

(12) STANDARD PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. **AU 2013362686 B2**

(54) Title
Flow-guide-type foamed structure and prefab composite wall panel, and preparation method thereof

(51) International Patent Classification(s)
E04C 2/38 (2006.01) **B32B 37/02** (2006.01)
B32B 3/22 (2006.01) **E04C 2/284** (2006.01)
B32B 27/40 (2006.01) **E04C 2/34** (2006.01)

(21) Application No: **2013362686** (22) Date of Filing: **2013.03.18**

(87) WIPO No: **WO14/094343**

(30) Priority Data

| | | |
|-----------------------|-------------------|--------------|
| (31) Number | (32) Date | (33) Country |
| 201210549758.1 | 2012.12.17 | CN |

(43) Publication Date: **2014.06.26**

(44) Accepted Journal Date: **2016.11.17**

(71) Applicant(s)
Shenyang Yuanda Science and Technology Park Co., Ltd.

(72) Inventor(s)
Kang, Baohua;Shao, Feng;Liang, Guocheng;Zhao, Lianfang

(74) Agent / Attorney
FB Rice, Level 23 44 Market Street, Sydney, NSW, 2000

(56) Related Art
CN 201730236 U
CN 2515327 Y

(12) 按照专利合作条约所公布的国际申请

(19) 世界知识产权组织
国际局

(43) 国际公布日
2014年6月26日 (26.06.2014)



(10) 国际公布号
WO 2014/094343 A1

- (51) 国际专利分类号:
E04C 2/38 (2006.01) B32B 3/22 (2006.01)
E04C 2/284 (2006.01) B32B 27/40 (2006.01)
E04C 2/34 (2006.01) B32B 37/02 (2006.01)
- (21) 国际申请号: PCT/CN2013/000308
- (22) 国际申请日: 2013年3月18日 (18.03.2013)
- (25) 申请语言: 中文
- (26) 公布语言: 中文
- (30) 优先权:
201210549758.1 2012年12月17日 (17.12.2012) CN
- (71) 申请人: 沈阳瑞福工业住宅有限公司 (SHENYANG THRIVE INDUSTRIALIZED HOUSING CO., LTD.) [CN/CN]; 中国辽宁省沈阳市经济技术开发区十六号街6号, Liaoning 110027 (CN)。
- (72) 发明人: 康宝华 (KANG, Baohua); 中国辽宁省沈阳市经济技术开发区十六号街6号, Liaoning 110027

(CN)。邵峰 (SHAO, Feng); 中国辽宁省沈阳市经济技术开发区十六号街6号, Liaoning 110027 (CN)。梁国成 (LIANG, Guocheng); 中国辽宁省沈阳市经济技术开发区十六号街6号, Liaoning 110027 (CN)。赵连方 (ZHAO, Lianfang); 中国辽宁省沈阳市经济技术开发区十六号街6号, Liaoning 110027 (CN)。

(74) 代理人: 沈阳晨创科技专利代理有限责任公司 (SHENYANG CHENCHUANG TECHNICAL PATENT AGENT LTD); 中国辽宁省沈阳市浑南新区沈营路3号瑞宝国际花苑2号楼1单元5-1室, Liaoning 110013 (CN)。

(81) 指定国 (除另有指明, 要求每一种可提供的国家保护): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY,

[见续页]

(54) Title: FLOW-GUIDE-TYPE FOAMED STRUCTURE AND PREFAB COMPOSITE WALL PANEL, AND PREPARATION METHOD THEREOF

(54) 发明名称: 一种导流式发泡结构和预制件复合墙板及其制备方法

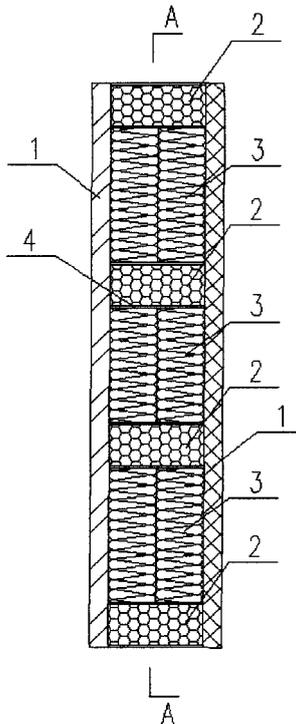


图1 / FIG.1

(57) Abstract: Disclosed are a flow-guide-type foamed structure and a prefab composite wall panel, and a preparation method thereof, wherein the composite wall panel is formed of foamed structures (2), prefabs (3), a flow-guide frame (4) and a face panel (1). The flow-guide frame (4) is a plate-like structure, a plate face of which is arranged perpendicular to the panel (1). The entire composite wall panel is divided into multiple unit blocks of foamed structure (2) or prefab (3) by means of the flow-guide frame (4). The flow-guide frame (4) is located between the foamed structures (2) and the prefabs (3) and/or along an outer edge of the entire composite wall panel. There are two panels (1), and the prefabs (3) have a maximum value of 75% of the total area of the cross section. The prefabs (3) are pieces of sound-proofing and heat-insulating plate-like material containing air, the thickness thereof is 50 mm-100 mm and the unit weight thereof is 30 kg/m³-150 kg/m³. The composite wall panel has properties such as heat-insulation, sound-insulation, light weight, and high strength, and has a simple structure.

(57) 摘要: 一种导流式发泡结构和预制件复合墙板及其制备方法, 其中的复合墙板由发泡结构(2)、预制件(3)、导流框架(4)和面板(1)构成; 导流框架(4)为板状结构, 其板面垂直于面板(1)布置; 整个复合墙板通过导流框架(4)分割成多个单元块: 发泡结构(2)或预制件(3); 导流框架(4)位于发泡结构(2)和预制件(3)之间和/或整个复合墙板的外边沿; 面板(1)为两块, 预制件(3)在横截面总面积中最大值为75%; 预制件(3)为内含空气的隔音、保温板状材料件, 其厚度50mm-100mm, 容重30kg/m³-150kg/m³。该复合墙板具有保温、隔音、轻质、高强度等性能, 且结构简单。

WO 2014/094343 A1



MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW。

RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)。

(84) **指定国** (除另有指明, 要求每一种可提供的地区保护): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), 欧亚 (AM, AZ, BY, KG, KZ, RU, TJ, TM), 欧洲 (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT,

根据细则 4.17 的声明:

— 发明人资格(细则 4.17(iv))

本国际公布:

— 包括国际检索报告(条约第 21 条(3))。

Flow-guide-type formed structure and prefab composite wall panel,
and preparation method thereof

Technical Field

5 The present disclosure relates to the technical field of building wall board structure design and its application, particularly provides a flow-guide-type composite wall board comprising foamed structure and prefabricated parts, and manufacture method thereof.

Background art

10 With the rapid development of construction industry, it is an important development direction of green building boards to achieve fast assembling, highly efficient heat insulation, sound insulation and fire protection. However, most of conventional building composite wall boards adopt single core materials. At present, with one single core material, the comprehensive performance of heat insulation, sound insulation, light weight and high strength etc. cannot be
15 well achieved. In addition, the manufacture processes of conventional composite wall boards are generally complex, heavy in labor-intensity, demanding on environmental and climatic conditions when constructing and installing, prone to form dust resulting in environmental pollutions.

20 Throughout this specification the word "comprise", or variations such as "comprises" or "comprising" will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

Summary

25 In order to address the above-mentioned deficiencies in the prior art, there is provided a flow-guide-type composite wall board comprising foamed structure and prefabricated parts, which has an advantageous technical effect, and manufacturing method thereof.

30 It is desirable to solve the problem of building wall boards in the prior art which cannot simultaneously satisfy the good properties of heat insulation, sound insulation, light weight, high strength etc. Specifically, the present disclosure provides a flow-guide-type composite wall board comprising foamed structure and prefabricated parts, and manufacture method thereof. Said wall boards are simple in structure and manufacture process.

5 Some embodiments relate to a flow-guide-type composite wall board comprising a foamed structure, prefabricated parts, a flow-guide frame and face panels, wherein: the flow-guide frame is a plate-like structure, a plate face of which is arranged perpendicularly to the face panels; the flow-guide-type composite wall board, as a whole, is divided into multiple cell blocks by the flow-guide frame; every cell block is specifically a foamed structure or a prefabricated part; the flow-guide-frame is located between the foamed structure and the prefabricated parts and along the circumference of the whole flow-guide-type composite wall board; the number of the face panels is two, an entire internal space enclosed together by the flow-guide frame and two pieces of face panels is divided into multiple cell blocks by the flow-guide frame arranged in an interior of the face panel; and an opening for introducing the foaming material is located on an outermost connected cell block close to the flow-guide frame arranged at the circumference of the face panel; the flow-guide-type composite wall board being manufactured by: installing the flow-guide frame pre-filled with the prefabricated parts between the two face panels, and fixing with clamping fixtures; then, injecting foaming material into the flow-guide-type composite wall board through the opening, wherein the material of said foaming material comprises polyurethane; after the injection is finished, the polyurethane foaming material expands gradually along the flow-guide frame and fills the internal space of the flow-guide frame; after the polyurethane foaming material is aged for 20-30 minutes to form a foamed structure, said foamed structure bonds the face panels and the flow-guide frame together; on the cross-section of the plate face at which the whole flow-guide-type composite wall board is located, the maximum cross sectional area of prefabricated parts is 75% of the total cross sectional area; specifically, the prefabricated parts are sound-insulating and heat-insulating plate-like components which contain air, the thickness thereof is 50 mm-100 mm, the unit weight thereof is 30 kg/m^3 - 150 kg/m^3 .

15
20
25 The maximum cross sectional area of prefabricated parts being 75% of the total cross sectional area ensures that the comprehensive performance indexes of heat insulation and sound insulation of the composite wall board satisfy the relevant construction standards for building. Additionally, it should be emphasized that, when the cross sectional area of the prefabricated parts is greater than 75%, the adhesion area by foaming is lower than 25% of the total cross sectional area of the face panel, so that the adhesion by foaming will not be firm.

30 According to the present disclosure, said flow-guide-type composite wall board comprising foamed structure and prefabricated parts may further meet the following requirements:

35 the material of prefabricated parts may be one of the following materials: rock wool board, centrifugal glass wool board, perlite board, aluminum silicate wool board, and foamed cement board;

when the material of prefabricated parts is rock wool board, the thickness thereof is 50mm-100mm, and the unit weight thereof is 40 kg/m^3 - 80 kg/m^3 .

The structural shape of the foamed structure may satisfy one of the following requirements or may be a shape formed by some combination thereof in the longitudinal or transverse

directions: □-shaped structure, ▤-shaped structure, ▥-shaped structure, ▦-shaped structure, and triangular structure, that is, said composite wall board comprising foamed structure and prefabricated parts can be a combination of any structure units, and the size of structure unit can be set arbitrarily based on practical requirements. At the same time, the
5 specific structural shape of each structural unit can be: □-shaped structure, ▤-shaped structure, ▥-shaped structure, ▦-shaped structure, and triangular structure.

The material of said foamed structure may be polyurethane foam.

The material of said flow-guide frame may comprise any one or more of: light steel sheet, PVC or other materials that can achieve the purpose of flow guiding.

- 10 Some embodiments relate to a method for manufacturing flow-guide-type composite wall board comprising foamed structure and prefabricated parts, characterized in that the requirements of said manufacturing method are as follows in sequence:

15 first, laying a piece of face panel, arranging the flow-guide frame at the circumference of and in the interior of the face panel in accordance with design requirements, wherein the flow-guide frame is a plate-like structure, the plate face of which is arranged perpendicularly to the face panel; the flow-guide frame arranged at the circumference of the face panel is a continuously annular structure;

20 then, filling the prefabricated parts in the space of the assembled cell blocks divided and reserved by the flow-guide frame arranged in the interior of the face panel; on the cross-section of the plate face at which the whole flow-guide-type composite wall board comprising foamed structure and prefabricated parts is located, the maximum cross sectional area of prefabricated parts is 75% of the total cross sectional area. When the cross sectional area of the prefabricated parts is greater than 75%, the adhesion area by foaming is lower than 25% of the total cross sectional area of the face panel, which makes that the adhesion by
25 foaming is not firm; the height of the filled prefabricated parts 3 is not higher than the height of the flow-guide frame 4 to ensure that the inner face panel and the outer face panel can be bonded tightly with the flow-guide frame 4 when they are combined;

30 then, laying another piece of the face panel; so far, the entire internal space enclosed together by the flow-guide frame and two pieces of face panels is divided into multiple cell blocks, by the flow-guide frame arranged in the interior of the face panels; and on the connected chamber close to the flow-guide frame arranged at the circumference of the face panel, setting an opening for introducing the foaming material;

then, fixing, with clamping fixtures, the whole set which has been installed with the flow-guide frame and pre-filled with the prefabricated parts between two pieces of face panels;

then, introducing the foaming material through opening for introducing the foaming material, wherein the requirements of the introducing are: the reaction temperature being 40-50°C, the foam density being 37-44 kg/m³, and calculating the injection time under the injection speed of 1.5-2 L/second according to the volume of the foamed polyurethane inside the board; performing the introducing operation by injecting foaming material into the board; after the injection is finished, the foaming material expanding gradually and filling the internal space of the flow-guide frame; after aging the polyurethane foaming material for 20-30 minutes, the foamed structure bonds the face panels and the flow-guide frame together;

then, cleaning the polyurethane foaming material overflown from the vent holes and the opening for introducing the foaming material;

then, removing the clamping fixtures to obtain the flow-guide-type composite wall board comprising foamed structure and prefabricated parts.

5 In an embodiment, when the foam density is lower than 37 kg/m^3 , the heat insulation effect of the composite board as a whole cannot satisfy the requirements; when foam density is higher than 44 kg/m^3 , the sound insulation performance of the composite board is unsatisfactory and uneconomical.

10 In an embodiment, when the injection speed is lower than 1.5 L/second, it is not easy for the polyurethane foam being injected into the inside of the board to fill into the interior of the board; when the injection speed is higher than 2 L/second, the injection time is difficult to be controlled.

In some embodiments, the foaming material expands gradually along the flow-guide frame.

In an embodiment, when there is a small amount of polyurethane foam overflowing from all the vent holes around the board, this shows that polyurethane foam has filled the internal chambers of the composite board.

15 Said method for manufacturing a flow-guide-type composite wall board comprising foamed structure and prefabricated parts, characterized in that:

20 the material of flow-guide frame is specifically light steel sheet, PVC or other materials that can achieve the purpose of flow guiding; examples of said other materials include the following: metallic and non-metallic materials such as [-shaped steel, wood frame, bamboo frame, wood-plastic composite frame, aluminum alloy profile;

the material of the foamed structure may specifically be polyurethane foam, the finished product thereof having a density of $37\text{-}44 \text{ kg/m}^3$; the structure shape of the finished product of the foamed structure satisfies one of the following requirements or a shape formed by a combination thereof in the longitudinal or transverse directions: -shaped structure,

25 -shaped structure, -shaped structure, -shaped structure, and triangular structure, that is, said composite wall board comprising foamed structure and prefabricated parts can be a combination of any structure units, the size of structure unit can be set arbitrarily based on practical requirements. At the same time, the specific structural shape of each structural unit can be -shaped structure, -shaped structure, -shaped structure, -shaped structure, and triangular structure;

30 the material of said foamed structure is polyurethane foam;

said prefabricated parts may specifically be rock wool board, the thickness thereof may be 50mm-100mm, and the unit weight thereof is $40 \text{ kg/m}^3\text{-}80 \text{ kg/m}^3$. Said prefabricated parts may

specifically be sound-insulating and heat-insulating plate-like components which contain air, such as rock wool board, centrifugal glass wool board, perlite board, aluminum silicate wool board, and foamed cement board. The preferred combination in said flow-guide-type composite wall board comprising foamed structure and prefabricated parts according to the present invention is: outer face panel + polyurethane foam + rock wool + flow-guide frame + inner face panel;

one of the following light boards may be adopted as each of the face panel: cement fiber board and/or magnesium oxide board, clay board, fiber cement board, calcium silicate board, gypsum board, ETERPAN board, glass, fiber glass reinforced plastics board, thin ceramic tiles, acrylic sheet, sunlight panel, polycarbonate endurance panel, honeycomb panel, wood panel, thin stone panel, stainless steel sheet, aluminum single panel, aluminum composite panel, copper composite panel, steel sheet, copper sheet, titanium alloy panel, color steel panel, aluminum zinc alloy panel.

More preferably, cement fiberboard or magnesium oxide board is adopted as the face panel 1. According to architectural requirements, the inner face panel is located inside the building wall, the outer face panel is located outside the building wall. The material and thickness of the inner face panel and the outer face panel can be selected respectively according to practical requirements to achieve optimal comprehensive performance requirements.

Said prefabricated parts may specifically be sound-insulating and heat-insulating plate-like components which contain air, specifically, the materials of which are any one of the following materials or any combination thereof: rock wool board, centrifugal glass wool board, perlite board, aluminum silicate wool board, foamed cement board, etc., preferably, cement fiberboard + polyurethane foam + rock wool + flow-guide frame + magnesium oxide panel.

In the present invention, the term "plate face" refers to the two largest surfaces of a plate-like structural member, and the rest surfaces except the two largest surfaces are side surfaces of plate-like structural member in thickness direction.

The manufacture method of the flow-guide-type composite wall board comprising foamed structure and prefabricated parts comprises: as shown in Fig. 3, for example, C-shaped light steel keel 401 used as a flow-guide frame 4 is processed into four pieces of frame borders each with 45° angle at both ends. The frame borders are divided into upper horizontal frame border, lower horizontal frame border, left vertical frame border, and right vertical frame border, the four frame borders are connected from head to tail in order, and the junction of the four frame borders is mechanically connected using L-shaped bracket joint of galvanized steel and fastener 403; four prefabricated rectangular light steel sheets 402 with connection flange are attached by fasteners 403 to the frame borders of light steel keel to compose light steel keel flow-guide frame. The shape of the flow-guide frame 4 of the light steel keel is not limited to the rectangle in Fig.3, it can be manufactured into various shapes according to practical requirements of building, such as diamond, triangle.

The advantages and positive effects of the present invention are: as compared with the prior art, the core material filled in the wall board of the present invention can consist of polyurethane foaming layer and prefabricated parts embedded with rock wool boards, which combines the advantages of both, not only significantly improving heat insulation and sound insulation properties of the board, but also taking into account the light weight and high structural strength of the board per se. The wall board of the present invention can better meet the relevant standards and requirements of building construction and achieve good performance indexes and has high performance-price ratio, which is simple in structure and relatively easy to manufacture, and has predictable great economic and social value.

Brief description of the drawings

Figure 1: one of structural schematic diagram of the composite wall board comprising foamed and prefabricated parts (a sectional view of the cross section of the plate face)

Figure 2: A-A sectional view of Figure 1;

Figure 3: a structural diagram of light steel keel flow-guide frame;

Figure 4: the second structural schematic diagram of the composite wall board comprising foamed and prefabricated parts;

Figure 5: B-B sectional view of Figure 4;

Figure 6: the third structural schematic diagram of the composite wall board comprising foamed and prefabricated parts;

Figure 7: C-C sectional view of Figure 6;

Figure 8: a schematic diagram of the manufacture process of the composite wall board.

Embodiments

In Figure 3, the numbers have following meanings: 401 denotes light steel keel frame border, 402 denotes light steel sheet, 403 denotes fasteners. In Figure 8, the numbers have following meanings: 801 denotes clamping fixture, 802 denotes the whole set of composite wall board after assembly and before injection of foaming material, 803 denotes vent hole for foaming, 804 denotes the opening for introducing the forming material, 805 denotes injection gun of foam.

Example 1

A flow-guide-type composite wall board comprising foamed structure and prefabricated parts consisting of a foamed structures 2, prefabricated parts 3, a flow-guide frame 4 and face panels 1, wherein:

5 the flow-guide frame 4 was a plate-like structure, the plate face of which was arranged perpendicularly to the face panel 1; the flow-guide-type composite wall board comprising foamed structures and prefabricated parts, as a whole, was divided into multiple cell blocks by the flow-guide frame 4; every cell block was specifically a foamed structure 2 or a prefabricated part 3; the flow-guide-frame 4 was located between the foamed structure 2 and the prefabricated parts 3 and/or along the circumference of the whole flow-guide-type composite wall board comprising foamed structure and prefabricated parts; the number of the face panels 1 is two.

10 On the cross-section of the plate face at which the entire flow-guide-type composite wall board comprising foamed structure and prefabricated parts was located, the cross sectional area of prefabricated parts 3 occupied 65% of the total cross sectional area to ensure that the comprehensive performance indexes of heat insulation and sound insulation of the composite wall board satisfied the relevant construction standards for building, and simultaneously ensure enough adhesive area by foaming to ensure firmness of adhesion by foaming.

15 The prefabricated parts 3 were specifically sound-insulating and heat-insulating plate-like components which contain air. The material of prefabricated parts 3 was rock wool board, the thickness thereof was 50 mm-100 mm, the unit weight thereof was 40 kg/m³-80 kg/m³.

20 The structure shape of foamed structure 2 was a shape formed by combining two -shaped structure in the transverse direction, the material of said foamed structure 2 was polyurethane foam.

The material of said flow-guide frame 4 was specifically light steel sheet or PVC.

25 The example also related to the method for manufacturing the flow-guide-type composite wall board comprising foamed structure and prefabricated parts, the requirements of said manufacturing method were as follows in sequence:

30 first, a piece of face panel 1 was laid, and a flow-guide frame 4 was arranged at the circumference of and in the interior of the face panel 1 in accordance with design requirements, the flow-guide frame 4 was a plate-like structure, the plate face of which was arranged perpendicularly to the face panel 1; the flow-guide frame 4 arranged at the circumference of the face panel 1 was a continuously annular structure;

35 then, the prefabricated parts 3 was filled in the space of the assembled cell blocks divided and reserved by the flow-guide frame 4 arranged in the interior of the face panel 1; on the cross-section of the plate face at which the whole flow-guide-type composite wall board comprising foamed structure and prefabricated parts was located, the maximum cross

sectional area of prefabricated parts 3 is 75% of the total cross sectional area; when the cross sectional area of the prefabricated parts was higher than 75%, the adhesion area by foaming was lower than 25% of the total cross sectional area of the face panel, which makes that the adhesion by foaming was not firm; the height of filled prefabricated parts 3 was not higher than the height of the flow-guide frame 4 to ensure that the inner face panel and the outer face panel were bonded tightly with the flow-guide frame 4 when they were combined;

then, another piece of the panel 1 was laid; so far, the entire internal space enclosed together by the flow-guide frame 4 and two pieces of face panels 1 was divided into multiple cell blocks, i.e. multiple closed chambers, by the flow-guide frame 4 arranged in the interior of the face panel 1; and on the connected chamber close to the flow-guide frame 4 arranged at the circumference of the face panel 1, i.e. the outermost cell block, a common opening 804 for introducing the foaming material was set ;

then, the whole set was fixed with clamping fixtures, which was installed with the flow-guide frame 4 and pre-filled with the prefabricated part 3 between two pieces of face panels 1;

then, the introducing operation of the foaming material was carried out through the opening 804 for introducing the foaming material, wherein the requirements of the introducing were: the reaction temperature was 40-50°C, the foam density was 37-44 kg/m³ (when the foam density was lower than 37 kg/m³, the heat insulation effect of the composite board whole could not satisfy the requirements; when foam density was higher than 44 kg/m³, the sound insulation performance of the composite board was not unsatisfactory and uneconomical), and according to the volume of the foamed polyurethane inside the board, the injection time was calculated under the injection speed of 1.75 L/second (when the injection speed was lower than 1.5 L/second, it is not easy for the polyurethane foam being injected into the inside of the board to fill into the interior of the board; when the injection speed was higher than 2 L/second, the injection time was difficult to control, the optimal effect was achieved at an injection speed of 1.75 L/second), the introducing operation was performed by injecting foaming material into the board; after the injection was finished, the foaming material expanded gradually along the flow-guide frame 4 and filled the internal space of the flow-guide frame 4; when there was a small amount of polyurethane foam overflowing from all the vent holes around the board, it was proved that polyurethane foam had filled the internal chambers of the composite board; after the polyurethane foaming material was aged for 20-30 minutes, the foamed structure 2 bonded the face panels 1 and the flow-guide frame 4 together;

then, the polyurethane foaming material overflow from the vent holes and the opening for introducing the foam material were cleaned; and

the clamping fixtures were removed to obtain the flow-guide-type composite wall board comprising foamed structure and prefabricated parts.

The material of the flow-guide frame 4 was specifically light steel sheet, PVC.

The foamed structure 2 adopted specifically polyurethane foam; the finished product thereof had a density of 37-44 kg/m³.

The material of said foamed structure 2 was polyurethane foam.

The prefabricated part 3 was rock wool board, the thickness thereof is 50mm-100mm, and the unit density thereof is 40 kg/m³-80 kg/m³.

One of the following light boards was adopted as the face panel 1: cement fiberboard, magnesium oxide board. According to architectural requirements, the inner face panel was located inside building wall, the outer face panel was located outside the building wall; the material and thickness of the inner face panel and the outer face panel was selected respectively according to practical requirements to achieve optimal comprehensive performance requirements.

The combined form of the flow-guide-type composite wall board comprising foamed structure and prefabricated parts described in the example was: outer face panel (cement fiberboard) + polyurethane foam + rock wool + flow-guide frame + inner face panel (magnesium oxide panel).

In the example, the term "plate face" referred to the two largest surfaces of a plate-like structural member, and the rest surfaces except the two largest surfaces were side surfaces of plate-like structural member in thickness direction.

The manufacture method of the flow-guide-type composite wall board comprising foamed structure and prefabricated parts comprised: as shown in Fig. 3, for example, C-shaped light steel keel 401 used as a flow-guide frame 4 was processed into four pieces of frame borders each with 45° angle at both ends. The frame borders were divided into upper horizontal frame border, lower horizontal frame border, left vertical frame border, and right vertical frame border. The four frame borders were connected from head to tail in order, and the junction of the four frame borders was mechanically connected using L-shaped bracket joint of galvanized steel and fastener 403; four prefabricated rectangular light steel sheets 402 with connection flange were attached by fasteners 403 to the frame border of light steel keel to compose light steel keel flow-guide frame. The shape of the flow-guide frame 4 of the light steel keel was not limited to the rectangle in Fig.3, it was manufactured into various shapes according to practical requirements of building, such as diamond, triangle.

The advantages and positive effects of the example were: as compared with the prior art, the core material filled in the wall board of the example consisted of polyurethane foaming layer and prefabricated parts embedded with rock wool boards, which combined the advantages of both, not only significantly improving heat insulation and sound insulation properties of the board, but also taking into account the light weight and high structural strength of the board per se. The wall board met better the relevant standards and requirements of building construction, and achieved good performance indexes and had high performance-price ratio, which was

simple in structure and relatively easy to manufacture, and had predictable great economic and social value.

Example 2

5 The example was substantially identical to example 1 except, as shown in Figs.4 and 5, the structure shape of foamed structure 2 was -shaped structure unit or a combination of more -shaped structure units.

Example 3

10 The example was substantially identical to example 1 except, as shown in Figs. 6 and.7, the structure shape of foamed structure 2 was -shaped structure unit or a combination of more -shaped structure units.

Example 4

The example was substantially identical to example 1 except:

15 on the cross-section of the plate face at which the whole flow-guide-type composite wall board comprising foamed structure and prefabricated parts was located, the maximum cross sectional area of prefabricated parts 3 was 75% of the total cross sectional area to ensure that the comprehensive performance indexes of heat insulation and sound insulation of the composite wall board satisfied relevant construction standards for building;

20 the prefabricated parts 3 were specifically sound-insulating and heat-insulating plate-like components which contain air, the material thereof was one of the following materials: centrifugal glass wool board, perlite board, aluminum silicate wool board, and foamed cement board;

the structural shape of the foamed structure 2 satisfied one of the following requirements or a shape formed by some combination thereof in the longitudinal or transverse directions:

25 -shaped structure, -shaped structure, -shaped structure, -shaped structure, and triangular structure, that was, said composite wall board comprising foamed structure and prefabricated parts could be a combination of any structure units, the size of structure unit could be set arbitrarily based on practical requirements. At the same time, the specific structural shape of each structural unit could be -shaped structure, -shaped structure, -shaped structure, -shaped structure, and triangular structure;

The material of said foamed structure 2 was other available materials which were different from polyurethane foam;

the material of the flow-guide frame 4 was specifically metallic and non-metallic materials, such as [-shaped steel, wood frame, bamboo frame, wood- plastic composite frame, aluminum alloy profile;

the material of said foamed structure 2 was specifically polyurethane foam, the finished product thereof had a density of 37-44 kg/m³; the structure shape of the finished product of the foamed structure 2 satisfied one of the following requirements or a shape formed by a combination thereof in the longitudinal or transverse directions: -shaped structure,

-shaped structure, -shaped structure, -shaped structure, and triangular structure, that was, said composite wall board comprising foamed structure and prefabricated parts could be a combination of any structure units, the size of structure unit could be set arbitrarily based on practical requirements. At the same time, the specific structural shape of each structural unit could be -shaped structure, -shaped structure, -shaped structure, -shaped structure, and triangular structure;

one of the following light boards was adopted as the face panel 1: cement fiberboard and/or magnesium oxide board, clay board, fiber cement board, calcium silicate board, gypsum board, ETERPAN board, glass, fiber glass reinforced plastics board, thin ceramic tiles, acrylic sheet, sunlight panel, polycarbonate endurance panel, honeycomb panel, wood panel, thin stone panel, stainless steel sheet, aluminum single panel, aluminum composite panel, copper composite panel, steel sheet, copper sheet, titanium alloy panel, color steel panel, aluminum zinc alloy panel.

The shape of the flow-guide frame 4 was not limited to the rectangle in Fig.3, it was manufactured into various shapes according to practical requirements of building, such as, diamond, triangle.

Example 5

The example was substantially identical to example 1 except:

on the cross-section of the plate face at which the whole flow-guide-type composite wall board comprising foamed structure and prefabricated parts was located, the cross sectional area of prefabricated parts 3 occupied 45% of the total cross sectional area to ensure that the comprehensive performance indexes of heat insulation and sound insulation of the composite wall board satisfied relevant construction standards for building;

the material of prefabricated parts 3 was one of the following materials: rock wool board, centrifugal glass wool board, perlite board, aluminum silicate wool board, and foamed cement board;

the structure shape of the foamed structure 2 satisfied one of the following requirements or a

5 shape formed by a combination thereof in the longitudinal or transverse directions: -shaped

structure, -shaped structure, -shaped structure, -shaped structure, and triangular structure, that was, said composite wall board comprising foamed structure and prefabricated parts could be a combination of any structure units, the size of structure unit could be set arbitrarily based on practical requirements. At the same time, the specific structural shape of

10 each structural unit could be -shaped structure, -shaped structure, -shaped structure, -shaped structure, and triangular structure;

The material of said foamed structure 2 was other available materials which were different from polyurethane foam;

15 the material of flow-guide frame 4 was specifically light steel sheet, PVC or other materials that could achieve the purpose of flow guiding;

20 In the method of manufacturing the flow-guide-type composite wall board comprising foamed structure and prefabricated parts, the introducing operation of the foaming material was carried out through the opening 804 for introducing the foaming material, the requirements of the introducing were: the reaction temperature was 40-50°C, the foam density was about 40 kg/m³, and according to the volume of the foamed polyurethane inside the board, the injection time was calculated under the injection speed of 1.5-2 L/second, the introducing operation was performed by injecting foaming material into the board.

CLAIMS

1. A flow-guide-type composite wall board comprising a foamed structure, prefabricated parts, a flow-guide frame and face panels, wherein:

5 the flow-guide frame is a plate-like structure, a plate face of which is arranged perpendicularly to the face panels; said flow-guide-type composite wall board, as a whole, is divided into multiple cell blocks by the flow-guide frame; every cell block is specifically a foamed structure or a prefabricated part; the flow-guide-frame is located between the foamed structure and the prefabricated parts and along the circumference of the whole flow-guide-type composite wall board; the number of the face panels is two, an entire internal space enclosed together by the flow-guide frame and two pieces of face panels is divided into multiple cell blocks by the flow-guide frame arranged in an interior of the face panel; and an opening for introducing the foaming material is located on an outermost connected cell block close to the flow-guide frame arranged at the circumference of the face panel;

15 the flow-guide-type composite wall board being manufactured by:

installing the flow-guide frame pre-filled with the prefabricated parts between the two face panels, and fixing with clamping fixtures;

then, injecting foaming material into the flow-guide-type composite wall board through the opening, wherein the material of said foaming material comprises polyurethane;

20 after the injection is finished, the polyurethane foaming material expands gradually along the flow-guide frame and fills the internal space of the flow-guide frame;

after the polyurethane foaming material is aged for 20-30 minutes to form a foamed structure, said foamed structure bonds the face panels and the flow-guide frame together;

25 on the cross-section of the plate face at which the whole flow-guide-type composite wall board is located, the maximum cross sectional area of prefabricated parts is 75% of the total cross sectional area;

30 the prefabricated parts are specifically sound-insulating and heat-insulating plate-like components which contain air, wherein the thickness thereof is 50 mm-100 mm, and the unit weight thereof is 30 kg/m^3 - 150 kg/m^3 .

2. The flow-guide-type composite wall board according to claim 1, wherein the material of prefabricated parts comprises one of the following materials: rock wool board, centrifugal glass

wool board, perlite board, aluminum silicate wool board, and foamed cement board; and

when the material of prefabricated parts comprises rock wool board, the thickness thereof is 50mm-100mm, and the unit weight thereof is 40 kg/m³-80 kg/m³.

- 5 3. The flow-guide-type composite wall board according to either claim 1 or 2, wherein the structural shape of the foamed structure satisfies one of the following requirements or a shape formed by some combination thereof in the longitudinal or transverse directions:

□-shaped structure, ▤-shaped structure, ▥-shaped structure, ▦-shaped structure, and triangular structure.

10

4. The flow-guide-type composite wall board according to any one of the preceding claims, wherein the material of said foamed structure is polyurethane foam.

15

5. The flow-guide-type composite wall board according to any one of the preceding claims, wherein the material of said flow-guide frame comprises light steel sheet and/or PVC.

6. A method for manufacturing a flow-guide-type composite wall board comprising foamed structure and prefabricated parts, wherein the requirements of said manufacturing method are as follows in sequence:

20 first, laying a piece of face panel, arranging the flow-guide frame at the circumference of and in the interior of the face panel in accordance with design requirements, wherein the flow-guide frame is a plate-like structure, the plate face of which is arranged perpendicularly to the face panel; the flow-guide frame arranged at the circumference of the face panel is a continuously annular structure,

25 then, filling the prefabricated parts in the spaces of the assembled cell blocks divided and reserved by the flow-guide frame arranged in the interior of the face panel; on the cross-section of the plate face at which the whole flow-guide-type composite wall board comprising foamed structures and prefabricated parts is located, the maximum cross sectional area of prefabricated parts is 75% of the total cross sectional area;

30 then, laying another piece of the face panel; so far, the entire internal space enclosed together by the flow-guide frame and two pieces of face panels is divided into multiple cell

blocks, by the flow-guide frame arranged in the interior of the face panels; and on the connected chamber close to the flow-guide frame arranged at the circumference of the face panel, setting a common opening for introducing the foaming material;

5 then, fixing, with clamping fixtures, the whole set which has been installed with the flow-guide frame and pre-filled with the prefabricated parts between two pieces of face panels;

10 then, introducing the foaming material through the opening for introducing the foaming material, the requirements of the introducing are: the reaction temperature being 40-50°C, the foam density being 37-44 kg/m³, and according to the volume of the foamed polyurethane inside the board, calculating the injection time under the injection speed of 1.5-2 L/second, and performing introducing operation by injecting foaming material into the board; after the injection is finished, the foaming material expanding gradually and filling the internal space of the flow-guide frame, after aging the polyurethane foaming material for 20-30 minutes, the foamed structure bonds the face panels and the flow-guide frame together;

15 then, cleaning the polyurethane foaming material overflown from the vent holes and the opening for introducing the foam material; and

then, removing the clamping fixtures to obtain the flow-guide-type composite wall board comprising foamed structure and prefabricated parts.

20 7. The method for manufacturing a flow-guide-type composite wall board according to claim 6, wherein the material of the flow-guide frame comprises any one or more of: light steel sheet, PVC or other materials that can achieve the purpose of flow guiding.

25 8. The method for manufacturing a flow-guide-type composite wall board according to either claim 6 or 7, wherein the material of the foamed structure comprises polyurethane foam, the finished product thereof having a density of 37-44 kg/m³; the structure shape of the finished product of the foamed structure satisfies one of the following requirements or a shape formed by a combination thereof in the longitudinal or transverse directions: □-shaped structure, ▤-shaped structure, ▥-shaped structure, ▧-shaped structure, and triangular structure.

30 9. The method for manufacturing a flow-guide-type composite wall board according to any one of claims 6 to 8, wherein the material of said foamed structure is polyurethane foam.

10. The method for manufacturing a flow-guide-type composite wall board according to any one of claims 6 to 9, wherein when said prefabricated parts comprise rock wool board, the thickness thereof is 50mm-100mm, and the unit weight thereof is 40 kg/m^3 - 80 kg/m^3 .
- 5 11. The method for manufacturing a flow-guide-type composite wall board according to any one of claims 6 to 10, wherein each of the face panels comprise any one of the following light board materials: cement fiber board and/or magnesium oxide board, clay board, fiber cement board, calcium silicate board, gypsum board, ETERPAN board, glass, fiber glass reinforced plastics board, thin ceramic tiles, acrylic sheet, sunlight panel, polycarbonate endurance panel, honeycomb panel, wood panel, thin stone panel, stainless steel sheet, aluminum single panel, aluminum composite panel, copper composite panel, steel sheet, copper sheet, titanium alloy panel, color steel panel, aluminum zinc alloy panel.
- 10
12. The method for manufacturing a flow-guide-type composite wall board according to any one of claims 6 to 11, wherein said prefabricated parts are sound-insulating and heat-insulating plate-like components which contain air, specifically, the materials of which are any one of the following materials or any combination thereof: rock wool board, centrifugal glass wool board, perlite board, aluminum silicate wool board, and foamed cement board.
- 15
- 20 13. The method for manufacturing a flow-guide-type composite wall board according to any one of claims 6 to 12, wherein the entire internal space enclosed together by the flow-guide frame and two pieces of face panels is divided into multiple cell blocks, i.e. multiple closed chambers, by the flow-guide frame arranged in the interior of the face panels.
- 25 14. The method for manufacturing a flow-guide-type composite wall board according to any one of claims 6 to 13, wherein the connected chamber close to the flow-guide frame arranged at the circumference of the face panel, i.e. the outermost cell block, sets a common opening for introducing the foaming material.

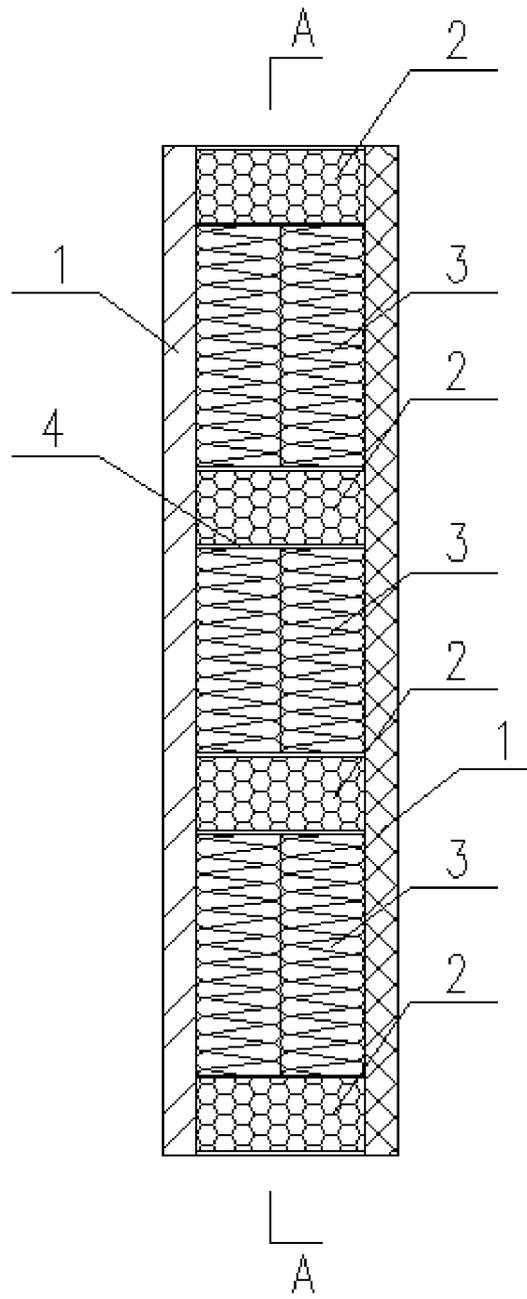


Fig.1

A-A

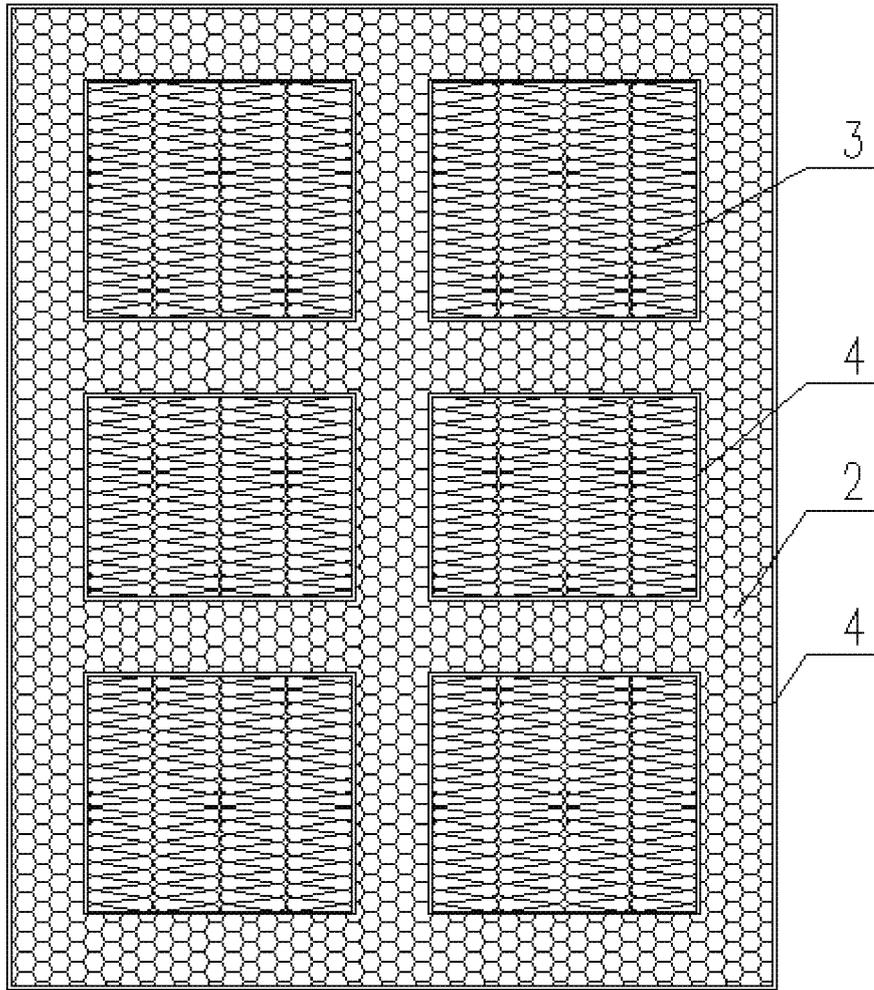


Fig.2

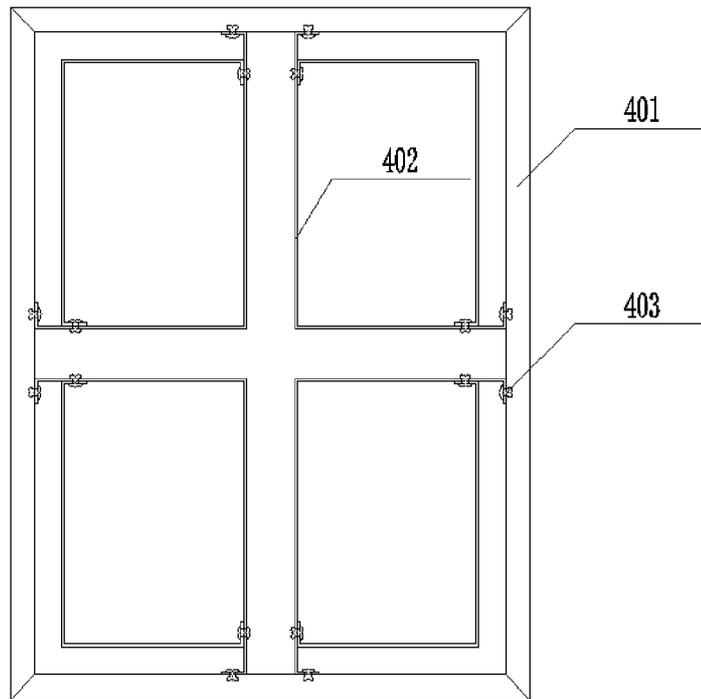


Fig.3

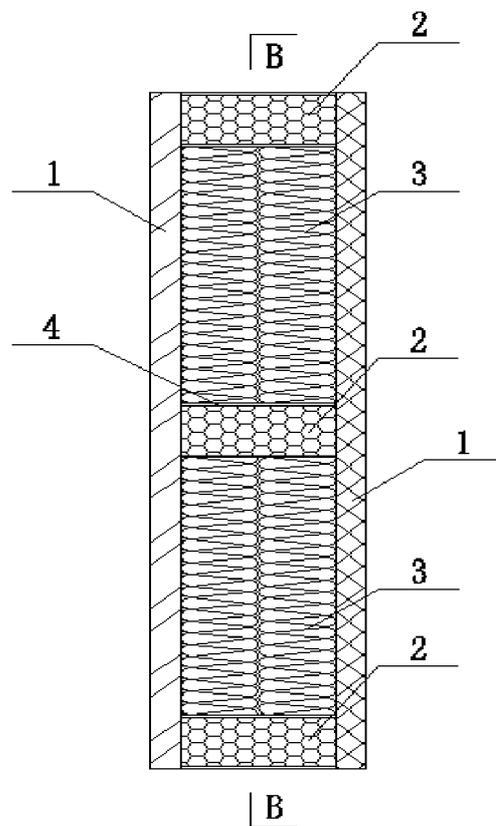


Fig.4

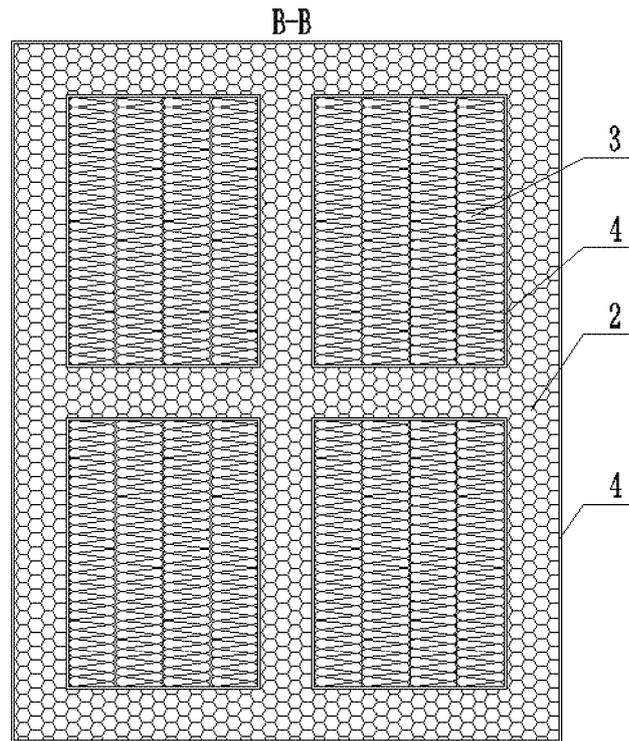


Fig.5

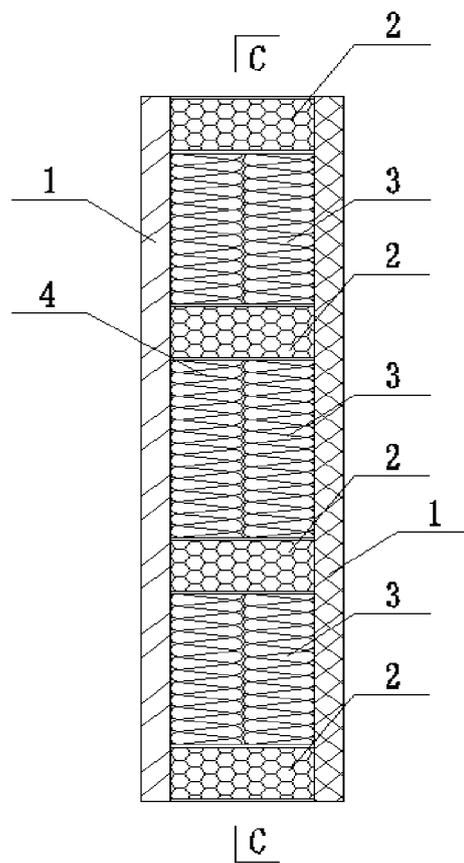


Fig.6

C-C

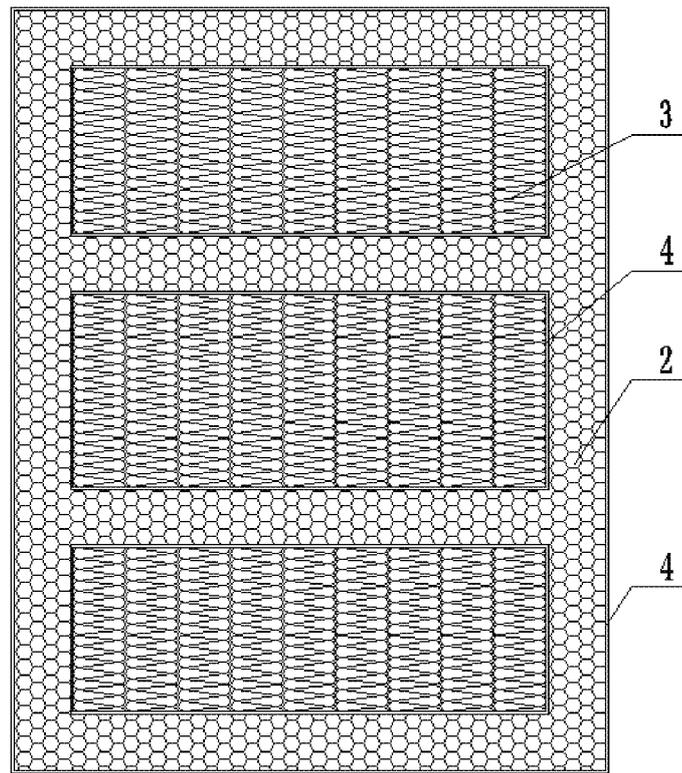


Fig.7

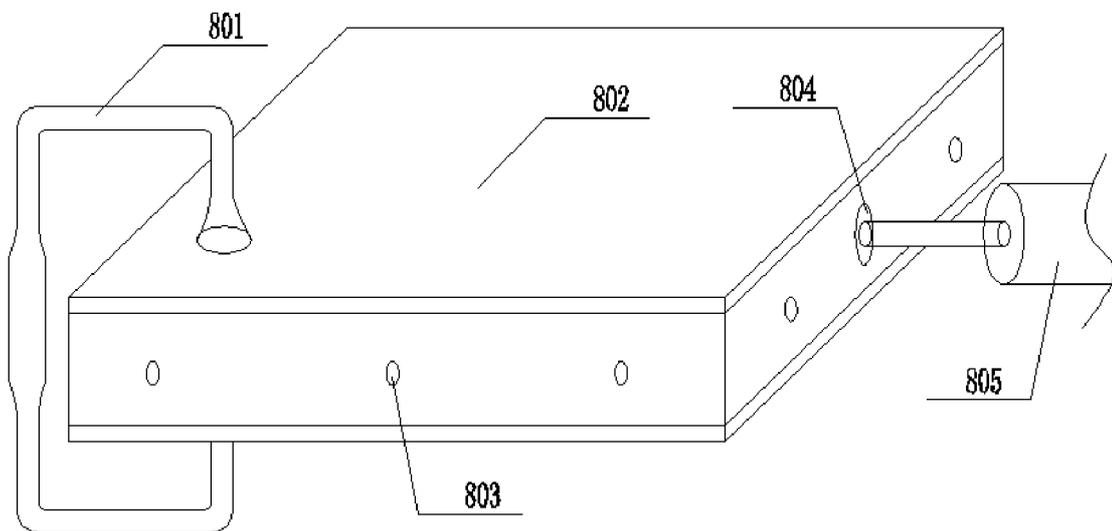


Fig.8