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(54) Title: PERIPHERAL LOAD-BEARING WALL FOR LOW-ENERGY BUILDINGS

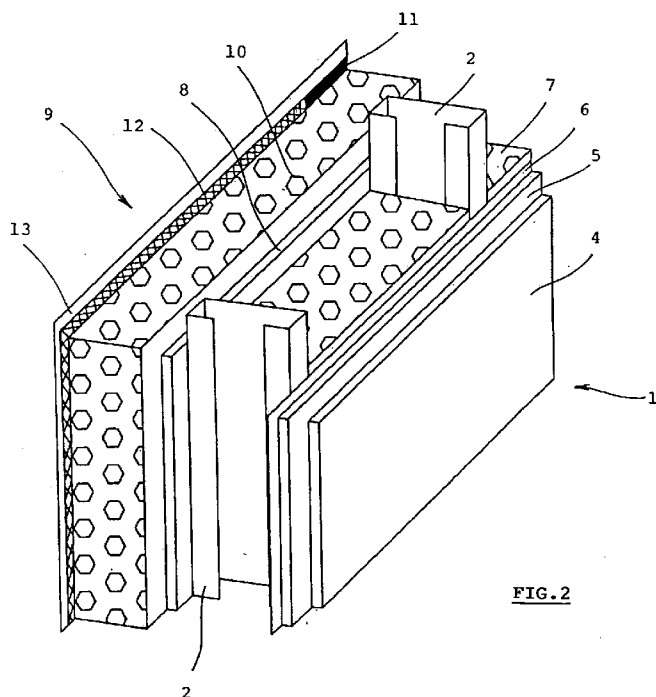


FIG. 2

(57) Abstract: The peripheral load-bearing wall (1) of the low-energy building consists of the frame (14) from vertical thin-walled sheet "C" profiles (2) and horizontal thin-walled galvanized sheet "U" profiles (3). In these profiles at least one insulation layer is arranged, and also of the moisture stop and coverage layers. The inner coverage layer consists of two layers of plasterboard (4, 5) attached to the frame (14), behind which there is a moisture stop (6). The insulation layer consists of mineral felt (7) with the thickness of at least 150 mm. The external layer consists of the load-bearing plaster-fibre or wood-fibre boards (8), to which the contact thermal insulation system (9) is attached, which includes the boards from mineral felt (10) with the thickness from 100 to 240 mm, gluing and armoring material (11) and armoring mesh (12) for the application of the silicone plaster (13).



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PERIPHERAL LOAD-BEARING WALL FOR LOW-ENERGY BUILDINGS

Background and summary of the invention

The invention concerns the peripheral load-bearing wall of the low-energy building consisting of metal vertical and horizontal beams, thermal insulating and acoustic and fire-protection layers, moisture stops and coverage layers.

In addition to the classic bricked structures, wooden structures have also been represented in the market nowadays; their walls consist of the basic wooden frame (or panel) structure, which is jacketed from both sides with load-bearing board materials, e.g. wood-chip, chipboard or plywood boards, plaster-fibre boards, etc. There is a sandwich filling between the boards, which consists of thermal and acoustic insulation, moisture stop or, as the case may be, air gap, and the façade thermal insulation system is usually attached from the external side on the boards.

Instead of the wooden frames, special structural systems from metal have been applied increasingly. In comparison with the wooden structures, the steel load-bearing structures have higher strength, better fire-protection properties, smaller condensation of humidity (higher dew point) and also better acoustic insulation properties.

The metal structures consist of a set of vertical and horizontal beams with reinforcements and jacketing. The beams may be thick-walled, e.g. with the cross-section "L" or "U", as it is described e.g. in the utility design no. 17 159, which proposes the elimination of cold bridges in connections and proposes to relieve the beams by means of relieving holes.

It is advantageous to use thin-walled pressed sheet profiles, e.g. with the cross-section "C" or "U", for the steel structures, with the completion with suitable reinforcements and connecting items. For example from the

patent GB 807 543, the metal structure with profiles is known, into which the internal thermal insulation and the peripheral jacket from corrugated sheet are inserted. Also the published patent application CA 2 208 391 describes the structure with the vertical beams of the profile "C", into which the insulation material of the insulation is inserted, and which are provided with through-holes and sleeves for the electrical installation. In the published patent application US 2006/0096229, a structural system is described consisting of three basic prefabricated elements, which are mutually interconnected and form the basic frame of the structure. The pre-fabricated profiles are thin-walled sheet "C" profiles and "U" profiles, which have different shapes at the webs, crossbars and beams. Some profiles are provided with relieving holes but their disadvantage consists in the fact that the load-bearing system does not comply with some requirements for acoustic insulation.

The disadvantage of the currently known peripheral wall systems consists in the fact that they do not include such combination of load-bearing, filling and jacketing items, which would feature a simple and easy installation directly in the construction site and, at the same time, high thermally and acoustic insulating properties, long service life and high applied value, which would be suitable for application to energetically economical or low-energy buildings.

The aforesaid shortcomings are largely eliminated by the peripheral wall of the energetically economical or low-energy building according to the presented technical solution, which consists of a frame from thin-walled galvanized "C" profiles and "U" profiles, and its nature consists in the fact that the inner coverage layer consists of two layers of plasterboard attached to the frame, behind which a moisture stop is applied; the insulation layer consists of the board from mineral felt with the thickness of 150 mm and the external layer consists of load-bearing plaster-fibre boards or wood-fibre boards, on which the mechanically anchored and additionally glued contact thermal insulation system is applied with thermal

insulation boards from mineral felt with the insulation thickness from 100 to 240 mm.

In the advantageous embodiment of the technical solution, the plasterboard has a thickness of 12.5 mm. The first layer of plasterboard covers the connections of the second layer of plasterboard.

The advantage of doubling and overlapping the boards consists in the fact that it improves accumulation and acoustic properties of the wall, including the fire-protection resistance, which reduces the disadvantage of light structures in comparison with the traditional construction materials (brick, concrete).

In another advantageous embodiment of the technical solution, the mineral felt of the insulation consists of two layers with the thickness of 100 mm and 50 mm, which shall increase fire resistance, improve acoustics and simplify the installation. The boards of individual layers shall have a side overlap of at least 150 mm.

It is also advantageous when the load-bearing plaster-fibre or wood-fibre boards OSB 3 have the thickness from 12.5 to 18 mm and the joints between them are cemented with a gluing and armouring material. The thickness from 12.5 to 18 mm is sufficient for anchoring the contact thermal insulation system and covering the joints improves the thermal and acoustic insulation.

The advantage of the peripheral wall according to the technical solution, in comparison with other known solutions, consists especially in the fact that simple and easy installation directly in the construction site is possible and the peripheral wall features extraordinary fire resistance in case of fire outside the building and very good fire resistance of the actual load-bearing structure in case of a fire inside the building.

The material composition of the peripheral wall complies with the standard requirements for energetically economical and low-energy buildings, including the accumulation nearing the traditional materials (brick etc). The composition of the peripheral wall represents an efficient solution of the dew point of the structure. A significant benefit is also very good acoustics preventing from penetration of outside noise.

Brief description of the drawings

The invention will be explained in more detail by means of the drawings, where Fig. 1 illustrates the view of the frame of the peripheral wall and Fig. 2 the perspective axonometric view of the cut of the peripheral wall.

Detailed description of the preferred embodiments

The example embodiments described and depicted below are understood as illustrative and they do not represent limitation of the invention example embodiments to those herein mentioned. Experts knowing the state of technology will find or will be able to find higher or lower number of equivalents to specific implementation of the invention specifically described herein, using routine experimenting. Such equivalents will be also covered by the below claims.

The external load-bearing wall 1 consists of a frame 14 from metal profiles, namely from vertical thin-walled galvanized (Zn) sheet "C" profiles 2, performing the function of posts, and horizontal thin-walled galvanized (Zn) sheet "U" profiles 3, which are located horizontally in the upper and lower part of the wall 1 and to which the "C" profiles 2 are connected by means of self-driving screws that are not illustrated. The profiles 2, 3 are galvanized Zn, the height of the frame complies with the required standards for designing residential buildings and the usual height is 2750 mm, dimensions of the "C" profile 2 are 50 x 150 x 1.5 mm (width x thickness x thickness of the metal sheet); dimensions of the "U" profile 3

are 50 x 152 x 1.5 mm (width x thickness x thickness of the metal sheet).

From the interior side, the first layer of plasterboard 4 is attached to the frame 14 and the second layer of plasterboard 5. It concerns fire-protection boards, with the thickness of 12.5 mm, with minimum specific gravity of 883 kg/m³. They are composed so that the first layer of plasterboard 4 overlaps the connections of the second layer of plasterboard 5. The connections of the boards are covered with cement and the boards 4, 5 are attached to the load-bearing structure with the screws HILTI S DD 01B with the maximum pitch of 40 mm. Under the boards 4, 5 there is a moisture stop 6 Jutaful Reflex N150, thickness 0.18 mm. The hollow of the wall 1 between the profiles 2, 3 is filled with thermal and acoustic insulation, namely mineral felt 7 Airrock ND manufactured by Rockwool, with the total thickness of 150 mm, which consists of two layers of boards with the thickness of 100 mm and 50 mm. The specific gravity of the felt 7 with the thickness of 100 mm is at least 50 kg/m³; the specific gravity of the felt 7 with the thickness of 50 mm is at least 45 kg/m³.

It concerns a half-soft stripe of rock wool (mineral felt) cemented with organic resin, hydrofobized within the whole volume, cut to fit the boards.

The basic properties of mineral felt 7 include thermal insulation properties, non-flammability and protection against spreading of flame and fire, noise absorption capacity, water-repellent capacity and resistance to humidity (the board is hydrofobized within the whole volume) and also steam permeability and dimensional stability.

The dimensions of the boards are 1000 x 600 (625) with the thickness of 100 mm and 50 mm.

Characteristics of applied mineral felt 7:

Property	Designation	Value	Unit
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Fire response class		---	A1	---
Declared coefficient of thermal conductivity		λ_D	0.035	W.m-1.K-1
Noise absorption capacity	Weighted	α_W	0.90 / 60 mm	(-)
	At f = 0.25-4 kHz	α_N	0.97 / 60 mm 1.1 / 100 mm	
Resistance to air flow		R	12.0 / 120 mm	kPa.s.m-2
Load of construction with own weight		---	Max. 0.840	kN.m-3
Thermal capacity		C_p	840	J.kg-1.K-1
Melting point		t_T	> 1000	°C

The external layer of the wall 1 consists of plaster-fibre board 8 of type Vidiwall (manufacturer KNAUF, thickness 12.5 mm, with dimensions 1200 x 2000 mm, with minimum specific gravity of 1160 kg/m³). The boards 8 are attached to the load-bearing structure from the external side with the screws HILTI S DD 01B with the maximum pitch of 40 mm. Connections of the boards 8 are cemented with a gluing and armouring material 11 Rockwool Ecorock.

On the plaster-fibre boards 8, the contact and thermal insulation system 9 consisting of several layers is connected from the external side. On the boards 8, there is mineral felt 10 FASROCK L with the thickness of 140 mm, with the minimum specific gravity of 88 kg/m³, which is connected by means of the insulation holders EJOT – STR – A x 180 with an additional disc, which are not illustrated. The holders are located vertically with the pitch of max. 200 mm. On the mineral felt 10, there is an applied 3-mm strong layer of gluing and armouring material 11, into which the armouring mesh 12 R 131 is pressed; it is covered with another 2-mm strong layer of the armouring material 11 (Ecorock of the firm Rockwool). On the façade, there is a plaster face 13.

As for the mineral felt 10 for contact and thermal insulation system 9, it is possible to use at least the two following embodiments:

Example 1 – Thermally insulating board with vertical fibres

The board (lamella) from rock wool (mineral felt) with the orientation of fibres mainly vertically to the surface of the board is cemented with the organic resin and is hydrofobized within the whole volume. The board is designed for the construction thermal, fire-protection and acoustic insulations in the outdoor contact thermal insulation systems. It is designed for the application as an additionally full-surface glued and mechanically anchored insulation system (ETICS) and the load-bearing base for thin cultivated gravel reinforcement and plaster layers with permeability for water steam.

The basic properties of the board include good thermal insulating properties, non-flammability and protection against spreading of flame and fire, noise absorption capacity, water-repellent capacity and resistance to humidity (the board is hydrofobized within the whole volume) and also steam permeability, dimensional stability and resistance to alkali.

The dimensions of the boards are 1200 x 200 with the thickness of 140 mm.

Characteristics of applied mineral felt 10 in the first example of realization:

Property	Designation	Value	Unit
Fire response class	---	A1	---
Declared coefficient of thermal conductivity	λ_D	0.042	W.m-1.K-1
Compressive stress with 10% compression	σ_{10}	40	kPa
Tensile strength perpendicular to board	σ_{mt}	80	kPa

Thickness tolerance class	---	T5	---
Short-term absorption power	W_p	≤ 1	kg.m ²
Long-term absorption power	W_{fp}	≤ 3	kg.m ²
Load of construction with own weight	---	Max. 1.470	kN.m ⁻³
Thermal capacity	C_p	840	J.kg ⁻¹ .K ⁻¹
Melting point	t_T	> 1000	°C

Example 2 – Rigid two-layer thermally insulating board

Rigid heavy board from rock wool (mineral felt) with integrated two-layer characteristics, cemented with the organic resin, hydrofobized within the whole volume. The top very rigid layer with the thickness up to 20 mm ensures high resistance to mechanical stress.

The board is designed for the construction thermal, fire-protection and acoustic insulations in the outdoor contact thermal insulation systems (ETICS). It is designed for the application in the systems ETICS that are mechanically anchored and additionally glued. To anchor the thermally insulating boards, it is necessary to use dowels designed for anchoring ETICS by the manufacturer of the system and the basic discs with the diameter of 90 or 140 mm.

The basic properties of the board include good thermal insulating properties, non-flammability and protection against spreading of flame and fire, noise absorption capacity, water-repellent capacity and resistance to humidity (the board is hydrofobized within the whole volume) and also steam permeability, dimensional stability and resistance to alkali.

The dimensions of the boards are 1000 x 500 (600) with the thickness of 140 mm.

Characteristics of applied mineral felt 10 in the second example of realization:

Property	Designation	Value	Unit
Fire response class	---	A1	---
Declared coefficient of thermal conductivity	λ_D	0.036	W.m-1.K-1
Factor of diffusion resistance	μ	1	(-)
Compressive stress with 10% compression	σ_{10}	20	kPa
Tensile strength perpendicular to board	σ_{mt}	10	kPa
Point load	F_p	250	N
Thickness tolerance class	---	T5	---
Thermal capacity	C_P	840	J.kg-1.K-1
Short-term absorption power	W_p	≤ 1	kg.m2
Long-term absorption power	W_{fp}	≤ 3	kg.m2
Melting point	t_T	> 1000	°C
Load of construction with own weight	---	Max. 1.527	kN.m-3

Industrial applicability

The peripheral wall according to the technical solution can be used for the construction of energetically economical and low-energy family and residential houses and, as the case may be, other building objects.

Summary of the reference marks used in the drawings

- 1 Peripheral load-bearing wall
- 2 "C" profile
- 3 "U" profile
- 4 Plasterboard
- 5 Plasterboard
- 6 Moisture stop
- 7 Mineral felt – thermal insulation
- 8 Load-bearing plaster-fibre board or wood-fibre board
- 9 Contact thermal insulation system
- 10 Mineral felt for the contact and thermal insulation system
- 11 Gluing and armouring material
- 12 Armouring mesh
- 13 Silicone plaster
- 14 Frame

CLAIMS

1. The peripheral load-bearing wall (1) of the low-energy building consisting of the frame (14) from vertical thin-walled sheet "C" profiles (2) and horizontal thin-walled galvanized sheet "U" profiles (3), in which at least one insulation layer is arranged, and also of the moisture stop and coverage layers ***characterized in that*** the inner coverage layer consists of two layers of plasterboard (4, 5) attached to the frame (14), behind which there is a moisture stop (6); the insulation layer consists of mineral felt (7) with the thickness of at least 150 mm, and the external layer consists of the load-bearing plaster-fibre or wood-fibre boards (8), to which the contact thermal insulation system (9) is attached, which includes the boards from mineral felt (10) with the thickness from 100 to 240 mm, gluing and armouring material (11) and armouring mesh (12) for the application of the silicone plaster (13).
2. The peripheral load-bearing wall according to the claim 1 ***characterized in that*** the plasterboards (4, 5) have minimum thickness of 12.5 mm and the first layer of plasterboard (4) overlaps the connections of the second layer of plasterboard (5).
3. The peripheral load-bearing wall according to the claim 1 or 2 ***characterized in that*** the mineral felt (7) of the insulation consists of two layers of the boards with the thickness of 100 mm and 50 mm.
4. The peripheral load-bearing wall according to at least one of the claims 1 to 3 ***characterized in that*** the plaster-fibre boards or wood-boards (8) have the thickness from 12.5 mm to 18 mm and the joints between them are cemented with gluing and armouring material (11).

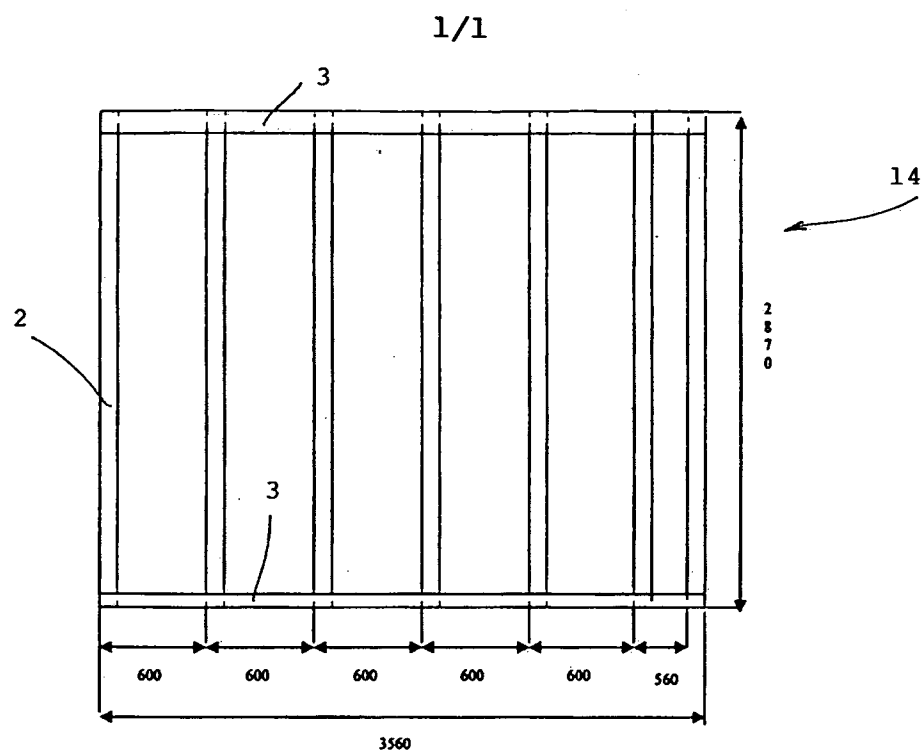


FIG.1

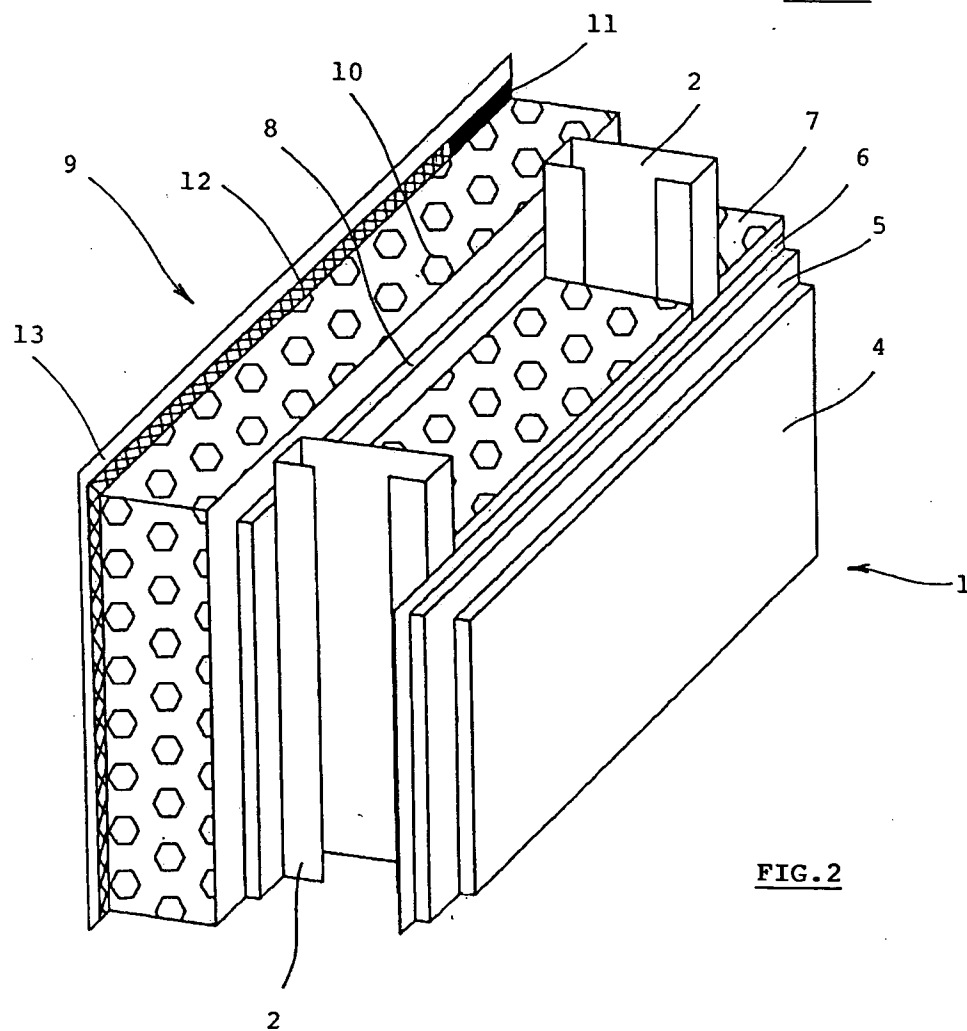


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/CZ2009/000136

A. CLASSIFICATION OF SUBJECT MATTER

INV. E04B2/58

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)

E04B

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 94 22 067 U1 (WILHELM NUSSE GMBH & CO [DE]) 18 December 1997 (1997-12-18) page 8, line 8 - page 9, line 1; figures 5,7,10,12	1-4
Y	EP 0 581 269 A2 (STO AG [DE]) 2 February 1994 (1994-02-02) column 5, lines 42-49; figure 2b	1-4
A	FR 2 738 270 A1 (SECOND OEUVRE COMP INT DE [FR]) 7 March 1997 (1997-03-07) page 5, line 19 - page 6, line 16; figures 3,5	1-4
A	US 6 745 531 B1 (EGAN WILLIAM F [US]) 8 June 2004 (2004-06-08) column 6, lines 57-65; figure 1	1,4
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 533 205 A (PESTEL PAUL ET AL) 13 October 1970 (1970-10-13) figure 3 -----	2
A	FR 2 906 277 A1 (APR ENTPR SARL [FR]) 28 March 2008 (2008-03-28) claims 15,19,32; figure 4 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/CZ2009/000136

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 9422067	U1	18-12-1997	NONE
EP 0581269	A2	02-02-1994	AT 159069 T 15-10-1997 CA 2101505 A1 10-01-1994 CZ 9301506 A3 16-02-1994 DE 59307485 D1 13-11-1997 DK 581269 T3 27-10-1997 ES 2052472 T1 16-07-1994 FI 933387 A 29-01-1994 GB 2269194 A 02-02-1994 GR 94300035 T1 30-06-1994 GR 3025147 T3 27-02-1998 HU 65304 A2 02-05-1994 NO 932658 A 31-01-1994 PL 299804 A1 07-02-1994 RU 2079612 C1 20-05-1997 SK 80593 A3 06-07-1994 US 5410852 A 02-05-1995
FR 2738270	A1	07-03-1997	NONE
US 6745531	B1	08-06-2004	NONE
US 3533205	A	13-10-1970	NONE
FR 2906277	A1	28-03-2008	NONE