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(71) Applicant: **F.H.U.P. "M-3" Iwona Pacura**
32-800 Brzesko (PL)

(72) Inventor: **Pacura, Boguslaw**
32-800 Brzesko (PL)

(74) Representative: **Bartula-Toch, Marta**
Biuro Techniczno-Prawne PATENT,
Ul. Boleslawa Chrobrego 2A/3
32-095 Krakow (PL)

(54) **Self-bearing construction structure**

(57) Construction structure consisting of a building (1) made of segments (2) in the form of vaults created by joining shaping elements being monolithic blocks (3) of large dimensions, blocks (3) are made of foamed polystyrene or foamed polyurethane, with blocks (3) having their internal surfaces unidirectional according to a segment of an approximation of a circle and their sum forms the shape of internal surface of segments' (2) vault.

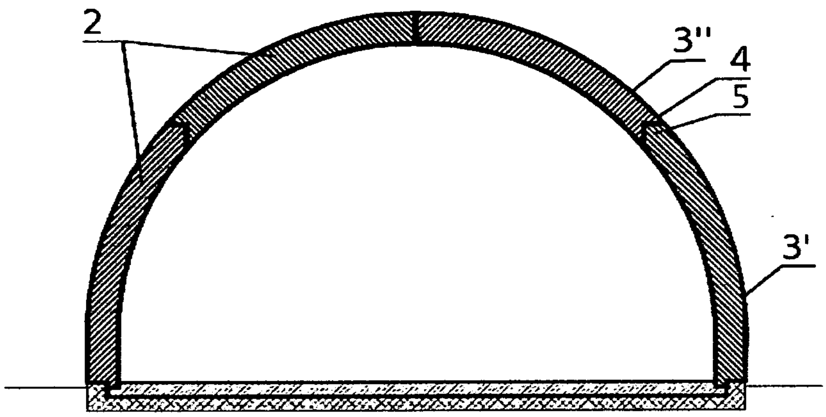

Fig. 1

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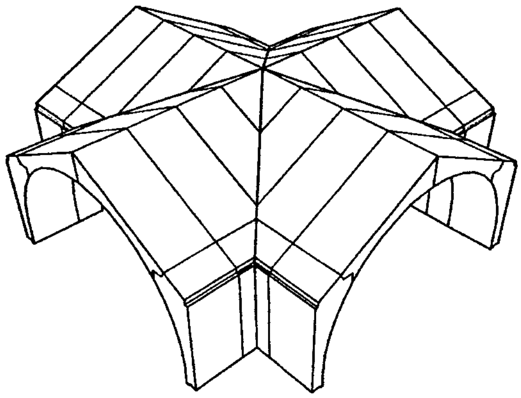

Fig. 17b

Description

[0001] This invention relates to a self-bearing construction structure in the form of a residential building or a general purpose building, for instance a garage, shop, warehouse, catering facility, nursery.

[0002] In patent description No. DE 2627884 a demountable container structure is presented, consisting of vertical, mounted in a certain distance from each other, circular or multilateral halfrings connected with each other with horizontal supports to which floor and wall elements are mounted. The horizontal supports, halfrings and floor thresholds, on which halfrings are placed, are constructed of identical channel sections, entering one another. The halfrings consist of segments that enter one another along their endings and this way are connected by overlapping. External load bearing walls are parallel, with internal sections of opposite walls at an acute angle, and sections of external and internal walls are at an angle of 105°.

[0003] Patent descriptions PL 197489 (application PCT/GB99/02239) and patent application in Poland P. 364050 (application PCT/GB00/03966) include domical construction structures, with their roofing consisting of connected panels of various shapes and sizes.

[0004] Foamed polystyrene and foamed polyurethane are commonly used for filling technical spaces in construction industry and for thermal insulation of buildings and installations. These materials are used to make forms, covers, fillers for packaging for protection purposes during loading, transport and unloading, and for storage of a variety of products. They are also used when light material with low durability parameters is needed.

[0005] The solution according to this invention consists in using foamed polystyrene or foamed polyurethane as a material for making of monolithic blocks of huge dimensions that are combined, joined with each other to form a self-bearing vault which constitutes an independent segment of a building or a component thereof. The internal surfaces of blocks are unidirectional according to a segment of an approximation of a circle and their sum forms the shape of internal surface of segments' vault.

[0006] Preferably the segments are combined with each other at an angle between axes a = 70°-110° by connecting their constituent extreme blocks having their joining sides cut at an angle β = 25°-65°, however in case of joining the segments at an angle α = 90°, the sides of extreme blocks are cut at an angle β = 45°.

Preferably, particular blocks are connected with each other with glue or staples or self-adhesive tapes.

Preferably, the surfaces of blocks' contact walls are developed and their shape corresponds to the contact surface of their adjacent blocks.

Preferably, the blocks are connected with faying surfaces or with rebates. Preferably, the blocks are connected with locks (latches) placed in transverse, coaxial holes of faying connections or rebates of adjacent sides, and the surfaces of holes and locks are covered with glue.

Preferably, the blocks have their internal surfaces vaulted, and external surfaces flat; moreover, internal surface of lower part of lower row of blocks is flat.

[0007] The basic advantage of the solution according to this invention is its simple construction and ease of producing the shaping blocks with at least two technologies: in a factory producing foamed polystyrene or foamed polyurethane, by shaping the blocks directly in forms or in a processing plant by cutting the blocks from cubicoid elements. Such plants may be permanent, with mass-production profile, or transportable, for cutting blocks on construction site of e.g. a complex of buildings. The method of cutting the blocks is more flexible, as it allows to easily change their shapes and dimensions.

[0008] What is particularly surprising and advantageous, is the use of a very brittle insulation material for construction purposes.

[0009] Another vital issue is low specific gravity of the material of which the blocks are made, as it considerably facilitates their production, loading, transport, unloading, as well as combining them and joining them in a construction structure. The cubicoid elements, as well as ready blocks, may be stored outside.

[0010] The construction of buildings is self-bearing, does not require any construction elements, which however does not preclude using them not for purposes of strengthening the structure, but for purposes of facilitating e.g. frontal connection with a vestibule or for bigger glazing of the walls.

[0011] The construction of the building and the materials used considerably shorten the construction time, exclude any noisy operations on construction sire with heavy duty equipment, which reduces harm to the environment. Virtually all component parts of the structure can be transported to the construction site as pre-cast units, combined there and connected with simple operations.

[0012] What is of crucial and manifold significance, is that materials used for external walls and roofs are of very low heat conductivity, thereby allowing to skip thermal insulations, and the construction itself eliminates thermal bridges.

[0013] Another advantage is the little number of types of blocks in terms of their shapes and dimensions, thanks to which a building may be constructed of two to six types, which facilitates the production of blocks ad combining them with each other.

[0014] Basing on a pilot construction we see that constructing a one-family building with three bedrooms, kitchen, bathroom and hall with equipment, of total usable area amounting to 100 square metres should last not longer than two months. Construction of buildings with less equipment, for instance a warehouse, office building, will last adequately shorter.

[0015] All advantages of the construction and the material used directly translate into economic, time, environmentally friendly and landscape benefits, as with this technology mostly relatively small and one-floor buildings will be made.

[0016] Another advantage of the solution is the shaping of the self-bearing construction structure in multiple configurations as a result of joining at various angles the segments forming the vaulting, composed of shaping elements in the form of blocks.

[0017] The construction of buildings of diverse shapes adds more possibilities to using the self-bearing structure for a variety of functions; moreover, it may be vital in adjusting it to local conditions of construction, including natural topography.

[0018] The solution according to the invention is illustrated with examples on drawings, where particular figures present:

Fig.1-vertical transverse section to the axis of the building for example 1,
Fig.2-vertical transverse section to the axis of the building for example 2,
Fig.3-vertical transverse section to the axis of the building for example 3,
Fig.4-axonometric projection of a lower part of vaulting block for example 2,
Fig.5-axonometric projection of an upper part of vaulting block for example 2,
Fig.6-detail 1 presented in fig. 2-enlarged,
Fig.7-detail 2 presented in fig. 2-eniarged,
Fig.8-detail 3 presented in fig. 2-enlarged,
Fig.9a-bird's eye view of a more or less L-shaped building,
Fig. 9b-perspective view of a more or less L-shaped building,
Fig. 10a-bird's eye view of a more or less T-shaped building,
Fig. 10b-perspective view of a more or less T-shaped building,
Fig. 11a-bird's eye view of a more or less Z-shaped building,
Fig. 11b-perspective view of a more or less Z-shaped building,
Fig. 12a-bird's eye view of a more or less C-shaped building,
Fig. 12b-perspective view of a more or less C-shaped building,
Fig. 13a-bird's eye view of a more or less double T-shaped building (double-tee bar shape),
Fig. 13b-perspective view of a more or less double T-shaped building (double-tee bar shape),
Fig. 14a-bird's eye view of a cross-shaped building,
Fig. 14b-perspective view of a cross-shaped building,
Fig. 15a-bird's eye view of a rectangular building,
Fig. 15b-perspective view of a rectangular building,
Fig. 16a-bird's eye view of a building consisting of two segments joined at an angle α = 110°,
Fig. 16b-perspective view of a building consisting of two segments joined at an angle α = 110°,
Fig. 17a-axonometric projection of connection of two segments at an angle α = 90°,
Fig. 17b-axonometric projection of crosswise connection at an angle α = 90°,
Fig. 18a-axonometric projection of connection of two segments at an angle α = 110° as viewed from the side of a greater angle,
Fig. 18b-axonometric projection of connection of two segments at an angle α = 110° as viewed from the side of a lesser angle,
Fig. 19-axonometric projection of joining two top blocks 3a and 3b of connection of one inside corner at an angle α = 90°,
Fig. 20-axonometric projection of joining two blocks 3c and 3d of the second from top level of segment connection at an angle α = 90°,
Fig. 21-axonometric projection of joining two blocks 3e and 3f of the third from top level of segment connection at an angle α = 90°,
Fig. 22-axonometric projection of joining two blocks 3g and 3h of the fourth from top level,
Fig. 23-axonometric projection of connection at an angle α = 110° of two top blocks 3i and 3j of internal corner of connection of two segments,
Fig. 24-axonometric projection of connection at an angle α = 110° of two blocks 3k and 3l second from top level of connection of two segments,
Fig. 25-axonometric projection of connection at an angle α = 110° of two blocks 3m and 3n third from top level of connection of two segments,
Fig. 26-axonometric projection of connection at an angle α = 70° of two top blocks 3o and 3p of internal corner of connection of two segments,
Fig. 27-axonometric projection of connection at an angle α = 70° of two blocks 3r and 3s second from top level of connection of two segments at an angle α = 110°,
Fig. 28-axonometric projection of connection at an angle α = 70° of two blocks 3t and 3u third from top level of connection of two segments connected at an angle α = 110°,
Fig. 29-axonometric projection of connection at an angle α = 70° of two blocks 3w and 3x fourth from top level of connection of two segments connected at an angle α = 110°,
Fig. 30-axonometric projection of connection at an angle α = 70° of two blocks 3y and 3z fifth from top level of connection of two segments connected at an angle α = 110°.

[0019] In the patent description and patent claim, blocks were marked jointly with number 3, with blocks of lower part of the building marked as 3', and blocks of the upper part of the building marked as 3". On figures 9a - 18b, internal thin lines indicate places where blocks 3 are in contact.

[0020] Descriptions of implementation examples and information contained within cannot in any way limit the presentation of the solution and the range of its protection, particularly in the independent patent claim 1.

[0021] All examples show - for the sake of clarity - the structure of the building as a vaulting made of blocks of foamed polystyrene or foamed polyurethane without showing, for instance, the shape and covering of roofs, windows or door, facade finishing possibilities, as such elements are not covered by the range of the solution and are left to the designer's or investor's creativity. As an example, it is specified that roof construction does not require roof truss and its shape may result directly from the upper part of the vaulting surface, thus it may have the shape of a longitudinal segment of a cylinder (examples 1 and 3 and fig. 1 and 3) or be pitched (fig. 2 and figs 9a - 18b), with roofing made of, e.g. sheet, plastic, tarboard, preferably with an eaves. External surfaces of the building may be finished with plaster or any materials, e.g. wood, ceramic tiles or module plates made of sheet metal or plastic. Figures to all examples show, for the sake of simplification, vaulting 1 made of four blocks 3' and 3", which does not preclude making the vaulting of a different number of blocks 3.

Example 1

[0022] Example presented in fig. 1 shows the implementation of the solution in a basic, simplest way, i.e. using foamed polystyrene blocks 3' and 3" with their mirror images n the form of double-sided panels formed according to circle segments. Resulting from such shape of blocks 3 the vaulting of segment 2 is shaped according to a semicircle in its vertical transverse section. The length of segment 2 is unlimited, and its width depends on the shape (curve) of blocks 3.

[0023] Vaulting of segment 2 in its section is joined symmetrically, which requires only four types of blocks 3 - one type of block 3' to construct the lower part of the building 1, the second type of block 3" to construct the upper part of the building 1 and their mirror images. Lower blocks 3' have in their upper walls longitudinal rebates 5, of triangular shape in transverse section, and upper blocks 3" have in their lower front wall longitudinal rebates 4, of triangular shape in transverse section, corresponding in their shape, dimensions and size to rebates 5 of upper front wall of second block 3'.

[0024] Contact surfaces of blocks 3" of the upper part of the vaulting of segment 2 are flat and placed radially. All contact surfaces of blocks 3 are joined with glue.

Example 2

[0025] This example, presented in fig. 2, covers the implementation of the solution using blocks 3 made of foamed polyurethane in the form of panels internally formed according to semicircle segments, with flat external surfaces. As a result, the thickness of walls of vaulting of segment 2 varies, however only the cylinder layer formed along the internal surface of blocks 3, as in examples 1 and 3 presented in figs 1 and 3, is load-bearing.

[0026] Vaulting of segment 2 in its section is joined symmetrically, which requires only four types of blocks 3 - one type of block 3' to construct the lower part of the building 1, the second type of block 3" to construct the upper part of the building 1 and their mirror images.
Vaulting of segment 2 is symmetrical, which requires only two types of blocks 3 with their mirror images - one to construct the lower part and the other to construct the upper part of the building 1.

[0027] Block 3' of lower part of the building 1 externally has a vertical, flat surface that becomes a segment of a flat slanting surface that constitutes a fragment of roof surface. Front upper walls of lower blocks 3' are developed in their transverse section according to straight segments located in respect to each other at a right and an obtuse angle.

[0028] The external wall of block 3" of upper part of building 1 is flat, and the lower front wall is a mirror image of the upper front wall of block 3' of lower part of the building 1. Thus, surfaces of front walls are developed, thanks to which they can be successfully joined with glue and extra self-adhesive tapes.

[0029] Front upper walls of blocks 3" of upper part of the building 1 are flat and connected with each other with glue and extra wire staples.

[0030] In fig.2, the horizontal joining with the development of contact surfaces of blocks 3' and 3" was presented as detail 1, presented enlarged in fig.6.

Example 3

[0031] The solution presented as an example in fig. 3 is a vaulting of segment 2, the walls of which are shaped according to less than half of a circle, becoming short, vertical segments at the bottom. The vaulting is made of three kinds of blocks 3, bottom blocks 3' being identical and possible to be composed at any side of the axis, while the upper part of the vaulting is made of two different blocks 3". Blocks 3' of lower part are joined with blocks 3" of upper part with faying surfaces and locks 6. In interlocking elements of blocks 3' and 3", coaxial holes are made, where latches 7 being bars or laths connected with glue are placed.

[0032] The front upper wall of one block 3" has got longitudinal, trapezoidal in shape in transverse section, rebate 4, and front upper wall of the second block 3" has got longitudinal, trapezoidal in shape in transverse section, rebate 5. The surfaces of rebates 4 and 5 are joined with glue.

[0033] In fig.3, the connection of blocks 3" on rebates 4 and 5 is presented as detail 2, and enlarged in fig.7; and as detail 3 - the connection of blocks 3' and 3" with lock 6, enlarged in fig. 8.

[0034] For better visual presentation of internal corners of solutions according to the examples 4 to 10 of implementation of the invention, connections of two segments 2 were presented enlarged in perspective view in fig. 17a and connections of four segments 2 in crosswise layout were presented in fig. 17b. For purposes of presenting the corners themselves, only fragments of segments 2 creating the corners were presented.

Example 4

[0035] Building 1 is made of two segments: 2a and 2b located in respect to each other at an angle α = 90° resembling an L-shape, as presented in drawings in two views: in a bird's eye view presented in fig. 9a and in perspective view in fig. 9b.

[0036] Internal corner between segments 2a and 2b is made by combining blocks 3 on different levels. The highest level consists of top blocks 3a and 3b, presented in fig. 19, in the shape of a wedge cut at an angle β = 45°. Blocks 3a and 3b are mirror images of each other.

[0037] On the second from top level, blocks 3c and 3d are connected, having their connection sides cut at an angle β = 45°. Blocks 3c and 3d are mirror images of each other, as presented in fig. 20.

[0038] On the third from top level, blocks 3e and 3f are connected, having their bottom, adjacent corners cut at an angle β = 45°, as presented in fig. 21.

[0039] On the fifth from top level, blocks 3g and 3h are connected, having their side, adjacent walls cut at an angle β = 45°, with internal curved walls and external flat walls narrowing from top to bottom, as presented in fig. 22.

Example 5

[0040] Building 1 is made of two segments: 2a and 2b, connected with each other at an angle α = 90° resembling a T-shape, as presented in drawings in two views: in a bird's eye view presented in fig. 10a and in perspective view in fig. 10b.

[0041] In the presented example, there are two internal corners constructed of blocks from 3a to 3h, as in example 1.

Example 6

[0042] Building 1 is made of a combination of three segments: 2a, 2b and 2c, resembling a Z-shape, as presented in drawings in two views: in a bird's eye view presented in fig. 11a and in perspective view in fig. 11b.

[0043] In the presented example, there are two internal corners constructed of blocks from 3a to 3h, as in example 1.

Example 7

[0044] Building 1 is made of a combination of three segments: 2a, 2b and 2c, resembling a C-shape, as presented in drawings in two views: in a bird's eye view presented in fig. 12a and in perspective view in fig. 12b.

[0045] Building 1 has got two internal corners constructed of blocks from 3a to 3h, as in example 1.

Example 8

[0046] Building 1 is made of a combination of three segments: 2a, 2b and 2c, resembling a double T-shape, as presented in drawings in two views: in a bird's eye view presented in fig. 13a and in perspective view in fig. 13b.

[0047] Building 1 has got four internal corners constructed of blocks from 3a to 3h, in analogy to example 1.

Example 9

[0048] Building 1 is a combination of four segments: 2a, 2b, 2c and 2d, arranged in a crosswise manner, as presented in drawings in two views: in a bird's eye view presented in fig. 14a and in perspective view in fig. 14b.

[0049] Building 1 has got four internal corners identical as in example 1.

Example 10

[0050] Building 1 is a combination of four segments: 2a, 2b, 2c and 2d, arranged as a rectangle, as presented in drawings in two views: in a bird's eye view presented in fig. 15a and in perspective view in fig. 15b.

[0051] Building 1 has got eight internal corners identical as in example 1.

Example 11

[0052] Building 1 is made of two segments: 2a and 2b located in respect to each other at an angle between their axes a = 110°, presented in a bird's eye view in fig. 16a and in a perspective view in fig. 16b, additionally enlarged for purposes of better presentation in fig. 18a in a perspective view from the angle α = 110° and in fig. 18b in a perspective view from the angle α = 70°. For presentation purposes only, lengths of segments 2a, 2b and 2c were shortened.

[0053] The building has got two internal corners as in example 1, with various angles.

[0054] The corner with a greater angle is constructed of three pairs of blocks (mirror images of each other): 3i and 3j, 3k and 3l, 3m and 3n, presented in figures from 23 to 25.

[0055] The corner with a lesser angle is constructed of five pairs of blocks :

3o and 3p, 3r and 3s, 3t and 3u, 3w and 3x, 3y and 3z, presented in figures from 26 to 30.

Claims

1. A self-bearing construction structure constituting a building made of segments in the form of vaulting created by joining shaping elements, **characterised by** the fact that the material of which the shaping

elements being monolithic blocks (3) of large dimensions are made is foamed polystyrene or foamed polyurethane, with blocks (3) having their internal surfaces unidirectional according to a segment of an approximation of a circle and their sum forms the shape of internal surface of segments' (2) vault.

2. Construction structure according to claim No. 1, **characterised by** that segments (2) are connected with each other at an angle between their axes α = 70° - 110° by joining together their constituent extreme blocks (3), the contact sides of which are cut at an angle β = 25° - 65°, with the sides of extreme blocks (3) being cut at an angle β = 45° in case of joining the segments (2) at an angle α = 90°.

3. Construction structure according to claim No. 1 **characterised by** that particular blocks (3) are joined by glue or staples or self-adhesive tapes.

4. Construction structure according to claim No. 1 **characterised by** that contact surfaces of blocks (3) are developed and their shape corresponds to the shape of contact surfaces of their adjacent blocks (3).

5. Construction structure according to claim No. 1 **characterised by** that blocks (3) are joined by faying surfaces or with rebates (4) and (5).

6. Construction structure according to claim No. 5 **characterised by** that blocks (3) are joined with locks (6) being latches (7) placed in crosswise, coaxial holes of faying surfaces or rebates (4) and (5) of adjacent blocks (3).

7. Construction structure according to claim No. 6 **characterised by** that surfaces of holes and latches (7) are covered with glue.

8. Construction structure according to claim No. 1 **characterised by** that blocks (3) have their internal surfaces curved and external surfaces flat.

9. Construction structure according to claim No. 1 **characterised by** that the internal surface of lower row of blocks (3) is flat.

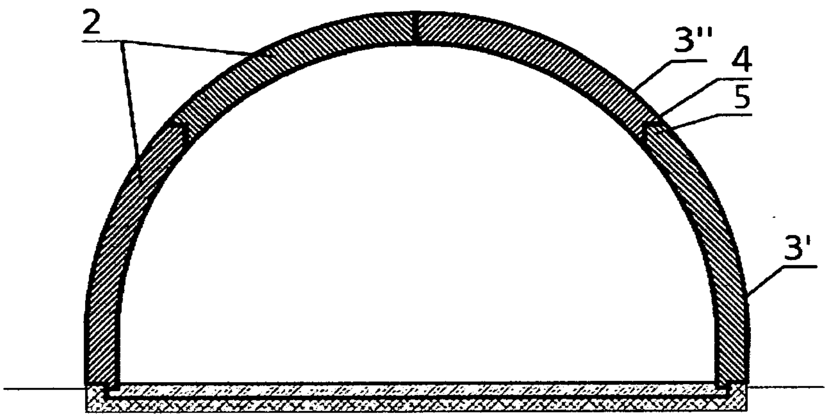

Fig. 1

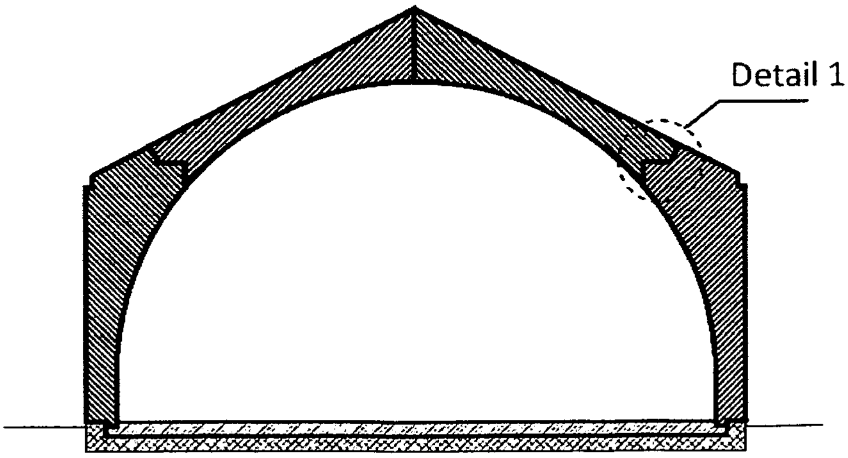

Fig. 2

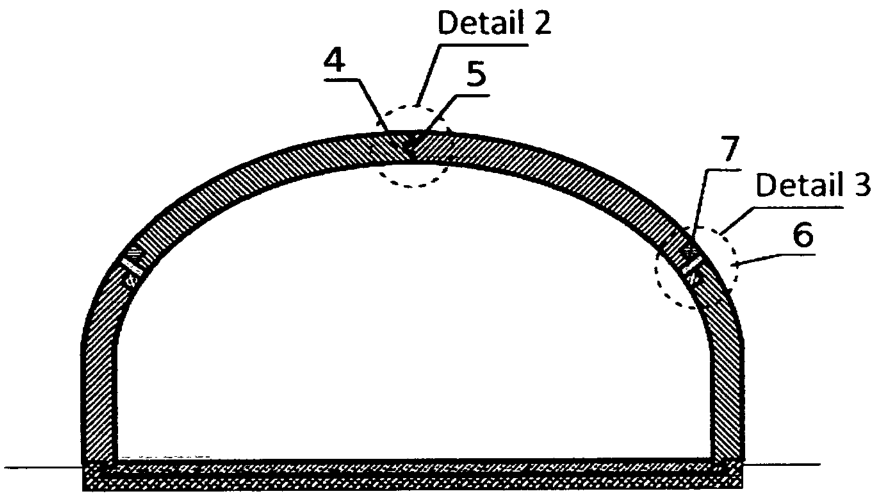

Fig.3

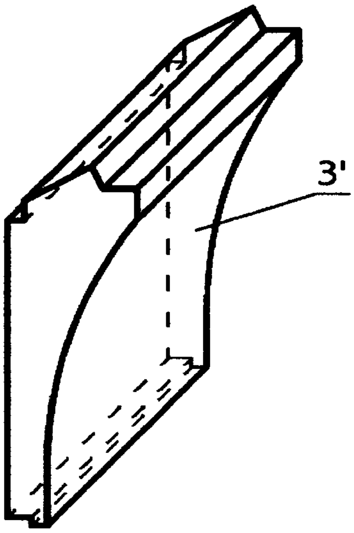

Fig.4

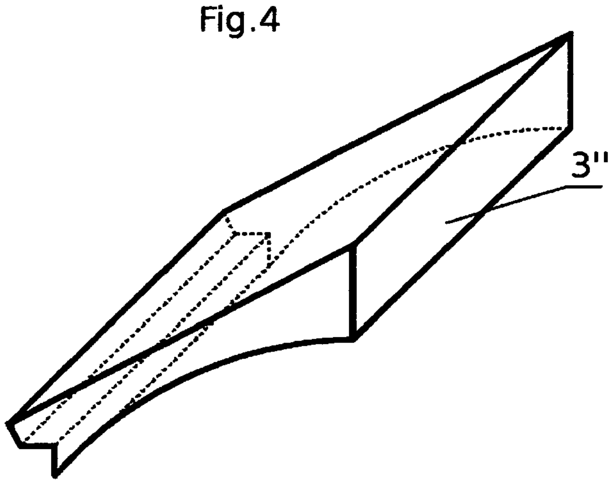

Fig.5

Detail 1

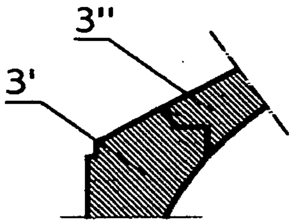

Fig.6

Detail 2

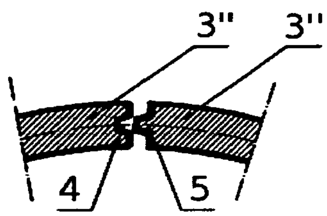

Fig.7

Detail 3

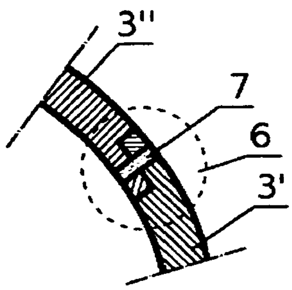

Fig.8

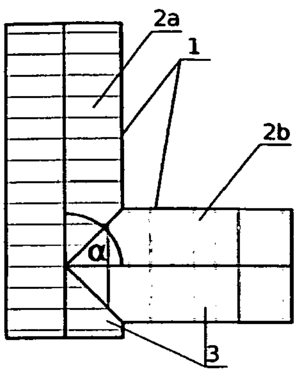

Fig.9a

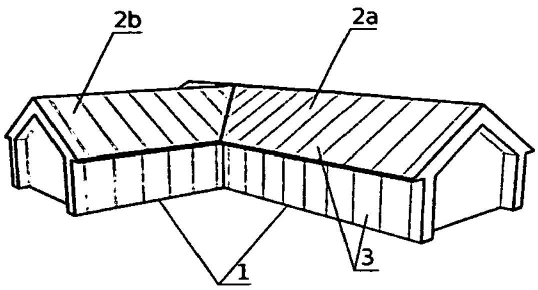

Fig.9b

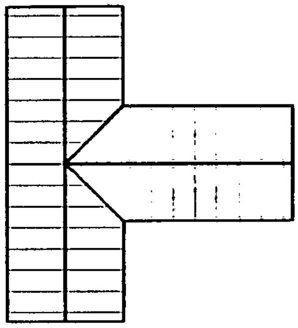

Fig.10a

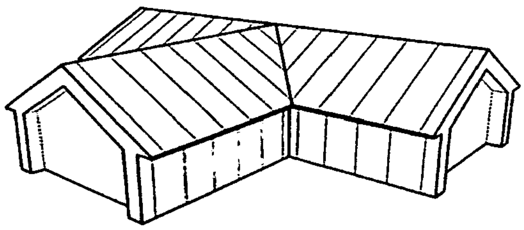

Fig.10b

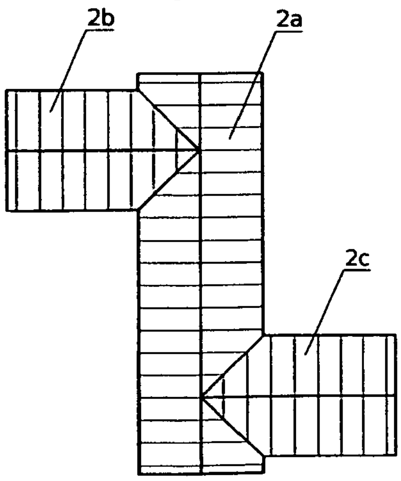

Fig.11a

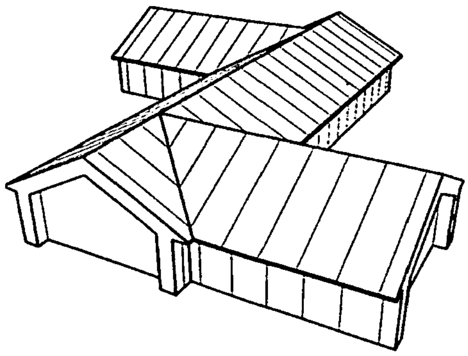

Fig.11b

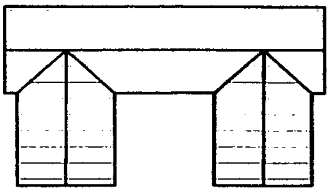
Fig.12a

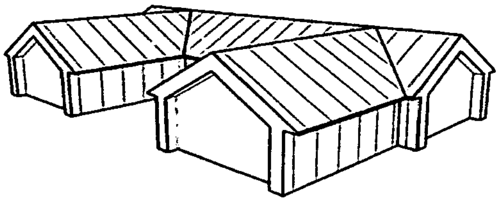
Fig.12b

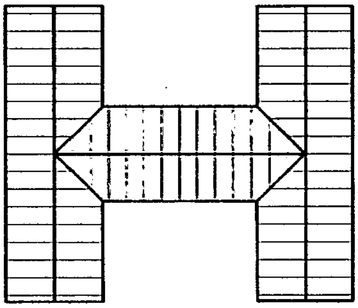
Fig.13a

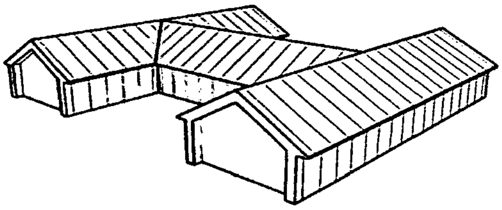
Fig.13b

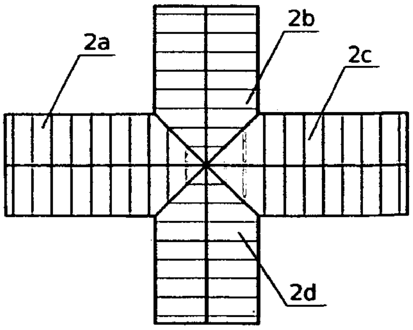

Fig.14a

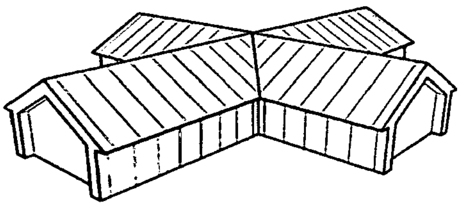
Fig.14b

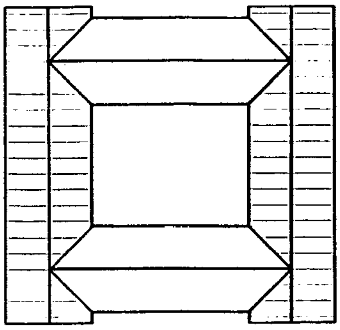

Fig.15a

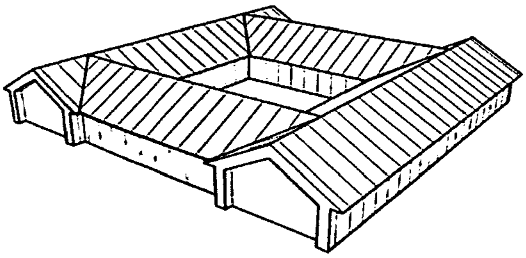

Fig.15b

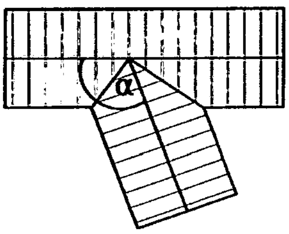

Fig.16a

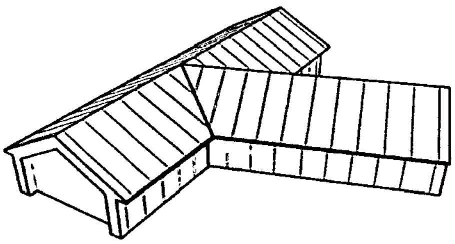

Fig.16b

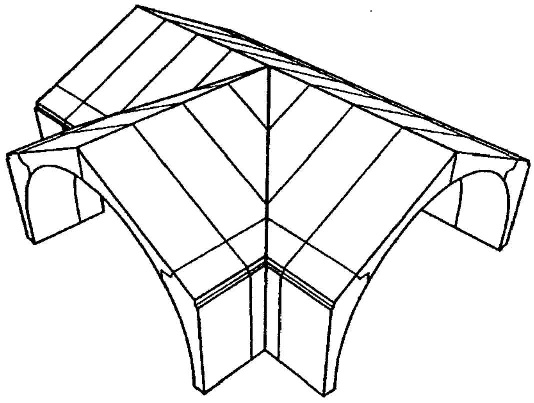

Fig. 17a

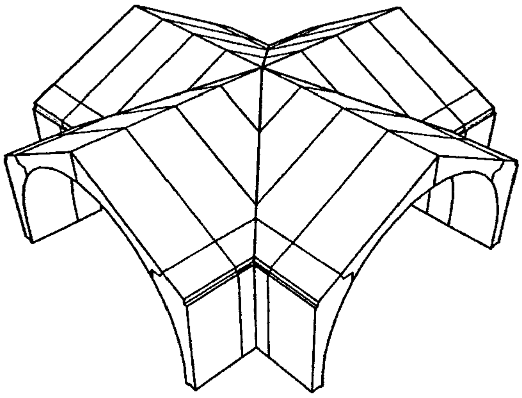

Fig. 17b

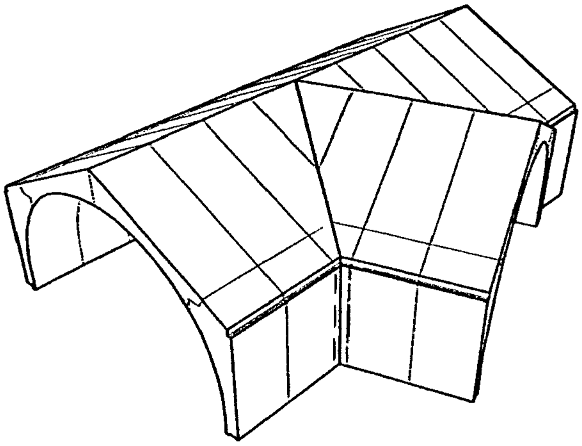

Fig. 18a

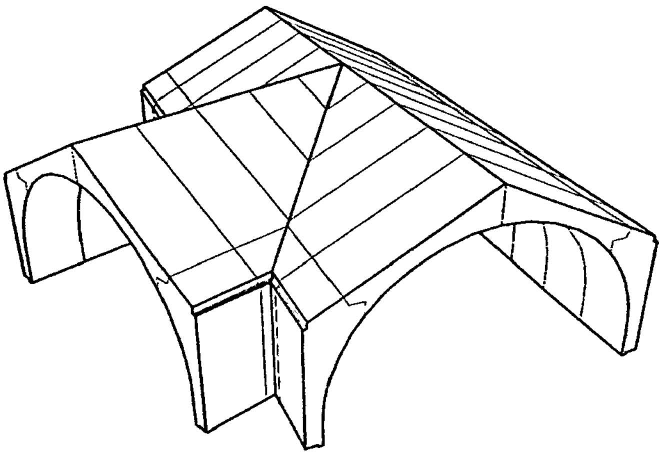

Fig.18b

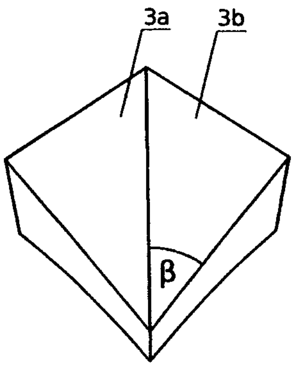

Fig.19

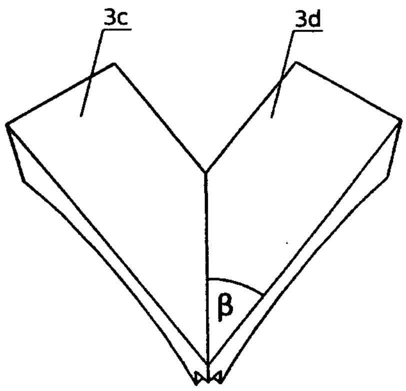

Fig.20

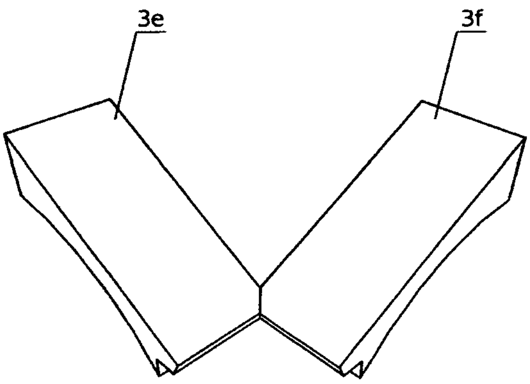

Fig. 21

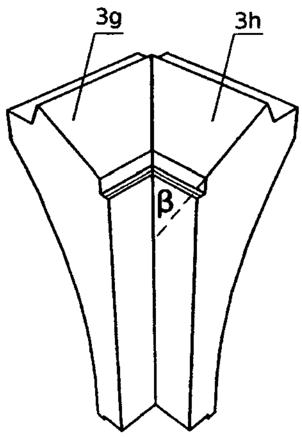

Fig. 22

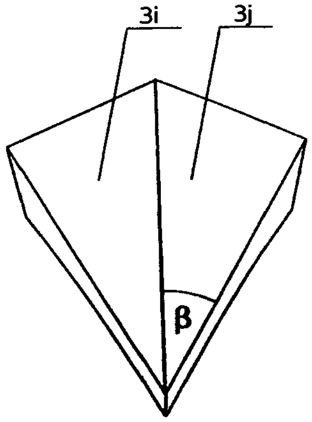

Fig. 23

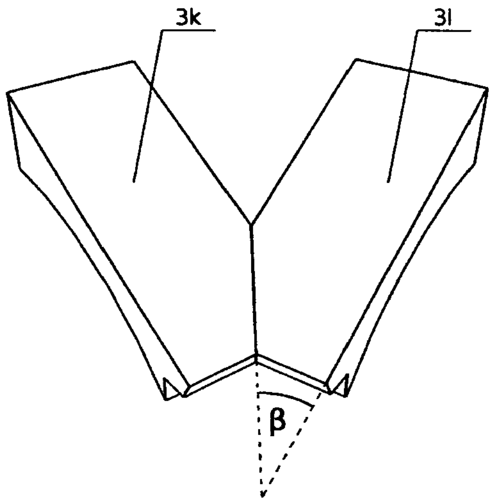

Fig. 24

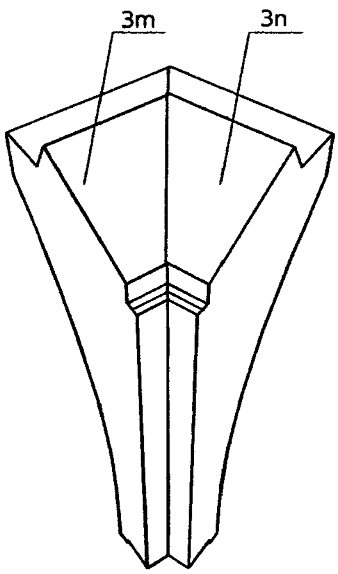

Fig. 25

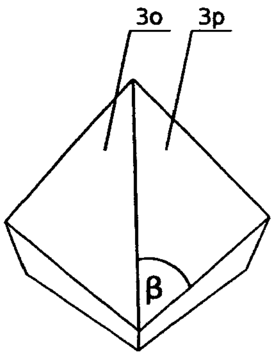

Fig. 26

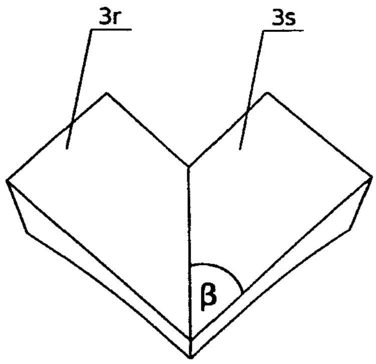

Fig. 27

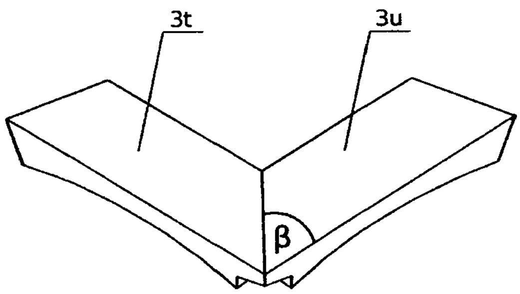

Fig.28

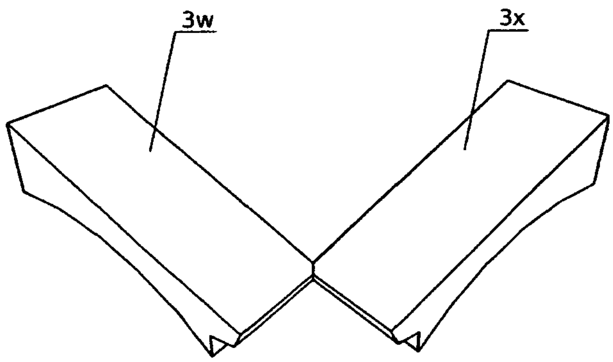

Fig. 29

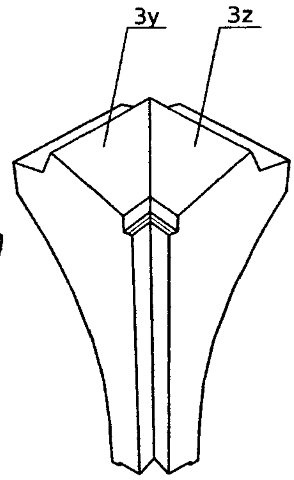

Fig. 30

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 2627884 A **[0002]**
- PL 197489 **[0003]**
- GB 9902239 W **[0003]**
- PL 364050 **[0003]**
- GB 0003966 W **[0003]**