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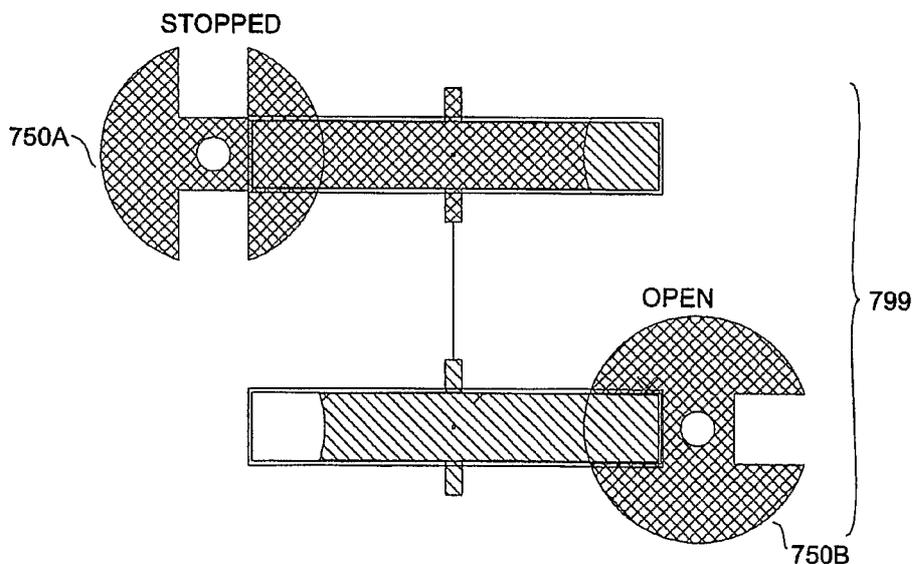
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: VACUUM CLEANERS ESPECIALLY QUIET VACUUM CLEANERS, PUMPS, AND ENGINES



(57) Abstract: This impeller-free vacuum cleaner is based on a rotary piston. Vacuum suction of 300 inches of water or better can be delivered. Quietness of below 70 db can be delivered. Tongued rotary piston assemblies may be strategically placed, such as stacked, to eliminate vacuum suction dead zones. Sealing problems that otherwise were encountered with previous reciprocating and rotary piston structures for vacuum cleaners are solved by using a tongued rotary piston with a double-notched rotary valve operating by a Geneva mechanism, and a novel pancake-cylindrical structure to house the rotary piston. An inventive rotary combustion engine also is disclosed.



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**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US05/14652

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC: A47L 5/20( 2007.01)  
  
 USPC: 15/326,412,320  
 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)  
 U.S. : 15/326,412,320

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

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

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2,378,347 A (WILLIAMS) 12 June 1945 (12.06.1945), see entire document.	1-6
X	US 4,235,293 A (ELLIS) 25 November 1980 (25.11.1980), column 1, lines 13-20 and column 2, lines 58-63.	9
A		7-8
X	US 2,994,098 A (FUKUBA) 01 August 1961(01.08.1961), title.	10
A		11-19
A	US 3,410,477 A (HARTLEY) 12 November 1968 (12.11.1968), see entire document.	20-27
X	US 3,380,103 A (RITZAU) 30 April 1968 (30.04.1968), column 1, lines 9-15 and column 7, lines 50-55.	28

<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.	<input type="checkbox"/> See patent family annex.
* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"B" earlier application or patent published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search 30 October 2006 (30.10.2006)	Date of mailing of the international search report <b>28 NOV 2006</b>
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Authorized officer Theresa T. Snider Telephone No. (571) 272-1300  <b>Jean Proctor</b> <b>Paralegal Specialist</b>

**INTERNATIONAL SEARCH REPORT**International application No.  
PCT/US05/14652**C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,797,366 A (ADAMOVSKI) 25 August 1998 (25.08.1998), figure 1A.	29-30
A	US 5,243,733 A (STEINER et al.) 14 September 1993 (14.09.1993), column 1, lines 24-25.	7-27

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US05/14652

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 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 No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:  
Please See Continuation 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 additional fees, this Authority did not invite payment of any additional fees.
  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.:
- Remark on Protest  The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**

International application No.  
PCT/US05/14652

**BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING**

Group I, claim(s) 1-6, drawn to a vacuum cleaner without an impeller or siren noise.

Group II, claim(s) 7-8, drawn to a vacuum cleaner with a reciprocating piston.

Group III, claim(s) 9, drawn to a vacuum cleaner with a double-acting piston.

Group IV, claim(s) 10-27, drawn to a vacuum cleaner with at least one rotary piston.

Group V, claim(s) 28, drawn to a vacuum cleaner with a Geneva mechanism.

Group VI, claim(s) 29, drawn to a rotary engine without a trochoidal chamber.

Group VII, claim(s) 30, drawn to a rotary engine with at least one piston.

The inventions listed as Groups I-VII do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: Groups I-V all pertain to vacuum cleaners however they each possess different technical features. Groups VI-VII pertain to a rotary engine that possess different technical features.

Continuation of B. FIELDS SEARCHED Item 3:

EAST

search terms: vacuum cleaner, piston, geneva