

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
4 October 2001 (04.10.2001)

PCT

(10) International Publication Number
WO 01/72396 A1

- (51) International Patent Classification⁷: **B01D 36/00**, 29/00, 17/04, F02M 37/22
- (21) International Application Number: PCT/EP01/03052
- (22) International Filing Date: 16 March 2001 (16.03.2001)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
MI2000A000633 24 March 2000 (24.03.2000) IT
- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- (71) Applicant (*for all designated States except US*): **SOGEFI FILTRATION S.P.A** [IT/IT]; Via Barbieri, 1, I-46100 Mantova (IT).
- 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
- (72) Inventors; and
- (75) Inventors/Applicants (*for US only*): **BARACCHI, Paolo** [IT/IT]; Via Isernia, 5/A, I-10155 Torino (IT). **CROVETTI, Claudio** [IT/IT]; Via Primiceriale, 10, I-46100 Mantova (IT). **TALLANO, Sergio** [IT/IT]; Via Roma, 70, I-46047 Porto Mantovano (IT).
- (74) Agent: **MODIANO, Guido**; Modiano & Associati, Via Meravigli, 16, I-20123 Milano (IT).
- 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: FILTER FOR DIESEL ENGINE FUEL

(57) Abstract: A filter for Diesel engine fuel, comprising a filtering mass (5) which is contained within an enclosure (2) and is designed to be crossed by the fuel in its path inside the filter between an intake connector (3) and a discharge connector (4). The enclosure (2) comprises a water collection chamber (7) at its bottom. The filter further comprises at least two micromeshes (8, 10) which are adapted to be crossed sequentially by the fuel that exists from the filtering mass (5).

WO 01/72396 A1

FILTER FOR DIESEL ENGINE FUEL

Technical field

The present invention relates to a filter for Diesel engine fuel.

Background art

5 It is known that filters inserted in the supply circuit of Diesel engine fuel, commonly known as Diesel fuel, comprise means adapted to separate the water contained in the fuel, but these means are less than fully satisfactory.

A very common type of filter utilizes the phenomenon of coalescence, according to which the microscopic water droplets that pass through the filtering mass mixed in with the Diesel fuel tend to merge along the path
10 leading to the peripheral region of the fibers of said filtering mass, forming drops of a certain size which appear on the surface on which the Diesel fuel exits from said mass.

Some of these drops slide downward along said surface by gravity and
15 collect in a chamber provided at the bottom of the filter, forming a mass of water which is periodically evacuated, but many of the drops escape from the surface, entrained by the Diesel fuel in its motion, and thus remain included therein, causing a loss of effectiveness of the filter.

Disclosure of the Invention

20 The aim of the present invention is to provide a filter for Diesel engine fuel which ensures high efficiency in eliminating water from the fuel.

This aim is achieved by a filter for Diesel engine fuel, according to the invention, comprising a filtering mass which is contained within an enclosure, said mass being designed to be crossed by the fuel in its path
25 inside the filter between an intake connector and a discharge connector, said enclosure comprising a water collection chamber at the bottom, characterized in that it comprises at least two micromeshes which are adapted to be crossed sequentially by the fuel that exits from the filtering mass.

30 Brief description of the drawings

Further characteristics and advantages of the present invention will become better apparent from the following detailed description of some preferred but not exclusive embodiments thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

5 Figure 1 is a partial sectional view, taken along a longitudinal plane, of the invention according to a first embodiment;

Figure 2 is a view of a second embodiment of the invention;

Figures 3, 4 and 5 are views of three variations of the invention, comprising a sleeve for reinforcing the filtering mass;

10 Figures 6 and 7 are views of two further embodiments of the invention.

Ways of carrying out the Invention

With reference to Figure 1, reference numeral 1 generally designates a filter comprising a per se known structure which is adapted to determine, inside the enclosure 2, the circulation of the Diesel fuel indicated by the
15 arrows in the figure between the intake connector 3 located at the enclosure and the discharge connector 4 located in the central region, passing through the filtering mass 5.

The water droplets that have formed by coalescence during the flow of the Diesel fuel through said filtering mass emerge from the surface 5a of
20 said filtering mass, and while some of the droplets, such as 6a, slide by gravity along the surface 5a to collect in the collection chamber 7 provided at the bottom of the enclosure 2, the remaining droplets continue along their path, included within the Diesel fuel, and encounter the first micromesh 8 located proximate to the surface 5a.

25 Some droplets, such as 6b, are retained at the intake of the mesh, while others, such as 9a, form at the discharge of said mesh: all the droplets in any case slide toward the collection chamber 7.

The Diesel fuel continues in its motion, and any water droplets that might still be present, such as 9b, are captured by the second micromesh 10 and
30 separate from the Diesel fuel, descending into the chamber 7.

The above operating methods have been described merely as an indication, since operation is greatly influenced by the functional parameters of the motor supplied with the treated Diesel fuel and by the dimensions of the micromeshes.

5 At the output of the micromesh 10, the purified Diesel fuel is sent to the engine, while the water collected in the chamber 7 is emptied periodically when indicated by the sensor 11.

The micromesh 10 has a complete bottom 10a, also made of micromesh, but said bottom might be only partial and provided with a blind surface, and
10 might also be omitted.

Figure 2 illustrates a filter 12 having the structure as described above and in which the first micromesh 13 is arranged so as to adhere to the filtering mass 5, while the second micromesh 14 is located proximate to the first micromesh 13.

15 Some of the water droplets such as 15a that form by coalescence during the flow of the fuel through the filtering mass 5 are captured immediately by the first micromesh 13 and slide downward along it, collecting in the collection chamber 7.

As the Diesel fuel continues in its motion, it encounters the second
20 micromesh 14, and the water droplets being still present therein, such as 15b, are captured and slide toward the chamber 7.

The micromesh 14 has a complete bottom 14a, also made of micromesh, but said bottom might be only partial and provided with a blind surface, and might also be omitted.

25 The filters shown in Figures 3, 4 and 5 also have a structure as described above, but they also comprise in a known manner the sleeve 16 for reinforcing the filtering mass 5 which is adjacent to the internal surface of said mass.

According to the invention, the filter 17 shown in Figure 3 has the first
30 micromesh 18 proximate to the sleeve 16 and the second micromesh 19

proximate to the first micromesh 18; the filter 20 shown in Figure 4 has the first micromesh 21 in contact with the sleeve 16 and the second micromesh 22 proximate to the first micromesh 21; and the filter 23 shown in Figure 5 has the first micromesh 24 interposed between the sleeve 16 and the filtering mass 5 and the second micromesh 25 proximate to the sleeve 16.

The description given regarding the bottoms 10a and 14a of the micromeshes 10 and 14 provided in the embodiments of the invention considered with reference to Figures 1 and 2, respectively, also applies to the bottom of the micromeshes 19, 22 and 25, designated by the reference numerals 19a, 22a, 25a respectively.

Upon the above description, the functional characteristics of these filters are obvious and are in any case highlighted by the illustration of the water droplets shown in the respective figures; accordingly, an analytical description of said figures is deemed unnecessary.

The filter 26 shown in Figure 6 has a structure as described above; in said filter, the first micromesh 27 comprises, at its lower end, the perforated bottom 27a, which is connected to the second micromesh 28; variations are also possible in which said bottom 27a is extended so as to connect to the filtering mass 5 or the bottom 28a of the second micromesh has the variety of shapes mentioned earlier; the first micromesh might have a bottom such as 27a even if it is located so as to adhere to the filtering mass 5.

In the filter 29 of Figure 7, the fuel intake is provided by way of the connector 30 located centrally, and after passing through the filtering mass 31 along the arrows shown in the figure, the fuel exits from the filter by way of the connector 32 at the outer enclosure 33, which is provided, proximate to the bottom, with the water collection chamber 34.

In this case, the two micromeshes 35 and 36, connected by the perforated bottom 35a, are arranged outside the filtering mass 31; the bottom 35a might also be omitted and the first micromesh 35 might of course be arranged proximate to said filtering mass 31 instead of adhering thereto.

The described invention is susceptible of numerous other modifications and variations, all of which are within the scope of the appended claims; thus, for example, the ends of the micromeshes can be associated in any manner with the structure of the filter and be fixed thereto or not, and if the
5 micromesh adheres to the supporting sleeve it can be provided monolithically therewith; the two micromeshes may further be joined in a monolithic unit.

Additional micromeshes, in addition to the two described ones, may also be provided.

10 The disclosures in Italian Patent Application No. MI20000A000633 from which this application claims priority are incorporated herein by reference.

CLAIMS

1. A filter for Diesel engine fuel, comprising a filtering mass (5,31) which is contained within an enclosure (2), said mass (5,31) being designed to be crossed by the fuel in its path inside the filter between an intake connector (3,30) and a discharge connector (4,32), said enclosure
5 comprising a water collection chamber (7,34) at the bottom, characterized in that it comprises at least two micromeshes (8,10,13,14,18,19,21,22,24,25,27,28) which are adapted to be crossed sequentially by the fuel that exits from the filtering mass (5,31).
- 10 2. The filter according to claim 1, characterized in that it comprises a first micromesh (8), which is adapted to be crossed by the fuel that exits from the filtering mass (5) and is located proximate to the surface (5a) of said mass (5), and a second micromesh (10), which is adapted to be crossed by the fuel that exits from the first micromesh (8) and is located proximate to said first
15 micromesh (8).
3. The filter according to claim 1, characterized in that it comprises a first micromesh (13), which is adapted to be crossed by the fuel that exits from the filtering mass (5) and adheres to said mass, and a second micromesh (14), which is adapted to be crossed by the fuel that exits from the first
20 micromesh (13) and is located proximate to said first micromesh (13).
4. The filter according to one or more of the preceding claims, comprising a fuel intake connector (3) which is located proximate to the enclosure (2), with discharge through a connector (4) located in the central region, characterized in that the second micromesh (10,14,19,22,25) located
25 inside the filtering mass is at least partially provided with a bottom (10a,14a,19a,22a,25a).
5. The filter according to claim 4, characterized in that the bottom (10a,14a,19a,22a,25a) of the second micromesh (10,14,19,22,25) is made of micromesh.
- 30 6. The filter according to claim 4, characterized in that the bottom (14a)

of the second micromesh (14) is provided with a blind surface.

7. The filter according to one or more of the preceding claims, comprising a fuel intake connector (3) which is located proximate to the enclosure (2), with discharge through a connector (4) located in the central
5 region, characterized in that the second micromesh (10) located inside the filtering mass (5) is bottomless.

8. The filter according to one or more of the preceding claims, comprising a reinforcement sleeve (16) which is adjacent to the internal surface (5a) of the filtering mass (5), characterized in that the first
10 micromesh (18) is located proximate to said sleeve (16).

9. The filter according to one or more of the preceding claims, comprising a reinforcement sleeve (16) which is adjacent to the internal surface (5a) of the filtering mass (5), characterized in that the first micromesh (21) is arranged so as to adhere to said sleeve (16) on the inner
15 part of said sleeve (16).

10. The filter according to one or more of the preceding claims, comprising a reinforcement sleeve (16) which is adjacent to the internal surface (5a) of the filtering mass (5), characterized in that the first micromesh (24) is interposed between the sleeve (16) and the filtering mass
20 (5).

11. The filter according to one or more of the preceding claims, characterized in that the first micromesh (27) is provided, at its lower end, with a perforated bottom (27a) for connection to the second micromesh (28).

12. The filter according to one or more of the preceding claims,
25 characterized in that the first micromesh (27) located proximate to the filtering mass (5) has, at its lower end, a perforated bottom (27a) for connection to said filtering mass (5).

13. The filter according to one or more of the preceding claims, characterized in that the first (18,21) and second (19,22) micromeshes are
30 joinable in a monolithic unit.

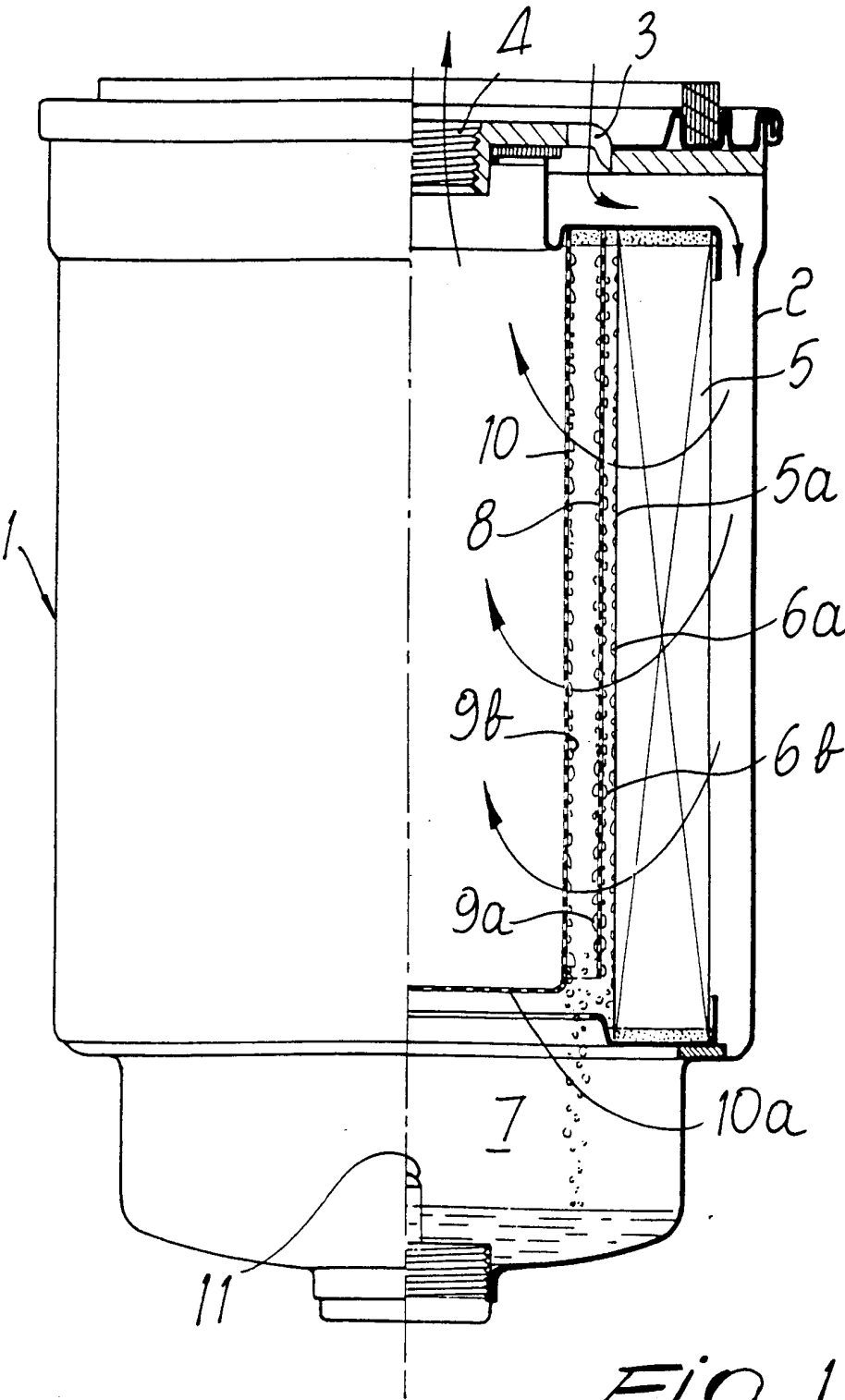


Fig. 1

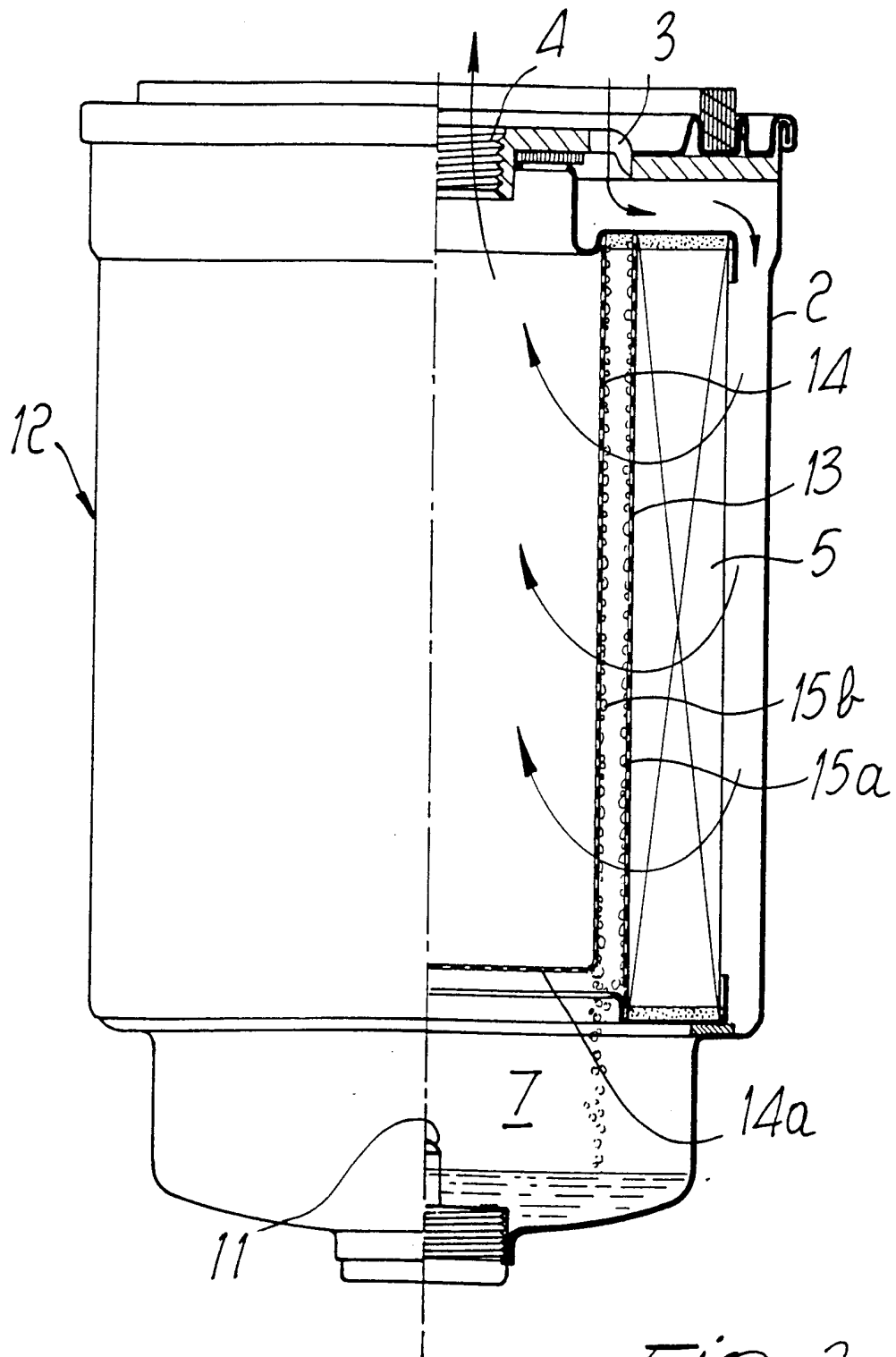


Fig. 2

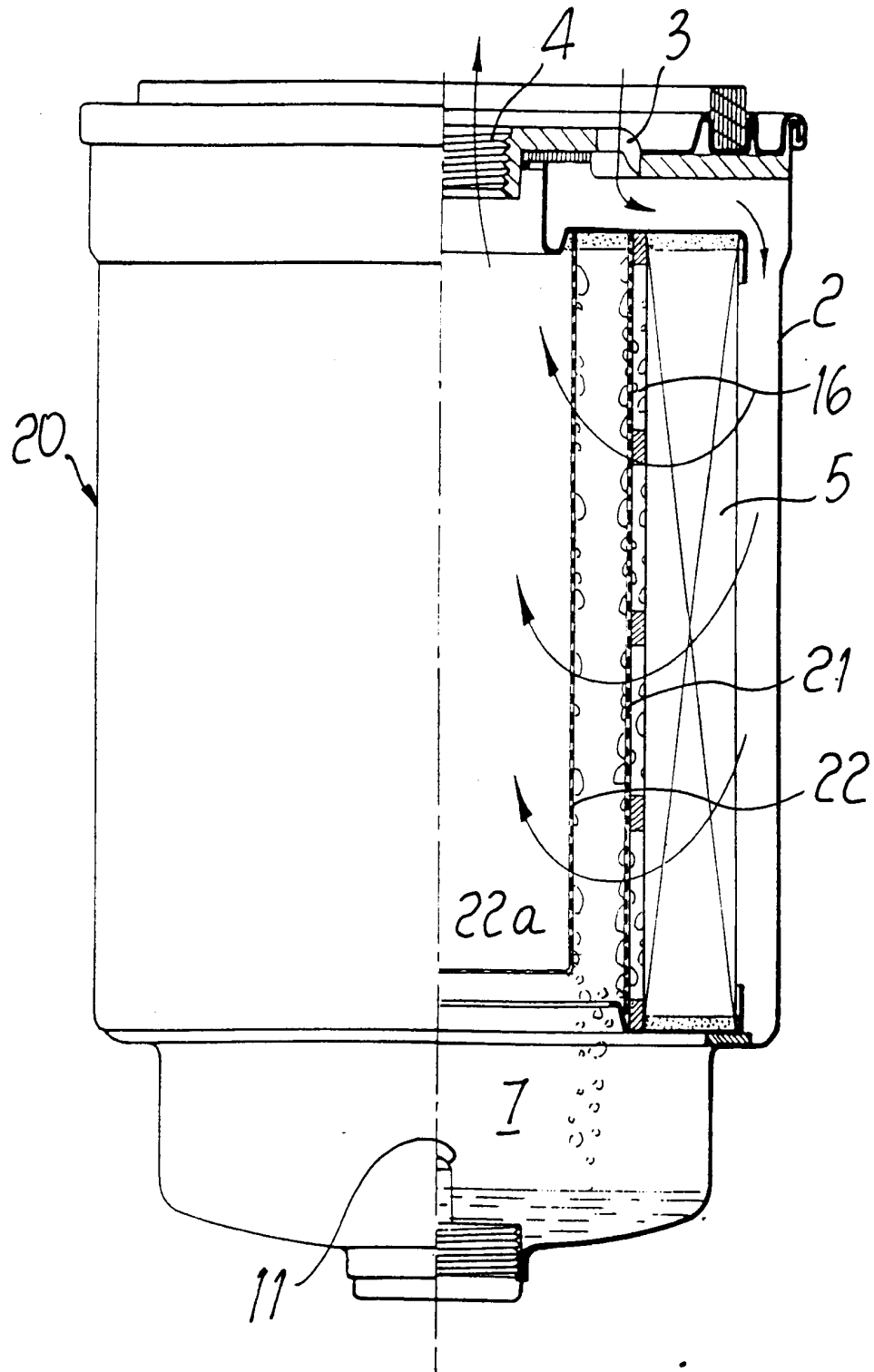
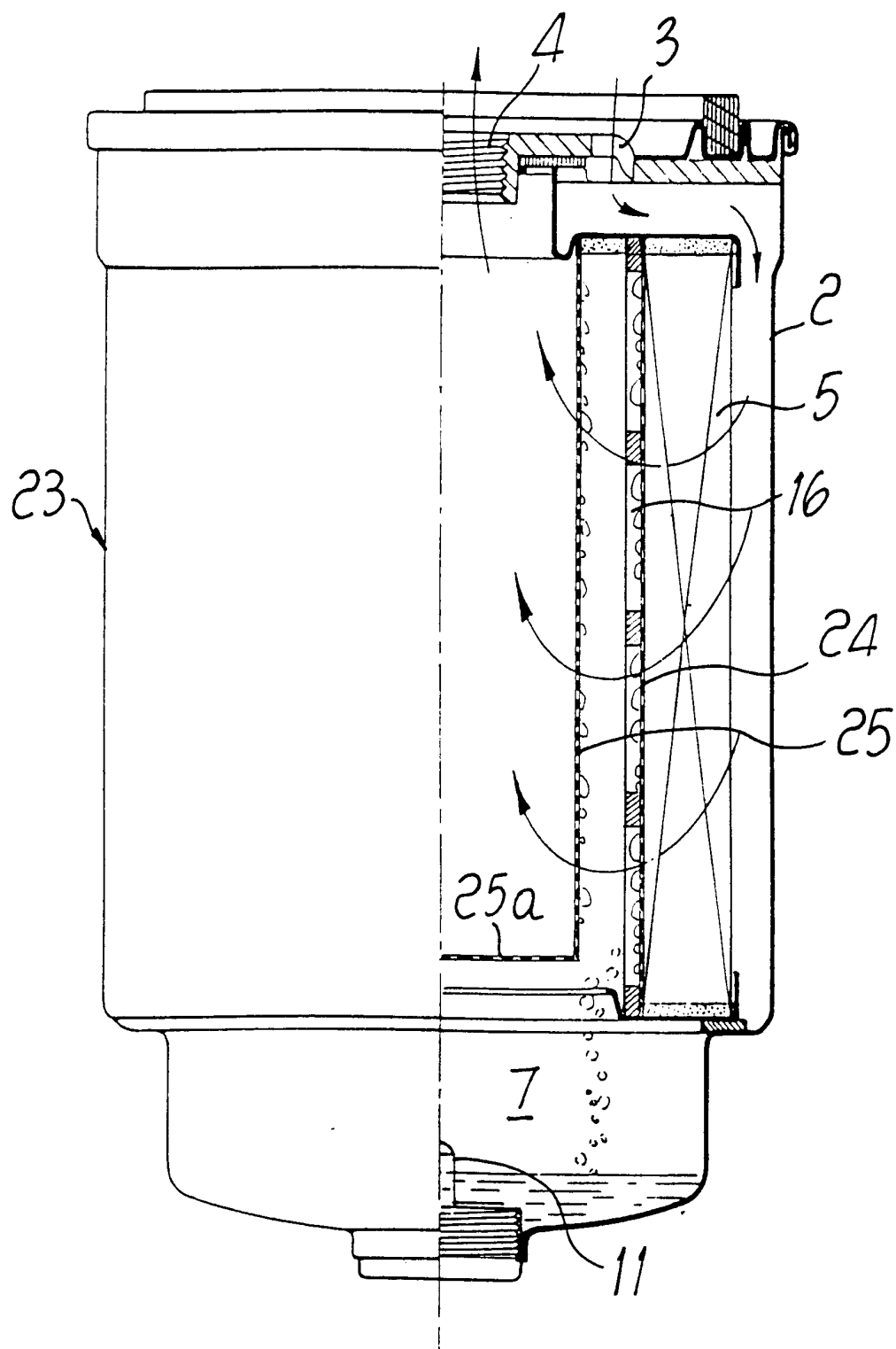
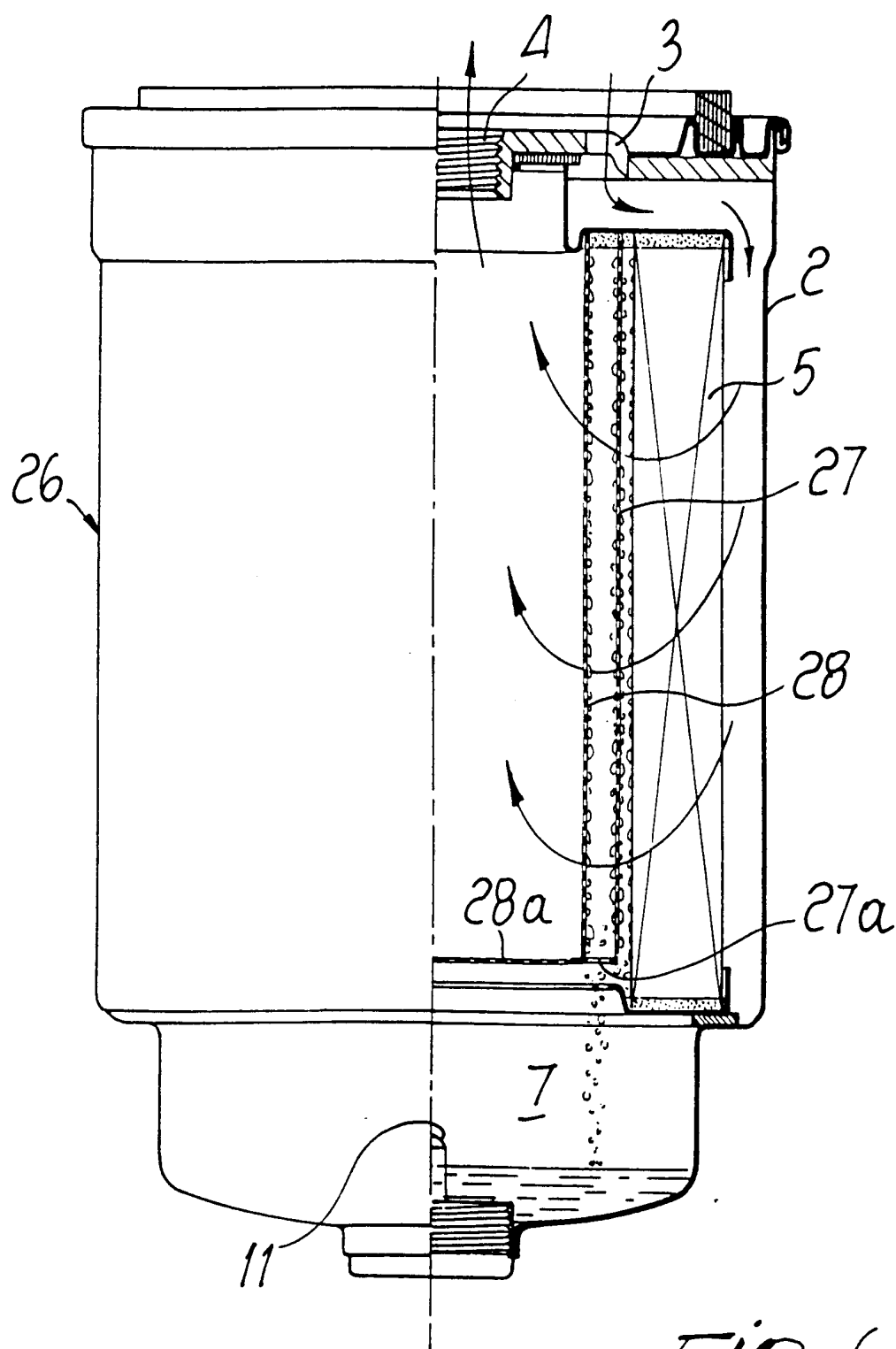


Fig. 4

*Fig. 5*

*Fig. 6*

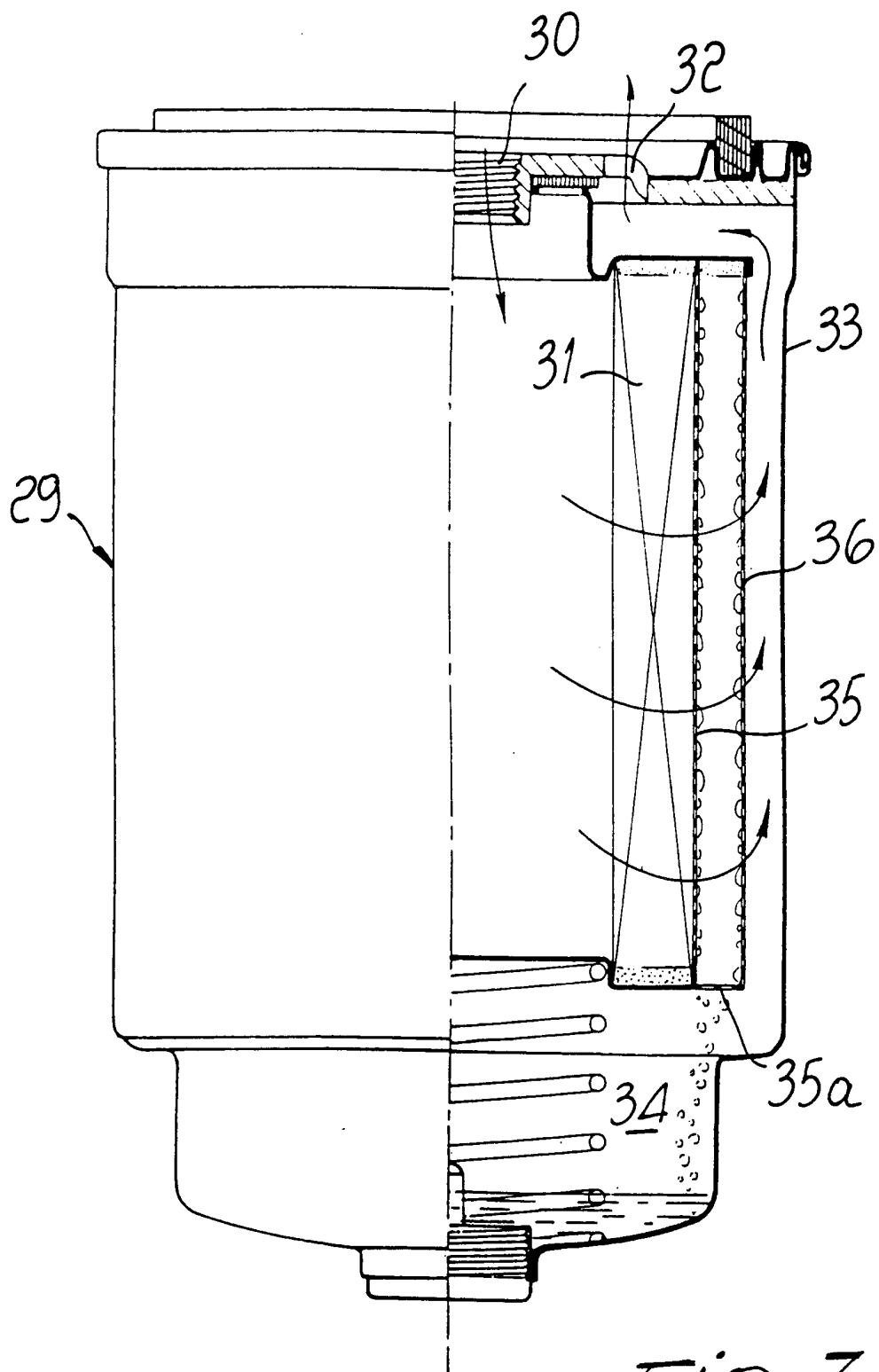


Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/03052

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B01D36/00 B01D29/00 B01D17/04 F02M37/22

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 7 B01D F02M

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)

EPO-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 4 477 345 A (SZLAGA JR EMIL) 16 October 1984 (1984-10-16) column 3, line 4-37; figures 1,2 ---	1-3,11
Y	US 4 372 847 A (LEWIS ANDREW D) 8 February 1983 (1983-02-08) column 7, line 40 -column 9, line 7; figure 2 Y-document with US-A-4740299 ---	1-4
Y	DE 34 40 506 A (POETZ KARL) 7 May 1986 (1986-05-07) page 6, paragraph 2; claims 1,3; figure 1 Y-document with US-A-4740299 --- -/--	1-4

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in 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 document 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.
- *G* document member of the same patent family

Date of the actual completion of the international search

31 July 2001

Date of mailing of the international search report

06/08/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Hoffmann, A

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/03052

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 740 299 A (CHURCH JOHN F ET AL) 26 April 1988 (1988-04-26) column 5, line 44 -column 6, line 17; figures 2,6 column 7, line 13-36 ----	1-4
A	US 4 233 042 A (TAO TING C) 11 November 1980 (1980-11-11) column 4, line 10-19; figure 1 ----	1-3
A	US 5 800 584 A (KELLER LOTHAR ET AL) 1 September 1998 (1998-09-01) column 3, line 5-38 column 4, line 4-18; figures 1,4 ----	1-3
A	GB 950 333 A (WINSLOW ENGINEERING AND MFG CO) 26 February 1964 (1964-02-26) page 2, line 51 -page 4, line 108; figures 1-4 ----	1-3,11, 12
A	WO 98 52676 A (DOMNICK HUNTER LTD ;SMITH STEPHEN NICHOLAS (GB)) 26 November 1998 (1998-11-26) page 12, paragraph 1 -page 14, paragraph 2; figures 1-3 ----	1
A	WO 93 01874 A (WINN HOUSTON) 4 February 1993 (1993-02-04) abstract ----	1
A	US 4 502 955 A (SCHAUPP RICHARD E) 5 March 1985 (1985-03-05) abstract -----	1

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/03052

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4477345 A	16-10-1984	CA 1208570 A	29-07-1986
US 4372847 A	08-02-1983	AU 7187681 A	07-01-1982
		CA 1167774 A	22-05-1984
		DE 3124602 A	01-07-1982
		FR 2484859 A	24-12-1981
		GB 2078536 A,B	13-01-1982
		GB 2138693 A,B	31-10-1984
		JP 57030513 A	18-02-1982
DE 3440506 A	07-05-1986	NONE	
US 4740299 A	26-04-1988	US 4668393 A	26-05-1987
		US 4692245 A	08-09-1987
		BR 8704643 A	26-04-1988
		EP 0260069 A	16-03-1988
		AU 582436 B	23-03-1989
		AU 5731986 A	20-11-1986
		CA 1266008 A	20-02-1990
		DE 3664870 D	14-09-1989
		EP 0202071 A	20-11-1986
		US 5643446 A	01-07-1997
		US 5645718 A	08-07-1997
		US 5547572 A	20-08-1996
		US 4997555 A	05-03-1991
		US 5622623 A	22-04-1997
		US 5244571 A	14-09-1993
		US 5904844 A	18-05-1999
		US 5362389 A	08-11-1994
		ZA 8603561 A	28-01-1987
US 4233042 A	11-11-1980	NONE	
US 5800584 A	01-09-1998	DE 4427753 A	15-02-1996
		BR 9502470 A	21-05-1996
		CN 1133198 A	16-10-1996
		CZ 9501788 A	12-06-1996
		EP 0695572 A	07-02-1996
		FI 953680 A	06-02-1996
		JP 8057229 A	05-03-1996
		ZA 9506079 A	27-02-1996
GB 950333 A	26-02-1964	FR 1326746 A	21-08-1963
WO 9852676 A	26-11-1998	NONE	
WO 9301874 A	04-02-1993	EP 0604410 A	06-07-1994
US 4502955 A	05-03-1985	AT 54261 T	15-07-1990
		BR 8406598 A	12-03-1985
		CA 1228303 A	20-10-1987
		DE 3482634 D	09-08-1990
		EP 0139003 A	02-05-1985
		IT 1176044 B	12-08-1987
		JP 3059723 B	11-09-1991
		JP 60501049 T	11-07-1985
		MX 159103 A	17-04-1989
		WO 8404051 A	25-10-1984