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Stengel(10) **Pub. No.: US 2023/0249089 A1**(43) **Pub. Date: Aug. 10, 2023**(54) **TRUSS-TYPE RAIL AND ROLLER COASTER
ARRANGEMENT COMPRISING SAME****Publication Classification**(71) Applicant: **Ingenieurbüro Stengel GmbH,**
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CPC **A63G 7/00** (2013.01)(72) Inventor: **Werner Stengel, München (DE)**(21) Appl. No.: **18/014,909**(22) PCT Filed: **Jun. 10, 2021**(86) PCT No.: **PCT/EP2021/065682**

§ 371 (c)(1),

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(57) **ABSTRACT**

The invention relates to a truss-type rail for an amusement ride, having two rail tubes which are directly trafficable by a roller coaster train; a non-trafficable truss chord tube; and vertical truss profiles, which reinforcingly connect the rail tubes and the truss chord tube and include vertically diagonal profiles alternatingly ascending and descending diagonally between the truss chord tubes and the rail tubes. According to the invention, in at least one connection region of the vertically diagonal profiles there are no additional vertical truss profiles connected to the truss chord tube.

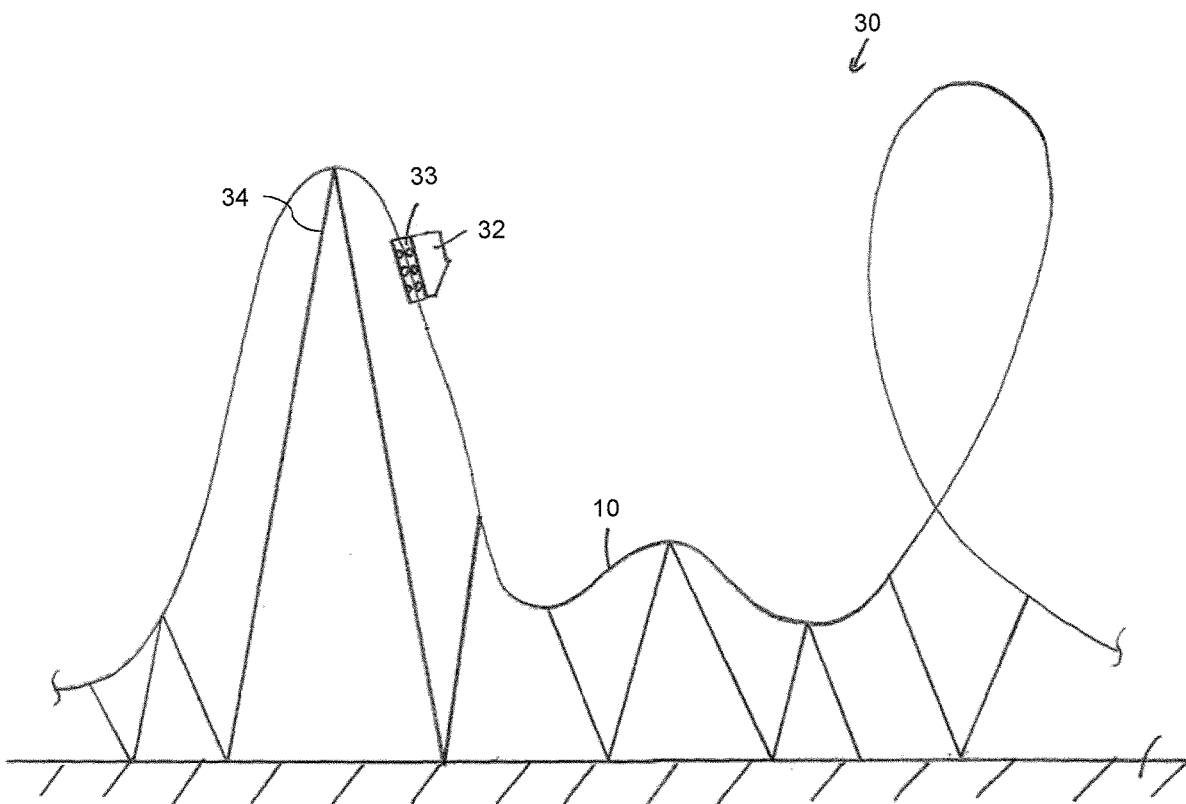


Fig. 1

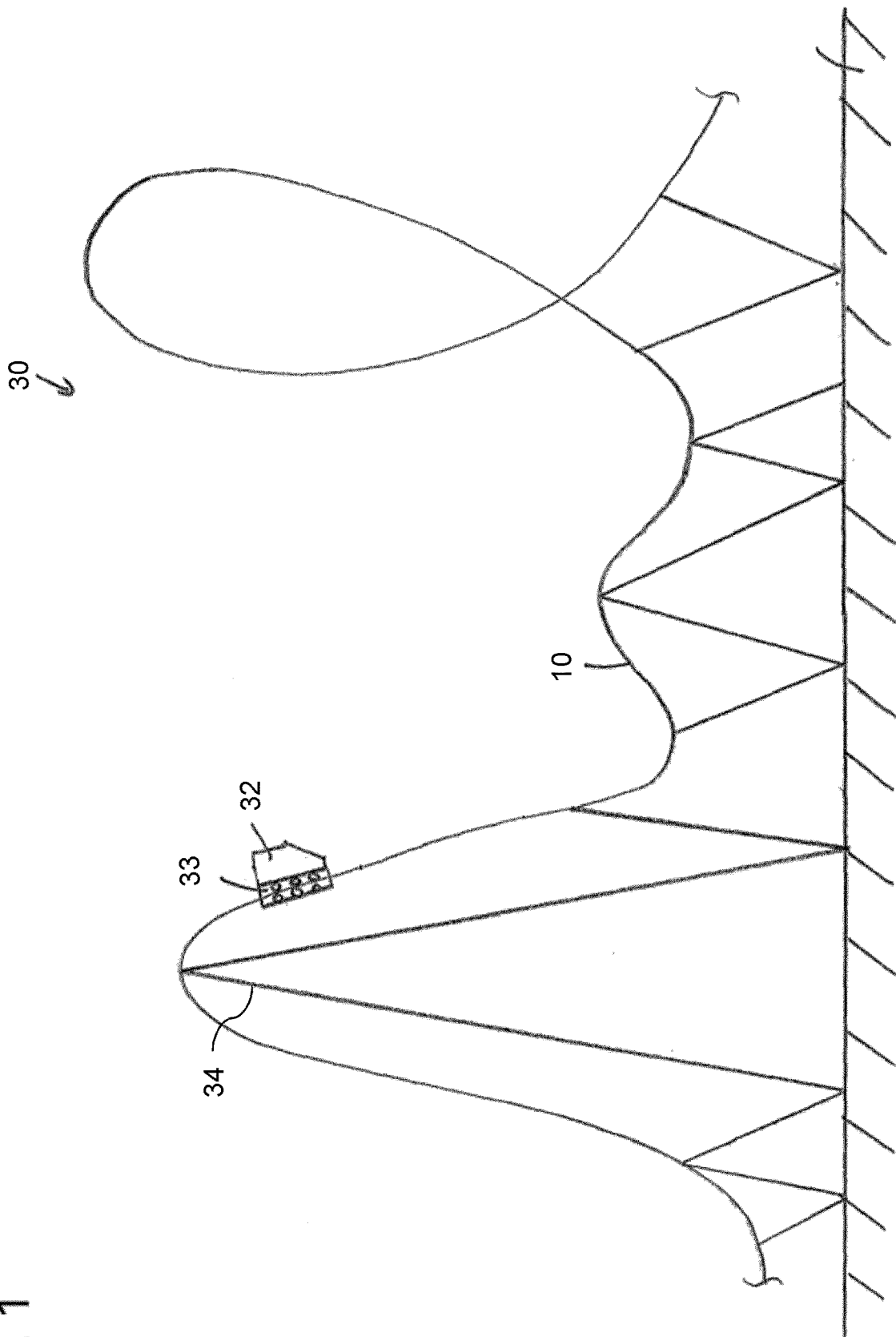


Fig. 2A

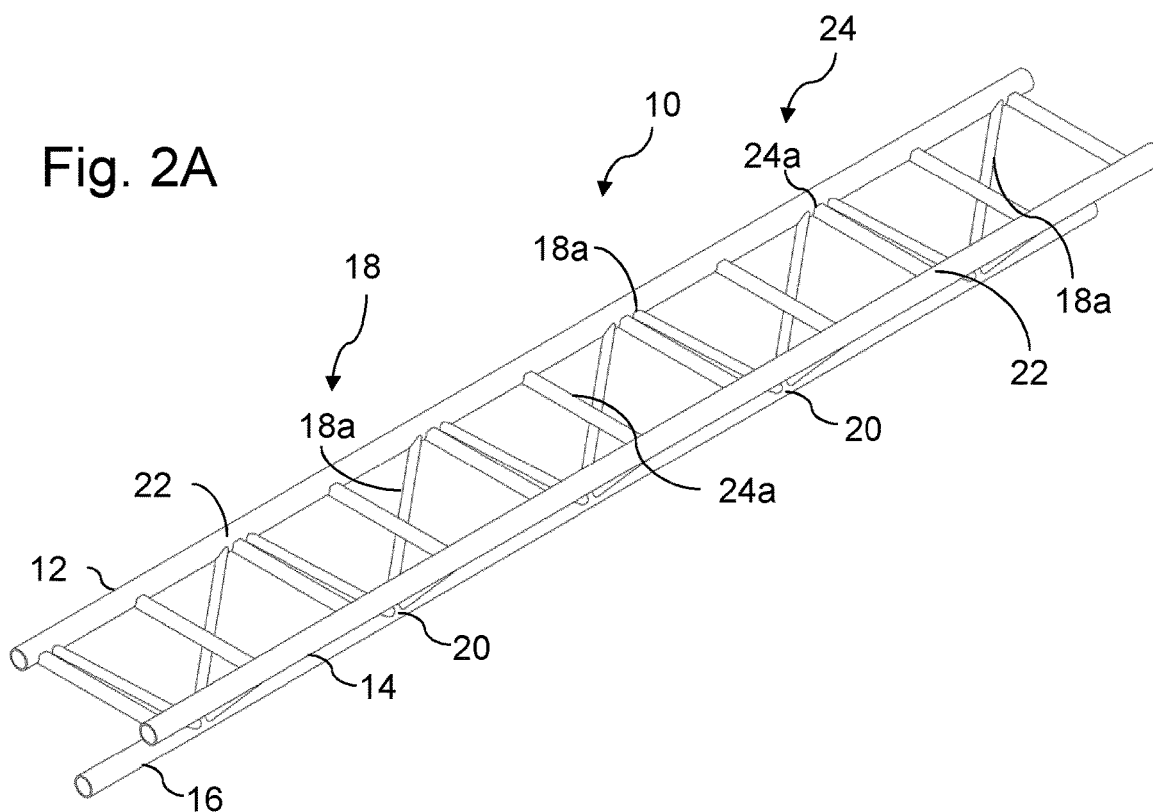


Fig. 2B

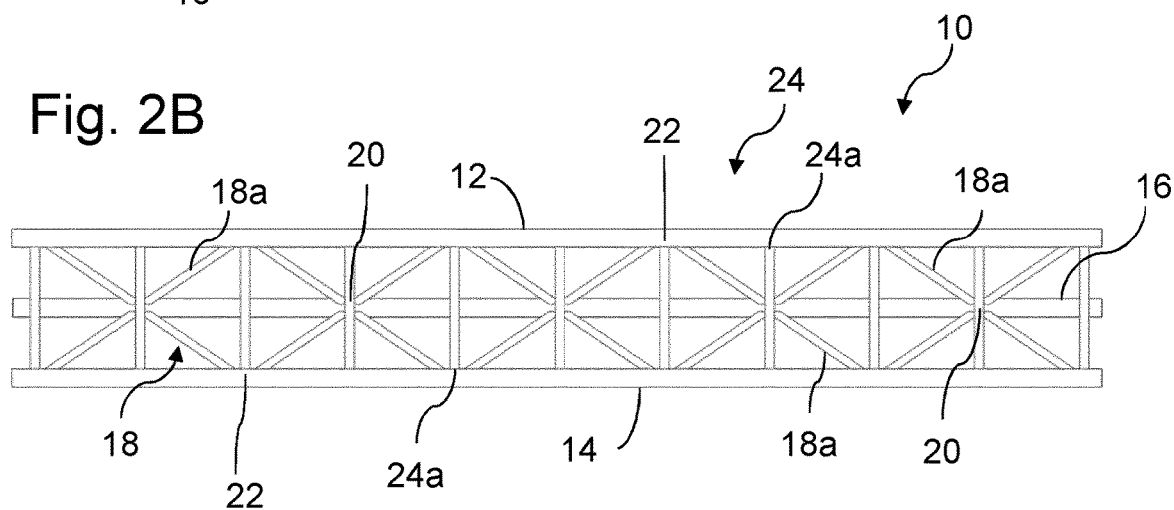


Fig. 2C

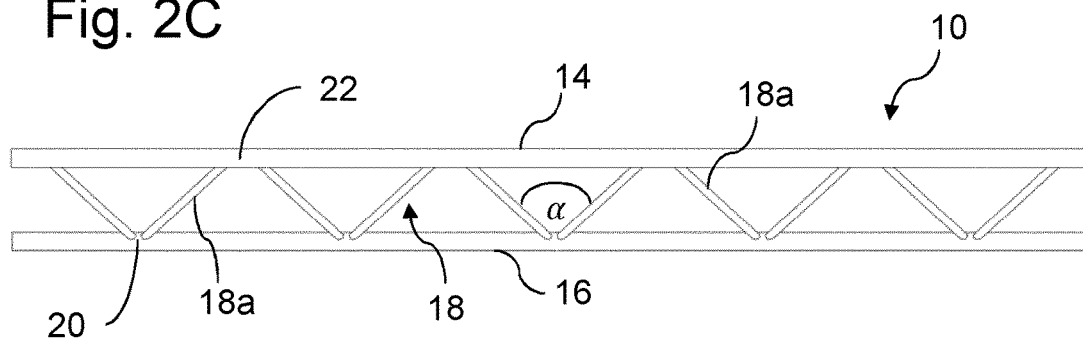


Fig. 3

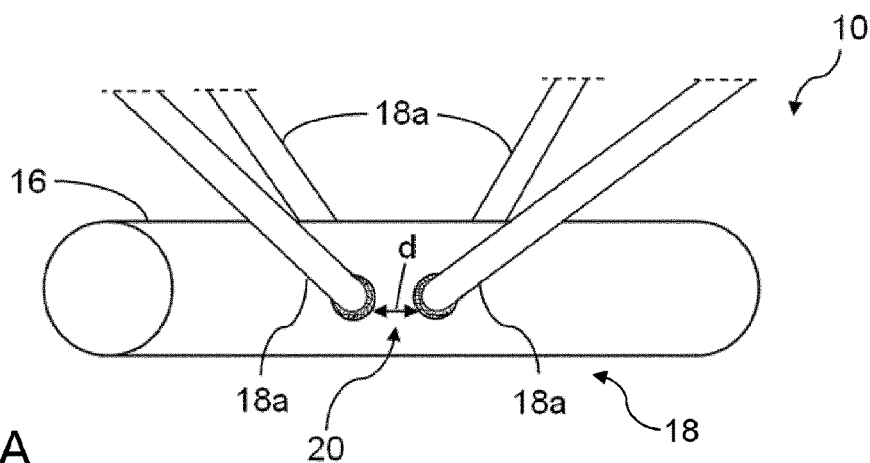


Fig. 4A

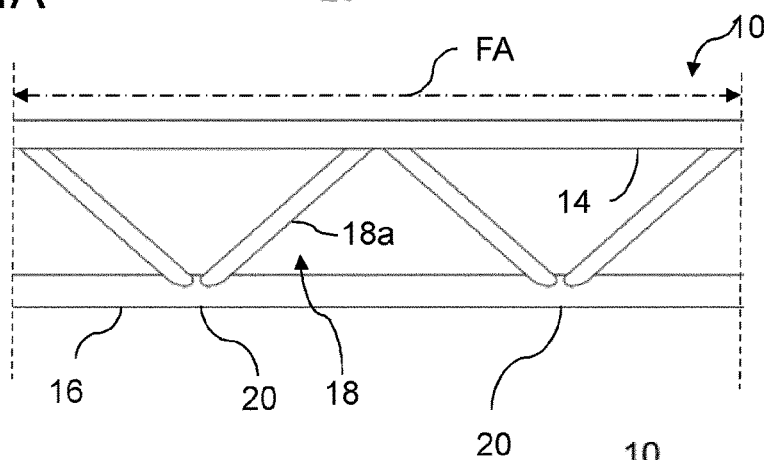


Fig. 4B

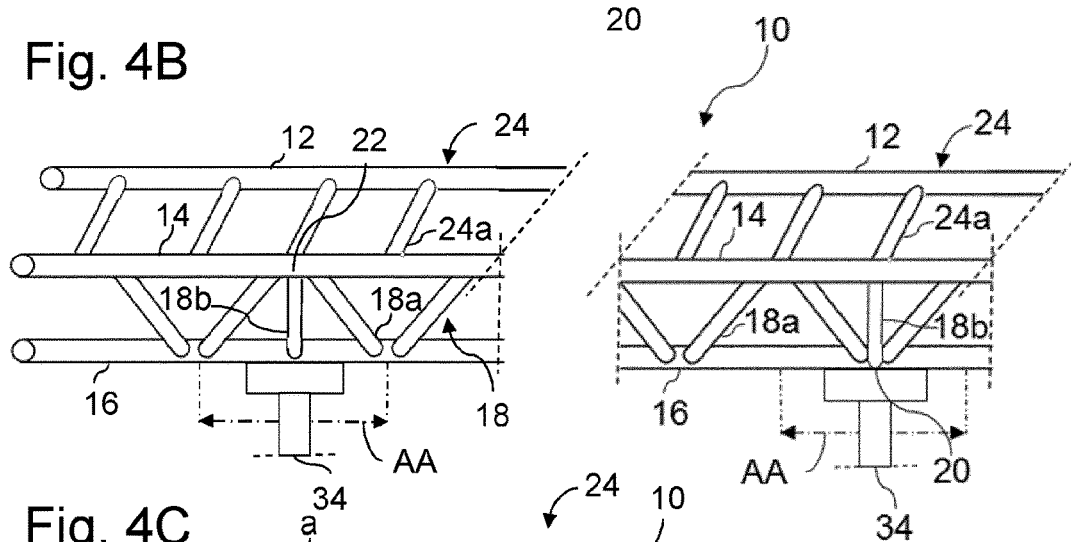


Fig. 4C

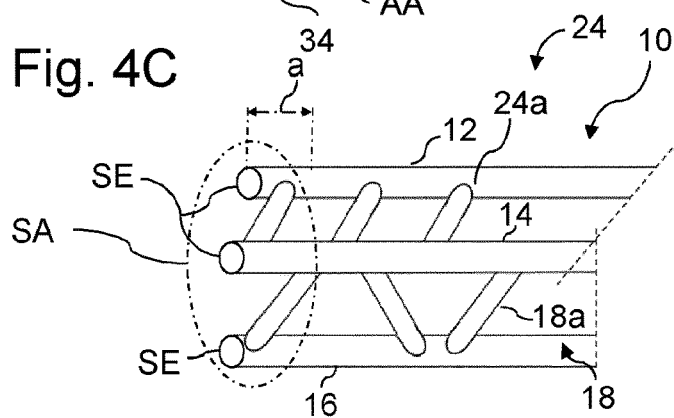


Fig. 5A

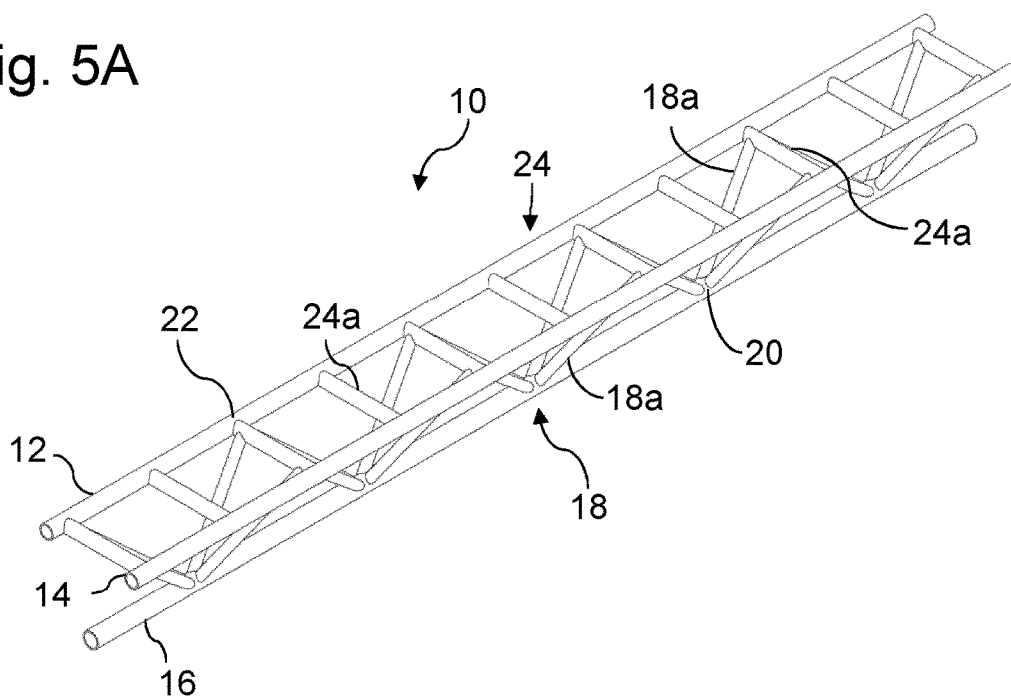


Fig. 5B

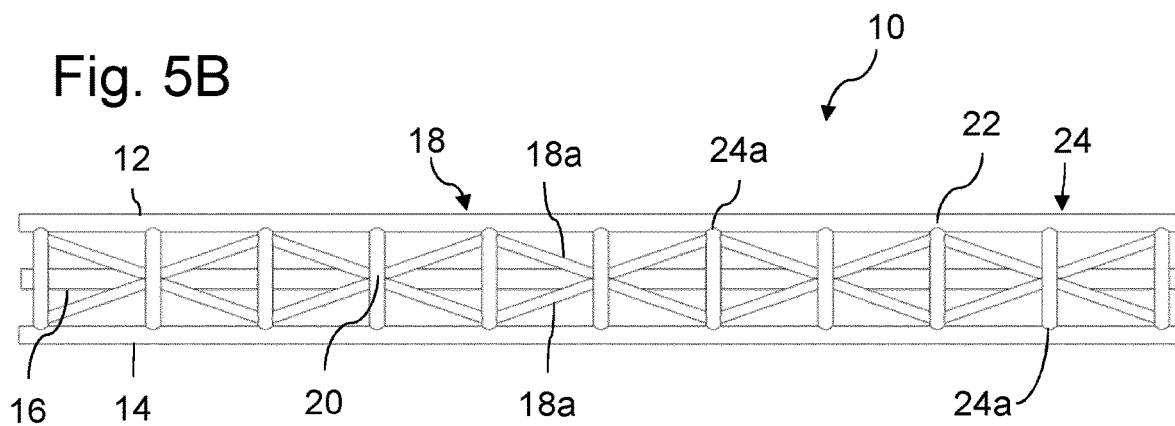


Fig. 5C

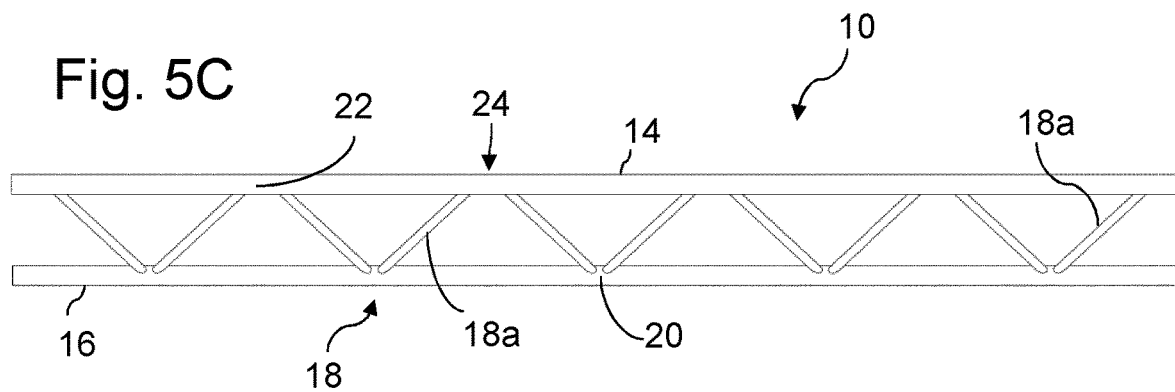


Fig. 5D

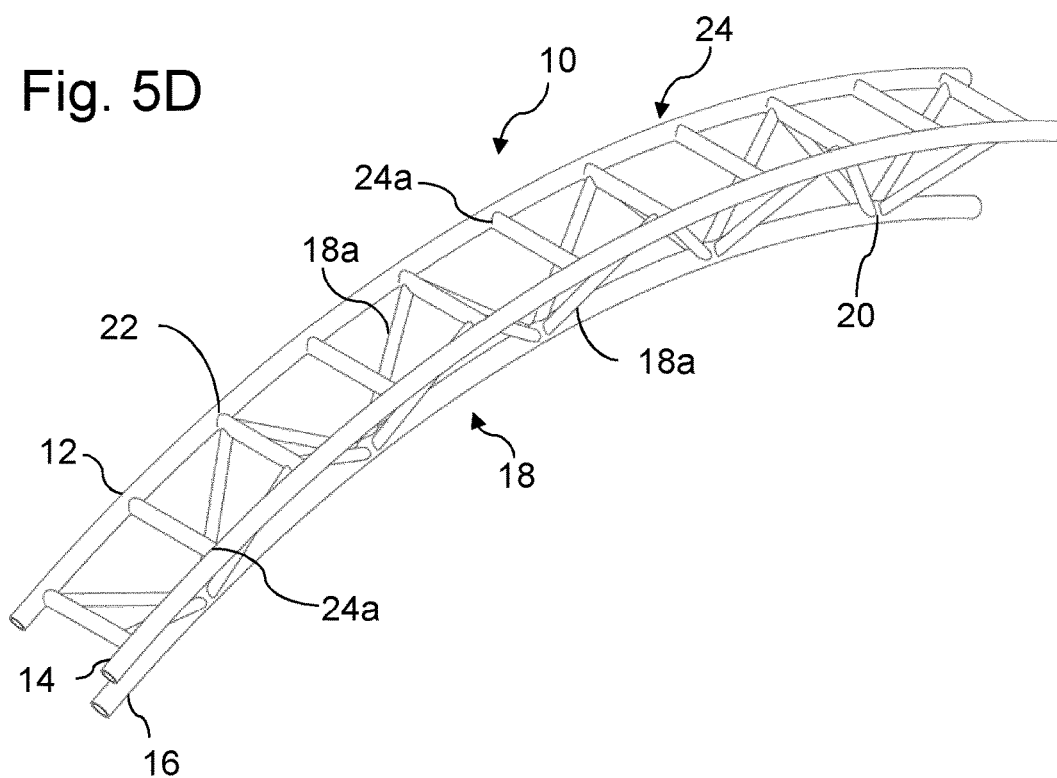


Fig. 5E

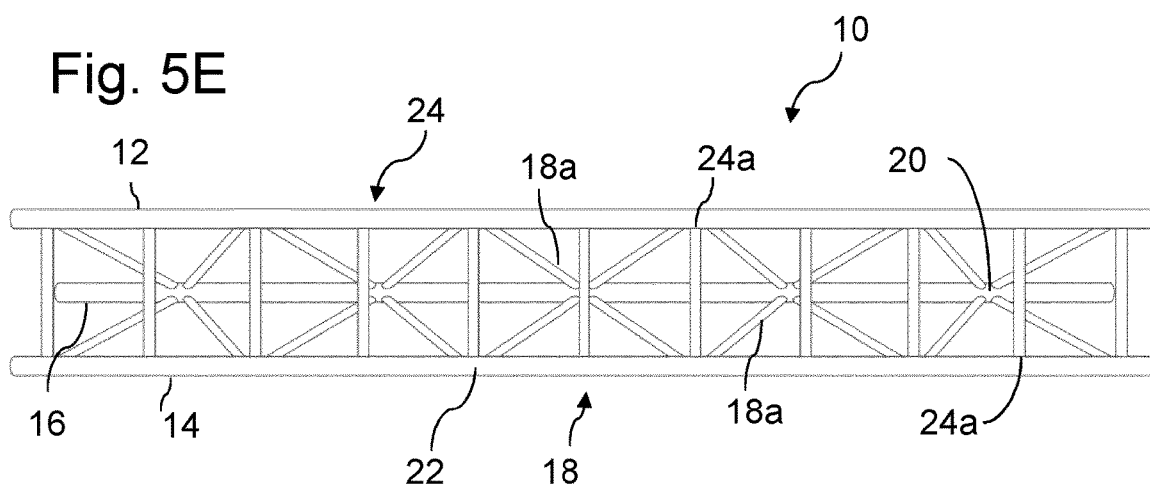


Fig. 5F

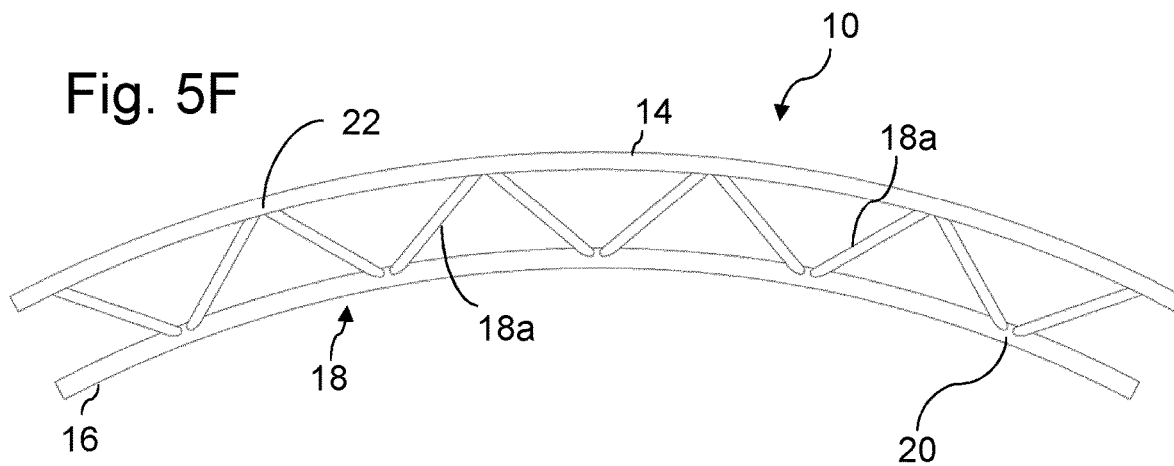


Fig. 6A

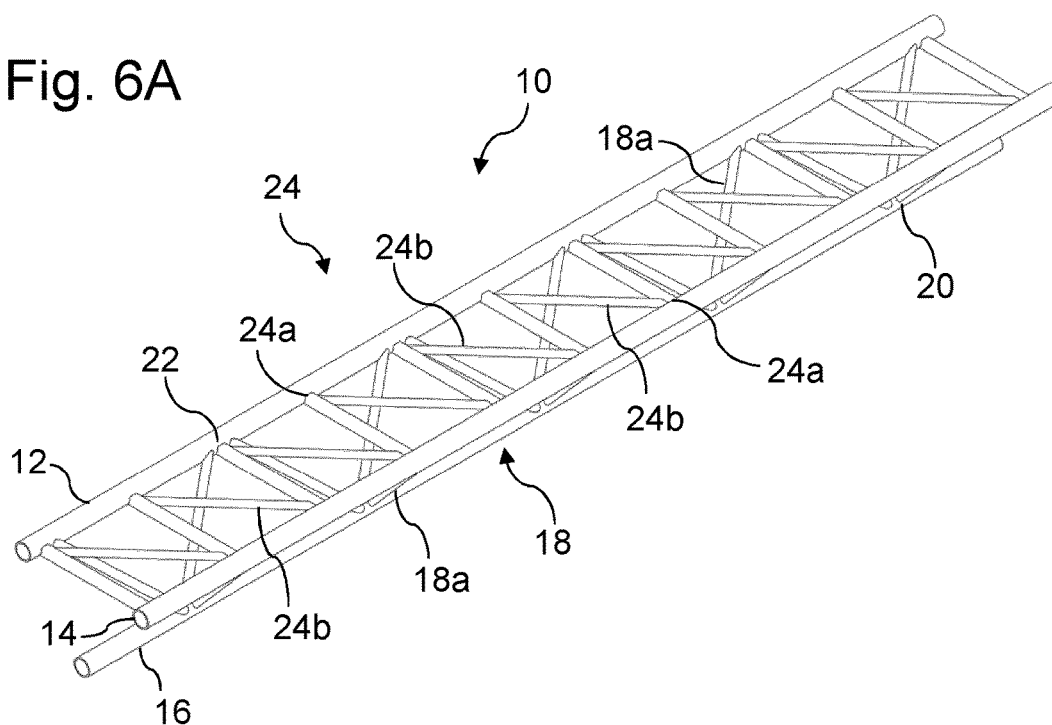


Fig. 6B

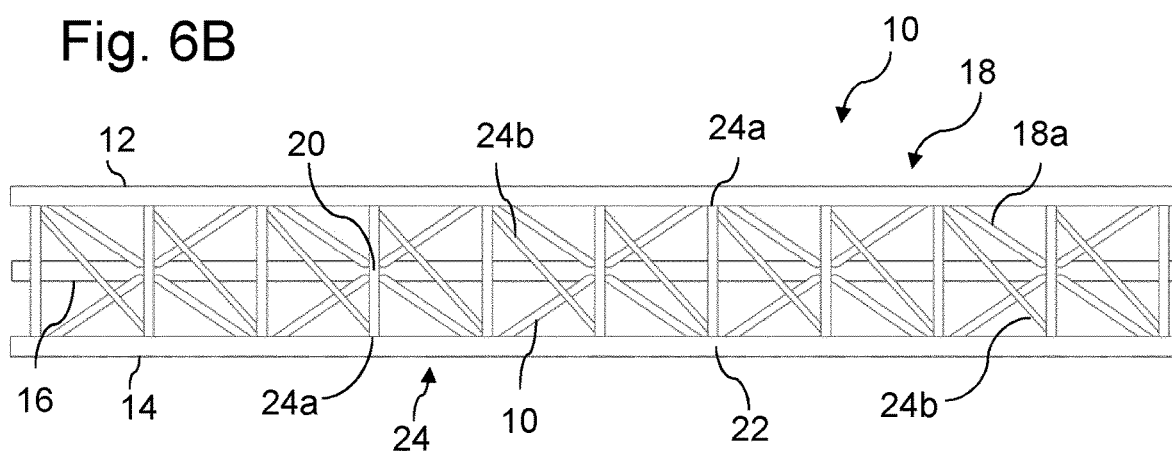


Fig. 6C

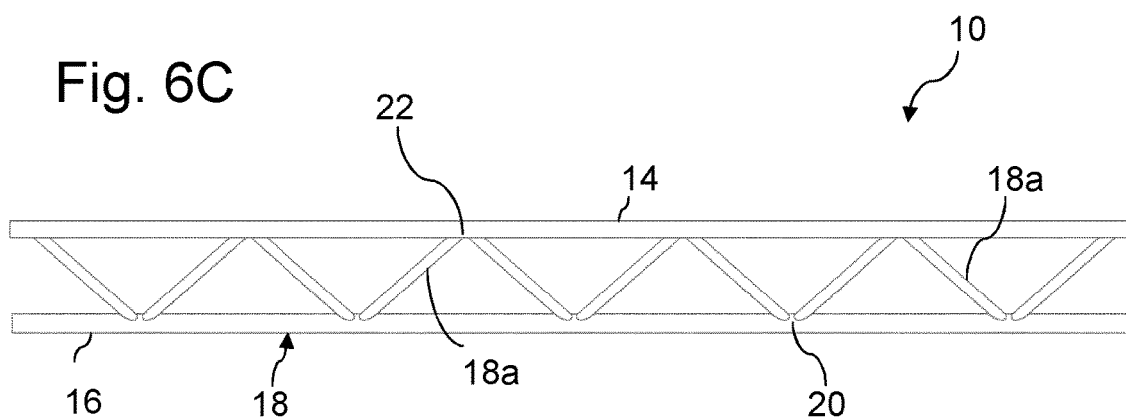


Fig. 7A

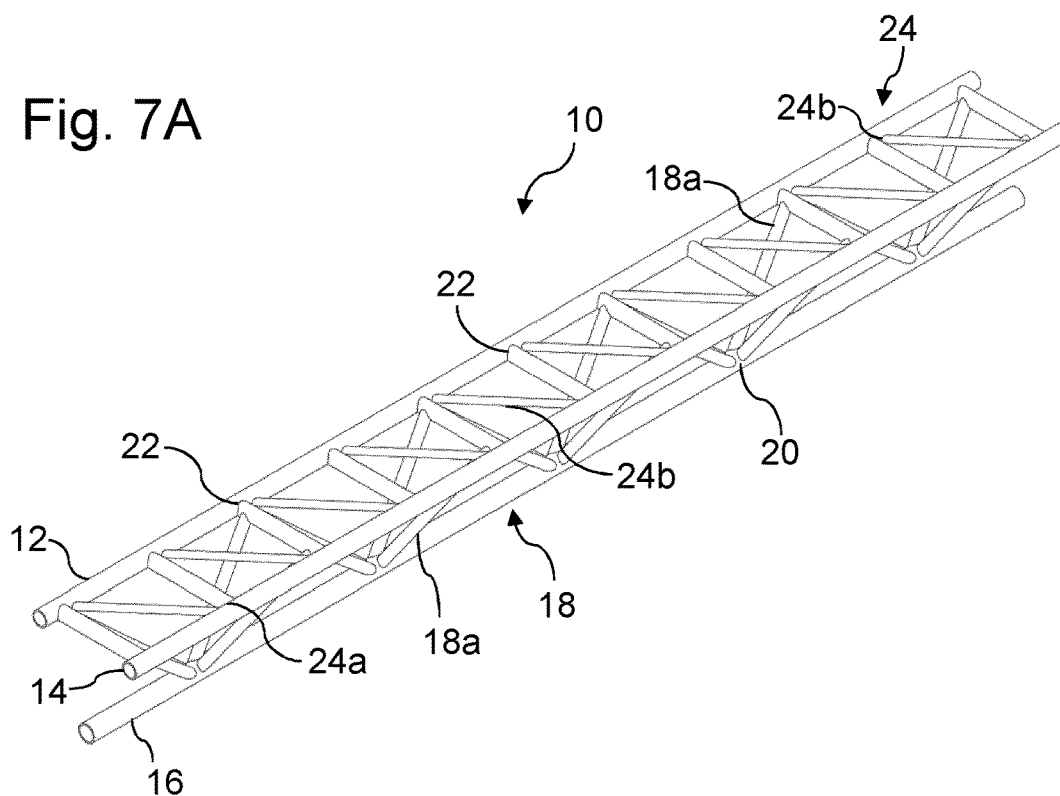


Fig. 7B

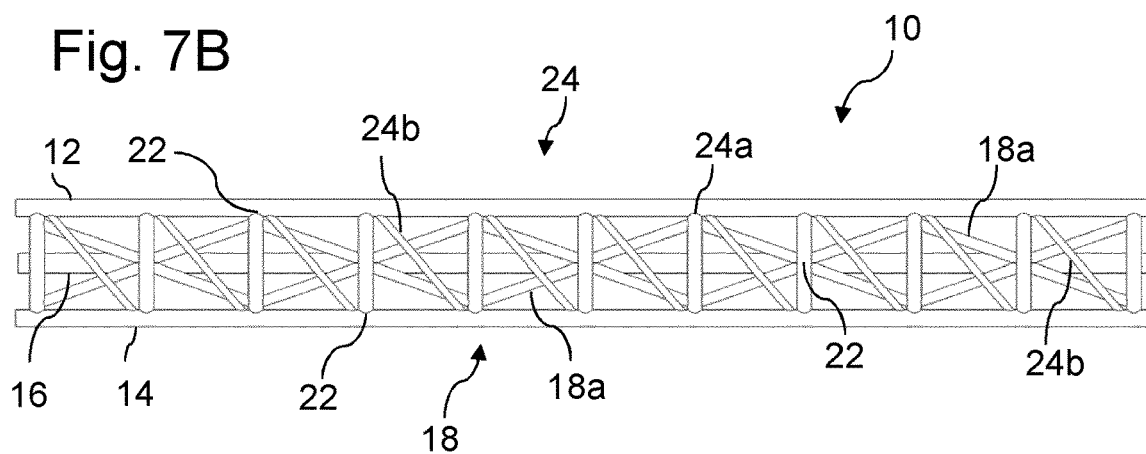


Fig. 7C

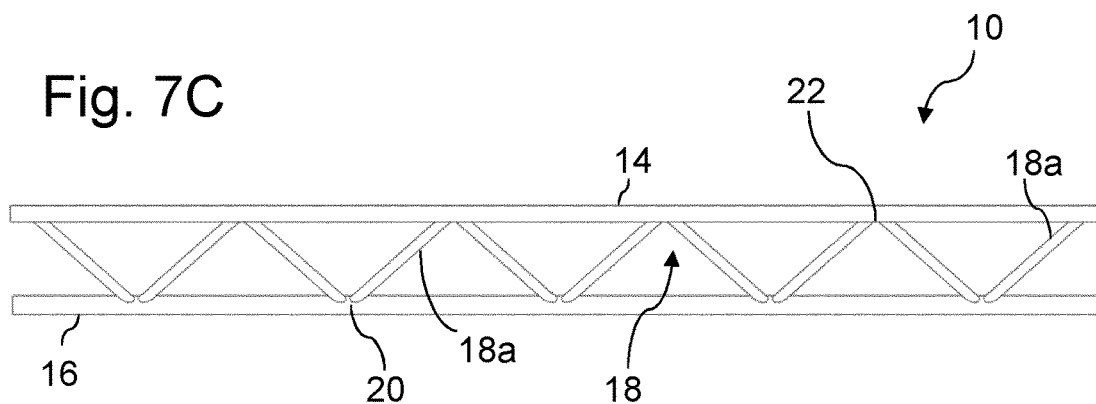


Fig. 8A

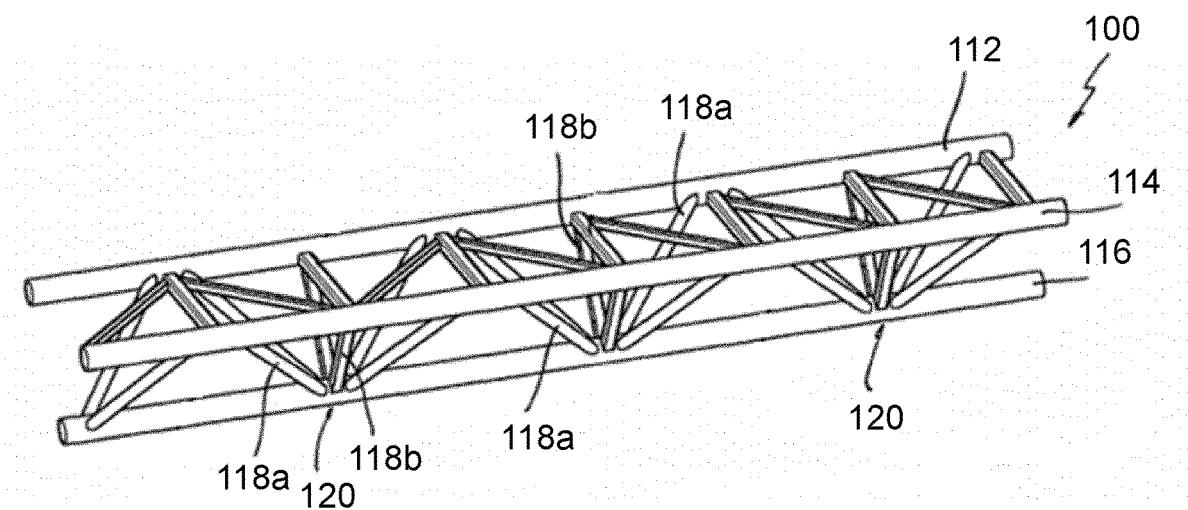


Fig. 8B

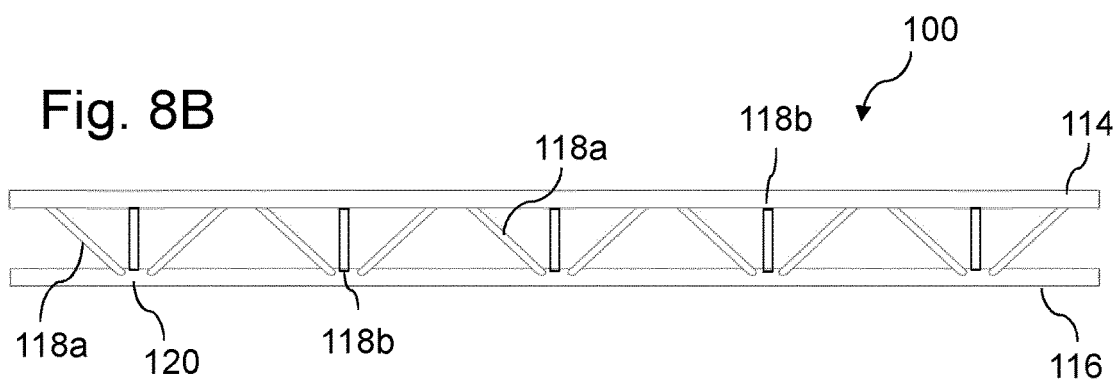
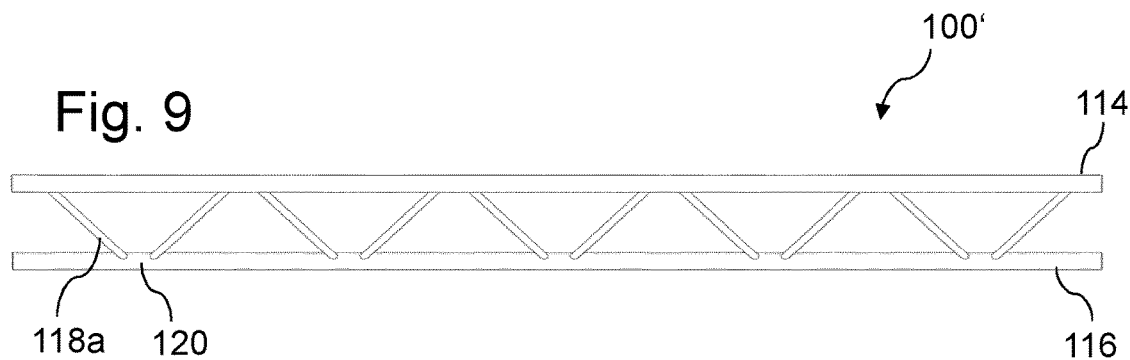


Fig. 9



TRUSS-TYPE RAIL AND ROLLER COASTER ARRANGEMENT COMPRISING SAME

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a truss-type rail for a roller coaster or a similar amusement ride, comprising two rail tubes directly passable with a car arrangement and a non-passable chord tube, and vertical truss profiles which connect the rail tubes and the chord tube to one another so that they brace each other and which comprise vertical diagonal profiles which run diagonally between the chord tube and the respective rail tube in an alternately ascending and descending manner. Furthermore, the invention relates to a roller coaster arrangement comprising a car arrangement and at least one truss-type rail of the aforementioned type.

[0002] Such rails and arrangements are known from the prior art. There are, for example, a plurality of different rail systems for guiding the car arrangement of a roller coaster consisting of one or more cars along a given track geometry. These rail systems comprise, for example, rails made of wood or steel, with one or more rail profiles of basically any shape, where the load-bearing capacity of the rail or the individual rail profiles, hereinafter also referred to as rail tubes, can be improved through bracing by means of truss profiles.

[0003] The present invention relates to a common embodiment of a rail, which is designed as such a truss-type rail, and most of the time consists of two directly passable rail tubes and a third, non-passable chord tube. The rail tubes and the chord tubes are most of the time designed with the same diameter, and, moreover, are most of the time designed as tubes or similar round profiles. To brace the rail tubes and chord tubes, truss profiles are used that run between the individual tubes and brace them. It is relevant in this context that the truss profiles are arranged in such a manner that they do not obstruct the free movement of the wheels or other parts of the train along the rail and especially the rail tubes. These truss profiles comprise vertical truss profiles with vertical diagonal profiles and mullion profiles, as well as horizontal truss profiles with horizontal diagonal profiles and transverse profiles. The web bracing on such truss-type rails has the mullions and/or transverse profiles in the normal section of the rail, i.e., in the compartment plane, and the vertical diagonal profiles and horizontal diagonal profiles in the bays between these “compartments”. In addition to these so-called 3-chord truss-type rails, there are also 4-chord truss-type rails with two directly passable rail tubes and two non-passable chord tubes, which are also connected to one another via truss profiles so that they brace each other, but whose statics and driving dynamics are not comparable to a 3-chord truss-type rail. However, the invention is directed to a 3-chord truss-type rail, in particular, to a truss-type rail consisting of two directly passable rail tubes and a third, single or only, non-passable chord tube, i.e., to a truss-type rail with a total of three rail tubes.

[0004] In a common embodiment of such truss-type rails, a right and left-hand rail tube are connected to one another by means of transverse profiles so that they brace each other. A chord tube is coupled to the rail tubes via mullion profiles, with the mullion profiles being connected to the above-mentioned transverse profiles. Vertical diagonal profiles run diagonally between the individual mullion profiles in common designs. Horizontal diagonal profiles run between the individual transverse profiles in the rail plane. The fact that

in these embodiments of truss-type rails the vertical diagonal profiles are guided into the mullion profiles and the horizontal diagonal profiles into the transverse profiles, has a manufacturing background as this ensured reliable stability of the truss-type rails with a relatively simple manufacture. According to the applicable standards, the wall thicknesses of the profiles placed underneath should be greater than those of the superimposed profiles. However, this leads to very thick wall thicknesses of the profiles placed underneath in the case of step-by-step construction.

[0005] Another disadvantage of these designs is the large number of welded joints in total, as well as the large number of vertical truss profiles, such as mullion profiles, specifically.

[0006] An arrangement for a track system with a total of eight vertical truss profiles which are connected to a chord tube in a connection area or truss node is, for example, known from the published document WO 2015/049162 A1. This results in a high number of welded joints on the chord tube and leads to additional material consumption due to the numerous mullion and vertical diagonal profiles.

[0007] Furthermore, an arrangement for a steel truss-type rail is known from the utility model specification DE 20 2015 001 425 U1, in which mullion profiles are omitted in the connection area of vertical diagonal profiles on the rail tube. This arrangement is depicted in FIGS. 8A and 8B and will be described in detail later. However, as can be seen from FIGS. 8A and 8B, mullion profiles are also necessary in this arrangement at the connection areas of the vertical diagonal profiles on a chord tube, so as to ensure load-bearing behavior in accordance with applicable standards. Furthermore, in this known arrangement, a rail joint is part of a truss node.

SUMMARY OF THE INVENTION

[0008] Consequently, it is the object of the present invention to provide an improved truss-type rail which can be manufactured with a comparable global load-bearing behavior with a low welding volume and reduced material input, as well as an improved joint situation.

[0009] This object is achieved by a truss-type rail as disclosed herein and a roller coaster arrangement also as disclosed herein. Advantageous embodiments and further developments of the invention are given in the sub-claims and/or disclosed herein.

[0010] In particular, this object is achieved by a truss-type rail for an amusement ride, comprising two rail tubes directly passable with a car arrangement, a non-passable chord tube, and vertical truss profiles which connect the rail tubes and the chord tube to one another so that they brace each other and which comprise vertical diagonal profiles which run diagonally between the chord tube and the respective rail tube in an alternately ascending and descending manner, where in at least one connection area or truss node of the vertical diagonal profiles on the chord tube, no additional vertical truss profile and especially no mullion profile is connected thereto.

[0011] In addition, this object is also achieved by a roller coaster arrangement comprising a car arrangement and at least one truss-type rail of the type mentioned above and described in more detail below.

[0012] Within the scope of the invention, a steel truss-type rail is understood to be any truss-type rail made of a metallic material or a similar statically effective material. However,

the invention is not intended to be limited to steel truss-type rails, so an application of materials having similar material properties to steel is also conceivable, such as aluminum, fiber composites based on carbon fibers, glass fibers, nylon fibers, ceramic fibers, aramid fibers, or natural fibers. Wood composites are also conceivable for use with truss-type rails. Within the scope of the invention, a truss-type rail is understood to be a rail the rail tubes and chord tubes of which are braced by means of truss profiles, such as the vertical truss profiles and horizontal truss profiles described above, with these truss profiles preferably being loaded mainly as normal bars. However, also such rail arrangements are understood thereby in which the truss profiles are also subjected to bending loads due to a substantially bend-resistant connection of the truss profiles to the rail tube or the chord tube. A rail tube or tube is understood to be any type of tube with a cross-sectional geometry suitable for load transfer. Preferably, closed-walled beams and especially tubes with a circular cross section are understood thereby. However, other tube geometries may also be used. These are also included under the term “tube” within the scope of the invention. These include, among others, rectangular profiles, box profiles or similar closed profiles, but also open profiles such as T-profiles, I-profiles, multi-layer or multi-element profiles, etc.

[0013] In accordance with the invention, in the truss-type rail described herein, no additional vertical truss profile is connected thereto in at least one connection area of the vertical diagonal profiles on the chord tube. At least one means, in particular, that at least one connection area of the truss-type rail must fulfill this condition. Contrary to the prejudice known in the prior art, namely that vertical mullion profiles are statically indispensable at least in the connection area of the vertical diagonal profiles on the chord tube, mullion profiles are dispensed with in the at least one connection area. This has several advantages.

[0014] On one hand, the number of connections in the at least one connection area on the chord tube is reduced. This reduces, for example, the welding volume, which is quadratic with the wall thickness of the welded profiles. On the other hand, the material costs are reduced as additional vertical truss profiles such as mullion profiles are omitted. The result is therefore reduced material costs and a reduced overall weight of the rail.

[0015] In this context, preferably only four vertical diagonal profiles are connected to the chord tube as vertical truss profiles in the at least one connection area.

[0016] This results in a further advantageous arrangement for a truss-type rail for an amusement ride, comprising two rail tubes directly passable with a car arrangement, a non-passable chord tube, and vertical truss profiles which connect the rail tubes and the chord tube to one another so that they brace each other and which comprise vertical diagonal profiles which run diagonally between the chord tube and the respective rail tube in an alternately ascending and descending manner, where, in accordance with the invention, a reduced number of connected vertical truss profiles is provided on at least one connection area or at least one truss node on the chord tube. Reducing the number creates more space in the truss node. This, in turn, makes it possible to form vertical truss profiles with a larger diameter. With larger tube diameters, the wall thickness can be reduced due to the increased rigidity. This further reduces the welding volume, which—as described above—is quadratic with the

wall thickness, and saves weight. A ratio of tube diameter (D) to wall thickness (thickness t), hereinafter referred to as D/t ratio, can be greater than 6, or greater than 7, or greater than 8, or greater than 9, or greater than 10, or greater than 11, or greater than 12 in the structure according to the invention with, in particular, only four vertical truss profiles which open into a connection area.

[0017] In the at least one connection area, the connection joints of the vertical diagonal profiles connected to the chord tube have a respective minimum distance from one another which is always less than the diameter of the vertical diagonal profiles in the connection area. This can reduce the occurrence of additional bending moments at the connection joints when a load is absorbed, thus enabling improved load bearing and bending behavior of the truss-type rail.

[0018] The truss-type rail can be made of steel, and the connection joint can be a welded seam.

[0019] Preferably, in a bay section of the truss-type rail in all connection areas of the vertical diagonal profiles on the chord tube, no additional vertical truss profile, especially a mullion profile, is connected thereto in each case. In doing so, the bay section can have two connection areas on the chord tube.

[0020] Furthermore, in a load bearing section of the truss-type rail in the connection area of the vertical diagonal profiles on the chord tube or on the respective rail tube, mullion profiles can be provided which run substantially orthogonally between the chord tube and the respective rail tube and are connected directly to the chord tube and to the rail tube. Within the scope of the invention, orthogonal means, in particular, that the mullion profiles are connected to at least one tube of the truss-type rail substantially perpendicularly, as seen in the side view of the truss-type rail. Orthogonal preferably also means that the mullion profiles are guided substantially in the compartment plane of the truss-type rail. The effective span of the rail tubes can be reduced by the mullion profiles. Furthermore, the mullion profiles can improve load transfer from the rail tubes into the support pillars in the load bearing section.

[0021] In a joint section of the truss-type rail, no vertical truss profile and especially no mullion profile may be connected to the respective rail tube. By dispensing with the mullion profile at a joint, the occurrence of transverse forces, bending moments, and torsional forces can be reduced as the joint is no longer located at a truss node. This makes it possible to further improve the situation of the joint.

[0022] It is possible to connect the vertical diagonal profiles directly to the chord tube and directly to the rail tube. The direct connection of the vertical diagonal profiles to the rail tube eliminates the need for a mullion profile, which served to connect the rail tube according to the prior art. Loads are transferred by the direct connection of the rail tube to the vertical diagonal profiles via the vertical diagonal profiles into the chord tube, so that the mullion profile has little significance as an unstrained member.

[0023] Therefore, preferably in at least one connection area of the vertical diagonal profiles, no additional vertical truss profile or especially a mullion profile is connected to the respective rail tube. Preferably, there is no need for a mullion profile, which further reduces the material costs and the amount of welding work required and, in addition, improves the overall impression of the truss-type rail.

[0024] Preferably, the rail tubes are connected to one another via horizontal truss profiles so that they brace each other.

[0025] In doing so, the horizontal truss profiles comprise transverse profiles that run substantially orthogonally between the rail tubes, with the transverse profiles being connected directly to the rail tubes. The transverse profiles preferably run in the area of the connection points of the vertical diagonal profiles into the rail tubes.

[0026] The vertical diagonal profiles can therefore be connected directly to a transverse profile in the connection area on the respective rail tube.

[0027] The horizontal truss profiles can preferably further comprise horizontal diagonal profiles which run diagonally between the rail tubes and which are connected directly to at least one transverse profile, preferably two transverse profiles, close to the rail tubes.

[0028] Preferably, the vertical truss profiles are connected or coupled to the rail tubes, for example, via the transverse profiles, in such a manner that carriage free space for a carriage of the car arrangement is formed on the top, bottom and outside of the rail tube. On the top is defined herein as the space above a plane formed by the rail tubes and facing away from the chord tube. In particular, when vertical diagonal profiles are connected directly to the rail tubes, influence can be exerted on the carriage free space.

[0029] As already mentioned, the invention also relates to a roller coaster arrangement comprising a car arrangement and at least one truss-type rail according to the type mentioned above and described in detail below. Preferably, in this context, the car arrangement has at least one carriage which encompasses at least one rail tube of the steel truss-type rail on the top, bottom and outside. All of the designs, special features and advantages of the steel truss-type rail according to the invention mentioned herein are transferable to such a roller coaster arrangement and vice versa.

[0030] Further embodiments of the invention emerge from the sub-claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] In the following text, the invention will be described based on an exemplary embodiment, which is explained in more detail by the accompanying drawings.

[0032] In this connection,

[0033] FIG. 1 shows a schematic view of a roller coaster arrangement with a truss-type rail and a car arrangement according to the invention;

[0034] FIG. 2A shows an isometric view of an embodiment of the truss-type rail according to the invention;

[0035] FIG. 2B shows a top view of the embodiment according to FIG. 2A;

[0036] FIG. 2C shows a side view of the embodiment according to FIG. 2A;

[0037] FIG. 3 shows a detailed view of the connection joints in the connection area of the vertical diagonal profiles in an embodiment of the truss-type rail according to the invention;

[0038] FIG. 4A shows a side view of a bay section of an embodiment of the truss-type rail according to the invention;

[0039] FIG. 4B shows an isometric detailed view of load bearing sections of an embodiment of the truss-type rail according to the invention;

[0040] FIG. 4C shows an isometric detailed view of a joint section of an embodiment of the truss-type rail according to the invention;

[0041] FIG. 5A shows an isometric view of another embodiment of the truss-type rail according to the invention;

[0042] FIG. 5B shows a top view of the embodiment according to FIG. 5A;

[0043] FIG. 5C shows a side view of the embodiment according to FIG. 5A;

[0044] FIG. 5D shows an isometric view of an embodiment of the truss-type rail according to the invention;

[0045] FIG. 5E shows a top view of the embodiment according to FIG. 5D;

[0046] FIG. 5F shows a side view of the embodiment according to FIG. 5D;

[0047] FIG. 6A shows an isometric view of another embodiment of the truss-type rail according to the invention;

[0048] FIG. 6B shows a top view of the embodiment according to FIG. 6A;

[0049] FIG. 6C shows a side view of the embodiment according to FIG. 6A;

[0050] FIG. 7A shows an isometric view of another embodiment of the truss-type rail according to the invention;

[0051] FIG. 7B shows a top view of the embodiment according to FIG. 6A;

[0052] FIG. 7C shows a side view of the embodiment according to FIG. 7A;

[0053] FIG. 8A shows an isometric view, and FIG. 8B shows a side view of a steel truss-type rail according to the prior art; and

[0054] FIG. 9 shows a side view of a steel truss-type rail without mullion profiles.

[0055] In the following text, the same reference numerals are used for identical components and components with the same effect.

DETAILED DESCRIPTION

[0056] FIG. 8A and FIG. 8B show a steel truss-type rail 100 known from the prior art in an isometric view and side view. This steel truss-type rail 100 has vertical mullion profiles 118b in connection areas 120 of vertical diagonal profiles 118a on a chord tube 116. A prevailing assumption in the prior art is that these vertical mullion profiles 118b are statically required at least in the connection area 120 on the chord tube 116. However, for a steel truss-type rail 100' according to the invention that dispenses with these mullion profiles 118b, as illustrated in FIG. 9, and as described with reference to the following embodiments of the truss-type rail 10 according to the invention, several advantages arise with regard to manufacturing costs, material costs, or material weights. In addition, the omission of the mullion profiles, as shown in FIG. 9, offers the possibility of attaching the vertical diagonal profiles 118a in the connection area 120 on the chord tube 116 at a small distance from one another on the chord tube 116, so that the four vertical diagonal profiles 118a can converge practically punctiform in the connection area 120, as illustrated in FIG. 2C and FIG. 3 for the additional truss-type rail 10 according to the invention in the connection area 20.

[0057] FIG. 1 shows a roller coaster arrangement 30 or a similar amusement ride comprising at least one truss-type rail 10 according to the invention, which will be described in detail later with reference to FIG. 2 to FIG. 7. A car arrangement 32 can have a carriage 33 with running wheels

which encompasses at least one rail tube of the truss-type rail 10 on the top, bottom and outside. The carriage is depicted schematically in FIG. 1 and can have various designs. The truss-type rail 10 is stabilized by support pillars 34.

[0058] The roller coaster arrangement 30 is typically made of a material that allows for a high level of operational safety to ensure that passengers ride safely. As material for the roller coaster arrangement 30, steel, for example, can be advantageous, but wood can also be used.

[0059] FIG. 2A shows an isometric view of an embodiment of the truss-type rail 10. The truss-type rail 10 comprises two rail tubes 12, 14 directly passable with a car arrangement 32 and a non-passable chord tube 16. In addition, the truss-type rail 10 has vertical truss profiles 18 which connect the rail tubes 12, 14 and the chord tube 16 to one another so that they brace each other. The vertical truss profiles 18 are connected to the rail tubes 12, 14 in such a manner that carriage free space for the carriage 33 of the car arrangement 32 is formed on the top, bottom and outside of the rail tube 12, 14. The vertical truss profiles 18 comprise vertical diagonal profiles 18a which run diagonally between the chord tube 16 and the respective rail tube 12, 14 in an alternately ascending and descending manner. An angle α between the vertical diagonal profiles 18a, as illustrated in FIG. 2C, can be in the range of 30° to 60°, and can preferably be 45° or lower. In this way, loads entered into the rail tubes 12, 14 are safely transferred into the chord tube 16, activating the vertical diagonal profiles 18a.

[0060] In accordance with the invention, in at least one connection area 20 of the vertical diagonal profiles 18a on the chord tube 16, no additional vertical truss profile 18 is connected thereto. By dispensing with additional vertical truss profiles 18, such as vertical mullion profiles 18b (FIG. 4B), which, in particular, can be seen in the side view of the truss-type rail 1 shown in FIG. 2C, the welded joints in the connection area 20 on the chord tube 16 are reduced and material costs are saved.

[0061] However, the truss-type rail 10 according to the invention is not limited to the above embodiment. In a further embodiment of the truss-type rail 10 for an amusement ride, comprising two rail tubes 12, 14 directly passable with a car arrangement, a non-passable chord tube 16, and vertical truss profiles 18 which connect the rail tubes 12, 14 and the chord tube 16 to one another so that they brace each other and which comprise vertical diagonal profiles 18a which run diagonally between the chord tube 16 and the respective rail tube 12, 14 in an alternately ascending and descending manner, no vertical truss profile 18 may, in accordance with the invention, be connected to the truss-type rail in a joint section SA of the truss-type rail.

[0062] Preferably, only four vertical diagonal profiles 18a are connected to the chord tube 16 in the connection area 20 as vertical truss profiles 18, which can be seen from the top view of the truss-type rail 10 shown in FIG. 2B.

[0063] In doing so, the vertical diagonal profiles 18a can be connected directly to the chord tube 16 and to the rail tube 12, 14. In this process, in at least one connection area 22 of the vertical diagonal profiles 18a to the respective rail tube 12, 14, no additional vertical truss profile 18 may be connected thereto. In particular, no mullion profile 18b (as shown in FIG. 4B) may be connected in the connection area 22 of the vertical diagonal profiles 18a to the respective rail tube 12, 14, which runs substantially orthogonally between

the chord tube 16 and the respective rail tube 12, 14. Preferably, only two vertical diagonal profiles 18a are connected to a respective rail tube 12, 14 as vertical truss profiles 18 in the connection area 22. The direct connection to the rail tubes 12, 14 enables load transfer by the vertical diagonal profiles 18a without additional mullion profiles 18b. The truss-type rail 10 can therefore have sections without mullion profiles 18b in the connection areas 20 on the chord tube 16 and in the connection areas 22 on the rail tubes 12, 14.

[0064] The rail tubes 12, 14 can be connected to one another via horizontal truss profiles 24 so that they brace each other. In this process, the horizontal truss profiles 24 comprise transverse profiles 24a which run substantially orthogonally between the rail tubes 12, 14, as illustrated in FIG. 2A. In this process, the transverse profiles 24a are preferably connected directly to the rail tubes 12, 14.

[0065] In the embodiment shown in FIG. 2A to FIG. 2C, the rail tube profiles 12, 14, the vertical diagonal profiles 18a, the chord tube 16, and the transverse profiles 24a are configured as round profiles. It is, naturally, also possible to choose other cross-sectional shapes, with the round cross section being preferable to an angular cross section.

[0066] Furthermore, a tube diameter of the respective profiles may be in the range of 130 to 190 mm, or in the range of 110 to 170 mm. The wall thickness of the profiles can range from 12 to 25 mm. A ratio of tube diameter D to wall thickness t (D/t ratio) is usually in the range of 5 to 20. For a “thick” tube, for example, with a diameter of 70 mm and a wall thickness of 10 mm, the D/t ratio is equal to 7. For a “slim” tube, for example, with a diameter of 88 mm and a wall thickness of 5 mm, the D/t ratio is about 17. In this case, the wall thickness can decrease as the tube diameter increases, i.e., the greater the tube diameter, the greater the D/t ratio can be. An advantage of the roller coaster arrangement 30 according to the invention and the truss-type rail 10 is that, due to the reduced number of connected truss profiles, more space is created in the truss node and thus the truss profiles can be designed with a larger diameter, as well as a smaller wall thickness. This can save weight and further reduce the amount of welding work required. In particular, the D/t ratio can be greater than 6, or greater than 7, or greater than 8, or greater than 9, or greater than 10, or greater than 11, or greater than 12.

[0067] The arrangement of the vertical diagonal profiles 18a in conjunction with the horizontal truss profiles 24 according to the invention makes it possible to ensure global load-bearing behavior, as well as global stiffness in accordance with the common standards. By omitting the mullion profiles 18b, material and weight can be saved, and the manufacturing process can be simplified.

[0068] FIG. 3 shows a detailed view of the truss-type rail 10, in particular, of the connection area 20 on the chord tube 16. In the connection area 20, due to a missing mullion profile 18b, connection joints illustrated by the hatched areas can have a respective minimum distance d from each other, which is always less than three times, two times or one time the diameter of the vertical diagonal profiles 18a in the connection area 20. In this context, an eccentricity of the vertical diagonal profiles 18a on the chord tube 16 can be kept low in relation to a line of action of a force acting by load absorption. This can reduce the occurrence of additional bending moments at the connection joints and thus increase the load-bearing capacity of the truss-type rail 10.

In the example shown in FIG. 3, this line of action can, for example, refer to the center point of the minimum distance d between the connection joints. In other words, by dispensing with additional vertical truss profiles **18**, especially mullion profiles **18b**, a span or support width of the truss-type rail **10**, in which the truss-type rail **10** must withstand a load applied by a car arrangement **32**, can be increased. In particular, the occurrence of secondary bending moments at the connection joints can be at least partially compensated for by a low eccentricity, i.e., by the minimum distance between the mounted truss profiles in a truss node. In this way, the reduced local load-bearing behavior resulting from the omission of the mullion profiles **18b** is at least partially compensated for due to the increased bracing by the vertical diagonal profiles **18a** connected to the chord tube **16** at a minimum distance d from each other. In accordance with the invention, this bracing is facilitated by the fact that, due to the reduced number of connected truss profiles in the truss node, more space is available for the connection of the, in particular, four truss diagonal profiles and these can thus be designed with a larger diameter and larger D/t ratio.

[0069] Preferably, in the at least one connection area **20**, the connection joints of the vertical diagonal profiles **18a** connected to the chord tube **16** or the circumferential outer edge area of the vertical diagonal profiles **18a** in the connection area **20** can have a respective minimum distance d which is always less than three times, two times or one time the maximum diameter of the vertical diagonal profiles **18a** in the connection area **20**, and which is especially less than 90%, or less than 80%, or less than 70%, or less than 60%, or less than 50%, or less than 40% of the maximum diameter of the vertical diagonal profiles **18a**. Furthermore, the minimum distance d can be less than 500 mm, or less than 400 mm, or less than 300 mm, or less than 200 mm, or less than 150 mm, or less than 100 mm, or less than 50 mm. In addition, the mutual distance of the tube's center points in the connection area **20** from the, in particular, four vertical diagonal profiles **18a** can always be less than 800 mm, or less than 700 mm, or less than 600 mm, or less than 500 mm, or less than 400 mm, or less than 300 mm, or less than 200 mm. In addition, the mutual distance of the tube's center points in the connection area **20** from the, in particular, four vertical diagonal profiles **18a** can always be less than four times, or less than 3.5 times, or less than three times, or less than 2.5 times, or less than two times, or less than 1.5 times, or less than one time the maximum diameter of the vertical diagonal profiles **18a**.

[0070] In this process, the truss-type rail **10** can be made of steel and the connection joint can be a welded seam. However, other connection joints are also conceivable, such as an adhesive bead or adhesive trace, in the case of a non-metallic composite or fiber composite.

[0071] Furthermore, in a bay section FA of the truss-type rail **10**, no additional vertical truss profile **18** may, in each case, be connected to the chord tube **16** in all of the connection areas **20** of the vertical diagonal profiles **18a** on the chord tube **16**. However, it is also conceivable that in a bay section FA of the truss-type rail **10**, no additional vertical truss profile **18** is, in each case, connected to the chord tube **16** for more than 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80% or 90% of all of the connection areas **20** of the vertical diagonal profiles **18a** on the chord tube **16**. In doing so, the bay section FA denotes a cantilevered section in which no support pillars or similar load bearing supports bear a rail

section of the truss-type rail **10**. The bay section FA also does not contain a rail connection area or joint ends of the truss-type rail. In particular, the bay section FA thus denotes a section of the truss-type rail **10** of the roller coaster arrangement **30** that does not have a load bearing section AA and a joint section SA, which will be described in detail in the following text. This is shown in FIG. 4A, where the bay area FA is illustrated by an arrow. In the example shown in FIG. 4A, the bay area FA comprises two connection areas **20** on the chord tube **16** where no mullion profiles **18b** are connected to the chord tube **16**. In further embodiments, more than 10%, more than 20%, more than 30%, more than 40%, more than 50%, more than 60%, more than 70%, more than 80%, and more than 90% of all connection areas **20** on the chord tube **16** may not have another vertical chord profile **18** and especially not a mullion profile **18b** in the entire truss-type rail track of the roller coaster arrangement **30**.

[0072] FIG. 4B shows a schematic view of the truss-type rail **10**, which depicts a load bearing section AA of the truss-type rail **10** in the connection area **20** of the vertical diagonal profiles **18a** on the chord tube **16** or on the respective rail tube **12**, **14**. The truss-type rail **10** is depicted in a highly simplified form in FIGS. 4B and 4C, with the vertical diagonal profiles **18a** connected to the rail tube **12** being omitted for clarity. In the load bearing section AA illustrated by an arrow, mullion profiles **18b** are provided which run substantially orthogonally between the chord tube **16** and the respective rail tube **12**, **14** and are connected directly to the chord tube **16** and the rail tube **12**, **14**. According to the left-hand detailed view of the truss-type rail **10** in FIG. 4B, the mullion profiles **18b** can be connected to the respective rail tube **12**, **14** at the connection area **22** of the vertical diagonal profiles **18a**. However, the mullion profiles **18b** can also be connected to the chord tube **16** at the connection area **20** of the vertical diagonal profiles **18a**, which is depicted in the right-hand detailed view in FIG. 4B. In doing so, the mullion profiles **18b** are stabilized by the support pillars **34** (FIG. 1) and supported by a floor area (not shown). In one embodiment, no additional vertical truss profile **18** and especially no mullion profile **18b** may be connected to the chord tube **16** in the load bearing section AA of the truss-type rail **10** in the connection area **20** of the vertical diagonal profiles **18a** to the chord tube **16**. The extension of the load bearing section AA in the rail direction of the truss-type rail **10** corresponds at least to the width of the load bearing support or support pillar **34**. The load bearing section AA can further extend symmetrically to the load bearing point of the support pillar **34** on either side of the support pillar **34** by 100 mm, 200 mm, 300 mm, 400 mm or 500 mm along the truss-type rail **10** away from the load bearing point. The decisive factor is that the load bearing section AA covers a rail area of the truss-type rail **10** which is immediately adjacent to the load bearing support or support pillar **34**. In some roller coasters, a joint section SA described below may also coincide with a load bearing section AA. In any case, however, a bay section FA does not contain a joint section SA or a load bearing section AA.

[0073] FIG. 4C shows an isometric detailed view of the truss-type rail **10**, which illustrates the joint section SA of the truss-type rail **10**. The joint section SA is represented by a circle in this example. The joint section SA of the truss-type rail **10** is to be interpreted as an area of the truss-type rail **10** immediately adjacent to a joint end SE and, in particular, extends away from the joint end SE by a distance

a. In doing so, the distance *a* can be ten times, five times, three times or two times the maximum diameter of the rail tube **12**, **14**. Furthermore, the distance *a* can be equal to 500 mm, 1000 mm or 1500 mm. It is pointed out that the end sections shown in FIG. 2A to FIG. 9, with the exception of the end sections shown in FIG. 4C, do not show any joint sections, but that the truss-type rail **10** has been cut at arbitrary ends in the drawing. In the example shown in FIG. 4C, no vertical truss profile **18** and especially no mullion profile **18b** is connected to the respective rail tube **12**, **14** in the joint section SA. In other words, the joint section is not part of or embedded in a truss node on the respective rail tube **12**, **14**. The omission of the mullion profile **18b** makes it possible to produce a joint line on the respective rail tube **12**, **14** in which no additional transverse forces, bending moments or torsional loads act on the joint. By reducing these secondary loads, tensile and compressive forces acting on the respective rail tubes **12**, **14** are optimally transmitted by the joint. Furthermore, carriage free space can be formed, which enables optimal accommodation of the carriage **33**. FIG. 4C further shows a transverse profile **24a** which is spaced from the joint section SA. However, this is not restrictive. The transverse profile **24a** can also be arranged at the joint section SA. The connection area **20** of the vertical diagonal profiles **10** to the chord tube **16** can be located in the joint section SA, in which case, in the connection area **20** of the, in particular, two vertical diagonal profiles **18a** on the chord tube **16**, no additional vertical truss profile **18** and especially no mullion profile **18b** is connected thereto.

[0074] FIG. 5A to FIG. 5C show an embodiment of the truss-type rail **10** with vertical diagonal profiles **18a** which are connected directly to the transverse profiles **24a**. Due to the direct connection to the transverse profiles **24a**, a small eccentricity can be produced on the respective rail tube **12**, **14**, whereby additional bending moments and torque are reduced at the connection areas **22**. This is particularly advantageous if the truss-type rail **10** has a curved shape, as illustrated in FIG. 5D to FIG. 5F.

[0075] FIG. 6A to FIG. 6C show the truss-type rail **10** with horizontal diagonal profiles **24b** which run diagonally between the rail tubes **12**, **14** and are connected directly to at least one transverse profile **24a**, preferably two transverse profiles **24a**, near the rail tubes **12**, **14**. In this embodiment of the truss-type rail **10**, the vertical diagonal profiles **18a** are connected directly to the respective rail tube **12**, **14**. By means of the horizontal diagonal profiles **24b**, the truss-type rail **10** can be additionally stabilized with regard to horizontal loads and torsional loads. Furthermore, by connecting the vertical diagonal profiles **18a** directly to the respective rail tube **12**, **14** and chord tube **16**, additional mullion profiles **18b** can be omitted. This reduces the increase of wall thickness, as no intermediate step has to be made via mullion profiles **18b** or transverse profiles **24a** and, as described above, the vertical truss profiles can be formed with a larger diameter and smaller wall thickness.

[0076] FIG. 7A to FIG. 7C show a preferred embodiment of the truss-type rail **10** with horizontal diagonal profiles **24b** which are connected to the respective rail tubes **12**, **14** and which has vertical diagonal profiles **18a** connected to the transverse profiles **24a**. As described above, a small eccentricity can be produced on the respective rail tube **12**, **14** by connecting the vertical diagonal profiles **18a** directly to the transverse profiles **24a**. Thus, locally occurring bending moments can be further reduced. In connection with the

arrangement according to the invention, which omits connecting additional vertical truss profiles **18**, especially the mullion profiles **18b**, to the chord tube **16**, this results in a low bottom eccentricity on the chord tube **16** and a low top eccentricity on the respective rail tube **12**, **14**. The resulting reduction in local secondary stresses can enable an improved global load-bearing behavior.

[0077] A local vertical load direction is understood to be the vertical load into or out of the seat in the vehicle's local reference frame of the carriage arrangement **32**. This load direction represents the main load direction in the roller coaster arrangement **30** within the meaning of the invention. This means that the largest sharing in terms of amount are to be expected in this direction. The invention relates to a roller coaster arrangement **30** in which the local vertical load direction is substantially perpendicular to a straight line in the compartment plane through left and right-hand rail tubes **12**, **14**. The chord tube **16** is therefore located between the two rail tubes **12**, **14** as seen in the local vertical direction or main load direction.

[0078] Thus, in accordance with the invention, a truss-type rail **10** in the form of a three-chord rail is provided for an amusement ride which only has two rail tubes **12**, **14** directly passable with a car arrangement **32** and only one non-passable chord tube **16**, wherein the local vertical load or main load exerted on the truss-type rail **10** by traveling over the rail tubes **12**, **14** by the car arrangement **32** always has a direction which is substantially perpendicular or perpendicular to the rail plane and/or substantially parallel or parallel to the compartment plane of the rail tubes **12**, **14**. In this process, the chord tube **16** is, in the local vertical load direction or main load direction, always located below or behind (in the case of load direction into the seat) the rail plane of the rail tubes **12**, **14**. Furthermore, the chord tube **16** is, in the local vertical load direction or main load direction, always located below or behind (in the case of load direction into the seat) both the one and the other rail tube **12**, **14**. Furthermore, the chord tube **16** is, in the local vertical load direction or main load direction, always located below or behind (in the case of load direction into the seat) and between both rail tubes **12**, **14**.

[0079] In accordance with the invention, a roller coaster arrangement **30** is also provided, which includes a car arrangement **32** and at least one truss-type rail **10**, where the at least one truss-type rail **10** includes the aforescribed rail tube/chord tube arrangement corresponding to the local vertical load direction.

1. A truss-type rail (**10**) for an amusement ride, comprising
 - two rail tubes (**12**, **14**) directly passable with a car arrangement,
 - a non-passable chord tube (**16**), and
 - vertical truss profiles (**18**) which connect the rail tubes (**12**, **14**) and the chord tube (**16**) to one another so that they brace each other and which comprise vertical diagonal profiles (**18a**) which run diagonally between the chord tube (**16**) and the respective rail tube (**12**, **14**) in an alternately ascending and descending manner, wherein in at least one connection area (**20**) of the vertical diagonal profiles (**18a**) on the chord tube (**16**), no additional vertical truss profile (**18**) is connected thereto.
2. The truss-type rail (**10**) according to claim 1, wherein only four vertical diagonal profiles (**18a**) are connected to

the chord tube (16) as vertical truss profiles (18) in the at least one connection area (20).

3. The truss-type rail (10) according to claim 1, wherein in the at least one connection area (20), the connection joints of the vertical diagonal profiles (18a) connected to the chord tube (16) have a respective minimum distance (d) from one another which is always less than three times the diameter of the vertical diagonal profiles (18a) in the connection area (20).

4. The truss-type rail (10) according to claim 1, wherein in a bay section (FA) of the truss-type rail (10) in all connection areas (20) of the vertical diagonal profiles (18a) on the chord tube (16), no additional vertical truss profile (18) is connected thereto in each case.

5. The truss-type rail (10) according to claim 1, wherein in a load bearing section (AA) of the truss-type rail (10) in the connection area (20) of the vertical diagonal profiles (18a) on the chord tube (16) or on the respective rail tube (12, 14), mullion profiles (18b) are provided which run substantially orthogonally between the chord tube (16) and the respective rail tube (12, 14) and are connected directly to the chord tube (16) and to the rail tube (12, 14).

6. The truss-type rail (10) according to claim 1, wherein in a joint section (SA) of the truss-type rail (10) on the respective rail tube (12, 14), no vertical truss profile (18) is connected thereto.

7. The truss-type rail (10) according to claim 1, wherein the vertical diagonal profiles (18a) are connected directly to the chord tube (16) and directly to the rail tube (12, 14).

8. The truss-type rail (10) according to claim 1, wherein in at least one connection area (22) of the vertical diagonal profiles (18a) on the respective rail tube (12, 14), no additional vertical truss profile (18) is connected thereto.

9. The truss-type rail (10) according to claim 1, wherein the rail tubes (12, 14) are connected to one another via horizontal truss profiles (24) so that they brace each other.

10. The truss-type rail (10) according to claim 9, wherein the horizontal truss profiles (24) comprise transverse profiles (24a) which run substantially orthogonally between the rail tubes (12, 14), with the transverse profiles (24a) being connected directly to the rail tubes (12, 14).

11. The truss-type rail (10) according to claim 10, wherein the vertical diagonal profiles (18a) are connected directly to a transverse profile (24a) in the connection area (20) on the respective rail tube (12, 14).

12. The truss-type rail (10) according to claim 1, wherein the horizontal truss profiles (24) comprise horizontal diagonal profiles (24b) which run diagonally between the rail tubes (12, 14) and which are connected directly to at least one transverse profile (24a) near the rail tubes (12, 14).

13. The truss-type rail (10) according to claim 1, wherein the vertical truss profiles (18) are connected or coupled to the rail tubes (12, 14) in use in such a manner that carriage free space for a carriage (33) of the car arrangement (32) is formed on the top, bottom and outside of the rail tube (12, 14).

14. The truss-type rail (10) according to claim 1, wherein the local vertical load exerted on the truss-type rail (10) in use by traveling over the rail tubes (12, 14) by the car arrangement (32) always has a direction which is substantially perpendicular to the rail plane of the rail tubes (12, 14).

15. A roller coaster arrangement (30) comprising a car arrangement (32) and at least one truss-type rail (10) according to claim 1.

16. The roller coaster arrangement (30) according to claim 15, wherein the car arrangement (32) has at least one carriage (33) which encompasses at least one rail tube (12, 14) of the truss-type rail (10) on the top, bottom and outside.

17. The truss-type rail (10) according to claim 12, wherein the horizontal diagonal profiles (24b) are connected directly to two transverse profiles (24a) near the rail tubes (12, 14).

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