(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 242 090 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
08.11.2017 Bulletin 2017/45

(51) Int Cl.:
F24F 5/00 *(2006.01)*

(21) Application number: **16168084.8**

(22) Date of filing: **03.05.2016**

(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
Designated Validation States:
MA MD

(71) Applicant: **Halton OY**
47400 Kausala (FI)

(72) Inventors:
- **Mustakallio, Panu**
  45100 Kouvola (FI)
- **Viinanen, Pauli**
  47400 Kausala (FI)
- **Summanen, Janne**
  45360 Valkeala (FI)

(74) Representative: **Papula Oy**
P.O. Box 981
00101 Helsinki (FI)

(54) **RADIANT PANEL ELEMENT**

(57) The invention provides a radiant panel element (1) comprising a first panel (2) and a tubing (4), which comprises at least one circuit (4a), and wherein heat transfer medium flow. The tubing (4) is fastened to the first panel (2) with heat conducting adhesive (7). The radiant panel element (1) comprises also a second panel (3), which is arranged parallel to the first panel (2) so that the tubing (4) is arranged between the first and the second panel (2, 3). The tubing (4) is fastened also to the second panel (3) with heat conducting adhesive (7).

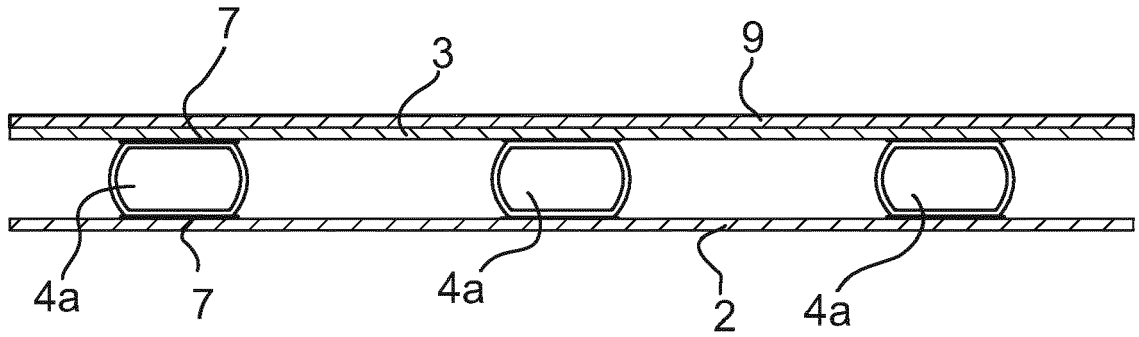

FIG. 2

EP 3 242 090 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a radiant panel element for heating or cooling rooms.

BACKGROUND OF THE INVENTION

[0002] In prior art radiant panel elements are used for heating and cooling rooms. They are assembled for example to the ceiling. The radial panel elements comprise a radiant panel which is arranged as a bottom panel in the element so that it radiates towards the room. The radial panel elements comprise also tubing in which the heat transfer medium is flown. The tubing is usually made of round pipe and it is fastened to the radiant panel with grooves or clips. Because the upper part of these radiant panel elements is open, they collect dust and dirt and are hard to keep clean. Also they waste heat energy to the building structures.

OBJECTIVE OF THE INVENTION

[0003] The objective of the invention is to alleviate the disadvantages mentioned above.

[0004] In particular, it is an objective of the present invention to provide a radiant panel element, which is more energy efficient and also easier to maintain.

SUMMARY OF THE INVENTION

[0005] According to an aspect, the present invention provides a radiant panel element comprising a first panel and a tubing, which comprises at least one circuit, and wherein heat transfer medium flow. The tubing is fastened to the first panel with heat conducting adhesive. The radiant panel element comprises also a second panel, which is arranged parallel to the first panel so that the tubing is arranged between the first and the second panel. The tubing is fastened also to the second panel with heat conducting adhesive.

[0006] The advantage of the invention is that the heat transfer more efficiently not only to the first panel but also to the second panel from the heat transfer medium. Specially, when the radiant panel element is assembled hanging from the ceiling, the heat radiates from both of the first and the second panels to the room. By adding a second panel, the interior of the radiant panel element stays cleaner and is, therefore, easier to maintain.

[0007] In an embodiment of the invention, the profile of the tubing is flat.

[0008] In an embodiment of the invention, the profile of the tubing is flat so that its width is greater than height.

[0009] In an embodiment of the invention, the tubing comprises a second circuit, wherein second heat transfer medium flow.

[0010] In an embodiment of the invention, the second circuit is arranged on top of the first circuit.

[0011] In an embodiment of the invention, the second circuit is fastened to the first circuit, the first panel is fastened to the first circuit, and the second panel is fastened to the second circuit with heat conducting adhesive.

[0012] In an embodiment of the invention, the first and second circuits are arranged to run in pairs in the same plane between the first and second panels.

[0013] In an embodiment of the invention, the radiant panel element comprises heat conducting plates between the tubing, which are fastened to the first and second panels with heat conducting adhesive.

[0014] In an embodiment of the invention, the heat conducting plates are folded towards the first panel from the middle so that the ends of the plates are fastened to the second panel and the folded middle part is fastened to the first panel.

[0015] In an embodiment of the invention, the second panel comprises insulation layer outside of the radial panel element.

[0016] In an embodiment of the invention, the heat conductive adhesive comprises aluminum powder.

[0017] In an embodiment of the invention, the heat conductive adhesive comprises aluminum powder at least 20 %.

[0018] In an embodiment of the invention, the system for heating or cooling a room comprises a radiant panel element according to any of the previous embodiments, which is assembled either to the ceiling or hanging from the ceiling.

[0019] It is to be understood that the aspects and embodiments of the invention described above may be used in any combination with each other. Several of the aspects and embodiments may be combined together to form a further embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The accompanying drawings, which are included to provide a further understanding of the invention and constitute a part of this specification, illustrate embodiments of the invention and together with the description help to explain the principles of the invention. In the drawings:

Fig. 1 shows an axonometric view of a radiant panel element. The second panel is cut open to show the tubing inside the radiant panel element.

Fig. 2 is a cross section of the radiant panel element, and

Fig. 3 is a cross section of the radiant panel element comprising a tubing with two circuits, which are arranged on top of each other.

Fig. 4 is a cross section of the radiant panel element comprising a tubing with two circuits, which are ar-

ranged in the same plane and they run in pairs.

Fig. 5 is a cross section of the radiant panel element comprising a tubing with two circuits, which are arranged in the same plane, and there are heat transfer plates between the tubing.

DETAILED DESCRIPTION OF THE INVENTION

[0021] Figure 1 shows an axonometric view of a radiant panel element 1 comprising a first panel 2 as a bottom of the radiant panel element 1 and a second panel 3 as a roof of the radiant panel element 1. In fig. 1, the second panel 2 is cut open to show the interiors of the radiant panel element 1, but in use it is a closed structure. The first panel 2 and the second panel 3 are arranged parallel to each other and a tubing 4 is arranged between them. The tubing 4 comprises at least one circuit 4a, in which a heat transfer medium is flown. Each circuit 4a, 4b... comprises an inlet 5 and an outlet 6 for the heat transfer medium. The tubing 4 is arranged to wind end to end of the radiant panel element 1 to cover the whole area of the first panel 2. The second panel 3 can comprise an insulation layer 9 (see FIG. 2) outside of the radiant panel element 1. The insulation layer 9 prevents the heat transferring upwards from the radiant panel element 1. This is may be preferable when the radiant panel element 1 is assembled to the ceiling.

[0022] Figure 2 shows a cross section of the radiant panel element 1 comprising a first panel 2, a second panel 3 and a tubing 4. The tubing 4 comprises one circuit 4a and it has a flat profile. The tubing 4 is fastened to the first panel 2 and to the second panel 3 with heat conducting adhesive 7. The flat profile of the tubing allows the structure of the radiant panel element 1 to be thinner and lighter, and therefore easier to assemble. Also the heat transfer is more efficient. The profile of the tubing may, however, be other than flat i.e. rectangular or round. The radiant panel element 1 in FIG. 2 comprises also an insulation layer 9 fastened to the second panel 3 outside of the radiant panel element 1. The heat conducting adhesive 7 may comprise aluminum powder to improve the heat transferring. One suitable solution is to use aluminum powder at least 20%, but it is also suitable to use heat conducting adhesive 7 comprising aluminum powder at least 50%. Figure 3 shows a cross section of the radiant panel element 1 comprising a tubing 4 with two circuits 4a and 4b. The circuits 4a and 4b are arranged on top of each other and they are fastened to each other with heat conducting adhesive 7. The first circuit 4a is fastened to the first panel 2 and the second circuit 4b is fastened to the second panel 3 with heat conducting adhesive 7. Each circuit 4a, 4b... has an inlet 5 and an outlet 6 for the heat transfer medium. Therefore, it is possible to use heating medium in other circuit and cooling medium in other circuit. The profile of the tubing is preferably flat but it may be other also in this embodiment.

[0023] Figure 4 shows a cross section of the radiant panel element 1 comprising a tubing 4 with two circuits 4a and 4b. The circuits 4a and 4b are arranged to run in the same plane in pairs. Both circuits 4a and 4b are fastened to the first panel 2 and to the second panel 3 with the heat conducting adhesive 7. The profile of the tubing is preferably flat but it may be other also in this embodiment.

[0024] Figure 5 shows heat conducting plates 8 between the tubing 4. In fig. 5 the tubing 4 comprises two circuits 4a and 4b arranged to run in the same plane in pairs. However, the tubing 4 can also comprise only one circuit or more circuits. The heat conducting plates 8 are arranged to transfer heat from the second panel 3 to the first panel 2. The heat conducting plates 8 are folded towards the first panel 2 from the middle so that the ends 10 and 11 of the heat conducting plates 8 are fastened to the second panel 3 and the middle part 12 to the first panel 2.

[0025] The radiant panel element 1 is used in systems for heating and/or cooling rooms. The radiant panel elements can be assembled to the ceiling or hanging from the ceiling.

[0026] Although the invention has been the described in conjunction with a certain type of radiant panel element, it should be understood that the invention is not limited to any certain type of radiant panel element. While the present inventions have been described in connection with a number of exemplary embodiments, and implementations, the present inventions are not so limited, but rather cover various modifications, and equivalent arrangements, which fall within the purview of prospective claims.

Claims

1. Radiant panel element (1) comprising a first panel (2); a tubing (4) arranged on the first panel (2), which tubing (4) comprises at least one circuit (4a), wherein heat transfer medium flows, and the tubing (4) is fastened to the first panel (2) with heat conducting adhesive (7) **characterized in that** the radiant panel element (1) comprises a second panel (3) arranged parallel to the first panel (2) so that the tubing (4) is arranged between the first and the second panels (2, 3), and the tubing (4) is fastened also to the second panel (3) with heat conducting adhesive (7).

2. Radiant panel element (1) according to claim 1 **characterized** in that the profile of the tubing (4) is flat.

3. Radiant panel element (1) according to claim 1 or 2 **characterized in that** the profile of the tubing (4) is flat so that its width is greater than height.

4. Radiant panel element (1) according to any of claims 1-3 **characterized in that** the tubing (4) comprises a second circuit (4b), wherein second

heat transfer medium flow.

5. Radiant panel element (1) according to claim 4 **characterized** in that the second circuit (4b) is arranged on top of the first circuit (4a).

6. Radiant panel element (1) according to claim 5 **characterized** in that the second circuit (4b) is fastened to the first circuit (4a), the first panel (2) is fastened to the first circuit (4a), and the second panel (3) is fastened to the second circuit (4b) with heat conducting adhesive (7).

7. Radiant panel element (1) according to claim 4 **characterized** in that the first and second circuits (4a, 4b) are arranged to run in pairs in the same plane between the first and second panels (2, 3).

8. Radiant panel element (1) according to any of claims 1-7 **characterized in that** the radiant panel element (1) comprises heat conducting plates (8) between the tubing (4), which are fastened to the first and second panels (2, 3) with heat conducting adhesive (7).

9. Radiant panel element (1) according to claim 8 **characterized** in that the heat conducting plates (8) are folded towards the first panel (2) from the middle so that the ends (10, 11) of the heat conducting plates (8) are fastened to the second panel (3) and the folded middle part (12) is fastened to the first panel (2).

10. Radiant panel element (1) according to any of claims 1-9 **characterized in that** the second panel (3) comprises insulation layer (9) outside of the radial panel element (1).

11. Radiant panel element (1) according to any of claims 1-10 **characterized in that** the heat conductive adhesive (7) comprises aluminum powder.

12. Radiant panel element (1) according to claim 11 **characterized** in that the heat conductive adhesive (7) comprises aluminum powder at least 20 %.

13. A system for heating or cooling a room **characterized** in that the system comprises a radiant panel element (1) according to any of claims 1-12, which is assembled either to the ceiling or hanging from the ceiling.

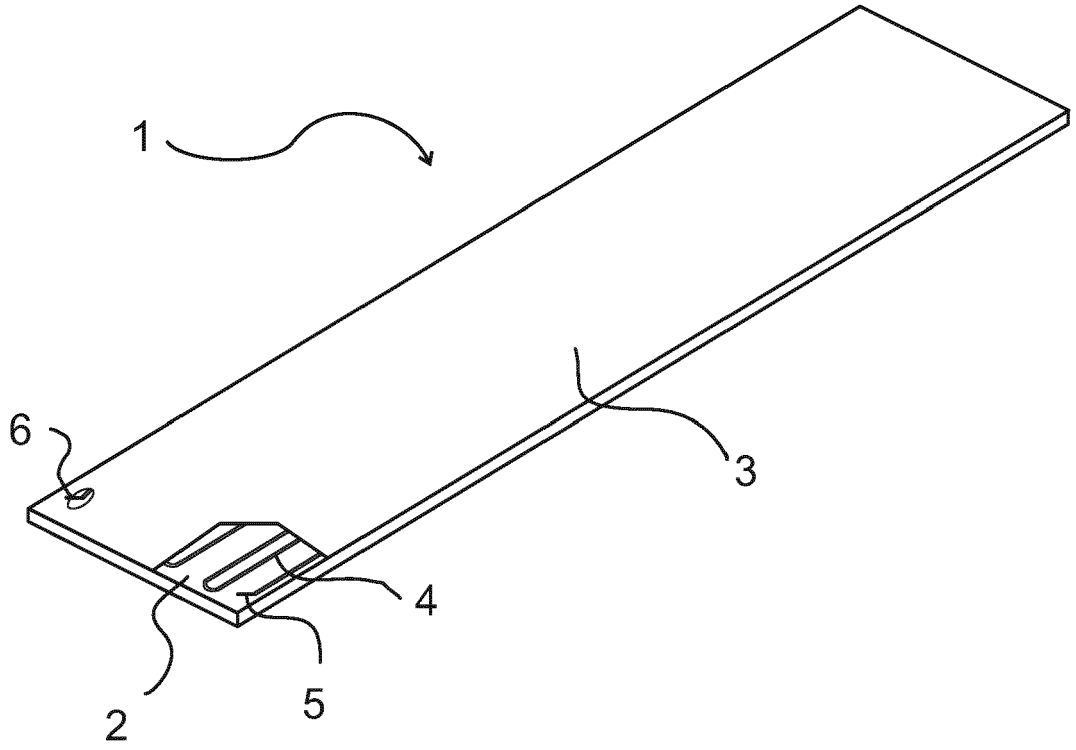

FIG. 1

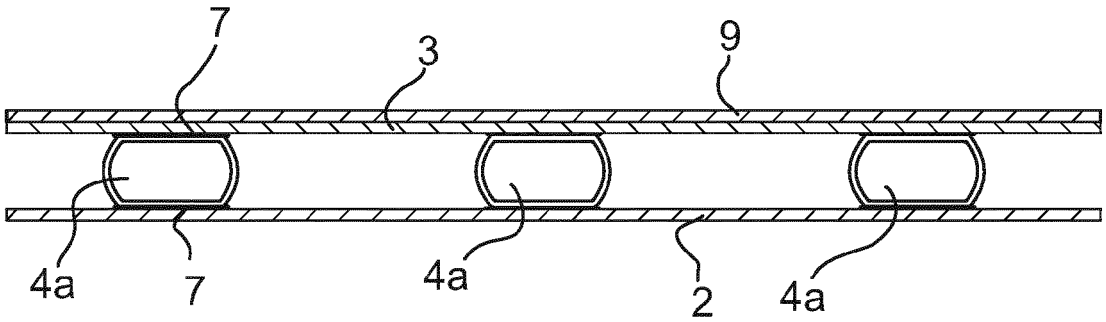

FIG. 2

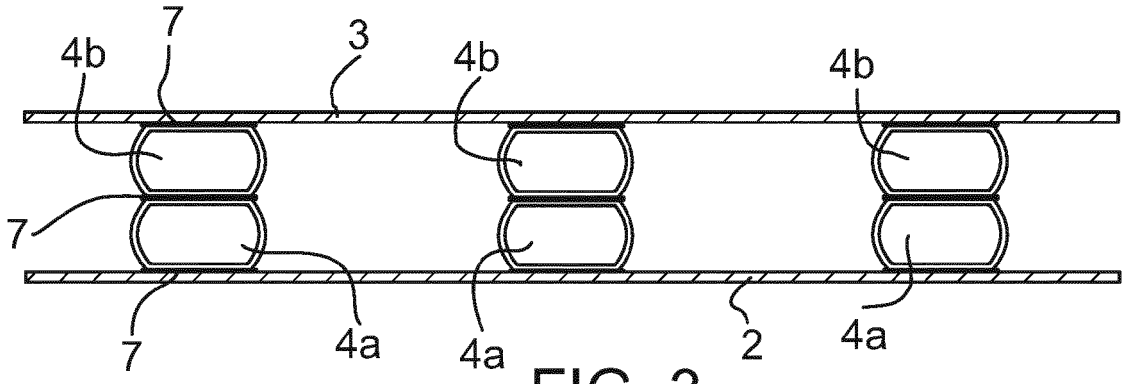

FIG. 3

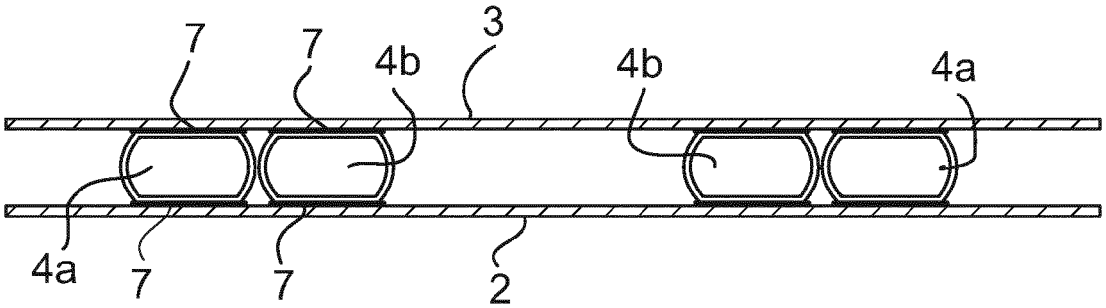

FIG. 4

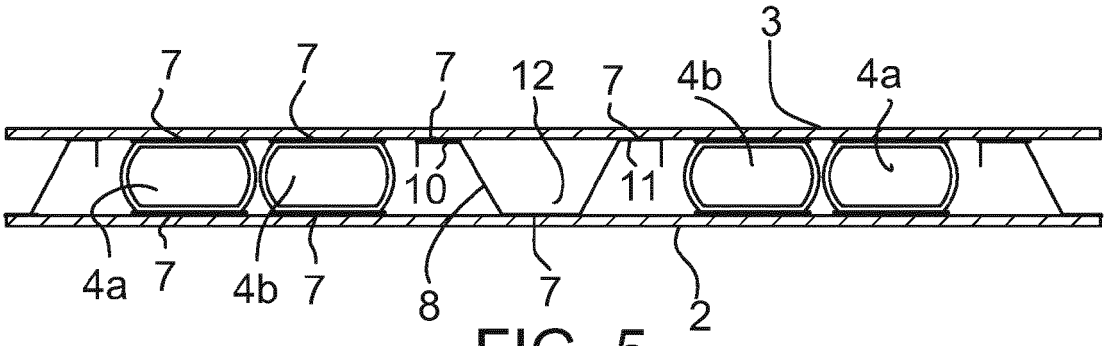

FIG. 5

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 16 8084

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 5 930 962 A (SOKOLEAN HELMUTH [CH]) 3 August 1999 (1999-08-03) * column 2, line 40 - column 5, line 8; figures 1-11 *	1-9, 11-13 10	INV. F24F5/00
X	KR 2015 0029206 A (SNU R&DB FOUNDATION [KR]) 18 March 2015 (2015-03-18) * paragraph [0043] - paragraph [0049]; figures 1-5 *	1,2, 10-13	
X	DE 20 2013 003763 U1 (BEKA HEIZ UND KUEHLMATTEN GMBH [DE]) 13 June 2013 (2013-06-13) * paragraph [0021] - paragraph [0023]; figures 2-4 *	1,2, 10-13	
A	DE 93 13 531 U1 (TROX GMBH GEB [DE]) 13 January 1994 (1994-01-13) * page 3 - page 4; figure 1 *	1-3,10, 13	
A	EP 1 512 915 A2 (PLASCORE INC [US]) 9 March 2005 (2005-03-09) * paragraph [0034] - paragraph [0041]; figures 1-3 *	1-13	TECHNICAL FIELDS SEARCHED (IPC) F24F
A	US 2012/125562 A1 (MOHMEYER NILS [DE] ET AL) 24 May 2012 (2012-05-24) * paragraph [0159] - paragraph [0161]; figures 1-3 *	1-13	
A	US 2013/192793 A1 (GUCKERT WERNER [DE] ET AL) 1 August 2013 (2013-08-01) * paragraph [0018] - paragraph [0023]; figures 1-3 *	1,2,10, 13	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 October 2016	Anconetani, Mirco

CATEGORY OF CITED DOCUMENTS

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 16 8084

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.

25-10-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5930962 A	03-08-1999	AT 173043 T	15-11-1998
		CA 2139449 A1	06-07-1995
		DE 59407227 D1	10-12-1998
		DK 0662547 T3	19-07-1999
		EP 0662547 A1	12-07-1995
		ES 2125392 T3	01-03-1999
		FI 946146 A	06-07-1995
		NO 950028 A	06-07-1995
		US 5930962 A	03-08-1999
KR 20150029206 A	18-03-2015	NONE	
DE 202013003763 U1	13-06-2013	NONE	
DE 9313531 U1	13-01-1994	NONE	
EP 1512915 A2	09-03-2005	AT 494513 T	15-01-2011
		CA 2478268 A1	28-02-2005
		EP 1512915 A2	09-03-2005
		ES 2360760 T3	08-06-2011
		US 2005045317 A1	03-03-2005
		US 2007039609 A1	22-02-2007
US 2012125562 A1	24-05-2012	NONE	
US 2013192793 A1	01-08-2013	CA 2786157 A1	07-07-2011
		EP 2519783 A1	07-11-2012
		SG 182296 A1	30-08-2012
		US 2013192793 A1	01-08-2013
		WO 2011080338 A1	07-07-2011

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82