(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 378 355 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
26.09.2018 Bulletin 2018/39

(51) Int Cl.:
A47B 96/20 *(2006.01)* ***A47F 5/11*** *(2006.01)*

(21) Application number: **18020109.7**

(22) Date of filing: **22.03.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **23.03.2017 PL 42097517**

(71) Applicant: **Piotr, Babel**
88-100 Inowroclaw (PL)

(72) Inventor: **Piotr, Babel**
88-100 Inowroclaw (PL)

(74) Representative: **Cwiklinski, Grzegorz**
Ul. Hallera 7/9
85-795 Bydgoszcz (PL)

(54) SELF-SUPPORTING SPATIAL STRUCTURE, PARTICULARLY FOR FURNITURE CONSTRUCTION

(57) A self-supporting spatial structure, particularly for furniture construction, comprising connectors and walls, characterised in that the structure is created by folding a cut-out sheet along the incisions, creating at least two parallel rows of rectangles (1) or squares (1) separated by symmetrical placed triangles (2), whose apexes coincide with the line of incision of the first row, and the angle between them is the condition for the angle between the blocks after folding by complementing the angle to obtain 180° and the trapeziums (1) joining these parallel rows of rectangles (1) or squares (1) and which are provided with foldable triangular, trapezoidal or rectangular overlaps (5), wherein in the second row of the rectangles (1) or squares (1) the rectangles or squares are separated by symmetrical trapeziums (6) touching each other along shorter bases, wherein the bases are located in the line of incisions of the first row of the rectangles (1) or squares (1), and a rhombic pass-through cut-out (7) is created between symmetrically-placed triangles and symmetrical trapeziums.

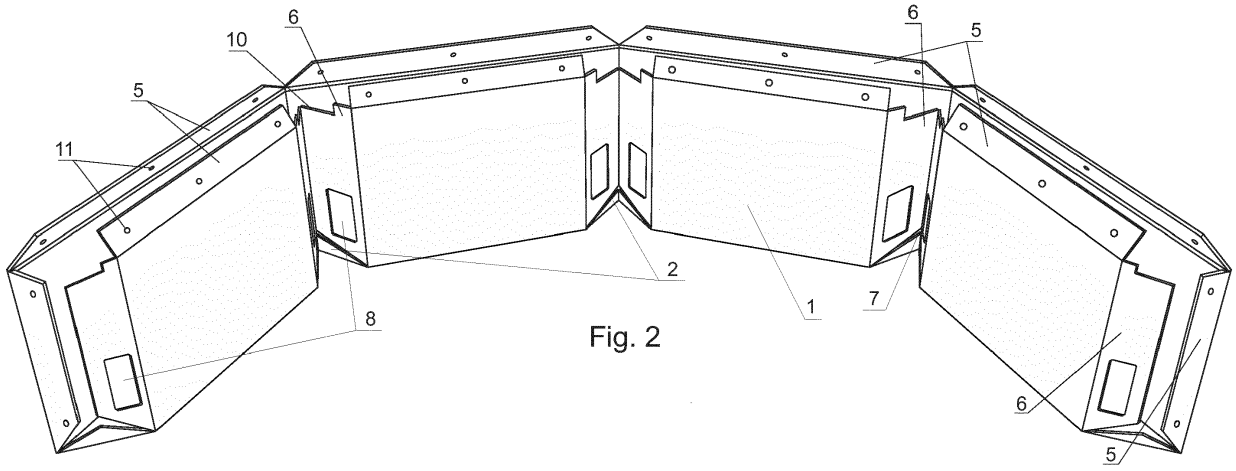


Fig. 2

EP 3 378 355 A1

Description

[0001] The invention relates to a self-supporting spatial structure, particularly for furniture construction, such as closets, cabinets, shelves, book shelves, especially display units and customised furniture sets.

[0002] Commonly known solutions for furniture construction are characterised in that they comprise horizontal and vertical board components appropriately featuring (on connecting edges) holes and pins as well as connectors, most often made of metal, also plastics, to reinforce and stiffen such edge joints, and hinge connectors.

[0003] Commonly known furniture structures are made of cellulose raw materials in the form of wooden boards and/or other wood-like or composite materials in order to obtain structurally defined shapes of the components, with enhancement treatment of the material surface, joining of the machined components with hardware or pins or screws or nails or by adhesive bonding of properly prepared ends of the components and/or upholstering of certain components, such as seats, backrests, cushions, and the mounting of hinges, wheels, brakes, handles.

[0004] Such structures, composed of conventional furniture components, have many limitations, such as difficulty in obtaining thick walls so as to avoid a significant increase in the mass of the furniture structure, inability to make butt joints of two different boards, inability to obtain a rounded (curved) furniture corner when using oblique joints and, above all, the necessity to use furniture edging products, the application of which requires a separate production process.

[0005] The object of the present invention is to develop a simple and inexpensive technology to manufacture a wide range of exhibition furniture based on paper, cardboard, sandwich panels and furniture hardware, with the possible use of other materials.

[0006] The essence of the invention is that the self-supporting spatial structure is created by folding the cut-out sheet along the incisions forming at least two rows of rectangles or squares separated by symmetrically placed triangles, whose apexes coincide with the line of incision of the first row, and the angle between them is the condition for obtaining the angle between the blocks formed after folding by complementing the angle to obtain 180°. Additionally, trapeziums joining these parallel rows of rectangles or squares, and that are provided with foldable triangular, trapezoidal or rectangular overlaps, wherein in the second row of rectangles or squares, these rectangles or squares are separated by symmetrical trapeziums joined with each other along shorter bases, wherein the bases create the line of incisions and are located in along the line of incisions of the first row of rectangles or squares, and a rhombic pass-through cut-out is formed between symmetrically placed triangles and symmetrical trapeziums.

[0007] It is preferable when each of the symmetrical trapeziums touching each other with shorter bases is provided with square or rectangular holes located in parallel to each other and create pairs into which the locking-joining insert is installed.

[0008] It is preferable when the sheet forms a uniform whole made of a laminated composite material in the form of a sheet, folded along the lines created by single-sided removal of the material to create a groove.

[0009] It is preferable when the sheet forms a uniform unit made of a sheet-shaped laminated composite material, folded along the lines created double-sided removal of the material to create a groove on one side or both sides of the sheet.

[0010] It is very preferable when the cross-section of the groove has the V-shaped or U-shaped profile.

[0011] It is preferable when the sheet is a laminated composite material in the form of the AL/LDPE/AL laminate folded along the lines created by single-sided or double-sided removal of the AL material to create a single-sided or double-sided groove in the composite material.

[0012] It is very beneficial when cross-section of the groove in the AL/LDPE/AL laminate has the V-shaped or U-shaped profile.

[0013] It is very preferable when at least one of the outer AL surfaces is covered with a plastic decorating element or varnish.

[0014] It is most preferable when one of the AL layers is printed.

[0015] It is preferable when the incised sheet, once folded, is stiffened at the back with a flat element inserted into the internal contour of the created geometric solid.

[0016] It is preferable when the element that stiffens and closes the back of the structure and joins the overlap portions is made of plywood.

[0017] It is preferable when the self-supporting structure, created by incising the sheet and once folded, is open on one side and fixed to the flat board with screws passing through the holes in the folded overlaps.

[0018] It is preferable when the self-supporting structure, created by incising the sheet and once folded, is open on one side and fixed to a flat board with a block covering the folded overlaps using bolts or screws passing through the holes in the block and in the folded overlaps.

[0019] This design of the furniture system is suitable to create various geometric solids and all shapes of the furniture by using a laminated composite panel, which can be incised and folded to adapt the shape to the needs and demands of the user, as shown below in the description and drawing. In addition, the laminate surface may be printed with any pattern or image, resulting in a smooth transition of decorative artistic forms from the front to the side walls and a very pleasing and useful visual effect.

[0020] The invention is presented in the embodiments in the drawing, but not limited in any way with the use of a composite board comprising two thin top aluminium sheets with a polymer core, wherein:

Fig. 1 shows a view of a blank cut-out of the com-

posite board sheet with incisions, wherein the folded blank creates a spatial structure in the form of a cuboid with the outer contour of a cube;

Fig. 2 shows the composite board sheet shown in Fig. 1 being folded along the incisions and gradually assuming the form of a geometric solid;

Fig. 3 shows the composite board sheet shown in Fig. 1 being folded along the incisions in the same folding phase as in Fig. 2 but reversed by 180°;

Fig. 4 shows a geometric solid created with the folded composite board in Fig. 1 in the rear view;

Fig. 5 shows a frame that stiffens the structure and closes the back of the structure and joins the internal overlaps, made of any thin-walled material, preferably plywood;

Fig. 6 shows the geometric solid in Fig. 4 but with the mounted stiffening frame in Fig. 5;

Fig.7 shows the finally assembled self-supporting spatial structure in the rear view shown in Fig. 6;

Fig. 8 shows the self-supporting spatial structure in Fig. 7 but in the front view;

Fig. 9 shows a blank-out of the composite board sheet which, when assembled, creates a spatial structure in the form of a cube without the use of any stiffening frame, with the internal pass-through void with differently shaped overlaps relative to the blank in Fig. 1;

Fig. 10 shows a geometric solid created with the blank in Fig. 9 before the rear wall is closed;

Fig. 11 shows the geometric solid in Fig. 10 with the closed rear wall by screwing or riveting the overlaps together;

Fig. 12 shows the front view of the geometric solid in Fig. 11;

Fig. 9 shows a blank-out of the composite board sheet which, when assembled, creates a spatial structure in the form of a cube with the internal pass-through void without the lower overlaps relative to the blank in Fig. 9;

Fig. 14 shows the geometric solid in Fig. 13 before the rear wall is closed;

Fig. 15 shows a blank made of any board, preferably a wood-like laminated board, with a cut-out, non-pass-through groove as the back wall of the geometric solid in Fig. 14 by embedding at the edges of the composite board;

Fig. 16 shows the geometric solid in Fig. 15 in the rear view, with the inserted blank with the groove in Fig. 15, into which the closing overlaps will be screwed;

Fig. 17 shows a blank out of a composite board sheet with incisions after folding, creating a spatial structure in the form of a shelf and shown in Fig. 19 and Fig. 20;

Fig. 18 shows the stiffening frame that also closes the back of the spatial structure made with the blank in Fig. 17;

Fig. 19 shows the geometric solid created with the blank in Fig. 17 in the rear view;

Fig. 20 shows the finished self-supporting spatial structure in Fig. 19 in the front view;

Fig. 21 shows a section of the cut-out sheet with incisions at an angle of α=120°;

Fig. 22 shows a spatial structure made with the composite plate sheet blank with the incisions in Fig. 21 but in the shape of a spatial triangle;

Fig. 23 shows a section of the cut-out composite board sheet, with incisions at an angle α=80°, the change of which results in a different position of the walls of the folded solid relative to each other (Fig. 24);

Fig. 24 shows a spatial structure created out of the cut-out composite board sheet in Fig. 23, wherein angles α=80°;

Fig. 25 shows a spatial structure with one open wall, fixed to any board, preferably a wood-like or glass-based board.

Fig. 25A shows an example of fastening with a wooden block with two longitudinal grooves in which extended overlaps are embedded by means of pass-through screwing to the board;

Fig. 25B shows the fastening with screws directly to the board;

Fig. 26 shows a schematic view of the double-sided fastening of geometric solids that are open relative to the board;

Fig. 27 shows an example of the one-sided fastening of the geometric solid that is open relative to the

board;

Fig. 28 shows a direct joint of two open solids in Fig. 25A;

Fig. 29 shows a schematic view of a shelf made with the use of two open spatial structures;

Fig. 30 shows a schematic view of a cabinet with shelves fixed according to the structure in Fig. 25A;

Fig. 31 shows a schematic view of a shelf made with the use of two closed spatial structures joined together;

Fig. 32 shows an example of a cabinet with a door, whose entire "supporting frame" is made with the use of a closed spatial structure;

Fig. 33 shows an example of a shelf made using two open solids in the perspective view, as shown in Fig. 28, fastened using the method in Fig. 25B, wherein one of the solids is printed with a pattern on one layer of the outer composite board before folding.

Fig. 34 shows a portion of the composite board;

Fig. 35 shows the locking-joining inserts of the corners of the folds of the composite board;

Fig. 36 shows the perspective view of a portion of the corner of the folded composite board with the location of the locking-joining insert in Fig. 35;

Fig. 37 shows a portion in the rear view of two corners of the folded composite board with the location of the locking-joining inserts in Fig. 35;

Fig. 38 shows a portion in the perspective view of the back of two corners of the folded composite board with the location of the locking-joining insert in Fig. 35;

Fig. 39 shows a portion of the composite board with a double-incision system, which allows a closed profile to be formed from one sheet (in the cross-section) and folding at any number of locations and at different angles;

Fig. 40 shows a cross-section of the profile created with a folded sheet incised as in Fig. 39;

Fig. 41 shows an example solid created out of the sheet in Fig. 39, in the front view;

Fig. 42 shows an example solid created out of the sheet in Fig. 39, in the rear view.

[0021] The sheet has incisions creating two parallel rows of four rectangles 1 separated by symmetrically-placed triangles 2, the apexes of which coincide with the line of incision of the first row and the apex angle 3 is 90°, and the two rows of rectangles 1 are joined by the trapeziums 4, which are equipped at their outer edges with foldable triangular, trapezoidal or rectangular overlaps 5, wherein in the second rows the rectangles 1 are separated from each other by the trapeziums 6 touching each other along shorter bases, wherein the bases form the line of incisions and are located in the line of incision of the first row of rectangles squares and, wherein rhombic pass-through cut-outs 7 are formed between symmetrically placed triangles and symmetrical trapeziums. The symmetrical trapeziums 6 are provided with rectangular openings 8, into which the locking-joining insert 9 is installed and slips 10, during the final sheet folding phase. The overlaps 5 are provided with openings 11. To stiffen the structure, the insert 12 provided with incisions 13 is inserted into the folded sheet.

[0022] In the example of the arrangement of incisions shown on Fig. 17, sheet folding creates a shelf structure. To stiffen it at the back, insert 14 is installed.

[0023] As shown in Fig. 21, Fig. 22 as well as Fig. 23, Fig. 24, a change of the apex angle causes that the angle between the walls created out of the rectangles 1 after sheet folding is complemented to obtain 180°.

[0024] As shown in Fig. 25 to Fig. 28, the cut-out sheets (after folding) may be attached to the supporting board 15 using the blocks 16 that are bolted 17 together and locked with protrusions 18. The created spatial structures may be equipped with doors 19, as in the example in Fig. 32.

Claims

1. A self-supporting spatial structure, particularly for furniture construction, comprising connectors and walls, **characterised in that** the structure is created by folding a cut-out sheet along the incisions, creating at least two parallel rows of rectangles (1) or squares (1) separated by symmetrical placed triangles (2), whose apexes coincide with the line of incision of the first row, and the angle between them is the condition for the angle between the blocks after folding by complementing the angle to obtain 180° and the trapeziums (1) joining these parallel rows of rectangles (1) or squares (1) and which are provided with foldable triangular, trapezoidal or rectangular overlaps (5), wherein in the second row of the rectangles (1) or squares (1) the rectangles or squares are separated by symmetrical trapeziums (6) touching each other along shorter bases, wherein the bases are located in the line of incisions of the first row of the rectangles (1) or squares (1), and a rhombic pass-through cut-out (7) is created between symmetrically-placed triangles and symmetrical trapezi-

ums.

2. A self-supporting spatial structure according to claim 1, **characterised in that** each of the symmetrical trapeziums (6) touching each other along shorter bases is provided with a square or rectangular opening (8), wherein the openings are located in parallel relative to each other and create pairs into which the locking-joining insert (9) is installed.

3. A self-supporting spatial structure according to claim 1, **characterised in that** the structure is uniform whole made of a laminated composite material, made of the sheet folded along the lines of incisions by single-sided removal of the material from such incision to create a groove.

4. A self-supporting spatial structure according to claim 1, **characterised in that** the sheet creates a uniform whole made of a composite material, folded along the lines of incisions created by single-sided or double-sided removal of the material to create a groove on one or both sides of the sheet.

5. A self-supporting spatial structure according to claim 2 or 3, **characterised in that** the cross-section of the groove has the V-shape or U-shape profile.

6. A self-supporting spatial structure according to claim 1, **characterised in that** the sheet is a laminated composite material in the form of the AL/LDPE/AL laminate folded along the lines created by single-sided or double-sided removal of the AL material to create a single-sided or double-sided groove in the composite material.

7. A self-supporting spatial structure according to claim 5, **characterised in that** the cross-section of the groove in the AL/LDPE/AL laminate has the V-shaped or U-shaped profile.

8. A self-supporting spatial structure according to claim 5 or 6, **characterised in that** at least one of the outer AL surfaces is covered with a plastic decorating element or varnish.

9. A self-supporting spatial structure according to claim 7, **characterised in that** one of the AL layers is printed.

10. A self-supporting spatial structure according to claim 1, **characterised in that** the incised sheet, once folded, is stiffened at the back with a flat element (12), (13), (14) inserted into the internal contour of the created geometric solid.

11. A self-supporting spatial structure according to claim 9, **characterised in that** the element (12), (13), (14) stiffening the structure and closing the rear of the structure and joining parts of the overlaps (5) is made of plywood.

12. A self-supporting spatial structure according to claim 1, **characterised in that** the self-supporting structure created by incisions of the sheet, when folded, is open on one side and fixed to the flat board with screws passing through the openings in the folded overlaps.

13. A self-supporting spatial structure according to claim 1, **characterised in that** the self-supporting structure created by incisions of the sheet, once folded, is open on one side and fixed to the flat board by the block (16) covering the folded overlaps with bolts (17) or screws (17) passing through the openings in the block and the folded overlaps.

14. A self-supporting spatial structure according to claim 1, **characterised in that** the laminated composite material used to create the walls is the AL/LDPE/AL laminate.

15. A self-supporting spatial structure according to claim 14, **characterised in that** at least one of the AL layers is printed.

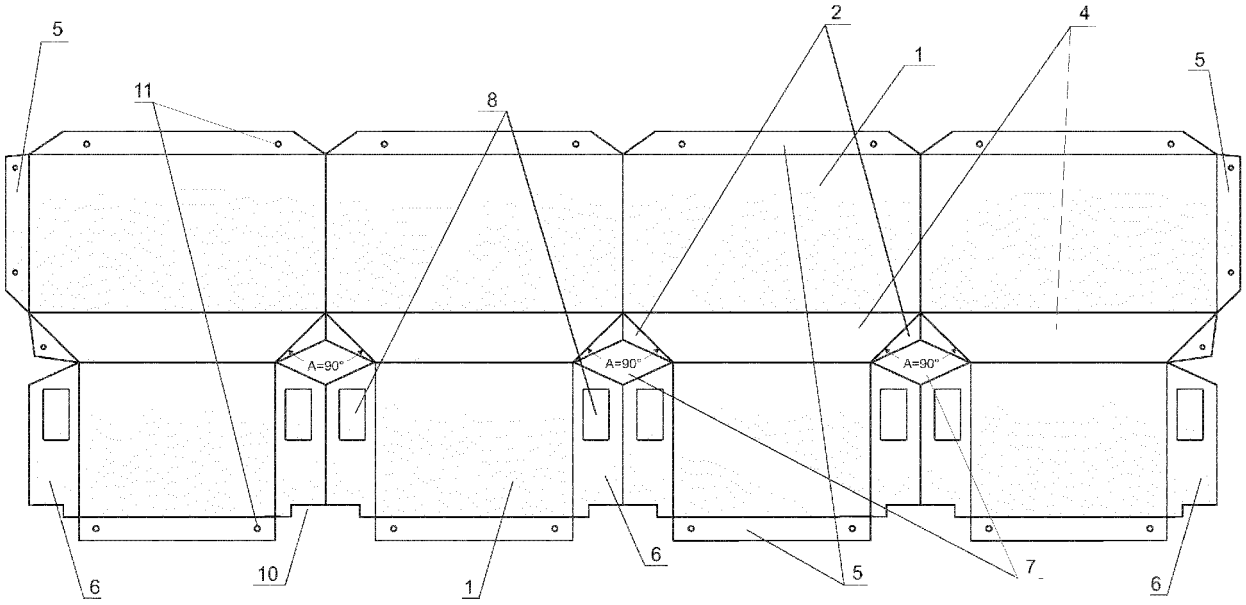


Fig. 1

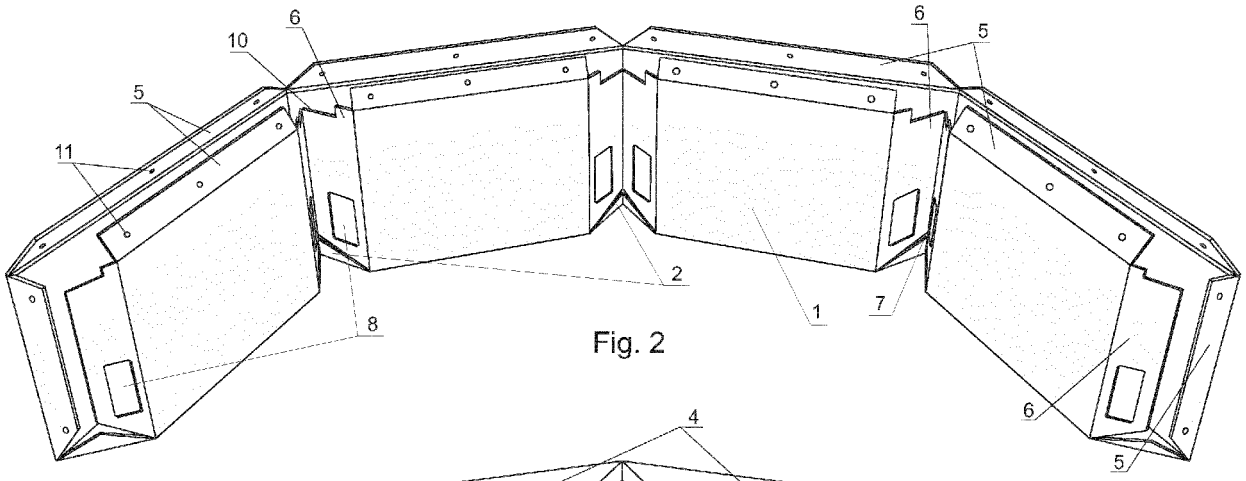


Fig. 2

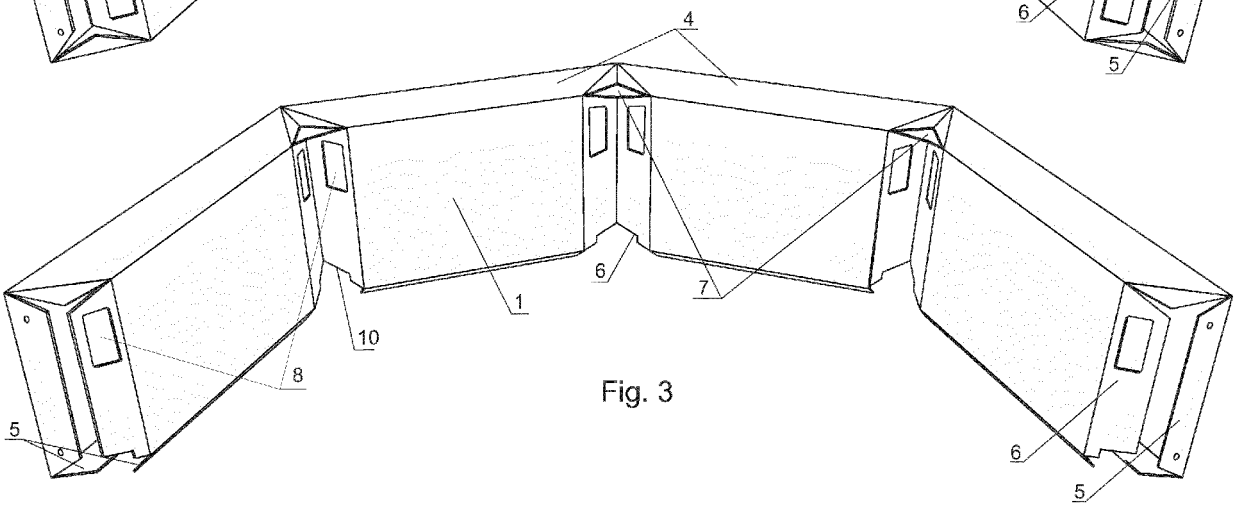


Fig. 3

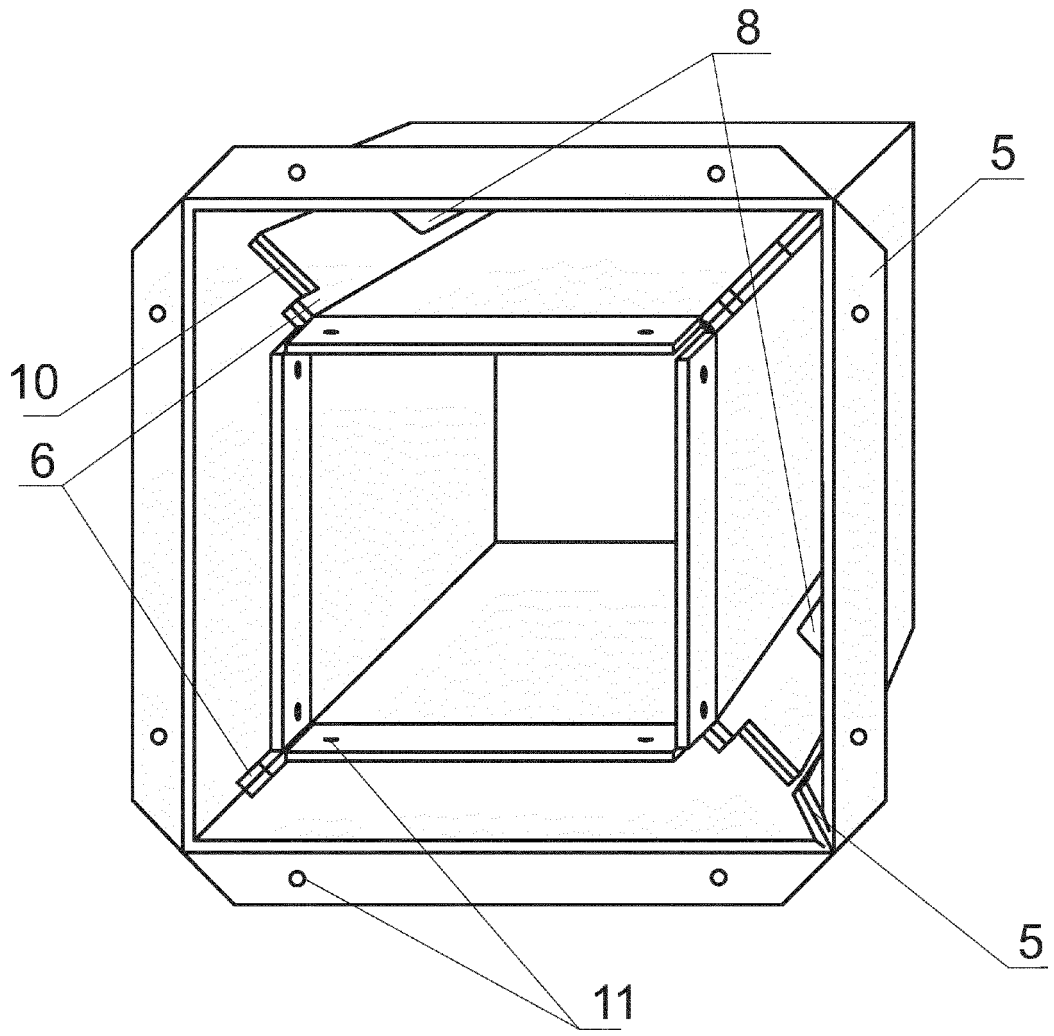


Fig. 4

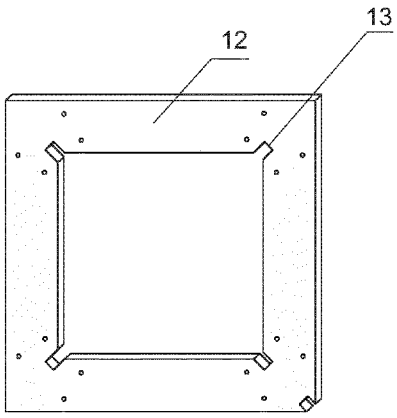


Fig. 5

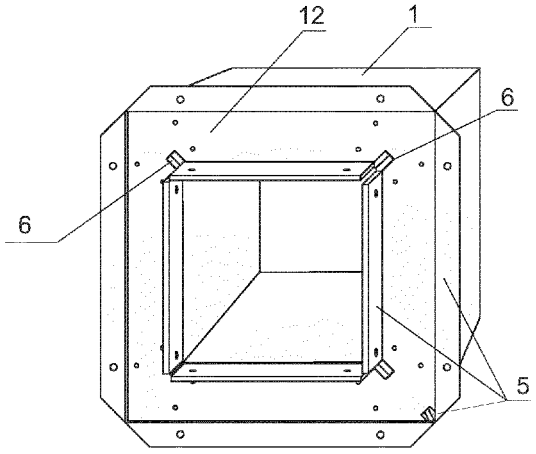


Fig. 6

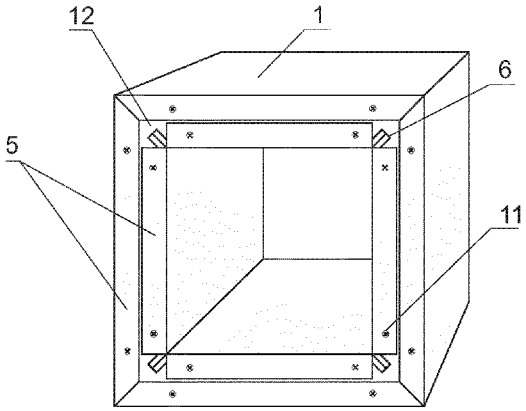


Fig. 7

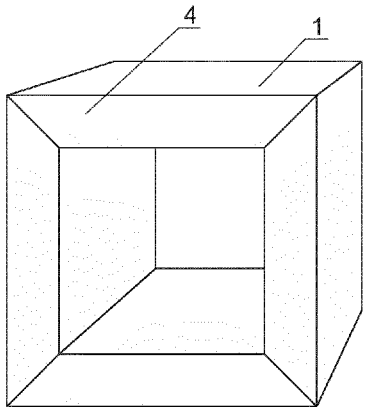


Fig. 8

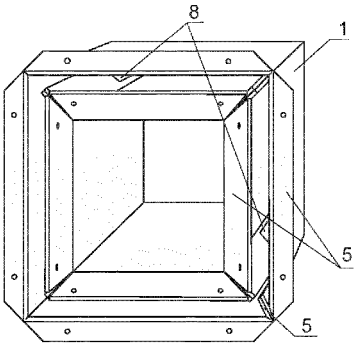


Fig. 10

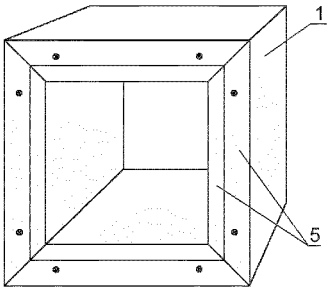


Fig. 11

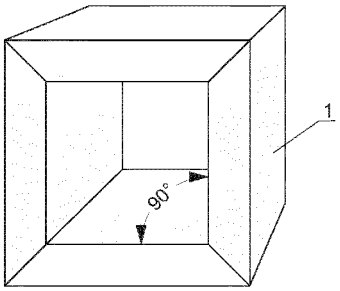


Fig. 12

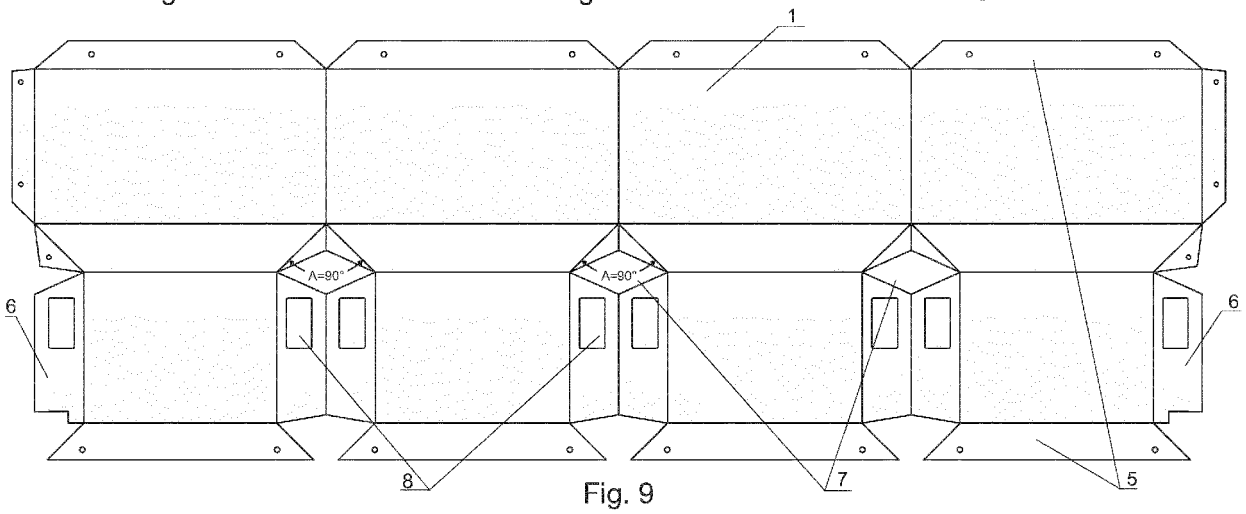


Fig. 9

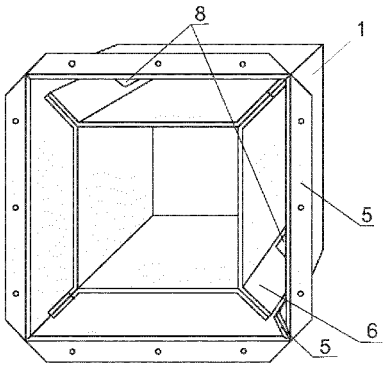


Fig. 14

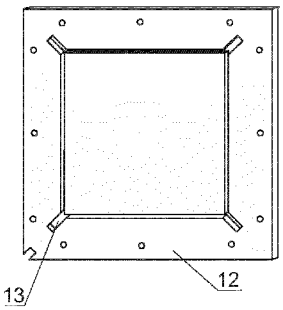


Fig. 15

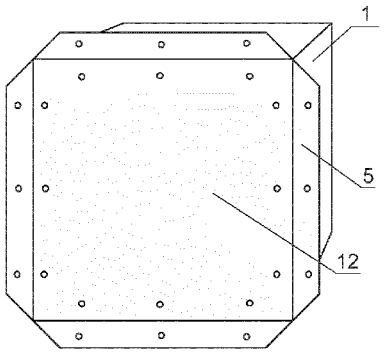


Fig. 16

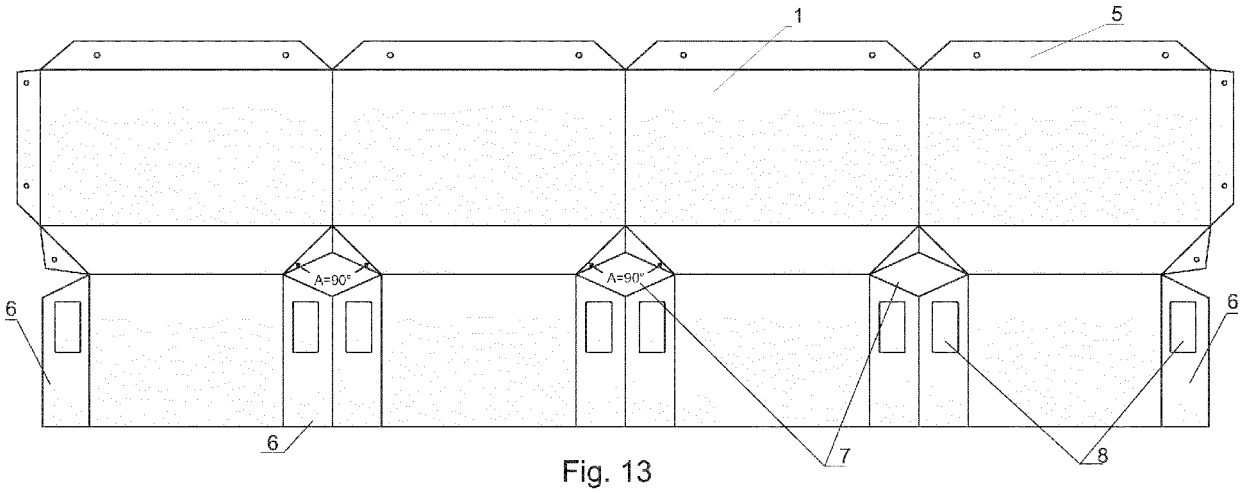


Fig. 13

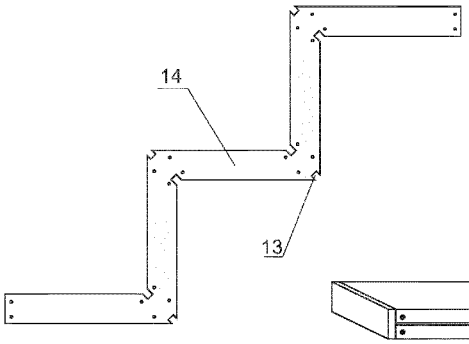


Fig. 18

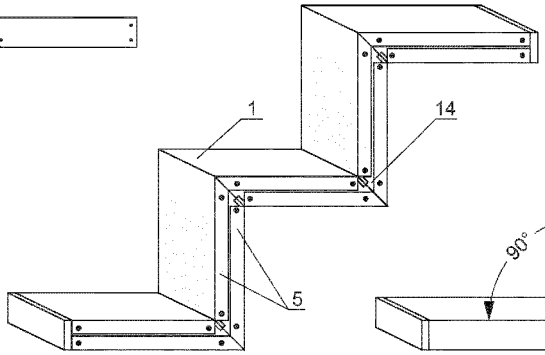


Fig. 19

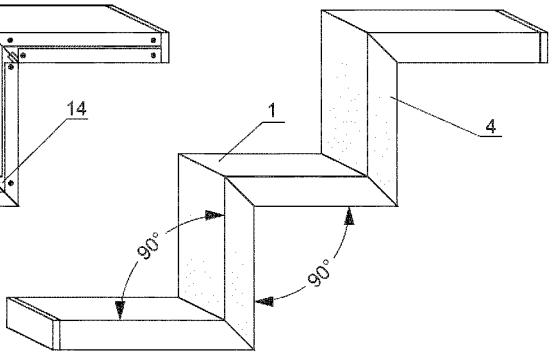


Fig. 20

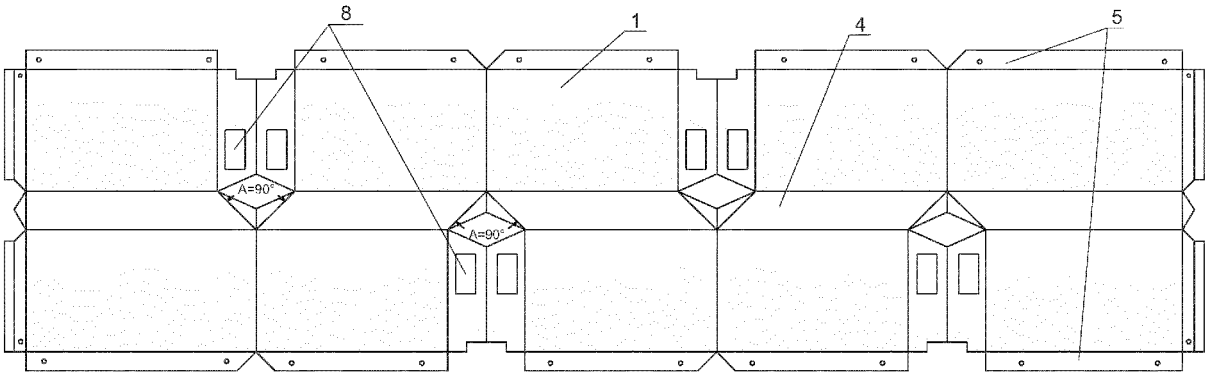


Fig. 17

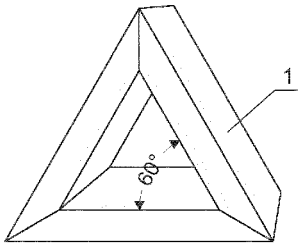


Fig. 22

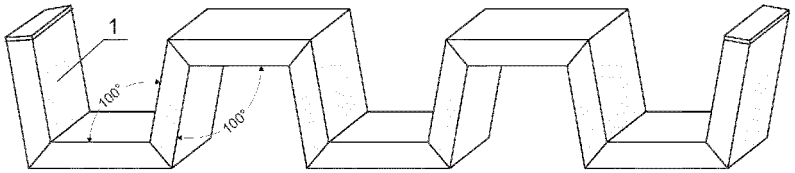


Fig. 24

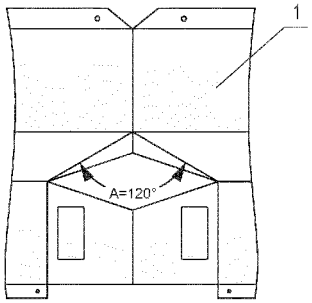


Fig. 21

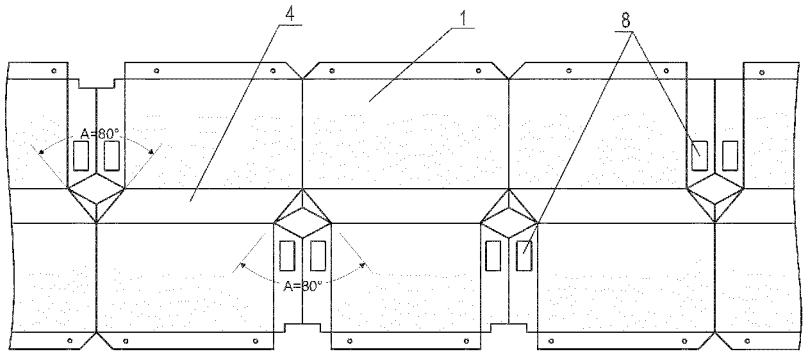


Fig. 23

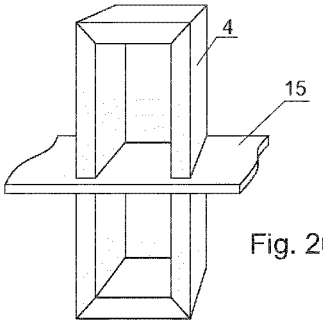


Fig. 26

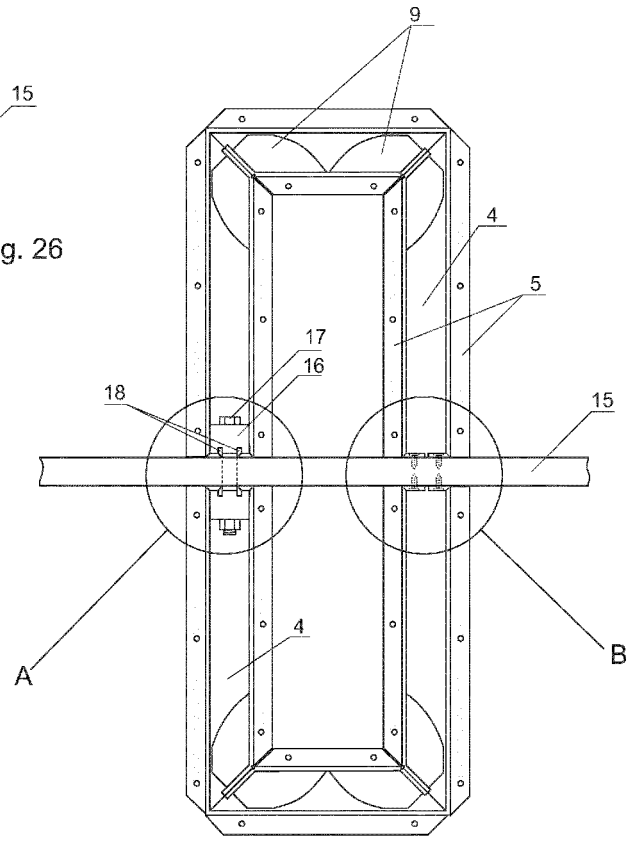


Fig. 25

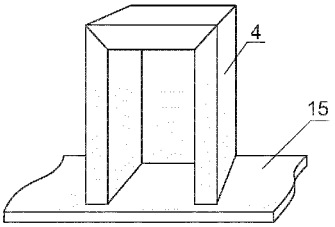
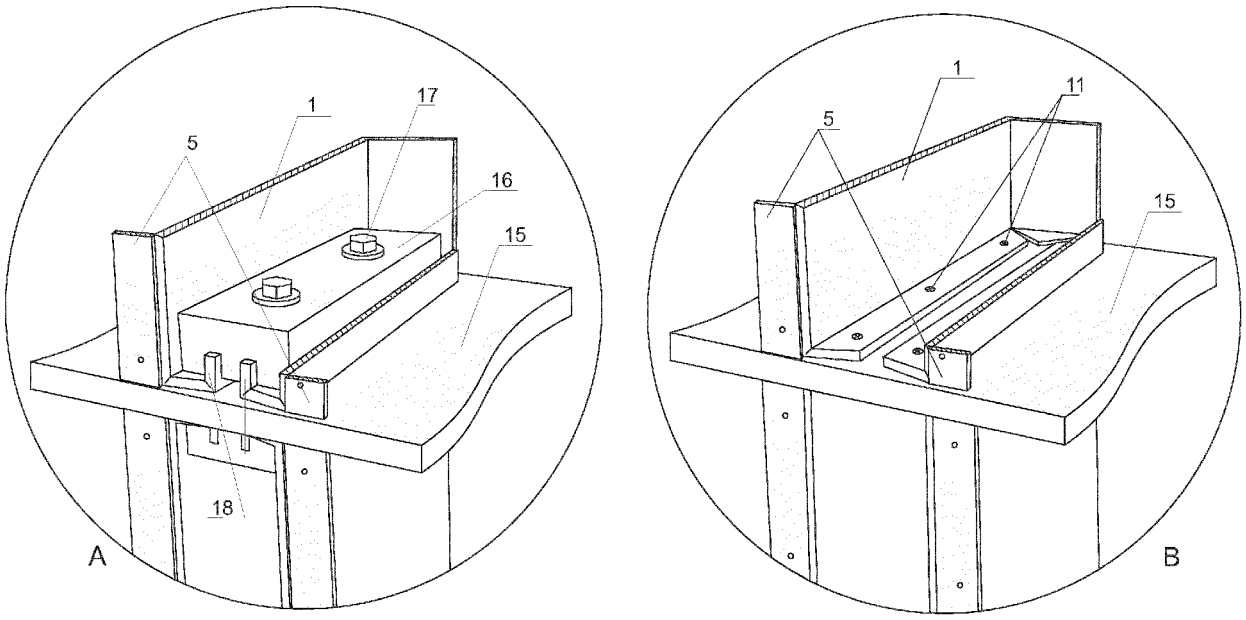


Fig. 27


1
17
5
16
15
18
A
1
11
5
15
B

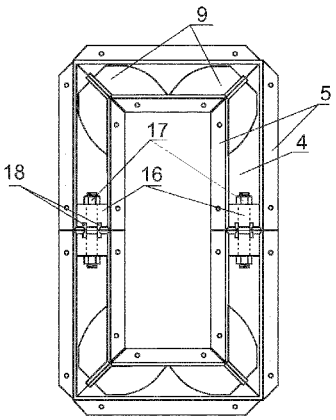


Fig. 28

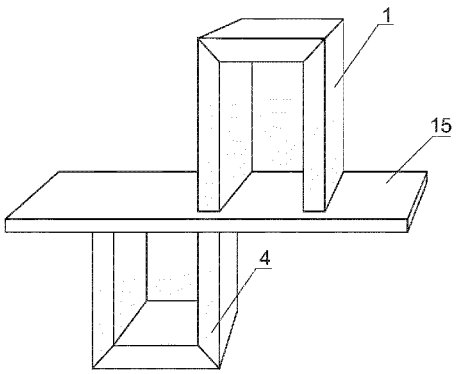


Fig. 29

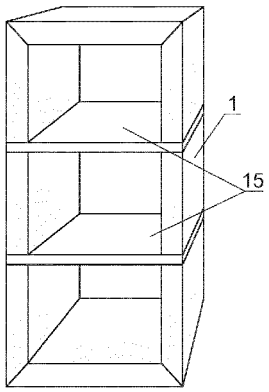


Fig. 30

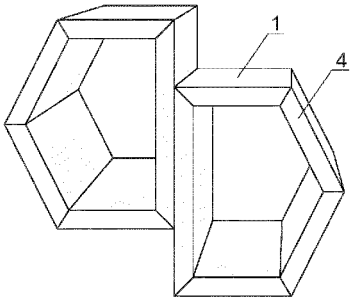


Fig. 31

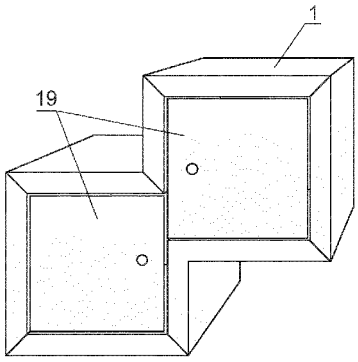


Fig. 32

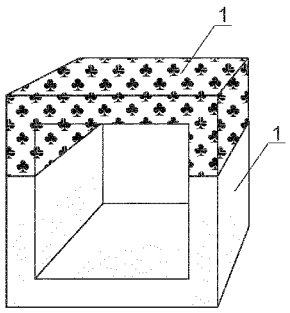


Fig. 33

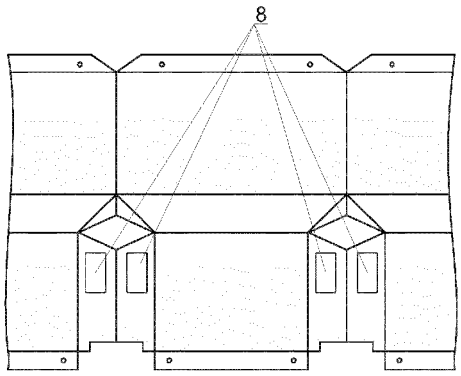


Fig. 34

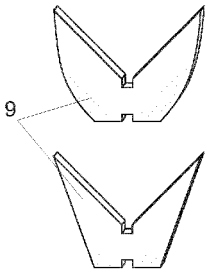


Fig. 35

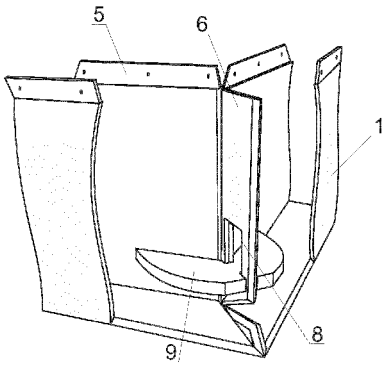


Fig. 36

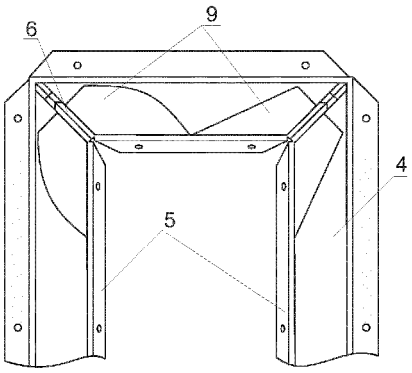


Fig. 37

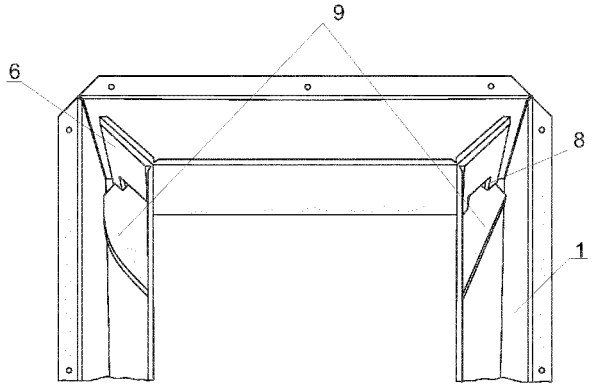


Fig. 38

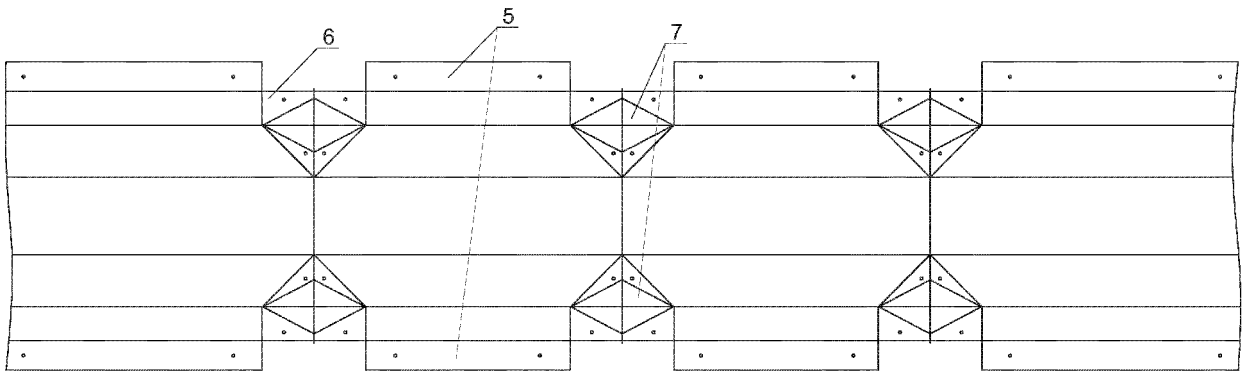


Fig. 39

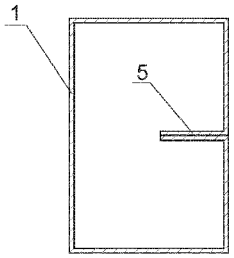


Fig. 40

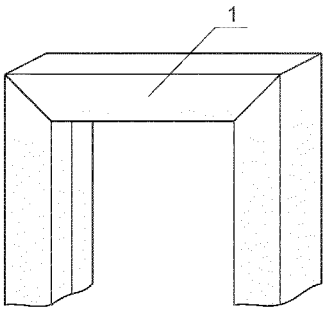


Fig. 41

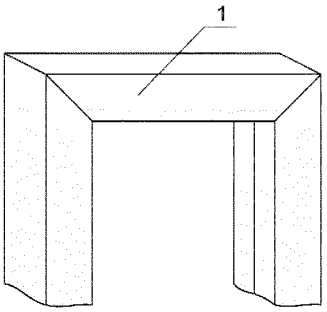


Fig. 42

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 18 02 0109

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2010/314437 A1 (DOWD FRED [US]) 16 December 2010 (2010-12-16) * paragraph [0004] - paragraph [0035]; figures 1,7,10 * -----	1-5,12, 13	INV. A47B96/20 A47F5/11
A	US 2012/074823 A1 (BEZICH LARA [US] ET AL) 29 March 2012 (2012-03-29) * paragraph [0045] - paragraph [0078]; figures 1-6a * -----	1-15	
A	FR 2 750 074 A1 (GAUDIN OLIVIER RENE GUSTAVE [FR]) 26 December 1997 (1997-12-26) * page 1 - page 2; figures 1-3 * -----	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

A47B
B65D
A47F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 June 2018	Kohler, Pierre

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 02 0109

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-06-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010314437 A1	16-12-2010	NONE	
US 2012074823 A1	29-03-2012	US 2012074823 A1	29-03-2012
		US 2014231285 A1	21-08-2014
FR 2750074 A1	26-12-1997	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82