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(54) **ROLLER-COASTER WITH A VERTICAL CLIMB**

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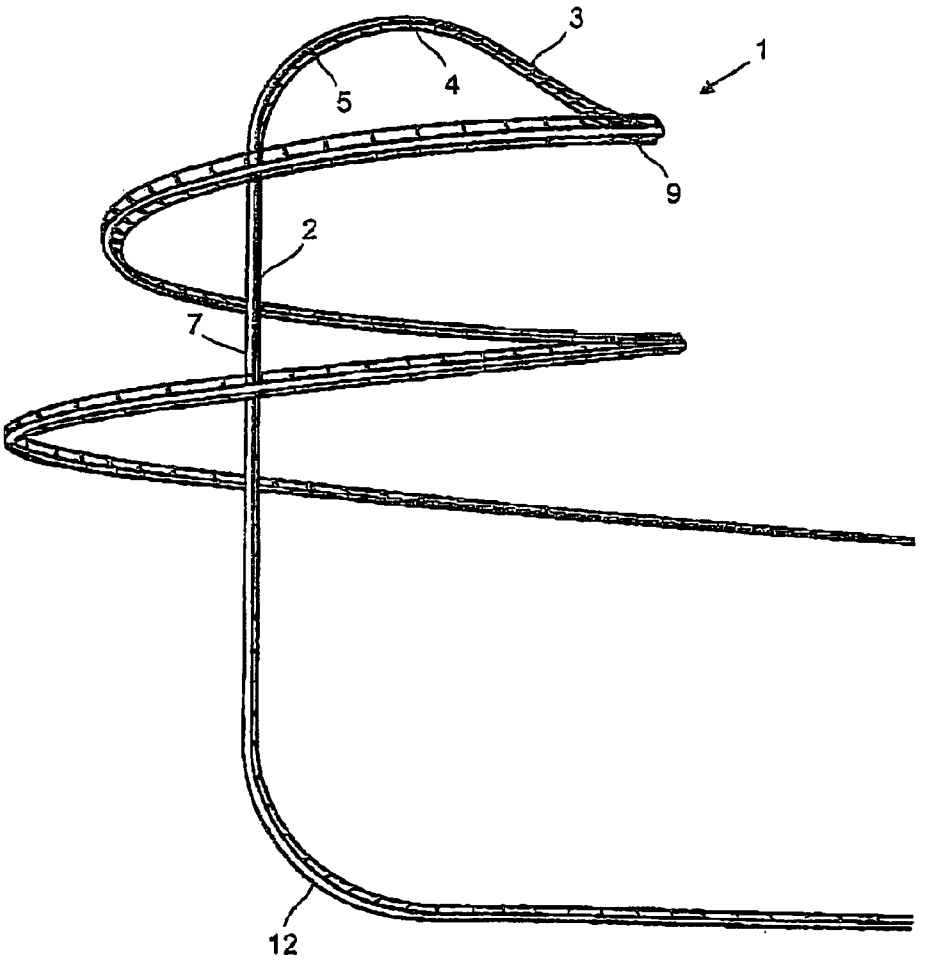
(57) **ABSTRACT**

An amusement apparatus and more particularly a roller-coaster has a more particularly closed travel path (**1**) which comprises guide means for guiding and/or holding a vehicle (**11**) on the travel path, the vehicle (**11**) and the travel path (**1**) being so adapted to each other that the passengers are aligned essentially perpendicularly to the travel path during travel and in the travel path a climb section (**2**) is provided, in which the travel path rises and at its top end (**5**) is so curved that the vehicle leaves the climb section (**2**) upside down and the vehicle is conveyed by a conveying means provided on the travel path, the climb section (**2**) extending at least partly essentially vertically or vertically with an overhang, the conveying means being so designed that the speed of the vehicle is able to be controlled at any time during said climb and/or the upside down exit has a radius of curvature of ≦7 m, more particularly ≦5 m and even more selectively ≦3 m.



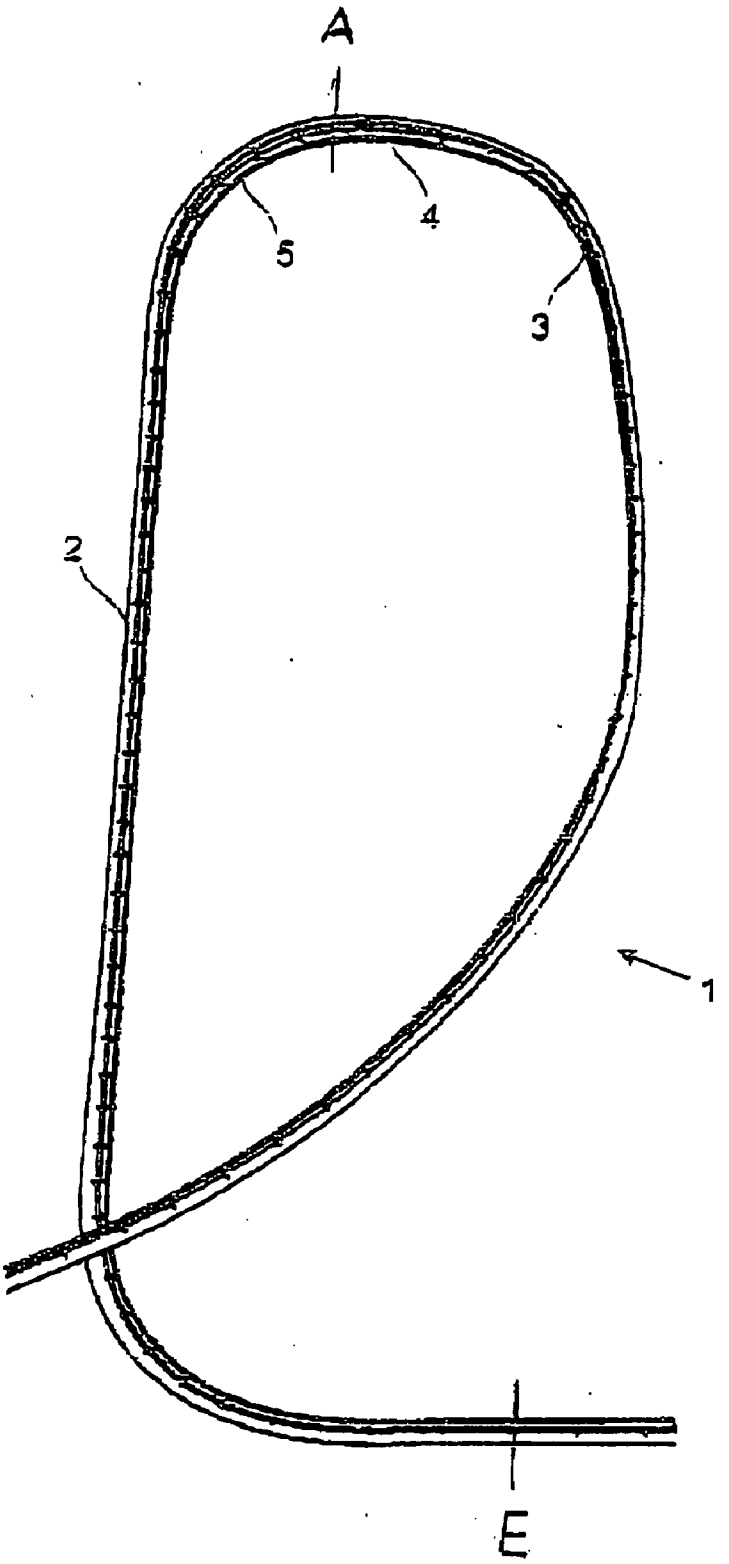


Fig. 1

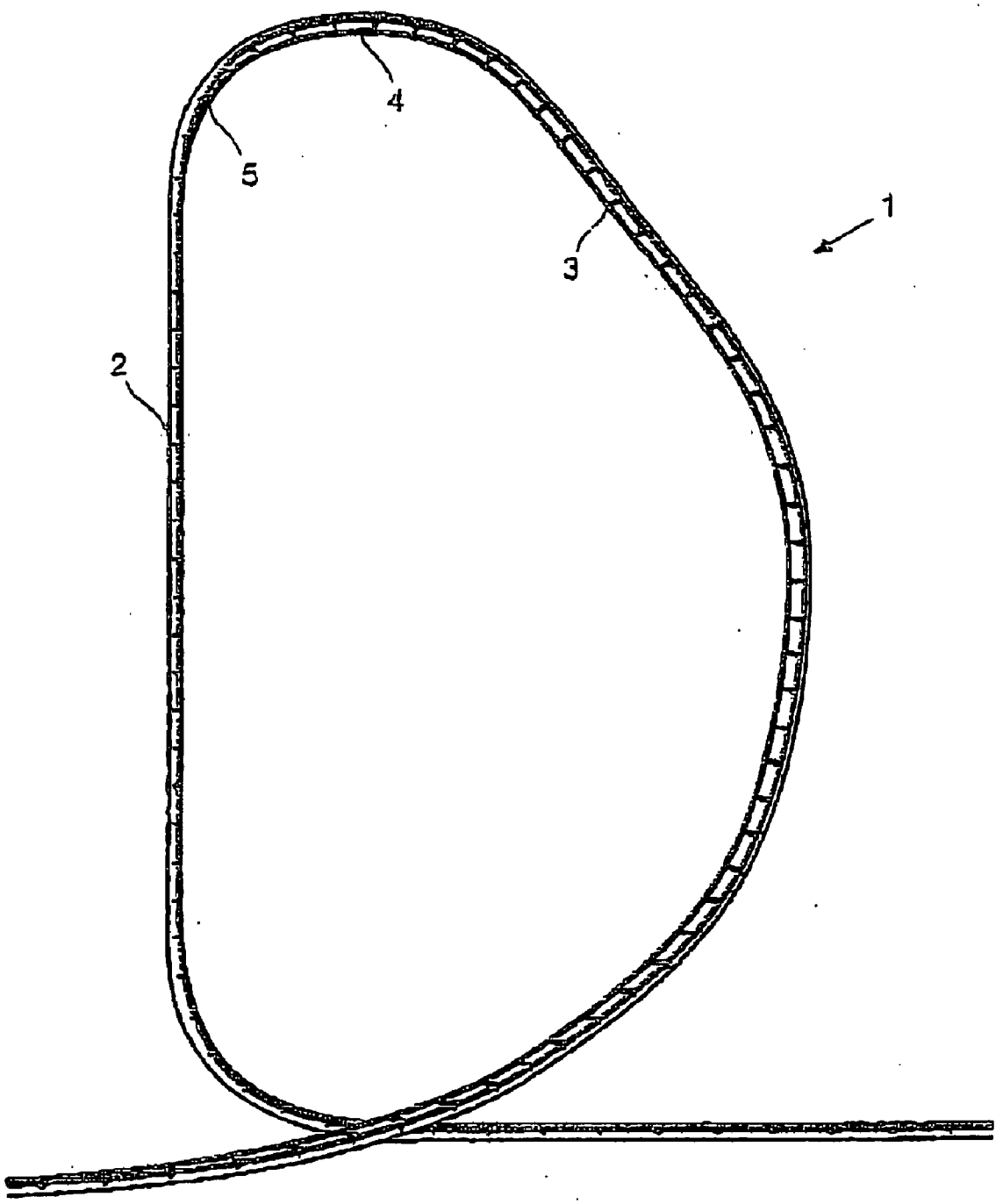


Fig. 2

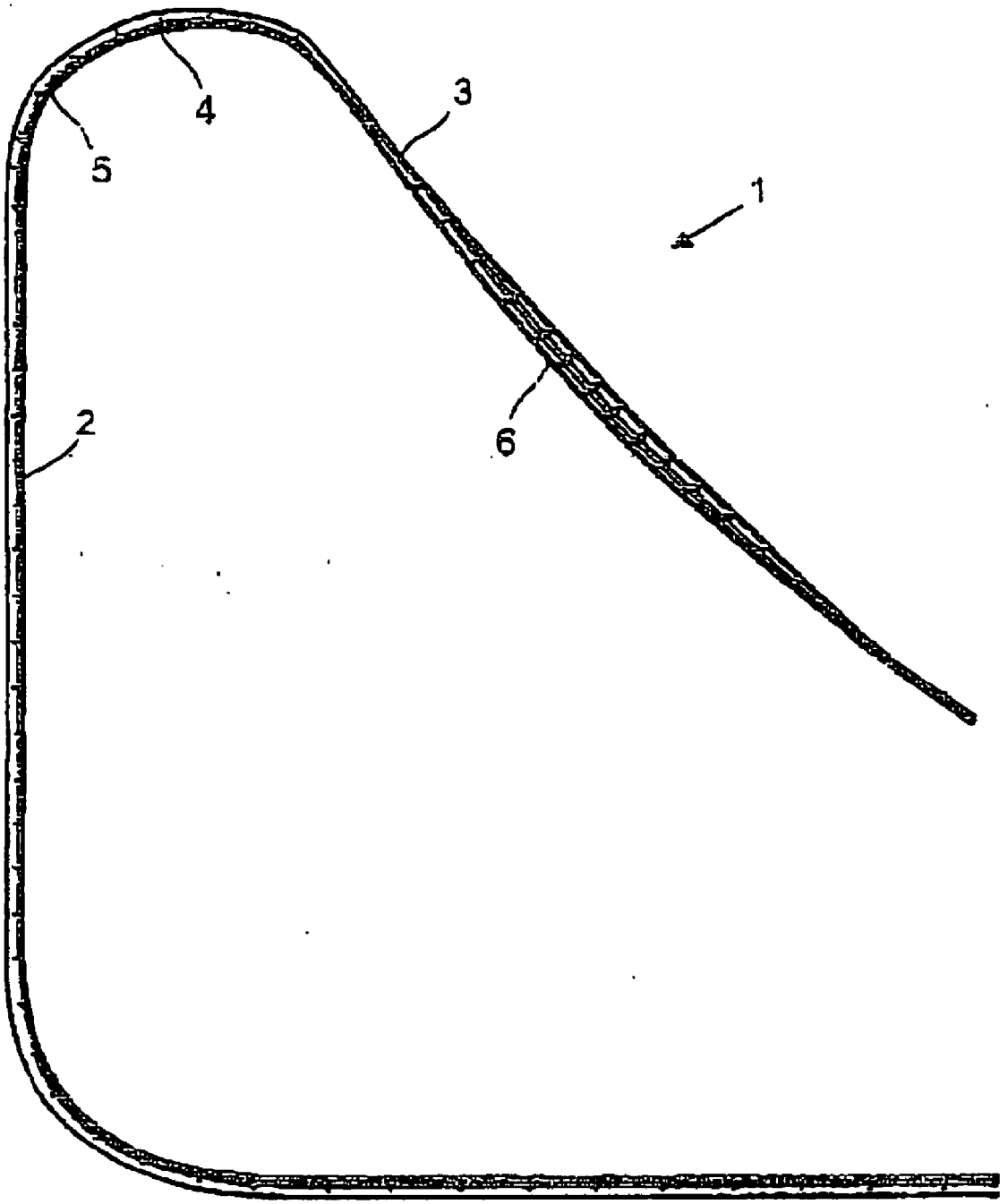


Fig. 3

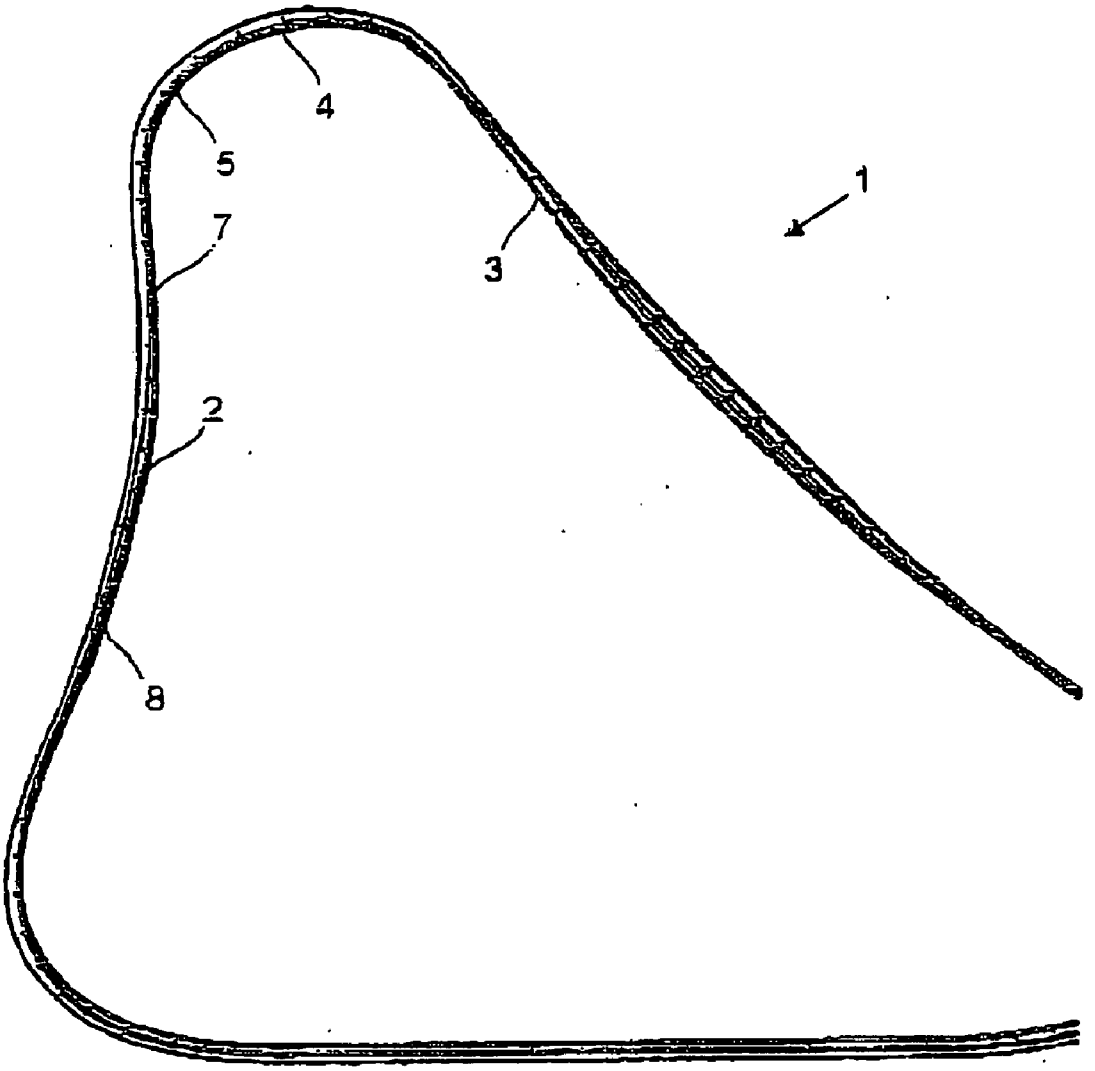


Fig. 4

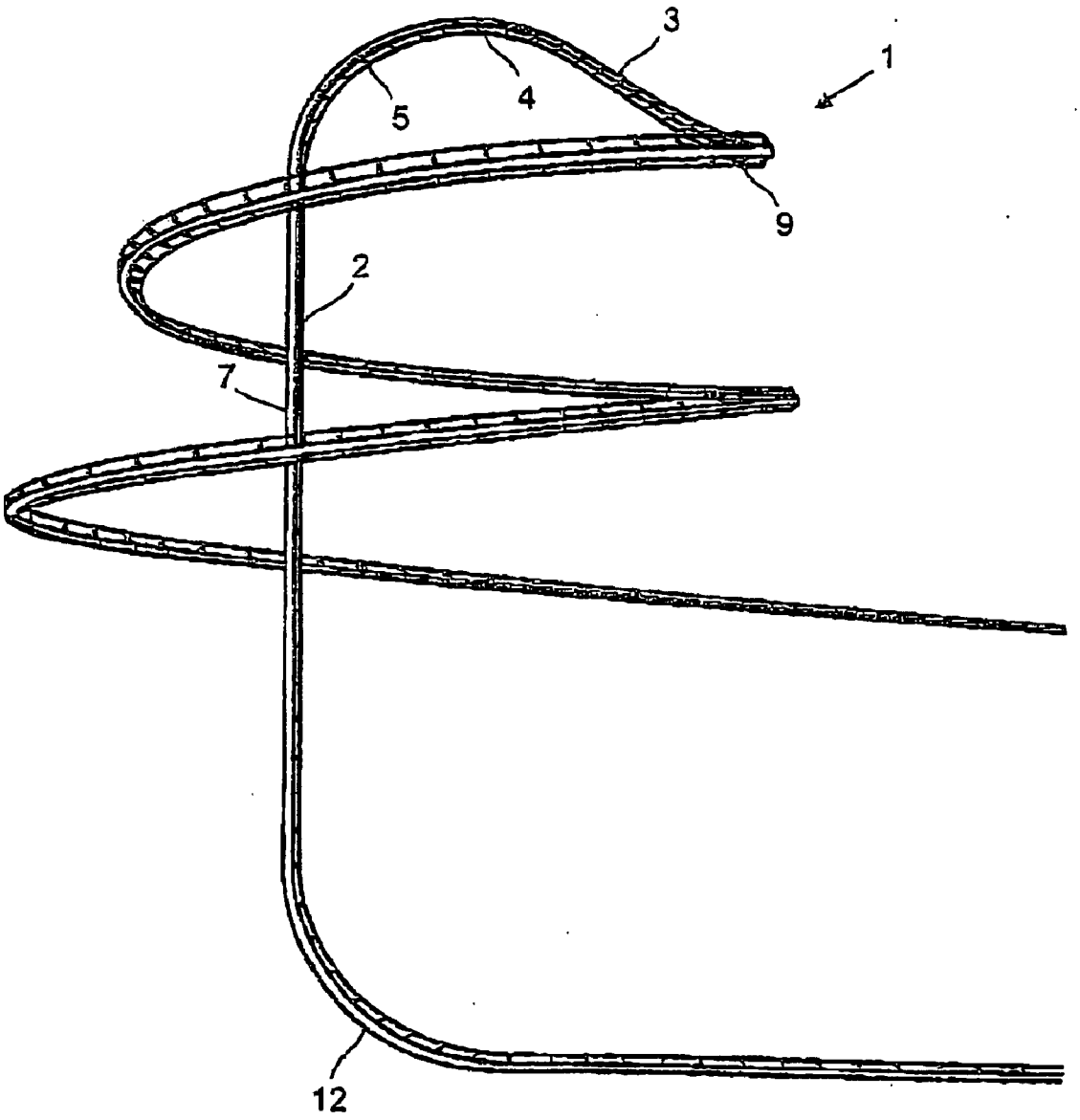


Fig. 5

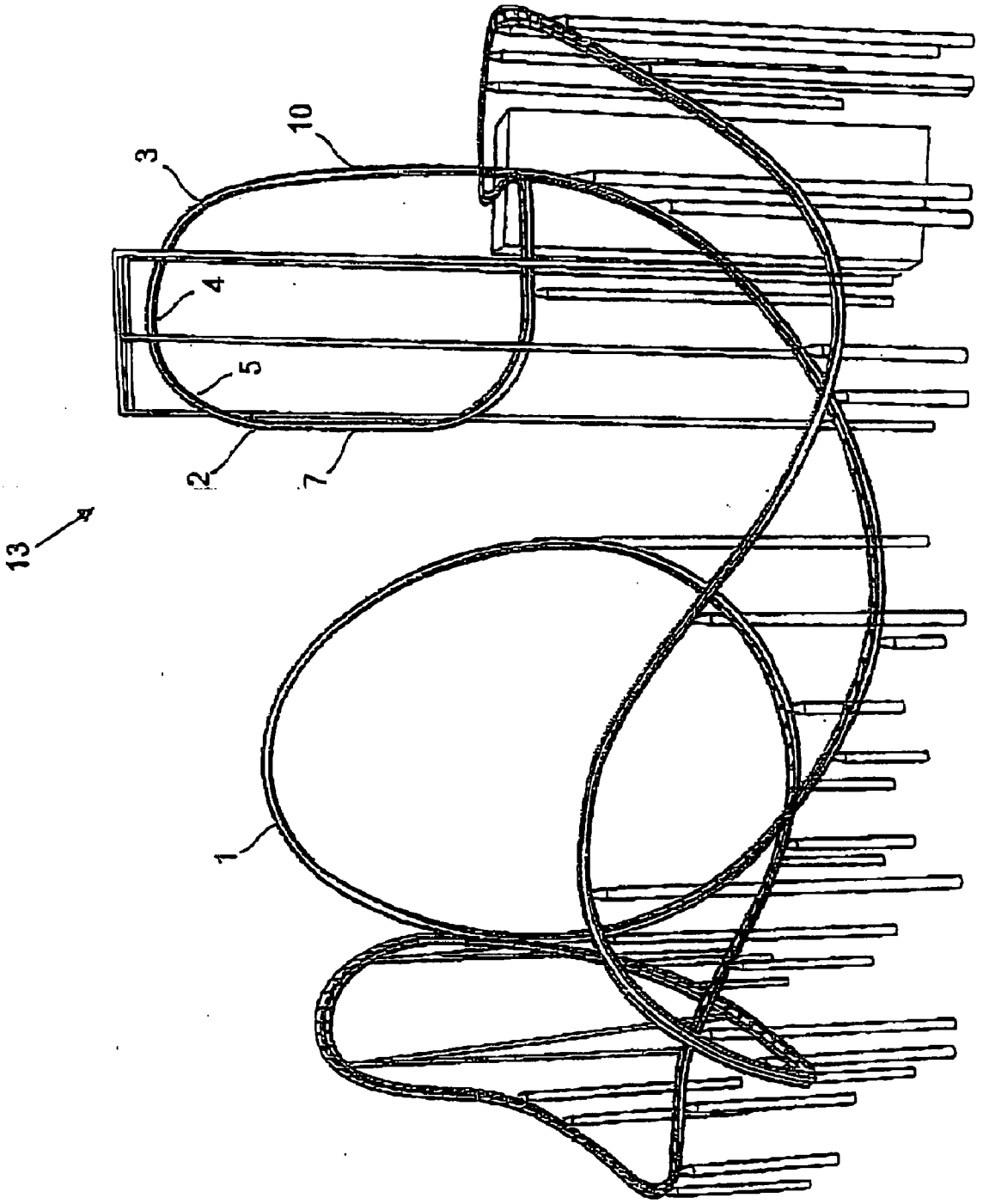


Fig. 6

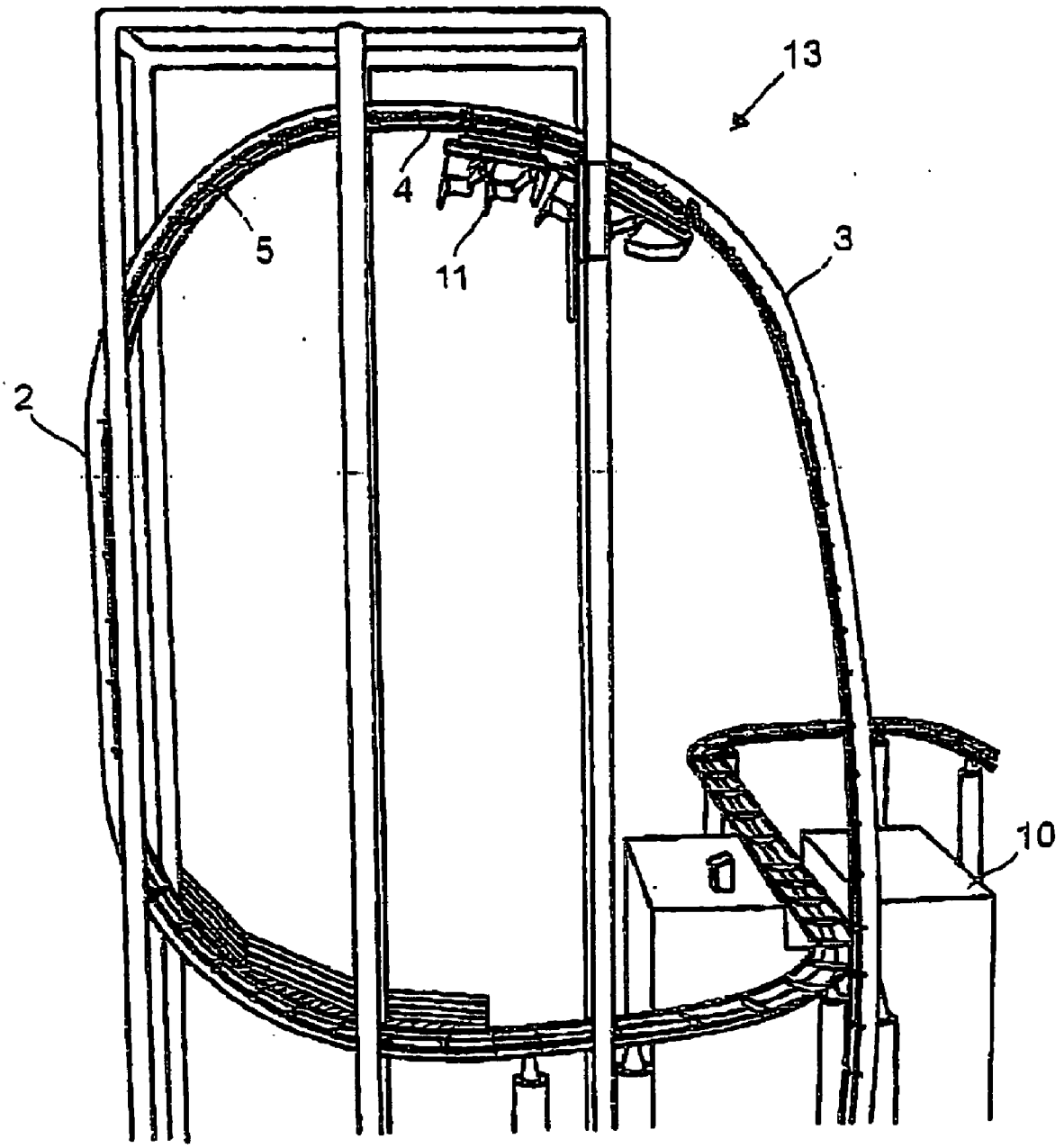


Fig. 7

ROLLER-COASTER WITH A VERTICAL CLIMB

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to German application number 203 16 345.1 filed Oct. 24, 2003.

FIELD OF THE INVENTION

[0002] The present invention relates to an amusement apparatus and more particularly to a roller-coaster in accordance with the preamble of claim **1** herein.

BACKGROUND OF THE INVENTION

[0003] Amusement apparatus and more particularly roller-coasters have long been known and enjoy a high degree of popularity at festivals, funfairs and in amusement parks. Although there is already a large number of so-called fun rides with the most various ride effects, there is a need for continuous further development of the equipment. On the one hand this is to meet the passengers' desire for more and move novel attractions and on the other hand to render the manufacture and operation of such systems more effective by making corresponding developments.

BRIEF SUMMARY OF THE INVENTION

[0004] Accordingly one object of the of the invention is to provide an amusement apparatus and more particularly a roller-coaster, which provides the passengers with a novel exciting feeling during the ride and furthermore offers technical and economic advantages during operation and during the manufacture of the system. More particularly, a roller-coaster is to be provided, which generally requires only a small amount of space and renders possible rational drive technology for its vehicles.

[0005] This aim is to be attained by an amusement apparatus having the feature of claim **1**. Advantageous developments of the apparatus are recited in the dependent claims.

[0006] Conventionally roller-coasters are so designed that a closed circuit travel path is present in the case of which the passengers alight and get off in a station a ground level. After alighting the vehicles are moved upward by means of a conveying means along an oblique ramp to then complete the remaining travel path with its steep descents, curves, vertical loops or the like under the action of gravity.

[0007] Such a structure involves a high space requirement, which leads to a generally very large size of the apparatus. Admittedly roller-coasters are known in which the vehicle travel along a tower vertically upward in order to economize in space. Such systems do however suffer from other problems, since more particularly the descent must be designed projecting out to the side or involved engineering work are required to keep to reasonable dimensions as in the case of a system in which the descent takes place on the same mast in a downward direction like the climb, it the being necessary for the transfer at the mast end to be suitably engineered.

[0008] The inventors have now recognized that technically as regards the space requirement and also as regards the sensations of a ride and as regards the impression left it is advantageous for the climb to be terminated with the passengers standing on their heads since for the one part the thrill is increased and the further layout of the travel path may be optimized. Accordingly the amusement apparatus in accordance with the invention possesses a climb section which at least partly runs essentially vertically, in which however the passengers are not placed as in an elevator or lift in parallelism to the direction of movement, but athwart the travel path. This is possible in the case of roller-coasters without difficulties, since the passenger are normally so held that even in the case of steep climbs or a vertical loop they cannot be slung out of the vehicle. Accordingly the passengers are conveyed in the vertical climb section with their backs on the seat backs in a prone position, i. e. lying, something which additionally leads to a special feeling of dynamic movement and increases the attraction of the amusement apparatus. This may all be enhanced if the climb section is partly so designed that the passengers have a rearwardly directed overhang and inclined slightly toward the upside down position (out of the horizontal position) during the ascent of the vehicles.

[0009] The vertical form of the climb section means that the substantial space requirement otherwise necessary for inclined climb ramps is considerably reduced. It is in this manner that it is possible to provide a respective amusement apparatus with a constant travel path length and accordingly approximately constant circuit time on a substantially smaller area or base, something which in view of the high site rentals for transportable roller-coasters at funfairs and carnivals or the high purchase prices for land for permanent amusement parks which renders possible substantially more profitable operation. There is an even greater advantage to be obtained here if in accordance with the invention the climb section is so curved at its top end that the vehicles leave the climb section while tilted back, that is to say in an upside down position. This will provide a substantial additional thrill and an additional fun experience for the passengers, since during the normally relatively slow climb excitement about the coming descent will constantly increase and the passengers will however be unable to recognize when the downhill run actually starts. A source of particular excitement will also be that the vehicle may be seen to be irrevocably approaching the top rail arch as a point of no return.

[0010] The vertical setting of the climb section also makes it possible to employ various new drive technologies as utilized in the elevator and lift arts and more particularly technologies using counter weights for upward movement of vehicles, such weights moving downward in order to reduce the load on the drive. Naturally conventional drives are also possible such as a chain drive or a chain lift. In accordance with a first aspect it is important for the drive preferably to be exactly controlled or monitored over an entire climb length, that is to say the speed is able to be exactly controlled or regulated. It is in this manner that the exit speed, which is important for leaving the climb upside down, is able to be exactly set or able to be changed in accordance with predetermined criteria.

[0011] Accordingly in a further aspect of the invention, for which independent preemption is claimed, it is possible for the inverted or upside down exit to have a radius of curvature of $\leqq$7 m, more particularly $\leqq$5 m and even more selectively $\leqq$3 m.

[0012] Since the device of the invention is suitable for conventional vehicles, which during horizontal travel are

over the travel path and for so-called inverted vehicles, which during horizontal travel are underneath the travel path, the vehicle, on leaving the climb section upside down may be either on the inner side of the curved travel path or on the outer side of the curved travel path.

[0013] Preferably the climb section and the descent section following the climb section together constitute a vertical loop so that owing to the return of the travel path toward the climb section the space requirement for the amusement apparatus is substantially reduced, there simultaneously being the guarantee of abundant thrills and fun specifically owing to the arrangement of the travel path in a vertical loop. The vertical climb section and the descent section merge continuously with one another without a switch or any other means being necessary for the rearrangement of the vehicle. A substantial aspect for effective and economic operation is that the vehicle is able to continuously move from the climb section directly into the descent section.

[0014] Further advantages, characteristic and features of the present invention will become apparent from the following detailed description of a plurality of working examples with reference to the accompanying purely diagrammatic drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] **FIG. 1** shows a part of a roller-coaster with a climb in accordance with the invention.

[0016] **FIG. 2** shows a for the part of a roller-coaster in the different embodiment.

[0017] **FIG. 3** shows a part of a roller-coaster according to a further embodiment.

[0018] **FIG. 4** is a view of part of a roller-coaster in accordance with a different embodiment.

[0019] **FIG. 5** is view of part of a further roller-coaster.

[0020] **FIG. 6** is a perspective elevation of an embodiment of a roller-coaster in accordance with the invention.

[0021] **FIG. 7** shows a detail of the design of **FIG. 6**.

DETAILED DESCRIPTION OF THE INVENTION

[0022] Although the present invention is susceptible of embodiment in various forms, there is shown in the drawings and will hereinafter be described presently preferred embodiments with the understanding that the present disclosure is to be considered an exemplification of the invention and is not intended to limit the invention to the specific embodiments illustrated.

[0023] It is to be further understood that the title of this section of the specification, namely, "Detailed Description of the Invention" relates to a rule of the United States Patent and Trademark Office, and is not intended to, does not imply, nor should be inferred to limit the subject matter disclosed herein or the scope of the invention.

[0024] **FIG. 1** is a diagrammatic representation of a part of a travel path **1** of a roller-coaster. In the represented part of the travel path **1** there is a substantially vertical climb **2** with a slight overhang, the vehicles, which are present in the bottom part of the figure, being conventional vehicles (not illustrated), in the case of which in the horizontal direction the vehicles are arranged above the travel path. Accordingly in the climb **2** the vehicles are to the right of the travel path **1** so that at the end of the climb section they are turned upside down in the curved part **5**.

[0025] At the end of the climb section **2**, which is referenced **4**, the travel path **1** smoothly merges with the descent **3**, the climb section **2** and the descent **3** constituting a vertical loop.

[0026] The drive in the form of a chain elevator is in the present case arranged to extend from the entry point (position E) or, respectively, the horizontal part, as far as the exit point (position A) or, respectively, the point of inflection of the upward curvature or arch at **4**, the endless chain extending for example underneath or in the rail.

[0027] A similar embodiment of part of a travel path **1** of a roller-coaster is represented in **FIG. 2**, this working embodiment only differing from **FIG. 1** in that the descent **3** has a different configuration. The vertical loop, which is jointly constituted by the climb section **2** and the descent **3** together, is made somewhat wider in the working example of **FIG. 2**, there being a straight oblique part adjacent to the exit point **3**, which only merges with a curved part in the middle or, respectively, bottom part of the descent **3**.

[0028] **FIG. 3** shows a further working example, which is similar to those of **FIGS. 1 and 2**. This design in **FIG. 3** differs from those of **FIGS. 1 and 2** merely because as regards the climb section **2** there is no vertical loop formed by the descent **3** in relation to the climb section and in fact the descent **3** extends substantially obliquely downward, there being a twist of the travel path along the axis of the travel path at **6** so that the passengers are changed over from the inverted position approximately in the middle of the descent **4** into the normal position.

[0029] The section of the travel path **1**, which is illustrated in **FIG. 4** for a further design of a roller-coaster, is similar to the embodiment of **FIG. 3**. It only differs because the climb section **2** is characterized not only by essentially two portions, namely by a straight, long substantially vertical section **7** and a curved section **5** at the end of the climb section **2** but by essentially three portions

[0030] At the top end of the climb section **2** there is, as already mentioned, a curve part **5** so that vehicles moving in a normal position on the travel path **1**,(that is to say in the horizontal part above the travel path, unlike the inverted vehicles, which are located in the horizontal position underneath the vehicle) are moved upside down from the climb section **2** into the descent section **3**. Moreover there is also a provision, as already mentioned, of a substantially vertical climb section **7**, which is located in a middle part of the climb section **2**. At the start of the climb section **2** a portion **8** with an overhang is provided in the case of which the travel path **1** is inclined from the vertical so that the passenger are already inclined toward an inverted position, that is to say they are in a sort of overhang.

[0031] In **FIG. 5 a** roller-coaster in accordance with the invention is illustrated in a perspective representation in the case of which the climb section **2** again consists essentially of a bottom vertical portion and a curved top portion **5** and furthermore a bottom entry curved part **12**. However in the case of this working embodiment the descent section **3** is

designed differently to the previous working example. The descent section **3** is namely twisted in a spiral fashion about the vertical part **7** of the descent section **2** and thus constitutes a helix. This is a particularly space saving design, since both the climb and also the descent can be arranged on a very small area without the length of the travel path and the pleasure of travelling being excessively reduced.

[**0032**] **FIG. 6** shows a perspective representation as an overall view of a roller-coaster **13** in accordance with the invention, in the case of which an descent section **2** with a vertical **7** and a curved portion **5** and provided so that the vehicles leave the descent section **2** upside down. The roller-coaster **13** of **FIG. 6** furthermore has an elevated station **10**, which is not located at the lowest point of the roller-coaster, but at a medium height. From this station **10** the vehicles are moved upward by way of the climb section **2** to the highest point of the roller-coaster at **4**, at which there is also the connection between the climb section **2** and the descent section **3**.

[**0033**] **FIG. 7** is a detailed view as part of **FIG. 6** with the exit point of a conventional roller-coaster vehicle, which is located in the horizontal part above the travel path on leaving the exit point from the climb section **2** or, respectively, the entry point to the descent section **3**. As is clearly to be seen the vehicle **11** leaves the climb section **2** upside down so that the passengers, after being conveyed during the climb with their backs on the seat backs in a horizontal position, leave the vertical position while being tilted to the rear. This produces a particularly thrilling dynamic feeling, since the passengers may on the one hand realize that they are just to start the downhill portion without however being able to see the part of the travel path owing to being tilted backward.

[**0034**] From the foregoing it will be observed that numerous modifications and variations can be effectuated without departing from the true spirit and scope of the novel concepts of the present invention. It is to be understood that no limitation with respect to the specific embodiment illustrated is intended or should be inferred. The disclosure is intended to cover by the appended claims all such modifications as fall within the scope of the claims.

1. An amusement apparatus and more particularly a roller-coaster having a more particularly closed travel path which comprises guide means for guiding and/or holding a vehicle on the travel path, the vehicle and the travel path being so adapted to each other that the passengers are aligned essentially perpendicularly to the travel path during travel and in the travel path a climb section is provided, in which the travel path rises and at its top end is so curved that the vehicle leaves the climb section upside down and the vehicle is conveyed by a conveying means provided on the travel path, the climb section extending at least partly essentially vertically or vertically with an overhang, characterized in that the conveying means is so designed that the speed of the vehicle is able to be controlled at any time during said climb.

2. The amusement apparatus as set forth in claim 1, characterized in that the conveying means is designed in the form of an elevator and more particularly a chain elevator or lift.

3. The amusement apparatus as set forth in claim 1, characterized in that the curvature at the end of the climb section has a radius of 7 m, preferably and more particularly 3 m.

4. The amusement apparatus as set forth in claim 1, characterized in that the climb section is designed in the form of part of a vertical loop.

5. The amusement apparatus as set forth in claim 1, characterized in that a descent section adjoins the climb section, and the travel path provides smooth transition from the descent section to the climb section.

6. The amusement apparatus as set forth in claim 1, characterized in that the conveying means extends over the full climb section and more particularly as far as the center of curvature of the exit point and/or a horizontal entry at the foot of the climb section.

7. An amusement apparatus and more particularly a roller-coaster having a more particularly closed travel path which comprises guide means for guiding and/or holding a vehicle on the travel path, the vehicle and the travel path being so adapted to each other that the passengers are aligned essentially perpendicularly to the travel path during travel and in the travel path a climb section is provided, in which the travel path rises and at its top end is so curved that the vehicle leaves the climb section upside down and the vehicle is conveyed by a conveying means provided on the travel path, the climb section extending at least partly essentially vertically or vertically with an overhang, characterized in that the upside down exit has a radius of curvature of $\leqq$7 in, more particularly $\leqq$5 m and even more selectively $\leqq$3 m.

8. The amusement apparatus as set forth in claim 7, characterized in that the conveying means is designed in the form of an elevator and more particularly a chain elevator or lift.

9. The amusement apparatus as set forth in **8**, characterized in that the curvature at the end of the climb section has a radius of 7 m, preferably and more particularly 3 m.

10. The amusement apparatus as set forth in claim 7, characterized in that the climb section is designed in the form of part of a vertical loop.

11. The amusement apparatus as set forth claim 7, characterized in that a descent section adjoins the climb section, and the travel path provides smooth transition from the descent section to the climb section.

12. The amusement apparatus as set forth in claim 7, characterized in that the conveying means extends over the full climb section and more particularly as far as the center of curvature of the exit point and/or a horizontal entry at the foot of the climb section.

* * * * *