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(54) Smoke evacuation damper comprising a piece of intumescent material

(57) A smoke evacuation damper comprising a housing (2) defining a duct (3) for the evacuation of smoke there through from an upstream end (4) of said duct to a downstream end (5) ; a valve (6) mounted in said duct (3) and movable between a open position and a closed position; at least one piece of intumescent material (7,8) provided in the smoke evacuation damper for sealing the valve (6) in the housing (2) when activated, characterized in the smoke evacuation damper further comprises a conductor (9,12) made in a heat conductive material, said conductor contacting the piece of intumescent material (7,8) and extending in a downstream direction from said piece of intumescent material (7,8).

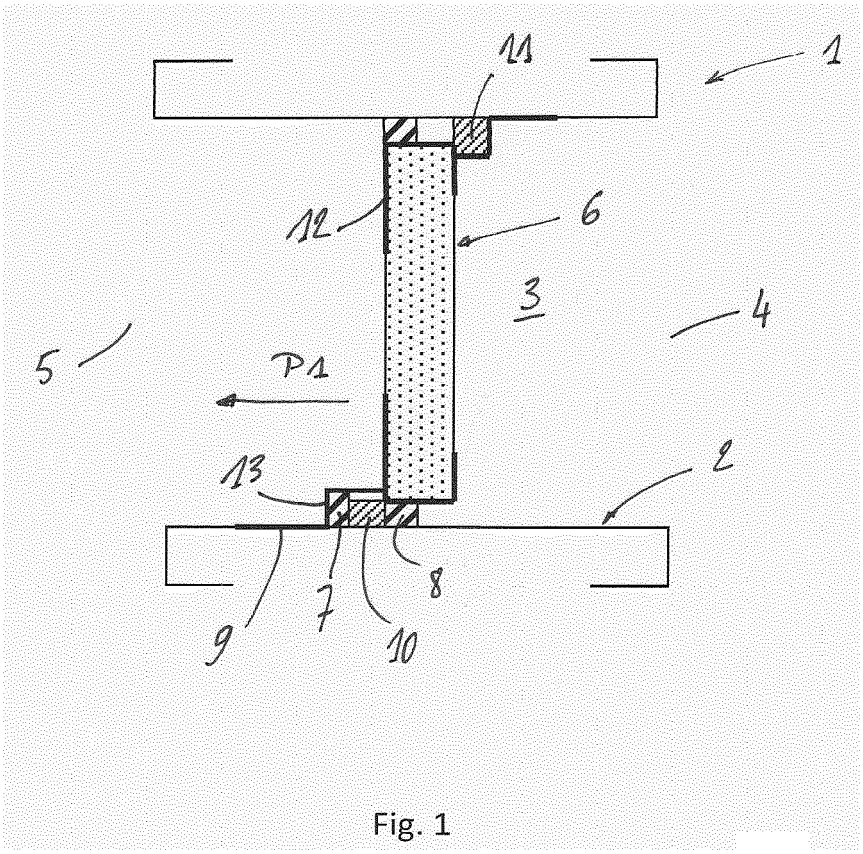

Fig. 1

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Description

Field of the Invention

[0001] The present invention concerns a smoke evacuation damper comprising a housing defining a duct and a door assembly.

Background of the Invention

[0002] In modern fire fighting, the concept of tactical ventilation is commonly used. Tactical ventilation can be described as performing specific venting and fire isolation actions in order to evacuate smoke and heat, to provide firefighters a clear view on the seat of fire, to pull fire away from trapped occupants, and to limit property damage.

[0003] Since in modern buildings, modern materials, especially the polymers, produce a lot more heat than traditional materials (wood, plaster, stone, bricks, etc.), tactical ventilation is even more crucial, such that smoke exhaust systems with dedicated smoke evacuation dampers have been developed and introduced in the buildings.

[0004] Typically the smoke evacuation damper is installed in connection to an exhaust air duct and is default in closed position. Only in case of fire in the room where the damper is installed and where the evacuation of smoke and heat is desired, the damper is opened either manually by the fireman or remotely via a control system.

[0005] In case of a fire on for example the first floor of a building, the smoke evacuation dampers on that floor or in the room(s) where the fire rages, will open, while the smoke evacuation dampers on other floors will remain closed to prevent smoke spreading on these floors. For that reason, smoke evacuation dampers should withstand elevated temperatures of the smoke being evacuated through the exhaust shaft during extended periods and provide for a good smoke barrier during such extreme conditions.

[0006] Smoke evacuation dampers are known comprising a housing defining a duct for the evacuation of smoke there through from an upstream end of said duct (room side) to a downstream end (exhaust shaft); a valve mounted in said duct and movable between a open position and a closed position; at least one piece of intumescent material provided in the smoke evacuation damper for sealing the valve in the housing when activated.

[0007] A drawback of the known smoke evacuation dampers is that the sealing properties and especially the smoke barrier properties are only sufficient after activation of the intumescent material and do not prevent smoke from spreading through a building during early stages of a fire.

[0008] Therefor there remains a need for smoke evacuation dampers that solve the above-mentioned drawback.

Summary of the Invention

[0009] The present invention addresses the above-mentioned need by providing a smoke evacuation damper comprising a housing defining a duct for the evacuation of smoke there through from an upstream end of said duct to a downstream end; a valve mounted in said duct and movable between a open position and a closed position; at least one piece of intumescent material provided in the smoke evacuation damper for sealing the valve in the housing when activated, characterized in the smoke evacuation damper further comprises a conductor made in a heat conductive material, said conductor contacting the piece of intumescent material and extending in a downstream direction from said piece of intumescent material, in or along the smoke evacuation damper.

[0010] Applicant observed that by providing conductor made in a heat conductive material, said conductor contacting the piece of intumescent material and extending in a downstream direction from said piece of intumescent material, the piece of intumescent material is activated sooner than without such conductor, thereby allowing effectively sealing the smoke evacuation damper is early stages of a fire, thereby preventing smoke from travelling through the duct in an upstream direction.

[0011] Preventing spreading of smoke throughout a building, especially on floors were no fire is raging, effectively helps in maximizing evacuation efficiency and preventing damage.

[0012] According to a preferred embodiment the damper further comprises a first sealing member provided in the duct such that valve abuts the first sealing member when in a closed position, whereby the piece of intumescent material is provided downstream of and adjacent said first sealing member such that in case of activation of the intumescent material, the first sealing member is pressed against the closed valve.

[0013] The first sealing member and the piece of intumescent material are preferably spaced apart in a non-activated condition of the intumescent material.

[0014] Preferably the conductor defines a cover plate covering the downstream oriented surface of the piece of intumescent material, even more preferably, the cover plate is profiled and covers both the downstream oriented surface and the side of the piece of intumescent material facing the center of the duct, such as to define a guide for guiding the expansion of the intumescent material upon activation.

[0015] The piece of intumescent material preferably has dimensions allowing covering the entire downstream oriented surface of the first sealing member when expanded.

[0016] According to a preferred embodiment the piece of intumescent material is provided between the inner circumference of the duct and the outer circumference of the valve, preferably on the valve.

[0017] Said valve preferably comprises reinforced edge profiles provided at the circumference of fire resist-

ant panel and wherein said reinforced edge profiles are made in a heat conductive material, the profiles extending from the piece of intumescent material to the downstream surface of the valve.

Brief Description of the Drawings

[0018]

Figure 1 schematically represents a cross section of a smoke evacuation damper according to the present invention;
Figure 2 represents the same cross section as figure 1 but after activation of the intumescent material of the smoke evacuation damper.
Figure 3 schematically represents a detail of a cross section of an alternative embodiment of figure 1.

Description of a preferred Embodiment

[0019] Figure 1 represents a smoke evacuation damper 1 according to the present invention. The smoke evacuation damper 1 comprises a housing 2 defining a duct 3 for the evacuation of smoke there through from an upstream end 4 of said duct to a downstream end 5; a valve 6 mounted in said duct and movable between a open position and a closed position; at least one piece of intumescent material 7, 8 provided in the smoke evacuation damper for sealing the valve 6 in the housing 2 when activated.

[0020] According to the invention the smoke evacuation damper 1 further comprises a conductor 9, 12 made in a heat conductive material, said conductor contacting the piece of intumescent material 7 and/or 8 and extending in a downstream direction from said piece of intumescent material.

[0021] The housing is typically rectangular and comprises four shaped profiles of a material having good heat resistance properties such as galvanized steel or stainless steel, optionally coated with a fire resistant material such as calcium silicate.

[0022] The valve is pivotally mounted in the housing and is manufactured in a fire resistant material such as calcium silicate. Preferably the valve comprises at least one panel of fire resistant material at its downstream oriented side and a panel in a material convenient for finishing, such as gypsum at its upstream oriented side. In the embodiment of figure 1, the valve comprises a reinforced edge profile 12 allowing protecting the edges at the circumference of the valve. This profile is preferably made in a heat conductive (at least 5 $Wm^{-1}K^{-1}$, preferably at least 10 $Wm^{-1}K^{-1}$, most preferably at least 15 $Wm^{-1}K^{-1}$ or more) and heat resistant material (resistant to temperatures up to 800°C) such as galvanized steel, stainless steel or copper.

[0023] Preferably the profile extends from the upstream oriented surface of the valve over the circumference of the valve towards the downstream oriented surface of the valve, whereby the surface of the valve covered by the profile at the downstream side is larger than the surface of the valve covered by the profile at the upstream side.

[0024] The valve further comprises a strip of intumescent material 8 extending along the entire circumference of the valve 6. The strip 8 is in this case attached directly on the reinforced edge profile 12. It is clear that in a non-expanded (non-activated) condition of the strip 8 a small opening remains between the strip 8 and the housing in a closed position of the valve.

[0025] Intumescent materials are materials that swell (expands) as a result of heat exposure, thus increasing in volume. More particular an intumescent material undergoes a chemical change when exposed to heat or flames, becoming viscous then forming expanding bubbles that harden into a dense, heat insulating multicellular char. Intumescent materials are well known in the field of smoke evacuation dampers and will not be discussed in further detail. Examples of intumescent materials can be found in US 4,273,879.

[0026] In the embodiment represented in figure 1, the smoke evacuation shutter further comprises a first sealing member 10 and a second sealing member 11 extending along a section of the inner circumference of the housing and positioned such that these sealing members 10, 11 abut the valve when in a closed position. The first sealing member 10 being positioned downstream of the valve, while the second sealing member 11 is positioned upstream the valve 6. Both sealing members 10 and 11 are so-called cold-seals that show good sealing properties at temperatures between -50 - 150°C such as EPDM rubbers.

[0027] Downstream of the first sealing member 10 a piece of intumescent material 7 is provided that, at its downstream oriented side contacts conductor 9. Preferably the sealing member 10 and the piece of intumescent material 7 are spaced apart when the intumescent material 7 is in a non-expanded state, thereby allowing visual control and independent replacement of both parts.

[0028] The conductor 9 in this case defines a cover plate 13 covering the downstream oriented side of the piece of intumescent material 7 and protecting it from direct contact with flames. It is especially preferred that the conductor 9 is profiled and covers both the downstream oriented surface and the side of the piece of intumescent material facing the center of the duct, such that the conductor 9 defines a guide for a directed expansion of the intumescent material in a direction of the valve. Even more preferably, the conductor 9 extends upto a point where in contacts the reinforced edge 12 at the downstream surface of valve 6. The piece of intumescent material 7 preferably has dimensions that allow, in an expanded state of the intumescent material 7, to cover the entire downstream oriented side of sealing member 10.

[0029] The conductor 9 is preferably manufactured in a heat resistant and heat conductive (at least 5 $Wm^{-1}K^{-1}$,

preferably at least 10 $Wm^{-1}K^{-1}$, most preferably at least 15 $Wm^{-1}K^{-1}$ or more) material such as galvanized steel, stainless steel or copper.

[0030] As mentioned, the smoke evacuation damper is closed in normal circumstances when no fire is detected in a building. During normal circumstances, the smoke evacuation dampers should prevent ambient warm (room temperature) air from flowing in a upstream to downstream direction through the damper. This goal is achieved by providing the above-mentioned sealing members 10 and 11 abutting the valve 6.

[0031] In case a fire is detected in the room where the smoke evacuation damper is provided, the valve 6 is opened allowing smoke to be evacuated from the room. In this situation, an under pressure in the smoke exhaust shaft is created and maintained such that smoke from in the room is sucked out through the smoke evacuation damper.

[0032] In order to prevent smoke and heat from one floor of a building to enter other floors through the smoke evacuation shaft, the smoke evacuation dampers on the floors where no fire is detected remain shut and function as a smoke and heat barrier. To effectively prevent smoke and heat to enter the other floors, the smoke and evacuation dampers should be heat resistant and perfectly tight from early stages of a fire onwards.

[0033] In the case of heated smoke is exhausted through the exhaust shaft and the smoke evacuation damper is to function as a smoke and heat barrier towards an enclosed space, the heat in the exhaust shaft (downstream side of the smoke evacuation damper) will result in heat being conducted through conductor 9 which will cause activation of the piece 7 of intumescent material, which as such will firmly press the sealing member 10 against the valve as represented in figure 2, thereby increasing the sealing effect and preventing smoke from travelling across the seal and valve through the duct. With increasing heat, also the intumescent material between the circumference of the valve and the duct will be activated to entirely seal the smoke evacuation damper over an extended period.

[0034] In the preferred case the conductor extends over the seal upto the reinforced edge 12 of the valve, the conductor will provide the additional benefit that it effectively protects the seal from immediate contact with fire or smoke, thereby preventing early failure of the seal. Additionally, by contacting the reinforcing edge made of heat conductive material, the heat conducted by the conductor 9 will accelerate the activation of the intumescent layer 8 between the door and the duct, such that the smoke barrier to be created by the smoke evacuation damper in a closed position can be achieved very early after hot smoke travelling through the exhaust shaft, thereby preventing early smoke spreading throughout buildings.

[0035] Figure 3 shows an alternative embodiment of a smoke evacuation damper according to the present invention, wherein the conductor 9 comprises two profiles, one providing the contact plate 13 and guide and another providing a channel for fastening the first sealing member 10 therein.

[0036] It is clear that at least either the piece of intumescent material 8 or the piece of intumescent material 7 can be present in a smoke evacuation damper according to the present invention. Preferably, however both are present.

Claims

1. A smoke evacuation damper comprising a housing (2) defining a duct (3) for the evacuation of smoke there through from an upstream end (4) of said duct to a downstream end (5); a valve (6) mounted in said duct and movable between a open position and a closed position; at least one piece of intumescent material (7, 8) provided in the smoke evacuation damper (1) for sealing the valve (6) in the housing when activated, **characterized in** the smoke evacuation damper (1) further comprises a conductor (9, 12) made in a heat conductive material, said conductor (9, 12) contacting the piece of intumescent material (7, 8) and extending in a downstream direction (P1) from said piece of intumescent material, in or along the smoke evacuation damper (1).

2. The smoke evacuation damper according to claim 1, wherein the damper further comprises a first sealing member (10) provided in the duct (3) such that valve (6) abuts the first sealing member (10) when in a closed position, whereby the piece of intumescent material (7) is provided downstream of and adjacent said first sealing member (10).

3. The smoke evacuation damper according to claim 2, wherein the first sealing member (10) and the piece of intumescent material (7) are spaced apart in a non-activated condition of the intumescent material.

4. The smoke evacuation damper according to any of the preceding claims, wherein the conductor (9) defines a cover plate (13) covering the downstream oriented surface of the piece of intumescent material (7).

5. The smoke evacuation damper according to claim 5, wherein the cover plate (13) is profiled and covers both the downstream oriented surface and the side of the piece of intumescent material (7) facing the center of the duct, such as to define a guide for guiding the expansion of the intumescent material upon activation.

6. The smoke evacuation damper according to any of claims 2 to 5, wherein the piece of intumescent ma-

terial (7) has dimensions allowing covering the entire downstream oriented surface of the first sealing member (10) when expanded.

7. The smoke evacuation damper according to claim 1, wherein the piece of intumescent material (8) is provided between the inner circumference of the duct (3) and the outer circumference of the valve (6).

8. The smoke evacuation damper according to claim 7, wherein the piece of intumescent material (8) is provided on the valve.

9. The smoke evacuation damper according to any of the preceding claims, wherein the valve (6) comprises at least one fire resistant panel or coating at is side facing downstream when in a closed position.

10. The smoke evacuation damper according to claim 8 and 9, wherein said valve comprises a reinforced edge profile (12) provided at the circumference of fire resistant panel and wherein said reinforced edge profile (12) is made in a heat conductive material, the profile extending from the piece of intumescent material (8) to the downstream surface of the valve.

11. The smoke evacuation damper according to any of the preceding claims, wherein the conductor (9, 12) is manufactured in a heat resistant material.

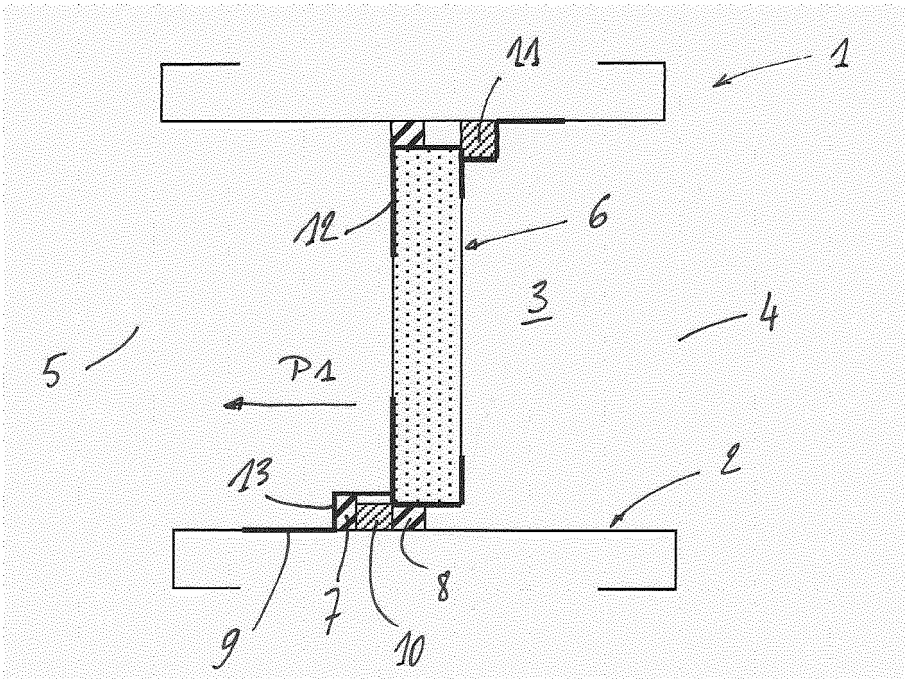

Fig. 1

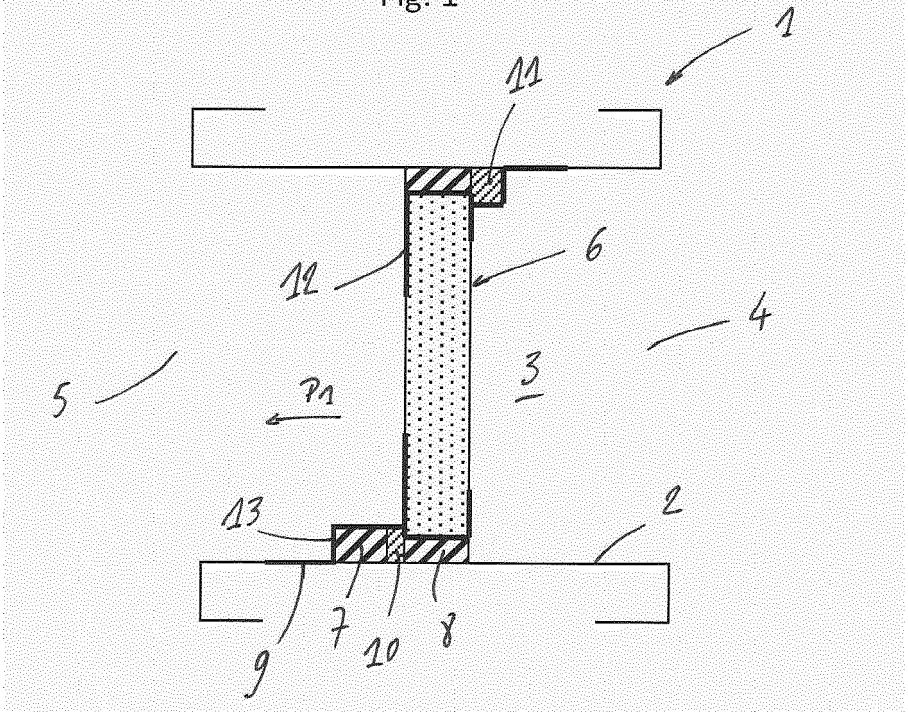

Fig. 2

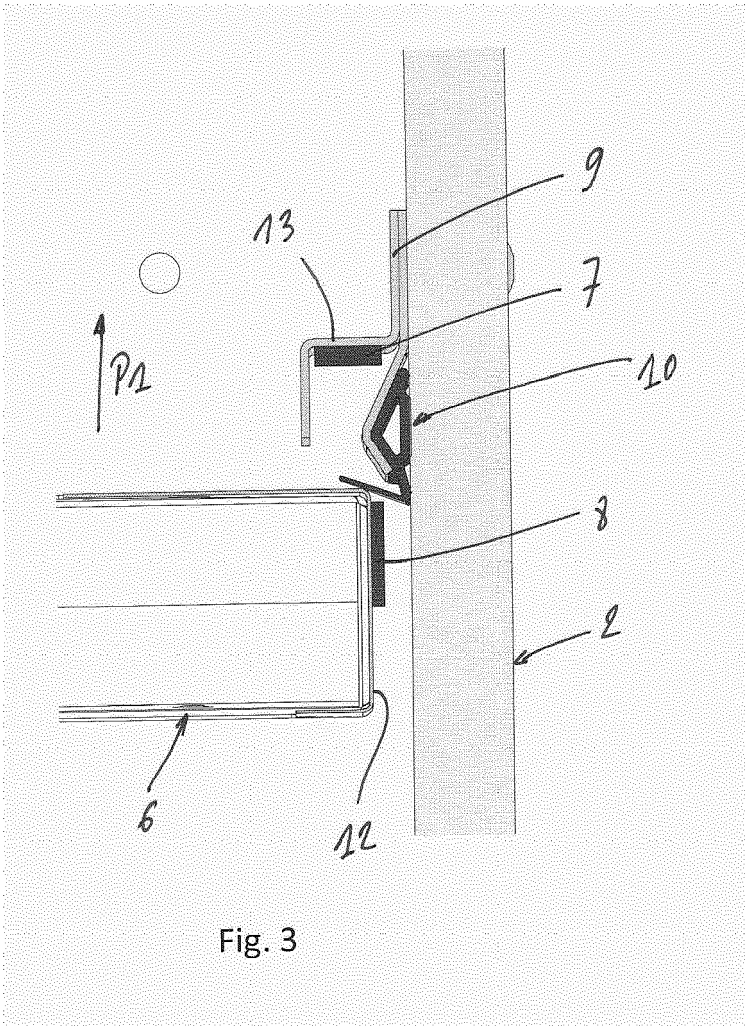

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 12 19 5500

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 512 414 A2 (SCHAKO METALLWARENFABRIK [DE]) 11 November 1992 (1992-11-11) * column 8, line 3 - column 8, line 31; claims 8,9; figure 4 * -----	1-11	INV. F24F13/14 A62C2/06 A62C2/12 F16L5/04
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X	WO 2007/068786 A1 (FLAEKT WOODS AB [SE]; LAMPINEN ESA [FI]) 21 June 2007 (2007-06-21) * page 4; claim 1; figures 4-6 * -----	1	
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TECHNICAL FIELDS SEARCHED (IPC)

F24F
A62C
F16L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 June 2013	Decking, Oliver

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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