



- (51) **International Patent Classification:**
B01D 35/027 (2006.01)
- (21) **International Application Number:**
PCT/IB2012/050934
- (22) **International Filing Date:**
28 February 2012 (28.02.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
1154030 10 May 2011 (10.05.2011) FR
1251004 2 February 2012 (02.02.2012) FR
- (71) **Applicant** (for all designated States except US): **FILTER-TEK** [FR/FR]; ZA du Pré de la Dame Jeanne, F-60128 Plailly (FR).
- (72) **Inventors; and**
- (75) **Inventors/Applicants** (for US only): **COUTY, Franck** [FR/FR]; 51 rue Jean Giraudoux, F-95130 Le Plessis Bouchard (FR). **CHANTOME, Isabelle** [FR/FR]; 14 rue des Pointes, F-95110 Sannois (FR).
- (74) **Agent:** **SANTARELLI**; BP 237, 14 avenue de la Grande-Armée, F-75822 Paris Cedex 17 (FR).

(81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) **Title:** FLUID FILTRATION UNIT

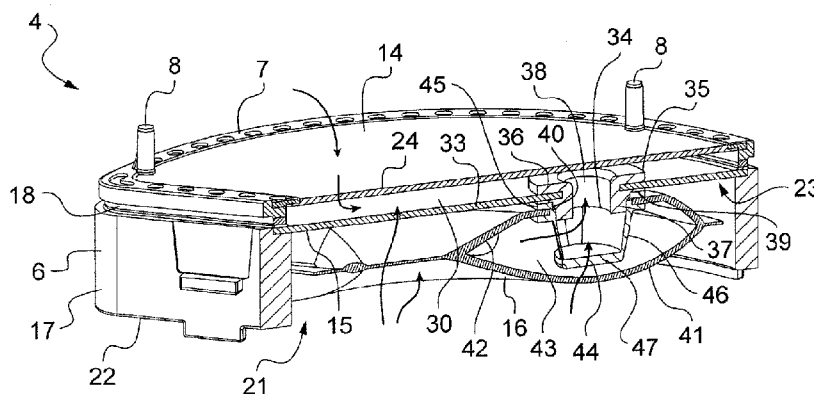


Fig. 6

(57) **Abstract:** The invention relates to a fluid filtration unit comprising a support (6, 7), a first flat filter member (14) and a second flat filter member (15) which are each mounted on said support (6, 7) facing each other and defining between them a space forming an outlet chamber (30) for a filtered fluid with fluid communication to this chamber being exclusively through themselves, a third filter member (16) in bag form mounted on said support (6, 7) and having an internal filtration chamber (43) provided with a first opening (34) for passage of a fluid opening into a communicating tube (35) of the fluid filtration unit, which tube is open by a second opening (38) for passage of said fluid through said second flat filter member (15).



FLUID FILTRATION UNIT

The invention relates to filtration units for fluids, in particular liquid
5 additives for motor vehicle exhaust systems.

The invention also relates to systems provided with such fluid
filtration units, and groups of filtration units provided with such fluid filtration
units.

It is known that motor vehicle exhaust systems are in a standard
10 fashion provided with catalytic converters, also called catalysers. The latter are
configured to reduce by catalysis the unburned pollutant exhaust gases,
typically carbon monoxide, hydrocarbons and nitrogen oxide. In an engine, the
higher the combustion temperature, the more the formation of nitrogen oxide is
promoted. Catalytic converters help to degrade a major part of the pollutant
15 gases but, because of changes in pollution control standards "EURO", there is a
risk that they will no longer be sufficient.

In order to satisfy these antipollution standards, most vehicle
manufacturers opt for a technology of selective catalytic reduction (SCR) of
nitrogen oxide (NOx). This selective catalytic reduction technology is based on
20 the injection of a fluid additive, known by the name AdBlue™, into the exhaust
system.

This fluid additive is an aqueous solution of synthetic urea that, under
the effect of temperature, is converted to ammonia, which in the presence of a
catalytic converter (or catalyst), converts the nitrogen oxides (NOx) into water
25 vapour and nitrogen which are harmless to the environment.

This fluid additive is carried in an independent tank, generally close
to the fuel tank.

This fluid additive, just like engine and transmission fuel and oils in
particular, requires filtering before use, i.e. in this case before injection into the
30 silencer using a metering pump.

Fluid filtration units for motor vehicle exhaust systems are already known, comprising a support, a flat filter member and a conical filter member which are mounted on the support and arranged facing each other.

These two filter members are used in combination and have a dirt holding capacity (DHC) which allows these filtration units to be used in light motor vehicles, i.e. having small-capacity internal combustion engines.

The invention aims to provide a fluid filtration unit offering a greater dirt holding capacity, with this filtration unit which is particularly simple, convenient and economical.

10 A subject of the invention is therefore, in a first aspect, a fluid filtration unit comprising a support, a first flat filter member and a second flat filter member, each mounted on said support facing each other, characterized in that it further comprises a third filter member having the form of a bag mounted on said support and a communicating tube, with said first member and said
15 second member being configured such that they define between them a space forming an outlet chamber for a filtered fluid and being configured to allow a fluid communication to said outlet chamber exclusively through themselves, with said third filter member having an internal filtration chamber provided with a first outlet opening for a fluid into said communicating tube, and with said tube being
20 open by a second outlet opening for said fluid through said second flat filter member.

The filtration unit according to the invention makes it possible to offer a filtration unit having a particularly long life span, without maintenance.

25 The combination of the third filter member in bag form with the second flat filter member in fact makes it possible to increase the dirt retention capacity of the filtration unit.

This combination is particularly convenient in comparison with a filter member of the folded type used alone, which would itself also make it possible to increase the dirt holding capacity.

30 In fact, the production of a folded filter member is complex since it is necessary to fold the fabric forming the filtration surface before cutting it to the desired dimensions (the reverse being even more complicated due to the

fibrous material with a variable density which is used, which does not by itself retain the shape given to it). The cutting can be done by temporarily folding the fabric but the elasticity is then lost, or by gripping the folds but the cut is then not clean.

5 Moreover, the automatic production of such folded filter members is difficult, in particular when the latter are automatically loaded.

 It should be noted that such a filter member in bag form has a filtration surface area which is smaller than that of a folded filter member. However, the folds of a folded filter member are not all used in the same
10 manner, so that the dirt holding capacity is not homogeneous over the whole surface area of the folded filter member, whereas the dirt holding capacity is substantially homogeneous over the entire filtration surface of the filter member in bag form.

 The filtration unit according to the invention makes it possible to offer
15 a utilization which is particularly simple, convenient and economical.

 The filtration unit according to the invention is moreover compatible with an exhaust system provided with a catalytic converter and configured to implement the technology of selective catalytic reduction by the injection of a fluid additive. In fact, the filtration unit according to the invention is compatible
20 with a tank of such a fluid additive.

 The filtration unit according to the invention is moreover particularly useful for this purpose since, in the light of current and future antipollution standards, the majority of vehicle manufacturers equip the latter with such reservoirs of fluid additives to be injected into the vehicle exhaust system, and
25 therefore to be filtered prior to injection via the filtration unit according to the invention.

 As the filtration unit according to the invention offers the advantage of having a capacity which is particularly large, this unit might not require any maintenance throughout the life span of the vehicle.

30 The filtration unit according to the invention is therefore particularly simple, convenient and economical.

The invention also relates to a fluid filtration unit comprising a support, a first flat filter member and a second flat filter member each mounted on said support facing each other, characterized in that it further comprises a third filter member having the form of a bag mounted on said support facing
5 said second flat filter member, so that the latter is interposed between said first flat filter member and said third filter member in bag form, and a communicating tube, with said first member and said second member being configured so that they define between them a space forming an outlet chamber for a filtered fluid and being configured to allow a fluid communication to said outlet chamber
10 exclusively through themselves, with said third filter member having an internal filtration chamber provided with a first outlet opening for said filtered fluid opening into said communicating tube, and with said tube being open by a second outlet opening for said filtered fluid into said outlet chamber for said filtered fluid.

15 The invention also relates to a fluid filtration unit comprising a support, a first flat filter member and a second flat filter member each mounted on said support facing each other, characterized in that it further comprises a third filter member having the form of a bag mounted on said support and interposed between said first flat filter member and said second flat filter
20 member, and a communicating tube, with said first member and said second member being configured so that they define between them a space forming an outlet chamber for a filtered fluid and being configured to allow a fluid communication to said outlet chamber exclusively through themselves, with said third filter member having an internal filtration chamber arranged in said outlet
25 chamber and provided with a first inlet opening for a fluid to be filtered opening into said communicating tube and with said tube being open by a second opening out of said outlet chamber.

If appropriate, said tube therefore opens by its second opening out of the internal space of said support.

30 According to preferred, simple, convenient and economical characteristics of the filtration unit according to the invention:

- said first flat filter member has a first filtration surface and said second flat filter member has a second filtration surface and comprises said communicating tube, and said fluid communication to said outlet chamber is carried out exclusively through said first filtration surface and/or said second filtration surface and/or said communicating tube;
5
- said second filter member and said third filter member are fastened to a common stay;
 - said common stay is formed as a single part with said second filter member, which makes the filtration unit particularly simple and convenient;
- 10 - said stay is formed by a ring situated on a second filtration surface of said second filter member and said third filter member is configured to be mounted on said ring;
 - said ring has an internal space opening at its ends and forms said communicating tube;
- 15 - said ring is of substantially cylindrical shape with a first flat tubular portion engaged with said second filtration surface of said second filter member and a second tubular portion on which said third filter member is configured to be mounted;
 - said third filter member comprises an anchorage device configured
20 to be fastened to said communicating tube and in which is formed said first outlet opening for said filtered fluid;
 - said third filter member comprises several walls forming an envelope defining said internal filtration chamber and a spacing device configured to hold said walls apart;
- 25 - said anchorage device and said spacing device are formed as a single piece;
 - said spacing device is provided with at least one arm which extends into said internal chamber and which bears a plurality of fins configured to guide the filtered fluid;
- 30 - the unit is formed by a first part comprising said first filter member and by a second part comprising said second filter member, said third filter

member and said communicating tube, with said first part and said second part being fastened together;

- said support comprises an outlet channel extending from said outlet chamber to an outlet connection for said filtered fluid, said outlet channel
5 delimiting an internal space open to said outlet chamber by at least one third outlet opening for said filtered fluid and being open through said outlet connection by at least one fourth outlet opening for said filtered fluid;

- said support is formed by an envelope having a partly cylindrical wall with a closed outline and provided with an edge at the location of which is
10 mounted said second filter member, said wall being configured to surround said third filter member; and by a frame on which is mounted said first filter member, which frame is mounted on said edge of said wall; and/or

- the unit comprises a fourth filter member having the form of a bag mounted on said support and another communicating tube, with said fourth filter
15 member having an internal filtration chamber provided with a first outlet opening for a fluid into said communicating tube, and with said tube being open by a second outlet opening for said fluid through said first flat filter member.

A subject of the invention is also, in a second aspect, a system comprising a tank configured to receive a fluid to be filtered, a unit as described
20 above and a pump provided with an inlet connection configured to be connected to an outlet connection for filtered fluid from said filtration unit, which is configured so that said first filter member, second filter member and third filter member are immersed in said tank.

By means of the filtration unit of the system according to the
25 invention, it is particularly advantageous to use the latter for the filtration of various fluids such as in particular fluid additives, for example of the AdBlue™ type, for vehicle exhaust systems, or transmission or vehicle engine lubricants, or also vehicle fuels.

In a third aspect the invention also relates to a group of filtration
30 units, comprising a first filtration unit as described above and a second filtration unit comprising a support identical to the support of said first filtration unit, a first flat filter member identical to the first flat filter member of said first filtration unit,

a second flat filter member identical to the second flat filter member of said first filtration unit; said second filtration unit having no third filter member.

Such a group can therefore be produced in a particularly simple, convenient and economical manner, the main components of the filtration units
5 being identical.

Moreover, this group makes it possible to very simply adapt the dirt holding capacity according to need, by mounting or not mounting the third filter member in bag form.

According to preferred, simple, convenient and economical features
10 of the group according to the invention, said second filtration unit has a communicating tube identical to the communicating tube of said first filtration unit, with said communicating tube having, in its internal space, a portion of filtration fabric of said second flat filter member.

The disclosure of the invention now continues with a description of
15 embodiment examples, given hereafter by way of illustration and not limitative, and with reference to the attached drawings, in which:

- Figure 1 diagrammatically represents a motor vehicle exhaust system comprising in particular a fluid tank and a filtration unit for this fluid according to a first embodiment;
- 20 - Figures 2 and 3 diagrammatically represent, in perspective, the filtration unit visible in Figure 1 in isolation, from different viewing angles making it possible to see the top and bottom of this filtration unit;
- Figures 4 and 5 diagrammatically represent, in perspective, the filtration unit visible in Figure 1 in an exploded view, from different viewing
25 angles making it possible to see the top and bottom of the components of this filtration unit;
- Figure 6 is a cross-section showing the inside of the filtration unit visible in Figure 1 in more detail;
- Figure 7 diagrammatically represents, in perspective, an
30 embodiment variant of the filtration unit visible in Figure 1, in an exploded view and from a viewing angle making it possible to see the top of this filtration unit;

- Figure 8 diagrammatically represents, in perspective, the filtration unit illustrated in Figure 7, in an assembled state and from a viewing angle making it possible to see the bottom of this filtration unit;
 - Figure 9 is a highly schematic cross-section of a filtration unit
5 according to a second embodiment;
 - Figure 10 diagrammatically represents, in perspective, the filtration unit illustrated in Figure 9 in isolation, from a viewing angle making it possible to see the bottom of this filtration unit;
 - Figures 11 and 12 are cross-sections through different cross-
10 sectional axes showing the inside of the filtration unit illustrated in Figures 9 and 10 in more detail;
 - Figure 13 diagrammatically represents, in perspective, an embodiment variant of the filtration unit illustrated in Figures 9 to 12, in an exploded view and from a viewing angle making it possible to see the top of this
15 filtration unit; and
 - Figures 14 and 15 are highly schematic cross-sections of filtration units according to a third and a fourth embodiment respectively.
- Figure 1 illustrates an exhaust system 1 of a motor vehicle (not shown) comprising a silencer 2 provided with a catalyst, a fluid tank 3, a
20 filtration unit 4 according to a first embodiment and a pump 5.
- The exhaust system 1 is here a selective catalytic reduction (SCR) system for reducing nitrogen oxide (NOx).
- The tank 3 is here distinct from the silencer 2 and arranged in proximity to a fuel tank (not shown).
- 25 This tank 3 is configured to receive a fluid, and more precisely a liquid additive, for example AdBlue™.
- Selective catalytic reduction technology is based on the injection of this liquid additive into the silencer 2.
- This liquid additive is an aqueous solution of synthetic urea which,
30 under the effect of temperature, is converted to ammonia, which, in the presence of the catalyst in the silencer 2, converts the nitrogen oxides (NOx) into water vapour and nitrogen which are harmless to the environment.

This liquid additive requires filtering before being injected into the silencer 2. This is why the filtration unit 4 is at least partly immersed in the tank 3.

This filtration unit 4 comprises a support having the general shape of an annular frame, i.e. like a cylindrical wall open at its ends which are opposite.

This annular support is thus formed by an envelope 6 and a frame 7 mounted on the envelope 6, with this frame 7 having three spacing pins 8 as well as a thermally conductive element 9.

It can be seen in Figure 1 that the envelope 6 and the frame 7 extend in a substantially longitudinal direction and the spacing pins and the thermally conductive element 9 for their part extend in a transverse direction to the longitudinal direction.

Here, the filtration unit 4 is shown completely immersed in the tank 3, but in certain cases, this filtration unit 4 is partly immersed in the tank 3.

The spacing pins 8 are here configured to be supported against an internal component (not shown) of the tank 3 in order to hold the frame 7 apart from the internal component of the tank 3, so that the unit 4 is not supported tightly against this component.

The pump 5 is configured to draw the liquid additive contained in the tank 3 by suction through the filtration unit 4 in order to inject this additive into the catalyst of the silencer 2 in order to reduce the emission of pollutant gases, and in particular of nitrogen oxide (NO_x).

Here, the pump 5 is shown completely immersed in the tank 3 but in certain cases, this pump 5 is not immersed in this tank 3 but is arranged in immediate proximity to the outside of the tank 3.

Here, the liquid additive feed to the filtration unit 4 is shown highly diagrammatically by the arrows arranged at the upper level of the unit 4 and at the lower level of the unit 4 in Figure 1, so that the filtration unit 4 does not require a specific inlet tube, as will be seen in detail hereafter.

This filtration unit 4 is provided with a pump connection 10, also called a filtered fluid outlet connection, shown here at a free end of the thermally conductive element 9, but in reality, this outlet connection 10 is arranged at the

opposite end of this thermally conductive element 9 (Figures 2 and 3), i.e. at the lower level of the unit 4 (Figures 2 and 3).

This thermally conductive element 9 is configured to be electrically connected in order to heat the filtered fluid before it leaves the filtration unit.

5 The pump 5 is for its part provided with an inlet connection 11 configured to be connected, directly or via a pipe, to the pump connection 10.

Here, the link between the filtration unit 4 and the pump 5 is shown very diagrammatically by a solid line with an arrow indicating the direction of flow of the liquid additive from the filtration unit 4 towards the pump 5, which
10 arrow is shown between the pump connection 10 of the filtration unit 4 and the inlet connection 11 of the pump 5.

This pump 5 also comprises an injection connection 13 configured to be connected, directly or via a pipe, to another inlet connection 12 arranged for its part on the silencer 2.

15 Here, the link between the pump 5 and the silencer 2 is shown highly diagrammatically by a solid line with an arrow indicating the direction of flow of the fluid additive of the pump 5 towards the silencer 2.

The existing lines in Figure 1 between the connectors 10 and 11 and the connectors 12 and 13 respectively diagrammatically represent the
20 mechanical inter-engagement, direct or indirect, between these respective connectors 10, 11 and 12, 13.

The liquid additive originating from the filtration unit 4 is drawn in by suction by the pump 5 then driven out by the pump 5 to feed liquid additive into the catalyst in the silencer 2 of the exhaust system 1.

25 Thus, between the tank 3 and the inlet opening 12 of the silencer 2, the liquid additive is filtered by the unit 4.

The filtration unit 4 will now be described in more detail, with reference to Figures 2 to 6.

30 The filtration unit 4 is formed by the envelope 6 made from plastic material and by the frame 7 which is itself also made from plastic material.

The filtration unit 4 moreover has a first flat filter member 14 (Figure 2), a second flat filter member 15 (Figure 4) and a third filter member in the form of a bag 16 (Figure 3).

5 The envelope 6 and the frame 7 are two distinct parts fastened to each other, here by welding.

The envelope 6 and the frame 7 thus form a support for the first flat filter member 14, second flat filter member 15 and third filter member.

10 The first filter member 14 and the second filter member 15 are here flat members, also referred to as planes, the dirt holding capacity (DHC) of which is a function of the filtration surface area of each of them.

In total, the filtration surface area of this first filter member 14 and this second filter member 15 in combination is here approximately 9500 mm².

The third filter member in bag form 16 (also referred to as a "baggy") also has a dirt holding capacity which is a function of its filtration surface area.

15 The filtration surface area of this third filter member 16 is here approximately 7600 mm², i.e. a total filtration surface area of the three filter members 14 to 16 in combination which is here approximately 17100 mm².

The envelope 6 of the filtration unit 4 will now be described in more detail, with reference to Figures 2 to 6.

20 The envelope 6 has a substantially cylindrical shape, which is substantially semi-annular in section, and has a thickness (or a height with reference here to Figure 2) which substantially gives it the form of a housing into which the second filter member 15 and the third filter member 16 are introduced (Figure 3).

25 This envelope 6 has a partly cylindrical side wall 17 forming a closed outline of the envelope 6, which side wall 17 has an upper edge 18 as well as a lower edge 22 opposite the upper edge 18.

These edges 18 and 22 are therefore situated at the ends of the support which are opposed to each other.

30 The side wall 17 has a first portion shaped like the arc of a circle with a large diameter, a second substantially straight portion attached to the first portion shaped like the arc of a circle, from which second portion projects a

lower arm 19, a third portion shaped like the arc of a circle with a small diameter attached to the lower arm 19 and a fourth substantially straight portion attached at one end to the third portion shaped like the arc of a circle and at another opposite end to the first portion shaped like the arc of a circle.

5 The envelope 6 is provided with an internal space 20 defined only by the side wall 17, so that this envelope 6 is open at this upper edge 18 by an upper opening 23 (Figure 6) and at the lower edge 22 by a lower opening 21 (Figure 3).

10 The pump connection 10 is formed at the free end of this lower arm 19.

 The envelope 6 also has, at its upper edge 18, a half-channel 26 formed along the lower arm 19 along the second substantially straight portion of the side wall 17.

15 This half-channel 26 has a base wall 27 formed by the body of the envelope 6 and low walls 28 defining the height of the half-channel 26.

 This half-channel has an internal space opening through the pump connection 10 by an outlet opening 29, also called a fourth outlet opening for filtered fluid.

20 This internal space of the half-channel 26 moreover opens into an outlet chamber 30 (Figure 6) by two openings 31 and 32, also called third outlet openings for filtered fluid.

 The second flat filter member 15 which is formed here by a flat piece of fabric 33 directly fixed on the envelope 6, is introduced inside the internal space 20 of the envelope 6, at the upper edge 18.

25 The internal space 20 at the lower edge 22 of the envelope 6 thus defines the surface of the fabric 33 and consequently the filtration surface of the second filter member 15.

 The envelope 6 also has a stay formed as a single part with the fabric 33 of the second filter member 15.

30 This common stay is formed by a ring 35 of substantially cylindrical shape having a first tubular portion 36 (Figure 6) which is flat and which is configured to be engaged with the fabric 33 of the second filter member 15.

This ring 35 also has a second tubular portion 37 on which the third filter member in bag form 16 is configured to be mounted and fastened, here by welding.

5 The ring 35, and in particular its first tubular portion 36, is in fact moulded on the fabric 33 of the second filter member 15.

Then the fabric 33 is perforated at the space inside the ring 35.

The second tubular portion 37 of the ring 35 is provided with a first part having a first outer diameter, which first part is attached to the first tubular portion 36, and with a second part having a second outer diameter smaller than
10 the first outer diameter, which second part is attached to the first part.

The first and second tubular portions 36 and 37 form a first shoulder 39 and a second shoulder 40 (Figure 6).

This ring 35 forms a communicating tube which has, at one end, an opening 38 also called a second outlet opening for filtered fluid, opening into the
15 outlet chamber for filtered fluid 30.

It can be seen in Figures 4 and 5 that the common stay also has two moulding lugs 48 each joining the ring 35 and the frame 7.

The third filter member 16 is for its part formed by two flexible walls 41 and 42 sealed between them at their ends to form a bag having a closed
20 outline.

These flexible walls 41 and 42 therefore form a bag having an internal space which forms an internal filtration chamber 43.

This internal chamber 43 is provided with an opening 34, also called a first outlet opening for filtered fluid, opening into the communicating tube
25 formed by the ring 35, at an opposite end to the end where the opening 38, also called a second opening, is arranged.

The envelope 6 also has an anchorage and spacing device 44 which is provided with a base 45 to which the flexible wall 42 is sealed.

This base 45 has a shape complementary to the shape of the second
30 tubular portion 37 of the ring 35 so that the device 44 is configured to be anchored by its base 45 to the ring 35.

Here, the base 45 of the device 44 is fastened by welding to this ring 35 on the first and second shoulders 39 and 40.

This device 44 also has three conical feet 46 (two of which are visible in Figure 6) rooted on the base 45 and extending away from this base 45 and
5 from the ring 35 as far as a base wall 47 of this device 44, in order to hold the flexible walls 41 and 42 of the third filter member in bag form 16 apart from each other.

These three feet 46 are spaced apart from each other for the flow of the filtered fluid.

10 It can be seen in Figure 4 that the third filter member in bag form 16 has the general shape of the arc of a circle, like the envelope 6.

It can also be seen in Figures 3 and 6 that this third filter member in bag form 16 is introduced in its entirety inside the envelope 6 between the upper opening 23 at which the second flat filter member 15 and the lower
15 opening 21 are sealed.

The concepts of thickness, height of the envelope 6 and upper 18 and lower edges 22, as well as the concepts of longitudinal and transverse directions have been defined with reference to the orientation of the filtration unit 4 in Figures 1, 2, 4 and 6, but this orientation can be different in practice,
20 since the filtration unit 4 can be mounted differently inside the tank 3.

The frame 7 will now be described in more detail, with reference to Figures 2 to 6.

The frame 7 has a general shape substantially similar to that of the envelope 6 except that its thickness, or its height with reference to Figure 2, is
25 for its part much less than the thickness of the envelope 6.

The frame 7 therefore has a substantially semi-annular shape and a thickness which gives it the form of a stay configured to receive the first flat filter member 14.

This frame 7 therefore has a first portion shaped like the arc of a
30 circle of the same large diameter as that of the first portion of the envelope 6, a second substantially straight portion attached to the first portion shaped like the arc of a circle, from which second portion an upper arm 25 projects, a third

portion shaped like the arc of a circle with the same small diameter as that of the first portion of the envelope 6 attached to the upper arm 25, and a fourth substantially straight portion attached at one end to the third portion shaped like the arc of a circle and at another opposite end to the first portion shaped like the arc of a circle.

The frame 7 also has an internal space (not shown) the outline of which is defined by an inner edge (not shown) of the frame 7.

The first flat filter member 14 which is formed here by a flat piece of fabric 24 directly fastened on the frame 7 is introduced inside this internal space.

The internal space of the frame 7 thus defines the surface of the fabric 24 and consequently the filtration surface of the first filter member 14.

The three spacing pins 8 are rooted both on the frame 7, at its inner edge, and on the fabric 24.

The thermally conductive element 9 is mounted on the upper arm 25 of the frame 7.

It can be seen in Figure 5 that the frame 7 also has another half-channel 49 formed along the upper arm 25 along the second substantially straight portion of the frame 7.

This half-channel 49 has a base wall 50 formed by the body of the frame 7 and low walls 51 defining the height of the half-channel 49.

This half-channel has an internal space opening at the thermally conductive element 9 by an outlet opening 52, also called a fourth outlet opening for filtered fluid.

The internal space of the half-channel 49 moreover opens into an outlet chamber 30 (Figure 6) by two openings 53 and 54, also called third outlet openings for filtered fluid.

The filtration unit 4 in its assembled state will now be described in more detail, with reference to Figures 1 to 3 and 6.

As already described above, the second flat filter member 15 is sealed on the side wall 17 of the envelope 6 at its upper opening 23.

The ring 35, and in particular its first tubular portion 36, is moulded on the fabric 33 of this second flat filter member 15.

The portion of fabric of the second filter member 15 which is situated inside the ring 35 is cut out then removed.

5 The third filter member in bag form 16 is for its part sealed, by its flexible wall 42, to the base 45 of the retaining and anchoring device 44.

This base 45 is for its part welded on the second tubular portion 37 of the actuating ring 35.

10 Thus, the third filter member in bag form 16 is mounted on the envelope 6 using the ring 35 which also forms the communicating tube and which is engaged with the second flat filter member 15.

As indicated above, the second flat filter member 15 and the third filter member in bag form 16 are integrated in their entirety in the enclosure (or the internal space) of the envelope 6.

15 The third filter member in bag form 16 and the second flat filter member 15 are therefore arranged facing each other and mounted on the common stay formed by the ring 35.

As also mentioned above, the first flat filter member 14 is for its part sealed on the frame 7, which frame 7 is welded on the upper edge 18 of the side wall 17 of the envelope 6, with the two filter members 14 and 15 facing, and a relatively short distance apart from, each other.

20 The distance separating the filter members 14 and 15 is less than the height of the envelope 6.

25 The frame 7 and the envelope 6 are fastened together so that the two half-channels 26 and 49 are facing with the low walls 28 and 51 coming into contact to form an outlet channel for filtered fluid.

Moreover, the openings 29, 31 and 32 are arranged facing the respective openings 52, 53 and 54 to form together respectively larger openings.

30 Thus, the second flat filter member 15 is interposed between the first flat filter member 14 and the third filter member in bag form 16.

The assembly formed by the envelope 6, the second flat filter member 15 and the third filter member in bag form 16 form a first, so-called lower, part of the filtration unit 4.

5 This filtration unit 4 also has a second, so-called upper, part which is formed for its part by the frame 7 and the first flat filter member 14.

This first flat filter member 14 is arranged facing the second flat filter member 15, with the respective filtration surfaces being arranged substantially parallel.

10 Thus, the first and second flat filter members 14 and 15 define between them a relatively reduced space which forms the outlet chamber 30 for filtered fluid.

It can also be seen in Figure 6 that this outlet chamber 30 communicates with the communicating tube formed by the ring 35 and consequently with the internal chamber 43 of the third filter member in bag form 15 16.

Thus, the filtration unit 4 is configured to allow a fluid communication to the outlet chamber 30 exclusively through the filtration surface of the first flat filter member 14, the filtration surface of the second flat filter member 16 and of the communicating tube formed by the space inside the ring 35.

20 The fluid paths taken by the liquid additive to be filtered and the filtered liquid additive to be injected into the silencer 2 of the exhaust system 1 will now be described with reference to Figures 1 to 6.

When the motor vehicle is started, the liquid additive is mostly situated in the tank 3.

25 The vehicle's heat engine is then in operation and the exhaust gases are forced away from the heat engine into the exhaust system 1, and in particular into the silencer 2 equipped with its catalyst.

The pump 5 of the exhaust system 1 then starts up in order to force liquid additive into the catalyst of the silencer 2.

30 When the pump 5 is in operation, the liquid additive to be filtered which is present in the tank 3 is drawn by suction, on the one hand towards the

first flat filter member 14 and, on the other hand, towards the third member in bag form 16 and towards the second flat filter member 15.

As indicated above, the filtration unit 4 here comprises no inlet tube of liquid to be filtered. This is due to the fact that the filtration unit 4 is immersed
5 in the tank 3.

At the upper part of the filtration unit 4, it is the first flat filter member 14 which is arranged flush and therefore in direct contact with the additive (there is no inlet chamber for the liquid to be filtered before coming into contact with the filter member 14).

10 At the lower part of the filtration unit 4, it is the internal space of the envelope 6 which forms an inlet chamber for the liquid to be filtered before coming into contact with the filter members 15 and 16.

In Figures 1 and 6 arrows can be seen at the upper part and at the lower part of the filtration unit 4 indicating the direction of flow of the liquid
15 additive from the tank 3 towards the filtration unit 4, which is immersed in this tank 3.

This liquid additive thus passes through the fabric 24 of the first flat filter member 14 in order to be filtered and emerges in the outlet chamber 30.

The liquid additive to be filtered moreover passes through the fabric
20 33 of the second flat filter member 15 in order to be filtered and emerges in the outlet chamber 30.

The liquid additive to be filtered also passes through the flexible walls 41 and 42 of the third filter member 16 to be filtered, emerges in the internal chamber 43 then passes into this internal chamber 43 until it emerges in the
25 communicating tube, formed by the ring 35, through its opening 34.

The filtered additive passes into the communicating tube until it emerges in the outlet chamber 30 through the opening 38.

The additive filtered through the first flat filter member 14, the second flat filter member 15 and the third filter member in bag form 16 and situated in
30 the outlet chamber 30 for filtered fluid then progresses until it emerges in an outlet channel formed by the two half-channels 26 and 49 through the openings 31, 32, 53 and 54.

The filtered additive passes into an outlet channel for filtered fluid as far as the pump connection 10 where it passes through the openings 29 and 52 in order to rejoin the inlet connection 11 of the pump 5 of the exhaust system 1, which pump 5 forces the filtered additive into the catalyst of the silencer 2.

5 Before reaching the inlet connection 11 of the pump 5, the filtered liquid additive is heated at the openings 29 and 52 by the thermally conductive element 9.

This step is in fact a preheating of the filtered additive since the latter is also heated on entering the silencer 2.

10 The step of preheating the filtered additive allows the latter to fulfil its function more rapidly, i.e. as soon as it enters the silencer 2, in particular in cold weather.

The filtration unit 4 is particularly convenient since its total dirt holding capacity is high compared with the filtration units of the state of the art, and is particularly economical due to the fact that this filtration unit 4 can be permanently mounted in the tank 3 without requiring any maintenance throughout the life span of the motor vehicle.

15 Figures 7 and 8 illustrate an embodiment variant of the filtration unit, representing a low capacity version of the unit, compared to the high capacity version of the unit illustrated in Figures 1 to 6.

20 Generally, for similar components, the same references have been used but with 100 added.

The filtration unit 104 of Figures 7 and 8 is in every point identical to the filtration unit 4 of Figures 1 to 6, except that the filtration unit 104 has no third filter member in bag form.

25 In fact, the filtration unit 104 has only a combination of the first flat filter member 114 and the second flat filter member 115.

The first part of the filtration unit 104 is therefore formed, as in the case of the filtration unit 4, by the frame 107 on which the first flat filter member 114 is sealed.

30 By contrast, the second part of the filtration unit 104 is formed only by the envelope 106 on which the second flat filter member 115 is sealed.

It can be seen in Figures 7 and 8 that the portion of fabric 160 of the second filter member has not been cut out from the internal space of the communicating tube formed by the ring 135. In fact, this portion of fabric 160 is retained, and is not perforated as in the unit 4 of Figures 1 to 6

5 The fluid communication to the outlet chamber (not shown) is therefore allowed exclusively through the fabric of the first flat filter member 114 and the fabric of the second flat filter member 115, including through the portion of fabric 160.

10 This filtration unit 104 is particularly useful in the case where a lower dirt holding capacity is required.

The filtration unit 4 and the filtration unit 104 therefore form a group of two filtration units which is particularly convenient.

15 In fact, this group comprises a first filtration unit 4 and a second filtration unit 104 each of which comprise an identical support formed by the envelope 6, 106 and the frame 7, 107, a first identical flat filter member 14, 114, a second identical flat filter member 15, 115 and an identical communicating tube formed by the ring 35, 135.

20 The difference between the first filtration unit 4 and the second filtration unit 104 is that only the first filtration unit 4 is provided with the third filter member in bag form 16 and that, for this reason, the portion of fabric 160 at the space inside the ring 135 is not perforated.

The two filtration units 4 and 104 therefore have different dirt-holding capacities, a high capacity and a lower capacity respectively.

25 This group of two filtration units is therefore particularly simple, convenient and economical both to manufacture and to use.

Figures 9 to 12 illustrate a filtration unit 204 of the same type as that illustrated in Figures 2 to 6, according to a second embodiment.

Generally, for similar components, the same references have been used but with 200 added.

30 Like the filtration unit 4 visible in Figure 1, the filtration unit 204 is configured to be immersed at least partly in a fluid tank of a motor vehicle

exhaust system, which fluid is for example AdBlue™ and which system also has a silencer provided with a catalyst and a pump.

The filtration unit 204 has the same general form as the filtration unit 4 and is very similar to the latter.

5 In fact, the filtration unit 204 comprises a support formed by an envelope 206 and a frame 207 mounted on the envelope 206, with this frame 207 having three spacing pins 208 (Figures 10 to 12) as well as a thermally conductive element 209 (Figures 10 to 12).

10 The envelope 206 and the frame 207 extend in a substantially longitudinal direction and the spacing pins 208 and the thermally conductive element 209 extend for their part in a transverse direction to the longitudinal direction.

The spacing pins 208 are configured to be supported against an internal component (not shown) of the tank in order to hold the frame 207 apart
15 from the internal component of the tank, so that the unit 204 is not closely supported against this component.

The pump is configured to draw the liquid additive contained in the tank by suction through the filtration unit 204 in order to inject this additive into the catalyst of the silencer to reduce the emission of pollutant gases, and in
20 particular of nitrogen oxide (NOx).

Here, the liquid additive feed to the filtration unit 204 is shown very diagrammatically by the arrows arranged at the upper level of the unit 204 and at the lower level of the unit 204 in Figure 9, so that the filtration unit 204 does not require a specific inlet tube, as will be seen in detail hereafter.

25 This filtration unit 204 is provided with a pump connection 210 (Figure 10), also called a filtered fluid outlet connection.

This thermally conductive element 209 is configured to be electrically connected in order to heat the filtered fluid before it leaves the filtration unit 204.

The pump is for its part provided with an inlet connection configured
30 to be connected, directly or via a pipe, to the pump connection 210.

This pump also comprises an injection connection configured to be connected, directly or via a pipe, to another inlet connection arranged for its part on the silencer.

The liquid additive originating from the filtration unit 204 is drawn in
5 by suction by the pump then forced out by the pump to feed liquid additive into the catalyst of the silencer of the exhaust system.

Thus, between the tank and the inlet opening of the silencer, the liquid additive is filtered by the filtration unit 204.

The filtration unit 204 is formed by the envelope 206 made from
10 plastic material and the frame 207 itself also made from plastic material.

The filtration unit 204 also has a first flat filter member 214, a second flat filter member 215 and a third filter member having the form of a bag 216.

The envelope 206 and the frame 207 are two distinct pieces fastened to each other, here by welding.

15 The envelope 206 and the frame 207 thus form a support for the first flat filter member 214, second flat filter member 215 and third filter member 216.

The first filter member 214 and the second filter member 215 are here flat members, also called planes, the dirt holding capacity (DHC) of which is a function of the filtration surface area of each of them.

20 In total, the filtration surface area of these first filter member 214 and second filter member 215 in combination is here approximately 9500 mm².

The third filter member in bag form 216 (also called a "baggy") also has a dirt holding capacity which is a function of its filtration surface.

The filtration surface area of this third filter member 216 is here
25 approximately 7600 mm², i.e. a total filtration surface area of the three filter members 214 to 216 in combination here being approximately 17100 mm².

The envelope 206 has a substantially cylindrical shape, which, in section, is substantially semi-annular, and has a thickness (or a height with reference here to Figures 9, 11 and 12) which substantially gives it the form of a
30 housing into which the second filter member 215 and the third filter member 216 are introduced (Figures 9, 11 and 12).

This envelope 206 has a partly cylindrical side wall 217 forming a closed outline of the envelope 206, which side wall 217 has an upper edge 218 as well as a lower edge 222 opposite the upper edge 218.

5 The side wall 217 has a first portion shaped like the arc of a circle with a large diameter, a second substantially straight portion attached to the first portion shaped like the arc of a circle, from which second portion projects a lower arm 219, a third portion shaped like the arc of a circle with a small diameter attached to the lower arm 219 and a fourth substantially straight portion attached at one end to the third portion shaped like the arc of a circle
10 and at another opposite end to the first portion shaped like the arc of a circle.

The envelope 206 is provided with an internal space 220 defined only by the side wall 217, so that this envelope 206 is open at this upper edge 218 by an upper opening 223 and at the lower edge 222 by a lower opening 221.

15 The pump connection 210 is formed at the free end of this lower arm 219.

Just like the envelope 6 of the unit 4 illustrated in Figures 2 to 6, the envelope 206 has at its upper edge 218, a half-channel (not shown) formed along the lower arm 219 and along the second substantially straight portion of the side wall 217.

20 This half-channel has a base wall formed by the body of the envelope 206, low walls defining its height as well as an internal space opening through the pump connection 210 by an outlet opening 229, also called a fourth outlet opening for filtered fluid. The internal space of the half-channel opens into an outlet chamber 230 (Figures 11 and 12) by two openings, also called third
25 outlet openings for filtered fluid.

Within the internal space 220 of the envelope 206, at the lower edge 222, is mounted the second flat filter member 215 which is formed here by a flat piece of fabric 233 directly fastened on the envelope 206.

The internal space 220 at the lower edge 222 of the envelope 206 thus defines the surface of the fabric 233 and consequently the filtration surface of the second filter member 215.

5 The envelope 206 also has a stay formed as a single part with the fabric 233 of the second filter member 215.

This common stay is formed by a ring 235 with a substantially cylindrical shape which has a first tubular portion 236 (Figure 11) which is flat and which is configured to be engaged with the fabric 233 of the second filter member 215.

10 This ring 235 also has a second tubular portion 237 on which the third filter member in bag form 216 is configured to be mounted and fastened, here by welding.

The ring 235 and in particular its first tubular portion 236, is in fact moulded on the fabric 233 of the second filter member 215.

15 Then, the fabric 233 is perforated at the space inside the ring 235.

The second tubular portion 237 of the ring 235 is provided with a first part having a first outer diameter, which first part is attached to the first tubular portion 236, and with a second part having a second outer diameter smaller than the first outer diameter, which second part is attached to the first part.

20 This ring 235 forms a communicating tube which has, at one end, an opening 238 also called a second outlet opening for filtered fluid, opening into the outlet chamber for filtered fluid 230.

The common stay also has two moulding lugs 248 each joining the ring 235 and the envelope 206.

25 The third filter member 216 is for its part formed by two flexible walls 241 and 242 sealed between them at their ends to form a bag having a closed outline.

These flexible walls 241 and 242 therefore form a bag having an internal space which forms an internal filtration chamber 243.

30 This internal chamber 243 is provided with an opening 234, also called a first outlet opening for filtered fluid, opening into the communicating

tube formed by the ring 235, at an end opposite the end where the opening 238, also called a second opening, is arranged.

The envelope 206 also has an anchorage and spacing device 244 which is provided with a base 245 to which the flexible wall 242 is sealed.

5 The base 245 and the second tubular portion 237 of the ring 235 are jointly formed from plastic material so that the anchorage device 244 and the ring 235 are formed from plastic material in a single piece.

 This member 244 also has three conical feet 246 rooted on the base 245 and extending away from this base 245 and from the ring 235 as far as a
10 base wall 247 of this member 244, in order to keep the flexible walls 241 and 242 of the third filter member in bag form 216 apart from each other.

 These three feet 246 are spaced apart from each other for the flow of the fluid to be filtered.

 This member is moreover provided with arms 280 which extend into
15 the internal chamber 243, with these arms 280 bearing fins 281 configured to guide the fluid to be filtered.

 The third filter member in bag form 216 has the general shape of the arc of a circle, like the envelope 206.

 This third filter member in bag form 216 is introduced in its entirety
20 inside the envelope 206 between the lower opening 221 at which is sealed the second flat filter member 215 and the upper opening 223.

 The third filter member 216 is therefore interposed between the first and second filter members 214 and 215 so that it is situated in the outlet chamber 230.

25 The concepts of thickness, height of the envelope 206 and upper 218 and lower edges 222, as well as the concepts of longitudinal and transverse directions have been defined with reference to the orientation of the filtration unit 204 in Figures 9, 11 and 12, but this orientation can be different in practice, since the filtration unit 204 can be mounted differently inside the tank.

30 The frame 207 will now be described in more detail.

The frame 207 has a general shape substantially similar to that of the envelope 206 except that its thickness, or its height with reference to Figure 9, is for its part much less than the thickness of the envelope 206.

5 The frame 207 has a substantially semi-annular shape and a thickness which gives it the form of a stay configured to receive the first flat filter member 214.

10 This frame 207 has a first portion shaped like the arc of a circle with the same large diameter as that of the first portion of the envelope 206, a second substantially straight portion attached to the first portion shaped like the arc of a circle, from which second portion projects an upper arm 225, a third portion shaped like the arc of a circle with the same small diameter as that of the first portion of the envelope 206 attached to the upper arm 225, and a fourth substantially straight portion attached at one end to the third portion shaped like the arc of a circle and at another opposite end to the first portion shaped like the arc of a circle.

The frame 207 also has an internal space (not shown) the outline of which is defined by an inner edge (not shown) of the frame 207.

20 The first flat filter member 214 which is formed here by a flat piece of fabric 224 directly fastened on the frame 207 is introduced into this internal space.

The internal space of the frame 207 thus defines the surface of the fabric 224 and consequently the filtration surface of the first filter member 214.

The three spacing pins 208 are rooted both on the frame 207, at its inner edge, and on the fabric 224.

25 The thermally conductive element 209 is mounted on the upper arm 225 of the frame 207.

30 Just like the frame 7 of the unit 4, the frame 207 of the unit 204 has another half-channel (not shown) formed along the upper arm 225 and along the second substantially straight portion of the frame 207. This half-channel has a base wall formed by the body of the frame 207, low walls defining its height as well as an internal space opening at the thermally conductive element 209 by an outlet opening, also called a fourth outlet opening for filtered fluid. The

internal space of the half-channel moreover opens into the outlet chamber 230 by two openings, also called third outlet openings for filtered fluid.

The filtration unit 204 in its assembled state will now be described in more detail.

5 As has already been described above, the second flat filter member 215 is sealed on the side wall 217 of the envelope 206 at its lower opening 221.

The ring 235 is moulded on the fabric 233 of this second flat filter member 215, and in particular on its first tubular portion 236.

10 The portion of fabric of the second filter member 215 which is situated inside the ring 235 is cut out then removed.

The third filter member in bag form 216 is for its part sealed, by its flexible wall 242, to the base 245 of the retaining and anchoring device 244, which base 245 is jointly formed from plastic material with the second tubular portion 237 of the ring 235.

15 Thus, the third filter member in bag form 216 is mounted on the envelope 206 via the ring 235 which moreover forms the communicating tube and which is engaged with the second flat filter member 215.

20 As indicated above, the second flat filter member 215 and the third filter member in bag form 216 are integrated in their entirety in the enclosure (or the internal space) 220 of the envelope 206.

The third filter member in bag form 216 and the second flat filter member 215 are therefore arranged facing each other and mounted on the common stay formed by the ring 235.

25 As also mentioned above, the first flat filter member 214 is for its part sealed on the frame 207, which frame 207 is welded on the upper edge 218 of the side wall 217 of the envelope 206, with the two filter members 214 and 215 facing and relatively far apart from each other; and the third filter member in bag form 216 is interposed between these two latter.

30 The distance separating the filter members 214 and 215 is substantially equal to the height of the envelope 206.

The frame 207 and the envelope 206 are fastened together so that the two half-channels are facing with the low walls coming into contact to form an outlet channel for filtered fluid.

5 The assembly formed by the envelope 206, the second flat filter member 215 and the third filter member in bag form 216 form a first, so-called lower part of the filtration unit 204.

This filtration unit 204 also has a second, so-called upper part which for its part is formed by the frame 207 and the first flat filter member 214.

10 This first flat filter member 214 is arranged facing the second flat filter member 215, with the respective filtration surfaces being arranged substantially parallel.

The first and second flat filter members 214 and 215 define between them a relatively large space which forms the outlet chamber 230 for filtered fluid, in which the third filter member 216 is situated.

15 This outlet chamber 230 communicates indirectly with the communicating tube formed by the ring 235, via the internal chamber 243 of the third filter member in bag form 216 and with the inside of the tank since the second outlet opening for filtered fluid 238 opens through the second filter member 215, out of this outlet chamber 230, i.e. out of the internal space 220 of
20 the envelope 206 and more generally out of the support.

Thus, the filtration unit 204 is configured to allow a fluid communication to the outlet chamber 230 exclusively through the filtration surface of the first flat filter member 214, the filtration surface of the second flat filter member 215 and the third filter member 216 via the communicating tube
25 formed by the space inside the ring 235.

The fluid paths taken by the liquid additive to be filtered and the filtered liquid additive to be injected into the silencer of the exhaust system will now be described.

30 When the motor vehicle is started, the liquid additive is mostly situated in the tank.

The heat engine of the vehicle is then in operation and the exhaust gases are forced away from the heat engine into the exhaust system and in particular into the silencer equipped with its catalyst.

The pump of the exhaust system then starts up in order to force
5 liquid additive into the catalyst of the silencer.

When the pump is in operation, the liquid additive to be filtered which is present in the tank is drawn by suction, on the one hand, towards the first flat filter member 214 and, on the other hand, towards the second flat filter member 215 and towards the third member in bag form 216 via the ring 235.

10 At the upper part of the filtration unit 204, it is the first flat filter member 214 which is arranged flush and therefore in direct contact with the additive (there is no inlet chamber for the liquid to be filtered before coming into contact with the filter member 214).

At the lower part of the filtration unit 204, it is the second flat filter
15 member 215 which is arranged flush and therefore in direct contact with the additive (there is no inlet chamber for the liquid to be filtered before coming into contact with the filter member 215).

In Figure 9 arrows can be seen at the upper part and at the lower part of the filtration unit 204 indicating the direction of flow of the liquid additive
20 from the tank towards the filtration unit 204, which is immersed in this tank.

This liquid additive therefore passes through both the fabric 224 of the first flat filter member 214 and through the fabric 233 of the second flat filter member 215 in order to be filtered and emerges in the outlet chamber 230.

The liquid additive to be filtered also passes through the
25 communicating tube formed by the ring 235 in order to enter the internal chamber 243 of the third filter member in bag form 216 then through the flexible walls 241 and 242 of this third filter member 216 (being guided by the fins 281) in order to be filtered and emerges in the outlet chamber 230.

It will be noted that, unlike the filtration unit 4 illustrated in Figures 2
30 to 6 where the internal chamber 43 of the third filter member 16 is configured to contain filtered fluid, i.e. clean fluid, the internal chamber 243 of the third filter

member 216 of the unit 204 is configured to contain fluid to be filtered, i.e. dirty fluid.

The additive filtered through the first flat filter member 214, the second flat filter member 215 and the third filter member in bag form 216 and being situated in the outlet chamber 230 for filtered fluid then progresses until it emerges in an outlet channel formed by the two half-channels and associated openings.

The filtered additive progresses into an outlet channel for filtered fluid as far as the pump connection 210 where it passes through the associated openings in order to rejoin the inlet connection of the pump of the exhaust system, which pump forces the filtered additive into the catalyst of the silencer.

Before reaching the inlet connection of the pump, the filtered liquid additive is heated by the thermally conductive element 209.

This step is in fact a preheating of the filtered additive since the latter is also heated on entering the silencer.

The step of preheating of the filtered additive allows the latter to fulfil its function more rapidly, i.e. as soon as it enters the silencer, in particular in cold weather.

The filtration unit 204 is particularly convenient since its total dirt-holding capacity is high compared with the filtration units of the state of the art, and is particularly economical due to the fact that this filtration unit 204 can be permanently mounted in the tank without requiring any maintenance throughout the life span of the motor vehicle.

Figure 13 illustrates an embodiment variant of the filtration unit 204, showing a low capacity version of the unit, compared with the high capacity version of the unit illustrated in Figures 9 to 12.

Generally, for similar components, the same references have been used but with 100 added.

The filtration unit 304 is in every point identical to the filtration unit 204, except that the filtration unit 304 has no third filter member in bag form.

In fact, the filtration unit 304 has only the combination of the first flat filter member 314 and the second flat filter member 315.

The first part of the filtration unit 304 is therefore formed, as for the filtration unit 204, by the frame 307 on which the first flat filter member 314 is sealed.

By contrast, the second part of the filtration unit 304 is formed only by
5 the envelope 306 on which the second flat filter member 315 is sealed.

The portion of fabric 360 of the second filter member 315 has not been cut out from the internal space of the communicating tube formed by the ring 335. In fact, this portion of fabric 360 is retained, and is not perforated as in the unit 204.

10 The fluid communication to the outlet chamber (not shown) is therefore allowed exclusively through the fabric of the first flat filter member 314 and the fabric of the second flat filter member 315, including through the portion of fabric 360.

This filtration unit 304 is particularly useful in the case where a lower
15 dirt holding capacity is required.

The filtration unit 204 and the filtration unit 304 therefore form a group of two filtration units which is particularly convenient.

In fact, this group comprises a first filtration unit 204 and a second filtration unit 304 which each comprise an identical support formed by the
20 envelope 206, 306 and the frame 207, 307, a first identical flat filter member 214, 314, a second identical flat filter member 215, 315 and an identical communicating tube formed by the ring 235, 335.

The difference between the first filtration unit 204 and the second filtration unit 304 is that only the first filtration unit 204 is provided with the third
25 filter member in bag form 216 and that, for this reason, the portion of fabric 360 at the space inside the ring 335 is not perforated.

The two filtration units 204 and 304 therefore have different dirt-holding capacities, a high capacity and a lower capacity respectively.

This group of two filtration units is itself therefore also particularly
30 simple, convenient and economical both to manufacture and to use.

Figure 14 illustrates a filtration unit 404 of the same type as that illustrated in Figures 9 to 12, according to a third embodiment.

Generally, for similar components, the same references have been used but with 200 added.

The filtration unit 404 is in every point identical to the filtration unit 204 illustrated in Figures 9 to 12, with the difference that the ring 435 forming the communicating tube is here moulded on the fabric 424 of the first filter member 414 rather than on the fabric 433 of the second filter member 415.

Thus, this ring 435 is linked, via the fabric 424, to the frame 407 rather than to the envelope 406.

The third filter member 416, which is here also arranged in the outlet chamber 430 defined between the first filter member 414 and the second filter member 415, has its internal chamber 443 open by its opening 434 in the tube formed by the ring 435, which opens by its opening 438 at the upper part of the unit 404, through the first filter member 414 to the outside of this unit 404.

Figure 15 illustrates a filtration unit 504 of the same type as that illustrated in Figures 9 to 12, according to a fourth embodiment.

Generally, for similar components, the same references have been used but with 300 added.

The filtration unit 504 is in every point identical to the filtration units 204 and 404 illustrated in Figures 9 to 12 and 14 respectively, with the difference that here there is a combination of these two units 204 and 404.

In fact, the unit 504 here has two identical third filter members 516 each arranged in the outlet chamber 530 and each provided with an internal chamber 543 open by an opening 534 into a respective communicating tube each formed by a ring 535, each of these rings 535 open by a respective opening 538 outside the unit 504.

In other words, one of the rings 535 is moulded on the fabric 524 of the first flat filter member 514 and is consequently linked to the frame 507; and the other ring 535 is moulded on the fabric 533 of the second flat filter member 515 and is consequently linked to the envelope 506.

The total filtration surface area of the unit 504 is therefore even greater than that of the respective units 204 and 404.

In a variant of the group of filtration units, which is not illustrated, the second filtration unit moreover has no ring, and only the fabric forms the second flat filter member.

5 In another variant of the group of filtration units, which is not illustrated, at least one ring is moulded on the fabric of the second flat filter member and/or on the fabric of the first flat filter member; and the fabric at the space inside the ring is perforated. If appropriate, a shut-off device such as a stopper is mounted, for example by welding, on the ring in order to shut off its internal space.

10 In variants which are not illustrated:

- the filtration unit is not immersed in a tank of liquid additive for an exhaust system, but rather in a tank of motor vehicle transmission lubricant or heat engine lubricant, or also in a fuel tank;

- the spacing device of the flexible walls of the third filter member in bag form visible in Figure 4 is moreover provided with arms extending into the internal chamber of this third filter member in bag form, with these arms bearing fins configured to guide the filtered fluid and/or the spacing device of the flexible walls of the third filter member in bag form visible in Figure 11 has no such arms;

20 - the filtration unit has two filter members in bag form, the two being outside the outlet chamber or the two being inside the outlet chamber or one being inside the outlet chamber and the other outside; and they either both open into a tube which itself opens through the first filter member or the second filter member, or one opens into a tube which itself opens through the first filter member and the other opens into another tube which itself opens through the second filter member;

- the filtration unit does not only have one filter member in bag form or two, but rather more than one or two;

- the filtration unit does not have a substantially cylindrical shape, but rather a parallelepipedic shape or also a different shape; and/or

30 - the frame and the envelope of the filtration unit are not made completely from plastic material, but partly from a metallic material.

It is recalled more generally that the invention is not limited to the examples described and shown.

CLAIMS

5 1. Filtration unit for fluid, comprising a support (6, 7; 206, 207; 406, 407; 506, 507), a first flat filter member (14; 214; 414; 514) and a second flat filter member (15; 215; 415; 515) each mounted on said support (6, 7; 206, 207; 406, 407; 506, 507) facing each other, characterized in that it further comprises a third filter member (16; 216; 416; 516) having the form of a bag mounted on
10 said support (6, 7; 206, 207; 406, 407; 506, 507) and a communicating tube (35; 235; 435; 535), with said first member (14; 214; 414; 514) and said second member (15; 215; 415; 515) being configured so that they define between them a space forming an outlet chamber (30; 230; 430; 530) for a filtered fluid and being configured to allow fluid communication to said outlet chamber (30; 230; 430; 530) exclusively through themselves, with said third filter member (16; 216; 416; 516) having an internal filtration chamber (43; 243; 443; 543) provided with a first opening (34; 234; 434; 534) for passage of a fluid opening into said communicating tube (35; 235; 435; 535), and with said tube (35; 235; 435; 535) being open by a second opening (38; 238; 438; 538) for passage of said fluid
15 through said second flat filter member (15; 215; 415; 515).
20

 2. Filtration unit for fluid according to claim 1, comprising a support (6, 7), a first flat filter member (14) and a second flat filter member (15) each mounted on said support (6, 7) facing each other, a third filter member (16) having the form of a bag mounted on said support (6, 7) facing said second flat
25 filter member (15), so that the latter is interposed between said first flat filter member (14) and said third filter member in bag form (16), and a communicating tube (35), with said first member (14) and said second member (15) being configured so that they define between them a space forming an outlet chamber (30) of a filtered fluid and being configured to allow fluid
30 communication to said outlet chamber (30) exclusively through themselves, with said third filter member (16) having an internal filtration chamber (43) provided

with a first outlet opening (34) for said filtered fluid into said communicating tube (35), and with said tube (35) being open by a second outlet opening (38) of said filtered fluid into said outlet chamber (30) of said filtered fluid.

3. Filtration unit for fluid according to claim 1, comprising a support
5 (206, 207; 406, 407; 506, 507), a first flat filter member (214; 414; 514) and a second flat filter member (215; 415; 515) each mounted on said support (206, 207; 406, 407; 506, 507) facing each other, a third filter member (216; 416; 516) having the form of a bag mounted on said support (206, 207; 406, 407; 506, 507) and interposed between said first flat filter member (214; 414; 514) and
10 said second flat filter member (215; 415; 515), and a communicating tube (235; 435; 535), with said first member (214; 414; 514) and said second member (215; 415; 515) being configured so that they define between them a space forming an outlet chamber (230; 430; 530) of a filtered fluid and being configured to allow fluid communication to said outlet chamber (230; 430; 530)
15 exclusively through themselves, with said third filter member (216; 416; 516) having an internal filtration chamber (243; 443; 543) arranged in said outlet chamber (230; 430; 530) and provided with a first inlet opening (234; 434; 534) for a fluid to be filtered into said communicating tube (235; 435; 535), with said tube (235; 435; 535) being open by a second opening (238; 438; 538) out of
20 said support (206, 207; 406, 407; 506, 507).

4. Unit according to any one of claims 1 to 3, characterized in that said first flat filter member (14; 214) has a first filtration surface, said second flat filter member (15; 215) has a second filtration surface and comprises said communicating tube (35; 235), said third filter member (16; 216) comprises
25 several walls (41, 42; 241, 242) forming an envelope defining said internal filtration chamber (43; 243), and said fluid communication to said outlet chamber (30; 230) is carried out exclusively through said first filtration surface and/or said second filtration surface and/or said communicating tube (35; 235) and/or said envelope.

30 5. Unit according to any one of claims 1 to 4, characterized in that said second filter member (15; 215) and said third filter member (16; 216) are fastened to a common stay (35; 235).

6. Unit according to claim 5, characterized in that said common stay (35; 235) is formed as a single part with said second filter member (15; 215).

7. Unit according to one of claims 5 and 6, characterized in that said stay is formed by a ring (35; 235) situated on a second filtration surface of said second filter member (15; 215) and said third filter member (16; 216) is configured to be mounted on said ring (35; 235).

8. Unit according to claim 7, characterized in that said ring (35; 235) has an internal space opening at its ends and forms said communicating tube.

9. Unit according to one of the claims 7 and 8, characterized in that said ring (35; 235) is of substantially cylindrical shape with a first flat tubular portion (36; 236) engaged with said second filtration surface of said second filter member (15; 215) and a second tubular portion (37; 237) on which said third filter member (16; 216) is configured to be mounted.

10. Unit according to any one of claims 1 to 9, characterized in that said third filter member (16; 216) comprises an anchorage device (44; 244) configured to be fastened to said communicating tube (35; 235) and in which is formed said first outlet opening (34; 234) for said filtered fluid.

11. Unit according to any one of claims 1 to 10, characterized in that said third filter member (16; 216) comprises several walls (41, 42; 241, 242) forming an envelope defining said internal filtration chamber (43; 243) and a spacing device (44; 244) configured to hold said walls apart (41, 42; 241, 242).

12. Unit according to claim 11, characterized in that said anchorage device and said spacing device are formed as a single part (44; 244).

13. Unit according to any one of claims 10 to 12, characterized in that said spacing device (244) is provided with at least one arm (280) which extends into said internal chamber (243) and which bears a plurality of fins (281) configured to guide the fluid to be filtered.

14. Unit according to any one of claims 1 to 13, characterized in that it is formed by a first part comprising said first filter member (14; 214) and by a second part comprising said second filter member (15; 215), said third filter member (16; 216) and said communicating tube (35; 235), with said first part and said second part being fastened together.

15. Unit according to any one of claims 1 to 14, characterized in that said support (6, 7) comprises an outlet channel (26, 52) extending from said outlet chamber (30) as far as an outlet connection (10) of said filtered fluid, said outlet channel (26, 52) delimiting an internal space opening into said outlet chamber (30) by at least one third outlet opening (31, 32, 53, 54) for said filtered fluid and being open through said outlet connection (10) by at least one fourth outlet opening (29, 52) of said filtered fluid.

16. Unit according to any one of claims 1 to 15, characterized in that said support is formed by an envelope (6; 206) having a partly cylindrical wall (17; 217) with a closed outline and provided with an edge (18; 222) at the location of which said second filter member (15; 215) is mounted, said wall being configured to surround said third filter member (16; 216); and by a frame (7; 207) on which said first filter member (14; 214) is mounted, which frame (7; 207) is mounted on an edge (18; 218) of said wall (17; 217).

17. Unit according to any one of claims 1 to 16, characterized in that it comprises a fourth filter member (516) having the form of a bag mounted on said support (506, 507) and another communicating tube (535), with said fourth filter member (516) having an internal filtration chamber (543) provided with a first opening (534) for passage of a fluid opening into said communicating tube (535), and with said tube (535) being open by a second opening (538) for passage of said fluid through said first flat filter member (515).

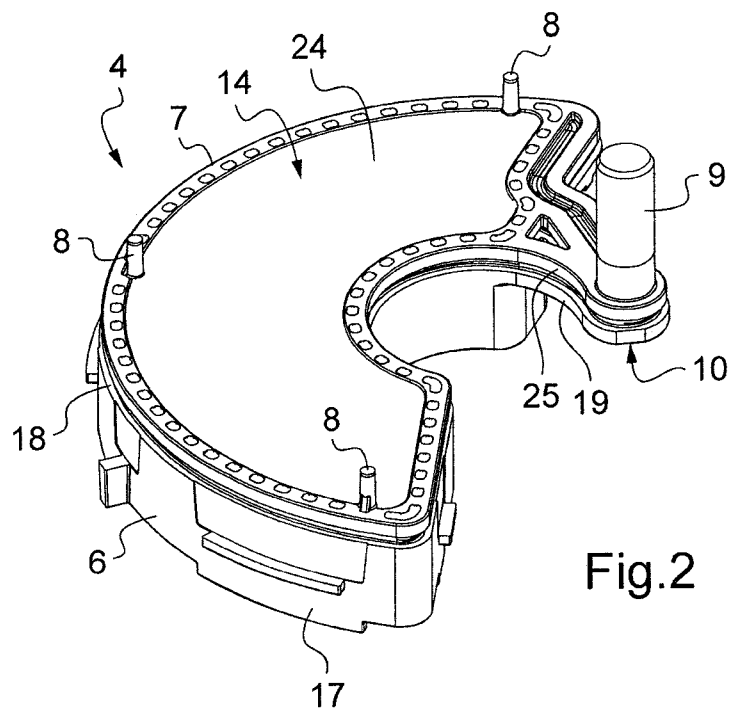
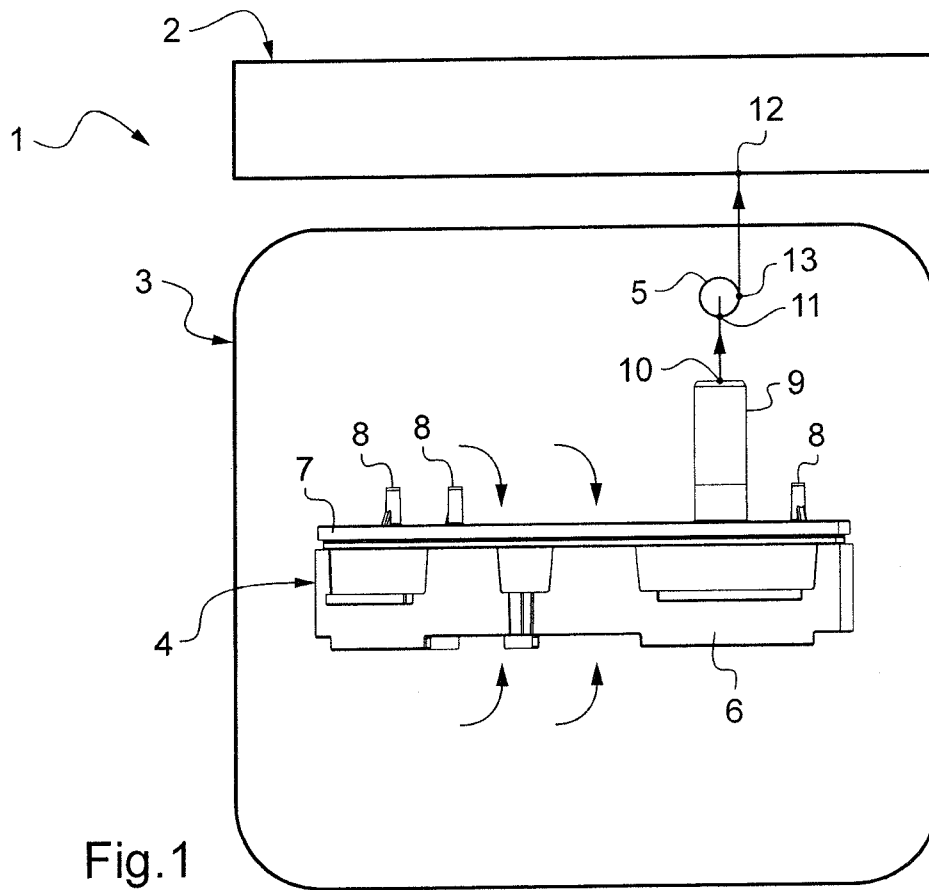
18. System comprising a tank (3) configured to receive a fluid to be filtered, a fluid filtration unit (4) according to any one of claims 1 to 17 and a pump (5) provided with an inlet connection (11) configured to be connected to a filtered fluid outlet connection (10) of said filtration unit (4), which is configured so that said first filter member (14), second filter member (15) and third filter member (16) are immersed in said tank (3).

19. Group of fluid filtration units, characterized in that it comprises a first filtration unit (4; 204) according to any one of claims 1 to 17 and a second filtration unit (104; 304) comprising a support (106, 107; 306, 307) identical to the support (6, 7; 206, 207) of said first filtration unit (4; 204), a first flat filter member (114; 314) identical to the first flat filter member (14; 214) of said first

filtration unit (4; 204), a second flat filter member (115; 315) identical to the second flat filter member (15; 215) of said first filtration unit (4; 204); said second filtration unit (104; 304) not having a third filter member (16; 216).

20. Group according to claim 19, characterized in that said second
- 5 filtration unit (104; 304) has a communicating tube (135; 335) identical to the communicating tube (35; 235) of said first filtration unit (4; 204), with said communicating tube (135; 335) having, in its internal space, a portion of filtration fabric (160; 360) of said second flat filter member (115; 315).

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Fig.3

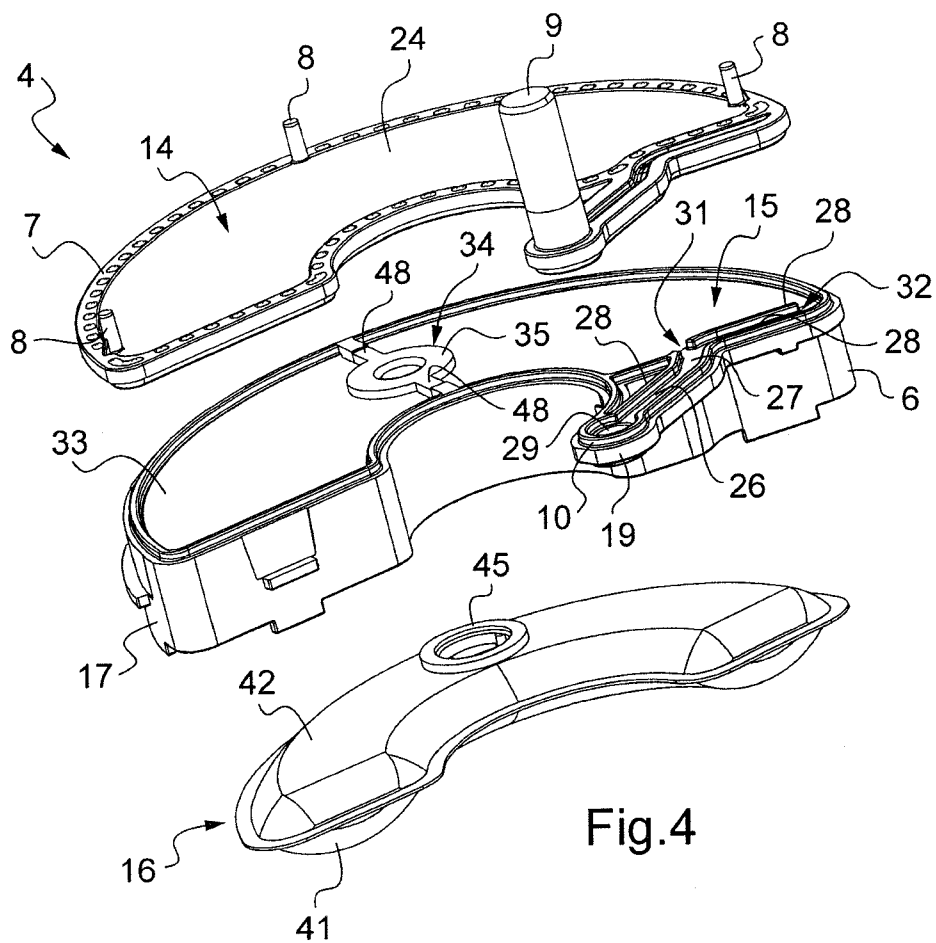
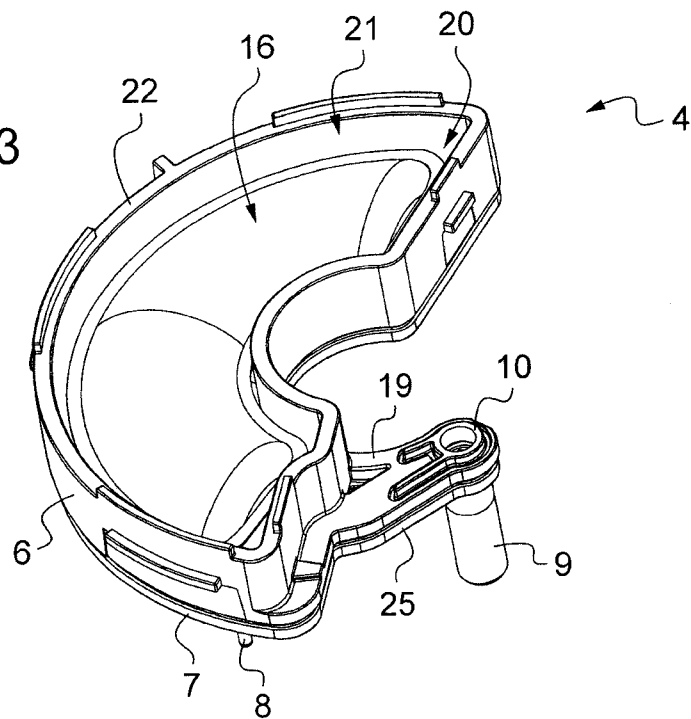


Fig.4

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Fig.5

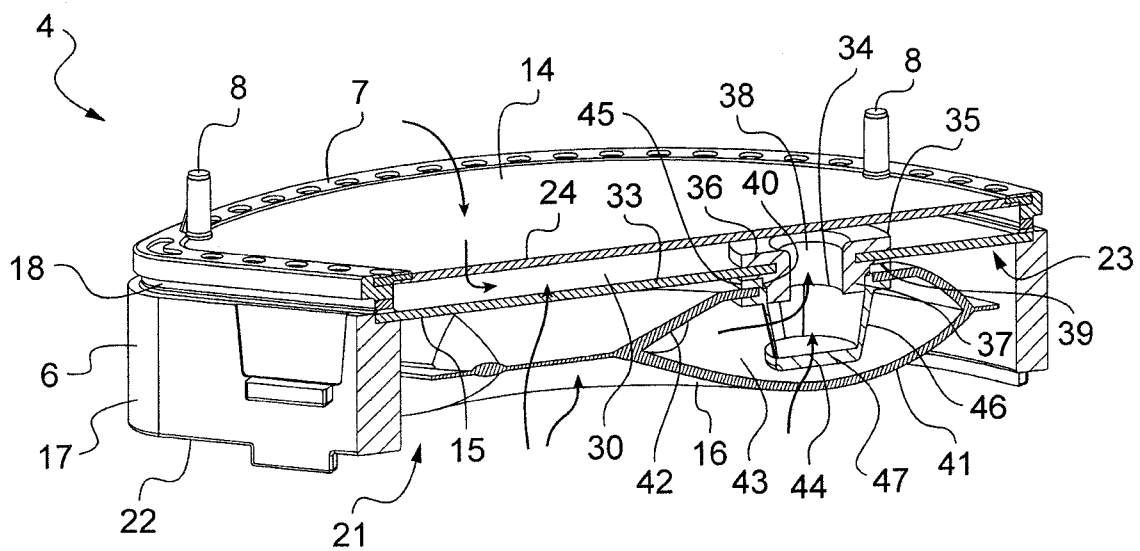
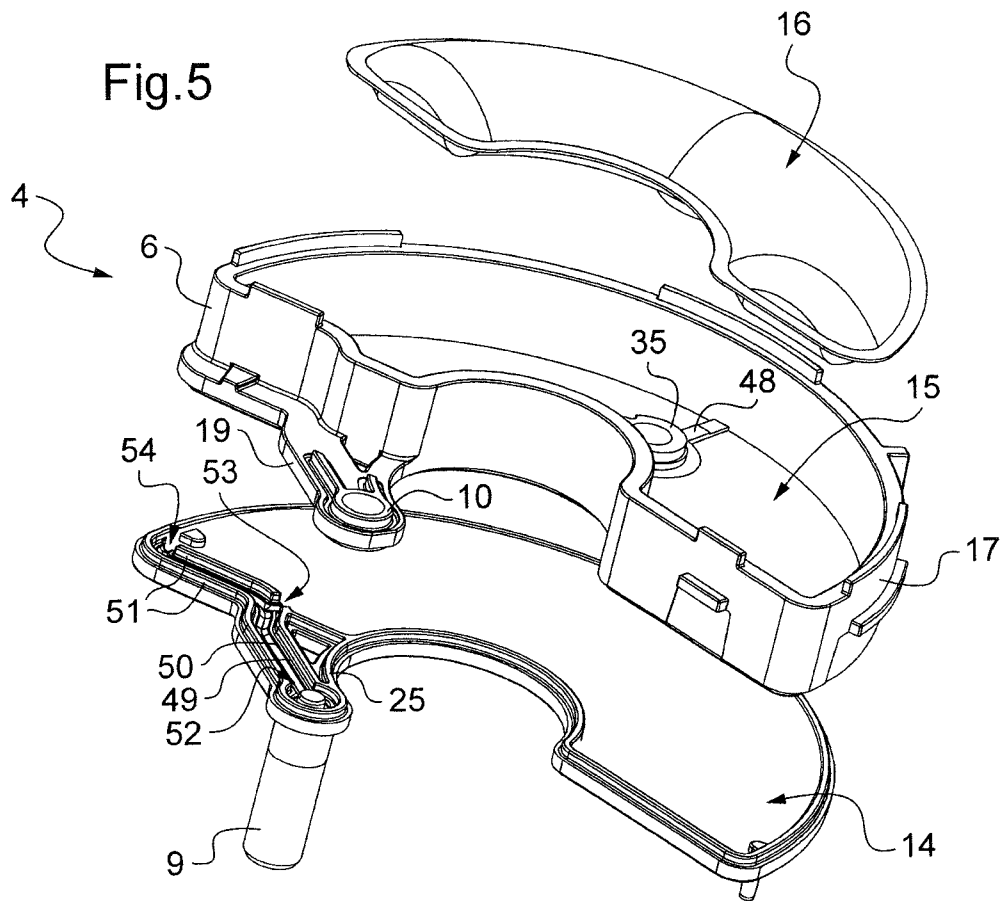
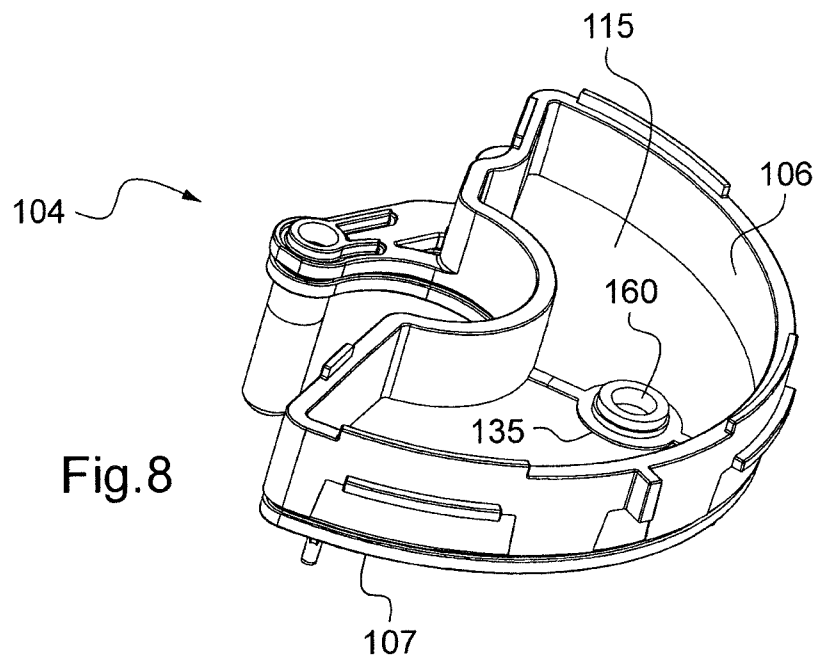
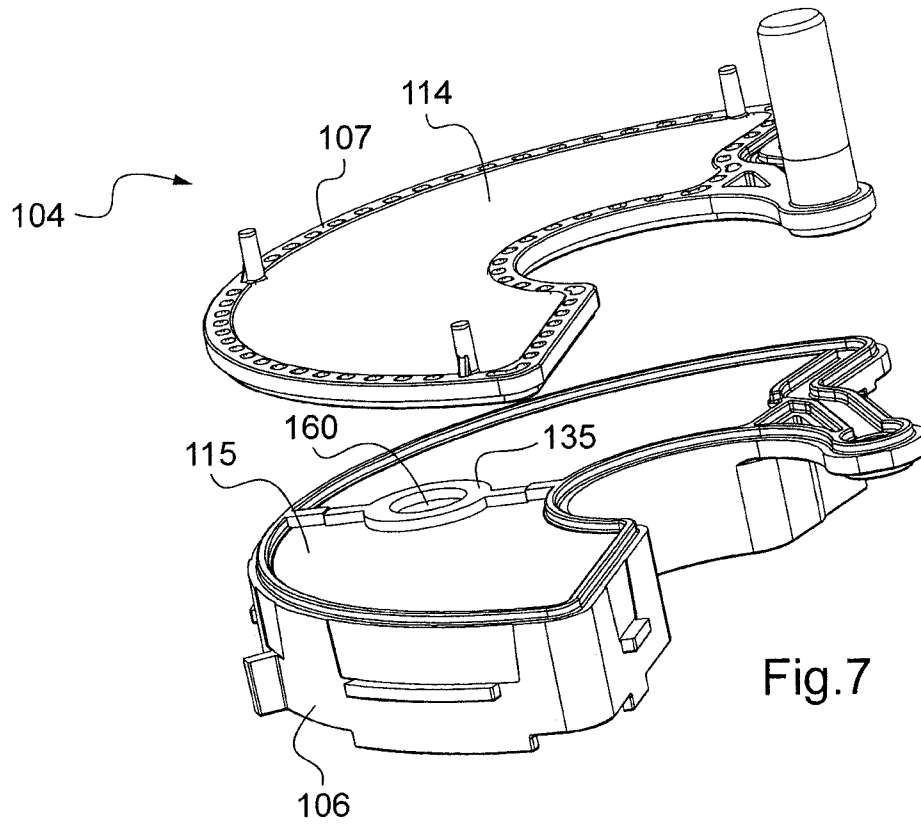
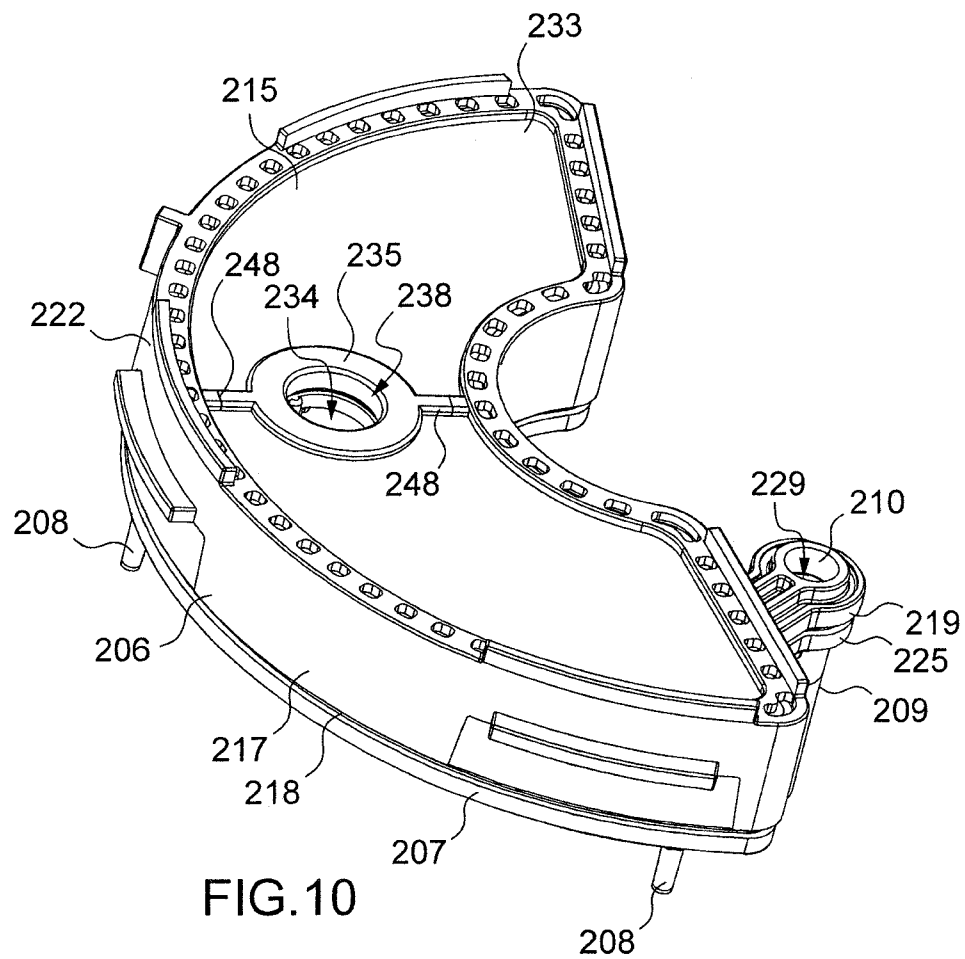
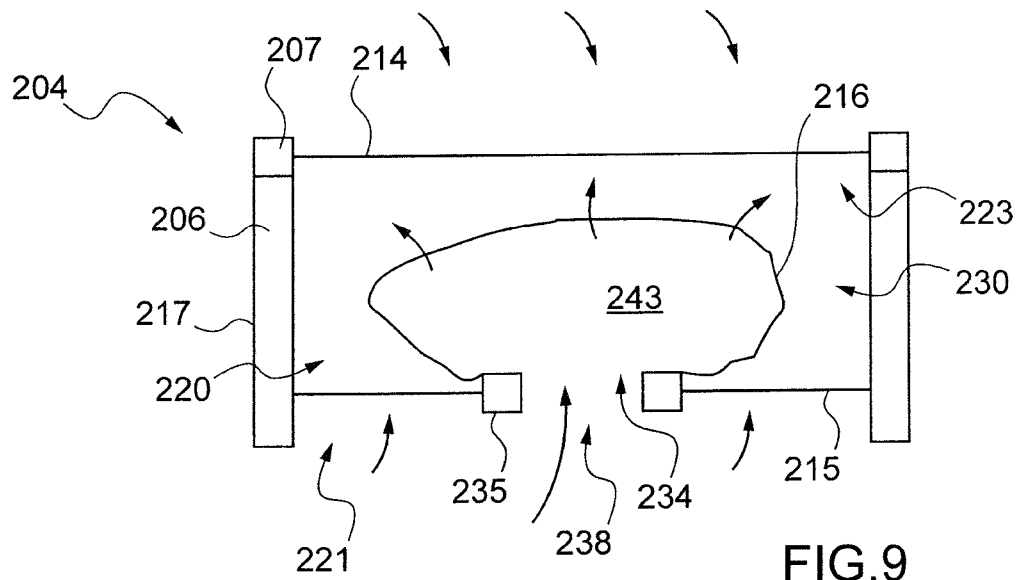


Fig.6

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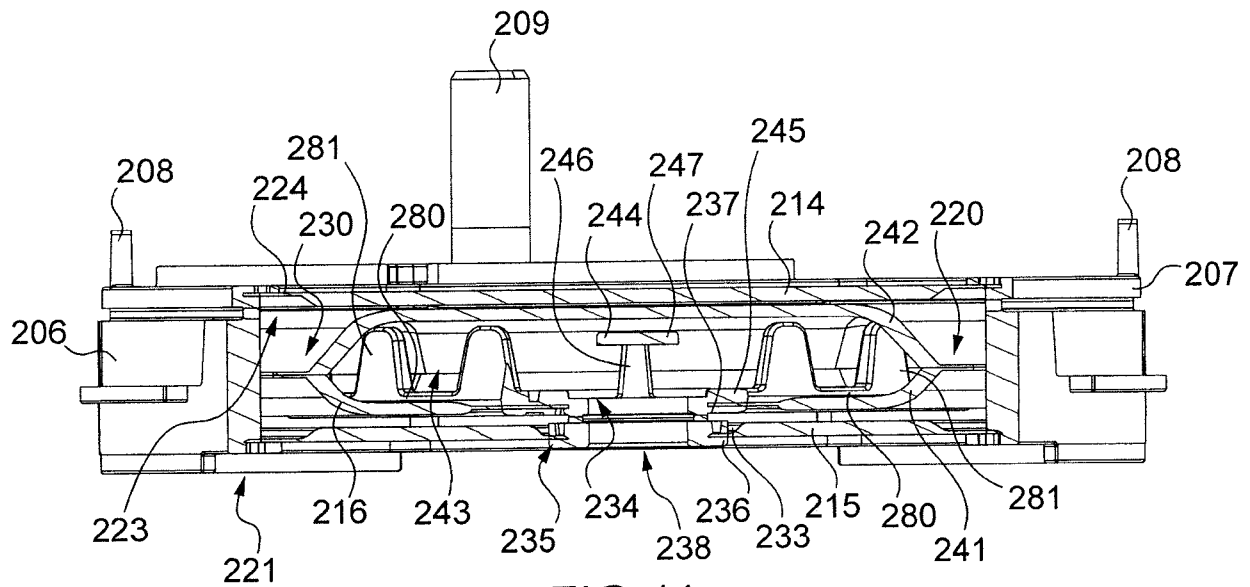


FIG. 11

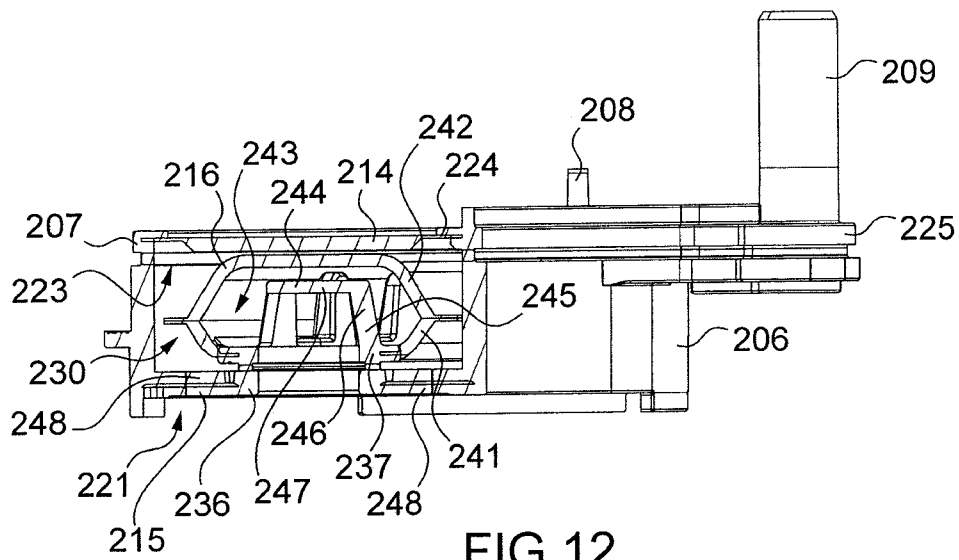


FIG. 12

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FIG.13

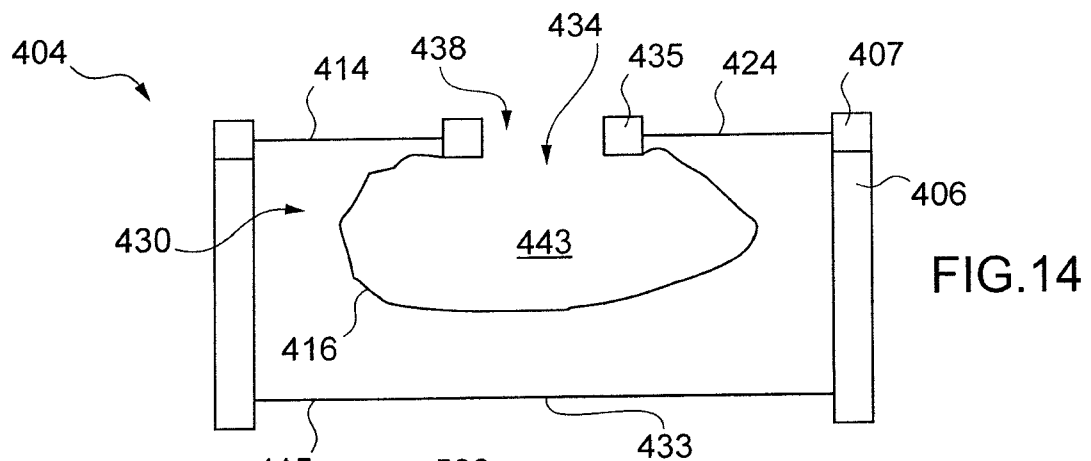
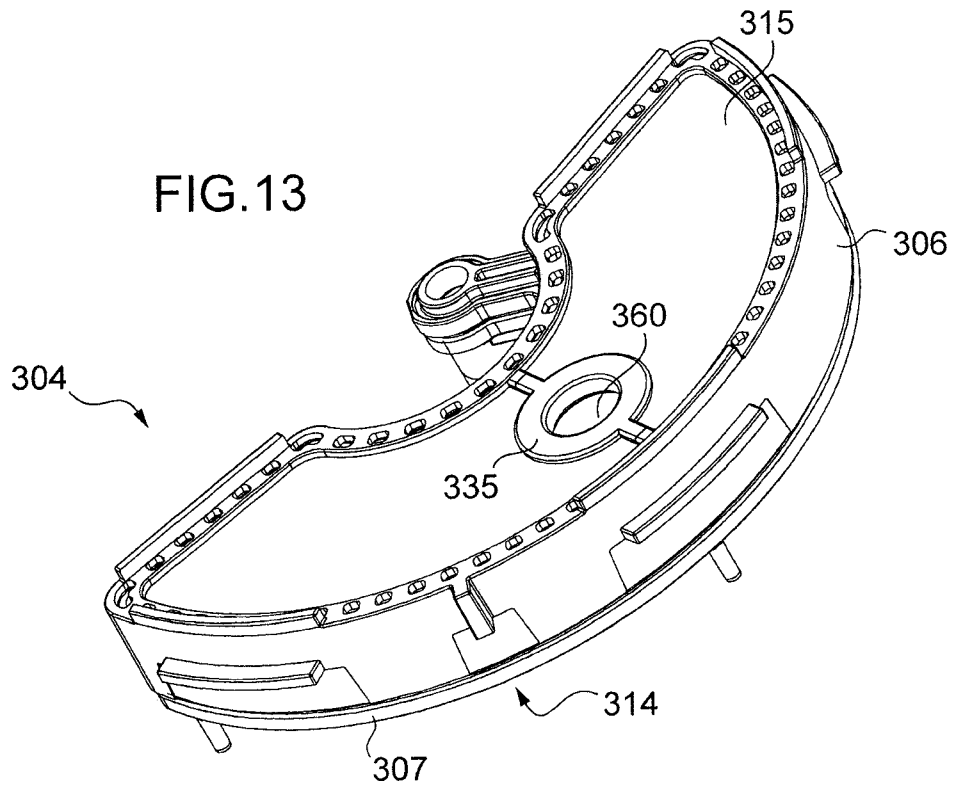


FIG.14

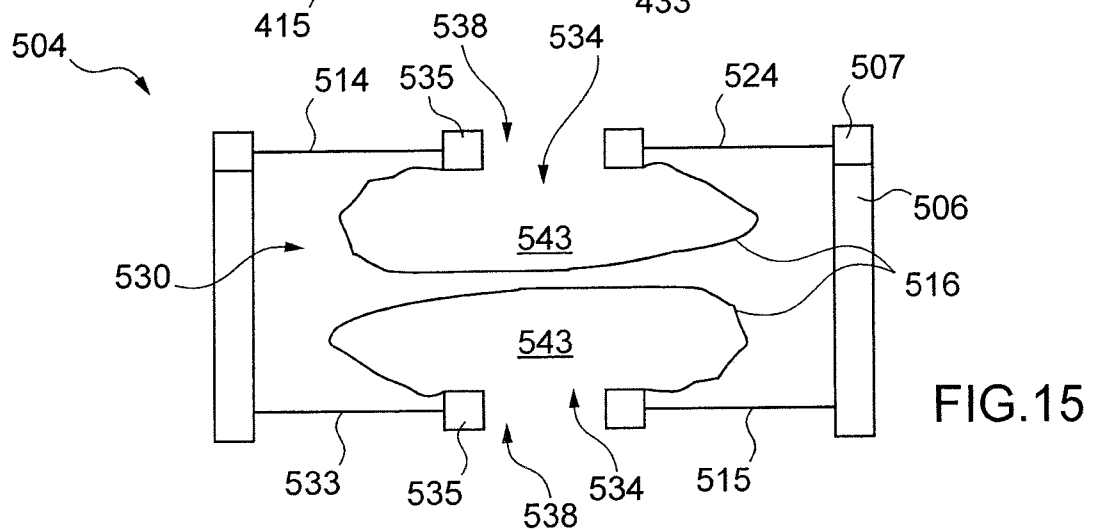


FIG.15

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2012/050934

A. CLASSIFICATION OF SUBJECT MATTER
INV. B01D35/027
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/294343 A1 (PEKARSKY LEV [US] ET AL) 3 December 2009 (2009-12-03)	1-9, 14-18
Y	figures 1,4-6	10-13
Y	----- EP 1 481 716 A1 (IBS FILTRAN KUNSTSTOFF METALL [DE]) 1 December 2004 (2004-12-01) figure 4	10-13
A	----- US 4 402 827 A (JOSEPH A DAVID [US]) 6 September 1983 (1983-09-06) figures 2,3	1-18
A	----- US 4 874 510 A (AKIRA MIZUSAWA [JP] ET AL) 17 October 1989 (1989-10-17) figures 1,8-10	1-18



Further documents are listed in the continuation of Box C.



See patent family annex.

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

30 April 2012

Date of mailing of the international search report

09/05/2012

Name and mailing address of the ISA/

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

Authorized officer

Hoffmann, Alexander

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2012/050934

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009294343 A1	03-12-2009	CN 201470214 U US 2009294343 A1	19-05-2010 03-12-2009
EP 1481716 A1	01-12-2004	AT 391543 T CN 1626267 A DE 60320234 T2 EP 1481716 A1 ES 2303575 T3 JP 2005048946 A KR 20040103472 A US 2004237485 A1	15-04-2008 15-06-2005 14-05-2009 01-12-2004 16-08-2008 24-02-2005 08-12-2004 02-12-2004
US 4402827 A	06-09-1983	NONE	
US 4874510 A	17-10-1989	JP 2054951 C JP 7073643 B JP 62168513 A US 4874510 A	23-05-1996 09-08-1995 24-07-1987 17-10-1989