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(54) **BUILDING PANEL AS STRUCTURE OF EXTERNAL AND INNER PLATE WITH INTERMEDIATE INSULATION SPACE**

BAUPLATTE ALS STRUKTUR EINER AUSSEN- UND INNENPLATTE MIT  
ZWISCHENISOLIERRAUM

PANNEAU DE CONSTRUCTION SERVANT DE STRUCTURE RÉALISÉE PAR UNE PLAQUE  
EXTERNE ET UNE PLAQUE INTERNE COMPORTANT UN ESPACE D'ISOLATION  
INTERMÉDIAIRE

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(73) Proprietor: **Univerza V Ljubljani**

**1000 Ljubljana (SI)**

(72) Inventors:

• **KRALJ, Ales**  
**SI-1000 Ljubljana (SI)**

• **ZNIDARSIC, Matjaz**  
**SI-1000 Ljubljana (SI)**

• **HALILOVIC, Miroslav**  
**SI-1000 Ljubljana (SI)**

• **VRH, Marko**  
**SI-6250 Ljirska Bistrica (SI)**

• **STOK, Boris**  
**SI-1358 Log pri Brezovica (SI)**

(74) Representative: **Marn, Jure**

**Ljubljanska ulica 9**  
**2000 Maribor (SI)**

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## Description

### Technical field

**[0001]** Invention is classified as technical solutions of civil engineering with integral thermal and sound insulation, performed using principles of composite, pre-fabricated panel, with side frame based on polymers and steel metal sheets, said panel to be used in building shells - integrated and hanged facades.

Suggested patent classification: E04C2/38E, E04C2/38C

### Technical problem

**[0002]** Facing diminishing stock of liquid fossil fuel which as the most user friendly energy form, our civilization faces need for new ways of using remaining sources of energy. One of the ways is also decrease in using energy for heating, cooling, and erecting of buildings. The thermal insulation of buildings is important for achieving decrease in energy use. Increase in need for effective thermal insulation resulted in insulation systems with low thermal conductivity. Such systems are based on composite panels using vacuum panels, nanofoams, aerogels or gas filled composites for their insulation core. The building panels using these cores usually cannot utilize these cores for providing of load carrying capability or stiffness of said panels due to mechanical weakness of such insulation cores.

**[0003]** The goal of presented invention is to propose such construction of composite panel where outer and inner panel provide for stiff box structure of building panel utilizing side frame, said building panel comprising optional insulation core. The frame must provide for stiffness of said panel with mechanical link between inner and outer plate and with its own stiffness. The frame should, if possible provide for effective inhibition of heat transfer and provide for dilatation of panels due to temperature difference within buildings, in particular on their exterior.

### State of the art

**[0004]** State of the art features three groups of relevant panels. The **first** group shows panels with various implementations of polymer border/ reinforcement of composite building panels: EP1333129, GB2344834, GB2451275 and WO2005070803. Particularly important seem subgroup of patents where the polymer border/ reinforcement is combined with inner steel reinforcement: FR2813624, US2004231275 and US4993204. The second group comprises patents where the panel is build based on steel reinforcement or spacers: EP1312725, WO9845545. The **third** group comprises of patent discussing choice of adhesive for connection of elements of the first and the second group: WO2004073973.

**[0005]** Patent FR2813624 describes polymer reinforcement which quite effectively prevents excess heat transfer and provides for suitable reinforcement with combination with steel reinforcement profiles for panels which are additionally supported with load carrying insulation core. For use of non-load carrying insulation cores such as necessary in above referenced technical problem use of simple thermoplastic extrudates such as for example PVC according to patent FR2813624 is not sufficient from the viewpoint of panel stiffness, and does not provide for match in linear temperature coefficients of expansion. The use of PVC would provide in increased use of inner steel reinforcement which would be detrimental to very desirable heat resistance of this reinforcement. Patent EP1333129 suggests use of glass reinforced pultruded profiles which may be used for panels with load carrying core without steel inner reinforcements, however this solution could not be used for system without load carrying core.

**[0006]** Patent WO2004073973 defines adhesive for attaching of side frame as follows: the adhesive should be from polyurethane, epoxy or methacrylate group. The adhesive should have tensile and/or shear strength at least 2 MPa. In our research we have shown that the adhesive having strength only at least 2 MPa does not satisfy criteria for use in building panels. Our experiment used polyurethane adhesive with strength significantly over 2 MPa and with modulus of elasticity over 1000 MPa. After attaching the panel onto the building the external panel fell off after approximately 2 months in summer. Hard polymer adhesives with high modulus of elasticity after exposure to varying day temperature between 10°C and 75°C or more show loss of adhesive properties. This fact has been known for some quite time with structural insulation glass coverings without load carrying insulation core where exterior glass is only attached using soft silicone adhesives with modulus of elasticity up to 1.5 MPa or hardness 20 to 35 Shore A. However in insulating glass technology the glass itself does not provide for stiffness of glass panel. The stiffness is provided with large metal elements usually found in entirety on inner side of the building.

**[0007]** In addition, US 3 994 105 A discloses multilayer panels comprising an exterior skin (aluminum sheet layer), a polymer composition foam layer, a divider skin aluminum skin layer, an aluminum honeycomb layer, and an interior skin (aluminum sheet layer). The five layers are bonded together to form the panel.

**[0008]** A building panel according to the preamble of claim 8 is known from FR2881767A1.

### Description of invention

**[0009]** The above referenced technical problem is solved by building panel as structure of external and inner plate with intermediate insulation space. According to the invention the problem of building panel is solved by external (11) and inner (12) plate attached by solid structural

connection (1). The structural connection (1) is attached to the plate with adhesive of appropriate thickness and hardness according to implementation of the invention. The building panel is structure of external (11) and inner (12) plate whereas between the plates (11) and (12) there is intermediate insulation space with any kind of thermal and/or sound insulation preferably not forming solid structure in connection with plates (11) and (12). The connection (1) comprises the link between plates (11) and (12). The connection (1) is implemented at least along the longitudinal part of panel frame. Further, the connection (1) comprises attached polymer based profile (2) or spacer stack (7) comprised of at least one spacer.

**[0010]** For better understanding this invention is presented in two embodiments. The first embodiment of building panel is structure of external (11) and inner (12) plate, said external plate for example of glass, and inner for example dry wall. Between plates (11) and (12) there is intermediate insulation space with optional thermal and/or sound insulation which preferably does not form solid structure in connection with plates (11) and (12), for example vacuum panels, gas filled panels, melamine foam, nanofoam or aerogels. The connection (1) forms connection between plates (11) and (12). The connection (1) is implemented at least along the longitudinal part of panel frame. In addition the connection (1) comprises the polymer based profile (2) into which is inserted additional profile (3) preferably taking advantage of protrusions (6). Additives for lowering of thermal conductivity may be added to polymer out of which the polymer based profile (2) is manufactured or said polymer component may be manufactured of polymer foam. Such additives should have thermal conductivity below 0.2 W/mK. The additives for lowering the thermal conductivity may be hollow mineral (glass, ceramic) or hollow polymer spheres. At least between plates (11) and (12) in the polymer based profile (2) there is at least thermally insulating pocket 4. An adhesive (5) based on rubbery-elastic polymer is positioned between the polymer based profile (2) and plates (11) and (12), this adhesive having hardness between 35 and 70 Shore A. Preferably the hardness of said adhesive is between 40 and 50 Shore A. The lower limit of adhesive hardness 35 Shore A stems from different adhesives known in structural glass facades which do not provide for stiffness of glass panels. In this invention said plates (11) and (12) provide for stiffness due to their distance and the adhesive should have as high stiffness as possible. The adhesives with hardness above 70 Shore A for sizes of building panels do not provide for sufficient compensation of mechanical stresses due to temperature dilatations of panel components. According to own research the best compromise between higher stiffness and dilatation elastic is provided by adhesive with hardness between 40 and 50 Shore A.

**[0011]** The polymer based profile (2) is preferably manufactured of extruded thermoplastic composite reinforced with 25% to 50%, preferably 40% of glass fibers by weight. The polymer based profile (2) provides for

bending rigidity of the panel. The thermoplastic polymers appropriate for use in civil engineering have relatively low modulus of elasticity ranging from 2000 to 3000 MPa. The polymer based profile would therefore contribute little to stiffness (rigidity) of whole panel. In particular, the contribution is estimated at 10%. It would be economical that the polymer based profile would contribute to stiffness. The thermoplastic composites with up to 55% weight filling with short or medium length glass fibers are state of the art. These may be up to five times stiffer than raw thermoplastics. Own research shows that the best choice are polyamide, polybutylene terephthalate or polyethylene terephthalate thermoplastic with at least 25% weight filling of short glass fibers. The variants with over 55% of glass fibers are too demanding for state of extrusion technology for profiles 80 mm or more. For profile size of about 100 mm and wall thickness in range of 2 mm the filling of around 40% of glass fibers was found to be optimal from viewpoints of technological process and product properties. The achieved modulus of elasticity is around 7000 MPa. The thermoplastic composites with less than 25% of glass fibers has excessive linear temperature expansions in direction of polymer based profile (2) to be used in combination with adhesive (5) according to own specification. Such polymer based profile provides for stiffness of panels between 25-30%. The profile based on base of polymer (2) can be manufactured using pultrusion process. In this case the polymer resin based on phenol- formaldehyde, polyester, preferably unsaturated, vinylester or epoxy, preferably with appropriate fillings, can be pulled with glass or basalt fibers and appropriate woven or nonwoven mats of glass or basalt fibers through pultrusion matrix. In addition, some other fibers may be used. The process having significantly less than 50% of weight part of fiber content is here technologically not possible. The upper limit of filling of fiber is again technologically limited and is around 75%. The achievable modulus of elasticity of the profile is here significantly higher and is in range between 15000 and 25000 MPa. Pultrusion process is more demanding. The modulus of elasticity of the polymer based profile is in this case so high that the required stiffness can be achieved without use of additional profile (3). The polymer based profile (2) can provide within itself one or more thermally insulating pockets (4) filled with air or thermally insulating material. In case of polymer based extruded profile (2) there are usually more pockets and they tend to be small. From viewpoint of prevention of convection of air and radiation heat transfer, filling of these insulation pockets with additional insulation usually is not necessary. In case of pultruded polymer based profile (2), preferably of thermosetting resin, the implementation with several insulation pockets is difficult. In such case only one larger insulation pocket can be provided, however this should be filled with thermal insulation such as polyurethane foam.

**[0012]** Connection (1) further comprises adhesive (5) which is composite based on rubbery-elastic polymer,

based on polyurethane, silicone, silane or preferably polysulfide. The composite adhesive (5) is further comprised of usual or special fillings such as calcite or other fillings to achieve desired properties. For achieving of appropriate panel temperature-dilatation resistance and providing for mitigation of errors in tolerances of the product the layer of adhesive (5) should be thick at least 1 mm. The thickness above 5 mm would significantly lower the stiffness of the panel, the best results are achieved at thicknesses between 2 and 3.5 mm.

**[0013]** Additional reinforcement profile (3) is in the form of steel construction pipe, or for purposes of lowering of heat transfer, glued glass beams.

**[0014]** The second embodiment of the building panel is structure of external (11) and inner (12) plate with intermediate insulation space. The connection (1) between plates (11) and (12) is provided at least along longitudinal part of panel frame. The connection (1) comprises two or more essentially one along another stacked spacers (7) which are attached one to another with at least one layer of polymer adhesive (8) with hardness between 45 and 95 Shore A, preferably between 60 and 85 Shore A.

**[0015]** The spacers (7) can be metal rectangular tubes, with or without ribs preferably manufactured of thin stainless steel with heat conductivity lower than 16 W/mK. Such commercially available steel spacers known in state of the art of insulation glasses may be used. The spacers may be of hybrid construction with profile partially made of metal (stainless steel) and partially of polymer semi-rectangular tube such as hybrid ("warm edge") spacers known in state of the art of thermally insulated glass.

**[0016]** The best heat resistance is provided by implementation of hybrid spacer (7) with thickness of steel part of the spacer between 0.05 and 0.2 mm. The thicknesses below 0.05 mm are too thin for mechanical strength of the spacer, the thicknesses above 0.2 mm conduct too much heat. According to own research the thickness of about 0.1 mm seems to be optimal. Due to particular properties of the system as suggested in this patent application for polymer part of hybrid spacer of thickness of about 1mm the polymers which are cheaper and conduct even less heat than those used in state of the art of insulation glasses may be used. These are for example polyvinyl chloride (PVC) or polystyrene (PS). Insulation glasses usually use polycarbonate (PC) and polypropylene (PP).

**[0017]** The connection (1) in addition to spacers in the second embodiment comprises also adhesive (4) on basis of methacrylate or hybrid polyurethane. Similarly to the first embodiment of the panel the hardness of said adhesive in combination with the thickness is of importance. To achieve appropriate stiffness of stack of more than one spacer the hardness of at least 45 Shore A is needed. The hardness of more than 95 Shore A, could cause early shear failure of adhesive connection between plates (11) and (12) in corners when this connection is subject to outside forces (for example wind) in the

corner of a building. The optimal is use of adhesive with final hardness between 60 and 85 Shore A, and layer of adhesive between 0.1 mm and 1 mm. More than one layer of adhesive (e.g. two) can be between spacers. Less than 0.2 mm combined thickness of adhesive between the spacers endangers the flexibility of the connection during exposure of the panel to wind, more than 1 mm of thickness does not provide sufficient stiffness. The thickness between 0.2 mm and 0.5 mm is optimal.

## Modes of invention

**[0018]** For the first implementation the hypothesis was tested whether the polymer adhesive fulfilling criterion from patent application WO2004073973 for adhesive to have tensile and/or shear strength greater than 2 MPa suffices for attaching of the system similar to one according to invention. On the panel of length of 1.4 m and width of 1 m, we used enameled float glass dark grey color manufactured by local manufacturer Reflex as external plate (11), said plate 8 mm thick. The inner plate (12) was 15 mm thick plate Rigidur H of manufacturer Rigips. The panel was equipped with two polymer based profiles (2) along longitudinal sides of the profile according to figure 1. The polymer based profile (2) was 100 mm wide and 43 mm thick. It was manufactured of polyamide 6.6 GF40. Into polymer based profile (2) standard steel rectangular profile (3) was inserted, said profile having dimensions 50x30x2.5 mm. The adhesive between polymer based profile (2) and plates was polyurethane, namely 1 part of isocyanate and 4 parts of polyol. Isocyanate was Suprasec 5025 of manufacturer Huntsman, the polyol was Mitopur A1/5 of local manufacturer Mitol. Adhesive had modulus of elasticity of approximately 2500 MPa and tensile strength much higher than 2 MPa. For insulation core of the panel the styrofoam of 100 mm thickness was used. Before attachment the polymer based profile (2) was prepared for improved grip with adhesive. Prepared panels were built into the experimental building. After approximately 60 days of summer weather at geographical latitude of approximate 45° the external plates (11) started to fell off. With this experiment we have proven that the criterion of strength of adhesive above 2 MPa is not decisive for use of appropriate adhesive in system such as presented here.

**[0019]** For the second implementation the panel using only the second embodiment according to this invention was used. For panel of length 1 m and width 0.5 m we used enameled float glass dark grey color manufactured by local manufacturer Reflex as external plate (11), said plate 8 mm thick. The inner plate (12) was 15 mm thick plate Rigidur H of manufacturer Rigips. For spacers (7) the modified spacers Chromatech Ultra manufactured by Rolltech of nominal height 20 mm were used. The polymer part of the spacer was manufactured of polystyrene. The stack was comprised of 5 rectangular spacers said spacers continuous around whole perimeter of the panel, said spacers having aluminum foils positioned between

themselves as the panel was gas filled. Between the spacers, and spacers and plates the structural adhesive SikaFast 3131 manufactured by Sika was used having thickness 0.3 mm. The adhesive has hardness 80 Shore A. Such panel has appropriate stiffness for lengths up to 3 m for building up to one story high buildings.

**[0020]** For the third implementation both embodiments were used together. For 10 panels of length 2.6 m and width of 1 m, we used transparent tempered float glass manufactured by local manufacturer Reflex as external plate (11), said plate 8 mm thick. The inner plate (12) was 15 mm thick plate Rigidur H of manufacturer Rigips. For spacers (7) the modified spacers Chromatech Ultra manufactured by Rolltech of nominal height 20 mm were used. The polymer part of the spacer was manufactured of polystyrene. The stack was comprised of 5 rectangular spacers said spacers continuous around whole perimeter of the panel, said spacers having aluminum foils positioned between themselves as the panel was gas filled. Between the spacers, and spacers and plates the structural adhesive SikaFast 3131 manufactured by Sika was used having thickness 0.3 mm. The panel was equipped with two profiles on base of polymer (2) along longitudinal sides of the panel according to figure 1. The polymer based profile (2) was wide 100 mm and thick 43 mm. It was manufactured of polyamide 6.6 GF40. Into polymer based profile (2) standard steel rectangular profile (3) was inserted, said profile having dimensions 50x30x2.5 mm. The adhesive between polymer based profile (2) and plates (11) and (12) was polysulfide adhesive GD116 manufactured by Kömerling chemische fabrik, hardness 38 Shore A and 3.5 mm thick. Before attachment the polymer based profile (2) was treated for improved grip using process of plasma treatment. The described panels were thoroughly examined from viewpoints of stiffness and strength. Strength wise the panel withstood wind load of up to 35 kN. Stiffness wise the panel withstood wind load of 12 kN or 4.6 kPa wind induced stress at nominal deflection of inner plate (12) of  $L/200=13$  mm. This corresponds to stagnation pressure of wind blowing at 85 m/s or 306 km/h. The panels were additionally exposed to 1000 cycles of similar wind load, and built into experimental building where they underwent realistic tests with temperature induced stresses.

## Claims

1. A building panel as structure of external (11) and inner (12) plate with intermediate insulation space, wherein a connection (1) between plates (11) and (12) is implemented at least along the longitudinal part of a panel frame where the connection (1) comprises at least

a. polymer based profile (2) whereas inside the polymer based profile (2) between the plates (11) and (12) there is at least one thermal insu-

lation pocket (4), and

b. an adhesive (5), preferably based on rubbery-elastic polymer, between polymer based profile (2) and plates (11) and (12), **characterized in that** the nominal hardness of the adhesive (5) is between 35 and 70 Shore A, preferably between 40 and 50 Shore A, and

wherein an additional profile (3), in the form of steel construction pipe or glued glass beams, is inserted into the polymer based profile (2).

2. The building panel according to claim 1, **characterized in that** the polymer based profile (2) is manufactured of extruded thermoplastic composite reinforced with 25% to 55% by weight, preferably around 40% by weight of glass fibers.
3. The building panel according to claim 2, **characterized in that** the polymer based profile (2) is manufactured on base of polyamide, polybutylene terephthalate or polyethylene terephthalate or blend thereof.
4. The building panel according to claim 1, **characterized in that** the polymer based profile (2) is manufactured of pultruded thermosetting composite reinforced with 50% to 75% by weight of fibers, said fibers either glass, basalt, appropriate woven or non-woven mats or combination thereof.
5. The building panel according to claim 4, **characterized in that** the polymer based profile (2) is manufactured of phenol-formaldehyde, polyester, vinylester or epoxy with appropriate fillers.
6. The building panel according to claim 1, **characterized in that** into the material of the polymer based profile (2) the additives with thermal conductivity lower than 0.2 W/mK are added, or the polymer component of material of the polymer based profile (2) is a polymer foam.
7. The building panels according to claim 1, **characterized in that** the adhesive (5) is composite based on polyurethane, silicone, silane or preferably polysulfide with thickness of adhesive (5) of 1 mm to 5 mm, preferably 2 mm to 3.5 mm.
8. A building panel as structure of external (11) and inner (12) plate with intermediate insulation space, wherein a connection (1) between plates (11) and (12) is implemented at least along the longitudinal part of a panel frame wherein the connection (1) comprises at least two essentially one on top of another stacked spacers (7) attached one to another with at least one layer of adhesive (8), **characterized in that** the adhesive is a polymer adhesive with hard-

ness between 45 and 95 Shore A, preferably 60 and 85 Shore A, wherein the spacers (7) are either metal tubes, preferably rectangular, or partially metal partially polymer tubes, preferably rectangular.

9. The building panel according to claim 8, **characterized in that** the spacers (7) are partially metal partially polymer tubes whereas the metal part is manufactured from stainless steel sheet thickness between 0.05 mm to 0.20 mm, preferably around 0.10 mm.
10. The building panel according to claim 8, **characterized in that** the spacers (7) are partially metal partially polymer tubes whereas the polymer part is manufactured of thermoplastic polymer based on polyvinyl chloride or polystyrene of thickness of around 1 mm.
11. The building panel according to claim 8, **characterized in that** the polymer adhesive (8) is on basis of methacrylate and/or hybrid polyurethane.
12. The building panel according to claim 8, **characterized in that** each layer of polymer adhesive (8) has approximate average thickness of 0.2 mm to 1 mm, preferably 0.3 mm to 0.5 mm.

#### Patentansprüche

1. Bauplatte als Struktur einer Außen- (11) und Innenplatte (12) mit einem Isolationszwischenraum, wobei eine Verbindung (1) zwischen Platten (11) und (12) mindestens entlang des längsgerichteten Teils eines Plattenrahmens implementiert ist, wo die Verbindung (1) mindestens umfasst:
  - a. polymerbasiertes Profil (2), wobei im polymerbasierten Profil (2) zwischen den Platten (11) und (12) mindestens eine Wärmeisolationstasche (4) ist, und
  - b. ein Klebstoff (5), vorzugsweise basierend auf einem gummielastischen Polymer, zwischen dem polymerbasierten Profil (2) und Platten (11) und (12), **dadurch gekennzeichnet, dass** die Nenn-Härte des Klebstoffs (5) zwischen 35 und 70 Shore A, vorzugsweise zwischen 40 und 50 Shore A ist, undwobei ein zusätzliches Profil (3) in Form eines Stahlkonstruktionsrohrs oder eines geklebten Glasbalkens in das polymerbasierte Profil (2) eingeführt ist.
2. Bauplatte nach Anspruch 1, **dadurch gekennzeichnet, dass** das polymerbasierte Profil (2) aus extrudiertem thermoplastischem Verbundmaterial hergestellt ist, das mit 25 Gew.-% bis 55 Gew.-%, vorzugs-

weise etwa 40 Gew.-%, Glasfasern verstärkt ist.

3. Bauplatte nach Anspruch 2, **dadurch gekennzeichnet, dass** das polymerbasierte Profil (2) auf der Basis von Polyamid, Polybutylenterephthalat oder Polyethylenterephthalat oder Mischungen daraus hergestellt ist.
4. Bauplatte nach Anspruch 1, **dadurch gekennzeichnet, dass** das polymerbasierte Profil (2) aus pultrudiertem thermohärtendem Verbundstoff, der mit 50 Gew.-% bis 75 Gew.-% Fasern verstärkt ist, hergestellt ist, wobei die Fasern entweder Glas, Basalt, geeignete gewebte oder nicht gewebte Matten oder Kombinationen daraus sind.
5. Bauplatte nach Anspruch 4, **dadurch gekennzeichnet, dass** das polymerbasierte Profil (2) aus Phenolformaldehyd, Polyester, Vinylester oder Epoxid mit geeigneten Füllstoffen hergestellt ist.
6. Bauplatte nach Anspruch 1, **dadurch gekennzeichnet, dass** in das Material des polymerbasierten Profils (2) die Zusatzstoffe mit einer Wärmeleitfähigkeit von unter 0,2 W/mK zugefügt werden oder die Polymerkomponente des Materials des polymerbasierten Profils (2) ein Polymerschaum ist.
7. Bauplatte nach Anspruch 1, **dadurch gekennzeichnet, dass** der Klebstoff (5) ein Verbundstoff basierend auf Polyurethan, Silikon, Silan oder vorzugsweise Polysulfid ist, wobei eine Dicke des Klebstoffs (5) von 1 mm bis 5 mm, vorzugsweise 2 mm bis 3,5 mm ist.
8. Bauplatte als Struktur einer Außen- (11) und Innenplatte (12) mit einem Isolationszwischenraum, wobei eine Verbindung (1) zwischen den Platten (11) und (12) mindestens entlang des längsgerichteten Teils eines Plattenrahmens implementiert ist, wobei die Verbindung (1) mindestens zwei Abstandselemente (7) umfasst, von denen im Wesentlichen einer auf den anderen gestapelt ist und die mit mindestens einer Schicht aus Klebstoff (8) aneinander befestigt sind, **dadurch gekennzeichnet, dass** der Klebstoff ein Polymerklebstoff mit einer Härte zwischen 45 und 95 Shore A, vorzugsweise 60 und 85 Shore A, ist, wobei die Abstandselemente (7) entweder Metallrohre, vorzugsweise rechteckige, oder teilweise Metall-, teilweise Polymerrohre, vorzugsweise rechteckige sind.
9. Bauplatte nach Anspruch 8, **dadurch gekennzeichnet, dass** die Abstandselemente (7) teilweise Metall-, teilweise Polymerrohre sind, wobei der Metallteil aus Edelstahlblech mit einer Dicke zwischen 0,05 mm bis 0,20 mm, vorzugsweise um 0,10 mm hergestellt ist.

10. Bauplatte nach Anspruch 8, **dadurch gekennzeichnet, dass** die Abstandselemente (7) teilweise Metall-, teilweise Polymerrohre sind, wobei der Polymerenteil aus thermoplastischem Polymer basierend auf Polyvinylchlorid oder Polystyrol mit einer Dicke von etwa 1 mm hergestellt ist. 5
11. Bauplatte nach Anspruch 8, **dadurch gekennzeichnet, dass** der Polymerklebstoff (8) auf der Basis von Methacrylat und/oder Hybridpolyurethan ist. 10
12. Bauplatte nach Anspruch 8, **dadurch gekennzeichnet, dass** jede Schicht des Polymerklebstoffs (8) eine ungefähre durchschnittliche Dicke von 0,2 mm bis 1 mm, vorzugsweise 0,3 mm bis 0,5 mm aufweist. 15

### Revendications

1. Panneau de construction sous forme de structure de plaque externe (11) et interne (12) comportant un espace d'isolation intermédiaire, un raccord (1) entre les plaques (11) et (12) étant mise en œuvre au moins le long de la partie longitudinale d'un cadre de panneau où le raccord (1) comprend au moins 20
- a. un profilé à base de polymère (2) alors qu'à l'intérieur du profilé à base de polymère (2) entre les plaques (11) et (12) au moins une poche d'isolation thermique (4) est présente, et 30
- b. un adhésif (5), de préférence à base de polymère caoutchouteux-élastique, entre le profilé à base de polymère (2) et les plaques (11) et (12), **caractérisé en ce que** la dureté nominale de l'adhésif (5) est comprise entre 35 et 70 Shore A, de préférence entre 40 et 50 Shore A, et un profil supplémentaire (3), sous forme de tube de construction en acier ou de poutres en verre collées, étant inséré dans le profilé à base de polymère (2). 35
2. Panneau de construction selon la revendication 1, **caractérisé en ce que** le profilé à base de polymère (2) est fabriqué en composite thermoplastique extrudé renforcé avec 25 % à 55 % en poids, de préférence environ 40 % en poids de fibres de verre. 40
3. Panneau de construction selon la revendication 2, **caractérisé en ce que** le profilé à base de polymère (2) est fabriqué à base de polyamide, de poly(téréphthalate de butylène) ou de poly(téréphthalate d'éthylène) ou d'un mélange de ceux-ci. 50
4. Panneau de construction selon la revendication 1, **caractérisé en ce que** le profilé à base de polymère (2) est fabriqué en composite thermodurcissable produit par pultrusion renforcé avec 50 % à 75 % en poids de fibres, lesdites fibres étant en verre, en ba- 55
- salte, en mats non tissés ou tissés appropriés ou une combinaison de ceux-ci.
5. Panneau de construction selon la revendication 4, **caractérisé en ce que** le profilé à base de polymère (2) est fabriqué en phénol-formaldéhyde, polyester, vinylester ou époxy avec des charges appropriées.
6. Panneau de construction selon la revendication 1, **caractérisé en ce que** dans le matériau du profilé à base de polymère (2) les additifs possédant une conductivité thermique inférieure à 0,2 W/mK sont ajoutés, ou le composant polymère du matériau du profilé à base de polymère (2) est une mousse polymère.
7. Panneaux de construction selon la revendication 1, **caractérisés en ce que** l'adhésif (5) est un composite à base de polyuréthane, de silicone, de silane ou de préférence de polysulfure avec une épaisseur d'adhésif (5) allant de 1 mm à 5 mm, de préférence allant de 2 mm à 3,5 mm.
8. Panneau de construction sous forme de structure de plaque externe (11) et interne (12) avec un espace d'isolation intermédiaire, un raccord (1) entre les plaques (11) et (12) étant mis en œuvre au moins le long de la partie longitudinale d'un cadre de panneau, ledit raccord (1) comprenant au moins deux entretoises (7) empilées essentiellement l'une au-dessus de l'autre fixées l'une à l'autre avec au moins une couche d'adhésif (8), **caractérisé en ce que** l'adhésif est un adhésif polymère avec une dureté comprise entre 45 et 95 Shore A, de préférence entre 60 et 85 Shore A, lesdites entretoises (7) étant soit des tubes métalliques, de préférence rectangulaires, soit des tubes partiellement métalliques partiellement polymères, de préférence rectangulaires.
9. Panneau de construction selon la revendication 8, **caractérisé en ce que** les entretoises (7) sont des tubes partiellement métalliques partiellement polymères tandis que la partie métallique est fabriquée à partir de feuille d'acier inoxydable d'épaisseur comprise entre 0,05 mm et 0,20 mm, étant de préférence d'environ 0,10 mm.
10. Panneau de construction selon la revendication 8, **caractérisé en ce que** les entretoises (7) sont des tubes partiellement métalliques partiellement polymères tandis que la partie polymère est fabriquée en polymère thermoplastique à base de chlorure de polyvinyle ou de polystyrène d'épaisseur égale à environ 1 mm.
11. Panneau de construction selon la revendication 8, **caractérisé en ce que** l'adhésif polymère (8) est à base de méthacrylate et/ou de polyuréthane hybride.

12. Panneau de construction selon la revendication 8, **caractérisé en ce que** chaque couche d'adhésif polymère (8) possède une épaisseur moyenne approximative allant de 0,2 mm à 1 mm, de préférence de 0,3 mm à 0,5 mm.

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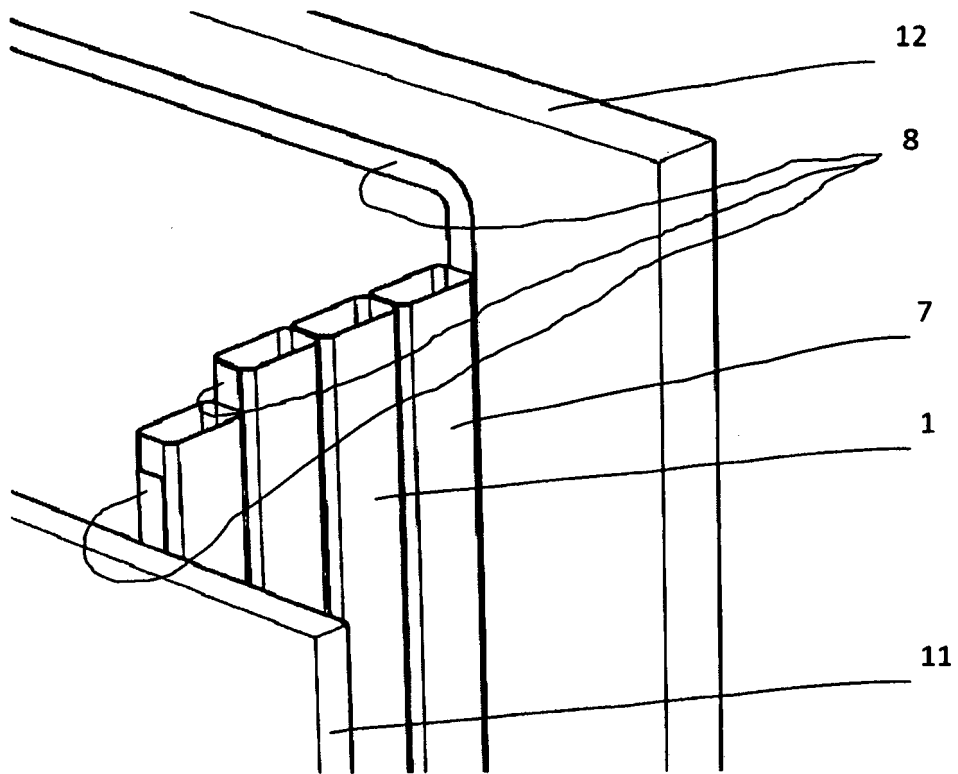


Fig. 2

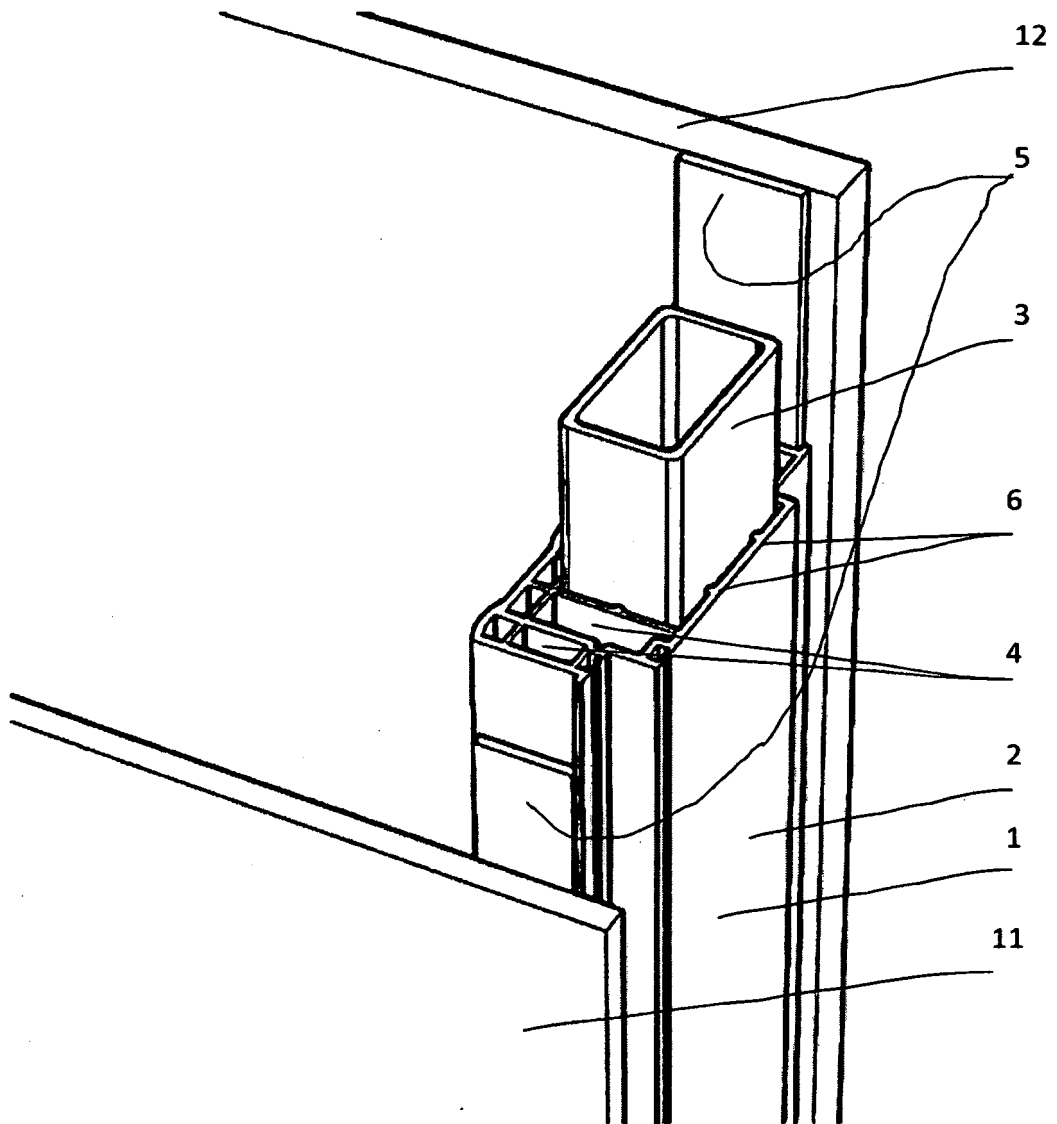


Fig. 1

**REFERENCES CITED IN THE DESCRIPTION**

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