UNITED STATES DISTRICT COURT
MIDDLE DISTRICT OF FLORIDA
ORLANDO DIVISION

VEKOMA RIDES ENGINEERING B.V.,

Plaintiff,

v.

BOLLIGER & MABILLARD CONSULTING ENGINEERS, INC.,

Defendant.

Civil Action No.: _____

JURY TRIAL DEMANDED
INJUNCTIVE RELIEF REQUESTED

COMPLAINT

Plaintiff Vekoma Rides Engineering B.V. ("Vekoma Rides" or "Plaintiff"), for its Complaint against Bolliger & Mabillard Consulting Engineers, Inc. ("Bolliger" or "Defendant"), alleges as follows:

INTRODUCTION

1. This is a civil action for patent infringement arising under the patent laws of the United States, 35 U.S.C. § 1 *et seq*., including 35 U.S.C. § 271, which gives rise to the remedies specified under 35 U.S.C. §§ 281 and 283–285.

2. Vekoma Rides is the owner of U.S. Patent No. 7,987,793 titled "Amusement Ride Device" ("the '793 Patent"). A true and correct copy of the '793 Patent is attached hereto as Exhibit 1.

3. Defendant is infringing the '793 Patent by offering for sale, manufacturing, and selling in the United States a roller coaster that includes all elements of at least one of the claims of the '793 Patent.

4. Vekoma Rides seeks injunctive relief, compensatory damages, treble damages, and attorneys' fees and costs as a result of Defendant's willful infringement of the '793 Patent.

PARTIES

5. Vekoma Rides is a besloten vennootschap (bv) existing under the laws of The Netherlands. The address of Vekoma Ride's headquarters is Schaapweg 18, 6063 BA Vlodrop, The Netherlands.

6. Vekoma Rides is a Dutch amusement ride manufacturer originating in 2001. Today, Vekoma Rides is one of the world's leading and most innovative roller coaster manufacturers, frequently winning awards. It specializes in the design, manufacturing and installation of roller coasters and special attractions for theme and amusement parks all over the world, including Disney, Universal, and Six Flags. As part of its constant efforts to create new and exhilarating experiences for thrill seekers, Vekoma Rides develops innovative technologies embodied in its rides and attractions. Vekoma Rides' innovative technology portfolio includes the inventions described and covered in the '793 Patent.

7. On information and belief, Defendant is a corporation organized and existing under the laws of Switzerland, having its principal place of business at Chemin des Dailles 31, CH-1870 Monthey, Switzerland.

8. Defendant specializes in the delivery of custom-designed roller coasters. (Ex. 2). Defendant is the manufacturer of the roller coaster **Pipeline: The Surf Coaster** ("Pipeline") at SeaWorld Orlando in Orlando, Florida. (Ex. 3).

JURISDICTION AND VENUE

9. This Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a).

10. This Court has personal jurisdiction over Defendant because, on information and belief, Defendant manufactures products that have been and are used, offered for sale, sold, and purchased in Florida.

11. Venue is proper in this judicial district pursuant to 28 U.S.C. §§ 1391(b)(2) and 1400 because a substantial part of the events giving rise to the claim, including the sale of an infringing product, occurred in this judicial district.

BACKGROUND

12. On August 2, 2011, the United States Patent and Trademark Office ("PTO") duly and legally issued the '793 Patent. At all times relevant hereto, the '793 Patent has been valid and subsisting.

13. Vekoma Rides is the owner by assignment of the '793 Patent and possesses all right and title in the '793 Patent, including the right to sue for infringement and recover damages.

14. The inventions claimed in the '793 patent provide a new and inventive amusement ride device on which passengers are allowed to perform movements during the ride while being restrained by a torso restraint. The movements of the passengers, e.g., bending and straightening of the knees, can be performed by the passengers themselves, thereby creating an enhanced sense of excitement. This allows the passengers to create their own experience and thus establish their own style, interpretation, and intensity of the ride.

15. Defendant and Vekoma Rides are familiar with one another. As recently as 2015, Vekoma Rides was a licensee under Defendant's European Patent EP1201280B1.

16. In 2019, Defendant referred to Vekoma Rides' published PCT application number WO/2007/136245, which is a patent family member of the '793 Patent, while prosecuting Defendant's U.S. patent application number 16/825,956 titled "Passenger Restraint System for Roller Coasters."

17. On or about October 18, 2022, SeaWorld Orlando introduced Pipeline and announced it was coming to SeaWord Orlando in 2023. In apparent reference to passengers' ability to squat and stand during the ride,

SeaWorld Orlando referred to Pipeline as the "[w]orld's first 'wave jumping' coaster." *See* https://twitter.com/OrlandoExperie1/status/1582404344221437953.

18. On or about November 30, 2022, Vekoma Rides informed Defendant by email, based on information publicly available at that time, that Pipeline appeared to infringe Vekoma Rides' patent on the "Board Coaster." On December 1, 2022, Defendant responded to Vekoma Rides' email.

19. On or about January 14, 2023, Vekoma Rides informed Defendant by letter of the existence of the '793 Patent and of the fact, based on information publicly available at a time, that Pipeline appeared to infringe the '793 Patent. (Ex. 4).

20. Despite being put on notice of the infringement of the '793 Patent, and refusing to take a license, Defendant proceeded to manufacture and sell Pipeline at SeaWorld in Orlando, Florida without a license from Vekoma Rides.

21. On or about May 12, 2023, SeaWorld Orlando hosted a media day for its new roller coaster – Pipeline. *See* https://www.youtube.com/watch?v=uI_IYi_1b_g

22. Pipeline opened to the public on May 27, 2023. *See* https://en.wikipedia.org/wiki/Pipeline:_The_Surf_Coaster

23. On or about September 1, 2023, Vekoma Rides sent Defendant another letter informing Defendant that Pipeline infringes the '793 Patent.

To this day, Pipeline continues to operate at SeaWorld Orlando and Defendant has refused a license under the '793 Patent.

CLAIM FOR RELIEF

(Infringement of U.S. Patent No. 7,987,793)

24. Vekoma Rides re-alleges and incorporates by reference Paragraphs 1-23 of its Complaint.

25. The '793 Patent, entitled "Amusement Ride Device," was duly and lawfully issued on August 2, 2011.

26. The '793 Patent names Stefanus Petrus Cornelis Maria Blonk and Joop Roodenburg as co-inventors.

27. The '793 Patent has been in full force and effect since its issuance. Vekoma Rides owns by assignment the entire right, title, and interest in and to the '793 Patent, including the right to seek damages for past, current, and future infringement thereof.

28. The '793 Patent relates to "an amusement ride device . . . in which the connecting means are designed to allow the passenger to perform movements during the ride while being restrained by the torso restraint, wherein the torso restraint performs a movement with respect to the platform during said movements of the passenger." Ex. 1 at 1:35-41.

29. Vekoma Rides is informed and believes, and thereon alleges, that Defendant has infringed and, unless enjoined, will continue to infringe one or more claims of the '793 Patent in violation of 35 U.S.C. § 271, by, among other things, making, using, offering to sell, and/or selling within the United States, supplying or causing to be supplied in the United States, and/or importing into the United States, without authority or license, infringing amusement ride devices, including Pipeline ("accused product").

30. Representative claim 20 (as embodied in Figs. 1-7) of the '793 Patent, reproduced below with the addition of the labels [a] – [g] corresponding to parts of the claim, recites an amusement ride device:

> 20. An amusement ride device, comprising [a] a track and at least one carriage, [b] wherein the carriage is moveable along the track in a transport direction, [c] wherein the carriage comprises:
>
> a transport part which engages on the track and comprises at least one platform that allows to support at least one passenger in a standing position thereon,
>
> [d] at least one passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger in at least the standing position, and
>
> [e] connecting means which connects the passenger torso restraint to the transport part, wherein the connecting means allows a movement of the torso restraint with respect to the platform, [f] wherein the connecting means is designed to allow the passenger to perform movements between the standing position and a squatting position during the ride while being restrained by the torso restraint,
>
> [g] wherein the torso restraint performs an up and down movement with respect to the platform during said movements of the passenger.

31. The accused product embodies every element and limitation of at least claim 20 of the '793 Patent, literally or under the doctrine of equivalents, as set forth below. The further descriptions below based on Pipeline are preliminary examples and are non-limiting.

"1. An amusement ride device comprising"

32. Pipeline is an amusement ride device (roller coaster). Shown below is a still image of a video posted to SeaWorld Orlando's X, formerly Twitter, account:

See https://twitter.com/OrlandoExperie1/status/1582404344221437953 at 0:33.

"[a] a track and at least one carriage"

33. Pipeline comprises a track and at least one carriage. *See* https://www.themeparktribune.com/seaworld-unveils-trains-for-first-surf-coaster/

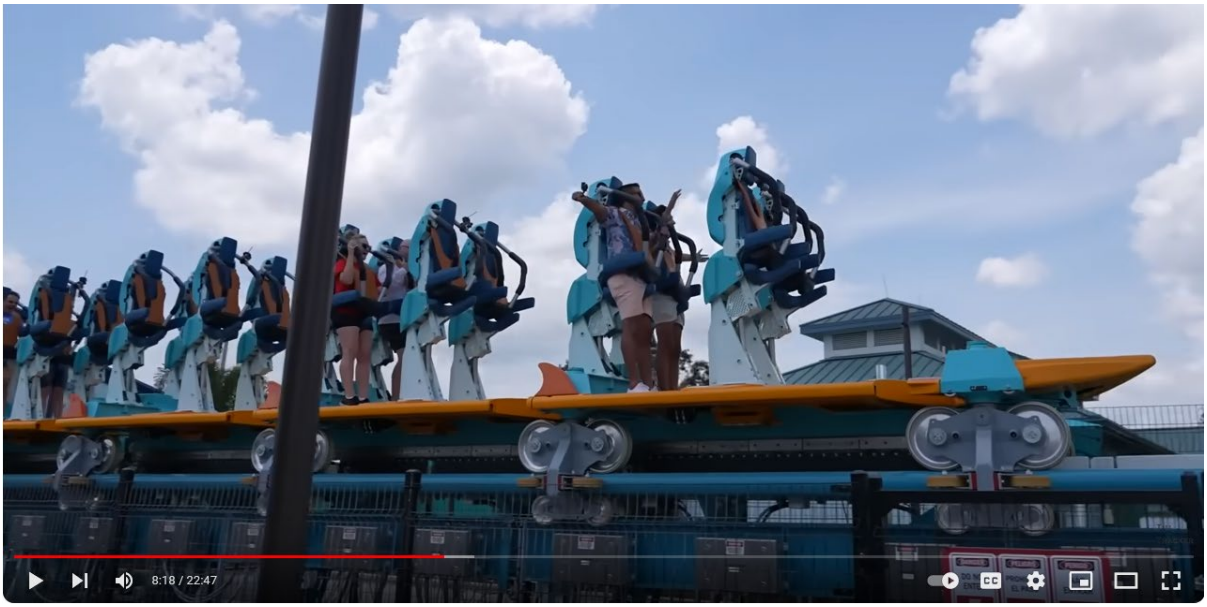
Side view of Pipeline trains. Note the decorative fins on the back. (Theme Park Tribune)

"[b] wherein the carriage is moveable along the track in a transport direction"

34. As shown in the video at https://www.youtube.com/watch?v=uI_IYi_1b_g, the carriage is moveable along the track in a transport direction.

"[c] wherein the carriage comprises: a transport part which engages on the track and comprises at least one platform that allows to support at least one passenger in a standing position thereon"

35. Shown below is a still image from the video at https://www.youtube.com/watch?v=uI_IYi_1b_g at 8:18, which shows the transport part of the Pipeline carriage engaged on the track.

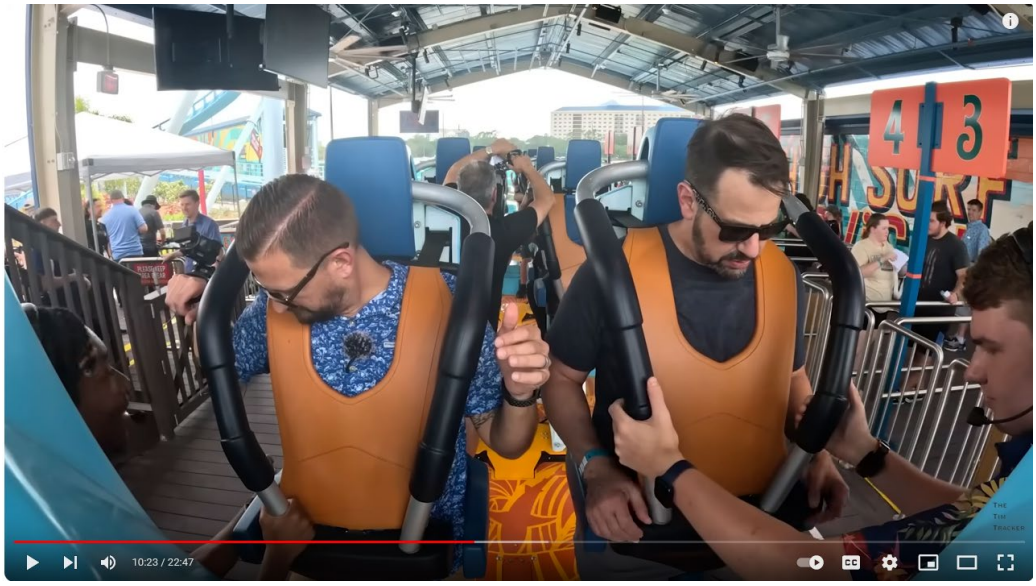


36. The transport part of Pipeline includes a platform that allows the support of the feet of at least one passenger in a standing position thereon. *See* https://www.youtube.com/watch?v=uI_IYi_1b_g at 9:43 shown below:

We Rode Orlando's NEWEST Roller Coaster! | Pipeline Stand Up Surf Coaster At Seaworld Orlando!

"[d] at least one passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger in at least the standing position"

37. Pipeline includes at least one passenger torso restraint, the passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger in at least the standing position. *See* https://www.youtube.com/watch?v=uI_IYi_1b_g at 10:23 shown below:



"[e] connecting means which connects the passenger torso restraint to the transport part, wherein the connecting means allows a movement of the torso restraint with respect to the platform"

38. As shown in the image and video below, Pipeline includes a connecting means for connecting the torso restraint to the transport part, wherein the connecting means allows a movement of the torso restraint with respect to the platform.

See https://www.youtube.com/watch?v=uI_IYi_1b_g at 9:29, 10:08.

> **"[f] wherein the connecting means is designed to allow the passenger to perform movements between the standing position and a squatting position during the ride while being restrained by the torso restraint"**

39. The connecting means in Pipeline is designed to allow passengers to move between a standing and squatting position during the ride while being restrained by the torso restraint. *See* https://www.youtube.com/watch?v=uI_IYi_1b_g at 10:08 shown below:

“[g] wherein the torso restraint performs an up and down movement with respect to the platform during said movements of the passenger.”

40. As shown below, the torso restraint in Pipeline performs an up and down movement with respect to the platform during the movements of the passenger.

See https://twitter.com/OrlandoExperie1/status/1582404344221437953 at 0:18.

41. As evidenced by Defendant's reference to the '793 Patent family during prosecution of its own patent application, Defendant has long had knowledge of the '793 Patent.

42. Furthermore, Vekoma Rides put Defendant on notice of the existence of the '793 Patent and of the infringement of the '793 Patent by Pipeline at least as early as November of 2022.

43. Vekoma Rides is informed and believes, and thereon alleges, that Defendant actively, knowingly, and intentionally has induced infringement of the '793 Patent by, for example, controlling the design and manufacture of,

offering for sale, selling, supplying, and otherwise providing instruction and guidance regarding the use and maintenance of Pipeline with the knowledge and specific intent to encourage and facilitate infringement of the '793 Patent.

44. As a result of Defendant's infringement of the '793 Patent, Vekoma Rides has been damaged. Vekoma Rides is entitled to recover for damages sustained as a result of Defendant's wrongful acts in an amount subject to proof at trial.

45. Vekoma Rides is informed and believes, and thereon alleges, that the infringement of the '793 Patent by Defendant has been and continues to be willful. As noted above, Defendant has long had knowledge of the '793 Patent and its need for a license to the same. Defendant has deliberately continued to infringe in a wanton, malicious, and egregious manner, with reckless disregard for Vekoma Ride's patent rights. Thus, Defendant's infringing actions have been and continue to be consciously wrongful.

46. Based on the information alleged in this claim, Vekoma Rides is informed and believes, and thereon alleges, that this is an exceptional case, which warrants an award of attorneys' fees to Vekoma Rides pursuant to 35 U.S.C. § 285.

PRAYER FOR RELIEF

WHEREFORE, Vekoma Rides prays for judgment against Bolliger as follows:

A. That Bolliger has infringed, and unless enjoined, will continue to infringe, the '793 Patent;

B. That Bolliger has willfully infringed the '793 Patent;

C. That Bolliger pay Vekoma Rides damages adequate to compensate Vekoma Rides for Bolliger's infringement of the '793 Patent, together with interest and costs under 35 U.S.C. § 284;

D. That Bolliger be ordered to pay pre-judgment and post-judgment interest on the damages assessed;

E. That Bolliger pay Vekoma Rides enhanced damages pursuant to 35 U.S.C. § 284;

F. That Bolliger be enjoined from infringing the '793 Patent, or if its infringement is not enjoined, that Bollinger be ordered to pay ongoing royalties to Vekoma Rides for any post-judgment infringement of the '793 Patent;

G. That Bolliger be enjoined from inducing others to infringe the '793 Patent;

H. That this is an exceptional case under 35 U.S.C. § 285, and that Bolliger pay Vekoma Rides' attorneys' fees and costs in this action; and

I. That Vekoma Rides be awarded such other and further relief as this Court deems just and proper.

DEMAND FOR JURY TRIAL

Pursuant to Federal Rule of Civil Procedure 38(b), Vekoma Rides hereby demands a trial by jury on all issues triable to a jury.

VEKOMA RIDES ENGINEERING B.V.,
by counsel:

Dated: April ___, 2024

/s/ Ava K. Doppelt

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Attorneys for Plaintiff Vekoma Rides Engineering B.V.

EXHIBIT 1

US007987793B2

(12) **United States Patent**
Blonk et al.

(10) **Patent No.: US 7,987,793 B2**
(45) **Date of Patent: Aug. 2, 2011**

(54) **AMUSEMENT RIDE DEVICE**

(75) Inventors: **Stefanus Petrus Cornelis Maria Blonk**, Apeldoorn (NL); **Joop Roodenburg**, Delft (NL)

(73) Assignee: **Vekoma Rides Engineering B.V.**, Vlodrop (NL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 295 days.

(21) Appl. No.: **12/302,005**

(22) PCT Filed: **May 24, 2006**

(86) PCT No.: **PCT/NL2006/000266**

§ 371 (c)(1),
(2), (4) Date: **Nov. 21, 2008**

(87) PCT Pub. No.: **WO2007/136245**

PCT Pub. Date: **Nov. 29, 2007**

(65) **Prior Publication Data**

US 2010/0236444 A1 Sep. 23, 2010

(51) **Int. Cl.**
A63G 1/00 (2006.01)
A63C 19/10 (2006.01)

(52) **U.S. Cl.** **104/53**; 104/75; 472/88

(58) **Field of Classification Search** 104/53, 104/55, 60, 63, 74–76, 82, 83, 85, 86; 472/88, 472/90, 91; 434/247, 253
See application file for complete search history.

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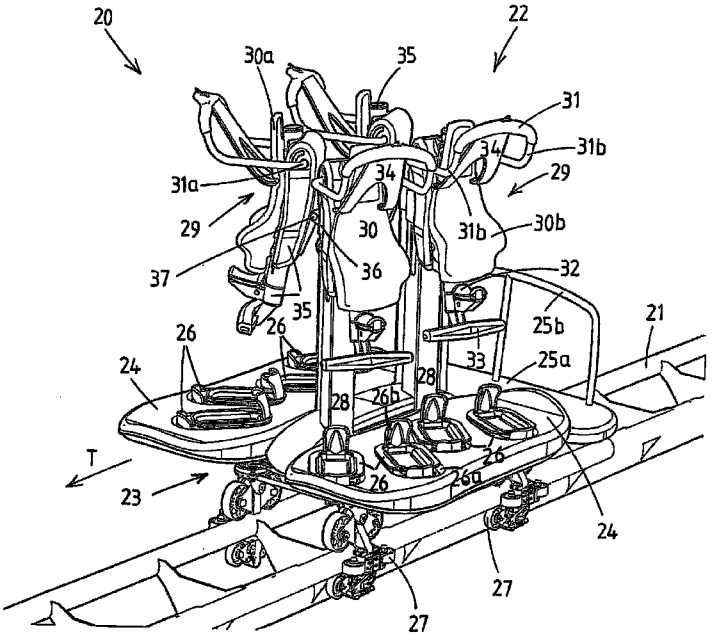
* cited by examiner

Primary Examiner — S. Joseph Morano
Assistant Examiner — R. J. McCarry, Jr.
(74) *Attorney, Agent, or Firm* — Birch, Stewart, Kolasch & Birch, LLP

(57) **ABSTRACT**

Amusement ride device, comprising a track and at least one carriage, which carriage is moveable along the track in a transport direction. The carriage comprises a transport part which engages on the track, at least one platform that allows to support the feet of at least one passenger, and at least one passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger. The transport part comprises one of the passenger torso restraint or the platform to support the passenger, while the other is connected by connecting means to the transport part. The connecting means are designed to allow the passenger to perform movements during the ride while being restrained by the torso restraint, wherein the torso restraint performs a movement with respect to the platform during said movements of the passenger.

36 Claims, 11 Drawing Sheets



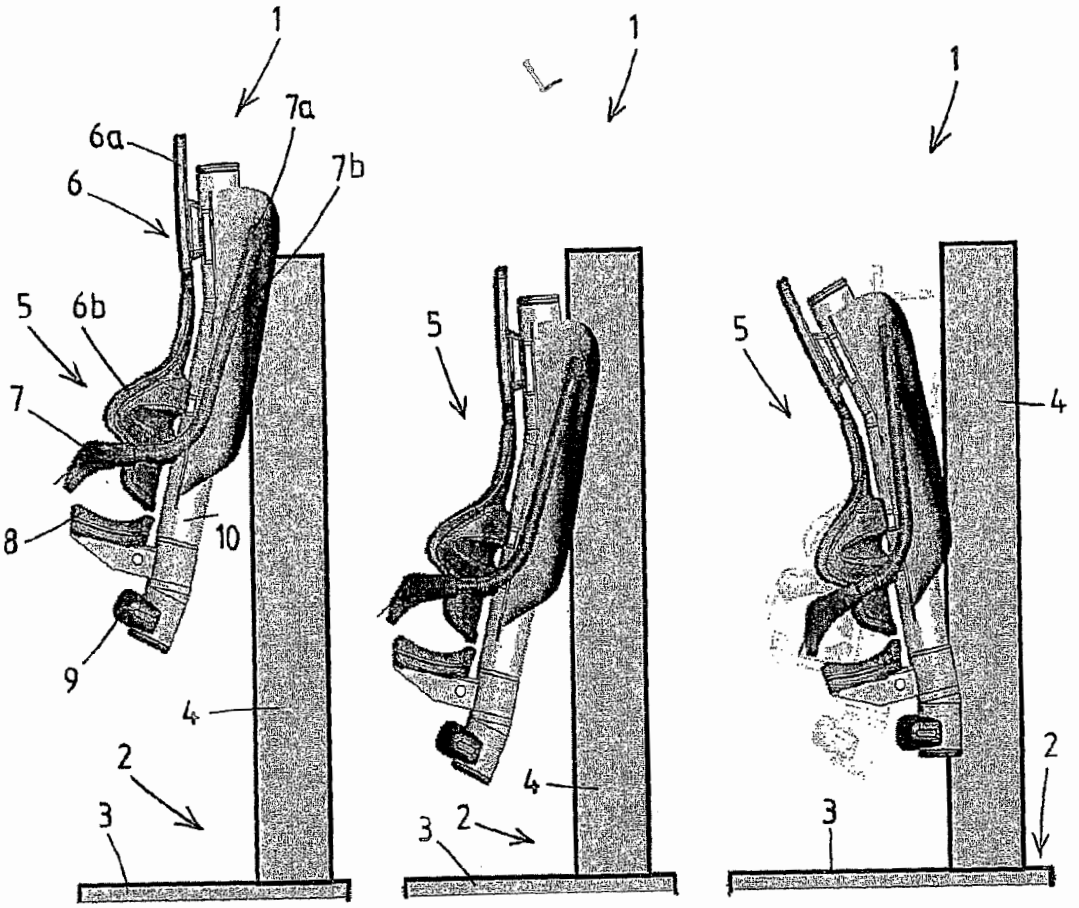


Fig.1A Fig.1B Fig.1C

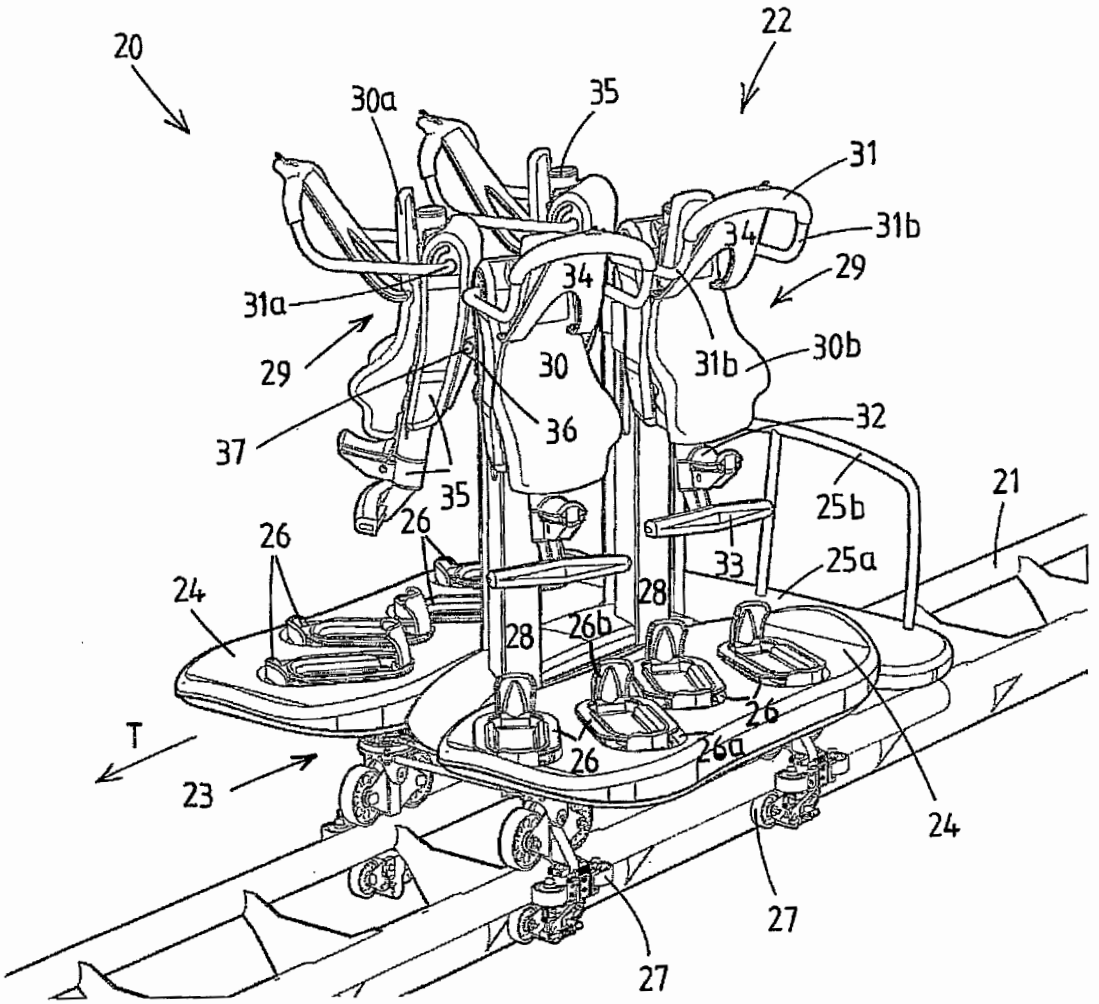

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Fig.2A

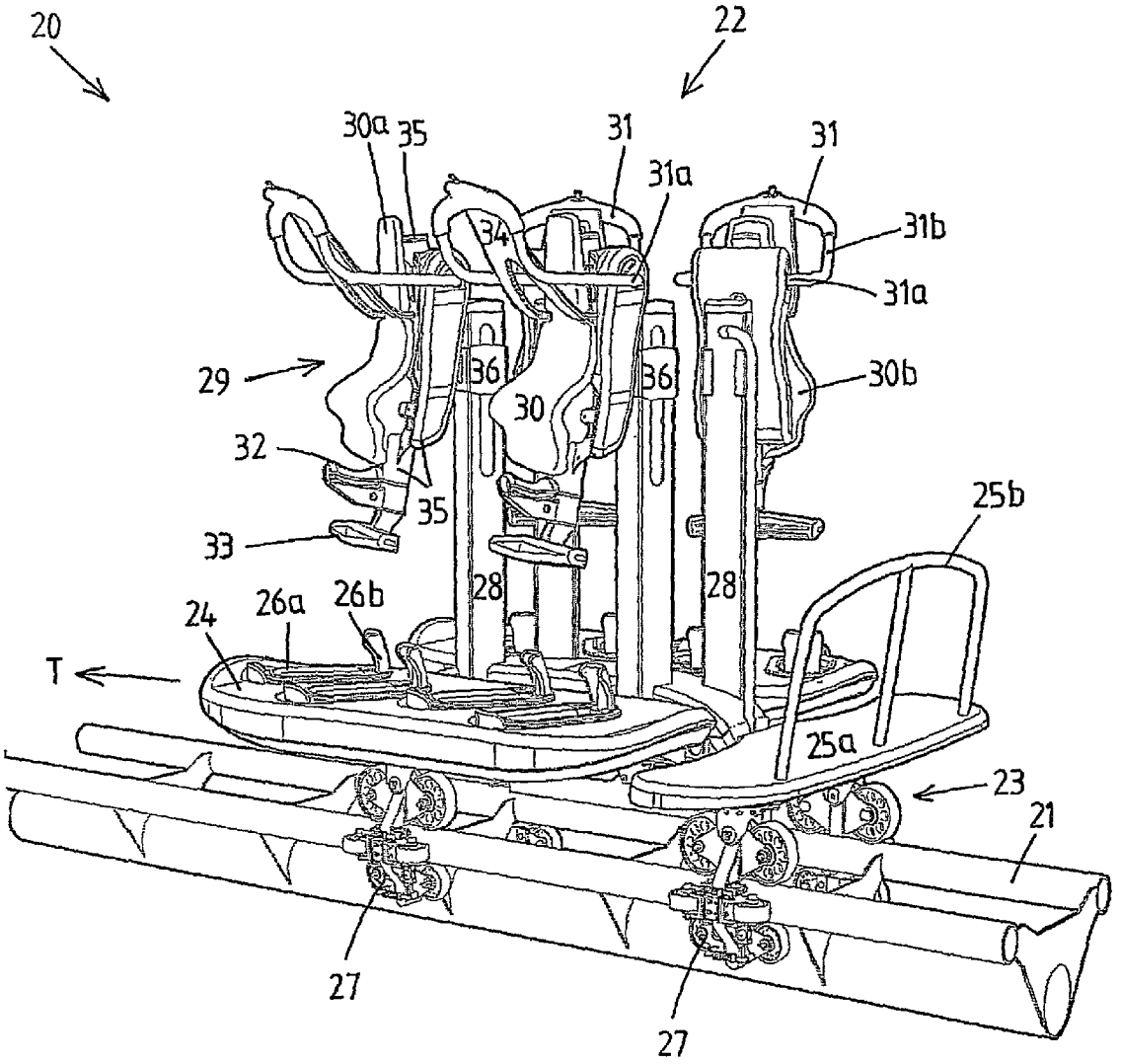
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Fig.2B

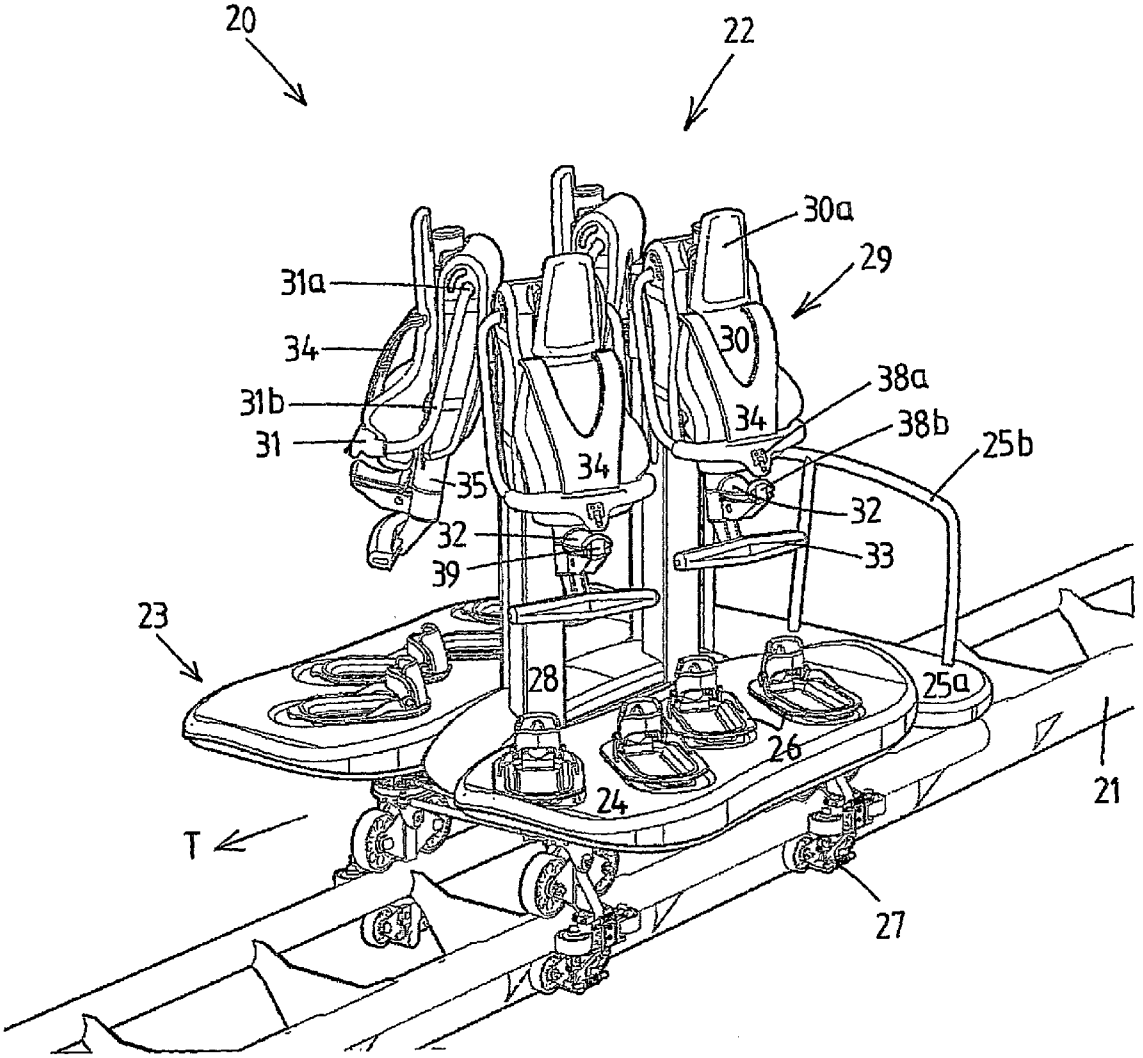
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Fig.2C

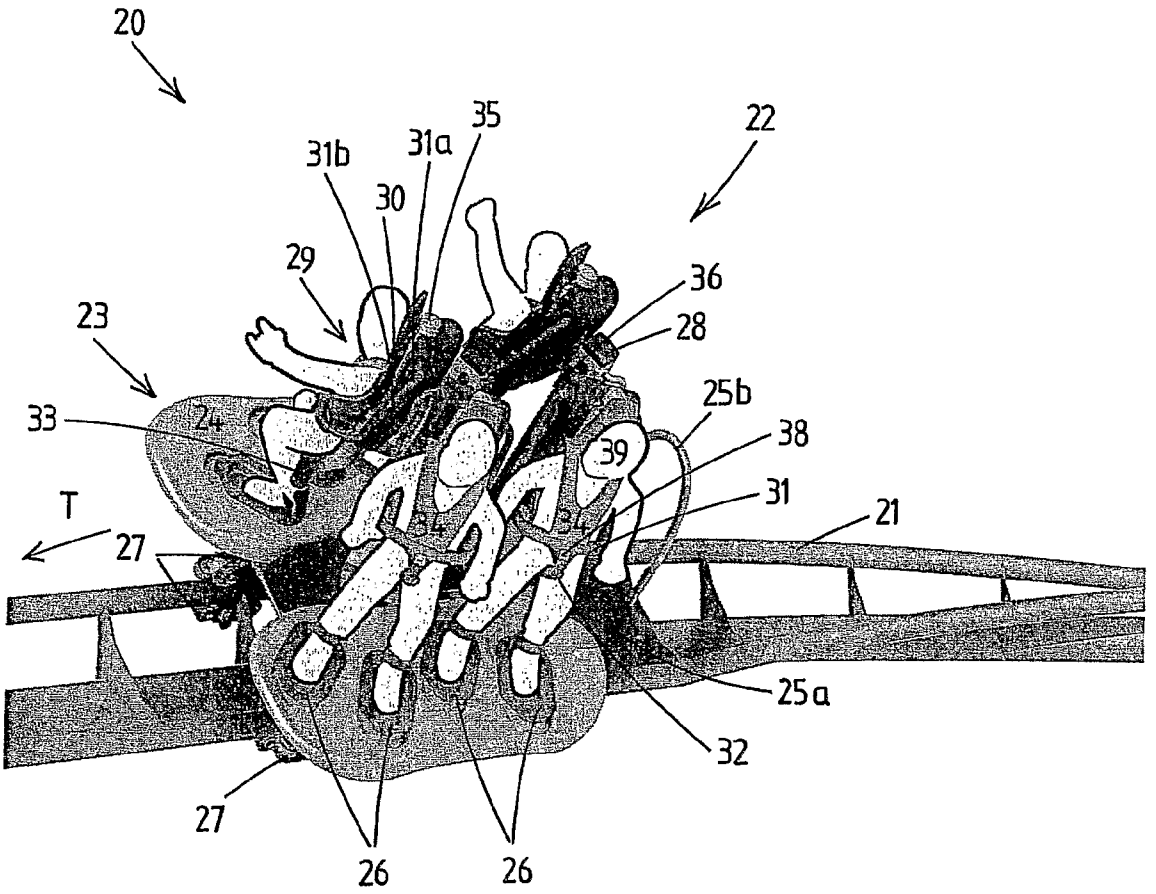
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Fig.2D

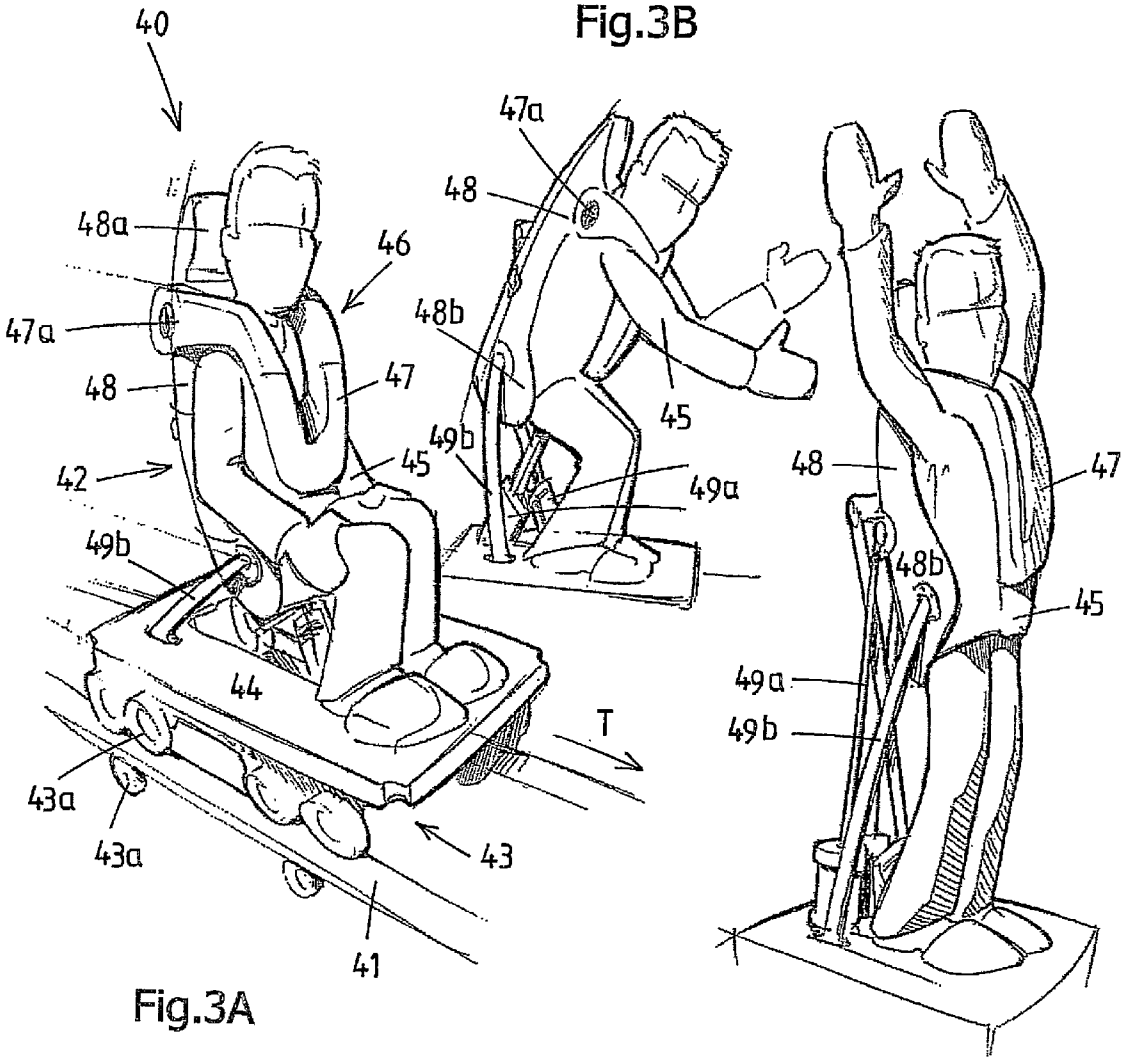

Fig.3A

Fig.3B

Fig.3C

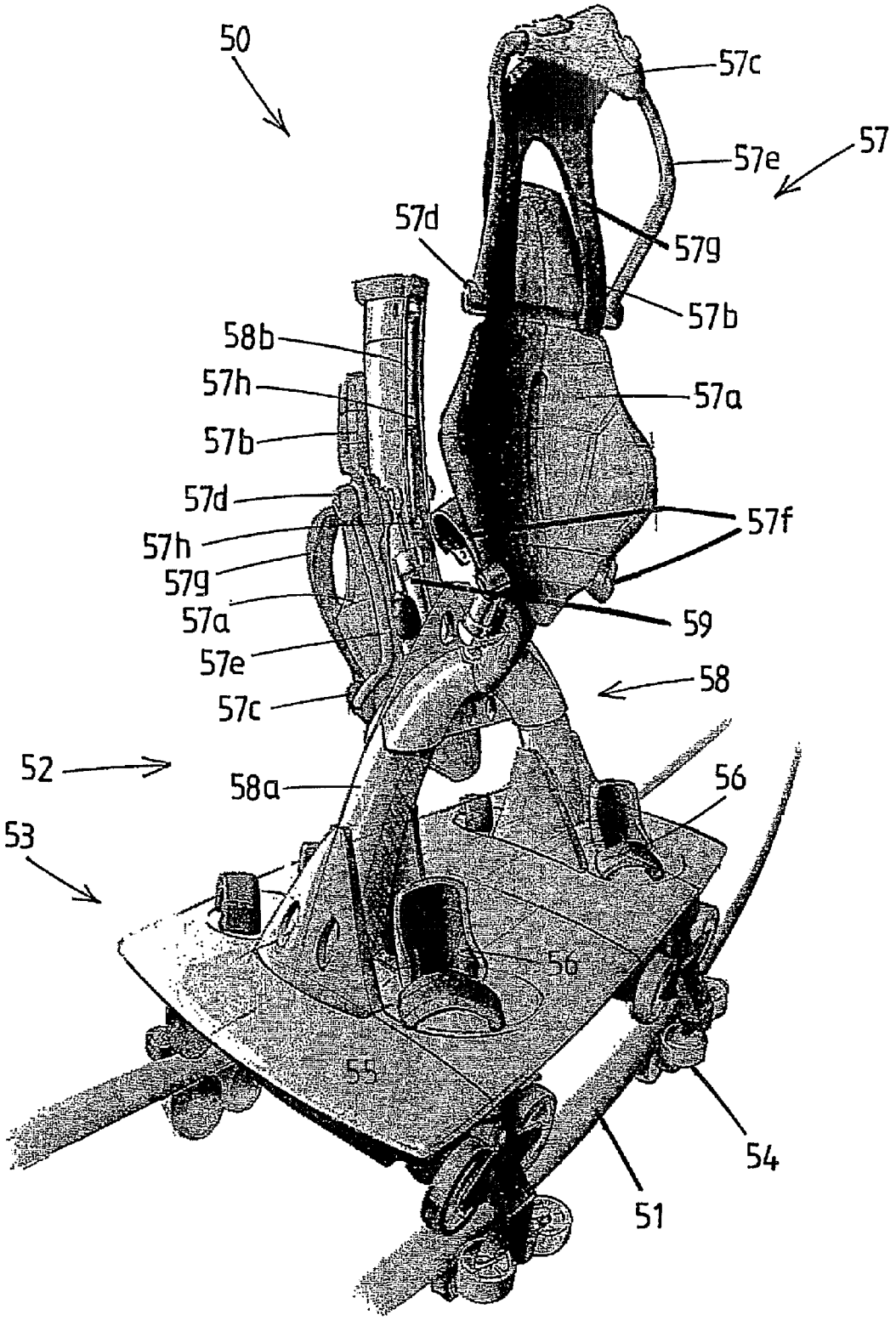
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Fig.4

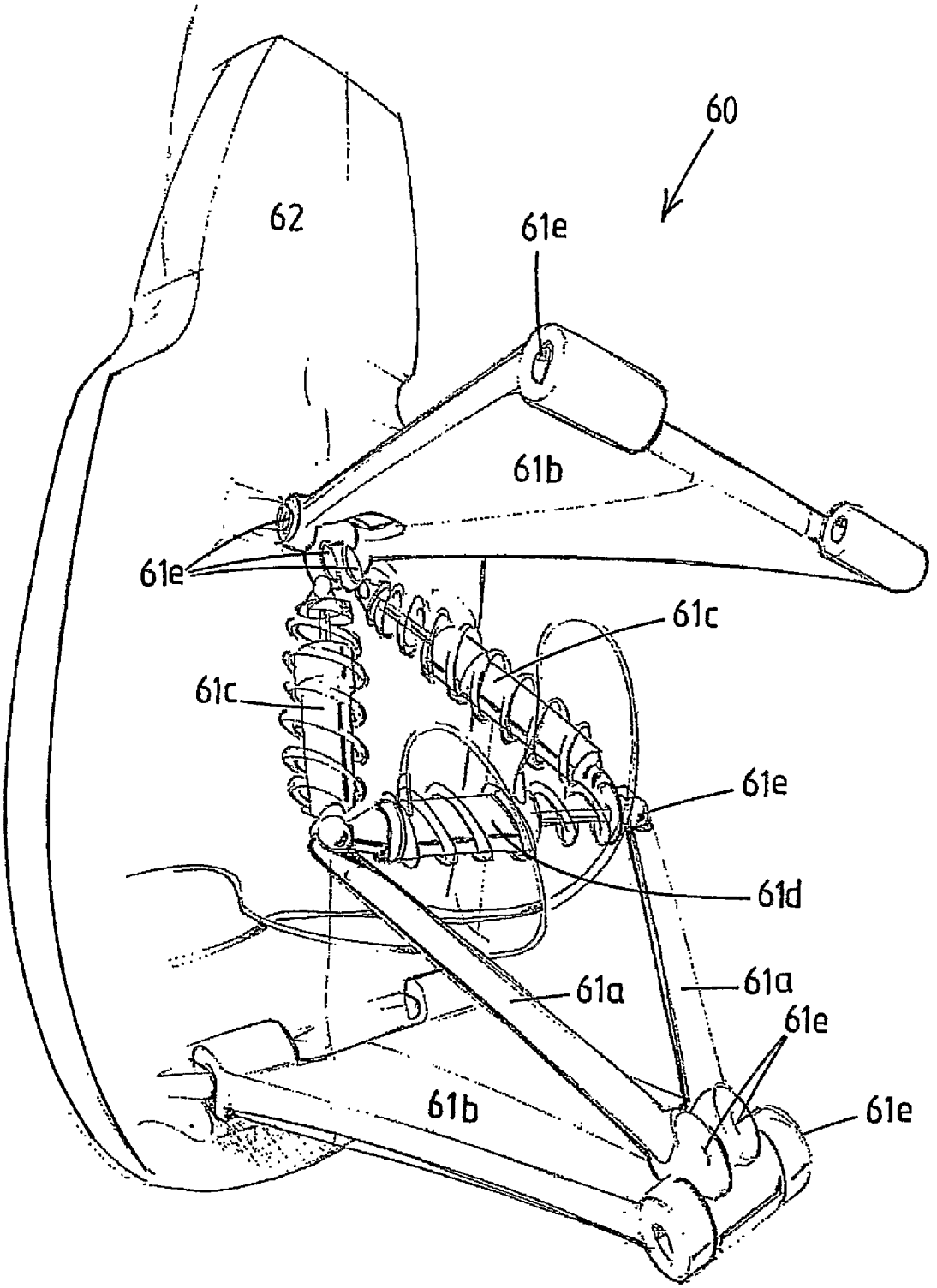

Fig.5

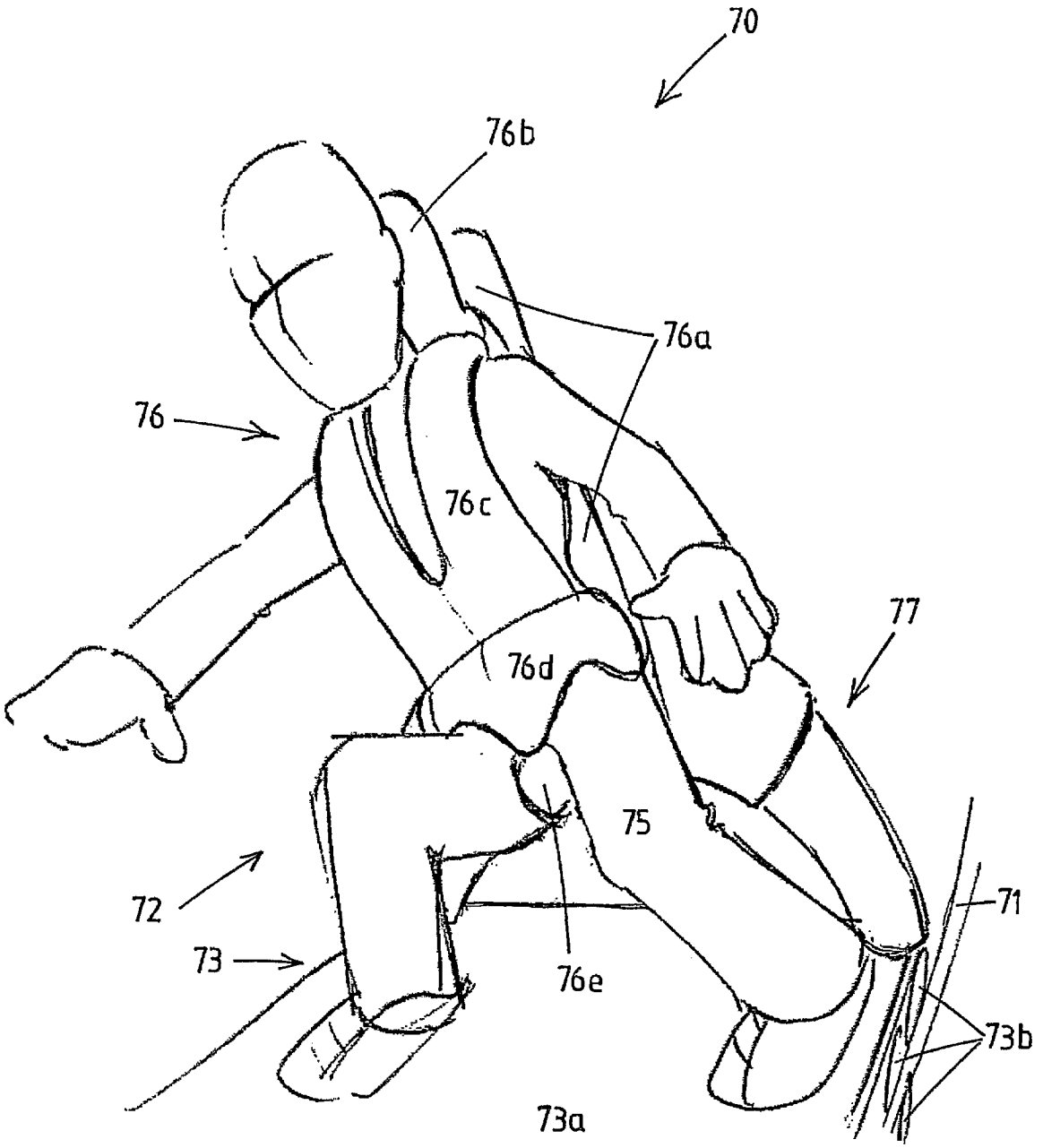

Fig.6

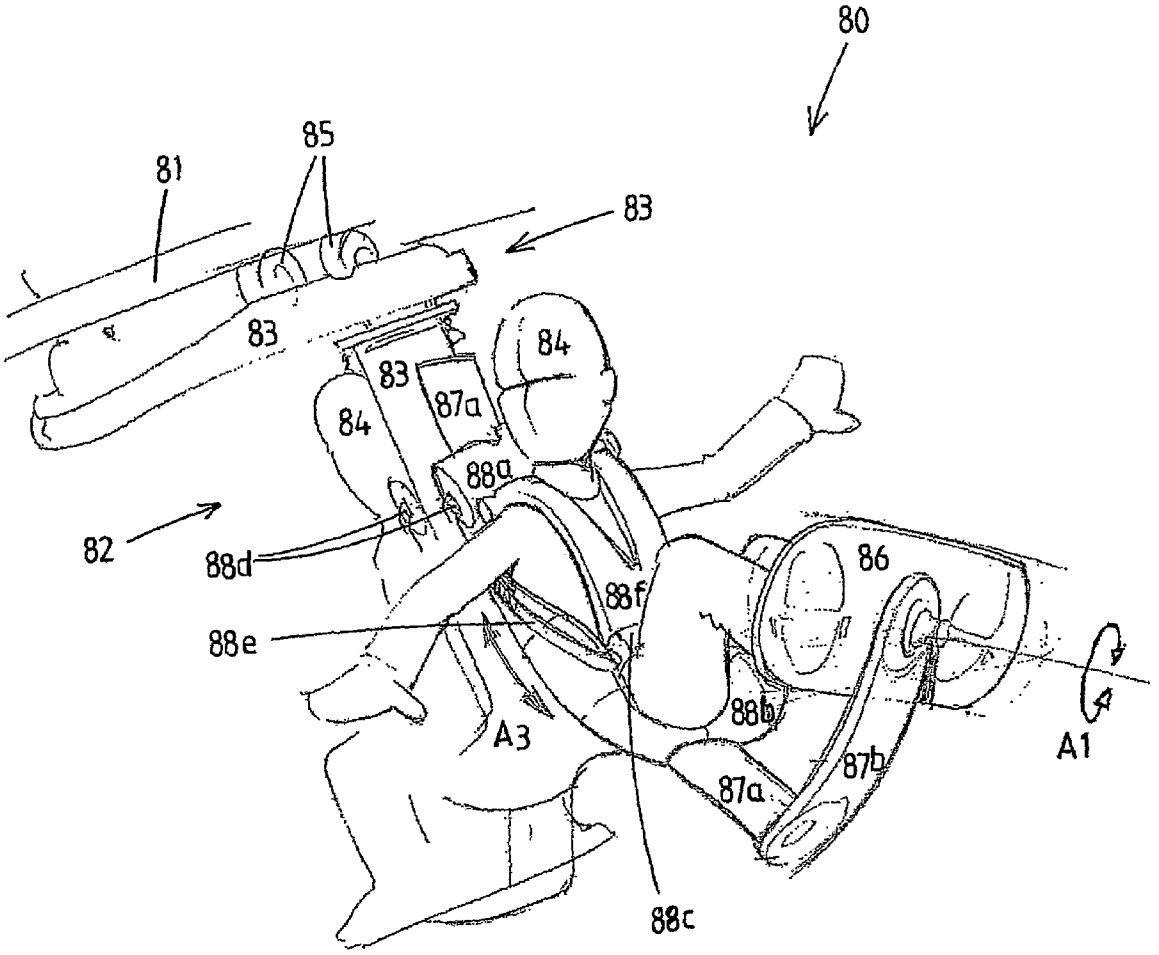
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Fig.7

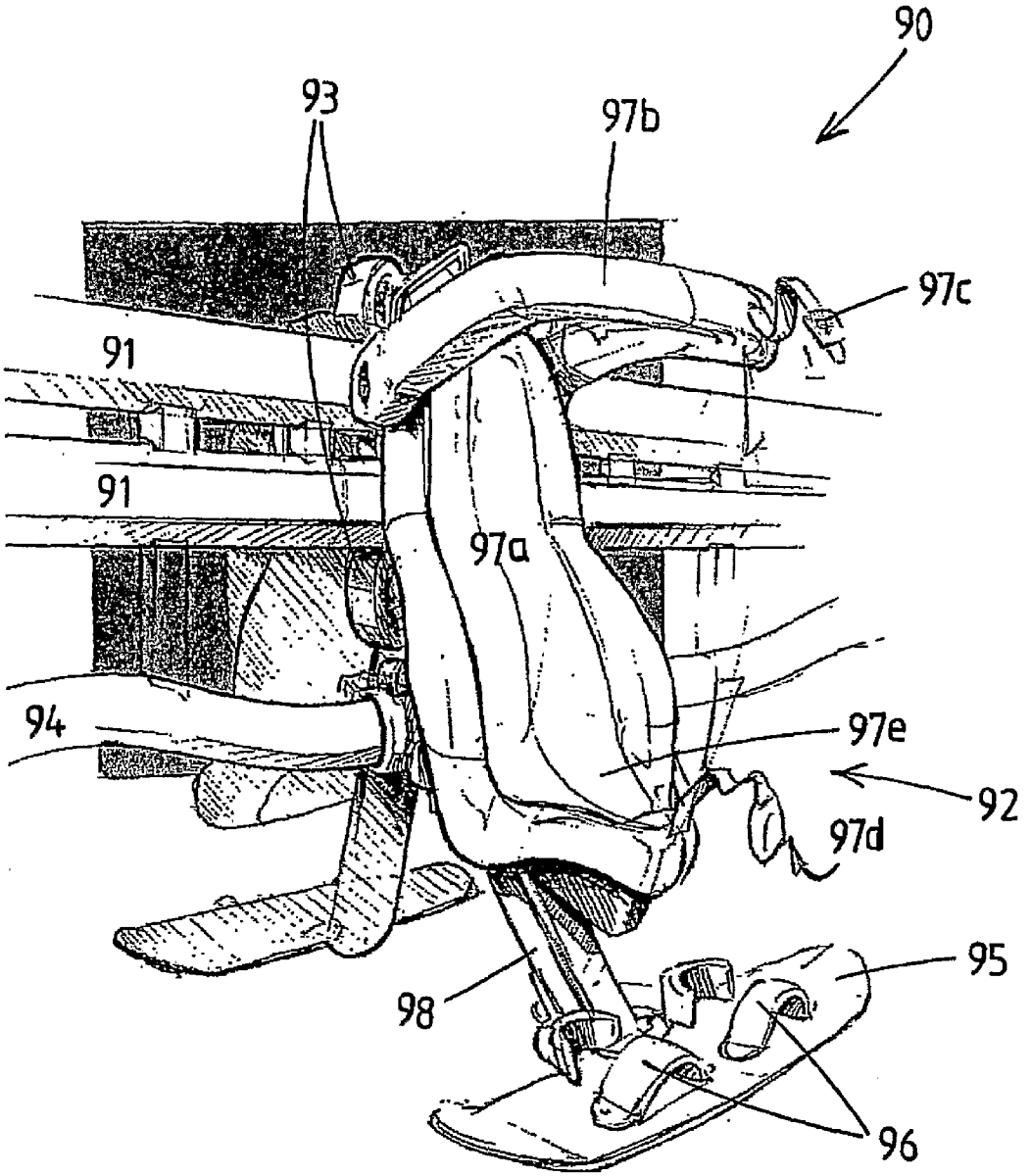

Fig.8

AMUSEMENT RIDE DEVICE

Amusement ride device, comprising a track and at least one carriage, which carriage is moveable along the track in a transport direction, which carriage comprises:

a transport part which engages on the track

at least one platform that allows to support the feet of at least one passenger,

at least one passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger,

wherein the transport part comprises one of the passenger torso restraint or the platform to support the passenger, while the other is connected by connecting means to the transport part,

This type of amusement ride device is well known from the art and applied in many stand-up roller coasters. An example of such an amusement ride device is described in U.S. Pat. No. 4,531,459. In this patent a carriage is described having a standing position support column for holding a passenger in an upright posture on a platform of a transport part which rolls or orbits along a track. A height-adjusting frame is disposed at the standing position support column to be vertically movable there-along and adjusted at a proper position in accordance with the height of the passenger. The frame has a locking mechanism for locking the height-adjusting frame during the ride. The torso restraint comprises a pair of right and left shoulder holders which support the upper half of the body and a saddle for supporting the pelvic portion of the body and an abdominal support for supporting the lower torso of the passenger. The shoulder holders are locked in the passenger holding positions during the ride.

The object of the invention is to provide an improved amusement ride device with an ameliorated ride experience.

This objective is accomplished by an amusement ride device according to the preamble of claim **1**, in which the connecting means are designed to allow the passenger to perform movements during the ride while being restrained by the torso restraint, wherein the torso restraint performs a movement with respect to the platform during said movements of the passenger.

Possibly, the feet of the passenger are connected to the platform. The connection between one of the passenger torso restraint or the transport part to the platform can possibly be moveable, e.g. by vibrations.

The movements of the passenger can be performed by the passenger itself, e.g. by bending his knees, or bending one knee and stretching the other leg. This way an enhanced sense of excitement is created, allowing the passengers the possibility to create their own attitude and thus establish their own style, interpretation and intensity of the ride. The movements of the passenger can also be imposed, e.g. by electrical means or by mechanical means related to the track, adjusting the position of the passenger to the scenery present at a particular position of the track, e.g. squatting the passenger when entering a tunnel. The movements of the torso restraint with respect to the platform can either be movements of the torso restraint with respect to a 'static' platform, or movements of a platform with respect to a 'static' torso restraint, or possibly both the torso restraint and the platform are moveable.

In a preferred embodiment, the amusement ride device comprises a track and at least one carriage, which carriage is moveable along the track in a transport direction, which carriage comprises:

a transport part which engages on the track and comprises at least one platform that allows to support at least one passenger in a standing position thereon,

at least one passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger in at least the standing position,

connecting means which connect the passenger torso restraint to the transport part, which connecting means allow a movement of the torso restraint with respect to the platform,

whereby the connecting means are designed to allow the passenger to perform movements during the ride while being restrained by the torso restraint, wherein the torso restraint performs a movement with respect to the platform during said movements of the passenger.

The connecting means are preferably designed to allow the passenger to perform movements between the standing position and a squatting position, wherein the torso restraint performs an up and down movement with respect to the platform during said movements of the passenger. This enables the passenger to be restrained on the amusement ride device while being able to squat for waves, tunnels etc. etc., while the carriage moves along the track performing turns, nose dives, horseshoes, camelbacks, helixes, possibly somersaults etc. etc., thereby providing a unique thrilling amusement.

Preferably, the passenger can board and disembark the carriage along the track. The track may also be an endless track, e.g. comprising slopes, curves, inclines and possibly also loops. The track can also not be endless, and designed e.g. as a half-pipe or be arranged at a natural slope, e.g. at a skiing area in the summer. One of the most feared (and by some most loved) parts of a roller coaster ride is the first drop. In this part of the track, the train converts its height into speed. In roller coasters with long trains, the first drop is often from the lift down to one of the lowest points in the ride in order to pick up as much speed as possible. In roller coasters with single coaches, the first drop is usually a short one in which the coach gains just enough speed to reach the following element. As snowboarders and skateboarders enter the half pipe, they experience about the same; a short bursting vertical movement. Surfers experience the same when they pick up their wave. Turning during the drop would make this experience even more thrilling; this element is called a 'hairpin dive'. Preferably, a track may comprise a so-called 'trick track'. The relatively unknown 'trick track' element features a sequence of small low banked turns. This can be compared with the sideways movement skiers and snowboarders make during descending a hill. In roller coaster track terms, this means that the track rotates back and forth over the sagittal axis. Applying this element in an amusement ride according to the invention (preferably with a near-perpendicular orientation of the occupants), this trick-track element does contribute to a thrilling sensation in which the occupants can assume several body positions since the vertical loads hardly increase during the element.

The initial speed that is needed can be given to the carriage by a lift or a launch. A disadvantage of a launch might be that due to the setup of the passengers on the carriage, possible high lateral forces could be experienced by the occupants. A traditional lift possibly suits the concept of this invention better and will possible cost less.

In order to maintain balanced, humans rotate their torso while squatting. Although several ways of squatting exist, this rotation can be seen as a natural movement and is in a preferred embodiment facilitated by the carriage. Ergonomic data indicate that this rotation occurs up to about 20 degrees in forward direction. In a preferred embodiment, the connecting means are designed to also allow a forward rotational movement of the torso of the passenger during the ride while being restrained by the torso restraint.

To further enhance the movements that can be performed by a passenger during the ride while being restrained, the connecting means are possibly designed to allow a lateral movement of the torso of the passenger. This enables the passenger to stretch one leg while bending the other one, simulating a skiing movement. This lateral movement can possibly be combined with a forward rotation movement, but this is not necessary according to the invention. Possibly, the platform is moveable with respect to the transport part. E.g. the platform comprises means to enable a tilting movement of the feet made when performing skiing movements, to prevent (over-) stretching of the ankles. These means can e.g. be springs or cushions. The platform can be made actively or passively moveable with respect to the transport part, e.g. by imposing a vibration of the platform or by imposing a movement of the platform as a whole. Possibly, the platform is rotatable about a vertical axis during the ride. In an advanced embodiment, the platform supporting the passenger comprises two independently moveable foot supports. This additional freedom of movement will make the amusement ride device to resemble reality even closer.

Preferably, the connecting means are designed as a guide structure arranged on the transport part, along which the torso restraint is moveable. The guide structure can e.g. be vertical to allow an up and down movement of the passenger in the torso restraint with respect to the platform. Alternatively, the guide structure is semicircular and perpendicular to the platform to allow a lateral and up and down movement of the passenger. Possibly, a substantial vertical guide structure is curved backwards at the lower part to cause a forward rotation of the trunk of the passenger when squatting during the ride. Preferably, the connecting means comprises a guide part connected to the torso restraint to be guided along the guide structure on the transport part. Alternatively, the connecting means further comprise a hinge to allow for a squatting movement during the ride. In this embodiment, the 'frontal' rotation (from an occupant's point of view) has been set independent of other movements. The occupant can rotate his or her trunk forwards and backwards anytime during the ride in every body position. The connecting means may alternatively comprise a combination of a curved guide structure and a hinge. In order to guide and damp this rotation, preferably damper such as a gas cylinder or spring is implemented in the system. This prevents the occupant from making sudden movements and possibly damaging himself or the system.

Alternatively, the connecting means may comprise springs, (flexible) rods, pistons, etc. etc.

Possibly, the platform supporting the passenger is designed as a surfboard, a skateboard, a snowboard or a pair of skis, e.g. anticipating to a theme of the amusement device. In a preferred embodiment the orientation of the passenger in the torso restraint in the standing position with respect to the transport direction is between 15° and 45°, preferably about 35° (as seen from above) to enhance the experience of surfing on water or snow or skateboarding. This results in an improved overall ride experience, without increasing the speed.

In a specific embodiment, multiple carriages move along a single track. The carriages can move individually along the track or can be coupled to form a train. In this preferred embodiment, each carriage comprises a single transport part with one or two platforms supporting an even number of passengers (one or more pairs of passengers) in a torso restraint in a standing position, which torso restraints are oriented such that the passengers are disposed back to back. E.g., the passengers are disposed in a 2-2 arrangement with their backs towards each other. Hence, two passengers are oriented with their right foot in the direction of transport, while the other two passengers are oriented with their left foot in the direction of transport. Of course, any other formation of the passengers is also possible: one passenger per carriage, or multiple passengers lined up behind each other on a single carriage, which can possibly each be differently orientated with respect to the transport direction.

The passenger torso restraint engaging on the torso of the passenger should be able to safely support the passenger in a standing and in a squatting position, and should be suitable for passengers who have different figures (e.g., tall, short, fat, slender).

In a preferred embodiment, the torso restraint comprises a possibly enclosing back support, an over-shoulder restraint or clamp as described in U.S. Pat. No. 4,531,459 and possibly an additive lap or hip bar. A drawback of such a shoulder restraint might be that the view of the passenger is restricted by the restraint.

Alternatively, the torso restraint may comprise a back support with a hip bar restraint. Possibly, the hip restraint can be hydraulically locked. In a preferred embodiment, an additional belt construction comprising one or two shoulder straps, such as a vest or harness, is provided between the back support and the hip restraint. In a preferred embodiment, the connection of the belt construction with the back support is adjustable, so that the belt construction can be fixed to the back support in multiple positions with varying height. This makes the restraint system more appropriate for passengers with varying lengths.

With only an upper restraint, occupants can slide out of the restraint fairly easy. A lower torso restraint can e.g. be designed as a parachute style groin belt or step-in restraint braces. A disadvantage of such a system might be that they are expensive and time consuming to apply. Preferably, the torso restraint further comprises a saddle between the passengers' legs to provide the adequate support and thus, together with other torso restraint elements provide a total enclosure of the torso of the occupant. The body is supported on the pubic bone and can be compared with sitting on a bicycle saddle. Possibly, a connecting belt and locking mechanism is present between the belt construction, shoulder restraint, lap bar or hip bar and this saddle, possibly as a redundant fastening system. The shape of the saddle is very important for its function as well as for legislation and for comfort of the occupants. The saddle has to support the pubic bone and should not leave too much room for people to get out of the restraint during the ride. Also, the width of the saddle should be tested empirical since small children (1.40 m) should fit the saddle as well as relatively fat persons with less or nearly no space between the legs.

Possibly, an additional bracket is provided behind the upper end of the legs of the occupant to prevent occupants from hyperextending their knees. This knee-bracket can be provided with a height-depending system or can be situated such that a small person will have the bracket nearly in the back of his knee and a large person will feel this bracket high up the back side of his upper leg.

In addition, the transport part of the carriage can further comprise one or more pairs of foot restraints on the platform, or alternatively a single foot restraint per passenger. The torso restraints will probably prevent the occupant from evacuation during the ride, allowing the foot restraints to prevent uncontrollable vertical movements and extreme excursions of the legs. A certain angle between the feet is advisable in order to provide a safe and comfortable squatting movement during the ride. An amount of 20° between the sagittal planes of the feet appeared to be a suitable angle. In relation to the sagittal

plane of the body, the toes should point outwards. In the snowboard industry, this is called the 'duckstance'. A preferred embodiment of the foot restraint comprises a rotating front part that travels towards a fixed rear part, by which the ankle of the occupant is restrained. The system can be closed and locked by a hydraulic piston.

Possibly, the foot restraint restrains the foot and ankle of the passenger, but the connection between the foot restraint and the platform enables some degree of tilting of the foot or feet when simulating a skiing movement.

Because of safety reasons, a manual check of the restraints prior the ride can be requested. To check an upper main body restraint the operator can e.g. pull a lap bar or pull on a vest to check whether the system is locked or not. A belt between the lap bar and saddle can also be checked visually or with a quick grip. Possibly present foot restraints though, demand the operator to bend over and pull each foot restraints. This will become considerably uncomfortable for the operator and will take a fair amount of dispatch time. A possible system by which the operator can quickly check the status of the foot restraints without too much effort and time is created by adding two pedals per occupant on the edge of the base floor plate, which are connected to the foot restraints. With this system, the operator can visually check the status of the foot restraints. Also, by stepping on the pedals (while—for instance—checking the body restraint), the foot restraints are pushed open by which the operator can check whether the system is locked properly or not. An unequal pedal position might indicate an unequal closure of the feet (are both feet in the right place) or a failure in the system. The operator can, when park policy allows it, easily press the foot restraints tighter on the restraints themselves if needed. This is a relatively low cost, mechanical solution that can easily be implemented in a coach.

Preferably the up and down movement of torso restraint with respect to the platform is limited to a lowermost position to support occupants when a high downwardly directed vertical load is experienced, or when people cannot or do not want to stand anymore, e.g. in case of fainting. Also an uppermost position is preferably provided to prevent too large forces on the legs of the passenger when experiencing high upwardly directed vertical loads. Advantageously, the upper- and/or lowermost position of the torso restraint with respect to the platform is adjustable depending on the length and possibly also the weight of the passenger.

In a preferred embodiment, a damper system damps the movements of the passenger to prevent excessive loads and impact on the human body. Possibly, a spring or alternatively an hydraulic or gas damper is used to dampen the movements of the torso restraint.

Even more preferably, an adjustable damper system is provided based on the weight of the passenger. The weighing of the passenger can occur directly, e.g. by a standing on a balance before entering the ride, or by a weighing system below the feet of the passenger. Once the occupant stands in foot restraints, the mass of the occupant is weighed and the smothering setting of the damper can be adjusted.

It is advantageously to provide for a passenger weight compensation system, e.g. by an upward force on the torso of the passenger, e.g. via the restraint, e.g. the saddle. The upward force on the torso experienced during the ride can be adjusted to the weight and/or height of the passenger. Possibly, weighing of the person can be performed indirectly by pressure measuring means measuring the upward force exerted on the passenger.

In a preferred embodiment of the invention, the torso restraint moves—with its mass—along with the body of the occupant. The influence of this added weight (and thus moment of inertia) can preferably be compensated by the implementation of a weight compensating system. For example, in a fully weight compensated system, the total weight of the torso restraint is compensated by a counterweight with an additional 2 to 4 kilograms, which will be experienced as a light pressure on the pubic bone.

In an alternative embodiment according to the invention, the amusement ride device comprises a track and at least one carriage, which carriage is moveable along the track in a transport direction, which carriage comprises:

- a transport part which engages on the track comprising at least one passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger, which transport part allows to support at least one passenger,
- a platform,
- connecting means which connect the platform to the transport part, which connecting means are designed to allow the passenger to perform movements during the ride while being restrained by the torso restraint, wherein the torso restraint performs a movement with respect to the platform during said movements of the passenger.

The invention will be explained in detail with respect to the drawings, in which:

FIGS. **1***a*-**1***c* depict a schematic side view of a preferred embodiment of a carriage according to the invention,

FIGS. **2***a*-**2***d* depict a schematic perspective view of a second preferred embodiment of an amusement ride device according to the invention,

FIGS. **3***a*-**3***c* depict a schematic perspective view of a third alternative embodiment of an amusement ride device according to the invention,

FIG. **4** depicts a schematic perspective view of a fourth alternative embodiment of an amusement ride device according to the invention,

FIG. **5** depicts a schematic perspective view of a fifth alternative embodiment of an amusement ride device according to the invention,

FIG. **6** depicts a schematic perspective view of a sixth alternative embodiment of an amusement ride device according to the invention,

FIG. **7** depicts a schematic perspective view of a seventh alternative embodiment of an amusement ride device according to the invention,

FIG. **8** depicts a schematic perspective view of an eight alternative embodiment of an amusement ride device according to the invention.

In FIG. **1** a schematic side view of a carriage **1** is presented. Carriage **1** comprises a schematically depicted transport part **2**, which transport part can engage on a track of an amusement ride device (not shown). Transport part **2** comprises a platform **3** that allows to support a passenger (not shown) in a standing position thereon. The carriage further comprises connecting means which connect the transport part **2** to a torso restraint **5**. In this embodiment, the connecting means comprise a guide structure **4** along which the torso restraint **5** is moveable in a substantial vertical direction, as visible from FIG. **1***b*. In this embodiment, the platform **3** is provided above the track. It is known from prior art that the torso restraint **5** is moveable along the guide structure **4** to adjust the torso restraint **5** to the height of the passenger. In prior art, the torso restraint **5** is adapted to the passenger after boarding and subsequently fixed before the start of the ride. According to the invention, the guide structure **4** is designed to allow the passenger to perform movements during the ride between the standing position and a squatting position while being

restrained by the torso restraint **5**. The torso restraint **5** performs an up and down movement with respect to the platform **3** during said squatting movements of the passenger. In FIG. **1***c* it is schematically depicted that the connecting means between the passenger torso restraint **5** and the platform **3** also allow for a rotation of the torso of the passenger and the torso restraint **5** when the passenger squats during the ride. Details on the operation will be given below.

The embodiment of the torso restraint **5** shown in FIG. **1** comprises a back support **6**, a hip bar **7**, saddle **8** and bracket **9**. Back support **6** comprises a head rest **6***a* and a lumbar support **6***b*. This will fix the passenger more firmly into the seat and will increase the sense of safety of the passenger. Hip bar **7** is rotatable about pivot axis **7***a* by pivot arms **7***b*. Hip bar **7** will be pivoted upwards when entering the amusement ride device, and when the passenger has entered he can lower the hip bar **7** himself or this will occur automatically, e.g. with the aid of hydraulics. The passenger sits/stands on the saddle **8** resembling sitting on a bicycle saddle. Optional bracket **9** prevents hyperextending of the knees ('locking' of the knees) when entering the carriage and during the ride. The connecting means which connect the transport part **2** to a torso restraint **5** comprise the guide structure **4** and a guide part (not shown) to be guided along the guide structure **4** on the transport part **2**. This guide part (not shown) is connected to a frame part **10** onto which all elements of the torso restraint **5** are mounted. The connecting means further comprise a hinge (not shown) between this guide part (not shown) and frame part **10** allowing a forward rotational movement of the torso restraint **5** about this hinge, enabling a forward rotation of the trunk or torso of the passenger during the ride while being restrained by the torso restraint **5**. This rotation is shown in FIG. **1***c*.

In FIG. **2***a* an amusement ride device **20** is shown, comprising a track **21** and a carriage **22**. In this embodiment, four passengers (not shown) are disposed on a single carriage **22** in a 2-2 arrangement with their backs towards each other. Two passengers are oriented with their right foot in the direction of transport T, while the other two passengers are oriented with their left foot in the direction of transport T. Of course, any other formation of the passengers is also possible.

Carriage **22** comprises a transport part **23** sliding across track **21** with four sets of guide wheels **27**. Transport part **23** comprises two platforms **24** supporting the passengers (not shown) in a standing position. Platform **24** is in this embodiment designed as a surfboard, skateboard or snowboard, and can be tuned to the scenery and/or theme of the amusement ride device **20**. A boarding platform **25***a* and handrail **25***b* is connected with the platform **24**.

Each platform **24** is provided with 2 sets of foot restraints **26**. A small angle between the feet is present in order to provide a safe and comfortable squatting movement during the ride. The toes point outwards, which is in the snowboard industry called the 'duckstance'. The shown embodiment of the foot restraint **26** comprises a rotating front part **26***a* that travels towards a fixed rear part **26***b*, by which the ankle of the occupant is restrained. The system can be closed and locked by a hydraulic piston (not shown).

The carriage **22** further comprises connecting means which connect the transport part **23** to four torso restraints **29**. The connecting means in this embodiment comprise four guide structures **28** along which the torso restraints **29** are moveable up and down with respect to the transport part **23**, in this embodiment in a substantial vertical direction.

The embodiment of the torso restraint **29** shown in FIG. **2** comprises a back support **30**, a hip bar **31**, saddle **32** and bracket **33**. Back support **30** comprises a head rest **30***a* and a lumbar support **30***b*. This will fix the passenger more firmly into the seat and will increase the sense of safety of the passenger. Hip bar **31** is rotatable about pivot axis **31***a* by pivot arms **31***b*. Hip bar **31** will be pivoted upwards when entering the amusement ride device, and when the passenger has entered he can lower the hip bar **31** himself or this will occur automatically, e.g. with the aid of hydraulics. A vest (or harness) **34** is provided between the hip bar **31** and the back rest **30** to furthermore restrain the passenger. Possibly this vest can be adapted to the height of the passenger. Preferably, the vest comprises an adjustable belt system to adapt the vest also to the size of the passenger. Preferable, the vest is designed as described in copending application PCT/EP2006/004562, hereby incorporated by reference. The passenger sits on the saddle **32** resembling sitting on a bicycle saddle, while being supported by the platform **24** in a standing position. Bracket **33** prevents hyperextending of the knees ('locking' of the knees) when entering the carriage and during the ride.

The connecting means comprising guide structures **28** further comprise guide parts **36** to be guided along the guide structure **28** on the transport part **23**. These guide parts **36** are connected to frame parts **35**, onto which elements of the torso restraint **29** are mounted. The connecting means further comprise hinges **37** between guide part **36** and frame part **35**, to allow for a forward rotational movement of the torso restraint **29** about this hinge **37**, allowing a forward rotation of the trunk of the passenger.

A damper or gas spring is preferably provided in guide structure **28** to dampen the up and down movement of the passenger. The position of the hinge **37** is behind the back of the person, preferably behind the lower part of the back to allow for a natural forward rotational movement while squatting.

FIG. **2***b* shows the same embodiment as shown in FIG. **2***a*, but from another perspective. Same components are given same numerals, but are possibly better or worse visible.

The perspective of FIG. **2***c* is the same as that of FIG. **2***a*, but the torso restraint **29** is now closed (without passengers being present). In the shown embodiment a locking member **38***a* is visible on hip bar **31**, that can lock vest **34**, or alternatively a belt or belt system (not shown) to a lock **38***b* provided in saddle **32**.

FIG. **2***d* shows the embodiment shown in FIGS. **2***a*-**2***c* with passengers **39**.

In FIGS. **3***a*-**3***c* an alternative embodiment of an amusement ride device **40** is depicted. In the previous shown embodiments, the passenger embarks and disembarks the amusement ride device in a standing position, and can squat during the ride. It can be seen that alternatively, e.g. in this embodiment, the passenger embarks the amusement ride device in a sitting position, and can stand up and squat during the ride. Possibly, aids are provided to help the passenger to stand up from the squatted position. For example, rods or rails are provided.

The device **40** comprises a track **41** and a carriage **42**. The carriage **42** comprises a transport part **43** comprising a platform **44**, that allows to support a passenger **45** in a sitting position (FIG. **3***a*), a squatting position (FIG. **3***b*) and in a standing position (FIG. **3***c*) thereon. The transport part **43** engages on the track **41** with guide wheels **43***a* and is free to move along the track **41** in a transport direction T. The carriage **42** further comprises a torso restraint **46** for safely supporting passenger **45** in a sitting, squatting and a standing position. In the shown embodiment, the torso restraint **46** comprises a shoulder restraint **47** and a back rest **48** comprising a head rest **48***a* and a lumbar support **48***b*, and possibly

some kind of seat or saddle (not shown), e.g. a semi-seat, possibly nothing more than a ladies' bicycle saddle or small ridge, to sit on in the position shown in FIG. **3***a*. Shoulder restraint **47** is pivotable about pivot axis **47***a*.

Connecting means **49** connect torso restraint **46** to transport part **43**, which connecting means **49** allow an up and down movement of the torso restraint **46** with respect to the platform **44**. Connecting means **49** further allow the passenger **45** to perform movements during the ride between the standing position and a squatting position and a forward rotational movement of the torso of the passenger while squatting and standing, while continuously being restrained by the torso restraint **46**. The torso restraint **46** performs an up and down movement with respect to the platform **44** during said movements of the passenger **45**. The connecting means **49** in this embodiment comprise pistons **49***a*, possibly dampers or gas springs, and rods **49***b*. The connecting means allow a lowermost position of the torso restraint and the passenger to rest or sit when fainted. Possibly, the connecting means **49** also aid to help the passenger to stand up from the squatted position when the ride takes off.

In FIG. **4** a fourth embodiment of an amusement ride device **50** according to the invention is shown. The amusement ride device **50** comprises a track **51** and a carriage **52**. The carriage comprises a transport part **53** which engages on the track **51** by four sets of guide wheels **54**. The transport part **53** comprises a platform **55** that allows to support two passengers (not shown) in a standing position thereon. The passengers will be disposed back-to-back on platform **55**, with their feet in the two sets of foot restraints **56** provided on the platform **55**. The passengers will further be restrained by a torso restraint **57**. The torso restraint **57** in this embodiment comprises a back rest **57***a*, a head rest **57***b*, a hip bar **57***c* which is pivotable about pivot axis **57***d* by pivot arms **57***e* and a parachute style hip restraint **57***f* which is a flexible belt to be placed along the groins of the passenger and connected to the hip bar **57***c*, thereby forming an X-shaped restraint. Between hip bar **57***c* and back restraint **57***a* a vest **57***g* is provided. The restraint **57** visible in a (large) front view is in an open position, allowing the entry of a passenger, while the (smaller) restraint **57** visible partly from behind is in a closed position.

The torso restraint **57** is connected to the transport part **53** by connecting means **58**. Connecting means **58** comprise a U-shaped frame part **58***a*, to which two tubular-shaped hollow guide structures **58***b* are connected (only one of which is visible in FIG. **4**). The connecting means comprise various guide parts **57***h* connected to torso restraint **57** that can be guided along the guide structure **58***b* to allow an up and down movement of the torso restraint **57** with respect to the platform **55**, and to allow the passenger to perform movements during the ride between a standing position and a squatting position while being restrained by the torso restraint **57**. To dampen the movements of the passenger a cylinder, possibly a hydraulic cylinder **59** is provided to dampen the motion of the passenger. To also cause a forward rotational movement of the torso of the passenger during the ride while being restrained by the torso restraint **57** the guide structure **58** is curved backwards.

In FIG. **5** a fifth embodiment of a detail of a carriage **60** is shown. A schematic view of a back rest **62** of a passenger torso restraint is visible, and part of connecting means **61** to connect the passenger torso restraint **62** to a transport part (not shown). The connecting means might further comprise a column (not shown) at the right-hand side of the drawing that can be placed on a platform (not shown). The shown part of connecting means **61** are designed as a so-called double wishbone construction, in the shown embodiment comprising rods **61***a*, plates **61***b*, diagonal dampers **61***c* and a horizontal damper **61***d*, all pivotable about pivot axes **61***e*. The horizontal damper **61***d* can be used to adjust the connecting means **61** to the height of the passenger. The two diagonal dampers **61***c* allow for a vertical movement of the passenger. The double wishbone geometry realizes a forward rotation of the back rest **62** of about 15-20°. A disadvantage of this system is the small variety in lengths of persons that can seat in this carriage.

In FIG. **6** a schematic perspective view of a sixth embodiment of an amusement ride device **70** according to the invention is shown. In this embodiment, the passenger is allowed to perform a skiing movement, comprising an up and down movement and a lateral sideways movement. The amusement ride device **70** comprises a track **71** and a carriage **72**. Carriage **72** comprises a transport part **73**. Transport part **73** comprises wheels **73***b* that engage on the track **71** and a platform **73***a* that allows to support a front facing passenger **75** in a standing position thereon.

Carriage **72** further comprises a passenger torso restraint **76** engaging on the torso of the passenger **75** for safely supporting the passenger in at least the standing position. The shown passenger torso restraint **76** comprises a back support **76***a* with a head rest **76***b*, a shoulder restraint **76***c* and hip restraint **76***d* in one piece and a saddle **76***e*. The hip restraint **76***d* is connected to the saddle **76***e* via a locking mechanism (not shown).

Carriage **72** further comprises connecting means **77** which connect the passenger torso restraint **76** to the transport part **73**. Connecting means **77** are designed to allow a lateral movement of the torso of the passenger **75** during the ride while being restrained by the torso restraint **76**, wherein the torso restraint **76** performs a movement with respect to the platform **73***a*. Simultaneously, the passenger **75** performs movements between the standing position and a squatting position, wherein the torso restraint **76** performs an up and down movement with respect to the platform **73***a* during said movements of the passenger **75**. Connecting means **77** comprise a semicircular guide structure (only part of which is visible).

In FIG. **7** a schematic perspective view of an eighth embodiment of an amusement ride device **80** according to the invention is shown. The amusement ride device **80** comprises a track **81** and a carriage **82**. In this embodiment, the carriage **82** is suspended under the track **81**.

Carriage **82** comprises a transport part **83** comprising wheels **85** that engage on the track **81**. The transport part **83** in this embodiment comprises a platform **86**, onto which the feet of passengers **84** are restrained by a pair of foot restraints (not shown). Each shown platform **86** allows to support a passengers **84**. The platform **86** is moveable to some extent with respect to the transport part **83** in that the platform can perform a rotational movement indicated by arrow A**1**.

Carriage **82** further comprises two passenger torso restraints **88** engaging on the torso of the passengers **84** for safely supporting the passengers **84**. The torso restraints **88** comprise a back rest **88***a*, a saddle **88***b*, a hip bar **88***c* which is pivotable about pivot axis **88***d* by pivot arms **88***e*. A vest **88***f* is present between the hip bar **88***c* and the back rest **88***a*, extending over the torso and shoulders of passenger **84**. The torso restraints **88** are connected to transport part **83** by connecting means **87**, which connecting means **87** comprise a connection plate **87***b* and a guide structure **87***a*. The guide structure **87***a* which connect the torso restraint **88** to the transport part **83** is designed to allow the passenger **84** to perform a squatting movement of the legs during the ride while being restrained by the torso restraint **88**, wherein the torso restraint **88** per-

forms an up and down movement with respect to the platform **86** during said movements of the passenger **84**, indicated by arrow A**3**.

In FIG. **8** part of an amusement ride device **90** is shown in perspective, comprising a track **91** and one carriage **92**, which carriage **92** is moveable along the track **91** in a transport direction. The carriage **92** comprises a transport part **93** comprising wheels and a frame part engaging on the track **91**. Substantially parallel to the track **91**, a guide track **94** is provided.

Carriage **92** further comprises a platform **95** that allows to support the feet of at least one passenger by a pair of foot restraints **96**.

Carriage **92** further comprises two passenger torso restraints **97** engaging on the torso of the passenger for safely supporting the passenger. The torso restraint **97** comprises a back support **97***a*, an over shoulder restraint **97***b*, a buckle security lock **97***c* that can lock into locking member **97***d* arranged on seat **97***e*.

In the shown embodiment, the passenger torso restraint **97** is fixedly connected to the transport part **93** in a suspended manner to support the passenger, while the platform **95** is connected by connecting means **98** to the transport part **93**, which connecting means **98** are designed to allow the passenger to perform movements during the ride while being restrained by the torso restraint **97**, wherein the torso restraint **97** performs a movement with respect to the platform **95** during said movements of the passenger. In the shown embodiment, the guide track **94** imposes movements of the platform **95** with respect to the restraint **97**.

The invention claimed is:

1. An amusement ride device, comprising a track and at least one carriage, wherein the carriage is moveable along the track in a transport direction, wherein the carriage comprises:

a transport part which engages on the track, and

at least one platform that allows to support the feet of at least one passenger in a standing position thereon,

wherein the transport part comprises at least one passenger torso restraint, the passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger in at least the standing position, the at least one platform being connected by connecting means to the transport part, and

wherein the connecting means is designed to allow the passenger to perform movements between the standing position and a squatting position during the ride while being restrained by the torso restraint, wherein the torso restraint performs an up and down movement with respect to the platform during said movements of the passenger.

2. The amusement ride device according to claim **1**, wherein the connecting means is designed to allow a forward rotational movement of the torso of the passenger during the ride while being restrained by the torso restraint.

3. The amusement ride device according to claim **1**, wherein the connecting means is designed to allow a lateral movement of the torso of the passenger during the ride while being restrained by the torso restraint.

4. The amusement ride device according to claim **1**, wherein the connecting means is designed as a guide structure arranged on the transport part, along which the torso restraint is moveable.

5. The amusement ride device according to claim **4**, wherein the guide structure is curved to cause a forward rotation of the torso restraint when squatting.

6. The amusement ride device according to claim **4**, wherein the connecting means comprises a guide part to be guided along the guide structure, and a hinge to allow for a forward rotational movement of the torso restraint during the ride.

7. The amusement ride device according to claim **1**, wherein the torso restraint comprises a back support, a hip bar and a saddle.

8. The amusement ride device according to claim **7**, wherein the hip bar is connectable to the saddle via a locking mechanism.

9. The amusement ride device according to claim **7**, wherein the torso restraint comprises a belt construction comprising one or two shoulder straps between the hip bar and the back support.

10. The amusement ride device according to claim **9**, wherein the connection of the belt construction with the back support is adjustable, so that the belt construction can be fixed to the back support in multiple positions with varying height.

11. The amusement ride device according to claim **7**, wherein the torso restraint comprises a bracket below the saddle which will be behind the legs of the passenger to prevent hyperextending of the knees of the passenger.

12. The amusement ride device according to claim **1**, wherein the torso restraint comprises a back support, a shoulder restraint and a saddle.

13. The amusement ride device according to claim **12**, wherein the shoulder restraint is connectable to the saddle via a locking mechanism.

14. The amusement ride device according to claim **1**, wherein the transport part further comprises one or more pairs of foot restraints on the platform.

15. The amusement ride device according to claim **1**, wherein the platform supporting the passenger is designed as a surfboard, a skateboard, a snowboard or a pair of skis.

16. The amusement ride device according to claim **1**, wherein the orientation of the passenger in the torso restraint with respect to the transport direction is between 15° and 45°, preferably about 35° as seen from above.

17. The amusement ride device according to claim **1**, wherein the platform is moveable with respect to the transport part.

18. The amusement ride device according to claim **1**, wherein the at least one passenger torso restraint is suspended under the track.

19. The amusement ride device according to claim **1**, wherein multiple carriages move along a track, wherein each carriage comprises a single transport part with one or two platforms supporting one or more pairs of passengers in a torso restraint, and the torso restraints are oriented such that the passengers are disposed back to back.

20. An amusement ride device, comprising a track and at least one carriage, wherein the carriage is moveable along the track in a transport direction, wherein the carriage comprises:

a transport part which engages on the track and comprises at least one platform that allows to support at least one passenger in a standing position thereon,

at least one passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger in at least the standing position, and

connecting means which connects the passenger torso restraint to the transport part, wherein the connecting means allows a movement of the torso restraint with respect to the platform,

wherein the connecting means is designed to allow the passenger to perform movements between the standing position and a squatting position during the ride while being restrained by the torso restraint, wherein the torso

restraint performs an up and down movement with respect to the platform during said movements of the passenger.

21. The amusement ride device according to claim **20**, wherein the connecting means is designed to allow a forward rotational movement of the torso of the passenger during the ride while being restrained by the torso restraint.

22. The amusement ride device according to claim **20**, wherein the connecting means is designed to allow a lateral movement of the torso of the passenger during the ride while being restrained by the torso restraint.

23. The amusement ride device according to claim **20**, wherein the connecting means is designed as a guide structure arranged on the transport part, along which the torso restraint is moveable.

24. The amusement ride device according to claim **23**, wherein the guide structure is curved to cause a forward rotation of the torso restraint when squatting.

25. The amusement ride device according to claim **23**, wherein the connecting means comprises a guide part to be guided along the guide structure, and a hinge to allow for a forward rotational movement of the torso restraint during the ride.

26. The amusement ride device according to claim **20**, wherein the torso restraint comprises a back support, a hip bar and a saddle.

27. The amusement ride device according to claim **26**, wherein the hip bar is connectable to the saddle via a locking mechanism.

28. The amusement ride device according to claim **26**, wherein the torso restraint comprises a belt construction comprising one or two shoulder straps between the hip bar and the back support.

29. The amusement ride device according to claim **28**, wherein the connection of the belt construction with the back support is adjustable, so that the belt construction can be fixed to the back support in multiple positions with varying height.

30. The amusement ride device according to claim **26**, wherein the torso restraint comprises a bracket below the saddle which will be behind the legs of the passenger to prevent hyperextending of the knees of the passenger.

31. The amusement ride device according to claim **20**, wherein the torso restraint comprises a back support, a shoulder restraint and a saddle.

32. The amusement ride device according to claim **31**, wherein the shoulder restraint is connectable to the saddle via a locking mechanism.

33. The amusement ride device according to claim **20**, wherein the platform supporting the passenger is designed as a surfboard, a skateboard, a snowboard or a pair of skis.

34. The amusement ride device according to claim **20**, wherein the orientation of the passenger in the torso restraint with respect to the transport direction is between 15° and 45°, preferably about 35° as seen from above.

35. The amusement ride device according to claim **20**, wherein the at least one passenger torso restraint is suspended under the track.

36. The amusement ride device according to claim **20**, wherein multiple carriages move along a track, wherein each carriage comprises a single transport part with one or two platforms supporting one or more pairs of passengers in a torso restraint, and the torso restraints are oriented such that the passengers are disposed back to back.

* * * * *

EXHIBIT 2

COMPANY (/COMPANY)

Company

Company Showreel (/sites/default/files/videos/original/00 Company Showreel web-low.mp4)

Bolliger & Mabillard is specialized in the delivery of custom-designed roller coasters. Each roller coaster is conceived to answer the specific needs and desires of the client and to adapt perfectly to the available topography.

Bolliger & Mabillard brings its original ideas to the amusement industry backed by sophisticated engineering, a broad base of practical experience, together with first-rate quality control and fast, conscientious after-sales service.

The company enjoys a worldwide reputation among the amusement parks clientele for providing and maintaining extremely smooth rides on all of its coaster designs.

Bolliger & Mabillard is committed to providing quality products and services, for complete client satisfaction.

EXHIBIT 3

WIKIPEDIA
The Free Encyclopedia

Pipeline: The Surf Coaster

Coordinates: 28.4109°N 81.4639°W

Pipeline: The Surf Coaster, or simply **Pipeline**, is a launched roller coaster located at SeaWorld Orlando in Orlando, Florida. Manufactured by Bolliger & Mabillard (B&M), the roller coaster opened on May 27, 2023. Pipeline is a Surf Coaster model from B&M and is themed to surfing, featuring surfboard-shaped vehicles.

The roller coaster is a first-of-a-kind prototype where the seats of riders shift up and down along the course layout. It reaches a height of 110 feet (34 m) and a maximum speed of 60 mph (97 km/h), and it features a track length of 2,950 feet (900 m). Following Mako, Manta and Kraken, Pipeline is the fourth B&M coaster located at SeaWorld Orlando.

Pipeline: The Surf Coaster	
	
 Pipeline's overbanked turn	
SeaWorld Orlando	
Location	SeaWorld Orlando
Park section	Sea of Power
Coordinates	28.4109°N 81.4639°W
Status	Operating
Soft opening date	May 12, 2023
Opening date	May 27, 2023
General statistics	
Type	Steel – Launched
Manufacturer	Bolliger & Mabillard
Model	Surf Coaster
Lift/launch system	LSM launch

History

Development for a new roller coaster prototype began in 2019, followed by the filing of a patent trademark for "Surf Coaster" by roller coaster manufacturer Bolliger & Mabillard on May 28, 2019.[2] A project codenamed "Project Penguin" was revealed in January 2020 after site-work plans were filed with Orange County officials for a new attraction in 2021.[3][4] The new project was planned to be built toward the front of the park near a pathway that runs along Bayside Stadium.[5] The area had been used in the past for festivals in the park.[5][6] Subsequent plans were made in June and September 2020, which also confirmed the new project to be a "custom launch coaster" featuring a stand-up restraint design. Early reports speculated that the Surf Coaster model would be built at SeaWorld Orlando.[2][7]

Teasers for SeaWorld Orlando's new roller coaster began in April 2022. A picture of trees with roller coaster track in the background was depicted in the first teaser. Construction fencing began appearing along the surrounding area.[3] In June 2022, the park teased with the warning, "High surf advisory".[8] The teaser warning would later be used as a hashtag to tease and promote

the roller coaster on social media.[9] Due to the fallout from Hurricane Ian in September 2022, the official unveiling of the new coaster in an announcement was delayed.[10]

The final teaser video was released in early October 2022. In the video, the attraction's construction progress was on display.[11][12] On October 18, 2022, the park officially unveiled Pipeline: The Surf Coaster in an announcement.[13][14] The scheduled opening was revealed to be spring of 2023.[15] It was marketed as the first surf coaster in the world.[16] Track construction went vertical in late October 2022.[17] Pipeline's trains were put on display at the International Association of Amusement Parks and Attractions (IAAPA) Expo on November 15, 2022.[18]

Construction of the track completed a month later on December 19, 2022,[19][20] which was followed by testing in March 2023.[6] The official opening date was revealed as May 27, 2023, with a soft opening preview period for passholders starting on May 12, 2023.[21]

Height	110 ft (34 m)
Length	2,950 ft (900 m)
Speed	60 mph (97 km/h)
Inversions	1
Duration	1:50
Height restriction	54–78 in (137–198 cm)
Trains	2 trains with 6 cars. Riders are arranged 2 across in 2 rows for a total of 24 riders per train.
Theme	Surfing
Website	Official website (https://seaworld.com/orlando/roller-coasters/pipeline)
QQ Quick Queue available[1]	
Pipeline: The Surf Coaster at RCDB (https://rcdb.com/20042.htm)	

Ride experience

After exiting the station, the surfboard-themed train launches 60 miles per hour (97 km/h) into a 110 feet (34 m) overbanked turn to the right. Following the overbanked turn, the train turns left into an inversion billed as the "wave curl" inversion by the park, before the train goes up and turns right into one of two helix elements. After succeeding the 360° helix, the train immediately turns into a second overbanked turn. Traveling into a banked airtime hill, the train turns right and then whips to the left into a second, 270° helix. Then, the train turns left immediately after the helix, before turning right, into the final brake run.[22][23] The total duration for the roller coaster is approximately one minute and fifty seconds.[24]

Characteristics

Pipeline: The Surf Coaster is a surf coaster model manufactured by Bolliger and Mabillard. Though the ride strikes similarities with the stand-up roller coaster model, the ride was clarified as not being one, as stated by Jonathan Smith, SeaWorld's vice president of rides and engineering. Smith expressed at the IAAPA Expo on November 15, 2022 that the differences were that unlike stand-up roller coasters where riders stand "erect", the restraints on surf coasters have movement.[25] The roller coaster is the fourth Bolliger & Mabillard roller coaster at SeaWorld Orlando, the other three being Mako, Manta and Kraken.[9][16]

Track

The steel track for Pipeline: The Surf Coaster is approximately 2,950 feet (900 m) long and the

height of the highest peak, the first overbanked turn, is 110 feet (34 m).[26][27] The color of the track is teal and the supports are white.[28][29]

Theme

Pipeline: The Surf Coaster is themed to surfing,[30] especially surfing cultures in California and Australia.[17] The park bills the launch section of the roller coaster as a "surfing launch", along with "wave jumping motions", which shift rider's seats up and down to resemble the feeling of surfing.[31][24][32] Additionally, the roller coaster's trains are designed to mimic surfboards.[13] The roller coaster's only inversion is titled the "wave curl" inversion, which is based on the "cork alley oop" surfing maneuver.[33]

See also

- Stand-up roller coaster

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External links

- Official website (https://seaworld.com/orlando/roller-coasters/pipeline/)
- Pipeline: The Surf Coaster (https://rcdb.com/20042.htm) at the Roller Coaster DataBase

EXHIBIT 4

VEKOMA

Bolliger & Mabillard
Ch. Des Dailles 31
1870 Monthey
Switzerland

Ref: Seaworld Orlando – Pipeline: The Surf Coaster

Dear Ms. Bolliger,

We like to explain our position in respect to presumed features of the vehicle of the Pipeline coaster at Seaworld Orlando which is presently under construction.

We were triggered by the promotion video displayed on Seaworld's website, where the opening of the Pipeline coaster is announced, supported by animated ride footage (https://youtu.be/EX21m85avyI?list=TLGGh7pQHZfCDuQxMDAxMjAyMw).

The section starting at 5min25sec shows guests performing a squat movement. If this is going to be the case in reality, we like to point to US patent 7.987.793, awarded to Vekoma Rides Engineering and which is valid until March 2027. This patent is primarily encompassing the squat movement and the device allowing the passenger to perform a squat movement as if riding a surfboard, ski or the like (see claims 1 and 33 in particular). Based on the footage of the promotion video we see a possible infringement upon this patent.

If above is applicable to the Pipeline coaster, we like to open discussions about an arrangement allowing B&M to make use of the intellectual property protected by the above mentioned patent along the lines of a release agreement as has been arranged between our companies in the past.

Looking forward to your reply, we remain

Yours sincerely

Har W.A.B. Kupers

VEKOMA
ingenuity that moves you

CEO

Att.: US patent 7.987.793

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US007987793B2

(12) **United States Patent**
Blonk et al.

(10) **Patent No.: US 7,987,793 B2**
(45) **Date of Patent: Aug. 2, 2011**

(54) **AMUSEMENT RIDE DEVICE**

(75) Inventors: **Stefanus Petrus Cornelis Maria Blonk**, Apeldoorn (NL); **Joop Roodenburg**, Delft (NL)

(73) Assignee: **Vekoma Rides Engineering B.V.**, Vlodrop (NL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 295 days.

(21) Appl. No.: **12/302,005**

(22) PCT Filed: **May 24, 2006**

(86) PCT No.: **PCT/NL2006/000266**

§ 371 (c)(1),
(2), (4) Date: **Nov. 21, 2008**

(87) PCT Pub. No.: **WO2007/136245**

PCT Pub. Date: **Nov. 29, 2007**

(65) **Prior Publication Data**

US 2010/0236444 A1 Sep. 23, 2010

(51) **Int. Cl.**
A63G 1/00 (2006.01)
A63C 19/10 (2006.01)

(52) **U.S. Cl.** **104/53**; 104/75; 472/88

(58) **Field of Classification Search** 104/53, 104/55, 60, 63, 74–76, 82, 83, 85, 86; 472/88, 472/90, 91; 434/247, 253
See application file for complete search history.

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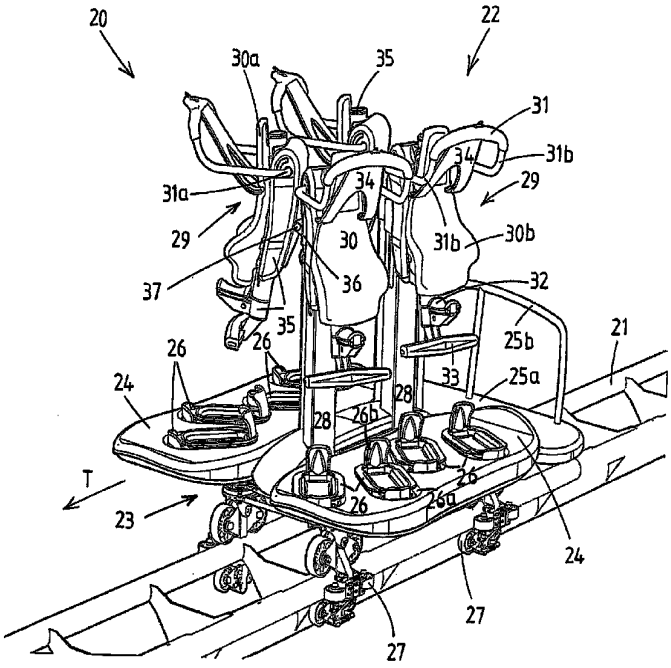
Primary Examiner — S. Joseph Morano
Assistant Examiner — R. J. McCarry, Jr.
(74) *Attorney, Agent, or Firm* — Birch, Stewart, Kolasch & Birch, LLP

(57) **ABSTRACT**

Amusement ride device, comprising a track and at least one carriage, which carriage is moveable along the track in a transport direction. The carriage comprises a transport part which engages on the track, at least one platform that allows to support the feet of at least one passenger, and at least one passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger. The transport part comprises one of the passenger torso restraint or the platform to support the passenger, while the other is connected by connecting means to the transport part. The connecting means are designed to allow the passenger to perform movements during the ride while being restrained by the torso restraint, wherein the torso restraint performs a movement with respect to the platform during said movements of the passenger.

36 Claims, 11 Drawing Sheets



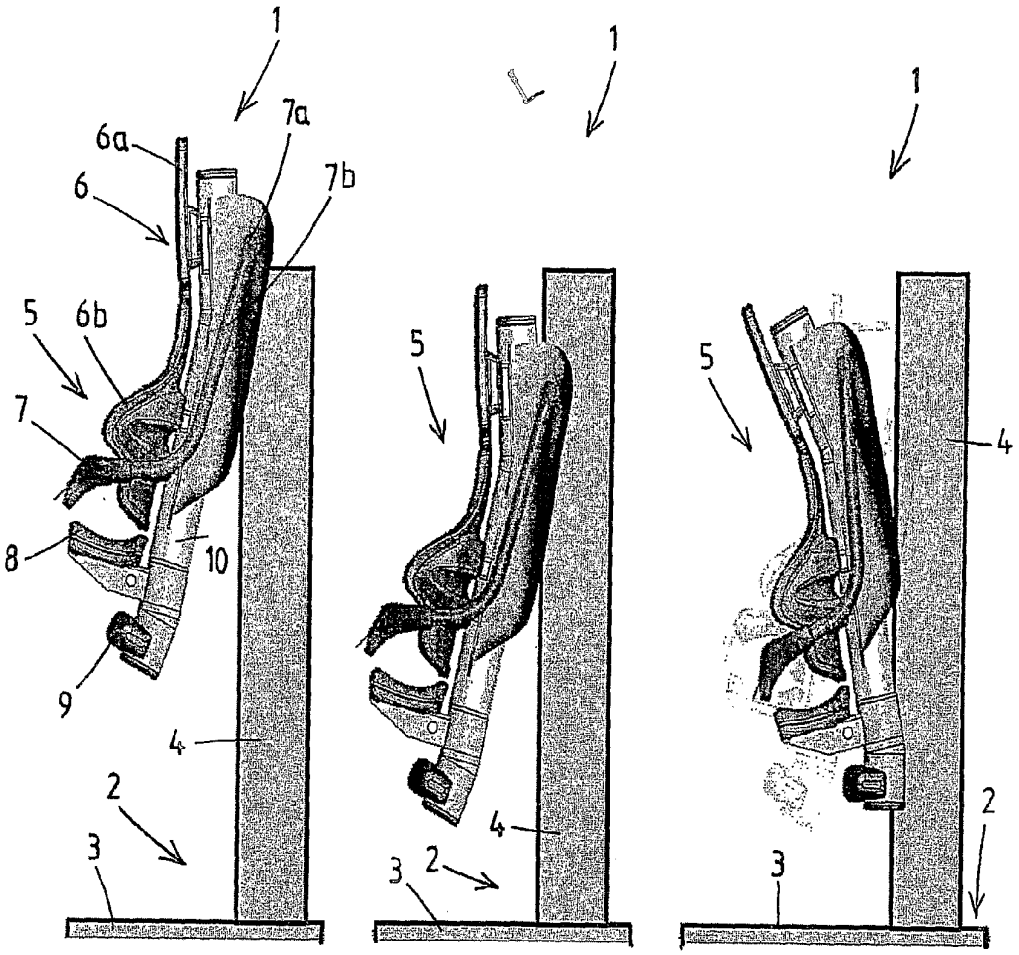


Fig.1A Fig.1B Fig.1C

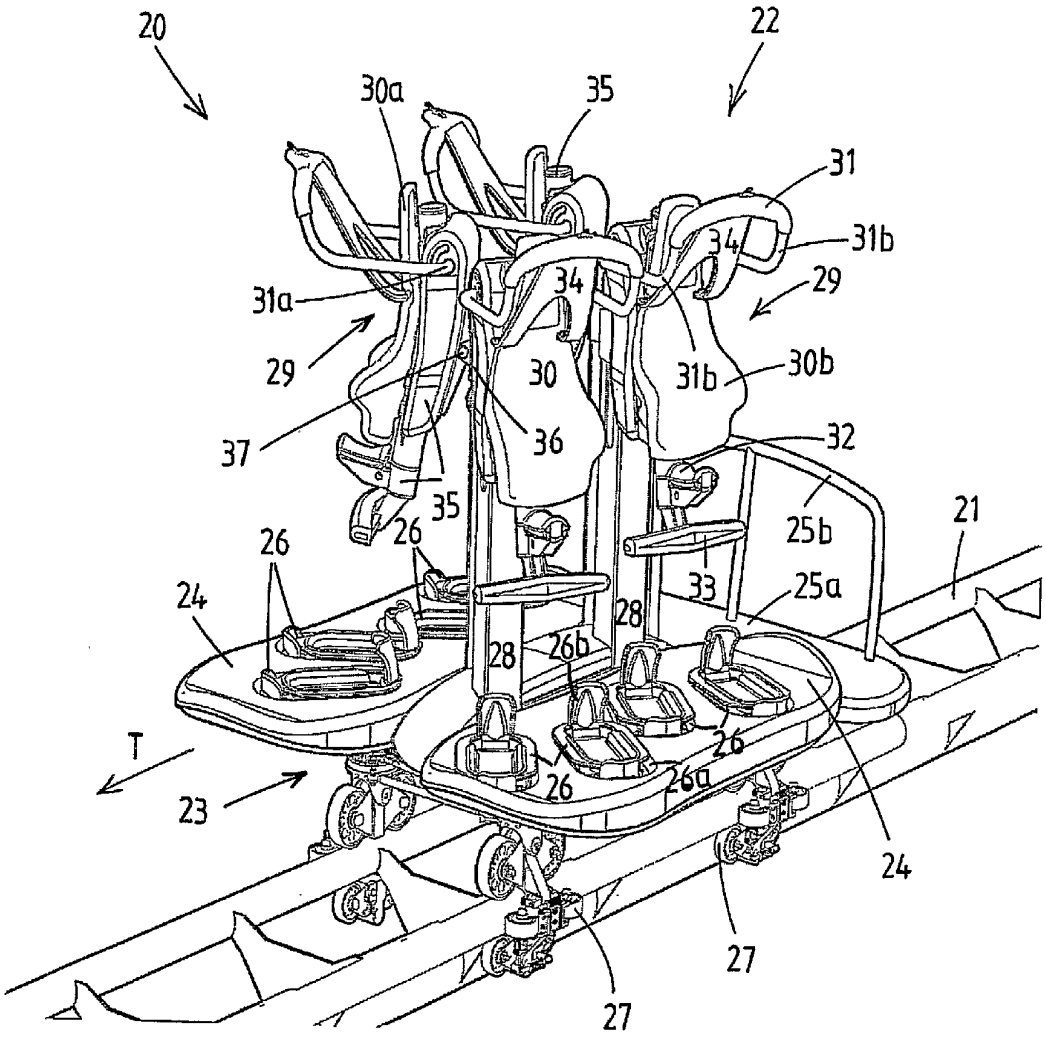

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Fig.2A

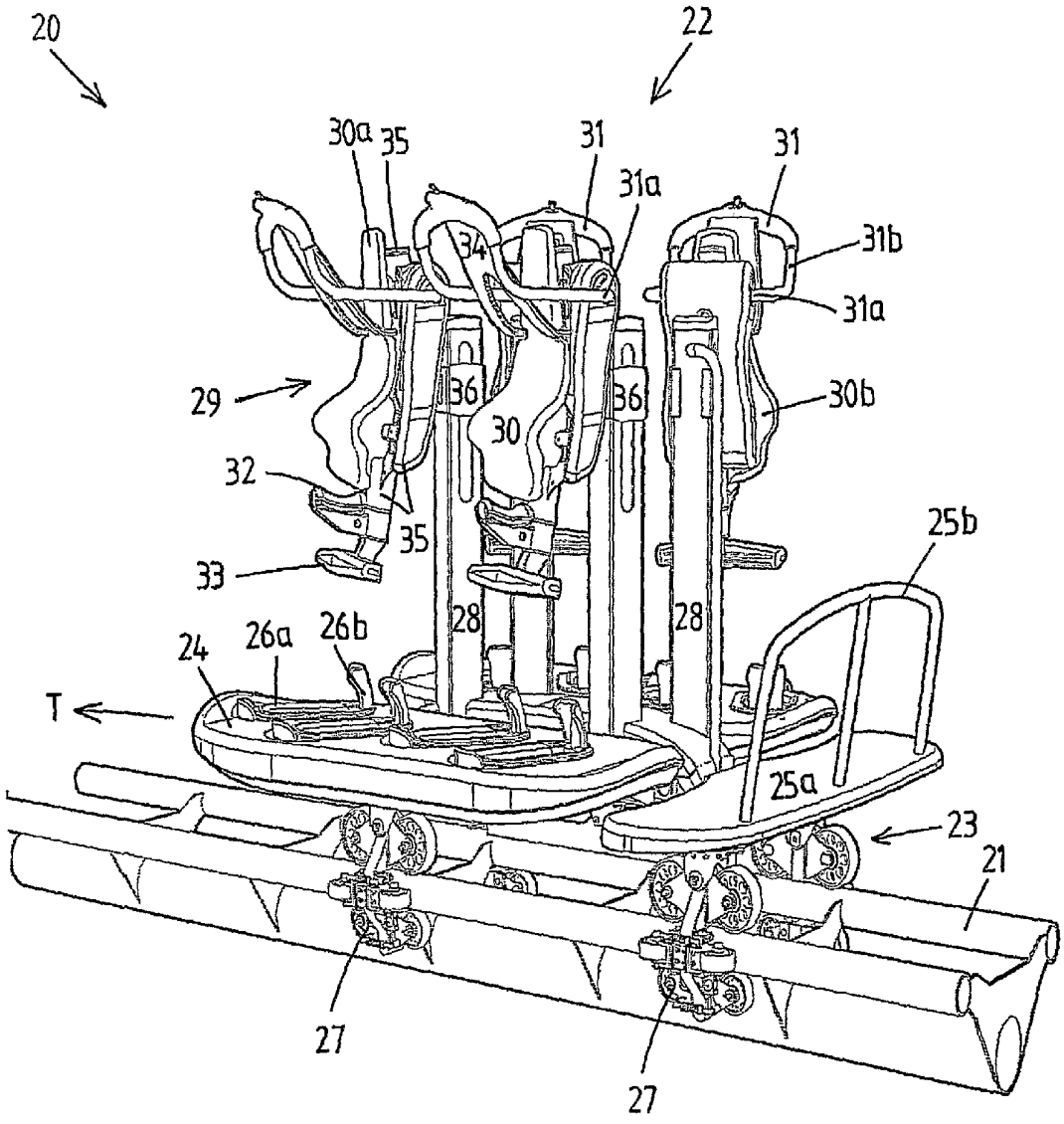
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Fig.2B

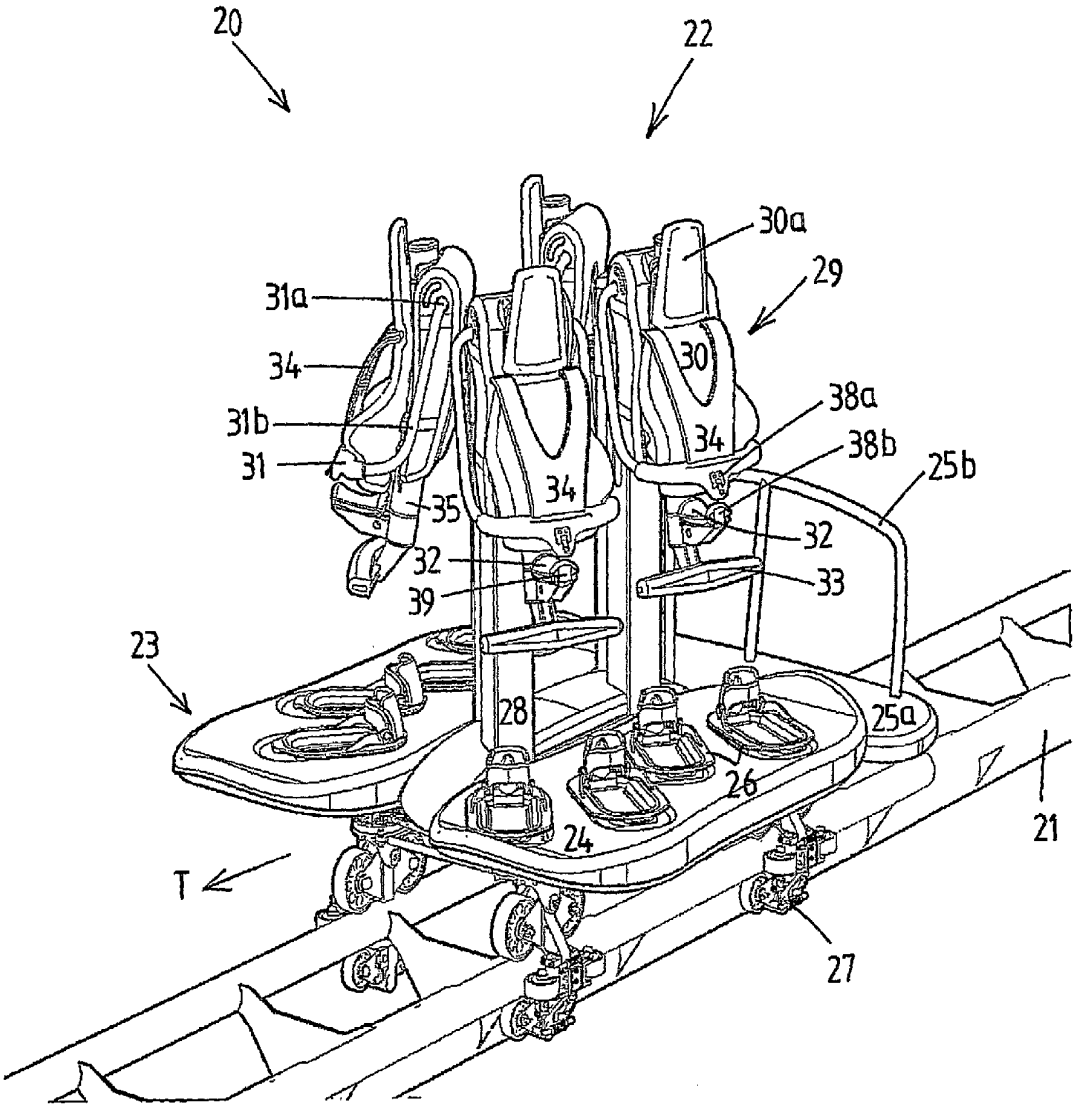
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Fig.2C

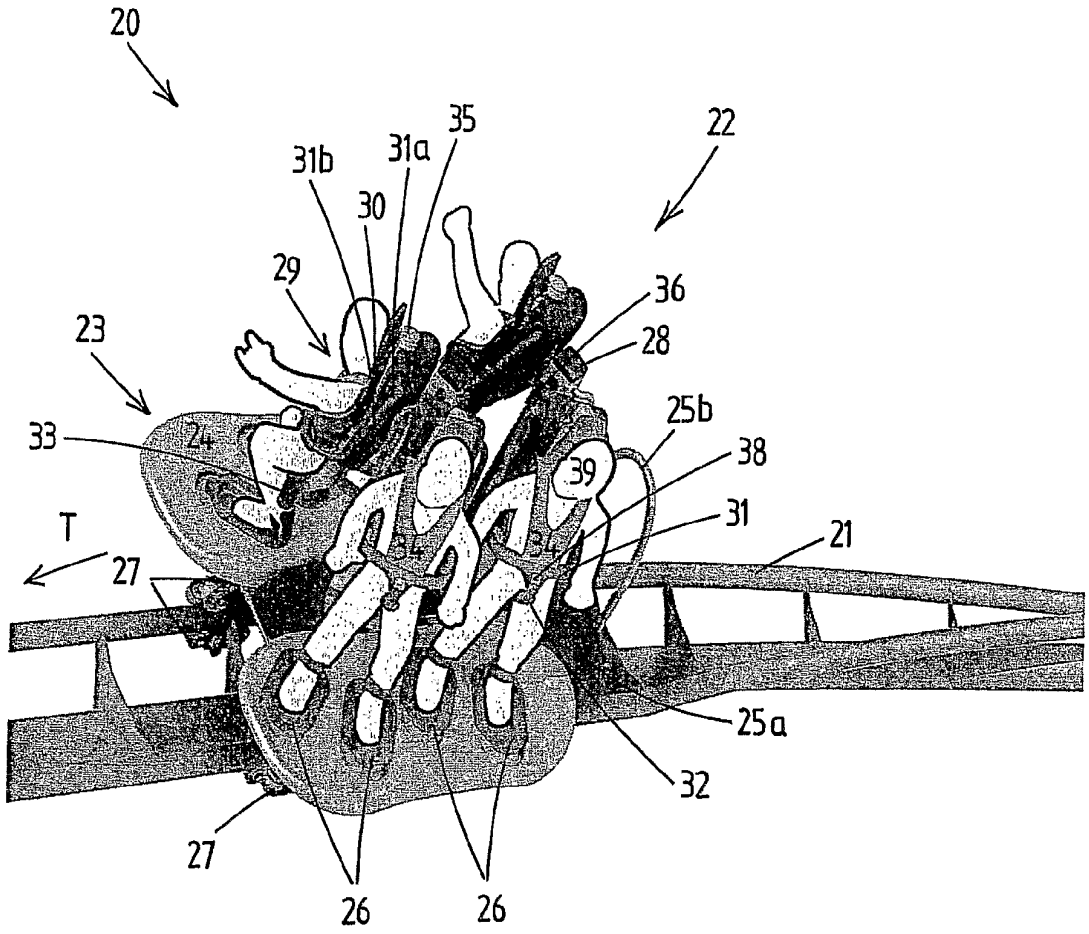

Fig.2D

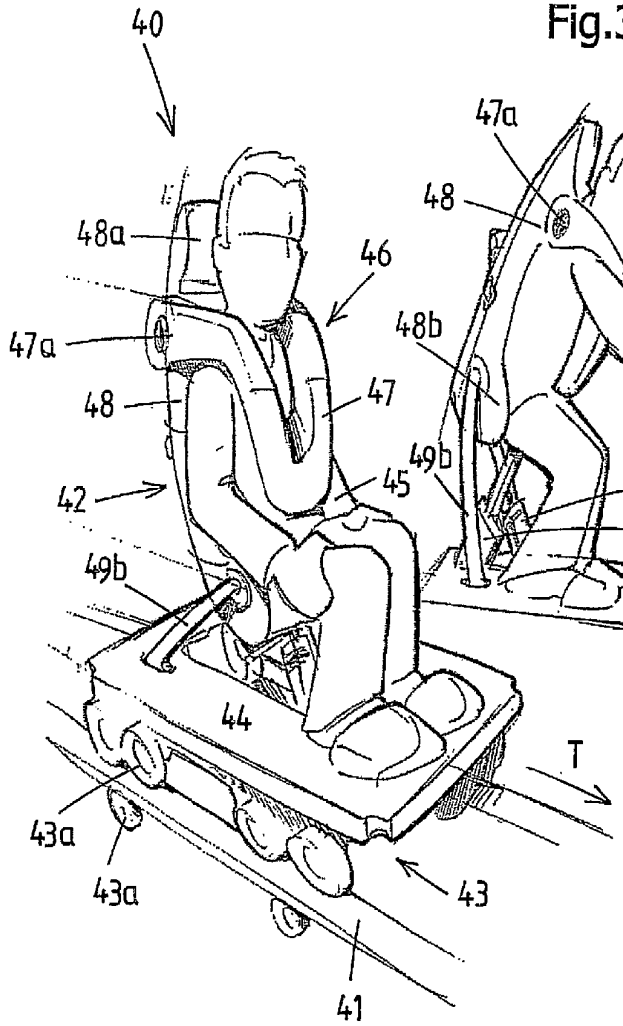

Fig.3A

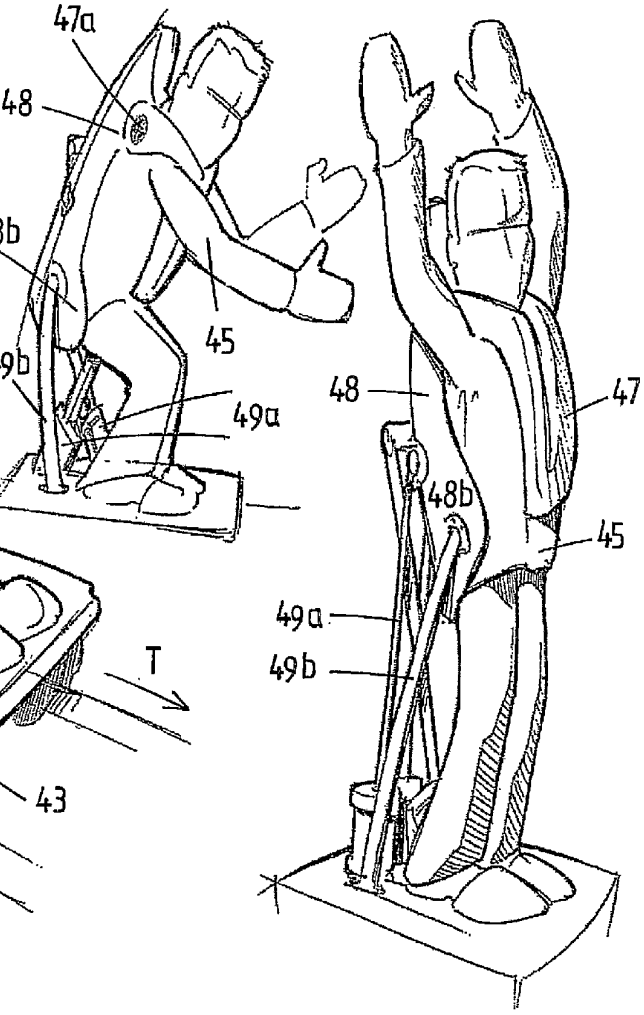

Fig.3B

Fig.3C

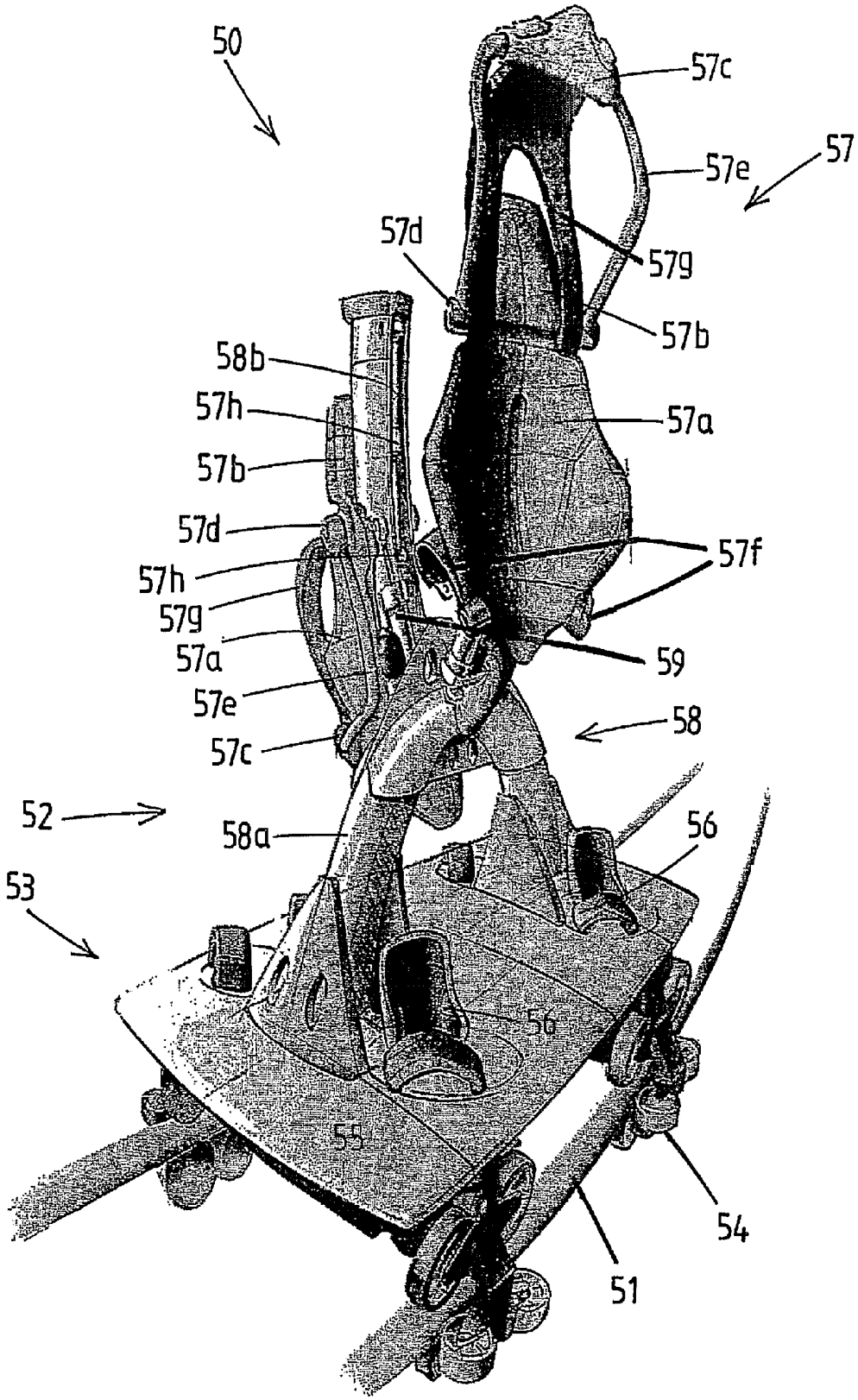
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Fig.4

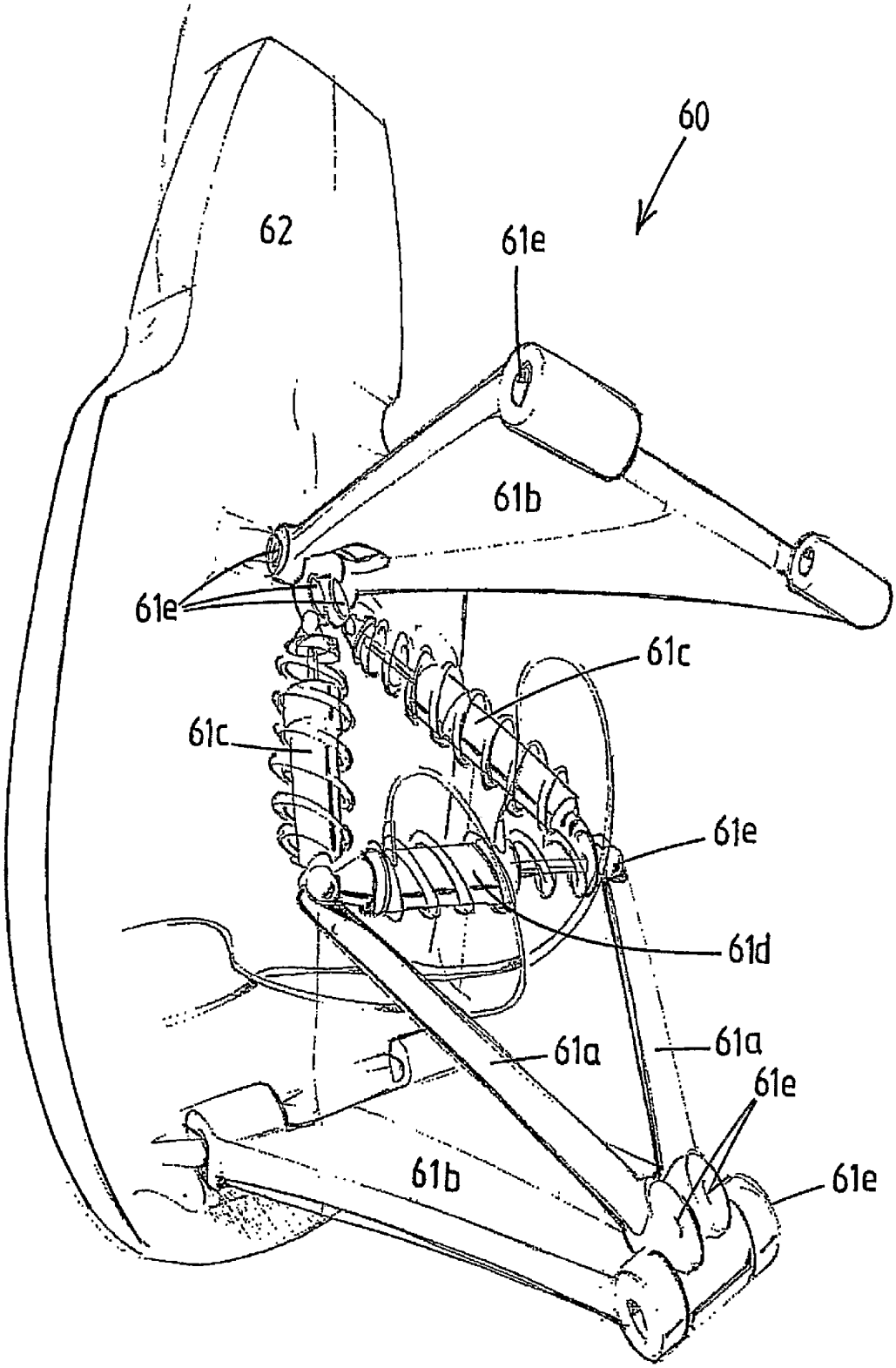

Fig.5

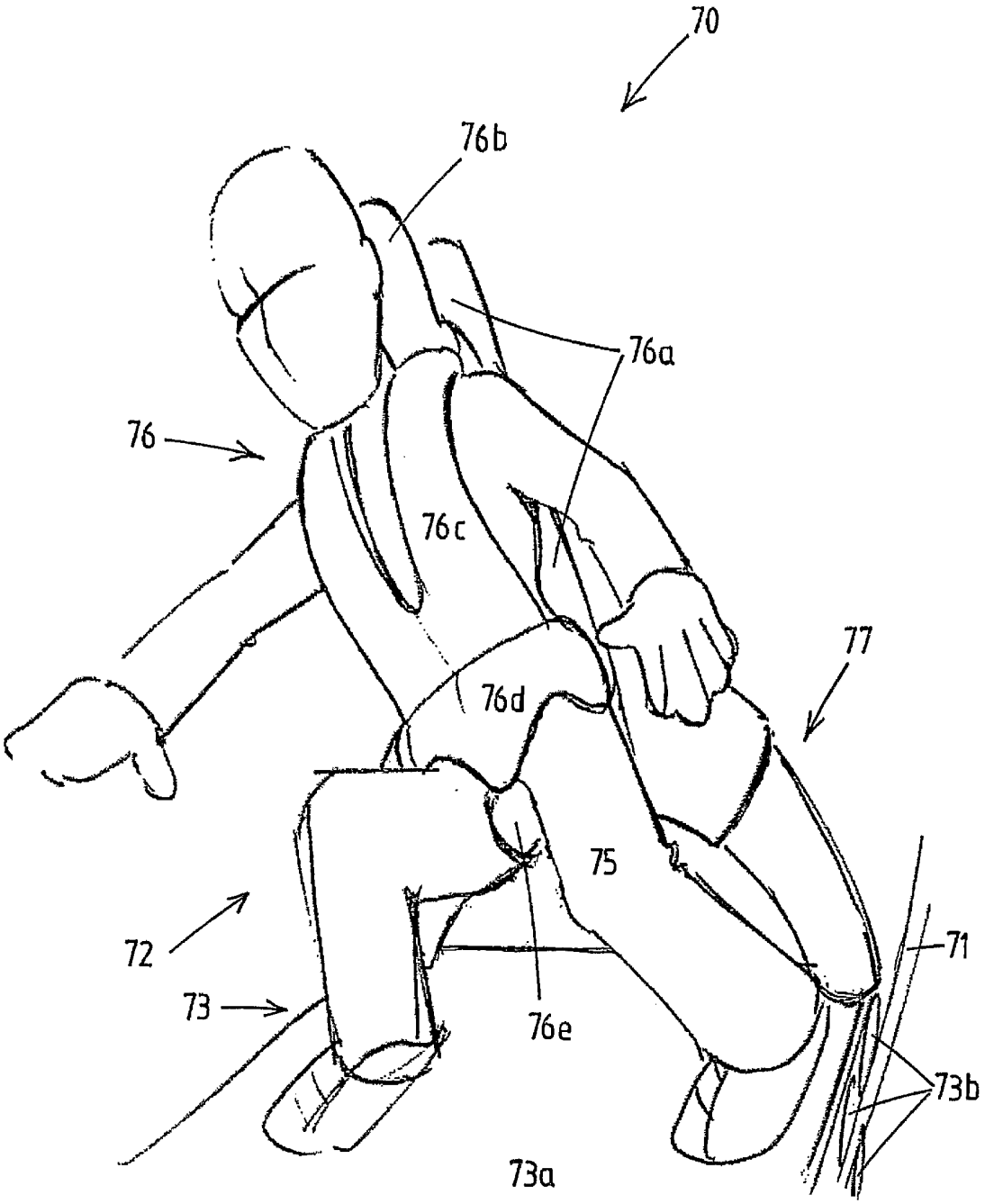

Fig.6

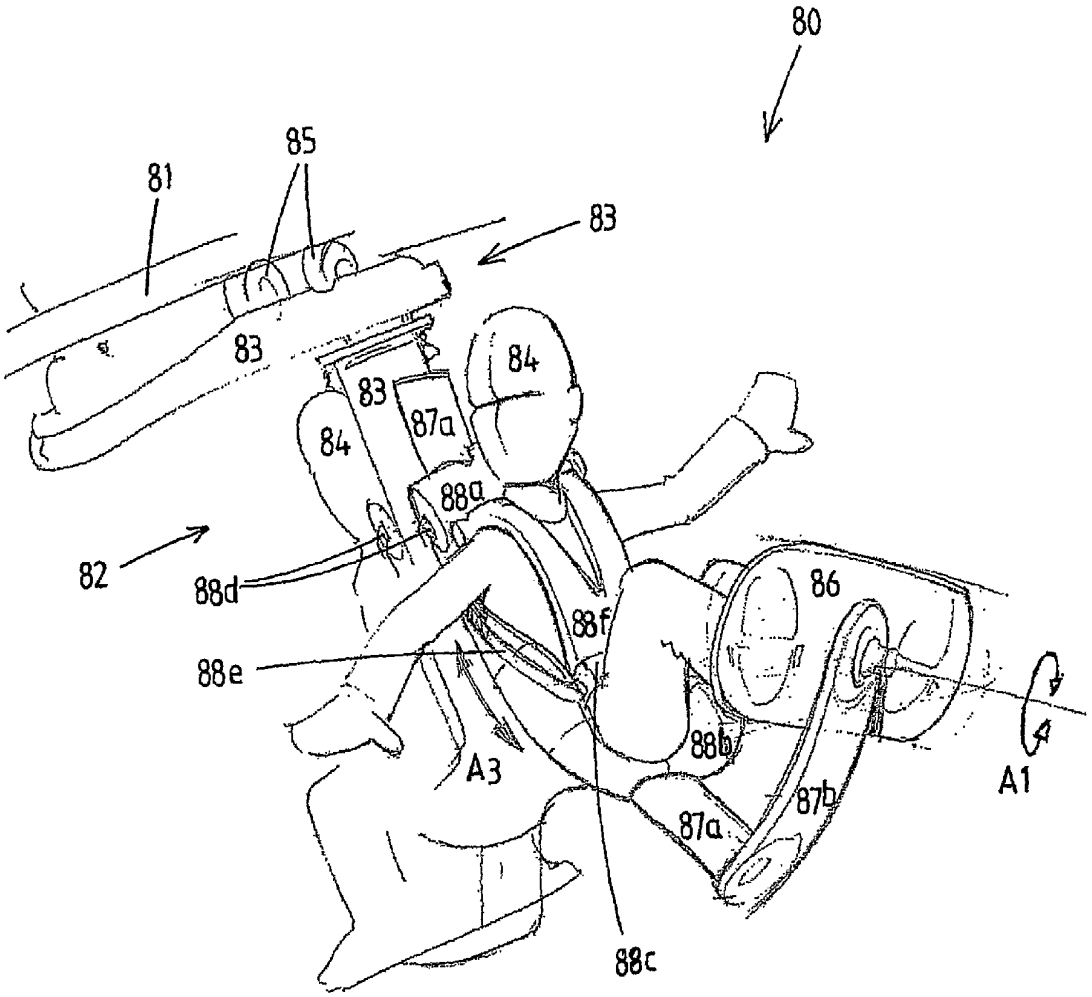
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Fig.7

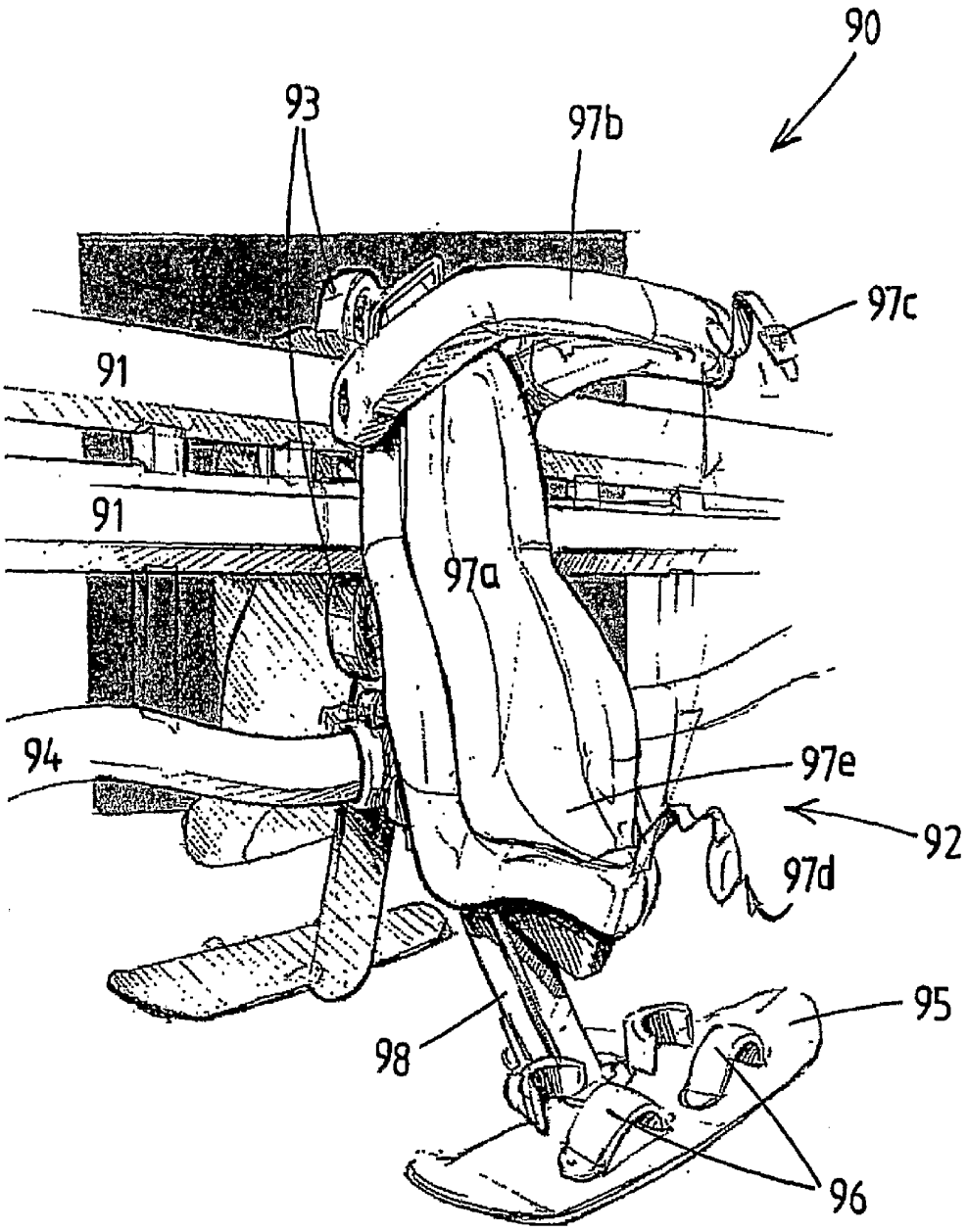

Fig.8

AMUSEMENT RIDE DEVICE

Amusement ride device, comprising a track and at least one carriage, which carriage is moveable along the track in a transport direction, which carriage comprises:

a transport part which engages on the track

at least one platform that allows to support the feet of at least one passenger,

at least one passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger,

wherein the transport part comprises one of the passenger torso restraint or the platform to support the passenger, while the other is connected by connecting means to the transport part,

This type of amusement ride device is well known from the art and applied in many stand-up roller coasters. An example of such an amusement ride device is described in U.S. Pat. No. 4,531,459. In this patent a carriage is described having a standing position support column for holding a passenger in an upright posture on a platform of a transport part which rolls or orbits along a track. A height-adjusting frame is disposed at the standing position support column to be vertically movable there-along and adjusted at a proper position in accordance with the height of the passenger. The frame has a locking mechanism for locking the height-adjusting frame during the ride. The torso restraint comprises a pair of right and left shoulder holders which support the upper half of the body and a saddle for supporting the pelvic portion of the body and an abdominal support for supporting the lower torso of the passenger. The shoulder holders are locked in the passenger holding positions during the ride.

The object of the invention is to provide an improved amusement ride device with an ameliorated ride experience.

This objective is accomplished by an amusement ride device according to the preamble of claim **1**, in which the connecting means are designed to allow the passenger to perform movements during the ride while being restrained by the torso restraint, wherein the torso restraint performs a movement with respect to the platform during said movements of the passenger.

Possibly, the feet of the passenger are connected to the platform. The connection between one of the passenger torso restraint or the transport part to the platform can possibly be moveable, e.g. by vibrations.

The movements of the passenger can be performed by the passenger itself, e.g. by bending his knees, or bending one knee and stretching the other leg. This way an enhanced sense of excitement is created, allowing the passengers the possibility to create their own attitude and thus establish their own style, interpretation and intensity of the ride. The movements of the passenger can also be imposed, e.g. by electrical means or by mechanical means related to the track, adjusting the position of the passenger to the scenery present at a particular position of the track, e.g. squatting the passenger when entering a tunnel. The movements of the torso restraint with respect to the platform can either be movements of the torso restraint with respect to a 'static' platform, or movements of a platform with respect to a 'static' torso restraint, or possibly both the torso restraint and the platform are moveable.

In a preferred embodiment, the amusement ride device comprises a track and at least one carriage, which carriage is moveable along the track in a transport direction, which carriage comprises:

a transport part which engages on the track and comprises at least one platform that allows to support at least one passenger in a standing position thereon,

at least one passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger in at least the standing position,

connecting means which connect the passenger torso restraint to the transport part, which connecting means allow a movement of the torso restraint with respect to the platform,

whereby the connecting means are designed to allow the passenger to perform movements during the ride while being restrained by the torso restraint, wherein the torso restraint performs a movement with respect to the platform during said movements of the passenger.

The connecting means are preferably designed to allow the passenger to perform movements between the standing position and a squatting position, wherein the torso restraint performs an up and down movement with respect to the platform during said movements of the passenger. This enables the passenger to be restrained on the amusement ride device while being able to squat for waves, tunnels etc. etc., while the carriage moves along the track performing turns, nose dives, horseshoes, camelbacks, helixes, possibly somersaults etc. etc., thereby providing a unique thrilling amusement.

Preferably, the passenger can board and disembark the carriage along the track. The track may also be an endless track, e.g. comprising slopes, curves, inclines and possibly also loops. The track can also not be endless, and designed e.g. as a half-pipe or be arranged at a natural slope, e.g. at a skiing area in the summer. One of the most feared (and by some most loved) parts of a roller coaster ride is the first drop. In this part of the track, the train converts its height into speed. In roller coasters with long trains, the first drop is often from the lift down to one of the lowest points in the ride in order to pick up as much speed as possible. In roller coasters with single coaches, the first drop is usually a short one in which the coach gains just enough speed to reach the following element. As snowboarders and skateboarders enter the half pipe, they experience about the same; a short bursting vertical movement. Surfers experience the same when they pick up their wave. Turning during the drop would make this experience even more thrilling; this element is called a 'hairpin dive'. Preferably, a track may comprise a so-called 'trick track'. The relatively unknown 'trick track' element features a sequence of small low banked turns. This can be compared with the sideways movement skiers and snowboarders make during descending a hill. In roller coaster track terms, this means that the track rotates back and forth over the sagittal axis. Applying this element in an amusement ride according to the invention (preferably with a near-perpendicular orientation of the occupants), this trick-track element does contribute to a thrilling sensation in which the occupants can assume several body positions since the vertical loads hardly increase during the element.

The initial speed that is needed can be given to the carriage by a lift or a launch. A disadvantage of a launch might be that due to the setup of the passengers on the carriage, possible high lateral forces could be experienced by the occupants. A traditional lift possibly suits the concept of this invention better and will possible cost less.

In order to maintain balanced, humans rotate their torso while squatting. Although several ways of squatting exist, this rotation can be seen as a natural movement and is in a preferred embodiment facilitated by the carriage. Ergonomic data indicate that this rotation occurs up to about 20 degrees in forward direction. In a preferred embodiment, the connecting means are designed to also allow a forward rotational movement of the torso of the passenger during the ride while being restrained by the torso restraint.

To further enhance the movements that can be performed by a passenger during the ride while being restrained, the connecting means are possibly designed to allow a lateral movement of the torso of the passenger. This enables the passenger to stretch one leg while bending the other one, simulating a skiing movement. This lateral movement can possibly be combined with a forward rotation movement, but this is not necessary according to the invention. Possibly, the platform is moveable with respect to the transport part. E.g. the platform comprises means to enable a tilting movement of the feet made when performing skiing movements, to prevent (over-) stretching of the ankles. These means can e.g. be springs or cushions. The platform can be made actively or passively moveable with respect to the transport part, e.g. by imposing a vibration of the platform or by imposing a movement of the platform as a whole. Possibly, the platform is rotatable about a vertical axis during the ride. In an advanced embodiment, the platform supporting the passenger comprises two independently moveable foot supports. This additional freedom of movement will make the amusement ride device to resemble reality even closer.

Preferably, the connecting means are designed as a guide structure arranged on the transport part, along which the torso restraint is moveable. The guide structure can e.g. be vertical to allow an up and down movement of the passenger in the torso restraint with respect to the platform. Alternatively, the guide structure is semicircular and perpendicular to the platform to allow a lateral and up and down movement of the passenger. Possibly, a substantial vertical guide structure is curved backwards at the lower part to cause a forward rotation of the trunk of the passenger when squatting during the ride. Preferably, the connecting means comprises a guide part connected to the torso restraint to be guided along the guide structure on the transport part. Alternatively, the connecting means further comprise a hinge to allow for a squatting movement during the ride. In this embodiment, the 'frontal' rotation (from an occupant's point of view) has been set independent of other movements. The occupant can rotate his or her trunk forwards and backwards anytime during the ride in every body position. The connecting means may alternatively comprise a combination of a curved guide structure and a hinge. In order to guide and damp this rotation, preferably damper such as a gas cylinder or spring is implemented in the system. This prevents the occupant from making sudden movements and possibly damaging himself or the system.

Alternatively, the connecting means may comprise springs, (flexible) rods, pistons, etc. etc.

Possibly, the platform supporting the passenger is designed as a surfboard, a skateboard, a snowboard or a pair of skis, e.g. anticipating to a theme of the amusement device. In a preferred embodiment the orientation of the passenger in the torso restraint in the standing position with respect to the transport direction is between 15° and 45°, preferably about 35° (as seen from above) to enhance the experience of surfing on water or snow or skateboarding. This results in an improved overall ride experience, without increasing the speed.

In a specific embodiment, multiple carriages move along a single track. The carriages can move individually along the track or can be coupled to form a train. In this preferred embodiment, each carriage comprises a single transport part with one or two platforms supporting an even number of passengers (one or more pairs of passengers) in a torso restraint in a standing position, which torso restraints are oriented such that the passengers are disposed back to back. E.g., the passengers are disposed in a 2-2 arrangement with their backs towards each other. Hence, two passengers are oriented with their right foot in the direction of transport, while the other two passengers are oriented with their left foot in the direction of transport. Of course, any other formation of the passengers is also possible: one passenger per carriage, or multiple passengers lined up behind each other on a single carriage, which can possibly each be differently orientated with respect to the transport direction.

The passenger torso restraint engaging on the torso of the passenger should be able to safely support the passenger in a standing and in a squatting position, and should be suitable for passengers who have different figures (e.g., tall, short, fat, slender).

In a preferred embodiment, the torso restraint comprises a possibly enclosing back support, an over-shoulder restraint or clamp as described in U.S. Pat. No. 4,531,459 and possibly an additive lap or hip bar. A drawback of such a shoulder restraint might be that the view of the passenger is restricted by the restraint.

Alternatively, the torso restraint may comprise a back support with a hip bar restraint. Possibly, the hip restraint can be hydraulically locked. In a preferred embodiment, an additional belt construction comprising one or two shoulder straps, such as a vest or harness, is provided between the back support and the hip restraint. In a preferred embodiment, the connection of the belt construction with the back support is adjustable, so that the belt construction can be fixed to the back support in multiple positions with varying height. This makes the restraint system more appropriate for passengers with varying lengths.

With only an upper restraint, occupants can slide out of the restraint fairly easy. A lower torso restraint can e.g. be designed as a parachute style groin belt or step-in restraint braces. A disadvantage of such a system might be that they are expensive and time consuming to apply. Preferably, the torso restraint further comprises a saddle between the passengers' legs to provide the adequate support and thus, together with other torso restraint elements provide a total enclosure of the torso of the occupant. The body is supported on the pubic bone and can be compared with sitting on a bicycle saddle. Possibly, a connecting belt and locking mechanism is present between the belt construction, shoulder restraint, lap bar or hip bar and this saddle, possibly as a redundant fastening system. The shape of the saddle is very important for its function as well as for legislation and for comfort of the occupants. The saddle has to support the pubic bone and should not leave too much room for people to get out of the restraint during the ride. Also, the width of the saddle should be tested empirical since small children (1.40 m) should fit the saddle as well as relatively fat persons with less or nearly no space between the legs.

Possibly, an additional bracket is provided behind the upper end of the legs of the occupant to prevent occupants from hyperextending their knees. This knee-bracket can be provided with a height-depending system or can be situated such that a small person will have the bracket nearly in the back of his knee and a large person will feel this bracket high up the back side of his upper leg.

In addition, the transport part of the carriage can further comprise one or more pairs of foot restraints on the platform, or alternatively a single foot restraint per passenger. The torso restraints will probably prevent the occupant from evacuation during the ride, allowing the foot restraints to prevent uncontrollable vertical movements and extreme excursions of the legs. A certain angle between the feet is advisable in order to provide a safe and comfortable squatting movement during the ride. An amount of 20° between the sagittal planes of the feet appeared to be a suitable angle. In relation to the sagittal

plane of the body, the toes should point outwards. In the snowboard industry, this is called the 'duckstance'. A preferred embodiment of the foot restraint comprises a rotating front part that travels towards a fixed rear part, by which the ankle of the occupant is restrained. The system can be closed and locked by a hydraulic piston.

Possibly, the foot restraint restrains the foot and ankle of the passenger, but the connection between the foot restraint and the platform enables some degree of tilting of the foot or feet when simulating a skiing movement.

Because of safety reasons, a manual check of the restraints prior the ride can be requested. To check an upper main body restraint the operator can e.g. pull a lap bar or pull on a vest to check whether the system is locked or not. A belt between the lap bar and saddle can also be checked visually or with a quick grip. Possibly present foot restraints though, demand the operator to bend over and pull each foot restraints. This will become considerably uncomfortable for the operator and will take a fair amount of dispatch time. A possible system by which the operator can quickly check the status of the foot restraints without too much effort and time is created by adding two pedals per occupant on the edge of the base floor plate, which are connected to the foot restraints. With this system, the operator can visually check the status of the foot restraints. Also, by stepping on the pedals (while—for instance—checking the body restraint), the foot restraints are pushed open by which the operator can check whether the system is locked properly or not. An unequal pedal position might indicate an unequal closure of the feet (are both feet in the right place) or a failure in the system. The operator can, when park policy allows it, easily press the foot restraints tighter on the restraints themselves if needed. This is a relatively low cost, mechanical solution that can easily be implemented in a coach.

Preferably the up and down movement of torso restraint with respect to the platform is limited to a lowermost position to support occupants when a high downwardly directed vertical load is experienced, or when people cannot or do not want to stand anymore, e.g. in case of fainting. Also an uppermost position is preferably provided to prevent too large forces on the legs of the passenger when experiencing high upwardly directed vertical loads. Advantageously, the upper- and/or lowermost position of the torso restraint with respect to the platform is adjustable depending on the length and possibly also the weight of the passenger.

In a preferred embodiment, a damper system damps the movements of the passenger to prevent excessive loads and impact on the human body. Possibly, a spring or alternatively an hydraulic or gas damper is used to dampen the movements of the torso restraint.

Even more preferably, an adjustable damper system is provided based on the weight of the passenger. The weighing of the passenger can occur directly, e.g. by a standing on a balance before entering the ride, or by a weighing system below the feet of the passenger. Once the occupant stands in foot restraints, the mass of the occupant is weighed and the smothering setting of the damper can be adjusted.

It is advantageously to provide for a passenger weight compensation system, e.g. by an upward force on the torso of the passenger, e.g. via the restraint, e.g. the saddle. The upward force on the torso experienced during the ride can be adjusted to the weight and/or height of the passenger. Possibly, weighing of the person can be performed indirectly by pressure measuring means measuring the upward force exerted on the passenger.

In a preferred embodiment of the invention, the torso restraint moves—with its mass—along with the body of the occupant. The influence of this added weight (and thus moment of inertia) can preferably be compensated by the implementation of a weight compensating system. For example, in a fully weight compensated system, the total weight of the torso restraint is compensated by a counterweight with an additional 2 to 4 kilograms, which will be experienced as a light pressure on the pubic bone.

In an alternative embodiment according to the invention, the amusement ride device comprises a track and at least one carriage, which carriage is moveable along the track in a transport direction, which carriage comprises:

- a transport part which engages on the track comprising at least one passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger, which transport part allows to support at least one passenger,
- a platform,
- connecting means which connect the platform to the transport part, which connecting means are designed to allow the passenger to perform movements during the ride while being restrained by the torso restraint, wherein the torso restraint performs a movement with respect to the platform during said movements of the passenger.

The invention will be explained in detail with respect to the drawings, in which:

FIGS. **1***a*-**1***c* depict a schematic side view of a preferred embodiment of a carriage according to the invention,

FIGS. **2***a*-**2***d* depict a schematic perspective view of a second preferred embodiment of an amusement ride device according to the invention,

FIGS. **3***a*-**3***c* depict a schematic perspective view of a third alternative embodiment of an amusement ride device according to the invention,

FIG. **4** depicts a schematic perspective view of a fourth alternative embodiment of an amusement ride device according to the invention,

FIG. **5** depicts a schematic perspective view of a fifth alternative embodiment of an amusement ride device according to the invention,

FIG. **6** depicts a schematic perspective view of a sixth alternative embodiment of an amusement ride device according to the invention,

FIG. **7** depicts a schematic perspective view of a seventh alternative embodiment of an amusement ride device according to the invention,

FIG. **8** depicts a schematic perspective view of an eight alternative embodiment of an amusement ride device according to the invention.

In FIG. **1** a schematic side view of a carriage **1** is presented. Carriage **1** comprises a schematically depicted transport part **2**, which transport part can engage on a track of an amusement ride device (not shown). Transport part **2** comprises a platform **3** that allows to support a passenger (not shown) in a standing position thereon. The carriage further comprises connecting means which connect the transport part **2** to a torso restraint **5**. In this embodiment, the connecting means comprise a guide structure **4** along which the torso restraint **5** is moveable in a substantial vertical direction, as visible from FIG. **1***b*. In this embodiment, the platform **3** is provided above the track. It is known from prior art that the torso restraint **5** is moveable along the guide structure **4** to adjust the torso restraint **5** to the height of the passenger. In prior art, the torso restraint **5** is adapted to the passenger after boarding and subsequently fixed before the start of the ride. According to the invention, the guide structure **4** is designed to allow the passenger to perform movements during the ride between the standing position and a squatting position while being

restrained by the torso restraint **5**. The torso restraint **5** performs an up and down movement with respect to the platform **3** during said squatting movements of the passenger. In FIG. **1***c* it is schematically depicted that the connecting means between the passenger torso restraint **5** and the platform **3** also allow for a rotation of the torso of the passenger and the torso restraint **5** when the passenger squats during the ride. Details on the operation will be given below.

The embodiment of the torso restraint **5** shown in FIG. **1** comprises a back support **6**, a hip bar **7**, saddle **8** and bracket **9**. Back support **6** comprises a head rest **6***a* and a lumbar support **6***b*. This will fix the passenger more firmly into the seat and will increase the sense of safety of the passenger. Hip bar **7** is rotatable about pivot axis **7***a* by pivot arms **7***b*. Hip bar **7** will be pivoted upwards when entering the amusement ride device, and when the passenger has entered he can lower the hip bar **7** himself or this will occur automatically, e.g. with the aid of hydraulics. The passenger sits/stands on the saddle **8** resembling sitting on a bicycle saddle. Optional bracket **9** prevents hyperextending of the knees ('locking' of the knees) when entering the carriage and during the ride. The connecting means which connect the transport part **2** to a torso restraint **5** comprise the guide structure **4** and a guide part (not shown) to be guided along the guide structure **4** on the transport part **2**. This guide part (not shown) is connected to a frame part **10** onto which all elements of the torso restraint **5** are mounted. The connecting means further comprise a hinge (not shown) between this guide part (not shown) and frame part **10** allowing a forward rotational movement of the torso restraint **5** about this hinge, enabling a forward rotation of the trunk or torso of the passenger during the ride while being restrained by the torso restraint **5**. This rotation is shown in FIG. **1***c*.

In FIG. **2***a* an amusement ride device **20** is shown, comprising a track **21** and a carriage **22**. In this embodiment, four passengers (not shown) are disposed on a single carriage **22** in a 2-2 arrangement with their backs towards each other. Two passengers are oriented with their right foot in the direction of transport T, while the other two passengers are oriented with their left foot in the direction of transport T. Of course, any other formation of the passengers is also possible.

Carriage **22** comprises a transport part **23** sliding across track **21** with four sets of guide wheels **27**. Transport part **23** comprises two platforms **24** supporting the passengers (not shown) in a standing position. Platform **24** is in this embodiment designed as a surfboard, skateboard or snowboard, and can be tuned to the scenery and/or theme of the amusement ride device **20**. A boarding platform **25***a* and handrail **25***b* is connected with the platform **24**.

Each platform **24** is provided with 2 sets of foot restraints **26**. A small angle between the feet is present in order to provide a safe and comfortable squatting movement during the ride. The toes point outwards, which is in the snowboard industry called the 'duckstance'. The shown embodiment of the foot restraint **26** comprises a rotating front part **26***a* that travels towards a fixed rear part **26***b*, by which the ankle of the occupant is restrained. The system can be closed and locked by a hydraulic piston (not shown).

The carriage **22** further comprises connecting means which connect the transport part **23** to four torso restraints **29**. The connecting means in this embodiment comprise four guide structures **28** along which the torso restraints **29** are moveable up and down with respect to the transport part **23**, in this embodiment in a substantial vertical direction.

The embodiment of the torso restraint **29** shown in FIG. **2** comprises a back support **30**, a hip bar **31**, saddle **32** and bracket **33**. Back support **30** comprises a head rest **30***a* and a lumbar support **30***b*. This will fix the passenger more firmly into the seat and will increase the sense of safety of the passenger. Hip bar **31** is rotatable about pivot axis **31***a* by pivot arms **31***b*. Hip bar **31** will be pivoted upwards when entering the amusement ride device, and when the passenger has entered he can lower the hip bar **31** himself or this will occur automatically, e.g. with the aid of hydraulics. A vest (or harness) **34** is provided between the hip bar **31** and the back rest **30** to furthermore restrain the passenger. Possibly this vest can be adapted to the height of the passenger. Preferably, the vest comprises an adjustable belt system to adapt the vest also to the size of the passenger. Preferable, the vest is designed as described in copending application PCT/EP2006/004562, hereby incorporated by reference. The passenger sits on the saddle **32** resembling sitting on a bicycle saddle, while being supported by the platform **24** in a standing position. Bracket **33** prevents hyperextending of the knees ('locking' of the knees) when entering the carriage and during the ride.

The connecting means comprising guide structures **28** further comprise guide parts **36** to be guided along the guide structure **28** on the transport part **23**. These guide parts **36** are connected to frame parts **35**, onto which elements of the torso restraint **29** are mounted. The connecting means further comprise hinges **37** between guide part **36** and frame part **35**, to allow for a forward rotational movement of the torso restraint **29** about this hinge **37**, allowing a forward rotation of the trunk of the passenger.

A damper or gas spring is preferably provided in guide structure **28** to dampen the up and down movement of the passenger. The position of the hinge **37** is behind the back of the person, preferably behind the lower part of the back to allow for a natural forward rotational movement while squatting.

FIG. **2***b* shows the same embodiment as shown in FIG. **2***a*, but from another perspective. Same components are given same numerals, but are possibly better or worse visible.

The perspective of FIG. **2***c* is the same as that of FIG. **2***a*, but the torso restraint **29** is now closed (without passengers being present). In the shown embodiment a locking member **38***a* is visible on hip bar **31**, that can lock vest **34**, or alternatively a belt or belt system (not shown) to a lock **38***b* provided in saddle **32**.

FIG. **2***d* shows the embodiment shown in FIGS. **2***a*-**2***c* with passengers **39**.

In FIGS. **3***a*-**3***c* an alternative embodiment of an amusement ride device **40** is depicted. In the previous shown embodiments, the passenger embarks and disembarks the amusement ride device in a standing position, and can squat during the ride. It can be seen that alternatively, e.g. in this embodiment, the passenger embarks the amusement ride device in a sitting position, and can stand up and squat during the ride. Possibly, aids are provided to help the passenger to stand up from the squatted position. For example, rods or rails are provided.

The device **40** comprises a track **41** and a carriage **42**. The carriage **42** comprises a transport part **43** comprising a platform **44**, that allows to support a passenger **45** in a sitting position (FIG. **3***a*), a squatting position (FIG. **3***b*) and in a standing position (FIG. **3***c*) thereon. The transport part **43** engages on the track **41** with guide wheels **43***a* and is free to move along the track **41** in a transport direction T. The carriage **42** further comprises a torso restraint **46** for safely supporting passenger **45** in a sitting, squatting and a standing position. In the shown embodiment, the torso restraint **46** comprises a shoulder restraint **47** and a back rest **48** comprising a head rest **48***a* and a lumbar support **48***b*, and possibly

some kind of seat or saddle (not shown), e.g. a semi-seat, possibly nothing more than a ladies' bicycle saddle or small ridge, to sit on in the position shown in FIG. **3***a*. Shoulder restraint **47** is pivotable about pivot axis **47***a*.

Connecting means **49** connect torso restraint **46** to transport part **43**, which connecting means **49** allow an up and down movement of the torso restraint **46** with respect to the platform **44**. Connecting means **49** further allow the passenger **45** to perform movements during the ride between the standing position and a squatting position and a forward rotational movement of the torso of the passenger while squatting and standing, while continuously being restrained by the torso restraint **46**. The torso restraint **46** performs an up and down movement with respect to the platform **44** during said movements of the passenger **45**. The connecting means **49** in this embodiment comprise pistons **49***a*, possibly dampers or gas springs, and rods **49***b*. The connecting means allow a lowermost position of the torso restraint and the passenger to rest or sit when fainted. Possibly, the connecting means **49** also aid to help the passenger to stand up from the squatted position when the ride takes off.

In FIG. **4** a fourth embodiment of an amusement ride device **50** according to the invention is shown. The amusement ride device **50** comprises a track **51** and a carriage **52**. The carriage comprises a transport part **53** which engages on the track **51** by four sets of guide wheels **54**. The transport part **53** comprises a platform **55** that allows to support two passengers (not shown) in a standing position thereon. The passengers will be disposed back-to-back on platform **55**, with their feet in the two sets of foot restraints **56** provided on the platform **55**. The passengers will further be restrained by a torso restraint **57**. The torso restraint **57** in this embodiment comprises a back rest **57***a*, a head rest **57***b*, a hip bar **57***c* which is pivotable about pivot axis **57***d* by pivot arms **57***e* and a parachute style hip restraint **57***f* which is a flexible belt to be placed along the groins of the passenger and connected to the hip bar **57***c*, thereby forming an X-shaped restraint. Between hip bar **57***c* and back restraint **57***a* a vest **57***g* is provided. The restraint **57** visible in a (large) front view is in an open position, allowing the entry of a passenger, while the (smaller) restraint **57** visible partly from behind is in a closed position.

The torso restraint **57** is connected to the transport part **53** by connecting means **58**. Connecting means **58** comprise a U-shaped frame part **58***a*, to which two tubular-shaped hollow guide structures **58***b* are connected (only one of which is visible in FIG. **4**). The connecting means comprise various guide parts **57***h* connected to torso restraint **57** that can be guided along the guide structure **58***b* to allow an up and down movement of the torso restraint **57** with respect to the platform **55**, and to allow the passenger to perform movements during the ride between a standing position and a squatting position while being restrained by the torso restraint **57**. To dampen the movements of the passenger a cylinder, possibly a hydraulic cylinder **59** is provided to dampen the motion of the passenger. To also cause a forward rotational movement of the torso of the passenger during the ride while being restrained by the torso restraint **57** the guide structure **58** is curved backwards.

In FIG. **5** a fifth embodiment of a detail of a carriage **60** is shown. A schematic view of a back rest **62** of a passenger torso restraint is visible, and part of connecting means **61** to connect the passenger torso restraint **62** to a transport part (not shown). The connecting means might further comprise a column (not shown) at the right-hand side of the drawing that can be placed on a platform (not shown). The shown part of connecting means **61** are designed as a so-called double wishbone construction, in the shown embodiment comprising rods **61***a*, plates **61***b*, diagonal dampers **61***c* and a horizontal damper **61***d*, all pivotable about pivot axes **61***e*. The horizontal damper **61***d* can be used to adjust the connecting means **61** to the height of the passenger. The two diagonal dampers **61***c* allow for a vertical movement of the passenger. The double wishbone geometry realizes a forward rotation of the back rest **62** of about 15-20°. A disadvantage of this system is the small variety in lengths of persons that can seat in this carriage.

In FIG. **6** a schematic perspective view of a sixth embodiment of an amusement ride device **70** according to the invention is shown. In this embodiment, the passenger is allowed to perform a skiing movement, comprising an up and down movement and a lateral sideways movement. The amusement ride device **70** comprises a track **71** and a carriage **72**. Carriage **72** comprises a transport part **73**. Transport part **73** comprises wheels **73***b* that engage on the track **71** and a platform **73***a* that allows to support a front facing passenger **75** in a standing position thereon.

Carriage **72** further comprises a passenger torso restraint **76** engaging on the torso of the passenger **75** for safely supporting the passenger in at least the standing position. The shown passenger torso restraint **76** comprises a back support **76***a* with a head rest **76***b*, a shoulder restraint **76***c* and hip restraint **76***d* in one piece and a saddle **76***e*. The hip restraint **76***d* is connected to the saddle **76***e* via a locking mechanism (not shown).

Carriage **72** further comprises connecting means **77** which connect the passenger torso restraint **76** to the transport part **73**. Connecting means **77** are designed to allow a lateral movement of the torso of the passenger **75** during the ride while being restrained by the torso restraint **76**, wherein the torso restraint **76** performs a movement with respect to the platform **73***a*. Simultaneously, the passenger **75** performs movements between the standing position and a squatting position, wherein the torso restraint **76** performs an up and down movement with respect to the platform **73***a* during said movements of the passenger **75**. Connecting means **77** comprise a semicircular guide structure (only part of which is visible).

In FIG. **7** a schematic perspective view of an eighth embodiment of an amusement ride device **80** according to the invention is shown. The amusement ride device **80** comprises a track **81** and a carriage **82**. In this embodiment, the carriage **82** is suspended under the track **81**.

Carriage **82** comprises a transport part **83** comprising wheels **85** that engage on the track **81**. The transport part **83** in this embodiment comprises a platform **86**, onto which the feet of passengers **84** are restrained by a pair of foot restraints (not shown). Each shown platform **86** allows to support a passengers **84**. The platform **86** is moveable to some extent with respect to the transport part **83** in that the platform can perform a rotational movement indicated by arrow A**1**.

Carriage **82** further comprises two passenger torso restraints **88** engaging on the torso of the passengers **84** for safely supporting the passengers **84**. The torso restraints **88** comprise a back rest **88***a*, a saddle **88***b*, a hip bar **88***c* which is pivotable about pivot axis **88***d* by pivot arms **88***e*. A vest **88***f* is present between the hip bar **88***c* and the back rest **88***a*, extending over the torso and shoulders of passenger **84**. The torso restraints **88** are connected to transport part **83** by connecting means **87**, which connecting means **87** comprise a connection plate **87***b* and a guide structure **87***a*. The guide structure **87***a* which connect the torso restraint **88** to the transport part **83** is designed to allow the passenger **84** to perform a squatting movement of the legs during the ride while being restrained by the torso restraint **88**, wherein the torso restraint **88** per-

forms an up and down movement with respect to the platform **86** during said movements of the passenger **84**, indicated by arrow A**3**.

In FIG. **8** part of an amusement ride device **90** is shown in perspective, comprising a track **91** and one carriage **92**, which carriage **92** is moveable along the track **91** in a transport direction. The carriage **92** comprises a transport part **93** comprising wheels and a frame part engaging on the track **91**. Substantially parallel to the track **91**, a guide track **94** is provided.

Carriage **92** further comprises a platform **95** that allows to support the feet of at least one passenger by a pair of foot restraints **96**.

Carriage **92** further comprises two passenger torso restraints **97** engaging on the torso of the passenger for safely supporting the passenger. The torso restraint **97** comprises a back support **97***a*, an over shoulder restraint **97***b*, a buckle security lock **97***c* that can lock into locking member **97***d* arranged on seat **97***e*.

In the shown embodiment, the passenger torso restraint **97** is fixedly connected to the transport part **93** in a suspended manner to support the passenger, while the platform **95** is connected by connecting means **98** to the transport part **93**, which connecting means **98** are designed to allow the passenger to perform movements during the ride while being restrained by the torso restraint **97**, wherein the torso restraint **97** performs a movement with respect to the platform **95** during said movements of the passenger. In the shown embodiment, the guide track **94** imposes movements of the platform **95** with respect to the restraint **97**.

The invention claimed is:

1. An amusement ride device, comprising a track and at least one carriage, wherein the carriage is moveable along the track in a transport direction, wherein the carriage comprises:

a transport part which engages on the track, and

at least one platform that allows to support the feet of at least one passenger in a standing position thereon,

wherein the transport part comprises at least one passenger torso restraint, the passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger in at least the standing position, the at least one platform being connected by connecting means to the transport part, and

wherein the connecting means is designed to allow the passenger to perform movements between the standing position and a squatting position during the ride while being restrained by the torso restraint, wherein the torso restraint performs an up and down movement with respect to the platform during said movements of the passenger.

2. The amusement ride device according to claim **1**, wherein the connecting means is designed to allow a forward rotational movement of the torso of the passenger during the ride while being restrained by the torso restraint.

3. The amusement ride device according to claim **1**, wherein the connecting means is designed to allow a lateral movement of the torso of the passenger during the ride while being restrained by the torso restraint.

4. The amusement ride device according to claim **1**, wherein the connecting means is designed as a guide structure arranged on the transport part, along which the torso restraint is moveable.

5. The amusement ride device according to claim **4**, wherein the guide structure is curved to cause a forward rotation of the torso restraint when squatting.

6. The amusement ride device according to claim **4**, wherein the connecting means comprises a guide part to be guided along the guide structure, and a hinge to allow for a forward rotational movement of the torso restraint during the ride.

7. The amusement ride device according to claim **1**, wherein the torso restraint comprises a back support, a hip bar and a saddle.

8. The amusement ride device according to claim **7**, wherein the hip bar is connectable to the saddle via a locking mechanism.

9. The amusement ride device according to claim **7**, wherein the torso restraint comprises a belt construction comprising one or two shoulder straps between the hip bar and the back support.

10. The amusement ride device according to claim **9**, wherein the connection of the belt construction with the back support is adjustable, so that the belt construction can be fixed to the back support in multiple positions with varying height.

11. The amusement ride device according to claim **7**, wherein the torso restraint comprises a bracket below the saddle which will be behind the legs of the passenger to prevent hyperextending of the knees of the passenger.

12. The amusement ride device according to claim **1**, wherein the torso restraint comprises a back support, a shoulder restraint and a saddle.

13. The amusement ride device according to claim **12**, wherein the shoulder restraint is connectable to the saddle via a locking mechanism.

14. The amusement ride device according to claim **1**, wherein the transport part further comprises one or more pairs of foot restraints on the platform.

15. The amusement ride device according to claim **1**, wherein the platform supporting the passenger is designed as a surfboard, a skateboard, a snowboard or a pair of skis.

16. The amusement ride device according to claim **1**, wherein the orientation of the passenger in the torso restraint with respect to the transport direction is between 15° and 45°, preferably about 35° as seen from above.

17. The amusement ride device according to claim **1**, wherein the platform is moveable with respect to the transport part.

18. The amusement ride device according to claim **1**, wherein the at least one passenger torso restraint is suspended under the track.

19. The amusement ride device according to claim **1**, wherein multiple carriages move along a track, wherein each carriage comprises a single transport part with one or two platforms supporting one or more pairs of passengers in a torso restraint, and the torso restraints are oriented such that the passengers are disposed back to back.

20. An amusement ride device, comprising a track and at least one carriage, wherein the carriage is moveable along the track in a transport direction, wherein the carriage comprises:

a transport part which engages on the track and comprises at least one platform that allows to support at least one passenger in a standing position thereon,

at least one passenger torso restraint engaging on the torso of the passenger for safely supporting the passenger in at least the standing position, and

connecting means which connects the passenger torso restraint to the transport part, wherein the connecting means allows a movement of the torso restraint with respect to the platform,

wherein the connecting means is designed to allow the passenger to perform movements between the standing position and a squatting position during the ride while being restrained by the torso restraint, wherein the torso

restraint performs an up and down movement with respect to the platform during said movements of the passenger.

21. The amusement ride device according to claim **20**, wherein the connecting means is designed to allow a forward rotational movement of the torso of the passenger during the ride while being restrained by the torso restraint.

22. The amusement ride device according to claim **20**, wherein the connecting means is designed to allow a lateral movement of the torso of the passenger during the ride while being restrained by the torso restraint.

23. The amusement ride device according to claim **20**, wherein the connecting means is designed as a guide structure arranged on the transport part, along which the torso restraint is moveable.

24. The amusement ride device according to claim **23**, wherein the guide structure is curved to cause a forward rotation of the torso restraint when squatting.

25. The amusement ride device according to claim **23**, wherein the connecting means comprises a guide part to be guided along the guide structure, and a hinge to allow for a forward rotational movement of the torso restraint during the ride.

26. The amusement ride device according to claim **20**, wherein the torso restraint comprises a back support, a hip bar and a saddle.

27. The amusement ride device according to claim **26**, wherein the hip bar is connectable to the saddle via a locking mechanism.

28. The amusement ride device according to claim **26**, wherein the torso restraint comprises a belt construction comprising one or two shoulder straps between the hip bar and the back support.

29. The amusement ride device according to claim **28**, wherein the connection of the belt construction with the back support is adjustable, so that the belt construction can be fixed to the back support in multiple positions with varying height.

30. The amusement ride device according to claim **26**, wherein the torso restraint comprises a bracket below the saddle which will be behind the legs of the passenger to prevent hyperextending of the knees of the passenger.

31. The amusement ride device according to claim **20**, wherein the torso restraint comprises a back support, a shoulder restraint and a saddle.

32. The amusement ride device according to claim **31**, wherein the shoulder restraint is connectable to the saddle via a locking mechanism.

33. The amusement ride device according to claim **20**, wherein the platform supporting the passenger is designed as a surfboard, a skateboard, a snowboard or a pair of skis.

34. The amusement ride device according to claim **20**, wherein the orientation of the passenger in the torso restraint with respect to the transport direction is between 15° and 45°, preferably about 35° as seen from above.

35. The amusement ride device according to claim **20**, wherein the at least one passenger torso restraint is suspended under the track.

36. The amusement ride device according to claim **20**, wherein multiple carriages move along a track, wherein each carriage comprises a single transport part with one or two platforms supporting one or more pairs of passengers in a torso restraint, and the torso restraints are oriented such that the passengers are disposed back to back.

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