Title: BALANCED FLOW VACUUM CLEANER

Abstract: An apparatus and method for transporting a flow of air and particulates through a vacuum cleaner. In one embodiment, the apparatus includes an intake body (100) having an intake opening (111) configured to receive the flow of air and particulates. An airflow propulsion device (200) is coupled to the intake opening (111) to draw the flow through the intake opening (111) and through a flow passage having an approximately constant flow area. The flow continues through one or more conduits (30) from the propulsion device (200) to a filter element (80) housed in a filter housing (70) where the particulates are separated from the flow of air.
Published:

— With international search report.
— Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(88) Date of publication of the international search report: 11 January 2001
# INTERNATIONAL SEARCH REPORT

### A. CLASSIFICATION OF SUBJECT MATTER

| IPC    | A47L5/28 | A47L9/00 |

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)

| IPC    | A47L |

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

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

EPO-Internal, WPI Data, PAJ

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>Y</td>
<td>GB 838 375 A (ROLLNICK &amp; GORDON LTD) 22 June 1960 (1960-06-22)</td>
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* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "E" document member of the same patent family

Further documents are listed in the continuation of box C. Patent family members are listed in annex.

Date of the actual completion of the international search

16 August 2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
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Authorized officer

Cabral Matos, A
<table>
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INTERNATIONAL SEARCH REPORT

Box I  Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. □ Claims Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2. □ Claims Nos.:
   because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. □ Claims Nos.:
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II  Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

   see additional sheet

1. □ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. □ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. □ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. □ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

   1-27, 29-30, 34-52

Remark on Protest

□ The additional search fees were accompanied by the applicant's protest.

□ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (1)) (July 1998)
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:


1.1. Claims: 1-10
A vacuum cleaner comprising
an intake body,
a filter element,
a conduit coupled between the intake body and the filter element,
an airflow propulsion device coupled between the intake opening and the conduit to draw the flow of air through the intake opening towards the filter element,
the intake opening, the propulsion device and the intake opening defining a flow path for the flow of air and particulates and wherein the flow path has an approximately constant flow area from the intake opening to the propulsion device.

1.2. Claims: 11-16
A vacuum cleaner comprising
an intake body,
a filter element,
a conduit coupled between the intake body and the filter element,
an airflow propulsion device coupled between the intake opening and the conduit to draw the flow of air through the intake opening towards the filter element,
the intake opening, the propulsion device and the intake opening defining a flow path for the flow of air and particulates, and the flow path having an approximately constant flow area from the intake opening to the propulsion device, wherein the flow path from the intake opening through the propulsion device has a radius of curvature not less than 0.29 inches.

1.3. Claims: 17-21
A vacuum cleaner comprising
an intake body having an intake opening for receiving a flow of air and particulates, the intake body further having at least two exit openings, a filter element, at least two conduits, each having a first aperture
coupled to one of the exit openings of the intake body and a second aperture in fluid communication with the filter element,
an airflow propulsion device coupled between the intake opening and the exit openings for moving the flow of air from the intake opening towards the filter element.

1.4. Claims: 22-26
A vacuum cleaner comprising
an intake body having an intake opening for receiving a flow of air and particulates,
a filter element,
two conduits coupled between the intake body and the filter element,
an airflow propulsion device coupled between the intake opening and the conduits,
wherein the intake opening, the propulsion device and the conduits define a flow path, the flow path being symmetric about a generally flat symmetry plane intersecting the intake opening and the propulsion device.

1.5. Claims: 27 and 29-30
A vacuum cleaner comprising an intake body, a filter element and a flow channel coupled between the intake body and the filter element,
the intake body having a forward edge, a rear edge opposite the forward edge and a lower surface between the forward and rear edges,
at least one wheel coupled to the intake body and projecting below at least a portion of the lower surface of the intake body to elevate the portion of the intake body above the floor surface, the wheel projecting forward of the forward edge or rearward of the rear edge by a selected distance.

1.6. Claims: 34-39
A method for drawing a flow of air and particulates into a vacuum cleaner, comprising:
drawing the flow of air and particulates through an intake opening;
passing this flow from the intake opening into an airflow propulsion device while maintaining a flow area equal to the intake flow area;
passing the flow through the airflow propulsion device to a filter element;
and separating a portion of the particulates from the flow of air at the filter element.

1.7. Claims: 40-44
A method for drawing a flow of air and particulates into a vacuum cleaner, comprising:
drawing the flow of air and particulates through an intake opening;
passing this flow from the intake opening into an airflow propulsion device while maintaining a flow area equal to the intake flow area,
while passing the flow of air and particulates along a curved flow path having all radii of curvature in a direction of the flow greater than or equal to 0.29 inches;
passing the flow through the airflow propulsion device to a filter element;
and separating a portion of the particulates from the flow of air at the filter element.

1.8. Claims: 45-48
A method for drawing a flow of air and particulates into a vacuum cleaner, comprising:
drawing the flow of air and particulates from the intake opening into and through an airflow propulsion device;
passing a first portion of the flow from the airflow propulsion device through a first conduit to a filter element;
passing a second portion of the flow from the airflow propulsion device through a second conduit to a filter element;
and separating a portion of the particulates from the flow of air at the filter element.

1.9. Claims: 49-52
A method for drawing a flow of air and particulates into a vacuum cleaner, comprising:
drawing the flow of air and particulates through an intake opening such that the flow of air and particulates is approximately symmetric about a symmetry plane intersecting the intake opening;
passing the flow of air and particulates from the intake opening into and through an airflow propulsion device with the flow remaining approximately symmetric about the symmetry plane;
passing the flow from the airflow propulsion device to a filter element;
and separating a portion of the particulates from the flow of air at the filter element.

2. Claim: 27 and 28
A vacuum cleaner comprising an intake body, a filter element and a flow channel coupled between the intake body and the filter element,
the intake body having a forward edge, a rear edge opposite the forward edge and a lower surface between the forward and rear edges, at least one wheel coupled to the intake body and projecting below at least a portion of the lower surface of the intake body to elevate the portion of the intake body above the floor surface, the wheel projecting forward of the forward edge or rearward of the rear edge by a selected distance, further comprising a power supply cord coupled to the intake body, the supply cord having a thickness being no larger than the selected distance by which the wheel projects forward of the forward edge or rearward of the rear edge of the intake body.

3. Claims: 31-33

A vacuum cleaner comprising an intake body, a filter element and a flow channel coupled between the intake body and the filter element, the intake body having a lower surface proximate to the floor surface and a vent for exhausting cooling flow for cooling a component within the intake body, at least one wheel coupled to the intake body and projecting below at least a portion of the lower surface of the intake body to elevate the portion of the intake body above the floor surface, the wheel being positioned in a path of the cooling air passing outwardly through the vent to diffuse the cooling air.

4. Claims: 53-54

A method for transporting a vacuum cleaner between a lower portion of a stepped surface and an upper portion of a stepped surface.

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.
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