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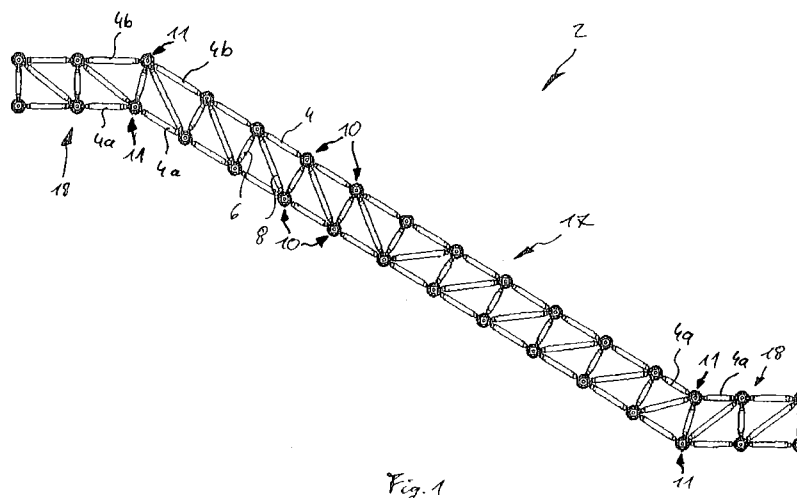


Fig. 1

(57) Abstract: A truss construction (2) for a passenger conveyor comprises a number of truss members (4, 4a, 4b, 6, 8), wherein each of the truss members (4, 4a, 4b, 6, 8) has at least one connection portion which is configured to provide a non-welded connection of the truss member (4, 4a, 4b, 6, 8) with at least one further truss member (4, 4a, 4b, 6, 8).



Truss construction for a passenger conveyor

5 The present invention relates to a passenger conveyor and in particular to a truss construction for a passenger conveyor.

Passenger conveyors are e.g. escalators or moving walkways. Escalators are passenger conveyors that typically carry passengers between landings at different levels in buildings, for example. Moving walkways are usually used to carry passengers along levels extending horizontally or with only slight inclination.

An escalator or moving walkway typically includes a truss construction, balustrades with movable handrails, tread members, e.g. plates, a drive system and a step chain for engaging and propelling the tread members. In an escalator the tread members have the form of steps, while they have the form of pallets in case of a moving walkway. The step chain travels in an endless way between turnaround sections located at an upstream landing and a downstream landing, respectively. The truss construction supports the other components of the conveyor and rests on a basement. The truss construction includes truss sections on lateral sides of the tread members, each truss section generally extending in a vertical plane in the conveying direction. Each truss section has two end sections, the end sections on a respective longitudinal side forming landings, respectively. The end sections of a same lateral side are connected by an inclined or - in case of a moving walkway - generally horizontal midsection. Typically, one of the landings, e.g. in case of an escalator usually the upper landing, houses the drive system or machine of the passenger conveyor positioned between the trusses.

In a common passenger conveyor the truss construction is entirely welded. I.e. all truss members are structural steel profiles, which are connected by welded nodes. The welding operation is either performed manually or automatically by means of welding robots. The required dimensional precision of the entire conveyor truss is achieved by manufacturing support means, i.e. welding tables, assembly and alignment fixtures. All additional components of the conveyor, such as a track system for guiding step chain rollers and/or step rollers, a machine, a balustrade or a handrail drive are attached to the truss by welding or bolting.

The assembly of such a conventional welded truss construction is complex and expensive. Welding the truss in the factory results in a large workpiece which is complicated to transport and to install on site. On-site welding during construction requires knowledge and experience and involves the particular problem of achieving the necessary exactness when mounting the guide rails, as the typical tolerances for the truss are some millimeters, while the typical tolerances for the guide rails are some tenths of a millimeter. The use of welding robots is almost impossible in on-site welding.

It is desirable to provide a truss construction for a passenger conveyor which can be produced and mounted easily with sufficiently high accuracy.

An exemplary embodiment of the invention provides a truss construction for a passenger conveyor with truss members, wherein each of the truss members has at least one connection portion which is configured to provide a non-welded connection of the truss member with at least one further truss member.

The invention also comprises a construction kit for assembling a truss construction without welding and a passenger conveyor including a truss construction as outlined before.

Exemplary embodiments of the invention are described in greater detail below with reference to the accompanying drawings.

Figure 1 shows a schematic side view of a truss construction according to a first embodiment of the invention;

Figures 2 and 3 show enlarged perspective views of a connection element of the truss construction according to the first embodiment of the invention;

Figure 4 shows a perspective view of a connection element of the truss construction according to a second embodiment of the invention;

Figure 5 shows a side view of a connection element of the truss construction according to the second embodiment of the invention;

Figure 6 shows a side view of a connection element of the truss construction according to a third embodiment of the invention;

5 Figure 7 shows a top view of a connection element of the truss construction according to the third embodiment of the invention;

Figure 8 shows a schematic side view of a fourth embodiment of a truss construction according to the invention;

10 Figure 9 shows a sectional view taken along line A-A through the connection portion of two adjacent truss members shown in FIG. 8, according to the fourth embodiment of the invention;

15 Figure 10 shows an alternative embodiment of a connection portion of two adjacent truss members according to the fourth embodiment of the invention;

Figure 11 shows an intermediate state of the assembly of a truss according to the fourth embodiment of the invention;

20 Figure 12 shows an enlarged sectional view of the connection between a truss member and a chord according to the fourth embodiment of the invention.

Figure 1 shows a schematic side view of a truss construction according to a first embodiment of the invention.

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In the following, longitudinal direction of the conveyor is to be understood to specify the conveying direction, lateral direction of the conveyor is to be understood to specify a direction essentially orthogonal to the conveying direction and parallel to the tread surface, and vertical direction is to be understood to specify a direction essentially orthogonal to the plane spanned by the conveying direction and the lateral direction; i.e. substantially orthogonal to the tread surface.

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The truss construction 2 comprises a framework with a plurality of truss members 4, 4a, 4b, 6, 8 connected to connection elements 10, 11. The truss members 4, 4a, 4b, 6, 8 are arranged forming rectangular frame elements with four corners, respectively, wherein a connection element 10, 11 is arranged at every corner of each frame element. Longitudinal truss members 4, 4a, 4b extend in the longitudi-

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nal conveying direction of the truss 2. Transversal members 6 are arranged rectangular to the longitudinal members 4, 4a, 4b in a vertical direction. The ends of the longitudinal members 4, 4a, 4b and of the transversal members 6 are fixed to the connection elements 10, 11, respectively, forming the rectangular frame elements. A diagonal member 8 connects two diagonally opposed connection elements 10, 11 of the rectangular frame element in order to increase the stability of the rectangular frame element.

The truss 2 comprises an inclined middle portion 17 and two horizontal ending portions 18 forming the landing portions of the truss 2. While the longitudinal truss members 4, 4a, 4b of every portion 17, 18 are arranged parallel to each other, the longitudinal members 4, 4a, 4b of the inclined middle portion 17 are angled with respect to the longitudinal members 4, 4a, 4b of the horizontal landing portions 18 at the connection elements 11 forming the transition between the inclined middle portion 17 and the horizontal landing portions 18.

Figs. 2 and 3 show an enlarged perspective view of a connection element 10 according to a first embodiment of the invention.

The connection element 10 comprises a disc 9 with an outer elevated circular rim 11, an elevated circular inner portion 13 and a circular groove 15 formed between the elevated outer rim 11 and the circular inner portion 13. A hole 17 (shown in FIG. 2) is formed in the center of the disc 9 in order to receive the end portion of a horizontal transverse member (not shown in FIGS. 2 and 3), such that the connection element 10 connects two or more truss members (such as longitudinal members 4, vertical transverse members 6, and diagonal members 8) with a horizontal transverse member. The hole 17, however, is not necessary for the function of the disc 9 according to the embodiment.

An exemplary truss member 4 is shown to the left of the disc 9. The exemplary truss member 4 is formed as a hollow profile or tube. A clamp-tube-connector 16 is arranged between the adjoining end of the truss member 4, which in Fig. 2 is the right end of the truss member 4, and the disc 9. On its side facing the truss member 4 the clamp-tube-connector 16 comprises a cylindrical portion and is configured to be fit into the open end of the hollow truss member 4. The clamp-tube-connector 16 may e.g. be fixed to the truss member 4 by press-fitting.

In a further embodiment, which is not shown in Fig. 2, the clamp-tube-connector 16 is additionally secured to the truss member 4 by a bolt or screw, which extends in radial direction through the truss member 4 and the clamp-tube-connector 16, when the clamp-tube-connector 16 is fitted into the truss member 4.

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Alternatively, the clamp-tube-connector 16 may be joined integrally to the truss member 4, e.g. by welding or brazing. This can be done in the factory by forming a prefabricated truss member 4, which already comprises the clamp-tube-connector 16 when it is delivered to the site of construction so that no on-site welding or brazing is necessary for assembling the truss 2.

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Two opposing side portions, e.g. in Fig. 2 the upper and lower side portion, of the clamp-tube-connector 16 at an end opposite to the truss member 4 are flattened. Opposing recesses 16b are formed in the flattened portions for receiving respective parts of a respective clamp shoe 12, which is shown in Figure 2 above and below the clamp-tube-connector 16. The ends of the flattened portions adjacent recesses 16b are elevated with respect to the recesses, as indicated by 16a. On the sides facing a clamp-tube-connector 16 the clamp shoe 12 comprises an elevation 12a and a recess 12b in order to be fitted to one of the recesses 16b formed in the clamp-tube-connector 16 and to the elevated end portion 16a, respectively.

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Each clamp shoe 12 also comprises a second recess 12c and a further elevation 12d to be fitted to the outer rim 11 and the groove 15 of the disc 9, respectively. The clamp shoe 12 further comprises an opening 13 for inserting a screw or a bolt 14 or similar fastening means extending through the clamp shoe 12 and an opposing clamp shoe 12 in order to join two opposing clamp shoes 12. The opening 13 of at least one of the clamp shoes 12 is threaded for fixing the screw or bolt 14 with the clamp shoe 12. Alternatively a nut or splint can be applied to at least one end of the screw or bolt 14.

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In order to fix a truss member 4 to a connection element 10, the clamp-tube-connector 16 is inserted into a hollow end of the truss member 4 and is fixed there, i.e. by press-fitting. Two clamp shoes 12 are arranged opposite to each other with the disc 9 and the flattened end of the clamp-tube-connector 16, which extends from the truss member 4, arranged in between the two opposing clamp shoes 12.

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A screw or threaded bolt 14 is introduced into the openings 13 of the opposing clamp shoes 12. The clamp shoes 12 are pressed to the clamp-tube-connector 16 and to the disc 9, respectively, by tightening the screw or threaded bolt 14. The elevations 12a and 12d of the clamp shoes 12 engage with the corresponding recess 16b of the clamp-tube-connector 16 and the groove 15 of the disc 9, respectively, and the recesses 12b and 12c of the clamp shoes 12 receive the elevated end portions 16a of the clamp-tube connector 16 and the outer rim 11 of disc 9, respectively, providing a form-fit connection between the clamp-tube-connector 16 and the disc 9, as shown in Figure 3.

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Due to the rotational symmetry of the disc 9 the clamp shoes 12 can be fixed to the disc 9 in any arbitrary position along the periphery of the disc 9. Thus, the truss members 4 can be arranged in any desired angled relation to each other. This allows to arrange diagonal truss members 8 in a rectangular frame and to provide the framework 2 with an angle for forming the transition from the inclined middle portion 17 to the horizontal landing portions 18 of the truss 2. It is, however, self-evident that a strict rotational symmetry of the disc 9 is not necessary in order to fulfill this functionality. For example, the disc 9 may have an elliptical shape, as well. A circular disc 9, however, is easier to produce.

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In an alternative embodiment the disc 9 may have a n-fold symmetry with n being a positive integer, especially an integer in the range of 3 to 8. A disc 9 with an n-fold symmetry provides n possible positions for fixing a truss member 4 to the disc 9. As the angle between the different positions are defined by the construction of the disc 9, the assembly of the truss construction 2 is facilitated since no adjustment of the angles is necessary during assembly.

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The disc 9, the clamp shoes 12 and the clamp-tube-connectors 16 forming integral parts of the connection element 10 according to a first embodiment of the invention can be produced easily by milling, machining or casting.

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The first embodiment of the invention provides a truss construction 2 for a passenger conveyor comprising elements, which are easy and inexpensive to produce and which are easy to assemble on-site in order to produce a truss construction 2 with high accuracy without the need of a complex on-site joining process, as e.g. welding. As an example, the truss members 4 can be joined together to form a suitable composite body, if necessary with the aid of further elements like bolts or

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screws for securing the connection. Due to the modular assembly and the flexibility provided by the connection elements 10, a truss construction 2 according to the first embodiment is easy to adjust to different conveyor geometries.

5 The length of the truss members 4, 4a, 4b, 6, 8, can be selected arbitrarily according to the desired geometry of the truss 2. While shorter elements are easier to transport, more connection elements 10, 11 will be needed for a given length of the truss 2 and the assembly is more elaborate if short truss members 4, 4a, 4b, 6, 8 are used. Thus, the advantages of shorter versus longer truss members 4, 4a,
10 4b, 6, 8 have to be weighed up in order to choose the optimal length of the truss members 4, 4a, 4b, 6, 8. Typically the longitudinal truss elements 4 have a length between 1 m and 1,5 m, in particular 1,16 m.

Typically, a number of different type truss members 4, 4a, 4b, 6, 8 will be used,
15 each type of truss member 4, 4a, 4b, 6, 8 having its respective length, e.g. a number of longitudinal truss members 4 of a first length, a number of transversal truss members 6 of a second length and a number of diagonal truss members 8 of a third length. To provide transitions between horizontal and inclined sections of the truss 2, additionally some special truss members 4a, 4b having a specific length
20 may be provided, e.g. longitudinal truss members 4a, 4b having a shorter or longer length than the regular longitudinal truss members 4, respectively.

Fig. 4 shows a perspective view of a connection element 20 according to a second embodiment of the invention. Figure 5 shows the connection element of Figure 4
25 in an on-side view.

The connection elements 20 according to the second embodiment are prefabricated one-piece elements, which are formed as a T-bar with a longitudinal bar 22 and a transversal bar 24 extending orthogonally from a middle portion of the longitudinal bar 22. The connection element 20 further comprises a diagonal bar 26 extending in an angle between 30 and 60 degrees, for example, in the illustrative embodiment, at an angle of 38.6 degrees measured from the longitudinal bar 22
30 between the longitudinal bar 22 and the transversal bar 24.

35 At the ends of each of the bars 22, 24, 26 openings 28 with a hammer head profile are formed. The openings 28 are configured for receiving appropriately correspondingly formed end portion of a corresponding truss member 4, 6, 8 in order to

fix the truss member 4, 6, 8 (not shown) by form-fit to the respective bar 22, 24, 26 of the connection element 20.

5 The truss members 4, 6, 8, are structural steel profiles comprising end portions which are formed with the appropriate profile to form-fit with the respective openings 28 of the bars 22, 24, 26 of the connection elements 20. In an alternative embodiment, which is not shown in the Figures, the openings 28 of the connection elements 20 and the ends of the truss members 4, 6, 8 respectively comprise a
10 dove tail profile or any other profile which is capable of providing a form-fit connection.

In a further embodiment, which is also not shown in the Figures, the truss members 4, 6, 8 may be additionally secured to the respective bars 22, 24, 26 of the connection element 20 by bolts or screws which are plugged through respective
15 openings formed in the bars and the truss members 4, 6, 8, respectively.

It is to be noted that these bolts or screws are not intended to bear any weight, as the weight-bearing connection is provided by the form-fit of the form-fit profiles. Instead, the bolts or screws are intended for securing the truss members 4, 6, 8 from
20 slipping out of the openings 28, especially during the assembly of the truss 2.

The connection elements 20 shown in Figures 4 and 5 have a rectangular profile, however, in an alternative embodiment the connection elements 20 may have a circular or elliptical profile in order to connect truss members 4, 4a, 4b, 6, 8 having
25 a circular or elliptical cross-section. Alternatively, the truss members 4, 4a, 4b, 6, 8 may have an n-fold profile with n being a positive integer, especially an integer in the range of 3 to 8.

The connection elements 20 according to the second embodiment may be made
30 of sheet metal, which is folded and welded in order to form the connection elements 20. Alternatively the connection elements 20 may be made by iron casting or by machining the connection elements 20 from a piece of steel. In all cases the truss members 4, 4a, 4b, 6, 8 may be structured profiles made from sheet material.
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Fig. 6 shows a side-view of a connection element 30 according to a third embodiment of the invention. Fig. 7 shows a top view of a connection element 30, wherein

a first truss member 4 is fixed to the connection element 30 on its left side; a second truss member 4, which is not fixed to the node member 30, is shown to right side of the connection element 30.

5 The connection elements 30 according to the third embodiment are prefabricated connection elements 30 comprising a longitudinal part 32, formed by a hollow profile and a transversal part 36, formed by another hollow profile extending orthogonally from the longitudinal part 32. The connection element 30 further comprises a
10 diagonal part 38 extending in an angle between 30 and 60 degrees, for example, as shown in the illustrative embodiment, at an angle of 38.6 degrees, measured from the longitudinal part 32, between the longitudinal part 32 and the transversal part 36.

15 The transversal part 36 and the diagonal part 38, which are formed as hollow profiles, as well, are joined with the longitudinal part 32 e.g. by welding.

Connection elements 34 are inserted in the openings at the open end faces of the longitudinal part 32, the transversal part 36 and the diagonal part 38, respectively. The connection elements 34 are fixed to the longitudinal part 32, the transversal
20 part 36 and the diagonal part 38 by press-fitting and/or welding. The welding may be done automatically in a factory by robots in order to produce prefabricated connection elements 30 of high quality with very small tolerances.

As shown in the top view of FIG. 7, a female dovetail opening 35 is formed in each
25 of the outer end faces of the connection elements 34 facing away from the respective part 32, 36, 38 of the connection element 30, respectively. Corresponding male dovetail shaped protrusions 37 are formed at the end faces of the truss members 4, 6, 8 in order to be fitted into the female dovetail opening 35 of the respective connection elements 34 providing a form-fit connection.

30 Additional openings 40 extending in radial direction through the connection elements 34 and the respective truss members 4, 6, 8, which are fitted into the connection elements 34, are formed in the dovetail portions 35, 37 of the connection elements 34 and of the truss members 4, 6, 8, respectively. Threaded or non-
35 threaded bolts or screws may be inserted into said openings 40 in order to secure the truss members 4, 6, 8 to the connection elements 34. The bolts or screws may be fixed by threads formed in the openings 40 or by additional threaded nuts or

splints applied to the bolts or screws. Other similar means for fastening truss members 4, 6, 8 to connection elements 34 may also be used.

5 It is to be noted that these bolts or screws are not intended to bear any weight, as the weight-bearing connection is provided by the form fit of the dovetail portion. Instead, the bolts, screws, or other fastening means are intended for securing the truss members 4, 6, 8 from slipping out of the form-fit connection, especially during the assembly of the truss 2.

10 For the assembly of a truss 2 according to the third embodiment of the invention, prefabricated connection elements 30 and truss members 4, 6, 8 are delivered to the construction site and are assembled on site without the need of an on-site joining process like welding. The fabrication of the connection elements 30 and truss members 4, 6, 8 can be done automatically with high quality in the factory. As no
15 welding is needed at the site of construction, a truss 2 of high quality with small tolerances can be assembled easily without the need for well-trained welders on site.

Fig. 8 shows a fourth embodiment of a truss construction 2 according to the invention.

20 The truss construction 2 according to the fourth embodiment is formed by a plurality of prefabricated truss members 42 having a generally triangular geometry. The truss members 42 are profiles made of sheets, which may be made of metal. The sheets may have, in one embodiment, a thickness of less than 2 mm, for example,
25 a thickness of 0,75 to 1 mm.

There are three different types of truss members 42, 44, 46 shown in Fig. 8:

30 1) Standard truss members 42 having the form of isosceles or equilateral triangles for forming the intermediate part of the inclined portion 17 and the landing portions 18, respectively. The side length of the truss members 42 is generally between 1 m and 1,5 m.

35 2) Transition truss members 44 having the form of a triangle with an acute angle at one of its corners for forming the transition between the inclined portion 17 and one of the landing portions 18.

3) End truss members 46 having the form of a triangle with a 90 degree angle at one of its corners for forming the outer ends of the landing zones 18 of the truss 2.

The individual truss members 42, 44, 46 are fixed to each other by connection elements 48, which are shown in Figure 9. The connection elements 48 are introduced into female connecting profiles 50 formed along the edges of the truss members 42, 44, 46.

A chord 52 is fixed to the upper and lower edge of the truss 2 by the same connection elements 48.

In the following the standard truss members 42 will be described in more detail, in particular with respect to the connecting profiles 50. It is to be understood that same considerations apply to the other truss members 44, 46 as well.

Fig. 9 shows a sectional view taken along line A-A through the connection portion of two adjacent truss members 42 shown in Fig. 8. Each truss member 42 comprises an interior portion 43, which is formed by a flat metal sheet. At each of the three edges of the triangular metal sheet forming the interior portion 43 of the truss member 42, a connecting profile 50, which extends in parallel to the respective edge of the truss member 42, is formed comprising a duct with a female dovetail profile.

The interior portion 43 and the connecting profiles 50 may be formed integrally from a single sheet material, e.g. by a roller forming process.

In order to fix two truss members 42 to each other, they are arranged so that the female dovetail profiles lie mirror-inverted opposite to each other. A connection element 48 having a double male dovetail profile is inserted into the opposing female dovetail profiles, fixing the two adjacent truss members 42 to each other by form-fit. The connection element 48 may be made of metal, but as the connection element 48 is not weight bearing and only intended for preventing a lateral shifting of the truss members 42, it may be made of a lightweight material, as e.g. plastic, in order to reduce the weight of the truss 2 and to facilitate its the assembly.

The two opposing connecting profiles 50 form a rectangle or square. Instead of a dovetail profile, any other suitable profile providing a form-fit connecting profile

which is easy to manufacture, e.g. by roller-molding or an extrusion process, may be used. For example, a hammer head profile may be used.

5 Since the connecting profiles 50 are formed symmetrically to the plane of the interior metal sheets 43, forces acting on the connecting profiles 50 are transferred symmetrically to the metal sheets 43 and shear forces, which may bend the metal sheets 43, are avoided. This allows the use of relatively thin metal sheets 43 in order to reduce the weight and the costs of the truss assembly 2.

10 In order to save further weight it is conceivable to use non-continuous thin metal sheets for forming the truss members 42, 44, 46, e.g. perforated sheets. Also, parts of the interior portions 43 may be punched out in order to save material and to reduce the weight.

15 Fig. 10 shows an alternative embodiment of connecting profiles 50 for connecting two adjacent truss members 42.

In the embodiment shown in Fig. 10, the connecting profiles 50 are not formed symmetrically to the plane of the metal sheet forming the inner portion 43 of the truss member 42 as in Fig. 9, but the connecting profiles 50 are formed by folding the respective sheet 43 to one side, only.

25 The functionality of the connecting profiles 50 shown in Fig. 10 is the same as in Fig. 9: Two opposing connecting profiles 50 of adjacent truss members 42 are fixed to each other by a connection element 48 having a double-sided male dovetail profile, which is introduced into the opposing female ducts formed in the opposing profiles 50, respectively. As in the embodiment shown in Fig. 9, the connection element 48 does not bear any weight so that the connection element 48 may be made of a light material, as e.g. plastic.

30 The embodiment shown in Fig. 10 provides a flat plane on one side of the sheets 43 (left side in Fig. 10). A flat plane on the outside of the truss 2 is visually attractive and reduces the risk of injury in case a passenger makes contact with the truss 2. Thus, no external covering is needed for a truss construction 2 according to this embodiment.

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Fig. 11 shows an intermediate state of the assembly of a truss 2 by connecting the triangular truss members 42.

5 Each of the truss members 42 shown in Fig. 11 comprises semicircular formed cutoffs 54 at each of its corners in order to facilitate the introduction of a connection element 48 between two adjacent truss members 42.

10 In a first step, a number of truss members 42 is arranged adjacent to each other, wherein directly neighboring triangular truss members 42 are oriented upside-down with respect to each other.

15 A string-shaped connection member 48 is introduced into the opposing profiles 50 of two adjacent truss members 42, for example, as shown in Figs. 9 and 10, fixing said truss members 42 by a form-fit connection. Further string-shaped connection members 48 are introduced in the open profiles 50 at the upper and lower edge of the truss members 42, respectively.

20 A chord 52 comprising a female dovetail profile on at least one side is pushed over the open male part of the connection member members 48 facing to the upper/lower side of the truss 2, respectively. The application of the chords 52 increases the stability of the truss 2.

25 Figure 12 shows an enlarged sectional view of the connection between a truss member 42 and a chord 52.

30 The chord 52 is made of a sheet of metal having a thickness of generally less than 2 mm which is formed to a rectangular profile. A female dovetail shaped duct is formed on one side of the chord 52. The cord 52 is fixed to a first truss member 42 by a connection member 48 having a double male dovetail shape, which is introduced into the female dovetail shaped duct of the chord 52 and a similar female dovetail shaped duct formed in a connecting profile 50 of a first truss member 42.

35 Similarly a second truss member 42 is fixed to the first truss member 42 by a second connection member 48 which is introduced in opposing connecting profiles of the first and second truss member 42, respectively.

A truss construction for a passenger conveyor comprises a number of truss members, wherein each of the truss members has at least one connection portion which is configured to provide a non-welded connection of the truss member with at least one further truss member. The truss members may be structural profiles.
5 In particular the truss members may be formed from sheet metal, e.g. by roller molding.

The truss members may be bar-like elements, as e.g. struts, and/or may comprise a flat metal sheet portion. In a particular embodiment the metal sheet portion has a
10 triangular shape. Shapes other than triangles are conceivable, as long as it is possible to arrange a plurality of truss members side by side with adjacent edge portions forming a common duct having a profile as described above.

The non-welded connection may be a releasable connection. A releasable connection may be released using simple tools on-site. After being released the truss
15 members may be connected again with each other or with other truss members. The connection may be realized by form-fit, screwing, bolting or clamping or any combination thereof. In particular a form-fit connection may be secured by additional screwing, bolting or clamping.
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The truss members may be connected directly to each other by joining their respective connection portions. Alternatively the truss members may be connected via connection elements, wherein a connection element is arranged between at
25 least two truss members. In case of a releasable connection also the connection elements may be used again after disengagement for providing other connections between other truss members.

A truss construction for a passenger conveyor, comprising a number of truss members, wherein each of the truss members has at least one connection portion
30 which is configured to provide a non-welded connection of the truss member with at least one further truss member, can be assembled easily at the site of construction. As no welding or similar joining process is necessary for the assembly of such a truss construction, there is no need for the work of highly qualified welders at the construction site. The necessary accuracy is achieved by the construction of
35 the truss elements which may be prefabricated in the factory. A releasable connection facilitates the disengagement of the truss in case of maintenance or deconstruction.

In an embodiment the truss construction comprises connection elements which are configured to connect the connecting portions of at least two adjacent truss members. Connection elements facilitate the assembly of the truss and enhance the flexibility of the truss construction. Truss constructions having different shapes can be assembled by combining a restricted number of prefabricated truss members of different kind using the same connection elements. Thus, only a restricted number of different truss members and connection elements has to be prefabricated reducing the fabrication costs.

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In an embodiment the truss members are configured to be connected by form fit connection, screw connection, or by clamping. Form fit provides a connection which can bear heavy loads. A truss can be assembled by simply joining together adjacent truss members, optionally with a connection element. No screwing or bolting may be necessary, which provides for very easy assembling and disassembling.

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Screwing and clamping provide very secure connections. By combining a form fit connection with screwing and/or clamping a very secure connection, which can bear very high loads, can be realized. Assembly can be comparatively easy, and disassembly is still possible.

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In an embodiment the truss members and the connection elements are configured to be connected to each other by a hammer head profile or by a dovetail profile. A hammer head or dovetail profile respectively provides a secure form fit connection which is capable to bear very high loads and which can be manufactured easily.

25

In an embodiment the connection elements have a generally circular symmetry. Connection elements having a circular symmetry allow great flexibility in joining the truss members. In particular, such connection elements allow to adjust the angle between adjacent truss members in a wide range providing much flexibility in the shape of the truss construction.

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In an embodiment each of the connection elements comprises an engagement structure, which is configured to interact with at least one counter-engagement structure of a connection portion of a truss member. Interacting engagement structures enhance the weight-bearing capacity of the connection and thus allow to pro-

35

vide the necessary weight-bearing capacity using only a small amount of material in order to reduce the weight and the costs of the truss.

5 In an embodiment the engagement structure of said connection element is configured to receive a plurality of said counter-engagement structures of said truss members allowing to connect a plurality of truss members with a single connection element.

10 In an embodiment the engagement structure has a generally circular symmetry. In particular the symmetry of the engagement structure may be n -fold, wherein n is a positive integer. In particular embodiments, n is 3, 6 or 8. An n -fold symmetry allows to arrange adjacent truss members in n different positions providing great flexibility for the assembly of the truss. An engagement structure having a circular symmetry provides an infinite number of possible positions.

15

In an embodiment at least one of the connection elements comprises a disc shaped body. A connection element having a disc shaped or cylindrical body provides a great flexibility of arranging the truss members and is easy to produce at low costs.

20

The engagement structure may be adopted to provide a form-fit connection with the counter engagement structure of a truss member, as set out before. In a simple configuration, adjacent truss members may be joined together via the connection element, as the engagement structure of the connection element provides for secure form-fit connection to the truss members.

25

30 In an embodiment the truss construction comprises at least one clamp-on member which is configured to be clamped to a connection element. Clamping provides a very secure and reliable connection. In particular, clamping may be used to secure such a connection, e.g. by form-fit, between an engagement structure of the connection element and the corresponding counter-engagement structure of a truss member.

35 The clamp-on member may comprise two adjacent clamp shoes which are connected by at least one screw. Clamping is done by tightening the screw, thereby moving and pressing the clamp shoes together. Alternatively or additionally, a

spring element may be used for pressing clamp shoes resiliently together and/or to the connection element.

5 In an embodiment the truss members include triangular sheet-like portions. Sheet-like portions enable to provide a plane-like truss construction extending in a plane, in particular in a vertical plane. Forces acting on the truss members are distributed over the plane so that a thinner material may be used for the truss members.

10 In an embodiment the truss members are made of sheet material, e.g. the truss members may be roller-formed profiles made of sheet metal. Roller-forming allows to manufacture a large number of identical truss members fast, easily and at low costs. Other forming techniques may be used instead of roller-forming.

15 In an embodiment the connection elements are shaped to be insertable into a space formed in between two opposing connection portions of two adjacent truss members in order to connect said truss members. Insertable connection elements allow an easy assembly of the truss. In particular, truss members may be arranged in the desired positions in a first step and then fixed to each other by inserting connection members in a second step without the need of moving the truss members
20 from their desired positions. Typically the direction of insertion of the assembling elements will be in a plane orthogonal to the direction into which the truss members extend.

25 In an embodiment a chord may be fixed to a top and/or to a bottom portion of the truss by the connection elements. Such chords fixed to top and/or bottom portions of the truss increase the stability of the truss and provide a secure termination of the truss covering possible sharp edges of the truss members in order to avoid the risk of injury for passengers and/or workers making contact with the truss.

30 The invention is also related to a construction kit for assembling a truss construction according to any of the preceding claims, the kit comprising truss members having at least one connection portion which is configured to provide a non-welded connection of the truss member with at least one further truss member.

35 Such a construction kit comprising a restricted number of different prefabricated truss member elements may be prefabricated in the factory and enables the assembly of truss constructions having very different shapes on-site. The prefabrica-

tion of the standardized members is not related to the specific truss to be assembled and can therefore be highly automated using an assembly line, reducing the costs of production considerably.

- 5 In an embodiment the kit further comprises connection elements which are configured to connect the connecting portions of at least two adjacent truss members. The use of connection elements increases the flexibility of the truss assembly allowing to build a large number of different truss designs from a limited number of different elements.

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The invention is also related to a people conveyor having a truss construction according to any of the preceding claims. Such a people conveyor is cheap as only prefabricated standard elements are used for assembling the truss; and it is easy to assemble as no on-site welding is necessary.

Claims

1. Truss construction (2) for a passenger conveyor comprising a number of truss members (4, 4a, 4b, 6, 8, 42), wherein each of the truss members (4, 4a, 4b, 6, 8, 42) has at least one connection portion (16, 37, 50) which is configured to provide a non-welded connection of the truss member (4, 4a, 4b, 6, 8, 42) with at least one further truss member (4, 4a, 4b, 6, 8, 42).
2. Truss construction (2) as claimed in claim 1, further comprising connection elements (10, 20, 30, 48) configured to connect the connecting portions (16, 37, 50) of at least two adjacent truss members (4, 4a, 4b, 6, 8, 42).
3. Truss construction (2) as claimed in claim 1 or 2, wherein the truss members (4, 4a, 4b, 6, 8, 42) are configured to be connected by at least one of form fit connection, screwing connection, and clamping.
4. Truss construction as claimed in claim 3, wherein the truss construction (2) comprises at least one clamping member (12) which is configured to be clamped to a connection element (10).
5. Truss construction (2) as claimed in claim 3 or 4, wherein the truss members (4, 4a, 4b, 6, 8, 42) and the connection elements (20, 30, 48) are configured to be connected to each other by a hammer head or by a dovetail profile.
6. Truss construction as claimed in any of the claims 2 to 5, wherein each of the connection elements (10, 20, 30, 48) comprises an engagement structure (35), which is configured to interact with at least one counter-engagement structure (37) of a connection portion of a truss member (4, 4a, 4b, 6, 8, 42).
7. Truss construction as claimed in claim 6, wherein the engagement structure is configured to receive a plurality of said counter-engagement structures of said truss members (4, 4a, 4b, 6, 8, 42).
8. Truss construction as claimed in claim 6 or claim 7, wherein the engagement structure has a generally circular symmetry.

9. Truss construction as claimed in any of the claims 6 to 8, wherein at least one of the connection (10) elements comprises a disc shaped body (9).
- 5 10. Truss construction as claimed in any of claims 1 to 7, wherein at least some of the truss members (42) include triangular sheet-like portions (43).
- 10 11. Truss construction as claimed in any of the preceding claims, wherein at least some of the truss members (42) are roll-formed profiles made of sheet metal.
12. Truss construction as claimed in any of claims 2 to 11, wherein the connection elements (48) are shaped such as to be insertable into a space formed in between two opposing connection portions (50) of two adjacent truss members (42) in order to connect said truss members (42).
- 15 13. Truss construction as claimed in any of the claims 2 to 12, wherein a chord (52) is fixed to a top and/or bottom portion of the truss (2) by at least one connection element (48).
- 20 14. Construction kit for assembling a truss construction (2) according to any of the preceding claims, the kit comprising:
truss members (4, 4a, 4b, 6, 8, 42), having at least one connection portion (16, 37, 50) which is configured to provide a non-welded connection of the truss member (4, 4a, 4b, 6, 8, 42) with at least one further truss member (4, 4a, 4b, 6, 8, 42).
- 25 15. Construction kit according to claim 14 further comprising connection elements (10, 20, 30, 48) which are configured to connect the connecting portions of at least two adjacent truss members (4, 4a, 4b, 6, 8, 42).
- 30 16. People conveyor having a truss construction according to any of the preceding claims.

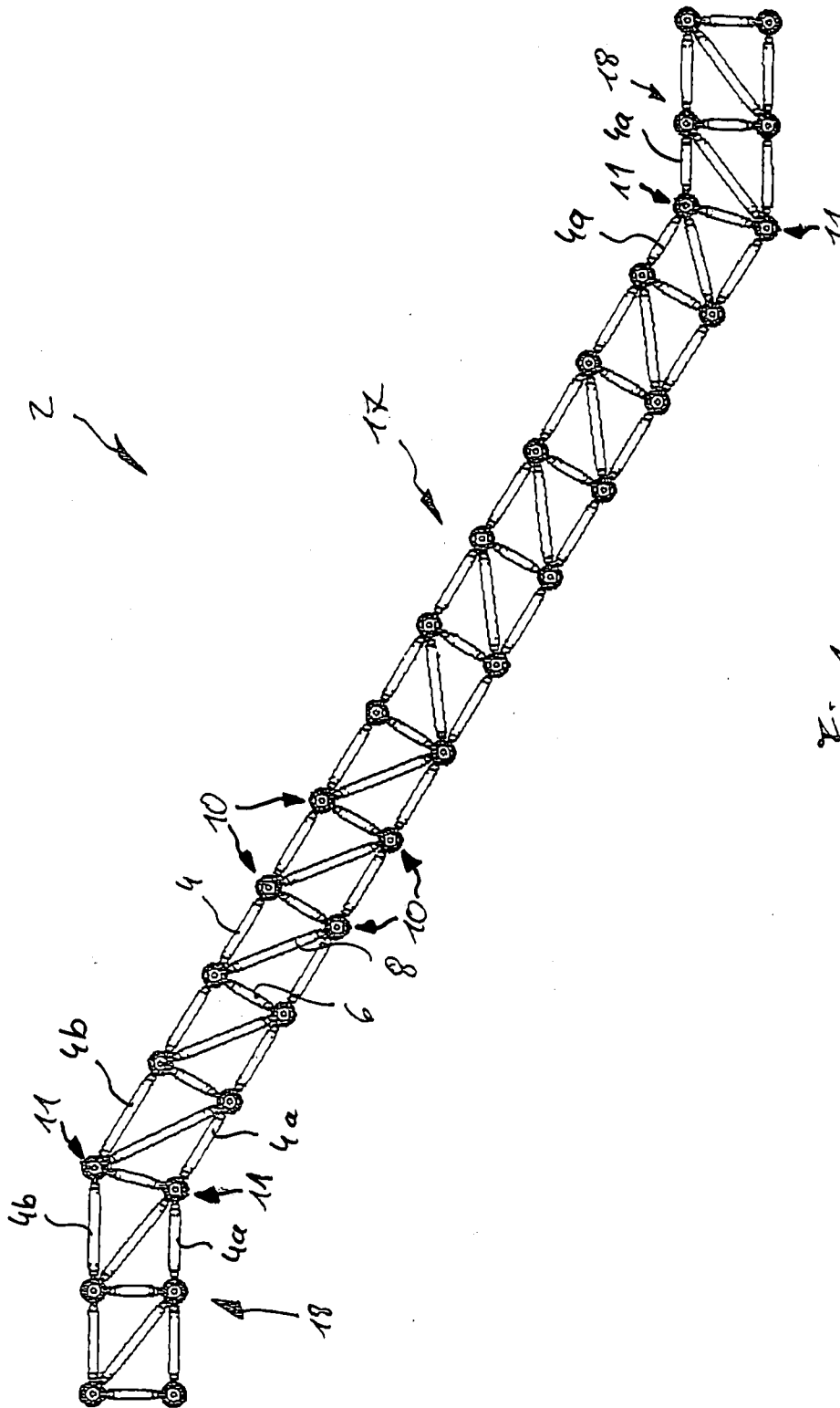


Fig. 1

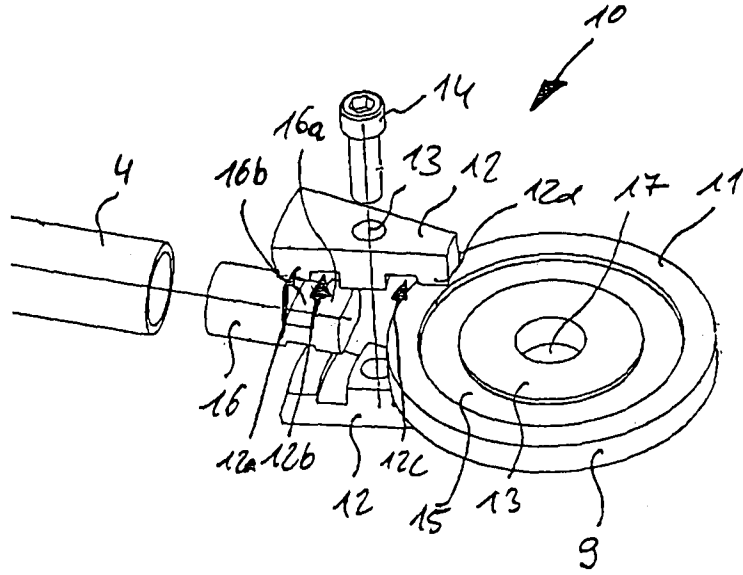


Fig. 2

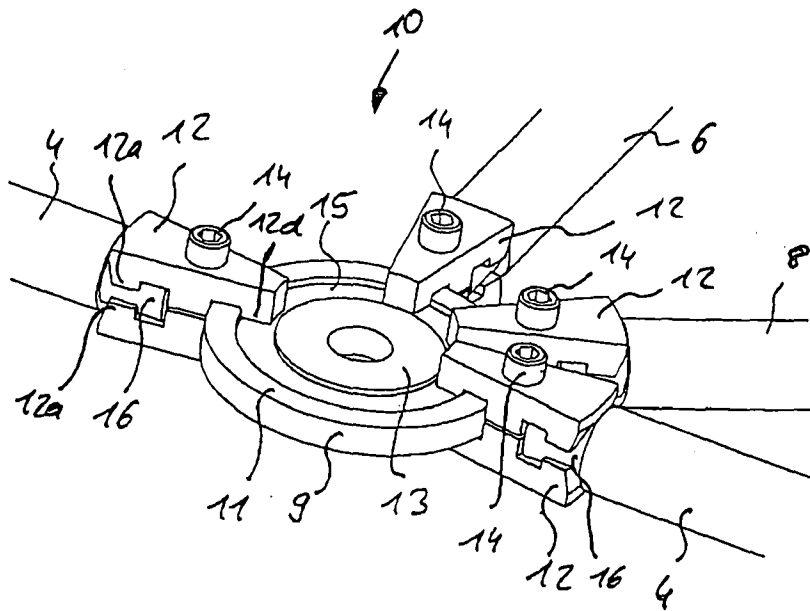
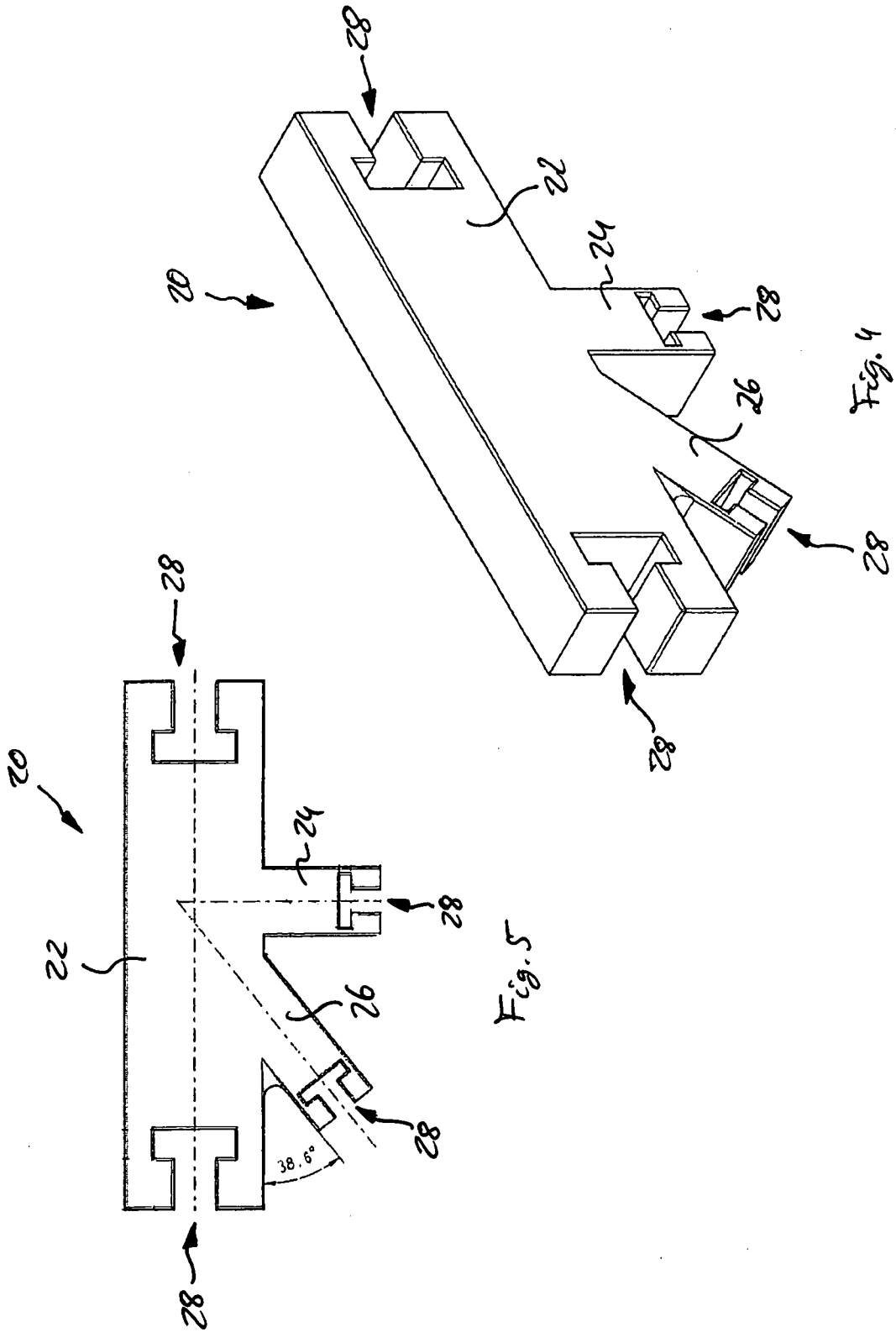
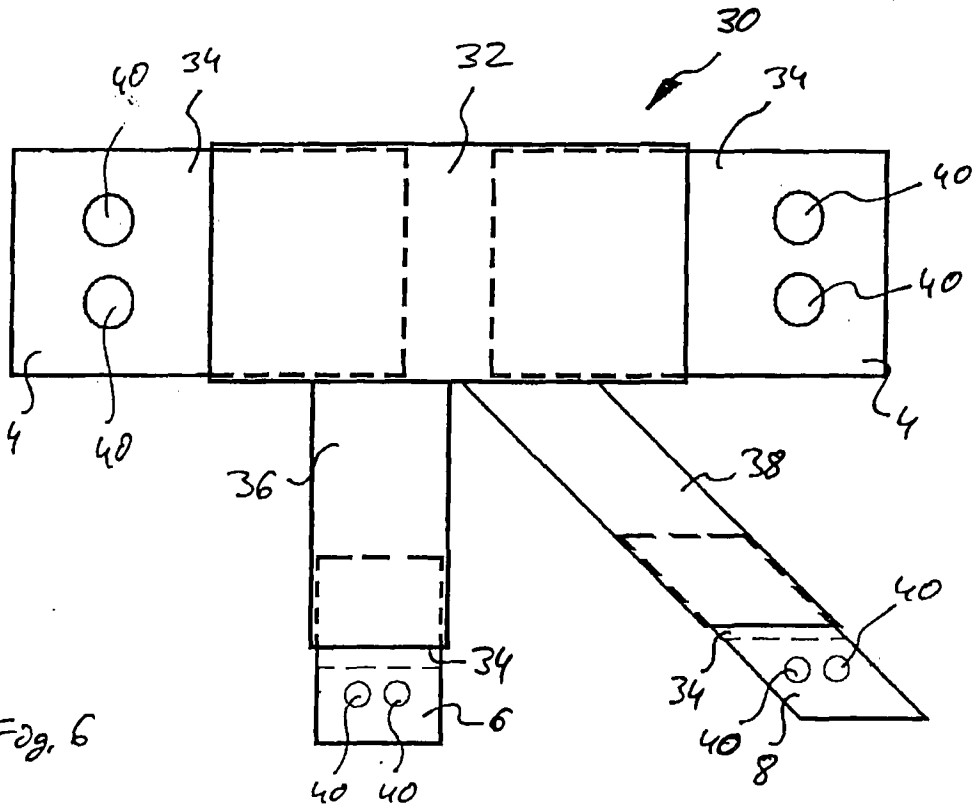


Fig. 3





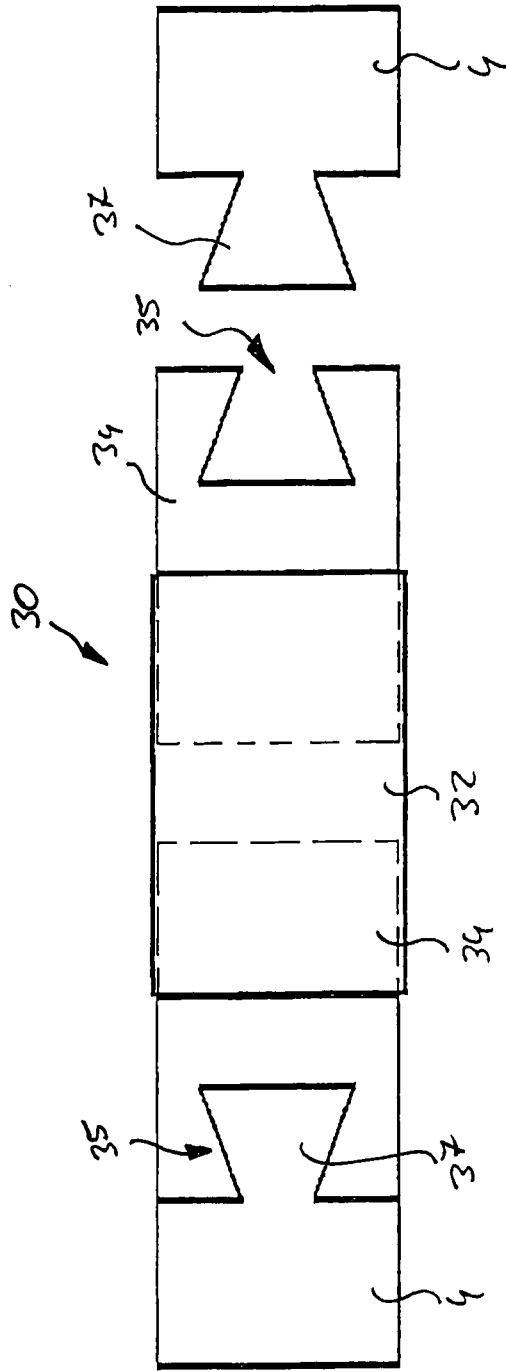


Fig. 7

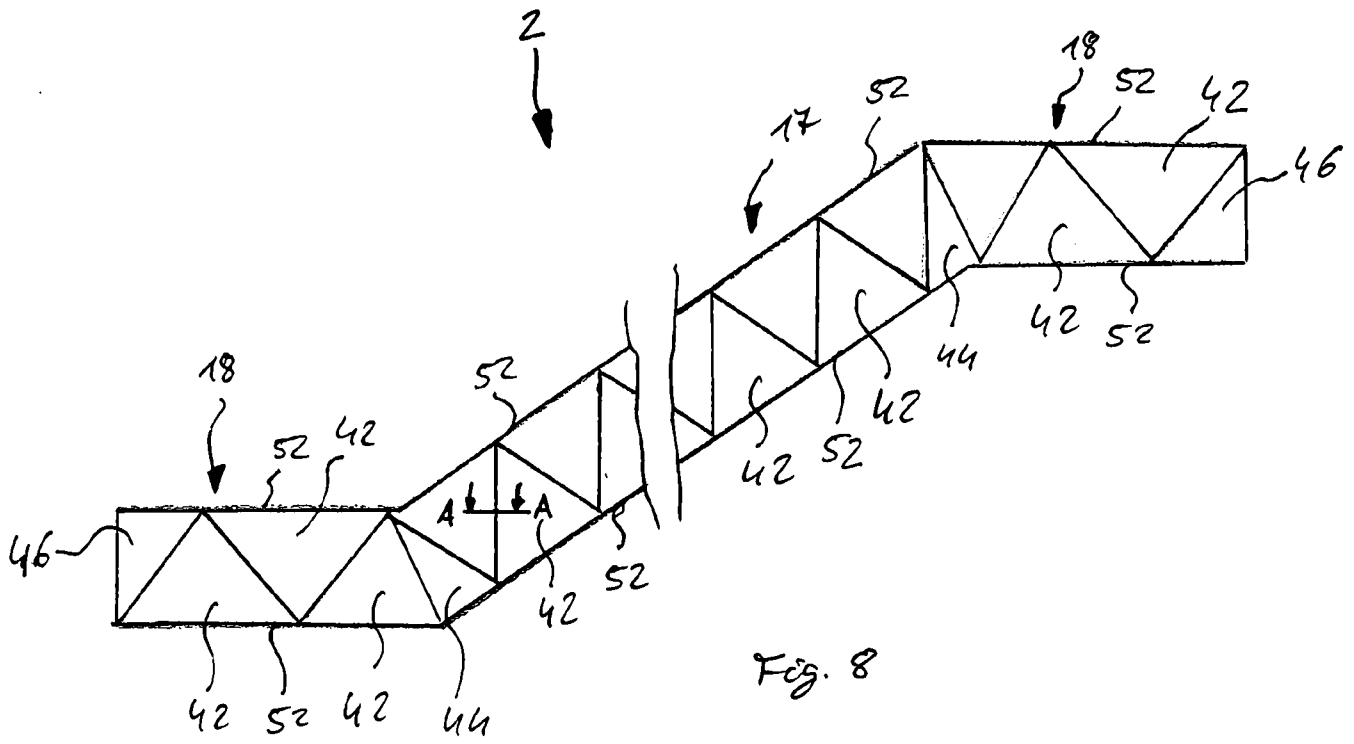


Fig. 8

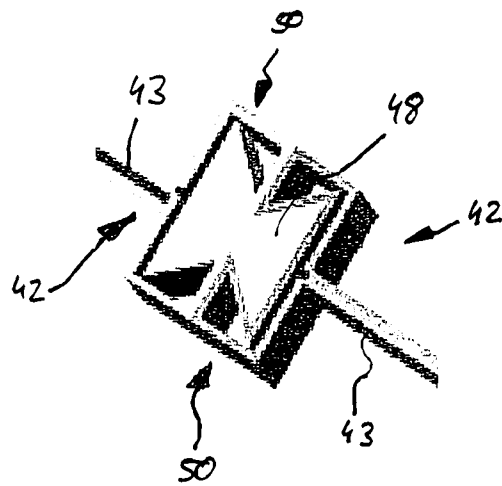


Fig. 9

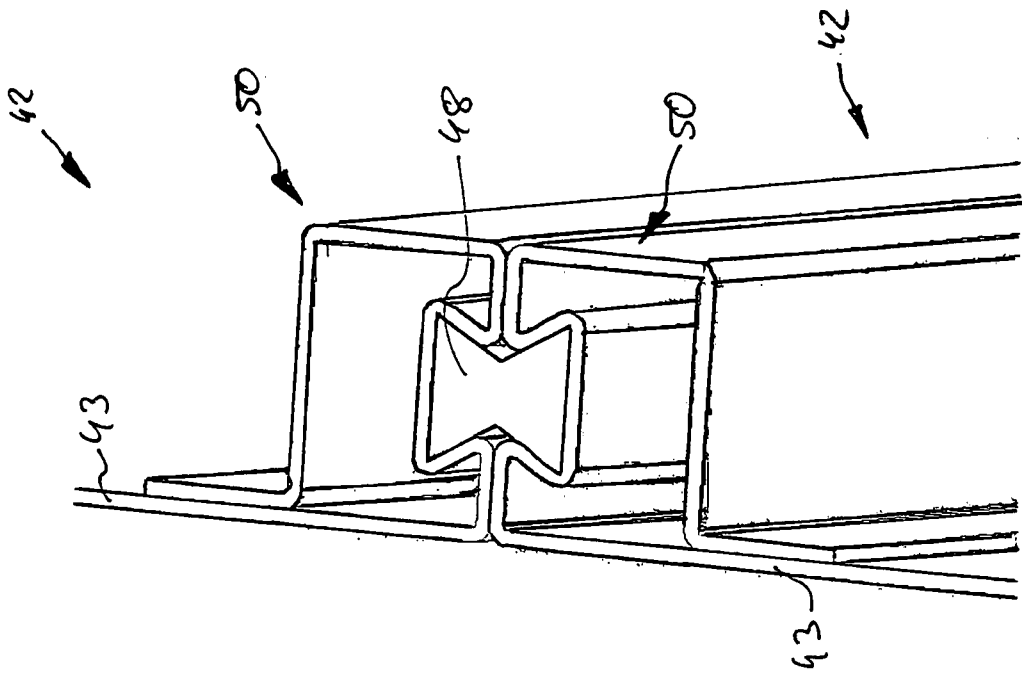


Fig. 10

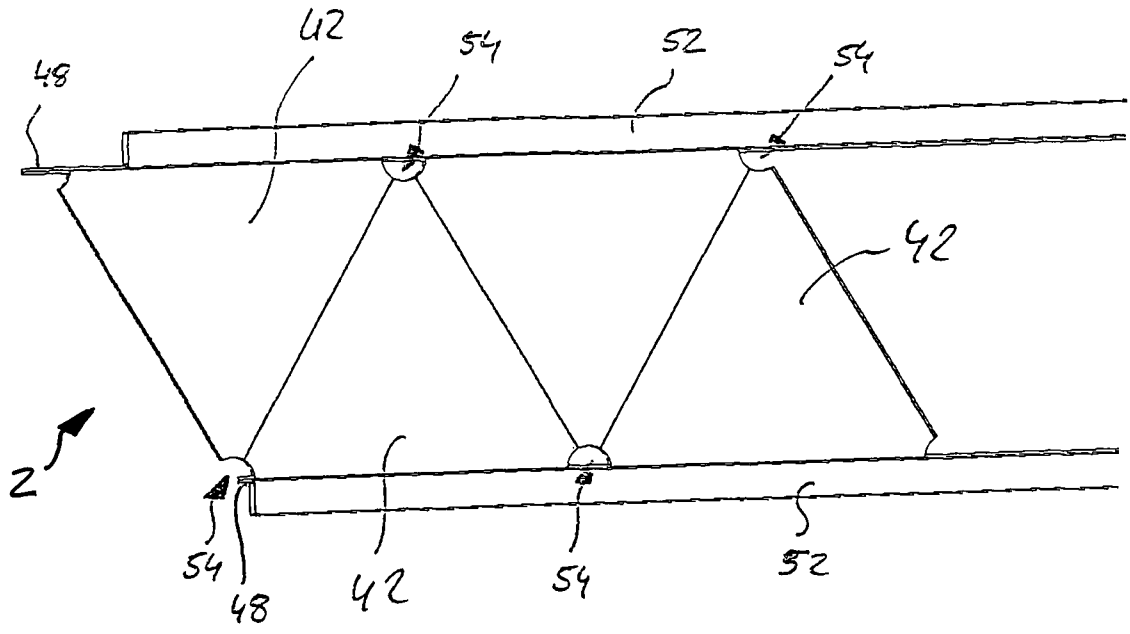


Fig. 11

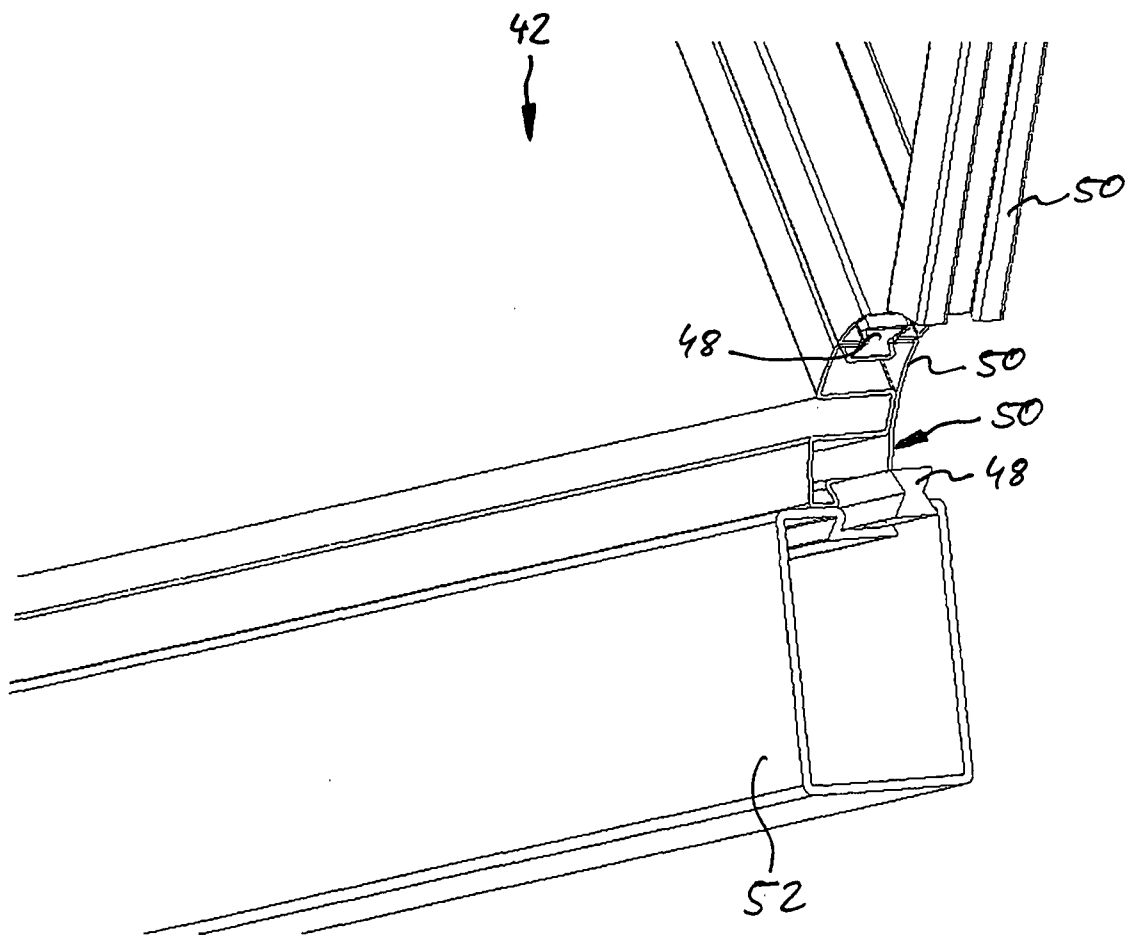

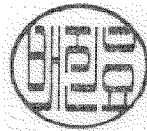


Fig. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2009/007758

| A. CLASSIFICATION OF SUBJECT MATTER | | |
|--|---|--|
| <i>B66B 23/00(2006.01)i</i> | | |
| According to International Patent Classification (IPC) or to both national classification and IPC | | |
| B. FIELDS SEARCHED | | |
| Minimum documentation searched (classification system followed by classification symbols) B66B 23/00; E04B 1/32; E04B 1/19 | | |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Korean utility models and applications for utility models Japanese utility models and applications for utility models | | |
| Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) eKOMPASS(KIPO internal) & Keywords: beam, truss, clamp, non-welding | | |
| C. DOCUMENTS CONSIDERED TO BE RELEVANT | | |
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| X | JP 09-111867 A (NIPPON LIGHT METAL CO., LTD.) 28 April 1997 See paragraphs 21-30; claim 1 and figures 3-6. | 1-4,14-15 |
| A | EP 0346536 A1 (KUMCHER, FELIPE) 20 December 1989 See column 6, lines 29- 54; claim 1 and figures 1&2. | 1-4,14-15 |
| A | JP 03575200 B2 (NIPPON LIGHT METAL CO., LTD.) 16 July 2004 See paragraphs 3-5; claim 1 and figure 20. | 1-4,14-15 |
| A | WO 01-004430 A1 (REYNOLDS, GLENN, A.) 18 January 2001 see page 5, lines 1-30; claim 1 and figure 4. | 1-4,14-15 |
| <input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex. | | |
| * Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family | | |
| Date of the actual completion of the international search 06 SEPTEMBER 2010 (06.09.2010) | | Date of mailing of the international search report 06 SEPTEMBER 2010 (06.09.2010) |
| Name and mailing address of the ISA/KR  Korean Intellectual Property Office Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140 | | Authorized officer BAE Jin Hyo Telephone No. 82-42-481-8426  |

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2009/007758**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: 7,16
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

Claims 7 and 16 are unclear since the claims refer to multiple dependent claims.

3. Claims Nos.: 5,6,8-13
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/IB2009/007758

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|--|------------------|-------------------------|------------------|
| JP 09-111867 A | 28.04.1997 | None | |
| EP 0346536 A1 | 20.12.1989 | None | |
| JP 03575200 B2 | 16.07.2004 | JP 10-169006 A | 23.06.1998 |
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| | | DE 69930635 D1 | 18.05.2006 |
| | | DE 69930635 T2 | 14.12.2006 |
| | | EP 1200683 A1 | 02.05.2002 |
| | | EP 1200683 B1 | 29.03.2006 |
| | | ES 2262329 T3 | 16.11.2006 |
| | | JP 2003-504540 A | 04.02.2003 |