

**OFFER
CESSION OR LICENCE OF PATENT OF
INVENTION**

regarding:

**Patent No. 117976: MANUFACTURING
PROCESS OF SANDWICH PANEL AND PANEL
OBTAINED OUT OF THIS PROCESS**

Business Directions:

- 1. THE MANUFACTURING OF COMPOSITE
SANDWICH PANELS.**
- 2. THE ACHIEVEMENT OF CIVIL, INDUSTRIAL AND
FARMING BUILDINGS OUT OF COMPOSITE
SANDWICH PANELS.**
- 3. THE MANUFACTURING OF SANDWICH PANELS
AND CONTAINER-TYPE CONSTRUCTIONS MADE
OUT OF THEM**

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B. THE TECHNICAL PRESENTATION

Patent No. 117976: Manufacturing Process of Sandwich Panel and Panel
Obtained out of this Process.

Business Directions:

- 1. The Manufacturing of Composite Sandwich Panels.*
- 2. The Achievement of Civil, Industrial and Farming Buildings out of Composite Sandwich Panels.*
- 3. The Manufacturing of Sandwich Panels and Container-Type Constructions Made out of them.*

A. THE IDEA OF THE PATENT OF INVENTION

THE PREMISES OF THE PATENT OF INVENTION:

In Romania, the markets for building materials, for civil and industrial constructions and for containers for commodities deposit, transportation and construction sites organization experience *a fast development*. In the countries of European Union these markets are functional, mature. The on-going *integration* of Romania in the unique European market has already been amplifying the dynamic of these markets.

In the latest years, in *civil and industrial construction*, the materials used on a large scale in EU countries have been the *panels with metallic face sheets and polyurethane foam or expanded polystyrene core*. These panels have also entered the Romanian market.

Law no. 2037 / 09.29.2000 of the European Parliament regarding the substances that deplete the ozone layer (Chap. II, Art. 5, par. 1, (d)) (see [http:// europa.eu.int/eur-lex](http://europa.eu.int/eur-lex)) **forbid**, beginning with 01.01.2004, **the usage of the panels with polyurethane foam** in every field. The reason for this interdiction is the use in the expanding proceedings of chloro-fluoro-carbon – type (CFCs) and hidro-chloro-fluoro-carbon - type (HCFCs) gases which deplete the ozone layer. Adopted *in Romania* (HG 731/14.05.2004).

The panels with expanded polystyrene core are forbidden for buildings both in EU and in Romania. The use of the panels with extruded polystyrene core is permitted, but their price is 3 – 5 times higher than the price of those of expanded polystyrene.

At present, because of this interdiction, the constructors in EU **readjust on re-usage of mineral wadding isolations** introduced in between the walls during the process of manufacturing (an ancient method, used before the panel with metallic face sheets and polyurethane foam or expanded polystyrene core was born).

The manufacturing and trading of products got on Romanian patents benefit of important economical advantages (see: The Advantages generated by the Patents of Invention).

THE IDEA OF THE PATENT OF INVENTION:

At present, in the manufacturing of *airplanes* parts (80% of an airplane, including: wings, floors, doors etc.) **panels with face sheets of composite materials and core of paper honeycomb** made through thermoforming. The two known manufacturing processes are: autoclave thermoformation and RTM (Resin Transfer Molding).

According to the specialized literature, the building materials world market experiences the following trends: on one hand, an increasing of the manufacturing cost per unit together with an increasing demand for higher quality materials; on the other hand, an intense

research activity aiming to reduce the manufacturing cost per unit for special building materials, now used in high-tech fields, including the composite materials used in airplane construction. On the forecasting of using composite materials in civil and industrial construction, there are plenty of studies written. (see also www.tifac.org.in). The common conclusion of several studies made by well – known institutions in different countries is the following:

“Sandwich panels with composite face sheets and honeycomb core - now used in aviation - and the strength structures of composite materials are the ideal materials for civil and industrial building because of their special physical and mechanical properties. The present high prices of these panels make them usable only for special buildings. Taking into account the prices of the classical building materials and the prices of these superior materials, numerous technical – economic prognosis studies (North American Architects Association, Japanese Building Research Institute, Technology Information Forecasting and Assessment Council) show that sandwich panels with composite face sheets and honeycomb core, as well as the structures of resistance of composite materials, will be price competitive around years 2010 -2015 and they will be the main (invincible) building materials for the next at least 150 – 200 years.”

For more details see D. H. Kim, *“Composite structures for Civil and Architectural Engineering”*, E & FN Spon, London. (D. H. Kim is a famous South Korean architect).

The panels from the above patent are similar to those used in aviation, but compared to the ones they have the following advantages and disadvantages: they are got through a new process which is cheaper and more simple; they have higher mechanical properties; they are 3 –5 times cheaper; they can have several cores; they are (10 – 20)% heavier.

The special physical and mechanical properties and the low manufacturing costs make it possible that these panels can be used on a large scale on civil and industrial buildings or in other fields.

The Sandwich Panels Family of these patents have the commercial name MOGAPAN. The Commercial Name is registered as a mark at the State Office for Inventions and Marks (OSIM) with the number in the marks register M200504205/13.04.2005.

The owner of the patent and their inventor is Vasile Moga Ph. D. (see C.V)

THE ADVANTAGES GENERATED BY THE PATENTS OF INVENTION:

The Patents grant to the Inventor/Titular certain industrial and intellectual rights and protect them against third parties.

The industrial and intellectual rights conferred by the Invention Patents in Romania (and their protection) are valid over the whole territory of Romania during a period of 20 years, beginning with the registration date of the Patent request.

Law no. 64/1991 modified gives the Titular of the Patent or his Licensees some more rights and advantages.

Art 33. The invention patent gives to its titular the **exclusive right to exploit it during the whole period of protection**. It is forbidden to pursue, without the titular's agreement, the following actions:

- a. manufacture, use, offer for sale or sell, or import in order to use, offer for sale or sell, when the patent object is a product;
- b. use the process and use, offer for sale, sell or import for these purposes of the product obtained directly by the patented process, when the object of the patent is a process.

Art. 73 **The profit** got through the effective application of an invention patented in Romania, including the product manufacturing or in any case the application of the process (method), by its titular or in any case by his licensees, **is excepted from corporate tax during the first 5 years from its first application**, counted from the date of application beginning and inside the patent validity period.

Art. 31 **The patent of invention protection period is of 20 years.**

The Price of the Licence and of the Cession as well the Price of the investments are deductible (inferable) from the profit.

The international industrial and intellectual rights resulted from the Invention Patents. The industrial and intellectual rights resulted from the Invention Patents are recognized all over the world (in the 154 countries that signed the Convention from Paris), which means that patentation of the Process and of the Products in any country or by any person in the world is not allowed by international law. At the same time it is forbidden the products manufacturing or the use of the owner's agreement. Low no. 105 / 1992 regarding the regulations of the private international right relations in art. 60 – 63 refers to the autor's rights and to the industrial rights as follows:

- The birth, the content and the extinctions of the industrials property right are subordinated to the law of the state where the deposit or the registration application was put by.

- The recovering of material or moral damages is subordinated to the law of the state where the trespassing of the industrials property right took place.

The Patents can be visualized on www.osim.ro.

THE CESSION AND LICENCES OF THE PATENTS OF INVENTION

The Patent Cession: It is the contract by which the patent owner (seller) passes his right upon the patent to another person (buyer) in exchange for a price. *The cession contract passes the buyer the property right upon the patent (the buyer becomes the patent owner).*

The *Cession* can be *final (for ever)* - when it refers to all the protection period of the patent – or *temporary* – when it refers to a certain period.

The *Cession* can be *total* - when it refers to the whole patent and to the whole of the protection territory – or *partial* – if it is limited to a part of the patent or to a part of the protection territory.

The *Cession* can be accompanied (or not) by other rights e.g. know – how.

The patent licence: It is the contract through which the owner of a patent (seller) gives to a person (buyer) totally or partly, the right to use in exchange for a price. The right to use may cover all the using formulas (forms) the owner may have or just a part of them. The property right upon the patent cannot be transferred by the licence contract.

The licence can be *exclusive* when the owner cannot give the licence to other persons, or the licence can be *non exclusive* when the owner can give the licence to other persons.

The licence can be *limited (partial)* and *unlimited (total)* depending on a territory, time and on the rights transferred.

The inventor is obliged by Art. 44 in Law 64/1991 to give technical assistance to the buyer.

THE DESTINATIONS OF THE PATENTED PRODUCTS AND THEIR COMPETITIVE PRODUCTS

The sandwich panels and the buildings composite strength structure to which the four patents refer have the following destinations:

- protected destinations by the patents: civil, industrial and farming constructions thermally and electromagnetically insulated containers;
- other destinations : electromagnetically insulated rooms (Faraday spaces), vans for vehicles, trailers, caravans, furniture, railway and underground wagon frames, ship-building, aerials, electromagnetic searchlights, swimming pools etc.

MOGAPAN panels enter in direct competition with the panels with a core made of polyurethane foam, expanded polystyrene or mineral wadding.

MOGAPAN panels are superior to the competitor ones in all the aspects – mechanical properties (compression strength, bending strength), the phonic and thermic insulation properties, fire proof, earthquake resistance, water proof environment resistance (air, water, snow, temperature, ultra-violet radiations), working life (lastingness), the safety in using, types of finishing, etc. (See the technical presentation and the technical agreement).

The manufacturing costs are lower than the costs of the competitor panels.

The panels with a core of polyurethane foam are forbidden by law in E.U. (see page 3).

The containers made of MOGAPAN panels enter in direct competition with *the metallic container* and with that built *from panels with polyurethane foam or expanded polystyrene* now largely used in deposit, transportation and construction sites organization.

The containers made of MOGAPAN panels are superior under all aspects to the competitor containers (thermic insulation, weight, the loading weight, etc.) and the manufacturing costs are lower. (see the tehcnical presentation).

The buildings of the patent *enter in competition with similar constructions made of classical materials* (concrete, brick, etc) or of panels with metallic or wood faces and with a core made of mineral wadding ((in the case of the E.U. countries), or polyurethane foam or of expanded polystyrene. (in the case of the countries out of E.U.)

The buildings of the patent are superior under all aspects, to the competitor buildings (working life, earthquake resistance, thermic and phonic insulation, types of finishing, low heating costs-under 40% out of the heating costs of the classical buildings, etc.) and the manufacturing costs are lower. (see the Tehcnical Presentation and the Technical Agreement)

THE PATENTED PRODUCTS AGREEMENT FOR THEIR USE IN INDUSTRIAL AND CIVIL BUILDINGS

According to laws in Romania and in E.U. in order to be used to civil and industrial buildings a material must have Tehnical Agreement and the Tehnical Official Approval given by the Permanent Tehnic Council for Buildings.

The patented products have the Technical Agreement and Technical Official Approval for their use in the industrial buildings

We have got: **Technical Agreement 016-02/145-2005 Composite Sandwich Panels type MOGAPAN for constructions and the Technical Official Approval 1-72/24.01.2006 given by the Permanent Technic Council for Buildings.**

The Technical Agreement was elaborated by ICECON S.A Bucharest (The Research Institute for Buildings Technologies and Equipments)

The experimental tests for getting the Technical Agreement were made at S.C. PROCEMA S.A.(The Research Design and Experimental Production Institute for Buildings and Building Materials) and at CNSIPC (The National Center for Fire Security and Civil Protection)

The experimental tests were made according to the E.U and RO standards. The above mentioned three institutions are authorised in RO and E.U.

B. THE TECHNICAL PRESENTATION

Patent of Invention No. 117976: MANUFACTURING PROCESS OF SANDWICH PANEL AND PANEL OBTAINED OUT OF THIS PROCESS.

Business Direction: THE MANUFACTURING OF COMPOSITE SANDWICH PANELS

The patented **Process** allows the manufacturing of the Sandwich Panel with light material core such as: open cells structures of honeycomb type, rigid polyurethane or polystyrene foam, mineral wadding, U, I, T, Ω profile structures and work faces of metallic or non-metallic materials, polymeric composites or hybrid materials.

The main types of Panels manufactured under this Process are: panel with simple core – made of honeycomb structure; panel with double core – made of 2 overlapped honeycomb structures separated by a middle layer; panel with multiple core – made of more overlapped honeycomb structures separated by interior layers; panel with hybrid double or multiple core – made of several honeycomb structures, rigid foam and overlapped structures separated by interior layers. All these types of panels can be flat (plane) or with complex geometry and they may have assembly profiles.

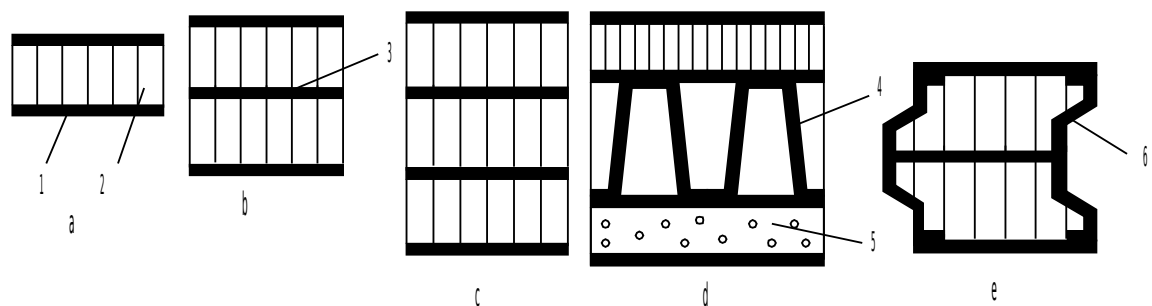


Fig.1 Types of panels made under Patent no. 117976.

a) panel with simple core of honeycomb structure; b) panel with double core of two honeycomb structures; c) panel with multiple core of honeycomb structures; d) panel with hybrid core of honeycomb structures, profiles and rigid foam; e) panel with different forms of assembly profiles (any of the types a, b, c, d may have assembly profiles).

1 - work faces of polymeric composites, metallic, non-metallic or hybrid sheets; 2 - metallic or non-metallic (paper, cardboard, plastic materials) honeycomb structure; 3 - interior layer (metallic, non-metallic, composite); 4 - U, I, T, Ω , rectangular etc. profile; 5 - rigid foam; 6 - assembly profiles.

Composite Sandwich Panels with honeycomb core and polymeric composite faces (the main aim of this Patent) are the most competitive sandwich materials that have ever existed, regarding strength, stiffness, weight, phonic and thermic insulation properties, the use life. This is why the sandwich Panel with simple honeycomb core (made through

autoclave method or R.T.M.) has been used, for some years now, for the manufacturing of airplanes, helicopters, rockets and space systems. In the following *Table* (adapted after D .H. Kim – “Composite Structures for Civil and Architectural Engineering“ , E & FN Spon Publishing house, London) we present by comparison the mechanical properties of the panels with different cores, taking as a starting point the properties of the panels with simple honeycomb core.

Table. Mechanical properties of panels with different cores.

<i>Type of Sandwich Panel</i>	<i>Relative Strength (%)</i>	<i>Relative Stiffness (%)</i>
<i>Honeycomb sandwich</i>	100	100
<i>Foam sandwich</i>	26	68
<i>Structural extrusion</i>	62	99
<i>Sheet and stringer</i>	64	86
<i>Plywood</i>	3	17

The Panels got out of this patented method have superior physical and mechanical properties and they are 2.5 up to 3 times cheaper than the same panels obtained through other methods (autoclave method , R.T.M)

The composite sandwich panels family of this patent has the commercial name of MOGAPAN. The commercial name is registered as a trade mark at The State Office for Inventions and Marks (OSIM) in the marks register.

MOGAPAN panels with composite faces and honeycomb structures core, as well as the other types of MOGAPAN panels (shown in figure 1) have many forms according to the number of cores and the types of lateral faces.

Depending on the number of cores, the panels can be with one core (commercial name MOGAPAN 1), with two cores (MOGAPAN 2), with three cores (MOGAPAN 3), and generally with more cores (MOGAPAN n).

In accordance with the form of the lateral face, MOGAPAN panels 3 forms (variations)

- Form **a** – commercial name MOGAPAN – N, has normal lateral faces (flat without assembling elements)
- Form **b** – commercial name MOGAPAN - LU, has the lateral faces of a rabbit - feather joint type, that allow the panels to be assembled one with another.
- Form **c** – commercial name MOGAPAN - LUs has both special lateral faces of a rabbit- feather joint type that allow, panels to be assembled one with another, and also the hiding of the fixing bolts of the supporting structure.

The main forms of the MOGAPAN panels are shown in fig. 2.

The work faces are of polymeric composite materials reinforced with fibers and they have the usual thickness between 0.5 mm and 2.5 mm. The work faces are fireproof, they are not hygroscopical, they are ultraviolet ray resistant, waterproof, they don't rot and they are resistant to the normal environment parameters (factors). They can be shiny or mat and they can have different colours. They can have the same aspect as gritstone, faience, wood, parquet ore other materials.

The core is from paper honeycomb structure. The honeycomb have the size of the hexagonal cell of: 6; 9; 12; 15; 18; 20; 22; 25; 28; 30; 40 mm. The paper has the thickness between 0.05 mm and 2mm and it is insensible to bacteria, micro-organisms, rats and mice and it is fireproof.

The lateral faces (smooth-normal, special rabbet type, special joint type) are from polymeric composite materials identical with those of the work faces.

The interior layer is made of polymeric composite materials identical with those of the work faces. It has the usual thickness between 0.50 mm and 1.5 mm.

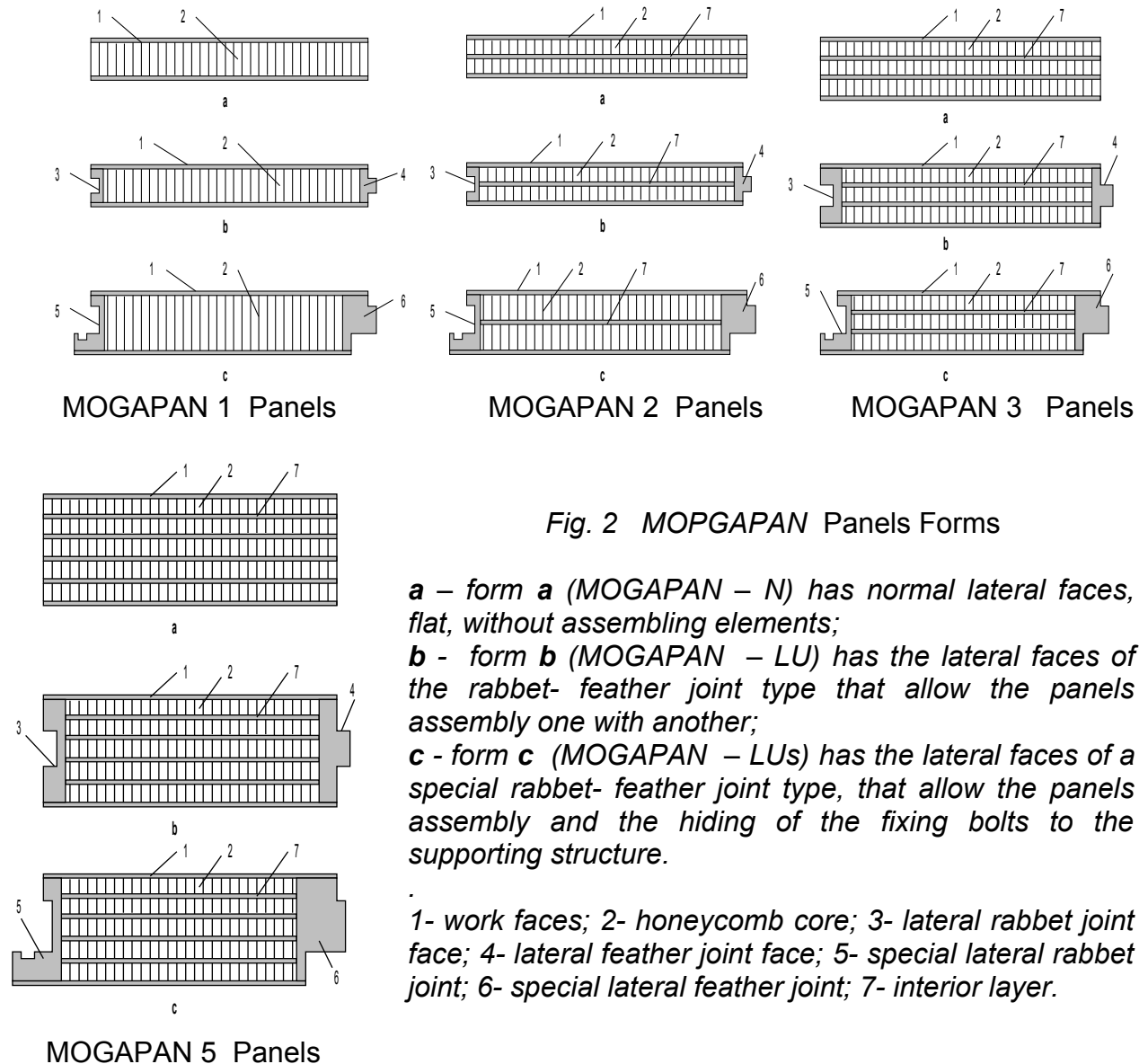


Fig. 2 MOPGAPAN Panels Forms

a – form *a* (MOGAPAN – N) has normal lateral faces, flat, without assembling elements;

b – form *b* (MOGAPAN – LU) has the lateral faces of the rabbet- feather joint type that allow the panels assembly one with another;

c – form *c* (MOGAPAN – LUs) has the lateral faces of a special rabbet- feather joint type, that allow the panels assembly and the hiding of the fixing bolts to the supporting structure.

1- work faces; 2- honeycomb core; 3- lateral rabbet joint face; 4- lateral feather joint face; 5- special lateral rabbet joint; 6- special lateral feather joint; 7- interior layer.

MOGAPAN panels are TECHNICALLY AGREED and recived the TECHNICAL OFFICIAL APPROVAL for their use in the feeld of Industrial and Civil Buildings.

We received: **THE TECHNICAL AGREEMENT 016-02/145-2005 Sandwich-Composite Panels Type MOGAPAN For Civil Engineering, and THE TECHNICAL OFFICIAL APPROVAL 1-72/24.01.2006 given by the Permanent Technical Board for Buildings.**

The Technical Agreement was done by ICECON S.A. Bucharest (The Research Institute for Building Technologies and Equipments)

The experimental tests for the agreement were done at S.C. PROCEMA S.A (Research Design and Experimental Production Institute for Buildings and Building Materials) and at CNSIPC (National Center for Fire Security and Civil Protection)

The experimental tests were done according to the U.E. and RO standards. The above mentioned three institutions are U.E. and RO authorised.

The usual size of the MOGAPAN sandwich panels is:

- Width: 990; 1000; 1040; 1500; 2000; 3000; 4000 mm.
- Length: 300 ---- 12000 mm.
- Thickness:
 - *Mogapan 1* panels have the usual thicknesses: 5; 10; 12; 15; 20; 25; 30; 40; 50; 60; 70; 80; 90; 100; 150; 200; 250; 300;
 - *Mogapan 2, 3, 4, 5, n* panels have the usual thicknesses: 8; 10; 20; 25; 30; 40; 50; 60; 70; 80; 90; 100; 150; 200; 250; 300; 400; 500 mm

There can be made panels with bigger or smaller dimensions than the above mentioned ones.

The panels can be flat or with complex geometry [bent (curved) surfaces or surfaces with special profiles].

MOGAPAN composite sandwich panels family is made to compartmentalize, to close, for exterior or interior plating, for thermic, phonic and waterproof isolations, ceilings, roofs, floors, interior and exterior walls, for civil, industrial and waterproof insulation, ceilings, roofs, floors, interior or exterior walls, for civil, industrial and farm buildings, for mobile products as containers, dismountable elements (for the fitting out of building sites, mobile hospitals, etc.) thermically or electromagnetically insulated rooms with exploring temperatures between -40°C and $+90^{\circ}\text{C}$.

MOGAPAN panels can be used for: car bodies, trailers, caravans, isothermal cars, underground frames, railway wagons, ship buildings, aerials electromagnetical searchlights, swimming pools, furniture, etc.

MOGAPAN panels are materials with special physical and mechanical properties which are proper to the advanced materials used in aviation. The specific physical and mechanical properties got at the tests done after U.E. and RO standards are shown in the Technical Agreement.

Apart from the above mentioned elements, MOGAPAN panels are characterised by the following aspects.

- thermic and phonic insulation capacity bigger than any type of building material;
- high mecanical properties (bending, compression strength);
- fire secure (combustion class –C1- “not inflammable”);

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- they do not need painting;
- they can have interior stiffeners made of composite materials or other materials;
- they can have beaded cutting outs with frames for doors and windows, etc.
- they have an outstanding resistance to ultra-violet radiations, variations of temperature, they are waterproof, they don't rot and they don't oxidize;
- they can be shiny or mat. They can have the exterior aspect similar to gritstone, faience, wood (parquet) or other aspects;
- they can be painted with washable paint, lime or with any other classical materials;
- they can have the life resource (the using time) af about (80-110) years.

The Panel assemblage one with another can be done either by assembly profiles that border the edges of the Panel or by sticking. The Panel assemblage with other pieces can be done by screws, rivets or by sticking, or by combinations of these devices.

The Panel assemblage are patented, agreemented and officially technically approved (TECHNICAL AGREEMENT 016-02/145-2005 and TECHNICAL OFFICIAL APPROVAL 1-72/24.01.2006).

THE MANUFACTURING COST

THE PANELS COSTS IN THE MANUAL PRODUCTION

TYPE OF PANEL	THICKNESS [MM]	COST [EURO / MP]
Panel with 1 core	50	7-9
	100	8-10
Panel with 2 cores	75	15-17
	100	16-18
Panel with 3 cores	110	24-26
	143	25-27
Panel with 4 cores	145	34-36
	190	35-37

NOTICE - In the case of the panels mass production with mechanized and automate production lines we think we can estimate the costs diminishing with (30-60) % as related to the manual productions.

MOGAPAN PANELS – PHOTO



Fig. 3. MOGAPAN panels samples - photo

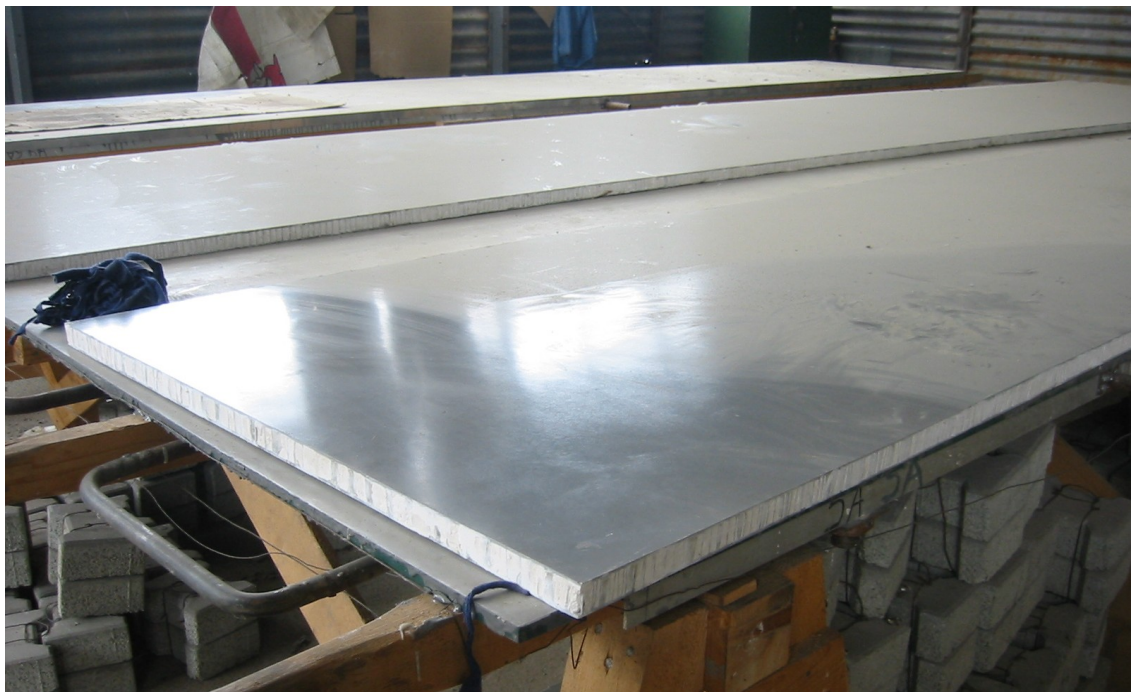


Fig. 4. MOGAPAN panel with the size (1×6)m – photo



Fig. 5 MOGAPAN panel with the size (2×6)m - photo



Fig. 6. Panel for thermal insulation (h=50mm, l=1.5m, L= 3 m)

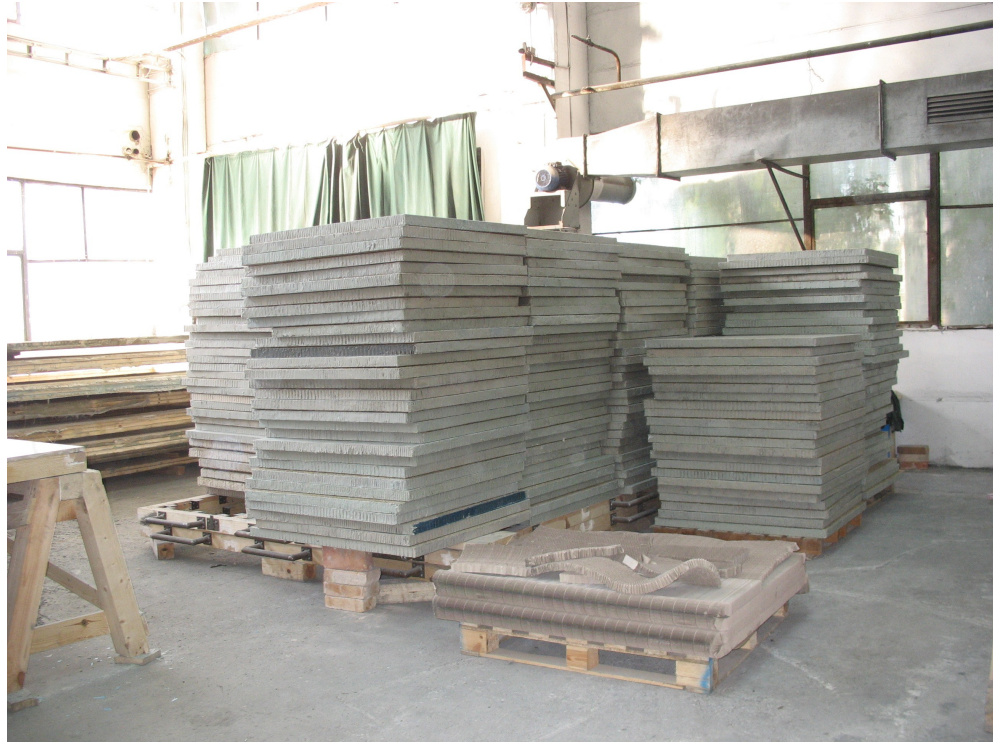


Fig.7 Panel for thermal insulation (h= 50 mm, l = 1m, L= 1 m)



Fig.8 Panel for roof (h = 145 mm ; l = 2.5 m ; L = 10 m)



Fig. 9. Panel for pedestrians bridges (h = 200 mm ; l = 1,5 m ; L = 3,5 m)

For **technical aspects** see **The Technic Agreement**

**Business Direction: THE ACHIEVEMENT OF CIVIL,
INDUSTRIAL AND FARMING BUILDINGS OUT OF
COMPOSITE SANDWICH PANELS**

**Patent of Invention No. 117867: SANDWICH PANEL AND BUILDINGS
MADE OF IT**

and

**Patent of Invention No. 118540: STRENGTH STRUCTURE FOR LIGHT
BUILDINGS.**

This Patent refers to a multiple core **Sandwich Panel [type MOGAPAN n (n > 3)]** and to a civil, industrial or farming **Building** made out of such panels

This patented Sandwich Panel [type MOGAPAN n (n > 3)] has the core made of 3 or more honeycomb structures separated by interior layers. The work face sheets and the panel interior layers are made of polymeric composite materials reinforced with fibres.

The Panel has simultaneously the four complementary characteristics and it also has some antagonistic ones regarding the thermic transfer such as: very low coefficient of thermic conductivity, high specific (latent) heat, low apparent thermic inertia and *dew point* in the interior of the Panel. This quality - to have the above mentioned characteristics simultaneously - is not equaled by any of the other sandwich or stratified panels.

The panel has the advantages of the double core Panel version (i.e. its high bending, stiffness and compression strength).

The Panel was designed to make up the walls and the ceilings of some civil, industrial or farming Building, but it may be used in other fields, too.

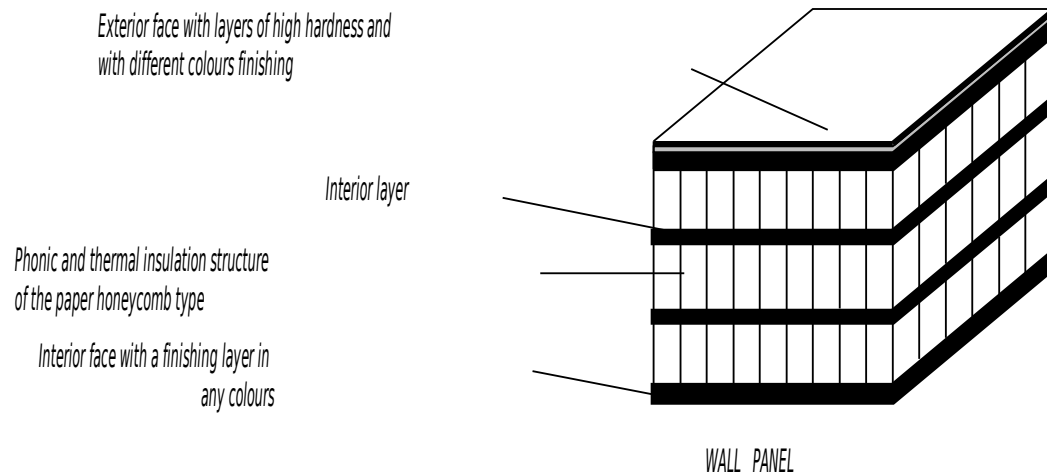


Fig 10. The panel structure for wall and roof

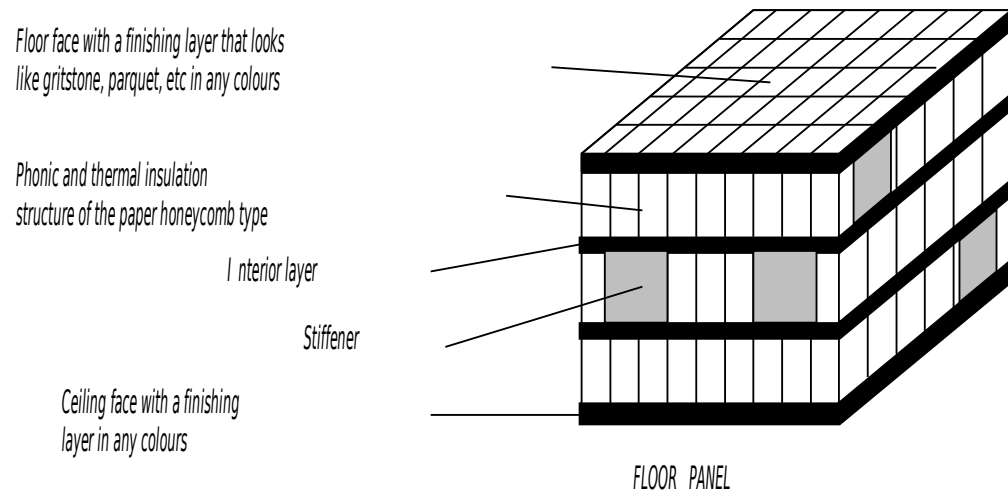


Fig.11. The Panel Structure for the Floor

MOGAPAN n panels are TECHNICALLY AGREED and received the TECHNICAL OFFICIAL APPROVAL for their use in the feeld of Industrial and Civil Buildings.

We recived: **THE TECHNICAL AGREEMENT 016-02/145-2005 SANDWICH-COMPOSITE PANELS TYPE MOGAPAN n FOR CIVIL ENGINEERING**, and **THE TECHNICAL OFFICIAL APPROVAL 1-72/24.01.2006** given by the Permanent Technical Board for Buildings.

The Technical Agreement was done by ICECON S.A. Bucharest (The Research Institute for Building Technologies and Equipments)

The experimental tests for the agreement were done at S.C. PROCEMA S.A (Research Design and Experimental Production Institute for Buildings and Building Materials) and at CNSIPC (National Center for Fire Security and Civil Protection)

The experimental tests were done according to the U.E. and RO standards. The above mentioned three institutions are U.E. and RO authorised.

The physical and mechanical properties of the panel MOGAPAN n obtained from the tests done after the U.E. and RO standards are shown in The Technic Agreement.

Types of Buildings that can be made

1. Buildings that can be made out of panels only. These buildings don't have the strength structure as a distinct or independent element of the building, but it is made out of strength panels (panels that contain the strength structure). In this category enter the civil buildings (houses, offices, etc.) not very high (basement, ground floor, first floor, second floor and attic.). These buildings have supporting (strength) walls, closing walls, floors and the roof out of MOGAPAN n panels.
2. Buildings with the strength structure out of clasical materials (reinforced concrete, metal, wood, etc.) and with the exterior and interior walls, the floor and the roof out of MOGAPAN n panels. In this category enter high civil buildings (over 3 floors) and the industrial buildings.
3. Buildings with the strength structure out of composite materials (as in patent no. 118540: Strength Structure for light buildings) and with the exterior and interior walls,

the floors and the roof out of MOGAPAN-n panels. In this category enter high and very high civil buildings with big lengths and widths.

The Jointing and the clamping Systems for all these types of buildings are designed, patented and Technically Agreemented and Technically Official Approved (Technical Agreement 016-02/145-2005 and Technical Official Approval 1-72/24.01.2006 refer to the jointing and clamping systems).

The Strength Structure out of Composite Materials (as in Patent no.118540: Strength Structure for Light Buildings) is made up of pillars and beams that are to be assembled with screws by the help of some linking pieces with a proper form (fig.8).

Fig.12. Strength Structure out of Composite Materials

The pillars are full or empty in the interior part, with constant exterior longitudinal section or by steps (stages) and with polygonal, circular or oval cross section, both at the exterior, and at the interior part.

According to their length the pillars can be made of one piece or of more pieces assembled through shrunk fit, liner (muff), tightening (hooping) of screws. The pillars with the length less than 20 m, are usually made of one piece.

The beams have the form of I, T profiles or the form of a pipe (tube) with the circular or polygonal section. For lengths up to 20 -22 m, the beams can be made entirely of one piece.

A strength structure out of composite materials with 50 % reinforcement was tested at S.C. PROCEMA S.A. In the following table we show the properties values obtained, according to the Testing Report nr. 583 / 29.11.2005 given by S.C. PROCEMA S.A.

Tab. Values, according to the Testing Report nr 583 / 29.11.2005 given by PROCEMA S.A.

CHARACTERISTIC	U.M	VALUE	THE TESTING METROD ACCORDING TO
Density	Kg/m ³	1790	SR EN ISO 12390/7:2002
Compression Strength	N/mm ²	490	SR EN ISO 12390/7:2002
Bending Strength	N/mm ²	240	SR EN ISO 12390/7:2002
Water Absorption	%	0,02	STAS 2414/91

Comparing the values in the above table with the similar properties values of the BC 250 concrete we see that the composite material has much bigger properties (e.g. the composite compression and bending strength are of 19,6 and 14,5 times bigger than in the case of concrete)

The advantages of the Building made of Composite Sandwich Panel are:

1. Earthquake resistance is superior to any other classical building. Such a Building resists to an earthquake of more than 8.5 degrees on Richter scale;
2. It does not need facing operations (like gritstone, faience, parquet, river stone etc.) because they can make panels with unfinished faces that can be painted classically after the carrying out of the building (in any kind of painting like washable painting, lime, clay, oil paint) and/or it can be applied classical finishing (sandstone/gritstone, faience, parquet, river stone, etc);
3. The total weight of the Building is smaller than in the case of any other classical versions. The weight of the wall with dimensions of 1 x 1 x 0.3 m of classical materials (concrete, brick, etc.) is of 660 – 750 kg, while the weight of a wall with the same dimensions made of Composite Sandwich Panel is of 10 – 20 kg (i.e. 67 times smaller);
4. Modulated building can be obtained;
5. The phonic and thermic insulation properties of the Composite Sandwich Panel are superior to those of any classical materials. A sandwich composite wall with the breadth of 125 mm has the same specific strength to thermal permeability as a brick wall with 4300 mm breadth. (For concrete values see The Technical Agreement and fig.9);
6. The Building does not need plastering, painting or liming because the Panel face sheets may have any color (bright or mat) and they can be of different colors;
7. In this way it is easy to assemble the walls together or with the strength structure because the sandwich composite wall has small weight and it is easy to handle;
8. Any wall or floor can be made of one Panel only;

Fig. 13. The Specific Strength to Thermic Permeability "R" - Comparison between the exterior walls made out of MOGAPAN3 panels and the exterior walls made of brick.

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9. The heating costs are reduced by 60 % reported to the heating costs of an identical building with 40 cm thick walls made of brick.

10. The assembly of electric installations is easier because the composite sandwich Panel can contain the tubes and the cables;

11. The ceiling panel can also contain the tubes of the heating installation through the floor;

12. All materials are fireproof;

13. The working life of such a house is around 100 years because composite sandwich panel has good resistance to ultra-violet radiation, to temperature changes, it is not hygroscopic, it doesn't rot, it doesn't oxidize;

14. The Building can be completely installed in 10 - 15 days;

15. The cost of the Building is 2 - 2.5 times smaller than that of classical buildings. The Manufacturing Cost (VAT not included) of a fully equipped villa is of about (250 – 350) EURO / sqm for individual manufacturing and of (200 – 250) EURO / sqm for mass production (modulated buildings).

PHOTOS



Fig.14. Panel for exterior wall (h=110 mm ; l = 3,3 m L = 6 m)



Fig.15. Panel for interior wall ($h = 75 \text{ mm}$; $l = 1,5 \text{ m}$ $L = 4,2 \text{ m}$)



Fig.16. Panel for roof (h = 145 mm ; l = 2,5 m ; L = 10 m)



Fig.17. Length and width joining systems for panels (testing samples)



Fig.18. Joining systems for panels at 90° (testing samples)



Fig.19. «V» form joining systems for panels (testing samples)



Fig.20. [Pillar](#) - crossbeam joining systems (testing samples)



Fig.21. The testing of the roof panel. Weight = 5800 Kg



Fig.22. Nursery school model



Fig.23. Construction (dimensions 3x3x3 m). Exterior 1



Fig.24. [Construction](#) (dimensions 3x3x3 m). Exterior 2



Fig.25 [Construction](#) (dimensions 3x3x3 m). Exterior 3



Fig.26 [Construction](#) (dimensions 3x3x3 m). Interior

For Building Details see The Technical Agreement.

Business Direction: THE MANUFACTURING OF SANDWICH PANELS AND CONTAINER-TYPE CONSTRUCTIONS MADE OUT OF THEM

Patent of Invention No. 117866: SANDWICH PANEL AND CONTAINER-TYPE CONSTRUCTION MADE OF IT

The Composite Sandwich Panel of this patent is of the **type MOGAPAN 2** and it is destined to the **containers manufacturing**, but it can be used in other fields, too (see the destinations of the patented products)

The Panel type MOGAPAN 2 has got double core made up of two honeycomb structures or of honeycomb structure and light material layer. The two elements of the core are separated by a thin middle layer. This middle layer is made of polymeric composites reinforced with fibre or with metallic face sheets. The Panel may have the two work face sheets made of composite or metallic materials (aluminum, steel etc.) or it may have one face sheet made of composites and the other made of metallic materials, or it may have one or both faces of hybrid materials (composite and metal).

The physical and mechanical properties of the MOGAPAN 2 panel, got out of the tests done after the U.E. and RO standards of the U.E. and RO authorised institutions are shown in The Technical Agreement.

The patent referes also to the thermical and / or electromagnetical insulated **containers** (Faraday room), which can be done out of this type of panel. The containers have a strenght structure made of reinforced composite materials or of metallic materials. The walls, the floor and the ceiling are made of MOGAPAN 2 panels.

The use of the panels with a middle layer, makes possible the building of the container walls without a metallic frame (stiffener) which can be found in the structure of some container walls made of panels with foam type core and also the middle layer delivers the strains between all the constituent elements of the container.

The panels assemblage one with another can be done by the help of the assembly profiles that border the panel edges and / or by sticking. The panels assemblage with other pieces can be done with bolts, selfthreading bolts, rivets, through sticking or combinations of these.

Both the panels assemblage between each other or with the container strenght structure are mainly similar to the assemblages used in the case of the buildings (see the Technical Agreement)

Fig.27. Assemblage details

The main advantages are:

1. Very good thermic insulation. The total specific coefficient of heat transfer is $K \approx 0,41 \text{ Kcal/m}^2\text{h}^\circ\text{K} \approx 0,35 \text{ W/m}^2 \text{ }^\circ\text{K}$ (In the case of foam core panels $K \approx 0,66 \text{ Kcal/m}^2\text{h}^\circ\text{K} \approx 0,76 \text{ W/m}^2 \text{ }^\circ\text{K}$)- *fore more details see The Technical Agreement*;
2. Its serviceable load can be between 10.000-45.000 Kg;
3. The container weight is smaller than in the case of classical versions. The weight of a container with its exterior dimensions of $L = 6058 \text{ mm}$, $l = 2438 \text{ mm}$, $h = 2831 \text{ mm}$ made of MOGAPAN 2 panels with both faces of composite materials is 670-710 Kg.
4. It doesn't need painting so that the face sheets of the MOGAPAN 2 panels can be obtained straight from manufacturing, in any colour shiny or mat, and it may be of different colours;
5. The assemblage is easy and it does not need welding;
6. All materials used are fireproof;
7. Modulated construction is available, that allows a wide range of dimensions without changing the mould;
8. Working life of 50 - 60 years;
9. The strength structure (longerons, rails and pillars) is continuous, without jointings. Thus very good mechanical properties can be obtained;
10. The manufacturing cost is very competitive. The manufacturing cost for a container with the exterior dimensions $L - 6058 \text{ mm}$; $l - 2438 \text{ mm}$; $h - 2831 \text{ mm}$ is shown in the following table:

Table.

<i>Type of Container</i>	<i>Manufacturing Cost Per Unit (EURO)</i>
<i>A. With thermic insulation (panels with both faces of composites)</i>	<i>1800 - 2000</i>
<i>B With thermic and electromagnetic insulation (Faraday spaces) (panels with one aluminum face and the other of composites)</i>	<i>2500 – 3000*</i>

* Without corner pieces, lock system, doorframe; welding costs for the aluminium profile structures and allodal costs not included.

PHOTOS



Fig. 27 Container model

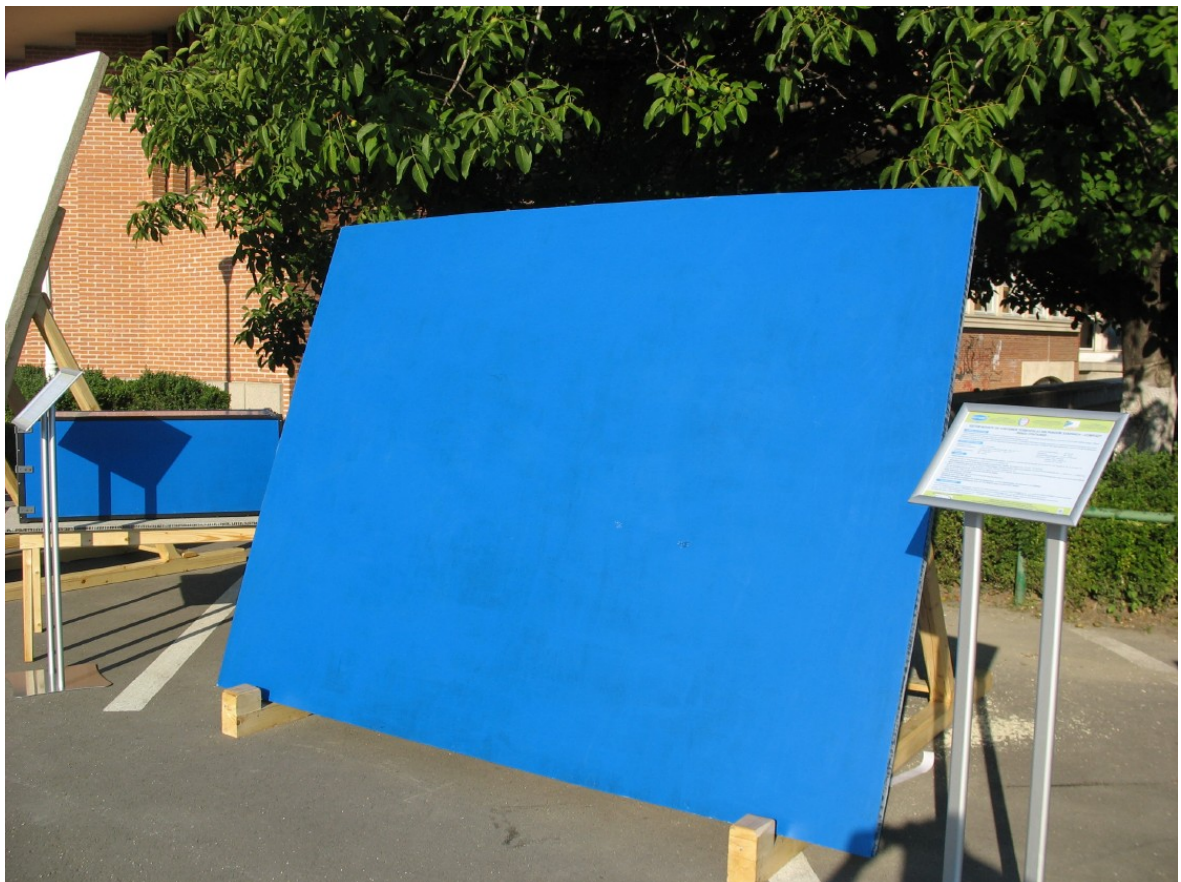


Fig. 28 Panel for container