US007757340B2

(12) **United States Patent**
**Sawalski**

(10) **Patent No.: US 7,757,340 B2**
(45) **Date of Patent: Jul. 20, 2010**

(54) **SOFT-SURFACE REMEDIATION DEVICE AND METHOD OF USING SAME**

(75) Inventor: **Michael M. Sawalski**, Racine, WI (US)

(73) Assignee: **S.C. Johnson & Son, Inc.**, Racine, WI (US)

( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1468 days.

(21) Appl. No.: **11/090,438**

(22) Filed: **Mar. 25, 2005**

(65) **Prior Publication Data**

US 2006/0213025 A1 Sep. 28, 2006

(51) **Int. Cl.**
*A47L 5/24* (2006.01)

(52) **U.S. Cl.** ..... **15/300.1**; 15/320; 15/339; 15/344; 15/346; 15/347; 15/363; 15/393

(58) **Field of Classification Search** ..... 15/300.1, 15/320, 339, 344, 346, 347, 363, 393; *A47L 5/24*
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 513,390 | A | | 1/1894 | Griswold |
| 822,064 | A | | 5/1906 | Milham |
| 2,052,869 | A | | 9/1936 | Coanda |
| 2,088,028 | A | | 7/1937 | Mailander |
| 2,291,826 | A | | 8/1942 | Muffly |
| 2,583,374 | A | | 1/1952 | Hoffman |
| 2,665,943 | A | | 1/1954 | Palm |
| 2,945,554 | A | | 7/1960 | Berly |
| 2,953,208 | A | | 9/1960 | O'Connor |
| 3,047,208 | A | | 7/1962 | Coanda |
| 3,061,959 | A | * | 11/1962 | Blumenfeld ..... 38/77.8 |
| 3,201,772 | A | | 8/1965 | Ladusaw |
| 3,323,710 | A | | 6/1967 | Daly |
| 3,633,240 | A | | 1/1972 | Crener |
| 3,635,001 | A | | 1/1972 | Komroff et al. |
| 3,718,982 | A | | 3/1973 | Deaton |
| 3,840,309 | A | | 10/1974 | Eckes et al. |
| 3,872,540 | A | | 3/1975 | Block |
| 3,904,314 | A | | 9/1975 | Pedersen |
| 3,934,543 | A | | 1/1976 | Howard |
| 4,040,042 | A | | 8/1977 | Mayer |
| 4,123,818 | A | | 11/1978 | Hurwitz |
| 4,137,988 | A | | 2/1979 | Croix-Marie |
| 4,178,127 | A | | 12/1979 | Zahorecz |
| 4,204,298 | A | | 5/1980 | Handa et al. |
| 4,321,070 | A | | 3/1982 | Bede |
| 4,419,784 | A | | 12/1983 | Lex |
| 4,462,137 | A | | 7/1984 | Berfield et al. |

(Continued)

FOREIGN PATENT DOCUMENTS

| | | |
|---|---|---|
| CA | 1135910 | 11/1982 |

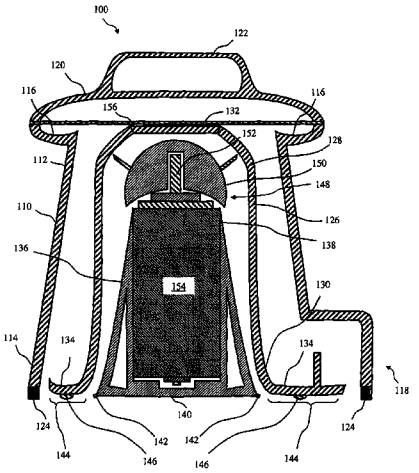
(Continued)

*Primary Examiner*—David A Redding

(57) **ABSTRACT**

A soft-surface remediation (SSR) device and method of remediating soft surfaces using preferably forced air is disclosed. The device is lightweight, and easy-to-use and preferably includes an outer housing with an optional corner pickup region and a removable cover, an inner housing, a motor housing for housing a fan assembly, an optional disposal catch mechanism, an optional mounted delivery device, a first air channel with an air outlet, a second air channel with an air inlet, and a return air channel in close proximity to the disposal mechanism. The method of performing soft-surface remediation preferably includes use of this SSR device.

**20 Claims, 33 Drawing Sheets**



U.S. PATENT DOCUMENTS


| | | | |
|---|---|---|---|
| 4,474,534 | A | 10/1984 | Thode |
| 4,521,158 | A | 6/1985 | Fickelscher |
| 4,554,698 | A | 11/1985 | Rennecker et al. |
| 4,571,849 | A | 2/1986 | Gardner et al. |
| 4,586,751 | A | 5/1986 | McGuire |
| 4,597,124 | A | 7/1986 | Williams, III et al. |
| 4,606,290 | A | 8/1986 | Marzotto |
| 4,610,600 | A | 9/1986 | Bleier |
| 4,624,649 | A | 11/1986 | Blocker |
| 4,624,690 | A | 11/1986 | Byrnes |
| 4,643,775 | A | 2/1987 | Reba et al. |
| 4,656,688 | A | 4/1987 | Jacob et al. |
| 4,658,464 | A | 4/1987 | Sharp |
| 4,671,567 | A | 6/1987 | Frobose |
| 4,672,695 | A | 6/1987 | Fuss |
| 4,675,347 | A | 6/1987 | Mochizuki et al. |
| 4,678,595 | A | 7/1987 | Malik et al. |
| 4,697,847 | A | 10/1987 | Herschlag |
| 4,703,538 | A | 11/1987 | Silverstrone |
| 4,714,097 | A | 12/1987 | Binzen et al. |
| 4,735,626 | A | 4/1988 | Smith et al. |
| 4,747,364 | A | 5/1988 | Horowitz |
| 4,751,501 | A | 6/1988 | Gut |
| 4,766,638 | A | 8/1988 | McDowell |
| 4,809,396 | A | 3/1989 | Houser |
| 4,824,719 | A | 4/1989 | Creyf et al. |
| 4,837,875 | A | 6/1989 | Shamie et al. |
| 4,848,839 | A | 7/1989 | Galardo |
| 4,857,377 | A | 8/1989 | Daimon et al. |
| 4,873,422 | A | 10/1989 | Streich et al. |
| 4,884,315 | A | 12/1989 | Ehnert |
| 4,914,772 | A | 4/1990 | Difloe |
| 4,932,720 | A | 6/1990 | Sherman |
| 4,951,346 | A | 8/1990 | Salmon |
| 4,955,995 | A | 9/1990 | Pontius |
| 5,029,359 | A | 7/1991 | Ortega |
| 5,060,341 | A | 10/1991 | Nelle |
| 5,074,997 | A | 12/1991 | Riley et al. |
| 5,115,765 | A | 5/1992 | El Omary |
| 5,141,204 | A | 8/1992 | Marosy |
| 5,141,309 | A | 8/1992 | Warwag |
| 5,154,398 | A | 10/1992 | Mayfield |
| 5,168,599 | A | 12/1992 | Williams |
| 5,173,307 | A | 12/1992 | Nestle |
| 5,176,860 | A | 1/1993 | Storch |
| 5,188,343 | A | 2/1993 | Galea |
| 5,203,521 | A | 4/1993 | Day |
| 5,205,156 | A | 4/1993 | Asano et al. |
| 5,219,633 | A | 6/1993 | Sabee |
| 5,228,157 | A | 7/1993 | Johenning et al. |
| 5,231,717 | A | 8/1993 | Scott et al. |
| 5,237,719 | A | 8/1993 | Dwyer et al. |
| 5,239,610 | A | 8/1993 | Shao |
| 5,244,468 | A | 9/1993 | Harris et al. |
| 5,249,925 | A | 10/1993 | Guimbal et al. |
| 5,259,984 | A | 11/1993 | Hull |
| 5,263,764 | A | 11/1993 | Laughlin et al. |
| 5,284,597 | A | 2/1994 | Rees |
| 5,287,588 | A | 2/1994 | Gurstein et al. |
| 5,289,610 | A | 3/1994 | Monson |
| 5,302,001 | A | 4/1994 | Van Dis |
| 5,311,023 | A | 5/1994 | Means, Jr. et al. |
| 5,315,726 | A | 5/1994 | Borenstein |
| 5,331,697 | A | 7/1994 | Siegel et al. |
| 5,335,383 | A | 8/1994 | Schwind |
| 5,348,556 | A | 9/1994 | Minns et al. |
| 5,351,646 | A | 10/1994 | Zoroufy |
| 5,377,378 | A | 1/1995 | Cutler |
| 5,378,254 | A | 1/1995 | Maly et al. |
| 5,388,302 | A | 2/1995 | Sundaram et al. |
| 5,392,490 | A | 2/1995 | Monson |
| 5,392,492 | A | 2/1995 | Fassauer |
| 5,394,810 | A | 3/1995 | Howard et al. |
| 5,394,926 | A | 3/1995 | Kraeutler |
| 5,415,461 | A | 5/1995 | Sakamoto |
| 5,432,975 | A | 7/1995 | Hilmanowski |
| 5,435,817 | A | 7/1995 | Davis et al. |
| 5,455,979 | A | 10/1995 | Bores et al. |
| 5,461,368 | A | 10/1995 | Comer |
| 5,478,133 | A | 12/1995 | Tidwell |
| 5,478,201 | A | 12/1995 | Amr |
| 5,492,540 | A | 2/1996 | Leifheit et al. |
| 5,493,752 | A | 2/1996 | Crouser et al. |
| 5,515,569 | A | 5/1996 | Montabaur et al. |
| 5,516,384 | A | 5/1996 | Mossbeck |
| 5,538,325 | A | 7/1996 | Bullard |
| 5,544,943 | A | 8/1996 | Durling |
| 5,551,122 | A | 9/1996 | Burkhardt et al. |
| 5,555,595 | A | 9/1996 | Ligman |
| 5,564,160 | A | 10/1996 | Luebbeing |
| 5,569,521 | A | 10/1996 | Francoeur et al. |
| 5,577,294 | A | 11/1996 | Pollock |
| 5,584,094 | A | 12/1996 | Gurstein |
| 5,601,340 | A | 2/1997 | Stout |
| 5,604,953 | A | 2/1997 | Castwall et al. |
| 5,613,269 | A | 3/1997 | Miwa |
| 5,620,306 | A | 4/1997 | Day |
| 5,624,465 | A | 4/1997 | Harris |
| 5,633,017 | A | 5/1997 | Sebag |
| 5,638,562 | A | 6/1997 | Masoncup |
| 5,640,739 | A | 6/1997 | Campbell |
| 5,643,775 | A | 7/1997 | Takahashi et al. |
| 5,647,092 | A | 7/1997 | Miwa |
| 5,647,285 | A | 7/1997 | Steward |
| 5,676,163 | A | 10/1997 | Behan et al. |
| 5,678,897 | A | 10/1997 | Prestia |
| 5,679,137 | A | 10/1997 | Erdman et al. |
| 5,700,060 | A | 12/1997 | Bullard et al. |
| 5,718,729 | A | 2/1998 | Harris |
| 5,718,822 | A | 2/1998 | Richter |
| 5,720,057 | A | 2/1998 | Duncan |
| 5,733,397 | A | 3/1998 | McDaniel |
| 5,753,607 | A | 5/1998 | Burke et al. |
| 5,768,747 | A | 6/1998 | Smith |
| 5,774,056 | A | 6/1998 | Berry, III et al. |
| 5,796,472 | A | 8/1998 | Wirthlin |
| 5,797,161 | A | 8/1998 | Campbell |
| 5,799,362 | A | 9/1998 | Huffman |
| 5,801,211 | A | 9/1998 | Tornero et al. |
| 5,802,637 | A | 9/1998 | Bordo |
| 5,802,664 | A | 9/1998 | Mondigo et al. |
| 5,810,908 | A | 9/1998 | Gray et al. |
| 5,822,817 | A | 10/1998 | Carew et al. |
| 5,823,200 | A | 10/1998 | Persaud |
| 5,826,301 | A | 10/1998 | Kang et al. |
| 5,832,559 | A | 11/1998 | Kang |
| 5,850,667 | A | 12/1998 | Orsini |
| 5,851,457 | A | 12/1998 | Peterson et al. |
| 5,860,188 | A | 1/1999 | Maurer et al. |
| 5,884,360 | A | 3/1999 | Palffy |
| 5,890,249 | A | 4/1999 | Hoffman |
| 5,890,258 | A | 4/1999 | Lee |
| 5,895,504 | A | 4/1999 | Sramek et al. |
| 5,904,755 | A | 5/1999 | Kanazashi et al. |
| 5,911,265 | A | 6/1999 | Dreher |
| 5,911,654 | A | 6/1999 | Webb |
| 5,914,453 | A | 6/1999 | James et al. |
| 5,917,141 | A | 6/1999 | Naquin, Jr. |
| 5,920,953 | A | 7/1999 | Shero |
| 5,935,364 | A | 8/1999 | Groendal et al. |
| 5,950,264 | A | 9/1999 | Wyner et al. |
| 5,966,759 | A | 10/1999 | Sanders et al. |
| 5,968,204 | A | 10/1999 | Wise |
| 5,970,577 | A | 10/1999 | Kim |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5,971,452 | A | 10/1999 | Marymor et al. | 6,595,753 | B1 | 7/2003 | Illingworth et al. |
| 5,979,003 | A | 11/1999 | Billat | 6,612,402 | B1 | 9/2003 | Illingworth |
| 5,983,442 | A | 11/1999 | Louis et al. | 6,616,736 | B2 | 9/2003 | Massey et al. |
| 5,985,811 | A | 11/1999 | Masayuki et al. | 6,619,922 | B2 | 9/2003 | Illingworth et al. |
| 6,010,539 | A | 1/2000 | Del Pesco | 6,623,265 | B1 | 9/2003 | Day |
| 6,038,722 | A | 3/2000 | Giori et al. | 6,623,352 | B2 | 9/2003 | Illingworth |
| 6,042,333 | A | 3/2000 | Day | 6,631,529 | B1 | 10/2003 | Erickson |
| 6,047,435 | A | 4/2000 | Suzuki et al. | 6,634,855 | B1 | 10/2003 | Rollo |
| 6,052,866 | A | 4/2000 | Tuvin et al. | 6,647,586 | B2 | 11/2003 | Rogers et al. |
| 6,055,699 | A | 5/2000 | Cho | 6,659,550 | B2 | 12/2003 | Hackett |
| 6,056,109 | A | 5/2000 | Hidai | 6,687,951 | B2 | 2/2004 | Illingworth et al. |
| 6,056,209 | A | 5/2000 | Rivera | 6,689,225 | B2 | 2/2004 | Illingworth |
| 6,066,011 | A | 5/2000 | Day | 6,691,369 | B1 * | 2/2004 | Weiss ..... 15/344 |
| 6,071,869 | A | 6/2000 | Materniak et al. | 6,696,395 | B1 | 2/2004 | Ireton et al. |
| 6,077,336 | A | 6/2000 | Ulrich et al. | 6,708,941 | B1 | 3/2004 | Bowen et al. |
| 6,082,376 | A | 7/2000 | Karr et al. | 6,719,830 | B2 | 4/2004 | Illingworth et al. |
| 6,101,670 | A | 8/2000 | Song | 6,721,982 | B2 | 4/2004 | Freeman |
| 6,110,260 | A | 8/2000 | Kubokawa | 6,725,500 | B2 | 4/2004 | Allen et al. |
| 6,116,693 | A | 9/2000 | Zammit | 6,726,284 | B2 | 4/2004 | Cleary |
| 6,119,290 | A | 9/2000 | Masoncup | 6,729,839 | B1 | 5/2004 | Illingworth et al. |
| 6,123,618 | A | 9/2000 | Day | 6,735,800 | B1 | 5/2004 | Salvatini et al. |
| 6,126,697 | A | 10/2000 | Ebberts | 6,742,626 | B2 | 6/2004 | Illingworth |
| 6,134,746 | A | 10/2000 | Miller et al. | 6,746,166 | B1 | 6/2004 | Jeon et al. |
| 6,135,127 | A | 10/2000 | Pieper | 6,746,617 | B2 | 6/2004 | Radomyselski et al. |
| 6,136,730 | A | 10/2000 | Kimbrell et al. | 6,772,472 | B2 | 8/2004 | Wang |
| 6,146,759 | A | 11/2000 | Land | 6,790,259 | B2 | 9/2004 | Rittri et al. |
| 6,170,293 | B1 | 1/2001 | Cody | 6,800,106 | B2 | 10/2004 | Cogar, Sr. et al. |
| 6,173,465 | B1 | 1/2001 | Deneau | 6,802,271 | B2 | 10/2004 | Oxley et al. |
| 6,185,781 | B1 | 2/2001 | Miller et al. | 6,802,693 | B2 | 10/2004 | Reinfeld et al. |
| 6,199,244 | B1 | 3/2001 | Hilgers et al. | 6,802,881 | B2 | 10/2004 | Illingworth et al. |
| 6,199,251 | B1 | 3/2001 | Zeiler | 6,807,694 | B1 | 10/2004 | Miller |
| 6,231,647 | B1 | 5/2001 | Cheng | 6,811,687 | B2 | 11/2004 | Illingworth |
| 6,235,090 | B1 | 5/2001 | Bernstein et al. | 6,813,807 | B2 | 11/2004 | Ibbertson et al. |
| 6,239,166 | B1 | 5/2001 | Black | 6,820,305 | B2 | 11/2004 | Kess et al. |
| 6,239,694 | B1 | 5/2001 | Honda et al. | 6,854,143 | B2 | 2/2005 | Sharples |
| 6,243,914 | B1 | 6/2001 | Studebaker | 6,863,704 | B2 | 3/2005 | Pillion et al. |
| 6,260,224 | B1 | 7/2001 | Pinkus | 6,881,025 | B2 | 4/2005 | Illingworth et al. |
| 6,260,233 | B1 | 7/2001 | Wareham | 6,901,618 | B2 | 6/2005 | Oakhill |
| 6,267,446 | B1 | 7/2001 | Wieland | 6,918,143 | B2 | 7/2005 | Wiberg |
| 6,277,808 | B1 | 8/2001 | Tcheou et al. | 6,925,945 | B2 | 8/2005 | Babick et al. |
| 6,295,674 | B1 | 10/2001 | Smith-McKelvey et al. | 6,935,839 | B2 | 8/2005 | Pascoe |
| 6,306,234 | B1 | 10/2001 | Barker et al. | 6,948,204 | B2 | 9/2005 | Chae |
| 6,324,722 | B1 | 12/2001 | Takemoto | 6,960,063 | B2 | 11/2005 | Reinfeld et al. |
| 6,324,875 | B1 | 12/2001 | Hoermann | 7,018,438 | B2 | 3/2006 | Duggan |
| 6,341,403 | B1 | 1/2002 | Strickrodt et al. | 2001/0045159 | A1 | 11/2001 | Johnson et al. |
| 6,363,553 | B1 | 4/2002 | Baumgartel et al. | 2001/0045325 | A1 | 11/2001 | Illingworth |
| 6,367,880 | B1 | 4/2002 | Niederman et al. | 2001/0052723 | A1 | 12/2001 | Wu |
| 6,412,435 | B1 | 7/2002 | Timmons, Jr. | 2002/0084218 | A1 | 7/2002 | Illingworth |
| 6,425,637 | B1 | 7/2002 | Peterson | 2002/0094271 | A1 | 7/2002 | Yeuan et al. |
| 6,438,778 | B1 | 8/2002 | Johnson | 2002/0104184 | A1 | 8/2002 | Rogers et al. |
| 6,442,780 | B1 | 9/2002 | Phillips et al. | 2002/0137156 | A1 | 9/2002 | Margolin et al. |
| 6,446,293 | B2 | 9/2002 | Lindquist et al. | 2002/0148069 | A1 | 10/2002 | Illingworth |
| 6,447,587 | B1 | 9/2002 | Pillion et al. | 2002/0151634 | A1 | 10/2002 | Rohrbaugh et al. |
| 6,448,896 | B1 | 9/2002 | Bankus et al. | 2002/0155002 | A1 | 10/2002 | Reinfeld et al. |
| 6,460,191 | B1 | 10/2002 | Lorkovic | 2002/0157210 | A1 | 10/2002 | Minor |
| 6,474,936 | B1 | 11/2002 | DeBlanc et al. | 2002/0176777 | A1 | 11/2002 | Reinfeld et al. |
| 6,481,963 | B1 | 11/2002 | Lin et al. | 2002/0176778 | A1 | 11/2002 | Reinfeld et al. |
| 6,490,753 | B1 * | 12/2002 | Chen ..... 15/320 | 2002/0176854 | A1 | 11/2002 | Payton |
| 6,490,755 | B2 | 12/2002 | Paterson | 2002/0182077 | A1 | 12/2002 | Reinfeld et al. |
| 6,492,563 | B2 | 12/2002 | Gautschi | 2002/0189048 | A1 | 12/2002 | Maruyama et al. |
| 6,494,940 | B1 | 12/2002 | Hak | 2003/0000021 | A1 | 1/2003 | O'Connell et al. |
| 6,497,553 | B2 | 12/2002 | Illingworth et al. | 2003/0049407 | A1 | 3/2003 | Kacher et al. |
| 6,500,445 | B1 | 12/2002 | Pullen | 2003/0062407 | A1 | 4/2003 | Kim |
| 6,505,379 | B2 | 1/2003 | Keller | 2003/0062507 | A1 | 4/2003 | Radomyselski et al. |
| 6,508,868 | B2 | 1/2003 | Pillion et al. | 2003/0066268 | A1 | 4/2003 | George |
| 6,543,726 | B2 | 4/2003 | Illingworth | 2003/0070692 | A1 | 4/2003 | Smith et al. |
| 6,547,519 | B2 | 4/2003 | DeBlanc et al. | 2003/0082972 | A1 | 5/2003 | Monfalcone et al. |
| 6,547,643 | B1 | 4/2003 | Miller, III et al. | 2003/0104745 | A1 | 6/2003 | Curtis |
| 6,550,639 | B2 | 4/2003 | Brown | 2003/0136094 | A1 | 7/2003 | Illingworth et al. |
| 6,554,207 | B2 | 4/2003 | Ebberts | 2003/0150060 | A1 | 8/2003 | Huang |
| 6,565,035 | B1 | 5/2003 | Kim et al. | 2003/0150198 | A1 | 8/2003 | Illingworth et al. |
| 6,565,321 | B1 | 5/2003 | Illingworth et al. | 2003/0151293 | A1 | 8/2003 | McLarty et al. |
| 6,581,241 | B2 | 6/2003 | Shaver et al. | 2003/0162685 | A1 | 8/2003 | Man et al. |

| | | | |
|---|---|---|---|
| 2003/0165383 | A1 | 9/2003 | Pascoe |
| 2003/0167741 | A1 | 9/2003 | Illingworth et al. |
| 2003/0170453 | A1 | 9/2003 | Foss et al. |
| 2003/0182756 | A1 | 10/2003 | Duggan |
| 2003/0183085 | A1 | 10/2003 | Alexander |
| 2003/0192144 | A1 | 10/2003 | Song et al. |
| 2003/0199220 | A1 | 10/2003 | Dawson, Jr. et al. |
| 2004/0005992 | A1 | 1/2004 | Ebberts |
| 2004/0009094 | A1 | 1/2004 | Adiga et al. |
| 2004/0014633 | A1 | 1/2004 | Aida et al. |
| 2004/0018089 | A1 | 1/2004 | Illingworth et al. |
| 2004/0040579 | A1 | 3/2004 | Smith |
| 2004/0069145 | A1 | 4/2004 | Illingworth et al. |
| 2004/0091357 | A1 | 5/2004 | Reinfeld et al. |
| 2004/0097156 | A1 | 5/2004 | McGuire et al. |
| 2004/0101347 | A1 | 5/2004 | Beard |
| 2004/0102562 | A1 | 5/2004 | Butuc |
| 2004/0118091 | A1 | 6/2004 | Illingworth et al. |
| 2004/0134024 | A1 | 7/2004 | Allen |
| 2004/0137812 | A1 | 7/2004 | Suzuki et al. |
| 2004/0139552 | A1 | 7/2004 | Walters |
| 2004/0139709 | A1 | 7/2004 | Illingworth et al. |
| 2004/0139710 | A1 | 7/2004 | Illingworth et al. |
| 2004/0147191 | A1 | 7/2004 | Wen |
| 2004/0154106 | A1 | 8/2004 | Oles et al. |
| 2004/0158058 | A1 | 8/2004 | Cash et al. |
| 2004/0158954 | A1 | 8/2004 | Bailey et al. |
| 2004/0172763 | A1 | 9/2004 | Sachs et al. |
| 2004/0172769 | A1 | 9/2004 | Giddings et al. |
| 2004/0208746 | A1 | 10/2004 | Crocker |
| 2004/0216264 | A1 | 11/2004 | Shaver et al. |
| 2004/0238976 | A1 | 12/2004 | Johns |
| 2006/0137132 | A1 * | 6/2006 | Orubor ..... 15/344 |
| 2008/0244858 | A1 * | 10/2008 | Shaver et al. ..... 15/327.5 |

FOREIGN PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| DE | 10246676 | A1 | 4/2004 |
| EP | 0285096 | A2 | 10/1988 |
| EP | 1059056 | A1 | 12/2000 |
| EP | 1097666 | A2 | 5/2001 |
| EP | 0 871 808 | B1 | 2/2003 |
| GB | 2338404 | A | 12/1999 |
| JP | 9-135795 | | 5/1997 |
| WO | WO 83/01734 | | 5/1983 |
| WO | WO 94/03553 | | 2/1994 |
| WO | WO 94/11638 | | 5/1994 |
| WO | WO 96/23140 | | 8/1996 |
| WO | WO 96/24772 | | 8/1996 |
| WO | WO 97/03180 | | 1/1997 |
| WO | WO 97/08983 | | 3/1997 |
| WO | WO 97/09234 | | 3/1997 |
| WO | WO 97/43374 | | 11/1997 |
| WO | WO 00/19881 | | 4/2000 |
| WO | WO 00/38896 | | 7/2000 |
| WO | WO 00/44271 | | 8/2000 |
| WO | WO 00/55292 | | 9/2000 |
| WO | WO 02/095646 | A2 | 11/2002 |
| WO | WO 03/070078 | A1 | 8/2003 |
| WO | WO 03/078100 | A1 | 9/2003 |
| WO | WO 03/100254 | A1 | 12/2003 |

* cited by examiner

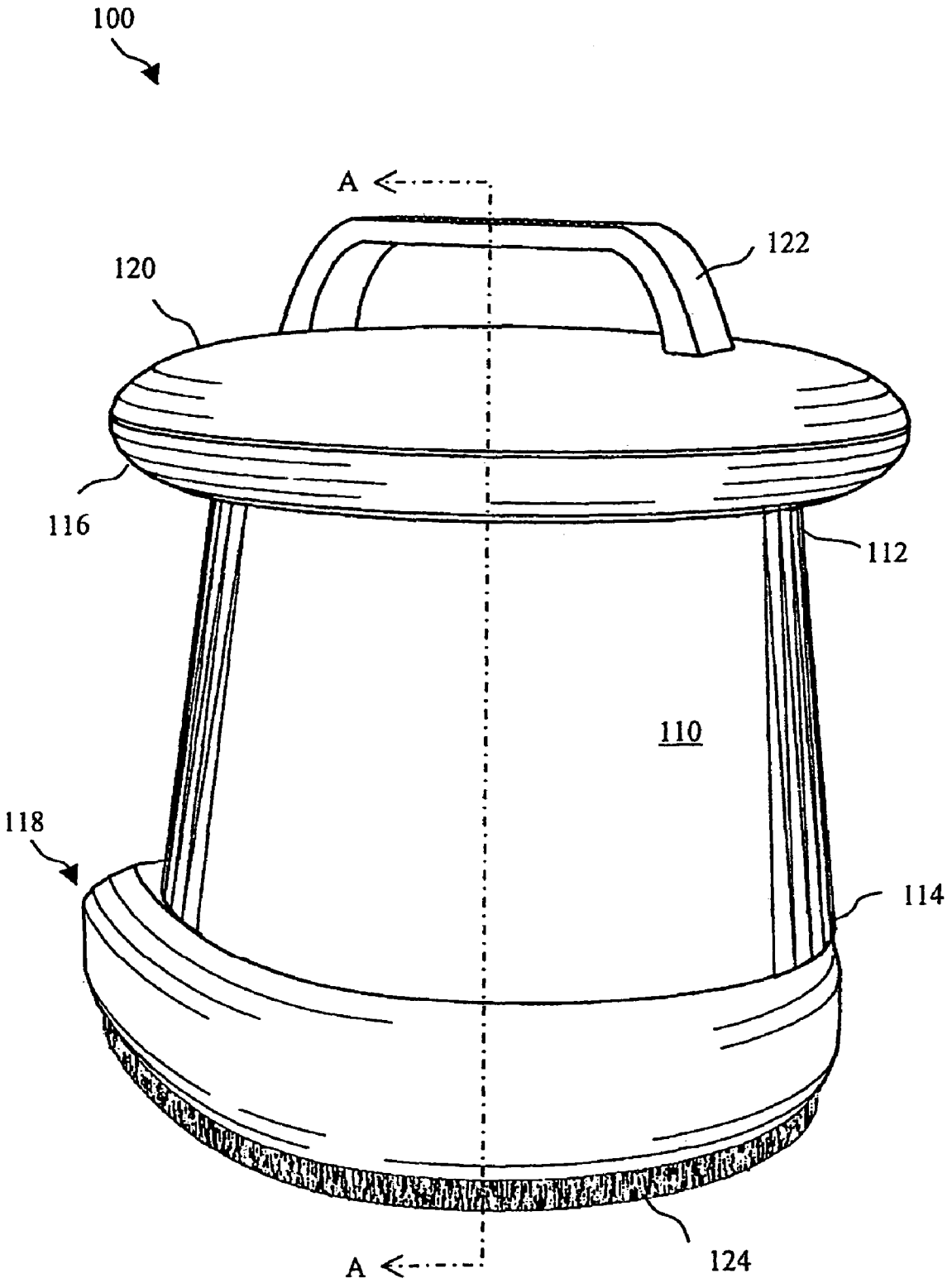



Fig. 1

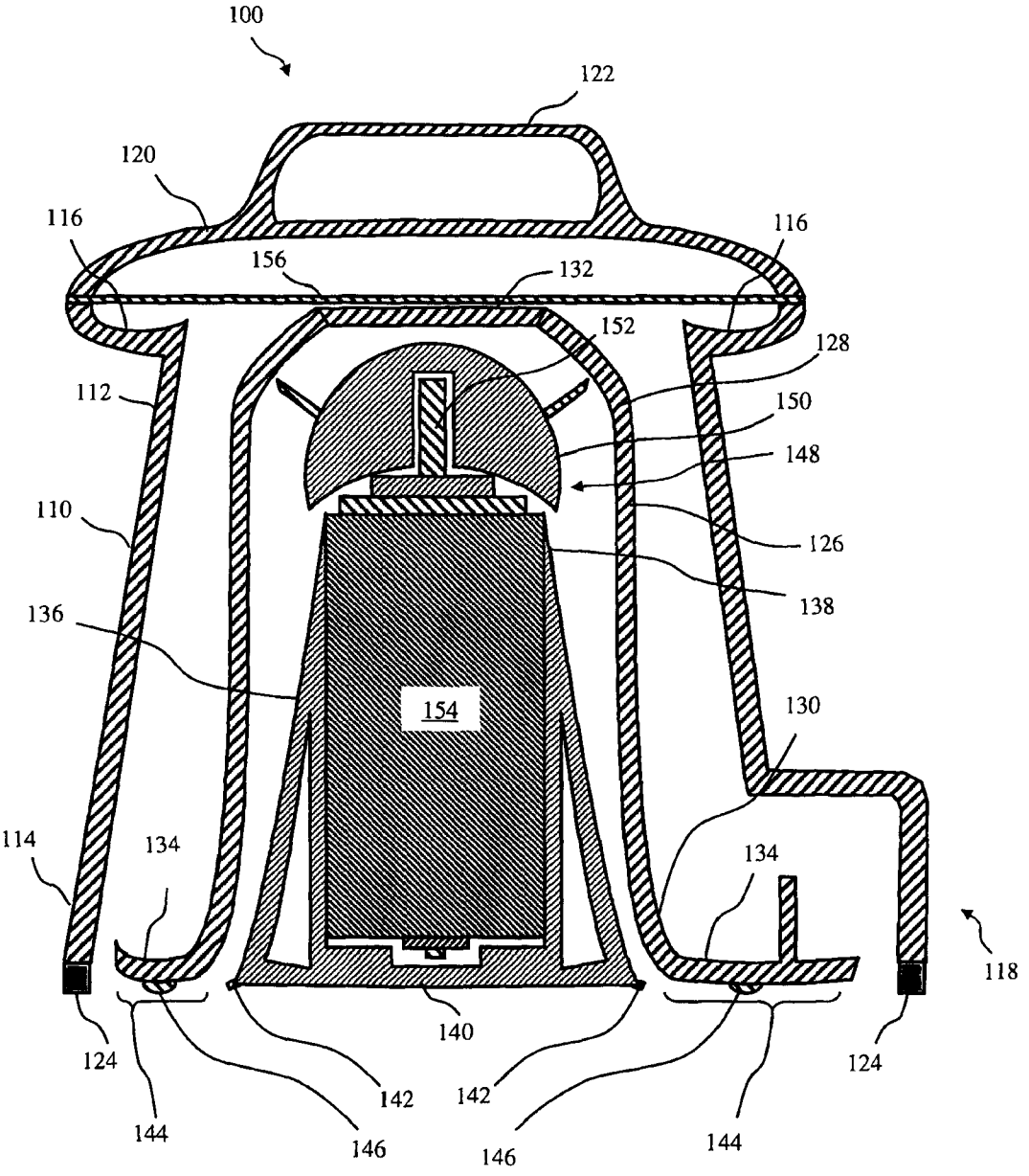

100
122
120
116
116
156
132
152
128
112
150
148
110
126
138
136
154
130
114
134
134
118
124
124
140
142
142
144
144
146
146

Fig. 2

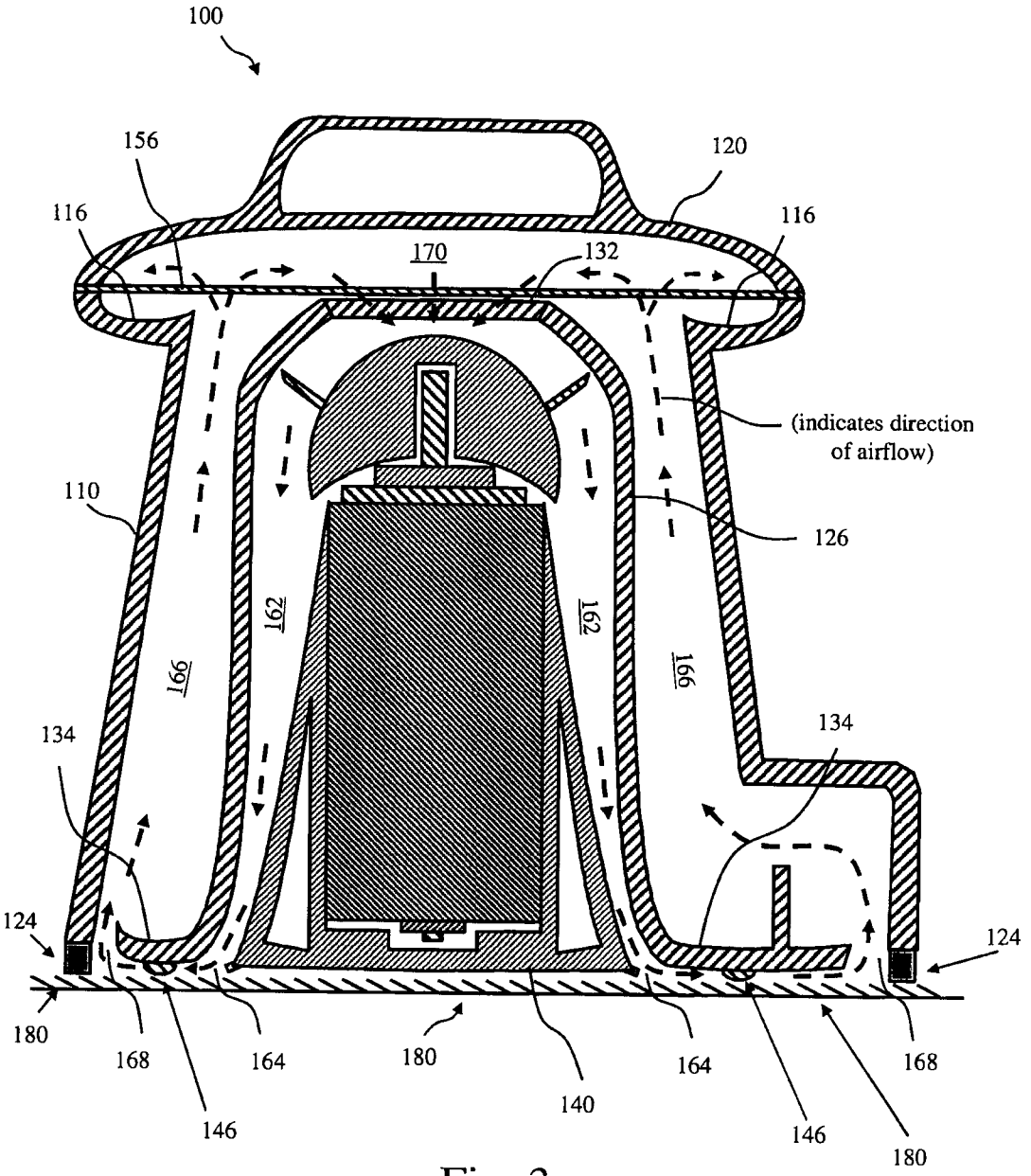

100
156
120
116
116
170
132
(indicates direction of airflow)
110
126
162
162
166
166
134
134
124
124
180
168
164
180
140
164
146
146
180
168

Fig. 3

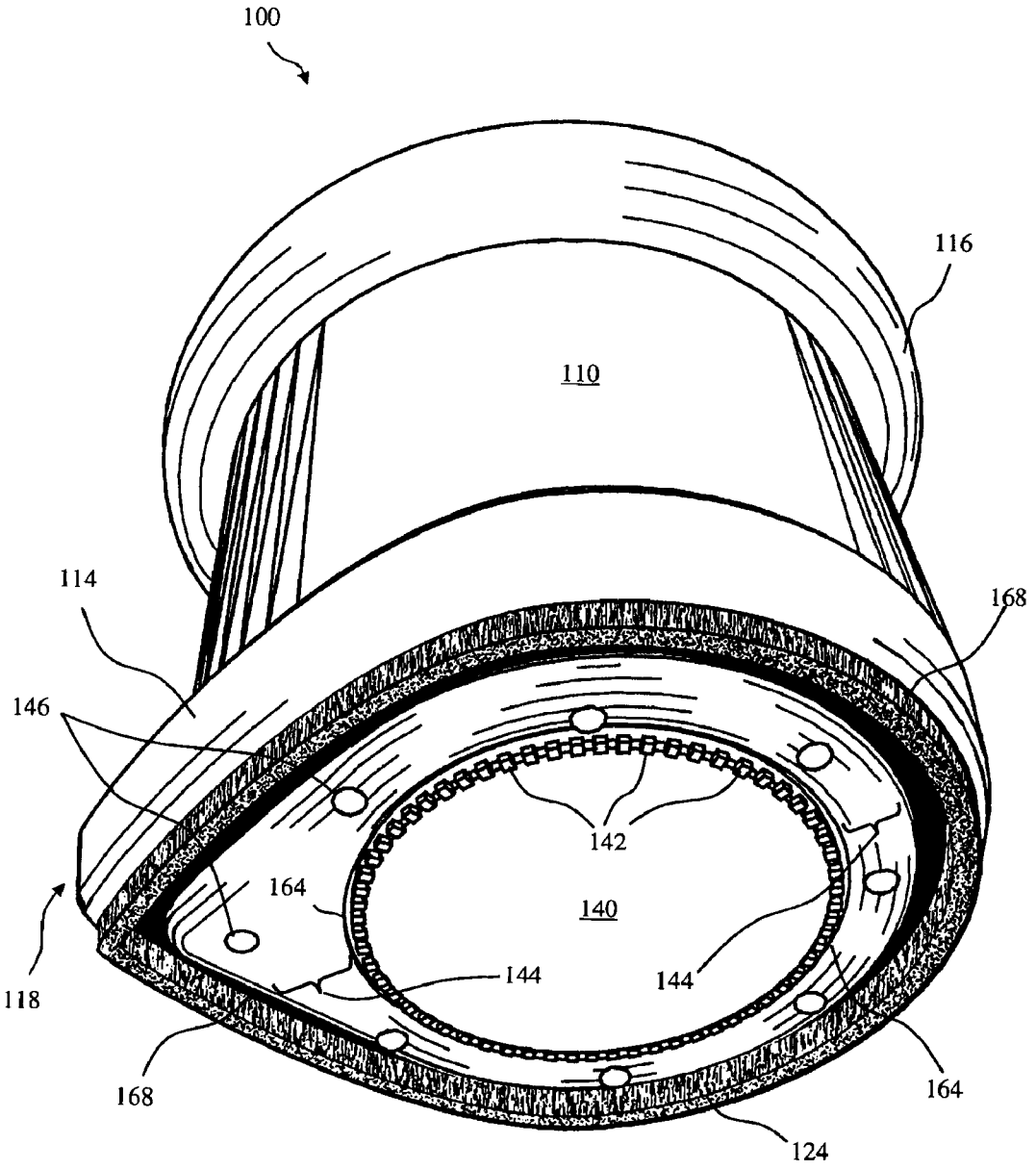



Fig. 4

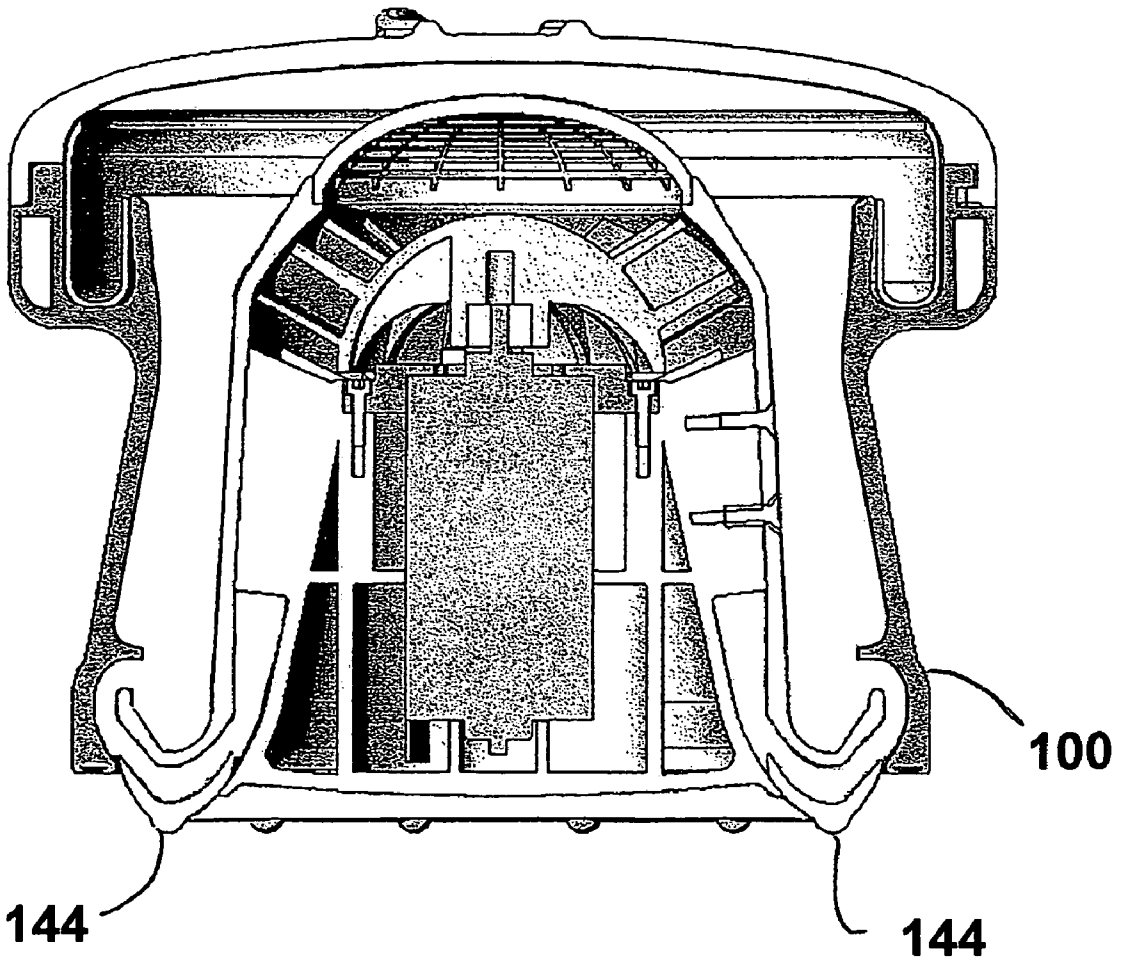



Fig. 5A

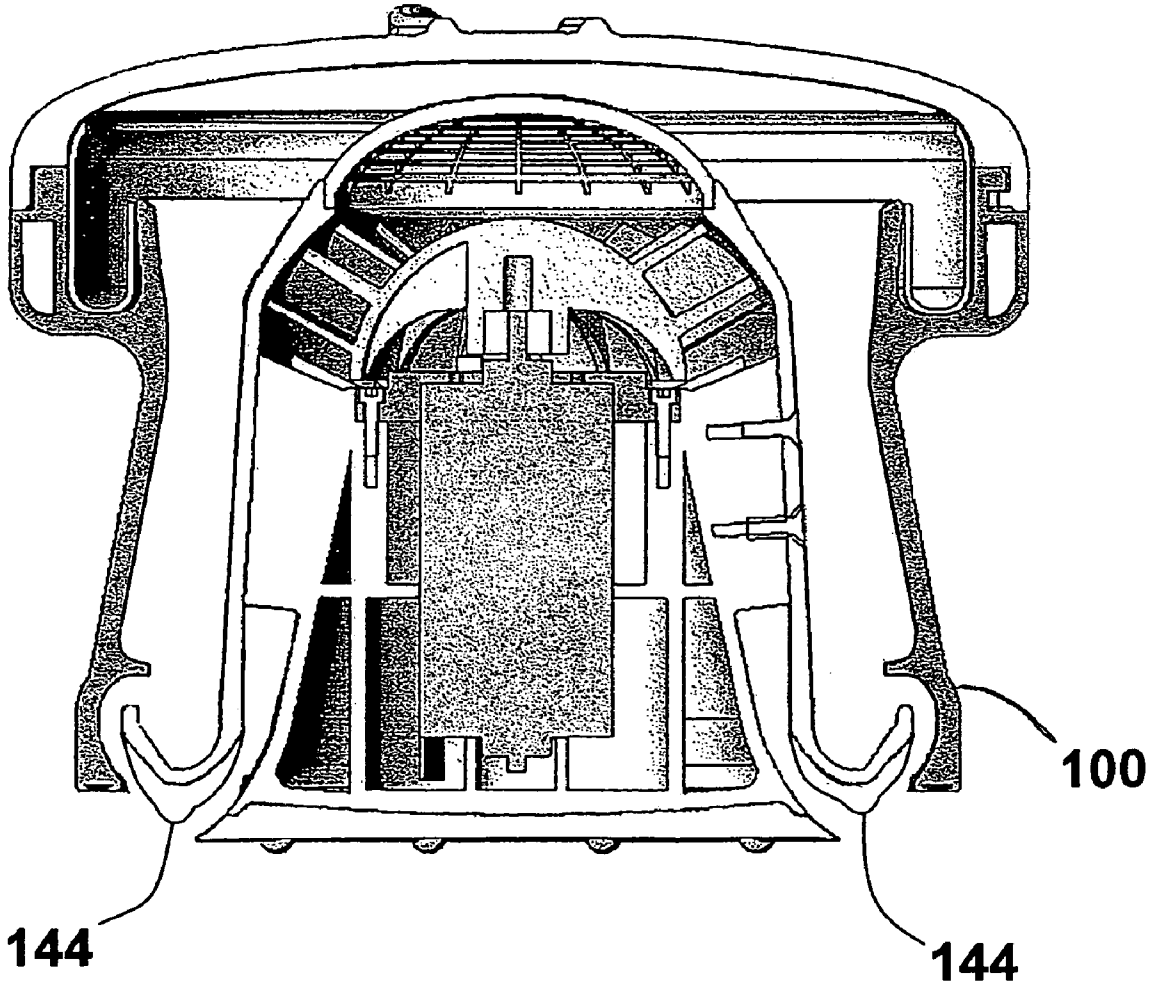



Fig. 5B

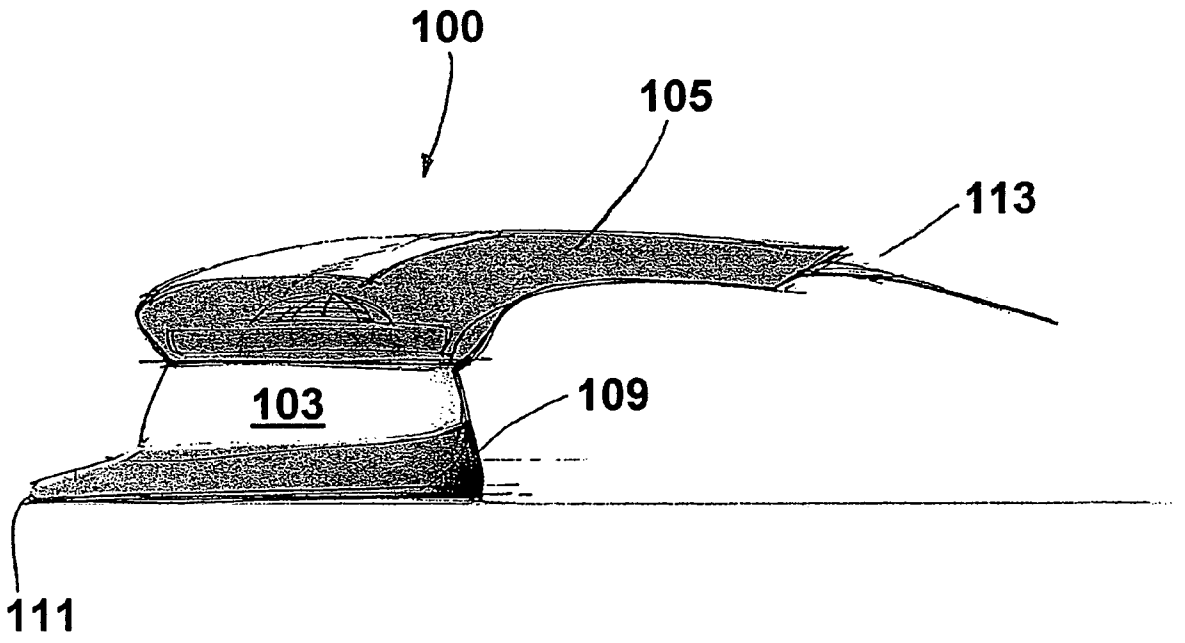



Fig. 6

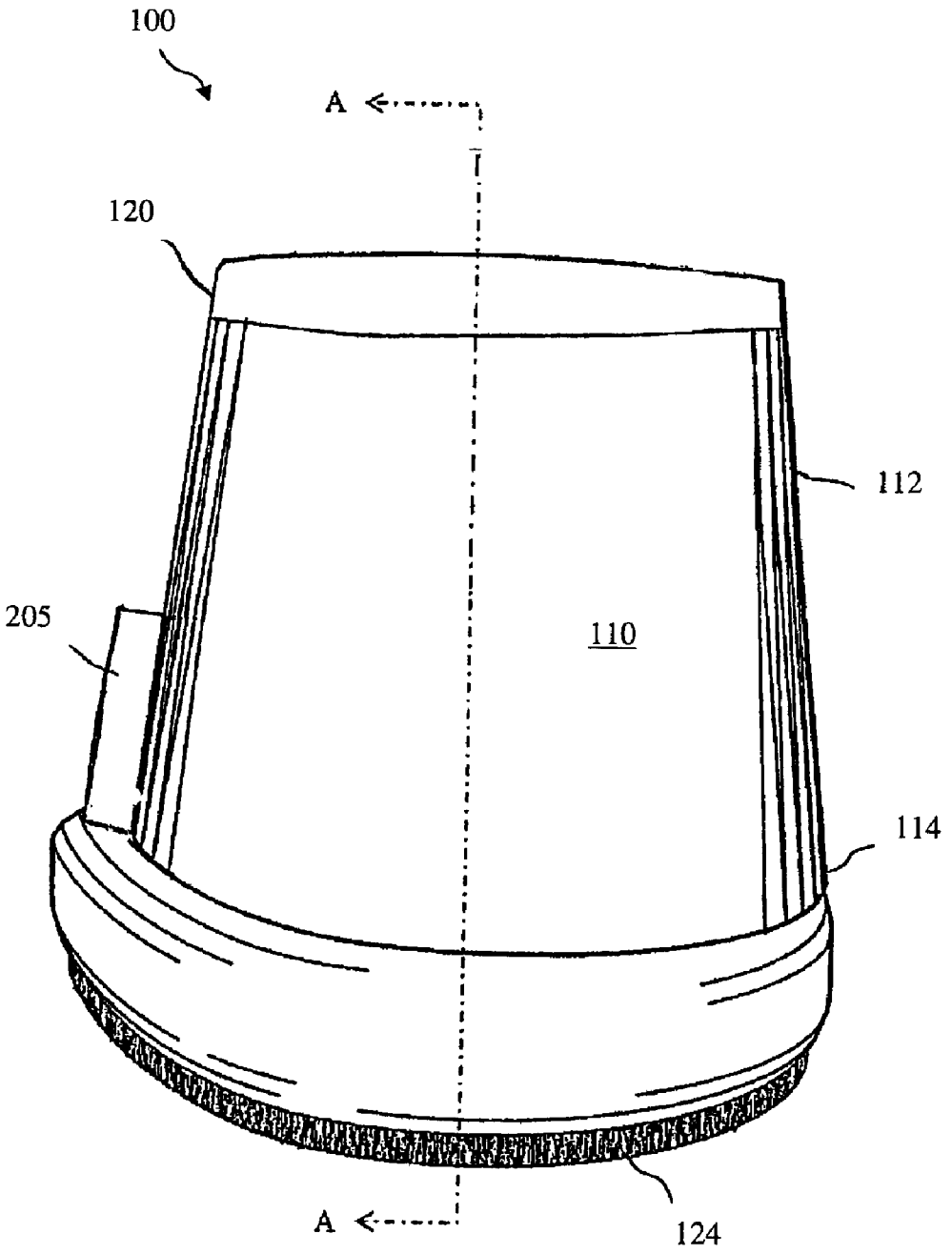



Fig. 7

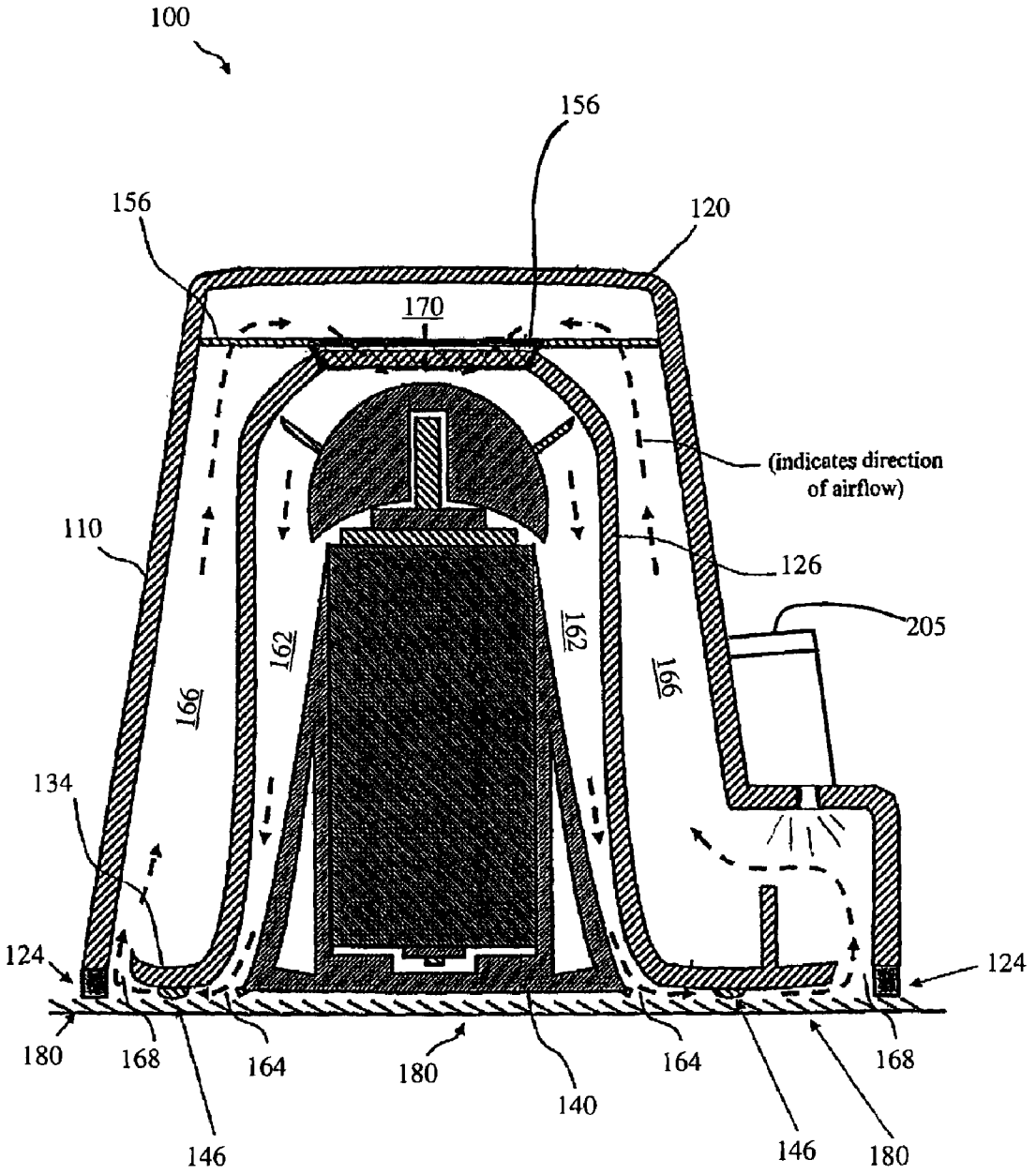

100
156
156
120
170
(indicates direction of airflow)
110
126
205
162
162
166
166
134
124
124
180
168
164
180
140
164
168
146
146
180

Fig. 8

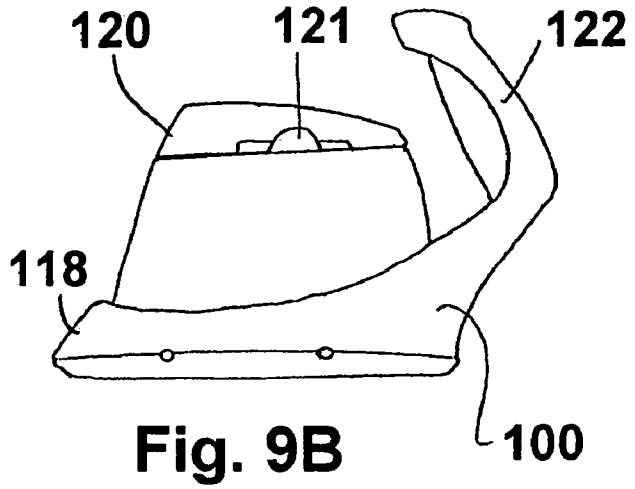



Fig. 9B

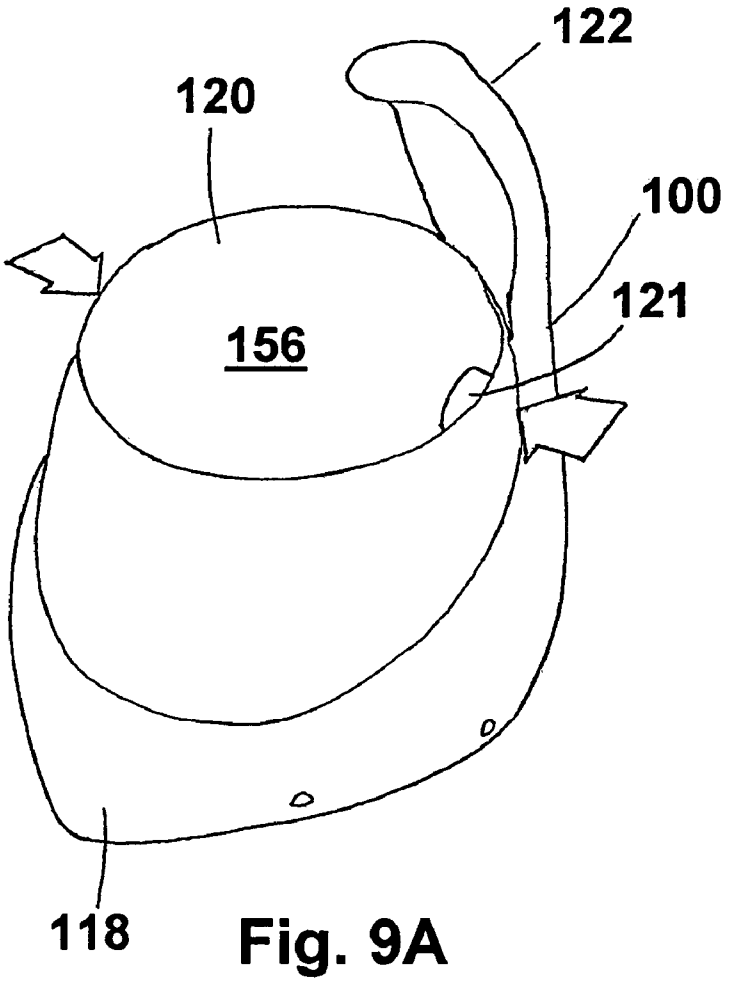



Fig. 9A

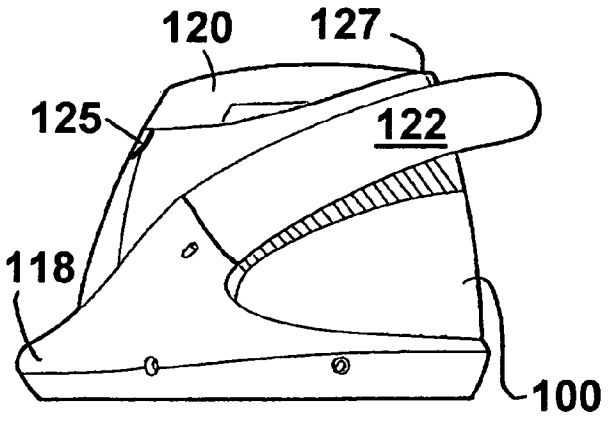



Fig. 9D

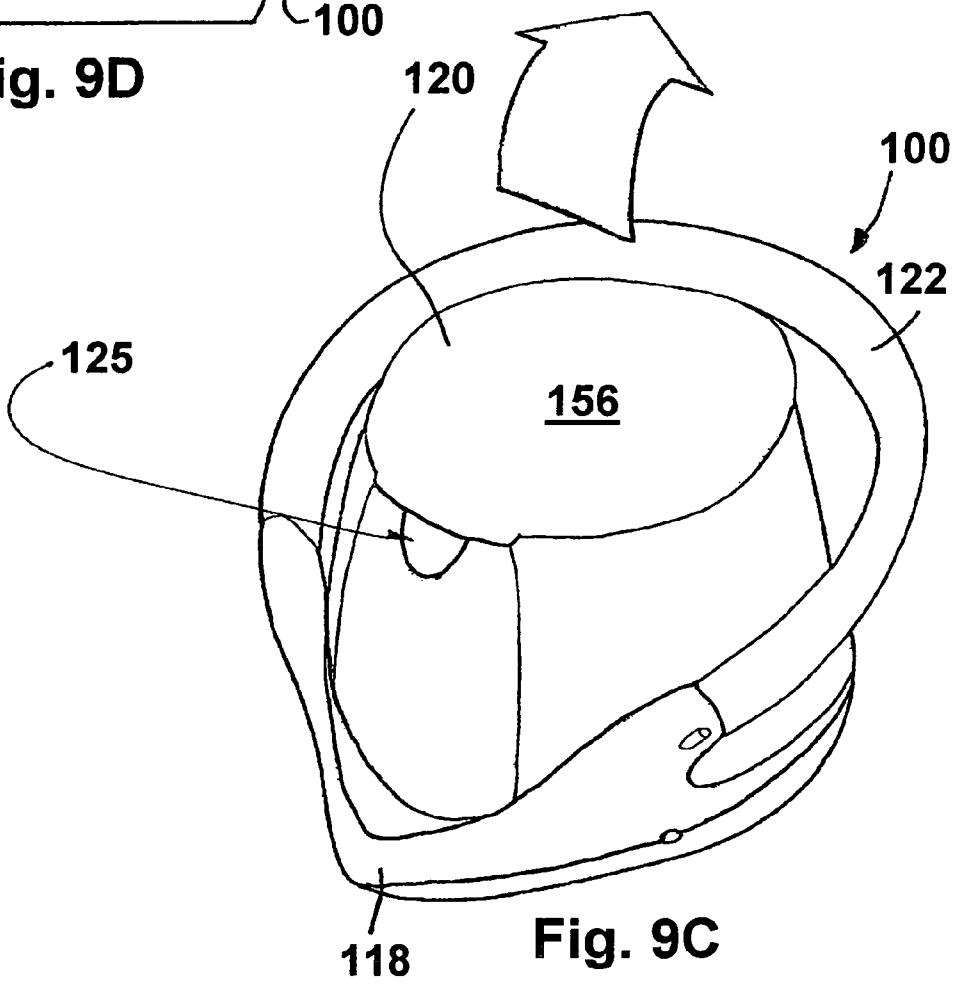



Fig. 9C

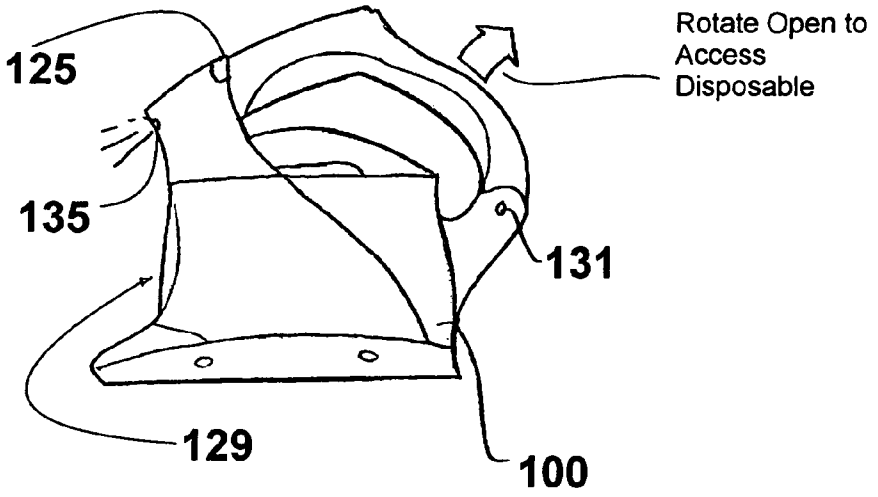

125
Rotate Open to Access Disposable
135
131
129
100

Fig. 9F

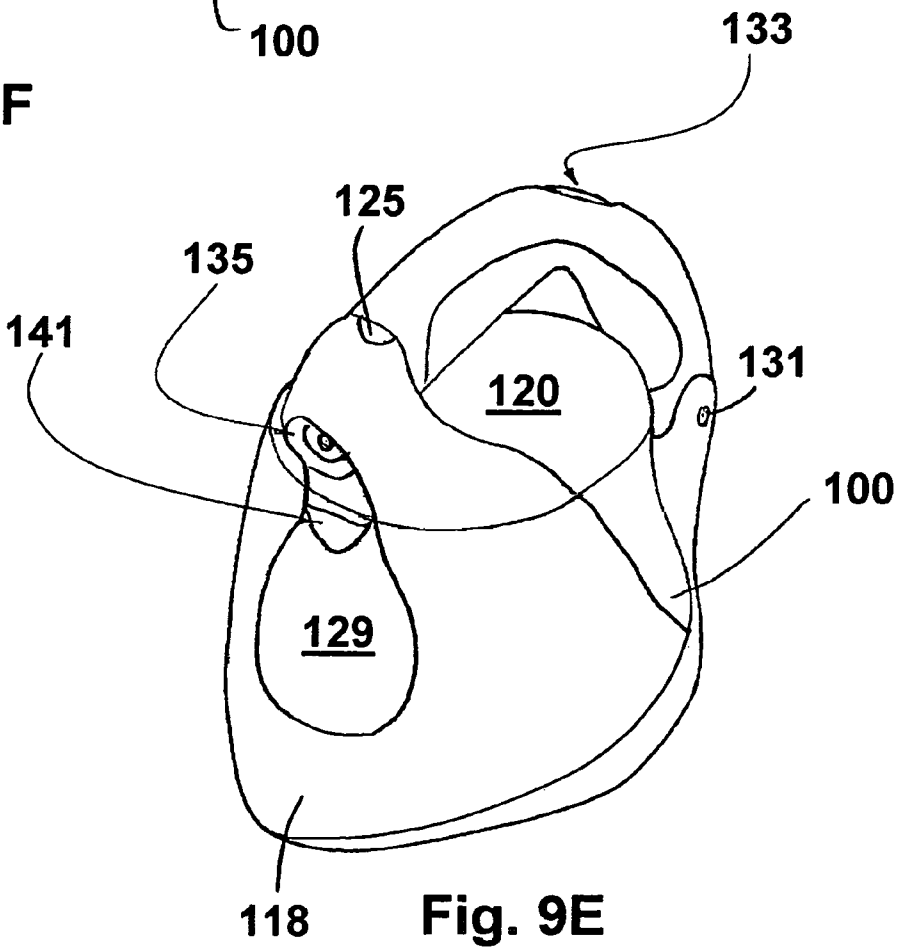

133
125
135
141
131
120
100
129
118

Fig. 9E

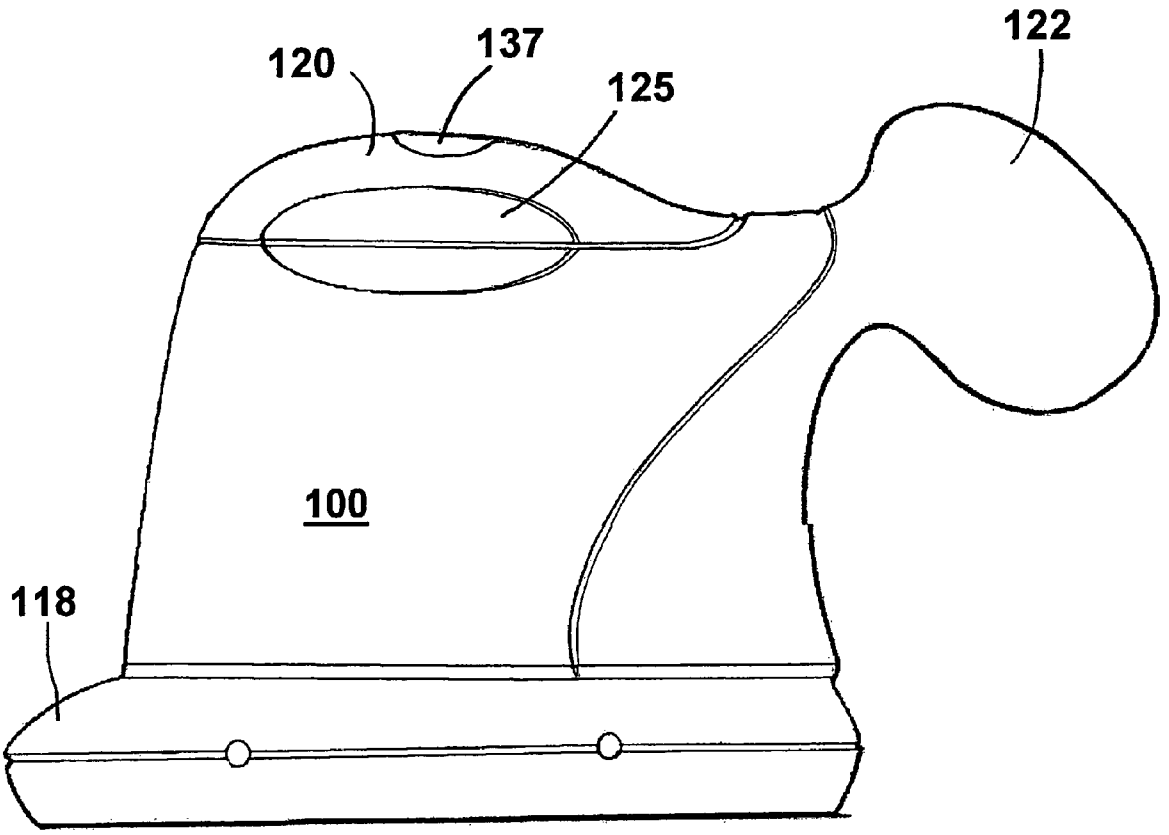



Fig. 10A

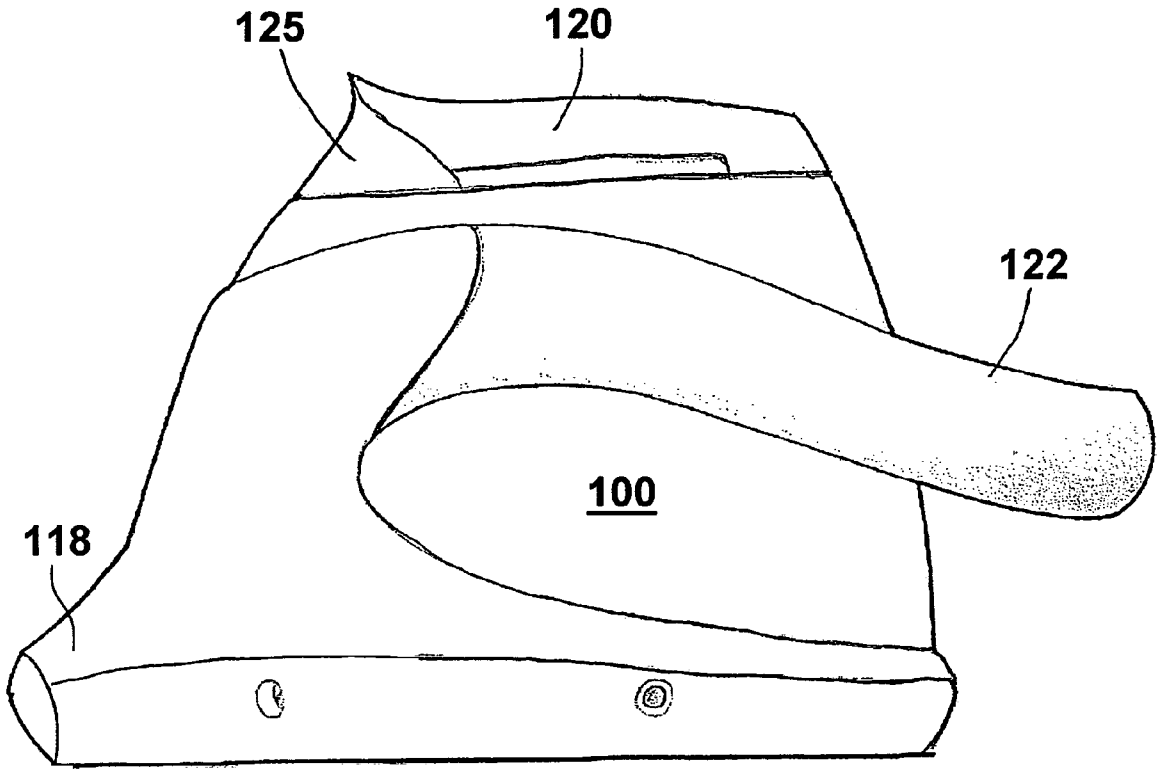



Fig. 10B

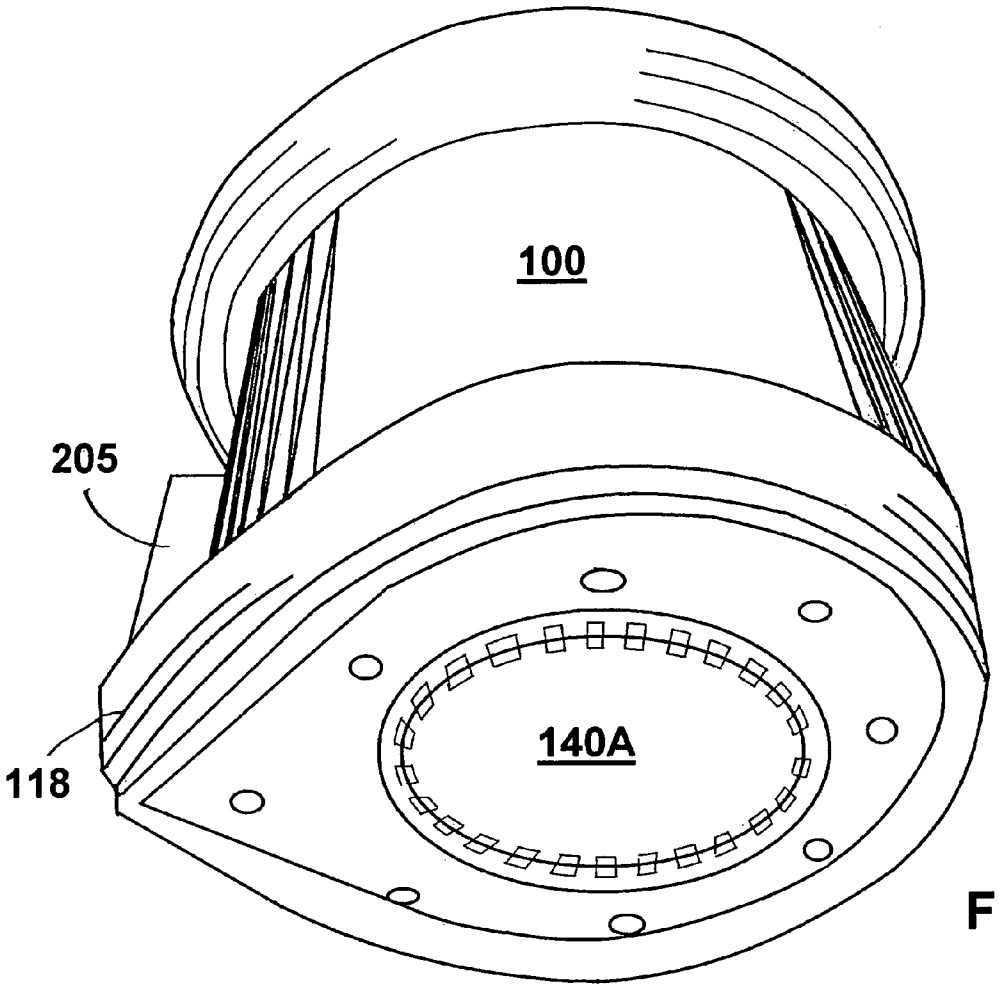
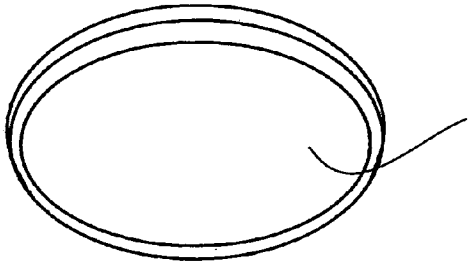



Fig. 11A



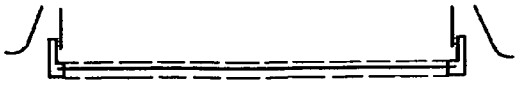



Fig. 11B

Snap fit to bottom of motor housing base plate

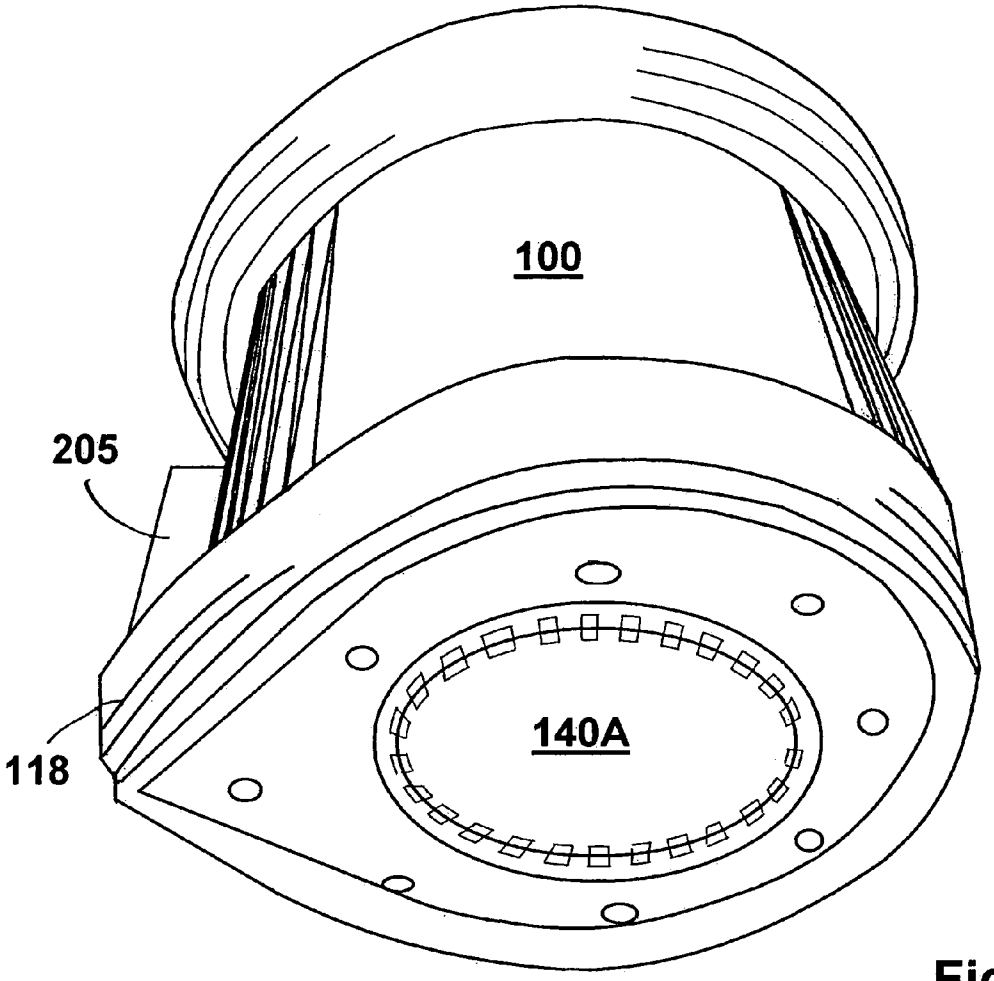
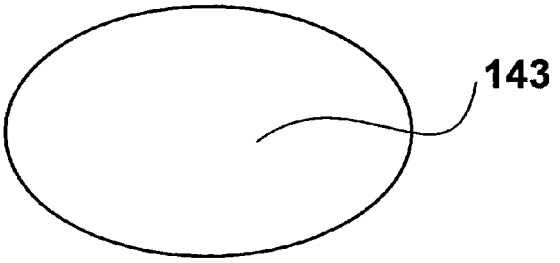



Fig. 12A



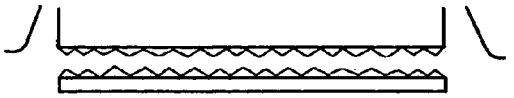



Fig. 12B

Pressed onto bottom of motor housing base plate using hook and loop lock or adhesive

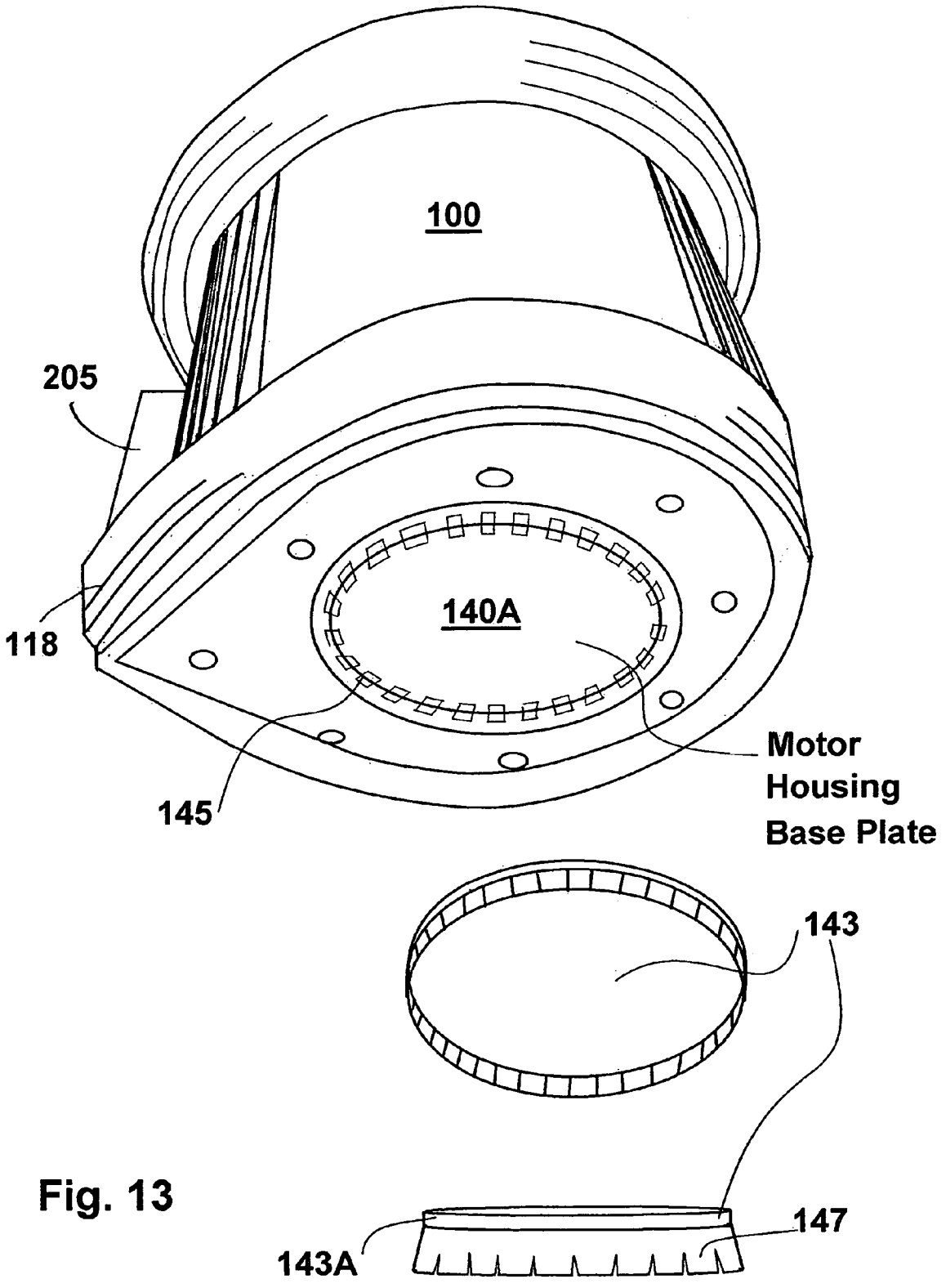



Fig. 13

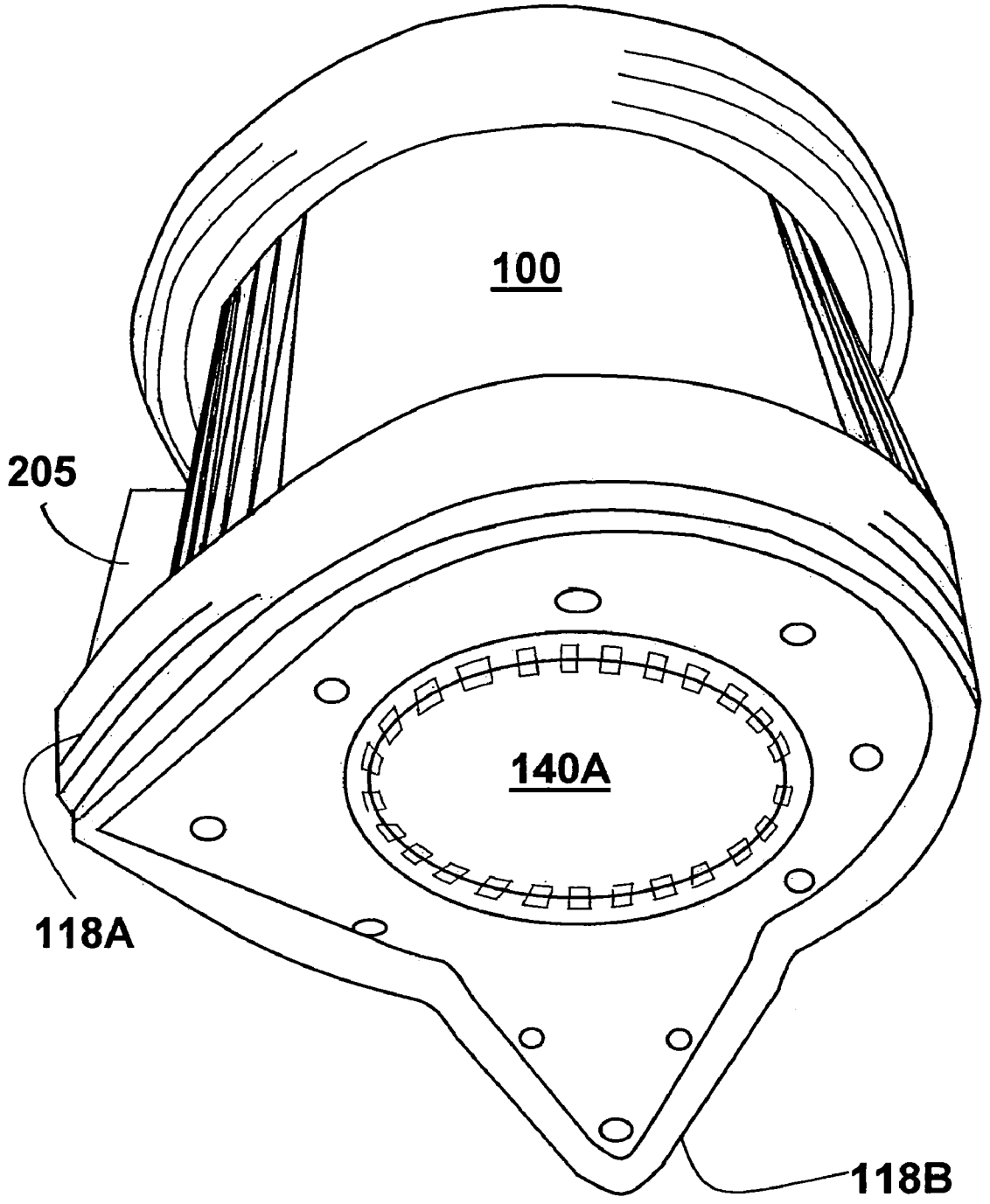



Fig. 14

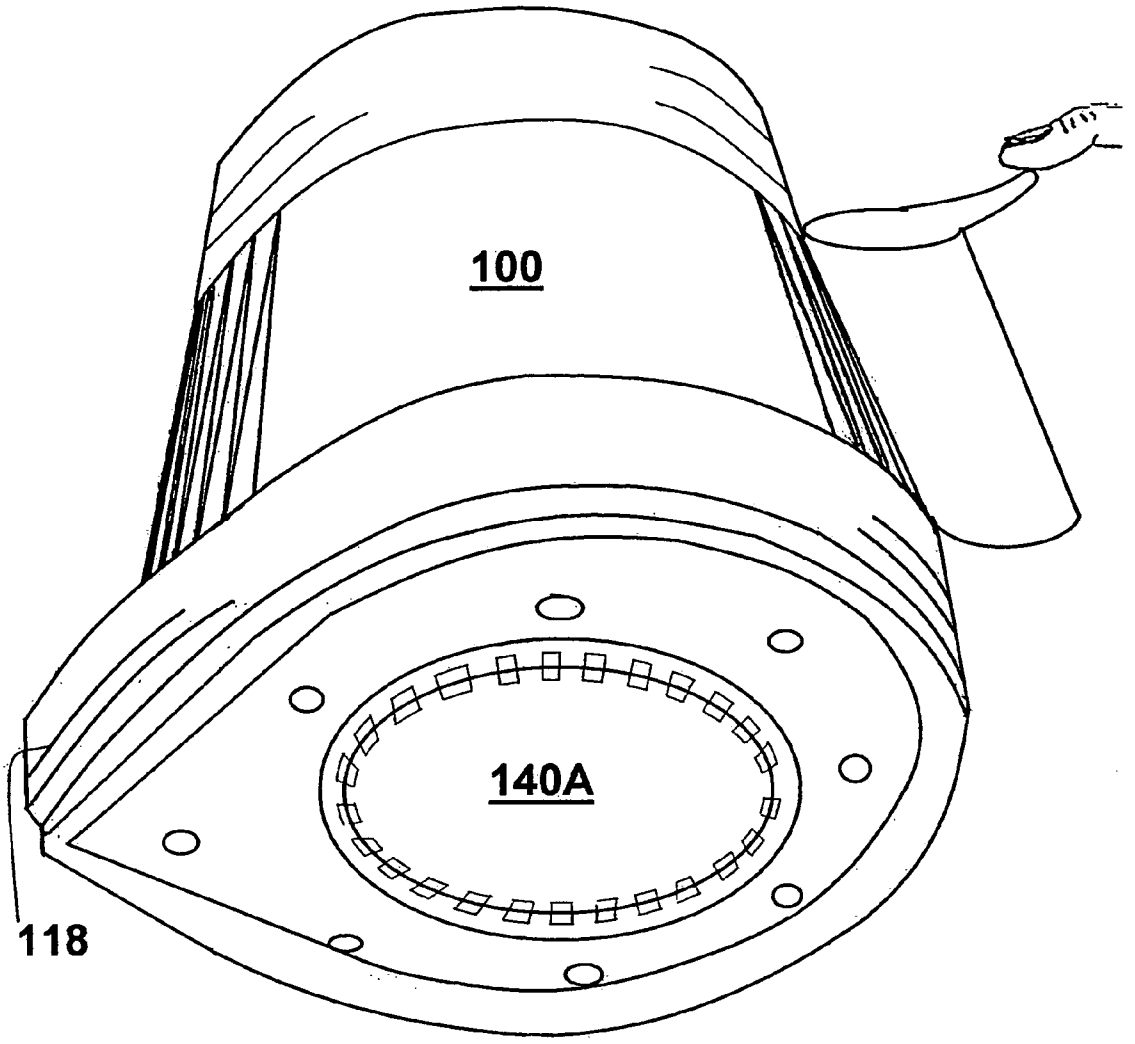



Fig. 15

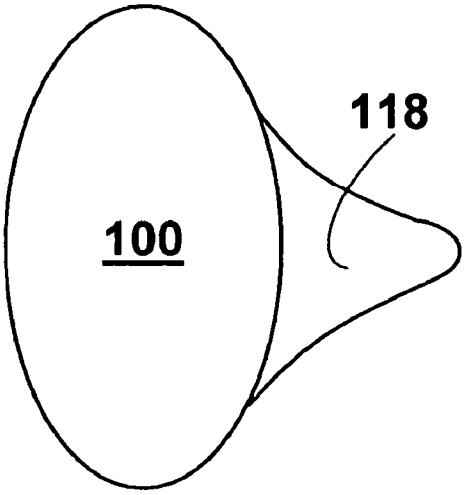



Fig. 16A

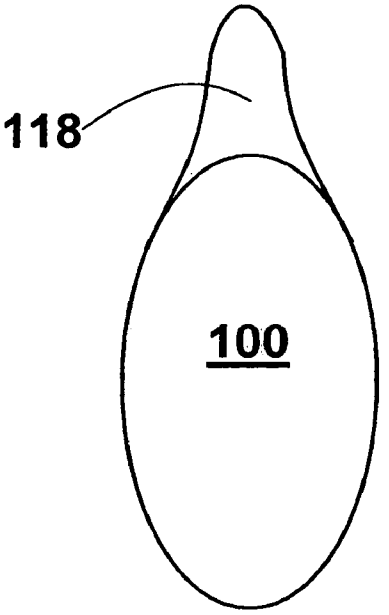



Fig. 16B

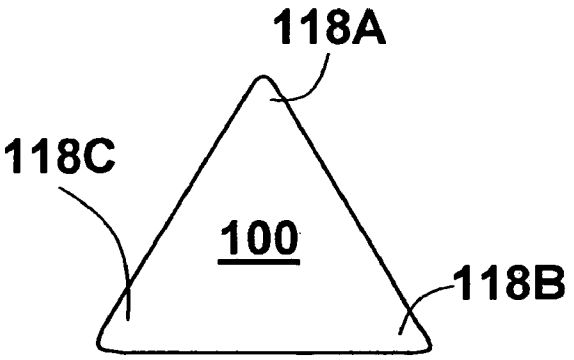



Fig. 16C

Fig. 16

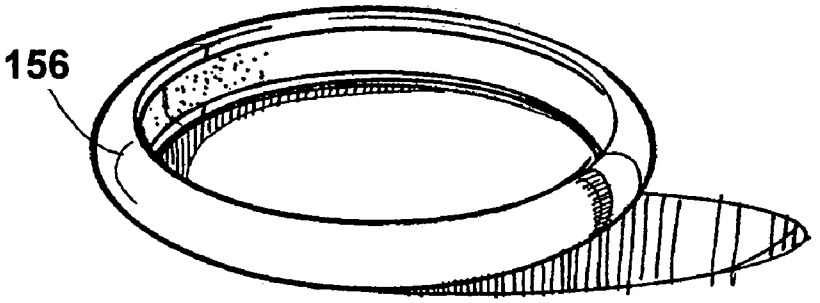



Fig. 17A

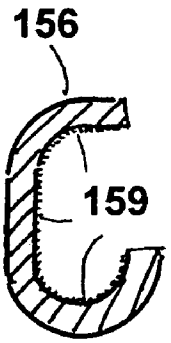



Fig. 17B

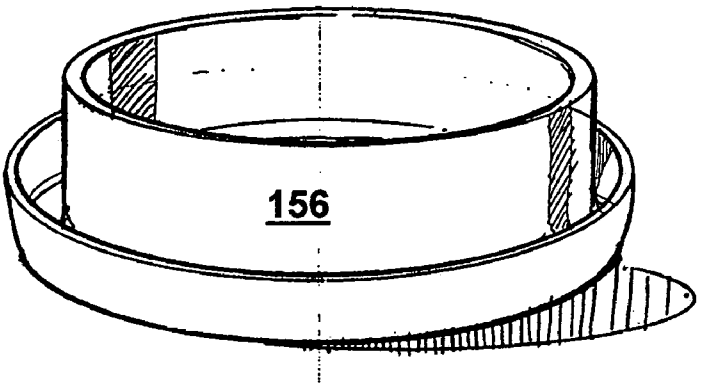



Fig. 18A

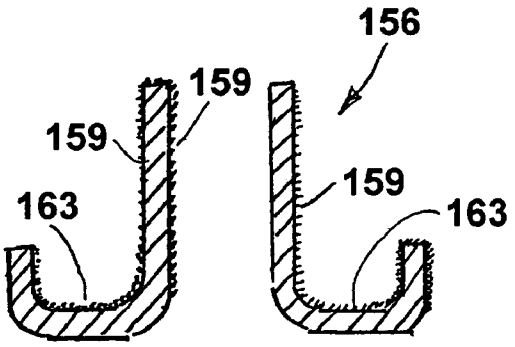



Fig. 18B

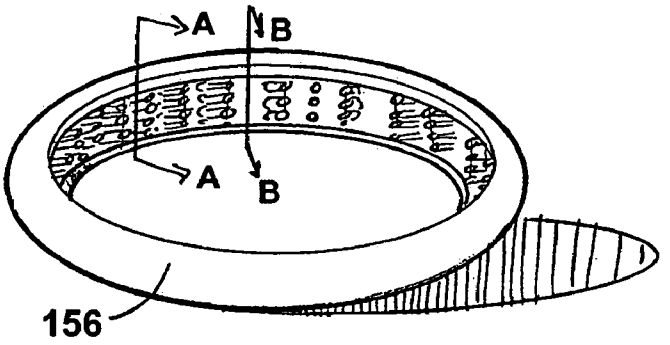



Fig. 19A

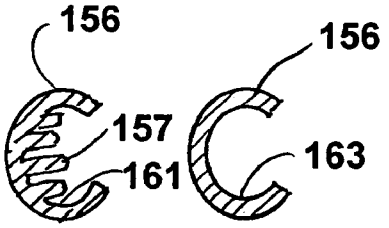



Fig. 19C Fig. 19B

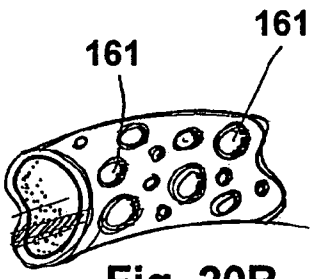



Fig. 20B

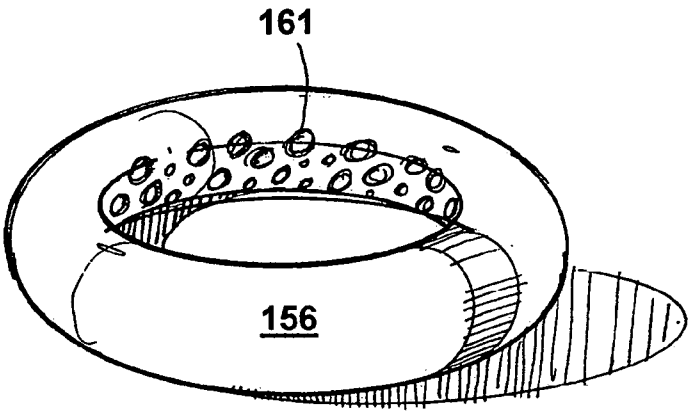



Fig. 20A

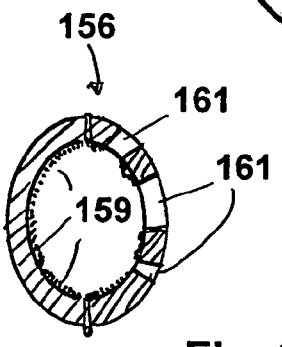



Fig. 20C

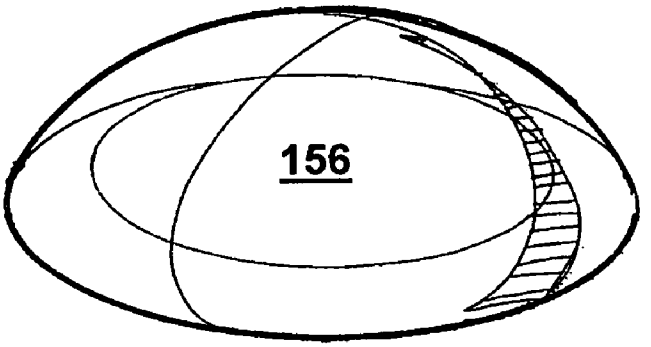



Fig. 21A

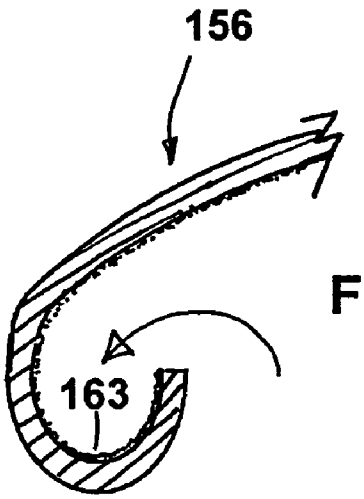



Fig. 21B

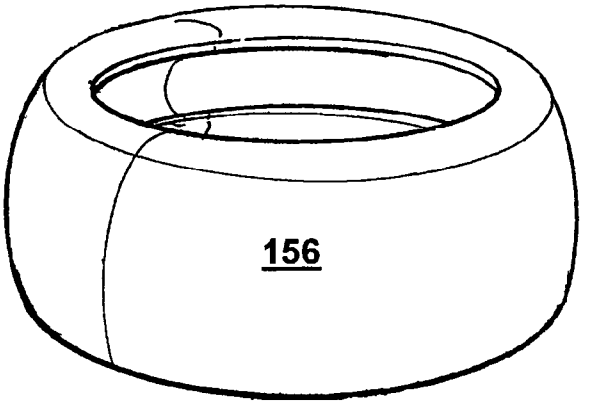



Fig. 22A

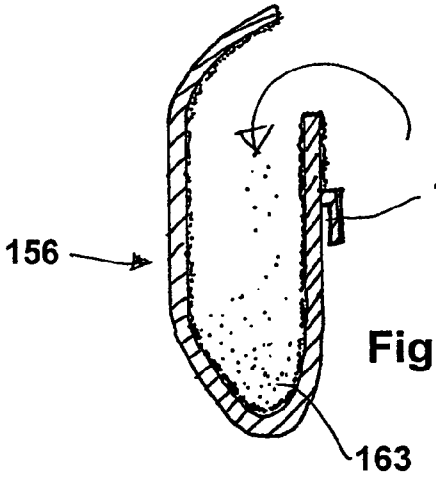



Fig. 22B

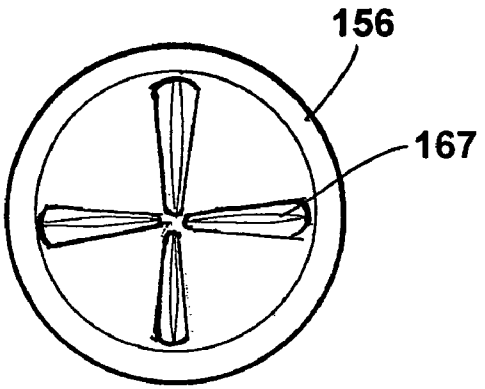



Fig. 23B

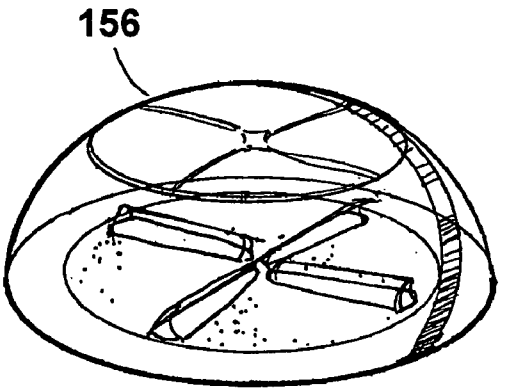



Fig. 23A

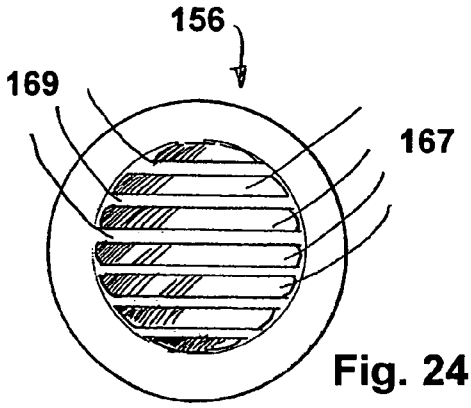



Fig. 24B

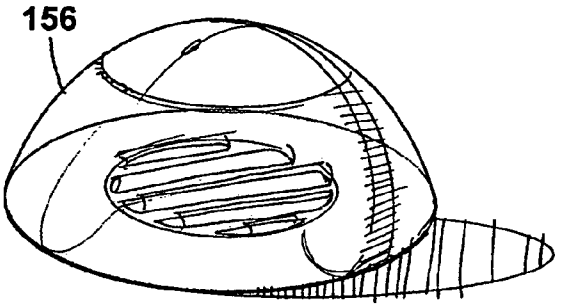



Fig. 24A

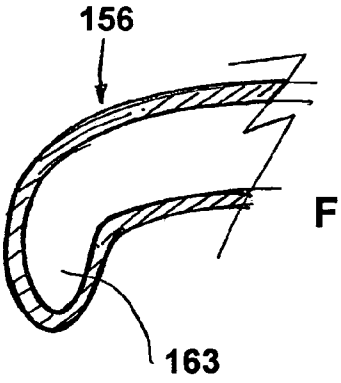



Fig. 24C

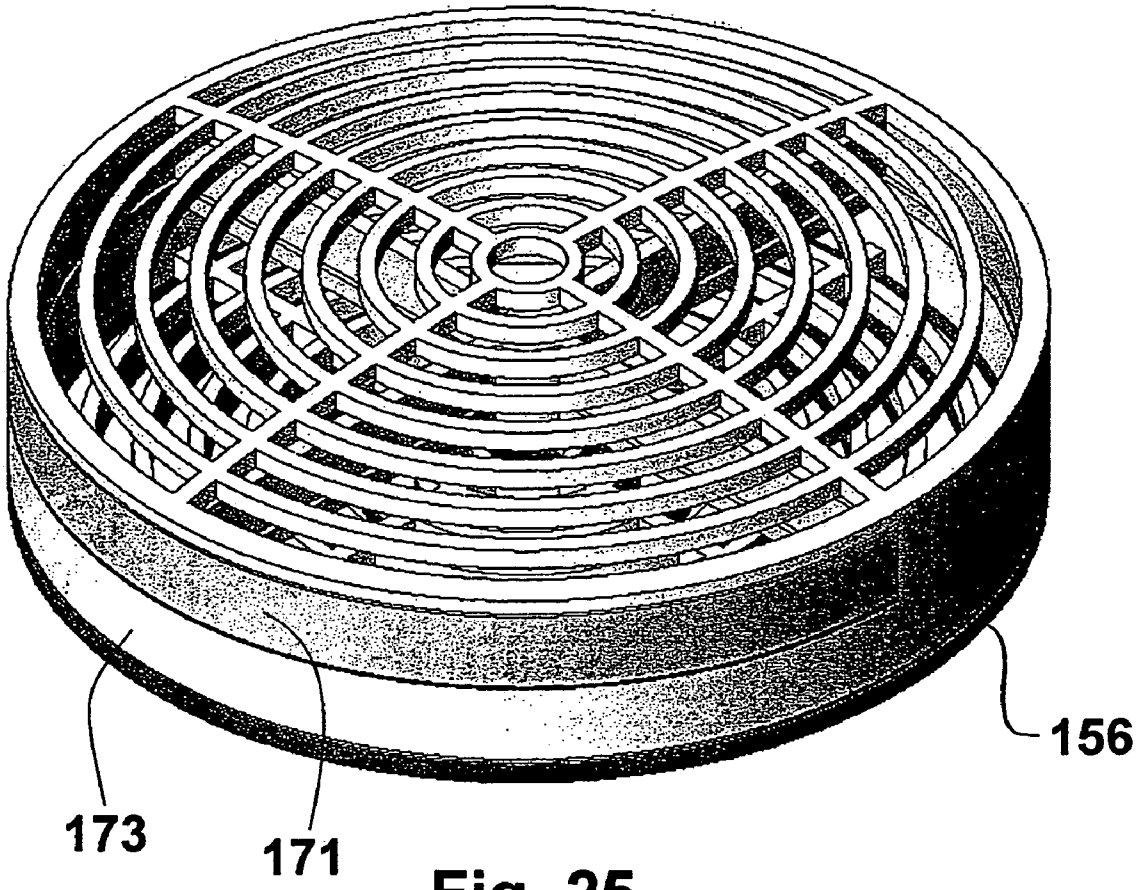



Fig. 25

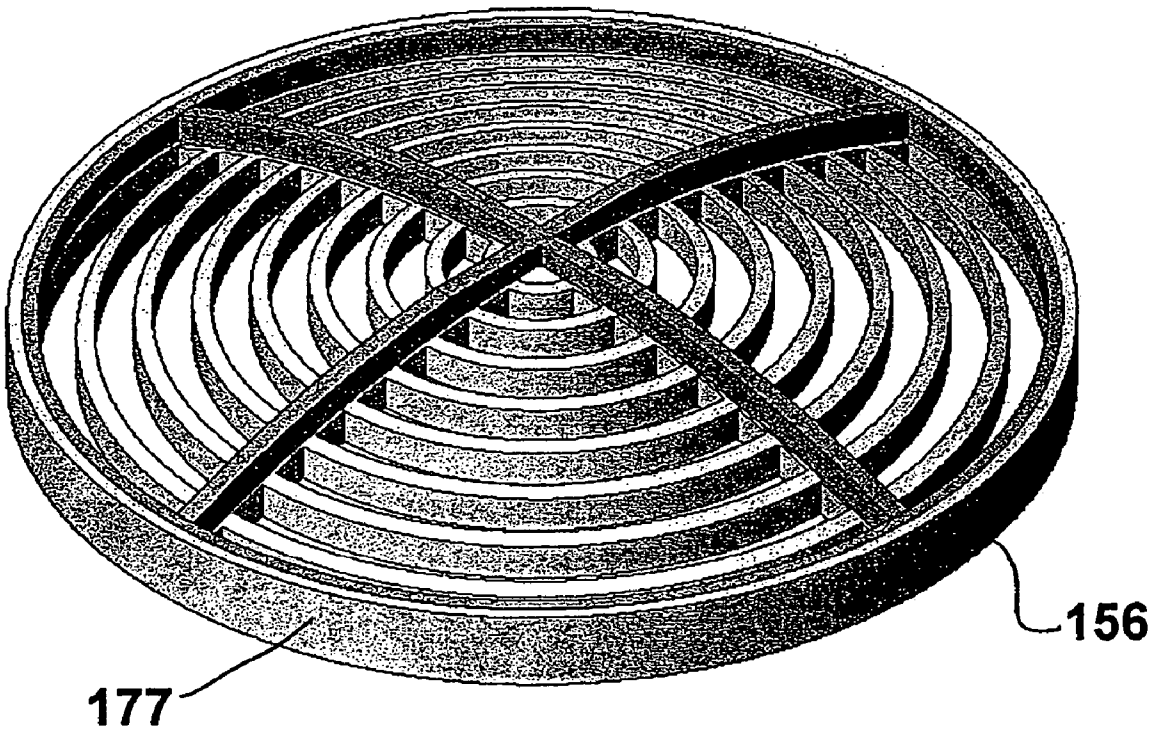



Fig. 26

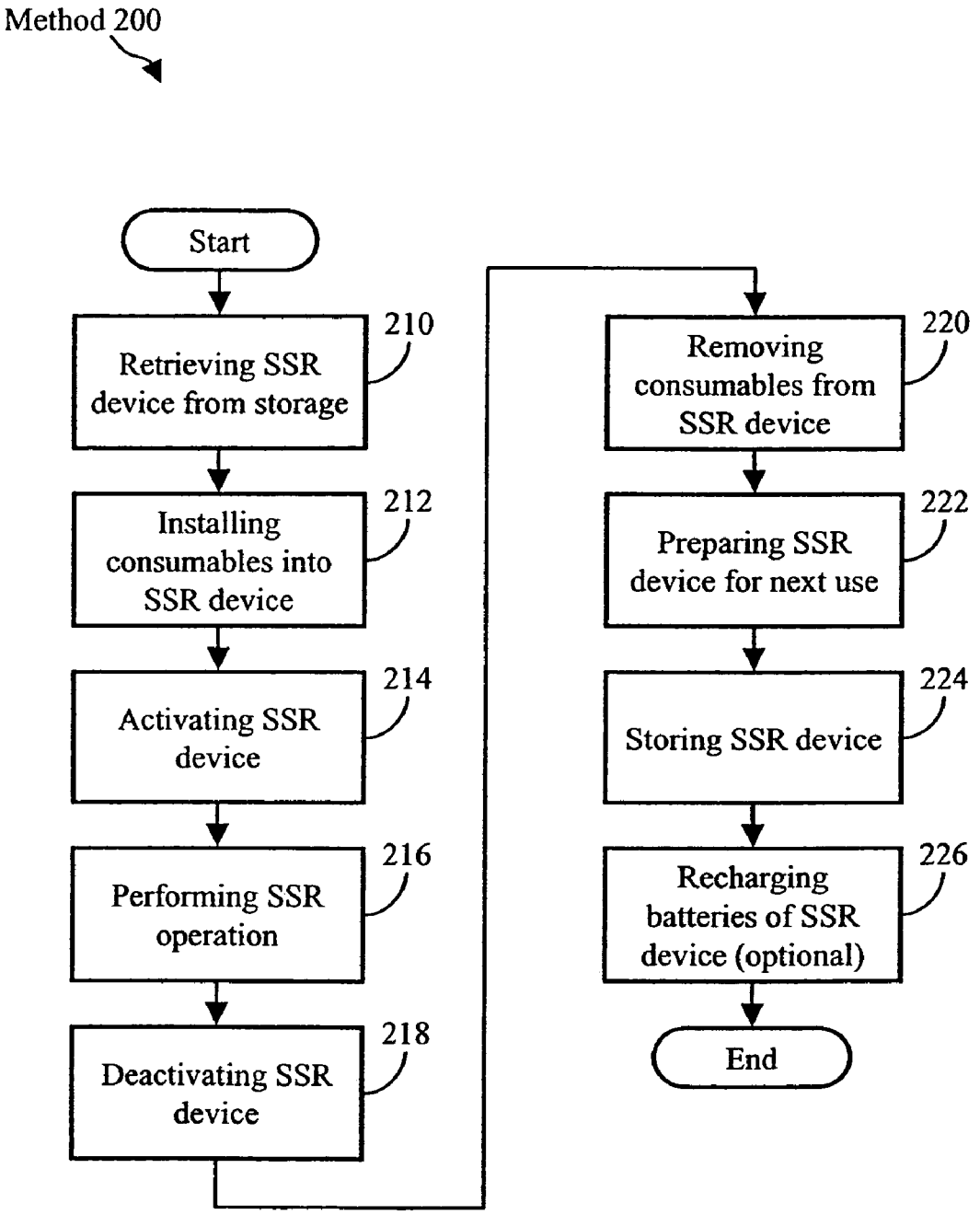

Method 200
Start
Retrieving SSR device from storage
210
Installing consumables into SSR device
212
Activating SSR device
214
Performing SSR operation
216
Deactivating SSR device
218
Removing consumables from SSR device
220
Preparing SSR device for next use
222
Storing SSR device
224
Recharging batteries of SSR device (optional)
226
End

Fig. 27

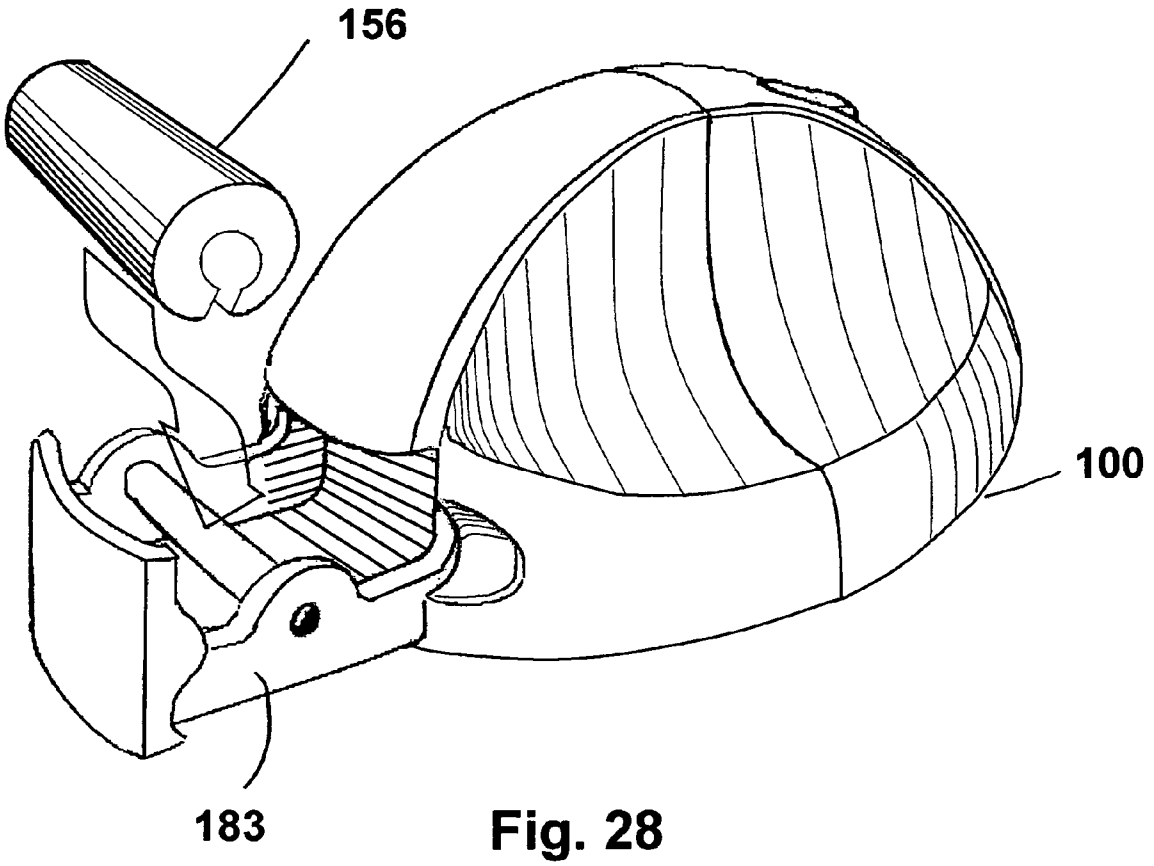



Fig. 28

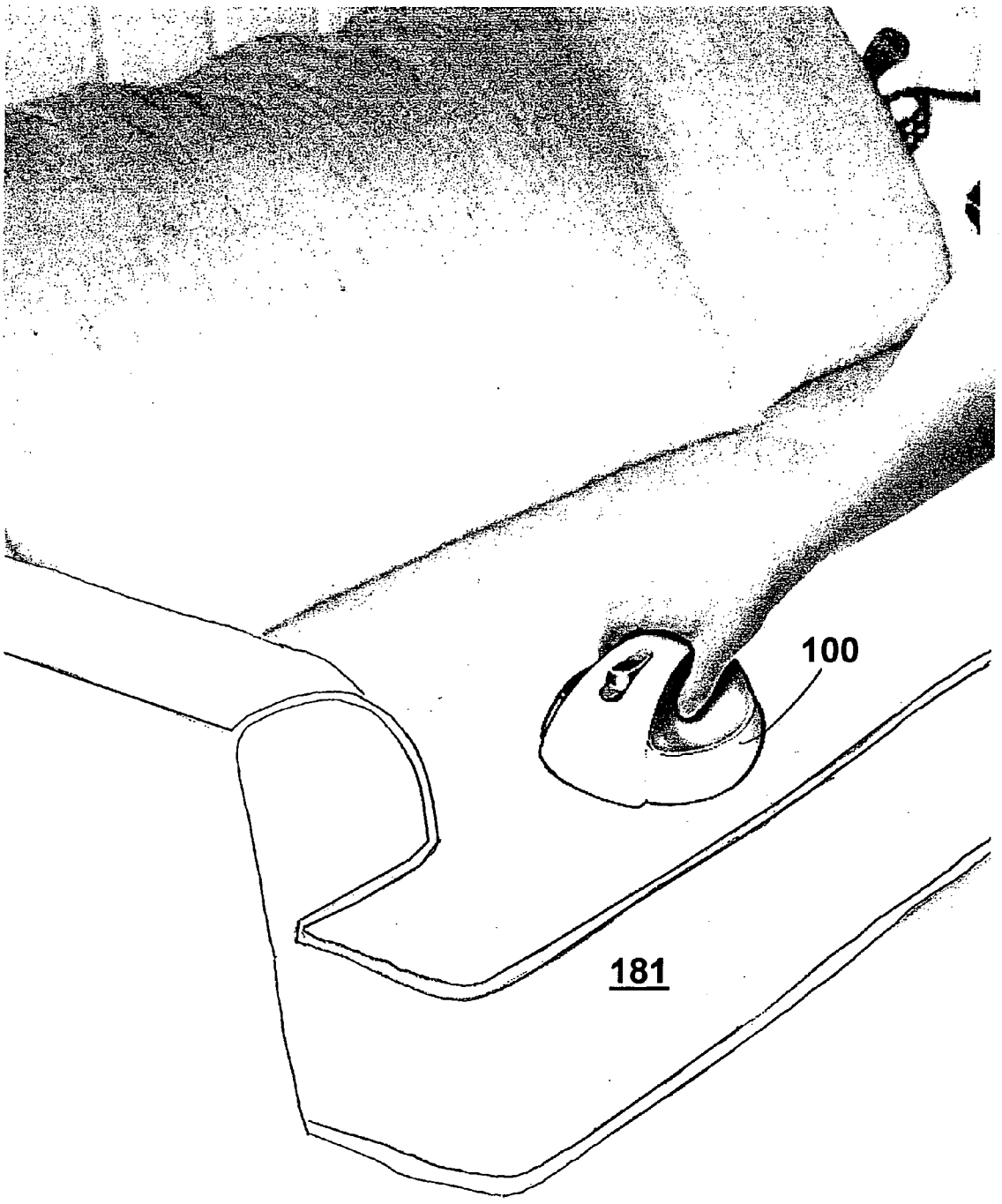



Fig. 29

# SOFT-SURFACE REMEDIATION DEVICE AND METHOD OF USING SAME

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an apparatus for soft-surface remediation (SSR). SSR is any treatment to relieve, prevent or cure the adverse effects of contaminants that collect on or in soft surfaces. In particular, this invention relates to a SSR device that preferably uses forced air as the dislodging, displacing and delivery mechanism.

2. Discussion of Related Art

Indoor air is a good transport mechanism for odors and airborne contaminants, such as dust and allergens. Dust is generally characterized as including, for example, soot, pet dander, skin flakes, carpet fibers, dust mite debris, hair, and lint. Allergens are generally characterized as including, for example, dust mites, pet dander, mold/mildew, pollen, and microbes, such as germs and bacteria. Odors are generally characterized as including, for example, pet smells, body odor, or cooking smells. For energy efficiency reasons, modern homes are constructed to be as airtight as possible. This has the adverse effect of creating an environment of poor indoor air quality because it takes a significant amount of time to circulate air into and out of a room. Consequently, airborne contaminants remain circulating in the air in the home and, over time, may land on hard and soft surfaces. Hard surfaces are, for example, floors, counter tops, and the wooden, metal, or glass components of furniture. Soft surfaces are, for example, upholstery, mattresses, pillows, carpets and drapes.

Soft surfaces are typically formed by a number of strands of thread or fiber. These strands may be woven together in a specific pattern to form a thick surface or may be in the form of a thin, non-woven mesh. Most furniture upholstery is of the woven type. Contaminants become lodged in between the weave of the fibers and on the fibers themselves. In the case of odors, the molecules attach themselves on or to the fibers. The typical structure of upholstered furniture is outer woven fabric atop a thin layer of batting material, which is atop a thick inner foam that provides firmness for, for example, supporting a person's weight. The vast majority of contaminants reside within the weave of the surface fabric or on or below the surface of the batting material of the upholstered item. The surface of the outer woven fabric becomes a collection area for crumbs, hair, dust, lint, and stains. In particular, hair, dust, lint, and dust mite debris become lodged between the surface fabric weave. The batting material becomes a repository for hair, dust mites, dust mite debris, and mold/mildew spores. Mold/mildew spores, bacteria, and germs are found on the surface of the inner foam.

Technical challenges exist with regard to soft surface remediation (SSR). SSR preferably involves a process supported by electrostatics, mechanics, air, acoustics, chemistry and/or other technologies to dislodge, displace and dispose of contaminants from soft surfaces and, optionally, to treat those same surfaces in at least two different ways. As such, there are preferably five components of soft-surface remediation: (1) dislodging, which is the act of freeing dust, dirt, hair, etc., from, near, or within the surface, (2) displacing, which is the act of moving dust, dirt, hair, etc., to a containment mechanism after it has been dislodged, (3) disposing, which is the act of capturing the contaminants via a containment mechanism, (4) delivery, which is the act of delivering a chemical or other benefit to the surface, e.g., disinfecting, or applying a treatment to control dust mites, bacteria, mold, etc. or, alternatively, to remove odors or otherwise improve the scent or perceived "freshness" of the soft surface, and (5) defending, which is the act of applying a treatment to protect the soft surface from future contaminants.



A vacuum cleaner is a well-known household item used for cleaning. A typical vacuum cleaner consists of a suction fan driven by a motor and a suction nozzle with a rotating brush that has a beating effect (for dislodging) on the surface to be cleaned, such as a carpet. Vacuum cleaners exist in various forms, such as a canister type or upright type of design. Both types of vacuum cleaners have considerable weight and are, therefore, cumbersome to use. Additionally, typical canister or upright vacuum cleaners are corded, which limits their easy accessibility to some areas of the home. Standard vacuum cleaners are too cumbersome for use on soft surfaces, such as furniture upholstery, mattresses, and drapes. And, the mechanical dislodging mechanism of standard vacuum cleaners may be destructive to the fabric itself.

Alternatively, handheld portable vacuum cleaners exist in the market today, such as the DustBuster® handheld vacuum manufactured by Black & Decker (Towson, Md.). However, handheld portable vacuum cleaners generally do not include a dislodging mechanism rather they use vacuum power only. Consequently, handheld portable vacuum cleaners are not powerful enough to clean to any sufficient depth and, thus, only the surface is cleaned. They may not have adequate power to get at contaminants which are embedded within the weave or fibers. In particular, handheld portable vacuum cleaners are not effective in removing hair, as hair is difficult to remove because of the static cling to fabrics and the entanglement into the weave of the fabric itself. Additionally, handheld portable vacuum cleaners generally have a small opening, so the user must operate the device slowly and with many passes over the surface to be cleaned, in order for it to work effectively.

In some cases, a chemical or other material may be desired for odor removal, freshening, disinfecting, assisting in the removal of contaminants from a soft surface or preventing future contaminants. However, it is difficult to introduce chemistry to the surface to be cleaned by use of a standard vacuum cleaner or a handheld portable vacuum cleaner as neither includes a chemical delivery system. The consumer typically must, therefore, resort to a separate device for applying a chemical, which means that the consumer is spending additional time performing separate freshening, disinfecting, cleaning and preventing operations.

As a preventative measure, frequent touchup cleaning is beneficial to soft surfaces for delaying more involved and destructive deep-cleaning events. Generally, upholstery does not get as dirty when frequent touchups are performed, as compared with relying on occasional deep cleaning. However, consumers tend not to do touchup cleaning, because existing soft-surface touchup cleaning approaches are not very effective or convenient. Deep cleaning is effective, but very laborious and requires powerful tools, chemistry, and energy. Furthermore, the more effective the deep-cleaning event, the more damaging it is potentially to the soft surface.

What is therefore needed is an easy-to-use, convenient mechanism for performing touchup cleaning that encourages frequent use and, thus, minimizes the need for deep-cleaning events. What is also needed is a more effective and efficient way to introduce chemistry onto a soft surface by use of a low-powered, lightweight, forced air SSR device and, therefore, reduce the overall time for performing cleaning, freshening, and disinfecting operations. What is additionally needed is a forced air SSR device that has a large pickup area in order to reduce the cleaning time. What is further needed is a forced air SSR device that has a dislodging mechanism for

effectively performing soft-surface remediation but in a non-destructive manner. What is further needed is a method to trap contaminants from the item being cleaned which allows for easy cleaning or disposal to remove the contaminants from the system and the users environment.

The disclosures of all of the below-referenced prior United States patents, and applications, in their entireties are hereby expressly incorporated by reference into the present application for purposes including, but not limited to, indicating the background of the present invention and illustrating the state of the art.

U.S. Patent Application No. 20040172769, "Method and apparatus for cleaning fabrics, floor coverings, and bare floor surfaces utilizing a soil transfer cleaning medium," to Giddings et. al. describes an apparatus and method for cleaning fabrics, floor coverings, and bare floor surfaces utilizing a soil transfer cleaning medium. A method of mechanically removing soil from a surface intended to be cleaned includes the steps of successively and repeatedly: wetting a portion of a cleaning medium with a cleaning liquid; extracting any soil and at least some of the cleaning liquid from the previously wetted portion of the cleaning medium; and wiping the surface intended to be cleaned with the portion of the cleaning medium so as to transfer soil from the surface intended to be cleaned to the cleaning medium. Portable and vehicle-based devices may be utilized to practice the method of cleaning.

U.S. Patent Application No. 20020104184, "Portable vacuum cleaning apparatus," to Rogers et. al. describes a portable vacuum cleaning apparatus intended to be carried either on a single shoulder or worn backpack style, wherein the vacuum cleaner has an extensible tube and nozzle arrangement that may be held substantially fully enclosed in the vacuum cleaner case, wherein the hose or wand may be collapsed when not in use to prevent entanglement, or may be incrementally extended and secured in a desired position for use. The invention also includes a suspension arrangement for flexibly suspending the internal components of the vacuum and for providing a moment to counteract the force and movement of the wand.

U.S. Pat. No. 6,042,333, "Adjustable pitch impeller," to Day describes an impeller that has a plurality of rotating passageways which can be defined between adjacent blades, the blades having a curved root portion and able to pivot across a part spherical hub to maintain a fine line contact. The passageways have a convergence to improve the efficiency of the impeller. The hub can be split into two relatively rotating portions, with the blades attached to each portion to provide an efficient means to vary the pitch of the blades.

U.S. Pat. No. 5,620,306, "Impeller," to Day describes a pressure boost impeller configured for compressing fluids, such as gases and liquids. Such impeller has a front intake area and a rear discharge area, and a hub containing the rotational axis of the impeller. Several blades extend about the hub, with some of the blades being in an overlapping relationship to define a passageway between adjacent blades. The passageway has an inlet communicating with the front intake area and an outlet communicating with the rear discharge area. The inlet is greater in area than the outlet, thus defining a step down in volume of fluid passing through the passageway.

U.S. Pat. No. 5,604,953, "Vacuum cleaner," to Castwall, et. al. describes vacuum cleaner including a unit, comprising an electric motor and an associated suction fan, and a suction nozzle connected to the inlet side of the unit via a dust separating device, either directly or via a connectable rigid conduit. The vacuum cleaner comprises a handheld unit which when not in use is arranged to be positioned on a stationary storage unit, said handheld unit incorporating the said unit and the dust separating device and being provided with a coupling means for connecting of the rigid conduit. For power supply purposes, by means of an extensible flex, the handheld unit is connected to the storage unit which via an additional flex is connectable to a mains outlet.

U.S. Pat. No. 5,551,122, "Corded handheld vacuum cleaner," to Burkhardt, et. al. describes a handheld vacuum cleaner that has a motor mounted with the rotational axis of its shaft parallel to the rotational axis of the rotating brush. The vacuum cleaner motor has an end bell, which is attached to the motor stator, and which holds a motor shaft bearing. The end bell is secured to the vacuum housing with an elastomeric mounting ring to dampen motor vibrations. The need for most motor mounting hardware is eliminated, because the housing supports the motor stator directly. The intake orifice of the vacuum is shaped to lie in two distinct planes, so that flat cleaning surfaces do not obstruct the orifice. The shape of the intake also allows one to clean immediately adjacent to a vertical wall.

U.S. Pat. No. **6,123,618**, "Air Movement Apparatus" to Day discloses an air movement apparatus that includes a curved, toroidal shaped body having a central passageway and an outer rim. The apparatus further includes an air acceleration means such as a bladed fan having a hub and a number of overlapping blades. The fan also has a shaft driven by a motor. The upper portion of the central passageway is partially closed by a first barrier member. Specifically, the peripheral edge of the first barrier member is paced inwardly from the outer wall of the body to define an annular blowing slot which forms the air outlet. The first barrier member is slidably attached by to float above the body in a manner that increases or decreases the size of the annular slot depending on the volume and velocity of air passing therethrough. Movement of air about the curved body creates turbulence such as vortices having a lower pressure than ambient air. The vortices roll around the curved body such that a portion of the air to be ejected out, and a remaining portion of the air to be re-circulated into the central passageway. A heating element is positioned to heat the air as it passes through the passageway.

Application No. WO 00/19881, "An Apparatus for Picking Up and Collecting Particulate Material" to Day discloses an apparatus to separate a particle containing fluid such as dust laden air. The apparatus uses a Coanda blowing slot to entrap particles into a recirculating fluid stream, and strips the particles out of the fluid stream in a separation chamber preferably using a vortex system. The apparatus can be a zero emission apparatus making it suitable in areas where conventional vacuum cleaners are inappropriate.

U.S. Patent No. **6,687,951**, "Toroidal Vortex Bagless Vacuum Cleaner" to Illingworth, et. al. builds on the technology disclosed in U.S. Pat. No 6,595,753, "Vortex Attractor" to Illingworth, et. al. The disclosed vortex attractor is used alone or in conjunction with mechanical or electronic devices to act upon a fluid to create a vortex flow in a closed circulating manner such that there is no separate fluid intake or exhaust. An impeller is conFig.d to draw a fluid tangentially in an upward direction that resembles a spiral, with a loop that travels through the center of the spiral to the region above an inlet to the impeller. The vortex attractor creates a low-pressure area that extends from the impeller toward an object to be attracted. The vortex attractor is used in the '951 patent to provide a toroidal vortex bagless vacuum cleaner.

U.S. Pat. No. 5,074,997, "Filter and Process for Making a Filter for Dispersing Ingredients into Effluent" to Riley et al. discloses a filter applied with differential levels of active

ingredients (e.g., deodorant, perfume, etc.) that can be employed in disposable vacuum cleaner bags. As air passes through the filter, the filter disperses the active ingredients into the effluent air. The active ingredients are distributed unevenly in the filter substrate in a pattern determined by the changing flow pattern of the air through the substrate as particulate matter accumulates against the filter.

Other patents are

U.S. Pat. No. 5,492,540, "Soft surface cleaning composition and method with hydrogen peroxide" to Leifheit, et. al.;

U.S. Pat. No. 5,895,504, "Methods for using a fabric wipe" to Sramek, et. al.;

U.S. Pat. No. 5,284,597, "Aqueous alkaline soft surface cleaning compositions comprising tertiary alkyl Hydroperoxides" to Rees;

U.S. Pat. 4,597,124, "Method and apparatus for cleaning upholstery" to Williams, et. al.;

U.S. Pat. No. 5,968,204, "Article for cleaning surfaces" to Wise; and

U.S. Pat. No. 6,696,395, "Perfumed liquid household cleaning fabric treatment and deodorizing compositions packaged in polyethylene bottles modified to preserve perfume integrity" to Woo, et. al.

## SUMMARY OF THE INVENTION

By way of summary, the present invention preferably provides:

- a convenient forced air SSR device that has a dislodging mechanism for effectively performing soft-surface remediation in a gentler manner;
- a SSR device that has a large pickup area, in order to reduce the cleaning time;
- a more effective and efficient way to introduce chemistry onto a soft surface by use of a low-powered, lightweight forced air SSR device;
- a forced air SSR device that reduces the time required for introducing material onto a soft surface for cleaning, freshening, and disinfecting operations;

an easy-to-use, convenient mechanism that encourages consumers to perform touchup cleaning events more frequently.

Various consumables may aid the device of the present invention in this purpose, for example, disposable filters, scrubbing members, cleaning heads, and various other cleaning materials. For example, perfume or other scents also may be used for freshening the air that is circulated through the device, and compositions for dealing with refreshing fabrics, stain removal and antibacterial control may also be provided.

These and other aspects of the present invention will be better appreciated and understood when considered in conjunction with the following description and the accompanying drawings. It should be understood, however, that the following description, while indicating preferred embodiments of the present invention, is given by way of illustration and not of limitation. Many changes and modifications may be made within the scope of the present invention without departing from the spirit thereof, and the invention includes all such modifications.

## BRIEF DESCRIPTION OF THE DRAWINGS

A clear conception of the advantages and features constituting the present invention, and of the construction and operation of typical mechanisms provided with the present invention, will become more readily apparent by referring to the exemplary, and therefore non-limiting, embodiments illustrated in the drawings accompanying and forming a part of this specification, wherein like reference numerals designate the same elements in the several views,

FIG. **1** illustrates a perspective view of a SSR device in accordance with the invention;

FIG. **2** illustrates the cross-sectional view of the SSR device of the present invention taken along line A-A of FIG. **1**;

FIG. **3** again illustrates the cross-sectional view of the SSR device of the present invention taken along line A-A of FIG. I and also indicates airflow within the forced air SSR device when in use;

FIG. **4** illustrates a bottom perspective view of the SSR device of the present invention;

FIGS. **5**A and **5**B illustrate a cut away view of another embodiment having a moving trap mechanism;.

FIG. **6** illustrates a side view of another embodiment of the present invention;

FIG. **7** illustrates a front perspective view of another possible embodiment of the device of the present invention;

FIG. **8** is a cross sectional of the embodiment of FIG. **7**;

FIG. **9**A illustrates another possible embodiment;

FIG. **9**B illustrates a side view of the embodiment of FIG. **9**A;

FIG. **9**C illustrates Still another possible embodiment;

FIG. **9**D illustrates a side view of the embodiment of FIG. **9**C;

FIG. **9**E illustrates yet another possible embodiment;

FIG. **9**F illustrates a side view of the embodiment of FIG. **9**E;

FIG. **10**A illustrates a side view of another possible embodiment;

FIG. **10**B illustrates a side view of another of the embodiment;

FIG. **11**A illustrates yet another possible embodiment similar to the embodiment shown in FIG. **7**;

FIG. **11**B illustrates a bottom magnified view of part of the embodiment shown in FIG. **11**A;

FIG. **12**A illustrates yet another possible embodiment similar to the embodiment shown in FIG. **7**;

FIG. **12**B illustrates a bottom magnified view of part of the embodiment shown in FIG. **11**A;

FIG. **13** illustrates another possible embodiment;

FIG. **14** illustrates a bottom up perspective view another possible embodiment;

FIG. **15** illustrates a perspective view of yet another possible embodiment;

FIG. **16**A-C illustrate other possible embodiments;

FIG. **17**A illustrates another possible embodiment of a catch of the present invention;

FIG. **17**B illustrates a side view of the embodiment of FIG. **17**A;

FIG. **18**A illustrates another possible embodiment of a catch;

FIG. **18**B illustrates a side view of the embodiment of FIG. **18**A;

FIG. **19**A illustrates yet another possible embodiment of a catch;

FIG. **19**B illustrates a cutaway of the embodiment shown in **19**A;

FIG. **19**C illustrates a cutaway of another embodiment similar to that of FIG. **19**A;

FIG. **20**A illustrates still another possible embodiment of a catch;

FIG. **20**B illustrates a tear away of the embodiment shown in **20**A;

FIG. **20**C illustrates a cutaway of the embodiment shown in **20**A;

FIG. **21**A illustrates a perspective view another possible embodiment of a filter of the present invention;

FIG. **21**B illustrates a cutaway of the embodiment shown in **21**A;

FIG. **22**A illustrates a a perspective view another possible embodiment of a filter of the present invention;

FIG. **22**B illustrates a cutaway of **22**A;

FIG. **23**A illustrates a perspective view another possible embodiment of a filter;

FIG. **23**B illustrates a bottom view of **23**A;

FIG. **24**A illustrates yet another possible embodiment of a catch;

FIG. **24**B illustrates a bottom view of **24**A;

FIG. **24**C illustrates a cutaway view of **24**A;

FIG. **25** illustrates a perspective view of yet another possible embodiment of a catch;

FIG. **26** illustrates a perspective view of yet another possible embodiment of a catch;

FIG. **27** illustrates a flow diagram of a method of performing soft-surface remediation by use of the SSR device of the present invention;

FIG. **28** illustrates a perspective view of yet another possible embodiment shown here used for cleaning a soft surface, for example, a couch; and

FIG. **29** illustrates yet another possible embodiment of a catch.

Note while some text has been added to the drawings it has been done to merely provide further detail to the illustrated embodiments and should be taken as limiting the invention to that which is shown or disclosed thereon.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

1. System Overview

The present invention is soft-surface remediation (SSR) device and method of remediating soft surfaces, such as upholstery that preferably uses forced air to accomplish its objective. In its simplest form, the SSR device is a device that pushes a fluid out and sucks it back in, cleaning the surface and the fluid as it does so.

The SSR device of the present invention is preferably a lightweight, easy-to-use device that includes an outer housing, at least one optional corner pickup region, a removable cover, an inner housing, a motor housing for housing a fan assembly, an optional disposal catch mechanism, an optional mounted delivery device, a first air channel with an air outlet, a second air channel with an air inlet, and a return air channel in close proximity to the disposal mechanism. The preferred method of performing soft-surface remediation by use of the SSR device of the present invention includes the steps of retrieving the SSR device from storage, installing the consumables into the device, activating the device, performing the SSR operation, deactivating the device, removing the consumables, preparing for another use, storing the device and, optionally, recharging batteries.

2. Detailed Description of the Preferred Embodiments

The present invention is preferably a forced air device for and method for soft surface remediation (SSR) including dislodging, displacing, and disposing of contaminants from soft surfaces, such as upholstery. The forced air SSR device of the present invention effectively performs soft-surface remediation in a gentler, less destructive manner and is preferably low-powered and lightweight. It also preferably has as large pickup area for providing a faster cleaning operation, provides a delivery mechanism for materials for protecting, freshening, disinfecting, cleaning and preventing and provides an easy-to-use, convenient mechanism that encourages consumers to perform touchup cleaning events more frequently. For the purposes of this disclosure, the term "cleaning" or "cleaned" is broadly expanded to include operations associated with SSR. The materials used for further cleaning may include cleaning chemicals, odor eliminators, stain removal, fabric protectors, fresheners, and disinfectants all of which may be in the form of liquids, gases, solids, gels, substrates and/or powders or combinations thereof.

FIG. **1** illustrates a perspective view of a forced air SSR device **100**, which is representative of a portable device for performing SSR, in accordance with the invention. The device **100** is preferably hand held for ease of use. Forced air SSSR device **100** includes an outer housing **110** that has an outer housing first end **112**, which is open, and an outer housing second end **114**. A first dust tray **116** is integrated concentrically within the opening of outer housing **110** at outer housing first end **112**. At least one corner pickup region **118** is optionally integrated in a protruding fashion within outer housing **110** at outer housing second end **114**. More details of optional corner pickup region **118** are shown in reference to FIGS. **2**, **3**, and **4**. In addition to optional corner pickup region **118**, there may be other pickup regions at either 90 degrees or 180 degrees from the first optional corner pickup region **118**. A removable cover **120** with a handle **122** is preferably installed atop the opening of outer housing **110** and thereby encloses outer housing first end **112** and first dust tray **116**. A brush **124** is also preferably integrated along the perimeter edge of outer housing **110** at outer housing second end **114**.

Outer housing **110** is substantially cylindrically shaped and is formed of preferably a rigid lightweight material, such as molded plastic, tin, or aluminum. Likewise, first dust tray **116**, optional corner pickup region **118**, removable cover **120**, and handle **122** are formed of a rigid lightweight material, such as molded plastic or aluminum. Removable cover **120** is secured to outer housing **110** by use of standard locking mechanisms that are engaged and disengaged, for example, by the user's rotating removable cover **120** a quarter- or half-turn, relative to outer housing **110**, which is held fixed. The implementation of handle **122** is not limited to that shown in FIG. **1**. Alternatively, handle **122** may be knob-shaped or may be a handle of standard known shapes, mounted in any ergonomically suitable manner, such as on the side of outer housing **110** opposite optional corner pickup region **118**. Alternatively, there may be two handles of standard known shapes located at any point on the side of outer housing **110**. Brush **124** is a preferably standard brush formed of a collection of bristles of an appropriate length, stiffness, and density for assisting in dislodging particulates and hair from the soft surface to be cleaned. It may also consist of other materials such as rubber or a composite mixture of various substrates that will allow for the loosening of contaminants and potentially for grooming the soft surface.

FIG. **2** illustrates a cross-sectional view of forced air SSR device **100** taken along line A-A of FIG. **1**. FIG. **2** shows that forced air SSR device **100** further includes an inner housing **126** arranged substantially concentrically within outer housing **110**. Inner housing **126** has an inner housing first end **128** and an inner housing second end **130** that are oriented toward outer housing first end **112** and outer housing second end **114**, respectively. Inner housing **126** also includes a top air inlet **132** at inner housing first end **128**. A second dust tray **134** is

integrated concentrically around the outer circumference of inner housing **126** at inner housing second end **130**. Forced air SSR device **100** further includes a motor housing **136** arranged substantially concentrically within inner housing **126**. Motor housing **136** has a motor housing open end **138** and a motor housing base plate **140** that are oriented toward inner housing first end **128** and inner housing second end **130**, respectively. Motor housing base plate **140** includes a plurality of protrusions or teeth **142** that are evenly spaced around and protrude from its perimeter, as shown. More details of teeth **142** are found in reference to FIG. **4**. These protrusions or teeth may be used to grab on and lift up what is on the surface, e.g., pet hair, paper, or even some other electrostatically bound matter. Alternatively, the teeth may be part of a rake, brush, or they may not resemble teeth at all but rather just a soft, spongy piece of material. The teeth may be more rounded to be more like fingers and may be made of plastic, rubber, or some equally stiff yet somewhat flexible material so as not to damage the surface. Inner housing **126** and motor housing **136** are substantially cylindrical shaped and are formed of a rigid lightweight material, such as molded plastic or aluminum. Furthermore, motor housing **136** is somewhat bell-shaped, as motor housing base plate **140** has a larger diameter than motor housing open end **138**, as shown in FIG. **2** for air flow and motor cooling reason. FIG. **2** also shows that inner housing **126** has a rounded geometry at inner housing second end **130**, in order to form an air restrictor **144** that has a curved surface upon which are mounted a plurality of standoffs **146**. More details of air restrictor **144** and standoffs **146** are found in reference to FIG. **4**.

Forced air SSR device **100** further includes a fan assembly **148** formed of a fan impeller **150** mounted on a motor shaft **152** of either an alternating current (AC) motor or a direct current (DC) motor **154** that is fitted through motor housing open end **138** and secured within motor housing **136**. Fan impeller **150** of fan assembly **148** is preferably oriented toward inner housing first end **128** of inner housing **126**.

Fan impeller **150** is a lightweight fan impeller formed of, for example, molded plastic or aluminum. Fan impeller **150** is preferably a highly efficient fan impeller formed by overlapping blades mounted to a spherical hub. Fan impeller **150** is capable of providing high pressure air for a given rotational speed and physical size, as compared with standard fan blade designs. In one example, fan impeller **150** may be a commercially available fan impeller manufactured by Jetfan Technology Limited (Arundel, AU) that uses its JetFan™ technology as described in U.S. Pat. No. 5,620,306, entitled, "Impeller." The '306 patent describes a pressure boost impeller configured for compressing fluids, such as gases and liquids. The impeller of the '306 patent has a front intake area, a rear discharge area, and a hub containing the rotational axis of the impeller. Several blades extend about the hub, with some of the blades being in an overlapping relationship, in order to define a passageway between adjacent blades.

In another example, fan impeller **150** is a mixed flow or "mixflow" fan. A mixflow fan has angled blades that impart some centrifugal direction to the air as it passes through. Closely positioned downstream of the rotating impeller is a row of stationary blades called stators. This stator row has the high speed air flung at it and that air then is slowed by the airfoil action of each stator blade.

Alternatively, the forced air stream may be derived from a conventional source, such as the exhaust fan from a typical vacuum cleaner.

In one embodiment, the preferred motor **154** is a standard low, powered, 6 volt to 24 volt DC motor capable of 5000 to 40000 rotations per minute (RPMs). AC or DC motor **154** may be either a single-speed or multi-speed motor. An example AC motor **154** is Johnson Electric 64335. Fan assembly **148**, by the action of AC motor **154** and fan impeller **150**, is capable of developing substantial airflow.

Forced air SSR device **100** further includes a collector or separation chamber for removing dust from the air stream. In addition to this collector, an optional catch mechanism **156** mounted at close proximity to top air inlet **132** of inner housing **126** and parallel to removable cover **120** at outer housing first end **112** of outer housing **110**. The mechanism **156** is preferably a consumable non-woven filter, electrostatic cloth or other such material positioned in close proximity to fan impeller **150**. Such a disposal mechanism or catch **156** may be a variety of shapes, including, but not limited to, a J-ring, a donut, or a slightly convex or concave cup. The disposal catch mechanism **156** is, for example, a non-woven material that acts like a filter for the air circulating within the device **100**. The filter may be supported by a plastic or cardboard ring, frame, or housing. In another example, disposal catch mechanism **156** is a Grab-It® Cloth from S.C. Johnson & Son, Inc. (Racine, Wis.) or a Swiffer® Cloth from Procter & Gamble (Cincinnati, Ohio). Alternatively, the disposal catch mechanism **156** is an easily removable and recyclable HEPA filter or some other fine particle filter. In yet another example, disposal catch mechanism may be located on or in the first dust tray **116** and may be a non-woven material, a gel, or some sticky substance that will act to trap and hold particulate matter within the air. Examples of possible catches are shown in FIGS. **17A-26**. These will be more fully explained below.

Disposal catch mechanism **156** may be also impregnated with an active material or ingredient to provide sanitation, such as, odor removal, odor neutralization, or dust mite control, to the soft surface to be cleaned. An example active ingredient for providing sanitation and that has suitably small particles that do not saturate the fabric is triethylene glycol (TEG). An example active ingredient for providing odor neutralization is also triethylene glycol (as found in Oust® from S.C. Johnson & Son). An example active ingredient for providing odor removal is cyclodextrin (as found in Febreze® from Procter & Gamble). Alternatively, the material may be added directly into the air flow within the device through a delivery system, e.g., an integral reservoir configured to release chemistry into the inside of the housing. The chemistry may include the following: cleaners, odor eliminators, fresheners, protectants, and disinfectants all of which may be in the form of liquids, gases, solids, gels and/or powders or combinations thereof. This chemistry is suitable to remediate hard and soft surfaces such as a pillow, mattress, carpet, car interior, drape, window, floor, plumbing drain, insect habitat, and/or couch.

Additionally, any active material or ingredient may be delivered to the surface being treated by the use of a reservoir **205** (as shown, e.g., in FIGS. **7** and **8**) or other system that is externally mounted to the unit, and which may include a trigger spray, pump spray, aerosol, or similar means. Alternatively, the material may be a foam cleaner (contained e.g., in a canister) which after being first set down by an outward flow is then picked up by the device. The foam may be activated by a variety of means as is known in the art, e.g., chemical reaction, surfactants, agitators, a dual bottle system, OXYCLEAN, etc.

Materials that both protect and renew also may be added to the fluid stream. These materials can rejuvenate the fibers of the soft surface and coat them to become more dirt resistant and water resistant in the future. For example, various compositions made by DuPont and 3M are known to make fabric water and/or stain resistant, such as SCOTCHGUARD™.

These materials may also include compositions comprised of a dispersant and/or microcapsules containing an active material.

Forced air SSR device **100** further may include a battery assembly (not pictured) formed of a plurality of batteries (not pictured), which are standard rechargeable or non-rechargeable batteries that are electrically connected to provide a DC voltage source of 6 to 24 volts to DC motor **154**. Alternatively, the device may be corded and operate via an AC voltage source.

The overall dimensions of forced air SSR device **100** are, for example, a diameter of between about 4 and 12 inches (approximately 10-26 cm) and a height of between and 6 and 12 inches (approximately 15-26 cm). Additionally, an example weight of forced air SSR device **100** is between 2 and 5 lbs (approximately 0.9-2.7 kg). The overall dimensions and weight of forced air SSR device **100** are not limited to those stated above, so long as they are practically suited to an easy to hold and use, portable device. Preferably, such a device **100** is ergonomically friendly to the user.

With continuing reference to FIGS. **1** and **2**, those skilled in the art will recognize that forced air SSR device **100** includes standard mechanical mounting structures for securing removable cover **120**, inner housing **126**, motor housing **136**, fan assembly **148**, disposal catch mechanism **156**, and battery assembly (for the DC powered version) but, for simplicity, are not shown.

FIG. **3** again illustrates the cross-sectional view of forced air SSR device **100** taken along line A-A of FIG. **1** for indicating airflow within forced air SSR device **100** when in use. FIG. **3** shows that forced air SSR device **100** further includes a first air channel **162**, which is an air cavity formed around the circumference of motor housing **136** between an outer wall of motor housing **136** and an inner wall of inner housing **126**. First air channel **162** has a bottom air outlet **164** around the circumference of motor housing **136**, where motor housing base plate **140** is in close proximity to the inner wall of inner housing **126** at inner housing second end **130**. Additionally, a second air channel **166** is an air cavity formed around the circumference of inner housing **126** between an outer wall of inner housing **126** and an inner wall of outer housing **110**. Second air channel **166** has a bottom air inlet **168** around the circumference of inner housing **126**, where the outer wall of inner housing **126** at inner housing second end **130** is in close proximity to the inner wall of outer housing **110** at outer housing second end **114**. A return air channel **170** is an air cavity formed in close proximity to disposal catch mechanism **156**, between removable cover **120** and top air inlet **132** of inner housing **126**. Air circulates through the channels **162**, **166**, and **170**. Air may also be moved to the outside toward the outer housing wall and thus allowing dust to settle in first dust tray **116**. Additionally, FIG. **3** shows brush **124** and standoffs **146** of forced air SSR device **100** contacting a soft surface **180**, which is representative of any soft surface to be cleaned, such as upholstery. More details of the portion of forced air SSR device **100** that contacts soft surface **180** are found in reference to FIG. **4**.

FIG. **4** illustrates a bottom perspective view of forced air SSR device **100**. FIG. **4** shows the plurality of teeth **142** spaced evenly around and protruding from the perimeter of motor housing base plate **140**. FIG. **4** also shows the set of standoffs **146** spaced evenly around and protruding from the surface of air restrictor **144**, which is slightly rounded. Additionally, FIG. **4** shows optional corner pickup region **118** forming a 90 degree structure at outer housing second end **114** of outer housing **110** in what is, otherwise, a circular cross section. Brush **124** is installed along the outermost perimeter of outer housing second end **114** of outer housing **110** that includes optional corner pickup region **118**.

Referring back to FIG. **4**, motor housing base plate **140**, teeth **142**, air restrictor **144**, and standoffs **146** are formed of a rigid lightweight material, such as molded plastic or aluminum. Optionally, the outer surface of motor housing base plate **140** may be covered with a lint or pet hair pickup up cloth or pad, which is another consumable item that is replaced, as needed. Standoffs **146** and teeth **142** are suitably sized and shaped to avoid snagging on the fabric of soft surface **180**. Standoffs **146** protrude from the surface of air restrictor **144** and are, for example, 1 to 10 mm in length and 1 to 15 mm in diameter. Teeth **142**, which are optional, protrude at an angle to motor housing base plate **140** and are, for example, 1 to 5 mm in length and 0.25 to 5 mm in diameter. Also shown are bottom air inlet **168** around the circumference of inner housing **126** and bottom air outlet **164** around the circumference of motor housing base plate **140**, whereby air restrictor **144** serves as the airflow interface there between. Standoffs **146** ensure that air restrictor **144** is maintained at the appropriate distance and slightly separated from soft surface **180** and, thus, an airflow path between air restrictor **144** and soft surface **180** is ensured.

With continuing reference to FIGS. **1** through **4**, the preferred operation of forced air SSR device **100** is as follows. The removal cover **120** is removed. A clean disposal catch mechanism **156** is installed within outer housing **110** of forced air SSR device **100**, in close proximity to first dust tray **116** and in the path of return air channel **170**. The removable cover **120** is replaced. The removable cover **120** includes an optional locking feature that prevents the unit from operating if the removable cover **120** is not locked into place. Forced air SSR device **100** is activated by a standard on/off switch (not shown) that makes an electrical connection between the output voltage of battery assembly and DC motor **154** or from a home's electrical-power outlet to the AC motor **154** As a result, fan impeller **150** rotates and creates a flow of air by drawing air into top air inlet **132** of inner housing **126**, through first air chamber **162** and exiting bottom air outlet **164**, passing around air restrictor **144**, returning through bottom air inlet **168** and into second air channel **166**, passing through disposal catch mechanism **156** and into return air channel **170**, and returning back into top air inlet **132** to preferably form a closed loop system within forced air SSR device **100**, which is a closed unit. Furthermore, the airflow from bottom air outlet **164**, around air restrictor **144**, and into bottom air inlet **168** is enhanced by a phenomenon known as the Coanda effect, which is the tendency of a stream of fluid to follow a convex surface, rather than follow a straight line in its original direction. For example, because of the Coanda effect, some of the stream of pressurized air emerging from bottom air outlet **164** tends to follow the nearby curved surface of air restrictor **144**. The remainder of the air will be directed toward the surface, loosening and dislodging the dirt, dust, odor molecules, particulate matter and whatever else might be trapped on or within the surface.

The user then preferably brings brush **124**, motor housing base plate **140**, and standoffs **146** into contact with the surface to be cleaned, such as soft surface **180**, as shown in FIG. **3**, and moves forced air SSR device **100** over soft surface **180** by using any back-and-forth or side-to-side motion. In doing so, pressurized air is released through bottom air outlet **164** and impinges upon soft surface **180**. This high pressure is created by the action of fan impeller **150** and the narrowing of first air channel **162**. For example, this is in part due to the bell shape of motor housing **136** that helps form a narrow bottom air outlet **164**. The combination of pressurized air exiting bottom

air outlet **164** and the action of brush **124** and teeth **142** impinging upon soft surface **180** serves to dislodge contaminants, typically in the form of particulates and hair, from soft surface **180**. These loose contaminants are caught either in the airflow of forced air SSR device **100** and are, consequently, carried into bottom air inlet **168** for collection within forced air SSR device **100**. Moving forced air SSR device **100** over soft surface **180** is effectively moving an air stream, which is gathering contaminants, over its surface. More specifically, contaminants that are dislodged by the pressurized air are drawn into second air channel **166**, wherein any particles that are too heavy to flow the full distance of second air channel **166** to disposal catch mechanism **156** fall, because of gravity, into second dust tray **134**. The remaining contaminants are drawn the full distance of second air channel **166**, wherein some additional particles are preferably captured within first dust tray **116** and the smallest contaminants are captured within disposal catch mechanism **156**. Filtered air flows through return air channel **170** onto top air inlet **132** of inner housing **126** and returns to fan impeller **150**. The air within return air channel **170** circulates in a cyclonic manner and, thereby, flings some particles outwardly and into first dust tray **116**. Additionally, any active ingredient that is impregnated within disposal catch mechanism **156** is delivered into the airflow of first air channel **162** by the action of fan impeller **150** and, subsequently, driven into the fabric of soft surface **180** via bottom air outlet **164**. Additionally, any cleaning fluids or other active ingredients may be delivered to the surface being treated by the use of a device that may be mounted internally in or externally to the device **100**. Such delivering mechanism may include a trigger spray, pump spray aerosol, or similar means of delivering active ingredients, e.g., chemistry, to the surface being treated.

The embodiment of the inventive device **100** shown in FIGS. **5**A and **5**B illustrates that air restrictor **144** may be a moveable, annular member that, when in its upper position, allows the unit to function as defined. When this member **144** or trap is pulled down preferably by gravity to its lower position (FIG. **5**B), it diverts the air between itself and the surface above it. The reason is that before the device **100** is placed on the surface to be cleaned the descending air jet disturbs the dirt and scatters it. This member prevents this by allowing the device **100** to approach the surface and the weight of the device **100** or the operator's down force pushes or moves it vertically up into the operating position. The trap **144** may be moved downward by either gravity or a spring device. In another embodiment, this member may be biased by a spring or similar such mechanism. Alternatively, this member may be linked to a secondary switch that rotates the fan once it is in contact with the surfaces. Note this embodiment shown in FIG. **5**A and **5**B does not show the optional corner pickup region.

In another embodiment as best shown in FIG. **6**, the device preferably has a long, extendable handle **105** connected to a body **103**. This device **100** preferably has a window **107** on a top side for viewing the inside of the body **103**. It also has a rubber bumper **109** at a rear side to protect items which be bumped by the device **100** during use. An extended nose **11 1** is preferably also included. This embodiment is preferably power through an electrical cord **113**. Because of it configuration, this device **100** may be used not only for soft surface cleaning but with minor modification to deliver material that includes an insecticide, repellant, herbicide, fungicide, antimicrobial, floor cleaner, window cleaner, drain cleaner, air freshening, etc. A long, extendable, preferably telescoping, handle allows the user to reach certain surfaces and/or provide distance between the user and the material treating the surface during application. In some instances, the motor is preferably impervious to water so that the device can be used in areas where these types of liquids are used.

FIGS. **7** and **8** show another embodiment of the present invention. Noticeably absent from the device **100** of this embodiment are the handle and the bulbous first dust tray housing. A removable cover **120** is preferably attached to housing **1 10**. A fluid reservoir **205** is preferably attached This embodiment is configured to fit into the palm of the user's hand for ease of use in touch-up cleaning particular in areas where is there is not much space. Air flow in this embodiment is limited to the channels **162**, **166**, and **170**. This embodiment may have a corner pick up region **118** but one is not necessary and debris can be collected in the disposal catch mechanism **156** that fits into the return air channel **170**. A dislodging mechanism or brush **124** may be present below the outer housing second end **114**. The dislodging mechanism **124** shown here may also include a brush, a duster, elastic fingers, a stiffer brush for pet hair removal, etc.

FIGS. **9**A-**10**B show many additional embodiments of the present invention. FIGS. **9**A and **9**B show a device **100** having a front corner pick-up region **118** for getting into tight corners or small spaces. A clear cover **120** preferably is attached to the top so that a user can see when the unit is full of debris and the filter **156** needs changing. Textured areas **121** on the sides of the cover **120** act as lock releases so that when pushed inwardly (as shown by the arrows), the cover can be removed and the filter changed. A longer rectangular shaped handle **122** protrudes from a rear of the body of the device **100**. The handle **122** preferably has a textured and cushioned grip **123**.

FIGS. **9**C and **9**D show yet another embodiment of the inventive device **100** having a front corner pick-up region **118**. A clear cover **120** preferably is attached to the top. A button **125** on the front of the cover triggers a latch and allows the cover to be opened. The cover **120** preferably rests on a hinge **127** so the cover opens like a clamshell (as indicated by the arrow) and the debris inside can be dumped into a garbage container. A longer, circular handle **122** wraps around the body of the device **100**. Handle **122** is covered with a spongy rubber material to provide a textured and cushioned grip.

FIGS. **9**E and **9**F show yet another embodiment of the inventive device **100** having a front corner pick-up region **118**. A door **129** may be at a front of the body. A clear cover **120** preferably is attached to the top but it is secured by a semi-circular handle **122** that fits over the top of the cover as shown. The handle is attached at a pivot point **131**. A button **125** on the front of an outer housing extension releases a latch and allows the handle **122** to swing back and opened as indicated by the arrow) so that fluid may be placed in a reservoir contained therein. A button **133** on a rear of handle **122** acts as a trigger to disperse a fluid from a front of the device through an orifice **135**. This mechanism is similar to that of a traditional clothes iron that disperses water. Handle **122** is covered with a spongy rubber material on an underside to provide a textured and cushioned grip. Button **141** allows the door **129** to be opened so that debris trapped in a cavity within the body can be emptied.

FIG. **10**A shows still another embodiment of the inventive device **100** having an elongated front corner pick-up region **118**. A cover **120** preferably is attached to the top and it has a window **137** to see a filter there below. A button **125** on the side of the cover triggers a latch and allows the cover **120** to be opened. The cover **120** preferably rests on a hinge so the cover opens like a clamshell. A smaller, knob-like handle **122** is attached to the rear of the body of the device **100**. Again, handle **122** is covered with a spongy rubber material to provide a textured and cushioned grip.

FIG. **10**B shows another embodiment of the inventive device **100** having a shorter front corner pick-up region **118**. Again, cover **120** preferably is attached to the top. A button **125** on the front of the cover triggers a latch and allows the cover **120** to be opened. The cover **120** preferably rests on a hinge so the cover opens like a clamshell. A longer, low swooping handle **122** is attached to the front of the body of the device **100** and is covered with a material to provide a textured and/or cushioned grip.

In the embodiments shown in FIGS. **11**A-**13**, additionally a lint cloth or pad, a scrubby cloth or pad or other similar devices **143** may be attached to the motor housing bottom **140**A to act as a particulate matter remover. These alternative pads may be changed in and out of the device and cleaned depending on the task at hand. U.S. Pat. No. 6,550,092 describes in detail a cleaning sheet that may be modified to act as a pad **143** for this purpose. Also, these may include items that may be thrown away after use. In some of these embodiments, the teeth protrusions **142** may be replaced by such a pad as best shown in FIG. **13**. In this embodiment the replaceable element **143** may consist of a paper like disposable ring **143**A having protrusions **147** sticking out of it that fits into a channel **145**.

Specifically, FIG. **11** A shows a consumable that is held within a ring made of appropriate material so that the ring stretches the consumable "fabric" or mesh (could be non woven cloth, plastic, rubber composite or other combinations thereof) and snap fits or uses another means to attach to the outer lip of the motor housing base plate. The consumable is taken out of the package and then pressed onto the bottom of the device and used. This consumable can be used for pet hair pickup, stain removal (use of a pad and chemistry to spot clean a stain), dislodging of pet hair or other methods of collecting particulate matter from a soft surface. This can be a dry cloth, a cloth impregnated with chemistry, a surface containing microencapsulated chemistry, or can be used as a semi permeable membrane to deliver chemistry to a surface (chemistry is in a liquid or gel form under the cloth).

In another embodiment, this fabric or cloth could be treated with chemistry that provides the user with a visual cue as to the state of the surface it passes over, similar to litmus paper. This consumable could do this in concert with another function, or simply as an indicator. Conditions it could be indicating are (but not limited to) the state of cleanliness of the surface, amount of allergens present, presence and degree of presence of specific contaminants or allergens, presence of biological entities, or odors.

FIG. **12**A shows a consumable that can be (but not limited to) either just plain material with no support, or held within a ring or another form made of appropriate material so that the ring stretches the consumable "fabric" or mesh (could be non woven cloth, plastic, rubber composite or other combinations thereof) and presses to the surface of the motor housing base plate. The consumable is affixed to this surface by some means of adhesion or loop and hook method similar to that employed by the commercial product Velcro. The consumable is taken out of the package and then pressed onto the bottom of the device and used. This consumable can be used for pet hair pickup, stain removal (use of a pad and chemistry to spot clean a stain), dislodging of pet hair or other methods of collecting particulate matter from a soft surface. This can be a dry cloth, a cloth impregnated with chemistry, a surface containing microencapsulated chemistry, or can be used as a semi permeable membrane to deliver chemistry to a surface (chemistry is in a liquid or gel form under the cloth).

In another embodiment, this cloth could be treated with chemistry that provides the user with a visual cue as to the state of the surface it passes over, similar to litmus paper. This consumable could do this in concert with another function, or simply as an indicator. Conditions it could be indicating are (but not limited to) the state of cleanliness of the surface, amount of allergens present, presence and degree of presence of specific contaminants or allergens, presence of biological entities, or odors.

FIG. **13** shows a consumable that can be (but not limited to) made from either rubber, a rubber composite, bristles of various compositions (natural or man made, or a combination thereof), or various materials. This ring is pressed into a channel that is cut into the motor housing base plate. The consumable is taken out of the package and then pressed onto the bottom of the device and used. This consumable can be used for pet hair pickup, dislodging of pet hair for pickup by the device, or as a methods to dislodge or disturb matter (dust, dirt, bacteria, odors, etc) from a soft surface. This can also contain some chemistry which is wicked or drawn towards the surface being cleaned by chemical, physical or electrical means.

In another embodiment, this ring could be treated with chemistry that provides the user with a visual cue as to the state of the surface it passes over, similar to litmus paper. This consumable could do this in concert with another function, or simply as an indicator. Conditions it could be indicating are (but not limited to) the state of cleanliness of the surface, amount of allergens present, presence and degree of presence of specific contaminants or allergens, presence of biological entities, or odors.

Obviously, the above-mentioned "consumables" will need to also be replenished from time to time. Such consumable materials may be supplied to consumers in a kit wherein more than one composition is included in the kit, along with a set of instructions. The consumer will then select the appropriate consumable and cleaning composition depending on the different uses for the device, for example, according to the surface to be cleaned, the kind of cleaning desired, etc, in accordance with the instructions.

FIG. **14** shows a unit **100** that has multiple corner pickup regions **118**A, **118**B to allow for greater flexibility of the unit **100**, and better access to corners, between cushions, under cushions and thin areas where access to dust, dirt and debris is desired. This additional corner could be offset from the original corner pickup by 90 degrees, 180 degrees or 270 degrees.

FIG. **15** shows an alternative method to deliver chemistry into the air stream or the device **100** using either an aerosol can **205**. This aerosol can be inserted into a tube affixed to the unit **100**, or molded onto the device and can be activated by a small button on top of the container. The consumer may be allowed determine the amount of chemistry used, or the use of a metered valve could be used to allow pre-determined doses of chemistry to flow. An alternate method would be to pour fluid into the container and allow it to venturi into the air stream. An alternate method would be to place a gel, solid or semi solid into the container and allow it to venturi into the air stream.

FIGS. **16**A-C show a top schematic view for alternate shapes for the device **100**. FIG. **16**A shows an oval or egg shaped unit **100** with the corner pickup region **118** on the side. FIG. **16**B shows an oval or egg shaped unit **100** with the corner pickup region **118** on the front or rear. FIG. **16**C shows a triangle shaped unit, where the corners are all corner pickup regions **118**A-C. In all cases, the second air channel is round or close to round to allow a vortex to form to aid in bringing dirty air into the consumable device.

FIGS. **17**A-**24**C show many possible embodiments of a catch **156** of the present invention. In some embodiments, the catch **156** may have projections **157** or hair-like protrusions **159**, pockets **161**, or cavities **163** for better catching and holding dust and dirt which can be best seen in the cutaway views provided. Preferably, many of the embodiments are circular or donut-shaped and sit inside or adjacent to the return air channel as best shown in FIG. **8**. Theses caches may be disposable filters made of non-wovens or may be able to be rinsed or cleaned and replaced. These catches may also be electrostatically charged or carbon-black filters.

In the embodiment shown in FIGS. **22**A and **22**B, a clip **165** is provided for clipping the filter **156** in place within the unit.

In the embodiment shown in FIGS. **23**A and **23**B, slots **167** are provided for allowing fluids to easily travel in and out of hemispherical filter **156** while generally heavier dirt and dust is trapped.

In the embodiment shown in FIGS. **24**A, **24**B and **24**C, slots **167** and vanes **169** are provided for allowing fluids to easily travel in and out of hemispherical filter **156** while generally heavier dirt and dust is trapped.

FIGS. **25** and **26** show a puck-like catch **156**. In FIG. **25**, the puck has a top section **171** and a bottom section **173**. A cloth or pad may fit between the sections **171**, **173** which may be press fit together.

FIG. **26** shows a catch having an outer ring **177** with vanes and slots arranged in circular configuration. This catch **156** may be made of a a plastic and reusable after cleaning. Alternatively, it may be made of paper or cardboard and disposable.

FIG. **27** illustrates a flow diagram of a preferred method **200** of performing soft-surface remediation by use of forced air SSR device **100** of the present invention. The inventive method **200** includes the following steps. As one of ordinary skill in the art will notice, the steps do not need to be necessarily practiced in the specific order set out below.

In step **210**, a user retrieves forced air SSR device **100** from its storage location (which may be a battery recharging device).

In step **212**, the user removes removable cover **120** atop outer housing **110** and installs a new or cleaned disposal catch mechanism **156**, which may contain a chemical substance impregnated therein and/or installs the optional internally or externally mounted chemistry or active ingredient material delivery devices. The user then reinstalls removable cover **120** atop outer housing **110**, optionally locking it into place. Method **200** proceeds to step **214**.

During step **214**, the user activates forced air SSR device **100** by a standard on/off switch and, thereby, activates AC or DC motor **154**. As a result, fan impeller **150** rotates and creates a flow of air by drawing air into top air inlet **132** of inner housing **126**, through first air chamber **162** and exiting bottom air outlet **164**, passing around air restrictor **144**, returning through bottom air inlet **168** and into second air channel **166**, passing through disposal catch mechanism **156** and into return air channel **170**, and returning back into top air inlet **132** to preferably form a closed loop system.

In step **216**, the user preferably grasps handle **122** and brings brush **124**, motor housing base plate **140**, and standoffs **146** into contact with a surface to be cleaned, such as soft surface **180**, as shown in FIG. **3**, and moves forced air SSR device **100** over soft surface **180** by using any back-and-forth or side-to-side motion, until the entire surface has been cleaned. The combination of pressurized air exiting bottom air outlet **164** and the action of brush **124** and teeth **142** impinging upon soft surface **180** serves to dislodge contaminants, typically in the form of particulates and hair, from soft surface **180**. These loose contaminants are caught in the airflow of forced air SSR device **100** and are, consequently, carried into bottom air inlet **168** for collection within forced air SSR device **100**. More specifically, contaminants are drawn into second air channel **166**, wherein any particles that are too heavy to flow the full distance of second air channel **166** to disposal catch mechanism **156** fall into second dust tray **134**, because of gravity. The remaining contaminants are drawn the full distance of second air channel **166**, wherein some portion of additional particles are captured within first dust tray **116** and any remaining and smallest contaminants are captured within disposal catch mechanism **156**. Filtered air flows through return air channel **170** onto top air inlet **132** of inner housing **126** and returns to fan impeller **150**. Additionally, any active ingredient that is impregnated within disposal catch mechanism **156** is delivered into the airflow of first air channel **162** by the action of fan impeller **150** and, subsequently, is driven into the fabric of soft surface **180** via bottom air outlet **164**. As mentioned, the active ingredient may be delivered by the use of a device that is mounted internally in or externally to the unit, which may include a trigger spray, pump spray, aerosol, or similar means of delivering material, e.g., chemistry to the surface being treated. Furthermore, in order to perform the SSR operation in corners, the user may direct optional corner pickup region **118** into the corner to be cleaned.

In step **218**, the user deactivates forced air SSR device **100** by a standard on/off switch, which deactivates DC motor **154**.

In step **220**, the user removes removable cover **120** atop outer housing **110**. The disposal catch mechanism **156** and optional internally or externally mounted delivery device consumables are removed.

In step **222**, the user empties first dust tray **116** and second dust tray **134**, installs a cleaned or new disposal catch mechanism **156**, replaces or refills optional internally or externally mounted delivery device and reinstalls removable cover **120** to prepare the device **100** for its next use.

In step **224**, the user returns forced air SSR device **100** to its storage location.

Step **226** is optional for a DC powered device. If the batteries used in the device **100** are rechargeable batteries, the user plugs forced air SSR device **100** or the batteries into an associated battery-recharging device.

FIG. **28** shows another embodiment of the device **100** of the present invention. In this embodiment, tray **183** slides out of the device body and cylindrical catch **156** is removed and replaced. The catch **156** has a cavity for fitting around a bar attached to the tray **183**.

FIG. **29** shows the embodiment of FIG. **28** in use by a user on a article **181** having a soft surface, for example, a couch.

It will be apparent to one skilled in the art that the key features of the device discussed above improve upon the ability to quickly and easily displace, dislodge, and dispose of dirt and to disinfect and freshen by the removal of germs, mites, and odors. Further, while the device of the present invention is primarily used for touchup cleaning, it can have a variety of other uses. For example, the device of the current invention can be modified for enhanced microbial control, stain removal, and deep cleaning.

As will be further appreciated by one skilled in the art, other mechanisms may also be added to improve the cleaning mechanism of the above described device, such as the use of acoustic means, thermal means, steam means and/or electrostatic means to dislodge dirt, hair and other unwanted foreign matter. For example, microbial control may be better managed by addition of acoustic means. Moreover, using an elec-

trostatic mechanism for touchup cleaning and freshening of fabric is also contemplated. In one embodiment, an ionizer may be added to freshen the air that travels through the cavity of the device.

The device may also be used as a special attachment for a vacuum specifically designed for cleaning upholstery or touch up cleaning. For example, key features from the device of the present invention may be incorporated into a handheld unit to form an extension to a common vacuum. Such vacuum extensions are easily detachable to the outermost end of the vacuum hose and are well known the art.

The device of the present invention is both economical and effective. The effectiveness of such a device may be calculated by special measurement diagnostics and metrics that measure the device's ability to displace, dislodge, and dispose of dirt and to disinfect and freshen by the removal of germs, mites, and odors. These include a variety of measurements.

As consumers are generally not familiar with such a device, objection to the present invention may be overcome by educating consumers in the use of such a device for soft surface remediation, particularly for touchup cleaning. The present invention encompasses a method of promoting the sale of such a device. The present invention further encompasses a method of promoting the sale of such a device by associating the device with the terms selected from the group consisting of remediator, soft surface remediator, Glade-ator, Zephyr, HoverBee, GlideAir, Oust and the like and combinations thereof.

The device may also include a mechanism that allows the user to see that the disposal catch mechanism is dirty and needs to be replaced or to hear that the disposal catch mechanism is full and needs to be changed. This may include a pressure alarm, a light sensor, a power sensor, a tri-color LED device or some other such device.

In another embodiment, the device may have attachable legs so that the device may be stationary for use also as an air filter, air purifier, fragrancer, a deodorizer, and/or remediator.

In yet another embodiment, the device has robotic systems to move the device along a surface without direct user interface.

Although the best mode contemplated by the inventor of carrying out the present invention is disclosed above, practice of the present invention is not limited thereto. It will be manifest that various additions, modifications and rearrangements of the features of the present invention may be made without deviating from the spirit and scope of the underlying inventive concept. For example, it should be noted that although the device of the present invention is preferably for use in the home, it also may be used during the furniture assembly process to clean the fabric and protect it before the furniture is assembled and the fabric is secured at the place thereon. Further, such a device can be used in furniture warehouse in showrooms to spruce up the furniture before it is put on display or before it is shipped to the purchaser. The device may also be used after the furniture has been used and is about to be discarded. For example, in some instances the fabrics, batting, foams, and other soft surfaces may be reused and recycled for other applications if they can properly be cleaned, disinfected, and renewed. The Applicant is unaware that any such device exists currently. Therefore, adapting the disclosed inventive device to this purpose could greatly aid in the recycling process.

In addition, the individual components disclosed herein need not be fabricated from the disclosed materials, but may be fabricated from virtually any suitable materials. Moreover, the individual components need not be formed in the disclosed shapes, or assembled in the disclosed configuration, but may be provided in virtually any shape, and assembled in virtually any configuration. Further, although several components are described herein as physically separate modules, it will be manifest that many components may be integrated into the apparatus with which it is associated. Furthermore, all the disclosed features of each disclosed embodiment may be combined with, or substituted for, the disclosed features of every other disclosed embodiment except where such features are mutually exclusive.

What is claimed is:

**1**. A hand held, forced air soft surface remediation device having

a housing defining at least a first and a second air channel, the air channels in fluid communication at both ends of the channels;

a cover removably attached to the housing;

a removable filter in fluid communication with at least one of the air channels;

a fan within the housing;

a motor attached to and configured to rotate the fan;

a means for assessing if the filter needs to be changed;

a pickup orifice in communication with the housing;

at least one dust tray in communication with one of the air channels;

at least one dislodging member mounted to a bottom surface of the housing;

at least one standoff mounted to the bottom surface of the housing and positioned between the first and second air channels;

a mechanism to introduce chemistry onto the surface in fluid communication with the fan.

**2**. The device of claim **1**, further comprising a handle configured to allow the user to move the housing from horizontal to vertical position.

**3**. An apparatus for cleaning a surface comprising

an outer shell defining at least a portion of a closed loop air flow system;

a reservoir for holding a chemistry that moves within the shell;

an impeller for creating within the shell a higher pressure air flow in a first direction and lower pressure in a second direction;

a motor for spinning the impeller; and

a retaining means for securing removable attachments to a bottom surface of the housing.

**4**. The device of claim **3**, further comprising a system for atomizing and delivering the chemistry to the surface and for then removing it from the surface.

**5**. The device of claim **4**, wherein the device creates at least one internal vortex for moving the chemistry within the housing.

**6**. The device of claim **4** wherein the chemistry remediates at least one of a: pillow, mattress, carpet, car interior, drape, window, floor, plumbing drain, insect habitat, and couch.

**7**. The device of claim **3**, further comprising a material delivery means in fluid communication with at least one air channel, and wherein the motor is driven by rechargeable battery power.

**8**. The device of claim **3**, wherein the device is configured to fit into the hand of a user; and

at least one integral corner pickup region adjacent the housing.

**9**. The device of claim **3**, further comprising a removable cover attached to the outer shell at a top, wherein the cover is at least one of: a screwed on cover, clip-on cover, and a transparent cover.

10. The device of claim 3, further comprising a disposable filter.

11. The device of claim 10, further comprising a mechanism that allows the user to see that the disposable filter is dirty and needs to be replaced.

12. The device of claim 10, further comprising a mechanism to allow the user to hear that the disposable filter is full and needs to be changed.

13. The device of claim 10, wherein the disposable filter is an easily removable and recyclable filter.

14. The device of claim 10, wherein the disposable filter is a HEPA filter.

15. The device of claim 3, wherein the chemistry includes at least one of the following: cleaners, odor eliminators, fresheners, protectants, herbicides, repellants, insecticides, antimicrobials, fragrances and disinfectants all of which may be in the form of liquids, gases, solids, gels and/or powders or combinations thereof.

16. The device of claim 3, wherein the chemistry includes at least one of: insecticide, herbicide, a fungicide, antimicrobial, drain cleaner, repellant, refresher, fragrance, and odor neutralizer.

17. The device of claim 3, wherein the motor is impervious to water so that the device can be used in areas containing liquids.

18. A cleaning device comprising

an outer housing,

an inner housing in communication with the outer housing,

a motor housing adjacent to the inner housing for housing a motor and fan assembly,

a first air channel with a first air outlet and a second air channel with a second air inlet in fluid communication with the inner housing and fan,

a return air channel in communication with at least one air channel,

at least one dust tray in communication with one of the air channels,

a replaceable catch mechanism in fluid communication with at least one air channel, and

a foam cleaner which after being first set down by an outward flow is then picked up by the device.

19. A cleaning device comprising

an outer housing,

an inner housing in communication with the outer housing,

a motor housing adjacent to the inner housing for housing a motor and fan assembly,

a first air channel with a first air outlet and a second air channel with a second air inlet in fluid communication with the inner housing and fan,

a return air channel in communication with at least one air channel,

at least one dust tray in communication with one of the air channels, and

a replaceable catch mechanism in fluid communication with at least one air channel, wherein:

a first dust tray is positioned substantially along a lower end of the second air channel and is connected to one of the outer, inner, or motor housings, and

a second dust tray is positioned substantially along an upper end of the second air channel and is connected to one of the outer, inner, or motor housings.

20. The device of claim 19 further comprising a removable catch mechanism disposed in at least one of the dust trays.

* * * * *