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(54) **JOINT ASSEMBLY FOR AN ARCH OF A TENT STRUCTURE AND RELATED TENT STRUCTURE**

(57) A joint assembly (8) for an arch of a tent structure (100) is suitable for joining at least two metal section bars of an arch of a tent structure (100). The joint assembly (8) comprises at least a first plate-like element (81) and at least a second plate-like element (82), the first plate-like element (81) and the second plate-like element (82) extending along a first direction (R) of extension being of reduced thickness in the third direction of extension thereof. The first plate-like element (81) runs parallel to the second plate-like element (82) and is spaced apart from the second plate-like element (82) along the third direction (S) of extension. The joint assembly (8) comprises one or more joining elements (850), which join the first plate-like element (81) and the second plate-like element (82) together.

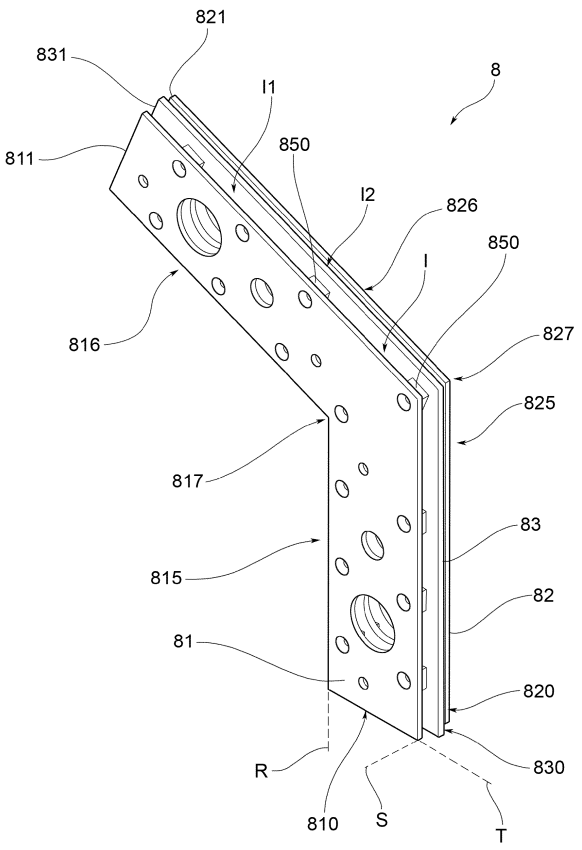

FIG.8

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Description

[0001] This invention relates to a joint assembly for an arch of a tent structure, a structural group for an arch of a tent structure and a related tent structure.

[0002] Transportable tent structures of enormous dimensions are known in the art, for example tent structures that have a width of 10 meters up to 25 or 30 meters and a length that may reach 25 meters and more, such as military-type hangars or marquees for sheltering vehicles, helicopters, or airplanes.

[0003] In particular, generally such tent structures envisage a plurality of arches arranged in succession that serve as a support for the cover sheet of the tent structure. The arches are made of metal section bars that may be assembled on site and to which the cover that covers the roof and side walls is then attached. The arches, therefore, are generally carried or assembled on the site of installation of the tent structure and are raised by motorized mechanical means.

[0004] The metal section bars (beams and pillars) used for this type of tent structure are generally made in different, dedicated pieces, each intended to perform the action of pillar or beam. In addition, these section bars are pre-drilled in order to fasten purlins and bracing rods or other accessories for fastening electrical systems or auxiliary installations in predetermined positions.

[0005] Typically, metal section bars are hollow on the inside and are joined together by appropriate joining elements that are fastened by screws and bolts on the outside of the section bar. In particular, the aforementioned joining elements are placed either between elements forming an entire arch beam, or near knee joints between columns and beams, or between said beams at the ridge of the arch.

[0006] Inconveniently, the aforementioned junction elements, having to withstand high loads and being subjected to constant stresses, are often made of steel or in any case of high-strength composite materials, such as carbon fiber composite materials, so as to ensure the support of the loads weighing on the structure, mainly due to wind or snow.

[0007] This results in the entire arch structure being heavy to transport in the case of steel joints or complex and expensive to manufacture where high-strength composite materials are used.

[0008] According to a further aspect, disadvantageously, the section bars of the prior art, although of similar size to each other, are not interchangeable due to the holes being made in a fixed and predetermined manner. Consequently, where it is necessary to change the position of the section bars due to unexpected needs at the time of installation, it is necessary to resort to costly operations for modifying the section bars, for example drilling new holes, in conditions that are not always easy, as they are performed during the set-up phase.

[0009] Also disadvantageously, in the production phase of the section bar, if the holes are made incorrectly in a way that differs from what was planned, it is no longer possible to correct the error except by making additional holes or ovalizing those made, thus causing problems in the assembly phase due to a possible imperfect sealing of the holes.

[0010] One of the objects of this invention is to propose a joint assembly for an arch of a tent structure, a structural group for an arch of a tent structure, and a corresponding tent structure capable of overcoming the drawbacks of the prior art. In particular, one of the objects of this invention is to provide a joint assembly for an arch of a tent structure, a structural group for an arch of a tent structure, and a tent structure related thereto, which allow for large tent structures, for example, that are transported in containers, to be transported more easily and which, at the same time, are sufficiently flexible to allow a quicker installation.

[0011] The aforementioned objects are achieved with a joint assembly for an arch of a tent structure, a structural group per an arch of a tent structure, and a tent structure according to the appended independent claims. The dependent claims describe preferred or advantageous embodiments.

[0012] The features and advantages of the joint assembly for an arch of a tent structure, of the structural group for an arch of a tent structure, and of the tent structure according to the invention will also become apparent from the description provided hereinafter of its preferred embodiments, given by way of non-limiting example, with reference to the appended figures, wherein:

Fig. 1 is an axonometric view of an embodiment of a tent structure in accordance with an embodiment according to this invention;

Fig. 1a is a planar elevation view of an embodiment of an arch of a tent structure in accordance with an embodiment according to this invention;

Fig. 2 is an axonometric sectional view of a metal section bar according to an embodiment of this invention;

Fig. 3 is an exploded view of a metal section bar according to an embodiment of this invention when used as a beam in a tent structure, in conjunction with a purlin;

Fig. 4 is an exploded view of a metal section bar according to an embodiment of this invention when used as a vertical upright in a tent structure;

Fig. 5 is an exploded view of a structural group according to an embodiment of this invention;

Fig. 6 is a front view of an assembled structural group according to an embodiment of this invention;

Fig. 7 is a sectional view of a metal section bar in which a joint assembly 8 is inserted, according to an embodiment of this invention, in particular along the sectional plane A in Fig. 6;

Fig. 8 is an axonometric view of a joint assembly according to an embodiment of this invention;

Fig. 9 is an axonometric view of an assembly joined

according to a further embodiment of this invention.

[0013] With reference to the aforesaid figures, a tent structure, preferably a field tent structure, has been globally indicated with the reference numeral 100.

[0014] It is apparent that a field tent structure refers to any tent suitable for use in the military or civil defense for the construction of temporary hospitals or temporary shelter as personnel housing or as a command center, meeting room, field office, recreational tent for club or meeting, or laundry.

[0015] As best appreciated in Fig. 1, the tent structure 100 comprises a plurality of arch frames 101, 102, 103 that extend vertically for a predetermined height H relative to a support plane P. The arch frames 101, 102, 103 are spaced apart from each other along a direction K of extension perpendicular to a vertical direction J and lying on the support plane P.

[0016] Each arch frame 101, 102, 103 comprises metal section bars 1, 1' joined together by means of assembly elements, i.e., joint assemblies. Each metal section bar 1, 1' may be used within the arch frame as either a vertical upright component or an oblique beam component.

[0017] A plurality of purlins 9 are arranged between adjacent arch frames 101, 102, 103, which extend mainly along the direction K of extension and are joined to adjacent arch frames to stabilize them to each other and to impart adequate structural support.

[0018] The metal section bar for the tent structure arch 100 is described below in detail, with particular reference to Fig. 2, which shows an example of an embodiment. Henceforth, the more general term "metal section bar" will refer both to a first metal section bar, indicated by reference number 1, and to a second metal section bar, indicated by reference number 1', in an entirely analogous manner, being preferably section bars that are similar to each other, i.e., that share the same technical features. Therefore, "metal section bar" may be read as "first metal section bar 1" or "second metal section bar 1'" in a completely equivalent manner.

[0019] The metal section bar 1, 1' extends mainly along one of its longitudinal direction X and is preferably made by extrusion, preferably entirely of aluminum.

[0020] The metal section bar 1, 1' is preferably made in one piece and comprises an upper wall 10, a lower wall 30, a right side wall 20, and a left side wall 40 defining an inner cavity C of the metal section bar 1. The upper wall 10 is joined in one piece to the left side wall 40 and to the right side wall 20 and is arranged opposite and apart from the lower wall 30.

[0021] Moreover, the metal section bar 1 comprises a first channel 21 having an open annular section that extends mainly along the longitudinal direction X. Said first channel 21 is obtained on the right wall 20 or in the vicinity of the joining region between the right wall 20 and the upper wall 10, on the side opposite the inner cavity C, for example in a corner of the metal section bar 1.

[0022] In addition, the metal section bar 1 comprises a second channel 22 having an open annular section that extends mainly along the longitudinal direction X. Said second channel 22 is formed on the right wall 20 or in the vicinity of the joining region between the right wall 20 and the lower wall 30, on a side opposite the inner cavity C.

[0023] A third channel 23 with an open annular section, extending mainly along the longitudinal direction X, is obtained on the right wall 20, on the side opposite the inner cavity C, and is interposed between the first channel 21 and the second channel 22, in the transverse direction Y of extension perpendicular to the longitudinal direction X. The third channel 23 is also spaced between the first 21 and the second channel 22. Preferably, the first 21, the second 22 and the third channel 23 all run parallel to each other along the longitudinal direction X.

[0024] The first 21, the second 22, and the third channel 23 are each suitable to receive an enlarged edge portion 51, 61, 71 of a respective cover sheet 5, 6, 7 in such a way that the enlarged edge portion 51, 61, 71 is slidably insertable into the respective channel 21, 22, 23 in a direction parallel to the longitudinal direction X. Further, in this manner, the enlarged edge portion 51, 61, 71 is constrained to remain in each respective channel 21, 22, 23 when stressed in the other spatial directions perpendicular to the longitudinal direction X.

[0025] The metal section bar 1 further comprises a first technical groove 24 with an open section and a second technical groove 25 with an open section extending mainly along the longitudinal direction X.

[0026] Said first 24 and second technical groove 25 are obtained on the right wall 20, on the side opposite the inner cavity C, i.e., with the open section on the side opposite the inner cavity C. Further, said first 24 and second technical groove 25 are spaced apart from each other and interposed between the first 21 and the second channel 22 or between the second 22 and the third channel 23.

[0027] Said first 24 and second technical grooves 25 are each suitable to receive a respective coupling portion 240', 250' of a fastening element 240, 250 for a purlin 9, for example the head of a screw or pin, in such a way that the coupling portion 240', 250' is slidably insertable into the respective technical groove 24, 25 in a direction parallel to the longitudinal direction X. Further, in this manner, the coupling portion 240', 250' is constrained to remain in each respective technical groove 24, 25 when stressed in the other spatial directions perpendicular to the longitudinal direction X.

[0028] According to an embodiment, the metal section bar 1 also comprises a fourth channel 21' having an open annular section extending mainly along the longitudinal direction X. Said fourth channel 21' is obtained on the left wall 40 or in the vicinity of the joining region between the left wall 40 and the upper wall 10, on a side opposite the inner cavity C.

[0029] In this embodiment, a fifth channel 22' having an open annular section extends mainly along the longitudinal direction X and is also formed on the left wall 40

or in the vicinity of the joining region between the left wall 40 and the lower wall 30, on the side opposite the inner cavity C.

[0030] Further, the metal section bar 1 in this embodiment also comprises a sixth channel 23' with an open annular section extending mainly along the longitudinal direction X. Said sixth channel 23' is obtained on the left wall 20, on the side opposite the inner cavity C, and is interposed between the fourth channel 21' and the fifth channel 22'. Further, said sixth channel 23' is spaced apart from said fourth 21' and fifth channel 22'.

[0031] The fourth channel 21', the fifth channel 22' and the sixth channel 23' are each suitable to receive an enlarged edge portion 51', 61', 71' of a respective cover sheet 5', 6', 7' in such a way that the enlarged edge portion 51', 61', 71' is slidably insertable into the respective channel 21', 22', 23' in a direction parallel to the longitudinal direction X and in such a way that the enlarged edge portion 51', 61', 71' is constrained to remain in each respective channel 21', 22', 23 when stressed in the other spatial directions perpendicular to the longitudinal direction X.

[0032] Preferably, the enlarged edge portion 51, 61, 71, 51', 61', 71' is formed by folding an edge portion of the sheet fabric back on itself to form a pocket that receives a piece of cable to produce the enlarged or bulbous cross section. The enlarged edge portion 51, 61, 71, 51', 61', 71' is axially inserted into one of the channels with an open annular section.

[0033] Preferably, the enlarged edge portion 51, 61, 71, 51', 61', 71' is a channel formed with the fabric of the sheet within which a cable is inserted, preferably a cable made of a plastic or elastomeric material that is more rigid than the material of the sheet, or a metal cable.

[0034] A particular example of such a type of enlarged edge portion 51, 61, 71, 51', 61', 71' is Keder's "Two Flap" design manufactured by the U.S. company Keder, Inc. of Rindge, N.H.

[0035] According to an embodiment, the metal section bar 1 also comprises a third technical groove 24' having an open section and a fourth technical groove 25' having an open section extending mainly along the longitudinal direction X. Said third 24' and fourth technical grooves 25' are formed on the left wall 40, on the side opposite the inner cavity C, i.e., with the open section on the side opposite the inner cavity C.

[0036] Said third 24' and fourth technical groove 25' are spaced apart and interposed between said fourth 21' and fifth channel 22' or between said fifth 22' and sixth channel 23'.

[0037] The third 24' and fourth technical grooves 25' are further suitable to each receive a respective coupling portion 240''', 250''' of a fastening element 240'', 250'' for a purlin 9, for example the head of a screw or a pin, such that the coupling portion 240''', 250''' is slidably insertable into the respective technical groove 24', 25' in a direction parallel to the longitudinal direction X and in such a way that the coupling portion 240''', 250''' is constrained to remain in each respective technical groove 24', 25' when stressed in the other spatial directions perpendicular to the longitudinal direction X.

[0038] According to an embodiment, the metal section bar 1 comprises one or more upper technical grooves 11, 12 with an open section extending mainly along the longitudinal direction X. Said one or more upper technical grooves 11, 12 are formed on the upper wall 10, on the side opposite the inner cavity C, i.e., with the open section opposite the inner cavity C.

[0039] The upper technical grooves 11, 12 are each suitable to receive a respective coupling portion 110', 120" of a fastening element 110, 120 for a technical accessory, for example the head of a screw or a pin for attaching a support plate for an accessory outside the tent structure, such that the coupling portion 110', 120' is slidably insertable into the upper technical groove 11, 12 in a direction parallel to the longitudinal direction X. Further, the coupling portion 110', 120' is constrained to remain in each respective upper technical groove 11, 12 when stressed in the other spatial directions perpendicular to the longitudinal direction X, precisely due to the shape of the section of the groove.

[0040] According to an embodiment, the metal section bar comprises one or more lower technical grooves 31, 32 with an open section, which extend mainly along the longitudinal direction X. Such lower technical grooves 31, 32 may be present either by themselves or together with the upper technical grooves 11, 12.

[0041] The lower technical grooves 31, 32 are formed on the lower wall 30, on the side opposite the inner cavity C, i.e., with the open section on the side opposite the inner cavity C.

[0042] The lower technical grooves 31, 32 are each suitable to receive a respective coupling portion of a fastening element for a technical accessory, such as the head of a screw or a pin for coupling a support plate for an accessory inside the tent structure, in such a way that the coupling portion is slidably insertable into the lower technical groove 31, 32 in a direction parallel to the longitudinal direction X and in such a way that the coupling portion is constrained to remain in each respective lower technical groove 31, 32 when stressed in the other spatial directions perpendicular to the longitudinal direction X.

[0043] Preferably, the first 21, the second 22 and the third channel 23 have a cross section, i.e., a section along a plane perpendicular to the longitudinal direction X, in a "C" shape or in an open circular shape.

[0044] Preferably, the first 24 and second technical grooves 25 have a cross section, i.e., a section along a plane perpendicular to the longitudinal direction X, substantially in the shape of a screw head.

[0045] Preferably, the first 21, second 22, and third channels 23 and/or the fourth 21', fifth 22', and sixth 23'' channels extend longitudinally substantially along the length of the metal section bar in the longitudinal direction X.

[0046] Preferably, the first 24 and second technical

grooves 25 extend longitudinally substantially along the length of the metal section bar in the longitudinal direction X.

[0047] Preferably, the third 24' and the fourth technical groove 25' extend longitudinally substantially along the length of the metal section bar in the longitudinal direction X.

[0048] Preferably, the upper technical grooves and/or the lower technical grooves extend longitudinally substantially along the length of the metal section bar in the longitudinal direction X.

[0049] According to a preferred embodiment, the metal section bar 1 has a quadrangular cross section, wherein the first 21 and fourth open channels 21' with an open annular section are arranged at two corners of the quadrangular section and wherein the second 22 and fifth channels 22' with an open annular section are arranged at the other two remaining corners of the quadrangular section.

[0050] According to the invention, the tent structure 100 therefore comprises at least one outer cover sheet 5, suitable to be subjected directly to the weather, and connected to the arch frames 101, 102, 103.

[0051] Preferably, the outer cover sheet 5 has an enlarged edge portion 51 inserted into the first channel 21 in such a way that the enlarged edge portion 51 is constrained to remain in the first channel 21 when stressed in the other spatial directions perpendicular to the longitudinal direction X.

[0052] Moreover, according to an advantageous embodiment, the tent structure 100 comprises at least a first inner cover sheet 6 or 7 having an enlarged edge portion 61 or 71 inserted into the second 22 or third channel 23 in such a way that the enlarged edge portion 61 or 71 is constrained to remain in the second or third channel 22, 23 when stressed in the other spatial directions perpendicular to the longitudinal direction X.

[0053] Further, the tent structure comprises at least one purlin 9 and at least one fastening element 240, 250 (generally a plurality of purlins and fastening elements) having a coupling portion 240', 250', such as a screw or a pin head, inserted into the first and/or second technical groove 24, 25 in such a way as to be constrained to remain in each respective technical groove 24, 25 when stressed at least in the spatial directions perpendicular to the longitudinal direction X.

[0054] According to a particularly advantageous embodiment, the tent structure 100 comprises at least a first inner cover sheet 6 having the enlarged edge portion 61 inserted into the third channel 23 and also a second inner cover sheet 7 having an enlarged edge portion 71 inserted into the second channel 22.

[0055] This allows for increased insulation, thereby reducing the impact of energy costs for heating and air conditioning in the tent.

[0056] Preferably, the tent structure also comprises a plurality of tension wires 91, 92, each attached to a respective arch frame by fastening means inserted into the upper technical grooves 11, 12, when the metal section bar is used, for example, as an upright of the arch frame.

[0057] Preferably, the arch frame 101, 102, 103, is constructed of a plurality of metal section bars 1 including vertical uprights 101' defining the vertical walls of the tent, a plurality of oblique beams 101" extending at an angle with respect to the vertical uprights and meeting at the apex 1000 of the tent 100. A plurality of purlins 160 extend longitudinally between the arch frames 10.

[0058] The arch frame 101, 102, 103 may be a free-span tent frame, without internal poles, or a full-span tent frame.

[0059] Preferably, the vertical uprights 101' are mounted on feet 116, which rest on the plane P on which the tent tent structure 100 is constructed. Preferably, during installation, the feet 116 allow the vertical uprights 101' to be rotated from a horizontal position to a vertical position.

[0060] Preferably, the tent structure 1 may further comprise strands at predetermined locations extending between the various structural elements to provide greater support and stability to the structure.

[0061] Each arch, and more specifically each arch frame 101, 102, 103, is composed from the joining of multiple structural groups 8' for a tent structure arch 100, also the subject matter of this invention and shown by way of example in Fig. 1a and in Fig. 5 and 6.

[0062] Each structural group 8' comprises a first metal section bar 1 extending mainly along a longitudinal direction X and comprising the upper wall 10, the lower wall 30, the right side wall 20 and the left side wall 40 which define the inner cavity C of the first metal section bar 1, wherein the upper wall 10 is joined in one piece to the left side wall 40 and to the right side wall 20 and is arranged opposite and spaced apart from the lower wall 30.

[0063] Further, each structural group 8' comprises a second metal section bar 1' extending mainly along a longitudinal direction X and comprising the upper wall 10', the lower wall 30', the right side wall 20', and the left side wall which define the inner cavity C of the first metal section bar 1, wherein the upper wall 10' is joined in one piece to the left side wall and the right side wall 20' and is arranged opposite and spaced apart from the lower wall 30'.

[0064] Additionally, each structural group 8' comprises a joint assembly 8, which itself is also a subject of this invention.

[0065] Said joint assembly 8 for an arch of a tent structure 100 is suitable for joining together at least two metal section bars of the arch of the tent structure 100, for example the first metal section bar 1 and the second metal section bar 1' described in this discussion. Said metal section bars 1, 1' are for example two beams or a beam and a pillar.

[0066] With particular reference to Fig. 8 and 9, the joint assembly 8 comprises at least one first plate-like element 81 extending between a first end of the first el-

ement 810 and a second end of the first element 811 and at least one second plate-like element 82 extending between a first end of the second element 820 and a second end of the second element 821.

[0067] The first plate-like element 81 and the second plate-like element 82 each extend along a first direction R of extension, along a second direction T of extension perpendicular to the first direction R of extension, and along a third of direction S of extension perpendicular to the first R and the second direction T of extension. Further, said first 81 and second plate-like element 82 extend along said third direction S of extension in a manner that is much less than the extension along the first R and the second direction T of extension, i.e., they are of reduced thickness in the third direction S of extension.

[0068] The first plate-like element 81 runs parallel to the second plate-like element 82 and is spaced apart from the second plate-like element 82 along the third direction S of extension.

[0069] Further, each joint assembly 8 comprises one or more joining elements 850, such as screws or bolts or spacer elements, that join the first plate-like element 81 and the second plate-like element 82 together, keeping them spaced apart in the third direction S of extension such that a interspace I results between the first 81 and the second plate-like element 82.

[0070] In addition, the first plate-like element 81 and the second plate-like element 82 are made entirely of aluminum alloy.

[0071] According to the invention, in the inner cavity C, each of said first 1 and second metal section bars 1' comprises a first seat C1 in which the first plate-like element 81 is engaged and a second seat C2 in which the second plate-like element 82 is engaged.

[0072] Further, the first end of the first element 810 and the first end of the second element 820 are received in the inner cavity C of the first metal section bar 1, and the second end of first element 811 and the second end of second element 821 are received in the inner cavity C of the second metal section bar 1'.

[0073] In particular, the first 81 and the second plate-like element 82 are suitable to be slidably inserted into the inner cavity C of each of the first 1 and second metal section bars 1', during the assembly phase of the structural group 8'.

[0074] According to an advantageous embodiment, the joint assembly 8 comprises a third plate-like element 83 extending between a first end of the third element 830 and a second end of the third element 831. Said third plate-like element 83 extends along a first direction R of extension, along a second direction T of extension perpendicular to the first direction R of extension, and along a third direction S of extension, perpendicular to the first R and the second direction T of extension. Said third plate-like element 83 extends along said third direction S of extension much less than it extends along the first R and the second direction T of extension, i.e., it is of reduced thickness in the third direction S of extension.

[0075] Said third plate-like element 83 also runs parallel to the first 81 and second plate-like elements 82 and is interposed apart from the first 81 and second plate-like elements 82 along the third direction S of extension.

[0076] Preferably, the one or more joining elements join together the first plate-like element 81, the second plate-like element 82, and the third plate-like element 83, keeping them spaced apart in the third direction S of extension so that a first interspace I1 between the first 81 and the third plate-like element 83 and a second interspace 12 between the second 82 and the third plate-like element 83 are formed.

[0077] According to a particularly advantageous embodiment, the aluminum alloy is an alloy comprising zinc Zn, preferably an alloy of the group 7XXX, also known by the trade name Ergal. This type of alloy makes it possible to obtain a joint assembly that is both light and strong.

[0078] Preferably, the aluminum alloy is an EN AW-7075 alloy or an EN AW-7020 alloy.

[0079] Preferably, the first 81 and the second plate-like element 82 are equal to each other.

[0080] According to a preferred embodiment, the first 81 and second plate-like elements 82 each comprise a first portion 815, 825 extending from the first end 820 and a second portion 816, 826 extending from the second end 811, 821. Said first portion and said second portion are joined together to form a knee portion 817, 827. In other words, said first portion and second portion are inclined toward each other so as to form a non-flat angle, preferably an obtuse angle. Such a shape allows a joint assembly to be obtained that is particularly suitable for joining a metal section bar that acts as a pillar to a metal section bar that acts as a beam, as for example shown in Fig. 8 and Fig. 6.

[0081] Advantageously, according to an embodiment, the knee portion 817, 827 extends between the first portion and the second portion to form a joining section between the first portion and the second portion to form an arch shape, for example shown in Fig. 9 or in the ridge of the tent structure of Fig. 1a. For example, this embodiment is particularly suitable for joining a pair of metal section bars that serve as beams of roof portions that are joined at the ridge to the tent structure 100 at the knee portion 817, 827.

[0082] Preferably, the first 81 and the second plate-like elements 82 are made in one piece.

[0083] According to an advantageous embodiment, in the inner cavity C, each of said first 1 and second metal section bars 1' comprises a third seat C3, which extends mainly in the longitudinal direction X and in which the third plate-like element 84 is engaged.

[0084] In this variation, the first end of the third element 830 is received in the inner cavity C of the first metal section bar 1 and the second end of the third element 831 is received in the inner cavity C of the second metal section bar 1' . Said third plate-like element 83 is suitable to be slidably inserted into the third seat C3 of each of

the first 1 and second metal section bars 1' being assembled.

[0085] According to an embodiment, the first C1 and/or the second C), and/or the third seat C3 are shaped to act as a translation guide in the longitudinal direction X of the first plate-like element 81, the second plate-like element 82 and/or the third plate-like element 83, respectively.

[0086] Preferably, the third seat C3 is a groove that extends mainly in the longitudinal direction and engages the third plate-like element 83 by shape coupling.

[0087] It is clear that, according to advantageous variant embodiments, the first or second metal section bar of the structural group 8' is made according to any of the variants of metal section bars described in this discussion.

[0088] It is also clear that, in this discussion, "open annular" or "C" shape has been intended to mean a shape or arrangement that has a mouth leading to an enlarged cavity. The mouth is restricted relative to the enlarged cavity and provides an undercut arrangement so that an enlarged object within the enlarged cavity cannot be pulled, without deformation, through the mouth.

[0089] Innovatively, the joint assembly and the structural group according to this invention make it possible to solve the drawbacks associated with the prior art. In particular, due to the synergistic presence of plate-like elements spaced between and inserted inside the metal section bars that act as beams or pillars, it is possible to obtain structural connections that are light and at the same time easy to construct and structurally suitable to support the loads required by the circumstances.

[0090] In a particularly advantageous way, the use of special aluminum alloys of the 7XXXX family indicated in the preceding paragraphs, together with the special configuration of plate-like elements joined together and inserted inside the metal section bars, allows structural joints to be obtained with performance at least similar to the performance obtained by joints obtained by the coupling of section bars made of aluminum-carbon fiber composite materials of the prior art. At the same time, however, the joint assembly and structural group of this invention is more economical and easier to manufacture.

[0091] In addition, due to the plate-like elements made of aluminum, the transportability of all components of the tent structure is facilitated. In fact, the aluminum joint assembly is much lighter than the heavy steel joints of the prior art.

[0092] In addition, in a particularly advantageous way, the channels that allow for the quick insertion of up to three sheets and the technical grooves for fastening the purlins of the metal section bars make it possible to position the purlins as desired along the entire length of the section bar, due to the variable sliding of the fastening elements along the entire length of the section bar, and at the same time the sheets may be inserted independently.

[0093] This is further facilitated by the fact that the joint assembly is inserted internally into the metal section bars and therefore does not hinder the operations of fastening the purlins, sheets, or other anchoring plates on the metal section bars.

[0094] Moreover, due to the possibility of moving the fastening elements for the purlins, even in the case of erroneous positioning, it is possible to remedy said erroneous positioning without any drilling or further maintenance, as it is sufficient to slide the fastening elements (for example the screw heads) along the technical grooves.

[0095] Additionally, the presence of the technical grooves makes it possible to increase the presence of purlins or bracing rods at any time during the life cycle of the tent structure, even after it has already been deployed, for example to increase the support of greater operating loads (e.g., to compensate for a sudden snowfall).

[0096] Advantageously, moreover, due to the presence also of lower technical grooves, it is possible to fasten cables, bracing rods, or reticular structures at will inside the arch to increase the support of additional loads.

[0097] Advantageously, due to the technical grooves in the lower wall 30, it is possible to fasten reinforcing struts, for example between a vertical upright and a beam in the vicinity of slope changes, on the inside of the tent structure, as well as horizontal ropes or chains to support snow loads, without the need for additional drilling and using the same structure of the arch.

[0098] Moreover, due to the technical grooves on the lower wall 30, it is possible to fasten the bracing rods in such a way that they are under all the sheets, i.e., facing the inner compartment of the tent structure and, therefore, "visible" (i.e. neither placed between the sheets, nor arranged above the sheet closest to the inner compartment of the tent structure), thus allowing a constant view of said bracing rods and their tensioners from inside the tent structure. This provides greater safety through easier inspections as well as greater simplicity in performing inspections.

[0099] Moreover, due to the extreme flexibility in positioning the sheets and fastening elements of the purlins, it is possible to use a beam element instead of a pillar element, without onerous operations of further drilling, but rather only by moving the fastening elements along the technical grooves.

[0100] Moreover, advantageously, it is possible to choose whether to insert only one or two inner sheets, in addition to the outer one, in order to obtain the maximum versatility of insulation according to the climatic conditions. Moreover, having two possible channels in which to insert the inner sheet, in the case of installation with only one inner sheet, it is possible to choose the thickness of the gap between the outer sheet and the inner sheet, thus offering further versatility in the choice of insulation.

[0101] A person skilled in the art may, in order to meet specific needs, make several changes or substitutions of elements with other functionally equivalent ones.

[0102] These variants are also contained within the scope of protection as defined by the following claims.

Claims

1. A joint assembly (8) for an arch of a tent structure (100), suitable to join at least two metal section bars of an arch of tent structure (100) to each other, for example two beams or a beam and a pillar, said joint assembly (8) comprising at least a first plate-like element (81) which extends between a first end (810) of first element and a second end (811) of first element and at least a second plate-like element (82) which extends between a first end (820) of second element and a second end (821) of second element, said first plate-like element (81) and said second plate-like element (82) extending along a first direction (R) of extension, along a second direction (T) of extension perpendicular to the first direction (R) of extension and along a third direction (S) of extension perpendicular to the first (R) and the second direction (T) of extension, said first (81) and second (82) plate-like elements extending along said third direction (S) of extension much less with respect to the extension along the first (R) and the second direction (T) of extension, i.e., being of reduced thickness in the third direction of extension,

   wherein the first plate-like element (81) runs parallel to the second plate-like element (82) and is spaced apart from the second plate-like element (82) along the third direction (S) of extension,
   wherein the joint assembly (8) comprises one or more joining elements (850) which join the first plate-like element (81) and the second plate-like element (82) to each other, keeping them spaced apart in the third direction (S) of extension so that there is a interspace (I) between the first (81) and the second (82) plate-like element, and wherein said first plate-like element (81) and second plate-like element (82) are entirely made of aluminum alloy.

2. Joint assembly (8) according to claim 1, comprising a third plate-like element (83) which extends between a first end (830) of third element and a second end (831) of third element, said third plate-like element (83) extending along a first direction (R) of extension, along a second direction (T) of extension perpendicular to the first direction (R) of extension and along a third direction (S) of extension perpendicular to the first (R) and the second (T) direction of extension, said third plate-like element (83) extending along said third direction (S) of extension much less with respect to the extension along the first (R) and the second direction (T) of extension, i.e., being of reduced thickness in the third direction (S) of extension,
   and wherein said third plate-like element (83) runs parallel to the first (81) and second (82) plate-like elements and is interposed spaced apart between the first (81) and the second (82) plate-like element, along the third direction (S) of extension.

3. Joint assembly (8) according to claim 2, wherein the one or more joining elements (850) join the first plate-like element (81), the second plate-like element (82) and the third plate-like element (83) to one another, keeping them spaced apart in the third direction (S) of extension so that there is a first interspace (II) between the first (81) and the third plate-like element (83) and a second interspace (12) between the second (82) and the third (83) plate-like elements.

4. Joint assembly (8) according to any one of the preceding claims, wherein the aluminum alloy is an alloy comprising zinc (Zn), preferably an alloy of the group 7XXX.

5. Joint assembly (8) according to any one of the preceding claims, wherein the aluminum alloy is an EN AW-7075 alloy or an EN AW-7020 alloy.

6. Joint assembly (8) according to any one of the preceding claims, wherein the first (81) and the second (82) plate-like elements are equal to each other.

7. Joint assembly (8) according to any one of the preceding claims, wherein the first (81) and the second (82) plate-like elements each comprise a first portion (815, 825) which extends from the first end (820) and a second portion (816, 826) which extends from the second end (811, 821), said first portion and said second portion being joined to each other so as to form a knee portion (817, 827), i.e. being inclined to each other so as to form a non-flat angle, preferably an obtuse angle.

8. Joint assembly (8) according to any one of the preceding claims, wherein the first (81) and the second (82) plate-like elements are made in one piece.

9. A structural group (8') of an arch of a tent structure (100), comprising a joint assembly (8) according to any one of the preceding claims, and:

   - a first metal section bar (1) mainly extending along a longitudinal direction (X) and comprising an upper wall (10), a lower wall (30), a right side wall (20) and a left side wall (40) which define an inner cavity (C) of the metal section bar (1), said upper wall (10) being joined in one piece to the left side wall (40) and right side wall (20) and being arranged opposing and spaced apart from

the lower wall (30);
- a second metal section bar (1') mainly extending along a longitudinal direction (X') and comprising an upper wall (10') of second section bar, a lower wall (30') of second section bar, a right side wall (20') of second section bar and a left side wall of second section bar which define an inner cavity (C) of the second metal section bar (1), said upper wall (10') of second section bar being joined in one piece to the left side wall and right side wall (20') of second section bar and being arranged opposing and spaced apart from the lower wall (30') of second section bar;
wherein, each of said first (1) and second (1') metal section bars in the inner cavity (C) comprises:
- a first seat (C1) in which the first plate-like element (81) is engaged;
- a second seat (C2) in which the second plate-like element (82) is engaged;

and wherein the first end (810) of first element and the first end (820) of second element are accommodated in the inner cavity (C) of the first metal section bar (1) and the second end (811) of first element and the second end (821) of second element are accommodated in the inner cavity (C) of the second metal section bar (1'),
and wherein the first (81) and the second (82) plate-like elements are suitable to be slidably inserted into the inner cavity (C) of each first (1) and second (1') metal section bars.

10. Structural group (8') for an arch of a tent structure (100) according to claim 9, comprising the joint assembly (8) according to claims 2 to 8, wherein each of said first (1) and second (1') metal section bars in the inner cavity (C) comprises a third seat (C3), which mainly extends in longitudinal direction (X) and in which the third plate-like element (84) is engaged;

and wherein the first end (830) of third element is accommodated in the inner cavity (C) of the first metal section bar (1) and the second end (831) of third element is in the inner cavity (C) of the second metal section bar (1'),
and wherein the third plate-like element (83) is suitable to be slidably inserted into the third seat (C3) of each first (1) and second (1') metal section bars.

11. Structural group (8') for an arch of a tent structure (100) according to claim 9 or 10, wherein the first (C1) and/or second (C2) and/or third (C3) seats are shaped to serve as translation guide in the longitudinal direction (X) of the first plate-like element (81), second plate-like element (82) and/or third plate-like element (83), respectively.

12. Structural group (8') for an arch of a tent structure (100) according to claim 11, wherein the third seat (C3) is a groove which mainly extends in the longitudinal direction and engages the third plate-like element (83) by shape coupling.

13. Structural group (8') for an arch of a tent structure (100) according to any one of claims 9 to 12, wherein the first (1) and the second (1') metal section bars each comprise:

- a first channel (21) with an open annular section which mainly extends along the longitudinal direction (X), said first channel being obtained on the right wall (20, 20') or in the vicinity of the joining region between the right wall (20, 20') and the upper wall (10, 10'), on the opposite side with respect to the inner cavity (C);
- a second channel (22) with an open annular section which mainly extends along the longitudinal direction (X), said second channel (22) being obtained on the right wall (20, 20') or in the vicinity of the joining region between the right wall (20, 20') and the lower wall (30, 30'), on the opposite side with respect to the inner cavity (C);
- a third channel (23) with an open annular section which mainly extends along the longitudinal direction (X), said third channel (23) being obtained on the right wall (20, 20'), on the opposite side with respect to the inner cavity (C), and being interposed between the first channel (21) and the second channel (22) and being spaced apart from said first (21) and second (22) channels;

wherein the first (21), the second (22) and the third (23) channels are suitable for each receiving an enlarged edge portion (51, 61, 71) of a respective cover sheet (5, 6, 7) so that the enlarged edge portion (51, 61, 71) is slidably insertable into the respective channel (21, 22, 23) in a direction parallel to the longitudinal direction (X) and so that the enlarged edge portion (51, 61, 71) is constrained to remain in each respective channel (21, 22, 23) when urged in the other spatial directions perpendicular to the longitudinal direction (X);
wherein each of said first metal section bar (1) and second metal section bar (1') further comprises a first technical groove (24) having open section and a second technical groove (25) having open section which mainly extends along the longitudinal direction (X), said first (24) and second (25) tech-

nical grooves being obtained on the right wall (20), on the opposite side with respect to the inner cavity (C), i.e., with the open section on the opposite side with respect to the inner cavity (C),
said first (24) and second (25) technical grooves being spaced apart from each other and being interposed between the first (21) and the second (22) channels or between the second (22) and the third (23) channels,
and wherein said first (24) and second (25) technical grooves are suitable to each receive a respective coupling portion (240', 250') of a fastening element (240, 250) for a purlin (9), for example the head of a screw or a pin, so that the coupling portion (240', 250') is slidably insertable into the respective technical groove (24, 25) in a direction parallel to the longitudinal direction (X) and so that the coupling portion (240', 250') is constrained to remain in each respective technical groove (24, 25) when urged in the other spatial directions perpendicular to the longitudinal direction (X).

14. Structural group (8') for an arch of a tent structure (100) according to claim 13, wherein the first (1) and the second (1') metal section bars each comprise:

a fourth channel (21') with an open annular section which mainly extends along the longitudinal direction (X), said fourth channel (21') being obtained on the left wall (40) or in the vicinity of the joining region between left wall (40) and the upper wall (10), on the opposite side with respect to the inner cavity (C);

- a fifth channel (22') with an open annular section which mainly extends along the longitudinal direction (X), said fifth channel (22') being obtained on the left wall (40) or in the vicinity of the joining region between left wall (40) and the lower wall (30), on the opposite side with respect to the inner cavity (C);
- a sixth channel (23') with an open annular section which mainly extends along the longitudinal direction (X), said sixth channel (23') being obtained on the left wall (20), on the opposite side with respect to the inner cavity (C), and being interposed between the fourth channel (21') and the fifth channel (22') and being spaced apart from said fourth (21') and fifth channel (22');

wherein the fourth (21'), the fifth (22') and the sixth channel (23') are suitable for each receiving an enlarged edge portion (51', 61', 71') of a respective cover sheet (5', 6', 7') so that the enlarged edge portion (51', 61', 71') is slidably insertable into the respective channel (21', 22', 23') in a direction parallel to the longitudinal direction (X) and so that the enlarged edge portion (51', 61', 71') is constrained to remain in each respective channel (21', 22', 23') when urged in the other spatial directions perpendicular to the longitudinal direction (X).

15. Structural group (8') for an arch of a tent structure (100) according to claim 14, wherein the first (1) and second (1') metal section bars each comprise a third technical groove (24') having open section and a fourth technical groove (25') having open section which mainly extends along the longitudinal direction (X), said third (24') and fourth (25') technical grooves being obtained on the left wall (40), on the opposite side with respect to the inner cavity (C), i.e. with the open section on the opposite side with respect to the inner cavity (C), said third (24') and fourth (25') technical grooves being spaced apart from each other and being interposed between the fourth (21') and the fifth channel (22') or between the fifth (22') and the sixth (23') channels,
and wherein said third (24') and fourth (25') technical grooves are suitable to each receive a respective coupling portion (240"', 250"') of a fastening element (240", 250") for a purlin (9), for example the head of a screw or a pin, so that the coupling portion (240"', 250"') is slidably insertable into the respective technical groove (24', 25') in a direction parallel to the longitudinal direction (X) and so that the coupling portion (240"', 250"') is constrained to remain in each respective technical groove (24', 25') when urged in the other spatial directions perpendicular to the longitudinal direction (X).

16. Structural group (8') for an arch of a tent structure (100) according to claim 14 or 15, wherein the first (1) and second (1') metal section bars each comprise one or more upper technical grooves (11, 12) having open section and which mainly extend along the longitudinal direction (X), said one or more upper technical grooves (11, 12) being obtained on the upper wall (10), on the opposite side with respect to the inner cavity (C), i.e. with the open section on the opposite side with respect to the inner cavity (C),

said one or more upper technical grooves (11, 12) being suitable to each receive a respective coupling portion (110', 120") of a fastening element (110, 120) for a technical accessory, for example the head of a screw or a pin for coupling a supporting plate for an accessory external to the tent structure, so that the coupling portion (110', 120') is slidably insertable into the upper

technical groove (11, 12) in a direction parallel to the longitudinal direction (X) and so that the coupling portion (110', 120') is constrained to remain in each respective upper technical groove (11, 12) when urged in the other spatial directions perpendicular to the longitudinal direction (X);
and/or one or more lower technical grooves (31, 32) having open section, and which mainly extend along the longitudinal direction (X), said one or more lower technical grooves (31, 32) being obtained on the lower wall (30), on the opposite side with respect to the inner cavity (C), i.e. with the open section on the opposite side with respect to the inner cavity (C),
said one or more lower technical grooves (31, 32) being suitable to each receive a respective coupling portion of a fastening element for a technical accessory, for example the head of a screw or a pin for coupling a supporting plate for an accessory inside the tent structure, so that the coupling portion is slidably insertable into the lower technical groove (31, 32) in a direction parallel to the longitudinal direction (X) and so that the coupling portion is constrained to remain in each respective lower technical groove (31, 32) when urged in the other spatial directions perpendicular to the longitudinal direction (X).

17. A tent structure (100) comprising:

- a plurality of arch frames (101, 102, 103) which vertically extend for a predefined height (H) with respect to a support plane (P), said arch frames (101, 102, 103) being arranged spaced apart from one another along a direction of extension (K) which is perpendicular to a vertical direction (J) and lying on the support plane (P), wherein each arch frame (101, 102, 103) comprises a plurality of structural groups (8') joined to form the arch,
- at least one outer cover sheet (5) suitable to be directly subjected to the atmospheric agents, connected to the arch frames.

18. Tent structure (100) according to claim 17, wherein the outer cover sheet (5) has an enlarged edge portion (51) inserted in the first channel (21) so that the enlarged edge portion (51) is constrained to remain in the first channel (21) when urged in the other spatial directions perpendicular to the longitudinal direction (X) ;

- at least a first inner cover sheet (6, 7) having an enlarged edge portion (61, 71) inserted in the second (22) or third channel (23) so that the enlarged edge portion (61, 71) is constrained to remain in the second or third channel (22, 23) when urged in the other spatial directions perpendicular to the longitudinal direction (X) ;
- at least one purlin (9) and at least one fastening element (240, 250) having a coupling portion (240', 250'), for example the head of a screw or a pin, wherein the coupling portion (240', 250') is inserted in the first and/or in the second technical groove (24, 25) so that it is constrained to remain in each respective technical groove (24, 25) when urged at least in the spatial directions perpendicular to the longitudinal direction (X).

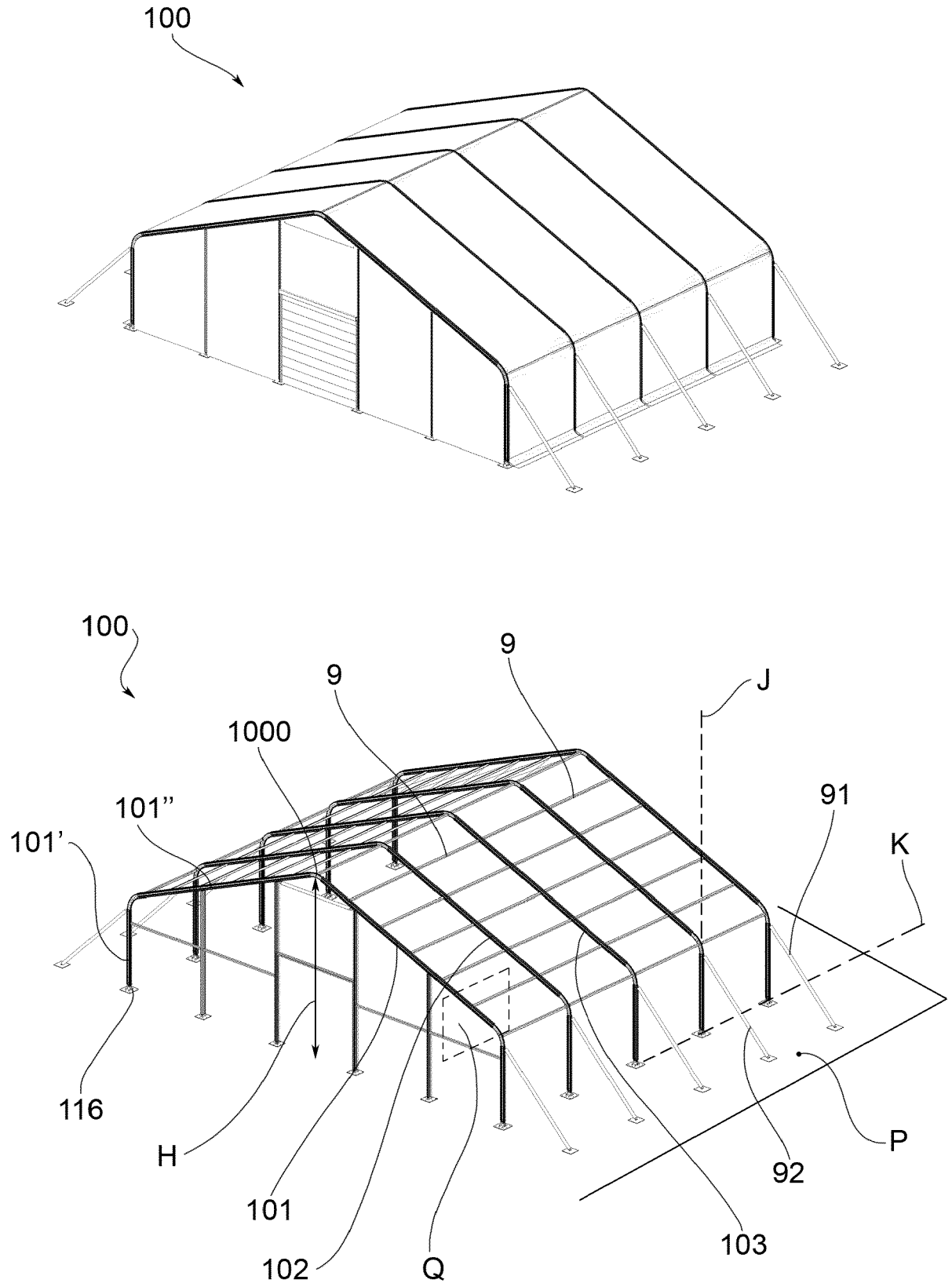


FIG.1

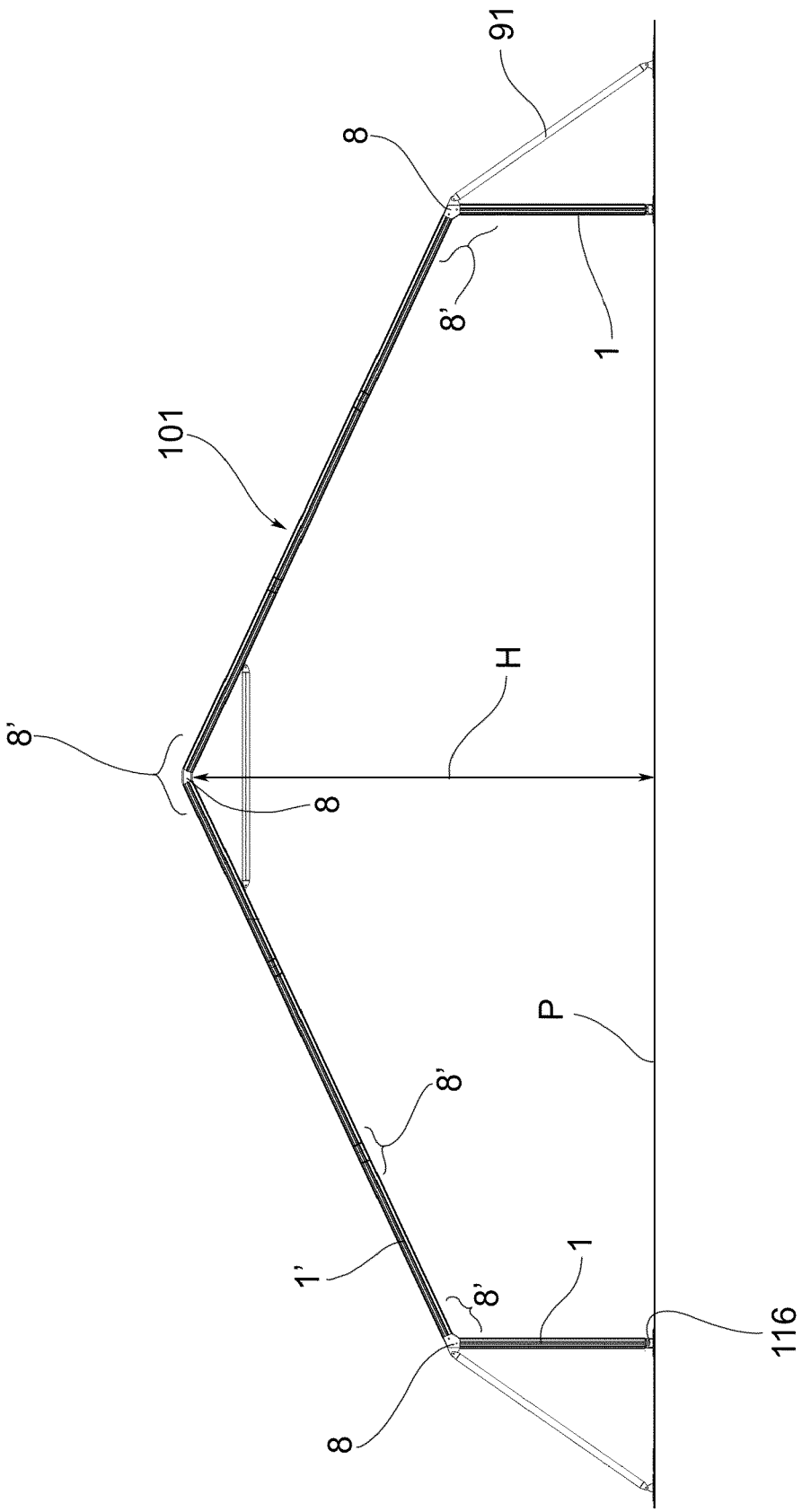
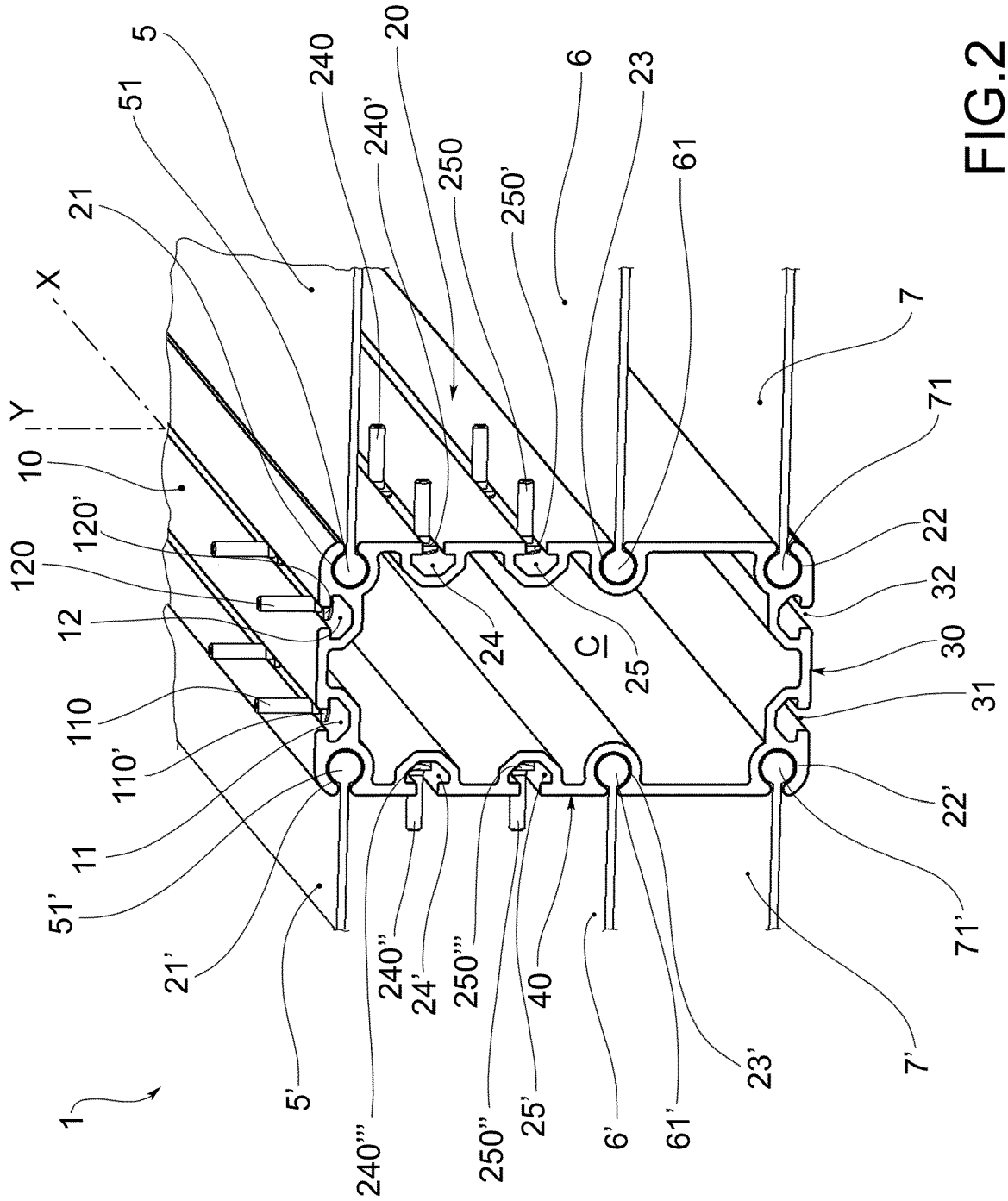


FIG.1a


5
51
240
20
240'
250
6
23
61
250'
21
X
Y
10
120'
120
12
110
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11
51'
21'
1
5'
240'''
240''
24'
250'''
250''
25'
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30
32
22
71
7
24
C
25

FIG.2

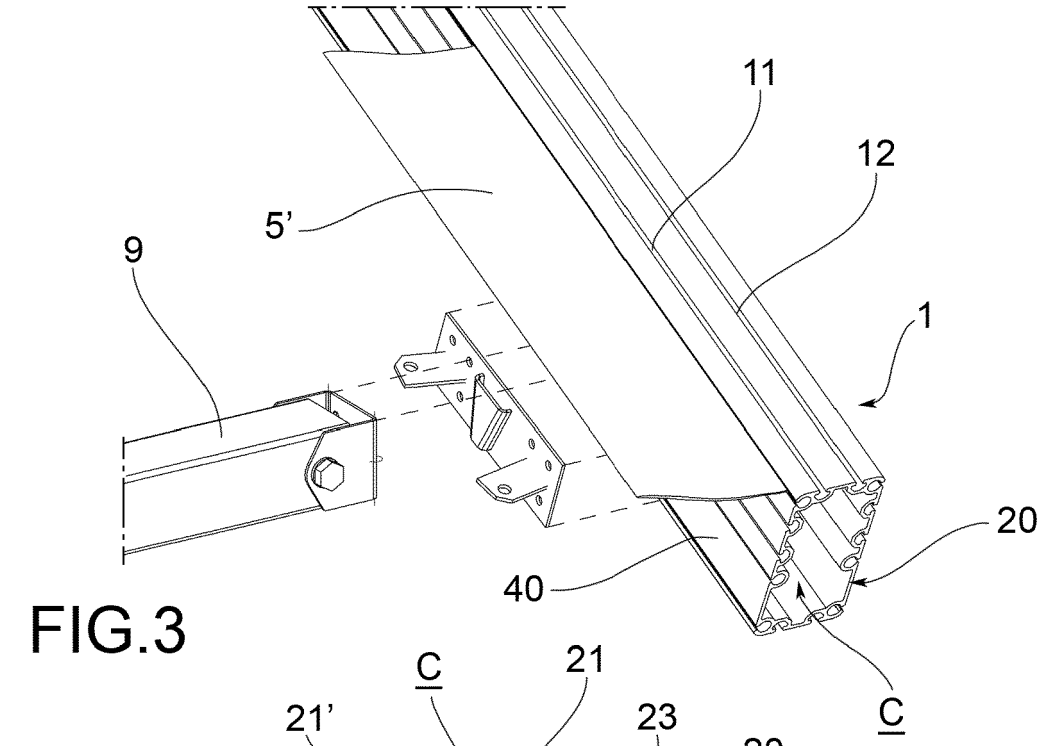


FIG.3

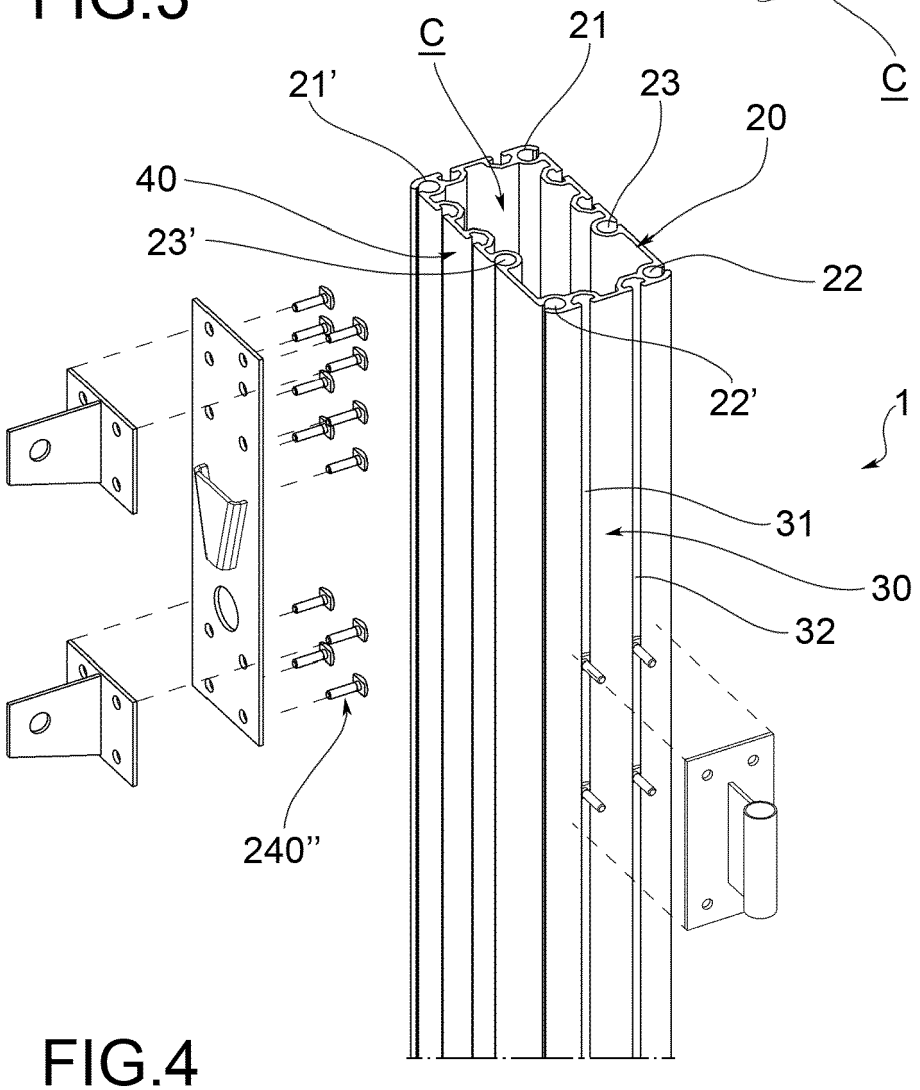


FIG.4

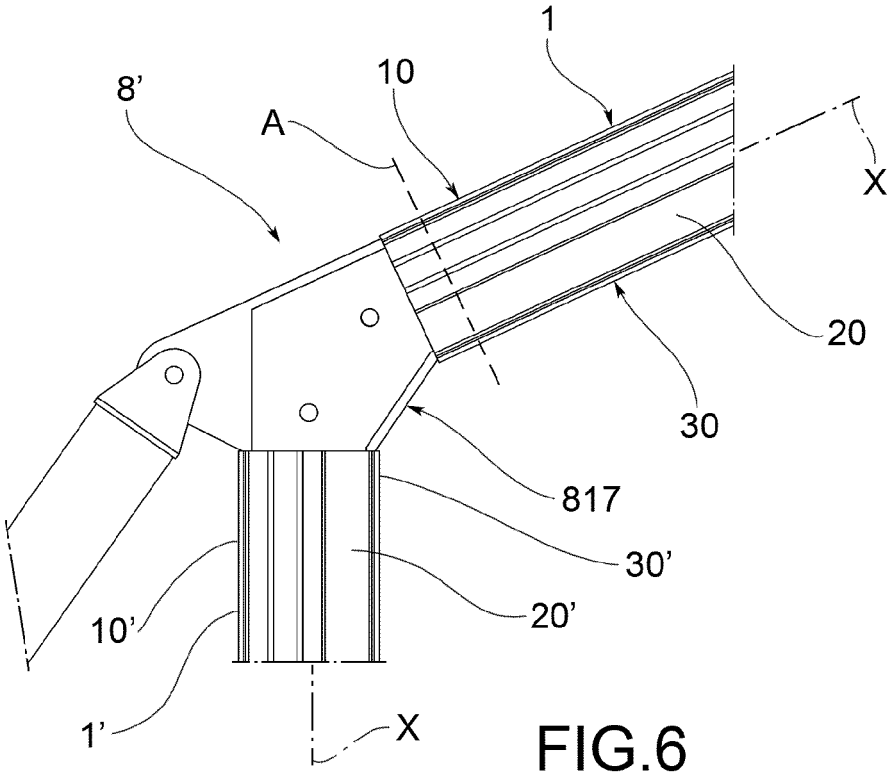


FIG.6

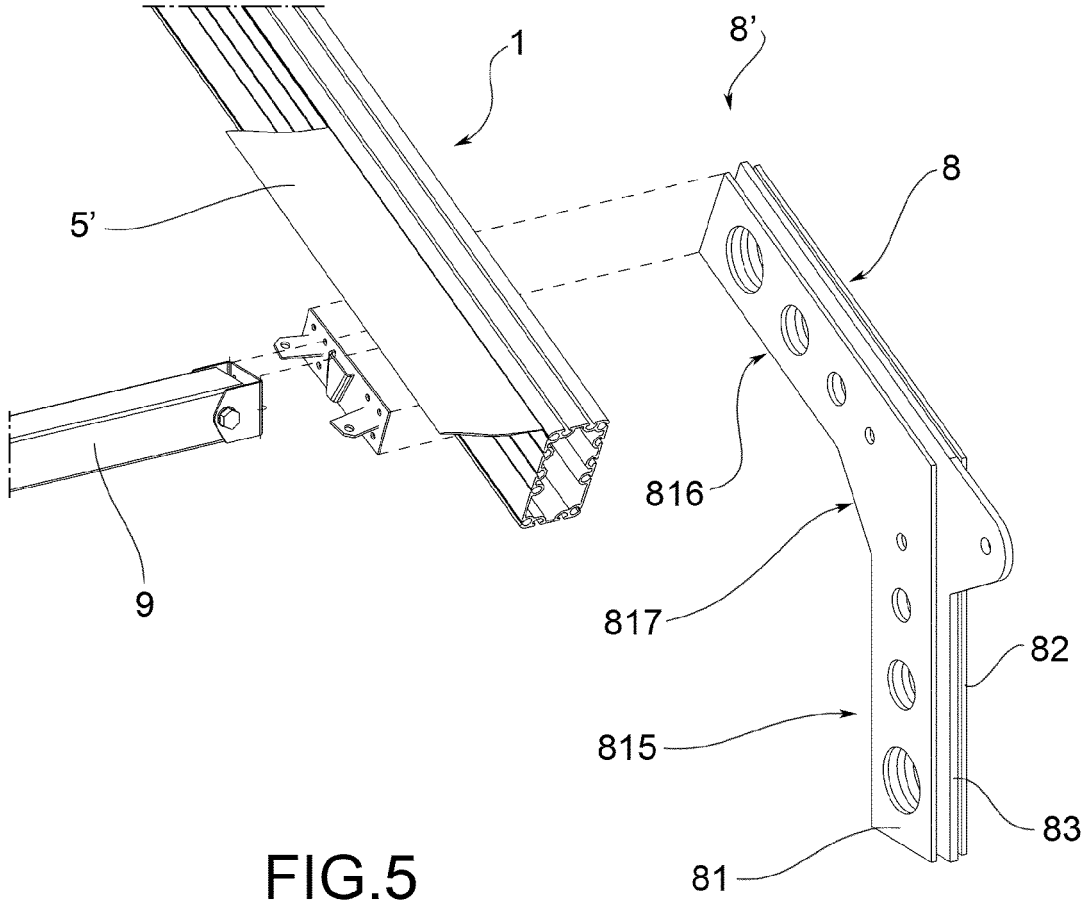


FIG.5

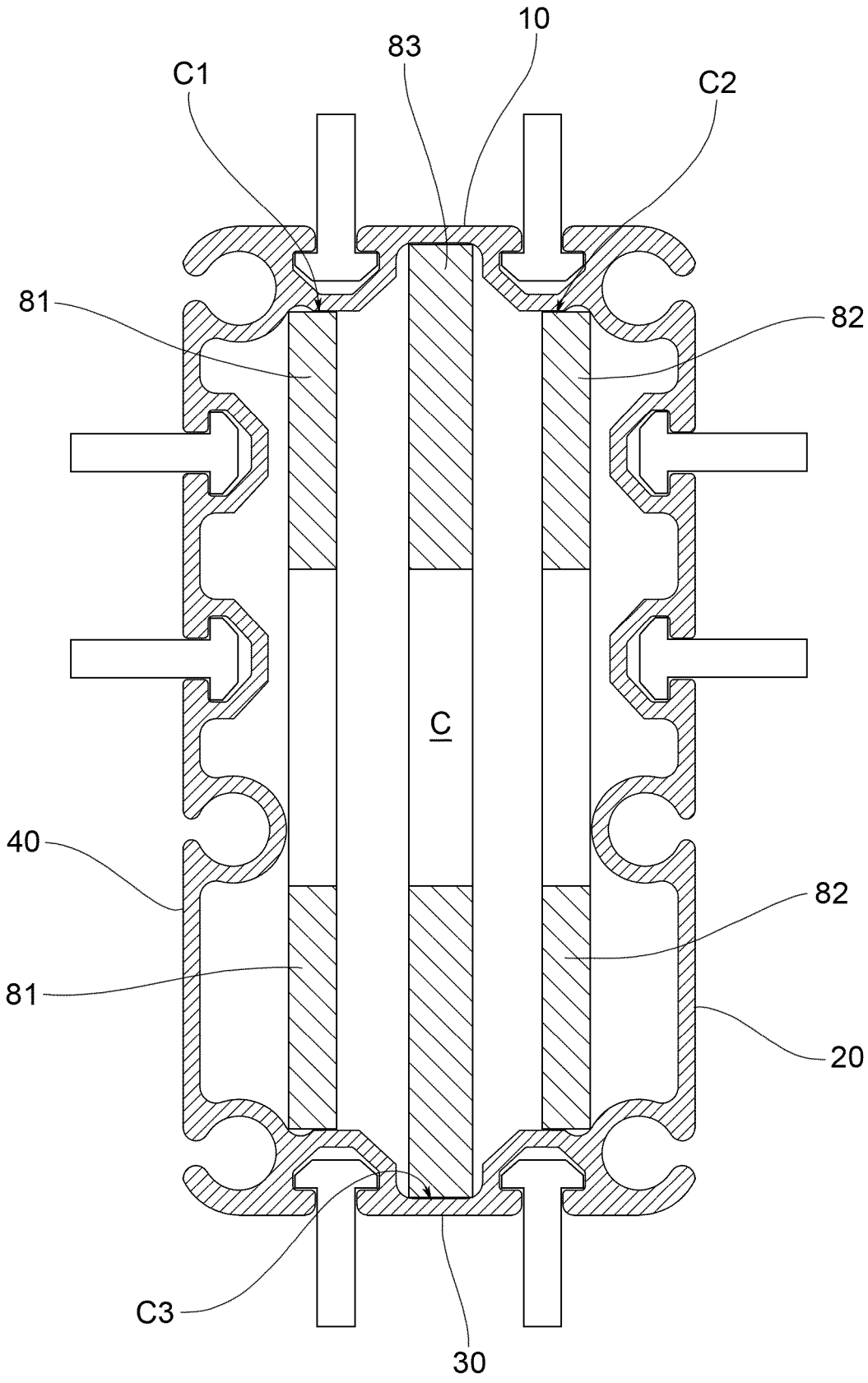
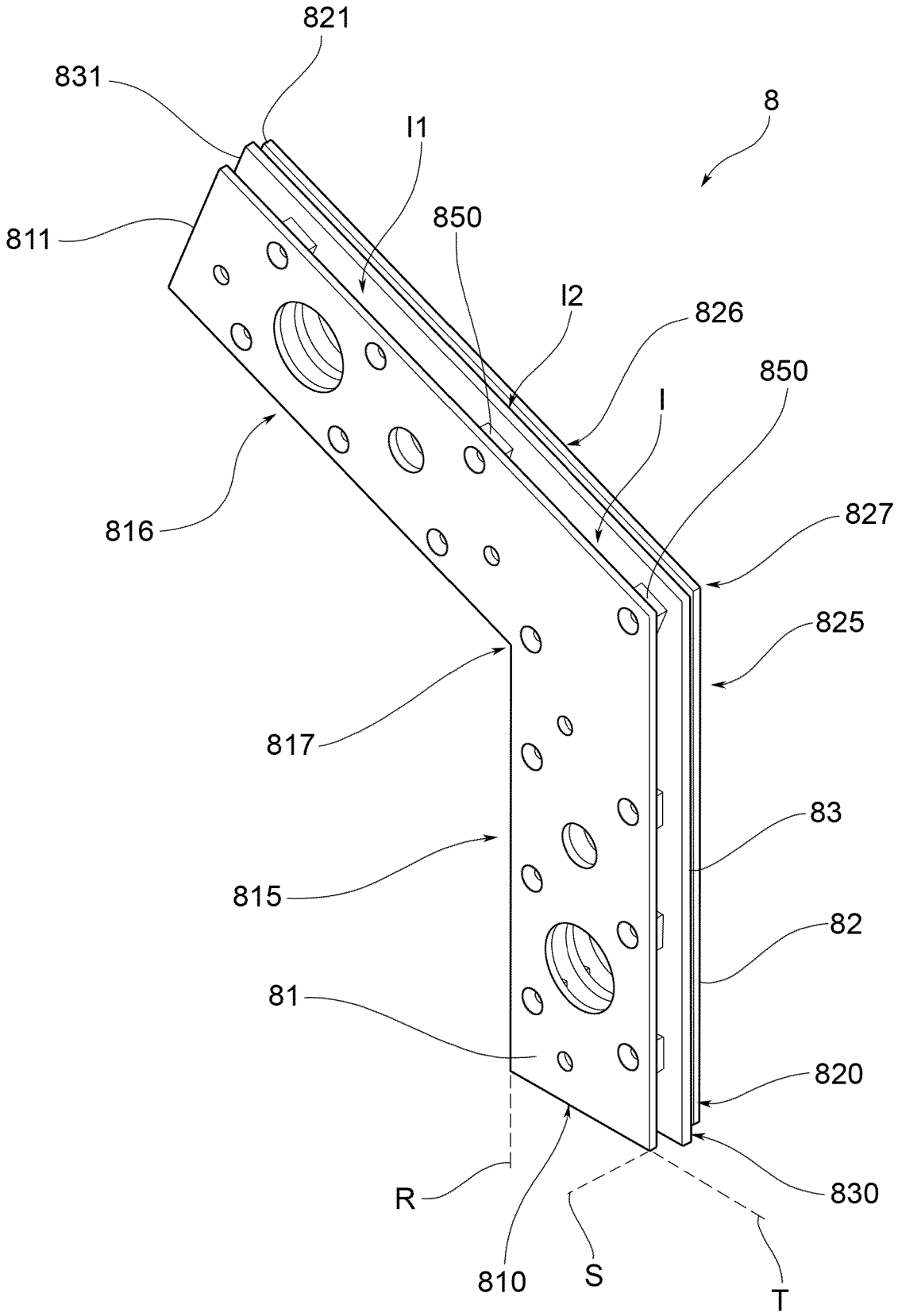


FIG.7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831
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I1
811
850
I2
826
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I
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817
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815
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81
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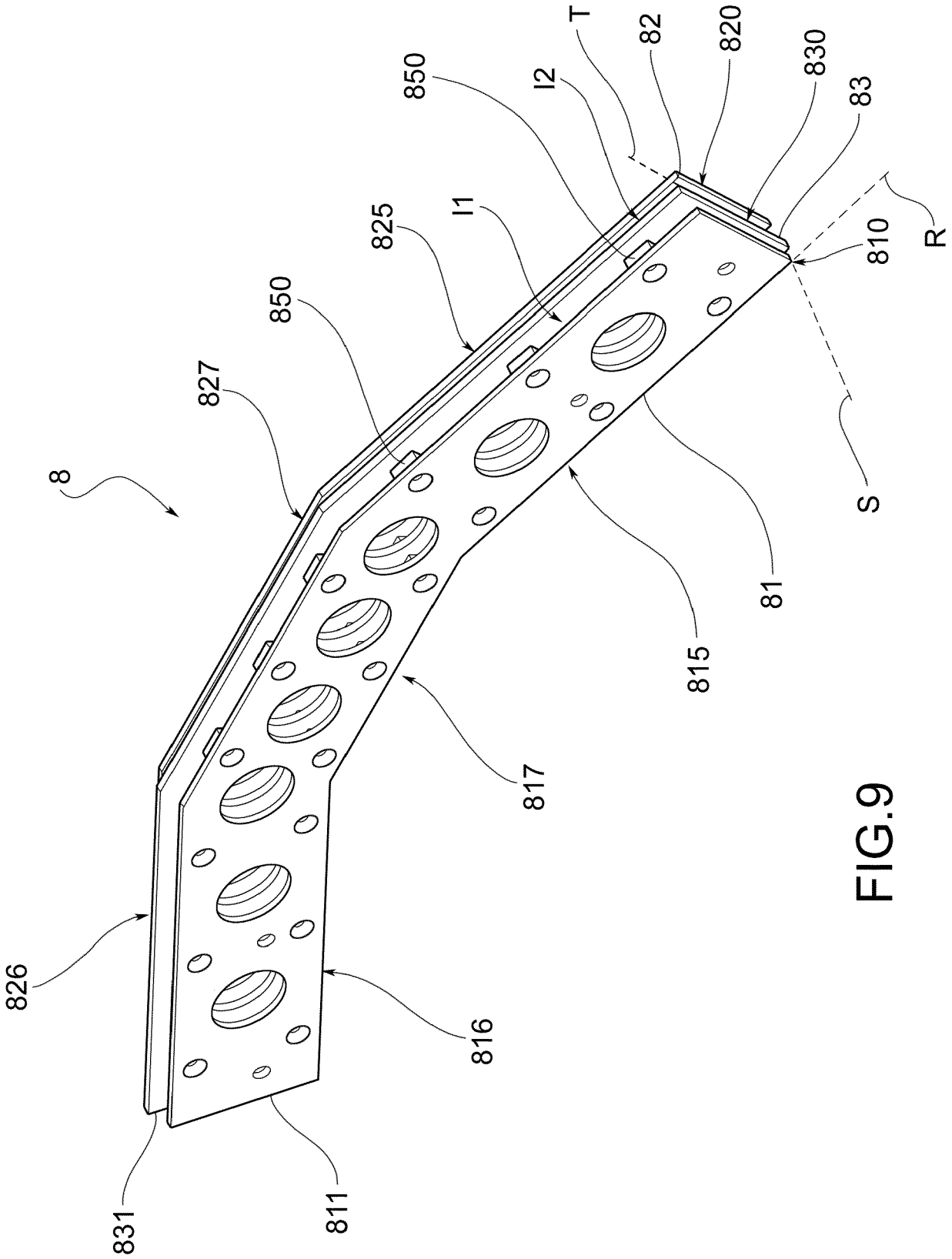
R
830
810
S
T

FIG.8


T
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I2
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817
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816
831
811

FIG.9

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EUROPEAN SEARCH REPORT

Application Number
EP 21 21 0568

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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02-05-2022

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