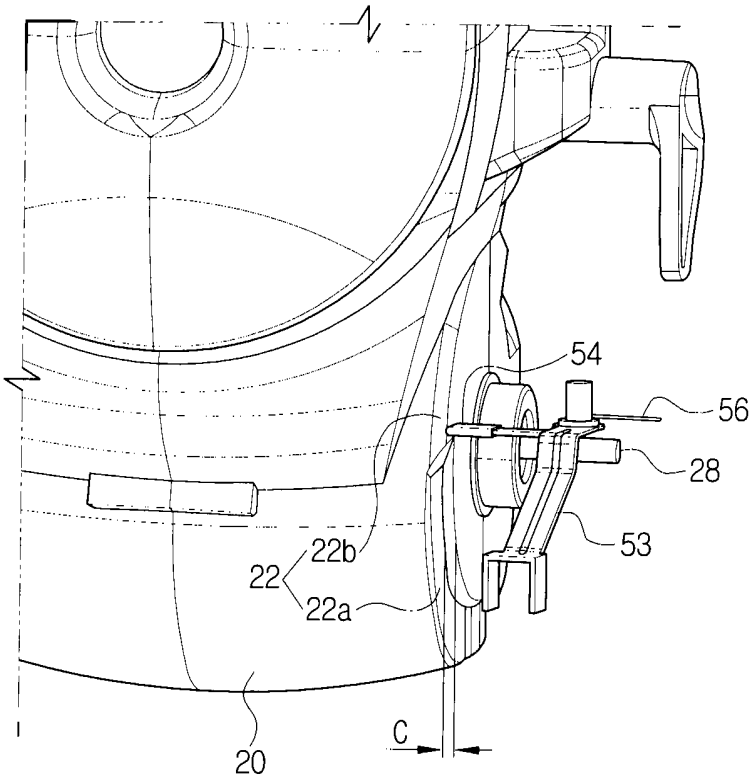


FIG. 9

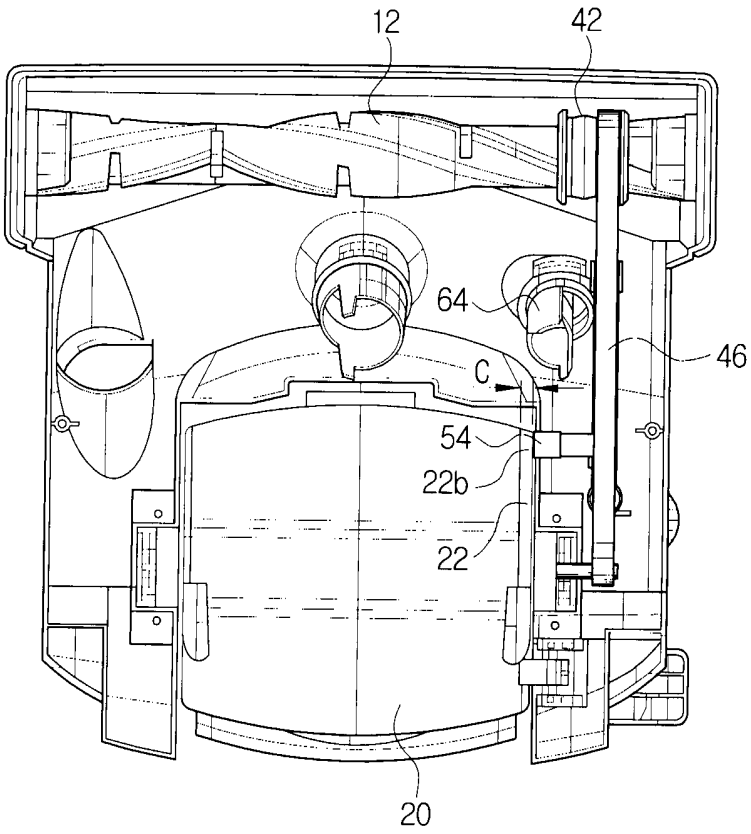


FIG. 10

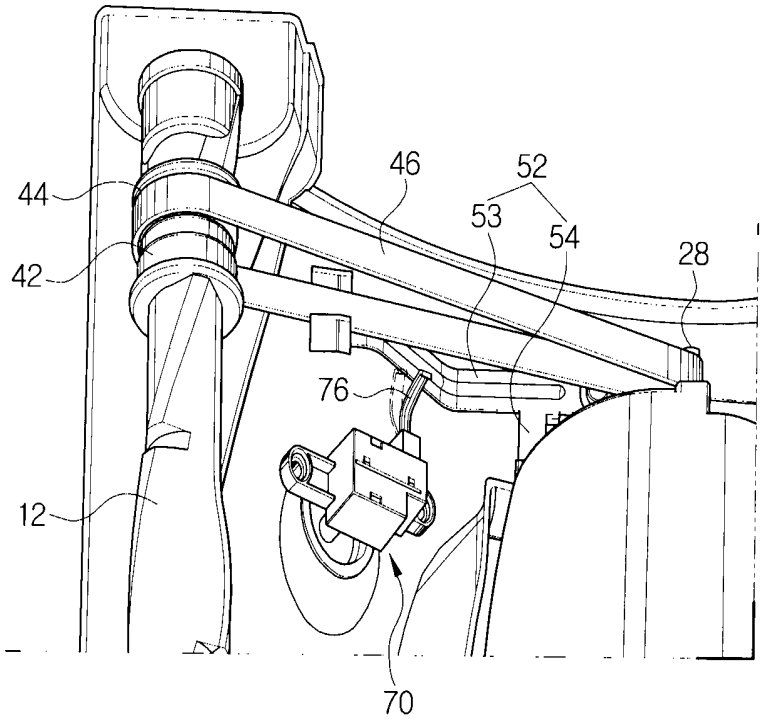


FIG. 11

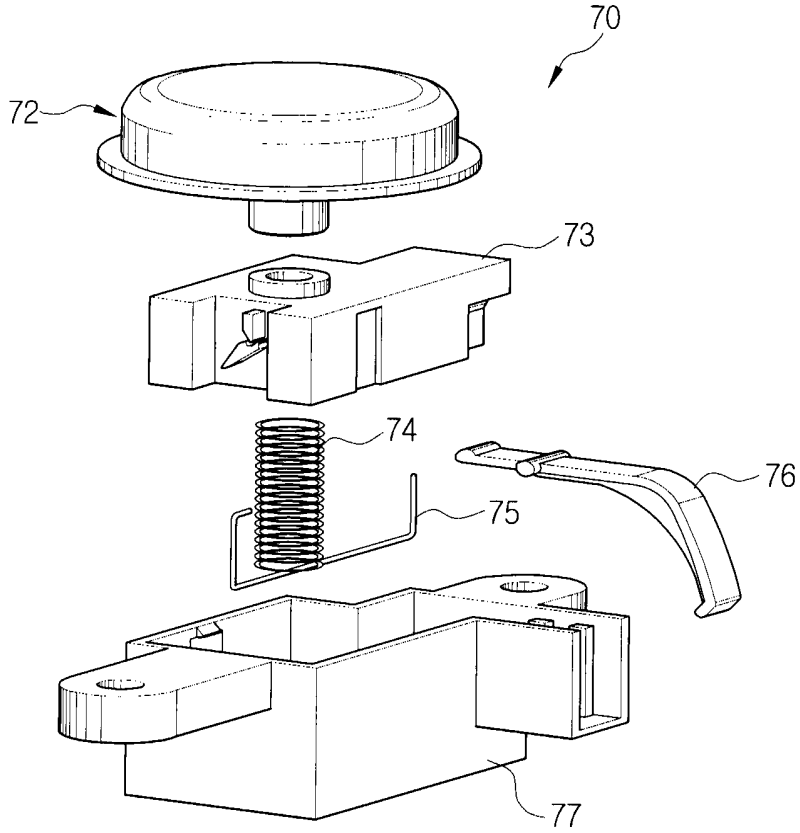
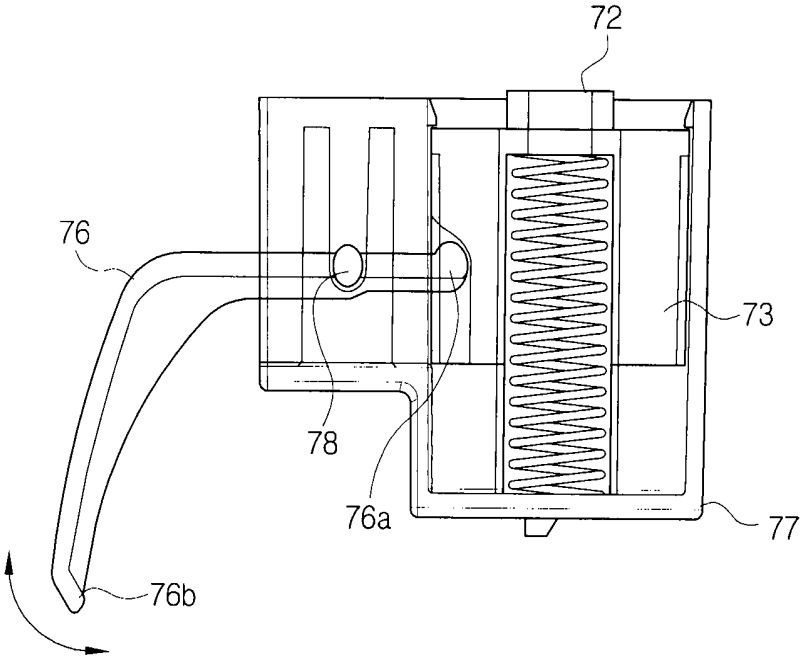


FIG. 12



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Vacuum Cleaner

This invention relates to a vacuum cleaner, and in particular to a vacuum cleaner having a controllable rotatable cleaning brush.

Generally, a vacuum cleaner has a motor-driven vacuum resource, and draws in dust, dirt and other contaminants (hereinafter referred to as "dust") by a suction force generated by the vacuum source. By drawing in dust, the suction force is used to clean a surface.

As is well known, however, certain surfaces and places are difficult to clean by only a vacuum. Depending on the type of surface, and the kind of dust to be removed, some surfaces and some kinds of dust can be more effectively picked up by a vacuum cleaner using a rotatable brush in combination with a suction force. As is also known, however, use of a rotatable brush is not always necessary. For example, a vacuum cleaner user does not want the noise that is generated by friction between the brush and the surface to be cleaned, or when cleaning a surface or an object that can be damaged by the rotating brush, it is necessary to stop the brush. In a vacuum cleaner equipped with a rotatable brush, cleaning work can be performed without rotating the brush by using various cleaning accessory tools attached to the vacuum source by a hose. If a rotatable brush is not needed for cleaning, the ability to stop the brush rotating would, among other things, enable a vacuum cleaner motor to direct all of its available power to the vacuum fan or other vacuum source, thereby reducing wear on the brush when it is not needed, and reducing the noise caused by the brush's rotation. Accordingly, a need exists for a vacuum cleaner which can selectively control a rotatable cleaning brush according to required cleaning circumstances or desired operation.

US Patent No. 6,044,520 discloses a vacuum cleaner having a controllable rotatable brush. However, the vacuum cleaner disclosed in this patent has a very

complicated structure, so that the size of the main body is relatively large, and accordingly the manufacturing cost increases.

The present invention provides a vacuum cleaner comprising:

a vacuum cleaner main body having a vacuum source and a dust-collecting receptacle for drawn-in dust;

a nozzle unit main body fluidly connected to the vacuum cleaner main body;

a rotatable brush mounted in the nozzle unit main body;

a drive pulley mounted on the rotatable brush;

an idler pulley disposed adjacent to the drive pulley;

a belt locatable on either the drive pulley or the idler pulley, and on a drive shaft of the vacuum source;

a belt guide unit having a belt guide member movable between a first position connecting the belt with the drive pulley and a second position connecting the belt with the idler pulley; and

a belt guide member controller for moving the belt guide member between the first position and the second position.

The belt is directed to engage either the drive pulley or the idler pulley by way of the belt guide unit having the belt guide member that is movable between the first position that directs the belt onto the drive pulley and the second position that directs the belt onto the idler pulley. The belt guide member controller moves the belt guide member to either the first position or the second position. The belt guide unit may further comprise a spring for biasing the belt guide member towards the first position.

In a preferred embodiment, the belt guide member controller is a belt control knob rotatably mounted to the nozzle unit main body for moving the belt guide

member moved between the first position and the second position by contact with the belt guide member when the belt control knob is rotated.

Preferably, the belt control knob comprises:

a knob exposed to the nozzle unit main body and rotatably mounted therein, and a cam member substantially configured as a half cylinder,

wherein the cam member is contacted by the belt guide member when the knob is located in a predetermined position, thereby moving the belt guide member to the second position.

In this case, the cleaner may further comprise:

a cam contactable with the belt guide member to prevent the belt guide member from moving to the first position when the vacuum cleaner main body is substantially upright,

wherein the vacuum cleaner main body is pivotally mounted to the nozzle unit main body.

Advantageously, the belt guide member comprises:

a first member, one end of which holds and moves the belt to one of the first position or the second position, the other end being attached to the nozzle unit main body ; and

a second member having a predetermined length and connected to the first member, the second member extending to the vacuum cleaner main body; whereby, when the vacuum cleaner main body is substantially upright, the second member is contacted by the cam of the vacuum cleaner main body to prevent the first member from moving to the first position.

In another preferred embodiment, the belt guide member controller is :

a button unit mounted on nozzle unit main body for moving the belt

guide member to one of the first position or the second position.

Preferably, the button unit comprises:

a button exposed at the nozzle unit main body;

an actuator contactable with a lower portion of the button, and movable with the button;

a return spring in contact with a lower portion of the actuator; and

a lever, one end of which is located on a lower portion of the actuator, the other end being attached to the belt guide member,

wherein the lever is moved according to the movement of the lower portion of the actuator to move the belt guide member to the first position or the second position.

Advantageously, the button unit further comprises:

a stop spring located on the return spring, for preventing the actuator from moving beyond a predetermined position; and

a housing for the return spring and the stop spring.

The invention will now be described in greater detail, by way of example, with reference to the drawings, in which:

Figure 1 is a perspective view of a first form of vacuum cleaner constructed according to the invention;

Figure 2 is an underneath view of the cleaner of Figure 1 with its belt missing;

Figure 3 is a perspective view, from another angle, of portion D of Figure 2, and showing the belt;

Figure 4 is a detailed view of a belt guide unit of the cleaner of Figure 3;

Figure 5 is an underneath view of the cleaner of Figure 1, showing a selection knob of a belt guide member controller located in a driving position;

Figure 6 is an underneath view of the cleaner of Figure 1, showing the selection knob of the belt guide member controller located in a non-driving position;

Figure 7 shows the cleaner body and the belt guide member of the cleaner of Figure 1 in operation;

Figure 8 shows the cleaner main body and the belt guide member of the cleaner of Figure 1 in operation, when the cleaner body is locked to an associated nozzle unit;

Figure 9 is an underneath view corresponding to Figure 8, showing the selection knob located in the driving position;

Figure 10 is a view of a modified form of belt guide member controller constructed according to the invention; and

Figure 11 and Figure 12 are detailed views of a button unit of the belt guide member controller of Figure 10.

In the following description, the same reference numerals are used for the same elements in the different drawings. The embodiments described are only examples, and are not intended to be limiting. Rather, the invention disclosed herein is set forth in the claims. Also, well-known functions and structures are not described in detail, since they would tend to obscure the invention in unnecessary detail.

Referring to the drawings, Figure 1 shows an upright vacuum cleaner 100 having a nozzle unit 10 that runs over a floor, carpet or other surface to be cleaned (not shown). A cleaner body 20 is mounted to the nozzle unit 10 for rotation about an axis 29, the cleaner body being inclined with respect to the surface to be cleaned. Two wheels 26 are provided at the rear of the nozzle unit 10 to allow the vacuum cleaner 100 to be moved about over the surface to be cleaned. A main body locking/release lever 30 is located at the rear, lower end of the main body 20. The vacuum cleaner 100 can be operated using a handle 24 that is connected with, and forms a portion of, the main body 20.

The main body 20 contains a motor-driven vacuum source (not shown), and a dust-collecting receptacle (not shown). The main body 20 is pivotally attached to the nozzle unit 10 so that it can incline upwardly and downwardly, about the axis 29, with respect to the surface to be cleaned.

The motor-driven vacuum source within the cleaner main body 20 fluidly communicates with the nozzle unit 10, which is the part of the vacuum cleaner 100 through which dust is taken up from the surface to be cleaned. The fluid communication between the motor-driven vacuum source and the nozzle unit 10 allows the vacuum provided by the vacuum source to reach the nozzle unit. Accordingly, dust in air from the surface to be cleaned enters the vacuum cleaner 100 via the nozzle unit 10, and is carried into the dust-collecting receptacle of the main body 20.

The locking/release lever 30 is provided for locking the main body 20 in a substantially upright position with respect to the nozzle unit 10. The locking/release lever 30 also serves to release the main body 20 from the substantially upright position to allow the main body to be upwardly and downwardly inclined with respect to the nozzle unit 10 and with respect to the surface to be cleaned. As such, a user pushes the locking/release lever 30 by hand or foot to release the main body 20. The user can thereafter operate the main body 20 to vacuum the surface to be cleaned. When cleaning is finished, or when an extension hose or the other accessory needs to be attached to the vacuum cleaner 100, the main body 20 is adjusted to the substantially upright position as shown in Figure 1. Cam members 22, 22a (see Figure 7) are provided at a lower portion of the main body 20 for controlling the adjustment of the main body. This will be explained below in greater detail.

Referring to Figures 1 and 2, the nozzle unit 10 comprises a main body 14, a rotatable brush 12, a height-adjustment knob 27 for adjusting the height of the nozzle unit, a drive pulley 42, an idler pulley 44, a belt guide unit 50 and a belt

guide member controller.

The rotatable brush 12 is shaped like a right circular cylinder, and is rotatably mounted in the main body 14 on bearings (not shown) that are preferably located at each end of the brush, so that the brush can easily spin on its axis of rotation (not shown). The brush 12 includes a plurality of bristles (not shown), which are planted or inserted along the outer circumference surface of the brush. The bristles extend away from the outer circumference surface of the brush 12, and act to dislodge dust from a surface to be cleaned.

The brush 12 is belt driven to rotate about its axis, and receives a driving force from a motor (not shown) in the main body 20.

The drive pulley 42 is fixed to the brush 12 so that rotation of the drive pulley causes the brush 12 to rotate when a belt 46 is on the drive pulley and moving. The idler pulley 44, which is located adjacent to the drive pulley 42, is free-wheeling on bearings (or a bearing surface) so that location of the belt 46 on the idler pulley does not impart rotation to the brush 12.

Referring to Figure 3, the belt 46 is selectively directed to engage either the drive pulley 42 or the idler pulley 44, and is driven by a rotatable output shaft 28 of a motor, preferably the motor used as the vacuum source (not shown). When the belt 46 is directed to engage the drive pulley 42, the brush 12 is rotated by the force transmitted to the drive pulley from the shaft 28 via the belt.

Referring to Figures 2 to 4, the belt guide unit 50 comprises a belt guide member 52 and a spring 56. The belt guide member 52 restricts the belt 46 for movement between a first position A (see Figure 2) in which the belt 46 engages the drive pulley 42, and a second position B (see Figure 2) in which the belt engages the idler pulley 44, in which case, the brush 12 is not driven.

As shown in Figures 3 and 4, the belt guide member 52 comprises a first member 53 and a second member 54. The first member 53 is sized and arranged to engage the belt 46, with one end of the first member positioning the belt in either the first position A or the second position B. The other end of the belt guide member 52 is pivotally mounted on the nozzle unit main body 14 by a pivot 55. The second member 54 of the belt guide member 52 is connected with the first member 53, and extends inwardly, that is turns towards the centre of the nozzle unit 10 as shown.

The spring 56 is mounted to the main body 14 around the pivot 55, prior to the belt guide member 52 being fixed to the main body, so as to bias the belt guide member 52 towards the first position A in which the belt 46 engages the drive pulley 42.

A belt guide member controller, embodied in part as a belt control, controls the movement of the belt guide member 52 to be in either the first position A or the second position B. The belt control has a knob 63 that extends through the top of the nozzle unit 10 (see Figure 1). The knob 63 is engageable with a cam member 64 as seen in Figures 2, 3, 5 and 6, and is used to operate the belt guide member 52 from the top of the nozzle unit 10, whereby a user of the vacuum cleaner 100 can control the operation of the rotatable brush 12. As shown in Figure 1, the knob 63 is exposed within the main body 14, and is rotatably mounted to have a driving or non-driving position, in which the brush 12 is either driven or not driven. As shown, the cam member 64 is formed in the shape of a half cylinder.

In one embodiment, when the knob 63 is rotated to a position for driving the rotatable brush 12, the cam member 64 does not contact the belt guide member 52. Rather, the belt guide member 52 is urged by the spring 56 to move the belt 46 to the first position A, indicated as a dotted line in Figure 2. As a result, the belt 46

is restricted by the first member 53 of the belt guide member 52 to engage the drive pulley 42 so that the brush 12 is rotated. If the knob 63 is moved to its non-driving position, the cam member 64 is rotated by the knob to engage the first member 53 of the belt guide member 52 to move the belt guide member to the second position B, as indicated by the solid line in Figure 2. As such, the belt 46 is then restricted by the first member 53 of the belt guide member 52 to engage the idler pulley 44 so that the brush 12 does not receive power via the belt. It is important to note that frictional losses between the idler pulley 44 and the brush 12 may continue to impart a small amount of torque to the brush. However, sufficient power to rotate the brush 12 is not provided via the idler pulley 44, so that the brush is considered to be un-powered or stopped.

The operation of the vacuum cleaner 100 will now be described.

Figures 5 to 7 show the main body 20 in the position where it is released from the nozzle unit 10, that is to say the main body is not locked substantially upright relative to the nozzle unit.

Referring to Figure 5, if the knob 63 is moved to the driving position, the belt guide member 52 does not contact the cam member 64, and is moved to the first position A (see Figure 2) by the spring 56. As such, the belt 46 engages the drive pulley 42 and is driven by the shaft 28 and restricted by the first member 53 of the belt guide member 52.

Referring to Figure 6, when the knob 63 is moved to the non-driving position, the first member 53 of the belt guide member 52 is contacted by the cam member 64, so that the belt guide member forces the belt 46 to the second position B (see Figure 2). As such, the belt 46 engages the idler pulley 44, so no driving torque is provided to the brush 12.

Figure 7 shows the operating relationship of the main body 20 and the belt guide member 52. The cam member 22 is provided at the lower portion of the main body 20, and is rotatable by movement of the vacuum cleaner 100. The groove 22a has a width C. As shown in Figure 7, if the main body 20 is released from being locked to the nozzle unit 10, the main body can be adjusted to a position other than the upright position with respect to the nozzle unit. The second member 54 of the belt guide member 52 contacts the groove 22a. When the belt guide member 52 is moved to the first position A (see Figure 2) by the spring 56, the second member 54 of the belt guide member is moved within the width C of the groove 22a, so that the belt guide member does not engage the cam member 22. The belt guide member 52 is, therefore, movable between the first position A and the second position B in accordance with the driving or non-driving position of the cam follower 63, as shown in Figure 5 and Figure 6. Therefore, the belt 46 is moved by the belt guide member 52 to engage the drive pulley 42 or the idler pulley 44 in accordance with the driving or non-driving position of the cam follower 63, and the brush 12 is driven or not driven accordingly.

When the vacuum cleaner is used with the main body 20 released from the upright position, the rotatable brush 12 is automatically driven or not driven according to the selection position (driving or non-driving) of the knob 63.

Figures 8 and 9 are partial views showing the vacuum cleaner main body 20 locked to the nozzle unit 10 in a substantially upright position. Referring to Figure 8, the belt guide member 52 is moved to the first position A by engagement with the cam member 22. In particular, the cam member 22 is rotated counterclockwise according to the movement of the main body 20. Therefore, the second member 54 of the belt guide member 52 contacts a partition 22b of the cam member 22. Accordingly, the second member 54 of the belt guide member 52 contacts the groove 22a of the cam member 22, and so the belt guide member cannot be moved to the first position A, and is located in the second position B (see Figure 2). Finally, the belt 46 is moved by the belt guide member 52 so as to engage the idler pulley 44, and so the brush 12 is not driven.

As shown in Figure 9, even if the knob 63 is in the driving position, the belt guide member 52 is located in the second position B owing to the engagement between the partition 22b and the second member 54. Accordingly, the belt 46 is moved by the first member 53 of the belt guide member 52 to engage the idler pulley 44, and so the brush 12 is not driven. If the knob 63 is in the non-driving position, the belt guide member 52 is positioned in the second position B as shown in Figure 9, because of the engagement of the cam member 64 with the knob and the first member 53 of the belt guide member 52, and the engagement of the partition 22b and the second member 54 of the belt guide member 52. The belt 40 is moved by the first member 53 of the belt guide member 52 to engage the idler pulley 44, and the brush 12 is not driven.

When the vacuum cleaner is stowed after cleaning, or when it is operated with an extension hose and various accessories, the main body 20 is locked to the nozzle unit 10 in a substantially upright position, and therefore the brush 12 is not driven, irrespective of the selection position (driving or non-driving) of the knob 63. Even though a user inadvertently turns on the power of the vacuum source, the brush 12 is not driven with the main body 20 in a substantially upright position, and therefore damage to the surface being cleaned, due to abrupt rotation of the brush, is prevented.

In a modified embodiment (see Figures 10 to 12), when the main body 20 is in its substantially upright position, the belt guide member 52 is located in the second position B (see Figure 2). As such, the belt 46 is moved by the belt guide member 52 to engage the idler pulley 44, so the brush 12 is not driven. In the first embodiment, when the main body 20 is not in a substantially upright position, the position of the belt guide member 52 is adjusted in accordance with the driving or non-driving position of the knob 63, and the belt 46 is moved by the belt guide member 52 to engage the drive pulley 42 or the idler pulley 44. In the second embodiment, the position of the belt guide member 52 is adjusted by a button unit 70.

The button unit 70 comprises a button cap 72 exposed on, and accessible from the exterior of the nozzle unit main body 14. When depressed, the button cap 72 moves an actuator 73 downwardly. A coil return spring 74 is seated against the base of the actuator 73, and acts to bias the button cap 72 upwardly. A stop spring 75 engages the base of the return spring 74 to prevent the actuator 73 from moving beyond a predetermined position. One end 76a of a lever 76 is engageable with the lower portion of the actuator 73. The other end 76b of the lever 76 is engageable with the belt guide member 52 of the belt guide unit 50 to move it in the direction of the idler pulley 44 when the lever rotates around a pivot 78. A housing 77 provides an enclosure and mount for the button cap 72, the actuator 73, the return spring 74, the stop spring 75, the lever 76 and the pivot 78.

When the main body 20 is not in a substantially upright position, the belt guide member 52 is located in the first position A (see Figure 2) by the spring 56, and the belt 46 is held by the first member 53 of the belt guide member 52 in engagement with the drive pulley 42. Therefore, the brush 12 is driven. If the button 72 is depressed, for a non-driven mode of operation, the actuator 73 is moved downwardly to rotate the lever 76 about the pivot 78 by the engagement of its end 76a with the lower portion of the actuator 73. The other end 76b of the lever 76, which is engaged with the belt guide member 52, moves the belt guide member to the second position B (see Figure 2) indicated as a solid line in Figure 10. The belt 46 is held by the first member 53 of the belt guide member 52 so as to engage the idler pulley 44 according to the movement of the belt guide member, and the brush 12 is not driven.

If the button 72 is depressed again, the actuator 73 is returned to its starting position by the return spring 56, and the lever 76 is returned to its starting position by the actuator 73. The belt guide member 52 connected with the other end 76b of the lever 76 is moved to the first position A (see Figure 2) indicated by a dotted line in Figure 10, and the belt 46 engages with the drive pulley 42, so

that the brush 12 is driven to rotate.

If the button unit 70 is depressed, when the locking of the main body 20 is released, and when the main body is not in a substantially upright position, the brush 12 is driven/not driven according to a simple button operation. As such, a user can easily operate the vacuum cleaner.

With this vacuum cleaner, the operation of the rotatable brush 12 is easily controlled by a simple belt guide member controller. As such, the operation of the brush 12 can be conveniently controlled as needed to reduce noise, wear on the brush, wear on a surface to be cleaned, and energy use can be reduced by disengaging the brush from its drive motor.

The foregoing embodiment and advantages are merely exemplary, and are not to be construed as limiting the present invention. The description of the embodiments of the present invention is intended to be illustrative, and not to limit the scope of the claims, and many alternatives, modifications, and variations will be apparent to those skilled in the art.

Claims

1. A vacuum cleaner comprising:

a vacuum cleaner main body having a vacuum source and a dust-collecting receptacle for drawn-in dust;

a nozzle unit main body fluidly connected to the vacuum cleaner main body;

a rotatable brush mounted in the nozzle unit main body;

a drive pulley mounted on the rotatable brush;

an idler pulley disposed adjacent to the drive pulley;

a belt locatable on either the drive pulley or the idler pulley, and on a drive shaft of the vacuum source;

a belt guide unit having a belt guide member movable between a first position connecting the belt with the drive pulley and a second position connecting the belt with the idler pulley; and

a belt guide member controller for moving the belt guide member between the first position and the second position.

2. A vacuum cleaner as claimed in claim 1, wherein the belt guide unit further comprises:

a spring for biasing the belt guide member toward the first position.

3. A vacuum cleaner as claimed in claim 1 or claim 2, wherein the belt guide member controller is a belt control knob rotatably mounted to the nozzle unit main body for moving the belt guide member between the first position and the second position by contact with the belt guide member when the belt control knob is rotated.

4. A vacuum cleaner as claimed in claim 3, wherein the belt control knob comprises:

a knob exposed to the nozzle unit main body and rotatably mounted therein, and a cam member substantially configured as a half cylinder,

wherein the cam member is contacted by the belt guide member when the knob is located in a predetermined position, thereby moving the belt guide member to the second position.

5. A vacuum cleaner as claimed in any one of claims 1 to 4, further comprising:

a cam contactable with the belt guide member to prevent the belt guide member from moving to the first position when the vacuum cleaner main body is substantially upright,

wherein the vacuum cleaner main body is pivotally mounted to the nozzle unit main body.

6. A vacuum cleaner as claimed in claim 5, wherein the belt guide member comprises:

a first member, one end of which holds and moves the belt to one of the first position or the second position, the other end being attached to the nozzle unit main body ; and

a second member having a predetermined length and connected to the first member, the second member extending to the vacuum cleaner main body; whereby, when the vacuum cleaner main body is substantially upright, the second member is contacted by the cam of the vacuum cleaner main body to prevent the first member from moving to the first position.

7. A vacuum cleaner as claimed in claim 1 or claim 2, wherein the belt guide member controller is :

a button unit mounted on nozzle unit main body for moving the belt guide member to one of the first position or the second position.

8. A vacuum cleaner as claimed in claim 7, wherein the button unit comprises:

a button exposed at the nozzle unit main body;

an actuator contactable with a lower portion of the button, and movable with the button;

a return spring in contact with a lower portion of the actuator; and

a lever, one end of which is located on a lower portion of the actuator, the other end being attached to the belt guide member,

wherein the lever is moved according to the movement of the lower portion of the actuator to move the belt guide member to the first position or the second position.

9. A vacuum cleaner as claimed in claim 8, wherein the button unit further comprises:

a stop spring located on the return spring, for preventing the actuator from moving beyond a predetermined position; and

a housing for the return spring and the stop spring.

10. A vacuum cleaner substantially as hereinbefore described with reference to, and as illustrated by, the drawings.

Application No: GB0501361.0 **Examiner:** Dave Woolf

Claims searched: 1-10 **Date of search:** 13 May 2005

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1, 3, 4	US 6044520 A (YAMAMOTO) Column 3 lines 16-67 and figures
X	1, 3, 4	GB 2196836 A (HOOVER) Page 1 lines 40-64 and figures
X	1, 3, 4	US 4446594 A (WATANABE) Column 3 lines 19-58 and figures 6-8
X	1, 2	JP 60261845 A (SHARP) PAJ Abstract and figures.
X	1, 7	JP 2003144358 A (SHARP) WPI Abstract Accession No.2003-444514 [42] and figures
X	1	JP 2000102498 A (SHARP) WPI Abstract Accession No. 2000-332185 [29] and figures
X	1	JP 2001112674 A (MATSUSHITA) WPI Abstract Accession No. 2001-377911 [40] and figures
X	1	US 4446595 A (NAKADA) Column 2 lines 45-51and figure 3

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

A4F

Worldwide search of patent documents classified in the following areas of the IPC[07]

A47L

The following online and other databases have been used in the preparation of this search report

WPI, Epodoc