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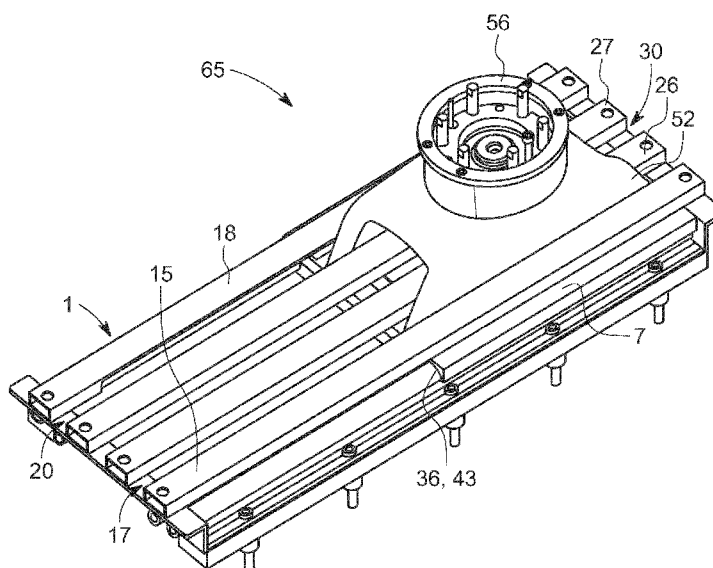


FIG. 4

(57) Abstract: Aspects of the present invention relate to a vehicle seat platform and a vehicle seat support. The vehicle seat platform slideably supports a seat frame in a vehicle and is mountable to a vehicle. The vehicle seat platform comprises a floor component configured to form or support a part of a cabin floor of the vehicle. The floor component comprises a plurality of slots therethrough, and a carriage mounting means configured to slideably mount a carriage beneath the floor component such that support struts are able to extend through the slots from above the floor component and engage with said carriage. The carriage mounting means is configured to permit sliding movement of the carriage in a direction parallel to the slots. The vehicle seat support supports a seat frame in a vehicle. The vehicle seat support comprises a carriage configured to be slideably mounted to the vehicle seat platform, a plurality of struts configured to extend through the slots within the floor component of the vehicle seat platform from above the floor component and



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engage with the carriage when mounted to the vehicle seat platform, and a bridge extending between the struts and configured to support the seat frame above the floor component when the carriage is mounted to the vehicle seat platform.

A VEHICLE SEAT PLATFORM

TECHNICAL FIELD

The present invention relates to a vehicle seat platform for slideably supporting a seat
5 frame. Further aspects of the invention relate to a vehicle seat support, a vehicle seat
assembly, a vehicle seat, and a vehicle comprising the vehicle seat platform.

BACKGROUND

Seats are an essential feature of a vehicle and can typically be modified so that they
10 provide comfort to an occupant. Conventional vehicle seats are mounted on two metal
rails that are fixed directly to the vehicle structure with mechanical fixings. Usually the
mechanical fixings are located at, or near to, the four corners of the vehicle seat.

The vehicle seats can be adjusted on the rails to slide longitudinally forwards and aft in
15 the vehicle to accommodate different occupants or loads placed in various positions
within the vehicle.

However, it is desirable to limit the length of conventional rails on which the vehicle
seat is slideable so that the rails do not extent beyond the footprint of the vehicle seat.
20 This is so that the rails do not take up space in the foot-well which is meant for the
legs and feet of an occupant. Limiting the rails to extending only under the vehicle seat
also removes a trip hazard from the floor of the cabin of the vehicle. As a result, the
range of movement of a conventional vehicle seat in the fore and aft directions is
limited.

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SUMMARY OF THE INVENTION

Aspects and embodiments of the invention provide a vehicle seat platform for slideably
supporting a seat frame, a vehicle seat support comprising the vehicle seat platform, a
vehicle seat assembly comprising the vehicle seat platform, a vehicle seat comprising
30 the vehicle seat platform, and a vehicle comprising the vehicle seat platform.

According to an aspect of the present invention, there is provided a vehicle seat
platform for slideably supporting a seat frame in a vehicle, the vehicle seat platform
mountable to the vehicle and comprising a floor component configured to form or
35 support a part of a cabin floor of the vehicle, the floor component comprising a plurality

of slots therethrough, and a carriage mounting means configured to slideably mount a carriage beneath the floor component such that support struts are able to extend through the slots from above the floor component and engage with said carriage, wherein the carriage mounting means is configured to permit sliding movement of the carriage in a direction parallel to the slots.

Advantageously, the vehicle seat platform provides a mounting position for a seat which is below the cabin floor and so does not provide a trip hazard whilst freeing up space in the foot well. The vehicle seat platform also provides a stable cabin floor which can be stood on by an occupant whilst providing a means of adjusting the longitudinal seat position in the cabin of the vehicle.

The carriage mounting means may comprise at least one track running parallel to the slots and along which the carriage can be slideably mounted.

Therefore, the carriage may be moved such that the struts slide along the slots to allow movement of a seat frame relative to the vehicle seat platform.

The floor component may comprise a first side element defining an outer side of a first slot, a second side element defining an outer side of a second slot, and at least one intermediate element defining an inner side of the first slot and an inner side of the second slot.

The floor component may further comprise a first intermediate element defining an inner side of the first slot, and a second intermediate element defining an inner side of the second slot, wherein at least one intermediate slot is defined between the first and second intermediate elements.

Optionally, at least one of the elements may be hollow. Advantageously, the hollow element may receive a cable guide configured to house a cable that may provide power from the vehicle to the vehicle seat support.

The first and second side elements may be supported along at least a part of their lengths.

Advantageously, the vehicle seat platform is made more robust and less prone to deformation of the floor component under loading when the floor component is being stood on by an occupant entering or exiting the vehicle.

- 5 The vehicle seat platform may further comprise side walls that define a channel for receiving a carriage and along which the carriage mounting means is configured to permit sliding movement of the carriage, wherein the first and second side elements may be supported along at least a part of their lengths by the side walls of the vehicle seat platform.

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Therefore, the side elements can withstand larger loads including vehicle occupants standing on the vehicle seat platform during ingress and egress without bending to contact the carriage.

- 15 The vehicle seat platform may further comprise a floor covering configured to be mounted to the elements of the floor component. The floor covering may comprise resiliently deformable foam element configured to temporarily seal the slots closed and be deformed by movement of a strut.

- 20 The floor covering may be supported by the elements and an upper surface of the floor covering may be configured to form a part of the cabin floor of a vehicle.

- According to another aspect of the present invention, there is provided a vehicle seat support for supporting a seat frame in a vehicle, the vehicle seat support comprising a carriage configured to be slideably mounted to a vehicle seat platform according to the invention, a plurality of struts configured to extend through the slots within the floor component of the vehicle seat platform from above the floor component and engage with the carriage when mounted to the vehicle seat platform, and a bridge extending between the struts and configured to support the seat frame above the floor component when the carriage is mounted to the vehicle seat platform.
- 25
- 30

Advantageously, the vehicle seat support allows a seat frame to be moved forwards and backwards in a vehicle relative to the vehicle seat platform. Another benefit is that the vehicle seat support takes up a small area of the cabin floor of a vehicle.

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The struts and the bridge may be integrally formed.

The vehicle seat support may comprise a mounting pedestal on the bridge, the mounting pedestal being configured to have the seat frame mounted thereto.

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Advantageously, a swivel mechanism may be provided between the bridge and the mounting pedestal to enable the seat frame to be swivelled relative to the vehicle seat support so that an occupant can change the orientation of their seat.

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The carriage may comprise bearings configured to engage with at least one track of the carriage mounting means.

The vehicle seat support may further comprise a drive mechanism to slide the carriage relative to the vehicle seat platform. The drive mechanism may be mounted to the carriage.

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Therefore, the vehicle seat support may be moved automatically relative to the vehicle seat platform or at least with minimum effort from the occupant.

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According to another aspect of the invention, there is provided a vehicle seat assembly comprising a vehicle seat platform according to the invention, and a vehicle seat support mounted thereto.

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The vehicle seat assembly may comprise a cable guide mounted at one end to the vehicle seat platform and mounted at the other end to the vehicle seat support, the cable guide configured to house a cable which provides power from a vehicle to the vehicle seat support.

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According to another aspect of the invention, there is provided a vehicle seat comprising a vehicle seat assembly according to the invention, and a seat frame mounted thereto.

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According to yet another aspect of the invention, there is provided a vehicle comprising a vehicle seat platform according to the invention, a vehicle seat assembly according to the invention, and/or a vehicle seat according to the invention.

The vehicle may comprise a cabin floor, wherein the vehicle seat platform is mounted within the vehicle such that the floor component of the vehicle seat platform forms or supports a part of the cabin floor of the vehicle.

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Advantageously, the vehicle seat platform does not protrude into the foot well and provide a solid floor section that an occupant can stand on during ingress and egress of the vehicle.

10 The vehicle seat platform may be mounted within the vehicle such that an upper surface of the floor component of the vehicle seat platform lies flush with an upper surface of the cabin floor.

Advantageously, because the vehicle seat platform does not protrude from the cabin floor, there is no trip hazard present as well as more space in the foot well.

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The vehicle may have a longitudinal medial plane and the vehicle seat platform is mounted such that the slots within the floor component of the vehicle seat platform may extend at an angle to said longitudinal medial plane.

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A benefit of this arrangement is that it enables an occupant to ingress and egress the vehicle easily and also enables a seat frame mounted on the vehicle seat support to be moved into an area of more space.

25 The vehicle may comprise a plurality of vehicle seat platforms mounted at a plurality of seat frame mounting positions, and the vehicle seat platform at each seat frame mounting position may be mounted such that the slots within the respective floor component extend at an angle to said longitudinal medial plane.

30 The vehicle may comprise front seat frame mounting positions adjacent to each other on opposite sides of the longitudinal medial plane, wherein the slots within the floor component of the vehicle seat platform at respective front seat frame mounting positions extend at a diverging angle with respect to the longitudinal medial plane in a direction from a front towards a rear of the vehicle.

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The vehicle may comprise rear seat frame mounting positions adjacent to each other on opposite sides of the longitudinal centre line, wherein the slots within the floor component of the vehicle seat platform at respective rear seat frame mounting positions extend at a converging angle with respect to the longitudinal centre line in a direction from a front towards a rear of the vehicle.

Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims and/or in the following description and drawings, and in particular individual features thereof, may be taken independently or in any combination, unless such features are incompatible. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and/or incorporate any other claim although not originally claimed in that manner.

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BRIEF DESCRIPTION OF THE DRAWINGS

One or more embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

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Figure 1 shows a perspective view of a vehicle seat platform according to an embodiment of the invention;

Figure 2 shows another perspective view of the vehicle seat platform of Figure 1;

Figure 3 shows a perspective view of a vehicle seat support according to an embodiment of the invention;

Figure 4 shows a perspective view of a vehicle seat assembly comprising the vehicle seat platform of Figure 1 and the vehicle seat support of Figure 3 mounted to the vehicle seat platform;

Figure 5 shows a schematic perspective view of a vehicle seat according to an embodiment of the invention, comprising the vehicle seat platform of Figure 1 with some of the elements omitted, a carriage of the vehicle seat support of Figure 2 mounted thereon, and a seat frame;

Figure 6 shows a perspective view of the vehicle seat assembly of Figure 4 with an element omitted;

Figure 7 shows a perspective view of a vehicle seat comprising the vehicle seat assembly of Figure 4 and a seat frame mounted to the vehicle seat assembly; Figure 8 shows a schematic rear cross-sectional view of the vehicle seat assembly; Figure 9 shows a perspective view of a vehicle according to the invention, with bodywork removed to reveal the floor of a cabin, the vehicle comprising the vehicle seat platform of Figure 1; and Figure 10 shows a cross-sectional view through the vehicle seat platform according to an embodiment of the invention.

10 DETAILED DESCRIPTION

Referring to Figures 1 and 2, there is shown a vehicle seat platform 1 for slideably supporting a seat frame 2, shown in Figures 5 and 7, in a vehicle 3, shown in Figure 9. The vehicle seat platform 1 is mountable to the vehicle 3. The vehicle seat platform 1 comprises a floor component 4 configured to form, or at least support, a part of a cabin floor 39 of the vehicle 3. The floor component 4 comprises a plurality of spaced parallel elements 12 having slots 5 therebetween. The vehicle seat platform 1 further comprises a carriage mounting means 6 configured to slideably mount a carriage 7, shown in Figures 3, 4 and 5, beneath the floor component 4 such that support struts 41, shown in Figure 3, are able to extend through the slots 5 from above the floor component 4 and engage with the carriage 7. The carriage mounting means 6 is configured to permit sliding movement of a carriage 7 in a direction parallel to the slots 5.

The vehicle seat platform 1 comprises a front end 10 and a rear end 11 which are separated along a longitudinal axis of the vehicle seat platform 1. The spaced parallel elements 12 are configured such that adjacent elements 10 define a single slot 5 between them. The floor component 4 also has a front end at or proximate to the front end 10 of the vehicle seat platform 1 and a rear end which is at or proximate to the rear end 11 of the vehicle seat platform 1. The front and rear ends of the floor component 4 are separated along a longitudinal axis of the floor component 4. The front end 10 of the vehicle seat platform 1, and floor component 4, is configured to be located closer to the front of a vehicle 3, shown in Figure 9, than the rear end 11 of the vehicle seat platform 1, and floor component 4.

As shown in Figure 1, the floor component 4 comprises a first side element 15 and a second side element 18. The first side element 15 is a section of the floor component which forms an outer portion of the floor component 4. The first side element 15 defines an outer side 16 of a first slot 17 in the floor component 4. That is, the first side element 15 is the outer portion of the floor component 4 between the edge of the floor component 4 and the first slot 17 in the floor component 4.

Likewise, the second side element 18 is a section of the floor component 4 which forms an opposing outer portion of the floor component 4 to the outer portion formed by the first side element 15. The second side element 18 defines an outer side 19 of a second slot 20 in the floor component 4. That is, the second side element 18 is the outer portion of the floor component 4 between the edge of the floor component 4 and the second slot 20 in the floor component 4.

The floor component 4 further comprises at least one intermediate element 22. The at least one intermediate element 22 defines an inner side 23 of the first slot 17 and an inner side 24 of the second slot 20. Therefore, the at least one intermediate element 22 is always located in between the first and second side elements 15, 18 of the floor component 4. However, the first and second side elements 15, 18 are always spaced from the adjacent at least one intermediate element 22 so as to define a plurality of slots 5.

For example, in one alternative embodiment to the embodiment shown in the Figures, the floor component 4 may comprise the first and second side elements 15, 18 and a first intermediate element 26. In such an embodiment, the first intermediate element 26 is the only intermediate element 26 between the first and second side elements 15, 18. Therefore, the floor component 4 of the embodiment comprises three elements 15, 18, 26, and two slots 5. In such an embodiment, the first intermediate element 26 defines an inner side of the first slot 17 and an inner side of the second slot 20. That is, opposite sides of the first intermediate element 26 define the inner sides of the first and second slots 17, 20.

Referring back to Figures 1 and 2, it can be seen that in the present embodiment, the floor component 4 comprises a first intermediate element 26 which defines the inner side 27 of the first slot 17, and a second intermediate element 28 which defines the

inner side 29 of the second slot 20. Furthermore, the first and second intermediate elements 26, 28 are adjacent to but spaced from one another. Therefore, at least one intermediate slot 30 is defined between the first and second intermediate elements 26, 28.

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It will be understood that in further alternative embodiments, there may be more than two intermediate elements 26, 28, a slot 5 being defined between each adjacent element 12 such that there is one less slot 5 than the number of elements 12 that form the floor component 4. In some embodiments, the elements 12 are dimensioned such that the slots 5 are spaced evenly from one another across the width of the floor component 4. That is, in some embodiments the slots are spaced evenly from one another in a direction perpendicular to the longitudinal axis of the vehicle seat platform 1.

15 The first and second side elements 15, 18 are supported along at least a part of their lengths. This has the advantage of making the vehicle seat platform 1 more robust, and therefore less prone to deformation of at least the first and second side elements 15, 18 of the floor component 4 under loading for example when the weight of an occupant is un-centred on the seat frame 2 causing torsional forces from the carriage 7 beneath being transferred to the underside of the elements 15, 18 or when the floor component 4 is being stood on from above by an occupant.

The vehicle seat platform 1 further comprises end walls 32, 33 and side walls 31 34 (Figure 10). The side walls 31, 34 which have been omitted from Figures 1 to 9 for clarity, define the periphery of the vehicle seat platform 1 between the front and rear ends 10, 11 of the vehicle seat platform 1. The side walls 31, 34 may form extremities of the vehicle seat platform 1. The side walls 31, 34 also enable the vehicle seat platform 1 to resist lateral forces transmitted to it through the carriage 7 during unexpected loading, such as, for example, collisions, by helping to preventing lateral movement of the carriage 7 relative to the vehicle seat platform 1.

Thus, the side walls 31, 34 define a channel 35, shown in Figure 5, for receiving a carriage 7, which will be described in further detail herein after. The side walls 31, 34 define the channel 35 along which the carriage mounting means 6 is configured to permit sliding movement of the carriage 7. That is, the carriage 7 is slideable along the

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carriage mounting means 6 along the channel 35 defined in between the side walls 31, 34.

5 In one embodiment, the first and second side elements 15, 18 are supported along at least a part of their lengths by the side walls 31, 34 of the vehicle seat platform 1. Therefore, loads can be transferred from the floor component 4 to the side walls 31, 34 of the vehicle seat platform 1 which helps to prevent the floor component 4 from buckling or bending under load.

10 In the Figures 1 to 9, the majority of the side walls 31, 34 have been omitted such that other features of the vehicle seat platform 1 can be viewed clearly but the side walls 31, 34 can be seen in Figure 10. The side walls 31, 34 may extend up from the bottom of the vehicle seat platform 1 to contact the underside of the first and second side elements 15, 18. Thus, the bending of the first and second side elements 15, 18 is
15 limited by the additional strength given to the side elements 15, 18 due to the support provided by the side walls 31, 34.

The carriage mounting means 6 of the vehicle seat platform 1 further comprises at least one track 36. The at least one track 36 extends beneath the floor component 4
20 and between the side walls 31, 34 of the vehicle seat platform 1. The at least one track 36 runs parallel to the slots 5 and is configured such that the carriage 7 can be slideably mounted thereto. Therefore, in the present embodiment, the at least one track 36 also extends parallel to the side walls 31, 34 of the vehicle seat platform 1. That is, the at least one track 36 is located in the channel 25 in which the carriage 7 is
25 slideable.

In the present embodiment, the carriage mounting means 6 comprises a first track 37 and a second track 38 which extend parallel to one another. The first and second tracks 37, 38 comprise a cylindrical member extending longitudinally between the front
30 and rear ends 10, 11 of the vehicle seat platform 1. However, it will be understood that the member forming the at least one track 36 may have a differently shaped cross-section.

The first track 37 is located at least partially beneath the first side element 15 and a
35 second track 38 is located at least partially beneath the second side element 18, as

shown in Figures 1 and 2. In one embodiment, the first track 37 may be completely beneath the first side element 15 and the second track 38 may be completely beneath the second side element 18. Alternatively, the tracks 37, 38 may be located in different positions below the floor component 4.

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In the present embodiment, the plurality of slots 17, 20, 30 extend parallel to one another and parallel to the longitudinal axis of the vehicle seat platform 1. The slots 5 are shown as extending the length of the floor component 4, although it will be understood by a person skilled in the art that the plurality of slots only need to partially extend along the length of the floor component 4. However, longer slots 5 mean, in general, a greater range over which a seat frame 2 can be positioned within a vehicle 3 relative to the vehicle seat platform 1.

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Furthermore, in the present embodiment, the slots 5 are defined by straight edges of the elements 12 which form the floor component 4 and run parallel to the at least one track 36 of the carriage mounting means 6 and the longitudinal axis of the vehicle seat platform 1. It will, however, be appreciated that the edges of the elements 12 defining the slots 5 do not necessarily need to be straight or parallel as long as they maintain a minimum distance between adjacent edges. As will become apparent hereinafter, it is beneficial to maintain the, or close to the, minimum slot width so as to minimise lateral movement of the carriage relative to the vehicle seat platform 1 and help to distribute lateral loads.

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As the floor component 4 is to form a part of a cabin floor 39 in a vehicle 3, it is preferable that the top surfaces of the elements 12 all extend in the same plane. Therefore, when the vehicle seat platform 1 is mounted in a vehicle 3, as will be explained in more detail hereinafter, the floor component 1 is flat and so does not provide trip hazards to a person entering or exiting the vehicle 3.

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In Figures 1 and 2, the elements 12 of the floor component 4 are shown as being formed by individual cuboidal members or rails with a flat rectangular top surface. The rails which form the elements 12 extend from the front part 10 of the vehicle seat platform 1 to the rear part 11 and are individually mounted thereto. However, it will be apparent that in an alternative embodiment, the floor component 4 may be formed from

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a single member with slots formed in the single member in order to define the individual elements 12 described above.

Preferably, the vehicle seat platform 1 is cuboidal in shape so that its footprint is
5 rectangular. This allows the elements 12, slots 5, side walls 31, 34, and channel 35 to
all be aligned such that they are parallel with each other and all extend the same length
as the range of movement of the carriage 7, shown in Figure 2, so that the vehicle seat
platform 1 is compact and does not occupy any unnecessary space. However, it will be
understood that the vehicle seat platform 1 may be any other shape.

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Referring now to Figure 3, a vehicle seat support 40 for supporting a seat frame 2 in a
vehicle 3 is shown. The vehicle seat support 40 comprises the carriage 7 which is
configured to be slideably mounted to the vehicle seat platform 1, described above with
reference to Figures 1 and 2 and shown mounted to the vehicle seat platform 1 in
15 Figures 4 and 5. Referring back to Figure 3, the vehicle seat support 40 further
comprises a plurality of struts 41 which are configured to extend through the slots 5
within the floor component 4. The plurality of struts 41 are configured to engage with
the carriage 7 when the vehicle seat support 40 is mounted to the vehicle seat platform
1. The vehicle seat support 40 also comprises a bridge 42 extending between the
20 struts 41. The bridge 42 is configured to support the seat frame 2 above the floor
component 4 when the carriage is mounted to the vehicle seat platform 1.

The carriage 7 of the vehicle seat support 40 is mountable to the at least one track 36
of the carriage mounting means 6 of the vehicle seat platform 1, which is described
25 above with reference to Figures 1 and 2. The carriage 7 comprises a bearing 43
configured to engage with the at least one track 36 of the carriage mounting means 6.
The bearing 43 has substantially the same profile as at least a section of the member
forming the at least one track 36 so as to cooperate with the at least one track 36 when
the carriage 7 is mounted to the vehicle seat platform 1, which is shown in Figures 4
30 and 5. The similar profiles of the at least one track 36 and the at least one bearing 43
can be best viewed in Figures 8 and 10, which shows a cross-sectional view of the
vehicle seat support 40 mounted to the vehicle seat platform 1.

In a preferred embodiment, there is at least one bearing 43 per track 36 of the carriage
35 mounting means 6. The cooperating profiles of the bearings 43 and tracks 36 are

configured to limit the movement of the carriage 7 of the vehicle seat support 40 along the tracks 36 to translational movement in the longitudinal direction between the front and rear ends 10, 11 of the vehicle seat platform 1 when the vehicle seat support 40 is mounted to the vehicle seat platform 1. This is illustrated in Figures 8 and 10 which
5 shows the at least one bearing 43 at least partially encapsulating or surrounding the at least one track 36.

Referring briefly to Figure 5, it can be seen that in the present embodiment, the carriage 7 comprises a first bearing 44 and a second bearing 45 which are both located
10 on the first track 37. The first bearing 44 is located at the end of the carriage 7 which is to be located proximate to the end of the carriage 7 that will be closest to the front end 10 of the vehicle seat platform 1 when the vehicle seat support 40 is mounted to the vehicle seat platform 1 and the second bearing 45 is to be located proximate to the end of the carriage 7 that will be nearest the rear end 11 of the vehicle seat platform 1.
15 Although not shown in the Figures, the opposite side of the carriage 7 has a similar configuration to the side described above in relation to Figure 5.

Locating the bearings 44, 45 at the front and rear of the carriage 7 to help with weight distribution of the seat frame 2 and an occupant etc. However, it will be understood,
20 that the bearing 43 on a track 36 may be formed by a single bearing that extends partially along the length of the carriage 7 or along the whole length of the carriage 7.

As shown in Figure 3, the bearing 43 of the carriage 7 is shaped so that it will at least partially encompass the at least one track 36 of the vehicle seat platform 1 when the carriage 7 is mounted to the vehicle seat platform 1. That is, the bearing 43 is
25 configured such that it will encompass the at least one track 36 of the vehicle seat platform 1 sufficiently such that the carriage 7 cannot be removed from the at least one track 36 when the vehicle seat support 40 is mounted to the vehicle seat platform 1, as shown in Figure 3.

30 In some embodiments, the carriage 7 may comprise a locking mechanism (not shown) configured to prevent movement of the carriage 7 along the at least one track 36 when the locking mechanism is activated by an occupant. The locking mechanism may be manually activated by the occupant.

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The carriage 7 forms the base of the vehicle seat support 40 and is configured to be located beneath the floor component 4 of the vehicle seat platform 1 when mounted to the vehicle seat platform 1, as shown in Figure 4. That is, the carriage 7 is configured to fit within the channel 35 formed between the front and rear ends 10, 11, side walls 31, 34 of the vehicle seat platform 1 and the lower surface of the elements 12 of the floor component 4 of the vehicle seat platform 1.

Referring to Figure 3, it can be seen that in some embodiments, the carriage 7 may comprise a further bearing 47 on its upper surface 48, as illustrated in Figure 5. The bearing 47 provides a frictionless, or low friction, surface. The bearing 47 may be, for example, but not limited to, a dry polymer bearing or skid block. The bearing 47 is located such that it is beneath and aligned with one of the elements 12 of the floor component 4 of the vehicle seat platform 1. In some embodiments, the carriage 7 may be provided with multiple bearings 47 on its upper surface 48 so that when the carriage 7 is mounted to the vehicle seat platform 1, each element 12 of the vehicle seat platform 1 has at least one bearing 47 located below it. Of course, in alternative embodiments, bearings 47 may only be located below selected elements 12 of the floor component 4.

The bearing 47 is configured so that friction between the upper surface 48 of the carriage 7 and the lower surface of the elements 12 of the floor component 4 of the vehicle seat platform 1 is minimised in the event of contact between the two when the carriage 7 is mounted to the vehicle seat platform 1 due to excessive loads. Advantageously, the bearing 47 reduces the force needed to slide the carriage 7 along the at least one track 36 in the event of contact between one of the elements 12 of the floor component 4 and the upper surface 48 of the carriage 7.

It will be understood that in normal operation it is envisaged that there will be no contact between the lower surface of the floor component 4 and the upper surface 48 of the carriage 7. That is, the carriage 7 is dimensioned such that it can be mounted on carriage mounting means 6 of the vehicle seat platform 1 without contacting the lower surface of the floor component 4 of the vehicle seat platform 1. However, the close proximity of the upper surface 48 of the carriage 7 to the lower surface of the floor component 4 means that the floor component 4 can prevent, or at least limit, pitching of the vehicle seat support 40 relative to the vehicle seat platform 1 under large

decelerations, such as during a collision, when the carriage 7 is mounted to the vehicle seat platform 1, as shown in Figure 4.

As previously mentioned, the vehicle seat support 40 comprises a plurality of struts 41
5 which are configured to extend through the slots 5 within the floor component 4. Each of the plurality of struts 41 are configured to be mounted to the carriage 7 at their bottom end 50 and to be mounted to the bridge 42 at the opposing upper end 51. Therefore, when the vehicle seat support 40 is mounted to the vehicle seat platform 1, the plurality of struts 41 extend from below the upper surface of the floor component 4
10 to above the floor component 4, as shown in Figure 4.

Referring to Figure 3, each of the plurality of struts 41 upstands substantially vertically from the carriage 7. The struts 41 are configured such that they can extend through the slots 5 in the floor component 4 of the vehicle seat platform 1 when the vehicle seat
15 support 40 is mounted to the vehicle seat platform 1. That is, the width of each of the struts 41 is less than that of the corresponding slot 5 in the floor component 4 of the vehicle seat platform 1 through which it is to extend. A struts 41 which has a width that is only slightly less than the width of the slot 5 in which it is located when the vehicle seat support 40 is mounted on the vehicle seat platform 1 may help prevent, or at least
20 limit, lateral movement of the vehicle seat support 40 relative to the vehicle seat platform 1, especially under large loads.

In some embodiments, each of the struts 41 is generally blade or fin-shaped. As illustrated in Figure 3, the struts 41 of the present embodiment extend the length of the carriage 7 in a direction parallel to the longitudinal axis of the carriage 7 when mounted
25 to the carriage 7. The struts 41 also taper from their bottom end 50 towards their upper end 51 so that the upper end 51 is shorter than the lower end 50. However, it will be appreciated that the struts 41 may have a different shape and length in alternative embodiments.

30 In the present embodiment, the vehicle seat support 40 comprises a first strut 52 and a second strut 53 which extend parallel to one another. The first and second struts 52, 53 are separated by a distance equal to the distance between two of the slots 5 in the floor component 4 of the vehicle seat platform 1. Furthermore, the first and second struts 52,
35 53 extend substantially parallel to the slots 5 in the floor component 4 of the vehicle

seat platform 1 through which the first and second struts 52, 53 are configured to extend.

As illustrated in Figure 4, the first strut 52 is located on the carriage 7 such that when
5 the vehicle seat support 40 is mounted to the vehicle seat platform 1, the first strut 52
extends through the first slot 17 which is defined between the first side element 15 and
the first intermediate element 26. The second strut 53 is located on the carriage 7 such
that when the vehicle seat support 40 is mounted to the vehicle seat platform 1, the
second strut 53 extends through the second slot 20 which is defined between the
10 second side element 18 and the second intermediate element 28.

In alternative embodiments, the vehicle seat support 40 may comprise a further
intermediate strut 54, as shown in Figure 8. The intermediate strut 54 is similar to the
first and second struts 52, 53 described above and is configured to extend through the
15 intermediate slot 30 defined between the first and second intermediate elements 26,
28. Advantageously, the third strut enables the vehicle seat support 40 to withstand
higher loads or allows the load to be distributed through more struts which enables the
struts to be smaller and therefore save weight and space. The intermediate strut 54
may comprise a slot or aperture (not shown) configured to provide a conduit for cables
20 (not shown) or vehicle seat orientation mechanisms (not shown) to be connected to a
seat or seat frame. The aperture may be an internal aperture.

In such an embodiment, each of the struts 41 may be spaced evenly from one another
across the width of the carriage 7. That is, the struts 41 are spaced evenly from one
25 another in a direction perpendicular to the longitudinal axis of the vehicle seat support
40 in a corresponding fashion to the slots 5 in the floor component 4 of the vehicle seat
platform 1. It will be appreciated that the vehicle seat support 40 may comprise as
many struts 41 as the number of slots 5 in the floor component 4 of the vehicle seat
platform 1 to which the vehicle seat support 40 is to be mounted to.

30 Referring back to Figure 3, the vehicle seat support 40 further comprises the bridge 42
which extends between the struts 41. The bridge 42 extends substantially horizontally
between the struts 41. That is, the bridge extends 42 substantially parallel to the upper
surface 48 of the carriage 7. The bridge 42 is located at the upper end 51 of the struts
35 41 and therefore, is located above the floor component 4 of the vehicle seat platform 1

when the vehicle seat support 40 is mounted to the vehicle seat platform 1. In some embodiments, the struts 41 and the bridge 42 may be integrally formed to improve the strength of the structure. As a result, the intermediate elements 26, 28 of the vehicle seat platform 1 are surrounded by the vehicle seat support 40 in order to couple the two apparatus together to provide a collision resilient structure which allows relative movement in the longitudinal direction between the two.

Referring to Figures 5 and 6, the bridge 42 of the vehicle seat support 40 is configured to support a seat frame 2 above the floor component 4 of the vehicle seat platform 1 when the vehicle seat support 40 is mounted thereon. Specifically, the vehicle seat frame support 40 comprises a mounting pedestal 55 on the bridge 42. The mounting pedestal 55 is configured to have the seat frame 2 mounted thereto. The bridge 42 may comprise a mounting portion 56, shown in Figures 3 and 4, to which the mounting pedestal 55 is attached. The mounting portion 56 may comprise an orientation mechanism (not shown) which enables the mounting pedestal to be rotated relative to the vehicle seat support 40 and/or moved vertically to adjust the height of the seat frame 2 relative to the vehicle seat platform 1. The mounting portion 56 may be mounted in the centre of the bridge 42. Advantageously, it means that the feet of an occupant in an adjacent seat can pass under the seat frame 2 without contacting the vehicle seat support 40 when the adjacent seat frame 2 is being swivel to face in the opposite direction.

The vehicle seat support 40 further comprises a drive mechanism 60 which is configured to slide the carriage 7 relative to the vehicle seat platform 1. Referring to Figure 5, it can be seen that the drive mechanism 60 is mounted to the carriage 7. The drive mechanism 60 comprises at least one motor 61 which is configured to drive a gearbox 62. The gearbox 62 is in engagement with a worm drive 63. A worm screw 64, which can also be seen in Figures 8 and 10, is mounted to the vehicle seat platform 1 and extends parallel to the at least one track 36 between the front and rear ends 10, 11 of the vehicle seat platform 1. Therefore, when the motor 61 is actuated, the gearbox 62 drives the worm gear 63 in order to slide the carriage 7 along the at least one track 36. Therefore, the vehicle seat support 40 can be positioned relative to the vehicle seat platform 1. In one embodiment, the drive mechanism 60 is used to hold the vehicle seat support 40 in position relative to the vehicle seat platform 1 when its position is not being adjusted.

Referring to Figure 4, a vehicle seat assembly 65 is shown. The vehicle seat assembly 65 comprises a vehicle seat platform 1 and a vehicle seat support 40 mounted thereto.

5 Figure 5 shows a vehicle seat platform 1 with a vehicle seat support 40 mounted thereto. The vehicle seat support 40 has a mounting pedestal 55 mounted, as described above.

Referring briefly to Figure 6, an embodiment of the vehicle seat assembly 65 of Figure
10 4 is shown with the first side element 15 removed. In the embodiment of the vehicle seat platform 1 shown in Figure 6, at least one of the elements 12 is hollow, as is also illustrated in Figures 8 and 10. The hollow elements 12 are tubular along their length. In such an embodiment, the vehicle seat assembly 65 further comprises a cable guide 66 configured to receive at least one cable (not shown). The cable guide 69 is configured
15 to house cables which deliver, for example, but not limited to, power to the carriage 7.

The cable guide 66 comprises a first end 67 which is configured to be mounted to the front end 10 of the vehicle seat platform 1, as shown in Figure 6. It will be appreciated that the first end 67 may be mounted to the rear end 11 of the vehicle seat platform 1.
20 The cable guide 66 further comprises a second end 68. The second end is configured to be mounted to the vehicle seat support 40, as shown in Figure 6. Preferably, the second end 68 of the cable guide 66 is mounted to the upper surface 48 of the carriage 7. The first and second ends 67, 68 of the cable guide 66 may comprise electric connections to transfer power from a vehicle 3 to the vehicle seat support 40.

25 In the present embodiment, the cable guide 66 is formed by a chain link guide 69 which is formed of individual links 69a which are rotatable, via a pivot point 69b, relative to the adjacent links. The length of the cable guide 66 is slightly greater than the range of movement of the vehicle seat support 40 relative to the vehicle seat platform 1. This
30 enables the cable guide 66 to allow the vehicle seat support 40 to operate over its full range of movement without inhibiting movement by impeding the struts 41.

In some embodiments, the cable guide 66 may be configured so that its range of motion is limited. For example, the pivot point 69b may be configured such that rotation
35 of the individual links relative to one another is within a limited range so as to prevent

the cable guide 66 bending into the path of the struts 41 when the vehicle seat support 40 is being moved towards the first end 67 of the cable guide 66.

5 The chain link cable guide 69, including the individual links 69a, is hollow such that a cable (not shown) can extend within the cable guide 66. In this way, a cable extending through the cable guide 66 is protected and cannot become tangled or block movement of the carriage 7 along the slots 5 during repeated forward and rearward movement of the vehicle seat support 40 relative to the vehicle seat platform 1.

10

In the present embodiment, the first side element 15, which has been omitted in Figure 6 but is visible in Figure 8, comprises a cut-out (not shown) through which the cable harness 66 extends so that the second end 68 can be mounted to the carriage 7. The cut-out extends along the length of the first side element 15 so as to allow the full range of movement of the vehicle seat support 40 relative to the vehicle seat platform 1.

15

In some embodiments, the vehicle seat support 40 may comprise a projection (not shown). The projection may upstand from the upper surface 48 of the carriage 7. The projection is configured to contact the cable guide 66 to give the cable guide 66 an element to bend around during movement of the vehicle seat support 40 relative to the vehicle seat platform 1. The projection helps to keep the cable guide taut and in the correct alignment.

20

Referring to Figure 7, a vehicle seat 70 is shown. The vehicle seat 70 comprises a vehicle seat platform 1 and a vehicle seat support mounted thereto. The vehicle seat support 40 has a seat frame 2 mounted thereto. The seat frame 2 may be mounted to the vehicle seat support 40 via the mounting pedestal 55.

25

Referring to Figure 8, the rear perspective view of an embodiment of the seat assembly 65 is shown. The seat assembly 65 comprises the vehicle seat platform 1 and the vehicle seat support 40, as described above. In the present embodiment, the vehicle seat platform 1 further comprises a floor covering 72 which forms a part of the floor component 4. The floor covering 72 comprises a covering 73. The covering 73 may be formed by, for example, but not limited to, carpet or lining.

30

35

In the embodiment of the vehicle seat platform 1 comprising the floor covering 72, the floor covering 72 is configured to form a part of the cabin floor 39 of a vehicle 3 and the elements 12 of the floor component 4 are configured to support the floor covering 72. An upper surface 74 of the floor covering 72 may be configured to lie flush with an
5 upper surface of the cabin floor 39 of a vehicle 3.

The floor covering 72 further comprises a support moulding 75. The support moulding 75 is configured to attach the floor covering 72 to elements 12 of the floor component 4. In the present embodiment, a support moulding 75 is mounted to the upper surface
10 of each of the elements 12 of the floor component 4. Furthermore, each covering 73 of the floor covering 72 is attached to each of the support moulding 75. The covering 73 may be bonded to the support moulding 75. Therefore, the support moulding 75 attaches the covering 73 to the element 12 it is mounted on and ensures that correct alignment is maintained.

15 In the present embodiment, each covering 73 extends across the element 12 to which it is mounted by the support moulding 75 and also extends over the side of the element 12 to which it is mounted such that at least a part of the covering 73 extends into one of the slots 5. That is, the covering 73 extends vertically into slots 5. This improves the
20 appearance of the vehicle seat platform 1.

The floor covering 72 further comprises a foam element 76. The foam element 76 is mounted to a side edge of the element 12 and configured to be placed in a slot 5 and extend along the side edge of an element 12 along slot 5. The foam element 76 is
25 configured to extend out into the slot 5 and bias the covering 73 to close the slot 5. This may be achieved by foam elements 76 attached to adjacent elements 12 contacting in the middle of the slot 5. Each side edge of an element 12 may comprise a foam element 76.

30 The foam elements 76 enable the floor covering 73 to close a length of the slot 5 when the vehicle seat support 40 is not present along that length of the vehicle seat platform 1. However, when the vehicle seat support 40 is moved along the slot 5, the struts 41 compress the foam elements 76 and separate adjacent floor coverings 72 allowing the vehicle seat support 40 to be moved forwards and backwards relative to the vehicle
35 seat platform 1. Advantageously, the blade shape of the struts 41 enables floor

coverings 72 to be separated easily. The foam element 76 may be bonded to the covering 73 and/or the side of an element 12.

5 The floor covering 72 may further comprise a spring strip 77. The spring strip 77 is bonded between the covering 73 and the foam element 76 and may extend along the length of the slot 5. The spring strip 77 is configured to help the foam element 76 regain its original shape when the vehicle seat support 40 is not present at that specific location.

10 Referring to Figure 9, a vehicle 3 is shown with the outer body work removed to show the internal features more clearly. The vehicle 3 comprises at least one vehicle seat platform 1 as described above. Although not shown in Figure 8, the vehicle 3 may comprise the vehicle seat 70 as described above.

15 More specifically, Figure 9 shows the cabin floor 39 of a vehicle 3 to which four vehicle seat platforms 1 have been mounted. Two pairs of vehicle seat platforms have been mounted to the cabin floor 39 of the vehicle 3 with one pair behind the other. One pair forms the mounting position for the front seats of the vehicle 3 whilst the other pair forms the mounting position of the rear seats of the vehicle 3.

20 Each of the vehicle seat platforms 1 have been mounted to the cabin floor 39 such that a vehicle seat support 40, which may have a seat frame 2 attached, supported by the vehicle seat platform 1 will slide in a direction between the front and rear of the vehicle 3 which extends at an angle to a longitudinal medial plane of the vehicle 3. That is, the longitudinal axis of each of the vehicle seat platforms 1 extends at an angle to the longitudinal medial plane of the vehicle 3. The longitudinal medial plane is a longitudinal plane that divides the vehicle 3 down the middle so that half the vehicle 3 is on one side of the longitudinal medial plane and the other half is on the other side of the longitudinal medial plane.

30 Whilst Figure 9 shows that all four vehicle seat platforms 1 have been mounted so that they extend at an angle to the longitudinal medial plane of the vehicle, it will be appreciated that only one or more of the vehicle seat platforms 1 may extend in the way. For example, at least one vehicle seat platform 1 may be configured so that the

vehicle seat support 40 slideably mounted to that vehicle seat platform 1 moves parallel to the longitudinal medial plane.

Alternatively, at least one vehicle seat platform 1 may be configured so that the vehicle
5 seat support 40 slideably mounted to that vehicle seat platform 1 moves in a direction away from the longitudinal medial plane as it slides in a direction from the front towards the rear of the vehicle 3. In another alternative, at least one vehicle seat platform 1 may be configured so that the vehicle seat support 40 is slideable in a direction towards the longitudinal medial plane as it slides from the front towards the rear of the vehicle 3.

10

The vehicle seat platforms 1 may form a pair to provide the front or rear seats of the vehicle 3 that are arranged so that the vehicle seat support 40 slideably mounted to the vehicle seat platform 1 of one pair are both slideable in a direction away or towards the longitudinal medial plane as they slide from the front towards the rear of the vehicle 3.

15

In the particular arrangement shown in Figure 9, the pair of vehicle seat platforms 1 providing the front seats of the vehicle 3 are arranged so that the vehicle seat supports 40 supported by each of the vehicle seat platforms 1 both move away from the longitudinal medial plane, and so away from each other, as the seat frame slides along
20 the platforms from the front towards the rear of the vehicle 3.

Furthermore, the pair of vehicle seat platforms 1 providing the rear seats of the vehicle are arranged so that the vehicle seat supports 40 supported by each of the support platforms both move towards the longitudinal medial planes, and so move closer to
25 each other, as the vehicle seat supports 40 slide along the vehicle seat supports 40 from the front towards the rear of the vehicle 3.

The arrangement of the vehicle seat platforms 1 as shown in Figure 9 most closely resembles the shape of a ~~rhombus~~rhombus or diamond. The benefit of this
30 arrangement is that it enables all the occupants to ingress and egress the vehicle 3 easily and also enables a seat frame 2 mounted on the vehicle seat support 40 to be moved into an area of more space so as to make it easier for an occupant to swivel the seat frame 2.

In some embodiments, at least one of the vehicle seat platforms 1 may be mounted at an angle to the plane of the cabin floor 39 of the vehicle 3. For example, the front end 10 of the vehicle seat platform 1 may be higher than the rear end of the vehicle seat platform 1. This enables an occupant to increase their elevation relative to the cabin floor 39 of the vehicle 3 as they move the vehicle seat platform 40, with a seat frame 2 mounted thereto. This is particularly advantageous for an occupant of the driver's seat so that they can adjust their view of the road.

It will be appreciated that various changes and modifications can be made to the present invention without departing from the scope of the present application.

CLAIMS

1. A vehicle seat platform for slideably supporting a seat frame in a vehicle, the vehicle seat platform mountable to the vehicle and comprising:
- 5 a floor component configured to form or support a part of a cabin floor of the vehicle, the floor component comprising a plurality of slots therethrough; and
- a carriage mounting means configured to slideably mount a carriage beneath the floor component such that support struts are able to extend through the slots from above the floor component and engage with said carriage,
- 10 wherein the carriage mounting means is configured to permit sliding movement of the carriage in a direction parallel to the slots.
2. A vehicle seat platform according to claim 1, wherein the carriage mounting means comprises at least one track running parallel to the slots and along which the
- 15 carriage can be slideably mounted.
3. A vehicle seat platform according to claim 1 or claim 2, wherein the floor component comprises:
- a first side element defining an outer side of a first slot;
- 20 a second side element defining an outer side of a second slot; and
- at least one intermediate element defining an inner side of the first slot and an inner side of the second slot.
4. A vehicle seat platform according to claim 3, wherein the floor component
- 25 comprises:
- a first intermediate element defining an inner side of the first slot; and
- a second intermediate element defining an inner side of the second slot,
- wherein at least one intermediate slot is defined between the first and second intermediate elements.
- 30
5. A vehicle seat platform according to claim 3 or claim 4, wherein at least one of the elements is hollow and configured to receive a cable guide.
6. A vehicle seat platform according to any one of claims 3 to 5, wherein the first
- 35 and second side elements are supported along at least a part of their lengths.

7. A vehicle seat platform according to any one of claims 3 to 6, further comprising a floor covering configured to be mounted to the elements of the floor component.

5 8. A vehicle seat platform according to claim 7, wherein the floor covering comprises a resiliently deformable foam element configured to temporarily seal the slots and be deformed by movement of a strut of the carriage.

9. A vehicle seat platform according to any one of claims 6 comprising side walls
10 that define a channel for receiving a carriage and along which the carriage mounting means is configured to permit sliding movement of the carriage; wherein the first and second side elements are supported along at least a part of their lengths by the side walls of the vehicle seat platform.

15 10. A vehicle seat support for supporting a seat frame in a vehicle, the vehicle seat support comprising:

a carriage configured to be slideably mounted to a vehicle seat platform of any preceding claim;

a plurality of struts configured to extend through the slots within the floor
20 component of the vehicle seat platform from above the floor component and engage with the carriage when mounted to the vehicle seat platform; and

a bridge extending between the struts and configured to support the seat frame above the floor component when the carriage is mounted to the vehicle seat platform.

25 11. A vehicle seat support according to claim 8, wherein the struts and the bridge are integrally formed.

12. A vehicle seat support according to claim 10 or claim 13, wherein the vehicle seat support comprises a mounting pedestal on the bridge, the mounting pedestal
30 being configured to have the seat frame mounted thereto.

13. A vehicle seat support according to any one of claims 10 to 12 wherein the carriage comprises bearings configured to engage with at least one track of the carriage mounting means.

14. A vehicle seat support according to any one of claims 10 to 13, comprising a drive mechanism to slide the carriage relative to the vehicle seat platform.
15. A vehicle seat support according to claim 14, wherein the drive mechanism is
5 mounted to the carriage.
16. A vehicle seat assembly comprising a vehicle seat platform of any one of claims 1 to 7 and a vehicle seat support mounted thereto.
- 10 17. A vehicle seat assembly according to claim 16, further comprising a cable guide mounted at one end to the vehicle seat platform and mounted at the other end to the vehicle seat support, the cable guide configured to house a cable which provides power from a vehicle to the vehicle seat support.
- 15 18. A vehicle seat comprising a vehicle seat assembly according to claim 16 and a seat frame mounted thereto.
19. A vehicle comprising a vehicle seat platform of any one of claims 1 to 9, a vehicle seat assembly according to claim 16 and/or a vehicle seat according to claim
20 17.
20. A vehicle according to claim 19 comprising a cabin floor, wherein the vehicle seat platform is mounted within the vehicle such that the floor component of the vehicle seat platform forms or supports a part of the cabin floor of the vehicle.
- 25 21. A vehicle according to claim 20, wherein the vehicle seat platform is mounted within the vehicle such that an upper surface of the floor component of the vehicle seat platform lies flush with an upper surface of the cabin floor.
- 30 22. A vehicle according to any of claims 19 to 21, wherein the vehicle has a longitudinal centre line and the vehicle seat platform is mounted such that the slots within the floor component of the vehicle seat platform extend at an angle to said longitudinal centre line.

23. A vehicle according to claim 22, wherein the vehicle comprises a plurality of vehicle seat platforms mounted at a plurality of seat frame mounting positions, and the vehicle seat platform at each seat frame mounting position is mounted such that the slots within the respective floor component extend at an angle to said longitudinal
5 centre line.

24. A vehicle according to claim 23, comprising front seat frame mounting positions adjacent to each other on opposite sides of the longitudinal centre line, wherein the slots within the floor component of the vehicle seat platform at respective front seat
10 frame mounting positions extend at a diverging angle with respect to the longitudinal centre line in a direction from a front towards a rear of the vehicle.

25. A vehicle according to claim 23 or claim 24, comprising rear seat frame mounting positions adjacent to each other on opposite sides of the longitudinal centre
15 line, wherein the slots within the floor component of the vehicle seat platform at respective rear seat frame mounting positions extend at a converging angle with respect to the longitudinal centre line in a direction from a front towards a rear of the vehicle.

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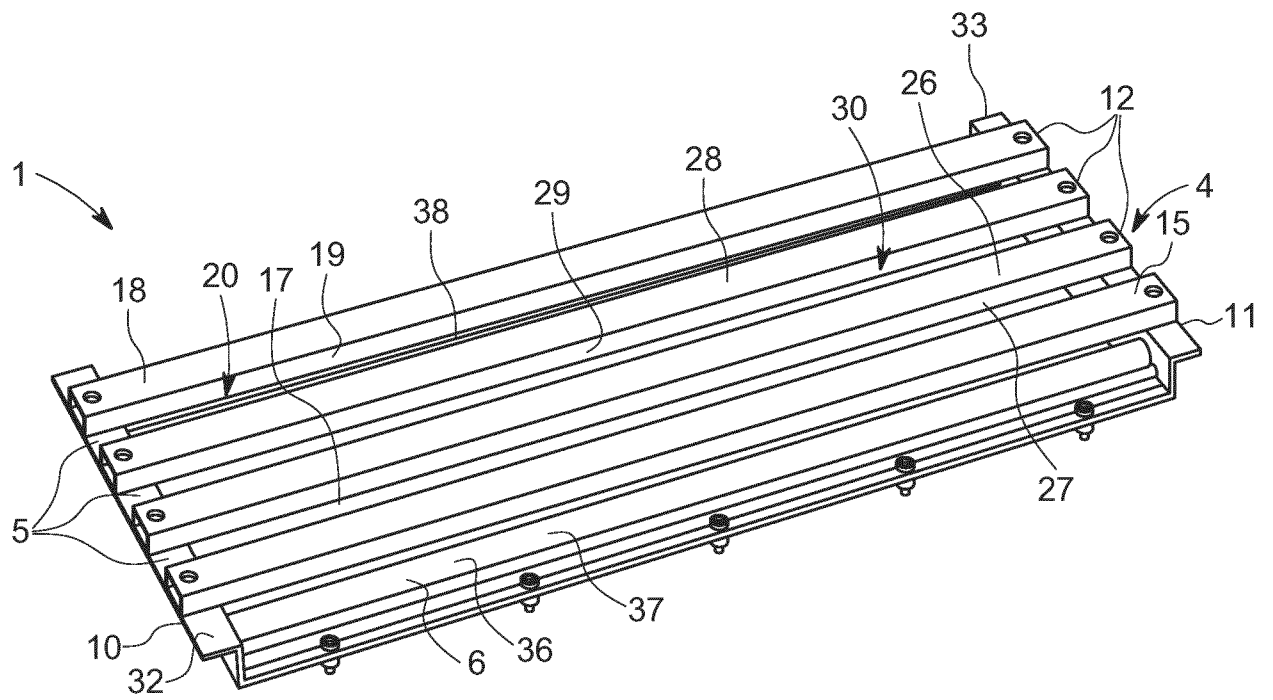


FIG. 1

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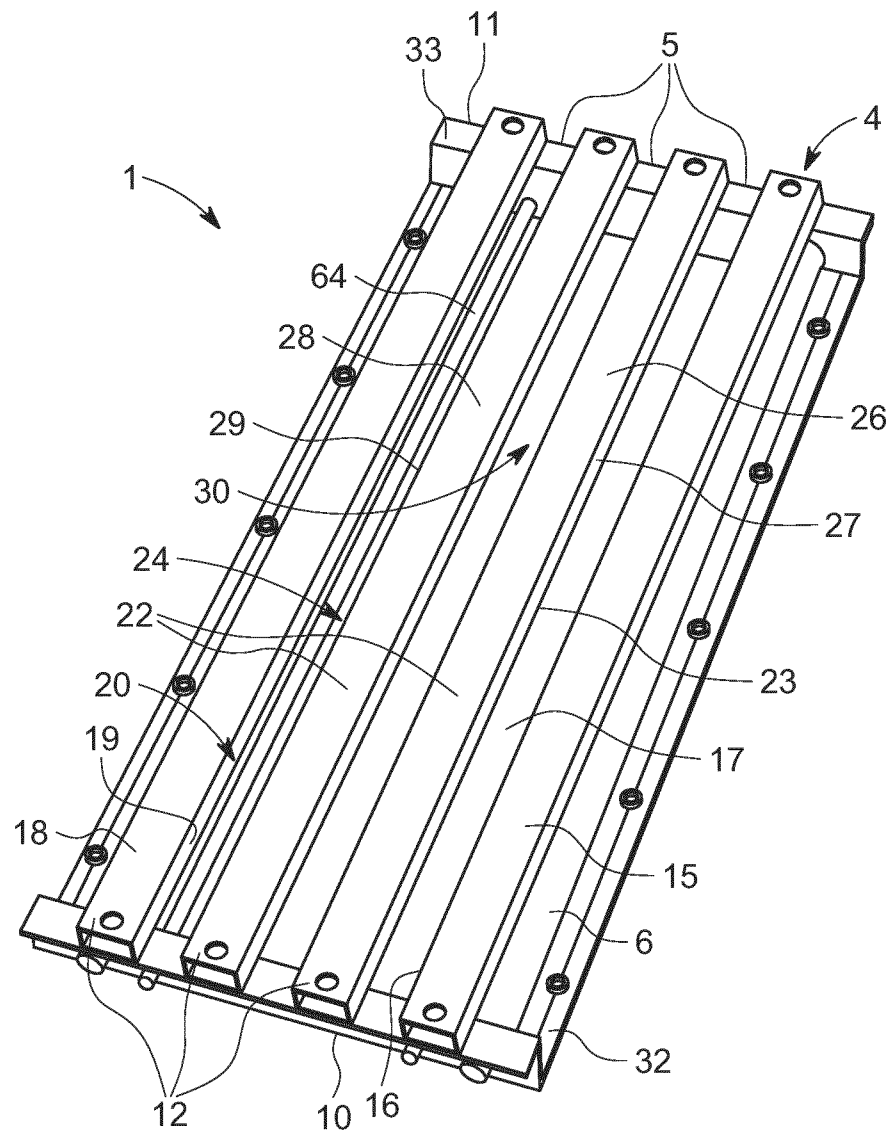


FIG. 2

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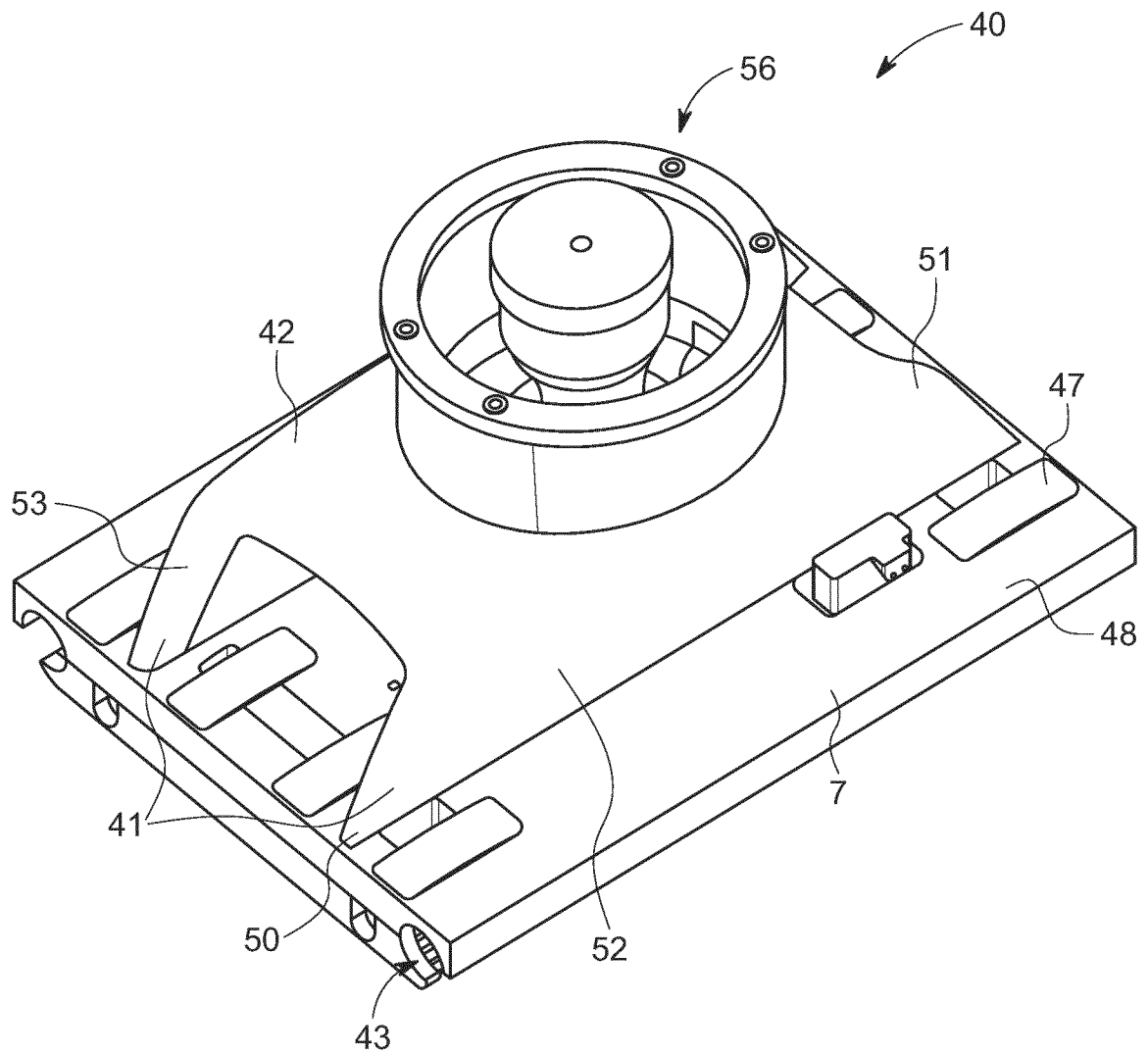


FIG. 3

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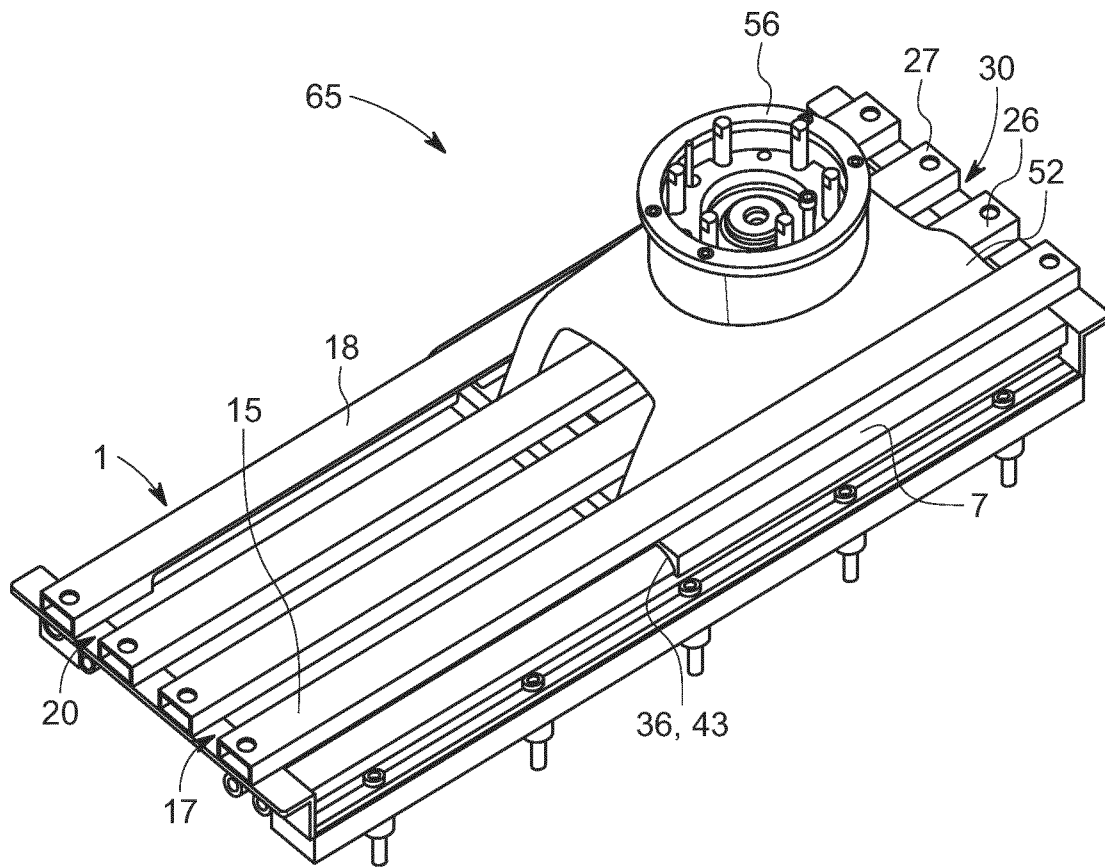


FIG. 4

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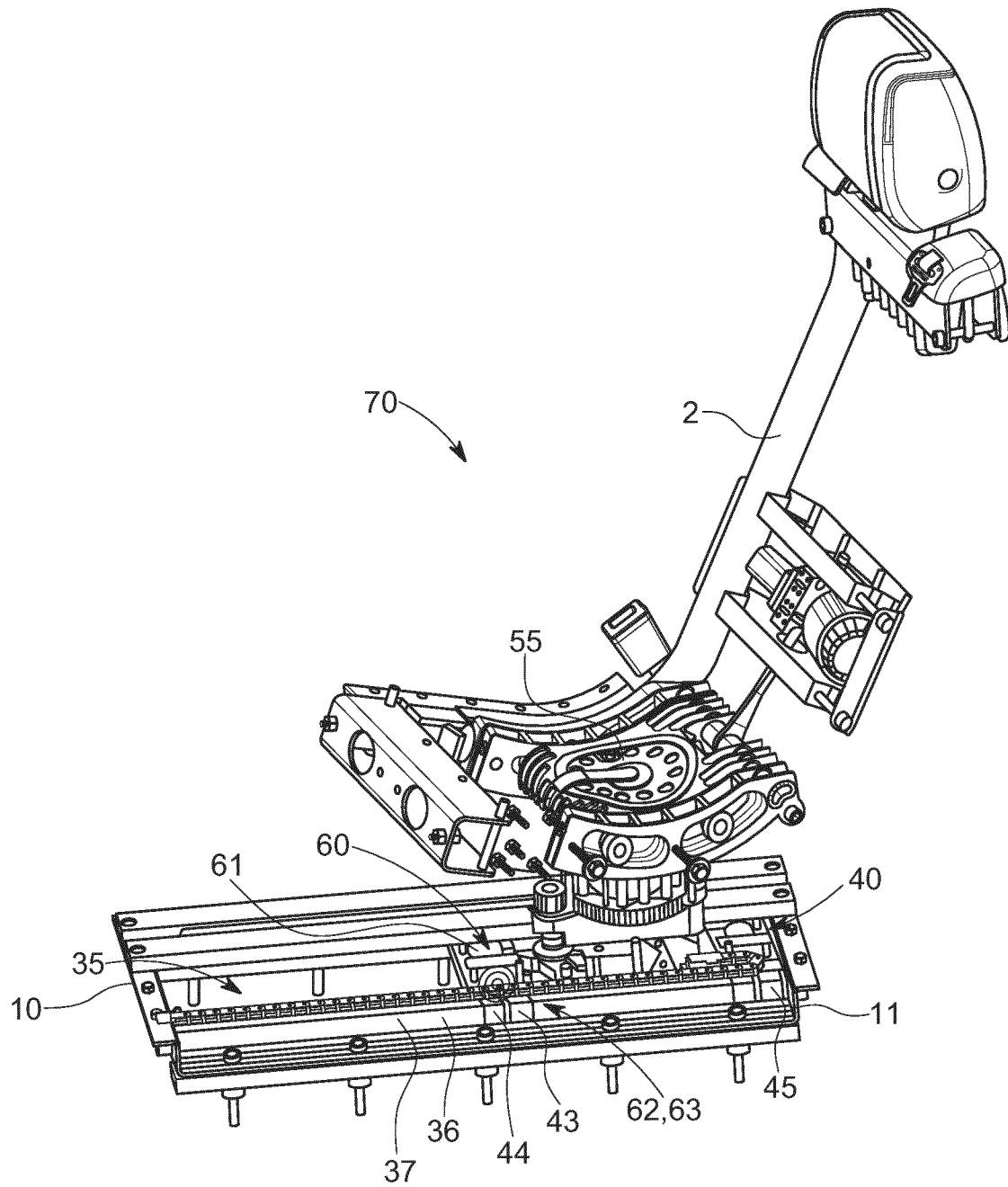


FIG. 5

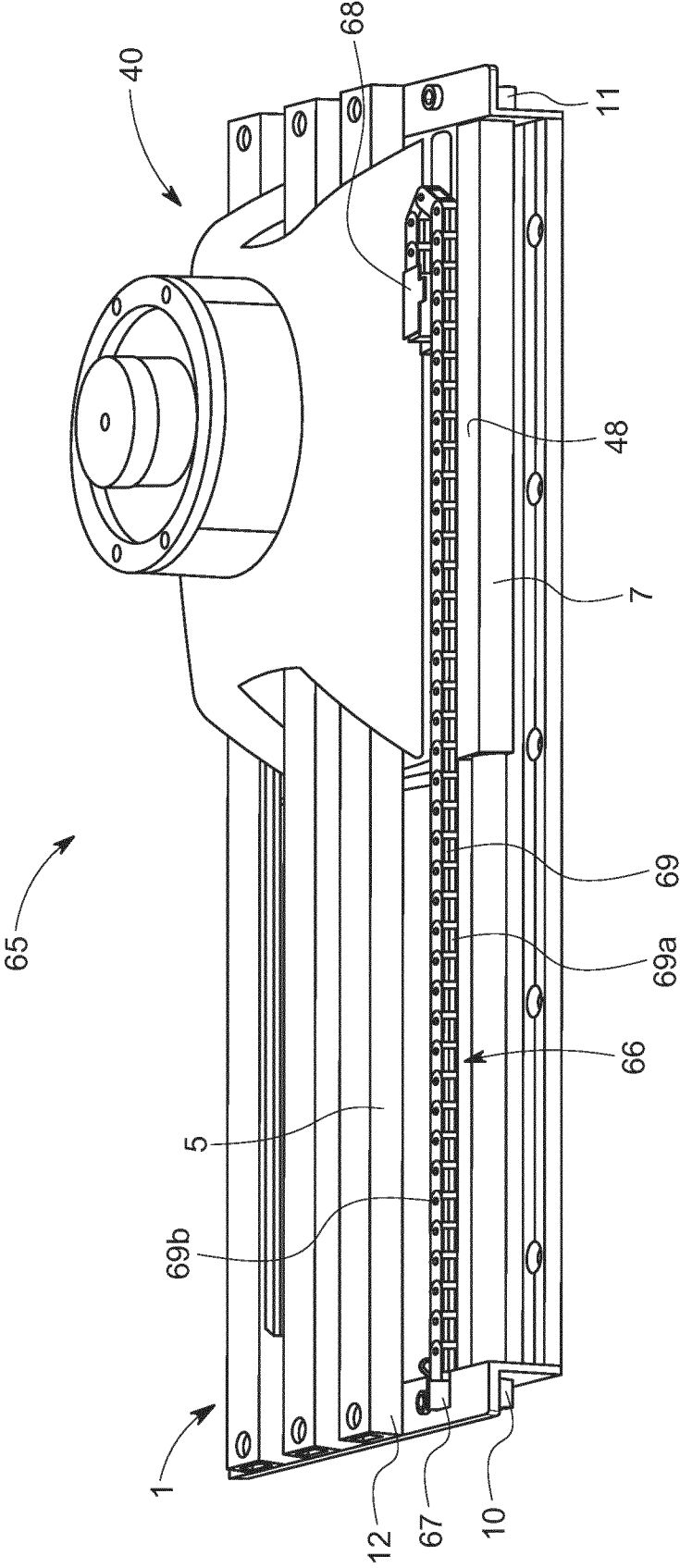


FIG. 6

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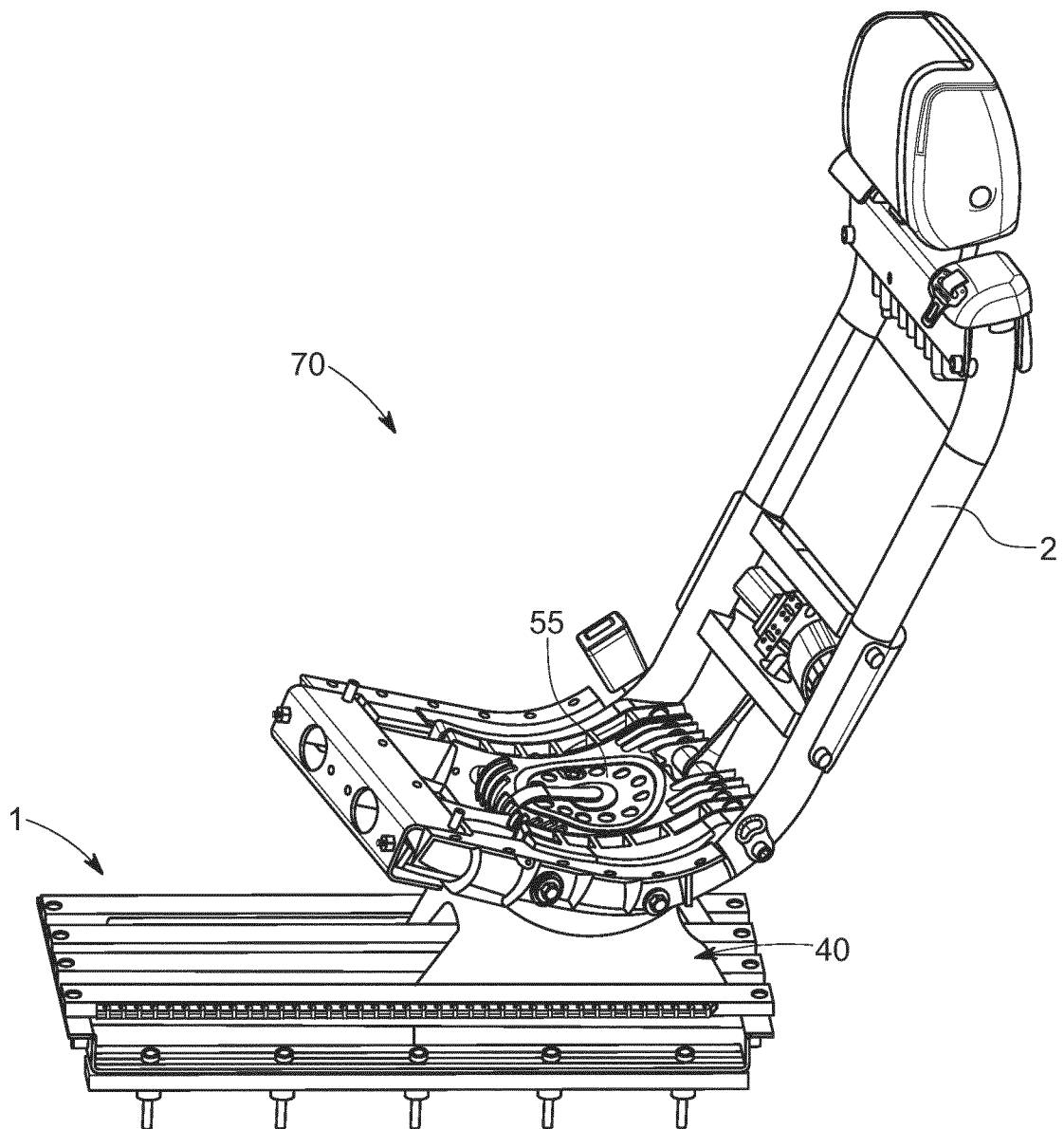
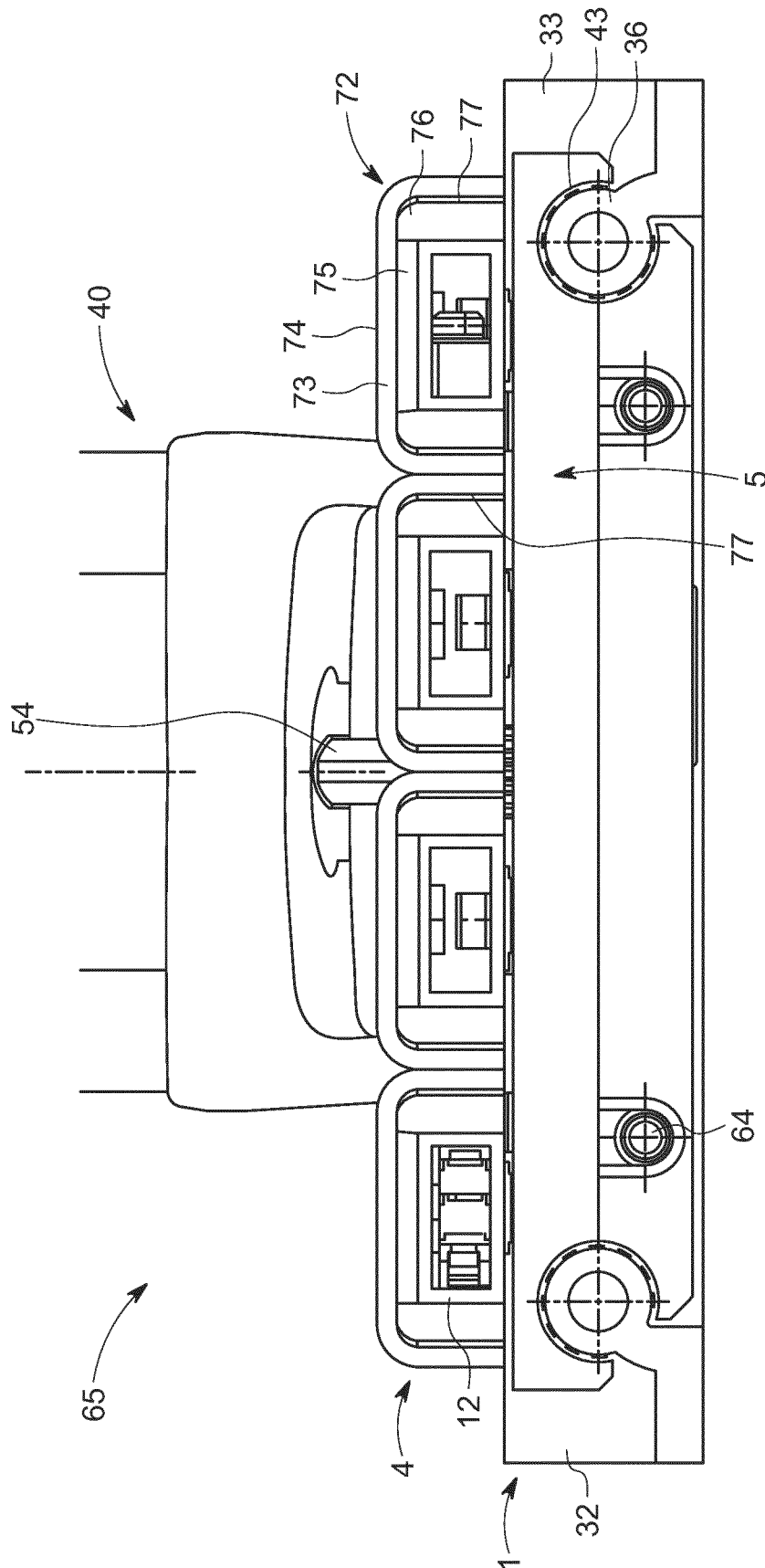


FIG. 7



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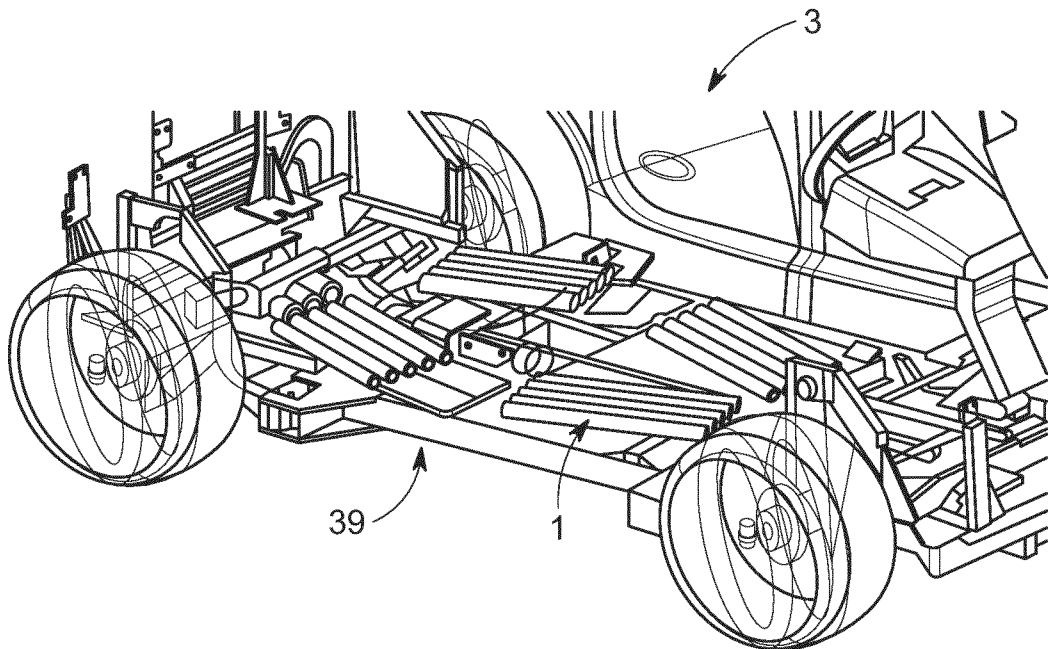


FIG. 9

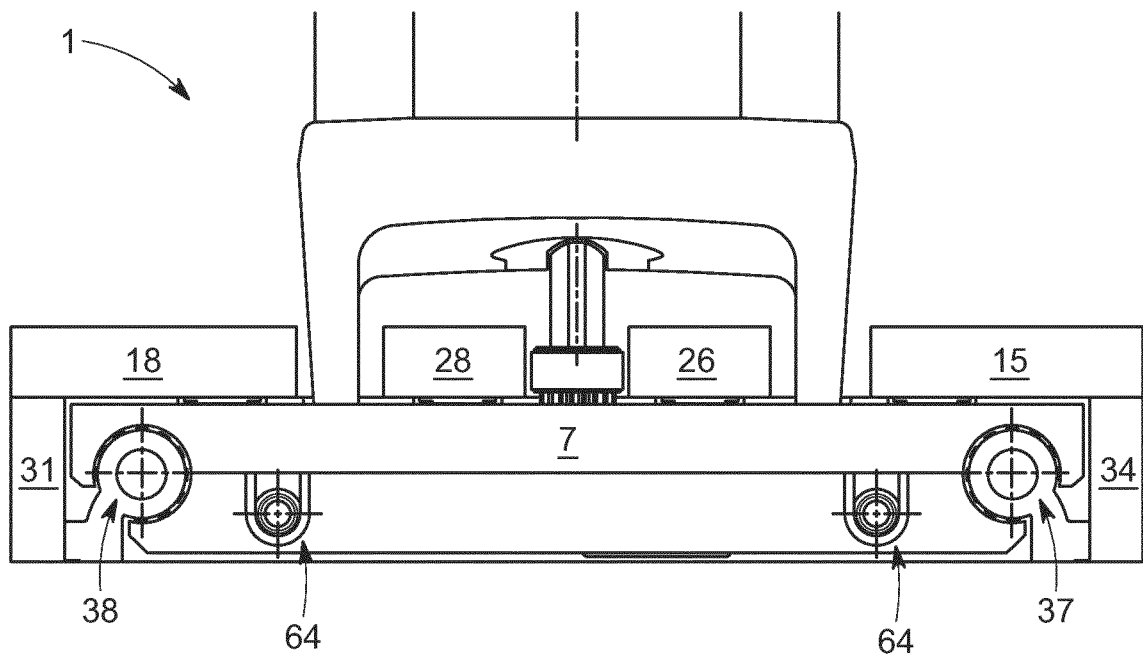


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/078931

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60N2/015 B60N2/07 B64D11/06
ADD.

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)
B60N B64D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2008/290680 A1 (BUSHA BRYAN [US] ET AL) 27 November 2008 (2008-11-27) the whole document	1-12, 16-23 13-15, 24,25
X A	----- US 2003/143052 A1 (FEHRLE BRETT V [US] ET AL) 31 July 2003 (2003-07-31) the whole document	1,3-6, 9-12,16 2,7,8, 13-15, 17,19-25
X A	----- FR 2 916 167 A3 (RENAULT SAS [FR]) 21 November 2008 (2008-11-21) the whole document	1-3,5-23 24,25
X A	----- FR 2 900 876 A1 (ANTOLIN GRUPO ING SA [ES]) 16 November 2007 (2007-11-16) the whole document	1-3,5-23 24,25



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

29 January 2020

Date of mailing of the international search report

06/02/2020

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2019/078931

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