

(19)



(11)

EP 4 230 546 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
23.08.2023 Bulletin 2023/34

(51) International Patent Classification (IPC):
B65D 19/28 ^(2006.01)

(21) Application number: **23156716.5**

(52) Cooperative Patent Classification (CPC):
B65D 19/0095; B65D 2519/00024;
B65D 2519/00059; B65D 2519/00094;
B65D 2519/00273; B65D 2519/00293;
B65D 2519/00323; B65D 2519/00333;
B65D 2519/00373; B65D 2519/00562;
B65D 2519/00572

(22) Date of filing: **15.02.2023**

(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 ME MK MT NL
NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

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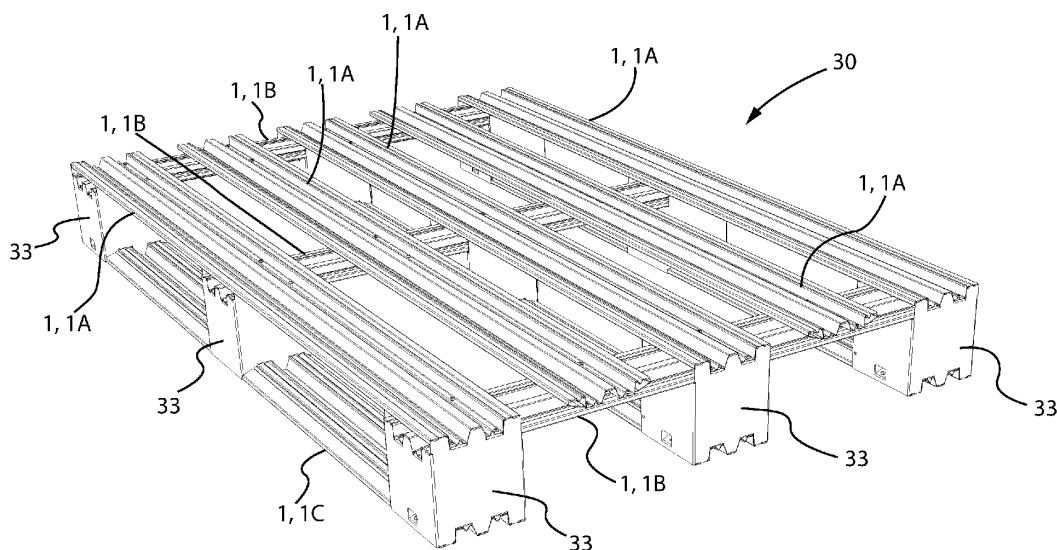
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(30) Priority: **16.02.2022 IT 202200002837**

(54) METAL PROFILE AND PALLET COMPRISING SAID METAL PROFILE

(57) A metal profile (1, 1A, 1B, 1C) comprises a main body which forms a first major "dorsal" face (3) and a second major "ventral" face (5). The cross-sections of the profile (1, 1A, 1B, 1C) form two lateral edges (7, 9) and two tubular portions (11, 13), each of which has a maximum width (WTB) less than or equal to 0.3 times the overall length (WP) of the cross-sections of the profile (1) itself. Each tubular portion (11, 13) has a maximum

height (HTB) substantially comprised between 0.5-1 times the maximum height (HP) of the cross-sections of the profile (1) itself. At or near their centreline, the cross-sections of the profile (1) form a central longitudinal groove (15) which extends over at least half of the overall height (HP) of the profile (1). The profile (1) allows to make metal pallets very resistant and easy to assemble.

**Fig. 4****EP 4 230 546 A1**

Description

Field of the invention

[0001] The present invention relates to a metal profile obtainable by bending a metal sheet.

[0002] The profile is particularly suitable to produce pallets for packaging, transporting, and moving goods as well as to make for example traffic signs, enclosures, guard rails, frames of walls made of plasterboard, laminated wood or other composite walls or other metal carpentry structures.

State of the art

[0003] In more or less recent times pallets, i.e., benches for transporting and moving goods, made of metal instead of the traditional wood of which they have been made for decades, have become widespread.

[0004] The main requirements a metal pallet must - or should - satisfy are low costs, ease of production, repair, recycle and disposal, strength.

[0005] The numerous versions of metal pallets conceived so far manage more or less well to satisfy these requirements, depending on the variation of pallet in question but not to such an extent to have led, until today, to a wide diffusion of these pallets compared to the wooden ones in transporting and distributing consumer goods and more generally of goods in the civil sector: to this day, the wooden pallets are - at least in Europe - the most common type overall.

[0006] Some examples of known metal pallets are shown for example in the Italian Patent Application PN2004A000037 or in the South-Korean utility model KR200417384 (Application No. KR20060002911U).

[0007] An object of the present invention is to solve the above-mentioned drawbacks of the state of the art and in particular to provide a metal profile suitable to produce metal pallets, and a metal pallet obtained therefrom, which proves to be meliorative with respect to known metal pallets.

Summary of the invention

[0008] Such object is achieved, according to the present invention, with a profile having the features according to claim 1.

[0009] In a second aspect of the present invention, such object is achieved by a pallet having the features according to claim 12.

[0010] In a pallet according to a particular embodiment of the invention, at least part and preferably all the profile sections (1, 1A, 1B, 1C) are overall straight.

[0011] Further features of the invention are object of the dependent claims.

[0012] The advantages obtainable with the present invention will become clearer, for those skilled in the art, from the following detailed description of some particular

exemplary embodiments of a non-limiting nature, illustrated with reference to the following schematic figures.

List of the Figures

[0013]

Figure 1 shows a first perspective view of a metal profile section according to a first particular embodiment of the present invention;

Figure 2 shows an enlarged detail of the view of Figure 1;

Figure 3 shows a second perspective view of the section of Figure 1, observed according to a direction more longitudinal to the longitudinal axis **AXP** of the profile itself;

Figures 3A and 3B show an enlarged detail of Figure 3;

Figure 4 shows a perspective top view of a pallet obtained from the profile of Figure 1, according to a particular embodiment of the present invention;

Figure 5 shows a perspective bottom view of the pallet of Figure 4;

Figure 6 shows an enlarged detail of Figure 4, depicting some elements in transparency;

Figure 7 shows a perspective view of a connecting plinth of the pallet of Figure 4;

Figure 8 shows a first perspective view of a metal profile section according to a second particular embodiment of the present invention;

Figure 9 shows a cross-section of the profile of Figure 8 according to the ideal section plane IX-IX perpendicular to the axis of the profile itself;

Figure 10 shows a plan view of the waived sheet layer or band from which the profile of Figure 8 is obtained;

Figure 11 shows a detail of the section of Figure 9;

Figure 12 shows an enlarged detail of Figure 8;

Figure 13 shows a perspective view of a pallet according to a third particular embodiment of the invention;

Figure 13A shows a perspective view of a detail of a plinth and of the ends of the portions of some profile sections of the pallet of Figure 13;

Figure 14 shows an axial view of two dismounted and stacked profile sections, usable to mount the pallet of Figure 13;

Figure 14A shows an enlarged detail of the two profile sections of Figure 14;

Figure 15 shows a partially sectional perspective view of a plinth and of the ends of the portions of some profile sections of the pallet of Figure 13, according to a section plane parallel to the longitudinal axis of some profile sections of the pallet;

Figure 16 shows a lateral view of two pallets of the type of Figure 13, stacked on top of each other;

Figure 17 shows a perspective bottom view of a plinth and a profile section of the pallet of Figure 13.

Detailed description

[0014] Figures 1-3, 3A, 3B show a metal profile according to a first particular embodiment of the present invention, denoted by the overall reference **1**, **1A**, **1B**, **1C** particularly suitable to make pallets - i.e., benches - for moving and transporting goods, pallets movable through forklift trucks.

[0015] The profile **1**, **1'**, **1''** can be further used to make for example enclosures, lofts, raised floors, reticular frames - such as for example the shelves of the pallet holders (so-called racks) or the perimetral frames of the pallets (so-called collars) - frames of walls made of plasterboard, laminated wood or other composite walls or other structures for example of metal carpentry, guard rails, or traffic sign.

[0016] The profile **1**, **1'**, **1''** is preferably obtained by bending or otherwise cold deforming a metal sheet band, for example made of steel or aluminium alloys.

[0017] Such sheet can have thicknesses for example comprised between **0.2-2** millimetres, or between **0.3-1.5** millimetres, between **0.3-1.2** millimetres or between **0.45-0.6** millimetres.

[0018] Preferably, the profile **1**, **1'**, **1''** is obtained by cold deforming a single metal sheet band.

[0019] Such band can be deformed in a suitable roller machine, i.e., a profiling machine, provided with a plurality of rollers which progressively bend or otherwise deform the band advancing along the profiling machine itself.

[0020] The roller axes can be for example substantially perpendicular to the advancing direction of the band in the profiling machine, which direction is parallel to the axis **AXP** of the profile **1**.

[0021] The sheet band forms the so-called main body of the profile **1**, **1'**, **1''**.

[0022] The main body of the profile **1**, **1'**, **1''** is bent so as to form a first major face conventionally referred to as "dorsal" **3** and a second major face **5** of the profile conventionally referred to as "ventral", wherein said major dorsal **3** and ventral **5** faces face two directions in space opposite to each other (Figure 3).

[0023] The profile **1**, **1'**, **1''** forms cross-sections substantially oblong in overall shape, wherein such cross-sections are related to ideal section planes perpendicular to the axis **AXP** of the profile **1**, **1'**, **1''**.

[0024] Such cross-sections form two lateral edges **7**, **9**, each of which is placed at a respective end of these cross-sections (Figure 2, 3).

[0025] At or near the two lateral edges **7**, **9** the profile **1**, **1'**, **1''** forms two respective tubular portions **11**, **13**, each of which is substantially tubular, hollow, in shape.

[0026] Each tubular portion **11**, **13** is preferably obtained by bending and folding on itself a strip of the sheet band so as to form closed cross-sections (Figure 2, 3), making the profile **1**, **1'**, **1''** particularly strength and resistant to deflection; for this purpose, such as for example in Figure 3, 3A, the longitudinal edges of the sheet band

can be folded on more internal portions of the same band so as to form tubular, or otherwise closed, cross-sections; however in not-shown embodiments the tubular portions can be also made with one or more sheet strips not entirely folded on themselves, and for example wound in a spiral or in a relatively very close C-shape.

[0027] The tubular portions **11**, **13** make the outer edges of the profile **1**, **1'**, **1''** rounded, preventing them from exposing dangerous sharp sheet edges which might injure, even seriously, the staff handling the profile **1**, **1'**, **1''** or a pallet **30**, **30''** obtained therefrom, or from damaging surrounding objects.

[0028] Each tubular portion **11**, **13** has a maximum width **WTB** substantially less than or equal to **0.3** times the overall length **WP** of the cross-sections of the profile **1** itself; in other words, in the profile **1** the ratio **WTB/WP** is preferably less than or equal to **0.3**.

[0029] More preferably the ratio **WTB/WP** is comprised between **0.15-0.27** times, and more preferably comprised between **0.18-0.25** times, between **0.19-0.23** times or between **0.19-0.21** times or approximately equal to **0.20** times.

[0030] Preferably, the central groove **15** forms a central longitudinal rib **16** on the major dorsal face **3** of the profile **1**, **1'**, **1''** (Figure 3).

[0031] Preferably, the major dorsal face **3** forms at least one - and more preferably at least two - connecting recesses **18**, each of which is located at one side of both a respective tubular portion **11**, **13** and the central longitudinal rib **16**.

[0032] More preferably each connecting recess **18** is placed between a respective tubular portion **11**, **13** and the central longitudinal rib **16** (Figure 3).

[0033] For this purpose, each connecting recess **18** can be delimited by a side of a respective tubular portion **11**, **13**, by a side of the central rib **16** and by the connecting portion **21**.

[0034] Advantageously each connecting recess **18** of a first profile **1**, **1'**, **1''** is arranged to accommodate at least part of the tubular portion **11**, **13** of a second profile **1**, **1'**, **1''** which is overlapped to the first profile **1**, **1'**, **1''** facing the major dorsal faces **3** of the two profiles.

[0035] It is thus possible to catch and horizontally constrain several stacked pallets to each other, in which the profile sections **1**, **1A** point their major dorsal faces **3** to the outside of the pallet **30**, **30''** itself (Figure 4, 6, 16), thus making the pallet stack much more solid and stable.

[0036] Alternatively to or in combination with the above, each tubular portion **11**, **13** has a maximum height **HTB** substantially comprised between **0.5-1** times the maximum height **HP** of the cross-sections of the profile **1** itself; in other words in the profile **1** the ratio **HTB/HP** is preferably comprised between **0.5-1** times.

[0037] More preferably the ratio **HTB/HP** is comprised between **0.7-0.9** times, or between **0.80-0.85** times or between **0.83-0.84** times.

[0038] Preferably, the cross-sections of the tubular portions **11**, **13** are substantially oblong in shape, which

extends preferably longitudinal to the direction along which the relative overall cross-section of the profile **1** (Figure **3**) extends.

[0039] For this purpose, the ratio **WTB/HTB** between the maximum height and length of each tubular portion **11**, **13** is preferably comprised between **0.3-2** times, and more preferably comprised between **0.5-1.8** times, between **1.2-1.7** times, between **1.6-1.7** times or between **1.65-1.69** times.

[0040] Preferably, the ratio **RDST/WT** between the square root **RDST** of the cross-sectional area of each tubular portion **11**, **13** and the overall width **WP** of the profile **1** is comprised between **0.1-0.2** times, and more preferably comprised between **0.14-0.15** times or between **0.141-0.143** times and preferably equal to about **0.141** times.

[0041] The ratio **RDST/HP** between the square root **RDST** of the cross-sectional area of each tubular portion **11**, **13** and the maximum height **HP** of the profile **1** is preferably comprised between **0.8-1.3** times, and more preferably comprised between **0.9-0.97** times or between **0.95-0.96** times and preferably equal to about **0.958** times.

[0042] The ratio **RDST/PRT** between the square root **RDST** of the cross-sectional area of each tubular portion **11**, **13** and the perimeter **PRT** of such tubular section **11**, **13** is preferably comprised between **0.2-0.28** times, and more preferably comprised between **0.22-0.24** times or between **0.23-0.24** times and preferably equal to about **0.235** times.

[0043] Preferably, each tubular portion **11**, **13** is obtained by folding on itself an edge or other strip of the sheet which forms the profile **1**, for example by folding the sheet edge on one of the connecting portions **21** of the profile (Figure **3**).

[0044] Preferably, the two sheet coats are subsequently clinched together, giving particular strength and deflection to the profile **1**; alternatively they can be for example rivetted, nailed, welded, brazed or screwed together.

[0045] The clinching points are preferably oblong in shape, for example in the form of straight lines.

[0046] Preferably, at or near their centreline the cross-sections of the profile **1** form a central longitudinal groove **15** on the major dorsal **3** or ventral **5** face which extends over at least half of the overall height **HP** of the profile, and more preferably at least on three quarters, four fifths or nine tenths of the overall height **HP**.

[0047] The central longitudinal groove **15** as well as the potential lateral grooves **17**, **19** extend preferably parallel or otherwise longitudinal to the axis **AXP** of the profile **1**.

[0048] As in the embodiment of Figure **1-3** the central groove **15** extends substantially over the entire height **HP** of the profile **1**.

[0049] If formed around its centreline by a single sheet layer, obviously if the portion of the profile **1** forms a central groove on the major ventral face **5**, it correspondingly

forms a central longitudinal rib **16** on the major dorsal face **3** (Figure **3**) and vice versa, if it forms a central longitudinal rib on the major ventral face **5** it correspondingly forms a central groove on the major dorsal face **3**.

5 [0050] Preferably, the central groove **15** at its deepest and innermost portion has a width **WS1** less than or equal to **0.2** times the overall width **WP** of the profile **1**.

[0051] More preferably the ratio **WS1/WP** is comprised between **0.15-0.3** times, or between **0.13-0.2** times, between **0.13-0.15** times or approximately equal to **0.12** times.

[0052] Such size of the width **WS1** is more than enough to place the fixing plinths **33** thereon.

[0053] The deepest and innermost portion of the central groove **15** is preferably flat in shape (Figure **3**).

15 [0054] Preferably, the central groove **15** at its outermost portion has a width **WS2** greater than or equal to **0.2** times the overall width **WP** of the profile **1**.

[0055] More preferably the ratio **WS2/WP** is comprised between **0.2-0.3** times, or between **0.23-0.35** times, between **0.23-0.27** times, between **0.22-0.24** times or approximately equal to **0.23** times.

[0056] Preferably, the ratio **WS2/WS1** is comprised between **1-2.5** times, and more preferably between **1.5-2** times, between **1.8-2** times, between **1.9-1.93** times and for example equal to **1.92** times.

[0057] Preferably, the central longitudinal groove **15** has sides substantially flared, tilted (Figure **3**) or otherwise progressively widening ideally moving outwards from its deepest zone (Figure **3**).

[0058] The sides of the central longitudinal groove **15** have a tilt α [alfa], with respect to the direction along which the cross-sections of the profile **1** extend overall, preferably comprised between **30-85°** and more preferably between **40-70°**, between **60-70°**, between **63-68°** or between **65°-68°**.

[0059] Such tilts give the profile **1** a particular resistance to crushing.

[0060] Advantageously the profile **1** forms at least one lateral longitudinal groove **17**, **19** which extends parallel or otherwise longitudinally to the longitudinal axis **AXP** of the profile **1** itself.

[0061] Each lateral longitudinal groove **17**, **19** is arranged preferably in one or more of the following positions:

- at one or more, or even all the tubular portions **11**;
- in one or more, or even all the connecting portions **21** of the profile **1**, where each connecting portion **21** extends between one of the tubular portions **11** and the central groove **15**.

50 [0062] The sides of each lateral longitudinal groove **17**, **19** have a tilt θ [theta], with respect to the direction along which the cross-sections of the profile **1** extend overall, preferably comprised between **30-85°** and more preferably between **40-70°**, between **50-70°**, between **55-65°** or between **60°-70°** (Figure **3A**).

[0063] Each lateral longitudinal groove **17, 19** has preferably substantially V-shaped cross-sections, along part or substantially along the entire length of the profile **1**.

[0064] Each lateral longitudinal groove **17, 19** has a height **HL** preferably comprised between **0.25-0.7** times the maximum height **HP** of the profile **1**; in other words, the ratio **HL/HP** is preferably comprised between **0.25-0.7** times, and more preferably comprised between **0.3-0.5** times, between **0.3-0.4** times, between **0.36-0.38** times and for example approximately equal to **0.36** times.

[0065] Each lateral longitudinal groove **17, 19** has a width **WL** preferably comprised between **0.02-0.1** times the overall width **WP** of the profile **1**; in other words the ratio **WL/WP** is preferably comprised between **0.02-0.1** times, and more preferably comprised between **0.04-0.09** times, between **0.05-0.08** times, between **0.06-0.08** times and for example approximately equal to **0.07** times.

[0066] The ratio **HL/HP** is preferably comprised between **0.2-0.8** times, and more preferably comprised between **0.3-0.6** times, between **0.3-0.4** times, between **0.35-0.45** times and for example equal to **0.36** times.

[0067] The ratio **WL/HL** is preferably comprised between **0.3-1.7** times, and more preferably comprised between **0.4-1.5** times, between **0.7-1.4** times, between **1.1-1.4** times or between **1.3-1.4** times and for example equal to **1.34** times.

[0068] The above-described lateral longitudinal grooves **17, 19** give the profile **1, 1', 1''** particular strength in particular to compression and deflection when the pallet is loaded on its major faces; in addition to being particularly effective for this purpose, the V-shape of their cross-section and the above-described size ratios facilitate the stacking thereof - a significant advantage -, the moulding simultaneously preventing the sheet from being excessively weakened and yielded during the moulding itself.

[0069] Advantageously at least one lateral longitudinal groove **17, 19** is formed at each tubular portion **11, 13**; preferably such lateral longitudinal groove **17, 19** protrudes inside a relative tubular portion **11, 13** (Figure 3).

[0070] Advantageously at least one, and more preferably at least two lateral longitudinal grooves **17, 19** open up to the major dorsal face **3** (Figure 3).

[0071] Advantageously at least one, and more preferably at least two lateral longitudinal grooves **17, 19** open up to the major ventral face **5** (Figure 3).

[0072] Preferably, the cross-sections of each tubular portion **11, 13** are substantially trapezoidal in shape (Figure 3).

[0073] For this purpose, the cross-section of each tubular portion **11, 13** can be delimited by a proximal side **131** and a distal side **133** respectively arranged closer to and further from the central longitudinal groove **15** (Figure 3B).

[0074] The proximal **131** and distal **133** sides can extend in a direction overall perpendicular or transverse to the direction along which the relative cross-section of the

profile **1** extends overall (Figure 3B), although the proximal **131** and distal **133** sides are not necessarily flat in shape.

[0075] The ratio **HTPX/THDX** between the overall height **HTPX** of the proximal side **131** and the overall height **HTDX** of the distal side **133** is preferably comprised between **1.5-2.5** times, and more preferably comprised between **1.7-2.3** times, between **1.8-2.2** times or between **1.9-2.0** times and for example approximately equal to **1.93** times.

[0076] Advantageously the portion of the profile which connects each tubular portion **11, 13** to the respective connecting portion **21** forms a step **23** or other longitudinal prominence further strengthening the profile **1, 1', 1''** to deflecting, cutting, and compressing stresses in directions on the major dorsal **3** and ventral **5** faces; the steps or other longitudinal prominences **23** can be advantageously used to orderly stack (Figure 14, 14A), grasp and handle the profile with automatic and non-automatic production equipment, or to align it thereon or on templates or assembling jigs; in particular the steps or other longitudinal prominences **23** horizontally constrain pallets stacked on top of each other making the stack much more stable, safe and ordered.

[0077] The cross-sections of the profile **1** are preferably symmetrical with respect to a plane passing through the longitudinal axis **AXP** of the profile itself and preferably perpendicular to the direction along which the cross-sections of the profile **1** extend overall (Figure 2, 3).

[0078] The major dorsal **3** and ventral **5** faces can form different width bearing surfaces, for example the major dorsal face **3** can form a wider bearing surface than that formed by the major ventral face **5** (Figure 3).

[0079] Preferably, the sides and the surfaces of the profile **1** are as possible devoid of holes and sheared zones, however they can have for example holes required for assembling different sections thereof to each other or with other components, or other preferably small openings, so as for example not to excessively reduce the structural resistance of the profile **1**.

[0080] The holes or other shears accommodating the nails, screws, or rivets or more generally serving to fix the various profile sections **1** composing the pallet **30, 30''** described below have a maximum length, width or diameter preferably less than or equal to **20** millimetres, and more preferably less than or equal to **15** millimetres, **10** millimetres or **5** millimetres.

[0081] Figures 4-7 and 13-17 show respectively a first and a second examples of pallet - i.e., bench - obtainable with the profile **1**.

[0082] Such pallet, denoted by the overall reference **30, 30''** preferably comprises a plurality of profile sections **1** arranged so as to form several rows of sections parallel or otherwise placed side by side to each other.

[0083] The pallet **30, 30''** preferably comprises an upper loading platform formed by a first row or other first group of profile sections **1, 1A** arranged parallel or otherwise longitudinal to each other.

[0084] The upper loading platform preferably comprises a second row or other second group of profile sections **1**, **1B** arranged parallel or otherwise longitudinal to each other and preferably perpendicular or otherwise transverse to the group of the sections **1A**.

[0085] Advantageously the profile sections **1**, **1A** point upwards, or more generally towards the outside of the pallet **30**, **30''**, their major face which forms a wider bearing surface, for example the major dorsal face **3**.

[0086] Preferably, the pallet **30**, **30''** further comprises a base comprising in turn a third row or other third group of profile sections **1**, **1C** arranged parallel or otherwise longitudinal to each other and preferably parallel or otherwise longitudinal to the group of the sections **1A**.

[0087] The base preferably comprises a plurality of fixing plinths **33** obtained for example such as sheet boxes (Figure 7), squat tubular sheet sections (Figure 7) (or even blocks made of plastic, wood, or other non-metallic materials).

[0088] Each fixing plinth **33** can be for example substantially cubic, or otherwise preferably squat, in overall shape (Figure 7).

[0089] Each fixing plinth **33** can be obtained for example by bending and folding on itself a sheet layer suitably sheared or otherwise cut.

[0090] Each fixing plinth **33** can be made of a sheet of thickness greater than or equal to the sheet the sections **1A**, **1B**, **1C**; **1A''**, **1B''**, **1C''** are made of and for example comprised between 0.6-1 millimetres.

[0091] Preferably, for this purpose the sides of the fixing plinth **33** surround, or otherwise extend around, a main loading axis **AXZ**, which is, during the normal use, preferably substantially parallel to the vertical axis or otherwise to the main loading direction of the pallet or is substantially perpendicular to the surface in which the upper loading platform of the pallet **1**, **1'**, **1''** lies.

[0092] Advantageously the edges of the open ends of the fixing plinth **33** form a plurality of axial protrusions **330** and a plurality of axial recesses **331**, which extend or otherwise lie in surfaces parallel or otherwise longitudinal to the main loading axis **AXZ** of the plinth **33**.

[0093] Advantageously the edges of the open ends of the fixing plinth **33** form one or more fixing protrusions **332**, each of which is arranged to be fixed - for example through riveting, gluing, or welding - to a profile section **1A**, **1B** and/or **1C**.

[0094] Preferably, at least some of the fixing protrusions **332** extend or otherwise lie in surfaces substantially perpendicular or transverse to the main loading axis **AXZ** (Figure 7), allowing to place and firmly fix through rivets, screws or welding the profile sections **1A**, **1B**, **1C**; **1A''**, **1B''**, **1C''** thereon, increasing the resistance to vertical loads of the pallet.

[0095] Each fixing plinth **33** preferably fixes three different profile sections **1** pertaining to the three above-mentioned and different groups of sections: the group sections **1A**, **1B** and **1C**; **1A''**, **1B''** and **1C''**.

[0096] The profile sections **1A** of the first group or the

first row can for example rest on the profile sections **1B** of the second group or the second row.

[0097] The profile sections **1A** of the first group or the first row and/or the profile sections **1B** of the second group or the second row can rest on a first end of the fixing plinths **33**.

[0098] The profile sections **1C** of the third group are preferably spaced apart from the sections **1A** and **1B** for example resting against a second end of the fixing plinths **33**, so as to lift and move away from the ground, floor or moisture the goods placed on the upper loading platform of the pallet **30**, preferably forming together with the sections **1C** of the base suitable openings arranged to accommodate the forks of a lift truck, a crane, a mechanical arm or other lifting device.

[0099] The various profile sections **1A**, **1B**, **1C** can be for example fixed together to each other and/or to the plinths **33** through screws, nails, rivets, welding, clinching, sheet metal flaps, welded or glued.

[0100] The pallet **30** is particularly simple and inexpensive to assemble, since it can be indeed assembled by simply sawing the sections **1A**, **1B**, **1C** from longer bars and then fixing them together or to the plinths **33** through extremely simple and inexpensive techniques such as screwing, riveting, or welding.

[0101] Advantageously the profile sections **1A**, **1B**, **1C** in the assembled and finished pallet **30** are substantially straight and are not particularly bent so as their axis **AXP** has different orientations and tilts in space in the various lines of the same section.

[0102] Therefore, it is very simple and inexpensive to make small workstations producing and assembling the pallet **30** near the final users thereof, i.e., the producers of the most different goods to be loaded and packed on the pallet **30**, in order not to transport already finished bulky loads of pallets up to the final users, as well as it is also very inexpensive to set the workstations to assemble the pallets **30** directly in the production plants of the final users thereof.

[0103] Once cut by a simple sawing machine, the sections **1A**, **1B**, **1C** can be easily hand-assembled, without the need for expensive equipment required for machinebending more complex known-type profiles, being too laborious to bend them by hand especially in large quantities or with high production rate.

[0104] The pallet **30** is suitable to be produced both manually and by highly automatized and high-productivity plants.

[0105] The straight and otherwise very simple shape of the profile sections composing the pallet **30** and their assembling through nails, screws, rivets, clinching and other above-mentioned fixing systems allow to very easily and quickly repair the pallet **30** - in order to dismount it, dismounting nails, screws or rivets can be enough - allowing to reuse it many times remarkably extending the service life and thus the acquisition and operating costs thereof and remarkably reducing the environmental pollution.

[0106] Therefore, the pallet **30** described above satisfies very well the requirement of having easily repairable pallets; the extent to which this requirement is popular is proven by the way by the rich and thriving network of companies and laboratories collecting, repairing and re-selling used wood pallets in Europe: it is a very active field which remarkably contributes to reduce the economic and ecologic costs of the logistic and transporting activities.

[0107] On the other hand, the difficulty of repair is a big drawback of plastic material pallets, mostly used in some fields, such as for example food or pharmaceutical industry, in which some of the advantages thereof, such as the ease of washing and disinfecting, become relevant such as to compensate the difficulty of repair.

[0108] When they can no longer be repaired, the pallets **30** can be for example remelted.

[0109] The above-described exemplary embodiments are subject to different modifications and variations while not departing from the scope of protection of the present invention.

[0110] For example, the central longitudinal groove **15** as well as the potential lateral grooves **17**, **19** can have substantially V-shaped, U-shaped, M-shaped, or W-shaped cross-sections.

[0111] As for example in the embodiment of Figure **4**, **5** the upper loading platform of the pallet **30** can comprise for example a first row or first group of five profile sections **1**, **1A** and three profile sections **1B** of the second group; the base of the pallet **30** can further comprise for example three profile sections **1C** of the third group or the third row; however, in not-shown embodiments of a pallet according to the invention, the loading platform and the base can also comprise numbers of profile sections **1A**, **1B** and **1C** different from that of Figure **4**, **5**, for example two, three, four, six, seven, eight, nine, ten or even more sections.

[0112] The profile sections **1A**, **1B** and **1C** can have an overall length, measured along the axis **AXP**, preferably comprised between **0.5-4** metres, or between **0.8-3** metres, between **0.8-2** metres, between **1-1.5** metres, between **1.1-1.2** metres.

[0113] The cross-sections of the tubular portions **11**, **13** can be not only substantially trapezoidal, but for example also rectangular, squared, triangular, rhomboidal, circular, polygonal, lobed, arcuated, in overall shape.

[0114] As for example in the embodiment of Figure **8** a profile **1'** according to the invention can be obtained by bending - for example in a profiling line - not only a substantially flat sheet layer or band but also sheet layers or bands from the ribbed surface or on which suitable embossments and cavities have been formed, for example through rolling and/or drawing and/or scuffing performed by a scuffing machine.

[0115] Advantageously the profile **1'** can be obtained by the following operations:

S.1) forming a plurality of ridges (**900**) extending par-

allel or otherwise substantially placed side by side to each other on a sheet, where at least part of the ridges (**900**) change direction forming on the sheet at least one first substantially acute angle (γ [gamma]);

S.2) bending the sheet so as to form at least two lateral faces (**500**) and at least a corner fold (**700**) connecting the lateral faces (**500**) and being placed therebetween, so that:

- the corner fold (**700**) and the at least two lateral faces (**5**) extend longitudinally with respect to the profile (**1'**);
- the vertex of the at least one first substantially acute angle (γ [gamma]) is at least at one of the corner folds (**700**);
- the line of such ridges (**900**) closest to a corner fold (**700**) is oblique with respect to such corner fold (**700**), where such obliquity is referred to a second and third angles (ϕ , ψ [phi, psi]) the ridges (**900**) and the corner fold (**700**) form one of the lateral faces (**500**).

[0116] Preferably, the profile **1'** is obtained by the following operations:

S.3) forming a plurality of throats (**1100**) on the sheet so that:

- the ridges (**900**) and the throats (**1100**) extend parallel or otherwise substantially placed side by side to each other;
- a plurality of ridges (**900**) are flanked each on both sides by at least a pair of throats (**1100**);
- a plurality of throats (**1100**) are flanked each on both sides by at least a pair of ridges (**900**);
- at least part of the ridges (**900**) and of the throats (**1100**) change direction also forming on the sheet at least the first substantially acute angle (γ [gamma]);

S.4) bending the sheet so as to form the lateral edges (**7**, **9**), the tubular portions (**11**, **13**) and the central longitudinal groove (**15**).

[0117] The operation S.4) can be performed for example through the above-mentioned roller machine, i.e., scuffing machine.

[0118] Preferably, the first substantially acute angle (γ [gamma]) is less than or equal to **90°**.

[0119] Preferably, at least one of the second and the third angles (ϕ , ψ [phi, psi]) is less than or equal to **45°**, **35°**, **30°** and still more preferably comprised between **5°-25°**.

[0120] Preferably, the first angle γ [gamma] formed by the ridges **900** before the operation S.4) is approximately equal to the sum of the second and third angles ϕ , ψ [phi, psi].

[0121] Preferably, the height **HC** of the ridges (**900**) measured with respect to the bottom of the two throats (**1100**) adjacent thereto is comprised between **0.2-2** millimetres and/or between **0.5-4** times the thickness **SL** of the sheet.

[0122] Preferably, the pitch of the ridges **PC** is comprised between **2-40** millimetres and/or between **2-40** times the thickness **SL** of the sheet.

[0123] Preferably, the ridges (**900**) and the throats (**1100**) follow V-shaped or zig-zag paths on the profile **1'**.

[0124] Preferably, all the ridges **900** change direction forming on the sheet layer or band at least the first substantially acute angle γ [gamma].

[0125] Preferably, as shown in Figures **8-12**, the profile **1'** forms a plurality of substantially acute angles γ [gamma] whose vertexes are aligned on one or more rows preferably straight and parallel, or otherwise longitudinal to the profile **1'** itself.

[0126] Advantageously the ends of the metal profile **1"**, **1A"**, **1B"**, **1C"** form one or more check strips **25**, **27**, **29** preferably obtained by bending the sheet which forms the profile itself (Figure **13**, **13A**, **14**, **14A**).

[0127] In the mounted pallet **30"** the check strips **25**, **27**, **29** are advantageously arranged to extend around and cover at least some lines of the edges of a respective fixing plinth **33** (Figure **13**, **13A**).

[0128] In the mounted pallet **30"** the check strips **25**, **27**, **29** advantageously rest - or are arranged for this purpose - against one or more portions of the edges of a respective fixing plinth **33**, more preferably against one or more axial protrusions **330** (Figure **13**, **13A**).

[0129] Advantageously the check strips **25**, **27**, **29** are arranged to rest against the one or more axial protrusions **330** in a direction parallel and/or perpendicular - and more preferably in both said directions - to the surface in which such axial protrusions **330** substantially lie.

[0130] Advantageously the ends of the metal profile **1"**, **1A"**, **1B"**, **1C"** form one or more recesses **250**, **270** arranged to accommodate portions of the edges of a respective fixing plinth **33**, accommodating transversally such edges of the plinth **33** so as to prevent or otherwise limit the deflections of such edges of the plinth **33** towards both the inside and the outside of the plinth **33** itself (Figure **13A**).

[0131] Thereby, the ends of the metal profile sections **1A"**, **1B"**, **1C"** almost eliminate, or otherwise remarkably limit the deflection deformations and the lateral protrusions of the check strips **25**, **27**, **29** and more generally of the lateral walls of the fixing plinths **33**, causing the sheet of the plinths **33** to be mostly or otherwise largely compression-stressed and stiffening and thus remarkably increasing the resistance to compression of the plinths **33** and of the entire pallet **30"**; in particular the sheet of the plinths **33** can be mostly or otherwise largely compression-stressed when transmitting the push of the floor on which the pallet **30** rests to the metal profile sections **1A"**, **1B"**, **1C"**, and vice versa when transmitting the pressure of the metal profile sections **1A"**, **1B"**, **1C"**

on the floor on which the pallet **30** rests.

[0132] Due to the above measures, the pallet **30"** is able to support vertical compression and deflection loads, when lifted on the forks of a lift truck equal to equivalent much heavier wooden - for example so-called EPAL - or plastic pallets.

[0133] Indeed, it has been found that the pallet **30"** can have a weight approximately equal to two thirds of the weight of a wooden pallet having the same resistance to compression and deflection, and approximately half the weight of a plastic material pallet having the same resistance to compression and deflection.

[0134] The values of resistance to compression and deflection of the pallet **30"** and of the wooden and plastic material pallets have been obtained testing them according to UNI EN ISO **8611** norm and respectively correspond to the resistance to the static vertical load and to the ensured dynamic (vertical) load defined by such norm.

[0135] The check strips **25**, **27**, **29** remarkably reduce the sharp edges of both the metal profile sections **1A"**, **1B"**, **1C"** and the fixing plinths **33** remarkably reducing the risk of injury by handling the pallet for the workers, equally facilitating and accelerating the moving of the pallet **30"**.

[0136] Advantageously the fixing plinth **33** is provided, in what is its bottom part during the normal use, with one or more fixing tabs **31** each of which is folded toward the inside of the plinth **33** itself and fixed for example by welding, one or more screws **35** or one or more rivets, at the sides of a metal profile section **1A"**, **1B"**, **1C"** (Figure **13**).

[0137] The tab **31** can be placed on a portion of a side of the profile section **1A"**, **1B"**, **1C"**.

[0138] Fixing the tab **31** avoids the sliding of the profile section **1A"**, **1B"**, **1C"** with respect to the plinth **33** when the pallet **30"** is deflection-stressed, for example in the dynamic resistance test according the above-mentioned UNI EN ISO **8611** norm, stiffening and remarkably increasing the resistance of the pallet **30"**; remarkably strengthening the assembly of the two; the author of the present invention has been able to obtain up to **50%** increases of the resistance to dynamic load and a comparable reduction, i.e., around **50%**, of the deflection.

[0139] Each fixing tab **31** can be more or less wide and be fixed to the relative profile section **1A**, **1B**, **1C**; **1"A**, **1"B**, **1"C** through one or more rivets, one or more screws, one or more welding or gluing points or lines.

[0140] Preferably, the various fixing protrusions **332** of a plinth **33** allows the latter to be fixed at or near the lateral - i.e., longitudinal - edges of a metal profile section **1A"**, **1B"**, **1C"**, and more preferably through at least two - and more preferably at least three - screws, rivets **35** or welding ribbons or points for each lateral edge of the metal profile section **1A"**, **1B"**, **1C"** (Figure **15**, **17**), contributing to remarkably strengthen the pallet **30"**.

[0141] The rivets facilitate the assembling automatization of the pallet **30"** in addition to ensuring a better endurance of the connections.

[0142] Advantageously in the metal profile sections **1A, 1B, 1C; 1A", 1B", 1C"** one or more drain holes **37** are formed to allow potential water to outflow preventing stagnation thereof (Figure 17).

Preferably the drain holes **37** are arranged at the fixing plinths **33** so as to allow water to outflow from the inside of the plinths **33** (Figure 17).

[0143] Each reference in this disclosure to "an embodiment", "an exemplary embodiment" means that a particular feature or structure described in connection with such embodiment is comprised in at least one embodiment of the invention is comprised in at least one embodiment of the invention and in particular in a particular variation of the invention as defined in a main claim.

[0144] The fact that such expressions occur in various steps of the disclosure does not mean that they are necessarily referred only to the same embodiment.

[0145] Further, when a feature, element, or structure is described in connection with a particular embodiment, it is observed that applying such feature, element, or structure to other embodiments falls within the competence of those skilled in the art.

[0146] Numerical references differing only by different single quote marks, e.g., **21'**, **21"**, **21'''**, when not otherwise specified denote different variations of an element referred to in the same manner.

[0147] Further, all the details are replaceable by technically equivalent elements.

[0148] For example, the materials used, as well as the size, can be any depending on the technical requirements.

[0149] It should be understood that an expression such as "A comprises B, C, D" or "A is formed by B, C, D" comprises and also describes the particular case wherein "A consists of B, C, D".

[0150] The expression "A comprises an element B" unless otherwise specified is to be understood as "A comprises one or more elements B".

[0151] References to a "first, second, third, ... nth entity" only aim to distinguish them from each other but the indication of the nth entity does not necessarily mean the existence of the first, second, ... (n-1)th entity.

[0152] The examples and lists of possible variations of the present application are to be intended as nonexhaustive lists.

Claims

1. Metal profile (**1, 1A, 1B, 1C**) comprising a main body obtained by bending a metal sheet forming a first major face (**3**) conventionally referred to as "dorsal" and a second major face (**5**) of the profile conventionally referred to as "ventral", wherein said major dorsal (**3**) and ventral (**5**) faces face two directions in space opposite to each other, and wherein:

- the profile (**1, 1A, 1B, 1C**) forms substantially

oblong cross-sections which form two lateral edges (**7, 9**), each of which is placed at a respective end of these cross-sections;

- at or near the two lateral edges (**7, 9**) the profile (**1**) forms two respective tubular portions (**11, 13**), each of which is substantially tubular in shape;

- each tubular portion (**11, 13**) has a maximum width (**WTB**) less than or equal to **0.3** times the overall length (**WP**) of the cross-sections of the profile (**1**) itself; and/or

- each tubular portion (**11, 13**) has a maximum height (**HTB**) substantially comprised between **0.5-1** times the maximum height (**HP**) of the cross-sections of the profile (**1**) itself; and further - at or near their centreline the cross-sections of the profile (**1**) form a central longitudinal groove (**15**) on the major dorsal (**3**) or ventral (**5**) face which extends over at least half of the overall height (**HP**) of the profile (**1**).

2. Profile (**1**) according to claim 1, the cross-sections of which are substantially symmetrical with respect to an ideal plane passing through the longitudinal axis (**AXP**) of the profile (**1**) itself.

3. Profile (**1**) according to claim 1 or 2, the cross-sections of which are substantially oblong in shape.

4. Profile (**1**) according to one or more preceding claims, wherein the central longitudinal groove (**15**) extends over the entire overall height (**HP**) of the profile (**1**).

5. Profile (**1**) according to one or more preceding claims, wherein the maximum width (**WTB**) of each tubular portion (**11, 13**) is greater than or equal to **0.15** times the overall length (**WP**) of the cross-sections of the profile (**1**) itself.

6. Profile (**1**) according to one or more preceding claims, wherein at least in some of its cross-sections at least one lateral longitudinal groove (**17, 19**) is formed which extends parallel or in any case longitudinally to the axis (**AXP**) of the profile (**1**) itself and is arranged in one or more of the following positions:

- at least at one of the tubular portions (**11, 13**);
- in at least one connecting portion (**21**) of the profile extending between one of the tubular portions (**11, 13**) and the central longitudinal groove (**15**).

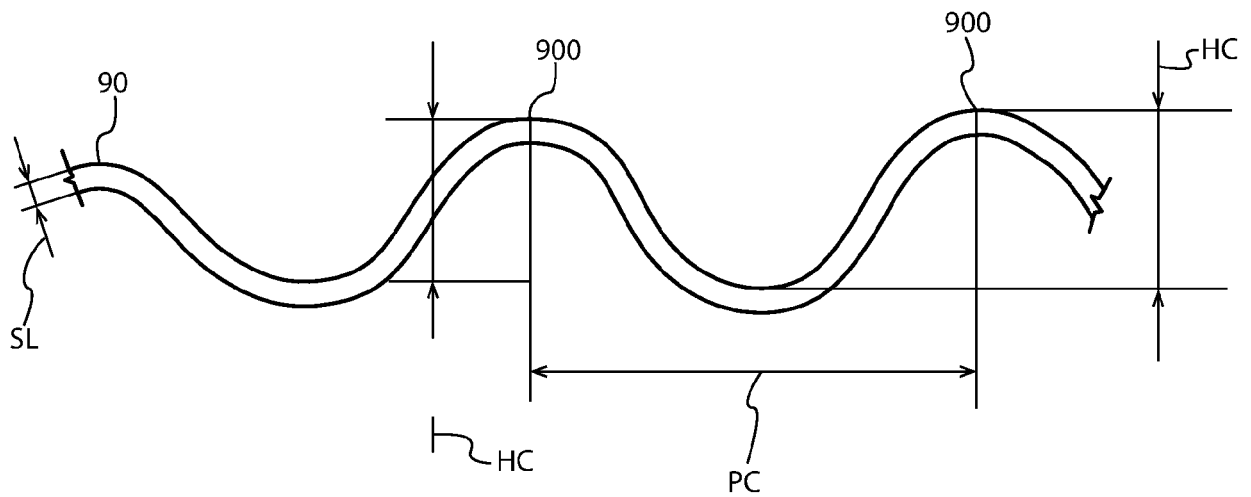
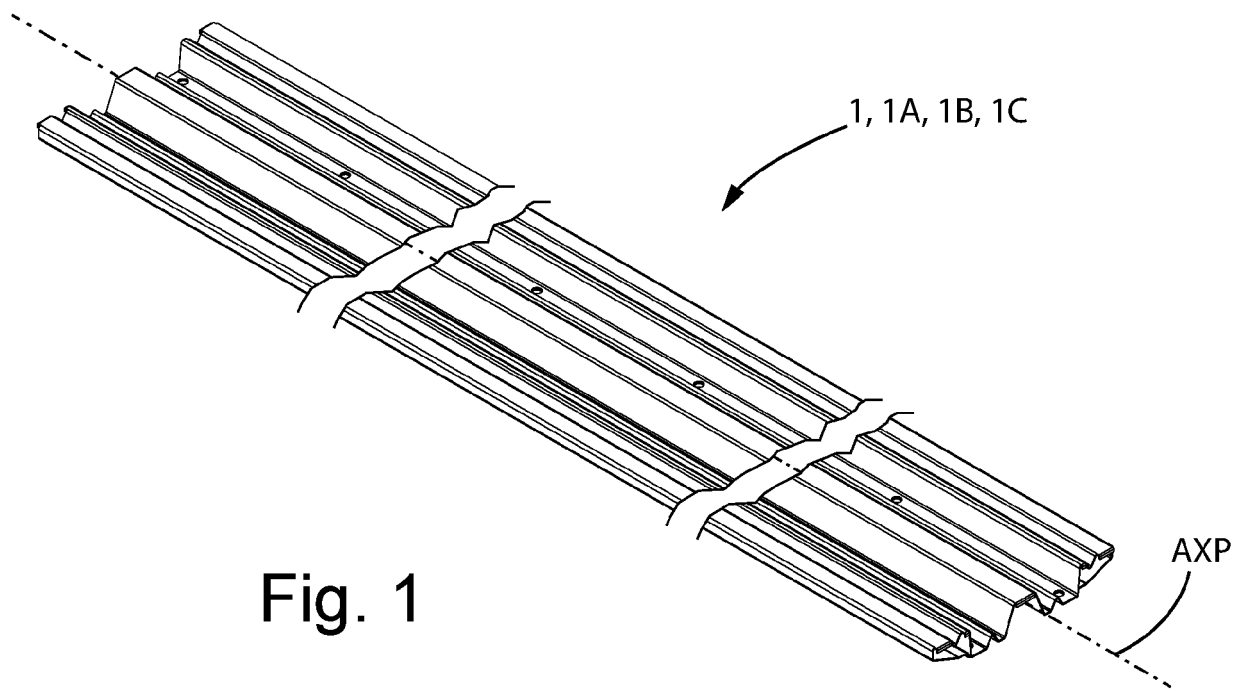
7. Profile according to claim 6, wherein each lateral longitudinal groove (**17, 19**) has one or more of the following features:

- a maximum depth (**HL**) comprised between

- 0.25-0.7** times the maximum height (**HP**) of the profile;
- a maximum width (**WL**) comprised between **0.02-0.1** times the overall width (**WP**) of the profile (**1**);
 - a ratio (**WL/HL**) between the maximum width (**WL**) and the maximum depth (**HL**) comprised between **0.3-1.7** times.
8. Profile according to one or more preceding claims, wherein the ratio (**RDST/WT**) between the square root (**RDST**) of the cross-sectional area of each tubular portion (**11, 13**) and the overall width (**WP**) of the profile **1** is comprised between **0.1-0.2** times.
9. Profile according to one or more preceding claims, wherein the ratio (**RDST/WT**) between the square root (**RDST**) of the cross-sectional area of each tubular portion (**11, 13**) and the overall width (**WP**) of the profile **1** is comprised between **0.141-0.143** times.
10. Profile according to one or more preceding claims, wherein the ratio (**RDST/HP**) between the square root (**RDST**) of the cross-sectional area of each tubular portion (**11, 13**) and the maximum height (**HP**) of the profile **1** is comprised between **0.8-1.3** times.
11. Profile according to one or more preceding claims, wherein the ratio (**RDST/HP**) between the square root (**RDST**) of the cross-sectional area of each tubular portion (**11, 13**) and the maximum height (**HP**) of the profile **1** is comprised between **0.95-0.96** times.
12. Pallet (**30, 30"**) for packaging, moving, and transporting goods comprising a plurality of sections of the profile (**1**) according to one or more of claims **1-11**.
13. Pallet (**30, 30"**) according to claim **12**, wherein the profile sections (**1**) form several rows and the sections (**1**) of each row are arranged substantially parallel or otherwise flanked to each other.
14. Pallet (**30, 30"**) according to claim **12** or **13**, wherein:
- the profile sections (**1**) form at least three rows;
 - a first row of sections (**1A**) forms a loading platform on which to place the goods to be packaged, moved and/or transported;
 - a third row of sections (**1C**) forms a base through which the pallet (**30**) can rest on a floor, ground, shelf, or other support;
 - a second row of sections (**1B**) is placed between the first row (**1A**) and the third row of sections (**1C**);
 - the sections of one of the three rows are per-

pendicular or otherwise transverse to the sections of at least another of the three rows of sections.

15. Pallet (**30, 30"**) according to one or more of claims **12** to **14**, comprising a plurality of fixing plinths (**33**) for fixing and connecting the plurality of profile sections (**1, 1A, 1B, 1C**) to each other, and the fixing plinths (**33**) are fixed to one or more profile sections (**1, 1A, 1B, 1C**) by one or more of the following systems: screws, screwing, rivets, nails, clinching, sheet metal flaps, gluing, welding, brazing, plastic co-moulding.



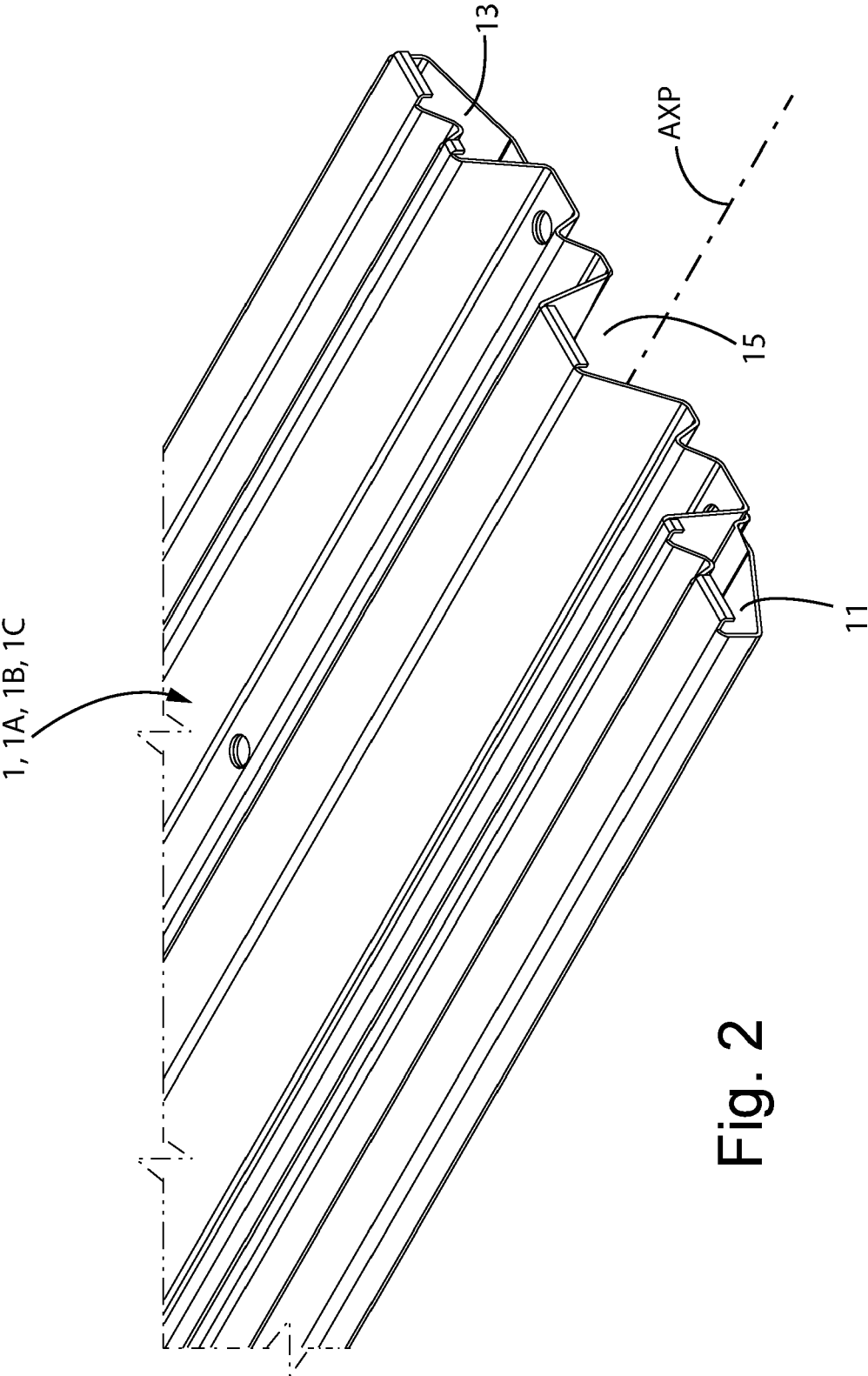


Fig. 2

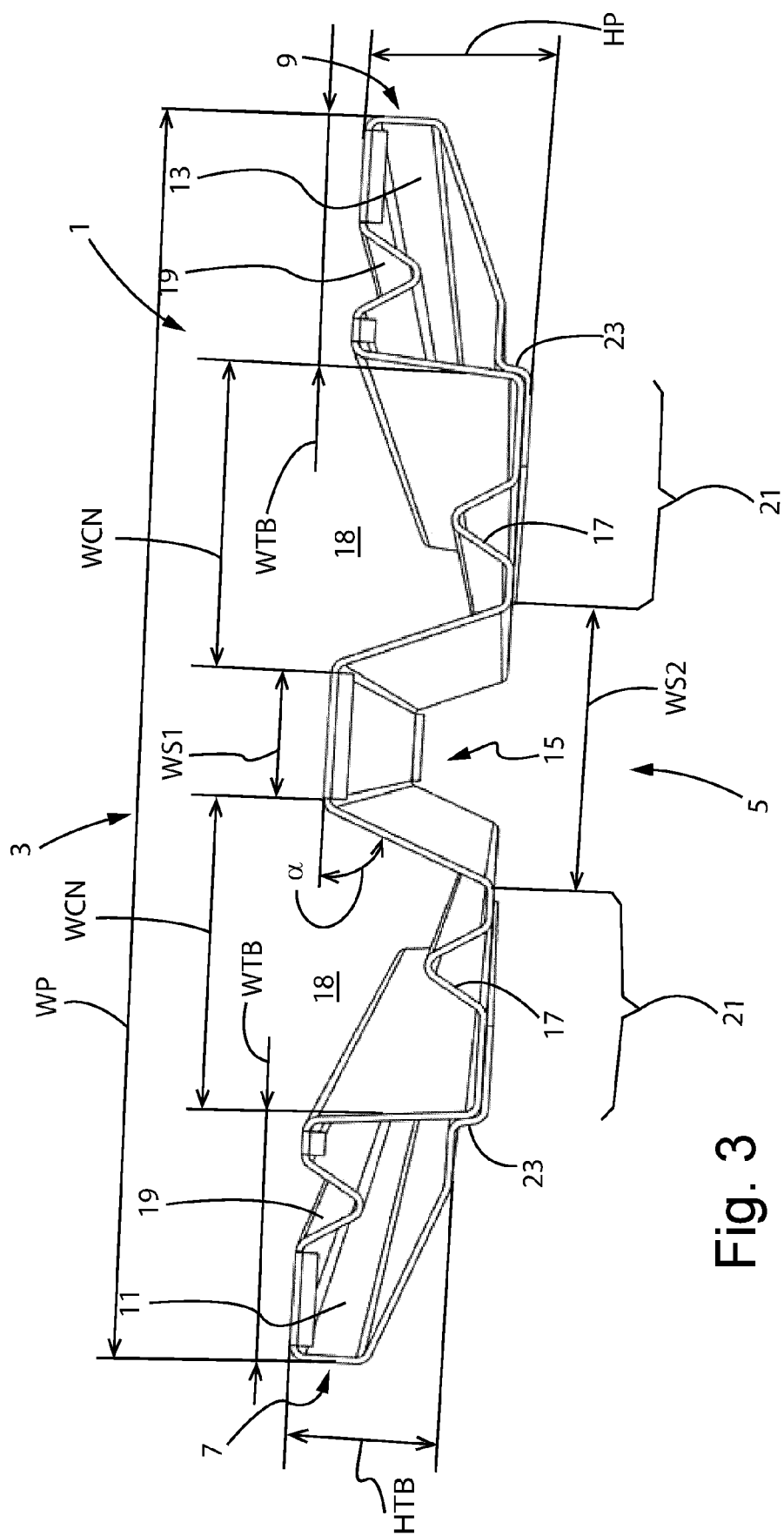


Fig. 3

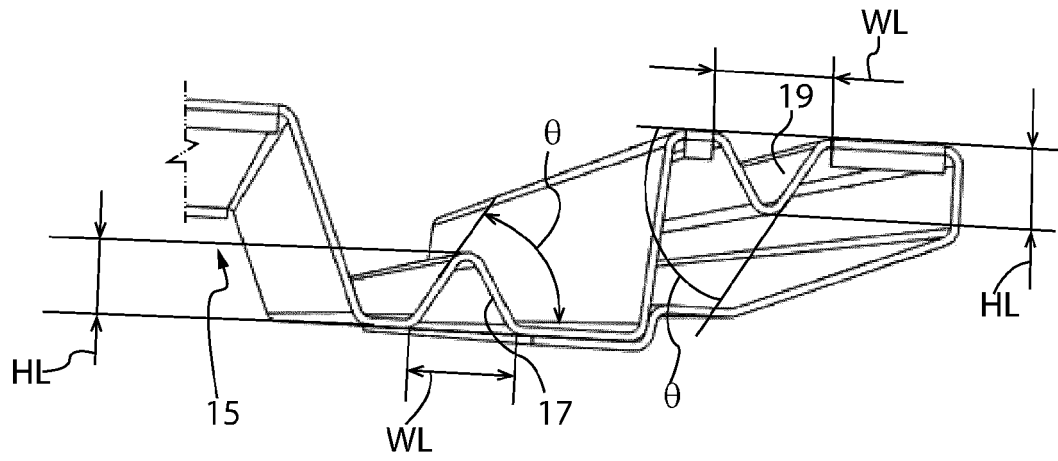


Fig. 3A

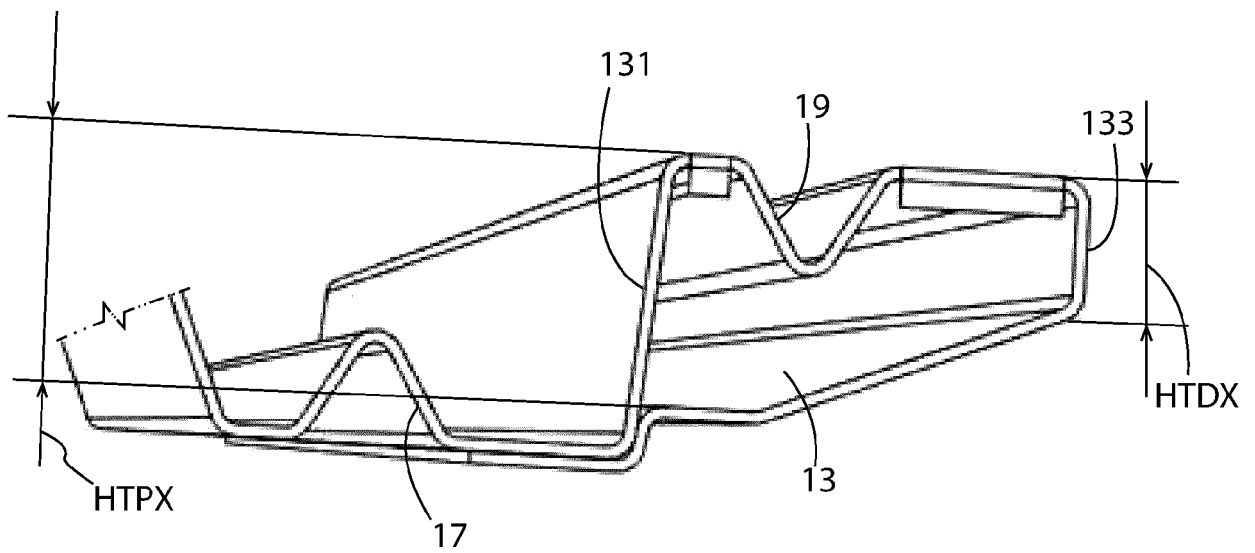


Fig. 3B

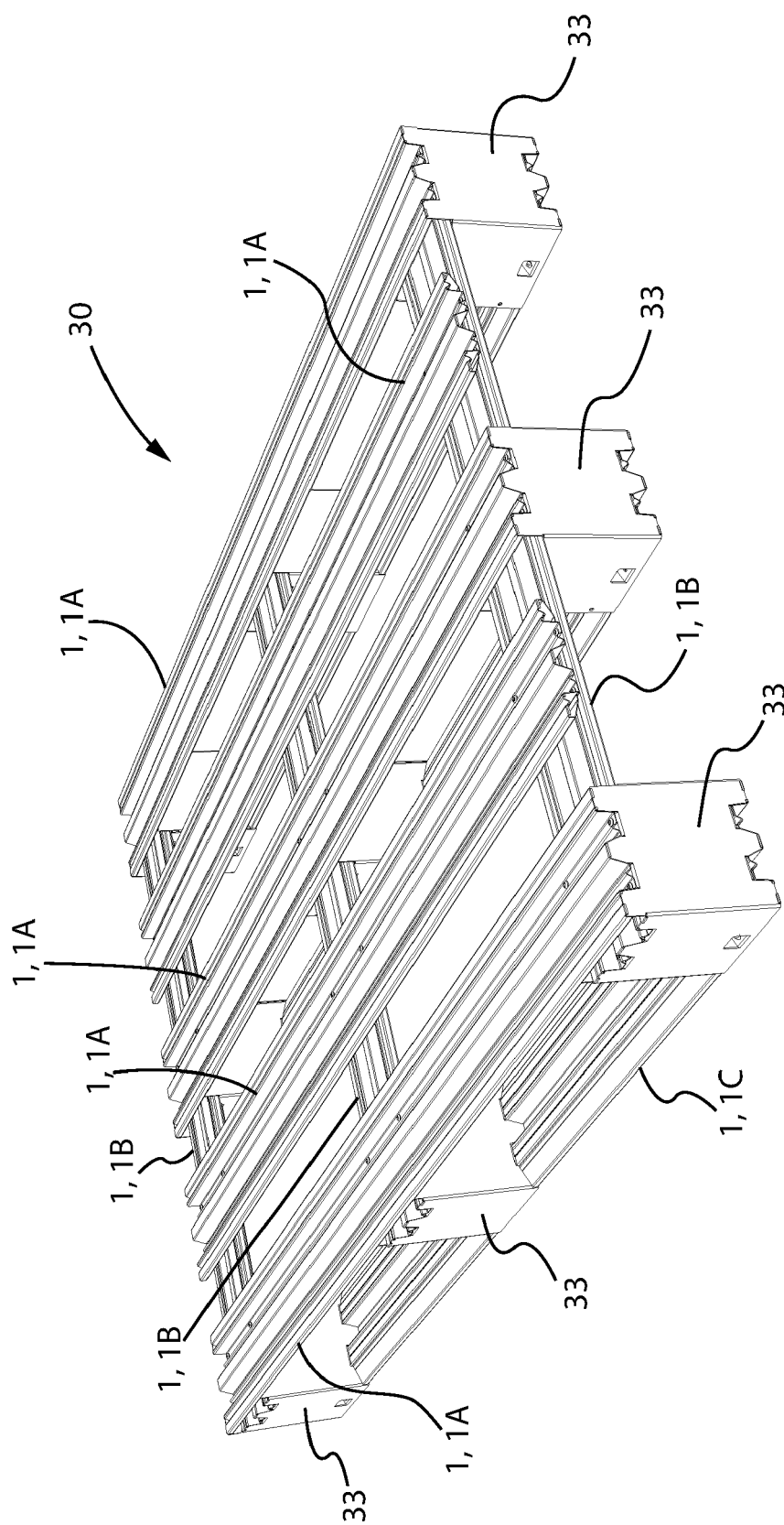


Fig. 4

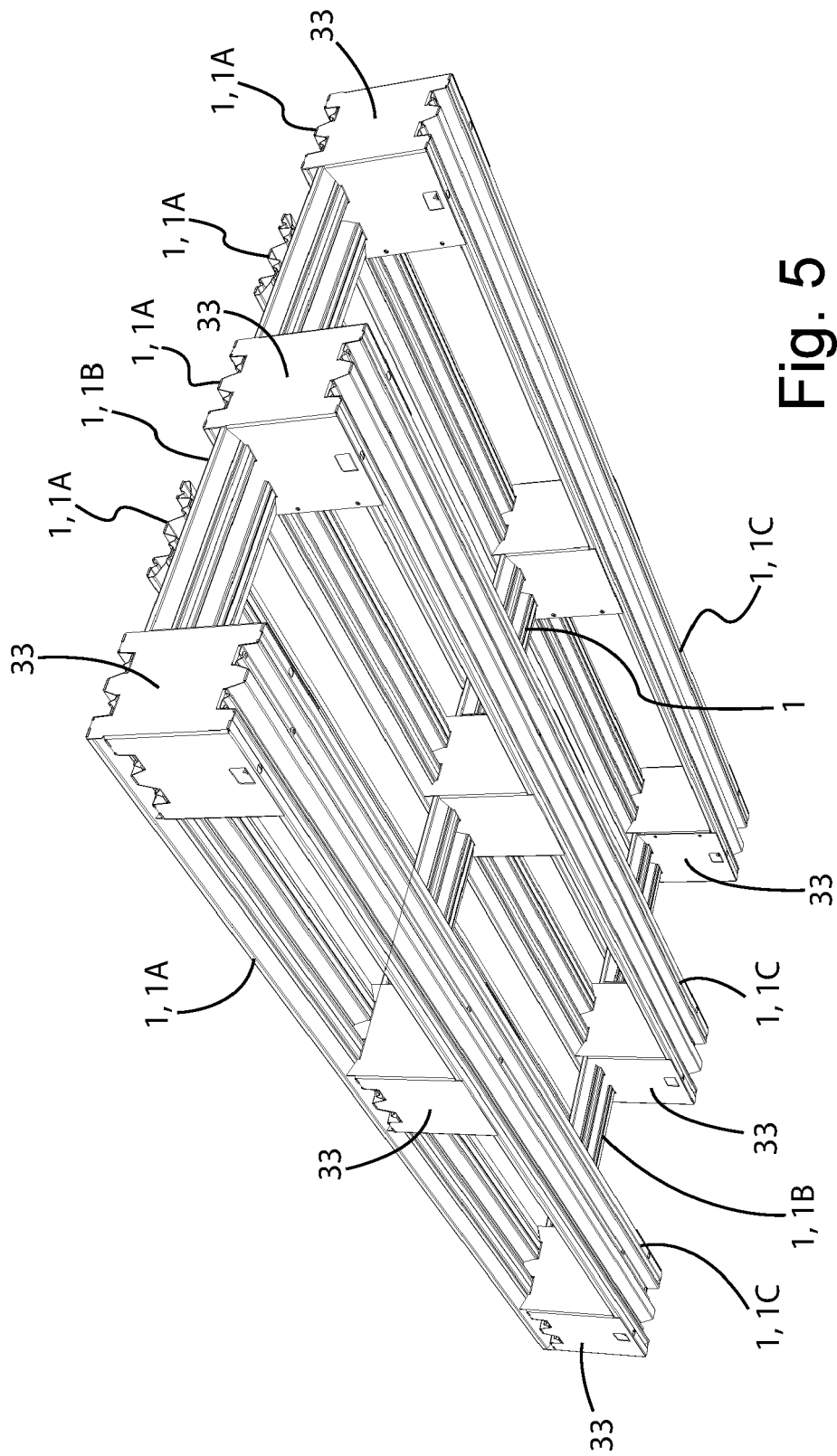


Fig. 5

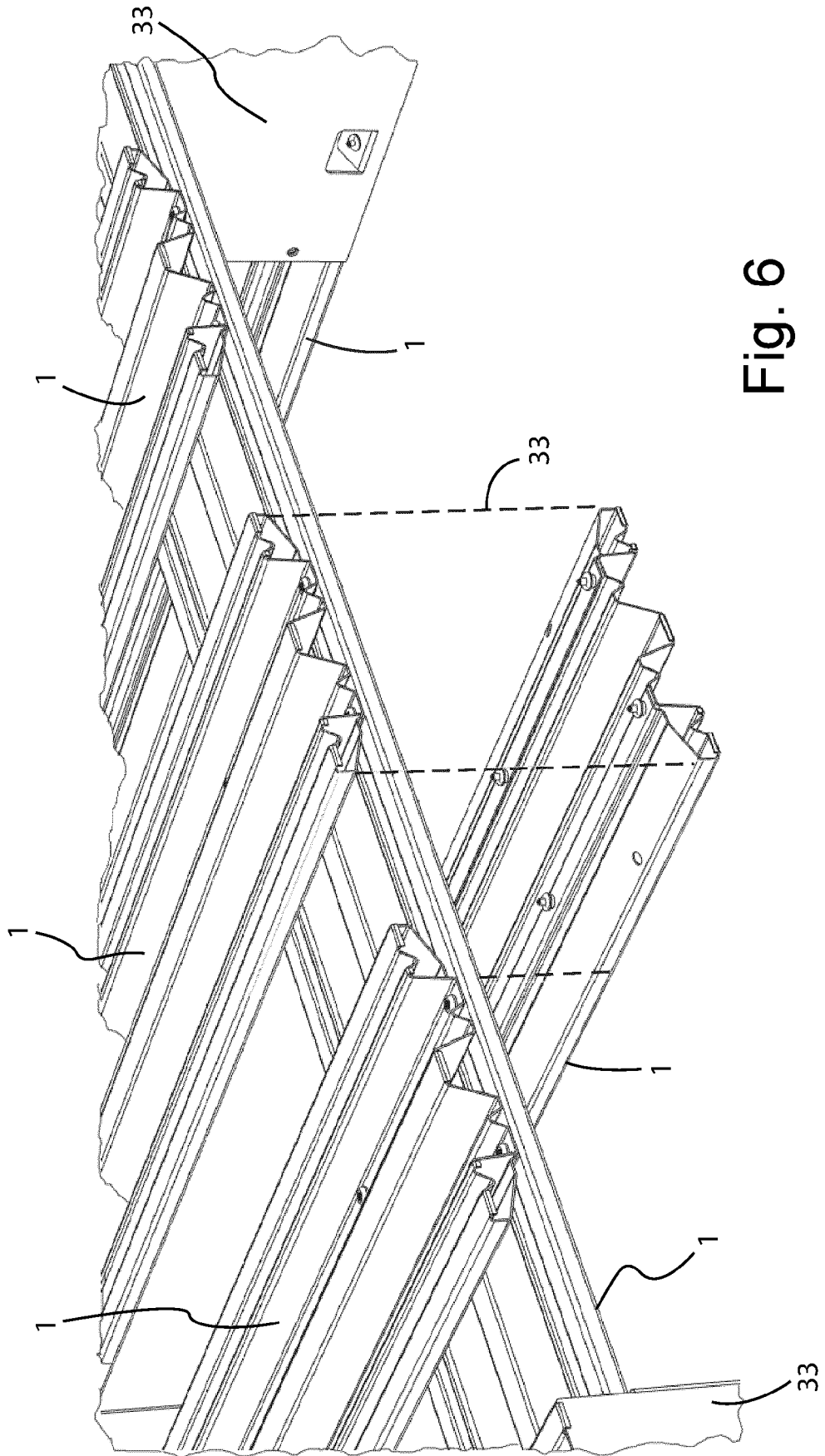
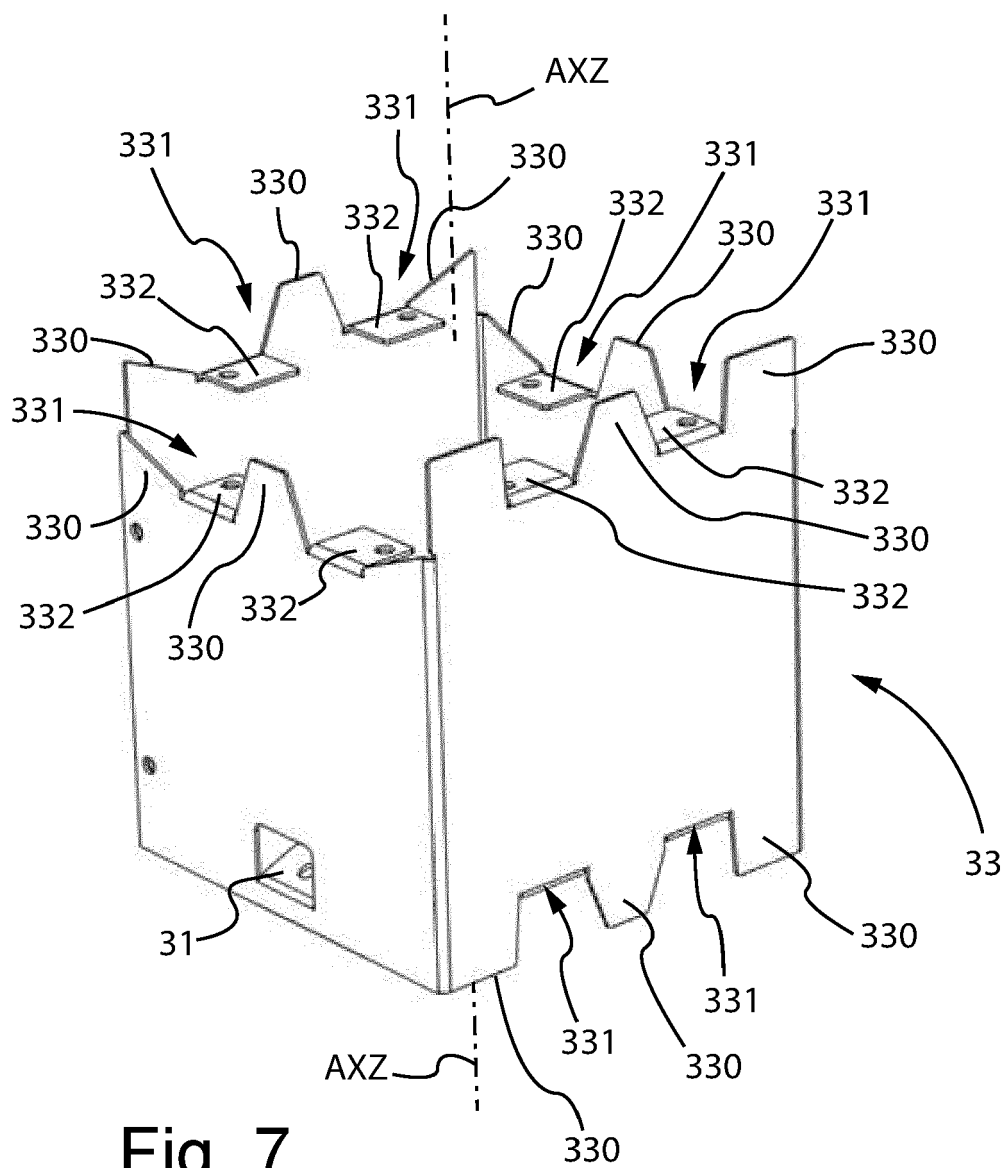


Fig. 6



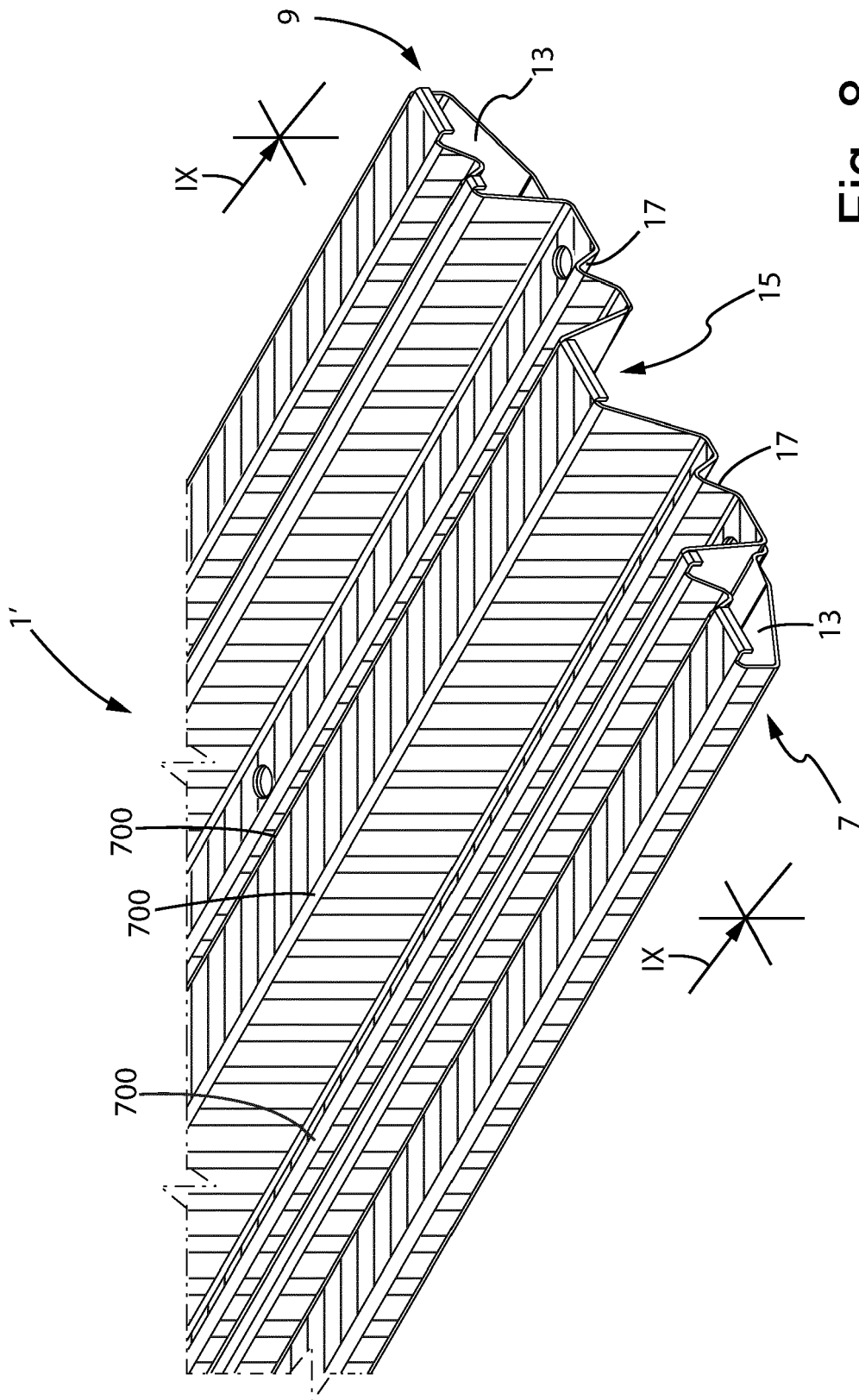


Fig. 8

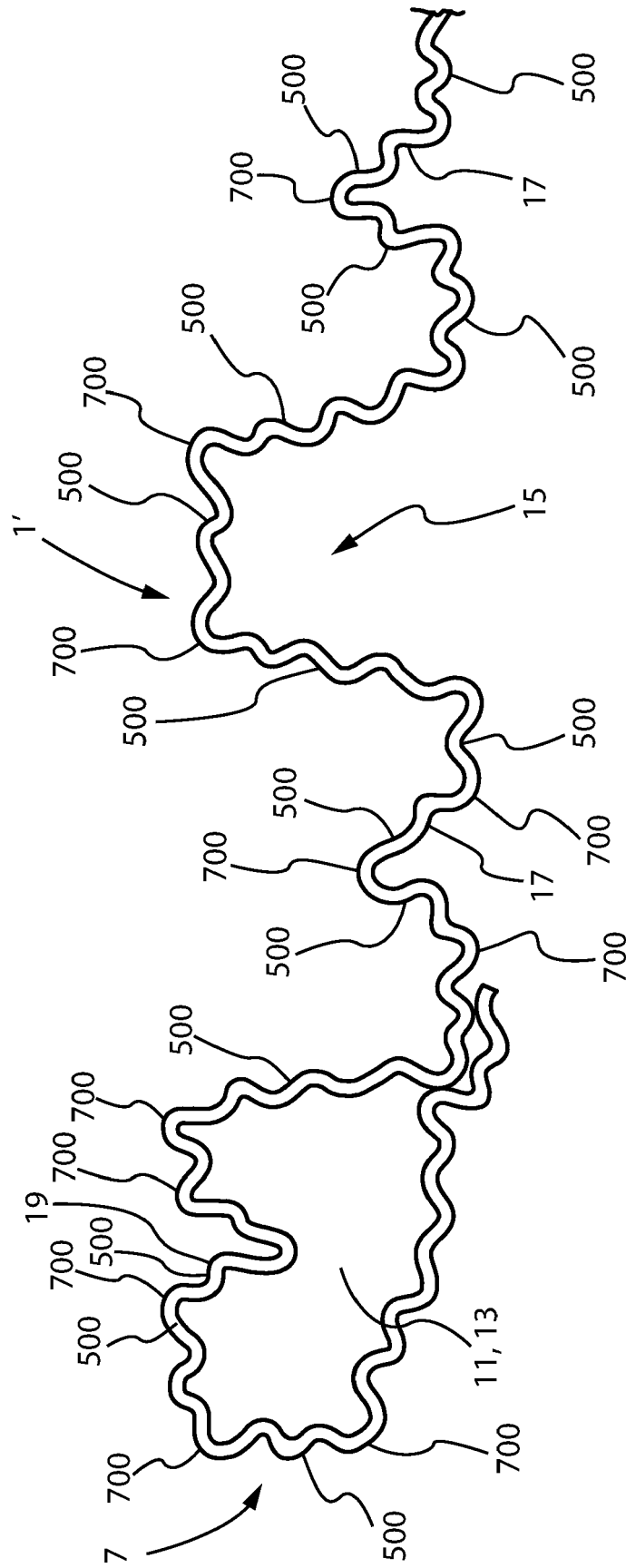


Fig. 9

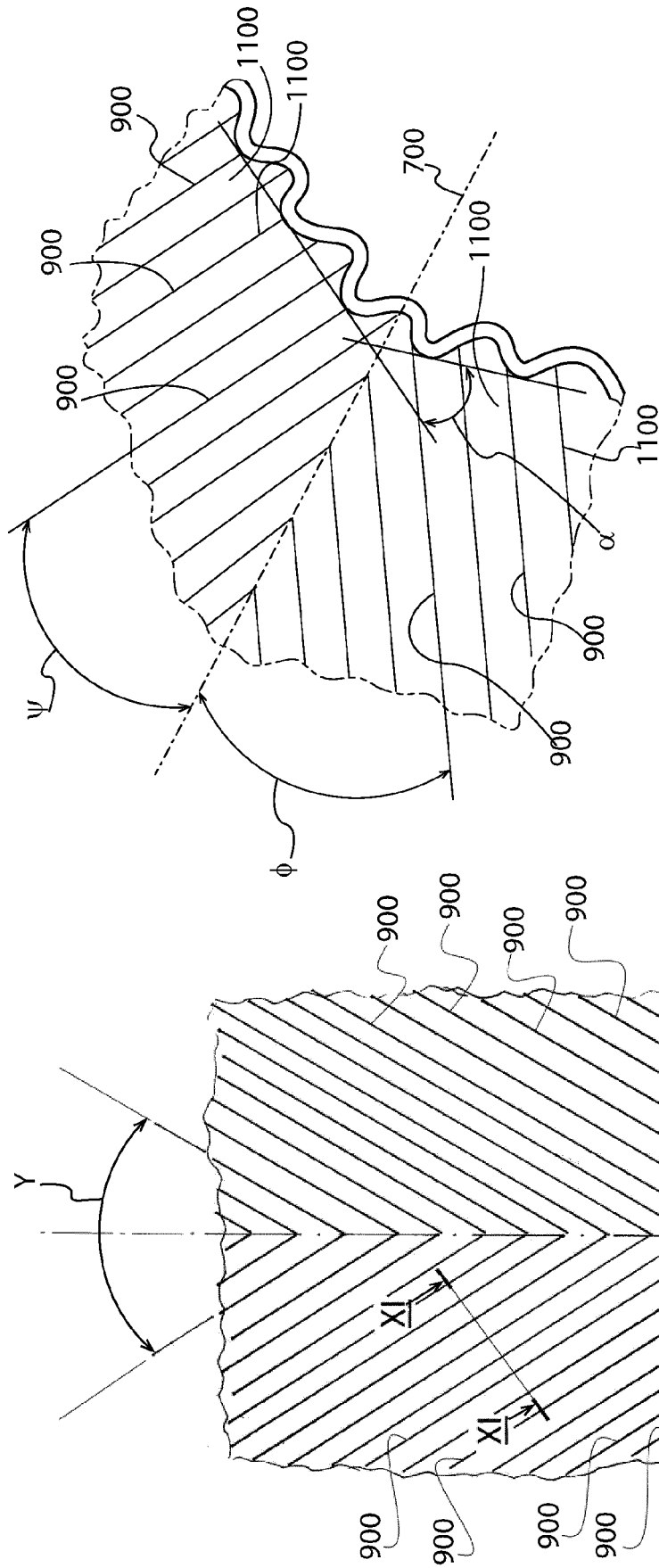


Fig. 12

Fig. 10

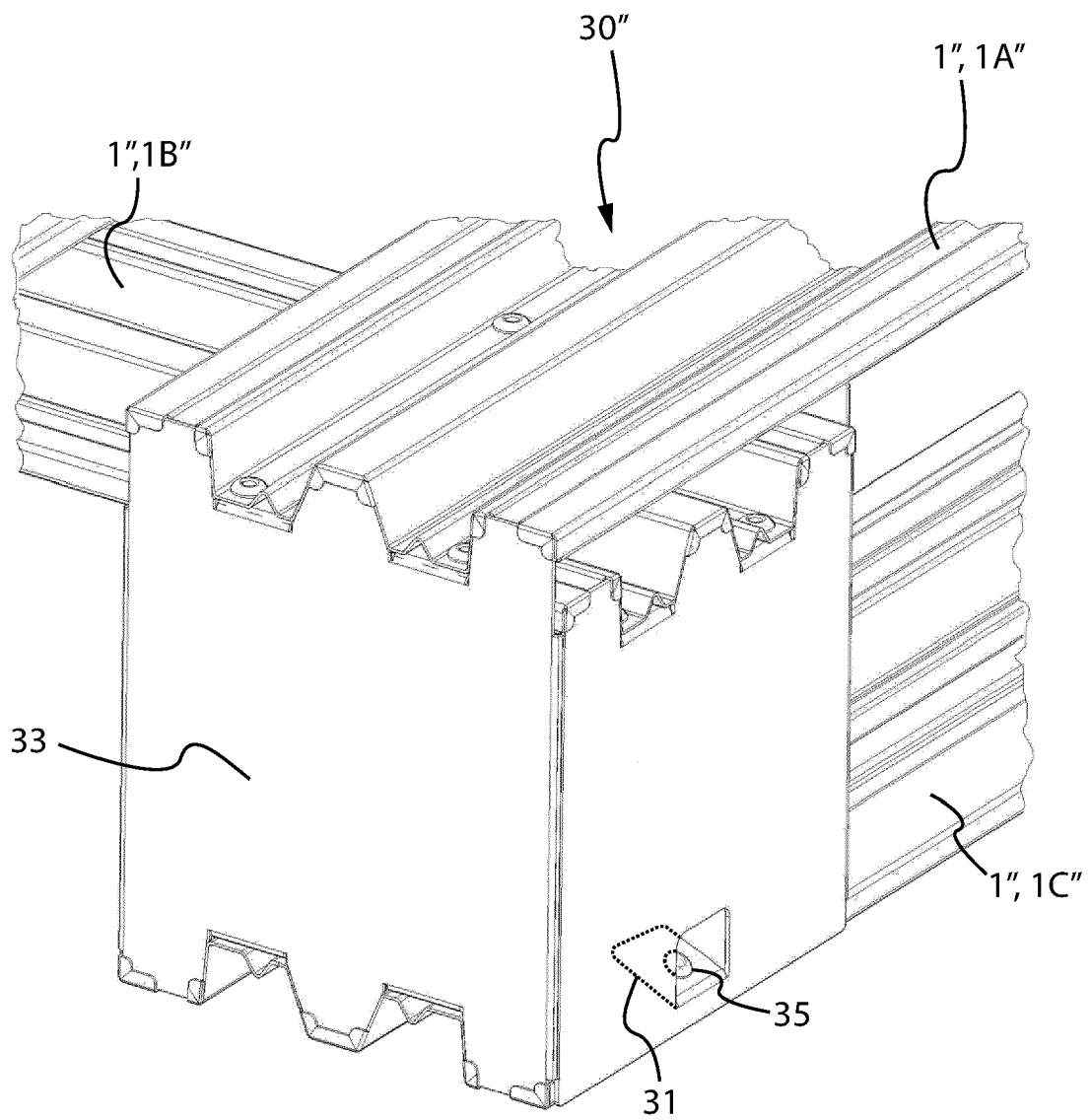


Fig. 13

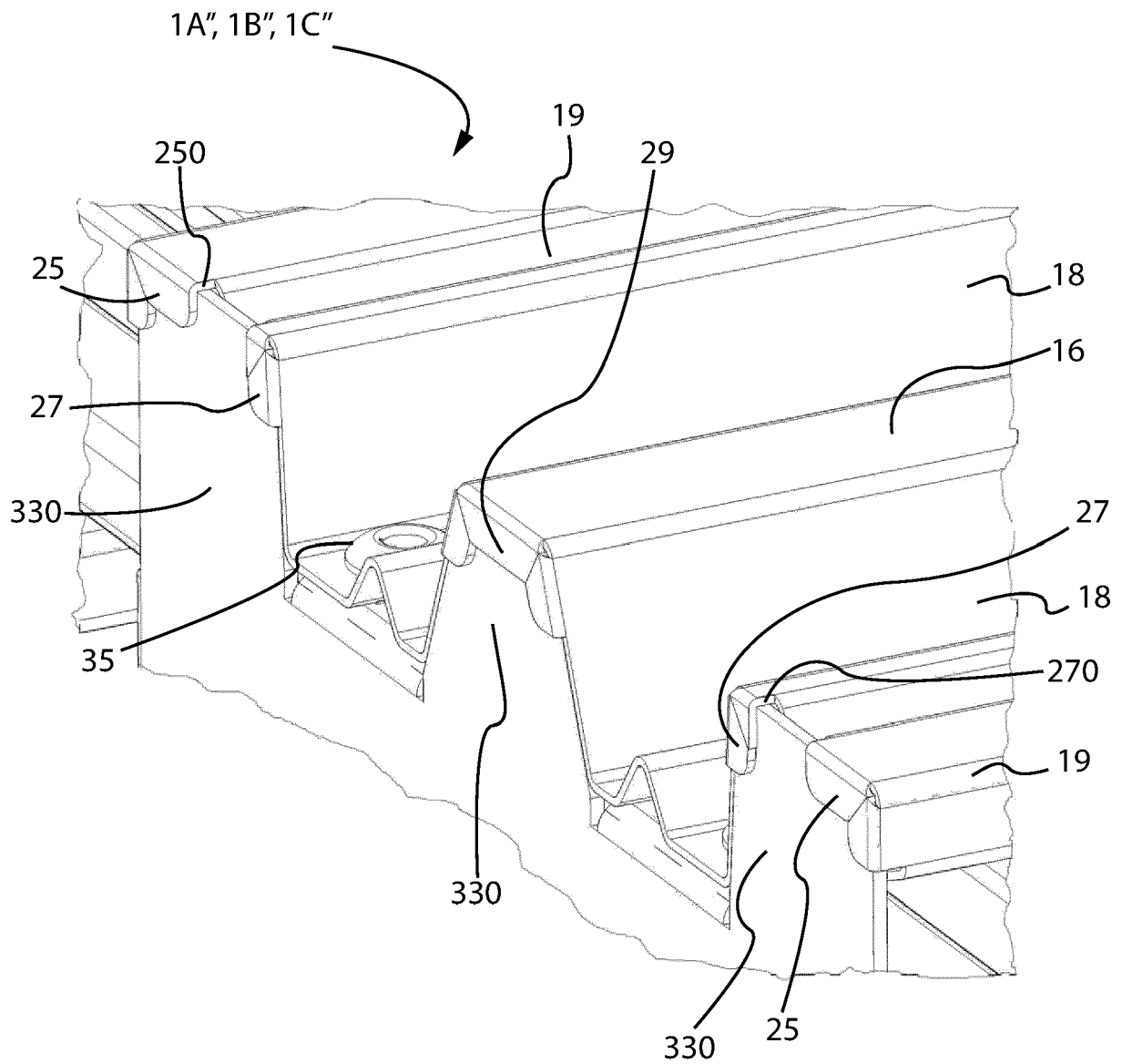


Fig. 13A

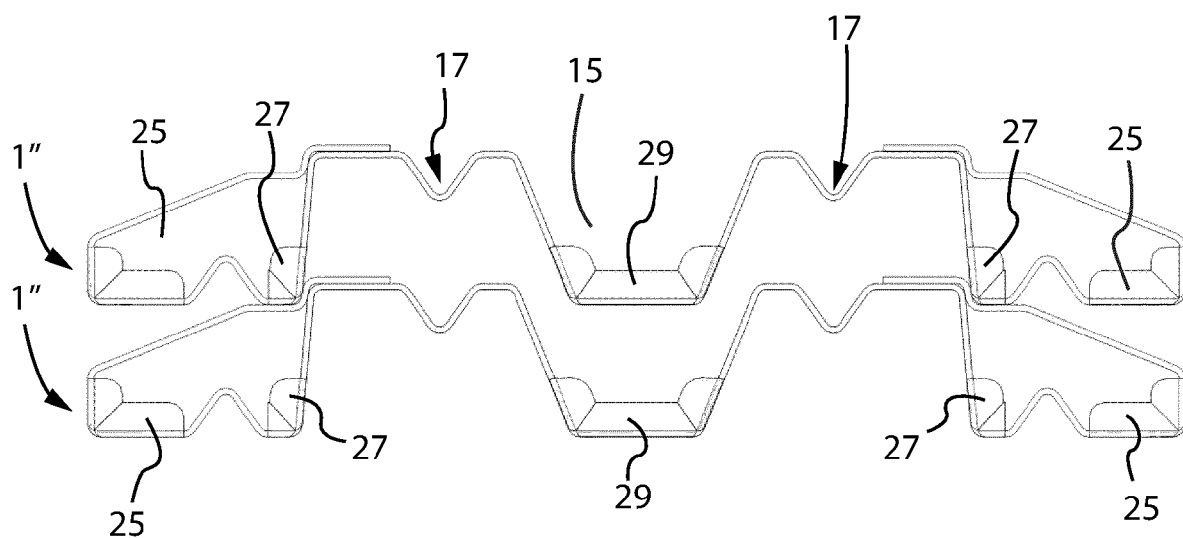


Fig. 14

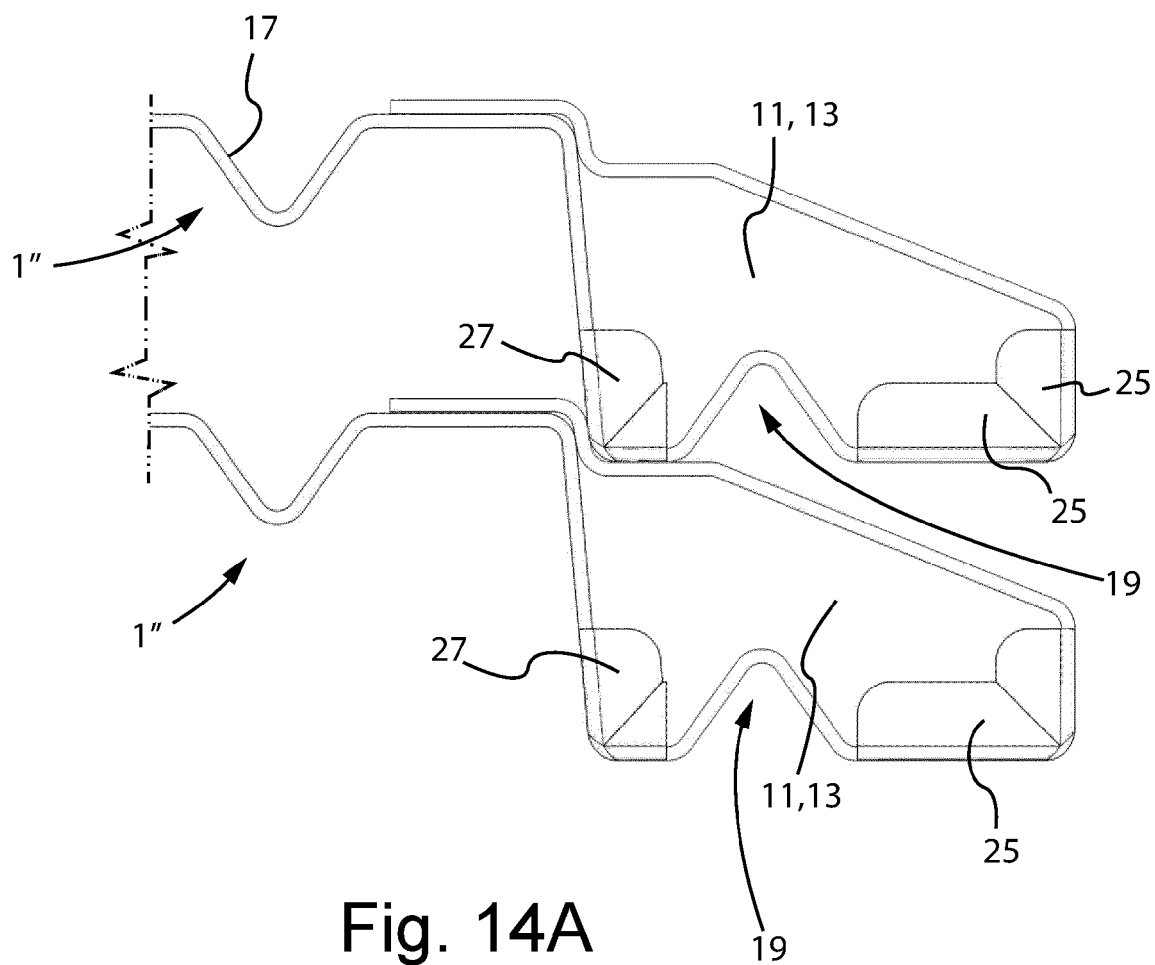
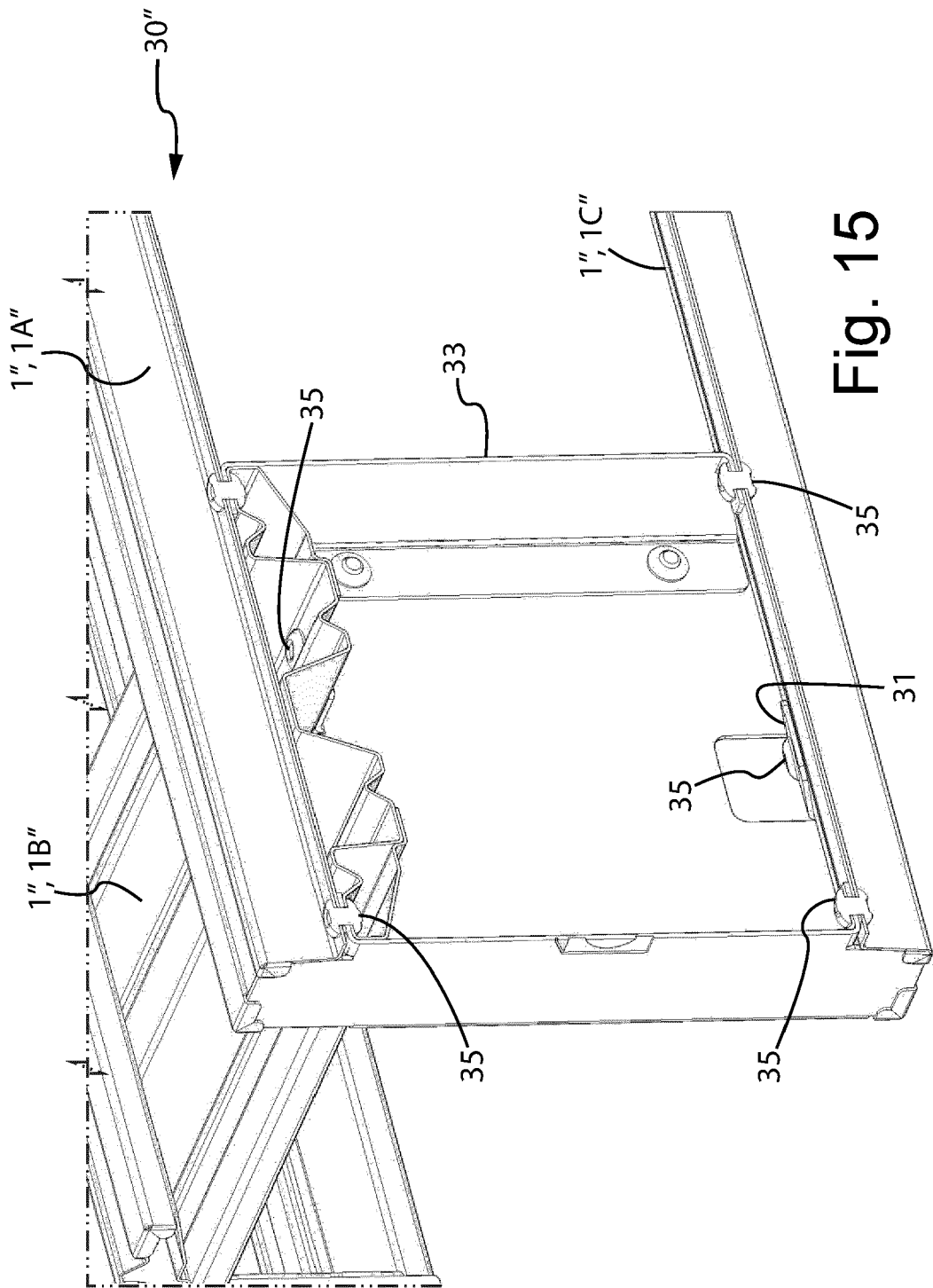


Fig. 14A



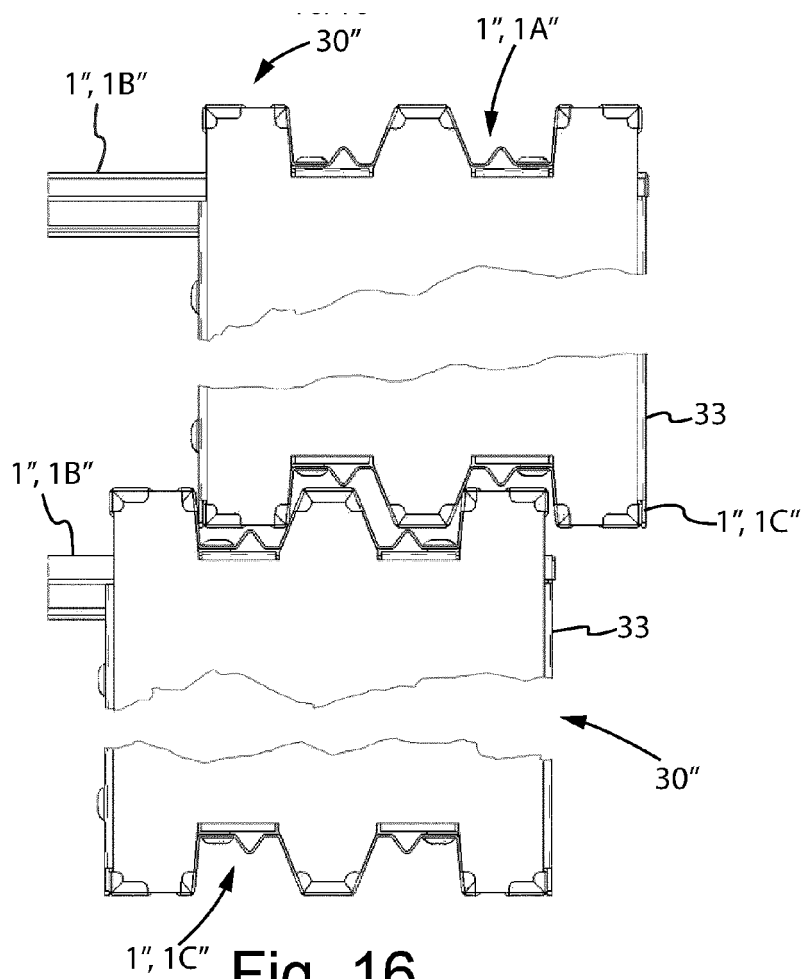


Fig. 16

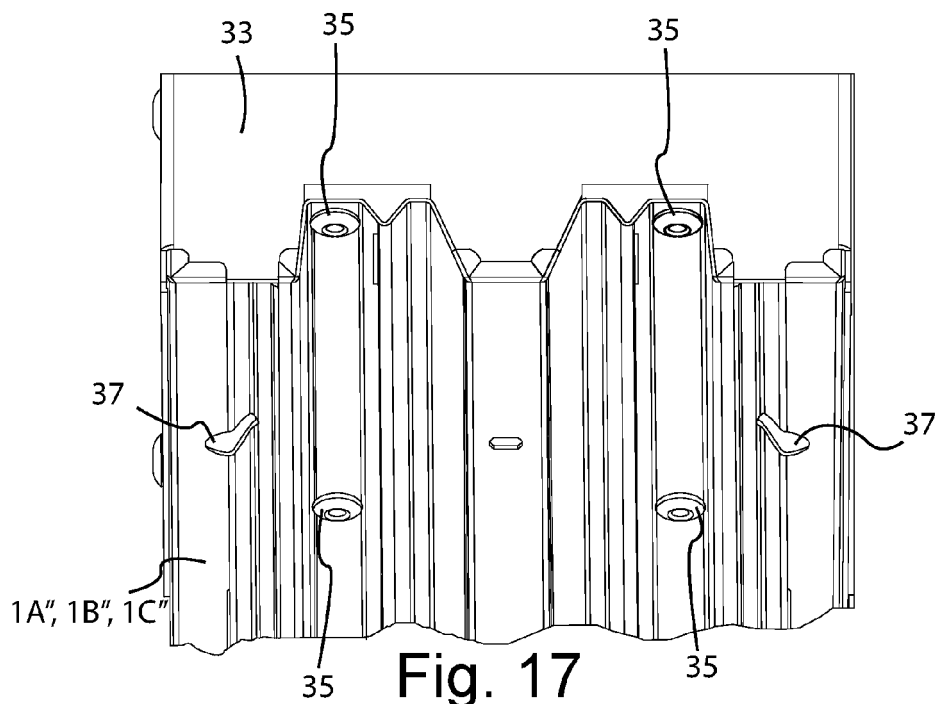


Fig. 17



EUROPEAN SEARCH REPORT

Application Number

EP 23 15 6716

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 July 2023	Examiner Fitterer, Johann
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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