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

(11) **EP 3 025 359 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
07.07.2021 Bulletin 2021/27

(21) Application number: **13811783.3**

(22) Date of filing: **28.11.2013**

(51) Int Cl.:
H01F 27/02 *(2006.01)* ***E04H 5/04*** *(2006.01)*
H05K 5/00 *(2006.01)*

(86) International application number:
PCT/EP2013/003602

(87) International publication number:
WO 2015/010708 (29.01.2015 Gazette 2015/04)

(54) A PREASSEMBLED TRANSFORMER SUBSTATION

VORMONTIERTE UMSPANNSTATION

SOUS-STATION DE TRANSFORMATEUR PRÉ-ASSEMBLÉE

(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

(30) Priority: **26.07.2013 CN 201320453033 U**

(43) Date of publication of application:
01.06.2016 Bulletin 2016/22

(73) Proprietor: **ABB Schweiz AG**
5400 Baden (CH)

(72) Inventors:
- **PEDERSEN, Ivan**
  7080 Boerkop (DK)
- **LIU, Jin Lou**
  Yangzhou
  Jiangsu Provence 225124 (CN)
- **WANG, Liang**
  Haidian District
  Beijing 100036 (CN)
- **LIN, Lu**
  Yangzhou
  Jiangsu Province 225000 (CN)
- **WANG, Yao Ming**
  Yangzhou
  Jiangsu Province 225000 (CN)

(74) Representative: **Maiwald Patent- und Rechtsanwaltsgesellschaft mbH**
Grünstraße 25
40212 Düsseldorf (DE)

(56) References cited:
EP-A1- 0 074 521
DE-A1- 1 434 673
DE-B3-102010 026 715
FR-A1- 2 762 029
US-A- 3 599 134
US-A- 6 161 349
US-A1- 2009 304 440
US-A1- 2012 218 067
WO-A1-2010/031448
DE-A1- 3 904 604
DE-U1- 9 405 114
JP-A- S56 118 312
US-A- 3 629 758
US-A1- 2006 181 837
US-A1- 2012 216 393

- **None**

EP 3 025 359 B1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to the field of electric power products, and specifically to a preassembled transformer substation used in the transmission and distribution system.

BACKGROUND OF THE INVENTION

[0002] Nowadays, the traditional preassembled box-type transformer substation uses an outer case material mainly including metal plate material and cement plate material. The outer case box of metal material can be made quickly, but is vulnerable to corrosion, and has a relatively high dependency on the environment and a poor capability of insulation for sound and heat; while the outer case box of cement of the preassembled transformer substation has a strong capability of corrosion resistance, but needs a long time to be made and installed and is relatively difficult for offsite assembly.So such boxes or enclosures are made of concrete or steel, or combinations of both. Furthermore it has to be considered, that steel as well as concrete are electric conductors. One further problem is, that steel or concrete can cause condensation of humity at the cold side of the wall. Examples for substations made of insulating material are disclosed in US 2012/216393 A1 and US 3 599 134 A. But the construction as well as the choice of material of compons are not optimized in sense of dielectric withstand.

SUMMARY OF THE INVENTION

[0003] The objective of the present invention is to overcome the defect of the prior art and provide a preassembled transformer substation, resistant in corrosion, electrically insulating against the environment and simple and fast in installing.According to that the invention is, that a preassembled transformer substation is provided having the features of claim 1. Preferred embodiments are specified in the dependent claims. The use of pultrusion technique for the manufacture of the elements of the substation is for obtaining electrical insulation behavior, for a better dielectric behavior and to enlarge the creepage distances.

[0004] The substation is made of glass fiber reinforced Polyester, so called GRP). The enclosure of the substation so fulfills ingress protection degree IP 54; and that for the use of station for medium- and high-voltage application.

[0005] With the technical solutions, the following beneficial effects can be achieved: as the assembling module and the like are glass fiber reinforced plastic modules, the glass fiber reinforced plastic has relatively good corrosion resistant property. Moreover, a modularized design is used to facilitate a fast installing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The subject matter of the Invention will be explained in more details in the following description illustrated in the drawings, in which:

Figure 1 is a structural diagram of a preassembled transformer substation in an embodiment of the invention.

Figure 2 is a partial section view of a wall body in an embodiment of the invention.

Figure 3 is a section view of an embodiment of an assembling module according to an embodiment of the invention.

Figure 4 is a section view of a wall corner module in an embodiment of the invention.

Figure 5 is a section view of a connector in an embodiment of the invention.

Figure 6 is a section view of a ridge in an embodiment of the invention.

Figure 7 is a partial structural diagram of a bottom of the wall body in an embodiment of the invention.

Figure 8 is a partial structural diagram of a structure between the wall body and the roof.

Figure 9 is a section view of an edge banding in an embodiment of the invention.

Figure 10 is a section view of a top rail in an embodiment of the invention.

Figure 11 is a partial structural diagram of a roof.

Figure 12 is a transverse partial cutaway view of a structure between the door body and the wall body in an embodiment of the invention.

Figure 13 is a longitudinal partial cutaway view of a structure between the door body and the roof.

Figure 14 is a section view of a seal strip.

Figure 15 is a section view of a top seal part.

Figure 16 a transverse cutaway view of the preassembled transformer substation.

Figure 17 is a side view of a heat dissipation window.

Checking list for the reference numerals:

[0007]

1--assembling module
2--wall corner module
3-connector
4-ridge
5--edge banding
6-top rail
7--seal strip
8--top seal part
9--heat dissipation window
10--wall body
20--door body
30-roof
40--transformer chamber
50--high voltage chamber
60--low voltage chamber
70-transformer
11--bottom side
12--base wall body metal connector
13--base longitudinal beam
21--door hinge
31--outer edge
32--ridge support metal part
33--roof wall body metal connector
91--blade

DETAILED DESCRIPTION OF THE DRAWINGS

[0008] Exemplary embodiments of the invention are described in conjunction with the accompanying drawings hereinafter. For the sake of clarity and conciseness, not all the features of actual implementations are described in the specification.

[0009] As shown in figure 1, a preassembled transformer substation comprises a plurality of strip-shaped assembling modules 1, a plurality of wall corner modules 2, connectors 3 which are located between the assembling modules 1 and the wall corner modules 2 (see figure 2), and a ridge 4; the assembling modules 1 are arranged longitudinally, and form, together with the wall corner modules 2 and the connectors 3, a wall body 10 and a door body 20 of the preassembled transformer substation; the assembling modules 1 are arranged transversely, and form, together with the ridge 4 and the connectors 3, a roof 30 of the preassembled transformer substation, wherein the ridge 4 is located at a center of the roof 30, and the assembling module 1 has one end connected with the ridge 4 and the other end inclined downward; each of the assembling module 1, the wall corner module 2, the connector 3 and the ridge 4 is a glass fiber reinforced plastic module.

[0010] The assembling modules 1 forming the wall body 10 and the door body 20 and the assembling modules 1 supporting the roof 30 are made of the same material, wherein the wall body 10, the door body 20 and the roof 30 have the same die section, but are different in length only. Between the adjacent assembling modules 1, and between the assembling module 1 and the wall corner module 2 are inserted for securing by the connector 3, without need of rivets or screws, thus facilitating instalment. As the glass fiber reinforced plastic has relatively good corrosion resistant property, the inventive transformer substation has a strong capability of corrosion resistance.

[0011] As shown in figures 2-4, the assembling module 1 and the wall corner module 2 have a hollow bilayer structure formed by die drawing. The hollow bilayer structure has excellent capability of insulation for sound and heat. As shown in figure 5, the connector 3 has a transverse section of I shape, both ends of the assembling module 1 and the wall corner module 2 can be inserted into two sides of the connector 3 and form an interference fit, thus functioning for secure connection.

[0012] As shown in figure 6, the shape of the ridge 4 is similar to that of the connector 3, but two sides of the ridge 4 incline downward. When the assembling module 1 is inserted into the ridge 4, a roof 30 high in the middle and low on two sides is formed.

[0013] As shown in figures 7-8, an edge banding 5 is coated on a bottom side 11 of the wall body 10 and an outer edge 31 of the roof 30. The edge banding 5 functions for improving support and water proofing. As shown in figures 7 and 9, the edge banding 5 on the bottom side 11 of the wall body 10 is connected, via a base wall body metal connector 12, with a base longitudinal beam 13. The base wall body metal connector 12 and the base longitudinal beam 13 function for securely supporting the whole preassembled transformer substation.

[0014] As shown in figures 8 and 10, the roof 30 and the wall body 10 are connected by a ridge support metal part 32, a roof wall body metal connector 33 and a top rail 6; the ridge support metal part 32 is arranged horizontally in a direction along the length of the assembling modules 1 of the roof 30, the top rail 6 is arranged horizontally in a direction perpendicular to the ridge support metal part 32, the roof wall body metal connector 33 connects the ridge support metal part 32 and the top rail 6; the top rail 6 is a glass fiber reinforced plastic module. The roof wall body metal connector 33 comprises two portions, one portion is connected with the ridge support metal part 32 and the other portion is connected with the assembling modules 1 forming the wall body, and the assembling module 1 is further connected with the top rail 6.

[0015] As shown in figure 11, the ridge support metal part 32 is installed below the ridge 4. The ridge support metal part 32 functions for supporting the ridge 4.

[0016] As shown in figures 12-15, a seal strip 7 is provided between the door body 20 and the wall body 10 and between the door body 20 and the roof 30, and a top seal part 8 is provided between the roof 30 and the door body 20, the seal strip 7 is inserted to the top seal part 8. In figure 12, the seal strip 7 is located between the wall

body 10 and a door hinge 21 on the side of the door body 20. In figure 13, the seal strip 7 is located between the top seal part 8 and the top of the door body 20. The seal strip and the top seal part can function for better protection.

[0017] As shown in figure 16, the preassembled transformer substation has a transverse section of shape, with a transformer chamber 40 in the middle and a high voltage chamber 50 and a low voltage chamber 60 at its two ends, respectively; the high voltage chamber 50 is connected by a cable or a copper busbar with a high voltage terminal of a transformer 70, and the low voltage chamber 60 is connected by a cable or a copper busbar with a low voltage terminal of a transformer 70. The preassembled transformer substation has in its interior a grounding copper busbar which generally connects various grounding points.

[0018] As shown in figure 1 and 17, a heat dissipation window 9 is provided on a door of the transformer chamber 40 and on the wall body 10, and the heat dissipation window 9 comprises a plurality of L-shaped blades 91 spaced apart with one another.

[0019] The preassembled transformer substation in the present invention can satisfy the requirements on distribution and transformation with a rated capacity in most areas, resistant to corrosion, simple and fast in installing, excellent in insulating property, light in weight, beautiful in appearance, and convenient for capacity regulation with its modularized design.

Claims

1. A preassembled transformer substation comprising

- a plurality of strip-shaped assembling modules (1),
- a plurality of wall corner modules (2),
- connectors (3) located between adjacent strip-shaped assembling modules (1) and between the wall corner modules (2) and adjacent strip-shaped assembling modules (1),
- a wall body (10) which is made from the plurality of strip-shaped assembling modules (1),
- a roof (30), which is made of other strip-shaped assembling modules (1),

characterized by

- a door comprising a door body (20) fixed at the wall body (10) with hinges (21), wherein the door body (20) is made of strip-shaped assembling modules (1),
- a ridge (4), being located at a middle of the roof (30), wherein the roof (30) of the preassembled transformer substation is formed by the other strip-shaped assembling modules (1) together with the ridge (4) and the connectors (3), wherein the other strip-shaped assembling modules (1) are disposed on both sides of the ridge (4) and have a first end connected with the ridge (4) and a second end which is parallel to the first end and is inclined downward toward the wall body (10) so as to form the roof (30) which has an high portion close to the ridge (4) and two lower portions close to second end portions of the assembling modules (1),

wherein the roof (30) and the wall body (10) are connected by a ridge support metal part (32) installed below the ridge (4), a top rail (6) and a roof wall body metal connector (33), wherein the roof wall body metal connector (33) connects, the ridge support metal part (32) and the top rail (6),
wherein the wall body (10), the door body (20), the top rail (6), the roof (30), the plurality of wall corner modules (2), the connectors (3) and the ridge (4) are made by pultrusion profiles of insulating material, wherein the insulating material is plastic or glasfiber reinforced Polyester, wherein the wall body (10), the roof (30), and the door body (20) are made in double layer insulating material with approximately 40 millimeter air distance between each layer, and wherein the hinges (21) of the door have fixation flanges being arranged in parallel and inside a space between an edge of the door body (20) and an edge of the wall body (10).

2. A preassembled transformer substation according to claim 1,
wherein each of the connectors (3) is a glass fiber reinforced plastic module.

3. A preassembled transformer substation according to claim 1 or 2,
wherein the assembling modules (1) and the wall corner modules (2) have a hollow die drawn bilayer structure.

4. A preassembled transformer substation according to claim 3, **wherein** the connector (3) has a transverse section of I -shape.

5. A preassembled transformer substation according to claim 1 or 2,
wherein
the wall body (10) has a bottom side (11) and a top side, wherein the bottom side (11) is parallel to the top side, wherein the top side is facing an outer edge (31) of the roof (30) and wherein an edge banding (5) is coated on:

- the bottom side (11) of the wall body (10); and
- the outer edge (31) of the roof (30).

6. A preassembled transformer substation according to claim 5, wherein the edge banding (5) on the bottom side (11) of the wall body (10) is connected, via a base wall body metal connector (12), with a base longitudinal beam (13).

Patentansprüche

1. Vormontierte Transformatorstation mit

- einer Vielzahl von streifenförmigen Aufbaumodulen (1),
- einer Vielzahl von Wandeckmodulen (2),
- Verbindern (3), die zwischen benachbarten streifenförmigen Aufbaumodulen (1) und zwischen den Wandeckmodulen (2) und benachbarten streifenförmigen Aufbaumodulen (1) angeordnet sind
- einen Wandkörper (10), der aus der Vielzahl von streifenförmigen Aufbaumodulen (1) hergestellt ist,
- ein Dach (30), das aus anderen streifenförmigen Aufbaumodulen (1) hergestellt ist,

gekennzeichnet durch

- eine Tür, die einen Türkörper (20) umfasst, der an dem Wandkörper (10) mit Scharnieren (21) befestigt ist, wobei der Türkörper (20) aus streifenförmigen Aufbaumodulen (1) hergestellt ist,
- einem First (4), der sich in einer Mitte des Daches (30) befindet, wobei das Dach (30) der vormontierten Transformatorstation durch die anderen streifenförmigen Aufbaumodule (1) zusammen mit dem First (4) und den Verbindern (3) gebildet ist, wobei die anderen streifenförmigen Aufbaumodule (1) auf beiden Seiten des Firstes (4) angeordnet sind und ein erstes Ende, das mit dem First (4) verbunden ist, und ein zweites Ende haben, das parallel zu dem ersten Ende ist und nach unten in Richtung des Wandkörpers (10) geneigt ist, um das Dach (30) zu bilden, das einen hohen Abschnitt nahe dem First (4) und zwei untere Abschnitte nahe den zweiten Endabschnitten der Aufbaumodule (1) hat,

wobei das Dach (30) und der Wandkörper (10) durch ein Firstträger-Metallteil (32), das unter dem First (4) installiert ist, eine obere Schiene (6) und einen Dachwandkörper-Metallverbinder (33) verbunden sind, wobei der Dachwandkörper-Metallverbinder (33), das Firstträger-Metallteil (32) und die obere Schiene (6), verbindet,
wobei der Wandkörper (10), der Türkörper (20), die obere Schiene (6), das Dach (30), die Vielzahl von Wandeckmodulen (2), die Verbinder (3) und der First (4) durch Pultrusionsprofile aus Isoliermaterial hergestellt sind, wobei das Isoliermaterial Kunststoff oder glasfaserverstärktes Polyester ist, wobei der Wandkörper (10), das Dach (30) und der Türkörper (20) aus doppelschichtigem Isoliermaterial mit einem Luftabstand von etwa 40 mm zwischen jeder Schicht hergestellt sind, und wobei die Scharniere (21) der Tür Befestigungsflansche haben, die parallel und innerhalb eines Raumes zwischen einer Kante des Türkörpers (20) und einer Kante des Wandkörpers (10) angeordnet sind.

2. Vormontierte Transformatorstation nach Anspruch 1, wobei jeder der Verbinder (3) ein glasfaserverstärktes Kunststoffmodul ist.

3. Vormontierte Transformatorstation nach Anspruch 1 oder 2, wobei die Aufbaumodule (1) und die Wandeckmodule (2) eine hohlgezogene Zweischichtstruktur aufweisen.

4. Vormontierte Transformatorstation nach Anspruch 3, wobei der Verbinder (3) einen I-förmigen Querschnitt aufweist.

5. Vormontierte Transformatorstation nach Anspruch 1 oder 2, wobei der Wandkörper (10) eine Unterseite (11) und eine Oberseite aufweist, wobei die Unterseite (11) parallel zur Oberseite ist, wobei die Oberseite einer Außenkante (31) des Daches (30) zugewandt ist und wobei ein Randstreifen (5) aufgetragen ist auf:

- der Unterseite (11) des Wandkörpers (10); und
- der Außenkante (31) des Daches (30).

6. Vormontierte Transformatorstation nach Anspruch 5, wobei der Randstreifen (5) an der Unterseite (11) des Wandkörpers (10) über einen Bodenwandkörper-Metallverbinder (12) mit einem Bodenlängsträger (13) verbunden ist.

Revendications

1. Sous-station de transformateur pré-assemblée comprenant
une pluralité de modules d'assemblage en forme de bande (1),
une pluralité de modules de coin de paroi (2),
des raccords (3) situés entre des modules d'assemblage en forme de bande (1) adjacents et entre les modules de coin de paroi (2) et les modules d'assemblage en forme de bande (1) adjacents,
un corps de paroi (10) qui est fait de la pluralité de modules d'assemblage en forme de bande (1),
un toit (30), qui est fait d'autres modules d'assemblage en forme de bande (1),
caractérisée par

une porte comprenant un corps de porte (20) fixé au corps de paroi (10) avec des charnières (21), le corps de porte (20) étant fait de modules d'assemblage en forme de bande (1),
une arête (4), située au milieu du toit (30), le toit (30) de la sous-station de transformateur pré-assemblée étant formé par les autres modules d'assemblage en forme de bande (1) avec l'arête (4) et les raccords (3), les autres modules d'assemblage en forme de bande (1) étant disposés sur les deux côtés de l'arête (4) et ayant une première extrémité reliée à l'arête (4) et une seconde extrémité qui est parallèle à la première extrémité et est inclinée vers le bas vers le corps de paroi (10) de sorte à former le toit (30) qui a une partie haute proche de l'arête (4) et deux parties inférieures proches des secondes parties d'extrémité des modules d'assemblage (1),
le toit (30) et le corps de paroi (10) étant reliés par une partie métallique (32) de support d'arête installée sous l'arête (4), un rail supérieur (6) et un raccord métallique (33) de corps de paroi de toit, le raccord métallique (33) de corps de paroi de toit reliant la partie métallique (32) de support d'arête et le rail supérieur (6),
le corps de paroi (10), le corps de porte (20), le rail supérieur (6), le toit (30), la pluralité de modules de coin de paroi (2), les raccords (3) et l'arête (4) étant faits de profils d'extrusion par étirage de matériau isolant, le matériau isolant étant du plastique ou du polyester renforcé de fibre de verre, le corps de paroi (10), le toit (30) et le corps de porte (20) étant faits d'un matériau isolant à double couche avec une distance d'air d'environ 40 millimètres entre chaque couche, et les charnières (21) de la porte ayant des brides de fixation disposées en parallèle et à l'intérieur d'un espace entre un bord du corps de porte (20) et un bord du corps de paroi (10).

2. Sous-station de transformateur pré-assemblée selon la revendication 1, chacun des raccords (3) étant un module en plastique renforcé de fibres de verre.

3. Sous-station de transformateur pré-assemblée selon la revendication 1 ou 2, les modules d'assemblage (1) et les modules de coin de paroi (2) ayant une structure bicouche extrudée étirée creuse.

4. Sous-station de transformateur pré-assemblée selon la revendication 3, le raccord (3) ayant une section transversale de forme en I.

5. Sous-station de transformateur pré-assemblée selon la revendication 1 ou 2,
le corps de paroi (10) ayant un côté inférieur (11) et un côté supérieur, le côté inférieur (11) étant parallèle au côté supérieur, le côté supérieur faisant face à un bord extérieur (31) du toit (30) et une bande de bord (5) étant appliquée sur :
le côté inférieur (11) du corps de paroi (10) ; et
le bord extérieur (31) du toit (30).

6. Sous-station de transformateur pré-assemblée selon la revendication 5, la bande de bord (5) sur le côté inférieur (11) du corps de paroi (10) étant reliée, par l'intermédiaire d'un raccord métallique (12) de corps de paroi de base, à une poutre longitudinale de base (13).

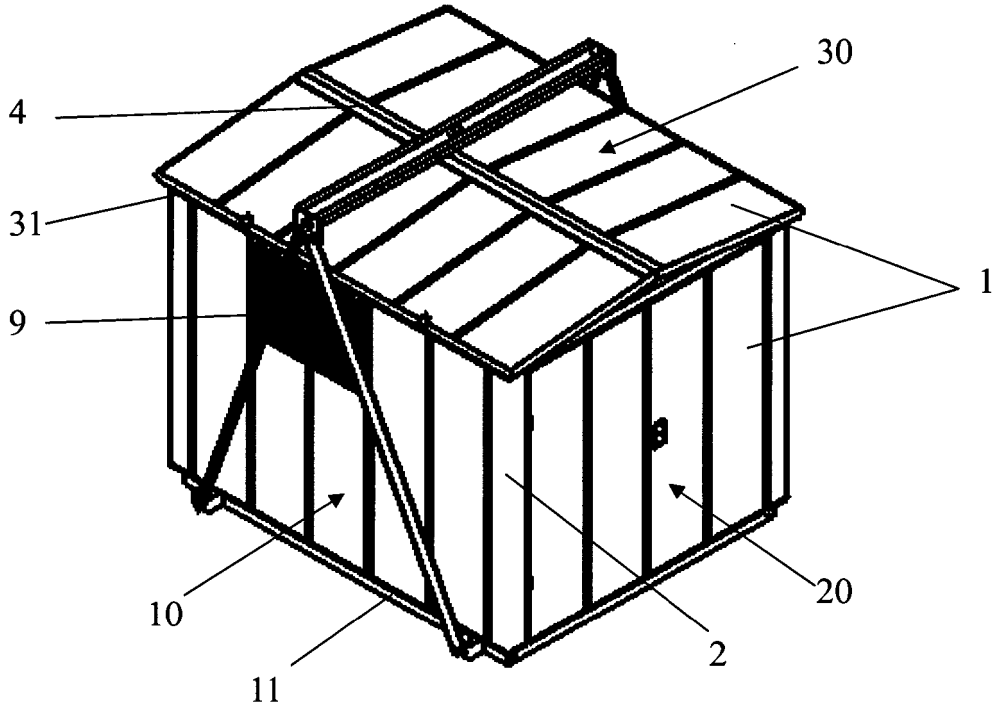

Fig. 1

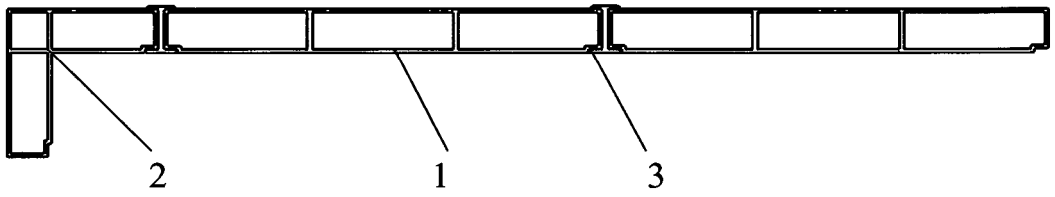

Fig. 2

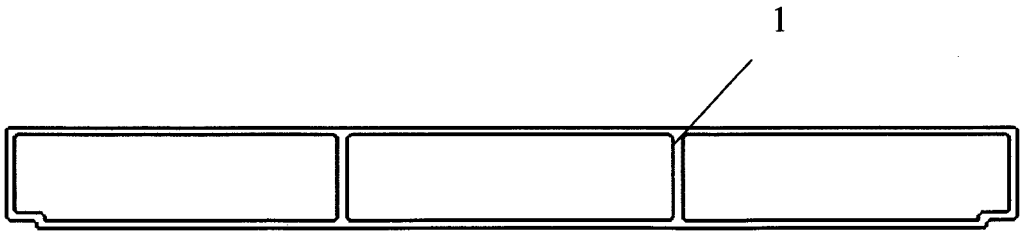

Fig. 3

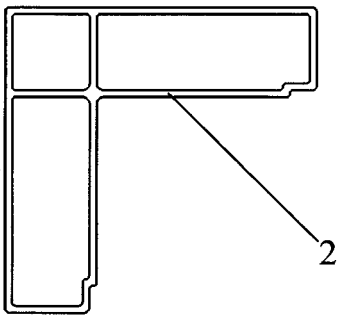

Fig. 4

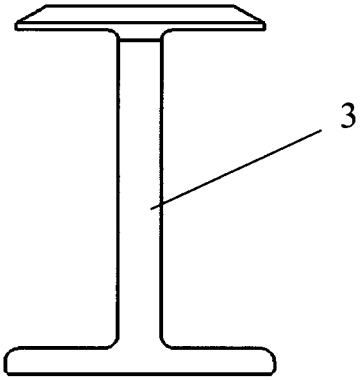

Fig. 5

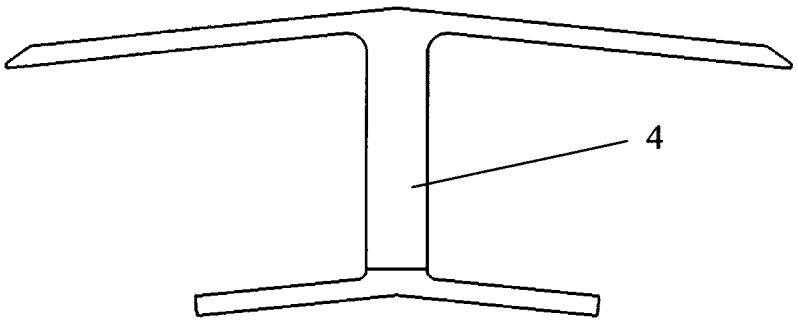

Fig. 6

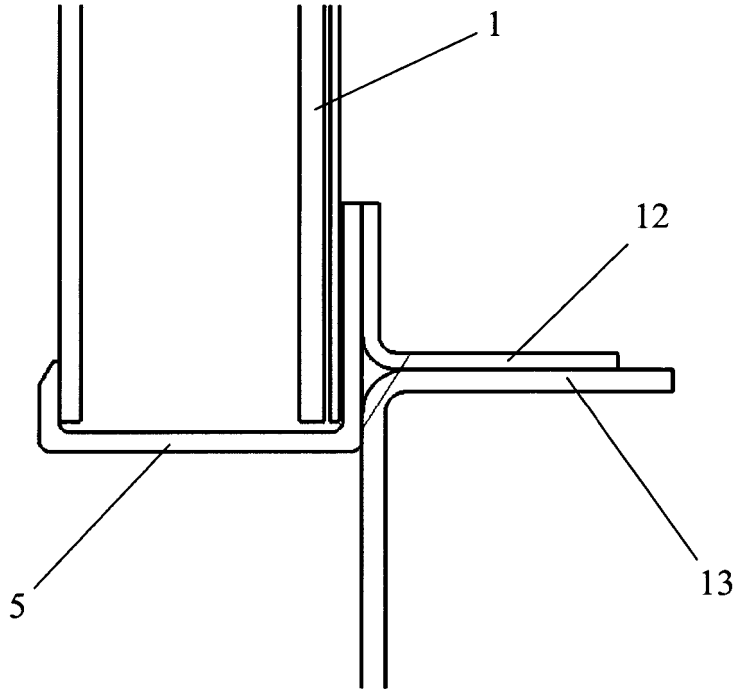

Fig. 7

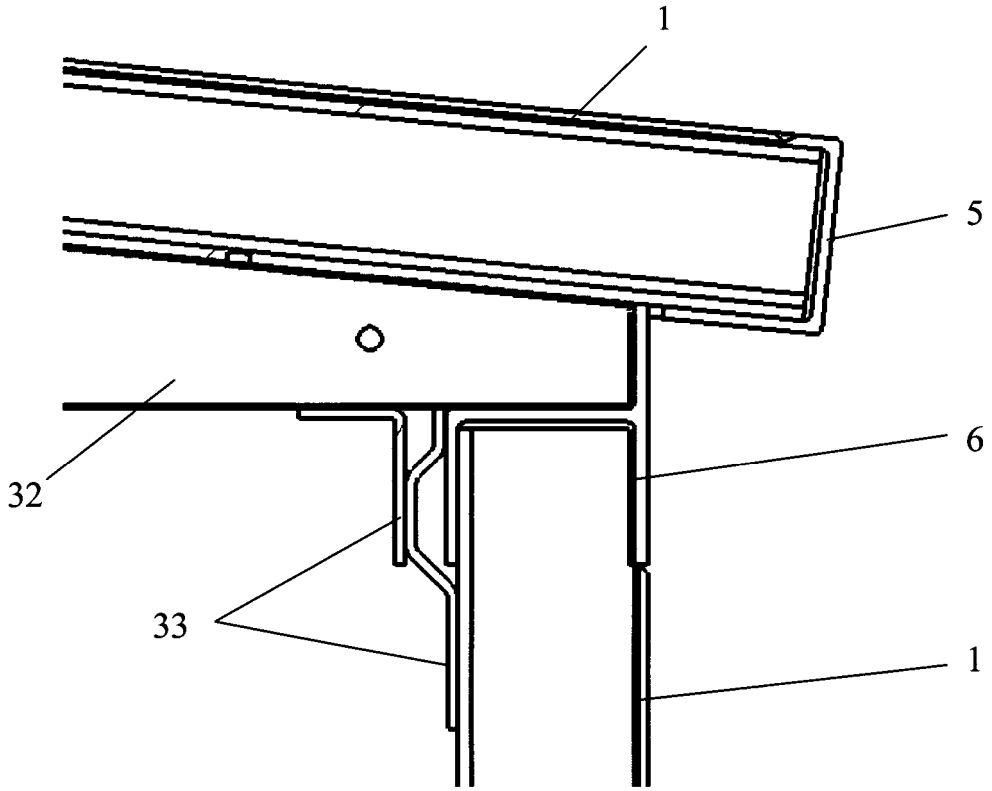

Fig. 8

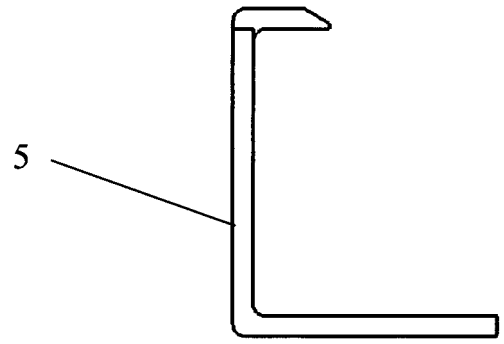

Fig. 9

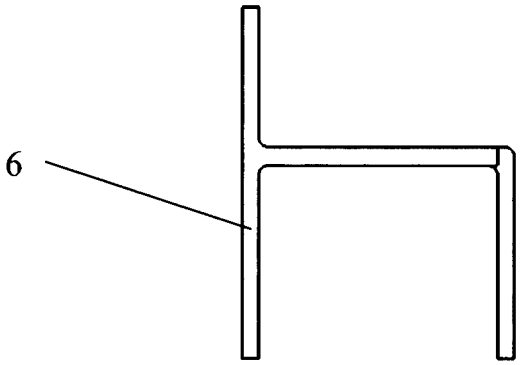

Fig. 10

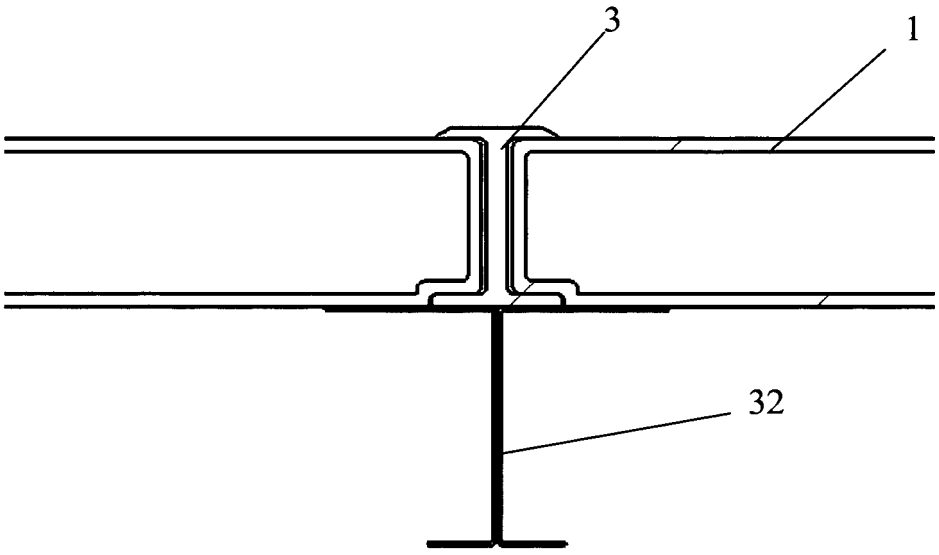

Fig. 11

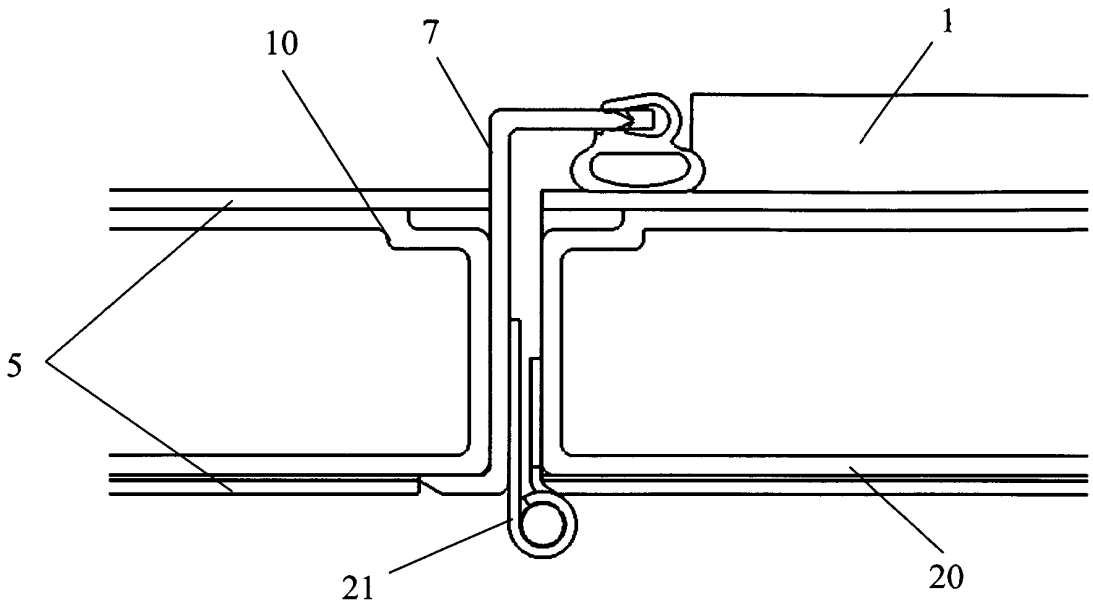

Fig. 12

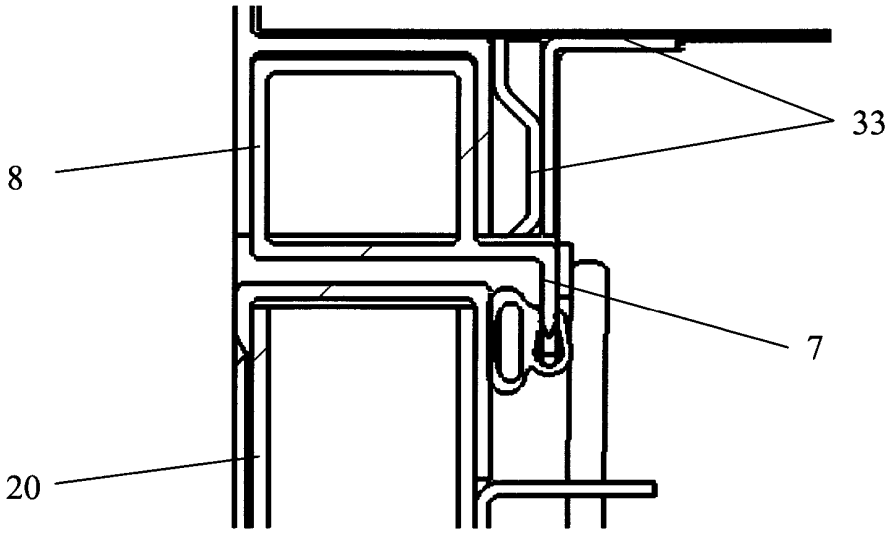

Fig. 13

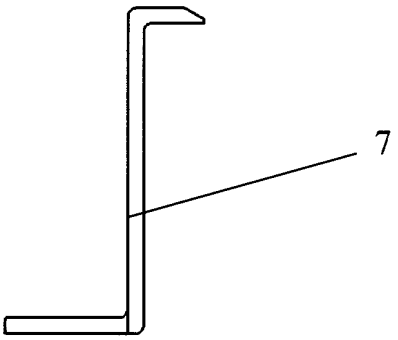

Fig. 14

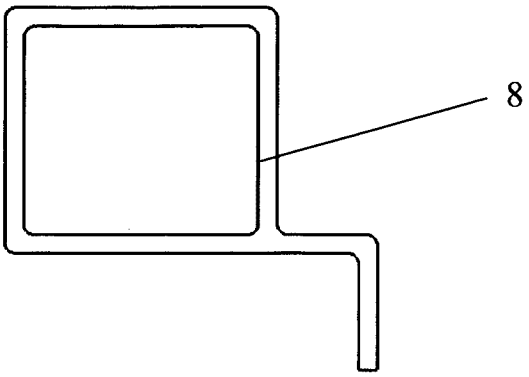

Fig. 15

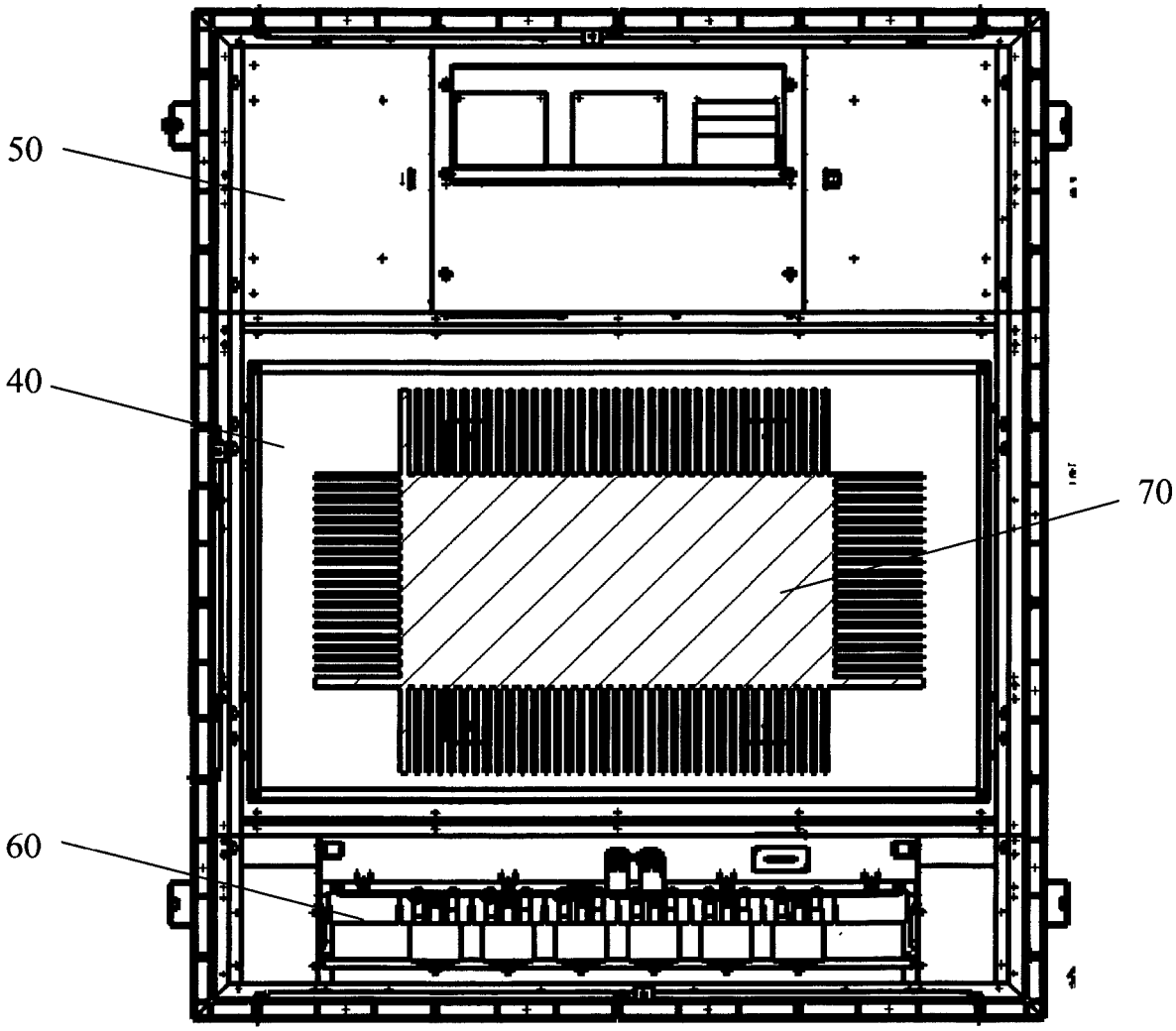

Fig. 16

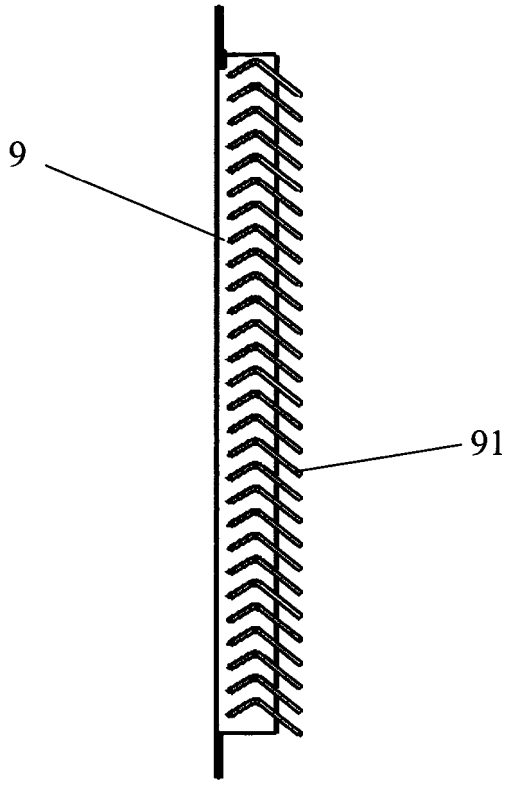

Fig. 17

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 2012216393 A1 **[0002]**
- US 3599134 A **[0002]**