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(54) **MODULAR STRUCTURAL PURLIN**

(57) The invention relates to a metallic purlin destined to be preferably used in roofs and façades of industrial buildings and other spaces, such as sports pavilions, or covered infrastructures which require beams covering large spans. Having in general a "Z" configuration, the purlin (1) comes from the union, in a single purlin, of two parts of purlins placed in opposite orientation: the purlin in sigma ("Z") and the purlin in C ("I"). The front flap (1-a), equipped with a front edge (1-c), is slightly larger than the back flap (1-b) provided with a back edge (1-d), which allows the flap of one purlin to hermetically fit in the flap of the other. The purlin (1) is provided with holes (2) distributed longitudinally, wherein the screws are tightened (3). The present purlin (1) can be coupled to another equal one, in opposition, giving rise to a tubular configuration and allowing the rotation thereof and successive fittings.

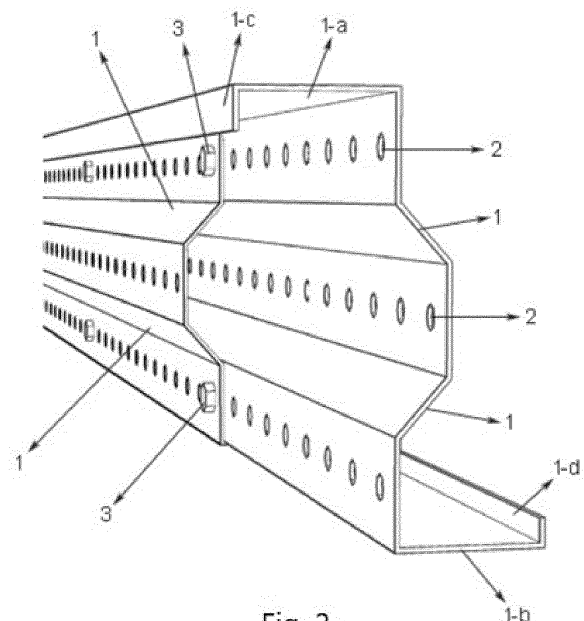


Fig. 2

Description

Technical Domain

[0001] This relates to a metallic structure destined to be preferably used in roofs and façades of industrial buildings and other spaces, such as sports pavilions, or covered infrastructures requiring beams covering large spans.

State of the Art

[0002] There exists in the market a great number of structural purlins with variable configuration, but which however go from the most elementary "[", passing through the common omega shape ("Ω") more or less open, until the more complex forms such as "Σ".

[0003] As part of the state of the art and closest to the invention, we consider the metallic purlin of the applicant, shown in the document corresponding to Utility Model 10888 (D1).

[0004] D1 represents a modular purlin in open "Ω". It also comprises longitudinal holes (in this case, on the back, sides, and flaps). Constructed with the purpose of overcoming large spans, it allows overlap through the coupling of two equal purlins and, further, allows obtaining a pillar through the placing, in opposition, of two equal purlins (which provide the desired tubular configuration).

[0005] However, the invention comprises a non-obvious improvement relative to D1, and all the remaining existing structural purlins: these, contrary to the purlin of the invention do not allow overlap according to the so-called weak axis (horizontal axis).

[0006] Thus, two purlins (equal to the object of the invention which will be claimed) placed in opposition, can run successively between each other and the hermetical coupling between the two is successively obtained.

Technical Problem

[0007] The need to overcome large spans in different structures led the manufacturers of structural metallic purlins to develop purlins capable of overcoming this challenge.

Solution of the Problem

[0008] The solution presented led to creating light, resistant metallic purlins, provided with longitudinal holes and capable of being overlapped.

[0009] The invention now claimed results from a set of parts in metal or another material having equivalent rigidity, having the possibility of overlapping by means of successive coupling, which grants a resistance to lateral instability in specific areas, by means of the tubular shape, whereby the immobilization and rigidity are assured by the hole points which, by existing throughout the

segment, allow a variable juxtaposition and, consequently, the creation of spans of variable dimensions. In this manner, only the pillars and the support beams will constitute rigid structural elements. Despite the fact that they are indirectly screwed to the pillars through stirrups and clips they can overlap or crisscross due to the holes.

[0010] In the proposed product, the parts are constantly sectioned, only varying the overlapping, producing a tubular shape, which does not make the size of the structures depend on the dimension of the area to be covered. Thus, while the conventional solutions always assume the same lateral resistance, this solution allows greater lateral stability where necessary and the modules can be superimposed on each other.

Advantageous effects of the Invention

[0011] Speed of execution, flexibility of solutions and reduction of raw material and labor costs are significant added value of the invention.

[0012] The purlin that is the object of the invention allows overcoming large spans as a result of the configuration thereof - which allows the overlapping of two similar purlins - and the fact of having holes placed longitudinally along the entire length thereof.

[0013] By oppositely placing two equal purlins, a tubular configuration is obtained, particularly important in structures which require particularly high structural strength, as is the case of long purlins, subject to phenomena of lateral instability of pillars, and façades of industrial installations, or others.

[0014] The particular configuration of the modular structural purlin that is the object of the invention (approximately in "Z") originated from the fusion, in a single purlin, of two segments of entirely different purlins and which, currently, are largely available in the market: the sigma purlin ("Σ") and the C purlin ("C"). As from the cut of a segment of a "Z" shape purlin and another segment of a "C" purlin, and joining the two in opposition, the creator obtained the purlin that is the object of the invention.

[0015] The entirely different configuration of the purlin thus obtained allows solutions not reached by the purlins already existing in the market, apart from the possibility of overlapping and opposite placing when obtaining the pillars.

[0016] By coupling two purlins such as the object of the invention, there is obtained a tubular purlin, which allows an increase in rigidity when it is a matter of overcoming large spans.

Brief Description of the Figures

[0017]

Fig. 1

[Fig. 1] represents, in perspective, a modular structural purlin (1) object of the invention, evidencing the front flap (1-a), the back flap (1-b), the front edge (1-

c) and the back edge (1-d), as well as the holes (2).

Fig. 2

[Fig.2] represents the modular structural purlin (1) arranged in inverted overlap on another identical purlin, obtaining the tubular configuration and evidencing the front flap (1-a), the back flap (1-b), the front edge (1-c) and the back edge (1-d), as well as the holes (2) and respective screws (3);

Fig. 3

[Fig.3] represents, in section, the profile of the modular structural purlin (1) arranged in inverted overlap on another identical purlin, evidencing the front flap (1-a), the back flap (1-b), the front edge (1-c) and the back edge (1-d), as well as the screws (3) placed on the holes, the difference in size between the front flap (1-a) and the back flap (1-b) of each one of the opposite purlins being particularly noticeable.

Description of the Embodiments

[0018] The modular structural purlin that is the object of the invention originates, in its essence, from the junction, in a single purlin, of two existing purlin segments: a sigma-shaped purlin "Σ" and a "Γ" shaped purlin.

[0019] Sectioning a segment (more than half, spanning the back) of a "Σ" purlin and another segment (less than half) of a "Γ" purlin and joining with the ends (the flaps) in opposite orientation essentially results in the purlin that is the object of the invention.

[0020] The flaps form, indicatively, a 90° angle relative to the axis of the purlin.

[0021] Thus, the purlin obtained presents, the two flaps in opposite orientation (Fig. 1), which results in a non-obvious configuration and appears to be in conflict with its shape-function.

[0022] The next step is to determine the absolutely exact dimension of the two flaps, the front flap (1-a) and the back flap (1-b). If both flaps had the same dimension, it would be entirely impossible to fit in inverted juxtaposition.

[0023] Thus, the front flat (1-a) is slightly larger than the back flap (1-b), as is particularly visible in Fig. 3. It is this difference that allows the back flap (1-b) of a smaller purlin to hermetically fit in the front flap (1-a), larger, of another purlin, when two purlins are placed in overlap with opposite orientation.

[0024] From the above, the difference in dimension between the front flap (1-a) and the back flap (1-b) must be indicatively, twice the thickness of a purlin.

[0025] Placed in inverted overlap, the two purlins allow obtaining the overlap and the tubular configuration (Fig. 2 and Fig. 3).

[0026] The holes (2) existing throughout the entire central area (back and sides) of the purlin allow its effective fixation overlapping through the placing of the screw (3).

[0027] As is evidenced by Fig.1 to Fig. 3, the front flap (1-a) is provided with a front edge (1-c) larger than the back edge (1-d) belonging to the back flap (1-b). Said circumstance is related to constructive questions - and, not structural - that attach with the greatest overlapping ease two purlins, one over the other.

[0028] The edge of each of the flaps forms, with those, an indicative angle of 90°.

[0029] It results from Fig. 3, that a purlin can be rotated over the other and continuously obtain the initial effect, given that the front flap (1-a) of one will couple on the back flap (1-b) of the other. The horizontal shift accompanied by a rotation (phenomena known as lateral instability or bending) is reduced due to the configuration of the purlin.

[0030] Therefore, there results an increase in functionality in obtaining this type of constructive structural elements results, making the coupling of two or more purlins more simple and efficient.

List of Reference Indications

[0031]

- 1 - purlin flaps
- 1-a - front flap
- 1-b - back flap
- 1-c - front edge
- 1-d - back edge
- 2 - holes
- 3 - screws

List of Citations

- [0032] Patent Literature** patcit1: Utility Model 10888

Claims

1. Modular structural purlin **characterized by** comprising a configuration approximately in "Z" denoting the junction of two segments of two purlins, a smaller segment in "Γ" configuration and another, larger segment, having a "Z" configuration, whereby the flaps of the purlin (1) are in opposite orientation, with the front flap (1-a) having larger dimension than the back flap (1-b), and the purlin comprising longitudinal holes (2) on the back and sides.
2. Modular structural purlin, according to the previous claim, **characterized by** each of the flaps forming, indicatively, a 90° angle relative to the axis of the purlin (1).

3. Modular structural purlin, according to the previous claim, **characterized by** the difference in dimension between the front flap (1-a) and the back flap (1-b) being, indicatively, twice the thickness of the purlin (1). 5
4. Modular structural purlin, according to the previous claims, **characterized by** both flaps comprising edges having indicative 90° angle relative to the surface of said flaps, whereby the front edge (1-c) 10 has a larger dimension than the back edge (1-d).
5. Modular structural purlin, according to the previous claims, **characterized by** comprising tightening and fastening screws (3) throughout the holes (2). 15

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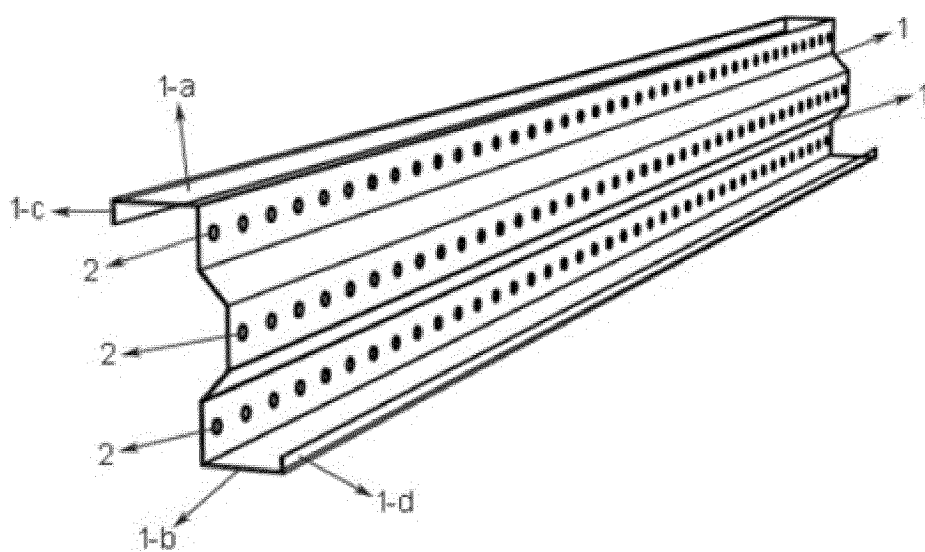


Fig. 1

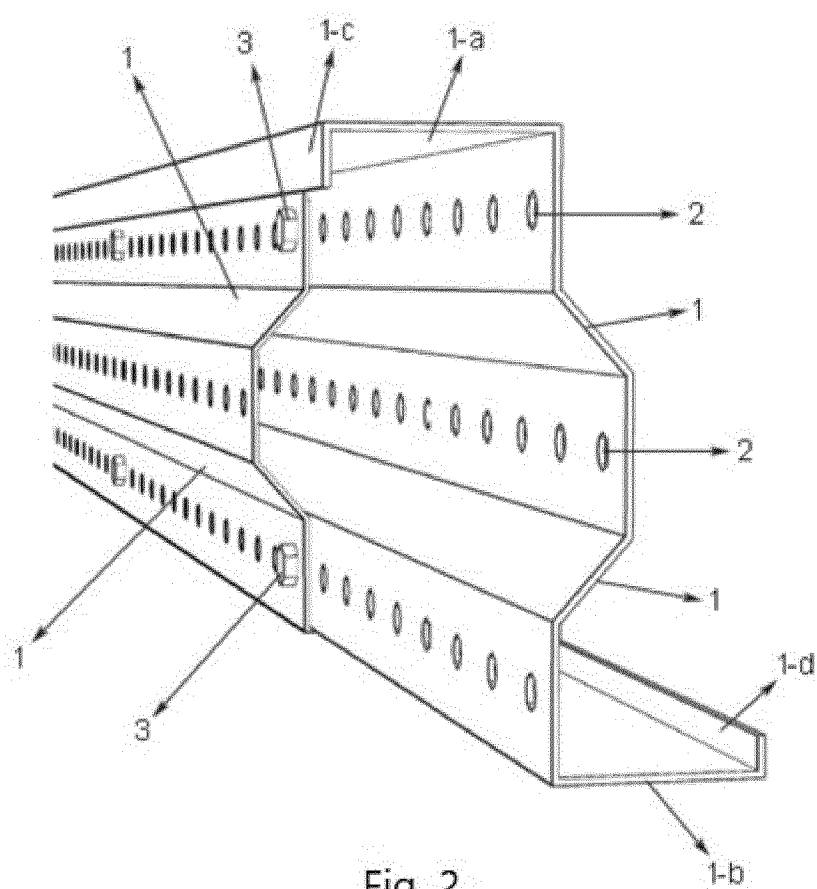


Fig. 2

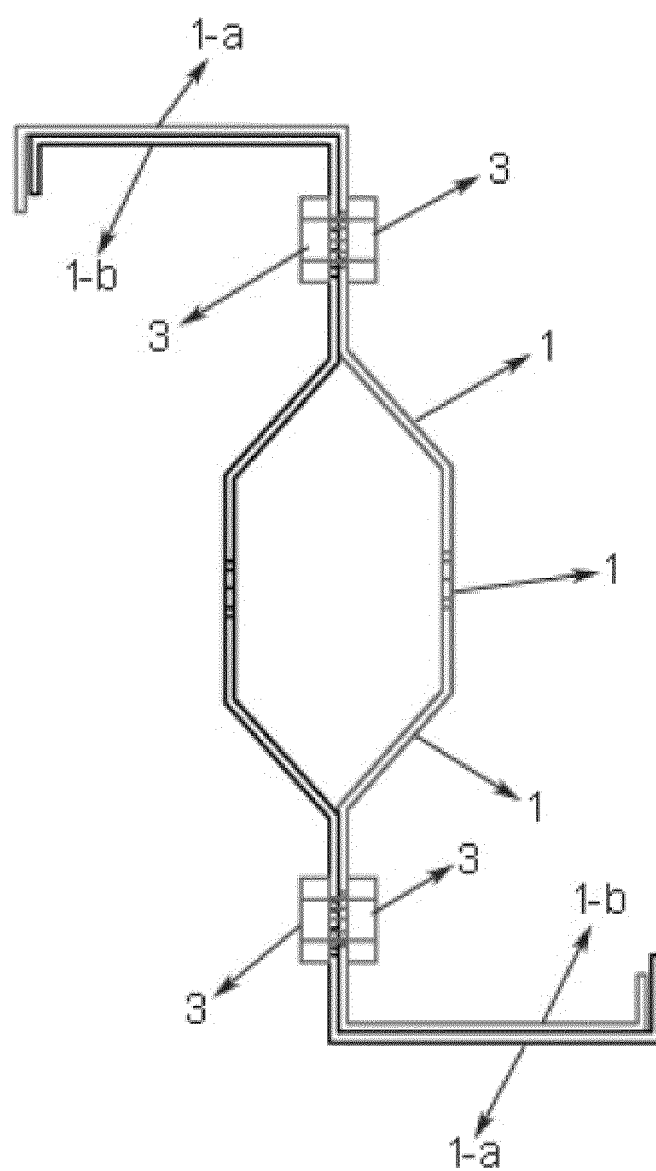


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/PT2022/050034

<p>A. CLASSIFICATION OF SUBJECT MATTER INV. E04G11/52 E04C3/04 E04C3/06 E04C3/07 E04B1/24 ADD.</p> <p>According to International Patent Classification (IPC) or to both national classification and IPC</p>															
<p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols) E04G E04C</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p>															
<p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)</p> <p>EPO-Internal</p>															
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>WO 2011/116437 A1 (DE ALMEIDA BORGES CARLOS ALBERTO [BR]) 29 September 2011 (2011-09-29) figures 6, 6B</td> <td>1-5</td> </tr> <tr> <td>X</td> <td>GB 2 228 752 A (STEELPRESS [GB]) 5 September 1990 (1990-09-05) figure 3</td> <td>1-5</td> </tr> <tr> <td>X</td> <td>US 2002/046540 A1 (WEEKS KEVIN W [AU]) 25 April 2002 (2002-04-25) figure 5</td> <td>1-5</td> </tr> <tr> <td>X</td> <td>US 5 079 884 A (MENCHETTI ROBERT J [US]) 14 January 1992 (1992-01-14) figure 2</td> <td>1-5</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	WO 2011/116437 A1 (DE ALMEIDA BORGES CARLOS ALBERTO [BR]) 29 September 2011 (2011-09-29) figures 6, 6B	1-5	X	GB 2 228 752 A (STEELPRESS [GB]) 5 September 1990 (1990-09-05) figure 3	1-5	X	US 2002/046540 A1 (WEEKS KEVIN W [AU]) 25 April 2002 (2002-04-25) figure 5	1-5	X	US 5 079 884 A (MENCHETTI ROBERT J [US]) 14 January 1992 (1992-01-14) figure 2	1-5
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<p>Date of the actual completion of the international search</p> <p>21 March 2023</p>	<p>Date of mailing of the international search report</p> <p>29/03/2023</p>														
<p>Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016</p>	<p>Authorized officer</p> <p>Tran, Kim Lien</p>														

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/PT2022/050034

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