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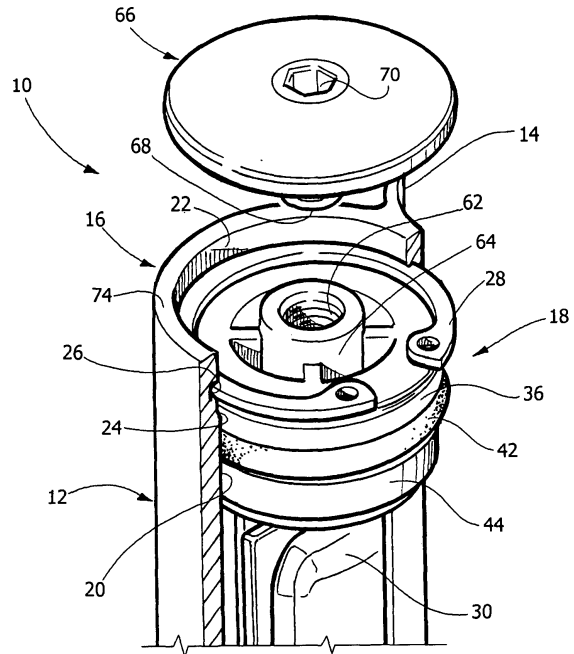
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(54) **Filter cartridge for air conditioning systems for vehicles**

(57) A filter assembly for air conditioning systems for vehicles, comprising:

- a tubular container (12) with an internal cylindrical wall (20) open at one end (16),
- a filter housed in the tubular container (12),
- a cap (18) with a cylindrical wall (36) guided with freedom of axial movement in the internal cylindrical wall (20) of the container (12) and provided with at least one circumferential seat (40, 48, 38) in which is housed at least one o-ring (42) positioned in sealing contact with the internal cylindrical wall (20) of the container (12),
- an elastic retaining ring (28) engaging a circumferential seat (26) formed on an end portion (16) of the container (12) and positioned in such a way as to prevent the extraction of the cap (18) from the container (12), and
- at least one protecting element (60, 66) able to prevent the entry of contaminants in the seal area between the o-ring (42) and the internal cylindrical wall (20) of the container (12).

FIG. 2



Description

[0001] The present invention relates to a filter assembly for air conditioning systems for vehicles.

[0002] An air conditioning system of a vehicle is generally provided with a filter assembly positioned between the condenser and the expansion valve. The filter assembly comprises a container with an inlet and an outlet and a particle filter positioned between the inlet and the outlet.

[0003] In some known solutions, the filter assembly is obtained in integral form with one of the distributors of the condensers. In these solutions, the container of the filter body is provided with a removable cap which closes in sealed fashion an opening of the container through which can be inserted and extracted a cartridge including the particle filter. The extractable cartridge can be provided with an extension bearing a permeable bag containing dehydrator material.

[0004] The document FR-A-2 798 456 describes a closure cap for a tubular container containing a dehydrator element. The cap is obtained in the form of a cylindrical element which is guided with freedom of axial displacement in a corresponding hole of the container. The cap is provided with two sealing o-rings which are inserted into corresponding annular seats of the cap and which act in sealing contact against an inner cylindrical wall of the container. An elastic retaining ring engages a circumferential seat formed on the inner cylindrical wall of the container and prevents the extraction of the cap from the container.

[0005] In a solution of the type described in the document FR-A-2 798 456 the fluid tightness is obtained solely by the tangential contact between the o-rings and the inner cylindrical wall of the container. Any damage to the o-ring would compromise the sealing capability of the cap and, consequently, of the entire air conditioning system of the vehicle.

[0006] The object of the present invention is to provide an enhanced filter assembly which allows to improve the seal guarantees provided by the cap over time.

[0007] According to the present invention, said object is achieved by a filter assembly having the characteristics set out in the main claim.

[0008] The characteristics and advantages of the present invention shall become readily apparent in the detailed description that follows, provided purely by way of non limiting example, with reference to the accompanying drawings, in which:

- Figure 1 is a partially sectioned perspective view of a filter assembly according to the present invention,
- Figure 2 is a partially exploded perspective view of the filter assembly of Figure 1,
- Figure 3 is an axial section showing the end portion of the filter assembly of Figures 1 and 2,
- Figure 4 is an axial section in the body of the cap used in the filter assembly according to the inven-

tion,

- Figure 5 is an enlarged detail of the part designated by the arrow V in Figure 4, and
- Figure 6 is an axial section of a preferred embodiment of an o-ring used in the filter assembly according to the invention.

[0009] With reference to Figures 1 through 3, the reference 10 designates a filter assembly for an air conditioning system for vehicles. The filter assembly 10, illustrated only partially in Figures 1 through 3, comprises a tubular container 12 with the shape of a cylinder with circular section elongated in the direction of its own axis, preferably made of aluminium or alloys thereof. The container 12 can be obtained by extrusion and it is preferably destined to be permanently fastened to a distributor of a condenser. For this purpose, the container 12 is preferably provided with an integral flange 14 (shown only partially in Figures 1 through 3) with a bearing surface having semi-circular shape which is destined to be fastened by furnace brazing on the external surface of the distributor. The container 12 has an end (not shown in the drawings) closed in permanent fashion, and an opposite end 16 closed in sealed fashion by a removable cap 18.

[0010] The container 12 of the filter assembly 10 has an internal cylindrical wall 20 with circular section. The cylindrical wall 20 has a portion 22 with greater diameter near the end 16. The portion with greater diameter 22 is joined to the cylindrical wall 20 by means of a conical chamfer 24. The portion with greater diameter 22 is provided with an annular groove 26 for an elastic retaining ring 28 made of metallic material of the kind commercially known as "Seeger ring".

[0011] The container 12 of the filter assembly 10 in use is inserted between the condenser and the expansion valve of the air conditioning system of the vehicle. In the cases in which the condenser is provided with a sub-cooling section, the filter assembly 10 is inserted in series between the condensing section and the sub-cooling section of the condenser.

[0012] The filter assembly 10 performs the function of expansion tank of the air conditioning system of the vehicle. It is also provided with a particle filter and with a dehydrator element.

[0013] To perform the filtering function, inside the container 12 is housed a cartridge provided with a mesh filter positioned between an inlet and an outlet of the container 12. The cartridge bearing the particle filter is preferably fastened in permanent fashion to the cap 18 as described in detail in a contemporary patent application by the same Applicant. Inside the container 12 is also housed a bag 30 made of permeable material containing a dehydrator material.

[0014] With reference in particular to Figures 3 and 4, the cap 18 comprises a body 32 made of injection moulded plastic material provided with integral teeth 34 (only one of which is shown in Figures 3 and 4) which

are used for the permanent fastening of the body of the cap 32 to the body of the filter cartridge, as described in detail in a contemporary patent application by the same Applicant.

[0015] The body of the cap 32 is constituted by a monolithic element made of injection moulded plastic material and comprises a cylindrical guiding surface 36 which in use is guided in the internal cylindrical surface 20 of the container 12. The body of the cap 32 has a cylindrical surface 38 with smaller diameter than the guiding surface 36. Between the guiding surface 36 and the portion with smaller diameter 38 is formed a step with a radial surface 40. In the surface 38 is inserted an o-ring 42 which establishes a sealing contact with the internal cylindrical surface 20 of the container. The body of the filter cartridge fastened to the body of the cap 32 has a portion 44 (Figures 1-3) which forms a second radial surface 48 parallel to and facing the first radial surface 40. The radial surfaces 40, 48 and the portion of cylindrical surface 38 included between said radial surfaces form an annular seat with U-shaped cross section in which the o-ring 42 is housed.

[0016] According to a preferred embodiment of the present invention, the o-ring 42 can be obtained as shown in Figure 6, with a lobed cross section having on the outer surface two seal areas 50 separated from each other by a depression 52. Similarly, the inner sealing surface of the o-ring 42 has two seal areas 54 mutually separated by a depression 56.

[0017] The cap 18 can also be provided with two o-rings 42 as described in the contemporary patent application by the same Applicant, mentioned previously. In the version with two o-rings, each of the two o-rings can have circular cross section or with lobed section as shown in Figure 6.

[0018] With reference to Figure 4, the guiding surface 36 of the body of the cap 32 terminates, at the opposite side with respect to the radial surface 40, with a conical chamfer 58 which is destined to engage the conical chamfer 24 formed on the internal surface 20 of the container 12 to form a stop that prevents the cap 18 to be sucked back into the container 12 when a vacuum is produced inside the air conditioning system. With reference to Figures 4 and 5, the body of the cap 32 is provided with a continuous annular lip 60 integral with the body of the cap, which forms a protection element able to engage with slight interference the surface 22 of the container 12. The protection lip 60 forms a closure which prevents the entry of contaminants of various kinds in the seal area between the o-ring 42 and the inner cylindrical wall 20 of the container 12. In particular, the protection lip 60 prevents dust, dirt or potentially corrosive liquid substances from coming in contact with the o-ring. The lip 60 also performs a scraping action against the cylindrical surface 22 which removes any dirt which may have accumulated on the part of surface 22 external to the cap during the extraction of the cap. Therefore, there is a reduction in the risk that, during the reinsertion of

the cap, traces of dust or dirt may collect on the external surface of the o-ring 42 which could compromise the sealing contact between the o-ring 42 and the surface 20.

[0019] The body of the cap 32 is also provided with a threaded hole 62 with an axis coinciding with the axis of the body of the cap 32 and formed in an integral central part 64 of the body of the cap 32. The threaded hole 62 can be engaged by a threaded tool for extracting the cap 18 from the container 12. The extraction of the cap is naturally possible only after removing the elastic retaining ring 28.

[0020] The threaded hole 62 can also be used to fasten a disk-shaped protecting element 66 (Figures 1-3). The disk-shaped protecting element 66 is provided with a threaded axial appendage 68 which engages the threaded hole 62 of the body of the cap 32. The disk-shaped protecting element 66 is preferably provided on its external part with a hexagonal hole 70 able to be engaged by an Allen wrench to screw and unscrew the protecting element 66 relative to the body of the cap 32.

[0021] The protecting element 66 has a slightly larger diameter than the diameter of the internal cylindrical surface 22 of the container 12. Therefore, when the disk-shaped protecting element 66 is screwed onto the cap 18, a surface 72 of the protecting element 66 comes in contact against a front surface 74 of the container 12 forming a closure which prevents the entry of dust or contaminants into the seal area of the cap 18.

[0022] The disk-shaped protecting element 66 can be used together with or instead of the protecting lip 60 formed on the body of the cap 32.

[0023] It is readily apparent that the presence of one or both the protecting elements 60, 66 allows to prevent the entry and the accumulation of contaminants on the internal wall of the container 12 outside the seal area. Therefore, these contaminants are prevented from coming in direct contact with the o-ring even during the extraction and reinsertion of the cap 18. This allows to prevent a deterioration of the sealing characteristics of the o-ring by effect of contact with contaminants and it also allows to prevent dust, dirt or other contaminants from being deposited on the outer surface of the o-ring during the extraction and reinsertion of the cap.

Claims

1. A filter assembly for air conditioning systems for vehicles, comprising:
 - a tubular container (12) with an internal cylindrical wall (20) open at one end (16),
 - a filter housed in the tubular container (12),
 - a cap (18) with a cylindrical wall (36) guided with freedom of axial movement in the internal cylindrical wall (20) of the container (12) and provided with at least one circumferential seat

- (40, 48, 38) in which is housed at least one o-ring (42) positioned in sealing contact with the inner cylindrical wall (20) of the container (12),
- an elastic retaining ring (28) engaging a circumferential seat (26) formed on an end portion (16) of the container (12) and positioned in such a way as to prevent the extraction of the cap (18) of the container (12),

characterised in that it comprises at least one protecting element (60, 66) able to prevent the entry of contaminants in the seal area between the o-ring (42) and the internal cylindrical wall (20) of the container (12).

2. A filter assembly as claimed in claim 1, **characterised in that** said protecting element comprises at least one protecting lip (60) formed in integral fashion with a body of the cap (32) and able to engage with slight interference a part (22) of the internal cylindrical surface (20) of the container (12).
3. A filter assembly as claimed in claim 2, **characterised in that** the protecting lip (60) is formed in the immediate vicinity of the part with greater diameter of a conical arresting chamfer (58) of the body of the cap (32).
4. A filter assembly as claimed in claim 1, **characterised in that** said protecting element comprises a disk-shaped element (66) fastened in separable fashion to the cap (18) and able to form a closure on a front wall (74) of the container (12).
5. A filter assembly as claimed in claim 4, **characterised in that** the disk-shaped element (66) has a threaded appendage (68) which engages a threaded hole (62) of the cap (18).
6. A filter assembly as claimed in one or more of the previous claims, **characterised in that** the o-ring (42) has a lobed cross section with two seal areas (50) separated from each other by a depression (52).

FIG. 1

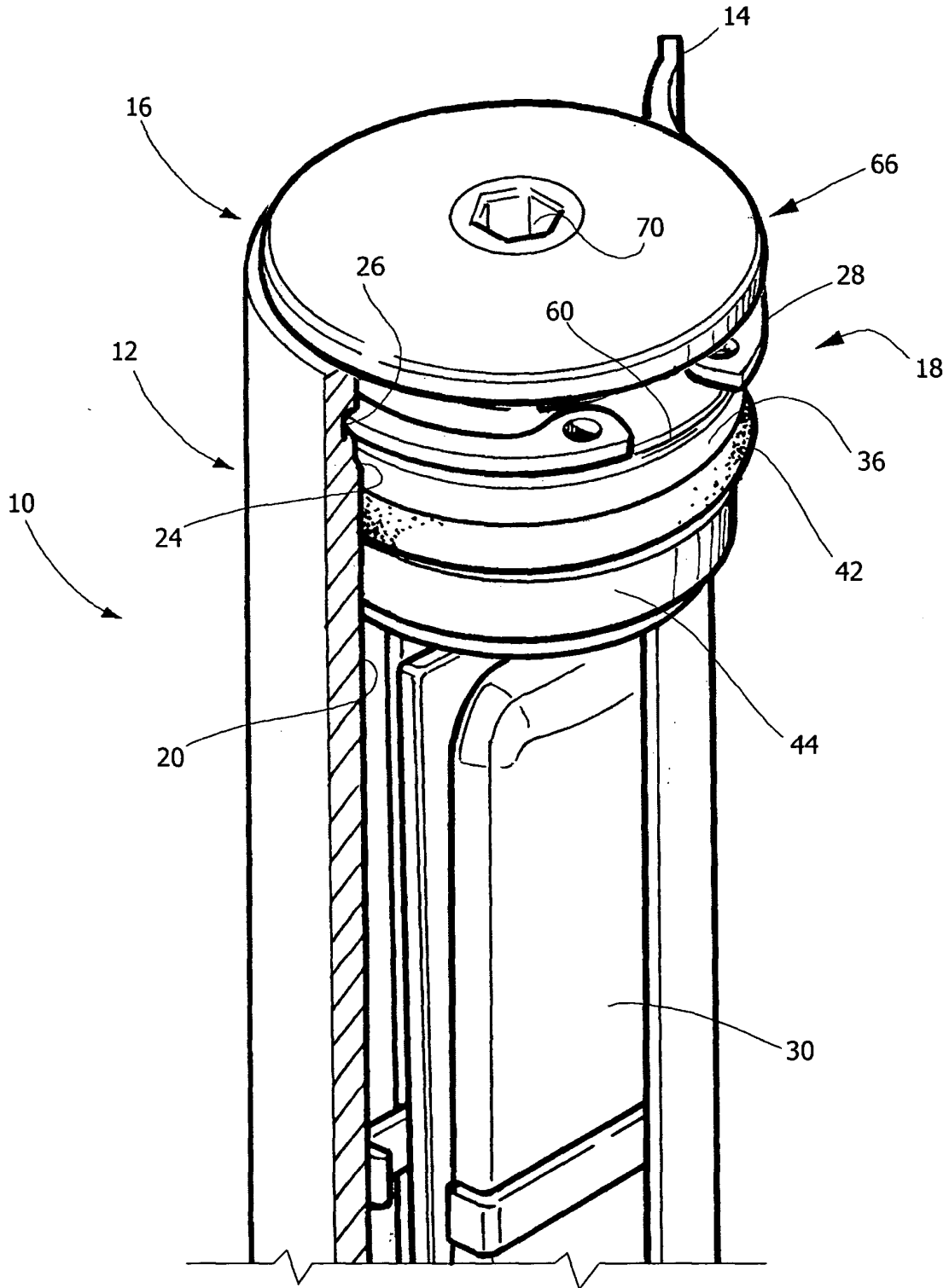


FIG. 2

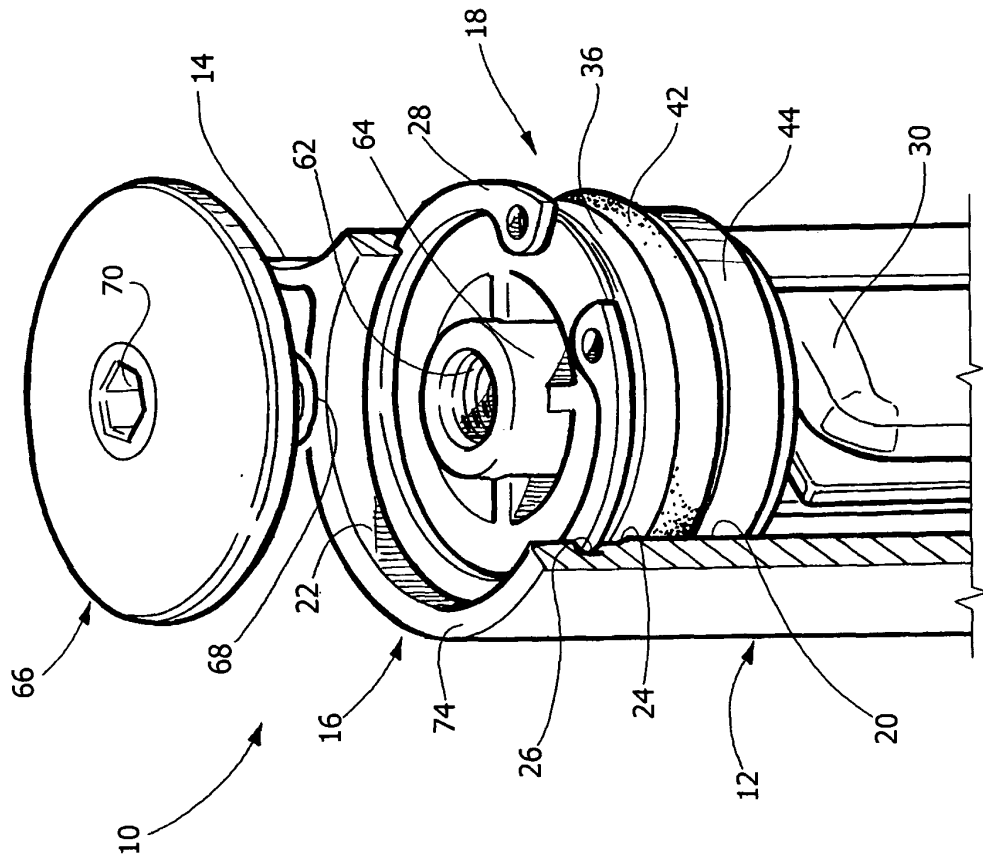


FIG. 3

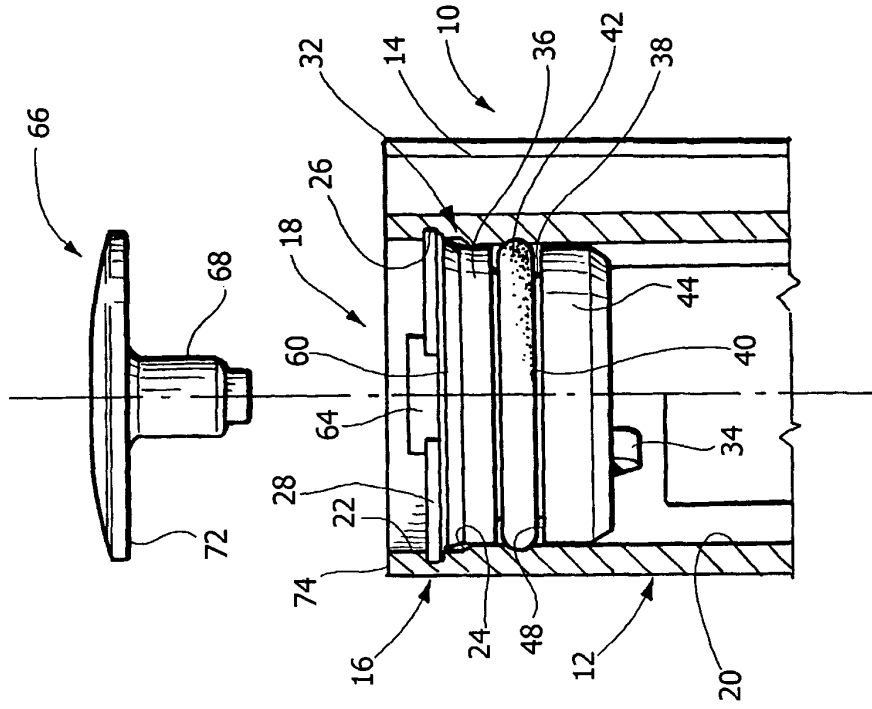


FIG. 4

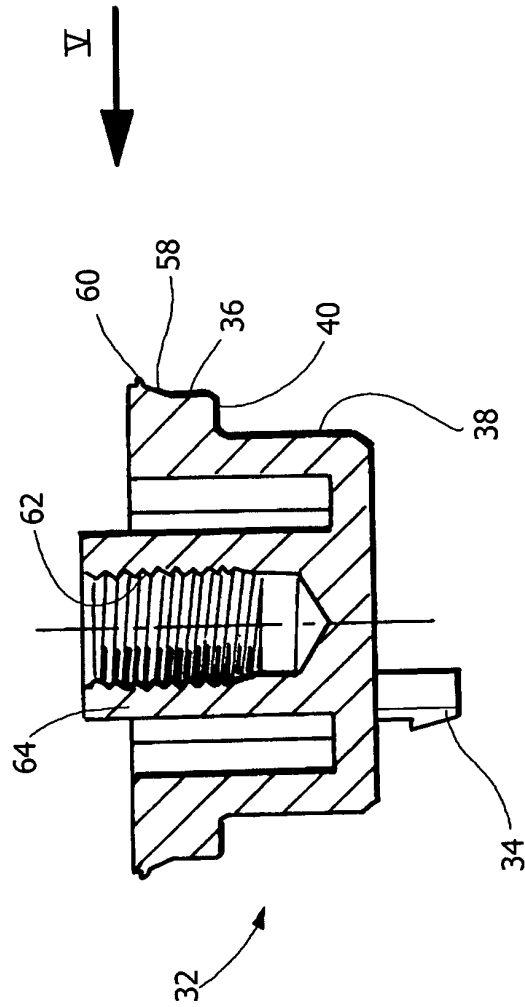


FIG. 5

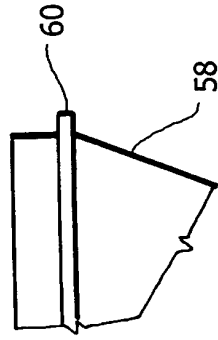
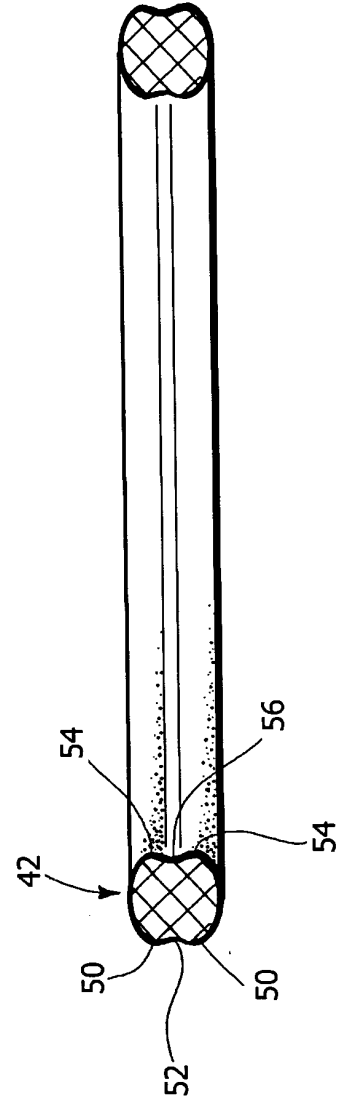


FIG. 6





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 42 5204

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
E	EP 1 437 560 A (BEHR LORRAINE S A R L) 14 July 2004 (2004-07-14) * the whole document *	1,4-6	F25B43/00 B01D35/30
X	----- PATENT ABSTRACTS OF JAPAN vol. 2002, no. 11, 6 November 2002 (2002-11-06) -& JP 2002 195701 A (NIKKEI NEKKO KK), 10 July 2002 (2002-07-10) * abstract; figures 5,2 *	1-3,6	
X	----- US 6 446 463 B2 (BERNINI MICHELE) 10 September 2002 (2002-09-10) * column 5, line 44 - line 54 * * figure 9 *	1,6	
A	----- FR 2 822 518 A (VALEO THERMIQUE MOTEUR) 27 September 2002 (2002-09-27) * the whole document *	1-6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B01D B60H F25B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		12 August 2004	Hilt, D
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X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EPO FORM 1503 03/82 (P04/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 42 5204

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12-08-2004

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 1437560	A	14-07-2004	EP 1437560 A1	14-07-2004
			WO 2004061376 A1	22-07-2004

JP 2002195701	A	10-07-2002	NONE	

US 6446463	B2	04-10-2001	DE 20004438 U1	21-06-2000
			EP 1132695 A1	12-09-2001
			US 2001025511 A1	04-10-2001

FR 2822518	A	27-09-2002	FR 2822518 A1	27-09-2002
			WO 02077498 A2	03-10-2002
