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(71) Applicant: **Ganzha, Vitalii V.**
03169 Kylv (UA)

(72) Inventor: **GANZHA, Vitalii V.**
03169 Kyiv (UA)

(74) Representative: **Jeck, Anton**
Klingengasse 2
71665 Vaihingen/Enz (DE)

(54) STRUCTURAL MODULE AND METHOD FOR MOUNTING STRUCTURAL MODULES

(57) The invention relates to a modular construction sector, in particular, to structures of modular building elements, which already have bearing, heat-insulating and facing layers and are used for construction of residential and public buildings having any number of stories without using a cement grout. Further, the invention relates to methods of mounting structural modules of the proposed design having bearing, heat-insulating and facing layers in construction of residential and public buildings.

The structural module comprises a bearing wall, preferably, reinforced concrete element having, preferably, the form of a rectangular parallelepiped, a heat-insulating layer, a reinforcing layer, and a facade layer. The heat-insulating layer, the reinforcing layer and the facade layer are made so that there is an indention from an edge of the bearing wall element. Width of indention L from an edge of the bearing wall element and an edge of the heat-insulating layer, the reinforced layer and the facade layer is within 100...250 mm. Thickness of the heat-insulating layer and facade layer provides thermal conductivity of the structural module within k=2.9...3.5 W/m^2K. The reinforcing layer has shear strength of at least 0.8 MPa when coupled with the facade layer.

A method of mounting structural modules comprises installation, fixing and fastening of bearing wall elements having heat-insulating, reinforcing and facade layers to each other with coupling elements, application of a protective coating on coupling elements and sealing of joints between bearing elements of adjacent structural modules. A gap between heat-insulating layers of adjacent modules is filled with a heat-insulating material followed by sealing of joints between the heat-insulating material and surfaces of structural modules followed by fixing insulating linings onto the surface of modules and mechanical fastening thereof to the bearing wall element of the module. Insulating linings are at least 5 % wider the gap between heat-insulating layers of adjacent modules.

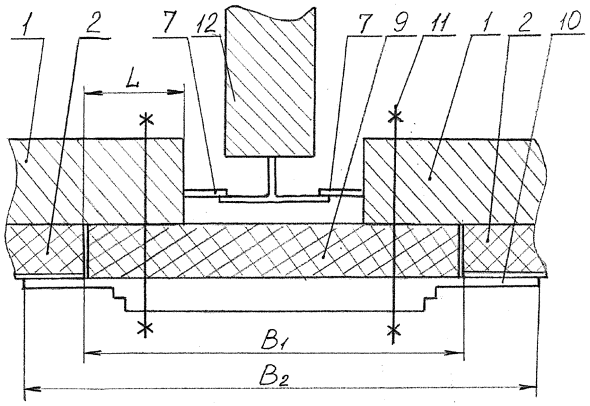

Fig. 3

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Description

[0001] The invention relates to a modular construction sector, in particular, to structures of modular structural elements which already have bearing, heat-insulating and facing layers and are used for construction of residential and public buildings having any number of storeys without using a cement grout. Further, the invention relates to methods of mounting structural modules of the proposed design having bearing, heat-insulating and facing layers in construction of residential and public buildings.

[0002] Many similar structural modules, considered the closest prior art based on the combination of essential features, are known to the applicant including the following.

[0003] A structural module having a bearing element and a heat-insulating layer made of expanded polystyrene and a facade layer made of brickwork attached thereto is known in the art. The method of modules mounting comprises coupling of their butt ends with vertical and horizontal beams of a pre-formed frame construction (Patent US 3 775 916 published on 04.12.1973).

[0004] The disadvantage of the known module and the related mounting method is the need for using a frame structure that complicates construction of building walls, limits the number of floors in the building and restricts the scope of decorative designing of a facade layer of the building. Further, this module does not provide for means to improve waterproofing of building walls.

[0005] Structural modules having a bearing base, a heat-insulating layer and a facade layer as well as means enhancing convenience of coupling modules to each other when they are mounted being made as a component of the bearing element are also known in the art. The heat-insulating layer is located inside the spatial bearing element or between its layers. The modules further have window or door systems or decorative elements mounted on a facade surface (Patent US 5 697 189 published on 16.12.1997, Application US 2011/0252728 A1 published on 20.10.2011, Application US 2014/0260030 A1 published on 18.09.2014).

[0006] The disadvantage of the above modules is a certain complexity of manufacturing of such blocks, lack of means to improve waterproofing of modules as well as the need for applying additional means and measures to waterproof joints when modules are mounted.

[0007] A structural module having a reinforced concrete bearing wall element with a heat-insulating layer fixed outside thereof, being made of a concrete mixture with plant-derived fibers, whereon a facade layer made of a plaster material is fixed is also known in the art (Application for an Invention FR 2 709 504 A1 published on 10.03.1995, IPC: E04C2/06; E04B1/90; E04B2/92; E04C2/06; E04C2/52).

[0008] The known structural module allows simplifying construction of residential and public buildings through the presence of heat-insulating and facade layers already mounted on a reinforced concrete bearing element. However, the disadvantage of the known solution is relatively insufficient shear strength of the facade layer and relatively high thermal conductivity of the facade module, both due to materials used in these layers, as well as relatively insufficient hydrophobicity of both the module and buildings constructed with such modules due to insufficient waterproofing of joints both between modules and between structural elements of modules, i.e. between heat-insulating layers and facade layers and window and/or door units or hanging structures such as balconies and the like.

[0009] A structural module having a heat-insulating layer and a facade layer is also known in the art. The heat-insulating layer is made of mineral fiber selected from fiberglass, asbestos fiber, slag wool fiber, ceramic fiber and having a multilayer structure with the outer and inner surfaces being hydrophobic (Patent of Ukraine No. 91984 published on 27.09.2010, IPC (2009): E04B 1/80).

[0010] The disadvantage of the known structural module is the lack of a bearing element necessitating the use of many elements of a frame, before an outer wall of a building is constructed, followed by mounting the above modules to the frame as well as the lack of means for waterproofing when modules are mounted together.

[0011] A structural module comprising a reinforced concrete wall element whereon an insulating element is fixed is also known in the art. The reinforced concrete wall element has shelves and ribs for fastening the insulating element. The insulating element is made of layers, so that, in particular, a layer of asbestos cement that performs a bearing, fire protective and decorative functions, and a layer of expanded polystyrene performs a heat-insulating function. The insulating element has elastic parts to compensate for temperature deformations as well as an elastic sealing gasket at a junction with the reinforced concrete wall element. (USSR Author's Certificate 872679 published on 15.10.1981, IPC: E04C1/28).

[0012] The disadvantage of the known structural module is the structural complexity and, consequently, higher manufacturability requirements due to shelves and ribs on the bearing structure required for fixing the insulating element. The known module may have insufficient parameters of heat insulation due to shelves and ribs on the reinforced concrete bearing structure which are not closed with a heat-insulating material. Further disadvantage is the embodiment of the insulating element that has relatively poor environmental and decorative properties due to materials used. When such building modules are mounted, further steps are required to ensure waterproofing and heat insulation of joints between adjacent modules.

[0013] A structural module comprising a bearing, preferably, reinforced concrete element having the form of a rectangular parallelepiped, a heat-insulating layer, a reinforcing layer and a facade layer is also known in the art. The outer surface of the facade layer features volumetric decorative elements attached with a mechanical fastener, located inside the heat-insulating layer. The module further features sites fit for installation of window and door systems (Patent EP 2 140 992 B1 published by 06.01.2010, IPC (2006.01): E04C 2/04, E04F 19/02, E04C 1/40, E04F 13/08, B28B 19/00).

[0014] The disadvantage of the known module is the lack of means to improve waterproofing of the module that may reduce its operational capabilities. Further, mounting of such modules to form a wall structure of a building requires additional measures to seal joints between adjacent modules.

[0015] A structural module, comprising a bearing wall, preferably, reinforced concrete element having, preferably, the form of a rectangular parallelepiped, a heat-insulating layer, a reinforcing layer and a facade layer, was chosen as a prototype. The module further comprises horizontal and vertical insulating inserts located along the perimeter of the module to provide additional insulation of modules upon mounting. (Ukrainian Utility Patent No. 78799 published on 25.03.2013, Bulletin No. 6). The known module allows enhancing the convenience of mounting in construction of buildings to some extent and prevents loss of heat-insulating properties or parameters of strength as may be possible when wall thus constructed are further decorated with necessary means. However, for the known module, heat-insulating and waterproof parameters, and parameters of strength may be improved, and waterproofing of joints between modules may become easier when modules are mounted.

[0016] The invention is based on the task to develop a building module having a bearing element, a heat-insulating layer, a reinforcing layer and a facade layer with improved thermal insulation and waterproof properties and parameters of strength and being easier-to-mount when buildings are constructed with structural modules of the claimed design and allows enhancing the convenience of waterproofing works at buildings during mounting of such blocks by redesigning the module and using materials with certain properties therein. A further task is to improve manufacturability of the structural module with the facade layer and decorative elements fixed on its surface.

[0017] This task is solved, so that in a building module comprising a bearing wall, preferably, reinforced concrete element having, preferably, the form of a rectangular parallelepiped, a heat-insulating layer, a reinforcing layer and a facade layer, according to the invention, the heat-insulating layer, the reinforcing layer and the facade layer are made, so that there is an indention from an edge of the bearing wall element and width of indention L from an edge of the bearing wall element and an edge of the heat-insulating layer, the reinforced layer and the facade layer is within 100 ... 250 mm, thickness of the heat-insulating layer and facade layer provides thermal conductivity of the structural module within k = 2.9...3.5 W/m^2K, and the reinforcing layer has shear strength of at least 0.8 MPa when coupled with the facade layer.

[0018] Thickness of the facade layer may be 50...150 mm, and thickness of the heat-insulating layer may be 40...160 mm.

[0019] The facade layer may be made using clinker tiles.

[0020] The building module may comprise window units and/or door units and/or balcony elements mounted.

[0021] The building module may further include protruding decorative elements fixed.

[0022] Decorative elements may be fixed at sites where window units and/or door units and/or balcony elements are located.

[0023] Decorative elements may be attached to the bearing wall element using an adhesive mixture.

[0024] Decorative elements may be made of reinforced expanded polystyrene.

[0025] The further task of the invention claimed is to simplify the method of mounting structural modules and, at the same time, to provide better hydrophobic parameters of a building, made of such modules, without affecting decorative properties of the facade of the building by waterproofing joints between modules using decorative elements of the facade.

[0026] This task is solved, so that in the method of mounting structural modules comprising installation, fixing and fastening of bearing wall elements having heat-insulating, reinforcing and facade layers to each other with coupling elements, application of a protective coating on coupling elements and sealing joints between bearing elements of adjacent structural modules, according to the invention, a gap between heat-insulating layers of adjacent modules is filled with a heat-insulating material followed by sealing joints between the heat-insulating material and surfaces of structural modules followed by fixing insulating linings onto the surface of modules and mechanical fastening thereof to the bearing wall element of the module, so that insulating linings are at least 5% wider the gap between heat-insulating layers of adjacent modules.

[0027] Protruding architectural decorative elements may be used as insulating linings. Horizontal or vertical structures of reinforced expanded polystyrene may be used as architectural decorative elements.

[0028] Expanded polystyrene may be used as a heat-insulating material.

[0029] Insulating linings may be fixed onto surfaces of adjacent modules by gluing.

[0030] The combination of essential features and the technical result claimed has the following cause-and-effect relationship.

[0031] An embodiment of the structural module comprising a bearing element, a heat-insulating layer, a reinforcing

layer and a facade layer allows simplifying the construction of residential and public buildings and, consequently, reducing their costs as well as increasing their heat-insulating properties by forming the necessary heat-insulating layer and facade layer that performs protective and decorative functions, when modules are mounted.

[0032] Providing the structural module with the means to insulate and waterproof building walls further improves the reliability of the overall wall structure in a building so constructed since integrity of the bearing structure may be compromised when walls constructed are faced with heat-insulating and waterproof layers.

[0033] An embodiment comprising the heat-insulating layer, the reinforcing layer and the facade layer with an indention L from an edge of the bearing wall element along its perimeter allows providing a surface, where the module may be caught with special means. The embodiment having an indention L within 100...250 mm from an edge of the bearing wall element and an edge of the heat-insulating layer, the reinforced layer and the facade layer allows forming a surface whereon means for sealing joints between adjacent modules, when mounted, may be fixed, which may include insulating linings, fixed on surfaces of the modules. The range of indentions within 100...250 mm was defined by the inventor bearing in mind the convenience of mounting building blocks followed by sealing of joints between thereof.

[0034] Further, the inventor empirically determined thickness of the heat-insulating layer that provides thermal conductivity of the structural module within k = 2.9...3.5 W/m^2K. These parameters of thermal conductivity are optimal in terms of ensuring heat-conducting properties in the structural module in terms of the requirements of applicable regulations, such as DBN B.2.6-31: 2006 "Heat Insulation of Buildings" and do not require equipping the structural module with additional heat-insulating layers or applying an additional coating with improved thermal insulation qualities etc. on the facade surface. The inventor further conducted a series of studies to identify optimal thickness of the heat-insulating layer made of expanded polystyrene and the facade layer to ensure the building module features the above parameters of thermal conductivity with due consideration of thermal conductivity of other elements, such as the bearing element made, preferably, of reinforced concrete. Studies were carried out according to DSTU B V.2.7-105-2000 for temperate continental climate conditions. The structural module, as used in the studies, comprised a bearing element of reinforced concrete 160 mm thick. The facade layer was made of clinker tiles and reinforced with a fiberglass grid. The results of the studies are presented in Table 1 and Table 2 below.

Table 1.

Thermal conductivity of the building module vs. thickness of the heat-insulating layer	
Thickness of heat-insulating layer, mm	Thermal conductivity coefficient of the structural module, W/m^2K
20	4.5
30	4.0
40	3.5
50	3.4
60	3.3
70	3.2
80	3.1
100	3.0
120	3.0
140	2.9
160	2.9
180	2.8
200	2.8

Table 2.

Thermal conductivity of the building module vs. thickness of the facade layer	
Thickness of facade layer, mm	Thermal conductivity coefficient of the structural module, W/m^2K
20	4.5
30	4.0

(continued)

Thermal conductivity of the building module vs. thickness of the facade layer	
Thickness of facade layer, mm	Thermal conductivity coefficient of the structural module, W/m^2K
40	3.8
50	3.5
60	3.3
70	3.2
80	3.1
100	3.0
120	3.0
140	2.9
150	2.9
170	2.8
200	2.8

[0035] The inventor has surprisingly found out during the studies that the embodiment of the structural module having the facade layer 50...150 mm thickness and the heat-insulating layer 40...160 mm thickness allows providing thermal conductivity of the structural module within k = 2.9...3.5 W/m^2K as required for operation of buildings in a fairly wide range of environmental conditions, particularly, close to continental, and no further insulation of building walls is required. This finding may be explained by a synergistic effect of using the heat-insulating layer made of expanded polystyrene of defined thickness and the facade layer of defined thickness which, when used together with preferably reinforced concrete base, provide the required parameters of thermal conductivity of the structural module within the above range.

[0036] The use of expanded polystyrene for the heat-insulating layer is preferred since it is relatively light-weighted and environmentally friendly and has excellent sound insulation due to its porous structure. Further, building items, particularly, structural modules preferably use modified expanded polystyrene with addition of flame retardants etc. providing significant reduction in fire safety when used in the structural module. Further, expanded polystyrene is resistant to various microorganisms and factors such as low temperature and high humidity. It is readily workable and deservedly considered a durable and strong material. All the above factors allow improving safety, heat resistance, durability and manufacturability of the structural module.

[0037] Further, providing the facade layer with both the decorative and protective functions, in particular, waterproofness and resistance to thermal conductivity as well as higher parameters of strength, in particular, wear resistance and temperature stability, improves overall heat resistance of the structural module and provides hydrophobicity, so required. In particular, clinker tiles, as a material for the facade layer, meet the above requirements with its low thermal conductivity, high hydrophobicity and resistance to abrasion. Being environmentally friendly and having many decorative options, this material further simplifies the construction technology of the structural module. Further, clinker tiles may have a special base.

[0038] An embodiment of the reinforcing layer having shear strength of at least 0.8 MPa when coupled with the facade layer allows improving reliability of the facade layer, so formed over the entire plane, especially when the facade layer features sufficiently high thickness and loads onto the outer surface of the facade layer are possible due to extreme weather conditions (snow, etc.) and thus increasing the life of the structural module.

[0039] Providing window units and/or door units and/or balconies and/or hanged elements on the facade module allows simplifying construction of building structures using such modules.

[0040] Also, using protruding decorative elements located on the outer surface of the facade layer further simplifies construction of building structures and, at the same time, increases aesthetic requirements to the exterior of buildings that is of prime importance residential housing.

[0041] The use of decorative elements fixed at sites where window units and/or door units and/or balcony and/or hanged elements are located allow providing additional waterproofing and thermal insulation of joints between the facade layer or the heat-insulating layer of the module and window units and/or door units and/or balcony and/or hanged elements, so to enhance the above parameters of the building as a whole.

[0042] Fixing decorative elements onto the bearing wall element using an adhesive mixture may improve manufacturability of the structural module, enhance reliability of its fastening and further improve waterproofing of joints between

window units and/or door units and/or balcony and/or hanged elements and elements of the structural module.

[0043] Making decorative elements from reinforced expanded polystyrene allows improving their reliability and resistance to external conditions while a building is in operation.

[0044] According to the invention, the heat-insulating layer, the reinforcing layer and the facade layer are made, so that there is an indention from an edge of the bearing wall element with width of indention L from the edge of the bearing wall element and the edge of the heat-insulating layer, the reinforced layer and the facade layer within 100...250 mm. This forms a space between heat-insulating layers of adjacent modules to ensure access to coupling elements to fasten modules to each other during mounting and to provide an option of applying a protective coating on coupling elements and sealing joints between bearing elements of adjacent structural modules. These steps are followed by filling a gap between heat-insulating layers of adjacent modules with a heat-insulating material, so to form continuous heat-insulating surface for a wall of a building comprising heat-insulating layers and linings of the heat-insulating material between them. Further sealing of joints between heat-insulating layers of modules and inserts of heat-insulating material may improve waterproof properties of the building. Further use of insulating linings allows forming the facade coupled with the facade layer of structural modules. Coupling of insulating linings with the surface of modules, in particular by gluing, provides durability of the facade, so formed and improves its hydrophobic properties. Further mechanical fastening of insulating linings onto the bearing wall element of the module allows improving the strength of fastening. Thus, insulating linings play the role of a protective element for joints between modules, so the requirements to waterproofing of joints become simpler, and the role of a decorative element forming the facade of the building. This simplifies mounting of modules during construction of buildings and improves heat-insulating and hydrophobic properties of walls in the building thus constructed. An embodiment of insulating linings being at least 5% wider the gap between heat-insulating layers of adjacent modules allows an insulating lining to overlap the surface of the heat-insulating insertion, and achieves better protection of joints between modules and easier mounting.

[0045] Using protruding architectural decorative elements as insulating linings allows improving aesthetic requirements to the facade of the building.

[0046] An embodiment of architectural decorative elements in the form of horizontal or vertical structures made of reinforced expanded polystyrene allow enhancing strength of insulating linings and, consequently, reliability of protection of joints between modules and, at the same time, reducing weight of the module and simplifying the technology of its manufacture. It also allows combining these additional decorative elements with protruding decorative elements, fixed at sites, where window units and/or door units and/or balcony and/or hanged elements are located on the structural module and increasing decorative properties of the facade of the building.

[0047] Using the structural module having the heat-insulating, the reinforcing and the facade layer made so that there is an indention from an edge of the bearing wall element allows ensuring mounting of bearing elements together and forming a single heat-insulating and facade layer in the building, indicating an association of a group of inventions, specifically, the structural module and the method of mounting of such building modules by a single inventive concept.

[0048] The invention claimed is illustrated by the following exemplary embodiment of the structural module and the method of mounting of such structural modules and by the following drawings:

- Fig. 1 shows a front view of the structural module,
- Fig. 2 shows a side view of the structural module,
- Fig. 3 shows a vertical view of the area of coupling of two adjacent modules when mounted during construction of a building (Position 12 shows an internal wall panel).

[0049] Figurative materials that illustrate the invention claimed as well as a particular embodiment of the structural module with the facade layer are merely exemplary in nature and are in no way intended to limit the claims appended hereto, but to explain the essence of the invention.

[0050] The structural module comprises a bearing wall element 1, a heat-insulating layer 2, a reinforcing layer 3 and a facade layer 4. The bearing wall element 1 is made preferably of reinforced concrete in a form of a rectangular parallelepiped.

[0051] The heat-insulating layer 2, the reinforcing layer 3 and the facade layer 4 are made, so that there is an indention L from an edge of the bearing wall element 1. Width of the indention L from an edge of the bearing wall element 1 and an edge of the heat-insulating layer 2, the reinforcing layer 3 and the facade layer 4 is within 100...250 mm. Thickness of the heat-insulating layer 2 may be within 40...160 mm, e.g. 100 mm. When coupled with the facade layer 4, the reinforcing layer 3 has shear strength of at least 0.8 MPa. Thickness of the facade layer 4 is within 50... 150 mm, e.g. 50 mm. Thickness of the heat-insulating layer 2 provides thermal conductivity of the structural module within k=2.9...3.5 W/m^2K. The facade layer may be made using clinker tiles fixed on its external surface. The external surface of the facade layer of the module may be equipped with both clinker facing tiles and natural stone, decorative mixtures etc. The structural module comprises window units and door units 5 mounted and protruding decorative elements 6 fixed thereon. Decorative elements 6 are fixed at sites where window units and door units 5 are located along their perimeter. Decorative

elements 6 are made of reinforced expanded polystyrene and fastened to the bearing wall element 1 using an adhesive mixture. The internal surface of the bearing element (not shown) may be decorated with a primer and have openings, made to locate electric elements, and inner slopes along windows or doors.

[0052] The structural module may be produced by forming the bearing element by making a spatial reinforced frame and placing it into a form together with coupling elements to mount modules followed by pouring concrete to obtain a reinforced concrete bearing element after hardening. The bearing element, so formed is then cleaned and primed, and window and/or door units are then mounted. The heat-insulating and reinforcing layers are then formed on the bearing element by adding an adhesive mixture and a fiber grid to expanded polystyrene to reinforce the structure with a fiberglass grid. Further, the facade layer is formed, e.g., using clinker tiles to be glued to the heat-insulating layer.

[0053] The method of mounting building modules according to the design disclosed above is implemented as follows:

First, bearing wall elements 1 having the heat-insulating layer 2, the reinforcing layer 3 and the facade layer 4 are mounted, fixed and fastened to each other with coupling elements. Any method of mounting structural modules known in the art, e.g. with embedded elements 7 located on side surfaces of the module and coupled to each other by welding, may be used as coupling elements. Coupling elements are then coated with a protective coating to prevent corrosion processes. Joints between bearing elements 1 of adjacent building modules are then sealed by isolating joints, inserting special linings and applying a special sealing compound or self-adhesive tape. The gap 8 between heat-insuring layers 2 of adjacent modules is then filled with a heat-insuring material. Filling with the heat-insuring material may be carried out by placing an expanded polystyrene insertion 9 in the gap 8. The insertion 9 is made, so that its geometric dimensions in section (length and width) correspond to those of the gap 8, and its length corresponds to a height of the structural module. Further, additional sealing of joints between side surfaces of insertion 9 and the respective side surfaces of heat-insulating layers may be carried out by the method disclosed above followed by fastening insulating linings 10 onto the surface of modules by gluing them to the surface of the heat-insulating layer 2 of each adjacent structural modules and by mechanical fastening to the bearing wall element of the module 1 (to reinforced concrete element). Protruding architectural decorative elements, such as horizontal or vertical structures made of reinforced expanded polystyrene, may be used as insulating linings 10. Width B_1 of insulating linings must be at least 5 % bigger than width B_2 of the gap between heat-insulating layers of adjacent modules. For example, when the gap 8 is 400 mm wide, the lining 10 must be at least 440 mm, e.g. 500 mm. To glue decorative insulating linings 10, a multifunctional cement-based adhesive mixture and the like may be used. Concrete nails 11 placed at certain intervals along the insulating lining 10 may be used as a mechanical fastener. For protruding decorative elements 6 and insulating linings 10, polystyrene may be reinforced with a fiberglass grid when respective elements are manufactured. For horizontal insulating linings 10 additional protection with a cornice placed on the top along the linings may be used when building modules are mounted. Decorative elements 6 and insulating linings 10 may have a coating layer of a facade textured putty and paint.

[0054] Thus, this invention provides the structural module comprising the bearing element, the heat-insulating layer, the reinforced layer and the facade layer having improved heat-insulating, hydrophobic and strength parameters and easier mounting in the construction of buildings with structural modules of the design claimed above and increases hydrophobic properties of the entire building.

Claims

1. A structural module comprising a bearing wall, preferably, reinforced concrete element having, preferably, the form of a rectangular parallelepiped, a heat-insulating layer, a reinforcing layer, and a facade layer, ***wherein*** the heat-insulating layer, the reinforcing layer and the facade layer are made, so that there is an indention from an edge of the bearing wall element and width of indention L from an edge of the bearing wall element and an edge of the heat-insulating layer, the reinforced layer and the facade layer is within 100...250 mm, thickness of the heat-insulating layer and facade layer provides thermal conductivity of the structural module within k = 2.9...3.5 W/m^2K, and the reinforcing layer has shear strength of at least 0.8 MPa when coupled with the facade layer.

2. The building module of claim 1, ***wherein*** thickness of the facade layer is within 50...150 mm.

3. The structural module of claim 1, ***wherein*** thickness of the heat-insulating layer is within 40...160 mm.

4. The structural module of claim 1, ***wherein*** the facade layer is made using clinker tiles.

5. The structural module of claim 1, ***wherein*** window units and/or door units and/or balcony and/or hanged elements

are mounted.

6. The structural module of claim 1, ***wherein*** the structural module further comprises protruding decorative elements mounted.

7. The structural module of claims 5 and 6, ***wherein*** decorative elements are fixed at sites where window units and/or door units and/or balcony and/or hanged elements are mounted.

8. The structural module of claims 5 and 6, ***wherein*** decorative elements are fixed to the bearing wall element using an adhesive mixture.

9. The structural module of claims 5-8, ***wherein*** decorative elements are made of reinforced expanded polystyrene.

10. A method of mounting structural modules of claim 1 comprising installation, fixing and fastening of bearing wall elements having heat-insulating, reinforcing and facade layers to each other with coupling elements, application of a protective coating on coupling elements and sealing of joints between bearing elements of adjacent structural modules, ***wherein*** a gap between heat-insulating layers of adjacent modules is filled with a heat-insulating material, followed by sealing of joints between the heat-insulating material and surfaces of structural modules, followed by fixing insulating linings onto the surface of modules and mechanical fastening thereof to the bearing wall element of the module, so that insulating linings are at least 5 % wider the gap between heat-insulating layers of adjacent modules.

11. The method of mounting structural modules of claim 10, ***wherein*** protruding architectural decorative elements are used as insulating linings.

12. The method of mounting structural modules of claim 10, ***wherein*** horizontal or vertical structures made of expanded polystyrene are used as architectural decorative elements.

13. The method of mounting structural modules of claim 10, ***wherein*** expanded polystyrene is used as the heat-insulating material.

14. The method of mounting structural modules of claim 10, ***wherein*** insulating linings are coupled to surfaces of adjacent modules by gluing.

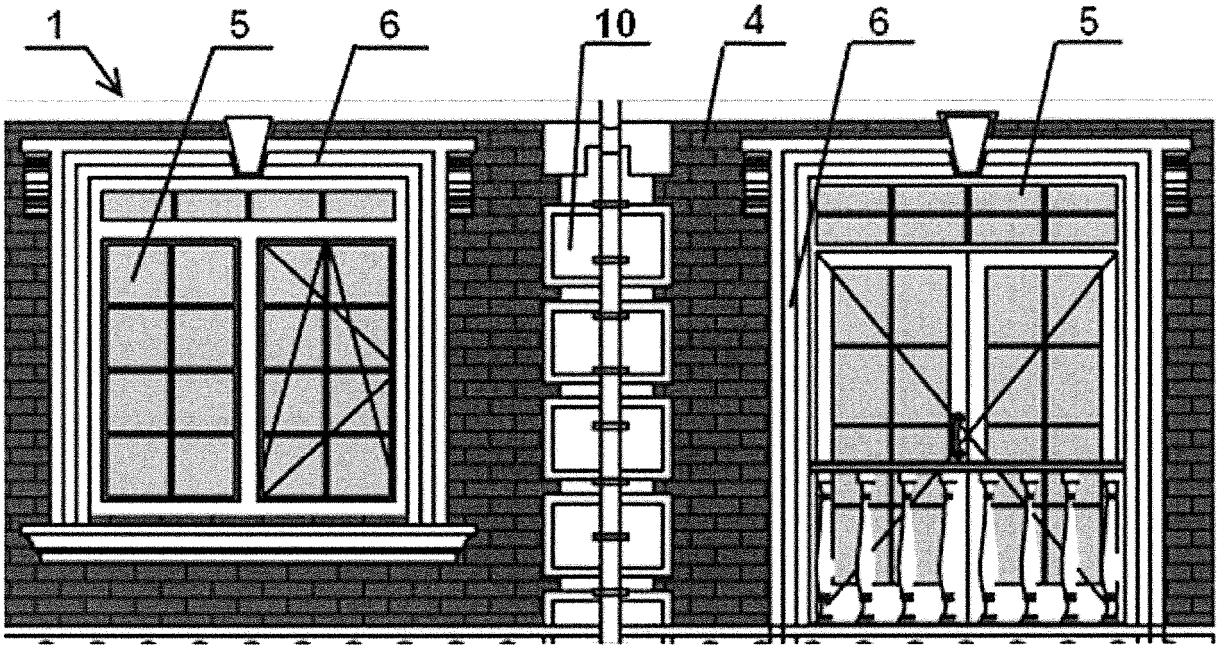

Fig. 1

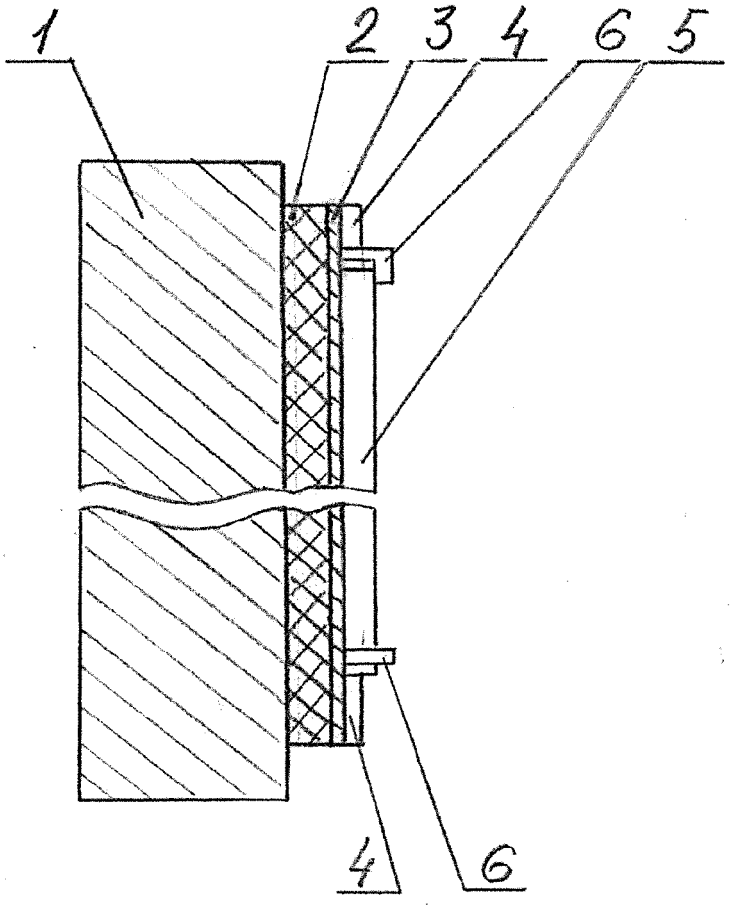

Fig. 2

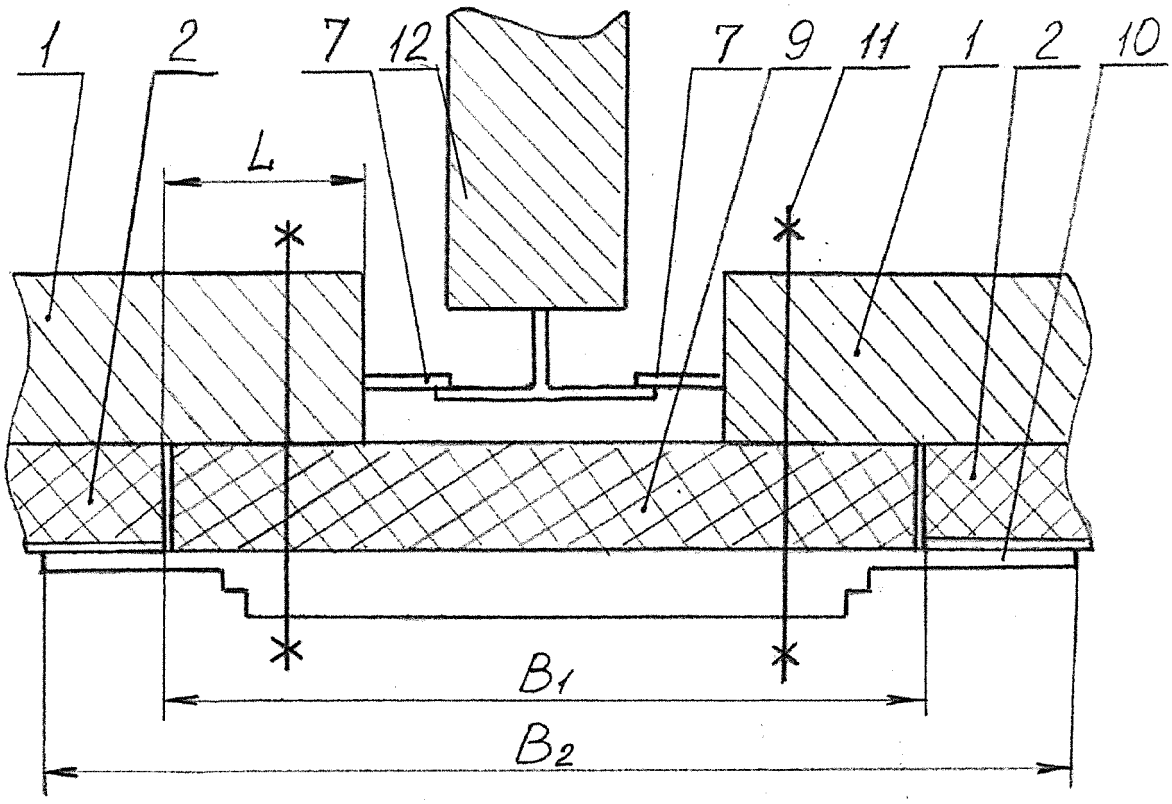

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 16 15 6124

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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E04B
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E04F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 July 2016	Fournier, Thomas

CATEGORY OF CITED DOCUMENTS

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