



(51) International Patent Classification:

B01D 46/02 (2006.01) *B01D 46/00* (2006.01)
A47L 9/10 (2006.01) *A47L 5/24* (2006.01)
A47L 9/14 (2006.01) *A47L 9/16* (2006.01)

(71) Applicant: **TTI (MACAO COMMERCIAL OFFSHORE) LIMITED** [—/CN]; Units A-C, 26/F Centro Comercial da Praia Grande, No. 429 Avenida da Praia Grande (CN).

(21) International Application Number:

PCT/US2017/027676

(72) Inventors; and

(71) Applicants (*for US only*): **WARREN, Robert, Patrick** [US/US]; 7200 Ridge Lane Road, Charlotte, NC 28262 (US). **BURGESS, Roderick** [GB/US]; 615 Cherry St., Charlotte, NC 28204 (US). **LEHMAN, Joseph, M.** [US/US]; 6758 Upper Brook Way, New Albany, OH 43504 (US). **FEE, Garry** [GB/US]; 15810 Gathering Oaks Drive, Huntersville, NC (US). **BLOOM, Michael** [US/US]; 914 Warren Burgess Lane, Charlotte, NC 28205 (US).

(22) International Filing Date:

14 April 2017 (14.04.2017)

(25) Filing Language:

English

(26) Publication Language:

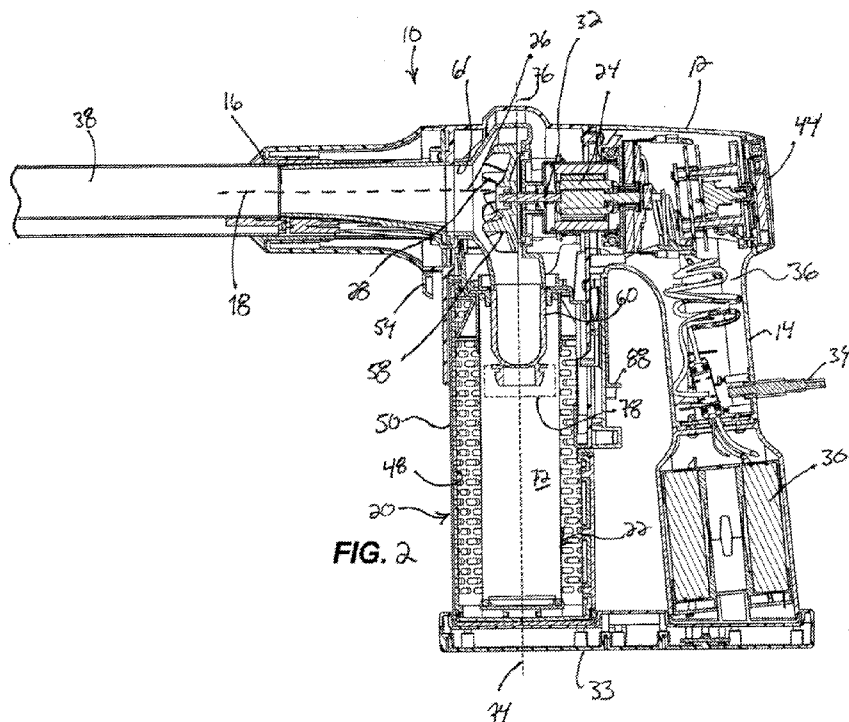
English

(30) Priority Data:

62/323,384 15 April 2016 (15.04.2016) US
62/361,718 13 July 2016 (13.07.2016) US
62/457,543 10 February 2017 (10.02.2017) US
62/457,329 10 February 2017 (10.02.2017) US

(74) Agent: **CHESLOCK, Alain C.** et al.; Michael Best & Friedrich LLP, 100 East Wisconsin Avenue, Suite 3300, Milwaukee, WI 53202-4108 (US).

(54) Title: HANDHELD VACUUM CLEANER



(57) Abstract: A handheld vacuum cleaner (10) including a suction inlet (16), a main body (12), a handle (14) defined by a portion of the main body, a motor (24) disposed within the main body operating a suction source (28), and a filter (22) coupled to the main body. The filter (22) is configured to separate debris from a flow of fluid drawn through the suction inlet (16). The filter (22) includes a housing (20) forming a first volume and a filter media (70) forming a second inner volume. The filter media (70) is coupled to the housing (20) such that the first and second inner volumes together at least partially define a collection container (72) configured to store debris separated by the filter media (70) from the flow of fluid. The filter (22) further includes an inlet opening (60) that extends through the housing (20) to provide fluid communication into the collection container (72) such that the flow of fluid with the debris can flow into the collection container (72) and a relatively clean flow of fluid exits through the filter media (70).



(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (*Art. 21(3)*)
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (*Rule 48.2(h)*)

(88) Date of publication of the international search report:
07 December 2017 (07.12.2017)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/027676

A. CLASSIFICATION OF SUBJECT MATTER
 INV. B01D46/02 A47L9/10 A47L9/14 B01D46/00 A47L5/24
 A47L9/16
 ADD.
 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)
 B01D A47L

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)
 EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CH 408 311 A (SIEMENS ELEKTROGERAETE GMBH [DE]) 28 February 1966 (1966-02-28) the whole document -----	1,2
X	US 2 729 303 A (MCMAHAN KENTON D) 3 January 1956 (1956-01-03) column 1, line 58 - column 4, line 57; figures -----	1
X	DE 10 2011 006542 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 4 October 2012 (2012-10-04) -----	1
A	paragraph [0025] - paragraph [0042]; figures 1,2 -----	2

Further documents are listed in the continuation of Box C.

See patent family annex.

* 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 application or patent but 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
- "&" document member of the same patent family

Date of the actual completion of the international search

6 September 2017

Date of mailing of the international search report

08/11/2017

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040,
 Fax: (+31-70) 340-3016

Authorized officer

Masset, Markus

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/027676

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:

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 fees, this Authority did not invite payment of 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.:

1, 2

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1, 2

Without touching

2. claims: 1, 3-5

Conduit

3. claims: 1, 6, 7

Actuator

4. claims: 1, 8

Outer housing

5. claims: 1, 9

Battery

6. claims: 1, 10

Downstream

7. claims: 1, 29

Upper housing

8. claims: 11-21

Volute

9. claims: 22-28

Rotational axis of motor and inlet

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2017/027676

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CH 408311	A	28-02-1966	NONE

US 2729303	A	03-01-1956	NONE

DE 102011006542 A1	04-10-2012	DE 102011006542 A1	04-10-2012
		EP 2537450 A1	26-12-2012
