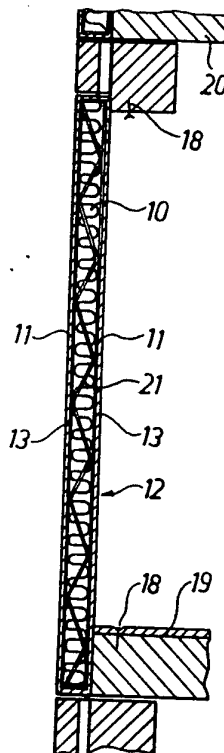




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(21) International Application Number: PCT/SE93/00734 (22) International Filing Date: 9 September 1993 (09.09.93) (30) Priority data: 9202586-5 9 September 1992 (09.09.92) SE (71) Applicant (for all designated States except US): SWESIB RITKONTOR AB [SE/SE]; Box 2068, S-431 02 Möln- dal (SE). (72) Inventors; and (75) Inventors/Applicants (for US only) : NULAND, Kjell [SE/ SE]; Fredagstomten 39, S-421 53 V Frölunda (SE). SVENNING, Johnny [SE/SE]; Pl 8625, S-430 41 Kulla- vik (SE). (74) Agent: AWAPATENT AB; Box 11394, S-404 28 Göteborg (SE).		(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, KZ, LK, LU, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>In English translation (filed in Swedish).</i>

(54) Title: STRUCTURAL UNIT**(57) Abstract**

A lightweight, dimensionally stable structural unit (12) for use as facing on houses and other buildings. The unit comprises a core (10) of foam glass, a layer (11) of fibre-reinforced concrete enclosing the foam glass core (10), and an interconnecting layer (13) of asphalt or silica glue and of wet-strength fibreglass reinforced cardboard or a fibreglass mat, such as a textile cloth of polymer glass fibre.

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STRUCTURAL UNIT

TECHNICAL FIELD

The subject invention concerns a lightweight,
5 dimensionally stable structural unit intended primarily as
a facing slab for apartment houses and other buildings.

BACKGROUND OF THE INVENTION

Structural units intended as facing on houses and
10 other premises must not contain combustible materials. A
material that is frequently used is e.g. concrete.

External walls made from prefabricated concrete
building elements usually must have an external insulation
layer and a cavity wall to protect the insulation, in
15 order to meet the heat-insulation standard. A wall of this
kind is comparatively expensive to manufacture and time-
consuming to produce. As an alternative to the cavity wall
construction sheet-metal or slabs of a weather-resistant
material may be used.

20 Various modifications of sandwich constructions also
exist, comprising insulation, an external facing and an
inner cover, which constructions meet the requirements for
low weight and dimension stability.

Hitherto, sandwich constructions have not, however,
25 been competitive on account of the considerable costs
involved. In addition, they have primarily been intended
for buildings not exceeding a height of five stories.

Other factors to consider in the construction and
arrangement of building elements or structural units
30 intended as facing for houses and other buildings are, in
addition to fire-resistance, durability, weather-
resistance, heat insulation properties, weight and manu-
facturing costs but also the coefficient of expansion,
vapour permeability and the ability to dampen the
35 transmission of sound are important factors in this
connection.

TECHNICAL PROBLEM

The purpose of the subject invention is to provide a building element or structural unit intended primarily as facing on apartment houses or office buildings or the like and exhibiting high values in respect of all the factors outlined in the foregoing, in addition to which, on account of its low weight and high dimension stability, the structural unit may be used in tall buildings and whenever the wall has to meet severe demands with respect to heat, cold and vapour pressure.

THE SOLUTION

This purpose is achieved in a structural unit in accordance with the invention having a foam glass core enclosed by a layer of fibre-reinforced concrete, a layer arranged to adhere to and to be laminated with said core and said concrete layer being positioned intermediate the foam glass core and the fibre-reinforced concrete layer.

DESCRIPTION OF THE DRAWING FIGURES

The invention will be described in closer detail in the following with reference to the accompanying drawings, wherein

Fig. 1 is a plan view of a building element or structural unit in accordance with the invention in the form of a facing slab,

Fig. 2 is a sectional view along line II-II of Fig. 1,

Fig. 3 is a lateral sectional view through the arrangement for fastening the structural unit in accordance with the invention to a horizontal concrete beam,

Fig. 4 is a view from above of a corner of a facade including the fastening arrangement of a structural unit in accordance with the invention to a vertical concrete beam,

Fig. 5 illustrates the fastening arrangement of the structural unit in accordance to the invention to a cellular concrete floor, and

Fig. 6 is a sectional view of a detail showing the structure of the structural unit.

DESCRIPTION OF an EMBODIMENT OF THE INVENTION

The building element or structural unit according to the invention and illustrated in the drawings is constructed as a facing wall unit and is provided with a core 10 of foamed quartz glass, known as foam glass. This glass is produced by heating melted quartz glass until it becomes liquid, whereupon the liquid glass is allowed to expand, by addition of a gas-generating substance, until the glass forms a fine-cell foam. When the glass has solidified, it forms a rigid block that may be sewn into slabs of suitable thickness.

The length and width of the slabs are adjusted to the intended measures of the finished structural unit. Apertures are made in the slab to accommodate various fittings to be used for the mounting of doors and windows in the facing unit, and to lift and mount the unit to the building framework. The fittings, including threaded sleeves and flat bars of e.g. stainless or galvanized steel, are positioned inside the foam glass core.

An adhesive layer 13 is then applied on top of the foam glass core 10, and the latter, together with the layer 13, is cast into an enclosing layer 11 of fibre-reinforced concrete which adheres to layer 13.

The layer 11 of fibre-reinforced concrete could have a thickness of approximately 15 - 20 mm whereas the foam glass core could have a thickness of 120-200 mm.

Fig. 1 illustrates a finished facing unit 12 including a window 27 which by means of a door-frame screw fastener 14 is mounted in a steel frame 15 cast into the unit. A lifting loop 16 is cast into the unit to be used in the handling thereof during transport to the building

site and to lift the unit in position on a building framework. Fittings 17 positioned at the upper and lower edges of the unit are used to secure the unit to the building framework.

5 Fig. 2 illustrates the unit 12 in a sectional view. As appears therefrom, horizontally projection portions of the fittings 17 are secured by means of screw fasteners 18 to the floor structure 19, 20 of the building frame. A reinforcement construction 21 of stainless steel
10 interconnects the two layers 11.

Figs. 3 - 5 illustrate in closer detail the manner in which units 12 are mounted in a building framework comprising a prefabricated cast cellular concrete floor 22, a horizontal concrete beam 23 and a vertical concrete
15 beam 24. The joints between two units 12 and between the unit and the framework are insulated by means of mineral wool caulking 25 (known as soft sealing).

In the corner portion of the building illustrated in Fig. 4, a corner unit 12 is secured by means of threaded
20 sleeves and bolts 26 cast into the unit and extending through the vertical concrete beam 24.

Fig. 6 is a detailed sectional view showing the structure of the facing wall unit 12. The centre is formed by the foam glass core 10, surrounded on either side by
25 the adhesive layer 13 and externally thereof and adhering to layer 13, by the fibre-reinforced concrete layer 11 enclosing the foam glass core 10 and forming the outermost layer.

Preferably, the adhesive layer 13 consists of an
30 asphalt adhesive or a silicate glue and glass-fibre reinforced and preferably wet-strength cardboard or a glass-fibre cloth, such as a textile cloth of polymer glass fibres.

The foam glass core described above preferably
35 consists of pure quartz glass without a binding agent and preferably having a completely closed-cell structure. The dimension stability is unchangeable. The dead weight is

5

about 1.2 kN/m³ and the density about 105 and 165 kg/m³.
The material is non-combustible and can withstand
temperatures between -260°C and +430°C. The vapour per-
meability is practically none and the sound transmission
5 value is 28dB for thicknesses of 100 mm and normal
frequency ranges.

The structural unit as a whole has a compressive
strength in the order of 400-1600 kN/cm² and a flexural
strength of between 300 and 1600 kN/cm².

10 In summary, the structural unit in accordance with
the invention exhibits the following properties_

- thermal insulating
- dimensionally stable
- 15 - diffusion proof
- impermeable to radon radiation
- non-combustible
- resistance to attacks from vermine and to mould-
formation
- 20 - manufactured without hazards to the environment
- recycable

The invention is not limited to the embodiments
described in the foregoing but several modifications are
25 possible within the scope of the appended claims.

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CLAIMS

1. A lightweight, dimensionally stable structural unit, primarily for use as facing on houses and other buildings, said unit having a core (10) of foam glass enclosed by a layer (11) fibre-reinforced concrete, characterized by an adhesive layer interposed between the foam glass core (10) and the layer (11) of fibre-reinforced concrete to adhere to and to be laminated with said core and said concrete layer.
2. A structural unit as claimed in claim 1, characterized in that said adhesive layer (13) consists of an asphalt adhesive applied on said foam glass core (10) and covered with fibreglass-reinforced cardboard, with a fibreglass mat or the like which adheres to the layer of fibre-reinforced concrete.
3. A structural unit as claimed in claim 1, characterized in that the adhesive layer (13) is formed by a silica glue adhesively applied on said foam glass core (10) and covered with fibreglass-reinforced cardboard, with a fibreglass mat or the like which adheres to the layer of fibre-reinforced concrete.
4. A structural unit as claimed in any one of the preceding claims, characterized in that the layers (11) of fibre-reinforced concrete on either side of the foam glass core (10) are anchored to one another by means of forked clamps, a reinforcement construction (21) or the like.

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Fig. 2

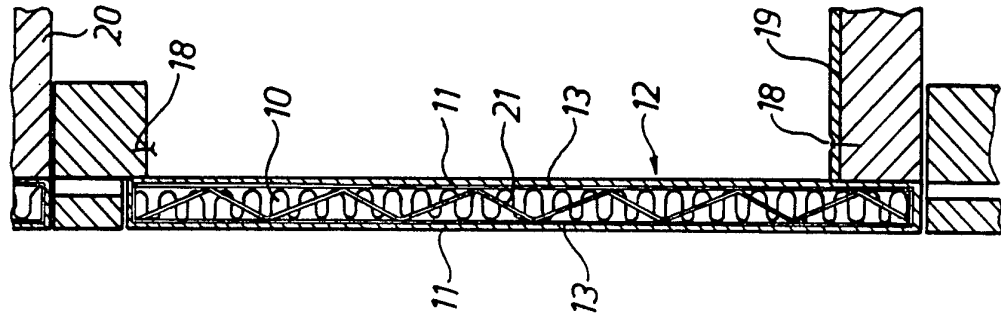
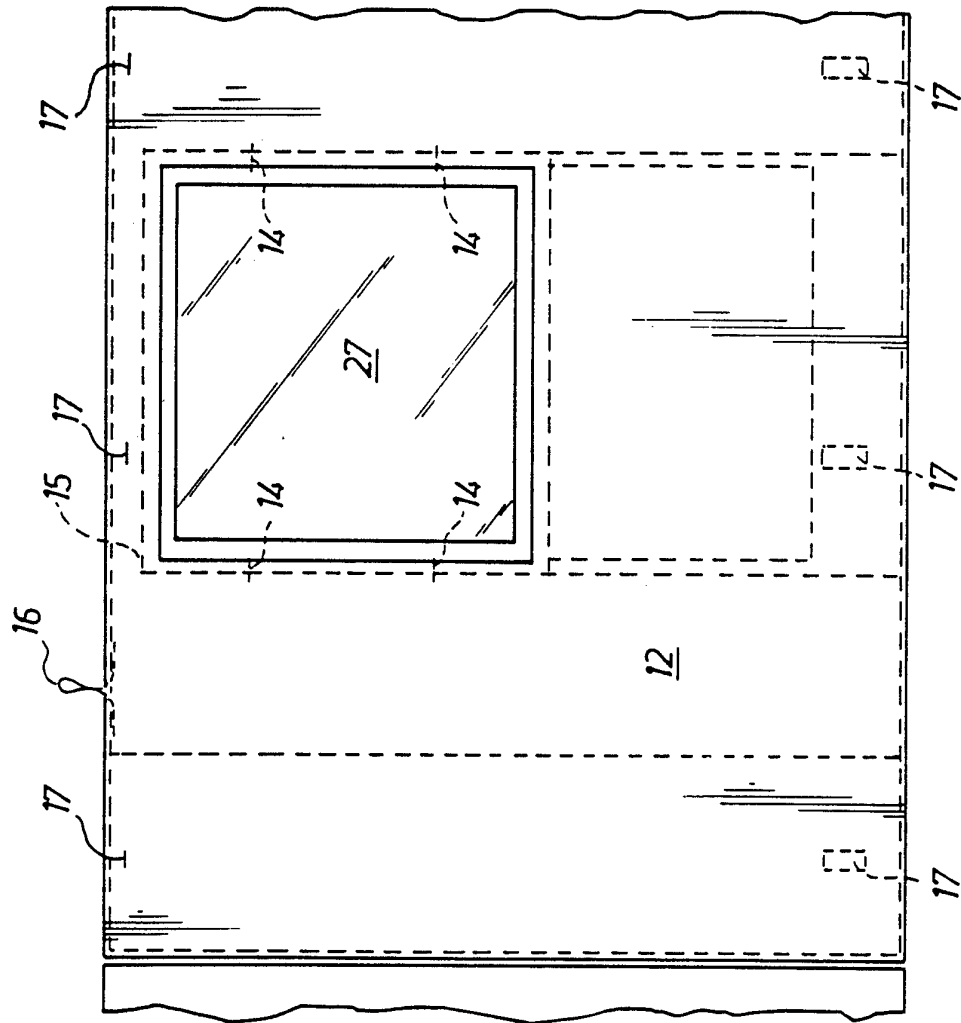


Fig. 1



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Fig. 3

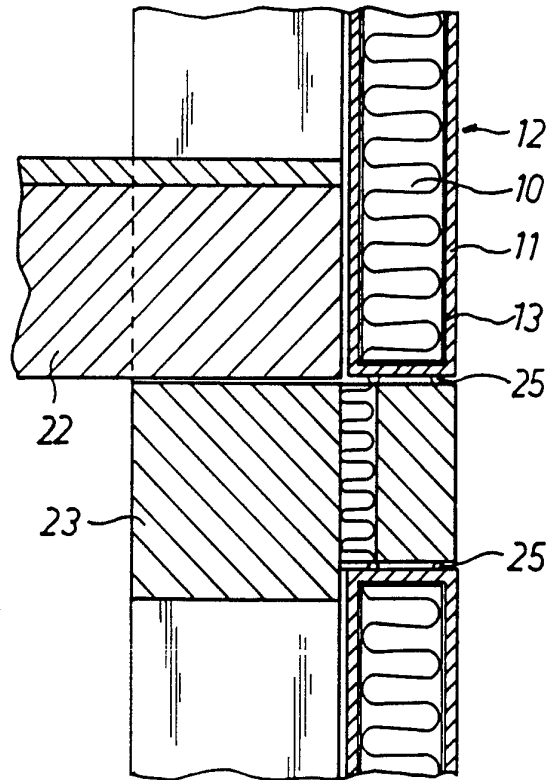
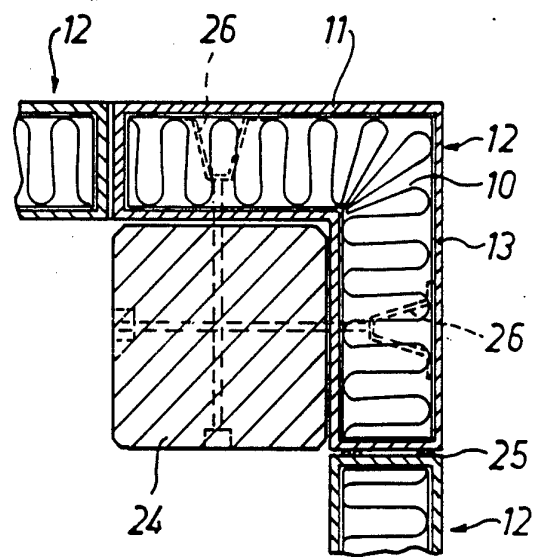


Fig. 4



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Fig. 5

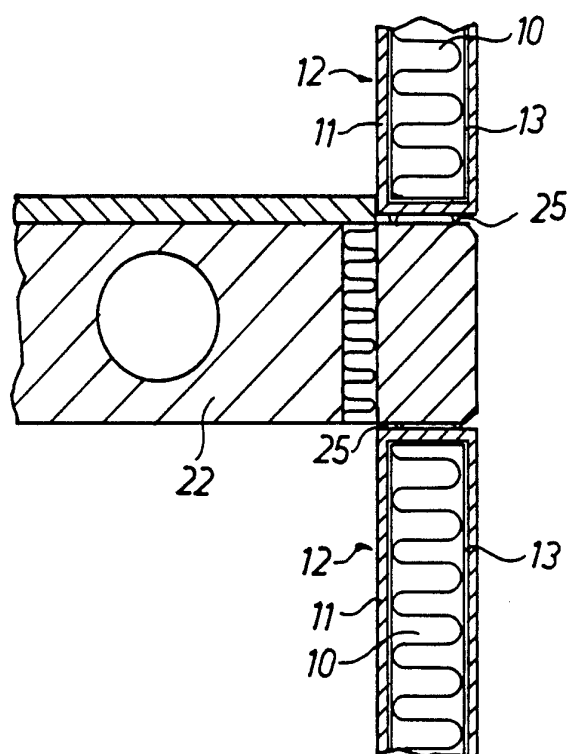
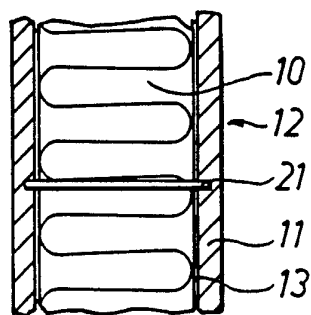


Fig. 6



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 93/00734

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: E04B 2/92, E04C 2/26

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)

IPC5: E04B, E04C

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

SE,DK,FI,NO classes as above

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CH, A5, 592792 (VEREINIGTE OESTERREICHISCHE EISEN- UND STAHLWERKE - ALPINE MONTAN AKTIENGESSELLSCHAFT), 15 November 1977 (15.11.77), column 2, line 24 - line 49, figure 2 --	1
Y	DE, A1, 2511293 (SCHNEIDER & CO.), 23 Sept 1976 (23.09.76), page 3, last paragraph - page 4, 5th paragraph, page 5, line 19 - line 26, figure 1 --	1
A	DE, A1, 2512597 (SCHNEIDER & CO.), 30 Sept 1976 (30.09.76), page 6, line 3 - line 15, figure 3 -- -----	1-4

☐

Further documents are listed in the continuation of Box C.

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See patent family annex.

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Date of the actual completion of the international search

3 December 1993

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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			DE-A,C-	2549585	11/11/76
DE-A1-	2511293	23/09/76	FR-A,B-	2303910	08/10/76
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