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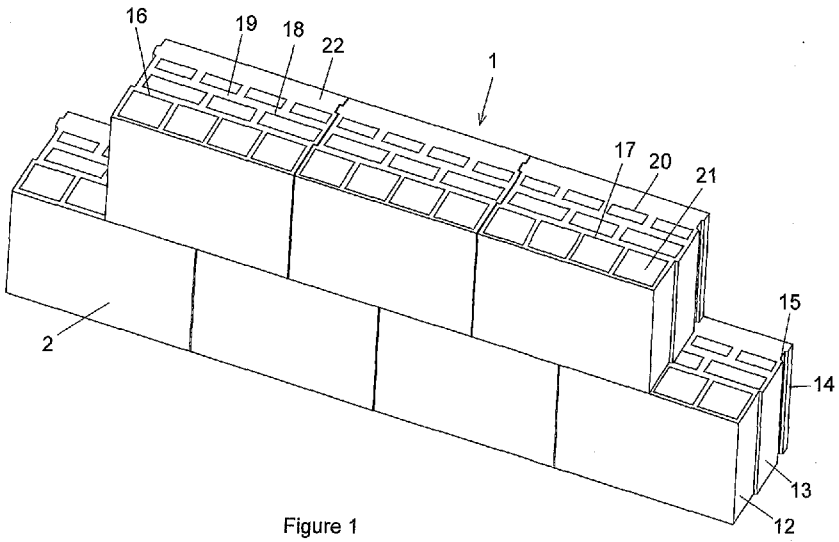


Figure 1

(57) Abstract: The universal asymmetrical heterogeneous construction brick for rapid construction involves a composite brick consisting of two segments: an accumulation of massive clay and insulation designed to allow efficient energy accumulation and a threefold increase in energy storage capacity, which is achieved while maintaining consistent building structure and ensuring rapid construction, all completed in a single phase. This is achieved by shaping the body (1) of the brick into a hollow, modified quadrilateral shape with flat sides (2, 3), base (4), and top surface (5), while the lateral sides (6, 7) are profiled with vertical projections (8, 9, 13, 14) and recesses (10, 11, 12, 15), with partitions (17, 19, 23) which form tubular openings (16, 18, 20) filled with fillers (21) made of insulation material. The brick is designed so that in the massive part of the brick, a clay plate (22) has a concentrated mass on the back, which serves for storage or energy accumulation, while the insulation part of the brick is on the front side, intended for thermal and acoustic insulation.

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UNIVERSAL ASYMMETRICAL HETEROGENEOUS CONSTRUCTION BRICK FOR RAPID CONSTRUCTION

TECHNICAL FIELD

The subject of the invention is generally considered to belong to the field of civil engineering, specifically pertaining to a universal asymmetrical heterogeneous clay construction brick with infill for rapid construction.

According to the International Patent Classification (IPC) Int. Cl. 2022.01, the invention is classified and identified with the primary classification symbol E04C 1/40, defining elements in the form of bricks or other shapes for building components made from various materials or stone with infill material or insulation inserts, as well as the secondary classification symbol E04C 1/41, which refers to elements in the form of bricks composed of insulating material and a supporting part made of stone-like material.

TECHNICAL PROBLEM

The technical problem that is solved by the present invention is the following: how to construct and produce a heterogeneous universal building brick made of clay and insulating material, for example, stone wool, asymmetric in terms of structure in relation to the longitudinal axis and formed by two segments, accumulation massive clay and insulation, enabling efficient accumulation of energy, with at least three times the energy storage capacity of similar bricks, with equal consistency of the building structure and faster construction that takes place through one, completing the process in a single phase rather than the three or more phases typically seen in conventional construction today, through a system comprising at least five elements: load-bearing wall, thermal insulation, an acoustic barrier, energy accumulation and a vapor-permeable non-transparent partition, resulting in a higher load-bearing capacity by its application internal surfaces, improved and safer hanging of

suspended parts on the inner walls, reduced operational costs for electricity, and an expanded useful area within the building due to thinner facade walls.

BACKGROUND ART

Energy efficiency is a crucial criterion for assessing the quality of a building, especially in today's global focus on energy conservation. Significant energy savings can be achieved through effective building insulation and careful material selection during construction, directly impacting heating and cooling costs. In recent decades, there has been a significant development in thermal bricks to enhance the thermal stability of buildings and improve comfort in living, working, and residential spaces. In addition to their thermal properties, these bricks are characterized by larger dimensions, enabling faster and simpler construction, reduced waste, and a range of other additional benefits.

Today it is known that the best characteristics are manifested by the so-called thermoblocks made of clay, which are therefore increasingly common in construction. "Giter" bricks, as they are often called, are made of high purity clay without artificial additives and are characterized by high compressive strength, fire resistance and the possibility of application for the production of thermal insulation, thermal barriers and acoustic barriers. Using them in building construction, the price of heating and cooling is reduced by more than 40%. In addition, clay bricks are long-lasting and do not require any maintenance. Today, it is well known that the thermal conductivity coefficient (λ value) for clay thermal bricks ranges from 0.2–0.40 W/mK, with a note that the lower this coefficient, the better the material is a thermal insulator. Therefore, clay thermal bricks have up to 5.5 times better thermal insulation properties than concrete and are approximately twice as good as solid bricks.

Based on the available domestic and international patent documentation, the following has been found:

The Chinese patent CN212613177U, published on February 26, 2021, titled "Energy-saving Construction Brick," describes a brick made of clay-based expanded aggregate composed of multiple layers where the first functional layer is applied to the outer side of the brick, including a crack-resistant mortar layer, followed by a rigid polyurethane foam layer and an inorganic vitrified micro-granular layer, whike the second functional layer is applied on the outside of the first functional layer and consists of epoxy resin and a polyurethane waterproof coating. According to the presented utility model, the base plate made of clay expanded clay is designed so that the properties of heat preservation, thermal insulation, sound insulation, resistance to moisture penetration, resistance to

fire, shocks, freezing, etc. are enhanced by using clay. A layer consisting of an anti-cracking mortar, a rigid foam polyurethane layer and an inorganic vitrified microlayer is placed on the base plate; while a layer of epoxy resin primer and a layer of waterproof polyurethane were applied to the second functional layer. The application for this utility model shows that the depicted heterogeneous brick does not effectively address the issue of heat accumulation and retention, making it unsuitable for environments with significant temperature variations.

A well-known technical solution is the large-format clay brick from the manufacturer Wienerberger, commercially named "Porotherm IzoProfi" which is heterogeneous, featuring thermal insulation filling its vertical cavities, but it lacks a solid internal wall, reducing its heat accumulation capacity.

A review of promotional materials revealed a large-format energy-saving clay brick from the Serbian manufacturer "Mladost" LLC. This brick features vertical cavities but lacks filling and a dedicated section for energy storage. Additionally, this brick has a significantly higher number of cavities, similar to those from other manufacturers like "Klima Blok", "Zorka" from Šabac, "Termo Blok", "Univerzum" from Aranđelovac, etc. The characteristic of these bricks is their symmetrical mass distribution, whereas the newly designed brick is asymmetrical.

To the inventor's surprise, despite a thorough search of available patent and non-patent documentation, no technical solution relevant to the invention has been found.

SUMMARY OF THE INVENTION

As envisioned by the inventor, the claim of the invention lies in the concept of a universal heterogeneous asymmetric construction brick, the heterogeneity of which is achieved by combining clay with an insulating material for rapid construction, such as mineral wool, while the asymmetry is realized through the structure of the mass in relation to the longitudinal axis, with the massive part of the brick, where a greater mass and predominantly clay are concentrated, serves to store and

accumulate energy. Meanwhile, the insulating part of the brick is designed for thermal and acoustic insulation.

The claim of the invention is also in the combination of clay external edges of the brick and partition walls, forming tubular openings perpendicular to the bedding plane which are symmetrically spaced in axial parallel rows and filled with insulation material arranged to create two functional parts, where the massive part of the brick, with a width of at least 24% of the total brick width, serves for energy storage and represents the inner or rear side of the brick, which is in contact with the space, maintaining thermal comfort, while the other insulating part functions as a thermal barrier and forms the outer side of the non-transparent partition, or the frontal side of the brick, noting that an increase in the brick width leads to an increase in the thickness of the energy storage part.

The claim of the invention is also that the brick, according to the invention, has at least three times greater energy storage capacity compared to other similar available products, allowing for the accumulation of 74.5 kJ/m^2K of energy compared to 18.2 kJ/m^2K, which is the estimated cumulative capacity of similar thermal bricks.

The novelty of the invention also lies in the fact that the brick in question has a greater load-bearing capacity on the inner surface due to the greater thickness of the clay part on the inner side.

What is a significant essential difference compared to previously known technical solutions is that the construction of the wall with this brick takes place through only one phase in which at least five elements are implemented: load-bearing wall, thermal insulation, acoustic barrier, energy accumulator, and vapour-permeable non-transparent partition, which makes it considerably more economical and enables significant savings even compared to construction that involves two separate phases, i.e., the construction of the load-bearing wall (phase 1) and the construction of the heat accumulator (phase 2), with the note that the application of this brick implies a solution according to which the heat accumulator becomes part of the building structure.

The newly constructed brick, according to this invention, has several advantages compared to previously known technical solutions, the most important of which are listed as follows:

– less construction time due to fewer phases by approximately 2–8%;

- lower construction costs by about 4–5% due to fewer work hours of workers and shorter use of scaffolding as a necessary element during construction;
- for the same dimensions of the object, there is a 4.4% larger net usable area due to the reduced thickness of the facade walls, with the same heat transfer coefficient of about 0.3 W/m^{2}K achieved by using both sides plastered brick with a thickness of 25 cm compared to constructions built of standard bricks with a thickness of 25 cm and additional thermal insulation in the form of a 12 cm thick facade.
- lower operational costs for electricity by 7–10% due to energy storage during off-peak electricity tariff times.

BRIEF DESCRIPTION OF FIGURES

For easier understanding of the invention, the inventor refers to the attached diagrams of the application, where:

- *Figure 1* is a schematic depiction of a wall constructed using universal asymmetric heterogeneous bricks in axonometry.
- *Figure 2* is a schematic depiction of the construction brick in question in axonometry with a top view.
- *Figure 3* is a schematic depiction of the construction brick in question in a bottom view;
- *Figure 4* is a schematic depiction of the construction brick in question in a front view;
- *Figure 5* is a schematic depiction of the construction brick in question in a rear view;
- *Figure 6* is a schematic depiction of the construction brick in a view from one shorter side;
- *Figure 7* is a schematic depiction of the construction brick in question from a view of the other shorter side;
- *Figure 8* is a schematic depiction of temperature oscillations on the inner surface of a wall without thermal insulation;

- *Figure 9* is a schematic depiction of temperature oscillations on the inner surface of a wall with thermal insulation on the external surface of the facade wall;
- *Figure 10* is a schematic depiction of temperature oscillations on the inner surface of a wall when the thermal insulation is placed inside the facade brick;
- *Figure 11* is a schematic depiction of temperature oscillations on the inner surface of a wall in the case of a facade wall with the brick in question.

DETAILED DESCRIPTION OF THE INVENTION

To construct a thermal brick with improved technological characteristics, primarily to expand its applicability to regions with pronounced cold and hot climatic conditions while reducing production costs and increasing construction speed, making it economically more competitive, easier to handle and transport, the inventor has opted for the construction of a universal asymmetric heterogeneous brick made of clay and filler whose application method, or positioning during construction, optimizes the constructed structure by placing a massive, accumulative part of the brick or an opposing part dominated by insulating material on the frontal side.

As illustrated in *Figures 1* and *2* of the attached drawings, the body of the brick is designed as a hollow, modified cuboid. Its longer sides 2 and 3, as well as the base 4 and the upper side 5, are made as flat surfaces, while the shorter sides 6 and 7 are profiled so that side 6 consists of laterally connected vertical outlets 8, 9 and recesses 10, 11, while on the other side 7, recesses 12, 15 are made, laterally interconnected with outlets 13, 14. All recesses and protrusions are perpendicular to the base surface and have a rectangular appearance in vertical cross-section.

This type of brick construction, with shorter side walls alternately arranged with vertical recesses and protrusions, allows for faster and easier construction of load-bearing, supporting, sandwich, fire-resistant walls, partitions, etc. while when laying the bricks, recesses 8 and 9 are aligned with the protrusions 12 and 15, while the protrusions 10 and 11 align with the recesses 13 and 14. By positioning the bricks in this way, i.e., by horizontally connecting them in the same direction with minimal gaps, a consistent wall is obtained, characterized by the dimensions: length

and width of the brick's body 1. As seen from *Figures 2* and *3* of the drawing, each brick has vertical tubular openings 16, 18, 20 perpendicular to the lying plane, with equally spaced and symmetrically positioned tubular openings 16 whose cross-sections are rectangular, limited on one side by the long side wall 2 and on the other by the vertical partition 17 separated from symmetrically arranged tubular openings 18 of rectangular cross-section, equally spaced and also separated by a partition 19 from tubular openings 20 of rectangular cross-section arranged between the vertical recess 15 and vertical protrusion 9. The rear part of the brick consists of a compact clay plate 22 bordered by the long side wall 3, side edges forming a vertical recess 11 and protrusion 14, and tubular openings 20. The heterogeneity of the brick is reflected in the fact that in body 1, with longer side walls 2, 3, shorter side walls 6, 7, axial partitions 17, 19, and partitions 23, made of clay, tubular openings 16, 18, 20 with fillers 21 of vapour-permeable insulation material, which simultaneously acts as a thermal and acoustic barrier, are formed. To proove the feasibility of the invention, stone wool is presented as the insulation material, noting that other vapour-permeable materials can be used instead, which prevent water penetration while allowing efficient drainage of water vapour from the bricks. Based on this, it is evident that, unlike the most commonly used bricks available on the market, which are exclusively symmetrical in relation to all three axes, the subject brick is asymmetrically structured in terms of mass in relation to the longitudinal axis. The consequence of this brick construction is that the massive part of the brick constitutes the part where a greater mass is concentrated, i.e., the part dominated by clay, bearing in mind that the main role of the mass is energy storage and accumulation.

When determining the design for this type of brick construction, the inventor started with the idea that the surface mass (kg/m^2) is determined as the product of the thickness of the accumulation layer and its density (kg/m^3); therefore, for the same dimensions of the clay brick, the thickness of the inner side of the brick/wall, when using the brick according to the invention, is 5–6 times greater than with walls made of standard bricks available on the market. When the surface mass (kg/m2) is multiplied by the specific heat of the given material (J/kgK), the material's

accumulativity (J/m^2K) is obtained, i.e., in this case, the clay part of the brick, so such distribution of the clay part of the construction achieves more efficient heat accumulation and optimal energy storage on the inner side of the constructed wall, noting that the density of clay is about 20 times higher than that of insulation materials.

It should also be emphasized that a massive part of the brick, i.e., clay slab 22, is made of clay oriented towards the rear long side 3 of body 1, or the side in contact with the space where thermal comfort is maintained and is intended for storing energy, while the other insulating part of the brick, which serves as a thermal barrier, represents the outer side of the non-transparent partition. This means that the part of the brick with little clay and much insulation is oriented towards the frontal side of body 1, while on the contrary, the part with significantly more clay and a reduced portion of insulation is located on the rear long side 3 of the brick. In this way, the thermal and sound insulation segment is "relieved" of clay material, i.e., a certain amount of clay found in the brick's central part and towards the outer surface in other products is redistributed to the segment for storing energy. In that part, the insulating material, i.e., stone wool, occupies a larger space, while the clay is kept in a minimal amount, i.e., in an amount that provides the necessary mechanical strength of the product.

The thermal stability of the brick in question is illustrated in the graphs in *Figures 8–11*. which demonstrate the relationship between temperature fluctuations on the inner surface of the wall and the distribution of the accumulation layer and the insulation layer within the brick. The ability of building constructions to maintain a consistent temperature on the inner surface defines their thermal stability, and it is known that higher thermal stability contributes to greater thermal comfort by eliminating the effects of a cold wall in winter and a hot wall in summer. Namely, a high thermal mass on the inner surface of the facade wall increases the thermal inertia of the inner wall surface, thereby balancing temperature fluctuations of the external air, as clearly shown in *Figures 8–11*. For this reason exactly, this brick provides the best thermal stability for building constructions.

Blocks made in this way, where the mechanical strength and dimensions are defined by the new distribution of clay in the construction, allow for building to proceed in a single phase, unlike

the currently widely used systems requiring five or three phases. This means that using these bricks provides the functions of a load-bearing wall, thermal insulation, acoustic barrier, energy accumulator, and vapour-permeable opaque partition, and it is important to highlight that the design of this brick integrates the heat accumulator (energy storage) into the opaque facade construction.

According to the invention, the brick has at least three times greater energy storage capacity than other available products, accumulating 74.5 kJ/m^{2}K compared to the estimated 18.2 kJ/m^{2}K accumulative capacity of similar thermal bricks. The advantage of using the subject brick is also reflected in the higher load-bearing capacity of the inner surface due to the greater thickness of the clay part on the inner side, which, among other things, provides better support for hanging furniture parts attached to the inner wall surface.

To demonstrate the feasibility of the invention, a technological process for manufacturing the brick is presented, which consists of the following steps:

The primary processing begins in box feeders, from which the raw material falls onto flat conveyors, transporting it to pan mills. Wet grinding is performed in pan mills by crushing and extruding the clay onto a perforated base plate, achieving partial raw material homogenization. The clay is squeezed through the perforations and falls onto plate feeders of the pan mills, then onto flat conveyors which transport the clay to coarse differential rollers, where it is ground to a maximum granularity of 2–3 mm. The final preparation is done in a fine mill, where the raw material is finalized to a granularity of 1–1.2 mm. Clay, in its final granularity, is transported by a rubber conveyor system to a two-way spreader that spreads the clay and fills the basin lengthwise with a reversible movement. The reversible movement, back and forth, ensures uniform filling of the basin, while the spreader also homogenizes the raw material by spreading it along the length and width of the basin. The deposited clay in the basin allows the factory to operate smoothly throughout the year, regardless of weather conditions. The clay in the basin undergoes ageing, acquiring necessary

properties for fine shaping (structural relaxation, plasticity, uniform moisture, moisture penetration into the fine structure of the clay mass, etc.). The production technology requires the raw material to undergo ageing after primary processing.

Clay is extracted from a pool using a loading shovel and transported to a box feeder for secondary processing. The pressing process of the clay brick is preceded by secondary processing of the raw material, where the processed clay is once again passed through a fine mill to remove so-called dry spots, a consequence of the raw material's ageing. The dimension of the raw material remains at 1–1.2 mm. Conveyors transport clay to a vacuum press mixer, water for shaping is added, and then it is intensively mixed and extruded into cylinders cut by knives at the mixer's outlet. The knives cut the clay into "noodles" that fall into the vacuum chamber. The clay, captured by the screws from the vacuum chamber, is extruded into the press cylinder. The raw material processed in this way is pushed into the tool by means of a screw transmission and is squeezed out through the mouthpiece on the head of the press in the form of a clay body of the desired cross-section. The discharge pressure is 20–25 bar. The shaped clay structure is accepted by a horizontal conveyor with rollers, where it is cut to the desired height of the finished product. The prepared distance of the steel wires on the cutting device predetermines the height of the product. After the cutting and shaping phase of the finished product in all three dimensions, the raw products are briefly stored in the warehouse, from where they are transported to the dryer after collecting a sufficient number of products.

Drying is the most critical phase, as the design of the product, due to its asymmetry, requires an innovative solution that enables the drying process to be carried out in a way that maintains a stable structure without deformations and cracks.

The drying process is in three stages:

- Heating phase: in a humid atmosphere at T=45–50°C, with a relative humidity of up to 80%, this phase can be up to ten times.
- Evaporation phase: introducing warm air at T=100–150°C, with the variable opening of the regulation valve for warm airflow; this phase lasts 5–7 times.
- The final drying phase is reducing the moisture to 16–17%, and it is performed with maximum warm airflow.

Dried products are transported to the dried products warehouse, from where they are precisely scheduled to be loaded onto tunnel kiln wagons which move along the track at a predetermined speed.

The firing process has three stages:

- The preheating phase includes the wagons up to the first firing group, where combustion gases from the firing zone move towards the flue gas fan, exchanging heat along the way, so that the products reach the first firing group at a temperature of 600–650°C.
- The firing phase is carried out by direct action of the burners, and the arrangement of the parts on the transport wagon is defined accordingly, with the firing temperature which can reach up to 1000°C.
- The cooling phase takes place after the firing phase upon exiting the last burner group. The accumulated heat in the products and on the transport wagons is directed towards the dryer by controlled air injection, making the production process as efficient as possible.

Once the cooling and stacking process of the products on pallets has been completed, they are transported to the final stage section of brick production, where the filling of vapour-permeable insulation material is added. Pallets, each containing one product per layer, pass through a track beside workstations where pre-prepared insulation fillings of precise dimensions are inserted into the vertical cavities of the clay brick, thus completing the brick manufacturing process of the brick.

After the insertion of the insulation material into the vertical cavities of the clay brick, a visual inspection of the finished product is conducted, and the final products are packed onto pallets, wrapped in stretch film, and sent to the warehouse of finished products.

INDUSTRIAL AND OTHER APPLICABILITY

According to this invention, the industrial or other method of obtaining the universal asymmetric heterogeneous clay and filler building brick is absolutely possible in companies that produce construction equipment and even in well-equipped construction workshops, and its application is recommended for the construction of buildings where rapid construction with

significant energy and material savings is required. Existing known technology for producing clay bricks with vertical cavities is used in the production of bricks.

The subject invention is suitable for mass production based on workshop documentation that experts in the field can create using the description and drawings from the patent application of the invention.

It is important to note that the efficiency of the brick has been successfully tested on prototypes, showing excellent results not only when used as a wall-building element but also as a product that, integrated with mechanical installations, meets the conditions for efficient energy storage in wall panels, emphasizing that it is compatible with low-temperature wall heating and high-temperature wall cooling installations, essential for using heat pumps and highly efficient devices that utilize renewable energy sources.

Claims

1. A universal asymmetric heterogeneous brick for rapid construction, **characterized in, that** a body designed as a hollow, modified cuboid (1) designed as a hollow, modified cuboid with longer side faces (2, 3), a base (4), and a top face (5) that are flat surfaces, while the shorter side faces (6, 7) are profiled, with one side (6) featuring vertically aligned, laterally connected protrusions (8, 9) and recesses (10, 11), while the other side (7) has recesses (12, 15) laterally connected by protrusions (13, 14), with a clay plate (22) positioned at the rear of the body (1), and tubular openings (16, 18, 20) which are axially arranged in parallel at the front.

2. The universal asymmetric heterogeneous building brick for rapid construction, according to claim 1, **characterized in, that** a clay plate (22) bordered on one side by the rear longer side face (3), with side edges forming a vertical recess (11) and protrusion (14), and on the other side by tubular openings (20).

3. The universal asymmetric heterogeneous building brick for rapid construction, according to claim 1, **characterized in, that** vertical tubular openings (16, 18, 20) perpendicular to the base surface, with symmetrically positioned tubular openings (16) of equal spacing between the lateral recess (12) and protrusion (8) which have a rectangular cross-section and are bounded on one side by the longer side face (2) and on the other side by a vertical partition (17), separated from three symmetrically arranged tubular openings (18) of rectangular cross-section, equally spaced apart and separated by a partition (19) from four tubular openings (20) of rectangular cross-section axially arranged between the vertical recess (15) and the vertical protrusion (9).

4. Use of the universal asymmetric heterogeneous brick for rapid construction, **characterized in, that** the construction of a wall in a single phase, incorporating all five elements: load-bearing wall, thermal insulation, acoustic barrier, energy accumulator, and vapour-permeable opaque partition.

5. Use of the universal asymmetric heterogeneous building brick for rapid construction, according to claim 1, **characterized in, that** the solid rear part of the brick, consisting of a clay plate (22), oriented towards the interior of the structure, while the insulation part of the brick, consisting of tubular openings (16, 18, 20) filled with insulation material (21), is oriented towards the exterior side of the masonry construction.

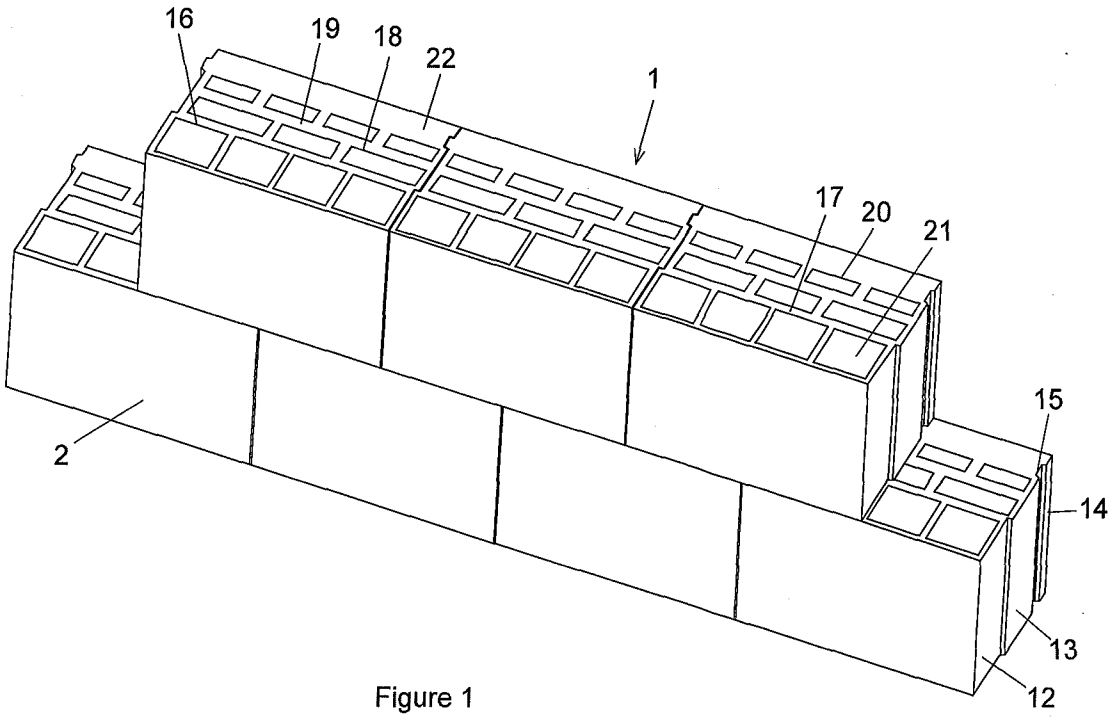


Figure 1

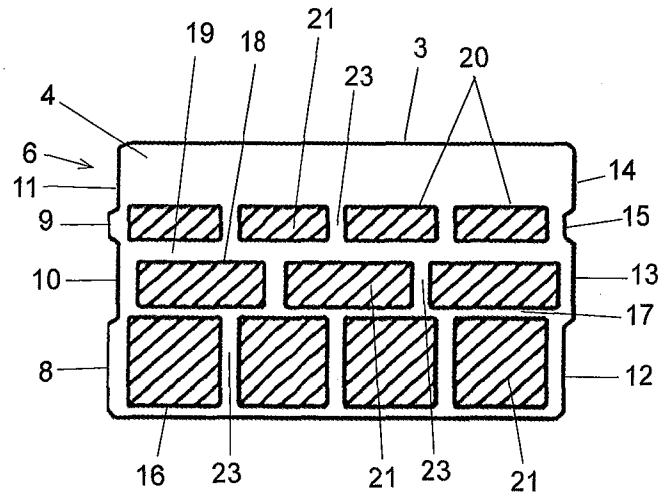


Figure 3

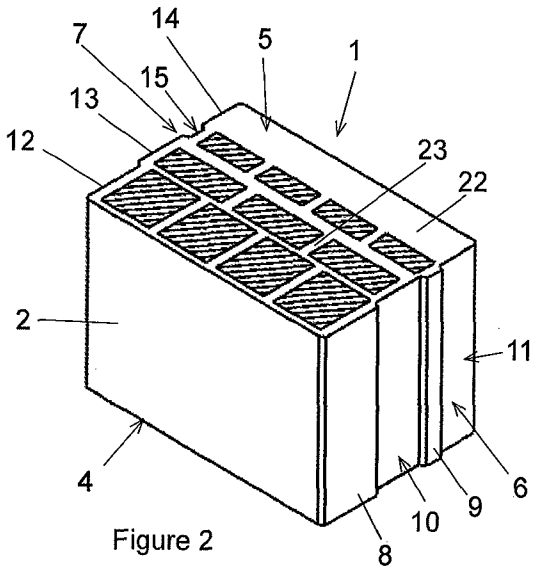


Figure 2

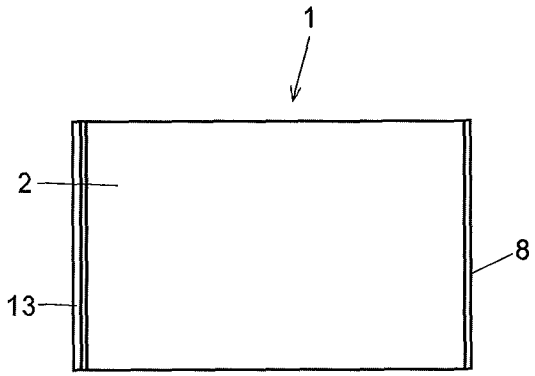


Figure 4

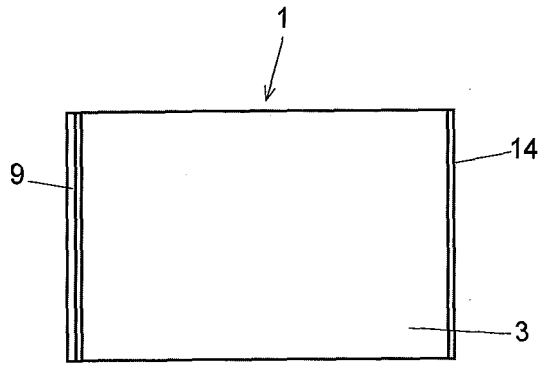


Figure 5

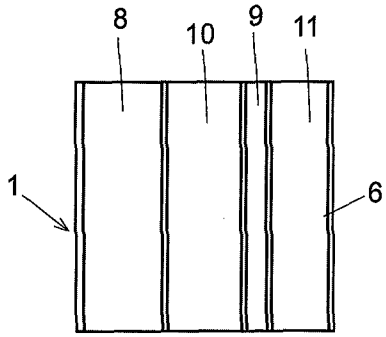


Figure 6

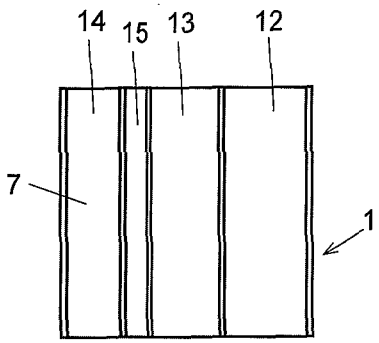


Figure 7

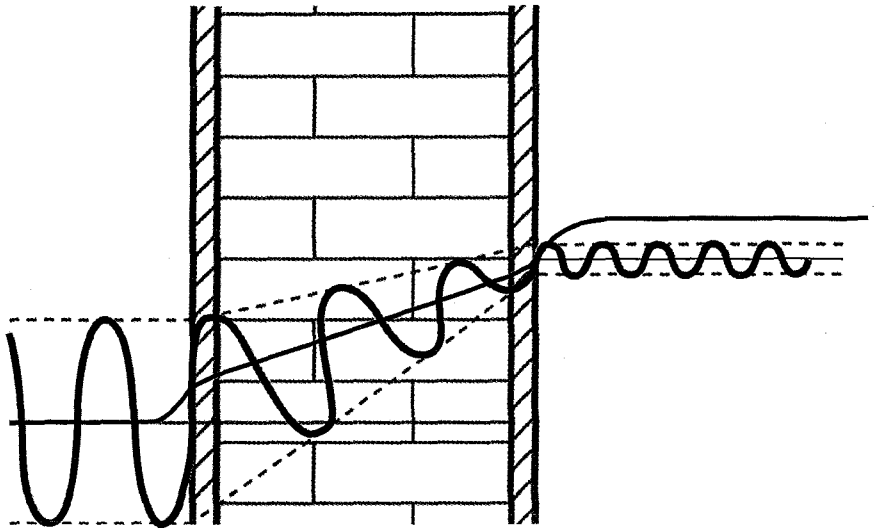


Figure 8

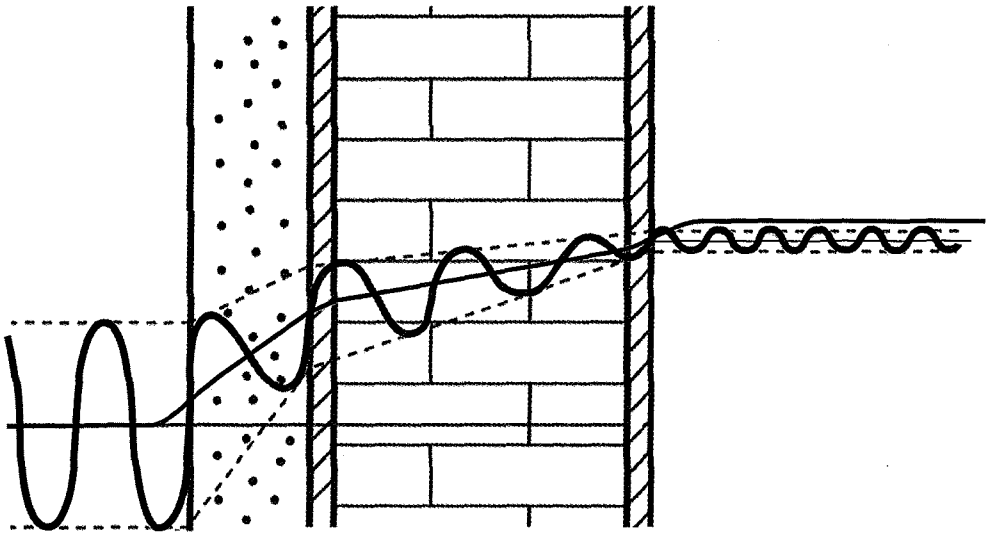


Figure 9

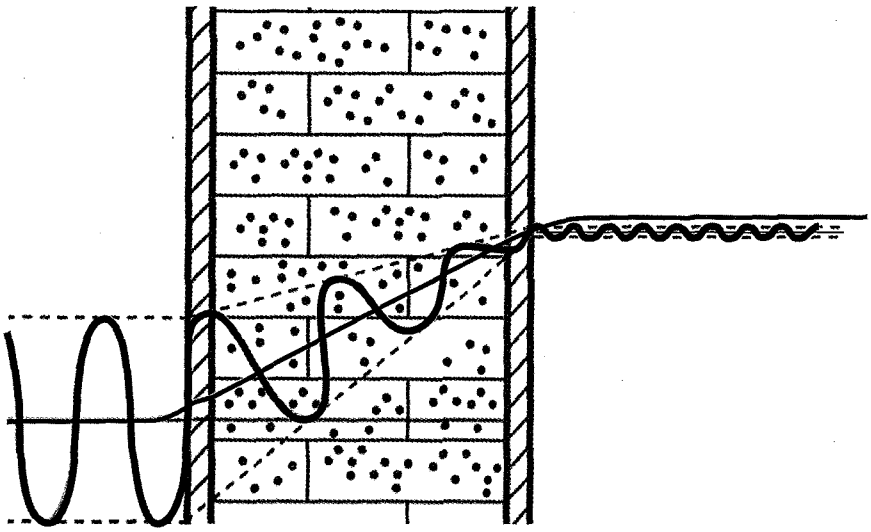


Figure 10

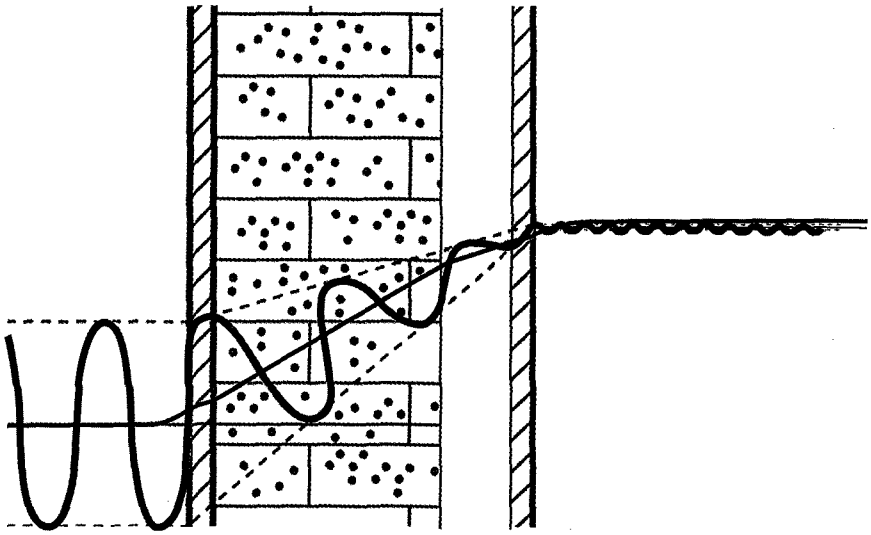


Figure 11

INTERNATIONAL SEARCH REPORT

International application No
PCT/RS2024/000008

A. CLASSIFICATION OF SUBJECT MATTER

INV. E04C1/41
ADD. E04B2/02

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 E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 289 643 A1 (FUCHS & CO GMBH [AT]) 9 November 1988 (1988-11-09) pages 4,5; figures 14,14a	1-5
Y	EP 2 148 018 A2 (ROITMAIR HELMUT [AT]) 27 January 2010 (2010-01-27) figure 8	1-5
A	DE 31 05 489 A1 (BAUMGAERTNER JUERGEN) 11 November 1982 (1982-11-11) pages 4,5; figure 4	1-5

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 September 2024	23/09/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Saretta, Guido

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/RS2024/000008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0289643 A1	09-11-1988	NONE	
EP 2148018 A2	27-01-2010	AT 7561 U2	25-05-2005
		AT E492696 T1	15-01-2011
		DE 212004000002 U1	20-01-2005
		DK 1623078 T3	28-03-2011
		DK 200900079 U1	24-07-2009
		DK 201100090 U1	10-06-2011
		EP 1623078 A1	08-02-2006
		EP 2148018 A2	27-01-2010
		ES 2357510 T3	27-04-2011
		FI 8581 U1	14-01-2010
		HR P20050884 A2	30-04-2006
		HU 3672 U	28-10-2009
		ME 00716 B	07-05-2010
		PL 1623078 T3	31-05-2011
		RS 20050684 A	31-12-2007
		SI 1623078 T1	29-04-2011
		WO 2004079116 A1	16-09-2004
DE 3105489 A1	11-11-1982	NONE	