(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 493 373 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.01.2005 Bulletin 2005/01

(51) Int Cl.[7]: **A47L 9/16**

(21) Application number: **03077116.6**

(22) Date of filing: **04.07.2003**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT RO SE SI SK TR
Designated Extension States:
AL LT LV MK

(71) Applicant: **Shell Electric MFG. (Holdings) Co. Ltd.**
Chai Wan, Hong Kong (CN)

(72) Inventor: **Yung Kwok Kee, Billy**
Chain Wan, Hong Kong (CN)

(74) Representative: **Axelsson, Nils Ake et al**
Groth & Co. KB,
Box 6107
102 32 Stockholm (SE)

(54) Bagless vacuum cleaner with helical passageway

(57) A bagless vacuum cleaner having a removable dust extraction and collection unit. The removable dust extraction and collection unit has a cover (47) which defines an air inlet port (46). The air inlet port includes a helical passageway (86,88) disposed within a peripheral portion of the cover (47). The helical passageway (86,88) directs incoming air to the dust extraction and collection unit in a downwardly directed cyclone flow pattern.

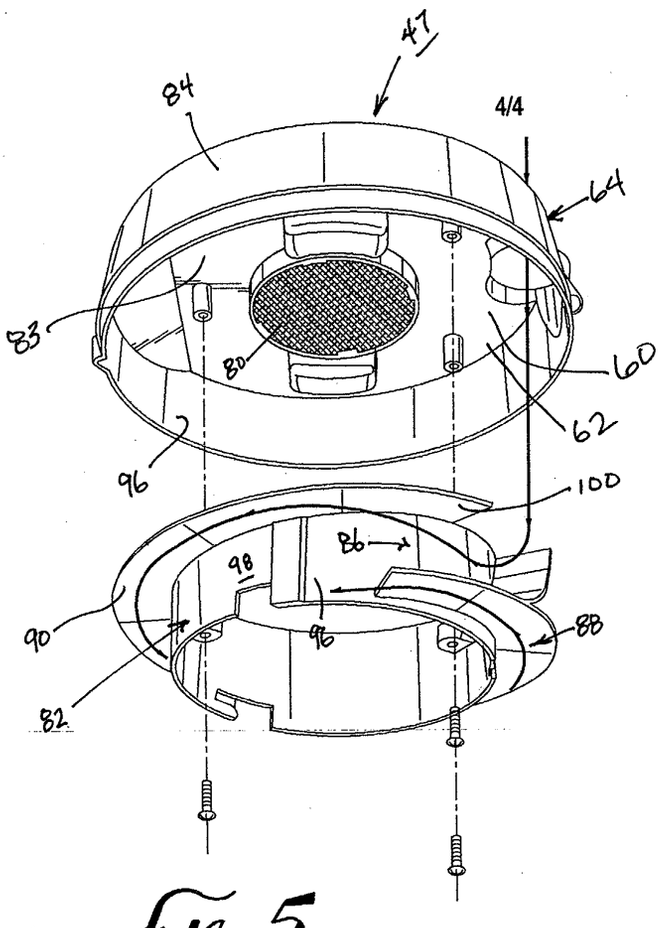

FIG. 5

EP 1 493 373 A1

Description

FIELD OF THE INVENTION

[0001] This invention relates generally to vacuum cleaners and, more particularly, to bagless vacuum cleaners.

BACKGROUND OF THE INVENTION

[0002] Bagless vacuum cleaners have become very popular over the last several years. This popularity is due in large part to the ease with which dust and dirt can be removed from such vacuum cleaners. In old style cloth bag-containing vacuum cleaners, dust and dirt removal is a difficult and awkward process, frequently requiring the user to extend his or her hand into the cloth bag to physically disengage dust clumps. Vacuum cleaners using disposable liner bags minimize the problems associated with cloth bags, but the use of such vacuum cleaners requires the continuous replenishment and installation of disposable liner bags. (Also, owners of older model disposable liner bag-containing vacuum cleaners often find it difficult to locate a source of properly sized replacement liner bags.)

[0003] Contrary to these problems associated with bag-containing vacuum cleaners, dirt and dust vacuumed up using bagless vacuum cleaners is conveniently deposited into an easily removable permanent container, from which dust and dirt can be disposed of without the effort associated with cloth bag-containing vacuum cleaners and without having to continually purchase and reinstall disposable liner bags.

[0004] The efficiency of bagless vacuum cleaners is dependent upon the "strength" of the cyclone formed within the dust extraction and collection unit of the vacuum cleaner. The stronger the cyclone, the better the separation of dust from the incoming dust-laden air.

[0005] Accordingly, there is a need for a bagless vacuum cleaner having improved cyclonic action.

SUMMARY

[0006] The invention satisfies this need. The invention is a vacuum cleaner having (a) a chassis having a base unit and a housing unit, the base unit having an air inlet and roller means for moving the vacuum cleaner across a flat surface, (b) an air blower disposed within the chassis, (c) a removable dust extraction and collection unit disposed within the housing unit, the dust extraction and collection unit comprising (i) an enclosed inlet chamber, the inlet chamber being substantially cylindrical in shape, the inlet chamber comprising a bottom wall, at least one generally vertical sidewall, a cover, an upper section and a lower section, and (ii) an enclosed outlet chamber suspended downwardly from the cover and disposed concentrically within the upper section of the inlet chamber, the outlet chamber having a bottom wall and at least one generally vertical side wall, the at least one sidewall having a plurality of inlet apertures, the inlet apertures being disposed in a band around the at least one sidewall, and (d) duct work for serially connecting in fluid communication the air inlet in the base unit, the inlet chamber, the outlet chamber and the air blower, wherein the cover comprises a central portion and a peripheral portion, the central portion defining an air outlet opening for the outlet chamber and the peripheral portion defining an air inlet opening for the inlet chamber, the peripheral portion further defining a helical passageway for directing incoming air to the inlet chamber in a downwardly directed cyclone flow pattern.

[0007] In one embodiment, the helical passageway extends at least once around the peripheral portion of the cover. Typically, the helical passageway extends between once and twice around the peripheral portion of the cover.

[0008] The helical portion typically comprises an upstream section and a downstream section. In one embodiment, the upstream section comprises a downwardly slanted top wall and a pair of spaced apart side walls. In a typical embodiment, such upstream section has at least one cross-section defining an area between about 5 cm^2 and about 8 cm^2, most typically between about 6 cm^2 and about 7 cm^2.

DRAWINGS

[0009] These features, aspects and advantages of the present invention will become better understood with regard to the following description, appended claims and accompanying figures where:

Figure 1 is a perspective view of a vacuum cleaner having features of the invention;

Figure 2 is a rear view of the vacuum cleaner illustrated in Figure 1;

Figure 3 is a diagrammatic cutaway view of the vacuum cleaner illustrated in Figure 1;

Figure 4 is a cross-section of a dust extraction and collection unit in the vacuum cleaner illustrated in Figure 1;

Figure 5 is an exploded perspective view of the cover of the dust extraction and collection unit in the vacuum cleaner illustrated in Figure 4; and

Figure 6 is a second exploded view of the cover illustrated in Figure 5.

DETAILED DESCRIPTION

[0010] The following discussion describes in detail one embodiment of the invention and several variations

of that embodiment. This discussion should not be construed, however, as limiting the invention to those particular embodiments. Practitioners skilled in the art will recognize numerous other embodiments as well.

[0011] The invention is a vacuum cleaner **10** having features which improve upon vacuum cleaners disclosed in my prior patents, U.S. Pat. No. 6,269,518 Bl and U.S. 6,484,350. As illustrated in Figures 1-4, the vacuum cleaner **10** has a chassis **12**, an air blower **14** and a dust extraction and collection unit **16**. The vacuum cleaner **10** can be a canister-style vacuum cleaner as illustrated in the drawings, or it can be of an upright style (not shown).

[0012] The chassis **12** comprises an air inlet **22** wherein dust and dirt is sucked up into the chassis **12.**

[0013] The chassis **12** further comprises roller means for moving the vacuum cleaner **10** across a flat surface. In the embodiment illustrated in the drawings, such roller means include a pair of wheels **26** disposed on opposite sides of the chassis **12**.

[0014] The air blower **14** is disposed within the chassis **12.** The air blower **14** is typically an electrically driven air blower having a capacity between about 50 m^3/hour and about 200 m^3/hour. A typical electrical motor **28** for driving the blower operates on ordinary house current and has a power capacity between about 800 watts and about 2000 watts.

[0015] The dust extraction and collection unit **16** is disposed within the chassis **12.** The dust extraction and collection unit **16** comprises an enclosed inlet chamber **32** and an enclosed outlet chamber **34.** The dust extraction and collection unit **16** is illustrated in detail in Figures 3-6.

[0016] The inlet chamber **32** is substantially cylindrical in shape with an internal diameter between about 130 mm and about 200 mm, preferably between about 150 mm and about 180 mm. The inlet chamber **32** comprises a body portion **35**. The body portion **35** has a bottom wall **36**, and at least one generally vertical sidewall **38**. The at least one sidewall **38** typically has an interior height between about 200 mm and about 250 mm, most typically between about 220 mm and about 230 mm.

[0017] The inlet chamber **32** has an upper section **42** and a lower section **44.** The inlet opening **46** of the inlet chamber **32** is configured to provide the ingress of dusty air into the inlet chamber **32** in tangential fashion wherein the ingressing dusty air is caused to downwardly spiral around the internal surface **48** of the at least one inlet chamber body portion sidewall **38**.

[0018] The inlet chamber **32** is preferably reversibly installable and deinstallable within the chassis **12.** In the embodiment illustrated in the drawings, the inlet chamber **32** is reversibly installable and deinstallable within the chassis **12** via a snap-on connection between the inlet chamber walls and the walls of the chassis **12**. In another embodiment (not shown), the inlet chamber **32** is reversibly installable and deinstallable within the chassis **12** using a press-fit connection.

[0019] The inlet chamber **32** further comprises a removable cover **47.** The cover **47** comprises a central portion **60** and a peripheral portion **62.** As illustrated in Figures 5 and 6, the cover **47** comprises a base **64** and a peripheral insert **82.** The base **64** has a top wall **83** and a downwardly depending circular side wall **84.** The cooperation of the circular side wall **84** and the peripheral insert **82** defines a helical passageway **85** having an upstream section **86** and a downstream section **88**. The upstream section **86** is attached in fluid tight communication with the inlet opening **46.** The upstream section **86** comprises a slanted top wall **90** and a pair of spaced apart side walls **96**, the outer of which is provided by the at least one side wall **84** of the base **64.** Typically, the vertical height of the pair of spaced apart side walls **96** is about 2.5 cm, and the side walls **96** are spaced apart by a distance of about 2.5 cm. Thus, at least one cross-section of the upstream section of the helical passageway **85** defines an area of between about 5 cm^2 and about 8 cm^2, most typically between about 6 cm^2 and about 7 cm^2. The peripheral insert **82** comprises a circular collar **98** with a helical flange **100** extending around it. The helical flange **100** provides the slanted top wall **90** in the upstream section **86.** Typically, the helical flange **100** extends more than once around the collar **98,** most typically between about once and about twice around the collar **98**.

[0020] The helical passageway **85** guides the incoming air to the inlet chamber **32** over a longer distance than the incoming air is guided in known prior art units. This results in higher air inlet velocities which, in turn, results in higher inlet air accelerations. The net result of the higher air inlet velocities and accelerations is a much stronger cyclone within the inlet chamber **32** than is possible in known prior art units.

[0021] The outlet chamber **34** is disposed concentrically within the upper section **42** of the inlet chamber **32**. The outlet chamber **34** is suspended from the top wall **83** of the cover **47**. The outlet chamber **34** has a bottom wall **50** and at least one generally vertical sidewall **54**. The at least one sidewall **54** has an interior height between about 50 mm and about 100 mm, preferably between about 80 mm and about 90 mm.

[0022] The at least one sidewall **54** of the outlet chamber **34** is perforated with a plurality of inlet apertures **56,** each defining an area between about 3 mm^2 and about 30 mm^2. In a typical embodiment, the at least one sidewall **54** defmes between about 1000 and about 1500 inlet apertures **56,** preferably between about 1300 and about 1400 inlet apertures **56.** Typically each of the inlet apertures **56** is separated from adjoining inlet apertures **56** by a distance of between about 1.5 mm and about 5 mm. The inlet apertures **56** are preferably disposed in a band **58** around the sidewalls **54** of the outlet chamber **34**. Typically, the band **58** has a width between about 20 mm and about 50 mm, preferably between about 30 mm and about 40 mm. The band **58** defines a median line (not shown) which divides the uppermost apertures **56**

from a substantially equal number of lowermost apertures **56**. Typically, the median line is disposed between about 30 mm and about 100 mm above the bottom wall **50** of the outlet chamber **34**, preferably between about 50 mm and about 60 mm above the bottom wall **50**.

[0023] In the embodiments illustrated in the drawings, the bottom wall **50** of the outlet chamber **34** has an X-shaped wall **75** which projects vertically above the bottom wall **50**. This X-shaped wall **75** supports the cylindrical filter **76.** Typically, such cylindrical filter **76** is made from polypropylene, paper, ceramic or polytetrafluoroethylene having a thickness between about 1.5 mm and about 5 mm.

[0024] The cylindrical filter **76** is suspended from the central portion **60** of the cover, such that the cylindrical filter **76** is disposed vertically and concentrically within the outlet chamber **34**.

[0025] The central portion **60** of the cover **47** defines a top wall opening **78** for the outlet chamber **34**.

[0026] In a preferred embodiment, the outlet chamber **34** comprises a planar filter **80** disposed across the top wall **78** opening of the outlet chamber **34.** In a typical embodiment, such planar filter **80** is made from sponge, fibrous polyethylene, fibrous polypropylene or paper, and typically has a thickness between about 5 mm and about 15 mm.

[0027] The invention further comprises duct work **92** for serially connecting in fluid communication the air inlet **22** in the base unit **18**, the inlet chamber **32**, the outlet chamber **34** and the air blower **14**.

[0028] It is very important that all such duct work **92** and all connection points within the duct work and between various components in the system and/or the duct work **92** be well-sealed. Even small leaks within the system can markedly decrease efficiency and increase power requirements.

[0029] In a preferred embodiment, a blower filter **94** is operatively disposed downstream of the air blower **14**. Preferably, such blower filter **94** is a HEPA filter.

[0030] The invention has been found to provide a vacuum cleaner with all the conveniences of prior art vacuum cleaners, but with increased dust removal efficiency and without excessive mechanical complexity and resulting expense of manufacture.

[0031] Having thus described the invention, it should be apparent that numerous structural modifications and adaptations may be resorted to without departing from the scope and fair meaning of the instant invention as set forth hereinabove and as described hereinbelow by the claims.

Claims

1. A vacuum cleaner comprising:

(a) a chassis having a base unit and a housing unit, the base unit having an air inlet and roller means for moving the vacuum cleaner across a flat surface;

(b) an air blower disposed within the chassis;

(c) a removable dust extraction and collection unit disposed within the housing unit, the dust extraction and collection unit comprising:

(i) an enclosed inlet chamber, the inlet chamber being substantially cylindrical in shape, the inlet chamber comprising a bottom wall, at least one generally vertical sidewall, a cover, an upper section and a lower section; and

(ii) an enclosed outlet chamber suspended downwardly from the cover and disposed concentrically within the upper section of the inlet chamber, the outlet chamber having a bottom wall and at least one generally vertical side wall, the at least one sidewall having a plurality of inlet apertures, the inlet apertures being disposed in a band around the at least one sidewall; and

(d) duct work for serially connecting in fluid communication the air inlet in the base unit, the inlet chamber, the outlet chamber and the air blower;

wherein the cover comprises a central portion and a peripheral portion, the central portion defining an air outlet opening for the outlet chamber and the peripheral portion defining an air inlet opening for the inlet chamber, the peripheral portion further defining a helical passageway for directing incoming air to the inlet chamber in a downwardly directed cyclone flow pattern.

2. The vacuum cleaner of claim 1 wherein the helical passageway extends at least once around the peripheral portion of the cover.

3. The vacuum cleaner of claim 1 wherein the helical passageway extends between once and twice around the peripheral portion of the cover.

4. The vacuum cleaner of claim 1 wherein the helical portion comprises an upstream section and a downstream section, the upstream section comprising a downwardly slanted top wall and a pair of spaced apart side walls.

5. The vacuum cleaner of claim 1 wherein at least one cross-section of the upstream section of the helical passageway defines an area between about 5 cm^2 and about 8 cm^2.

6. The vacuum cleaner of claim 1 wherein at least one cross-section of the upstream section of the helical

passageway defines an area between about 6 cm^2 and about 7 cm^2.

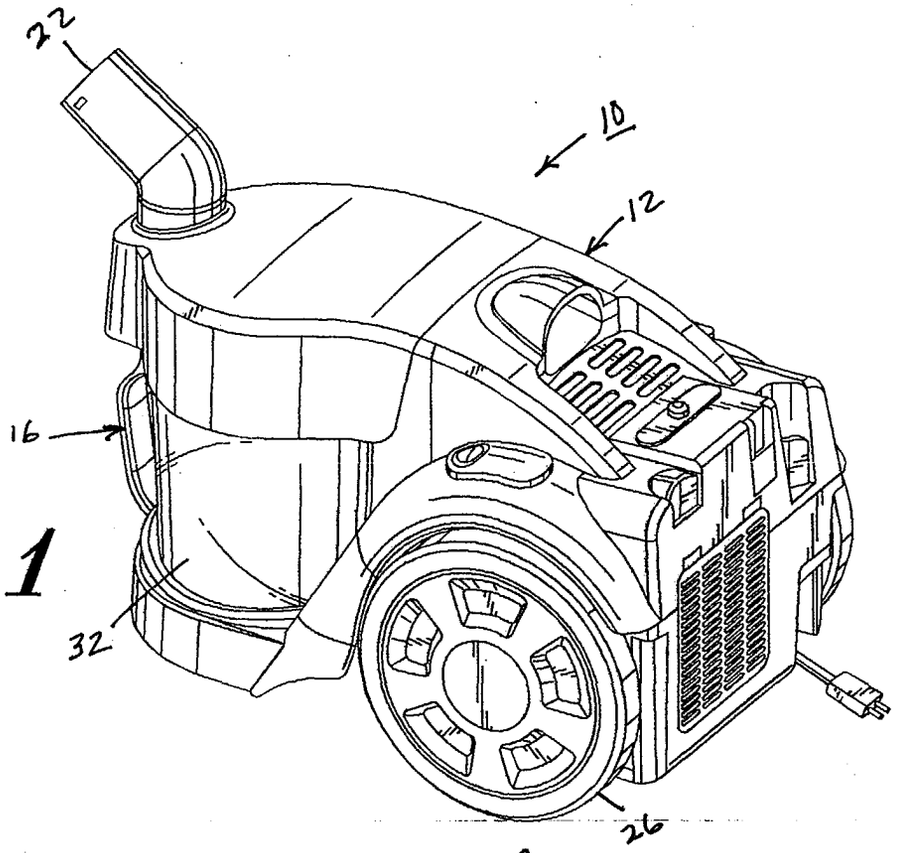

FIG. 1

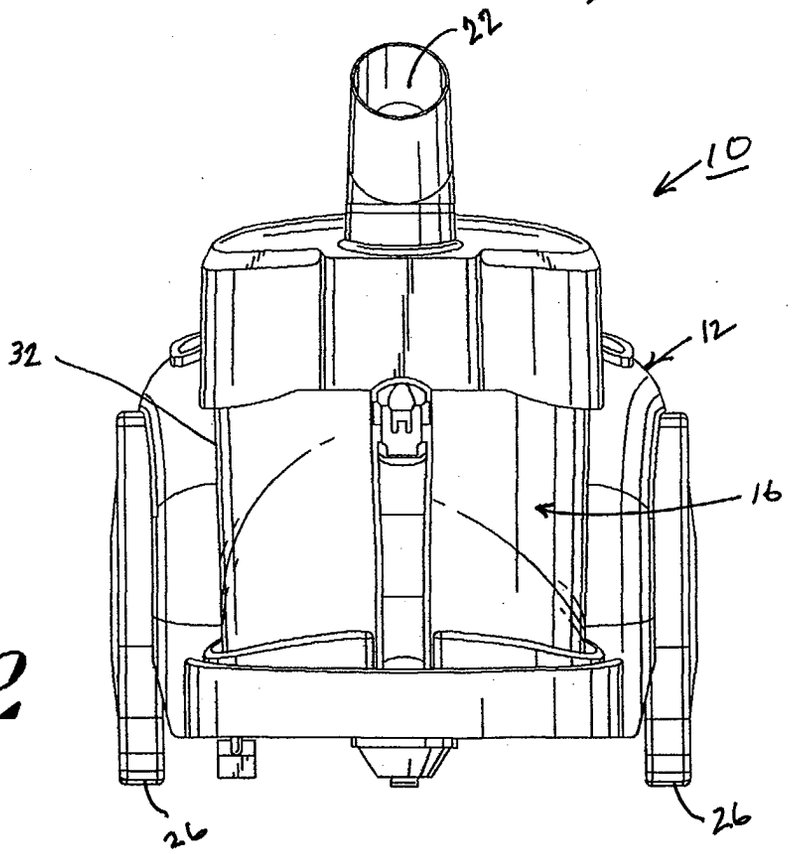

FIG. 2

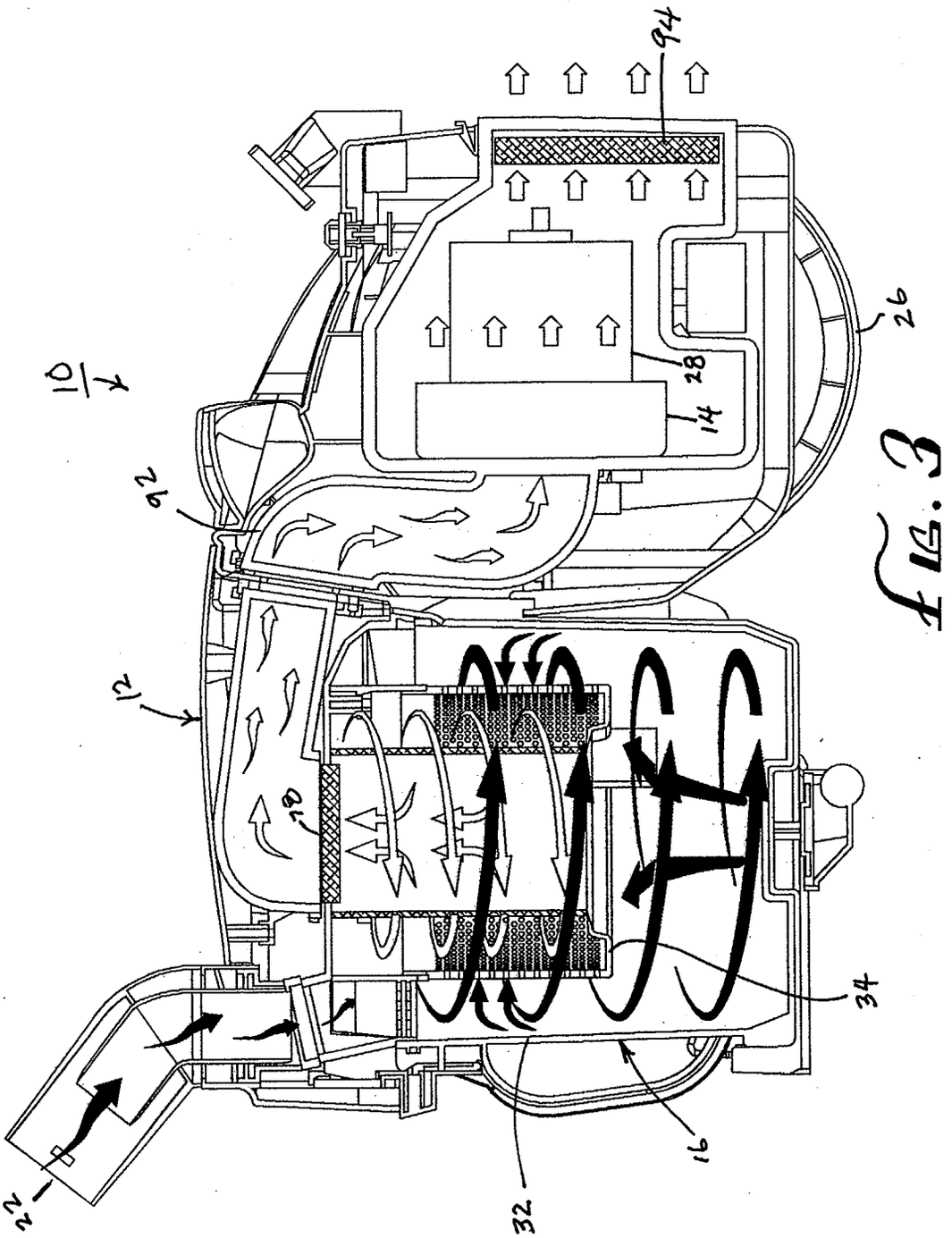

Fig. 3

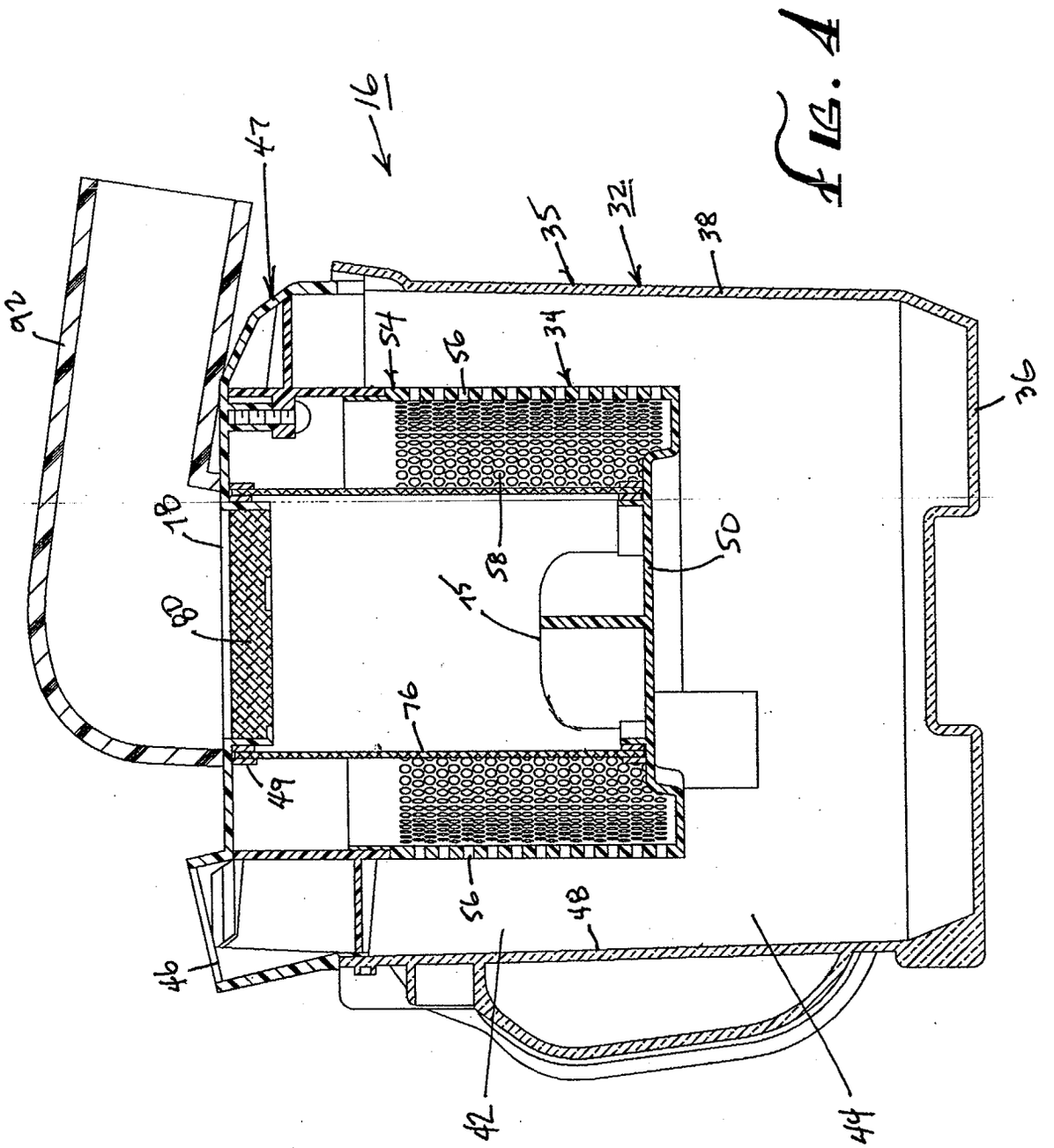

Fig. 4

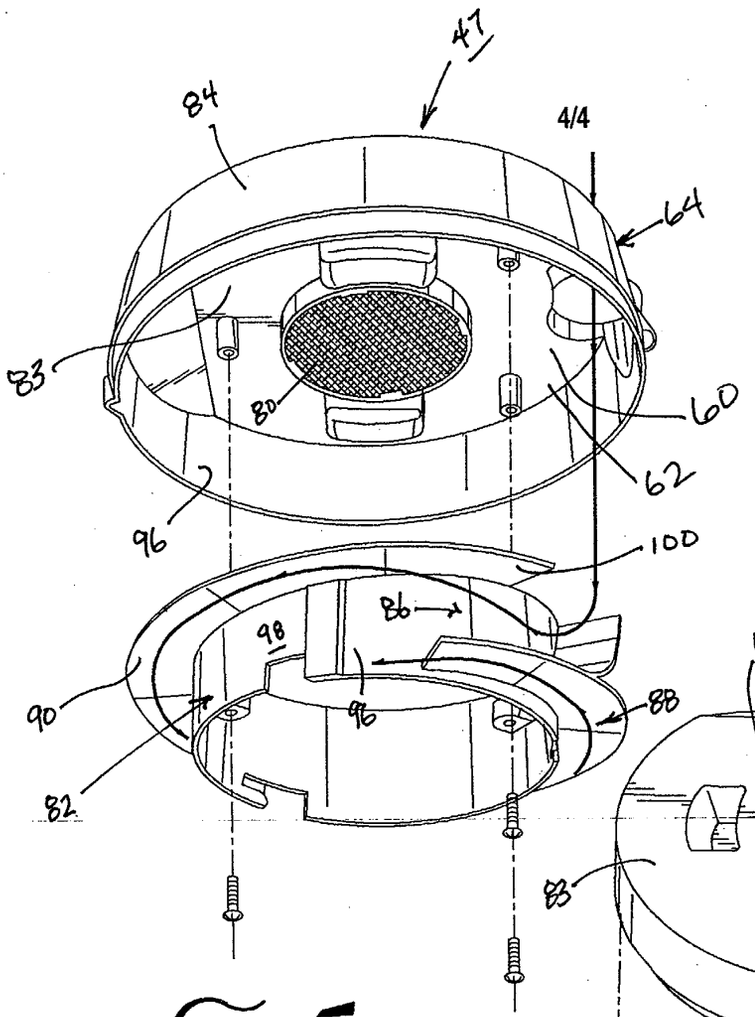
47
84
4/4
64
83
80
60
62
96
100
86
98
90
96
88
82

FIG. 5

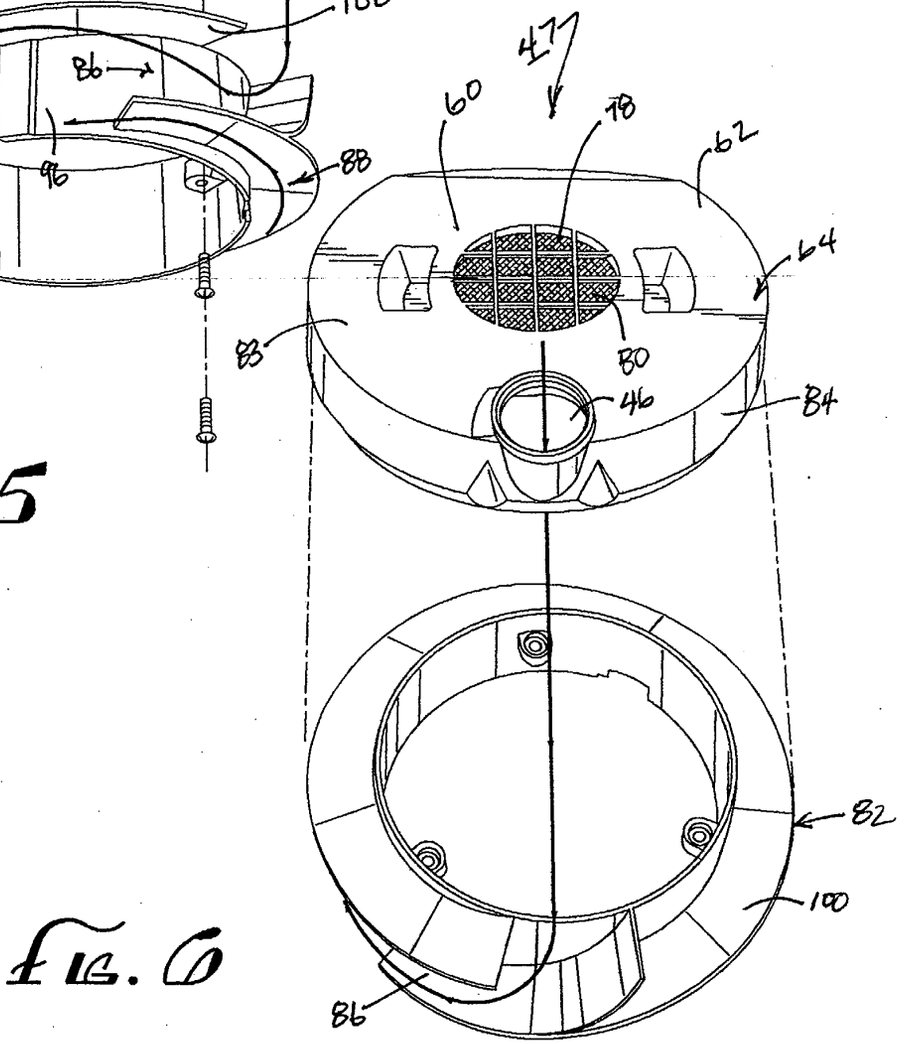
47
60
78
62
64
83
80
46
84
82
100
86

FIG. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 07 7116

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 2002/073663 A1 (MUCLAHY JOSEPH ET AL) 20 June 2002 (2002-06-20) * page 2, paragraph 44 - page 3, paragraph 52; figures 4,5 *	1-6	A47L9/16
X	US 2002/194993 A1 (GEN NI ZU) 26 December 2002 (2002-12-26) * page 2, paragraph 30 - page 3, paragraph 30 *	1-6	
X	US 2002/011053 A1 (OH JANG-KEUN) 31 January 2002 (2002-01-31) * figure 2 *	1,4-6	
X	US 6 553 612 B1 (BURLINGTON GEOFFREY MICHAEL ET AL) 29 April 2003 (2003-04-29) * figures 6,7 *	1	
A,D	US 6 269 518 B1 (YUNG BILLY) 7 August 2001 (2001-08-07)		
A	BE 464 443 A (L.A.G. ROUJOB) 31 May 1946 (1946-05-31)		TECHNICAL FIELDS SEARCHED (Int.Cl.7) A47L B04C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	14 November 2003	Martin Gonzalez, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 07 7116

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-11-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002073663 A1	20-06-2002	NONE	
US 2002194993 A1	26-12-2002	NONE	
US 2002011053 A1	31-01-2002	KR 2002009768 A	02-02-2002
		CN 1334062 A ,B	06-02-2002
		DE 10058314 A1	14-02-2002
		EG 22425 A	29-01-2003
		FR 2812183 A1	01-02-2002
		GB 2364940 A ,B	13-02-2002
		JP 2002051951 A	19-02-2002
		NL 1017181 C2	29-01-2002
		RU 2181254 C1	20-04-2002
US 6553612 B1	29-04-2003	GB 2344745 A	21-06-2000
		AT 249783 T	15-10-2003
		AU 762596 B2	26-06-2003
		AU 1667100 A	12-07-2000
		BR 9916309 A	02-10-2001
		CA 2355073 A1	29-06-2000
		CN 1330523 T	09-01-2002
		CZ 20012074 A3	14-11-2001
		DE 69911459 D1	23-10-2003
		EP 1139845 A1	10-10-2001
		WO 0036962 A1	29-06-2000
		JP 2002532178 T	02-10-2002
		NO 20012699 A	24-07-2001
		PL 348818 A1	17-06-2002
		SK 8622001 A3	03-12-2001
		ZA 200104459 A	30-08-2002
US 6269518 B1	07-08-2001	AU 2069401 A	18-06-2001
		CA 2361932 A1	14-06-2001
		EP 1198193 A1	24-04-2002
		WO 0141619 A1	14-06-2001
		US 2002011054 A1	31-01-2002
		US 2002069476 A1	13-06-2002
		ZA 200106476 A	13-02-2002
BE 464443 A		NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82