(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
2 May 2013 (02.05.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/060308 A1

(51) International Patent Classification:
B23B 3/12 (2006.01) *E04C 2/36* (2006.01)

(21) International Application Number:
PCT/CZ2012/000107

(22) International Filing Date:
24 October 2012 (24.10.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PV 2011-682 25 October 2011 (25.10.2011) CZ

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(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

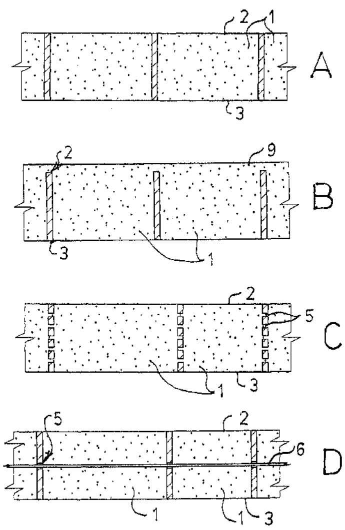
(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *of inventorship (Rule 4.17(iv))*

Published:
— *with international search report (Art. 21(3))*

(54) Title: CELLULAR PANEL

Fig.4



(57) Abstract: A cellular panel comprising at least one piece of cellular foil, cells (1) which are at least partilly filled with solid matter, where the cellula foil consists of a set of strips inter connected in to cells (1), said cells (1) having through cavities in unfilled state, said cellular panel containing at least one inner layer (4) of particles.

WO 2013/060308 A1

Cellular panel

Technical Field

The invention relates in particular to the field of building industry, in concrete terms to the panel with cellular structure, which is suitable for construction of insulation layers. The panel can be used in particular for facing and lining of buildings as well as for other purposes.

Background Art

Various types of construction and insulation panels are currently available on the market.

Common construction panels that are currently used for construction and for lining of buildings are more or less rigid and they are inflexible. The possibility to achieve thermal insulation and/or waterproofing with the help of lining with insulating panels is increasingly used, or the panels from insulating materials are eventually built-in directly into the floor, base, terrace, etc. Insulation panels are typically used as an interlayer or as a surface lining. Wide choice of hitherto existing insulating panels is available on the market, but generally each type of these panels shows significant disadvantages.

Usually only various foils from plastics are used for waterproofing. These foils have simple structure of a sheet of material or possibly vapour-permeable porous membrane and are usually supplied in rolls. Their advantages are flexibility and small volume, but the level of sound and thermal insulation reached is very poor.

Polystyrene boards and boards from rock wool are most widely used for sound and thermal insulations. Advantage of polystyrene boards is their low mass and no water absorption capacity, but their significant disadvantage is their inflexibility and low mechanical resistance. They are fragile and they can crack on impact, pressure, or when a heavier object is leaning against these boards. Polystyrene particles can pour out of possible loop holes, for instance when used under wood lining. Essential disadvantage of polystyrene is its inflexibility, because such inflexibility virtually eliminates the possibility to use it for lining of uneven or dissected surfaces. Polystyrene panels are very often used for insulation layers, however their effectiveness of sound and thermal insulation is limited.

Other well known and frequently used means for thermal and sound insulation are panels from rock wool. They have advantage of low weight, but their significant disadvantage is their water absorption capacity and very low mechanical resistance. Filamentous structure of these panels allows intrusion of pests and also liability to damage. Mineral wool is produced in compressed form as panels that are inflexible and brittle. For uneven surfaces, an uncompressed mineral wool is produced, which is supplied in rolls. Such uncompressed mineral wool is indeed flexible, but it is only suitable as an interlayer under a solid base, for instance under a wood lining. Its surface is unstable and has a loosened, fibrous structure, which cannot be strengthened even by a net, gauze or mesh commonly used for such purposes, so that it is not suitable for external lining under plaster etc.

None of the materials mentioned above has such strength to be used for loaded surface. Also none of them has simultaneously all required properties, i.e. waterproofing capability, thermal and sound insulation capability, strength and a load-weight and tensile resistance.

Document CZ U 9885 describes insulation panel consisting of parallel layers, for instance boards from insulation material, which are interconnected by means of grating. The parallel layers are at least two and the grating between the layers creates a spacer by means of which a system of hollow chambers is created in the panel. Air, gas, or vacuum is in these chambers. The grating is made of metal, plastic, or paper. This panel is strong, inflexible, and water-resistant. It has some, however insufficient, insulation properties. Currently known solid panels based on gratings are inflexible and therefore not suitable for lining of uneven and shaped surfaces.

File EP 2008805 A1 describes a panel with hollow chambers covered with elastic surface plates. Sound insulation and partially thermal insulation properties are attributed to the chambers filled with air only. Similar panel, but from flexible structure supplied to the market in rolls is described in EP 0776759 A1, this panel has its surface covered with an adhesive coating. These types of panels, which include hollow chambers filled with air only, have low weight; however their insulating properties are rather limited. The air gaps have a significant disadvantage in that they increase the risk of destruction of the panel by its breaking or collapsing into cavities. To reduce or eliminate this risk, the panels of the said type are designed as a combination of rigid cellular structure with a rigid or elastic shell, or as a combination of flexible cellular structure with rigid shell, which has a significant disadvantage in that they are not flexible and they are not adaptive to the shape of the surface.

Panel with cellular structure at least partially filled with material is described for example in the file JP 2004027788 (A). Rigid cellular structure is partially filled with phenol foam and covered with a shell on both sides over the holes of the cellular structure. An air layer is created inside the panel in the cellular structure. There is an additional compact layer of phenol foam on one side of the panel between the shell and the cellular structure. The air layer is formed because of sound insulation and thermal insulation. The disadvantage of this panel is its inflexibility. In case of using flexible cellular structure, however, the air layer would significantly reduce the panel strength and its resistance to destruction on pressure or impact, so this type of panels can not be used in the case of need for higher insulation capacity and where flexibility is needed.

There are also known already panels with cellular structure filled with construction foam or insulation foam such as e.g. phenol foam. For example, file JP 200240174 describes panel with cellular structure of non-flammable material filled with phenol foam and equipped with a cover shell on sides of openings of the cells. Material based on metal, ceramic, aluminium hydroxide or aramid is used as non-flammable material for the cell structure. Therefore the cellular structure is rigid and forms a solid supporting skeleton for phenol foam. A layer of carbonized fibres is used under the cover shell to prevent access of oxygen. This panel has high fire resistance, but it is rigid, inadaptable in shape.

At present, so called cellular foil is known in building industry that is available on the market under the name GEOCELL. Its arrangement is described for instance in US pat. 5,449,543, WO 1997/16604, EP 0378309, WO 2011045458. It is created as a system of strips of flexible plastic foil that are interconnected so that a structure of hollow chambers-cells is created between their walls. Cavities of these chambers-cells are open in vertical direction. For manipulation and distribution, the cellular foil is supplied in a folded state where the cellular walls are pressed together, and it is unfolded on a plane at the site of use, by which a honeycomb-like structure with open chambers is created. Hence, when the cellular foil is in folded state for distribution and storage, its chambers are flat, two-dimensional, and in the unfolded state for its use, its chambers are three-dimensional with through openings. This cellular foil is designed to be laid on surfaces of erosion attacked outdoor terrains, such as river banks or slopes along roads, or also backfilling of mining groves, where it is placed to prevent slacking of loosened rock from the walls and unwanted pulverization and fragmentation of surface elements. It is also used for consolidation of bed of constructions such as roads or railways, where it is loosely unfolded on earth base after baring and clearing away of arable soil, or over drainage blanket from gravel and/or sand. Here, the cellular foil is then overfilled with gravel and grouted with concrete and, as the case may be, coated with paving asphalt. Sometimes, it is filled directly with concrete. Various types of cellular foil are available already, in different types and versions, some of them having cell walls equipped with perforation to allow water permeation and to eliminate unwanted pressures in the building. File WO 1997/16604 also recommends reinforcement of the cellular foil with a flexible grating created from cables pulled through the chamber openings in cells and anchored in earth. For hitherto known applications, the cellular foil is used into terrain where it is freely unfolded to create a net, after which, at the site or after relocation in empty state to the site of use, this net is overfilled with loose materials, while its chambers are filled and covered with setting or non-solidifying loose matter. When used on constructions of bed for constructional objects, heavy machinery is commonly used on this cellular foil, when it is laid on the place of use and its overfilling with gravel follows using excavators and subsequently travels by road compaction roller.

Application CZ PV 2010-439 a CZ U 21326 describes panel with cellular structure in the form of portable body containing at least two parallel layers from impermeable water resistant material creating face wall and back wall of the panel, between which layers a filling is located that is created by flexible plastic cellular foil from strips of spliced together material with chambers, which are either empty or filled with loose filling. The cellular foil and the parallel layers are flexible and, as the case may be, covering walls of the panel are created on the circumference. The filling of chambers preferably consists of particles, predominantly of a dust size up to the diameter of 6.5 cm, from heat insulating material based on for instance glass cullet, so called foam glass, and/or polystyrene. The walls are forming a shell on the panel, thus creating protection against moisture penetration and preventing falling out of contained particles. This panel has thermal insulation and sound insulation properties as well as waterproofing properties and it is flexible to a significant extent so that it can be utilised for lining of uneven and shaped surfaces. The disadvantage of this panel is its relatively demanding production consisting in the necessity to incorporate the particles into the unfolded foil and to mount the surface walls to the unfolded semi-finished panel on both sides or on all sides. Unwanted falling out of contained particles can take place in the case of damage to the surface shell of the panel. In case of creation of crack or little hole in the surface shell, water can penetrate into the panel and as the case may be, water can even flow through the panel.

Application EP 1829674, published also as US 2011/0079338 A1, describes flexible panel based on cellular structure and water-absorbing expanded material based on polyurethane, polystyrene, and other plastics, preferably so called phenol foam, which is based on natural phenol and resins. The cellular structure is created as a clad with chambers that have through input and output openings. This cellular structure forms a bearing structure for the phenol foam that prevents breaking of the panel and cracking off of the panel parts from the panel body in its central areas, and also prevents unwanted dent of the panel when pressed on the front side. The foam material is chosen on the basis of such chemical as to be spontaneously glued to the material of the cellular structure. Thus, by choosing the phenol resin foam, adhesion of the filling to the cellular structure is achieved and a cohesive whole is created in all parts of the panel body after curing of the foam. The phenol foam material is well known in the construction industry and it is widely used as filling and bonding construction foam to fill construction joints. In case of the panel according to EP 1829674 and US 2011/0079338 A1, the filling from phenol foam exceeds at the panel circumference over the edges of the cellular structure clad, which is to prevent cracking off of the filling, i.e. the phenol foam, from peripheral parts of the cellular clad where the cells are dissected. Regarding the height of the foam filling in the cells of the cellular structure, the file presents alternatives where the foam filling fills the cells of the cellular structure below the edge, over the edge, and only partially, while in the case of partial filling of the cells with the foam, the remaining space of the cells is filled with air gap. The file presents also possibility to use more layers of the cellular structure placed in a sandwich-like manner one above the other, that are interconnected with uniform filling of foam as a bonding component. The foam fills as a single filling material the entire panel or peripheral parts of the panel. A possibility is also presented that empty pocket is created inside the panel. Fig.3 of the file and corresponding part of text describes a panel from two layers of cellular structure filled with foam, while air layer is enclosed in the middle between these layers in the panel creating here a sound-insulating air cushion. Figures 5 and 6 of that file and corresponding parts of text present a possibility to cover the panel surface with reinforcing and possibly waterproofing shell. This panel has low weight and is permeable to air. The file states that the panel is created as insulating lining for walls and floors of aircrafts, vehicles, and houses. Disadvantage is that foams of that type are relatively expensive, so the panel with filling over the entire panel body is considerably expensive compared to other linings on the market. If a maker would like to spare on the foam material and create the air cushion in the panel body as mentioned in the file with recommendation to do so to achieve better sound and thermal insulation, there is a risk that the empty unfilled space inside the panel can cause unwanted collapse or break of the panel during manipulations or under effect of pressure at the site of use. Fragile hollow linings are unwanted also in all cases where it is necessary to lean any object against the wall temporarily or permanently, they are also unsuitable for large surfaces where strain due to temperature changes during various seasons of the year and atmospheric action are effective in greater extent. Significant disadvantage of this panel with phenol foam is also its high water absorption capacity. For instance soaking with water causes problems connected with increased weight and causes problems with extreme strain and classic problems with erosion known in the construction industry in the winter season. Possible wrapping with envelope from water resistant non-soaking material to eliminate the absorption capacity would cause further rise of price of this panel and it would not prevent soaking of water in the areas with cracks and fastening elements. Another disadvantage of this panel is that it is rigid, inflexible, and inadaptable to shape of the base. This is caused by the fact that cellular structure from paper, metal, ceramics or plastic is used and filled entirely with the foam mass without interruption or only with air gap, while the cellular structure arrangement and material is selected without regard to possibilities of elasticity and bending, this cellular structure is combined with the foam kind of that type that is not flexible after curing of the foam, while the high height of the material, which is not interrupted in the direction of height inside cells of the cellular structure, creates hindrance to shaping of the panel. In case of the panel variant filled entirely with solidified polystyrene based foam, the panel is without any possibility of shape adaptation and it should be cut out for all projections and other irregularities. Also in this case, there is a risk that even the cellular structure will not prevent unwanted cracking of the panel and breaking off of peripheral parts in particular.

Disclosure of Invention:

The above-mentioned disadvantages are eliminated to a considerable extent by the invention. Cellular panel according to the invention is created as a freely movable body base of which is created by at least one piece of cellular foil, cells of which are at least partially filed with matter in solidified state closing at least inputs and outputs of cells of this cellular foil. The cellular foil used is of the type of width-extendable plastic flexible foil consisting of set of plastic strips interconnected into cells, where space in these cells is represented by cavities freely through from the outer space in case of the foil being in hitherto unfilled state. The matter in solidified state is contained in the cells at least within the frame of surface parts of the cells and it is one-piece at least within the frame of cells. The matter in solidified state means here material in solid state, workable by casting in liquid state, solidifying from this liquid state to a solid state. Inputs and outputs of the cells located at the front side and back side of the panel are filled with the matter in solidified state, while at least one inner layer from particles is created inside the panel.

Solution according to the invention can be realized as a variant where one layer of the cellular foil is contained in the panel. In this case, inputs and outputs of cells are filled with the matter in solidified state, while at least one inner layer from set of particles is created inside the cells. Since resins and other flexible matters with elasticity are considerably expensive, this variant may mean significant savings. Also lightening of panel weight can be achieved using different internal filling. Matter such as glass cullet, sawdust, polystyrene debris, rock wool fibres, or other cheap or lightweight material can thus be used inside the panel, while inputs and outputs of cells are sealed up with a layer or layers of material in solidified state to prevent these particles from falling out.

Panel can be alternatively made as a variant in which it preferably contains two or several layers of cellular foil, in such case at least upper and lower cellular foil, seen in the position of panel lying on the base with layers one above the other, have cells at least partially filled with the matter in solidified state. Within the framework of the solution according to the invention, also some additional elements can be included such as planar waterproofing foil inserted or sealed-in between individual layers of cellular foil etc.

Water resistant, elastic, compact matter is preferably selected as the solidifying matter. Cells of the cellular foil can preferably contain as the solidifying matter for example a matter based on filling and/or insulating foam known in the field of building industry as so called construction foam. It is a material in liquid state compressed in a pressure vessel that is applied on the site of use by spraying in a similar way as a spray, which after release from the pressure vessel creates foam that cures after some time into solid and elastic matter. From chemical point of view, materials based on polyurethane or other polymers, acrylates, bitumen, rubber, resin or combination of these substances are suitable as the elastic compact matter. The term matter based on, used herein, means that within the framework of the invention it is recommended to use matters from mentioned substances and also matters containing these substances partially or derived from these substances and also matters being a mixture in which the solidifying matter represents bonding base of the whole and additives or particles are included, such as for example polyacrylate matter with admixture of polystyrene debris or glass cullet or wood debris.

Perforated cellular foil can be preferably used for production of the panel. Cell walls of this type of cellular foil contain wall openings and if suitable solidifying matter is poured into this foil, union of the mater between neighbouring cells can take place through at least some of these wall openings, which prevents unwanted release of contained matter from the cells, namely during manipulation with the panels.

Perforated cellular foil can be used for production of the panel also from other reason. The walls of cells of the cellular foil containing wall openings can be reinforced through at least some of these wall openings using reinforcing filaments, which are pulled through the panel interior so that they are passing through the panel within the framework of its full length or width dimension. Flexible reinforcing filaments in the form of metallic cables are optimal for this purpose. Stronger reinforcing filaments such as wires can then serve for achieving and fixation of required shape of the panel, for example to achieve arch or wavy course of the panel etc. It is also possible to use imperforated cellular foil and to make the wall openings for the purpose of reinforcing by means of reinforcing filaments as late as during production of the panel according to the invention.

It will be possible to manufacture the panels according to the invention in piece production by filling each piece separately or in series production by filling the unfolded cellular foil, whole or divided to larger parts, and subsequent cutting. Filling could be freed from the peripheral parts of the panel after cutting or during manipulation. This can be prevented by addition of reinforcing element or elements to the circumferential parts of the panel, for example by taping it round with plastic adhesive tape or tying it round with non-adhesive plastic stripe.

For production reasons, depending on the material used for the filling, it can be advantageous that the panel can be produced for example so that the cellular foil is unfolded and filling is filled into its cells, while the solidifying matter is overlaid even over the edge of the cellular foil on at least one of the sides of the panel containing orifices of cells of the cellular foil. Filling matter then passes on this side into a continuous layer in which the edge of the cellular foil is hidden on at least part of the panel. This variant is out of the question in case of frangible materials because of risk of unwanted cracking of the panel surface during stress or bending of the panel, thus it could interfere with or eliminate effects of the invention. It is no trouble in case of elastic materials such as rubber etc. Optimal option of utilising this variant of the invention is for example multilayer sandwich-type panel with internal filling from cheap lightweight material such as sawdust or polystyrene debris and superficial filling from rubber. In this case, the cellular foil will ensure flexibility of the panel and its coherence and simultaneously lightening and price reduction of the product is achieved. For reasons of improvement of the panel coherence, some of the cells can have interconnected matter, in this case for example rubber, across the whole sandwich, from the facing side of the panel to its reverse side through the cells of the cellular foil or several cellular foils one over the other.

Cellular panel according to the invention is supposed to be in particular in the form of transportable, to certain extent flexible, body consisting of cellular foil with filling or fillings. The panel can be in some cases additionally equipped with covering layer or layers, for example flexible plastic foil, on the front and/or rear side. Combination of this variant with the variant mentioning the possibility of circumferential reinforcing of the panel can then give also encapsulated panel. However, the variants mentioned in this paragraph are not presumed to be much utilised in practice namely for economic reasons. Surface treatment of the panel with additional layer can be advantageous for aesthetic or technical reasons in the case when the panel will be equipped with an additional surface layer replacing additional surface treatment after mounting of the panel, for example with layer imitating appearance of stone, decorative mosaic, plaster or its imitation, advertising poster etc.

Main advantage of the devised panel is its flexibility together with the possibility to provide water-proofing, sound insulation, and thermal insulation. The devised panels are utilisable in building industry in particular for creation of lining and facing. They allow their use for uneven surfaces in particular and are valuable especially because they are able to copy the surface shape of the base on which they will be placed. Content of layer or layers of loose particles substantially supports the possibility of bending of the panel and functions here as important intercommunicating gangway preventing breaking or collapse of the panel and relieving stress that can otherwise arise in materials of bigger thickness due to temperature changes during seasons of the year and under load. Devised panels can find their use especially as insulating lining panels for lining of unloaded surfaces having dissected or uneven surface such as exteriors and interiors of buildings of rounded and other atypical shapes, arches of entrances, columns, etc. They can be used also for lining of ceilings, as roof insulation linings, or as interlayer in floor under a hard layer, for instance under a deal floor. At the same time, they can serve as humidity insulation, thermal insulation, and sound insulation. The panel can be manufactured in a flexible form that can be bent and modelled. It is therefore possible to use it even for very complicated floor structures and undulating walls and even for sharp angle bends. These panels can be custom made with various dimensions and height. During manufacture, even waste secondary raw materials such as wood sawdust, waste glass, rubber from worn-out tyres, material from PET bottles, etc. can be reutilised. The panel is not crumbling, cracking, and does not warp after contact with water. And it can have also relatively very low weight. Production of the devised panel is relatively undemanding regarding materials, manipulation, staff as well as qualification, and the panel thus allows availability for producer as well as consumer with low purchase costs. Cellular foil of suitable selectable height, preferably from 2 cm to 30 cm, can be used in the panel, with smaller or larger chambers considering the required panel elasticity, chamber filling used, spatial and other conditions at the place of application etc. In the case when steam permeability and air permeability is required, it is possible to use porous matter or matter with admixture of porous particles in the panel. Panels according to the invention can be utilised also in other fields, for example for insulation into cases of refrigerators, for insulation of shells of refrigerator vans, for vehicle chassis as well as for other insulation layers on products or in products, which significantly extends assortment of insulation linings on the market.

Brief Description of Drawings

The invention is illustrated using drawings, where Fig. 1 shows perspective view on example of the simple cellular panel according to the invention, Fig. 2 shows detail of structure of the sandwich cellular panel from one layer of cellular foil in the cross-sectional view of the panel, Fig. 3 shows detail of structure of the sandwich cellular panel from three layers of cellular foil in the cross-sectional view of the panel, Fig. 4 A to D shows detail of different variants of structure of a part of the cellular panel with cellular foil and solidified filling in cross-sectional view, where variant A shows layer of the cellular foil with filling up to the edge, variant B shows the layer where the filling is on one side overlaid over the edges of the cells, variant C shows the layer in the case of using perforated cellular foil, variant D shows the layer with perforated cellular foil and reinforcement with steel cable stabbed through the cell walls openings, and Fig. 5 shows perspective view of example of the encapsulated panel where at least one additional covering layer is contained around the whole surface of the panel.

Best Mode for Carrying Out the Invention

Descriptive example of optimal simpler variant of embodiment of the invention is the cellular panel according to the Fig. 1 and 2.

The panel represents a freely movable body. Cellular foil of suitable dimensions, for example 50 cm x 50 cm x 10 cm, is used. The cells 1 of the cellular foil have inputs 2 and outputs 3 of the cells filled with matter in solidified state closing inputs 2 and outputs 3 of the cells 1. The GEOCELL cellular foil is used for example, which is a flexible foil available on the market for the purpose of creation of terrain coverings. It is the type of width-extendable foil consisting of a set of flexible plastic strips that are interconnected so that a set of cells 1 is created having freely through cavities, of course in the case of the foil being in hitherto unfilled state. The matter in solidified state is one-piece in the area of surface parts of the cells 1 at least within the frame of the cells 1. In the cells 1, the solidified matter copies the shape of the cell 1. Practically any material workable by casting in liquid state and solidifying from this liquid state to a solid state can be used as the matter in solidified state, including mixture of binding component with solid or hollow particles. Matter of the type of filling and/or insulating construction foam is preferably used, which has insulating properties, is easily workable, and is able to fill cavities of the cells 1 without unwanted bubbles. Advantage of the construction matters is also the fact that they are easily available on the market directly in pressurised containers allowing immediate use, and they are elastic and have low weight after solidification.

according to the intended application of the panel and economic intentions, any optional solidifying matter can be used, however optimal fillings are water-resistant and elastic compact matters, for example the ones based on polyurethane or other polymers, acrylates, rubber, bitumens, resin or combination of these substances, or these matters with admixture of purpose-made particles such as polystyrene balls etc.

Examples shown on Figures 1 and 2, and also subsequent Figures 3 to 5, represent illustration of variants of applications of the devised solution.

Figures 2 and 3 show two demonstrative variants of optimal embodiment of the invention, in both cases it is the panel with several layers of material of the filling. For demonstrative reasons, illustration of simple construction of the panel with visibly different types of fillings is selected, where inputs 2 and outputs 3 of the cells 1 are filled with the matter in solidified state, while at least one different inner layer 4 of filling, namely from particles, wood sawdust in this case, is created inside the cells . This inner layer 4 of filling will significantly cheapen the panel and it can bring also useful advantages important for the panel properties, for example it can significantly lighten the panel or it can rationally use up waste materials such as , ceramic rubble or glass cullet, so called foam glass etc. The matter in solidified state closes inputs 2 and outputs 3 of the cells 1 and creates here plugs preventing unwanted falling out of particles.

Use of perforated cellular foil available on the market will be preferred for production of flexible panels. Cell walls 1 of this type of plastic cellular foil contain wall openings 5, which are in the case of existing cellular foils created for purposes completely different from purposes for which they are utilised by the invention, since these openings are there to allow ventilation and water permeation, because this type of cellular foil is marketed up to now only for the purpose of incorporation into terrain or into flat foundation pads under buildings. The wall openings 5 can present significant contribution for the purposes of the devised solution, namely when using fillings from matters solidifying into flexible or elastic form. Namely after imbedding of the cells 1, the matter of at least some adjacent cells 1 is connected through at least some of these wall openings 5 and these joints fulfil a function of rivets preventing unwanted release or possible falling out of filling from the cells 1. With that aim, it is advantageous to use the cellular foils particularly with the number of the wall openings 5 in the cells 1 higher than one, as shown on Figure 4 C.

Some wall openings 5 can be preferably utilised for stitching of the panel in the case of presumption that the panel will be intensely bent or stressed, and that it will be exposed to many manipulations. In this case, flexible reinforcing filaments 6, for example metallic cables, are passing through the selected wall openings 5 within the framework of the full length or width dimension. The cellular foil without perforation can be also used and the wall openings 5 can be made additionally, before or during placing of the reinforcing filaments 6. In the case of use of rigid, inelastic solidifying matter for inflexible variants of panels, gratings preventing falling out of parts of matter out of the cells 1 can be created similarly in the panel, and the filaments 6 need not to be flexible, they can have form of metallic rods for example. The inflexible filaments 6, for example in form of wires or rods, can also be preferably used for shaped panels of unusual or rounded courses to achieve and maintain required permanent curving of panels. In this way, the panel can be purposefully shaped before use or during mounting. During shaping, the content of particles functions similarly as a ball bearing, because the particles are not connected and hence they can migrate and draw close or move away without having the need to necessarily return back to the original place. Content of discontinuous matter in the form of individual particles thus significantly changes properties of the panel compared to the present state. Particles have also another effect in that they fill in cavities and thus prevent collapse of the panel during bending. Another effect of particles is that they allow necessary waving of the cellular foil without breaks. In the case of creation of pad from particles without content of cellular foil in the centre of the panel, the contained free particles will also allow local thinning of the inner layer 4 and approximation of layers of the solidified matter, which results in further improvement of flexibility. The wires can be shaped in advance and slid into the cellular foil before loading with the filling or, which is technologically simpler, flat panel containing appropriately rigid filaments

6 can be manufactured and this panel is shaped, for example by bending, only after filling with filling matter or matters and after partial or complete solidification of the filling matter. The filaments 6 then facilitate fixation of the panel shape, which is useful when the panel is used for lining of curved surfaces. Also in this case the filaments 6 have completely different purpose than in current applications of cellular foil in terrains where their purpose is only to anchor the cellular foil to the terrain and, as the case may be, to prevent tearing of the cellular foil on large surfaces and slopes. Using of filaments 6 in construction of the cellular panel is shown on Fig. 4 D. The filaments 6 can be anchored against the cellular foil by additional elements such as pegs, knot etc., not shown on figures.

Panel containing at least two layers of the cellular foil in preferred form is shown on Fig. 3. Fig. 3 shows variant of three layers of the cellular foil one above the other. Upper and lower cells 101, 103 of upper and lower layers of the cellular foil should be at least partially filled with the matter in solidified state. In this example of embodiment, for the purpose of demonstration, entire upper cells 101 of the upper cellular foil and entire lower cells 103 of the lower cellular foil are fully filled with the matter in solidified state. Middle cells 102 located in the middle cellular foil are filled with particles. Particles on Figure 3 are represented by wood sawdust demonstrating illustration of cheap available material creating the inner layer 4 in the panel. On this illustration, for the purpose of demonstration of variability of embodiment of devised solution, the peripheral parts of the panel are interconnected in the height direction by means of using the matter in solidified state for peripheral parts on circumference of the panel. Edge of the panel is shown on the right side of Figure 3. Cleaning down of dissected unfilled edges of the cellular foil and interconnection of the panel content in the height direction is achieved, by which the connection of content of all layers of cellular foils at the panel edges is achieved, which is aesthetic and fulfils simultaneously function of connecting as well as circumference reinforcing element 7. Such or similar connection needs not to be performed necessarily at the edges, it can be done alternatively or additionally for instance across the selected cells 1 as a plug across the middle parts of the panel, or it needs not to be contained in the panel at all. In such case, reinforcement of the panel edges for example with plastic adhesive tape can be expedient.

Figure 4 B shows how the filling matter can be overlaid also over the edges of the cells 1 of the cellular foil so that it passes on this side, upper side of the panel on the Figure and probably the future face side of the panel, into a continuous layer 9, in which the edges of the cellular foil with inputs 2 of the cells 1 are hidden on the panel.

Figure 5 shows encapsulated cellular panel. Cellular foil with filling of solidifying solidified matter in the cells 1 is in an envelope, for example of flexible plastic foil, that on the front as well as back side of the panel creates a covering layer 8 of material different from material of the matter contained in the inputs 2 and/or outputs 3 of the cells 1 and simultaneously creates the circumference reinforcing element 7 at the sides of the panel.

CLAIMS

1. Cellular panel created as a freely movable body comprising at least one piece of cellular foil, cells (1) of which are at least partially filed with matter in solidified state, where the cellular foil consists of set of strips interconnected into cells (1) having freely through cavities in case of the foil being in hitherto unfilled state, and where the matter in solidified state is one-piece at least in the area of surface parts of the cells (1) at least inside the cells (1), while the matter in solidified state means material in solid state, workable by casting in liquid state, solidifying from this liquid state to a solid state, **characterized by that** inputs (2) and outputs (3) of the cells (1) located at the front side and back side of the panel are filed with the matter in solidified state closing at least the inputs (2) and the outputs (3) of the cells (1), while at least one inner layer (4) of particles is created inside the panel, while flexible plastic cellular foil extendable into the width is used.

2. Cellular panel according to claim 1 **characterized by that** the panel contains one layer of cellular foil and inputs (2) and outputs (3) of the cells (1) are filled with the matter in solidified state, while at least one inner layer (4) from particles is created inside the cells (1).

3. Cellular panel according to claim 1 **characterized by that** the panel contains at least two layers of cellular foil, while at least upper cells (101) and/or lower cells (103) located in upper and lower cellular foil of the panel are at least partially filled with the matter in solidified state.

4. Cellular panel according to any of the claims 1 to 3 **characterized by that** filling in solidified state is created of water-resistant and elastic compact matter, for example the one based on polymers, polyurethane or other polymers, acrylates, rubber, bitumens, resin or combination of these substances, preferably insulating foam and/or filling construction foam.

5. Cellular panel according to any of the claims 1 to 4 **characterized by that** walls of the cells (1) of the cellular foil contain wall openings (5), where matter of at least some adjacent cells (1) is connected through at least some of these wall openings (5).

6. Cellular panel according to any of the claims 1 to 5 **characterized by that** walls of the cells (1) of the cellular foil contain wall openings (5), through at least some of which reinforcing filaments (6), for example flexible metallic cables or bent wires, are passing through within the framework of the full length and/or width dimension of the panel.

7. Cellular panel according to any of the claims 1 to 6 **characterized by that** circumferential sides of the panel are equipped with at least one circumference reinforcing element (7), for example plastic adhesive tape.

8. Cellular panel according to any of the claims 1 to 7 **characterized by that** on at least one of the panel sides containing orifices of cells (1) of the cellular foil, the matter contained in inputs (2) and/or outputs (3) of the cells (1) of the cellular foil is overlaid also over the edge of the cellular foil so that it passes on this side into a continuous layer (9) in which the input and output edges of cells (1) of the cellular foil are hidden on at least part of the panel.

9. Cellular panel according to any of the claims 1 to 8 **characterized by that** the panel is equipped on its front and/or back side with at least one covering layer (8) of material different from material of the matter contained in the inputs (2) and/or outputs (3) of the cells (1) of the cellular foil, for example with flexible plastic foil.

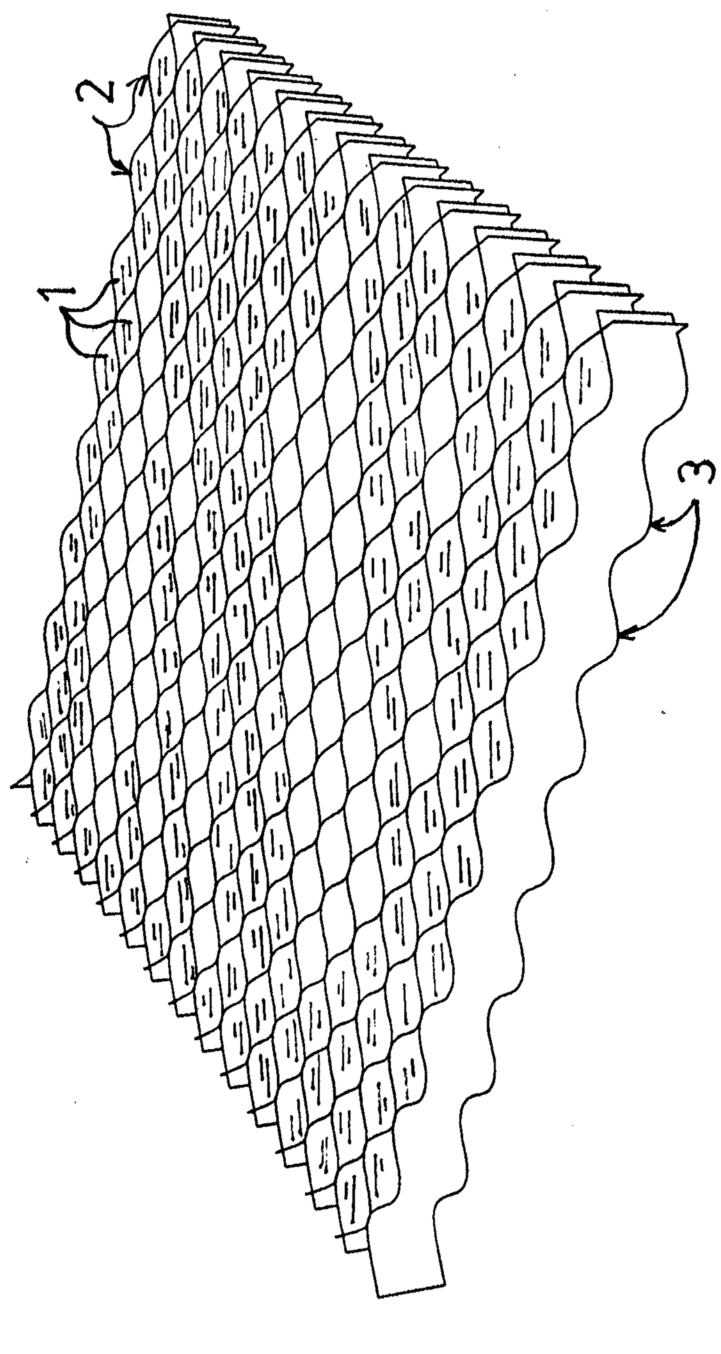


Fig.1

Fig.2

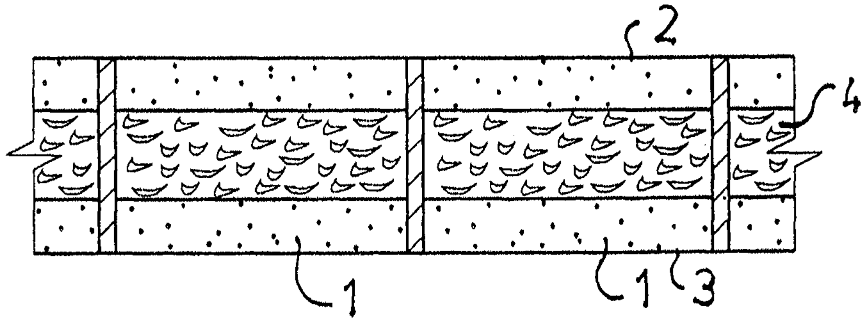


Fig.3

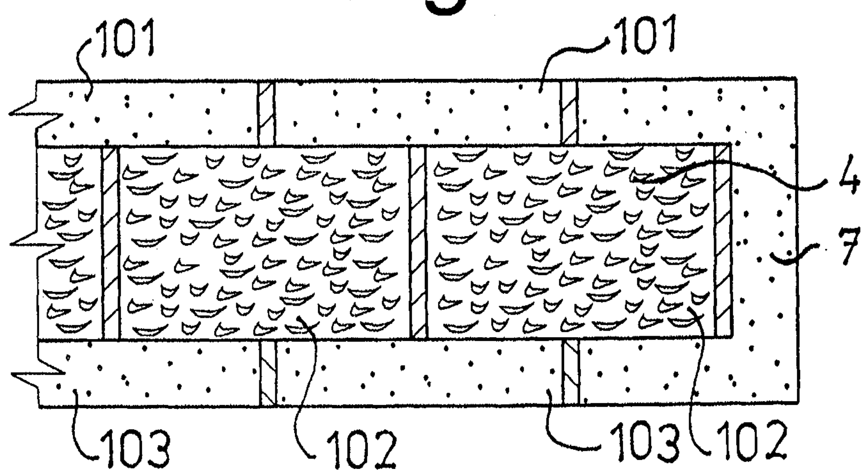


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Fig.4

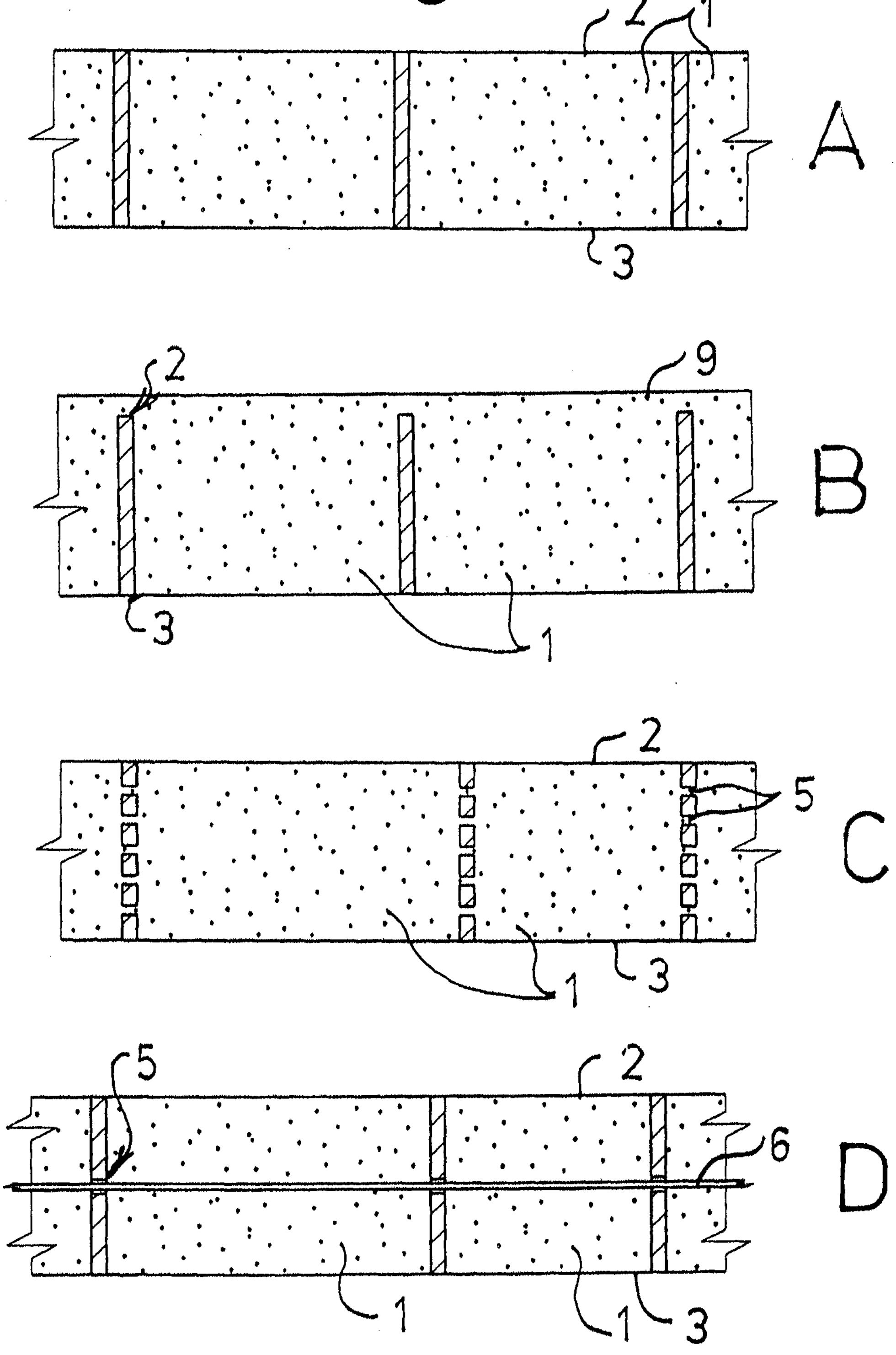
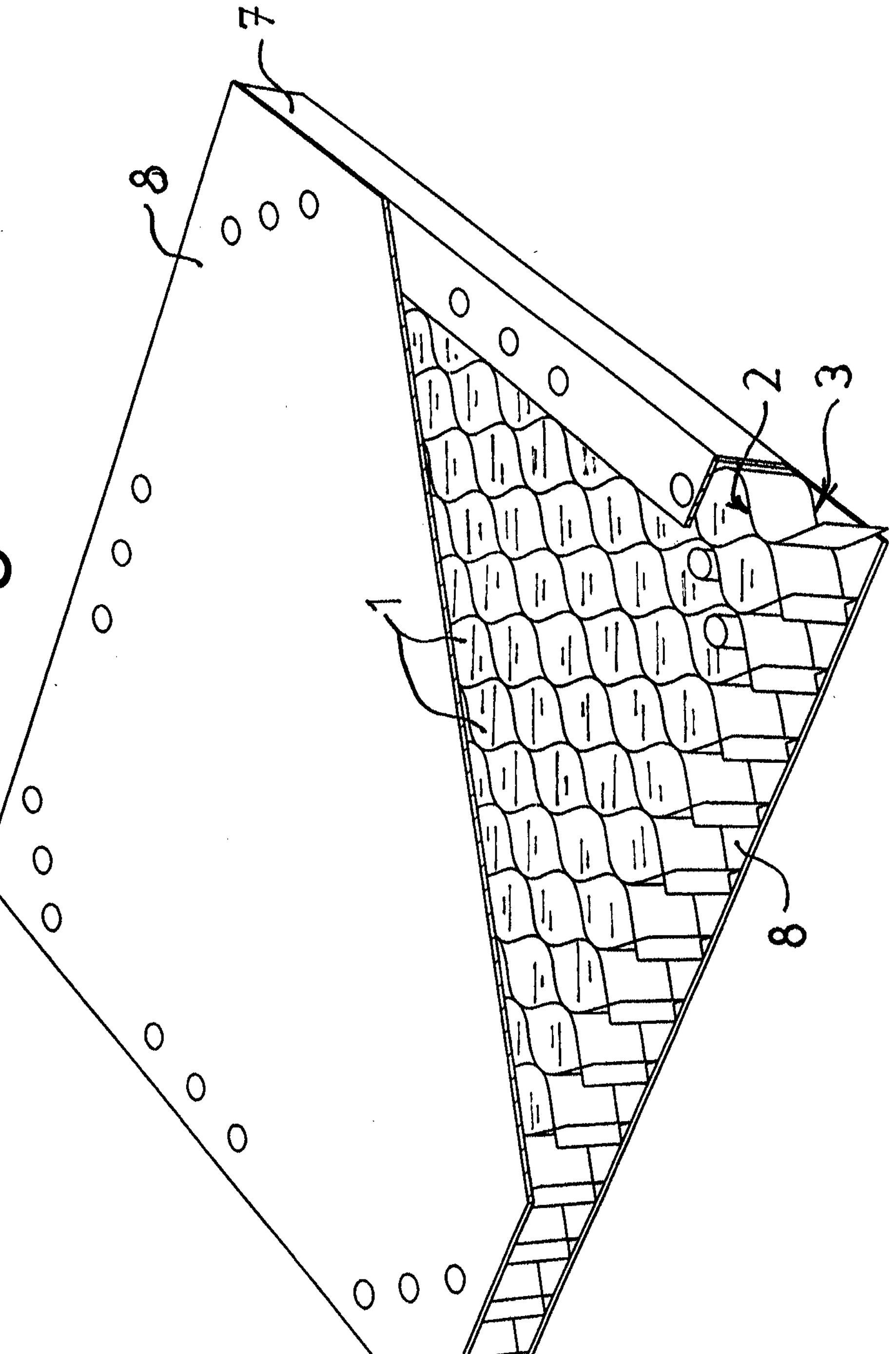


Fig.5



INTERNATIONAL SEARCH REPORT

International application No
PCT/CZ2012/000107

A. CLASSIFICATION OF SUBJECT MATTER
INV. B23B3/12 E04C2/36
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)
B23B E04C

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 practicable, search terms used)

EPO-Internal, WPI Data

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Y	page 3, lines 30-44; figures 1,2	3,5-7,9
X	EP 1 829 674 A1 (SHIZUKA KK [JP]) 5 September 2007 (2007-09-05) cited in the application	1,2,4
Y	paragraphs [0036] - [0037]; figure 3a	3,5-7,9
X	JP 2004 027788 A (JUNSEI KK) 29 January 2004 (2004-01-29) cited in the application	1,2,4
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Y	the whole document	3,5,7,9

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"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	Date of mailing of the international search report
5 February 2013	11/02/2013

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1

International application No
PCT/CZ2012/000107

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	DE 21 34 220 A1 (JAMES) 20 January 1972 (1972-01-20) page 4, last paragraph - page 5, paragraph first; figures 1-3	5
Y	WO 97/16604 A1 (REYNOLDS CONSUMER PROD [US]) 9 May 1997 (1997-05-09) cited in the application page 6, line 11; figure 1	6

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