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(54) **Air filter**

Luftfilter

Filtre à air

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Description

[0001] The present invention relates to air extraction apparatus and a method of manufacturing a filter for air extraction apparatus.

[0002] Extraction systems for extracting and filtering air to remove air-entrained particulate matter and gases are known. Apparatus of this type is used in a wide variety of industrial situations such as, for example, in the electronics industry and in the pharmaceutical industry. Workstations on an assembly at which fume and/or dust generating operations are carried such as for example, the fabrication of electronic circuit boards, requires an extraction system. Fume extraction assemblies manufactured and sold by the present applicant under the trademark "Purex" include a number of articulating arm assemblies for different workstations, linked together by appropriate pipework to a pump and filter assembly.

[0003] Many filtering assemblies are known and it is also well recognised that a filter must be appropriate for the type of material that is being filtered from the air stream, the filter must provide the requisite degree of filtering and furthermore the filter must provide an operational period of sufficient length. Problems arise with many filtering systems of this type in that in order to provide an appropriate degree of filtering, it is possible that the life of the filter will be reduced. Similarly, if attempts are made to increase the operational lifetime of the filter it is likely that, at some stage, this will reduce the filtering efficiency.

[0004] GB 1436905 discloses a extraction filter apparatus comprising:

a filter including:

a constricted inlet for receiving contaminated air; and

a wall structure comprising a plurality of envelopes formed from porous material and having filtering side walls, each of said envelopes having at least one orifice cut from a filtering side wall and connected to an orifice of an adjacent envelope, a sidewall of any one envelope being configured to allow contact with a side wall of an adjacent envelope; and

chamber walls defining a chamber in which said filter is located and supported during filtering by a support structure.

[0005] According to the present invention, such an apparatus is characterised in that:

said support structure includes perforated panels (403,404,405) substantially surrounding said envelopes and attached to said chamber walls thereby defining passageways for air flow between said chamber walls and said perforated panels,

said support structure is configured to allow contact between adjacent envelopes; and

said filter and support structure are configured such that, during filtering the area of contact between adjacent envelopes is dependent on the number of envelopes included in the filter.

[0006] Thus, since the filter comprises a plurality of connected envelopes, it provides an increased surface filtering area when compared to filter-bags having a single compartment. Furthermore, since the area of contact between adjacent envelopes is dependent upon the number of envelopes in the filter, the support structure may be a simple structure which allows easy replacement of the filter.

[0007] In a preferred embodiment each said envelope comprises a first and second sheet of filtering material and the outer perimeter of said first sheet is connected to the outer perimeter of said second sheet. Preferably said sheets of filtering material are connected by stitching.

[0008] In a preferred embodiment the number of envelopes included in said filter and the dimensions of the support structure are such that during filtering the side walls of the envelopes contact with adjacent filtering side walls only in the vicinity of said orifices. Thus, substantially all of the filtering material of the filter is used during filtering, since the area of contact between adjacent filtering side walls is limited to the vicinity of the orifices. Preferably said number of envelopes is such that the filtering surface area of said filter is maximised.

In a preferred embodiment said envelope defines a compartment such that said connected orifices provide connection between said compartments, and said filter is configured such that in use a portion of air drawn into said inlet passes through all of said compartments.

[0009] In a preferred embodiment said filter is configured as a pre-filter and said apparatus includes a further filter configured to filter air received from said pre-filter.

[0010] In a preferred embodiment said support structure consists of perforated panels.

[0011] In a preferred embodiment said apparatus comprises walls defining a chamber and said support structure consists of perforated panels attached to said walls thereby defining passageways for air flow between said walls and said perforated panels.

[0012] In a preferred embodiment said apparatus is arranged to filter air extracted from electronic circuitry soldering apparatus.

[0013] In a preferred embodiment said apparatus is arranged to filter air which is contaminated with particles of plastics material.

[0014] The present invention also provides a method of manufacturing a filter for air extraction apparatus as defined in claim 1, wherein said method comprises the sequential steps of: (a) providing a plurality of sheets of a porous material arranged to collect contaminants; (b) defining an orifice in selected ones of said sheets; and (c) connecting pairs of said selected sheets around their

orifices to form subassemblies; and (d) connecting said subassemblies together to form a plurality of envelopes having filtering side walls such that each of said envelopes has at least one orifice connected to an orifice of an adjacent envelope.

[0015] In a preferred embodiment each of said envelopes comprises a first and second sheet of filtering material and the outer perimeter of said first sheet is connected to the outer perimeter of said second sheet. Preferably said sheets of filtering material are connected by a sewing process.

[0016] In a preferred embodiment said filter is configured to be located within a support means of an air extraction apparatus and said filter is formed from a particular number of envelopes such that during operation an adjacent pair of connected filtering side walls are in mutual contact only in the vicinity of connection. Preferably said particular number is such that the filtering surface of said filter is maximised.

[0017] In a preferred embodiment said filter is configured such that each of said envelopes defines a compartment such that said connected orifices provide connection between said compartments, and said filter is configured such that in use a portion of air drawn into said inlet passes through all of said compartments.

[0018] In a preferred embodiment the restricted inlet is defined by a connection means for connecting to an air inlet of said extraction apparatus, and said method includes the steps of: connecting one of said selected sheets to said connection means to form an inlet subassembly; and connecting said inlet subassembly to a one of said subassemblies to form an envelope of said filter.

Brief Description of the Several Views of the Drawings

[0019]

Figure 1 shows an air purification system in which purification arms **101, 102, 103** are connected to a centralised purification system **104** via a conduit **105;**
Figure 2 shows the purification system **104;**
Figure 3 shows a schematic representation of operations performed within the purification system **104;**
Figure 4 shows the purification system **104** with the lower door **205** open, allowing the pre-filter **401** to be accessed;
Figure 5 shows a schematic cross-sectional diagram of the pre-filter **401** located within the chamber **402**;
Figure 6 illustrates the first steps in manufacturing the pre-filter **401**;
Figure 7 shows the sheets **601** and **602** of *Figure 6* sewn together;
Figure 8 illustrates the final steps in manufacturing the pre-filter **401**;
Figure 9 shows the complete pre-filter **401**.

Best Mode for Carrying Out the Invention

Figure 1

[0020] An air purification system is illustrated in *Figure 1* in which purification arms **101, 102, 103** are connected to a centralised purification system **104** via a conduit **105.** The conduit **105** allows up to fifty purification arms to be connected. Alternatively, filter life can be enhanced by installing a multiple of cellular systems or, with fewer systems connected, higher velocity of purification may be performed.

[0021] The purification system **104** provides sufficient purification for filtered air to be vented to atmosphere via an exhaust vent **106.** Purification arms **101, 102** and **103** can be arranged to remove and purify hazardous fumes and dust from many processors **107,108** and **109** that create contaminants of this type, including chemical and biological treatments, manual and automated soldering, etching, marking and cutting metals and plastics, welding, laser processes and powder handling and packaging etc.

Figure 2

[0022] Purification system **104** is shown in *Figure 2* and comprises, in its base configuration, a stainless steel cabinet of a size substantially similar to that of the domestic fridge freezer. Contaminated air is received at an air inlet **201** and purified air is supplied to an air outlet (shown in *Figure 3).* An LCD display **203** indicates operating conditions, such as filterable filter capacity, gas sensing, particle sensing, days to next service and temperature warning indicator. The front panel also includes control buttons, including on and off switches.

[0023] An upper door **204** provides access to a main filter, while a lower door **205** provides access to a pre-filter, for the purposes of filter replacement.

Figure 3

[0024] A schematic representation of operations performed within the purification system **104** is shown in *Figure 3.* Air inlet **201** supplies contaminated air to a pre-filter **301,** that in turn supplies partially filtered air to a main filter **302** that in turn supplies relatively well filtered air to an exhaust filter **303.** The output from the exhaust filter **303** is then supplied to the exhaust outlet **306** via a continuous exhaust air monitoring unit **304** that sounds an audible alarm **305** if air quality drops between a predetermined level. The combination of the pre-filter **301,** main filter **302** and exhaust filter **303** facilitates careful matching to provide an optimum combination for the particular type of hazardous fumes and dust that are being removed from a contaminated air stream.

Figure 4

[0025] The purification system **104** is shown in *Figure 4* with the lower door **205** open allowing the pre-filter **401** to be accessed. The pre-filter **401** is located in a chamber **402** having an outlet (not shown) through which air is drawn from the chamber during operation. The air drawn from the chamber is subsequently drawn through the main filter **302.** Each of the six walls of chamber **402** has a perforated stainless steel panel fixed parallel to it, thereby defining six corresponding passageways through which air may flow. Thus, for example, the floor of the chamber has a perforated panel **403,** the left side wall has a perforated panel **404** and the inside of the door **205** has a perforated panel **405.** (The rear wall, right wall and ceiling each have a similar panel attached.) In the present embodiment the perforated panels are stainless steel sheets having an array of apertures. However, in an alternative embodiment the perforated panels are fabricated from a mesh material.

[0026] In operation, air is drawn from all sides of the pre-filter **401** through the perforations in the perforated panels, through the passageways defined by the perforated panels and out though the outlet. Thus, the perforated panels provide a support structure which maintains the location of the pre-filter while allowing air to be drawn from all around it.

[0027] The air inlet **201** comprises a pipe section fixed rigidly in the side wall of the chamber **402,** such that it allows air to enter the chamber.

[0028] The pre-filter **401** comprises a bag formed from a porous material arranged to collect airborne contaminants. The pre-filter has a constricted inlet comprising a pipe (detailed later in *Figure 8* and *9*) which is configured to be a good push fit within inlet pipe section **201.** Therefore, during operation of the purification system **104,** contaminated air enters the pre-filter from the air inlet **201,** and some of the larger particulate matter is collected by the filter while the pre-filtered air passes through the porous walls of the pre-filter and eventually escapes through the chamber's outlet.

[0029] During use, as the pre-filter fills with particulate matter, its porosity gradually reduces, and eventually the pre-filter must be replaced. To remove the used filter **401,** the pipe which forms its inlet is pulled and twisted from the inlet pipe **201,** and then the pre-filter is withdrawn from the chamber **402** and disposed of. A new pre-filter is then located in its operating position by the reverse procedure. Since the pre-filter is bag-like and has a restricted inlet, an operator replacing the filter is not exposed to its inner contaminated surface, and the contaminants contained within the used pre-filter are substantially maintained within it during the replacement process. Thus risks of contaminating the operator replacing the filter are reduced compared to other known filters which have an open configuration, such that the contaminated side of the filtering material is exposed to the operator.

[0030] When the purification system **104** is used to purify air extracted from some processes such as metal welding, the particles tend to enter the pre-filter **401** and fall towards the bottom of the bag, thus leaving the pores within the upper regions of the walls relatively free from contamination. However, when the system **104** is used to purify air extracted from certain other processes such as laser cutting or welding of plastics, or soldering of electronic circuitry by a wave soldering process or in a reflow oven process, the contaminant entrapped by the pre-filter tends to stick to all of its inner surfaces. Therefore, in such circumstances, the useful life of the pre-filter is proportional to its filtering surface area. The pre-filter **401** has a long useful life when compared to known bag-like pre-filters of comparable volume, since filter **401** has been configured to have a relatively large filtering surface area. Whereas known filter bags comprise substantially of one cube or cuboid compartment, the filter of the present application has a plurality of interconnected compartments defined by a series of envelopes such as envelopes **406** and **407.** Therefore, it is this structure of connected envelopes which provides the filter **401** with its large filtering area and subsequent long life.

Figure 5

[0031] A schematic cross-sectional diagram of the pre-filter **401** located within the chamber **402** is shown in *Figure 5.* As described above, the pre-filter **401** is supported by panels such as panels **403** and **404,** that are perforated to allow air to be drawn out from all around the pre-filter and out through chamber outlet **501.**

[0032] The air inlet pipe **201** of the purification system is fixed to the wall of the chamber by a screw threaded mechanism **502.** The pre-filter **401** includes an inlet pipe **503** which is a good push fit in pipe **201.** The filter **401** comprises a bag having a total of nine envelopes **406, 407, 504, 505, 506, 507, 508, 509** and **510** which each define one of the nine compartments **511** to **519** within the bag. Each of the envelopes **407** and **504** to **509** has an orifice within each of its two side walls of filtering material, to provide connection between its compartment and adjacent compartments on either side. Envelope **510** has an orifice **520** in just one of its sides walls, **539,** to allow communication between its compartment **519** and the compartment **518** of its only neighbouring envelope **509.** Envelope **406** has an orifice in each of its two side walls, **531** and **541:** the first orifice **521** being connected to the orifice of its adjacent envelope **407,** and the second orifice **522** being connected to a tube **523** of filtering material which is itself bonded to the inlet pipe **503.**

[0033] Thus the pre-filter has a series of connecting compartments, connected such that during use air entering the inlet pipe **503** of the pre-filter enters the first compartment **511** and a portion of that air passes through each of the compartments in the series before passing into the end compartment **519** and out through its side walls.

[0034] It should be understood, that during use air

passes through each of the filtering side walls of each of the envelopes. In this example of nine envelopes, the filter **401** has a total of 18 side walls, each of which has an area almost as large as the side walls of the chamber itself. The filtering surface of the filter **401** is therefore much larger than a cuboid shaped filter bag as previously known.

[0035] When considering the number of envelopes which should be included in the construction of a filter bag, such as pre-filter **401,** up to a limit, its filtering surface area is approximately proportional to the number of envelopes. However, the dimensions of the support structure which maintains the location of the filter should be considered. During use each envelope's side walls tend to balloon out towards a side wall of an adjacent envelope. For example, side wall **541** of envelope **406** tends to be brought closer to side wall **532** of envelope **407.** If too many envelopes are included in the construction of a filter, for use in a particular support structure, the side walls come into contact over a proportion of their area and that proportion is lost for filtering purposes. Therefore, it is preferable that the number of envelopes be such that during use the envelope side walls do not press against one another, i.e. the filtering side walls are only in contact with adjacent side walls in the vicinity of the connection between them. In this manner, substantially all of the surface area of each envelope is used for filtering.

[0036] In the present example, the pre-filter **401** is located in a support structure having an internal height of 360mm , a depth (from front to back) of 360mm and a width 360mm. Consequently, the pre-filter has envelopes having a length of 360mm and width 360mm to fit the support structure and it has nine envelopes, since this is the most envelopes which can fit across the width of the support structure without losing significant filtering surface due to the above described contacting of side walls. Thus pre-filter **401** has a number of envelopes which maximises the filtering area, given the dimensions of the support structure.

[0037] It should also be noted that the optimum number of envelopes also depends on the material from which the filter is constructed. In the present embodiment, the material used is relatively thick, but in an alternative embodiment, the pre-filter material is a filtering paper and consequently the optimum number of envelopes is increased.

[0038] The orifices connecting compartments of the filter **401** are located centrally in their respective side walls, and thus the orifices of all the envelopes fall along a straight horizontal line when the filter is located in the chamber **402.** However, in an alternative embodiment the orifices are all arranged equally off centre. In a further embodiment, the orifices are arranged such that air enters an envelope towards its upper end and exits towards its lower end, or enters at its lower end and exits towards its upper end.

Figure 6

[0039] The first steps in manufacturing the pre-filter **401** are illustrated in *Figure 6.* A sheet of material **601** is cut to a rectangular shape, (which in the present example is a 36 centimetre square), and a 7 centimetre circular orifice **611** is cut from its centre. A second sheet of material **602** having a orifice **612** is then cut to replicate sheet **601.** Each of the sheets **601** and **602** is a made from 20mm thick, EU grade 5 filter material. The filter material is non-woven polyester material, and it has a graded structure. That is, it presents a more open structure for use on the inside of the filter than on the outside. Therefore, during use, particles of varying sizes are entrapped at various levels throughout the thickness of the material, with larger particles being caught, on average, earlier than smaller particles. Thus the graded structure in effect provides for a larger filter capacity.

Figure 7

[0040] The sheets **601** and **602** of *Figure 6* are shown sewn together in *Figure 7*. Having cut out the two sheets **601** and **602,** the two sheets are sewn together by stitching **704** around the perimeter of their orifices, such that the two rectangular shapes are aligned, to form sub-assembly **701.** The contacting inner surfaces **702** and **703** of sub-assembly **701** represent a portion of the outer surface of the complete filter **401.**

Figure 8

[0041] The final steps in manufacturing the pre-filter **401** are illustrated in *Figure 8.* Sub-assembly **701** is replicated to produce sub-assemblies **802, 803, 804, 805, 806, 807** and **808.** Sub-assembly **701** is then attached to subassembly **802** by sewing together the outer perimeter of sheet **602** and outer perimeter of a sheet **811** of subassembly **802.** Thus a first envelope **407** of the filter is formed. In a similar manner, the other sheet **812** of subassembly **802** is then sewn to a sheet **813** of sub-assembly **803** to form a second envelope **504.** Thus in this manner the sub-assemblies are sewn together to form a chain. Therefore, in a similar manner sub-assembly **804** is sewn to subassembly **803** before the remaining subassemblies **805** to **808** are sewn onto the chain.

[0042] A rectangle of filter material **815** having the same dimensions as sheets **601** and **602** is then attached to the last sheet **816** of subassembly **808** in the chain. Again the attachment is made by sewing together the perimeters of sheets **815** and **816.**

[0043] An inlet subassembly is formed by first sewing the opposing edges of a smaller rectangle of filter material together to form the tube **523.** A further rectangular sheet **821** of filter material, cut to replicate sheet **601,** is then attached to the tube **523** by sewing one end of the tube **523** to the perimeter of the orifice of sheet **821.** A piece of pipe **503,** made from PVC (polyvinyl chloride) is then

bonded into the tube **523** using a solvent cement sold by Polypipe Plc, England. A portion of the pipe **503** is left exposed, since it is this which is subsequently used to connect the complete pre-filter to the air inlet **201** of the purification unit. Alternatively, an ABS (acrylonitrile-butadiene-styrene) pipe may be used in place of the PVC pipe.

[0044] The inlet subassembly is then attached to the sheet **601** of subassembly **701** by sewing around the outer perimeters of sheets **601** and **821,** and thus the pre-filter is completed.

[0045] In an alternative embodiment the filter material is an EU grade 5 filter paper and the individual sheets are connected using a suitable paper adhesive, such as silicone adhesive, or a hot melt adhesive, instead of by sewing.

Figure 9

[0046] The complete pre-filter **401** is shown in *Figure 9.* As shown in *Figure 9* stitching **901** connects and seals the outer perimeters of alternate sheets to form the series of envelopes **406, 407** and **504** to **510.** Thus the first sheet is connected to the second, the third sheet is connected to the fourth, etc. Similarly, stitching around the perimeters of the orifices of the sheets connects the orifices of adjacent envelopes.

Claims

1. Air extraction filter apparatus (104) comprising:

a filter (401) including:

a constricted inlet for receiving contaminated air; and
a wall structure comprising a plurality of envelopes (406,407) formed from porous material and having filtering side walls (531,541), each of said envelopes having at least one orifice (521) cut from a filtering side wall and connected to an orifice of an adjacent envelope, a sidewall of any one envelope being configured to allow contact with a side wall of an adjacent envelope; and chamber walls defining a chamber in which said filter is located and supported during filtering by a support structure (403,404,405) said apparatus being

characterised in that:

said support structure includes perforated panels (403,404,405) substantially surrounding said envelopes and attached to said chamber walls thereby defining passageways for air flow between said chamber walls and said perforated panels,
said support structure (403,404,405) is configured to allow contact between adjacent envelopes (406,407); and
said filter (401) and support structure are configured such that, during filtering, the area of contact between adjacent envelopes is dependent on the number of envelopes included in the filter.

2. Air extraction apparatus (104) according to claim 1, wherein each said envelope (406,407) comprises a first (601) and second (602) sheet of filtering material and the outer perimeter of said first sheet is connected to the outer perimeter of said second sheet by stitching (704).

3. Air extraction apparatus (104) according to claim 1 or claim 2, wherein the number of envelopes (406,407) included in the filter (401) and the dimensions of the support structure (403,404,405) are such that during filtering the side walls (531,541) of the envelopes contact with adjacent filtering side walls only in the vicinity of said orifices (521).

4. Air extraction apparatus (104) according to any one of claims 1 to 3, wherein each said envelope (406,407) defines a compartment (511-519) such that said connected orifices (521) provide connection between compartments, and said filter is configured such that in use a portion of air drawn into said inlet passes through all of said compartments.

5. Air extraction apparatus (104) according to any one of claims 1 to 4, wherein said filtering side walls (531,541) are formed from a material having a graded fibrous structure such that it has, in the flow direction of the air to be filtered, a more open structure.

6. Air extraction apparatus (104) according to any one of claims 1 to 4, wherein said filter (401) is configured as a pre-filter and said apparatus includes a further filter (302) configured to filter air received from said pre-filter.

7. Air extraction apparatus (104) according to any one of claims 1 to 6, wherein said apparatus is arranged to filter air extracted from electronic circuitry soldering apparatus.

8. Air extraction apparatus (104) according to any one of claims 1 to 7, wherein said apparatus is arranged to filter air which is contaminated with particles of plastics material.

9. A method of manufacturing a filter (401) for air extraction filter apparatus (104) according to any one of claims 1 to 8, wherein said method comprises the

sequential steps of:

(a) providing a plurality of sheets (601,602) of a porous material arranged to collect contaminants;
(b) defining an orifice (611,612) in selected ones of said sheets;
(c) connecting pairs of said selected sheets around their orifices to form sub-assemblies (701); and
(d) connecting said sub-assemblies together at the outer perimeter of the selected sheets to form a plurality of envelopes (406,407) having filtering side walls such that each of said envelopes has at least one orifice connected to an orifice of an adjacent envelope.

Patentansprüche

1. Luftabsaugfiltervorrichtung (104), umfassend:

einen Filter (401), umfassend:

einen verengten Einlass zum Aufnehmen von verunreinigter Luft; und
eine Wandstruktur, umfassend eine Vielzahl von Hüllen (406, 407), die aus durchlässigem Material gebildet sind und filternde Seitenwände (531, 541) aufweisen, wobei jede der Hüllen zumindest eine Öffnung (521) aufweist, die aus einer filternden Seitenwand ausgeschnitten und mit einer Öffnung einer benachbarten Hülle verbunden ist, wobei eine Seitenwand jeder der Hüllen dazu ausgebildet ist, den Kontakt mit einer Seitenwand einer benachbarten Hülle zu ermöglichen; und
Kammerwände, die eine Kammer definieren, in der sich der Filter befindet und während des Filterns von einer Tragestruktur (403, 404, 405) getragen wird, wobei die Vorrichtung **dadurch gekennzeichnet ist, dass**:

die Tragestruktur perforierte Paneele (403, 404, 405) umfasst, welche die Hüllen im Wesentlichen umgeben und an den Kammerwänden befestigt sind, wodurch Durchgänge für den Luftstrom zwischen den Kammerwänden und den perforierten Paneelen definiert werden,
die Tragestruktur (403, 404, 405) dazu ausgebildet ist, den Kontakt zwischen benachbarten Hüllen (406, 407) zu ermöglichen; und
der Filter (401) und die Tragestruktur solcherart gestaltet sind, dass die Kontaktfläche zwischen benachbarten Hüllen während des Filterns von der Anzahl der in dem Filter enthaltenen Hüllen abhängig ist.

2. Luftabsaugvorrichtung (104) nach Anspruch 1, wobei jede der Hüllen (406, 407) einen ersten (601) und zweiten (602) Bogen Filtermaterial aufweist und der Außenumfang des ersten Bogens mit dem Außenumfang des zweiten Bogens durch Nähen (704) verbunden ist.

3. Luftabsaugvorrichtung (104) nach Anspruch 1 oder Anspruch 2, wobei die Anzahl der in dem Filter (401) enthaltenen Hüllen (406, 407) und die Dimensionen der Tragestruktur (403, 404, 405) solcherart ausgebildet sind, dass die Seitenwände (531, 541) der Hüllen während des Filterns die benachbarten filternden Seitenwände nur in der Nähe der Öffnungen (521) kontaktieren.

4. Luftabsaugvorrichtung (104) nach einem der Ansprüche 1 bis 3, wobei jede Hülle (406, 407) solcherart ein Abteil (511-519) definiert, dass die verbundenen Öffnungen (521) eine Verbindung zwischen den Abteilen bereitstellen, und der Filter solcherart gestaltet ist, dass bei Verwendung ein Teil der in den Einlass gesogenen Luft durch alle Abteile hindurchströmt.

5. Luftabsaugvorrichtung (104) nach einem der Ansprüche 1 bis 4, wobei die filternden Seitenwände (531, 541) aus einem Material gebildet sind, das eine abgestufte Faserstruktur aufweist, so dass es, in der Flussrichtung der zu filternden Luft, eine offenere Struktur hat.

6. Luftabsaugvorrichtung (104) nach einem der Ansprüche 1 bis 4, wobei der Filter (401) als Vorfilter ausgebildet ist und die Vorrichtung einen weiteren Filter (302) umfasst, der dazu ausgebildet ist, von dem Vorfilter empfangene Luft zu filtern.

7. Luftabsaugvorrichtung (104) nach einem der Ansprüche 1 bis 6, wobei die Vorrichtung dazu eingerichtet ist, aus einer Lötvorrichtung für elektronische Schaltungen abgesaugte Luft zu filtern.

8. Luftabsaugvorrichtung (104) nach einem der Ansprüche 1 bis 7, wobei die Vorrichtung dazu eingerichtet ist, mit Partikeln aus Kunststoffmaterial verunreinigte Luft zu filtern.

9. Verfahren zum Herstellen eins Filters (401) für eine Luftabsaugfiltervorrichtung (104) nach einem der Ansprüche 1 bis 8, wobei das Verfahren die aufeinanderfolgenden Schritte umfasst:

(a) Bereitstellen einer Vielzahl von Bögen (601, 602) eines durchlässigen Materials, eingerichtet zum Auffangen von Verunreinigungen;
(b) Definieren einer Öffnung (611, 612) in ausgewählten Bögen;
(c) Verbinden von Paaren der ausgewählten Bögen um ihre Öffnungen herum, um Teilbaugruppen (701) zu bilden; und
(d) Verbinden der Teilbaugruppen miteinander an dem Außenumfang der ausgewählten Bögen, um solcherart eine Vielzahl von Hüllen (406, 407) mit filternden Seitenwänden zu bilden, dass jede der Hüllen zumindest an einer Öffnung mit einer benachbarten Hülle verbunden ist.

Revendications

1. Appareil (104) à filtre d'extraction d'air, comportant :

un filtre (401) comprenant :

une entrée resserrée destinée à recevoir de l'air contaminé ; et
une structure de parois comportant de multiples enveloppes (406, 407) formées d'une matière poreuse et ayant des parois latérales filtrantes (531, 541), chacune desdites enveloppes ayant au moins un orifice (521) découpé dans une paroi latérale filtrante et raccordé à un orifice d'une enveloppe adjacente, une paroi latérale d'une enveloppe quelconque étant configurée pour permettre un contact avec une paroi latérale d'une enveloppe adjacente ; et
des parois de chambre définissant une chambre dans laquelle ledit filtre est placé et supporté pendant une filtration par une structure de support (403, 404, 405) ; ledit appareil étant **caractérisé en ce que :**

ladite structure de support comporte des panneaux perforés (403, 404, 405) entourant sensiblement lesdites enveloppes et reliés auxdites parois de la chambre, définissant ainsi des passages pour un écoulement d'air entre lesdites parois de la chambre et lesdits panneaux perforés,
ladite structure de support (403, 404, 405) est configurée pour permettre un contact entre des enveloppes adjacentes (406, 407) ; et
ledit filtre (401) et ladite structure de support sont configurés de manière que, pendant une filtration, l'étendue du contact entre des enveloppes adjacentes dépend du nombre d'enveloppes incluses dans le filtre.

2. Appareil d'extraction d'air (104) selon la revendication 1, dans lequel chaque enveloppe (406, 407) comporte des première (601) et seconde (602) feuilles de matière filtrante et le périmètre extérieur de ladite première feuille est relié par une couture (704) au périmètre extérieur de ladite seconde feuille.

3. Appareil d'extraction d'air (104) selon la revendication 1 ou la revendication 2, dans lequel le nombre d'enveloppes (406, 407) incluses dans le filtre (401) et les dimensions de la structure de support (403, 404, 405) sont tels que, pendant une filtration, les parois latérales (531, 541) des enveloppes entrent en contact avec des parois latérales de filtration adjacentes uniquement au voisinage desdits orifices (521).

4. Appareil d'extraction d'air (104) selon l'une quelconque des revendications 1 à 3, dans lequel chaque enveloppe (406, 407) définit un compartiment (511-519) tel que lesdits orifices raccordés (521) établissent une communication entre des compartiments, et ledit filtre est configuré de manière que, lors de l'utilisation, une partie de l'air aspiré dans ladite entrée passe à travers tous lesdits compartiments.

5. Appareil d'extraction d'air (104) selon l'une quelconque des revendications 1 à 4, dans lequel lesdites parois latérales filtrantes (531, 541) sont formées d'une matière ayant une structure fibreuse calibrée telle qu'elle présente une structure plus ouverte dans le sens d'écoulement de l'air devant être filtré.

6. Appareil d'extraction d'air (104) selon l'une quelconque des revendications 1 à 4, dans lequel ledit filtre (401) est configuré en un préfiltre et ledit appareil comprend un autre filtre (302) configuré pour filtrer l'air reçu dudit préfiltre.

7. Appareil d'extraction d'air (104) selon l'une quelconque des revendications 1 à 6, lequel appareil est agencé pour filtrer de l'air extrait d'un appareil de soudage de circuits électroniques.

8. Appareil d'extraction d'air (104) selon l'une quelconque des revendications 1 à 7, lequel appareil est agencé pour filtrer de l'air qui est contaminé par des particules de matière plastique.

9. Procédé de fabrication d'un filtre (401) pour un appareil (104) à filtre d'extraction d'air selon l'une quelconque des revendications 1 à 8, ledit procédé comprenant les étapes successives qui consistent à :

(a) utiliser plusieurs feuilles (601, 602) d'une matière poreuse, agencées pour collecter des contaminants ;
(b) définir un orifice (611, 612) dans certaines, choisies, desdites feuilles ;
(c) raccorder des paires desdites feuilles choisies autour de leurs orifices pour former des sous-ensembles (701) ; et
(d) raccorder ensemble lesdits sous-ensembles au périmètre extérieur des feuilles choisies afin de former plusieurs enveloppes (406, 407) ayant des parois latérales filtrantes telles que chacune desdites enveloppes a au moins un orifice raccordé à un orifice d'une enveloppe adjacente.

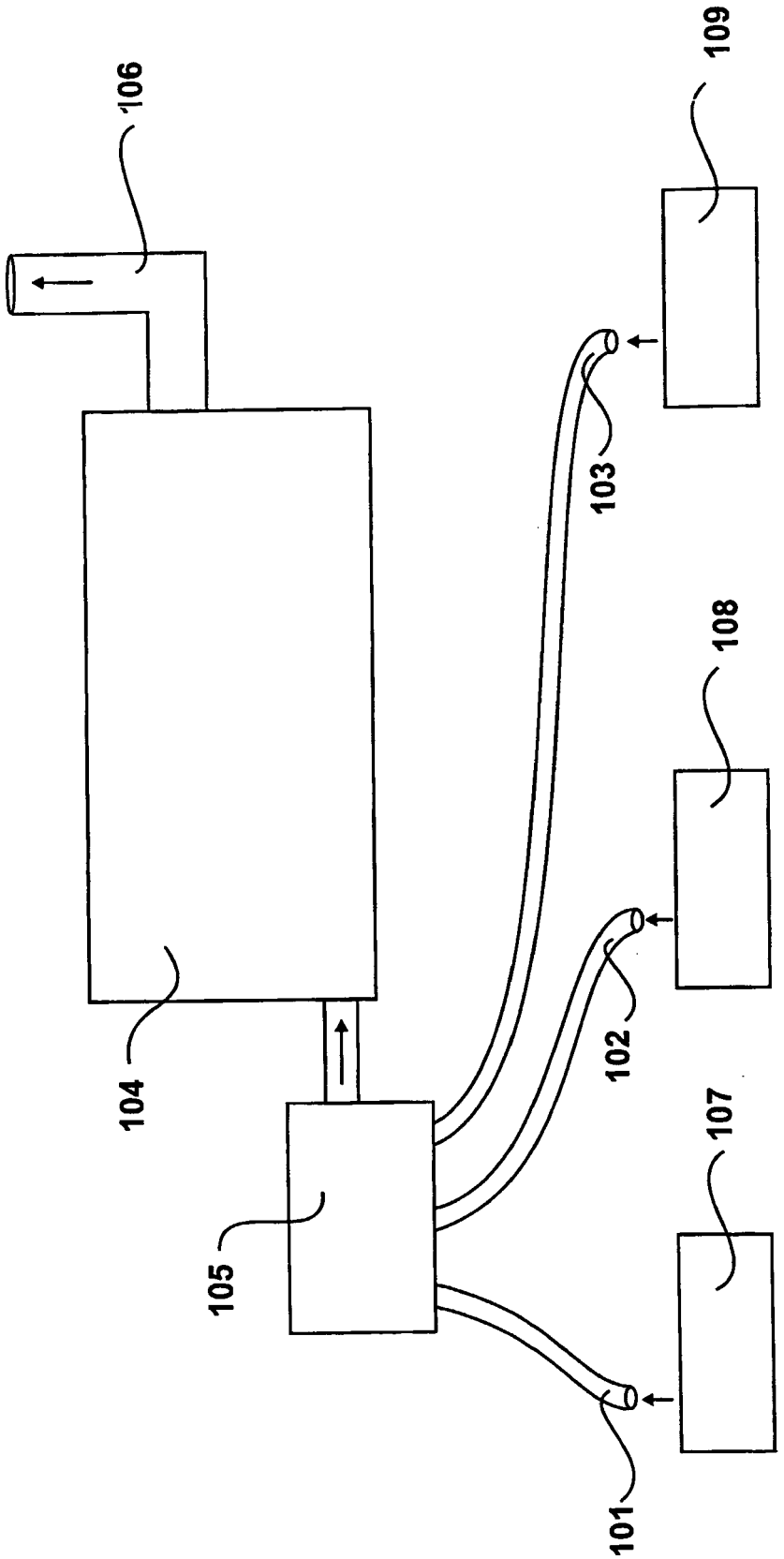

Figure 1

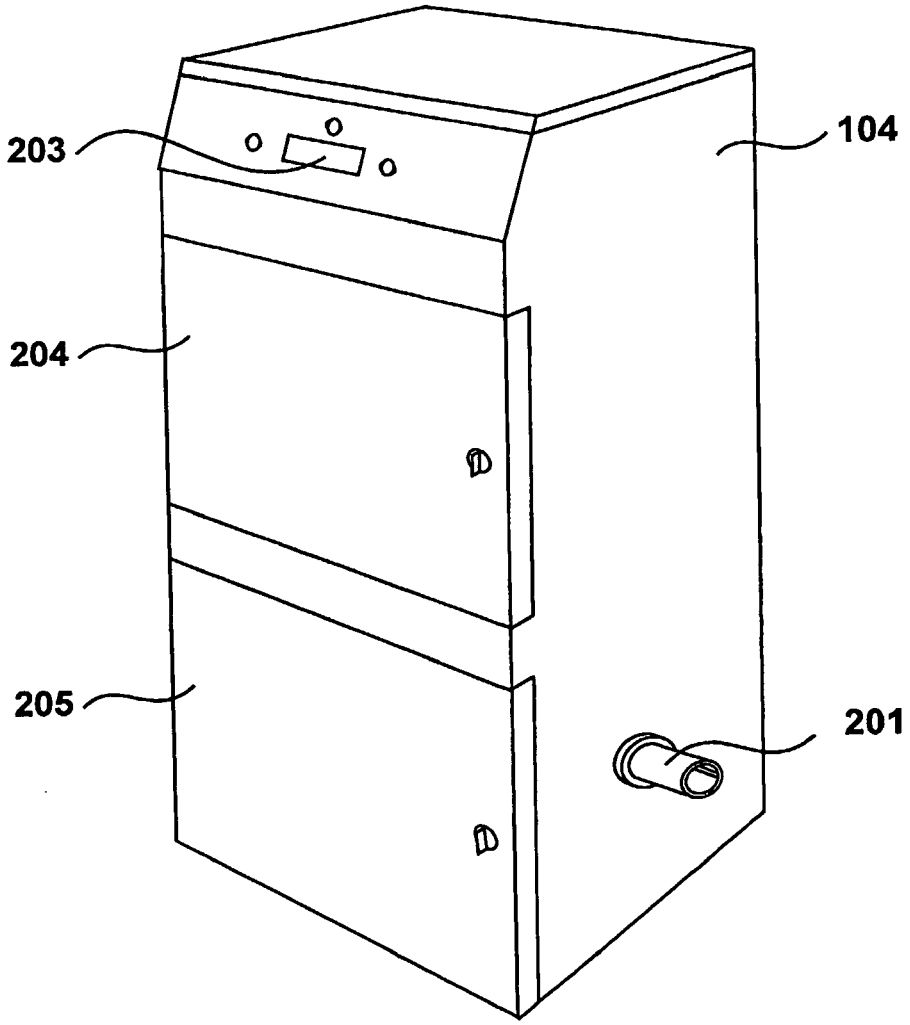

Figure 2

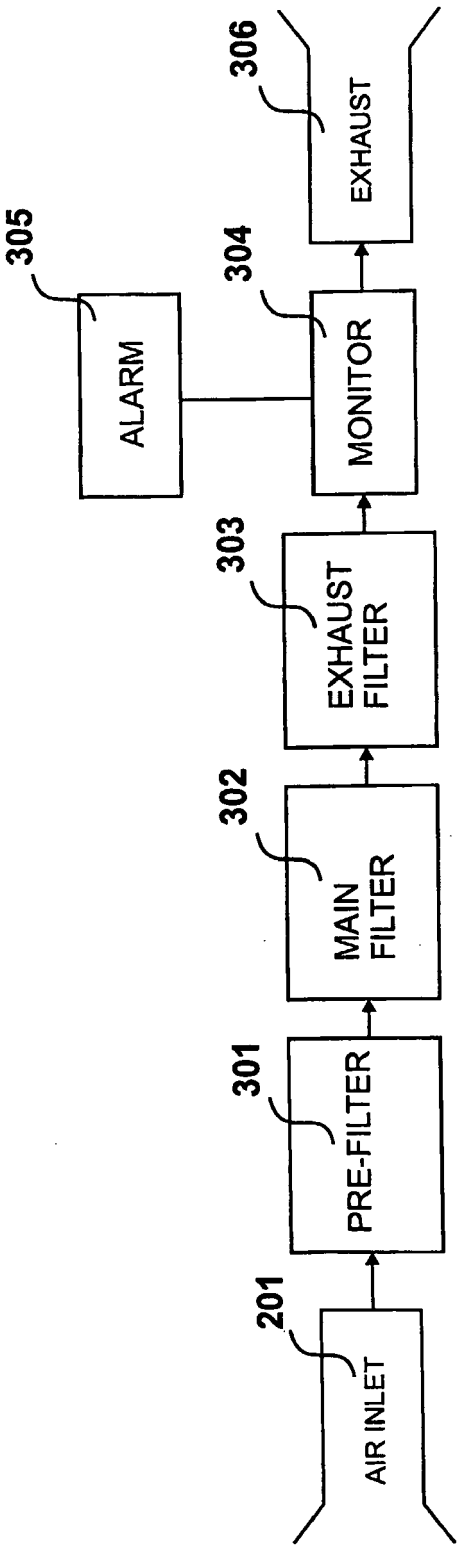
AIR INLET
201
PRE-FILTER
301
MAIN FILTER
302
EXHAUST FILTER
303
MONITOR
304
ALARM
305
EXHAUST
306

Figure 3

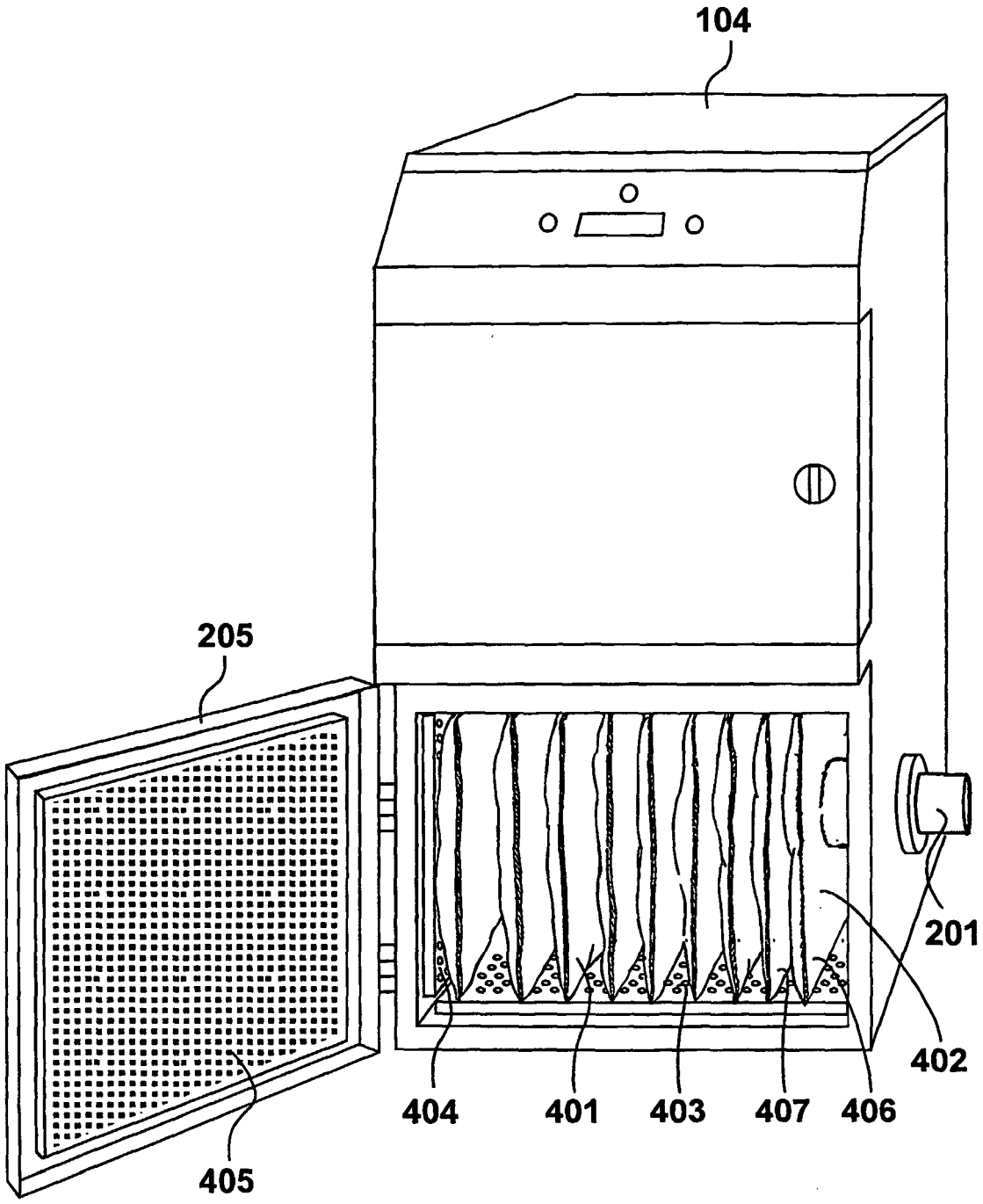

Figure 4

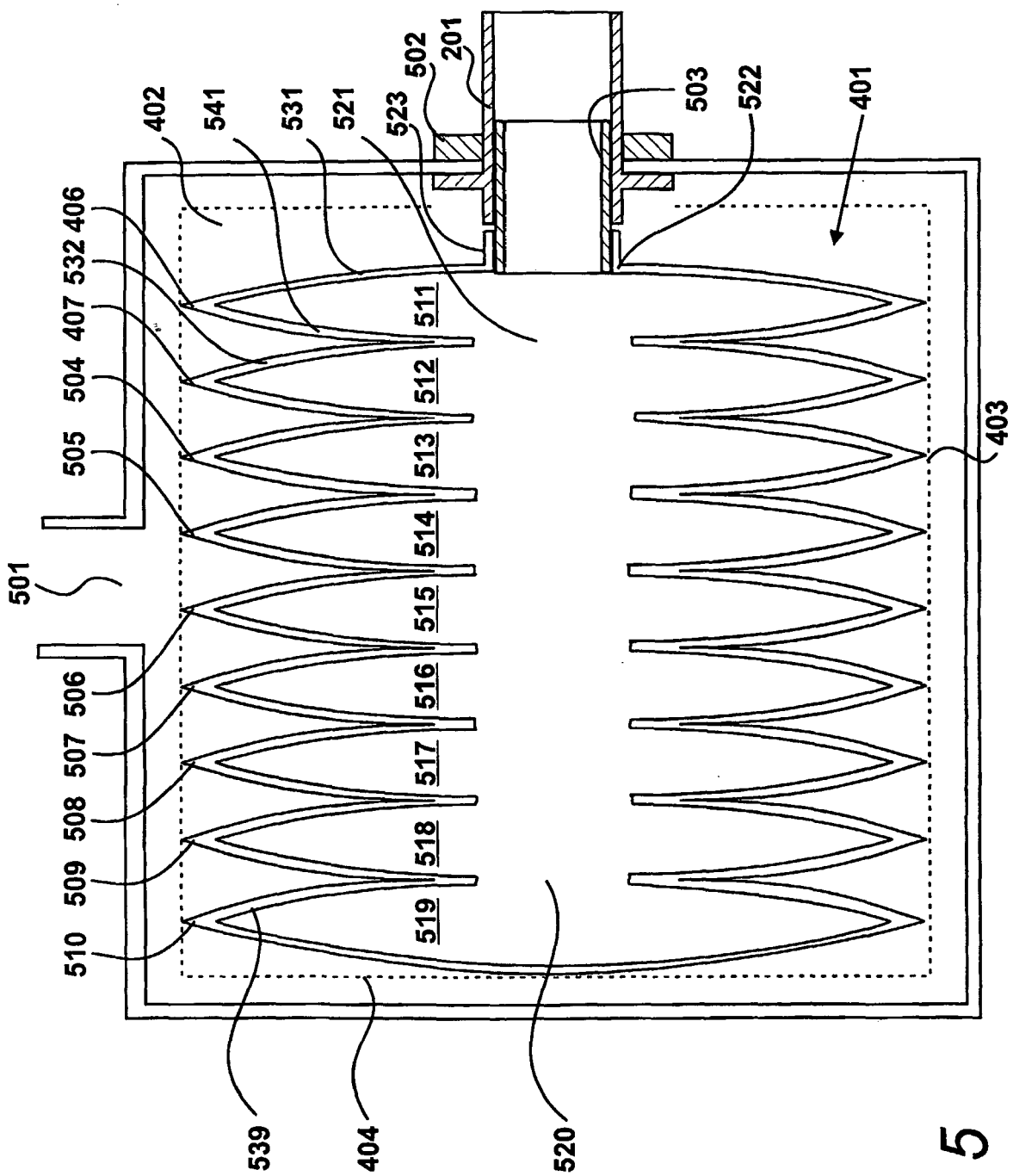
201
502
503
522
401
402
541
531
521
523
406
532
407
504
505
501
506
507
508
509
510
511
512
513
514
515
516
517
518
519
403
539
404
520

Figure 5

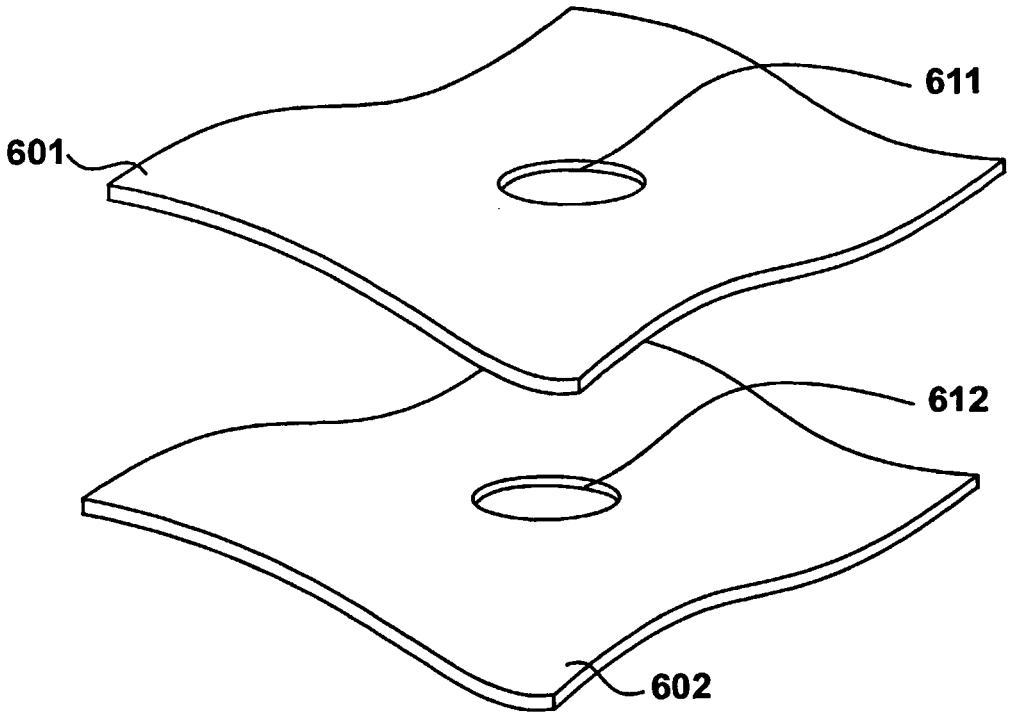

Figure 6

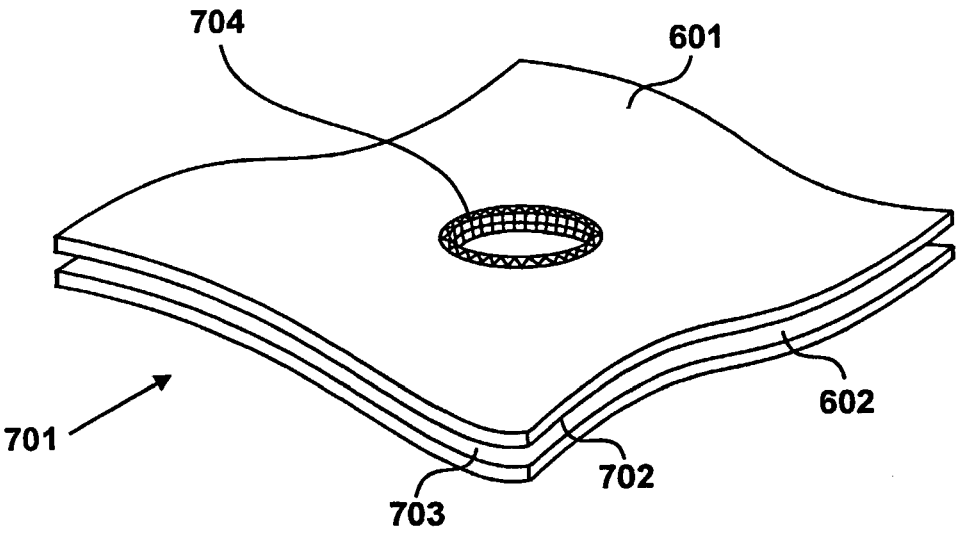

Figure 7

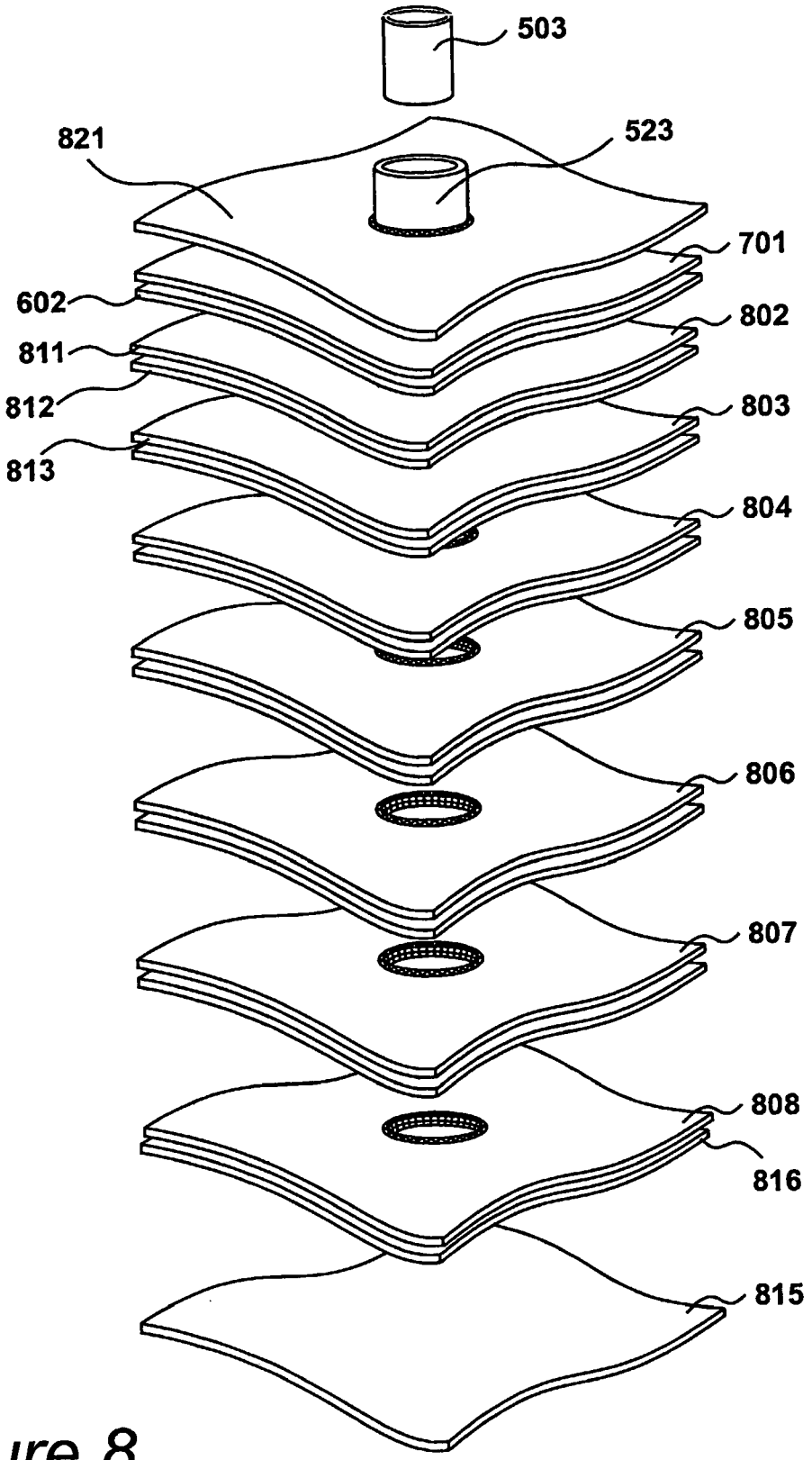
503
821
523
701
602
802
811
803
812
804
813
805
806
807
808
816
815

Figure 8

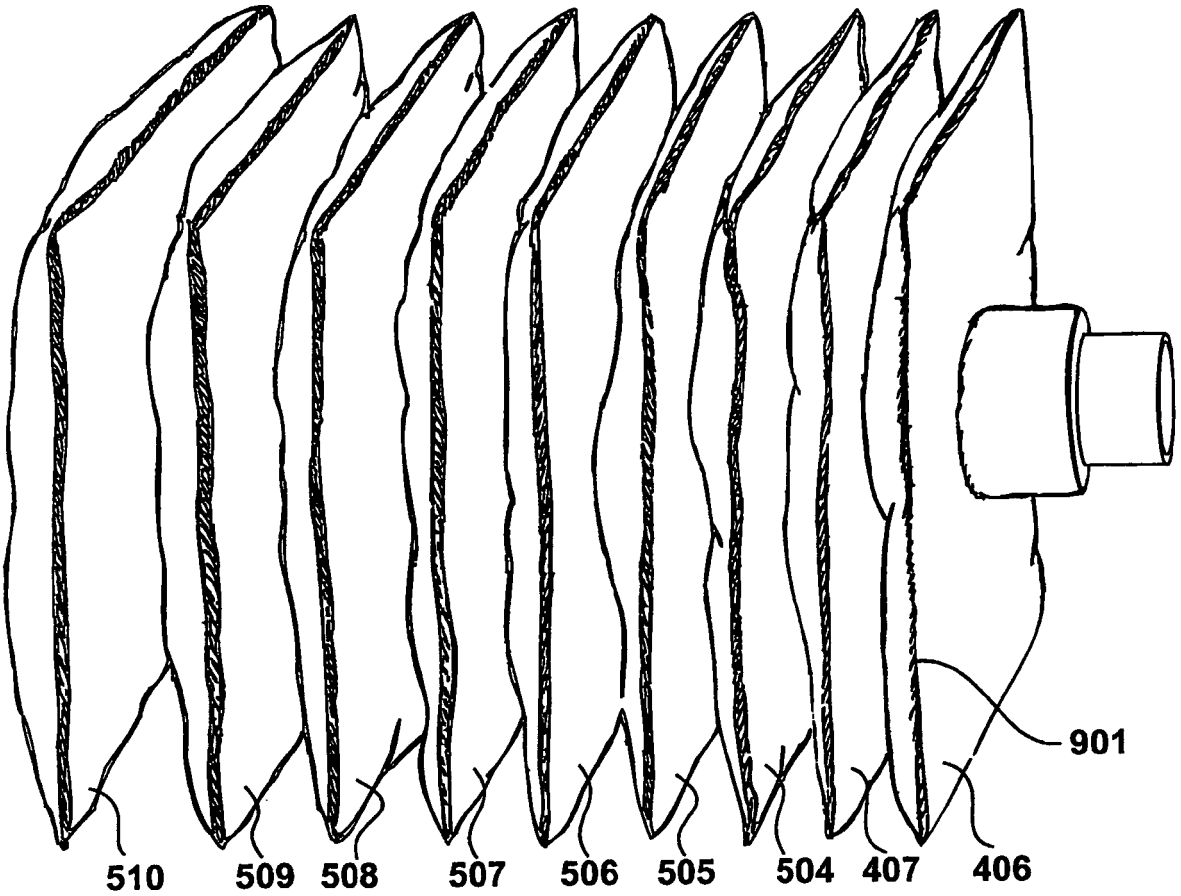

Figure 9

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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