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CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,
KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD,
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,
NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD,
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SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: PURIFICATION DEVICE AND METHOD FOR PURIFYING A FLUID

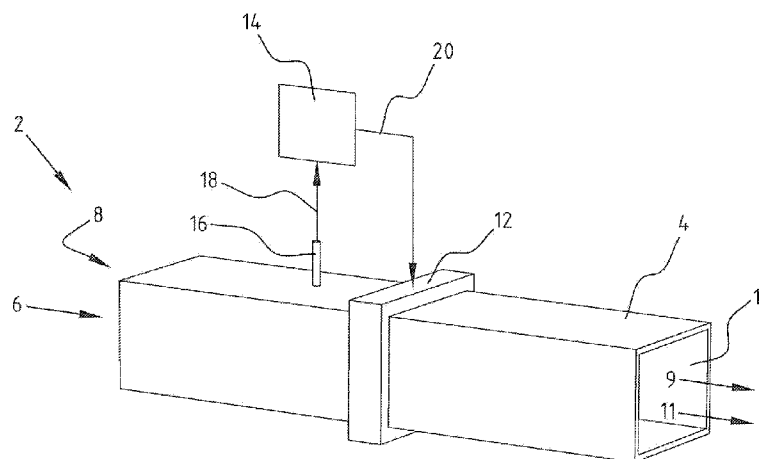


FIG. 1

(57) Abstract: The invention relates to a purification device and method for purifying a fluid. The purification device comprises:
–wave-generating means for generating acoustic and/or electromagnetic waves capable to produce wave interference and/or local enhancement of wave intensity;and
–control means for controlling the wave generating means capable to achieve a structure with the generated waves such that the structure behaves as a filter.

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- *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))*

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2011/050236

A. CLASSIFICATION OF SUBJECT MATTER

INV. C02F1/30 C02F1/36 C02F1/34 B01J19/12 B01J19/10
C02F1/38 C02F1/00

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)

C02F B01J B01D

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 practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| X | US 4 523 682 A (BARMATZ MARTIN B [US] ET AL) 18 June 1985 (1985-06-18) claims 1-5; figures 1,5 ----- | 1-4,14 |
| X | US 2004/173541 A1 (KURIHARA MASAHIRO [JP] ET AL) 9 September 2004 (2004-09-09) claims 1-37 ----- | 1-5,8, 14-16 |
| X | US 5 688 405 A (DICKINSON STUART C [US] ET AL) 18 November 1997 (1997-11-18) column 4, line 38 - column 5, line 40; claims 1-20; figures 3-11 ----- | 1-5,8, 14,15 |
| X | EP 0 633 049 A1 (TRAMPLER FELIX [AT]; BENES EWALD [AT]) 11 January 1995 (1995-01-11) claims 1-20 ----- -/- | 1-5,12, 14,15 |

☒ 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

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"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

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"&" document member of the same patent family

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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 5 225 089 A (BENES EWALD [AT] ET AL) 6 July 1993 (1993-07-06) claims 1-21 ----- | 1-5,12, 14,15 |
| X | US 5 164 094 A (STUCKART WOLFGANG [AT]) 17 November 1992 (1992-11-17) column 7, line 20 - column 7, line 51; claims 1-23; figures 2a,2b,3a,3b ----- | 1-5, 8-10,12, 14,15 |
| X | US 4 877 516 A (SCHRAM CORNELIUS J [GB]) 31 October 1989 (1989-10-31) column 6, line 22 - column 7, line 53; claims 1-19 ----- | 1-5, 8-10,12, 14,15 |
| X | US 4 759 775 A (PETERSON STEPHEN C [US] ET AL) 26 July 1988 (1988-07-26) column 12, line 63 - column 16, line 6; claims 1-145; figure 6 ----- | 1-5,14, 15 |
| X | US 4 673 512 A (SCHRAM CORNELIUS J [GB]) 16 June 1987 (1987-06-16) column 7, line 63 - column 8, line 44; claims 1-6; figure 7 ----- | 1-5,14, 15 |
| X | US 4 743 361 A (SCHRAM CORNELIUS J [GB]) 10 May 1988 (1988-05-10) claims 1-13; example 4 ----- | 1-5,14, 15 |
| X | US 2004/112841 A1 (SCOTT HAROLD W [US]) 17 June 2004 (2004-06-17) claims 1-20; figure 1 ----- | 1-5, 8-10,12, 14,15 |
| X | US 5 626 767 A (TRAMPLER FELIX [AT] ET AL) 6 May 1997 (1997-05-06) column 23, line 1 - column 23, line 26 ----- | 1-5,11, 14 |
| X | JP 2004 024959 A (NAT INST OF ADV IND & TECHNOL) 29 January 2004 (2004-01-29) abstract; figures 1-3,7 ----- | 1-5,14 |
| X | US 2004/057866 A1 (ZUMERIS JONA [IL] ET AL) 25 March 2004 (2004-03-25) paragraphs [0001], [0006] - [0013]; claims 1-43 ----- | 1-5,12, 14,15 |
| X | US 6 216 538 B1 (YASUDA KENJI [JP] ET AL) 17 April 2001 (2001-04-17) claims 1-46; figures 1-28 ----- | 1-5,11, 14,15 |
| X | US 2006/096353 A1 (HAWKES JEREMY J [GB] ET AL) 11 May 2006 (2006-05-11) paragraphs [0001] - [0010]; claims 1-21 ----- | 1-5,14 |

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NL2011/050236

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.:

5, 6, 16(completely); 1-4, 8-15(partially)

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: 5, 6, 16(completely); 1-4, 8-15(partially)

Device and process for purifying a liquid by means of
acoustic or ultrasonic waves

2. claims: 7, 17(completely); 1-4, 8-15(partially)

Device and process for purifying a liquid by means of
electromagnetic waves

INTERNATIONAL SEARCH REPORT

International application No

PCT/NL2011/050236

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
|---|----|---------------------|--|--|
| US 4523682 | A | 18-06-1985 | NONE | |
| US 2004173541 | A1 | 09-09-2004 | US 2004173541 A1 US 2007280861 A1 | 09-09-2004 06-12-2007 |
| US 5688405 | A | 18-11-1997 | NONE | |
| EP 0633049 | A1 | 11-01-1995 | AT 398707 B DE 69420339 D1 DE 69420339 T2 EP 0633049 A1 US 5527460 A | 25-01-1995 07-10-1999 30-03-2000 11-01-1995 18-06-1996 |
| US 5225089 | A | 06-07-1993 | AT 123662 T AT 390739 B DE 58909299 D1 EP 0400115 A1 US 5225089 A WO 9005008 A1 | 15-06-1995 25-06-1990 20-07-1995 05-12-1990 06-07-1993 17-05-1990 |
| US 5164094 | A | 17-11-1992 | AT 68369 T AT 389235 B AU 1726288 A CA 1320151 C DE 3865526 D1 EP 0292470 A1 EP 0362233 A1 ES 2027423 T3 GR 3003471 T3 JP H02503528 A PL 272541 A1 RU 2067079 C1 US 5164094 A WO 8809210 A1 | 15-11-1991 10-11-1989 21-12-1988 13-07-1993 21-11-1991 23-11-1988 11-04-1990 01-06-1992 17-02-1993 25-10-1990 20-03-1989 27-09-1996 17-11-1992 01-12-1988 |
| US 4877516 | A | 31-10-1989 | AT 82869 T DE 3782923 T2 EP 0270592 A1 JP 2545427 B2 JP S63503370 A US 4877516 A WO 8707178 A1 | 15-12-1992 27-05-1993 15-06-1988 16-10-1996 08-12-1988 31-10-1989 03-12-1987 |
| US 4759775 | A | 26-07-1988 | NONE | |
| US 4673512 | A | 16-06-1987 | DE 3583359 D1 EP 0167406 A2 JP 2108974 C JP 7112548 B JP 61050655 A US RE33524 E US 4673512 A | 08-08-1991 08-01-1986 21-11-1996 06-12-1995 12-03-1986 22-01-1991 16-06-1987 |
| US 4743361 | A | 10-05-1988 | DE 3481281 D1 EP 0147032 A1 JP 6079682 B US 4743361 A WO 8501892 A1 | 15-03-1990 03-07-1985 12-10-1994 10-05-1988 09-05-1985 |

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2011/050236

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|----------------------------|--|
| US 2004112841 | A1 | 17-06-2004 | NONE |
| US 5626767 | A | 06-05-1997 | AU 679083 B2 19-06-1997 AU 7118394 A 24-01-1995 CA 2166279 A1 12-01-1995 EP 0706417 A1 17-04-1996 US 5626767 A 06-05-1997 WO 9501214 A1 12-01-1995 |
| JP 2004024959 | A | 29-01-2004 | JP 4505624 B2 21-07-2010 JP 2004024959 A 29-01-2004 |
| US 2004057866 | A1 | 25-03-2004 | US 2004057866 A1 25-03-2004 US 2008292510 A1 27-11-2008 WO 03027027 A1 03-04-2003 |
| US 6216538 | B1 | 17-04-2001 | NONE |
| US 2006096353 | A1 | 11-05-2006 | AU 2003212536 A1 30-04-2004 CA 2499027 A1 25-03-2004 CN 1681573 A 12-10-2005 EP 1539322 A1 15-06-2005 HK 1078507 A1 08-08-2008 JP 4478023 B2 09-06-2010 JP 2005538830 A 22-12-2005 JP 2010032536 A 12-02-2010 US 2006096353 A1 11-05-2006 WO 2004024287 A1 25-03-2004 |