



(11) **EP 2 412 409 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**01.02.2012 Bulletin 2012/05**

(51) Int Cl.:  
**A62C 2/12 (2006.01)**

(21) Application number: **11175461.0**

(22) Date of filing: **26.07.2011**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB  
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO  
PL PT RO RS SE SI SK SM TR**  
Designated Extension States:  
**BA ME**

(72) Inventors:  
• **Lo Cicero, Federico**  
**20090 Segrate (Milano) (IT)**  
• **Ripa, Alberto**  
**20131 Milano (IT)**  
• **Passerini, Marco**  
**25057 Sale Marasino (Brescia) (IT)**  
• **Jung, Thierry**  
**67280 Urmatt (FR)**

(30) Priority: **28.07.2010 IT MI20101394**

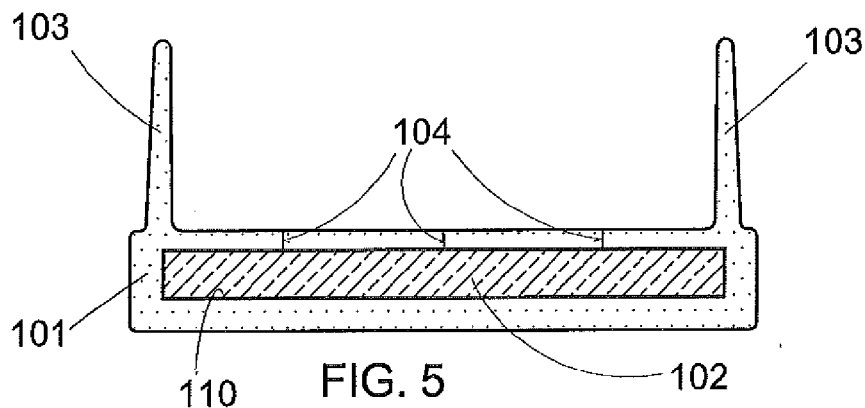
(71) Applicants:  
• **Posa S.P.A.**  
**20047 Brugheiro (Monza-Brianza) (IT)**  
• **JT Finance**  
**67280 Urmatt (FR)**

(74) Representative: **Petruzzello, Aldo**  
**Racheli S.r.l.**  
**Viale San Michele del Carso, 4**  
**20144 Milano (IT)**

(54) **Single-body intumescent gaskets for cold and hot smoke sealing, in particular for fire dampers**

(57) A description is given of a single-body gasket for fire dampers (100) formed by an intumescent material

(102) covered externally by a silicone elastomer crosslinkable without heat by means of UV radiation exposure.



**EP 2 412 409 A1**

## Description

**[0001]** The present invention relates to intumescent gaskets for hot smoke and also cold smoke sealing, particularly suitable for fire dampers.

**[0002]** Fire dampers are used in the compartmentalisation of fire-fighting zones in ventilation and/or air-conditioning systems and their purpose is to avoid the propagation of smoke in the air distribution channels during a fire by means of the closure of the respective blade mounted on said damper.

**[0003]** The closure of the blades generally takes place when a sensing member present thereon reaches the temperature of 72°C: however the intumescent gaskets mounted on the blade or in the immediate vicinity thereof generally ensure good hot smoke sealing, generally at temperatures higher than 110°C, thanks to the expansion of the intumescent material, but are not suitable for lower temperature smoke sealing.

**[0004]** This is due to the fact that gaskets for fire dampers available to date on the market are formed in actual fact by two different gaskets adjacent one to the other and not integral, each one suitable for performing a different task: the first gasket is suitable for fire damping and hot smoke sealing which is made up of a band (A) in intumescent material having a minimum expansion temperature of 120-200°C, which can also be covered by a profile (B) in plastic, rigid or semi-rigid; the second gasket is suitable for cold smoke sealing which is made up, for example, of expanded polyurethane foam (C).

**[0005]** The limits of this technical solution lie in having to use two different gaskets with different function to ensure the functioning of the entire system, and in having to attach the gasket (C), for example in polyurethane foam, close to the other gasket and to the blade by means of appropriate adhesives. Moreover, in the specific case of profiles for intumescent in rigid plastic, for example those for containing intumescent calcium silicates, their elastic and sealing performances are limited due to the reduced adaptability to curvilinear shapes.

**[0006]** To overcome this problem of elasticity and of sealing attempts were made to incorporate the intumescent material, in general intumescent graphite, in a PVC matrix so as to generate a composite suitable for being extruded in flexible tubular form: however the incorporation of intumescent material in a polymeric matrix such as PVC results in a smaller expansion of the intumescent material at the time of use since it expands partially already during the incorporation and/or crosslinking of the tubular article, and therefore with lower fire damping performances. Moreover the obtaining of flexible gaskets with smooth surface from said extrudable matrices is difficult and their combustion generates toxic fumes such as hydrochloric acid.

**[0007]** Profiles in plastic are not known to date which are flexible and which contain intumescent material able both to seal against cold smoke and to expand completely during the fire.

**[0008]** EP 2062617 describes a gasket for fire dampers formed by a band core made of intumescent material around which a flexible sheath is placed with an air gap for allowing the expansion of the intumescent material.

5 The sheath which limits the expansion of the intumescent material is formed by a flame-resistant woven material whose threads are covered with silicone to give the woven material flexibility and is fitted over the band of intumescent material.

10 **[0009]** This type of intumescent gaskets cannot take on complex forms and geometries but can only have regular shapes given that the external covering is formed by a fabric.

**[0010]** DE 102009000618 describes an intumescent gasket made up of two different gaskets, adjacent one to the other but not integral, formed by a first expansion gasket formed by intumescent material which is surrounded by a second elastic gasket in silicone or rubber, with an H shape. This type of gasket has the disadvantages listed above for the gaskets formed by two gaskets in contact.

20 **[0011]** The gasket in silicone or rubber described in DE 10 2009 000 618 and the sheath described in EP 2 062 617 are moreover made with a process which does not involve directly the intumescent material. They are applied or fitted around the intumescent material, to constitute with it a double gasket.

25 **[0012]** The object of the present invention is that of providing flexible and elastic gaskets for fire dampers suitable for being mounted on the blades of said dampers, or in the immediate vicinity, able to create a hot and cold smoke seal by means of a single body and which can be manufactured without causing the expansion, even only partial, of the intumescent material incorporated in them.

30 **[0013]** Another object of the present invention is that of providing such a gasket with smooth surface which is also practical, easy to make, economical and which can have an external covering of any form and geometry.

35 **[0014]** A further object of the present invention is to allow the making of fire dampers provided with sealing, also cold smoke sealing, without using fire gaskets formed by two different adjacent gaskets.

40 **[0015]** These objects are achieved in accordance with the invention with the features listed in the annexed independent claims 1 and 9,

**[0016]** Advantageous embodiments of the invention are disclosed by the dependent claims. The object of the present invention is a single-body intumescent gasket formed by a band of intumescent material covered by a profile in silicone elastomer material (defined also as silicone rubber) having a smooth surface.

45 **[0017]** In practice in the present gasket the intumescent material is incorporated as a band in a matrix of a silicone elastomer extrudable and crosslinkable without heat by means of UV rays.

**[0018]** In the present gasket, in fact, the intumescent strip or band forms a single body with the covering made

of silicone in that the intumescent material is internal and integral with said covering thanks to the fact that the latter is coextruded over the tumescent material. This means that the strip is non-removable in relation to the covering and removable from the gasket only by breaking said covering.

**[0019]** This single-body gasket is able to seal against both cold smoke thanks to the external profile in silicone crosslinkable without heat (i.e. without heat supplied as occurs for example in IR ovens, hot air ovens, UHF ovens, in molten salt baths, in autoclave) which can be made in any form and geometry complementary to the form of the seat, and against hot smoke thanks to the intumescent material contained inside said profile.

**[0020]** Therefore there is no need to couple to the gasket in accordance with the present invention a second gasket (C) in expanded polyurethane as instead occurs in the prior art described above.

**[0021]** In fact at ambient temperature it is the profile of the external covering which forms a seal in the seat, while in the case of fire or high heat it is the expanding intumescent material which forms a seal in the seat wherein the gasket has been placed since the external profile in silicone deforms and/or burns to ashes, leaving space for the expansion of the intumescent material.

**[0022]** It should be noted that this behaviour is opposed to what occurs in intumescent gaskets with woven glass fibre sheath where the sealing in the seat is always formed by the sheath even after expansion of the intumescent material.

**[0023]** The gasket in accordance with the present invention is also suitable for air and water sealing.

**[0024]** With intumescent material the intent here is to identify an incombustible material which reacts to high temperatures, expanding fast and ensuring a perfect sealing of the empty spaces against the hot smoke, such as for example expanded graphite, silicates and the like, preferably expandable graphite of flame-retardant grade.

**[0025]** Further features of the invention will be made clearer by the following detailed description referred to one of its embodiments purely by way of a non-limiting example, illustrated in the accompanying drawings, in which:

Fig. 1 is a simplified perspective view of a fire damper with circular section with blade open to allow the passage of air (indicated by the arrows);

Fig. 2 is a simplified perspective view of the fire damper of Fig. 1 with blade closed to block the passage of smoke (indicated by the arrows);

Figs. 3 a) and b) are partially sectioned plan top views of the fire damper of Figs. 1 and 2 with blade open and closed respectively;

Figs. 3 c) and d) are enlarged views of the detail denoted by A in Fig. 3b) illustrating respectively the closed damper gasket in condition of cold gas sealing (<120°C) and hot gas sealing (<120°C) after expansion of the intumescent material;

Fig. 4a is a front view of the damper of Fig. 3 a);

Fig. 4b is a front view of a second damper for ducts with square profile;

Fig. 5 is an enlarged section view of a gasket used in the dampers of the previous illustrations;

Figs. 6-7 are sectioned views of gaskets with different external profiles;

Figs. 8-10 are views from above of cross sections of gaskets with different external profiles inserted in the door sill of aluminium doors.

**[0026]** Figure 1 shows a typical cylindrical fire damper for air-conditioning or ventilation ducts denoted by reference numeral 1.

**[0027]** In normal ambient conditions this damper 1 is open since the blade 2 of circular shape is in line with the flow of air in the duct which is indicated in the drawing by means of arrows. Around its perimeter said blade 2 has mounted one or two gaskets 100 in accordance with the present invention, positioned parallel one to the other, which will go to form a seal between the perimeter of the blade 2 and the inner wall of the fire damper (Figs. 3c, 3d) when said blade 2 is to be closed, positioning perpendicular to the flow of air (Fig. 2 and Fig. 3b).

**[0028]** Thanks to the high sealing also against cold smoke of the gaskets 100 in accordance with the invention, the flow of air does not propagate in the duct whereon the fire damper 1 is mounted as illustrated by the curved tip arrows in Fig. 2, once the blade 2 of the damper 1 is closed.

**[0029]** The blade 2 is mounted on a small shaft 3 around which said blade can rotate when driven by actuation means 4 (Figs. 4a and 4b).

**[0030]** Going into detail, each gasket 100 is housed in a respective cavity formed in the thickness of the blade 2 around its perimeter to allow the housing thereof, or can be stapled on the blade or on the perimeter of the duct made in aluminium.

**[0031]** In this case the gasket 100 has an external profile with C shape in cross section, suitable for sealing when the gasket is mounted around the circular blade 2 (Fig. 5): in cross section the external profile of this gasket 100 is formed by a central portion or body 101, substantially rectangular and hollow, such as to define a tubular seat 110 which houses internally the intumescent material 102.

**[0032]** At the ends of said central portion 101 two fins 103 extend integral with the central portion 101 which are suitable for cold smoke sealing against the walls 5 (Figs. 3c and 3d) of the fire damper 1 inserted in the duct (not illustrated). The external profile is made in silicone crosslinkable without heat and the gasket is a single body since the various portions are continuous one with the other.

**[0033]** Said gasket 100 also has longitudinal incisions 104, preferably discontinuous, which encourage the breaking of the seat 110 of the intumescent material facilitating the release of said intumescent material 102

expanding in the case of increase of the temperature.

**[0034]** The siliconic material is coupled with the intumescent material so as to cover it entirely.

**[0035]** The gasket 100 in accordance with the invention is obtained by means of the coextrusion of a silicone elastomer around a layer of intumescent material. Said layer can have any thickness and depends in part on the degree of expandibility of the intumescent material. An example of suitable thickness can be a value comprised between 1.5 and 5.0 mm.

**[0036]** The coextrusion means that the external profile of the gasket constituted by the silicone elastomer is completely in contact with the intumescent material, adhering thereto without leaving any air gap between them.

**[0037]** Moreover the coextrusion allows intumescent gaskets to be obtained having an external profile of any form and geometry, a situation which cannot be achieved in the case of intumescent gaskets obtained by covering of the intumescent material or provided with external woven glass fibre sheath, such as those described for example in EP 2062617, wherein the covering/sheath adapts to the shape of the intumescent material generally in strip form.

**[0038]** Subsequently the silicone elastomer material is crosslinked without heat in a few seconds by means of UV radiation exposure, at a temperature extensively compatible with all intumescent materials including those which expand at lower temperatures.

**[0039]** The silicone elastomer used here is typically a solid silicone elastomer containing silicone polymers with high molecular weight and long polymer chains, perfectly suitable for the process of extrusion and which can be crosslinked without the use of heat (cold) by means of UV radiation exposure.

**[0040]** Thanks to the use of elastomeric silicone crosslinkable without heat it is possible therefore to manufacture highly flexible intumescent gaskets with smooth surfaces which can house internally expandable intumescent materials. These gaskets are suitable for being usable from -60°C to the temperature of expansion of the intumescent material. This siliconic material can also be formulated with one or more specific additives which give resistance, for example, to heat, flame, bacteria and mould.

**[0041]** Since the external profile in silicone elastomer material has the purpose of ensuring smoke sealing when the intumescent material has not yet expanded (smoke still "cold" with temperatures below 100°C), this profile will have the most suitable shape according to the final application and to the seat wherein said gasket will be housed, also being able to have hitching feet 106 (Figs. 8 and 10) or abutting balloons 105 (Figs. 6-7), etc., as an alternative to or in addition to the sealing fins 103.

**[0042]** For example the gasket 100 shown in Fig. 7 has the external covering with a P profile, in cross section, which is formed by a central portion 101 where the intumescent material 102 is contained, wherefrom a hitching foot 106 and an internally hollow abutting balloon 105

extend, which are both integral with said central portion 101.

**[0043]** In another embodiment the gasket 100 has an external covering as defined above and moreover comprises hitching feet 106 represented by a T portion, which is integral with said central portion 101, as illustrated in Figs. 8-9.

**[0044]** In Fig. 10 the gasket 100 has an external covering comprising two fins 103 and a T portion 106 which is however separated from said central portion 101 by means of a through cavity 107.

**[0045]** As can be seen from Figs. 8-10 the T portion 106 is suitable for being inserted in the guillotine 7 of a door sill 8 and ensures that it is restrained by said guillotine 7, forming a seal between the fire door and the respective frame.

**[0046]** In yet another embodiment the gasket 100 has the external covering whose profile, in cross section, is formed by a central portion 101 from whose end a hitching foot 106 and a hollow abutting balloon 105 extend, as illustrated in Fig. 6.

**[0047]** In practice the fins in silicone 103, like the abutting balloons 105 in silicone, represent means suitable for cold smoke sealing.

**[0048]** The lack of PVC ensures the lack of hydrochloric acid fumes in the event of fire.

**[0049]** It is to be understood that also other types of elastomers (rubbers) which can be crosslinked without heat can be used to make the external covering of the gasket in accordance with the present invention.

**[0050]** Numerous detail changes and variations can be made to the present embodiment of the invention within the reach of a person skilled in the art, in any case coming within the scope of the invention expressed by the annexed claims.

## Claims

1. Single-body intumescent gasket (100) formed by an external profile constituted by a polymeric material which surrounds and is in contact with an intumescent material (102) inside said profile and integral with it, **characterised in that** said polymeric material is coextruded around said intumescent material (102) and is constituted by a silicone elastomer crosslinkable without heat by means of UV radiation exposure.
2. Gasket according to claim 1, wherein the intumescent material (102) is expandable graphite, preferably "flame retardant" grade.
3. Gasket according to claim 1 or 2, wherein said external covering comprises a central portion (101) having a tubular seat (110) housing said intumescent material,

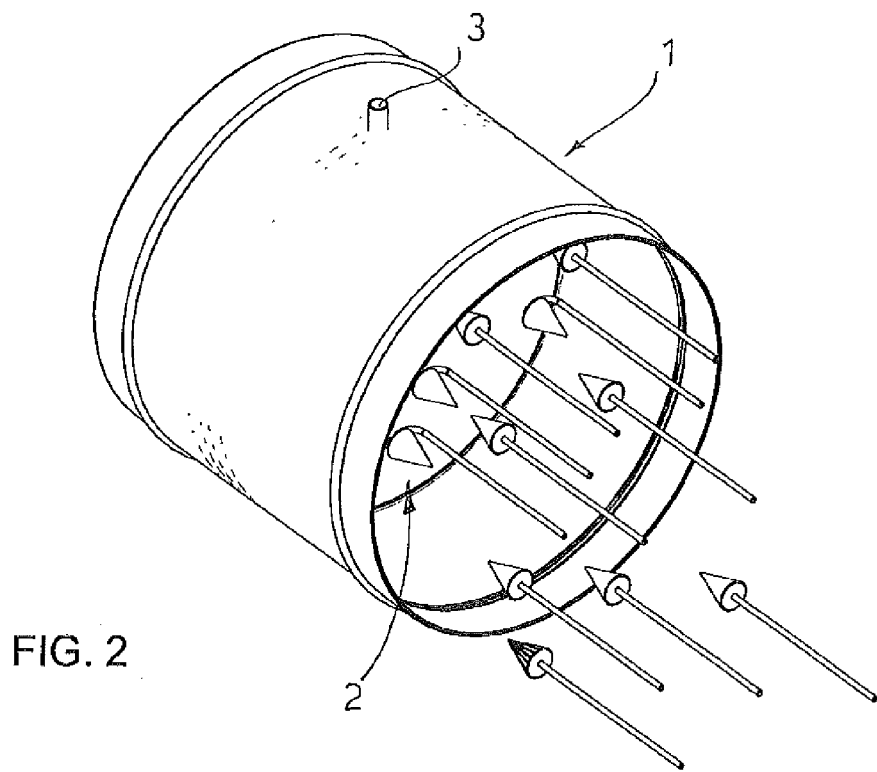
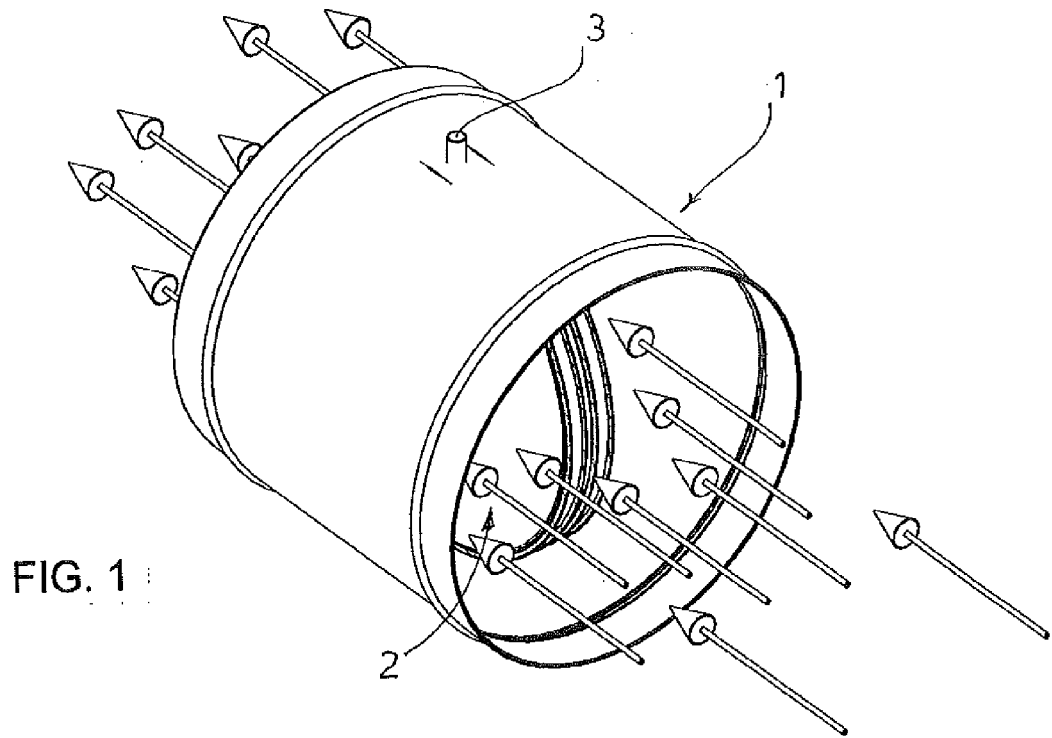
4. Gasket according to claim 3, **characterised in that** it has longitudinal incisions (104) suitable for promoting the breaking of said seat (110) and facilitating the expansion of said intumescent material (102) in the event of a temperature increase. 5
5. Gasket according to any one of the previous claims, **characterised in that** said covering comprises cold smoke sealing means (103;105). 10
6. Gasket according to any one of the previous claims, wherein said external covering has a C-form profile formed by a central portion (101) from whose ends two cold smoke sealing fins (103) extend and are integral with said central portion (101). 15
7. Gasket according to any one of previous claims 1 to 5, wherein said external covering is formed by a central portion (101) from whose ends at least one hitching foot (106) and an abutting balloon (105) for cold smoke sealing extend and are integral with said central portion (101). 20
8. Gasket according to any one of previous claims 3 to 7, wherein said central portion (101) further comprises a hollow cavity (107). 25
9. Fire damper (1) for ventilation and air-conditioning ducts comprising a blade (2) for the opening or closure of said damper (1), **characterised in that** around the perimeter of said blade (2) or around the perimeter of the duct at least one single-body intumescent gasket (100) is placed as defined by any one of previous claims 1-8. 30  
35

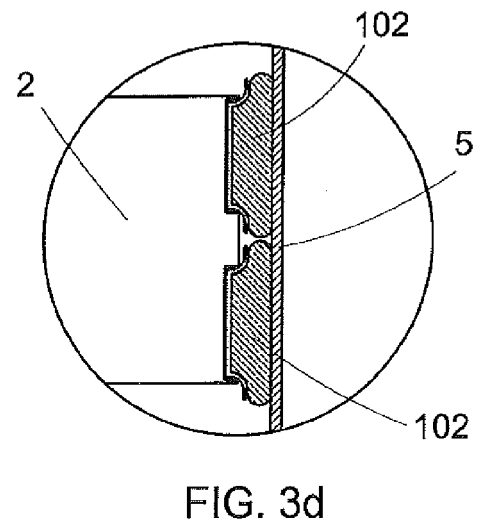
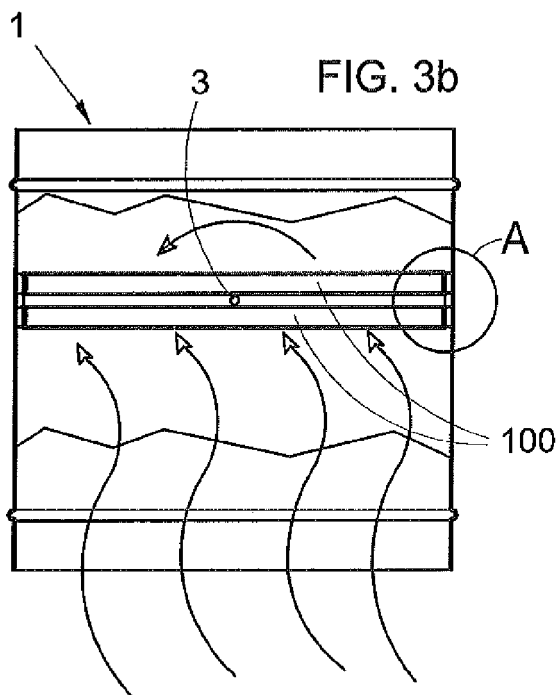
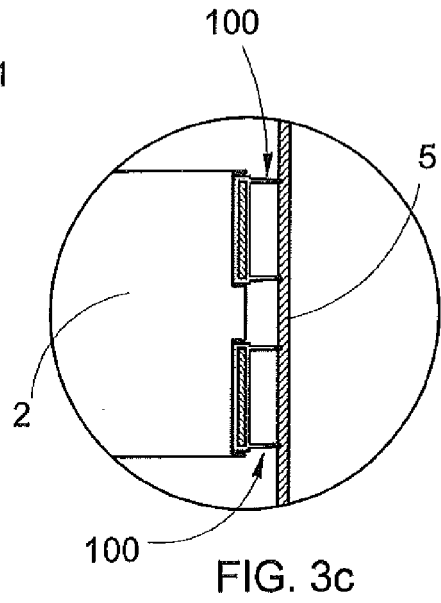
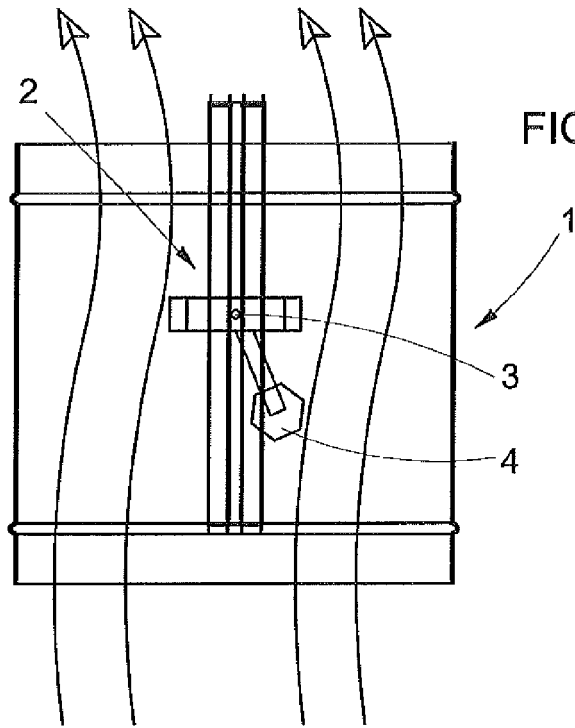
40

45

50

55





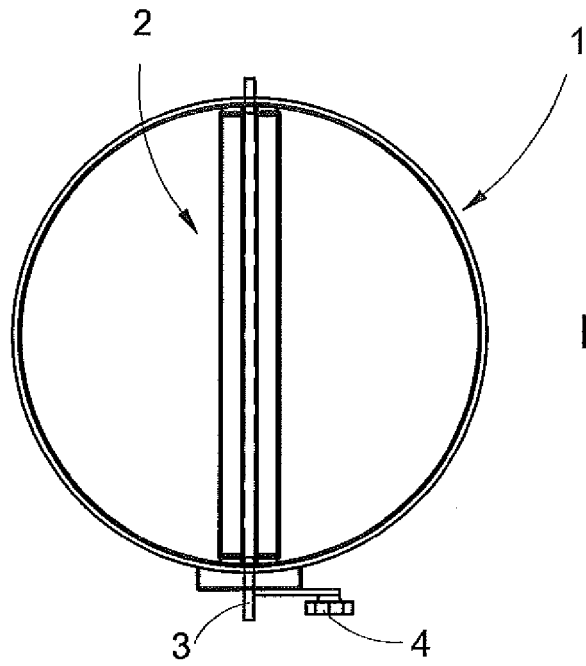


FIG. 4a

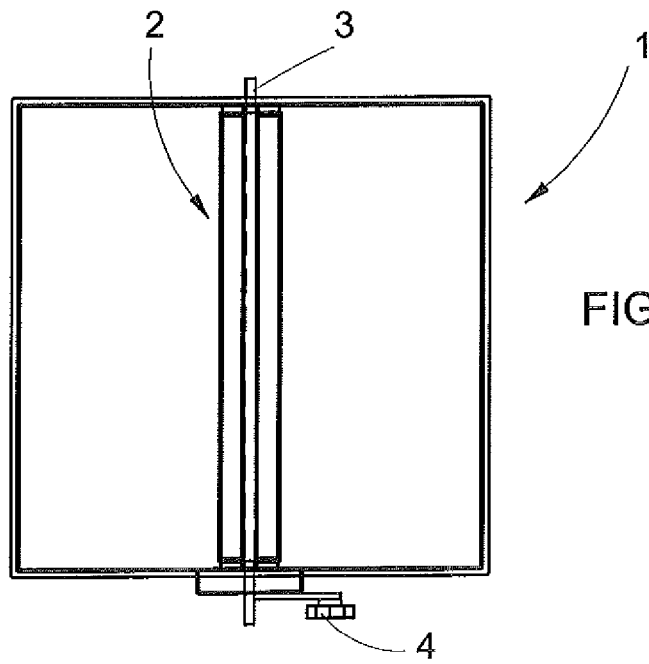


FIG. 4b

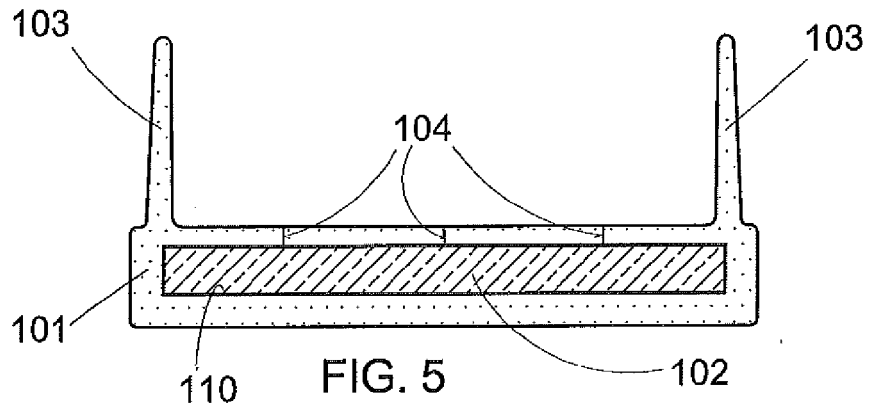
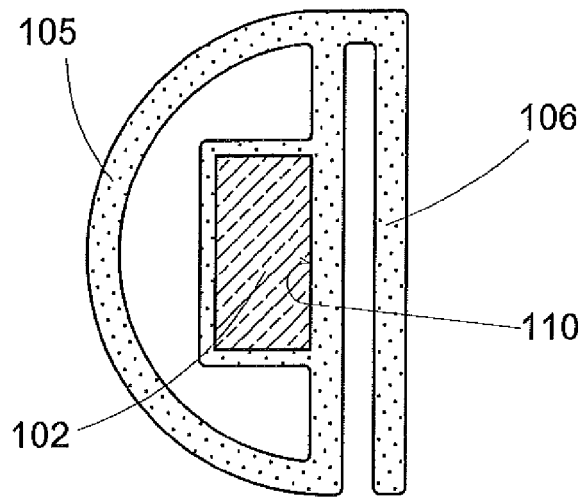


FIG. 6



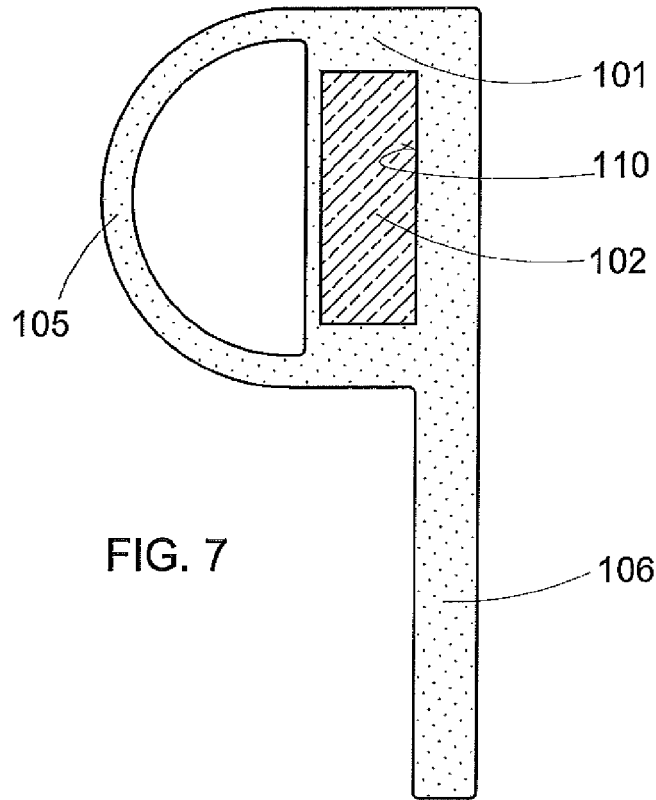
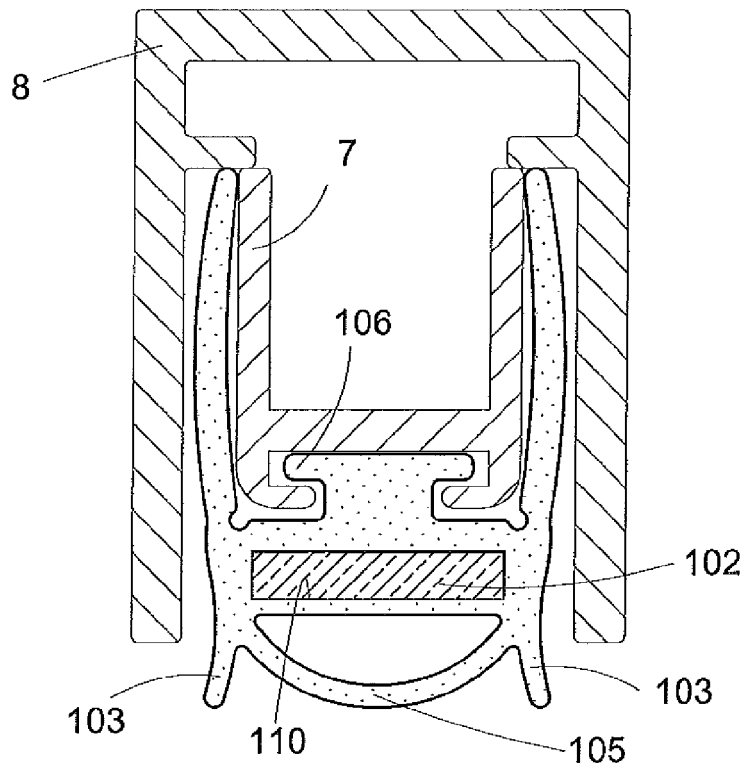


FIG. 8



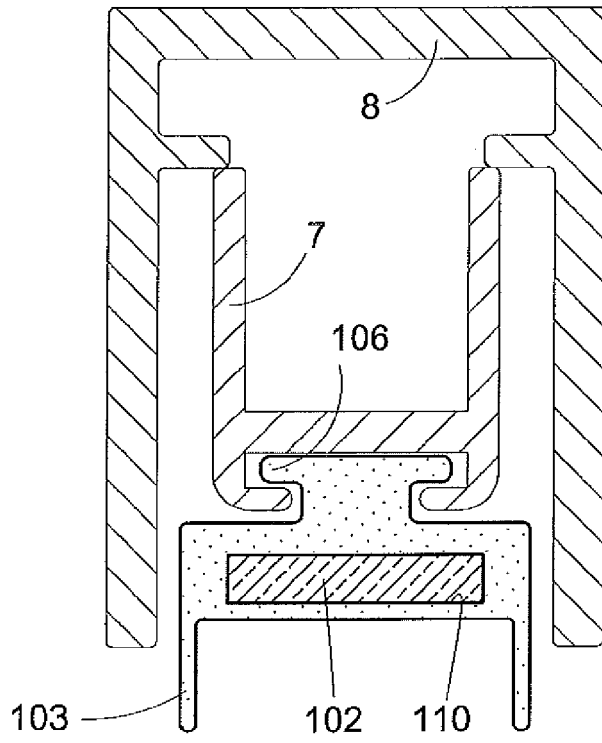


FIG. 9

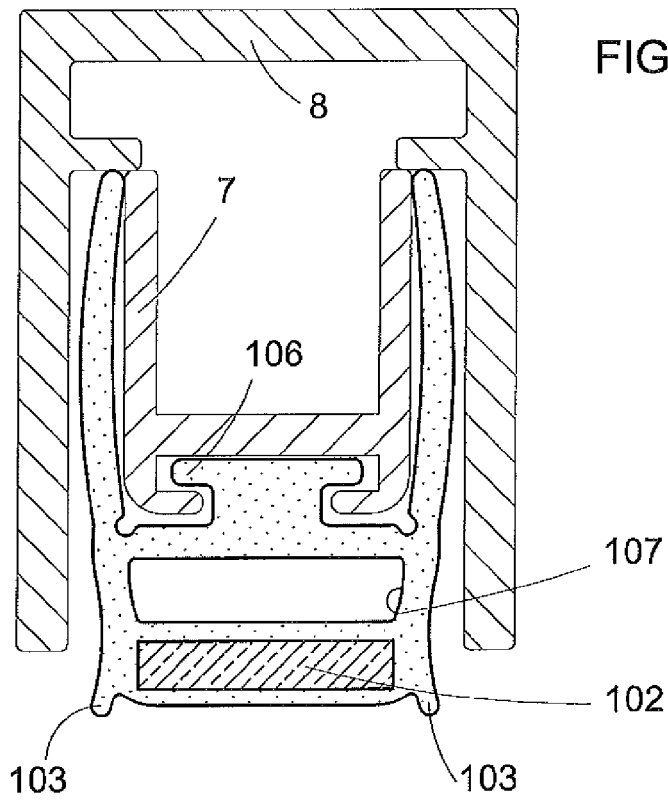


FIG. 10



EUROPEAN SEARCH REPORT

Application Number  
EP 11 17 5461

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	DE 10 2009 000618 A1 (HALTON OY) 13 August 2009 (2009-08-13) * paragraphs [0033], [0038]; figures * -----	1-3,5-9	INV. A62C2/12
Y	GB 2 079 669 A (LORIENT POLYPROD LTD) 27 January 1982 (1982-01-27) * abstract; figure *	1-3,5-9	
Y	EP 1 132 563 A2 (INTUMEX BRANDSCHUTZPRODUKTE AG [AT]) 12 September 2001 (2001-09-12) * abstract *	1-3,5-9	
A	EP 2 062 617 A1 (RUSKIN AIR MAN LTD) 27 May 2009 (2009-05-27) * abstract; figures * * paragraphs [0005], [0006], [0010], [0016] * -----	1-9	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			A62C
Place of search		Date of completion of the search	Examiner
The Hague		30 November 2011	Vervenne, Koen
CATEGORY OF CITED DOCUMENTS		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	
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			

1  
EPO FORM 1503 03 82 (P04C01)

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

EP 11 17 5461

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

30-11-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102009000618 A1	13-08-2009	AT 506328 A2	15-08-2009
		BE 1018915 A3	08-11-2011
		DE 102009000618 A1	13-08-2009
		FR 2927257 A1	14-08-2009
		GB 2459748 A	11-11-2009
		SE 0900083 A	09-08-2009
-----			
GB 2079669 A	27-01-1982	NONE	
-----			
EP 1132563 A2	12-09-2001	AT 408759 B	25-03-2002
		AU 774858 B2	08-07-2004
		AU 2489801 A	13-09-2001
		CA 2337317 A1	07-09-2001
		CZ 20010844 A3	17-10-2001
		EP 1132563 A2	12-09-2001
		HU 0100972 A2	28-04-2004
		NO 20011138 A	10-09-2001
		PL 346287 A1	10-09-2001
		US 2003035912 A1	20-02-2003
-----			
EP 2062617 A1	27-05-2009	AT 522252 T	15-09-2011
		EP 2062617 A1	27-05-2009
-----			

**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- EP 2062617 A [0008] [0011] [0037]
- DE 102009000618 [0010] [0011]