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- (72) Inventor; and  
(71) Applicant: SOWA, Andrzej [PL/PL]; ul. Worpie 6 lok.17, PL-41-906 Bytom (PL).
- (74) Agent: MALACHOWSKI, Marian; Kancelaria Patentowa Malachowski Marian, ul. Batorego 5/6, PL-41-902 Bytom (PL).

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(54) Title: SYSTEM OF STRUCTURAL SANDWICH PANELS

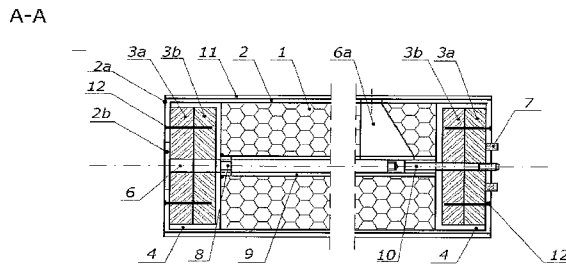


Fig 3

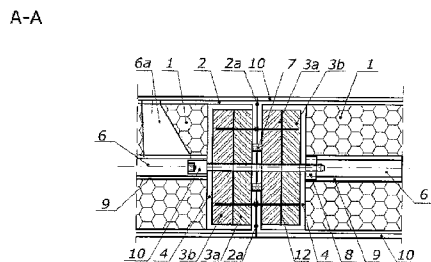


Fig 4

(57) Abstract: System of structural sandwich panels made of panels joined together by fasteners in the form of profiled side edges wherein it consists of base structural sandwich panels (A) interconnected by means of an internal connection (P), wherein the base structural sandwich panel (A) contains a heat-insulating core (1), to both surfaces of which metal sheets (2) are bonded, and in the side planes along the panel's entire length, supporting beams (3) in the form of composite wooden slats (3a) and (3b) are placed, whereas the metal sheets (2), along their longitudinal edges, are arched inwards forming longitudinal vertical reinforcements (2a) which are fastened to the supporting beams (3) by adhesive bonding or by mechanical connection, whereas between the longitudinal vertical reinforcements (2a) there is a gap (2b) with at least one flexible sealing element (7) provided at its periphery, whereas in the upper and lower planes inside the base structural sandwich panel (A), along its entire width, counter beams (11a) are set between the supporting beams (3), and on the outside terminal channel sections (11) are fixed, whereas in the plane of the base structural sandwich panel (A) there are lateral openings (6a) for fastening the supporting beams (3) of the base structural sandwich panels (A) by means of chipboard screws (13).



## **System of structural sandwich panels**

The invention relates to a system of structural sandwich panels used in the construction of pavilions, garages and small industrial and commercial buildings as well as fences or road noise barriers.

The Polish patent specification PL 212802A describes a construction sandwich panel having a core made of foamed polyurethane or foamed polystyrene, characterized in that the core is coated on both sides with a layer of epoxy resin in which glass fibres are embedded. The core has one or more metal profiles permanently fixed therein.

Polish patent application P.355128 discloses a modular sandwich panel the inner filling layer of which is made of expanded polystyrene panels separated from each other by a metal profile reinforcement. External claddings made of laminate are bonded to the side walls of the filling layer and reinforcement.

The Polish patent application P.398951 discloses a hybrid sandwich panel for use as an element of wall and/or roof structure, particularly in industrial, storage or commercial buildings. The hybrid sandwich panel, provided with a core arranged between the claddings, is characterized in that in the core having the form of a polyurethane filling there are spacers arranged in the form of rigid bodies, set preferably parallel to the long side of the panel. At least one side of the spacers adhere to the inner surface of the claddings, whereas the core with the spacers may comprise one or more layers.

The Polish patent application P.323952 discloses a structural sandwich panel for use in the construction of small residential or utility buildings, the panel having an outer and inner wall, between which a wooden support structure in the form of a lattice and layered stiffening elements arranged alternately longitudinally and transversely, preferably in the form of reed or wood chips or twigs, are embedded in expanded polyurethane.

The Polish utility model specification PL 064355 describes a wall sandwich panel having metal cladding and insulating core filling the space between the claddings and comprising profiled fasteners in the form of splines and recesses at its ends, characterized by the fact that the inner surfaces of the splines located at the inner recesses are inclined and they converge into inclined sections, while the outer surfaces of the splines located at the outer recesses are inclined in the same direction as the inner surfaces of the splines and they converge into sections inclined in the same direction as the sections located at the inner recesses. The inclined sections end with edges arched in the same direction, whereas the edges of the inner recess sections point towards the core of the panel. The splines and inner recesses are of matching trapezium shapes with rounded smaller base.

The object of the invention is a system of structural sandwich panels which, by combining a suitably profiled metal sheet with wooden elements and/or metal elements, can independently form a self-supporting wall or a flat roof of a building without using additional supporting structures, transverse bracing or external connectors.

The system of structural sandwich panels according to the invention consists of base structural sandwich panels interconnected by means of an internal connection. The base structural sandwich panel contains a heat-insulating core, to both surfaces of which a metal sheet is bonded, the main task of the latter being to counteract oblique stresses of the system panel, and in the side planes along the panel's entire length, supporting beams are placed. The metal sheets, along their longitudinal edges, are arched inwards forming longitudinal vertical reinforcements fastened to the supporting beams by adhesive bonding or by mechanical connection. Between the longitudinal vertical reinforcements there is a gap inside which mounting

holes are located with tubes fixed therein, and there is at least one flexible sealing element provided at their periphery. In the upper and lower planes inside the base structural sandwich panel, along its entire width, counter beams are set between the supporting beams, and terminal channel sections are fixed on the outside. A nut is attached to the section for binding together the base structural sandwich panels with a bolt. In the plane of the base structural sandwich panel there are lateral openings in which plugs are detachably mounted. The supporting beams are made of a section in the form of a U-shaped metal channel, with adhesive bonded composite wooden slats set inside the section, whereas all elements of the supporting beam located inside the section are bound together by adhesive bonding, while the section's external surfaces are also fixed to the core and to internal surfaces of the metal sheets by adhesive bonding.

In another embodiment the supporting beam is in the form of composite wooden slats.

In still another embodiment, the base structural sandwich panels are set with their shorter sides in a horizontal position in the internal space of vertical posts having the form of H-sections to form a property fence or road noise barriers.

In a different embodiment, the system of structural sandwich panels consists of base structural sandwich panels joined together by an internal connection, whereas the base structural sandwich panel contains a heat-insulating core, to both surfaces of which a metal sheet is bonded, the main task of the latter being to counteract oblique stresses of the system panel, and in the side planes along the panel's entire length, supporting beams are placed, the latter in the form of wooden slats. The metal sheets, along their longitudinal edges, are arched inwards forming longitudinal vertical reinforcements which are fastened to the supporting beams by adhesive bonding or by mechanical connection. Between the longitudinal vertical reinforcements there is a gap at the periphery of which there is provided at least one flexible sealing element, whereas in the upper and lower planes inside the base structural sandwich panel, along its entire width, counter beams are set between the supporting beams, and terminal channel sections are fixed on the outside. In the plane of the base structural sandwich panel there are lateral openings for fastening the supporting beams of the base structural sandwich panels by means of chipboard screws. In lateral openings plugs are detachably mounted.

In another embodiment, the base structural sandwich panels according to the above embodiment, are set with their shorter sides in a horizontal position in the internal space of vertical posts having the form of H-sections to form a property fence or road noise barriers.

The system of structural sandwich panels according to the invention enables the construction of small building objects, without the use of additional external or internal structural elements, which reduces costs and speeds up assembly at the construction site. The internal system of structural panel connections, with no additional external elements, makes it possible to maintain the smoothness of the joined segments, and improves the appearance of building structures constructed with the use of this system.

The accompanying drawings show some embodiments of the invention, wherein: **Fig. 1** shows the front view of the base structural sandwich panel with exposed internal mounting holes and lateral openings, **Fig. 2** shows the front view of a segment comprising three interconnected base structural sandwich panels of Fig. 1, **Fig. 3** shows an A - A section of the base structural sandwich panel of Fig. 1 according to the first embodiment, **Fig. 4** shows the internal "P" connection of the base structural sandwich panels of Fig. 3, **Fig. 5** shows an A - A section of the base structural sandwich panel of Fig. 1 according to the second embodiment, **Fig. 6** shows the internal "P" connection of the base structural sandwich panels of Fig. 5, **Fig. 7** shows an A - A section of the base structural sandwich panel of Fig. 1 according to the third embodiment, **Fig. 8** shows the internal "P" connection of the base structural sandwich panels according to the third embodiment, **Fig. 9** shows a segment of interconnected base structural sandwich panels assembled in a horizontal position and used to construct a road noise barrier.

### Example I

A system of structural sandwich panels consists of base structural sandwich panels **A** interconnected by means of an internal connection **P** (Fig. 2). The basic structural sandwich panel **A** (Fig. 3) contains a heat-insulating core **1** made of expanded polystyrene or polyurethane or insulation wool to both sides of which a corrosion-protected metal sheet **2** is adhesive bonded, the key task of the metal

sheet is to counteract oblique stresses of the system panel and to protect the core 1 against oxidation. Supporting beams 3 of composite structure are placed in the side planes along the entire length of the base structural sandwich panel A (Fig. 3), wherein the supporting beams are made of a section 4 in the form of a U-shaped metal channel, with adhesive bonded composite wooden slats 3a and 3b set inside the section. All elements of the supporting beam 3 located inside section 4 are bound together by adhesive bonding, while the external surfaces of section 4 are also fixed to the core 1 and to internal surfaces of metal sheet 2 by adhesive bonding. The metal sheets 2, along their longitudinal edges, are arched inwards forming additional longitudinal vertical reinforcements 2a which protect the supporting beam 3 against warping, which in turn increases the load-bearing capacity of the building object. The longitudinal vertical reinforcements 2a are connected to the supporting beams 3 by adhesive bonding or mechanically by screws or by means of nails 12. Between the longitudinal vertical reinforcements 2a there is a gap 2b inside which mounting holes 6 are located, and there are flexible sealing elements 7 provided at their periphery (Fig. 4). A tube 9 is set transversely in the opening 6 to maintain flow through this opening in the heat-insulating core 1. In the upper and lower planes inside the base structural sandwich panel A (Fig. 1), along its entire width, counter beams 11a are set between the supporting beams 3, and terminal channel sections 11 are fixed on the outside. A nut 8 is attached to section 4 to facilitate connecting with bolt 10. This manner of joining individual panels into larger segments results in a strong and tight connection of the supporting beams 3 of the joined panels. Alternatively, for instance when corner panels are joined at right angles, lateral openings 6a are made in the base structural sandwich panel A, which allow bolts 10 to be tightened bypassing the mounting hole 6. After the assembly is completed, typical plugs, not shown in the drawings, are fitted in the lateral openings 6a.

### Example II

In another embodiment (Fig. 5, Fig. 6), the structural sandwich panel system has the same structure as the system in the first example, whereas the supporting beam 3 has the form of composite wooden slats 3a and 3b.

**Example III**

In this embodiment (Fig. 7, Fig. 8), the structural sandwich panel system has the same structure as the system in the second example, whereas the heat-insulating core **1** has no opening **6** and no tube **9** transversely set therein, and the connecting element used instead of bolt **10** is a chipboard screw **13** set at an angle, where the only way of accessing the screw with a tightening tool is via appropriately shaped opening **6a**.

**Example IV**

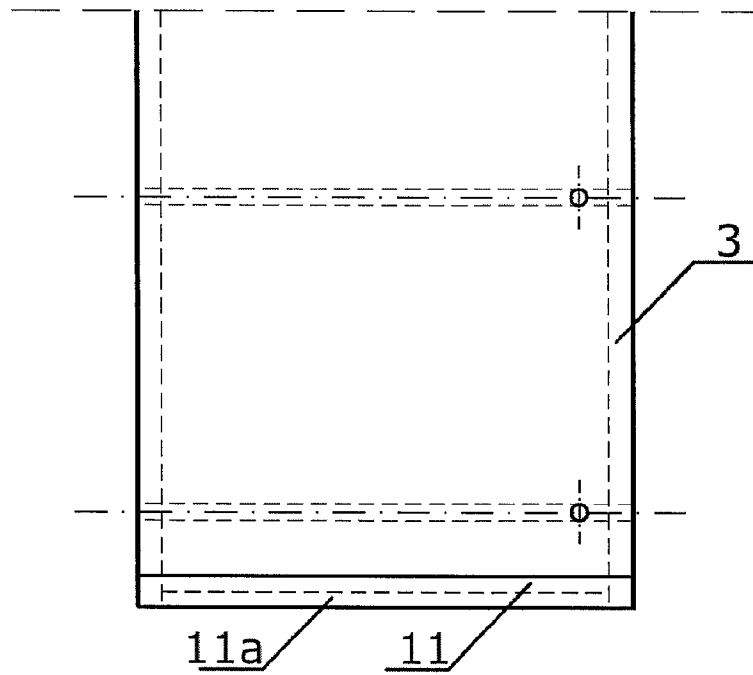
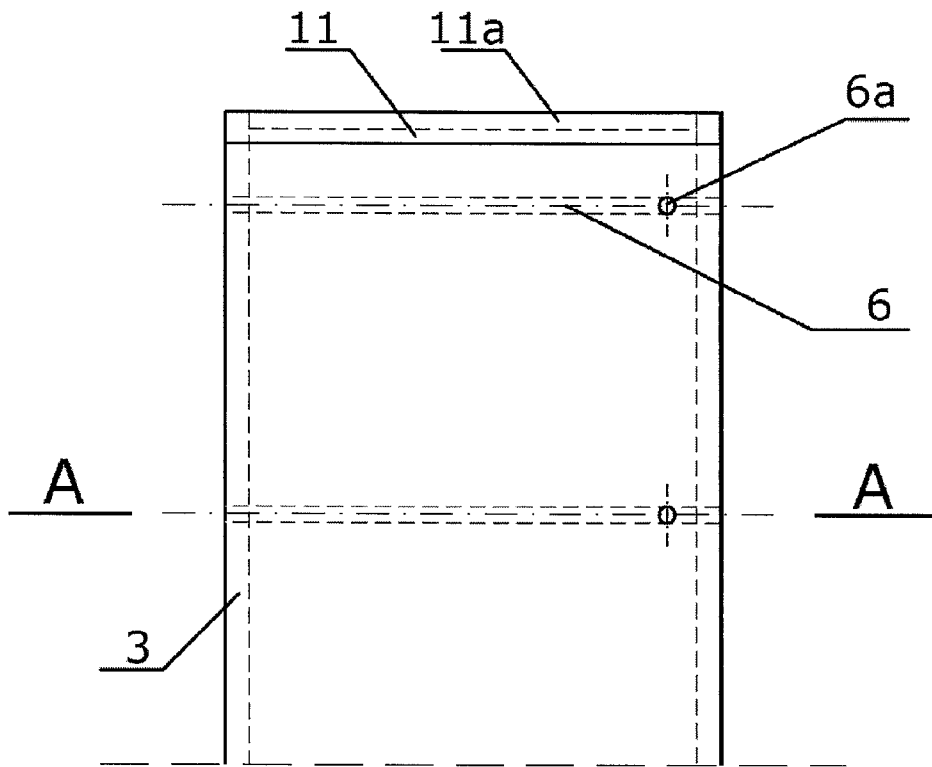
In another embodiment, the base structural sandwich panel systems **A** described in examples I - III are set horizontally with their shorter sides in the internal space of vertical posts **14** having the form of H-sections to construct a property fence or road noise barriers.

The solution according to the invention allows the construction of walls, roofs, floors in such objects as garages, summer houses, commercial pavilions, small buildings, cooling towers, whereas these structures do not require the use of additional framework for bracing. In addition, the structural sandwich panels mounted horizontally are used to build property fences or road noise barriers or other modular building structures.

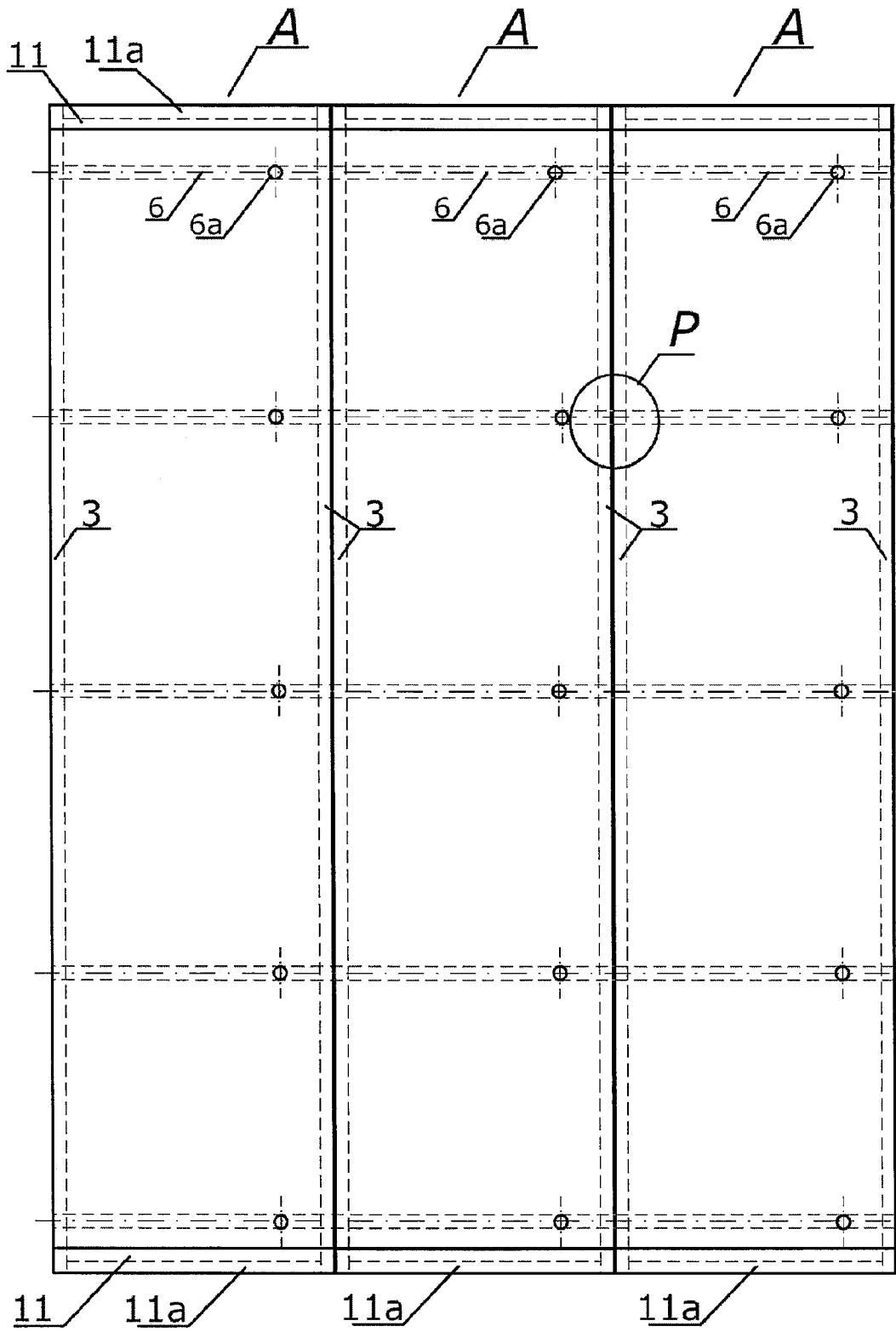
## Claims

1. A system of structural sandwich panels made of panels joined together by fasteners in the form of profiled side edges **characterized in that** it consists of base structural sandwich panels (A) interconnected by means of an internal connection (P), wherein the base structural sandwich panel (A) contains a heat-insulating core (1), to both surfaces of which metal sheets (2) are bonded, and in the side planes along the panel's entire length, supporting beams (3) are placed, whereas the metal sheets (2), along their longitudinal edges, are arched inwards forming longitudinal vertical reinforcements (2a) which are fastened to the supporting beams (3) by adhesive bonding or by mechanical connection, whereas between the longitudinal vertical reinforcements (2a) there is a gap (2b) inside which mounting holes (6) are located with tubes (9) fixed therein, and there is at least one flexible sealing element (7) provided at their periphery, whereas in the upper and lower planes inside the base structural sandwich panel (A), along its entire width, counter beams (11a) are set between the supporting beams (3), and on the outside terminal channel sections (11) are fixed, whereas a nut (8) is attached to the section (4) for binding together the base structural sandwich panels (A) with bolt (10).
2. System according to claim 1 **characterized in that** in the plane of the base structural sandwich panel (A) there are lateral openings (6a) in which plugs are detachably mounted.
3. System according to claim 1 or 2 **characterized in that** the supporting beams (3) are made of a section (4) in the form of a U-shaped metal channel, with adhesive bonded composite wooden slats (3a) and (3b) set inside the section, whereas all elements of the supporting beam (3) located inside the section (4) are bound together by adhesive bonding, while the section's external surfaces are also fixed to the core (1) and to internal surfaces of the metal sheets (2) by adhesive bonding.

4. System according to claim 1 or 2 or 3 **characterized in that** the supporting beam (3) is in the form of composite wooden slats (3a) and (3b).
5. System according to claim 1 or 2 or 3 or 4 **characterized in that** the base structural sandwich panels (A) are set with their shorter sides in a horizontal position in the internal space of vertical posts (14) having the form of H-sections to form a property fence or road noise barriers.
6. A system of structural sandwich panels made of panels joined together by fasteners in the form of profiled side edges **characterized in that** it consists of base structural sandwich panels (A) interconnected by means of an internal connection (P), wherein the base structural sandwich panel (A) contains a heat-insulating core (1), to both surfaces of which metal sheets (2) are bonded, and in the side planes along the panel's entire length, supporting beams (3) in the form of composite wooden slats (3a) and (3b) are placed, whereas the metal sheets (2), along their longitudinal edges, are arched inwards forming longitudinal vertical reinforcements (2a) which are fastened to the supporting beams (3) by adhesive bonding or by mechanical connection, whereas between the longitudinal vertical reinforcements (2a) there is a gap (2b) with at least one flexible sealing element (7) provided at its periphery, whereas in the upper and lower planes inside the base structural sandwich panel (A), along its entire width, counter beams (11a) are set between the supporting beams (3), and on the outside terminal channel sections (11) are fixed, whereas in the plane of the base structural sandwich panel (A) there are lateral openings (6a) for fastening the supporting beams (3) of the base structural sandwich panels (A) by means of chipboard screws (13).
7. System according to claim 6 **characterized in that** in lateral openings (6a) plugs are detachably mounted.
8. System according to claim 6 or 7 **characterized in that** the base structural sandwich panels (A) are set with their shorter sides in a horizontal position in the internal space of vertical posts (14) having the form of H-sections to form a property fence or road noise barriers



**Fig 1**



**Fig 2**

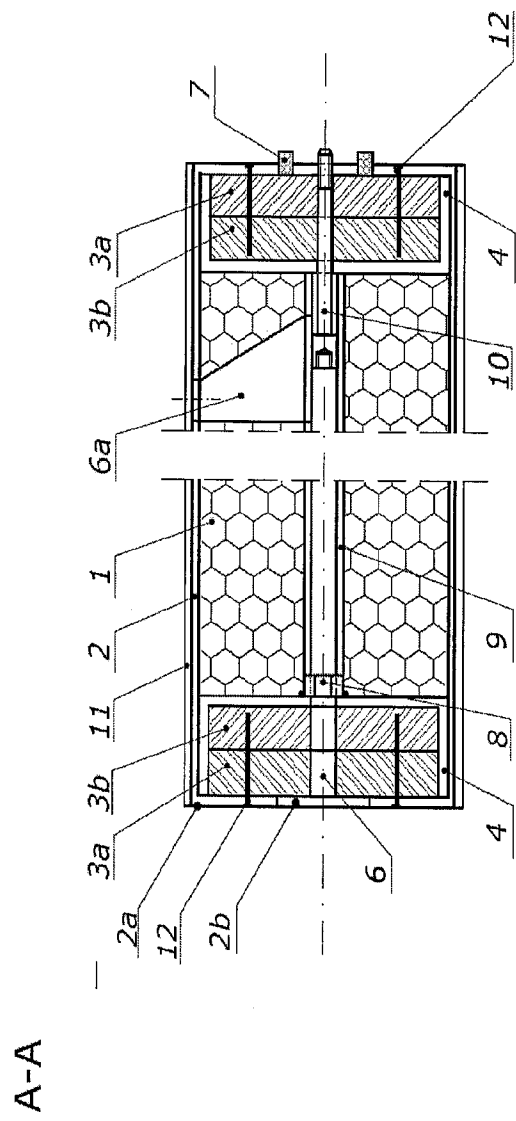


Fig 3



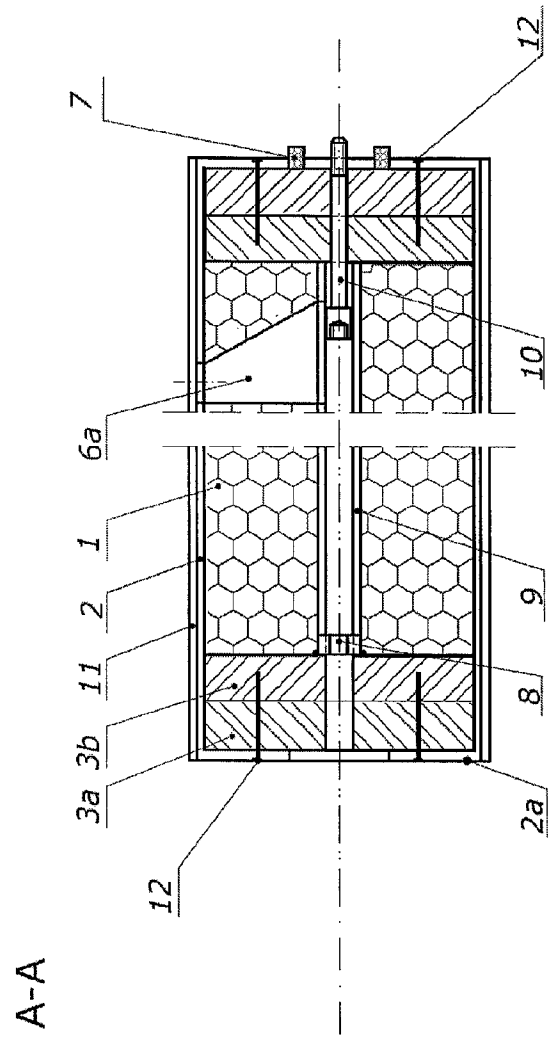


Fig 5

A-A

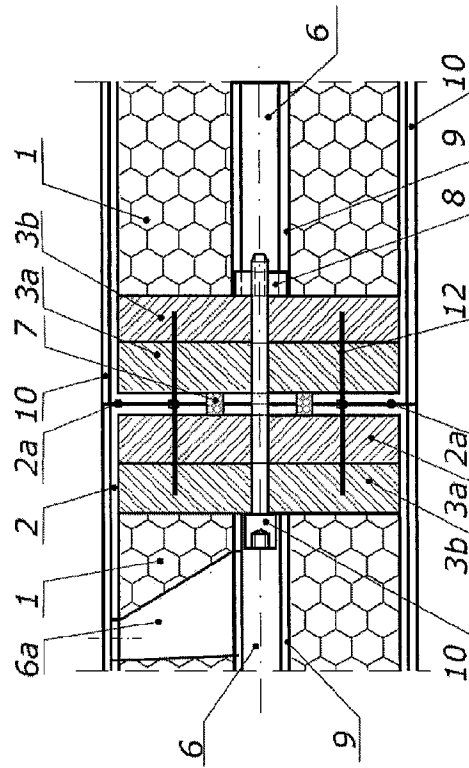


Fig 6

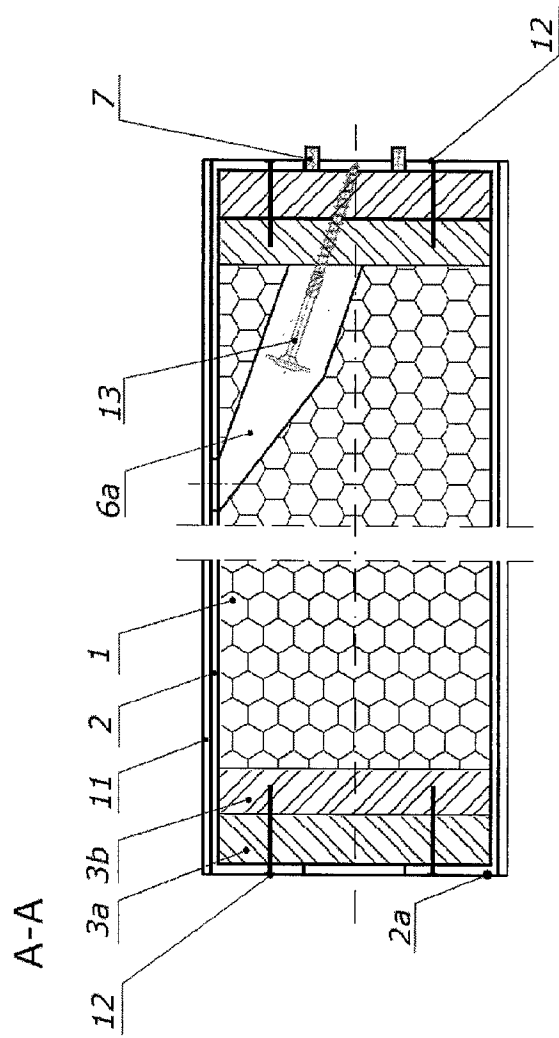


Fig 7

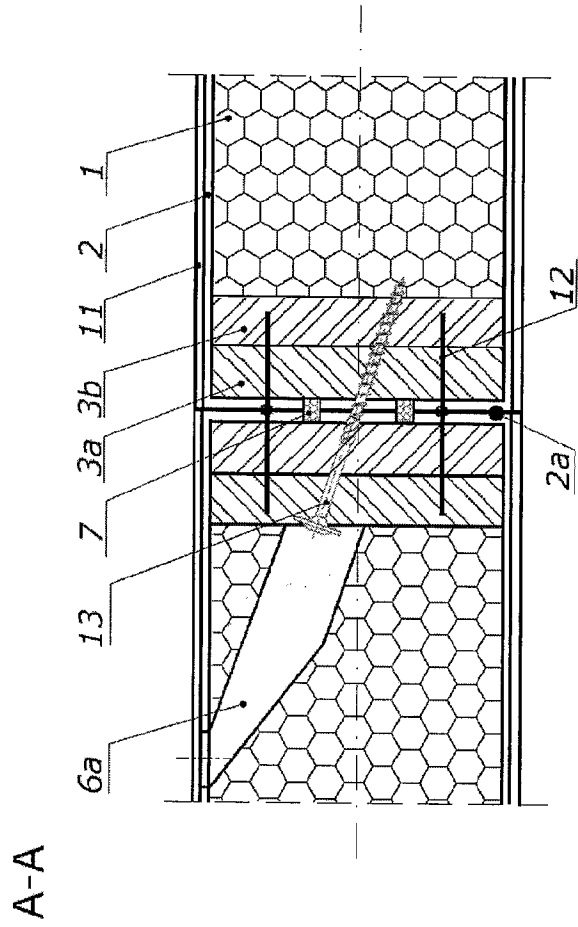


Fig 8

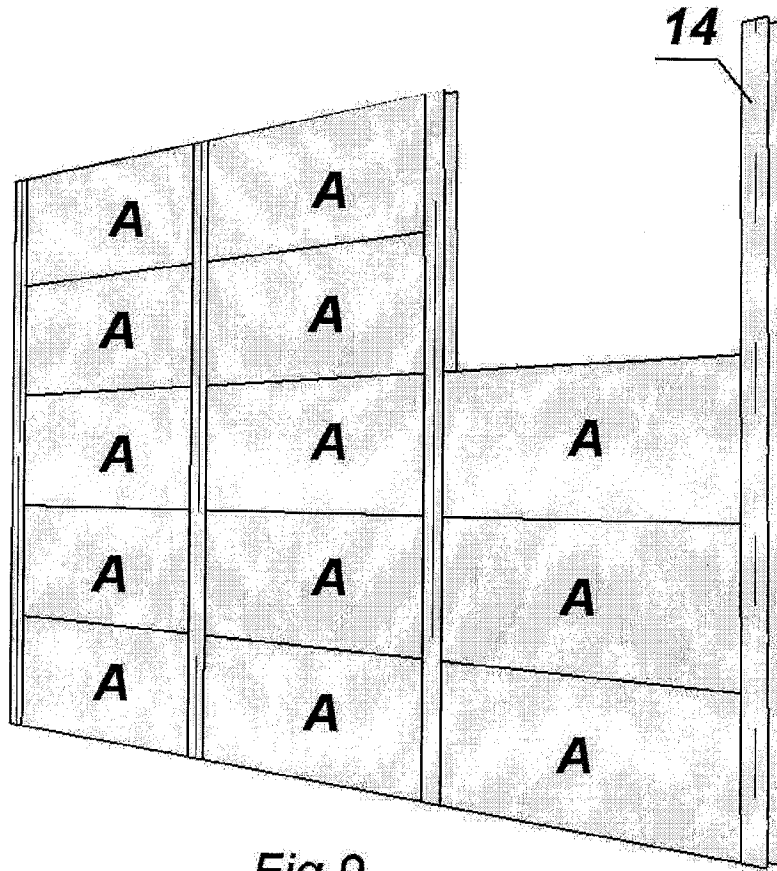


Fig 9

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/PL2019/000038A. CLASSIFICATION OF SUBJECT MATTER  
INV. E04C2/296 E04C2/38  
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)  
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

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 970 502 A (TURNER HAMISH) 20 July 1976 (1976-07-20) figures 1-5 column 1, line 59 - column 2, line 45 column 4, line 4 - line 29 column 5, line 27 - line 35 the whole document	6-8
A	BE 466 277 A (UNITY HEATING LTD, OHR W.) 30 May 1960 (1960-05-30) figures 1-7 the whole document	6-8

 Further documents are listed in the continuation of Box C. See patent family annex.

## \* Special categories of cited documents :

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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

2 August 2019

Date of mailing of the international search report

13/08/2019

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040,  
Fax: (+31-70) 340-3016

Authorized officer

Klein, A

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/PL2019/000038

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.: 1-5  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:  
**see FURTHER INFORMATION sheet PCT/ISA/210**
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

Continuation of Box II.2

Claims Nos.: 1-5

On 23.07.2019, pursuant to Article 17(2)(a)(ii) PCT, the applicant was invited to indicate the claims complying with the Article 6 PCT on the basis of which the search was to be carried out.

On 31.07.2019, the applicant replied that he wished the search to be carried out in respect of claims 6-7, which is understood as an appropriate answer to the invitation pursuant to Article 17(2)(a)(ii) PCT.

The search is therefore done, in accordance with Article 17(2)(a)(ii) PCT, on independent claim 6 and its dependent claims 7,8.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guidelines C-IV, 7.2), should the problems which led to the Article 17(2) declaration be overcome.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/PL2019/000038

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3970502	A	20-07-1976	NONE
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BE 466277	A	30-05-1960	BE 466277 A 30-05-1960
		FR 1280331 A	29-12-1961
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