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(54) **GUIDING STRUCTURE FOR A PRINT HEAD CARRIAGE**

(57) A guiding structure for a print head carriage comprises a sheet material panel assembly incorporating a carrier panel provided on one side with at least one array of mounting bodies, the array of mounting bodies oriented to extend in a first dimension of the carrier panel and providing an aggregate of mutually aligned reference faces facing a surface of a guide rail mounted on the mount-

ing bodies. The guiding structure further comprises an array of stiffening members positioned on an opposite side of the carrier panel with respect to the array of mounting bodies, each stiffening member arranged extending in a second dimension of the carrier panel, wherein each mounting body is lockingly held in place relative to the carrier panel by a respective stiffening member.

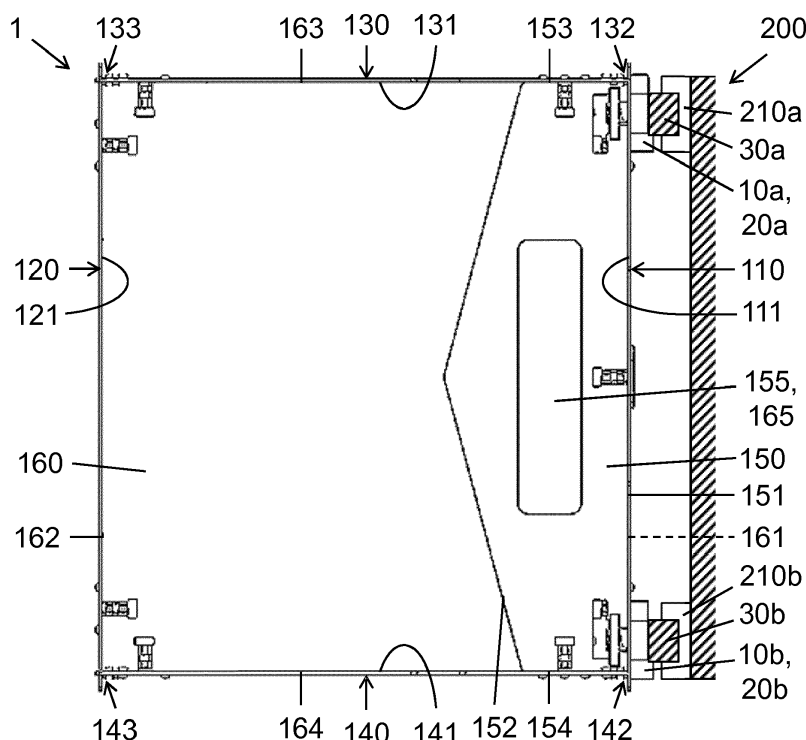


Fig. 3

## Description

### FIELD OF THE INVENTION

**[0001]** The present invention relates to a guiding structure for a print head carriage, and to a method for manufacturing such a guiding structure.

### BACKGROUND ART

**[0002]** A scanning-type inkjet printing system comprises an inkjet print head mounted on a carriage arranged to make a scanning motion in a certain direction while guided by a guiding structure, to deposit swaths of ink droplets onto a recording medium moving relative to the guiding structure in a direction normal to the direction of the scanning motion so that multiple swaths of ink droplets can be deposited side by side onto the recording medium in order for the multiple swaths of ink droplets to form a complete printed image.

**[0003]** A known guiding structure for guiding a print head carriage making a scanning motion relative to a recording medium comprises an extruded aluminum beam, stiff enough to be supported at two ends while carrying a print head carriage moving along the beam in between the two ends, wherein the beam is dimensioned to minimally deflect under the weight of the carriage. An outer surface of the beam is accurately shaped to provide a reference surface for interacting with a bearing device provided on the carriage, so that the carriage is configured to move along the beam in the axial direction with only little motion in the transverse directions resulting from inaccuracies in the guidance.

**[0004]** A guiding structure as described is relatively heavy. Especially for wider printing systems, the mass of the beam is negatively impacted by the transverse dimensions required to keep a center deflection of the beam at a minimum. Especially in a printing system in which the guiding structure is driven to move relative to a recording medium in between the deposition of a first swath of ink droplets and a second swath, the weight of a beam as described will be an issue. Also, especially for wider printing systems, a beam as described is relatively difficult to manufacture in case the outer surface is to be accurately shaped along a substantial part of the beam, or in case the beam is to be sufficiently straight, so that the carriage will follow a straight path.

**[0005]** An objective of the present application is to provide a guiding structure for guiding a print head carriage making a scanning motion in a certain direction relative to a recording medium, which guiding structure is relatively light-weight, and which can relatively cheaply and relatively easily be manufactured, while still allowing a carriage to follow an accurately defined path, guided by the guiding structure.

## SUMMARY OF THE INVENTION

**[0006]** According to an aspect of the invention, a guiding structure for guiding a print head carriage comprises an assembly of panels of sheet material, incorporating a carrier panel provided on one side with at least one array of mounting bodies, the array of mounting bodies oriented to extend in a first dimension of the carrier panel and providing an aggregate of mutually aligned reference faces facing a surface of a guide rail mounted on the mounting bodies, the guiding structure further comprising an array of stiffening members positioned on an opposite side of the carrier panel with respect to the array of mounting bodies, each stiffening member arranged extending in a second dimension of the carrier panel, wherein each mounting body is lockingly held in place relative to the carrier panel by a respective stiffening member.

**[0007]** An assembly of panels of sheet material provides a relatively light-weight structure for carrying the array of mounting bodies, while still providing for enough stiffness for the guide rail to remain sufficiently straight under the influence of torsional and bending loads exerted onto the structure by a print head carriage carried by the guide rail.

**[0008]** A mounting body being lockingly held in place relative to the carrier panel by a respective stiffening member assures that the mounting body and the stiffening member are each tightly held against the carrier panel. The stiffening member being tightly held opposite the mounting body assures that the stiffening member prevents the panel assembly from locally deflecting under the influence of a load exerted on the carrier panel by the mounting body. The mounting body being tightly held opposite the stiffening member assures that the mounting body is held against a portion of the panel assembly which is kept in a prescribed shape, so that a reference face provided by the mounting body is kept aligned with the reference faces provided by neighboring mounting bodies. This, in turn, assures that the guide rail is kept sufficiently straight.

**[0009]** The panel assembly may comprise one or more further panels forming the side walls of a beam together with the carrier panel, wherein a respective stiffening member connects the carrier panel to at least one further panel. This allows for the further panel to act as a support for the stiffening member, enabling the stiffening member to transfer loads acting to deflect the carrier panel away from the carrier panel towards the further panel.

**[0010]** Preferably, a respective stiffening member has one side abutting the carrier panel and another side abutting the further panel. The stiffening member may then keep the carrier panel and the further panel in a certain orientation with respect to each other as a result of its shape.

**[0011]** Preferably, a respective stiffening member comprises a panel of sheet material incorporated in the panel assembly. A stiffening member in the form of a panel of sheet material can be relatively light-weight,

while still being able to provide sufficient stiffness to prevent the carrier panel from locally deflecting by transferring a load from the carrier panel to a further panel.

**[0012]** The panel assembly may comprise additional panels of sheet material positioned in between neighboring stiffening members. Then, the stiffening members can remain relatively small and light-weight, specifically formed to provide stiffness to the carrier plate, while the additional panels may larger and heavier, specifically formed and positioned to provide bending or torsional stiffness to the panel assembly as a whole.

**[0013]** A mounting body may be connected to a respective stiffening member via an associated threaded end extending through a designated aperture in the carrier panel, engaged with a threaded hole associated with the stiffening member. This enables the mounting body to be mounted onto the panel assembly via a screwing operation, wherein the stiffening member at the same time is pulled tight against the carrier panel.

**[0014]** A respective stiffening member may comprise an accommodation space accommodating a nut member provided with the threaded hole. This allows for the stiffening member to have a relatively simple form and be relatively light-weight, without the threaded hole needing to be formed in the stiffening member itself.

**[0015]** An array of at least two neighboring stiffening members may accommodate a common nut member provided with a plurality of threaded holes. This enables a nut member to remain in position relative to a respective stiffening member when a threaded end is screwed into one of the threaded holes.

**[0016]** An outer contour of a respective nut member may have a recess accommodating a portion of a stiffening member, in order for the nut member to be secured at least in a certain direction with respect to the stiffening member.

**[0017]** Preferably, the panel assembly comprises flat panels connected at a face-to-edge joint. This provides for a relatively light-weight structure, which can be manufactured at a tolerance defined by the accuracy at which the flat panels can be cut out of a larger portion of sheet material.

**[0018]** In an embodiment, one panel of two panels connected at a face-to-edge joint may have an aperture passing a connecting member in a direction normal to a face of the one panel, the other panel having a receiving channel for receiving the connecting member, extending in a direction normal to an edge of the other panel. This provides for a relatively simple way of connecting two panels.

**[0019]** Furthermore, one of two panels connected at a face-to-edge joint may have at least two further apertures spaced apart in a certain direction, the other panel having at least two ears each accommodated in one of the further apertures. This facilitates a panel having an edge destined for contacting a face of another panel to be properly aligned relative to the other panel before the two panels are connected.

**[0020]** A respective stiffening member may have an

opening for passing a drive belt for driving a print head carriage to move along the guide rail. Having such an opening, a stiffening member can be relatively stiff by extending on opposite sides of a drive belt passing through the panel assembly, and also be relatively light-weight.

**[0021]** The mutually aligned reference faces may comprise collectively machined surfaces, so that the reference surfaces have a relatively high accuracy of mutual alignment.

**[0022]** According to another aspect of the invention, a method for manufacturing a guiding structure for a print head carriage comprises the steps of providing a carrier panel to form part of a panel assembly; providing an array of mother bodies on one side of the carrier panel; providing an array of stiffening members on the opposite side of the carrier panel; mutually locking a respective mother body and a respective stiffening member in place relative to the carrier panel; collectively machining the array of mother bodies to form an array of mounting bodies each providing a machined reference face, and mounting a guide rail on the mounting bodies such that the reference faces face a surface of the guide rail. This method provides a relatively light-weight structure which can be relatively cheaply manufactured, carrying a guide rail which is relatively accurately aligned to define a path to be followed by a print head carriage.

## BRIEF DESCRIPTION OF DRAWINGS

**[0023]** Other objects, features, and advantages of the present invention will become more apparent from the following detailed description when read in conjunction with the accompanying drawings, in which:

Figure 1 is a perspective view of a guiding structure according to the invention;

Figure 2 is a perspective view showing certain parts of the guiding structure of Figure 1 in detail;

Figure 3 is a full transverse cross-sectional view of the guiding structure of Figure 1;

Figure 4 is a transverse cross-sectional view showing certain parts of the cross section shown in Figure 3 in more detail, and

Figure 5 is again a perspective view showing certain parts of the guiding structure of Figure 1 in detail.

## DETAILED DESCRIPTION OF EMBODIMENTS

**[0024]** With reference to Figure 1, a guiding structure 1 for guiding a print head carriage to follow a straight path while performing a scanning motion for depositing a swath of ink droplets onto a recording medium comprises an assembly 100 of panels of sheet material 110, 120, 130, 140, 150, 160.

**[0025]** In the shown example, the panel assembly 100 comprises a front side panel 110, a back side panel 120, a top side panel 130, and a bottom side panel 140. The

side panels 110, 120, 130, 140 are arranged to form a hollow beam 101 of rectangular, in particular substantially square cross section, wherein each side panel 110, 120, 130, 140 forms a respective side wall of the beam 101.

**[0026]** With the beam 101 oriented to extend in a longitudinal direction Y, the beam 101 has a certain bending stiffness limiting the deflection of the beam 101 in two transverse directions X, Z normal to the longitudinal direction Y, and a certain torsional stiffness limiting torsion of the beam 101 about an axis extending in parallel to the longitudinal direction Y.

**[0027]** In addition to the side panels 110, 120, 130, 140, each oriented to extend in the longitudinal direction Y and one of the transverse directions X, Z, the panel assembly 100 further comprises additional panels of sheet material 150, 160, oriented to extend in the transverse directions X, Z. These additional panels 150, 160 are mutually spaced apart, being positioned at different locations along the beam 101 within the space enclosed by the side panels 110, 120, 130, 140.

**[0028]** As will be explained below, the edges of certain additional panels 160, mutually spaced apart at relatively long distances, are each positioned abutting a face of one of the side panels 110, 120, 130, 140, wherein each additional panel 160 is connected to a respective side panel 110, 120, 130, 140 via each of its edges, at a joint of a respective edge with a respective face. As a result, each additional panel 160 of this first type acts as a member reinforcing the structure formed by the side walls 110, 120, 130, 140, so that the beam 101, incorporating the additional panels 160 of this type, is relatively stiff with respect to both bending and torsion.

**[0029]** As will also be explained below, other additional panels 150, mutually spaced apart at shorter distances, only have some of their edges positioned abutting a face of one of the side panels 110, 120, 130, 140, wherein an additional panel 150 of this second type is connected to a respective side panel 110, 120, 130, 140 via only those edges, at a joint of a respective edge with a respective face.

**[0030]** The additional panels 150, 160 of each type are equidistantly spaced along the beam 101, wherein each additional panel 160 of the first type is positioned in between two neighboring panels 150 of the second type.

**[0031]** In accordance with a main aspect of the invention, the front side panel 110 incorporated in the panel assembly 100 serves as a carrier panel for carrying a pair of guide rails. To that end, on the outside of the beam 101, the front side panel 110 is provided with two arrays 10a, 10b of mounting bodies 20a, 20b, each oriented to extend in the longitudinal direction Y. An upper array 10a is located close to a joint of the front side panel 110 with the top side panel 130, and a lower array 10b is located close to a joint of the front side panel 110 with the bottom side panel 140.

**[0032]** In further accordance with a main aspect of the invention, the guiding structure 1 comprises an array 40

of stiffening members 150 positioned on an opposite side of the front side panel 110 with respect to the arrays 10a, 10b of mounting bodies 20a, 20b, wherein each mounting body 20a, 20b is lockingly held in place relative to the front side panel 110 by a respective stiffening member 150. In the shown embodiment, each stiffening member 150 is formed by one of the additional panels 150 of the second type.

**[0033]** With reference to Figure 2, showing a portion of the array 40 of stiffening members 150 each carrying one mounting body 20a from the upper array 10a and one mounting body 20b from the lower array 10b, the arrays 10a, 10b of mounting bodies 20a, 20b each provide an aggregate 11a, 11b of mutually aligned reference faces 21, 22. In the shown example, each mounting body 20a, 20b provides one reference face 21 which is horizontally oriented, and one reference face 22 which is vertically oriented.

**[0034]** With reference to Figure 3, an upper guide rail 30a is mounted on the mounting bodies 20a of the upper array 10a, and a lower guide rail 30b is mounted on the mounting bodies 20b of the lower array 10b. Each guide rail 30a, 30b serves to carry a respective runner block 210a, 210b of a print head carriage 200, slidable along the respective guide rail 30a, 30b in the longitudinal direction Y.

**[0035]** With further reference to Figure 3, each additional panel 160 forming a reinforcing member 160 has four edges 161, 162, 163, 164, each positioned abutting an inner face 111, 121, 131, 141 of one of the side panels 110, 120, 130, 140. At the joint of an edge 161, 162, 163, 164 with a respective face 111, 121, 131, 141, the reinforcing panel 160 is connected to the respective side panel 110, 120, 130, 140. The reinforcing panel 160 thus interconnects all side panels 110, 120, 130, 140.

**[0036]** Each additional panel 150 forming a stiffening member 160 has three edges 151, 153, 154, each positioned abutting an inner face 111, 131, 141 of one of the front side panel 110, the top side panel 130, and the bottom side panel 140. At the joint of an edge 151, 153, 154 with a respective face 111, 131, 141, the stiffening panel 150 is connected to the respective side panel 110, 130, 140. The stiffening panel 150 thus interconnects only the front side panel 110, the top side panel 130, and the bottom side panel 140. A fourth edge 152 of the stiffening panel 150 is positioned at a distance from the inner face 121 of the back side panel 120.

**[0037]** It is noted that in the shown embodiment, respective front side edges 132, 142 of the top side panel 130 and the bottom side panel 140 abut the inner face 111 of the front side panel 110, and respective back side edges 133, 143 of the top side panel 130 and the bottom side panel 140 abut the inner face 121 of the back side panel 120.

**[0038]** As further shown in Figure 3, each reinforcing panel 160 and each stiffening panel 150 has a respective opening 155, 165 for passing a loop portion of a continuous drive belt for driving the print head carriage 200 to

move along the guide rails 30a, 30b.

**[0039]** With reference to Figure 4, showing part of the cross section of Figure 3 in more detail, each reference face 21, 22 provided by a respective mounting body 20a serves to face a surface 31, 32 of a respective guide rail 30a mounted on the mounting body 20a. With reference also to Figure 5, the guide rail 30a may be held fixed on the reference faces 21, 22 by a bolt 33 extending through a designated aperture in the guide rail 30a, engaging with a threaded hole 23 provided in the mounting body 20a.

**[0040]** With further reference to Figure 4, a mechanism 24, 50 for connecting a stiffening panel 150 to a respective mounting body 20a such that the mounting body 20a is held in place relative to the front side panel 110 by the stiffening panel 150 comprises a threaded end 24 associated with the mounting body 20a, protruding through a designated aperture in the front side panel 110, engaging a threaded hole 51 of a nut plate 50 accommodated in a space 156 provided in the stiffening panel 150. In the shown example, the threaded end 24 forms an integral part of a respective mounting body 20a.

**[0041]** With reference also to Figure 5, the nut plate 50 may be provided with a plurality of threaded holes 51, wherein different portions of the nut plate 50 are accommodated in different stiffening panels 150. With further reference to Figure 5, an outer contour of a nut plate 50 may have one or more recesses 52a, 52b accommodating a portion of a stiffening member 150 for securing the nut plate 50 in the space 156 of the stiffening panel 150.

**[0042]** It is noted that in the shown embodiment, all panels of sheet material 110, 120, 130, 140, 150, 160 incorporated in the panel assembly 100 are flat. Preferably, any of the panels 110, 120, 130, 140, 150, 160 comprises sheet metal, or another type of sheet material that can be formed relatively thin, such as carbon fiber sheet material. The mounting bodies 20a, 20b preferably comprise solid elements of a millable material, such as aluminum.

**[0043]** The panel assembly 100 is configured to be assembled solely by the use of face-to-edge joints. To that end, with reference again to Figure 4, one panel 130 of each pair of panels 130, 150 to be connected at such a joint has an aperture designated for passing a connecting element such as a self-tapping screw 160 in a direction normal to a face 131 of the one panel 130, and the other panel 150 has a receiving channel 157 for receiving the connecting member 60, extending in a direction normal to an edge 153 of the other panel 150. As shown, the receiving channel 157 may be defined by portions of the respective panel 150 being bent away in opposite directions with respect to a main part of the panel 150. The one panel 130 may also have at least two further apertures spaced apart for accommodating two ears 158 formed on the other panel 150, protruding from the respective edge 153, to aid in aligning the one panel 130 relative to the other panel 150.

**[0044]** The guiding structure 1 can be assembled in a relatively simple way, by first mounting the reinforcing

panels 160 and the stiffening panels 150 onto the front side panel 110 and then mounting the arrays 10a, 10b of mounting bodies 20a, 20b; next, mounting the top side panel 130 and the bottom side panel 140 onto each of the reinforcing panels 160, the stiffening panels 150 and the front side panel 110, and then mounting the back side panel 120 onto each of the reinforcing panels 160, the stiffening panels 150, the top side panel 130, and the bottom side panel 140. Easy assembly is facilitated by at least each of the reinforcing panels 160 and the stiffening panels 150 having a symmetrical shape.

**[0045]** The panel assembly 100 in an assembled state already provides a relatively accurately shaped structure for carrying the mounting bodies 20a, 20b. In order to further improve an accuracy at which the reference faces 21, 22 of the mounting bodies 20a, 20b are aligned, after the mounting bodies 20a, 20b have been mounted in a relatively rough mother shape, the mounting bodies 20a, 20b can be collectively milled using a milling member travelling along an accurately defined path, so that the final mounting bodies 20a, 20b are shaped to have reference faces 21, 22 each comprising machined surfaces. Before machining, a dummy weight corresponding to the weight of a print head carriage 200 may be provided on the assembled structure to preliminary deform the structure, to account for deformations of the structure when the structure is in use in a printing apparatus. This further improves the alignment of the reference faces 21, 22. Finally, a guiding rail 30a, 30b may first be clamped onto and then screwed fixed onto each of the mounting bodies 20a, 20b.

**[0046]** The guiding structure 1 as a final product is a relatively stiff structure, thanks to the relatively large transverse cross section of the beam 101 formed by the panel assembly 100. At the same time, the guiding structure 1 is relatively light-weight due to the low mass of the individual panels 110, 120, 130, 140, 150, 160 used for making the beam 101, and as a result of the way that the panels 110, 120, 130, 140, 150, 160 are assembled to obtain a beam 101 of a certain size. One of the aspects aiding to keep the weight of the beam 101 low is that the number of reinforcing panels 160, extending over the full cross section of the beam 101, is smaller than the number of stiffening panels 150. The stiffening panels 150 each only extend over a portion of the cross section of the beam 101, which saves a lot of weight as compared to a situation in which the stiffening panels 150 would also have extended over the full cross section.

**[0047]** It is to be understood that the disclosed embodiments are merely exemplary of the invention, which can be embodied in various forms. Specific structural and functional details are not to be interpreted as limiting, but merely as a basis for the claims and as a teaching for one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure. In particular, features presented and described in separate dependent claims may be applied in combination, and any advantageous combination of such claims is

herewith disclosed.

**[0048]** The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

## Claims

1. Guiding structure (1) for a print head carriage (200), comprising a sheet material panel assembly (100) incorporating a carrier panel (110) provided on one side with at least one array (10a, 10b) of mounting bodies (20a, 20b), the array (10a, 10b) of mounting bodies (20a, 20b) oriented to extend in a first dimension (Y) of the carrier panel (110) and providing an aggregate (11a, 11b) of mutually aligned reference faces (21, 22) facing a surface (31, 32) of a guide rail (30a, 30b) mounted on the mounting bodies (20a, 20b), the guiding panel (1) further comprising an array (40) of stiffening members (150) positioned on an opposite side of the carrier panel (110) with respect to the array (10a, 10b) of mounting bodies (20a, 20b), each stiffening member (150) arranged extending in a second dimension (Z) of the carrier panel (110), wherein each mounting body (20a, 20b) is lockingly held in place relative to the carrier panel (110) by a respective stiffening member (150).
2. Guiding structure (1) according to claim 1, wherein the panel assembly (100) comprises one or more further panels (120, 130, 140) forming the side walls of a beam (101) together with the carrier panel (110), wherein a respective stiffening member (150) connects the carrier panel (110) to at least one further panel (130, 140).
3. Guiding structure (1) according to claim 1 or 2, wherein a respective stiffening member (150) has one side (151) abutting the carrier panel (110) and another side (152, 153) abutting the further panel (130, 140).
4. Guiding structure (1) according to one of the preceding claims, wherein a respective stiffening member (150) comprises a panel of sheet material (150) incorporated in the panel assembly (100).
5. Guiding structure (1) according to one of the preceding claims, wherein the panel assembly (100) comprises additional panels of sheet material (160) positioned in between neighboring stiffening members (150).
6. Guiding structure (1) according to one of the preceding claims, wherein a mounting body (20a, 20b) is connected to a respective stiffening member (150) via an associated threaded end (24) extending through a designated aperture in the carrier panel (110), engaging a threaded hole (51) associated with the stiffening member (150).
7. Guiding structure (1) according to claim 6, wherein a respective stiffening member (150) comprises an accommodation space (156) accommodating a nut member (50) provided with the threaded hole (51).
8. Guiding structure (1) according to claim 7, wherein an array of at least two neighboring stiffening members (150) accommodates a common nut member (50) provided with a plurality of threaded holes (51).
9. Guiding structure (1) according to claim 7 or 8, wherein an outer contour of a respective nut member (50) has a recess (52a, 52b) accommodating a portion of a stiffening member (150).
10. Guiding structure (1) according to one of the preceding claims, wherein the panel assembly (100) comprises flat panels (110, 120, 130, 140, 150, 160) connected at a face-to-edge joint.
11. Guiding structure (1) according to claim 10, wherein one panel (130) of two panels (130, 150) connected at a face-to-edge joint has an aperture for passing a connecting member (60) in a direction normal to a face (131) of the one panel (130), the other panel (150) having a receiving channel (157) for receiving the connecting member (60), extending in a direction normal to an edge of the other panel (150).
12. Guiding structure (1) according to claim 10 or 11, wherein one panel (130) of two panels (130, 150) connected at a face-to-edge joint has at least two further apertures spaced apart in a certain direction, the other panel (150) having at least two ears each accommodated in one of the further apertures.
13. Guiding structure (1) according to one of the preceding claims, wherein a respective stiffening member (150) has an opening (155) for passing a drive belt for driving a print head carriage (200) to move along the guide rail (30a, 30b).
14. Guiding structure (1) according to one of the preceding claims, wherein the mutually aligned reference faces (21, 22) comprise collectively machined surfaces (21, 22).
15. Method for manufacturing a guiding structure (1) for a print head carriage (100), comprising the steps of:
  - providing a carrier panel (110) to form part of

a panel assembly (100);  
- providing an array of mother bodies on one side of the carrier panel (110);  
- providing an array (40) of stiffening members (150) on the opposite side of the carrier panel (110);  
- mutually locking a respective mother body and a respective stiffening member (150) in place relative to the carrier panel (110);  
- collectively machining the array of mother bodies to form an array (10a, 10b) of mounting bodies (20a, 20b) each providing a machined reference face (21, 22), and  
- mounting a guide rail (30a, 30b) on the mounting bodies (20a, 20b) such that the reference faces (21, 22) face a surface (31, 32) of the guide rail (30a, 30b).

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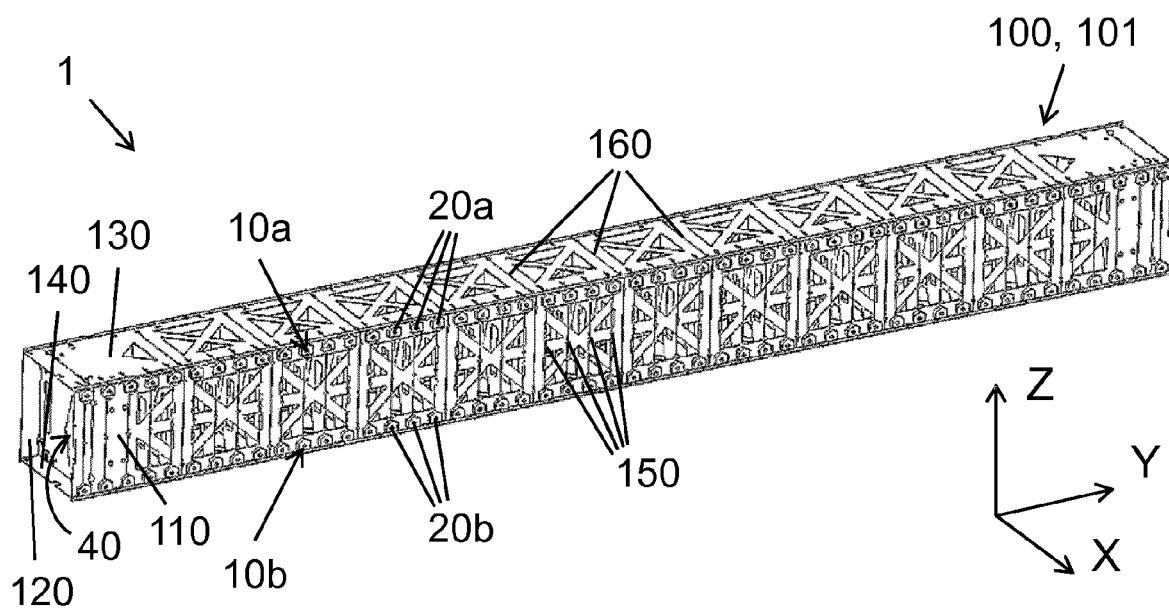


Fig. 1

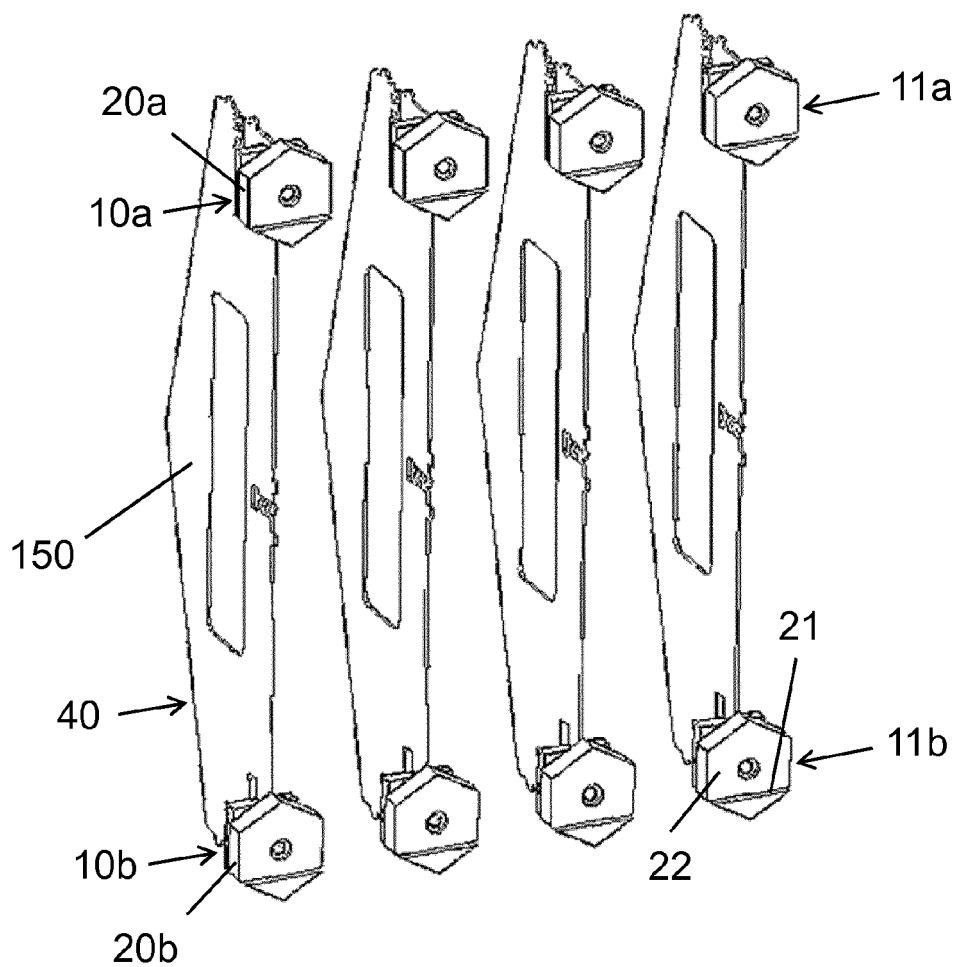


Fig. 2



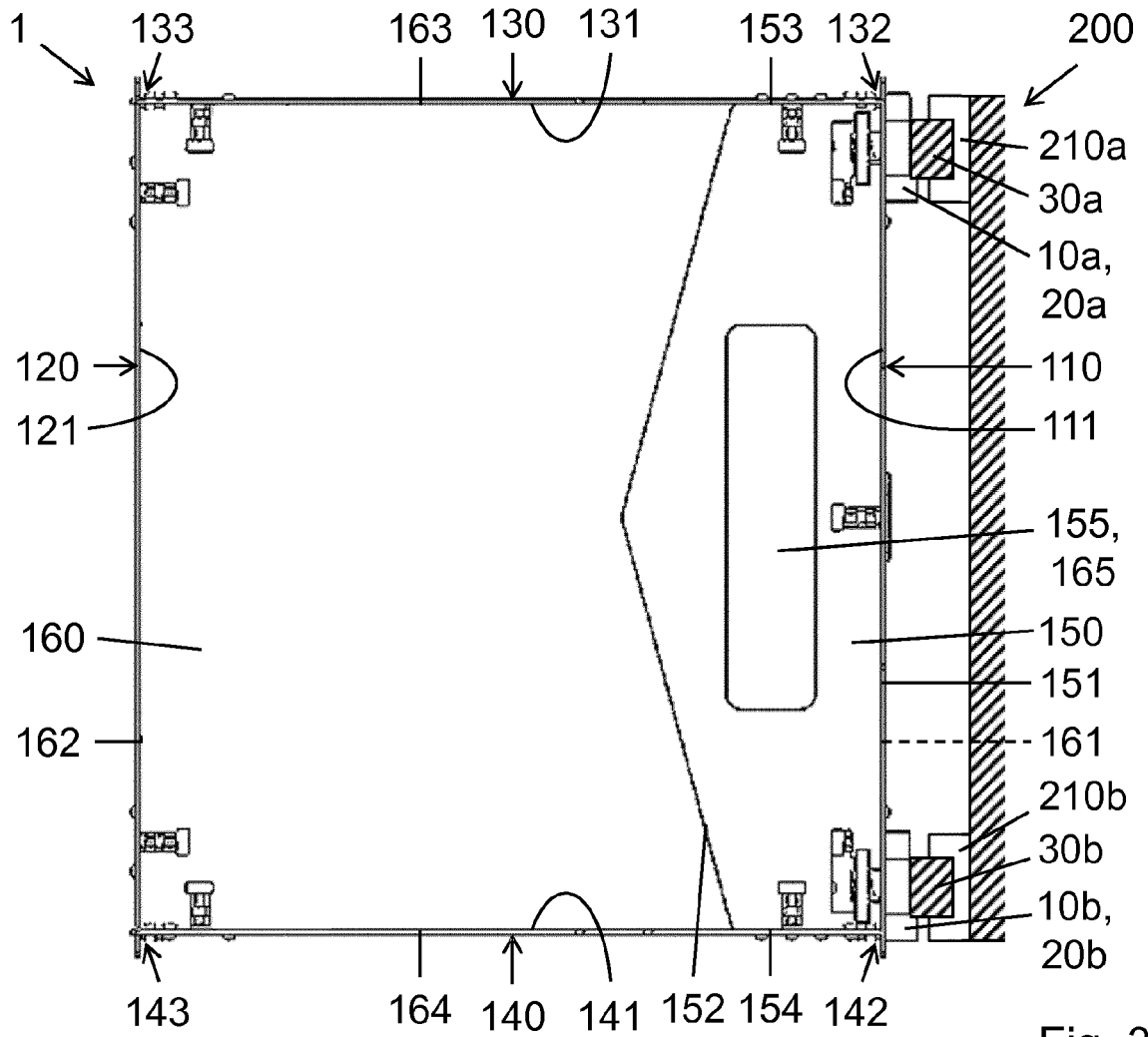


Fig. 3

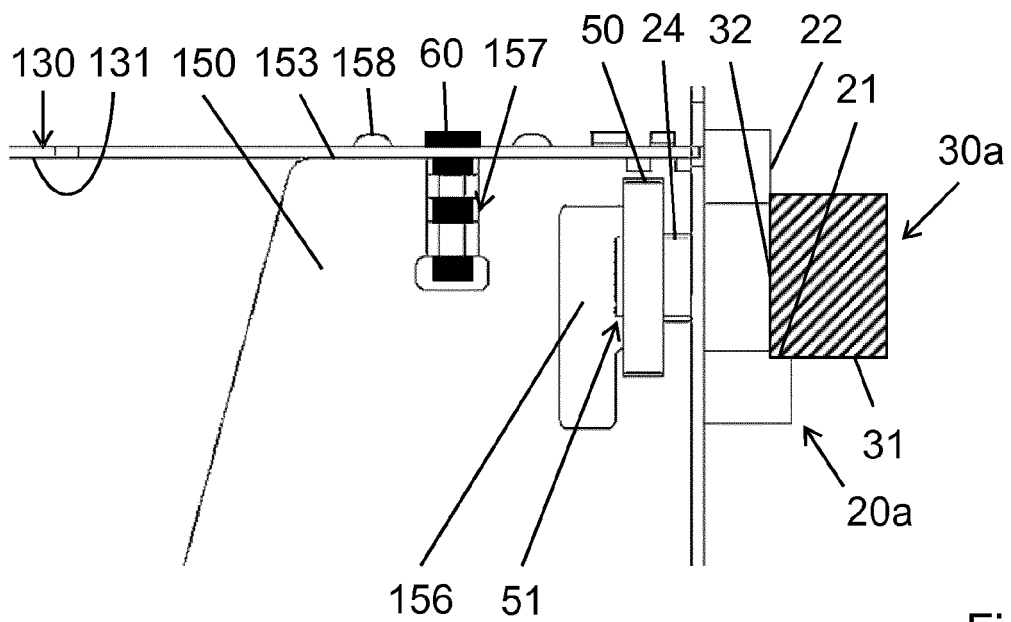


Fig. 4

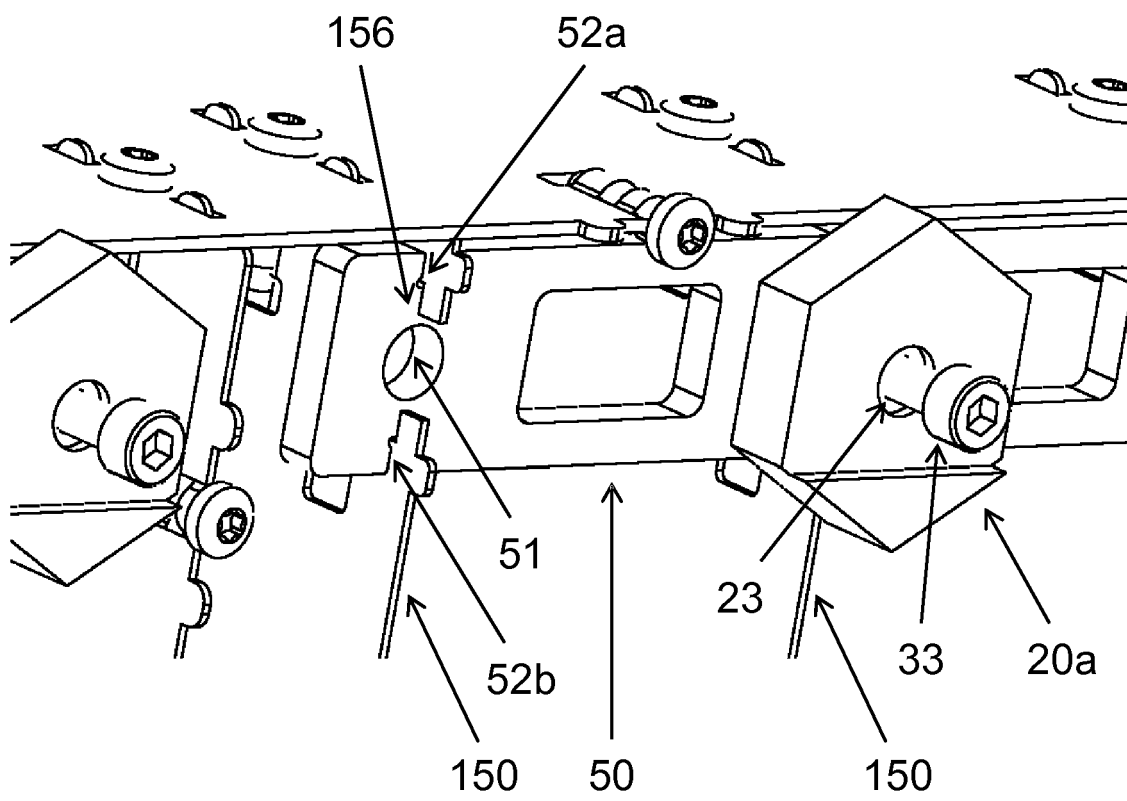


Fig. 5



## EUROPEAN SEARCH REPORT

 Application Number  
 EP 18 17 0744

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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                               |                                  |                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------|-----------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 5 195 836 A (LONGUST TIMOTHY A [US] ET AL) 23 March 1993 (1993-03-23)      | 1-6                              | INV.<br>B41J19/00                       |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                               |                                  | TECHNICAL FIELDS SEARCHED (IPC)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                                  | B41J                                    |
| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               | Date of completion of the search | Examiner                                |
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